

FIBER SENSORS

Each page features simple, easy-to-understand symbols representing the functions these devices are equipped with.



Self-diagnosis function



Test input (emission halt) function



Multi-voltage



PNP output type available



Timer function



External synchronization function



Light intensity monitor



Interference prevention function



Automatic sensitivity setting function

Information on the following sensors is found on the pages titled, “**Particular Use Sensors**”.

- Color Detection Fiber Sensor **FZ-10 P.939**
- Optical Lamp Fiber Sensor **LX-23 P.975**

Information on the following products is found on the pages titled, “**Simplified Wiring Saving Unit**”.

- Communication Unit for Open Network **SC-GU3 P.985**
- Communication Unit for CC-Link **SC-GU2-C P.999**
- Upper Communication Unit for Digital Sensors **SC-GU1-485 P.1009**
- Sensor-PLC Connection System **SC P.1011**

Fibers

Fiber Selection

FT / FD / FR ▶ P.5



Fiber Sensor Amplifiers

Digital Fiber Sensor

FX-500 Ver.2 ▶ P.73



Digital Fiber Sensor

FX-100 ▶ P.119



Digital Fiber Sensor

FX-300 ▶ P.139



Fiber Sensor Amplifiers

Digital Fiber Sensor

FX-410 ▶ P.167

Manually Set
Fiber Sensor

FX-311 ▶ P.183

Digital Fiber Sensor for Leak Detection
/ Liquid Detection Fibers Only

FX-301-F7 / FX-301-F ▶ P.199

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SENSORSMICRO
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FLOW
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PROXIMITY
SENSORSPARTICULAR
USE SENSORSSENSOR
OPTIONSSIMPLE
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UNITSWIRE-SAVING
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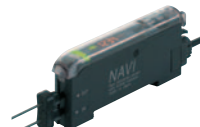
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Fiber Amplifier Selection

Refer to p.5~ for selection of the fiber heads.

Application	Feature / Type	Series / Model No.	
General sensing	At the industry's leading edge Digital / Dual display	FX-500 Ver.2	 ▶ P.73
	Digital / Dual display (Low Price)	FX-100	 ▶ P.119
	Digital / Standard	FX-301	 ▶ P.139
	Digital / Dual display (Manually set)	FX-411 FX-412	 ▶ P.167
	Manually set	FX-311	 ▶ P.183
High-speed sensing	35 μ s high-speed response	FX-301-HS	 ▶ P.177
	15 μ s high-speed response (Direct current lighting type)	FX2	 ▶ Website
Sheet meandering detection, Differential sensing, etc.	High-functional type	FX-305	 ▶ P.139
Detection of LED lighting	LED sensing type	FX2-A3R-LED	 ▶ Website
Detection of variations in turbidity, etc.	Analog output	FX-11A	 ▶ Website
Leak detection, Liquid detection	For leak detection / liquid detection fibers only	FX-301-F7 FX-301-F	 ▶ P.199

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Fiber Amplifiers

Convenient peripheral devices

Description	Designation	Series / Model No.	
For connecting directly to open network	Communication unit for open network	SC-GU3	 ▶ P.985
For connecting directly to CC-Link	Communication unit for CC-Link	SC-GU2-C	 ▶ P.999
For sensor control and setting from external devices	Upper communication unit for digital sensors	SC-GU1-485	 ▶ P.1009
For organized wiring	Sensor-PLC connection system	SC	 ▶ P.1011
For remote teaching	External input unit for digital sensor	FX-CH2 for FX-301/305	 ▶ Website

The best sensing capability for fast devices and miniaturized workpiece

- High stability! Digital control is essentially achieved
- A different accuracy! Sharply senses even minute changes in beam intensity
- Ultra high-speed 25μs

Digital Fiber Sensor

FX-500 Ver.2

[▶ P.73](#)



Information on the following sensors is found on the pages titled, "Particular Use Sensors".

Color detection	Color detection fiber sensor	FZ-10	▶ P.939
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Fiber Selection FT / FD / FR

Related Information

■ General terms and conditions..... F-7

■ Fiber sensor amplifiers selection guide P.3~

■ Glossary of terms..... P.1455~

■ General precautions..... P.1458~

**A full line-up from general use fibers to special fibers.
You can select the most suitable fibers.**

Fiber Selection Guide

Choose by model

Thru-beam type

Model No.	Page	
	Sensing range Specifications	Dimensions
FT-140	P.15	P.51
FT-30	P.14	
FT-31	P.15	
FT-31S	P.22	
FT-31W	P.15	
FT-40	P.14	
FT-42	P.15	
FT-42S	P.22	
FT-42W	P.15	
FT-43		
FT-45X	P.28	P.52
FT-A11		
FT-A11W		
FT-A32		
FT-A32W		
FT-AL05		
FT-E13	P.19 / P.22	
FT-E23		
FT-F93	P.38	
FT-H13-FM2	P.33	
FT-H20-J20-S		
FT-H20-J30-S		
FT-H20-J50-S		
FT-H20-M1		
FT-H20-VJ50-S		
FT-H20-VJ80-S		
FT-H20W-M1	P.35	
FT-H30-M1V-S		
FT-H35-M2		P.33
FT-H35-M2S6		P.32
FT-HL80Y	P.27	P.54
FT-KS40		
FT-KV26		
FT-KV40		
FT-KV40W		
FT-L80Y		
FT-R31	P.18	
FT-R40	P.15	
FT-R41W	P.18	
FT-R42W		
FT-R43		
FT-R44Y	P.18 / P.32	P.55
FT-R60Y		
FT-S11	P.19	
FT-S20	P.14	
FT-S21	P.19	
FT-S21W		
FT-S30	P.14	
FT-S31W	P.19	
FT-S32		
FT-V23	P.22	
FT-V24W		
FT-V25		
FT-V30		
FT-V40	P.19	
FT-V80Y	P.32	
FT-Z20HBW	P.23	
FT-Z20W		

Retroreflective type

Model No.	Page	
	Sensing range Specifications	Dimensions
FR-KZ22E	P.27 / P.30	P.58
FR-KZ50E		
FR-KZ50H		
FR-Z50HW		

Reflective type

Model No.	Page		
	Sensing range Specifications	Dimensions	
FD-30	P.14	P.59	
FD-31	P.16		
FD-31W			
FD-32G	P.16 / P.26		
FD-32GX			
FD-40	P.14		
FD-41	P.16		
FD-41S	P.22		
FD-41SW			
FD-41W	P.16		
FD-42G	P.16 / P.26	P.60	
FD-42GW			
FD-60	P.14		
FD-61	P.16		
FD-61G			
FD-61S	P.22		
FD-61W	P.16		
FD-62			
FD-64X	P.28		P.61
FD-A16			
FD-AL11			
FD-E13		P.20 / P.22	
FD-E23			
FD-EG30	P.16 / P.26		
FD-EG30S	P.22	P.62	
FD-EG31	P.16 / P.26		
FD-F4	P.38		
FD-F41			
FD-F41Y			
FD-F71			
FD-F8Y			
FD-FA93			
FD-H13-FM2			P.34
FD-H18-L31			
FD-H20-21			
FD-H20-M1			
FD-H25-L43			
FD-H25-L45			

Model No.	Page	
	Sensing range Specifications	Dimensions
FD-H30-KZ1V-S	P.35	P.64
FD-H30-L32	P.34	
FD-H30-L32V-S	P.35	
FD-H35-20S	P.34	
FD-H35-M2		
FD-H35-M2S6		
FD-HF40Y	P.38	
FD-L10	P.29	P.65
FD-L11		
FD-L12W		
FD-L20H		
FD-L21		
FD-L21W		
FD-L22A		
FD-L23		
FD-L30A		
FD-L31A		
FD-L32H	P.18 / P.26	P.66
FD-R31G		
FD-R32EG		
FD-R33EG		
FD-R34EG		
FD-R41		
FD-R60	P.18	
FD-R61Y	P.16	
FD-S21	P.18 / P.32	
FD-S30	P.20	
FD-S31	P.14	
FD-S32	P.20	P.67
FD-S32W		
FD-S33GW		
FD-S60Y	P.20 / P.32	
FD-V30	P.22	
FD-V30W		
FD-V50		
FD-Z20HBW	P.24	P.68
FD-Z20W		
FD-Z40HBW		
FD-Z40W		
FD-Z50HW	P.27	

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Choose by shape

Threaded Type

- Standard type which is mounted using nuts.



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Square Head Type

- Installed cleanly on the side of a conveyor belt.



P.17

Cylindrical Type

- Has a slender shape that is mounted using set screws.



P.19

Sleeve

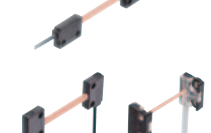
- Suitable for sensing in narrow locations and sensing minute objects.



P.21

Flat Type

- Thin and rectangular shape. Installed directly in narrow locations with screws.



P.23

Choose by beam shape

Small Spot

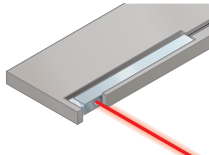
- Senses minute objects using a spot lens.



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Narrow Beam

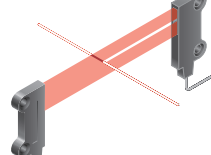
- Not easily affected by surrounding obstacles.



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Wide Beam

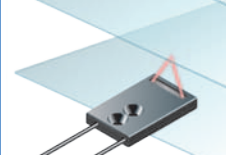
- Senses in the beam band without missing a work.



P.28

Convergent Reflective Type

- Senses in the limited range only.



P.29

Retroreflective Type

- Ideal for sensing transparent objects



P.30

Choose by quality

Super Quality

- The variance of beam intensity and beam axis is extremely small.



P.13

Chemical / Oil-resistant

- Various kinds of liquids can be detected due to the fluorine contained resin case



P.31

Heat-resistant

- Withstands at -60 °C
-76 °F to 350 °C 662 °F



P.33

Vacuum-resistant

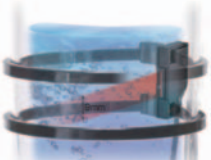
- Usable in high-temperatures of 300 °C 572 °F and vacuum



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Liquid Leak / Liquid Detection

- Corresponds to various liquid events.



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Choose by environment / performance

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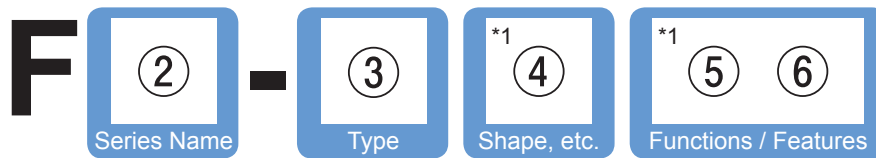
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How to read Model No.

Applies to the fiber in (p.13 to p.38)



*1: Excluding liquid leak / liquid detection fiber

②	Symbol	Details
	T	Thru-beam type
	D	Reflective type
	R	Retroreflective type

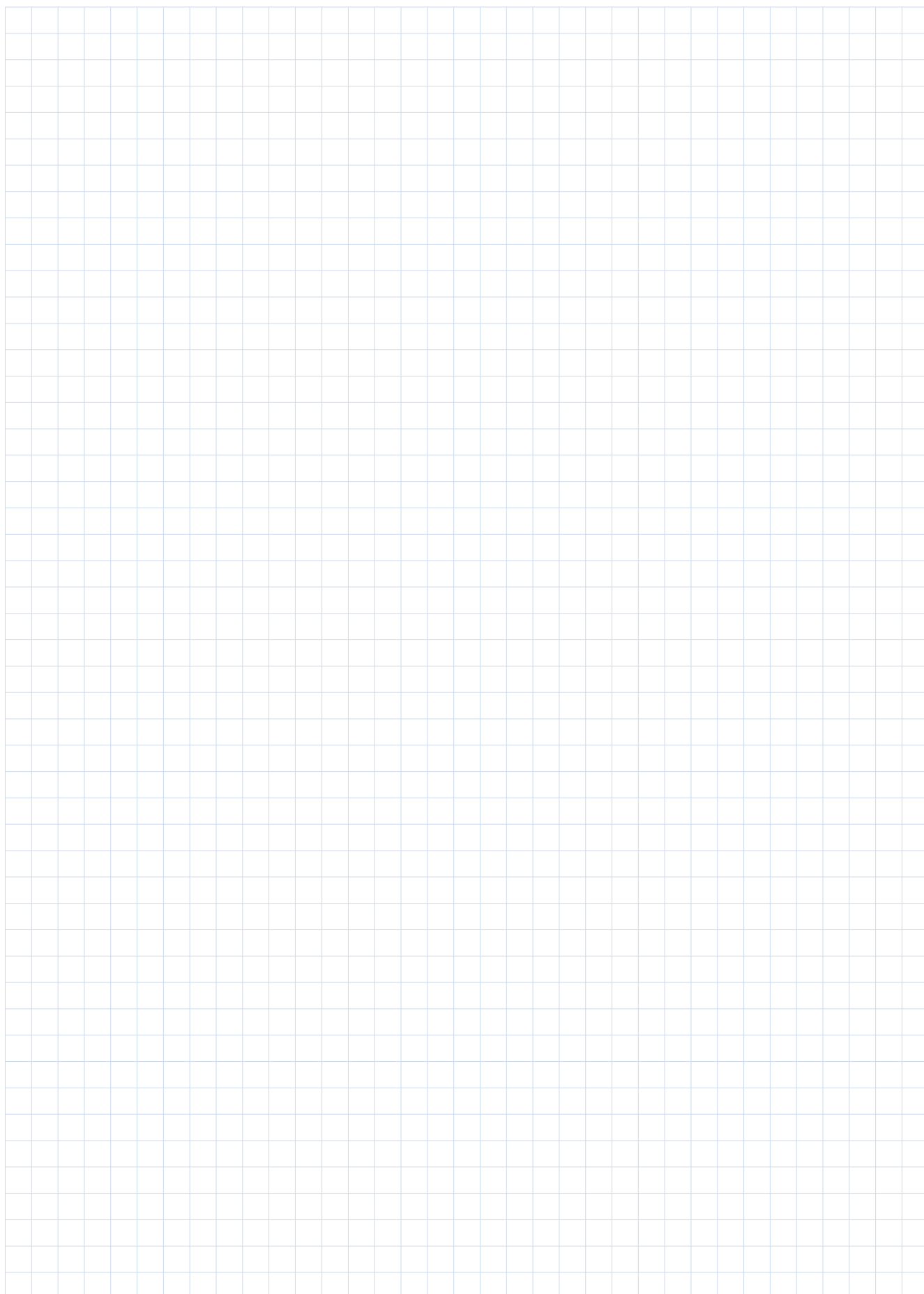
⑤	Symbol	Details
	None	General-purpose
	G	Coaxial reflective
	S	Sleeve
	H	Top sensing *
	E	Side sensing *
	HB	Top sensing + Bent *
	A	Alignment

*③ is for Flat type (**Z** and **KZ**) only

⑥	Symbol	Details
	None	General-purpose
	W	Sharp bending
	X	Stainless-jacketed
	Y	Chemical-resistant

③	Symbol	Details	④	Lead No.	Details
	None	Threaded type		3	M3
				4	M4
				6	M6
				14	M14
	R	Elbow or square head		4	M4
				6	M6
	S	Cylindrical type		1	ø1 mm
				2	ø1.5 mm
				3	ø2.5 or ø3 mm
	KS	Narrow beam		4	ø3.7 mm
				2	ø2 mm
	V	Side-view		3	ø2.5 or ø3 mm
				4	ø4 mm
				5	ø5 mm
	KV	Narrow beam / Side-view		4	ø4 mm
				2	1.5 × 2 mm
	E	Ultra small diameter		1	Fiber ø0.125 mm
				2	Fiber ø0.25 mm
	EG	Coaxial		3	M3
	Z	Flat type		2	Thickness 2 mm
				3	Thickness 3 mm
				4	Thickness 3.5 mm
				5	Thickness 5.2 mm
	KZ	Narrow beam		2	Thickness 2.2 mm
				5	Thickness 5.2 mm
	A	Wide beam		3	Sensing width 32 mm
				1	Sensing width 10 to 19 mm
	AL	Array		1	Sensing width 11.1 mm
				0	Sensing width 5.5 mm
	L	Convergent reflective type		1	Sensing range 0 to 10 mm (STD)
				2	Sensing range 11 to 30 mm (STD)
				3	Sensing range 31mm or more (STD)
	F	Liquid leak / Liquid detection		9	Mountable on pipe
				7	Liquid leak

MEMO



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Fiber Selection Guide

Earlier Models Comparison Table (The specification of new fiber may be changed from that of old one. Please confirm the specification before use.)

Thru-beam type

Old fiber Model No.	New fiber Model No.	Page	
		Sensing range Specifications	Dimensions
FT-A30	FT-A32	P.28	P.52
FT-A8	FT-A11		
FT-AFM2	FT-AL05		
FT-AFM2E			
FT-B8	FT-43	P.15	P.51
FT-E12	FT-E13	P.19 / P.22	P.52
FT-E22	FT-E23		
FT-F902	FT-F93	P.38	
FT-FM10L	FT-140	P.15	P.51
FT-FM2	FT-42		
FT-FM2S	FT-42S	P.22	
FT-FM2S4			
FT-K8	FT-KS40	P.27	P.54
FT-KV1	FT-KV26		
FT-KV8	FT-KV40		
FT-NFM2	FT-31	P.15	P.51
FT-NFM2S	FT-31S	P.22	
FT-NFM2S4			
FT-P2	FT-S21	P.19	P.55
FT-P40	FT-31	P.15	P.51
FT-P60	FT-42		
FT-P80			
FT-P81X	FT-45X		P.52
FT-PS1	FT-S11	P.19	P.55
FT-R80	FT-R40	P.15	P.54
FT-SFM2	FT-S32	P.19	P.55
FT-SFM2L			
FT-SFM2SV2	FT-V30	P.22	P.56
FT-SNFM2	FT-S21	P.19	P.55
FT-T80	FT-42	P.15	P.51
FT-V10	FT-V40	P.19	P.56
FT-V22	FT-V23	P.22	P.55
FT-V41	FT-V25		P.56
FT-W4	FT-31	P.15	P.51
	FT-31W		
FT-W8	FT-42		
	FT-42W		
FT-WA30	FT-A32	P.28	P.52
	FT-A32W		
FT-WA8	FT-A11		
	FT-A11W		

Old fiber Model No.	New fiber Model No.	Page	
		Sensing range Specifications	Dimensions
FT-WKV8	FT-KV40	P.27	P.54
	FT-KV40W		
FT-WR80	FT-R41W	P.18	
FT-WR80L	FT-R42W		
FT-WS3	FT-S31W	P.19	P.55
FT-WS4	FT-S21		
FT-WS4	FT-S21W		
FT-WS8	FT-S31W	P.22	
FT-WS8L	FT-S32		
FT-WV42	FT-V25	P.22	P.56
	FT-V24W		
FT-WZ4	FT-Z20W	P.23	P.57
FT-WZ4HB	FT-Z20HBW		
FT-WZ7	FT-Z40W		
FT-WZ7HB	FT-Z40HBW		
FT-WZ8	FT-Z30		P.56
	FT-Z30W		P.57
FT-WZ8E	FT-Z30E		P.56
	FT-Z30EW		P.57
FT-WZ8H	FT-Z30H		P.56
FT-WZ8H	FT-Z30HW		
FT-Z8	FT-Z30	P.18	P.54
FT-Z8E	FT-Z30E		P.55
FT-Z8H	FT-Z30H	P.18 / P.32	P.51
————	FT-30		P.55
————	FT-40		
————	FT-S20	P.18	P.54
————	FT-S30		P.55
————	FT-R31	P.18 / P.32	P.54
————	FT-R43		P.55
————	FT-R44Y	P.18 / P.32	P.55
————	FT-R60Y		P.55

Retroreflective type

Old fiber Model No.	New fiber Model No.	Page	
		Sensing range Specifications	Dimensions
FR-KV1	FR-KZ22E	P.27 / P.30	P.58
FR-KZ21	FR-KZ50H		
FR-KZ21E	FR-KZ50E		
FR-WKZ11	FR-Z50HW		

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Old fiber Model No.	New fiber Model No.	Page	
		Sensing range Specifications	Dimensions
FD-A15	FD-A16	P.28	P.61
FD-AFM2	FD-AL11		
FD-AFM2E			
FD-B8	FD-62	P.16	P.60
FD-E12	FD-E13	P.20 / P.22	P.61
FD-E22	FD-E23		
FD-EG1	FD-EG30	P.16 / P.26	
FD-EG2	FD-EG31		
FD-EG3			
FD-EN500S1	FD-EG30S	P.22	P.62
FD-ENM1S1			
FD-F705	FD-F71	P.38	
FD-FA90	FD-FA93		
FD-FM2	FD-61	P.16	P.60
	FD-61G		
FD-FM2S	FD-61S	P.22	
FD-FM2S4			
FD-G4	FD-42G	P.16 / P.26	P.59
FD-G6	FD-32G		
FD-G6X	FD-32GX		
FD-L4	FD-L20H	P.29	P.65
FD-L41	FD-L21		
FD-L43	FD-L22A		
FD-L44	FD-L11		
FD-L44S	FD-L10		
FD-L45	FD-L30A		
FD-L45A	FD-L31A		
FD-L46	FD-L32H		P.66
FD-L47	FD-L23		P.65
FD-NFM2	FD-41	P.16	P.59
FD-NFM2S	FD-41S	P.22	
FD-NFM2S4			
FD-P2	FD-S21	P.20	P.66
FD-P40	FD-31	P.16	P.59
FD-P50	FD-S32	P.20	P.67
FD-P60	FD-41	P.16	P.56
FD-P80	FD-61		P.60
FD-P81X	FD-64X		P.61
FD-R80	FD-R60		P.66
FD-S80	FD-S32	P.20	P.67

Old fiber Model No.	New fiber Model No.	Page	
		Sensing range Specifications	Dimensions
FD-SFM2SV2	FD-V50	P.22	P.68
FD-SNFM2	FD-S31	P.20	P.67
FD-T40	FD-31	P.16	P.59
FD-T80	FD-61		P.60
	FD-41		P.59
FD-V41	FD-V30	P.22	P.67
FD-W44	FD-41S		P.59
	FD-41SW		
FD-W8	FD-61	P.16	P.60
	FD-61W		
FD-WG4	FD-42G	P.16 / P.26	
	FD-42GW		
FD-WKZ1	FD-Z50HW	P.27	P.68
FD-WL41	FD-L21	P.29	P.65
	FD-L21W		
FD-WL48	FD-L12W		
FD-WS8	FD-S32	P.20	P.67
	FD-S32W		
FD-WSG4	FD-S33GW		
FD-WT4	FD-31	P.16	P.59
	FD-31W		
FD-WT8	FD-41		
	FD-41W		
FD-WV42	FD-V30	P.22	P.67
	FD-V30W		
FD-WZ4	FD-Z20W	P.24	P.68
FD-WZ4HB	FD-Z20HBW		
FD-WZ7	FD-Z40W		
FD-WZ7HB	FD-Z40HBW		
————	FD-30	P.14	P.59
————	FD-40		
————	FD-60		P.60
————	FD-R31G	P.18 / P.26	P.66
————	FD-R32EG		
————	FD-R33EG		
————	FD-R34EG		
————	FD-R41	P.18	
————	FD-R61Y	P.18 / P.32	P.66
————	FD-S30	P.14	P.67
————	FD-S60Y	P.32	

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Tough Fiber

Unbreakable! More flexible! ECO! Conventional 3 types rolled into 1!!

Flexible fiber
Flexible durability

1 million
times

Sharp bending fiber
Bending radius

R2~R1 mm

General purpose fiber
Bending radius

R25 mm

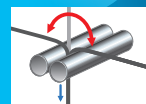
in

Tough Fiber

Unbreakable

Flexible durability **10** million times (Typical)

Bending conditions Bending radius: R10 mm
Reciprocating bending: 180°

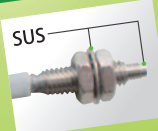


More flexible

Bending radius **R2~R4** mm



ECO



Stainless steel fittings are used
for the fiber head of all models.

- Clearly conforms to RoHS
- Can be used for secondary battery
- Improved mounting strength

New tough fibers exceed normal optic fibers!

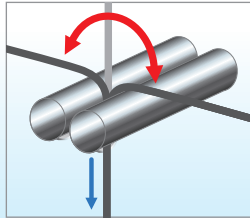
Tough fibers can be used on moving parts, can be bent with precision, and offer high quality for all purposes. They go beyond what was commonly thought to be possible.



Unbreakable

Bending conditions

Bending radius: R10 mm **R0.394 in**,
Reciprocating bending: 180°

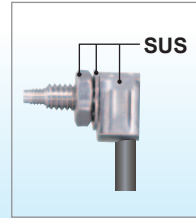


Flexible durability

10 million times
(Typical)

ECO

Stainless steel fittings are used for the fiber head of all models.



- Clearly conforms to RoHS
- Can be used for secondary batteries
- Improved tightening torque

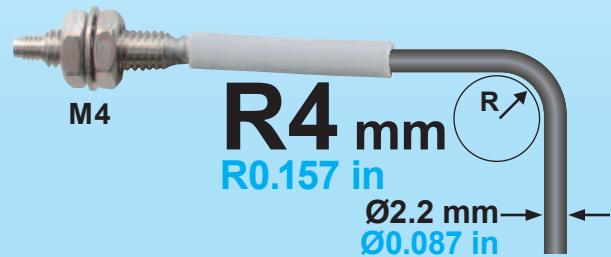
More flexible

R2 to R4 mm **R0.079 to R0.157 in**

Example: FT-31



Example: FT-42



Reduced the time in selecting fiber and in registering part numbers

For Designers

High-quality

- High-quality in whichever tough fiber you choose!
- Easy selection!
- Reduces risk of breaking and bending during installation!

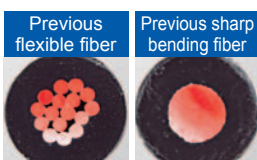
For Buyers

Low Price

- Cost savings!
- Reduced registration of part numbers!
- Reduced maintenance time in keeping stocks and replacement!

Reduced variation in detection

Beams at the fiber aperture are uniform, leading to stable sensing.



Generally flexible fibers and sharp bending fibers are composed of multiple fiber cores, often resulting in large variations in light intensity.



The new standard fiber is composed of a single fiber core, achieving uniform light intensity.

- Uniform and highly accurate sensing
- Stable sensing even if the fiber is bent

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FT/FD/FR

Super Quality

- It is a fiber with superior light intensity stability and simple digital management when combined with the **FX-500** series amplifier.
- It offers stable sensing with an extremely small beam axis curvature and gap.



Digital management is simple due to small differences in body.

When connected with the **FX-500** series amplifiers, it has up to 4 times improved stability of incident light intensity compared with traditional fibers. Management is simple even when replacing amplifiers because the digital display shows the approximate value.

Emitter intensity is also stable due to few curvatures and gaps in the beam axis.

Super quality fiber

+ **FX-500 series**

"Stabilized incident light intensities"
even in multiple units



Stable emission amount within $\pm 10\%$

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

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

Expanded temperature range

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

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

1.2 times
more than
previous model

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



Single core standard fiber
with high flexibility



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

More flexible! **R4**↑

Bending radius [Previous model is $R25\text{ mm } R0.984\text{ in}$]

R4 mm
R0.157 in

1/6
of that of
previous model



Integrated high-precision plug

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

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



More bendable!

Bending durability [Previous model is 1,000 times]

10 million times
10,000 times
more than previous model

* Bending conditions
Bending radius: $R10\text{ mm } R0.394\text{ in}$,
Reciprocating bending 180°

LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in)			Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)						
Threaded	M3	Tough FT-30	R2 Bending durability	2 m	STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	135 5.315 400 15.748	ø0.5	150 µm / ±2°	±10 %	IP67	-55 to +80 °C	P.51
	M4	Tough FT-40	R4 Bending durability		STD 1,200 47.244 HYPR (R0.394) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	320 12.598 870 34.252	ø1					
Cylindrical	ø1.5	Tough FT-S20	R2 Bending durability		STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	135 5.315 400 15.748	ø0.5					P.55
	ø3	Tough FT-S30	R4 Bending durability		STD 1,200 47.244 HYPR (R0.394) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	320 12.598 870 34.252	ø1					

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

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in) (Note)			Beam axis position / Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)					
Threaded	M3	Tough FD-30	R2 Bending durability	2 m	STD 160 6.299 HYPR 600 23.622	330 12.992 250 9.843 80 3.150 25 0.984	45 1.772 155 6.102	150 µm / ±3°	±10 %	IP67	-55 to +80 °C	P.59
	M4	Tough FD-40										
	M6	Tough FD-60	R4 Bending durability		STD 520 20.472 HYPR 1,550 61.024	900 35.433 740 29.134 260 10.236 90 3.543	140 5.512 420 16.535					P.60
Cylindrical	ø3	Tough FD-S30			STD 160 6.299 HYPR 600 23.622	330 12.992 250 9.843 80 3.150 25 0.984	45 1.772 155 6.102					P.67

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

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

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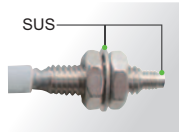
FT/FD/FR

Threaded Type

- It is a standard fiber which is mounted using nuts. It has reasonable pricing while drastically improving flexing performance.
- With the lens installable type, long distance sensing and microscopic object sensing is possible by installing a lens.
- A protective tube and a sturdy stainless jacket type that prevents disconnection are also prepared.

Stainless steel fittings are used for the fiber head of all models. 

- Clearly conforms to RoHS
- Can be used for secondary battery
- Improved mounting strength



* Some models not included (FT-140)

Coaxial type FD-□G□ in which high-precision positioning can be achieved.

It is a coaxial fiber that encloses the circumference of the emitter fiber at the center with the receiver fiber. This is suitable for high-precision positioning. It can perform sensing without affecting the approach direction of the work.



Supports spot lenses and zoom lenses!



FT-42

<Thru-beam type> FT-31/31W/43/42/42W FT-45X/R40

<Reflective type> FD-31/41/62/61/R60

More user-friendly, high quality fiber

Improved centering accuracy

The beam axis deviation of each unit is kept within $\pm 3^\circ$ and the beam axis centering accuracy is kept within $\pm 150 \mu\text{m}$.

(Within $\pm 5^\circ$ and $\pm 90 \mu\text{m}$ for ultra small diameter fibers)

- Makes beam axis adjustment easier
- Improves mounting hole machining accuracy
- Improves sensing accuracy



Improved specularity






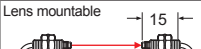
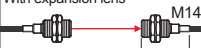





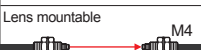
High precision polishing is accomplished by using the PCTC polishing technique.

The specularity of the end face of the fiber is 5 times greater.

- Light intensity is increased, enabling stable sensing.

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Thru-beam type (one pair set)

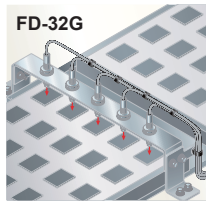
Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ☞ : Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimension
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)					
Threaded	M3	 Tough FT-31	R2 Bending durability		STD 315 12.402 HYPR 1,350 53.150	770 30.315 550 21.654 210 8.268 70 2.756	130 5.118 340 13.386	ø0.5	IP67	—	-55 to +80 °C	P.51
		FT-31W	R1		STD 260 10.236 HYPR 990 38.976	590 23.228 440 17.323 150 5.906 53 2.087	80 3.150 240 9.449					
		FT-43	R4 Bending durability		STD 1,400 55.118 HYPR (Note2) 3,600 141.732	2,800 110.236 2,100 82.677 770 30.315 240 9.449	350 13.780 970 38.189					
		Tough FT-42	R4		STD 1,130 44.488 HYPR (Note2) 3,600 141.732	2,050 80.709 1,600 62.992 530 20.866 190 7.480	300 11.811 800 31.496					
	M4	 Tough FT-42W	R1		STD 800 31.496 HYPR 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299	260 10.236 720 28.346	ø1	IP67	—	-40 to +60 °C	P.52
		 Tough FT-45X	R4		STD 1,200 47.244 HYPR (Note2) 1,600 62.992	1,600 62.992 (Note 2) 1,600 62.992 (Note 2) 630 24.803 200 7.874	340 13.386 920 36.220					
		 Tough FT-R40	R4		STD 930 36.614 HYPR (Note2) 3,600 141.732	1,750 68.898 1,500 59.055 500 19.685 160 6.299	270 10.630 740 29.134					
		 Tough FT-140	R4		STD (Note2) 19,600 771.654 HYPR (Note2) 19,600 771.654	19,600 771.654 (Note 2) 19,600 771.654 (Note 2) 16,000 629.921 6,300 248.031	14,000 551.181 19,600 771.654 (Note 2)					
	Elbow	 Tough FT-R40	R4		STD 930 36.614 HYPR (Note2) 3,600 141.732	1,750 68.898 1,500 59.055 500 19.685 160 6.299	270 10.630 740 29.134	ø1	IP67	—	-40 to +70 °C	P.51
		 Tough FT-140	R4		STD (Note2) 19,600 771.654 HYPR (Note2) 19,600 771.654	19,600 771.654 (Note 2) 19,600 771.654 (Note 2) 16,000 629.921 6,300 248.031	14,000 551.181 19,600 771.654 (Note 2)					
	Long range	 Tough FT-140	R4		STD (Note2) 19,600 771.654 HYPR (Note2) 19,600 771.654	19,600 771.654 (Note 2) 19,600 771.654 (Note 2) 16,000 629.921 6,300 248.031	14,000 551.181 19,600 771.654 (Note 2)	ø10	IP67	—	-40 to +70 °C	P.51
		 Tough FT-140	R4		STD (Note2) 19,600 771.654 HYPR (Note2) 19,600 771.654	19,600 771.654 (Note 2) 19,600 771.654 (Note 2) 16,000 629.921 6,300 248.031	14,000 551.181 19,600 771.654 (Note 2)					

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

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

Application

Detecting a presence of a workpiece



FIBER OPTIONS

Lens

(For thru-beam type fiber)

►P.45

Lens

(For reflective type fiber)

►P.46

Protective tube►P.48


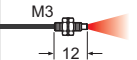


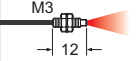

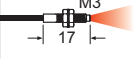


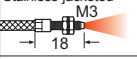

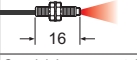

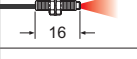



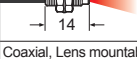

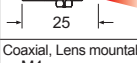


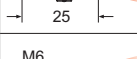

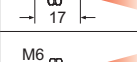

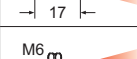
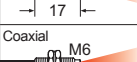









•FTP-□

•FDP-□



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Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  Free-cut	Sensing range (mm in) (Note 1, 2)			Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)					
M3		Tough FD-31	 R2 Bending durability	 2 m	STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	35 1.378 140 5.512	150 μm / ±3°	IP67	-55 to +80 °C	P.59	
		FD-31W	 R1		STD 80 3.150 HYPR 330 12.992	180 7.087 140 5.512 45 1.772 12 0.472	15 0.591 60 2.362	—		-40 to +60 °C		
		Tough FD-32G	 R2 Bending durability	 1 m (Note 3)	STD 200 7.874 HYPR 650 25.591	380 14.961 270 10.630 95 3.740 27 1.063	70 2.756 190 7.480	—	IP40	-55 to +80 °C	P.61	
		FD-32GX	 R2		STD 200 7.874 HYPR 630 24.803	410 16.142 360 14.173 100 3.937 30 1.181	75 2.953 210 8.268	—		-40 to +70 °C		
		FD-EG30	 R4		STD 48 1.890 HYPR 170 6.693	130 5.118 110 4.331 30 1.181 9 0.354	20 0.787 70 2.756	—		-20 to +60 °C		P.62
		FD-EG31			STD 20 0.787 HYPR 85 3.346	45 1.772 35 1.378 12 0.472 3.5 0.138	7 0.276 25 0.984	—		-20 to +60 °C		P.62
Threaded M4		Tough FD-41	 R2 Bending durability	 2 m	STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	35 1.378 140 5.512	150 μm / ±3°	IP67	-55 to +80 °C	P.59	
		FD-41W	 R1		STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	80 3.150 230 9.055	—		-40 to +60 °C		
		Tough FD-42G	 R2 Bending durability	 2 m	STD 200 7.874 HYPR 650 25.591	380 14.961 270 10.630 95 3.740 27 1.063	70 2.756 190 7.480	—	IP40	-55 to +80 °C	P.60	
		FD-42GW	 R1		STD 150 5.906 HYPR 670 26.378	340 13.386 280 11.024 90 3.543 25 0.984	45 1.772 140 5.512	—		-40 to +60 °C		
		FD-62	 R4 Bending durability		STD 520 20.472 HYPR 1,500 59.055	1,000 39.370 940 37.008 340 13.386 110 4.331	170 6.693 450 17.717	150 μm / ±3°		-55 to +80 °C		P.60
		FD-61		Tough	STD 450 17.717 HYPR 1,400 55.118	840 33.071 670 26.378 200 7.874 70 2.756	120 4.724 410 16.142	—	-40 to +60 °C	P.61		
M6		FD-61W	 R1	 2 m	STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	80 3.150 230 9.055	—	IP40	-55 to +80 °C	P.66	
		FD-61G	 R4 Bending durability		STD 420 16.535 HYPR 1,100 43.307	800 31.496 650 25.591 200 7.874 60 2.362	120 4.724 350 13.780	—		-55 to +80 °C		
		FD-64X	 R4		STD 280 11.024 HYPR 670 26.378	500 19.685 410 16.142 160 6.299 50 1.969	75 2.953 220 8.661	—		-55 to +80 °C		P.61
Elbow		Tough FD-R60	 R4 Bending durability	 2 m	STD 290 11.417 HYPR 1,100 43.307	600 23.622 550 21.654 190 7.480 65 2.559	110 4.331 240 9.449	150 μm / ±3°	IP67			

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

2) The sensing range is specified for white non-glossy paper.

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

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

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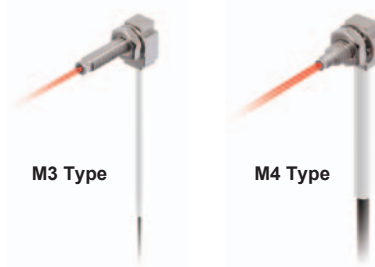
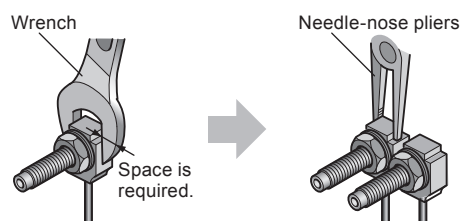
FT/FD/FR

Square Head Type

- Compact, space-saving design brings clean installation on the side of a conveyor belt.
- As for lens compatible type fiber head, sensing range becomes longer when a lens is attached to the thru-beam type fiber, spot detection is achieved in case of the reflective type.
- A lens equipped type fiber head is also available.
- Oil resistant type is also available. Please refer to p.31

Compact, space-saving

Fiber can be installed at a minimum pitch of M3: 6.5 mm **0.256 in** or M4: 8.5 mm **0.335 in** using needle-nose pliers.



Compact installation

Square head fiber heads can be installed cleanly on the side of a conveyor belt. The design makes it less likely for tools and other objects to catch on the fiber cable during installation.

FT-R□ / FD-R□



Standard fiber



Introducing square R1 mm (R0.039 in) (sharp bending) fiber

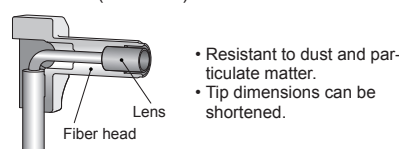
FT-R41W/R42W

We now offer a sharp bending fiber featuring a low level of light fluctuations, even when bent at R1 mm **R0.039 in**. It is also available with a lens capable of long-range sensing.

FT-R41W FT-R42W



FT-R42W (With lens)

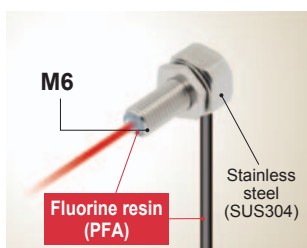


- Resistant to dust and particulate matter.
- Tip dimensions can be shortened.

Full-protection type

High environmental resistance

The head, nut, and washer are made from rust-resistant SUS304. The unbreakable tough fiber with high durability is covered in a fluorine resin tube. The fiber head is also covered with a fluorine resin component, achieving a high level of environmental resistance.



Less susceptibility to oil adhesion thanks to fluorine resin

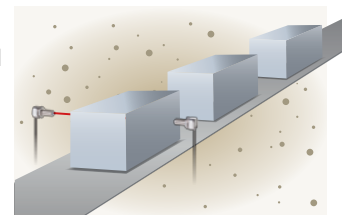
Fibers deliver stable detection, since the sensing part is sealed with fluorine resin, which does not allow oil penetration. Additionally, the detection part features a convex design made of fluorine resin, achieving lower friction than glass.



FT-R60Y (Square head type M6 / thru-beam type)

Resistant to oil and coolant

The fiber head and fiber cable are connected by the "fastening and caulking" method without using adhesives. This method eliminates concerns that adhesives will absorb moisture in high-humidity environments and damage the fiber. The enclosure achieves IP68G protection, so the fiber can be installed around metal processing machines shrouded in the oil mist.

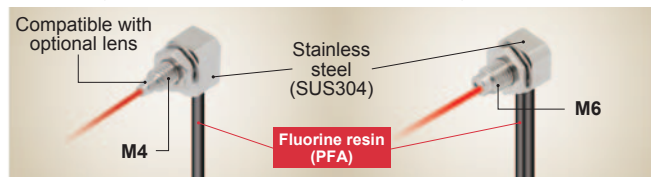


Test oil	Product
Lubricating oil	Velocite Oil No. 3
Non-water-soluble cutting oil	Yushiron Cut Abas KZ201 Yushiron Cut UH75
Water-soluble cutting oil	Syntilo 9954 (10% diluted) Yushiroken S50N (2% diluted)
Alcohol-based neutral detergent	Super Teepol

*Yushiron and Yushiroken are registered trademarks of Yushiro Chemical Industry Co., Ltd.

Cable-protection type

FT-R44Y / FD-R61Y
FT-R44Y (Square head type M4 / thru-beam type)

FD-R61Y (Square head type M6 / reflective type)


Even stronger than tough fiber

The tough fiber has been reinforced by covering it with a fluorine resin tube so that it can be used even in harsh environments where oils and solvents are used. The fiber cable will not harden or break, even if it is splashed with oil.


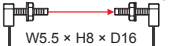






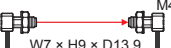





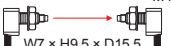


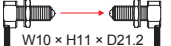


Protective structure IP67

The head, nut, and washer are made from rust-resistant SUS304.
























LIST OF FIBERS

Thru-beam type (one pair set)

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions
						FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Square head	M3	 W5.5 × H8 × D16	Tough FT-R31	R2 Bending durability	 2m	STD  270 10.630 HYPR  1,000 39.370	580 22.835 440 17.323 160 6.299 55 2.165	100 3.937 340 13.386	ø0.5	IP67	-55 to +80 °C	P.54
	M4	Lens mountable  W7 × H9 × D13.5	Tough FT-R43	R4 Bending durability		STD  720 28.346 HYPR  3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118	210 8.268 640 25.197	ø1			
		 W7 × H9 × D13.9	FT-R41W	R1		STD  800 31.496 HYPR  3,200 125.984	1,800 70.866 1,400 55.118 460 18.110 150 5.906	250 9.843 710 27.953	IP40	-40 to +60 °C		
		With expansion lens  W7 × H9 × D14.4	FT-R42W			STD  2,200 86.614 HYPR  (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,500 137.795 1,300 51.181 460 18.110	510 20.079 2,000 78.740			ø2.2	
		Cable-protection type Compatible with lens  W7 × H9.5 × D15.5	Tough NEW FT-R44Y	R4		STD  720 28.346 HYPR  3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118	210 8.268 640 25.197	ø1	IP67 (Note 3)	-55 to +80 °C	P.55
	M6	Full-protection type  W10 × H11 × D21.2	Tough NEW FT-R60Y	Bending durability		STD  2,100 82.677 HYPR  (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,260 49.606 400 15.748	690 27.165 1,890 74.409	ø3.5	IP68G		

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range. 3) The fiber part is oil-resistant.

Reflective type

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  : Free-cut	Sensing range (mm in) (Note 1, 2)			Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions
						FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Square head	M3	Coaxial, Lens mountable  W5.5 × H8 × D16	Tough FD-R31G	R2 Bending durability	 2m	STD  170 6.693 HYPR  530 20.866	310 12.205 260 10.236 85 3.346 27 1.063	45 1.772 150 5.906	Emitter ø0.5	IP40	-55 to +80 °C	P.66
		Coaxial, Lens mountable  W5.5 × H8 × D16	FD-R32EG	R4	500 mm	STD  45 1.772 HYPR  170 6.693	110 4.331 92 3.622 30 1.181 9 0.354	20 0.787 68 2.677	Emitter ø0.25			
		Coaxial, Lens mountable  W5.5 × H8 × D16	FD-R34EG			STD  38 1.496 HYPR  130 5.118	90 3.543 70 2.756 23 0.906 7 0.276	17 0.669 60 2.362	Emitter ø0.175		-20 to +60 °C	
		Coaxial, Lens mountable  W5.5 × H8 × D16	FD-R33EG			STD  19 0.748 HYPR  84 3.307	44 1.732 33 1.299 11 0.433 3 0.118	7 0.276 22 0.866	Emitter ø0.125			
	M4	 W7 × H9 × D13.5	Tough FD-R41	R2 Bending durability	 2m	STD  210 8.268 HYPR  710 27.953	430 16.929 320 12.598 100 3.937 34 1.339	60 2.362 170 6.693	ø0.75	IP67	-55 to +80 °C	
	M6	Cable-protection type  W10 × H11 × D15.5	Tough NEW FD-R61Y	R4 Bending durability	2m	STD  280 11.024 HYPR  990 38.976	610 24.016 435 17.126 160 6.299 50 1.969	85 3.346 185 7.283	—	IP67 (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 sensing range is specified for white non-glossy paper. 3) The fiber part is oil-resistant.

FIBER OPTIONS

Lens (For thru-beam type fiber) ▶ P.45



Lens (For square head M3 reflective fiber) ▶ P.46



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

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Cylindrical Type

- Has a slender shape which can be mounted in narrow locations using set screws.
- Line up that includes ultra-thin fibers with $\phi 0.25$ mm $\phi 0.010$ in tips.



<Thru-beam type> FT-S21/S21W/S31W

<Reflective type> FD-S32/S31




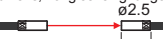

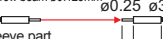

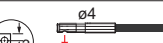
- User-friendly, high quality fiber
- Improved centering accuracy and specularity

Stainless steel fittings are used for the fiber head of all models.

- Clearly conforms to RoHS
- Can be used for secondary battery
- Improved mounting strength

LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)					
Cylindrical	$\phi 1$ 	Tough FT-S11	R2	500 mm	STD 90 3.543 HYPR 350 13.780	210 8.268 160 6.299 60 2.362 19 0.748	40 1.575 90 3.543	$\phi 0.25$	—	IP67	-55 to +80 °C	P.55
	$\phi 1.5$ 	Tough FT-S21	Bending durability	2 m	STD 315 12.402 HYPR 1,350 53.150	770 30.315 550 21.654 210 8.268 70 2.756	130 5.118 340 13.386	$\phi 0.5$	150 μ m / $\pm 2^\circ$			
	$\phi 1.5$ 	FT-S21W			R1	STD 260 10.236 HYPR 990 38.976	590 23.228 440 17.323 150 5.906 53 2.087		80 3.150 240 9.449	150 μ m / $\pm 3^\circ$	-40 to +60 °C	
	$\phi 2.5$ 	FT-S32	R10	Bending durability	STD 3,100 122.047 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,800 70.866 600 23.622	1,100 43.307 3,000 118.110	$\phi 2$	—	IP40	-40 to +70 °C	
	$\phi 3$ 	FT-S31W	R1	2 m	STD 800 31.496 HYPR 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299	260 10.236 720 28.346	$\phi 1$	150 μ m / $\pm 3^\circ$	-40 to +60 °C		
Ultra-small diameter	$\phi 0.3$ 	Tough FT-E13	R2	1 m	STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	6 0.236 19 0.748	$\phi 0.125$	—	IP67	-40 to +70 °C	P.52
	$\phi 0.3$ 	Tough FT-E23	Bending durability	1 m	STD 75 2.953 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512	22 0.866 80 3.150	$\phi 0.25$	—			
	$\phi 4$ 	Tough FT-V40			R4	2 m	STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 850 33.465	1,000 39.370 3,100 122.047	$\phi 2.5$	—	

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

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

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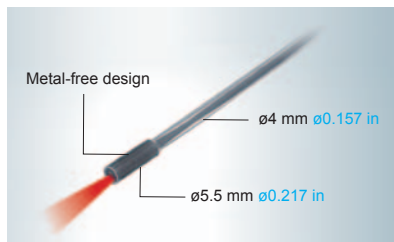
Full-protection type

FD-S60Y (Cylindrical type / reflective type)

Metal-free

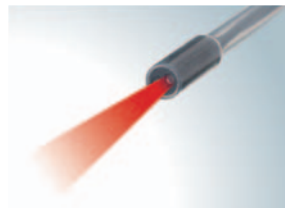
Metal-free design

Since no metal components are used, there is no need to worry about metal contamination, even if the protective tube is damaged. It is ideal for use in applications such as semiconductor front-end equipment where a clean environment is required.



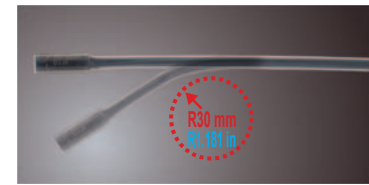
Detection in long range and narrow view

A built-in lens achieves narrow-view detection with an aperture angle of 30 degrees.


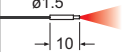


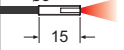







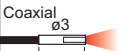


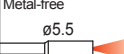



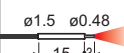


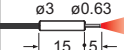




Improved tip flexibility

The protective tube features a bending radius of R30 mm R1.181 in, which improved the cable arrangement compared to previous (R40 mm R1.575 in) designs.



Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  Free-cut	Sensing range (mm in) (Note 1, 2)			Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Cylindrical	ø1.5 	Tough FD-S21	R2 Bending durability	1 m	STD  80 3.150 HYPR  190 7.480	130 5.118 110 4.331 37 1.457 11 0.433	25 0.984 70 2.756	—	IP40	-55 to +80 °C	P.66
	ø3 	Tough FD-S32	R4 Bending durability	 2 m	STD  420 16.535 HYPR  1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953	120 4.724 345 13.583	150 µm / ±3°	IP67		-40 to +60 °C
		FD-S32W	R1		STD  270 10.630 HYPR  900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	80 3.150 230 9.055	—			
		Tough FD-S31	R2 Bending durability		STD  125 4.921 HYPR  515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	35 1.378 140 5.512	150 µm / ±3°			
		Coaxial ø3 	FD-S33GW		R1	STD  150 5.906 HYPR  670 26.378	340 13.386 280 11.024 90 3.543 25 0.984	45 1.772 140 5.512		—	
	ø5.5 	Tough NEW FD-S60Y	Protective tube R30 mm Fiber R4 Bending durability	 2 m (Note 3)	STD  320 12.598 HYPR  600 23.622	590 23.228 420 16.535 200 7.874 75 2.953	140 5.512 300 11.811	—	IP68G	-40 to +70 °C	P.61
Ultra-small diameter	ø1.5  Sleeve part cannot be bent.	FD-E13	R4	1 m	STD  12 0.472 HYPR  50 1.969	29 1.142 25 0.984 7 0.276 2 0.079	5 0.197 15 0.591	—	IP40		
	ø3  Sleeve part cannot be bent.	FD-E23		STD  55 2.165 HYPR  170 6.693	120 4.724 80 3.150 30 1.181 9 0.354	20 0.787 70 2.756	—				

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

2) The sensing range is specified for white non-glossy paper.

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

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

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Sleeve

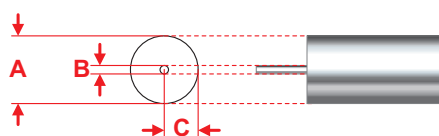
- It is suitable for sensing in narrow locations and sensing minute objects because the fiber tip is a thin sleeve.
- The 40 mm 1.575 in sleeve type can be bent in any direction.



<Thru-beam type> FT-E13 / FT-E23 Ultra-small diameter fiber

Centering accuracy of 1/10 mm or less

Ultra-small diameter fibers with a compact head ensure precision centering accuracy* to stably detect minute parts.



* Tolerance of A + Tolerance of B + Tolerance of C = $\pm 0.09 \text{ mm } \pm 0.004 \text{ in}$

Dimensions UNCLEAR

Previous general fiber

Dimensions unclear

Screw

Dimensions unclear

Extra clearance needs to be added when designing and machining the mounting hole due to unclear dimensions. As a result, mounting variation increases and the beam axis deviates, resulting in a decrease in sensing accuracy or causing the sleeve to bend or break.

Dimensions CLEAR

Example: FT-E13

New standard fiber

$\phi 0.5 \text{ mm } \begin{smallmatrix} +0.05 \\ -0 \end{smallmatrix} \begin{smallmatrix} +0.002 \\ 0 \end{smallmatrix}$

$\phi 0.118 \text{ in } \begin{smallmatrix} +0.002 \\ 0 \end{smallmatrix}$

Screw

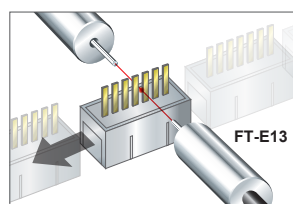
$\phi 3 \text{ mm } \begin{smallmatrix} +0.05 \\ -0 \end{smallmatrix} \begin{smallmatrix} +0.002 \\ 0 \end{smallmatrix}$

Dimensions clear

Highly accurate design and machining are possible due to clear mounting hole dimensions. As a result, mounting variation is minimal, improving sensing accuracy. In addition to this, as the beam axis alignment is not affected when the fiber is changed, readjustment is not necessary.

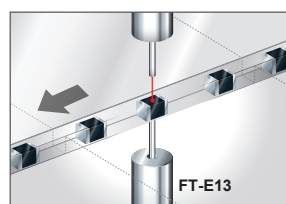
Minute sensing only possible with ultra small fiber

Detection of fine-pitch connector pins



Ultra-small diameter fiber with $\phi 0.125 \text{ mm } \phi 0.005 \text{ in}$ beam axis is able to detect the insertion or bending of fine-pitch connector pins.

Detection of tiny chips

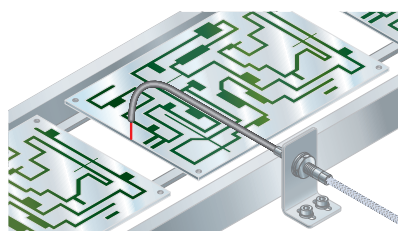


Fiber can be installed with only the $\phi 0.25 \text{ mm } \phi 0.010 \text{ in}$ sleeve close to the minute section.

Stainless steel fittings are used for the fiber head of all models.

- Clearly conforms to RoHS
- Can be used for secondary battery
- Improved mounting strength

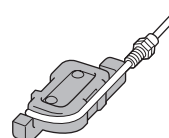
Application



FIBER OPTION

Fiber bender

·FB-1

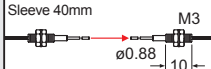
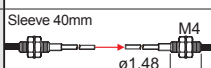
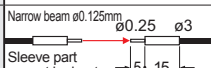
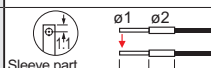
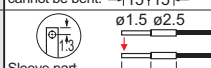


The fiber bender bends the sleeve part of the fiber head at the proper radius.

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

LIST OF FIBERS

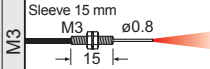
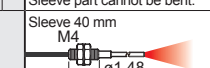
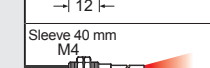
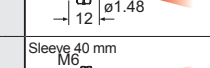
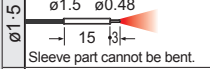
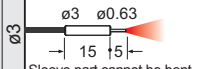
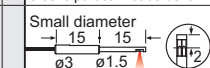
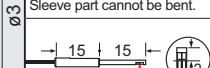
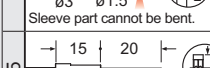
Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)			Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Threaded	M3 	Tough FT-31S	R2 Bending durability (Note 3)	2 m	STD 315 12.402 HYPR 1,220 48.031	740 29.134 550 21.654 195 7.677 63 2.480	130 5.118 340 13.386	ø0.5	IP67	-55 to +80 °C	P.51
	M4 	Tough FT-42S	R4 Bending durability (Note 3)		STD 1,130 44.488 HYPR 3,600 141.732	2,050 80.709 1,600 62.992 530 20.866 190 7.480	300 11.811 800 31.496	ø1			
Cylindrical	Ultra-small diameter ø3 	Tough FT-E13	R2 Bending durability	1 m	STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	6 0.236 19 0.748	ø0.125	IP67	-40 to +70 °C	P.52
		Tough FT-E23	R2 Bending durability		STD 75 2.953 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512	22 0.866 80 3.150	ø0.25			
	Side-view ø2 	Tough FT-V23	R4 Bending durability	2 m	STD 450 17.717 HYPR 1,800 70.866	1,000 39.370 880 34.646 280 11.024 90 3.543	160 6.299 400 15.748	ø0.75	IP30	-55 to +80 °C	P.55
		Tough FT-V25	R2 Bending durability		STD 240 9.449 HYPR 900 35.433	550 21.654 480 18.898 140 5.512 45 1.772	95 3.740 260 10.236	ø0.5			
		Tough FT-V24W	R1		STD 110 4.331 HYPR 380 14.961	230 9.055 200 7.874 60 2.362 20 0.787	35 1.378 90 3.543			-40 to +60 °C	P.56
		Tough FT-V30	R4 Bending durability		STD 680 26.772 HYPR 2,200 86.614	1,200 47.244 1,000 39.370 340 13.386 100 3.937	180 7.087 480 18.898				
	ø2.5 										

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

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

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)			Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
Threaded	Ultra-small diameter M3 	FD-EG30S	R4	1 m	STD 50 1.969 HYPR 170 6.693	110 4.331 80 3.150 30 1.181 9 0.354	20 0.787 70 2.756	IP40	-40 to +70 °C	P.62
	M4 	Tough FD-41S	R2 Bending durability (Note 3)	2 m	STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	35 1.378 140 5.512	IP67	-55 to +80 °C	P.59
	M4 	FD-41SW	R1 (Note 3)		STD 80 3.150 HYPR 330 12.992	180 7.087 140 5.512 45 1.772 12 0.472	15 0.591 60 2.362		-40 to +60 °C	
	M6 	Tough FD-61S	R4 Bending durability (Note 3)	2 m	STD 420 16.535 HYPR 1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953	130 5.118 360 14.173	IP67	-55 to +80 °C	P.60
Cylindrical	Ultra-small diameter ø1.5 	FD-E13	R4	1 m	STD 12 0.472 HYPR 50 1.969	29 1.142 25 0.984 7 0.276 2 0.079	5 0.197 15 0.591	IP40	-40 to +60 °C	P.61
	ø3 	FD-E23	R4		STD 55 2.165 HYPR 170 6.693	120 4.724 80 3.150 30 1.181 9 0.354	20 0.787 70 2.756		-40 to +70 °C	
	Side-view ø3 	Tough FD-V30	R2 Bending durability	2 m	STD 65 2.559 HYPR 240 9.449	130 5.118 120 4.724 35 1.378 14 0.551	25 0.984 75 2.953	IP30	-55 to +80 °C	P.67
	ø3 	FD-V30W	R1		STD 20 0.787 HYPR 80 3.150	40 1.575 30 1.181 10 0.394 2 0.079	6 0.236 20 0.787		-40 to +60 °C	
	ø5 	Tough FD-V50	R4 Bending durability		STD 120 4.724 HYPR 370 14.567	220 8.661 210 8.268 75 2.953 25 0.984	40 1.575 100 3.937		-55 to +80 °C	P.68

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

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

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

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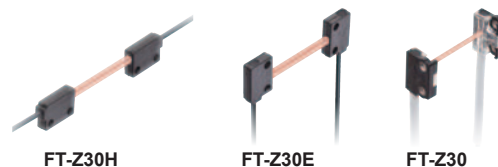
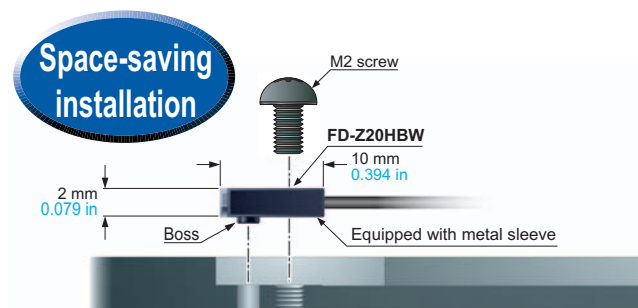
FT/FD/FR

Flat Type

■ Since it has a thin, rectangular shape, it can be installed in narrow locations. It is also a fiber with good workability and can be mounted directly with screws.

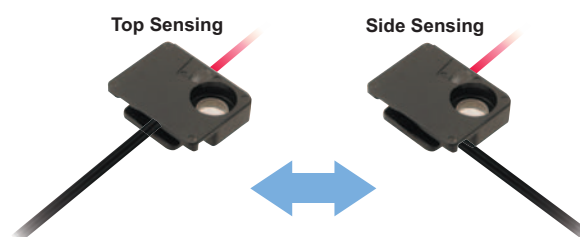
1 point mounting

The sensor can be mounted on 1 point with either M2 screw or M3 screw. Metal sleeve in the enclosure helps to be tightened firmly even with a single screw.



Fiber guide system contributes to space-saving

FT-Z□HBW and FD-Z□HBW is equipped with a fiber guide feature. This enables to mount either way of top sensing and side sensing.



LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Flat	Top sensing W3 × H8 × D12	Tough FT-Z30H	R2 Bending durability	2 m	STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 2,600 102.362 810 31.890	1,400 55.118 3,200 125.984	2 × 3	IP40	-40 to +60 °C	P.57
	Top sensing W3 × H8 × D12	FT-Z30HW	R1		STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 2,400 94.488 740 29.134	1,200 47.244 3,200 125.984				P.56
	Side sensing W3 × H12 × D8	Tough FT-Z30E	R2 Bending durability		STD 3,400 133.858 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 2,000 78.740 630 24.803	1,400 55.118 2,600 102.362				P.57
	Side sensing W3 × H12 × D8	FT-Z30EW	R1		STD 2,100 82.677 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 1,200 47.244 410 16.142	710 27.953 2,300 90.551				P.56
	Front sensing W8.5 × H12 × D3	Tough FT-Z30	R2 Bending durability		STD 1,500 59.055 HYPR (Note 2) 3,600 141.732	3,300 129.921 3,200 125.984 1,000 39.370 280 11.024	540 21.260 1,800 70.866				P.57
	Front sensing W8.5 × H12 × D3	FT-Z30W			STD 620 24.409 HYPR (Note 2) 1,600 62.992	1,500 59.055 1,100 43.307 420 16.535 130 5.118	280 11.024 730 28.740				P.56
	Fiber bending type W2 × H10 × D10	FT-Z20HBW	R1	1 m	STD 260 10.236 HYPR 1,100 43.307	670 26.378 570 22.441 180 7.087 55 2.165	100 3.937 320 12.598	ø0.5	IP67		P.56
	Front sensing W14 × H7 × D3.5	FT-Z40W		2 m	STD 1,500 59.055 HYPR (Note 2) 3,600 141.732	3,300 129.921 2,300 90.551 900 35.433 290 11.417	410 16.142 1,200 47.244	ø1.5	IP40		P.57
	Fiber bending type W3.5 × H14 × D11	FT-Z40HBW			STD 800 31.496 HYPR 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299	260 10.236 720 28.346	ø1	IP67		P.57
With boss	Front sensing W10 × H7 × D2	FT-Z20W			STD 620 24.409 HYPR (Note 2) 1,600 62.992	1,500 59.055 1,100 43.307 420 16.535 130 5.118	280 11.024 730 28.740	ø1.5			P.56

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

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

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


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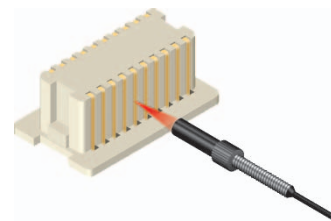
Reflective type

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂ : Free-cut	Sensing range (mm in) (Note 1, 2)			Protection	Ambient temp.	Dimensions
						FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
Flat	With boss	Front sensing  W10 × H7 × D2	FD-Z20W	R1	 1 m	STD 1 to 65 0.039 to 2.559 HYPR 260 10.236	150 5.906 130 5.118 2 to 45 0.079 to 1.772 5 to 13 0.197 to 0.512	2 to 32 0.079 to 1.260 1 to 80 0.039 to 3.150	IP40	-40 to +60 °C	P.68
		Fiber bending type  W2 × H10 × D10	FD-Z20HBW			STD 2 to 85 0.079 to 3.346 HYPR 1 to 340 0.039 to 13.386	1 to 210 0.039 to 8.268 1 to 180 0.039 to 7.087 2 to 55 0.079 to 2.165 3 to 15 0.118 to 0.591	2 to 30 0.079 to 1.181 1 to 90 0.039 to 3.543	IP67		
		Front sensing  W14 × H7 × D3.5	FD-Z40W		 2 m	STD 190 7.480 HYPR 790 31.102	440 17.323 390 15.354 1 to 120 0.039 to 4.724 2 to 35 0.079 to 1.378	1 to 74 0.039 to 2.913 200 7.874	IP40		
		Fiber bending type  W3.5 × H14 × D11	FD-Z40HBW			STD 260 10.236 HYPR 760 29.921	540 21.260 470 18.504 1 to 160 0.039 to 6.299 2 to 50 0.079 to 1.969	1 to 90 0.039 to 3.543 0.5 to 240 0.020 to 9.449	IP67		

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

Small Spot

■ Sensing of minute objects can be performed by combining the fiber and spot lens. The spot diameter can also be changed.



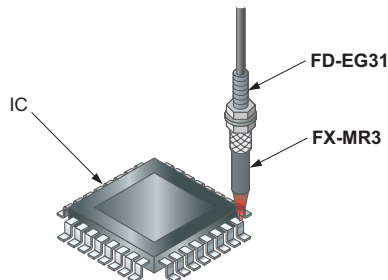
Applications

Packing detection

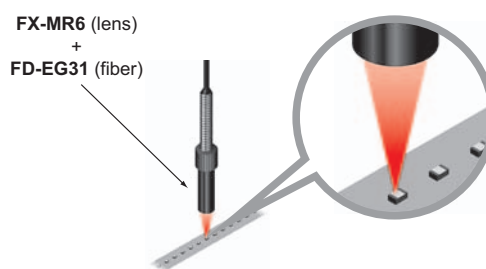


Because it's a side-view type, it can be mounted even in narrow spaces.

Number of IC pins checking



Discrimination of 0603 chip direction



Three optional lenses for reflective type fiber are available.
Perfect for chip component detection applications.

FX-MR7/MR8/MR9

Finest spot lens FX-MR7

About 3 times more light received (compared to previous models)

Since there is a large difference in the amount of light received in applications such as direction detection, it is easy to set a threshold that will allow stable detection. Additionally, these products offer an S/N ratio that is 1.3 times better than previous models.



Parallel light lens FX-MR9

Long-range parallel light

Depending on the fiber with which it is used, this lens creates parallel light with a spot diameter of approximately $\phi 4$ mm $\phi 0.157$ in at a sensing range of 0 to 30 mm 0 to 1.181 in.



Typical FX-501 erformance (STD mode)

	White	Black
FX-MR7 + FD-R33EG	3,200 digits	1,030 digits
FX-MR6 (compared to previous models) + FD-R33EG	1,000 digits	435 digits

Zoom lens FX-MR8

Variable spot diameter

Spot diameters ranging from $\phi 0.4$ to $\phi 3.5$ mm $\phi 0.016$ to $\phi 0.138$ in can be achieved by combining the lens with a variety of fibers.



All models

Tightening torque 5 times (compared to previous models)


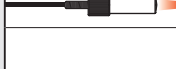


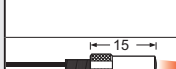
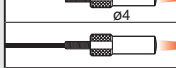

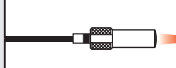



The standard aluminum body has been changed to stainless steel (SUS 303) to reduce the likelihood of damage from over-tightening.

Standard lens outer diameter of $\phi 4.3$ mm $\phi 0.169$ in














Use of the same mounting hardware across the product line means less inventory and lower costs.

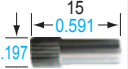
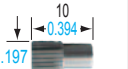
LIST OF FIBERS

High precision fiber & spot lens

Designation	Shape of head (mm) / Dimensions	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens		Applicable fibers								
				Model No.	Ambient temp.	Model No.	Fiber cable length ✂: Free-cut	Bending radius (mm)	Protection	Ambient temp.	Dimensions			
Finest spot lens		0.1 0.004	7 ±0.5 0.276 ±0.020	FX-MR6	-20 to +60 °C	FD-EG31	500 mm	R4	IP40	-20 to +60 °C	P.62			
		0.2 0.008				FD-EG30				-40 to +70 °C	P.61			
		0.4 0.016				Tough FD-42G	2 m	R2 Bending durability		-55 to +80 °C	P.60			
						FD-42GW		R1		-40 to +60 °C	P.60			
		0.4 0.016				Tough FD-32G	1 m	R2 Bending durability		-55 to +80 °C	P.59			
						FD-32GX		R2		-55 to +80 °C	P.59			
		0.15 0.006	7.5 ±0.5 0.295 ±0.020	FX-MR3	-40 to +70 °C	FD-EG31	500 mm	R4		-20 to +60 °C	P.62			
		0.3 0.012				FD-EG30				-40 to +70 °C	P.61			
		0.5 0.020				Tough FD-42G	2 m	R2 Bending durability		-55 to +80 °C	P.60			
						FD-42GW		R1		-40 to +60 °C	P.60			
	0.5 0.020				Tough FD-32G	1 m	R2 Bending durability	-55 to +80 °C		P.59				
					FD-32GX		R2	-55 to +80 °C		P.59				
Pinpoint spot lens		0.5 0.020	6 ±1 0.236 ±0.039	FX-MR1	-40 to +70 °C	Tough FD-42G	2 m	R2 Bending durability		-55 to +80 °C	P.60			
						FD-42GW		R1		-40 to +60 °C	P.60			
Zoom lens		0.7 to 2.0 0.028 to 0.079	18.5 to 43 approx. 0.728 to 1.693 approx.	FX-MR2	-40 to +70 °C	Tough FD-42G	2 m	R2 Bending durability		-55 to +80 °C	P.60			
						FD-42GW		R1		-40 to +60 °C	P.60			
Zoom lens (Side-view type)		0.5 to 3.0 0.020 to 0.118	13 to 30 approx. 0.512 to 1.181 approx.	FX-MR5	-40 to +70 °C	Tough FD-42G	2 m	R2 Bending durability	-55 to +80 °C	P.60				
						FD-42GW		R1	-40 to +60 °C	P.60				

Square head type M3, Reflective type fiber & spot lens

Type	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens		Fiber		
			Shape (mm in) / Dimensions	Model No.	Shape	Emitting fiber core (mm in)	Model No.
Finest spot lens	0.1 0.004 approx.	7 ±0.5 0.276 ±0.020		FX-MR7		0.125 0.005	FD-R33EG
	0.15 0.006 approx.					0.125 0.005	FD-EG31
	0.2 0.008 approx.					0.175 0.007	FD-R34EG
	0.4 0.016 approx.					0.25 0.010	FD-R32EG
						0.25 0.010	FD-EG30
						0.5 0.020	FD-R31G
						0.5 0.020	FD-32G
						0.5 0.020	FD-32GX
						0.5 0.020	FD-42G
						0.5 0.020	FD-42GW
						0.5 0.020	FD-42G
						0.5 0.020	FD-42GW

Type	Spot diameter (mm in) (Note)	Sensing range (mm in) (Note)	Lens		Applicable fibers	
			Shape (mm in)	Model No.	Emitting fiber core (mm in)	Model No.
Zoom lens	0.4 to 2.0 0.016 to 0.079 approx.	10 to 30 0.394 to 1.181		FX-MR8	0.125 0.005	FD-R33EG, FD-EG31
	0.4 to 2.2 0.016 to 0.087 approx.				0.175 0.007	FD-R34EG
	0.5 to 2.5 0.020 to 0.098 approx.				0.25 0.010	FD-R32EG, FD-EG30
	0.8 to 3.5 0.031 to 0.138 approx.				0.5 0.020	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW
Parallel light lens	0.4 to 2.0 0.016 to 0.079 approx.	0 to 30 0 to 1.181		FX-MR9	0.125 0.005	FD-R33EG, FD-EG31
	0.4 to 2.2 0.016 to 0.087 approx.				0.175 0.007	FD-R34EG
	0.5 to 2.5 0.020 to 0.098 approx.				0.25 0.010	FD-R32EG, FD-EG30
	0.8 to 3.5 0.031 to 0.138 approx.				0.5 0.020	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW

Note: Spot diameter, distance to focal point and sensing range are specified for FX-500 / FX-100 series.

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

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Narrow Beam

■ Since the beam is narrow, it has a feature by which it is not easily affected by surrounding obstacles even in long distances.

Applications

Detection of a transparent tube



FR-KZ50H

Mapping of a wafer



FT-KV40

Detection of a wafer



FR-KZ22E

LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)					
Narrow beam Side-view	Aperture angle 2° 	Tough FT-KS40	R2	2 m	STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244	2,200 86.614 3,600 141.732 (Note 2)	ø2.2	—	IP40		
	Aperture angle 2° ø4 	Tough FT-KV40	Bending durability		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244	2,200 86.614 3,600 141.732 (Note 2)	ø2.5	±0.8°	IP30	-40 to +60 °C	P.54
	Aperture angle 2° ø4 	FT-KV40W	R1		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,100 122.047 940 37.008	2,200 86.614 3,600 141.732 (Note 2)	ø2.5	±0.8°	IP30	-40 to +60 °C	P.54
	Aperture angle 3° 1.5 × 2 	Tough FT-KV26	R2		STD (Note 2) 710 27.953 HYPR (Note 2) 2,500 98.425	1,600 62.992 1,200 47.244 440 17.323 160 6.299	135 5.315 560 22.047	ø1	X ±1° Z ±0.5°			

Retroreflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length : Free-cut	Sensing range (mm in) (Note 1, 3)			Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
With polarizing filter	 W5.2 × H9.5 × D16 W30 × H30 × D0.5	FR-Z50HW	R1	2 m	STD 100 to 990 3.937 to 38.976 HYPR 100 to 1,900 3.937 to 74.803	100 to 1,400 3.937 to 55.118 100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291	100 to 550 3.937 to 21.654 100 to 830 3.937 to 32.677	IP40	-25 to +55 °C	P.58
Wafer mapping	 W7.5 × H2.2 × D11.2 Aperture angle 3° W4 × H2 × D21.5	Tough FR-KZ22E	R2		STD 15 to 310 0.591 to 12.205 HYPR 15 to 570 0.591 to 22.441	15 to 460 0.591 to 18.110 15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937	15 to 200 0.591 to 7.874 15 to 360 0.591 to 14.173	IP30	-40 to +60 °C	
Narrow beam	Top sensing W5.2 × H9.5 × D21 W10.6 × H28 × D10.1	Tough FR-KZ50H	Bending durability		STD 20 to 300 0.787 to 11.811 HYPR 20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874 20 to 350 0.787 to 13.780			
	Side sensing W9.5 × H25 × D5.2 W28 × H10.6 × D10.1	Tough FR-KZ50E								

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 4)			Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
Long range	W5.2 × H9.5 × D16 	FD-Z50HW	R1	2 m	STD 10 to 650 0.394 to 25.591 HYPR 10 to 2,500 0.394 to 98.425	10 to 1,100 0.394 to 43.307 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 200 0.394 to 7.874 10 to 530 0.394 to 20.866	IP40	-40 to +60 °C	P.68

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

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

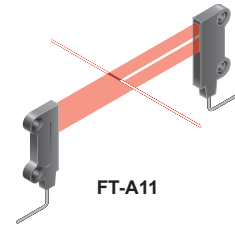
3) The sensing range is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector. Refer to p.30 or p.41 for the sensing range when FR-Z50HW is used in combination with a reflector (optional).

4) The sensing range is specified for white non-glossy paper.

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

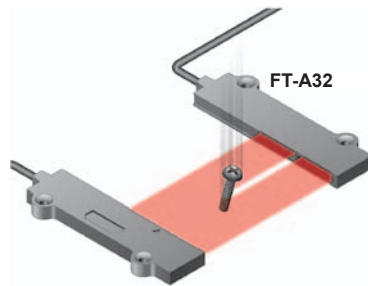
Wide Beam

■ Senses a workpiece with indefinite shape or position in the wide beam without missing. It can also be used to discriminate shape.

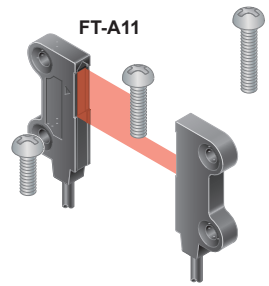


Applications

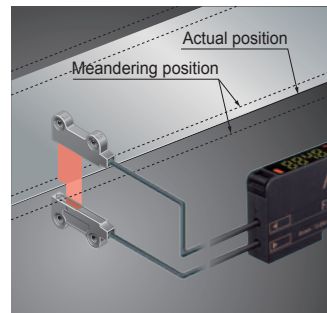
Sensing tiny moving objects



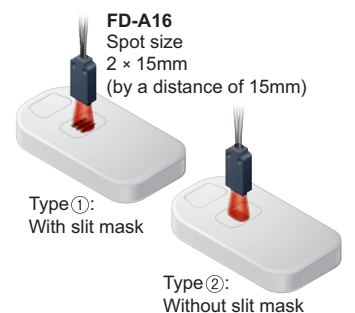
Inspecting screw height



Control the amount of meandering

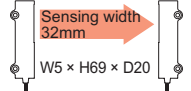
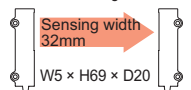
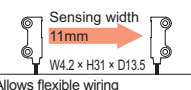
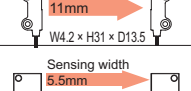
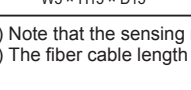


Confirming presence of slit mask



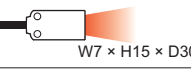
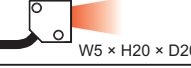
LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Wide beam	 Sensing width 32mm W5 × H69 × D20	Tough FT-A32	R2 Bending durability	2 m	STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,100 82.677	3,600 141.732 (Note 2)	3.2 × 32	IP40	-40 to +60 °C	P.52
	Allows flexible wiring  Sensing width 32mm W5 × H69 × D20	FT-A32W	R1		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,000 118.110	3,600 141.732 (Note 2)			-40 to +55 °C	
	 Sensing width 11mm W4.2 × H31 × D13.5	Tough FT-A11	R2 Bending durability		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,100 43.307	1,900 74.803 3,600 141.732 (Note 2)	2.2 × 11		-40 to +70 °C	
	Allows flexible wiring  Sensing width 11mm W4.2 × H31 × D13.5	FT-A11W	R1		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,300 51.181	1,700 66.929 3,400 133.858			-40 to +55 °C	
Array	 Sensing width 5.5mm W5 × H15 × D15	Tough FT-AL05	R2 Bending durability		STD 860 33.858 HYPR 2,300 90.551	1,550 61.024 1,500 59.055 500 19.685 170 6.693	250 9.843 660 25.984	0.25 × 5.5		-55 to +80 °C	

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

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)			Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
Wide beam	 W7 × H15 × D30	Tough FD-A16	R4 Bending durability	2 m	STD 200 7.874 HYPR Cannot use	200 7.874 140 5.512 75 2.953	120 4.724 240 9.449	IP40	-40 to +60 °C	P.61
Array	 W5 × H20 × D20	Tough FD-AL11	R2 Bending durability		STD 320 12.598 HYPR 670 26.378	530 20.866 510 20.079 180 7.087 50 1.969	100 3.937 285 11.220		-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.

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

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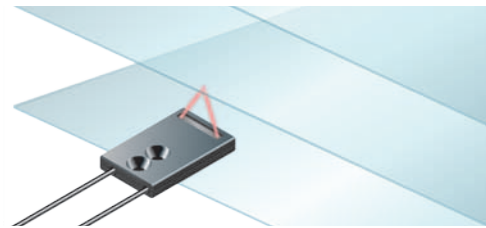
Fibers

Fiber Amplifiers

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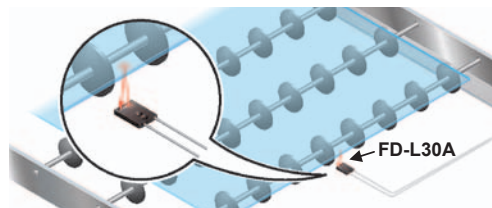
Convergent Reflective Type

It is a fiber in which the sensing distance is limited to a specific range so it is not easily affected by the background. It is effective when a workpiece is accumulated or when the background is near.

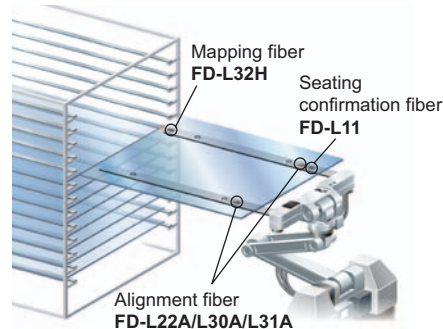


Applications

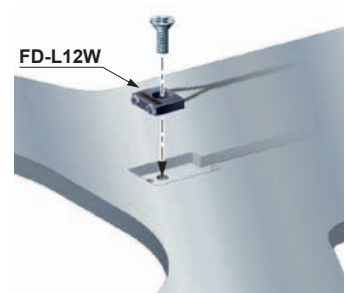
Detecting a passing glass



LCD transportation





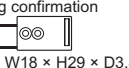








Mounting in handling arms



LIST OF FIBERS

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length (m) Free-cut	Sensing range (mm in) (Note 1, 2)			Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
Glass substrate detection	Mapping  W25 × H7.3 × D30	FD-L32H	R4 Bending durability	4 m	STD 0 to 56 0 to 2.205 HYPR 0 to 110 0 to 4.331	0 to 87 0 to 3.425 0 to 74 0 to 2.913 1 to 38 0.039 to 1.496 Cannot use	16 to 30 0.630 to 1.181 0 to 50 0 to 1.969	IP40	-40 to +60 °C	P.66
	Alignment  W20 × H29 × D3.8	Tough FD-L30A	R2 Bending durability	3 m	STD 0 to 43 0 to 1.693 HYPR 0 to 43 0 to 1.693	0 to 43 0 to 1.693 0 to 43 0 to 1.693 0 to 42 0 to 1.654 0 to 29 0 to 1.142	0 to 40 0 to 1.575 0 to 50 0 to 1.969		0 to +70 °C	P.65
	Alignment  W23.5 × H29 × D4.5	Tough FD-L31A	R4 Bending durability	3 m	STD 4 to 33 0.157 to 1.299 HYPR 3 to 35 0.118 to 1.378	4 to 33 0.157 to 1.299 4 to 33 0.157 to 1.299 4 to 32 0.157 to 1.260 5 to 25 0.197 to 0.984	5 to 30 0.197 to 1.181 4 to 33 0.157 to 1.299		0 to +70 °C	
	Alignment  W17 × H29 × D3.8	Tough FD-L22A	R2 Bending durability	2 m	STD 0 to 24 0 to 0.945 HYPR 0 to 31 0 to 1.220	0 to 28 0 to 1.102 0 to 27 0 to 1.063 0 to 24 0 to 0.945 0 to 18 0 to 0.709	0 to 19 0 to 0.748 0 to 25 0 to 0.984		-20 to +70 °C	
	Seating confirmation  W18 × H29 × D3.8	Tough FD-L23	R4 Bending durability	3 m	STD 0 to 29 0 to 1.142 HYPR 0 to 30 0 to 1.181	0 to 30 0 to 1.181 0 to 30 0 to 1.181 0 to 28 0 to 1.102 1.5 to 24 0.059 to 0.945	0 to 28 0 to 1.102 0 to 30 0 to 1.181		-20 to +70 °C	
	Seating confirmation  W12 × H19 × D3	Tough FD-L11	R4 Bending durability	3 m	STD 0 to 9.5 0 to 0.374 HYPR 0 to 11.5 0 to 0.453	0 to 10.5 0 to 0.413 0 to 10 0 to 0.394 0 to 9 0 to 0.354 0 to 8 0 to 0.315	0 to 8 0 to 0.315 0 to 9 0 to 0.354		-40 to +60 °C	
	Seating confirmation  W12 × H19 × D3	Tough FD-L10	R4 Bending durability	3 m	STD 0 to 5 0 to 0.197 HYPR 0 to 6 0 to 0.236	0 to 5.5 0 to 0.217 0 to 5.5 0 to 0.217 0 to 4.5 0 to 0.177 0 to 4 0 to 0.157	0 to 4.5 0 to 0.177 0 to 5.5 0 to 0.217		-40 to +60 °C	
	Seating confirmation  W24 × H21 × D4	Tough FD-L21	R2 Bending durability	2 m	STD 1.5 to 16 0.059 to 0.630 HYPR 1 to 19 0.039 to 0.748	1 to 18 0.039 to 0.709 1 to 18 0.039 to 0.709 2 to 15 0.079 to 0.591 3 to 12 0.118 to 0.472	3 to 15 0.118 to 0.591 1.5 to 16 0.059 to 0.630		-40 to +60 °C	
	Seating confirmation  W24 × H21 × D4	FD-L21W	R1 Bending durability	2 m	STD 3 to 14 0.118 to 0.551 HYPR 1.5 to 15 0.059 to 0.591	2 to 15 0.079 to 0.591 2 to 15 0.079 to 0.591 4 to 14 0.157 to 0.551 6.5 to 10 0.256 to 0.394	7 to 12 0.276 to 0.472 3 to 14 0.118 to 0.551		-40 to +60 °C	
	General purpose  W6 × H18 × D14	Tough FD-L20H	R2 Bending durability	2 m	STD 23 0.906 HYPR 45 1.772	35 1.378 32 1.260 2 to 15 0.079 to 0.591 5 to 9 0.197 to 0.354	5 to 15 0.197 to 0.591 1 to 30 0.039 to 1.181		-40 to +70 °C	
Ultra-small	Seating confirmation  W7.2 × H7.5 × D2	FD-L12W	R1 Bending durability	1 m	STD 8 0.315 HYPR 14 0.551	12.5 0.492 12 0.472 0.5 to 7 0.020 to 0.276 0.5 to 4 0.020 to 0.157	1 to 4.5 0.039 to 0.177 0.5 to 7 0.020 to 0.276	IP30	-40 to +60 °C	

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

2) The sensing range is specified for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in (FD-L32H: R edge, FD-L21 and FD-L21W: t2 mm 0.079 in) (FD-L20H: white non-glossy paper, FD-L10: silicon wafers 100 × 100 mm 3.937 × 3.937 in).

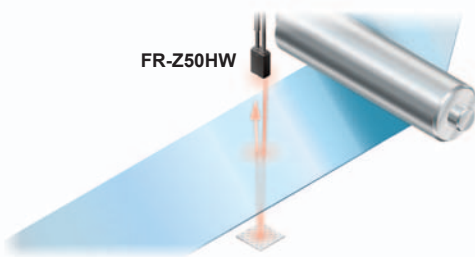
Tough: Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

Retroreflective Type

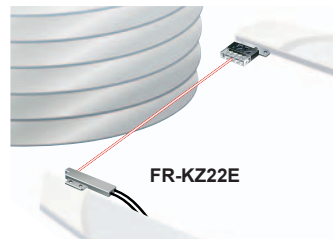
Compared with the thru-beam type, it is easier to arrange the fibers since one side is a reflector. Sensing transparent objects is also its advantage.

Applications

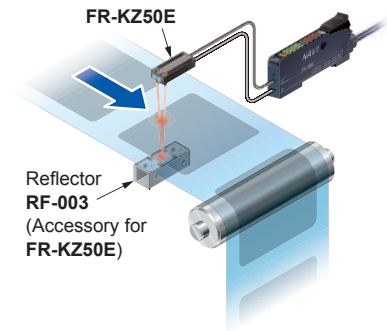
Detecting transparent film



Detecting wafers



Detecting transparent seals on transparent sheet



LIST OF FIBERS

Retroreflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)			Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
With polarizing filters	W5.2 × H9.5 × D16 W30 × H30 × D0.5	FR-Z50HW	R1		STD 100 to 990 3.937 to 38.976 HYPR 100 to 1,900 3.937 to 74.803	100 to 1,400 3.937 to 55.118 100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291	100 to 550 3.937 to 21.654 100 to 830 3.937 to 32.677	IP40	-25 to +55 °C	
Wafer mapping	W7.5 × H2.2 × D11.2 Aperture angle 3° (emitter) W4 × H2 × D21.5	Tough FR-KZ22E	R2	2 m	STD 15 to 310 0.591 to 12.205 HYPR 15 to 570 0.591 to 22.441	15 to 460 0.591 to 18.110 15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937	15 to 200 0.591 to 7.874 15 to 360 0.591 to 14.173	IP30	-40 to +60 °C	P.58
Narrow beam	W5.2 × H9.5 × D21 W10.6 × H28 × D10.1	Tough FR-KZ50H			STD 20 to 300 0.787 to 11.811 HYPR 20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874 20 to 350 0.787 to 13.780			
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-500 series						FX-101	FX-102
	HYPR	U-LG	LONG	STD	FAST	H-SP		
RF-230	100 to 19,000 3.937 to 748.030	100 to 8,000 3.937 to 314.960	100 to 5,000 3.937 to 196.850	100 to 3,600 3.937 to 141.732	100 to 2,900 3.937 to 114.173	100 to 1,400 3.937 to 55.118	100 to 2,400 3.937 to 94.488	100 to 5,000 3.937 to 196.850
RF-220	100 to 8,000 3.937 to 314.960	100 to 4,700 3.937 to 185.039	100 to 3,500 3.937 to 137.795	100 to 3,000 3.937 to 118.110	100 to 1,800 3.937 to 70.866	100 to 830 3.937 to 32.677	100 to 1,300 3.937 to 51.181	100 to 2,600 3.937 to 102.362
RF-210	100 to 5,500 3.937 to 216.535	100 to 2,700 3.937 to 106.299	100 to 2,400 3.937 to 94.488	100 to 1,500 3.937 to 59.055	100 to 1,200 3.937 to 47.244	100 to 530 3.937 to 20.866	100 to 980 3.937 to 38.583	100 to 1,300 3.937 to 51.181

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.

FIBER OPTION

Reflectors (for FR-Z50HW) ▶ P.48



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

FIBER SENSORS

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MICRO PHOTO-ELECTRIC SENSORS

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FT/FD/FR

Chemical / Oil-resistant



■ With the case and fiber sheath made of PFA, the fiber can be used with various types of chemical liquids.

■ The fiber core will not harden or break, even in environments where oil is present.

Full-protection type

High environmental resistance

The head, nut, and washer are made from rust-resistant SUS304. The unbreakable tough fiber with high durability is covered in a fluorine resin tube. The fiber head is also covered with a fluorine resin component, achieving a high level of environmental resistance.

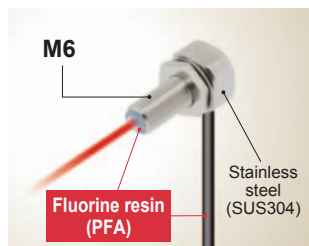
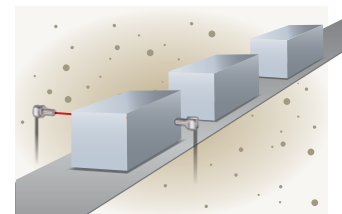
Less susceptibility to oil adhesion thanks to fluorine resin

Fibers deliver stable detection, since the sensing part is sealed with fluorine resin, which does not allow oil penetration. Additionally, the detection part features a convex design made of fluorine resin, achieving lower friction than glass.

FT-R60Y (Square head type M6 / thru-beam type)

Resistant to oil and coolant

The fiber head and fiber cable are connected by the “fastening and caulking” method without using adhesives. This method eliminates concerns that adhesives will absorb moisture in high-humidity environments and damage the fiber. The enclosure achieves IP68G protection, so the fiber can be installed around metal processing machines shrouded in the oil mist.



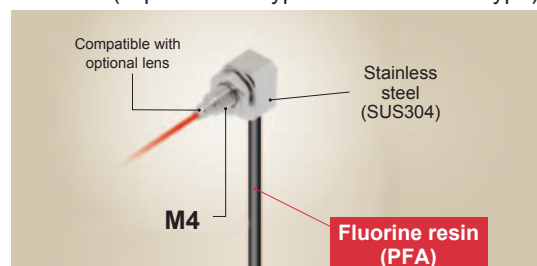
Test oil	Product
Lubricating oil	Velocite Oil No. 3
Non-water-soluble cutting oil	Yushiron Cut Abas KZ201
Water-soluble cutting oil	Yushiron Cut UH75
Alcohol-based neutral detergent	Syntilo 9954 (10% diluted)
	Yushiroken S50N (2% diluted)
	Super Teepol

*Yushiron and Yushiroken are registered trademarks of Yushiro Chemical Industry Co., Ltd.

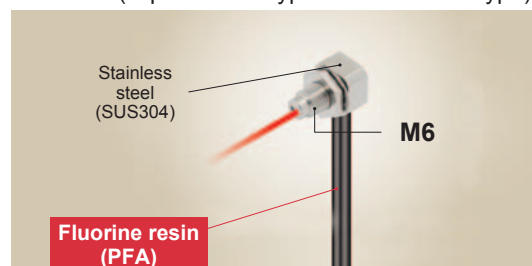
Cable-protection type

FT-R44Y / FD-R61Y

FT-R44Y (Square head type M4 / thru-beam type)



FD-R61Y (Square head type M6 / reflective type)

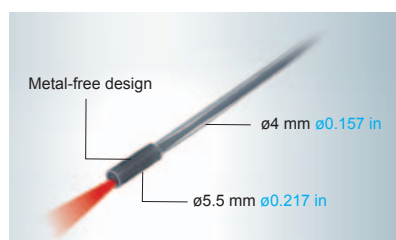


Full-protection type

FD-S60Y (Cylindrical type / reflective type) Metal-free

Metal-free design

Since no metal components are used, there is no need to worry about metal contamination, even if the protective tube is damaged. It is ideal for use in applications such as semiconductor front-end equipment where a clean environment is required.



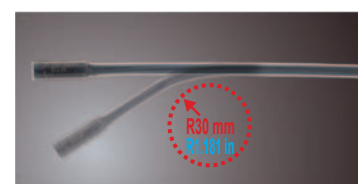
Detection in long range and narrow view

A built-in lens achieves narrow-view detection with an aperture angle of 30 degrees.



Improved tip flexibility

The protective tube features a bending radius of R30 mm [R1.181 in](#), which improved the cable arrangement compared to previous (R40 mm [R1.575 in](#)) designs.



LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Oil-resistant	Square head type Compatible with lens W7 × H9.5 × D15.5	Tough NEW FT-R44Y	R4 Bending durability	2 m	STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118	210 8.268 640 25.197	ø1	IP67 (Note 4)	-55 to +80 °C	P.55
	Full-protection type W10 × H11 × D21.2	Tough NEW FT-R60Y	R4 Bending durability	2 m	STD 2,100 82.677 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,260 49.606 400 15.748	690 27.165 1,890 74.409	ø3.5		-55 to +80 °C	P.55
Chemical-resistant	Easy mounting • Rectangular head SEMI S2 compliant W7 × H15 × D13 Metal-free	Tough FT-Z802Y	R4 Bending durability	2 m	STD 3,100 122.047 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,900 74.803 470 18.504	520 20.472 3,100 122.047			0 to +60 °C	P.57
	Heat-resistant 115 °C Metal-free ø5.5 (25)	FT-HL80Y			STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,300 90.551 740 29.134	990 38.976 2,340 92.126	ø3.7	IP68G	-40 to +115 °C	P.53
	Metal-free ø5.5 (25)	FT-L80Y			STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,800 110.236 920 36.220	1,100 43.307 2,600 102.362			-40 to +70 °C	P.54
	Side-view Metal-free ø5.5 (25)	FT-V80Y			STD 1,300 51.181 HYPR (Note 2) 3,600 141.732	2,800 110.236 2,200 86.614 800 31.496 240 9.449	340 13.386 800 31.496	ø2.8			P.56

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
 2) The fiber cable length practically limits the sensing range.
 3) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.
 4) The fiber part is oil-resistant.

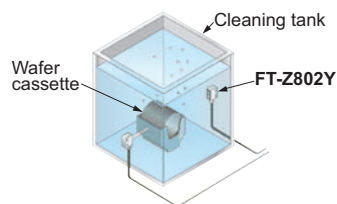
Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)			Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Oil-resistant	Cable-protection type W10 × H11 × D15.5	Tough NEW FD-R61Y	R4 Bending durability	2 m	STD 280 11.024 HYPR 990 38.976	610 24.016 435 17.126 160 6.299 50 1.969	85 3.346 185 7.283	—	IP67 (Note 3)	-55 to +80 °C	P.66
Chemical-resistant	Metal-free ø5.5 (16)	Tough NEW FD-S60Y	Protective tube R30 mm Fiber R4 Bending durability	2 m (Note 4)	STD 320 12.598 HYPR 600 23.622	590 23.228 420 16.535 200 7.874 75 2.953	140 5.512 300 11.811	—	IP68G	-40 to +70 °C	P.67

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

Applications

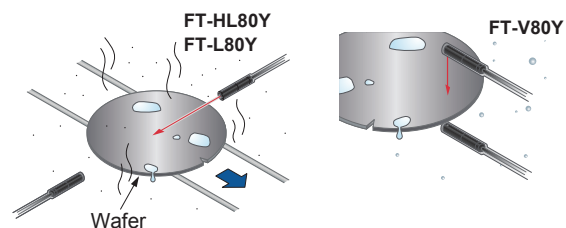
Detecting wafer cassette in cleaning tank



Detecting a container at a chemical Piller



Sensing a wafer in corrosive environment



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

FIBER SENSORS

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SENSORSPHOTO-
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SENSORSAREA
SENSORSLIGHT
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SAFETY
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Heat-resistant

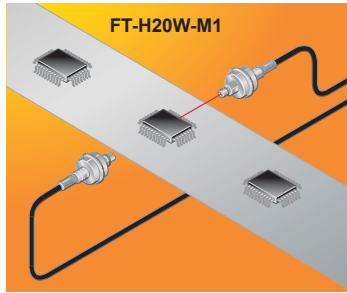
■ It can be used under environments of -60 to +350 °C
-76 to +662 °F.

■ A joint type for wider workability is also available.

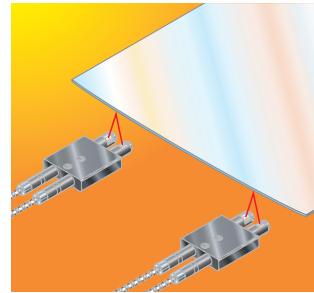
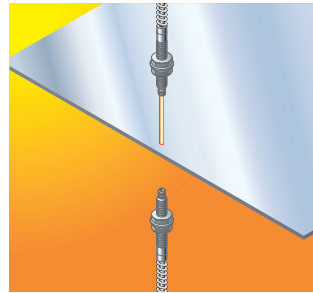


Applications

IC detection within a high temperature handler


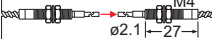
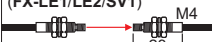



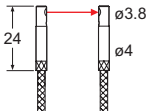


Detecting glass substrates



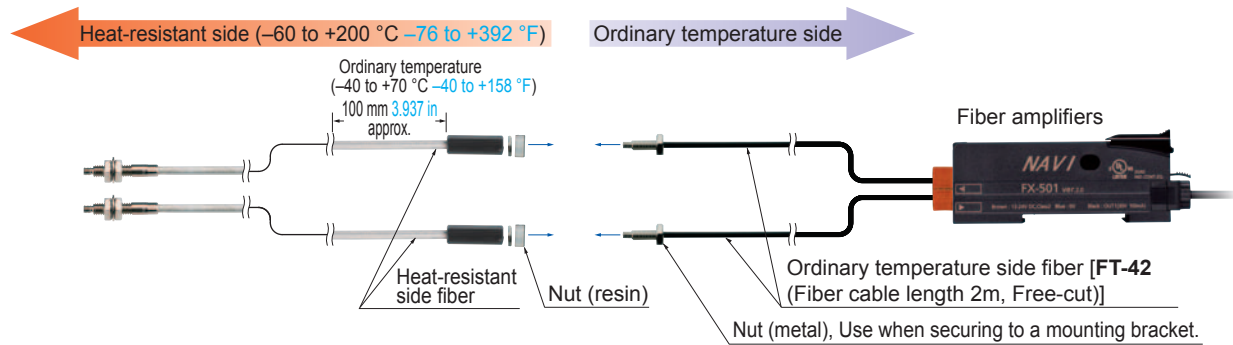
LIST OF FIBERS

Thru-beam type (one pair set)

Type	Heat-resistant temp.	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Ambient temp.	Dimensions	
						FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Heat-resistant	350 °C	Lens mountable (FX-LE1/LE2/SV1) 	FT-H35-M2	R25	2 m	STD 430 16.929 HYPR 1,200 47.244	880 34.646 670 26.378 250 9.843 80 3.150	170 6.693 490 19.291	ø1.2	-60 to +350 °C	P.53	
		Sleeve 60 mm 	FT-H35-M2S6	Fiber R25 Sleeve R10								
	200 °C	Allows flexible wiring Lens mountable (FX-LE1/LE2/SV1) 	FT-H20W-M1	R10	1 m	STD 470 18.504 HYPR (Note 2) 1,600 62.992	1,000 39.370 840 33.071 300 11.811 90 3.543	100 3.937 300 11.811	ø0.8	-60 to +200 °C		
		Lens mountable (FX-LE1/LE2/SV1) 	FT-H20-M1			STD 540 21.260 HYPR (Note 2) 1,600 62.992	1,300 51.181 960 37.795 330 12.992 110 4.331	210 8.268 540 21.260	ø1.2			
	130 °C	Lens mountable (FX-LE2 only) 	FT-H13-FM2	R25	✂ 2 m	STD 700 27.559 HYPR 3,300 129.921	1,900 74.803 1,300 51.181 410 16.142 140 5.512	250 9.843 700 27.559	ø1.5	-60 to +130 °C		P.52
	Heat-resistant (joint)	200 °C	Lens mountable (FX-LE1/LE2/SV1) 	FT-H20-J20-S (Note 5)	Heat-resistant side R18 (Note 4)	✂ 200 mm (Note 3)	STD 470 18.504 HYPR 1,600 62.992	1,000 39.370 790 31.102 300 11.811 90 3.543	135 5.315 420 16.535	ø1.2		-60 to +200 °C
			FT-H20-J30-S (Note 5)	✂ 300 mm (Note 3)								
			FT-H20-J50-S (Note 5)	✂ 500 mm (Note 3)		STD 600 23.622 HYPR 2,100 82.677	1,300 51.181 980 38.583 390 15.354 120 4.724	150 5.906 500 19.685				
Side-view 			FT-H20-VJ50-S (Note 5)	✂ 800 mm (Note 3)								
			FT-H20-VJ80-S (Note 5)									

- Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) Fiber length (fixed-length) for heat-resistant fiber side. Fiber length for ordinary temperature side is 2 m 6.562 ft (free-cut).
4) Bending durable fiber R4 mm R0.157 in or more for ordinary temperature side.
5) Heat-resistant joint fibers and ordinary-temperature fibers (FT-42) are sold as a set.

Heat-resistant joint fiber set contents


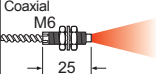


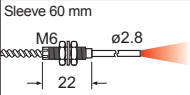
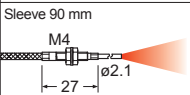


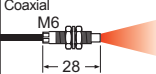


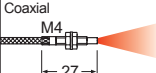


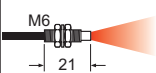



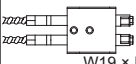


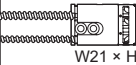


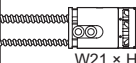


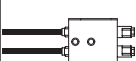





Model No. when ordering individually as spare parts

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

LIST OF FIBERS

Reflective type

Type		Heat-resistant temp.	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  : Free-cut	Sensing range (mm in) (Note 1, 2)			Ambient temp.	Dimensions	
							FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
Heat-resistant	Threaded	350 °C		FD-H35-M2	R25	2 m	STD  260 10.236 HYPR  720 28.346	540 21.260 460 18.110 150 5.906 45 1.772	75 2.953 280 11.024	-60 to +350 °C	P.64	
				FD-H35-M2S6	Fiber R25 Sleeve R10							
				FD-H35-20S			STD  260 10.236 HYPR  840 33.071	550 21.654 440 17.323 140 5.512 45 1.772	85 3.346 200 7.874			
		200 °C		FD-H20-M1	1 m	STD  330 12.992 HYPR  840 33.071	550 21.654 500 19.685 200 7.874 55 2.165	120 4.724 300 11.811	-60 to +200 °C			P.63
				FD-H20-21		STD  230 9.055 HYPR  770 30.315	500 19.685 380 14.961 130 5.118 45 1.772	90 3.543 280 11.024				
	130 °C		FD-H13-FM2	 2 m	STD  350 13.780 HYPR  880 34.646	640 25.197 600 23.622 200 7.874 65 2.559	100 3.937 280 11.024	-60 to +130 °C				
	Glass substrate detection convergent reflective	300 °C	 W19 × H27 × D5	FD-H30-L32	R25	2 m	STD  17 0.669 HYPR  40 1.575	30 1.181 25 0.984 12 0.472 1.5 to 6 0.059 to 0.236	2 to 9 0.079 to 0.354 0 to 17 0 to 0.669	-60 to +300 °C	P.64	
		250 °C	 W21 × H33.2 × D5	FD-H25-L43	3 m	STD  1.5 to 26 0.059 to 1.024 HYPR  1 to 31 0.039 to 1.220	1 to 30 0.039 to 1.181 1 to 28 0.039 to 1.102 1.5 to 24 0.059 to 0.945 2 to 18 0.079 to 0.709	4 to 16 0.157 to 0.630 4 to 23 0.157 to 0.906	-20 to +250 °C Ordinary temp. side: -20 to +70 °C	P.63		
			 W21 × H34.5 × D5	FD-H25-L45		STD  5 to 42 0.197 to 1.654 HYPR  4 to 43.5 0.157 to 1.713	4 to 43 0.157 to 1.693 4.5 to 43 0.177 to 1.693 5 to 40 0.197 to 1.575 6.5 to 34 0.256 to 1.339	7 to 35 0.276 to 1.378 7 to 38 0.276 to 1.496				
		180 °C	 W19 × H27 × D5	FD-H18-L31	 2 m	STD  16 0.630 HYPR  60 2.362	32 1.260 24 0.945 13 0.512 2 to 6.5 0.079 to 0.256	0 to 10 0 to 0.394 0 to 25 0 to 0.984	-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 × 0.7 mm 3.937 × 3.937 × 0.028 in for FD-H25-L43 and FD-H25-L45).

FIBER OPTION

Lens (For thru-beam type fiber) ▶ P.45



FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

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PRESSURE / FLOW SENSORS

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FA COMPONENTS

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UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FT/FD/FR

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS/
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-SAVING
UNITSWIRE-SAVING
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Fibers

Fiber
Amplifiers

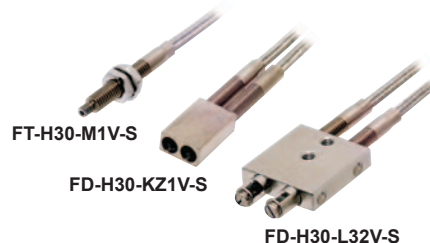
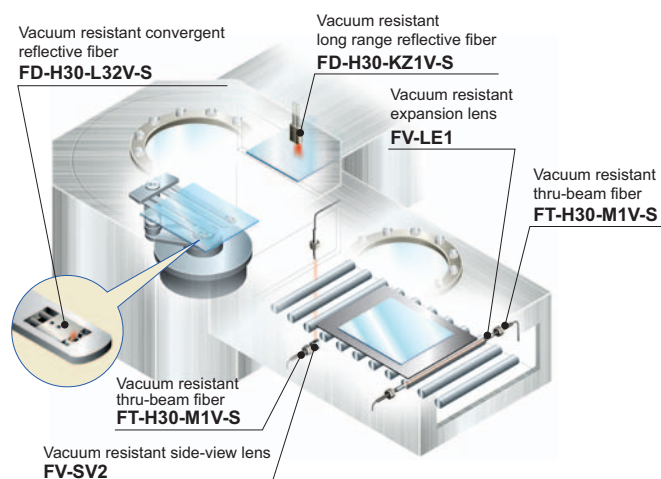
FT/FD/FR

Vacuum-resistant

- Usable in high-temperatures of 300 °C 572 °F vacuum
- The leakage of **FV-BR1** is still less than a very slight 1.33×10^{-10} Pa · m³/s [He], so that it can be used in vacuums with confidence.

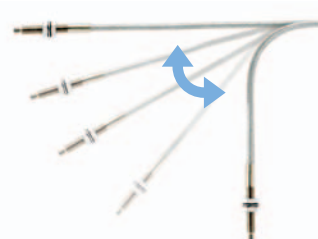
Applications

Detecting an FPD in vacuum chamber



Highly resistant to repeated bending

Because it has a bending durability of over 100,000 times (R20 mm R0.787 in), it is highly resistant to repeated bending and is optimal for mounting on moving robot hand.



LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in)			Beam axis dia. (mm)	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
Vacuum-resistant Thru-beam	300 °C Lens mountable (FV-LE1/SV2) M4 W9.5 × H5.2 × D15	FT-H30-M1V-S (Note)	R18	1 m	STD 270 10.630 HYPR 1,000 39.370	590 23.228 470 18.504 160 6.299 55 2.165	110 4.331 280 11.024	ø1.2	-30 to +300 °C	P.53

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

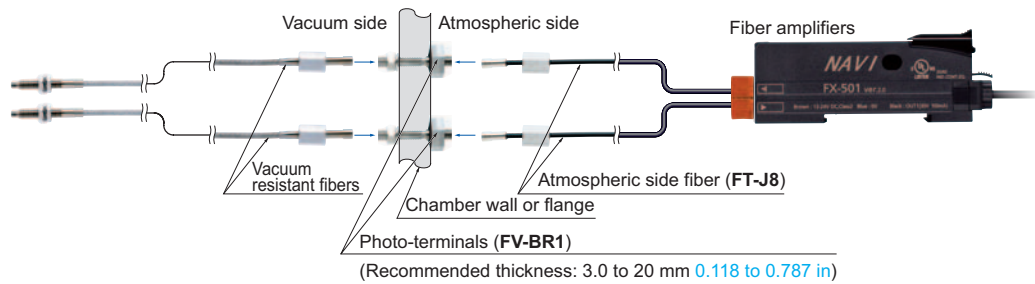
Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in)(Note 2)			Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)		
Vacuum-resistant Reflective	300 °C, Rectangular head W9.5 × H5.2 × D15	FD-H30-KZ1V-S (Note 1)	R18	1 m	STD 20 to 200 0.787 to 7.874 HYPR 5 to 500 0.197 to 19.685	10 to 340 0.394 to 13.386 15 to 270 0.591 to 10.630 20 to 120 0.787 to 4.724 20 to 45 0.787 to 1.772	25 to 80 0.984 to 3.150 10 to 220 0.394 to 8.661	-30 to +300 °C	P.64
Vacuum-resistant Convergent reflective	300 °C, Glass substrate detection W19 × H5 × D27	FD-H30-L32V-S (Note 1)		3 m	STD 8 0.315 HYPR 18 0.709	12 0.472 10 0.394 5.5 0.217 1.5 to 3 0.059 to 0.118	2.5 to 6.5 0.098 to 0.256 0 to 11 0 to 0.433		

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

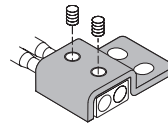
2) The sensing range is the value for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.

Vacuum-resistant fiber set contents




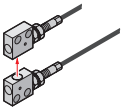
Model No. when ordering individually as spare parts

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



FIBER OPTIONS

Lens (For thru-beam fiber)

Designation		Model No.	Description																																																	
For thru-beam type fiber	Vacuum resistant expansion lens (Note 1)	FV-LE1		<div>Increases the sensing range 4 times or more.</div> <div><div>• Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 3)</div><div>• Beam axis dia: ø3.6 mm ø0.142 in</div></div> <div>Sensing range (mm in) [Lens on both sides] (Note 4)</div> <table><tr><th colspan="2">Amplifier</th><th colspan="6">FX-500 series</th><th colspan="2">FX-100 series</th></tr><tr><th>Fiber</th><th>Mode</th><th>HYPR</th><th>U-LG</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SP</th><th>FX-101</th><th>FX-102</th></tr><tr><td rowspan="2">FT-H30-M1V-S</td><td></td><td>3,600</td><td>3,600</td><td>3,400</td><td>1,500</td><td>900</td><td>370</td><td>450</td><td>1,600</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>133.858</td><td>59.055</td><td>35.433</td><td>14.567</td><td>17.717</td><td>62.992</td></tr></table>										Amplifier		FX-500 series						FX-100 series		Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	FT-H30-M1V-S		3,600	3,600	3,400	1,500	900	370	450	1,600		141.732 (Note 2)	141.732 (Note 2)	133.858	59.055	35.433	14.567	17.717	62.992
	Amplifier		FX-500 series						FX-100 series																																											
Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102																																											
FT-H30-M1V-S		3,600	3,600	3,400	1,500	900	370	450	1,600																																											
		141.732 (Note 2)	141.732 (Note 2)	133.858	59.055	35.433	14.567	17.717	62.992																																											
Vacuum resistant side-view lens (Note 1)	FV-SV2		<div>Beam axis is bent by 90°.</div> <div><div>• Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 3)</div><div>• Beam axis dia: ø3.7 mm ø0.146 in</div></div> <div>Sensing range (mm in) [Lens on both sides] (Note 4)</div> <table><tr><th colspan="2">Amplifier</th><th colspan="6">FX-500 series</th><th colspan="2">FX-100 series</th></tr><tr><th>Fiber</th><th>Mode</th><th>HYPR</th><th>U-LG</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SP</th><th>FX-101</th><th>FX-102</th></tr><tr><td rowspan="2">FT-H30-M1V-S</td><td></td><td>3,600</td><td>3,600</td><td>3,400</td><td>1,500</td><td>900</td><td>370</td><td>450</td><td>1,600</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>133.858</td><td>59.055</td><td>35.433</td><td>14.567</td><td>17.717</td><td>62.992</td></tr></table>										Amplifier		FX-500 series						FX-100 series		Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	FT-H30-M1V-S		3,600	3,600	3,400	1,500	900	370	450	1,600		141.732 (Note 2)	141.732 (Note 2)	133.858	59.055	35.433	14.567	17.717	62.992	
Amplifier		FX-500 series						FX-100 series																																												
Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102																																											
FT-H30-M1V-S		3,600	3,600	3,400	1,500	900	370	450	1,600																																											
		141.732 (Note 2)	141.732 (Note 2)	133.858	59.055	35.433	14.567	17.717	62.992																																											

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) Refer to previous page for the ambient temperature of fibers to be used in combination.

4) The fiber cable length for the **FT-H30-M1V-S** is 1 m **3.281 ft**. The sensing ranges in HYPR, U-LG and LONG of **FX-500** series, in **FX-102** take into account the length of the **FT-J8** atmospheric side fiber.

FIBER SENSORS

LASER SENSORS

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FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

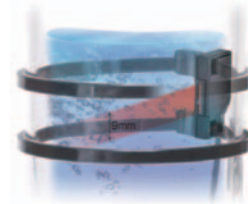
Fibers

Fiber Amplifiers

FT/FD/FR

Liquid Leak / Liquid Detection

■ It corresponds to various liquid events, from the contact (wetted) type to the pipe mounting type, and up to leak detection.



For detecting the upper limit of liquid surface level, sensor that receives beam when "liquid is absent" is recommended.

The sensor will turn OFF during abnormal conditions (excess fluid, fiber disconnection, etc.)!

Liquid absent: Beam received (Output ON)

Liquid present / fiber is cutoff: Beam not received (Output OFF)

FD-FA93 Strong against air bubbles

Applicable pipe: Transparent pipe, Outer diameter $\phi 8$ mm

$\phi 0.315$ in or more

(When used with the tying bands: $\phi 8$ to $\phi 80$ mm $\phi 0.315$ to $\phi 3.150$ in)

FD-F41

Standard type

FD-F4

For 1 mm 0.039 in thick pipes manufactured by PFA



For detecting the lower limit of liquid surface level, sensor that receives beam when "liquid is present" is recommended.

The sensor will turn OFF during abnormal conditions (insufficient liquid, fiber disconnection, etc.) !

Liquid present: Beam received (Output ON)

Liquid absent / fiber is cutoff: Beam not received (Output OFF)

FT-F93 Thru-beam



Full-protection type

FD-HF40Y / FD-F41Y (Liquid level sensing)

Metal-free

FD-HF40Y

R10 mm R0.394 in

Sheath: Polyethylene

R20 mm R0.787 in

$\phi 4$ mm $\phi 0.157$ in protective tube (fluorine resin)

Heat-resistant
+105 °C +221 °F

2,000 mm
78.740 in

500 mm
19.685 in
(Cuttable*)

FD-F41Y

R10 mm R0.394 in

Primary sheath: Polyethylene
Secondary sheath: Fluorine resin

R20 mm R0.787 in

$\phi 4$ mm $\phi 0.157$ in protective tube (fluorine resin)

Heat-resistant
+70 °C +158 °F

2,000 mm
78.740 in

500 mm
19.685 in
(Cuttable*)

Small diameter type
($\phi 4$ mm $\phi 0.157$ in)
Bends easily with its small bending radius, protective tube is cuttable and extendable

* The range of 50 mm 1.969 in from the fiber tip cannot be cut. Also, fiber length can be extended using **MS-FX-02Y** (optional).

Full-protection type

FD-F71 (Liquid level sensing)

SEMI S2 compliant

Detect chemical leaks in semiconductor and LCD manufacturing processes.

Compact, space-saving

Side-mountable fiber head as slim as 10 mm 0.394 in is good to use in confined spaces.


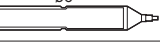

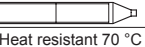

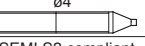
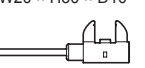






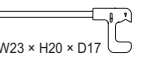
Ideal for use with chemicals and volatile materials

This fiber type sensor is safer to use with volatile materials (SEMI S2 compliant). The fluorine resin fiber head makes it ideal for use with chemicals.



LIST OF FIBERS

Reflective type / Thru-beam type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  Free-cut	Description		Protection	Ambient temp.	Dimensions
					FX-500 series (STD mode)	FX-101 FX-102			
Contact type	Liquid level sensing	Heat resistant 125 °C Fluorine resin coating ø6 	FD-F8Y	Protective tube R40 Fiber R15	 2 m (Note 1)	ø6 mm ø0.236 in Protective tube: Fluorine resin, length 1,000 mm 39.370 in (not cuttable) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam not received	IP68	-40 to +125 °C	P.62
		Heat resistant 105 °C Fluorine resin coating Metal-free ø4 	FD-HF40Y (Note 2)	Protective tube R20 Fiber R10	 2 m	ø4 mm ø0.157 in Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam not received	IP68G	-40 to +105 °C	P.64
		Heat resistant 70 °C Fluorine resin coating throughout the fiber Metal-free ø4 	FD-F41Y (Note 2)			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			
	Liquid leak detection	SEMI S2 compliant W20 × H30 × D10 	Tough FD-F71	R4 Bending durability	 5 m	Liquid leak detection Leak absent: Beam received, Leak present: Beam interrupted Compatible amplifire: FX-500 series only	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	P.62
		For 1 mm thick PFA pipe W25 × H13 × D20 	FD-F4			Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in] Liquid absent: Beam received, Liquid present: Beam not received			
	Liquid sensing	Mountable on pipe-array fiber W6.5 × H28.3 × D17 	Tough FD-FA93	R4 Bending durability	 2 m	Applicable pipe diameter: Outer dia. ø8 mm ø0.315 in or more transparent pipe (When used with the tying bands: ø8 to ø80 mm ø0.315 to ø3.150 in) [PFA (fluorine resin), including translucent] Liquid absent: Beam received, Liquid present: Beam not received	IP40	-40 to +70 °C	P.52
		SEMI S2 compliant W23 × H20 × D17 	Tough FT-F93	Protective tube R20 Fiber R2 Bending durability		Applicable pipe diameter: Outer dia. ø3 to ø10 mm ø0.118 to ø0.394 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 0.3 to 1 mm 0.012 to 0.039 in] Liquid absent: Beam not received, Liquid present: Beam received Compatible amplifire: FX-500 series only			

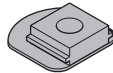
Notes: 1) The allowable cutting range is 1,000 mm **39.370 in** from the end that the amplifier inserted.

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

Accessories for additional supply

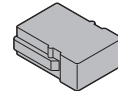
• MS-FD-F7-1

(SUS mounting bracket for FD-F71)



• MS-FD-F7-2

(PVC mounting bracket for FD-F71)



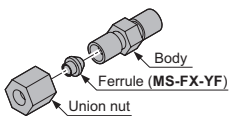
FIBER OPTIONS

Designation	Model No.	Description		
Liquid inflow prevention joint (Note)	MS-FX-01Y	Applicable fibers	FD-HF40Y FD-F41Y	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.

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

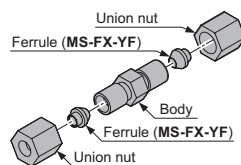
Liquid inflow prevention joint

• MS-FX-01Y



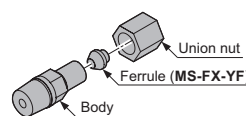
Protective tube extension joint

• MS-FX-02Y



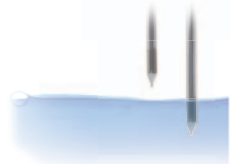
Fiber mounting joint

• MS-FX-03Y



Applications

Detecting liquid level in a tank



Leak detection for use in semiconductor device manufacturing



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

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SENSING RANGE

Fibers are listed in alphabetic order.
Refer to p.5~ for details of each fiber.

Thru-beam type (one pair set)



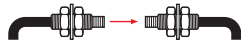
Model No.	Sensing range (mm in) (Note 1) / Description								Dimensions
	FX-500 series						FX-100 series		
	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	
FT-140	19,600 771.652 (Note 2)	19,600 771.652 (Note 2)	19,600 771.652 (Note 2)	19,600 771.652 (Note 2)	16,000 629.920	6,300 248.031	14,000 551.180	19,600 771.652 (Note 2)	P.51
FT-30	1,350 53.150	810 31.890	650 25.591	400 15.748	210 8.268	75 2.953	135 5.315	400 15.748	P.51
FT-31	1,350 53.150	770 30.315	550 21.654	315 12.402	210 8.268	70 2.756	130 5.118	340 13.386	P.51
FT-31S	1,220 48.031	740 29.134	550 21.654	315 12.402	195 7.677	63 2.480	130 5.118	340 13.386	P.51
FT-31W	990 38.976	590 23.228	440 17.323	260 10.236	150 5.906	53 2.087	80 3.150	240 9.449	P.51
FT-40	3,600 141.732 (Note 2)	2,200 86.614	1,700 66.929	1,200 47.244	530 20.866	190 7.480	320 12.598	870 34.252	P.51
FT-42	3,600 141.732 (Note 2)	2,050 80.709	1,600 62.992	1,130 44.488	530 20.866	190 7.480	300 11.811	800 31.496	P.51
FT-42S	3,600 141.732 (Note 2)	2,050 80.709	1,600 62.992	1,130 44.488	530 20.866	190 7.480	300 11.811	800 31.496	P.51
FT-42W	3,300 129.921	1,900 74.803	1,400 55.118	800 31.496	490 19.291	160 6.299	260 10.236	720 28.346	P.51
FT-43	3,600 141.732 (Note 2)	2,800 110.236	2,100 82.677	1,400 55.118	770 30.315	240 9.449	350 13.780	970 38.189	P.51
FT-45X	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,200 47.244	630 24.803	200 7.874	340 13.386	920 36.220	P.52
FT-A11	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,100 43.307	1,900 74.803	3,600 141.732 (Note 2)	P.52
FT-A11W	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,300 51.181	1,700 66.929	3,400 133.858	P.52
FT-A32	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,100 82.677	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	P.52
FT-A32W	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,000 118.110	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	P.52
FT-AL05	2,300 90.551	1,550 61.024	1,500 59.055	860 33.858	500 19.685	170 6.693	250 9.843	660 25.984	P.52
FT-E13	52 2.047	30 1.181	24 0.945	15 0.591	8 0.315	2 0.079	6 0.236	19 0.748	P.52
FT-E23	270 10.630	160 6.299	125 4.921	75 2.953	42 1.654	13 0.512	22 0.866	80 3.150	P.52
FT-F93	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 interrupted, Liquid present: Beam received Compatible amplifier: FX-500 series only								P.52
FT-H13-FM2	3,300 129.921	1,900 74.803	1,300 51.181	700 27.559	410 16.142	140 5.512	250 9.843	700 27.559	P.52
FT-H20-J20-S (Note 3)	1,600 62.992	1,000 39.370	790 31.102	470 18.504	300 11.811	90 3.543	135 5.315	420 16.535	P.53
FT-H20-J30-S (Note 3)	1,600 62.992	1,000 39.370	790 31.102	470 18.504	300 11.811	90 3.543	135 5.315	420 16.535	P.53
FT-H20-J50-S (Note 3)	1,600 62.992	1,000 39.370	790 31.102	470 18.504	300 11.811	90 3.543	135 5.315	420 16.535	P.53
FT-H20-M1	1,600 62.992 (Note 2)	1,300 51.181	960 37.795	540 21.260	330 12.992	110 4.331	210 8.268	540 21.260	P.53
FT-H20-VJ50-S (Note 3)	2,100 82.677	1,300 51.181	980 38.583	600 23.622	390 15.354	120 4.724	150 5.906	500 19.685	P.53
FT-H20-VJ80-S (Note 3)	2,100 82.677	1,300 51.181	980 38.583	600 23.622	390 15.354	120 4.724	150 5.906	500 19.685	P.53
FT-H20W-M1	1,600 62.992 (Note 2)	1,000 39.370	840 33.071	470 18.504	300 11.811	90 3.543	100 3.937	300 11.811	P.53
FT-H30-M1V-S (Note 4)	1,000 39.370	590 23.228	470 18.504	270 10.630	160 6.299	55 2.165	110 4.331	280 11.024	P.53
FT-H35-M2	1,200 47.244	880 34.646	670 26.378	430 16.929	250 9.843	80 3.150	170 6.693	490 19.291	P.53
FT-H35-M2S6	1,200 47.244	880 34.646	670 26.378	430 16.929	250 9.843	80 3.150	170 6.693	490 19.291	P.53
FT-HL80Y	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,300 90.551	740 29.134	990 38.976	2,340 92.126	P.53
FT-KS40	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,200 47.244	2,200 86.614	3,600 141.732 (Note 2)	P.54
FT-KV26	2,500 98.425	1,600 62.992	1,200 47.244	710 27.953	440 17.323	160 6.299	135 5.315	560 22.047	P.54
FT-KV40	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,200 47.244	2,200 86.614	3,600 141.732 (Note 2)	P.54
FT-KV40W	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,100 122.047	940 37.008	2,200 86.614	3,600 141.732 (Note 2)	P.54
FT-L80Y	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,800 110.236	920 36.220	1,100 43.307	2,600 102.362	P.54
FT-R31	1,000 39.370	580 22.835	440 17.323	270 10.630	160 6.299	55 2.165	100 3.937	340 13.386	P.54
FT-R40	3,600 141.732 (Note 2)	1,750 68.898	1,500 59.055	930 36.614	500 19.685	160 6.299	270 10.630	740 29.134	P.54
FT-R41W	3,200 125.984	1,800 70.866	1,400 55.118	800 31.496	460 18.110	150 5.906	250 9.843	710 27.953	P.54
FT-R42W	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795	2,200 86.614	1,300 51.181	460 18.110	510 20.079	2,000 78.740	P.54

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) Heat-resistant joint fibers and ordinary-temperature fibers (**FT-42**) are sold as a set.
4) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).

SENSING RANGE

Fibers are listed in alphabetic order.
Refer to p.5~ for details of each fiber.

Thru-beam type (one pair set)



Model No.	Sensing range (mm in) (Note 1)								Dimensions
	FX-500 series						FX-100 series		
	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	
FT-R43	3,000 118.110	1,600 62.992	1,100 43.307	720 28.346	430 16.929	130 5.118	210 8.268	640 25.197	P.54
FT-R44Y	3,000 118.110	1,600 62.992	1,100 43.307	720 28.346	430 16.929	130 5.118	210 8.268	640 25.197	P.55
FT-R60Y	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,100 82.677	1,260 49.606	400 15.748	690 27.165	1,890 74.409	P.55
FT-S11	350 13.780	210 8.268	160 6.299	90 3.543	60 2.362	19 0.748	40 1.575	90 3.543	P.55
FT-S20	1,350 53.150	810 31.890	650 25.591	400 15.748	210 8.268	75 2.953	135 5.315	400 15.748	P.55
FT-S21	1,350 53.150	770 30.315	550 21.654	315 12.402	210 8.268	70 2.756	130 5.118	340 13.386	P.55
FT-S21W	990 38.976	590 23.228	440 17.323	260 10.236	150 5.906	53 2.087	80 3.150	240 9.449	P.55
FT-S30	3,600 141.732 (Note 2)	2,200 86.614	1,700 66.929	1,200 47.244	530 20.866	190 7.480	320 12.598	870 34.252	P.55
FT-S31W	3,300 129.921	1,900 74.803	1,400 55.118	800 31.496	490 19.291	160 6.299	260 10.236	720 28.346	P.55
FT-S32	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,100 122.047	1,800 70.866	600 23.622	1,100 43.307	3,000 118.110	P.55
FT-V23	1,800 70.866	1,000 39.370	880 34.646	450 17.717	280 11.024	90 3.543	160 6.299	400 15.748	P.55
FT-V24W	380 14.961	230 9.055	200 7.874	110 4.331	60 2.362	20 0.787	35 1.378	90 3.543	P.56
FT-V25	900 35.433	550 21.654	480 18.898	240 9.449	140 5.512	45 1.772	95 3.740	260 10.236	P.56
FT-V30	2,200 86.614	1,200 47.244	1,000 39.370	680 26.772	340 13.386	100 3.937	180 7.087	480 18.898	P.56
FT-V40	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795	2,400 94.488	850 33.465	1,000 39.370	3,100 122.047	P.56
FT-V80Y	3,600 141.732 (Note 2)	2,800 110.236	2,200 86.614	1,300 51.181	800 31.496	240 9.449	340 13.386	800 31.496	P.56
FT-Z20HBW	1,100 43.307	670 26.378	570 22.441	260 10.236	180 7.087	55 2.165	100 3.937	320 12.598	P.56
FT-Z20W	1,600 62.992 (Note 2)	1,500 59.055	1,100 43.307	620 24.409	420 16.535	130 5.118	280 11.024	730 28.740	P.56
FT-Z30	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,100 82.677	1,200 47.244	410 16.142	710 27.953	2,300 90.551	P.56
FT-Z30E	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795	2,400 94.488	740 29.134	1,200 47.244	3,200 125.984	P.56
FT-Z30EW	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,400 133.858	2,000 78.740	630 24.803	1,400 55.118	2,600 102.362	P.57
FT-Z30H	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795	2,600 102.362	810 31.890	1,400 55.118	3,200 125.984	P.57
FT-Z30HW	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795	2,600 102.362	810 31.890	1,400 55.118	3,200 125.984	P.57
FT-Z30W	3,600 141.732 (Note 2)	3,300 129.921	3,200 125.984	1,500 59.055	1,000 39.370	280 11.024	540 21.260	1,800 70.866	P.57
FT-Z40HBW	3,300 129.921	1,900 74.803	1,400 55.118	800 31.496	490 19.291	160 6.299	260 10.236	720 28.346	P.57
FT-Z40W	3,600 141.732 (Note 2)	3,300 129.921	2,300 90.551	1,500 59.055	900 35.433	290 11.417	410 16.142	1,200 47.244	P.57
FT-Z802Y	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,100 122.047	1,900 74.803	470 18.504	520 20.472	3,100 122.047	P.57

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

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Fibers are listed in alphabetic order.
Refer to p.5~ for details of each fiber.

Retroreflective type



Model No.	Sensing range (mm in) (Note 1, 2)								Dimensions
	FX-500 series						FX-100 series		
	HYP R	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	
FR-KZ22E	15 to 570 0.591 to 22.441	15 to 460 0.591 to 18.110	15 to 410 0.591 to 16.142	15 to 310 0.591 to 12.205	15 to 220 0.591 to 8.661	15 to 100 0.591 to 3.937	15 to 200 0.591 to 7.874	15 to 360 0.591 to 14.173	P.58
FR-KZ50E	20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496	20 to 400 0.787 to 15.748	20 to 300 0.787 to 11.811	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 350 0.787 to 13.780	P.58
FR-KZ50H	20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496	20 to 400 0.787 to 15.748	20 to 300 0.787 to 11.811	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 350 0.787 to 13.780	P.58
FR-Z50HW	100 to 1,900 3.937 to 74.803	100 to 1,400 3.937 to 55.118	100 to 1,200 3.937 to 47.244	100 to 990 3.937 to 38.976	100 to 780 3.937 to 30.709	100 to 490 3.937 to 19.291	100 to 550 3.937 to 21.654	100 to 830 3.937 to 32.677	P.58

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

The sensing range of **FR-KZ22E** is specified for the attached reflector. The sensing range of **FR-KZ50E** and **FR-KZ50H** is specified for the attached reflector **RF-003**. The sensing range of **FR-Z50HW** is specified for the **RF-13**.

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

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

Reflector Model No.	Sensing range (mm in)							
	FX-500 series						FX-100 series	
	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102
RF-230	100 to 19,000 3.937 to 748.03	100 to 8,000 3.937 to 314.960	100 to 5,000 3.937 to 196.850	100 to 3,600 3.937 to 141.732	100 to 2,900 3.937 to 114.173	100 to 1,400 3.937 to 55.118	100 to 2,400 3.937 to 94.488	100 to 5,000 3.937 to 196.850
RF-220	100 to 8,000 3.937 to 314.960	100 to 4,700 3.937 to 185.039	100 to 3,500 3.937 to 137.795	100 to 3,000 3.937 to 118.110	100 to 1,800 3.937 to 70.866	100 to 830 3.937 to 32.677	100 to 1,300 3.937 to 51.181	100 to 2,600 3.937 to 102.362
RF-210	100 to 5,500 3.937 to 216.535	100 to 2,700 3.937 to 106.299	100 to 2,400 3.937 to 94.488	100 to 1,500 3.937 to 59.055	100 to 1,200 3.937 to 47.244	100 to 530 3.937 to 20.866	100 to 980 3.937 to 38.583	100 to 1,300 3.937 to 51.181

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.

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SENSING RANGE

Fibers are listed in alphabetic order.
Refer to p.5~ for details of each fiber.

Reflective type



Model No.	Sensing range (mm in) (Note 1, 2) / Description								Dimensions
	FX-500 series						FX-100 series		
	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	
FD-30	600 23.622	330 12.992	250 9.843	160 6.299	80 3.150	25 0.984	45 1.772	155 6.102	P.59
FD-31	515 20.276	290 11.417	220 8.661	125 4.921	80 3.150	25 0.984	35 1.378	140 5.512	P.59
FD-31W	330 12.992	180 7.087	140 5.512	80 3.150	45 1.772	12 0.472	15 0.591	60 2.362	P.59
FD-32G	650 25.591	380 14.961	270 10.630	200 7.874	95 3.740	27 1.063	70 2.756	190 7.480	P.59
FD-32GX	630 24.803	410 16.142	360 14.173	200 7.874	100 3.937	30 1.181	75 2.953	210 8.268	P.59
FD-40	600 23.622	330 12.992	250 9.843	160 6.299	80 3.150	25 0.984	45 1.772	155 6.102	P.59
FD-41	515 20.276	290 11.417	220 8.661	125 4.921	80 3.150	25 0.984	35 1.378	140 5.512	P.59
FD-41S	515 20.276	290 11.417	220 8.661	125 4.921	80 3.150	25 0.984	35 1.378	140 5.512	P.59
FD-41SW	330 12.992	180 7.087	140 5.512	80 3.150	45 1.772	12 0.472	15 0.591	60 2.362	P.59
FD-41W	900 35.433	630 24.803	430 16.929	270 10.630	150 5.906	45 1.772	80 3.150	230 9.055	P.59
FD-42G	650 25.591	380 14.961	270 10.630	200 7.874	95 3.740	27 1.063	70 2.756	190 7.480	P.60
FD-42GW	670 26.378	340 13.386	280 11.024	150 5.906	90 3.543	25 0.984	45 1.772	140 5.512	P.60
FD-60	1,550 61.024	900 35.433	740 29.134	520 20.472	260 10.236	90 3.543	140 5.512	420 16.535	P.60
FD-61	1,400 55.118	840 33.071	670 26.378	450 17.717	200 7.874	70 2.756	120 4.724	410 16.142	P.60
FD-61G	1,100 43.307	800 31.496	650 25.591	420 16.535	200 7.874	60 2.362	120 4.724	350 13.780	P.60
FD-61S	1,200 47.244	790 31.102	660 25.984	420 16.535	220 8.661	75 2.953	130 5.118	360 14.173	P.60
FD-61W	900 35.433	630 24.803	430 16.929	270 10.630	150 5.906	45 1.772	80 3.150	230 9.055	P.60
FD-62	1,500 59.055	1,000 39.370	940 37.008	520 20.472	340 13.386	110 4.331	170 6.693	450 17.717	P.60
FD-64X	670 26.378	500 19.685	410 16.142	280 11.024	160 6.299	50 1.969	75 2.953	220 8.661	P.61
FD-A16		200 7.874	200 7.874	200 7.874	140 5.512	75 2.953	120 4.724	240 9.449	P.61
FD-AL11	670 26.378	530 20.866	510 20.079	320 12.598	180 7.087	50 1.969	100 3.937	285 11.220	P.61
FD-E13	50 1.969	29 1.142	25 0.984	12 0.472	7 0.276	2 0.079	5 0.197	15 0.591	P.61
FD-E23	170 6.693	120 4.724	80 3.150	55 2.165	30 1.181	9 0.354	20 0.787	70 2.756	P.61
FD-EG30	170 6.693	130 5.118	110 4.331	48 1.890	30 1.181	9 0.354	20 0.787	70 2.756	P.61
FD-EG30S	170 6.693	110 4.331	80 3.150	50 1.969	30 1.181	9 0.354	20 0.787	70 2.756	P.62
FD-EG31	85 3.346	45 1.772	35 1.378	20 0.787	12 0.472	3.5 0.138	7 0.276	25 0.984	P.62
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 interrupted								P.62
FD-F41	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 interrupted								P.62
FD-F41Y (Note 3)	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 interrupted								P.62
FD-F71	Liquid leak detection Leak absent: Beam received, Leak present: Beam interrupted Compatible amplifier: FX-500 series only								P.62
FD-F8Y	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 interrupted								P.62
FD-FA93	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 interrupted								P.62

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) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

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Reflective type



Model No.	Sensing range (mm in) (Note 1, 2) / Description								Dimensions
	FX-500 series						FX-100 series		
	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	
FD-H13-FM2	880 34.646	640 25.197	600 23.622	350 13.780	200 7.874	65 2.559	100 3.937	280 11.024	P.63
FD-H18-L31	60 2.362	32 1.260	24 0.945	16 0.630	13 0.512	2 to 6.5 0.079 to 0.256	0 to 10 0 to 0.394	0 to 25 0 to 0.984	P.63
FD-H20-21	770 30.315	500 19.685	380 14.961	230 9.055	130 5.118	45 1.772	90 3.543	280 11.024	P.63
FD-H20-M1	840 33.071	550 21.654	500 19.685	330 12.992	200 7.874	55 2.165	120 4.724	300 11.811	P.63
FD-H25-L43 (Note 3)	1 to 31 0.039 to 1.220	1 to 30 0.039 to 1.181	1 to 28 0.039 to 1.102	1.5 to 26 0.059 to 1.024	1.5 to 24 0.059 to 0.945	2 to 18 0.079 to 0.709	4 to 16 0.157 to 0.630	4 to 23 0.157 to 0.906	P.63
FD-H25-L45 (Note 3)	4 to 43.5 0.157 to 1.713	4 to 43 0.157 to 1.693	4.5 to 43 0.177 to 1.693	5 to 42 0.197 to 1.654	5 to 40 0.197 to 1.575	6.5 to 34 0.256 to 1.339	7 to 35 0.276 to 1.378	7 to 38 0.276 to 1.496	P.63
FD-H30-KZ1V-S (Note 3, 4)	5 to 500 0.197 to 19.685	10 to 340 0.394 to 13.386	15 to 270 0.591 to 10.630	20 to 200 0.787 to 7.874	20 to 120 0.787 to 4.724	20 to 45 0.787 to 1.772	25 to 80 0.984 to 3.150	10 to 220 0.394 to 8.661	P.64
FD-H30-L32	40 1.575	30 1.181	25 0.984	17 0.669	12 0.472	1.5 to 6 0.059 to 0.236	2 to 9 0.079 to 0.354	0 to 17 0 to 0.669	P.64
FD-H30-L32V-S (Note 3, 4)	18 0.709	12 0.472	10 0.394	8 0.315	5.5 0.217	1.5 to 3 0.059 to 0.118	2.5 to 6.5 0.098 to 0.256	0 to 11 0 to 0.433	P.64
FD-H35-20S	840 33.071	550 21.654	440 17.323	260 10.236	140 5.512	45 1.772	85 3.346	200 7.874	P.64
FD-H35-M2	720 28.346	540 21.260	460 18.110	260 10.236	150 5.906	45 1.772	75 2.953	280 11.024	P.64
FD-H35-M2S6	720 28.346	540 21.260	460 18.110	260 10.236	150 5.906	45 1.772	75 2.953	280 11.024	P.64
FD-HF40Y (Note 5)	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								P.64
FD-L10 (Note 3)	0 to 6 0 to 0.236	0 to 5.5 0 to 0.217	0 to 5.5 0 to 0.217	0 to 5 0 to 0.197	0 to 4.5 0 to 0.177	0 to 4 0 to 0.157	0 to 4.5 0 to 0.177	0 to 5.5 0 to 0.217	P.65
FD-L11 (Note 3)	0 to 11.5 0 to 0.453	0 to 10.5 0 to 0.413	0 to 10 0 to 0.394	0 to 9.5 0 to 0.374	0 to 9 0 to 0.354	0 to 8 0 to 0.315	0 to 8 0 to 0.315	0 to 9 0 to 0.354	P.65
FD-L12W (Note 3)	14 0.551	12.5 0.492	12 0.472	8 0.315	0.5 to 7 0.020 to 0.276	0.5 to 4 0.020 to 0.157	1 to 4.5 0.039 to 0.177	0.5 to 7 0.020 to 0.276	P.65
FD-L20H	45 1.772	35 1.378	32 1.260	23 0.906	2 to 15 0.079 to 0.591	5 to 9 0.197 to 0.354	5 to 15 0.197 to 0.591	1 to 30 0.039 to 1.181	P.65
FD-L21 (Note 3)	1 to 19 0.039 to 0.748	1 to 18 0.039 to 0.709	1 to 18 0.039 to 0.709	1.5 to 16 0.059 to 0.630	2 to 15 0.079 to 0.591	3 to 12 0.118 to 0.472	3 to 15 0.118 to 0.591	1.5 to 16 0.059 to 0.630	P.65
FD-L21W (Note 3)	1.5 to 15 0.059 to 0.591	2 to 15 0.079 to 0.591	2 to 15 0.079 to 0.591	3 to 14 0.118 to 0.551	4 to 14 0.158 to 0.551	6.5 to 10 0.256 to 0.394	7 to 12 0.276 to 0.472	3 to 14 0.118 to 0.551	P.65
FD-L22A (Note 3)	0 to 31 0 to 1.220	0 to 28 0 to 1.102	0 to 27 0 to 1.063	0 to 24 0 to 0.945	0 to 24 0 to 0.945	0 to 18 0 to 0.709	0 to 18 0 to 0.748	0 to 25 0 to 0.984	P.65
FD-L23 (Note 3)	0 to 30 0 to 1.181	0 to 30 0 to 1.181	0 to 30 0 to 1.181	0 to 29 0 to 1.142	0 to 28 0 to 1.102	1.5 to 24 0.059 to 0.945	0 to 28 0 to 1.102	0 to 30 0 to 1.181	P.65
FD-L30A (Note 3)	0 to 43 0 to 1.693	0 to 43 0 to 1.693	0 to 43 0 to 1.693	0 to 43 0 to 1.693	0 to 42 0 to 1.654	0 to 29 0 to 1.142	0 to 40 0 to 1.575	0 to 50 0 to 1.969	P.65
FD-L31A (Note 3)	3 to 35 0.118 to 1.378	4 to 33 0.157 to 1.299	4 to 33 0.157 to 1.299	4 to 33 0.157 to 1.299	4 to 32 0.157 to 1.260	5 to 25 0.197 to 0.984	5 to 30 0.197 to 1.181	4 to 33 0.157 to 1.299	P.65
FD-L32H (Note 3)	0 to 110 0 to 4.331	0 to 87 0 to 3.425	0 to 74 0 to 2.913	0 to 56 0 to 2.205	1 to 38 0.039 to 1.496	—	16 to 30 0.630 to 1.181	0 to 50 0 to 1.969	P.66
FD-R31G	530 20.866	310 12.205	260 10.236	170 6.693	85 3.346	27 1.063	45 1.772	150 5.906	P.66
FD-R32EG	170 6.693	110 4.331	92 3.622	45 1.772	30 1.181	9 0.354	20 0.787	68 2.677	P.66
FD-R33EG	84 3.307	44 1.732	33 1.299	19 0.748	11 0.433	3 0.118	7 0.276	22 0.866	P.66
FD-R34EG	130 5.118	90 3.543	70 2.756	38 1.496	23 0.906	7 0.276	17 0.669	60 2.362	P.66
FD-R41	710 27.953	430 16.929	320 12.598	210 8.268	100 3.937	34 1.339	60 2.362	170 6.693	P.66
FD-R60	1,100 43.307	600 23.622	550 21.654	290 11.417	190 7.480	65 2.559	110 4.331	240 9.449	P.66
FD-R61Y	990 38.976	610 24.016	435 17.126	280 11.024	160 6.299	50 1.969	85 3.346	185 7.283	P.66
FD-S21	190 7.480	130 5.118	110 4.331	80 3.150	37 1.457	11 0.433	25 0.984	70 2.756	P.66
FD-S30	600 23.622	330 12.992	250 9.843	160 6.299	80 3.15	25 0.984	45 1.772	155 6.102	P.67
FD-S31	515 20.276	290 11.417	220 8.661	125 4.921	80 3.15	25 0.984	35 1.378	140 5.512	P.67
FD-S32	1,200 47.244	790 31.102	660 25.984	420 16.535	220 8.661	75 2.953	120 4.724	345 13.583	P.67

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 (as for **FD-H30-L32** and **FD-H18-L31** 50 × 50 mm 1.969 × 1.969 in glass substrate).

3) 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-L10**: silicon wafers 100 × 100 mm 3.937 × 3.937 in].

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

5) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

SENSING RANGE

Fibers are listed in alphabetic order.
Refer to p.5~ for details of each fiber.

Reflective type



Model No.	Sensing range (mm in) (Note 1, 2)								Dimensions
	FX-500 series						FX-100 series		
	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	
FD-S32W	900 35.433	630 24.803	430 16.929	270 10.630	150 5.906	45 1.772	80 3.150	230 9.055	P.67
FD-S33GW	670 26.378	340 13.386	280 11.024	150 5.906	90 3.543	25 0.984	45 1.772	140 5.512	P.67
FD-S60Y	600 23.622	590 23.228	420 16.535	320 12.598	200 7.874	75 2.953	140 5.512	300 11.811	P.67
FD-V30	240 9.449	130 5.118	120 4.724	65 2.559	35 1.378	14 0.551	25 0.984	75 2.953	P.67
FD-V30W	80 3.150	40 1.575	30 1.181	20 0.787	10 0.394	2 0.079	6 0.236	20 0.787	P.67
FD-V50	370 14.567	220 8.661	210 8.268	120 4.724	75 2.953	25 0.984	40 1.575	100 3.937	P.68
FD-Z20HBW	1 to 340 0.039 to 13.386	1 to 210 0.039 to 8.268	1 to 180 0.039 to 7.087	2 to 85 0.079 to 3.346	2 to 55 0.079 to 2.165	3 to 15 0.118 to 0.591	2 to 30 0.079 to 1.181	1 to 90 0.039 to 3.543	P.68
FD-Z20W	260 10.236	150 5.906	130 5.118	1 to 65 0.039 to 2.559	2 to 45 0.079 to 1.772	5 to 13 0.197 to 0.512	2 to 32 0.079 to 1.260	1 to 80 0.039 to 3.150	P.68
FD-Z40HBW	760 29.921	540 21.260	470 18.504	260 10.236	1 to 160 0.039 to 6.299	2 to 50 0.079 to 1.969	1 to 90 0.039 to 3.543	0.5 to 240 0.020 to 9.449	P.68
FD-Z40W	790 31.102	440 17.323	390 15.354	190 7.480	1 to 120 0.039 to 4.724	2 to 35 0.079 to 1.378	1 to 74 0.039 to 2.913	200 7.874	P.68
FD-Z50HW	10 to 2,500 0.394 to 98.425	10 to 1,100 0.394 to 43.307	10 to 1,000 0.394 to 39.370	10 to 650 0.394 to 25.591	10 to 410 0.394 to 16.142	15 to 130 0.591 to 5.118	10 to 200 0.394 to 7.874	10 to 530 0.394 to 20.866	P.68

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

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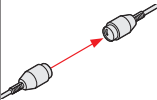


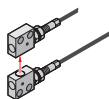
Fiber Amplifiers

FT/FD/FR

FIBER OPTIONS

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

Lens (For thru-beam type fiber)


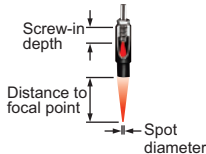
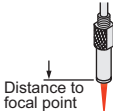
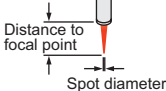
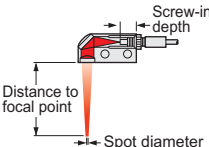
Designation	Model No.		Description																																																																																																																																																					
Expansion lens (Note 1)	FX-LE1		Increases the sensing range by 5 times or more. • Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4) • 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-500 series</th><th colspan="2">FX-100 series</th></tr><tr><th>Fiber</th><th>Mode</th><th>HYPR</th><th>U-LG</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SP</th><th>FX-101</th><th>FX-102</th></tr><tr><td>FT-43</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>1,600 62.992</td><td>2,400 94.488</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-42</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>2,200 86.614</td><td>3,400 133.858</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-42W</td><td></td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,500 59.055</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-45X</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>1,900 74.803</td><td>3,100 122.047</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-R40</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>1,900 74.803</td><td>670 26.378</td><td>1,300 51.181</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-R43</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,300 129.921</td><td>1,400 55.118</td><td>2,000 78.740</td><td>3,500 137.795 (Note 2)</td></tr><tr><td>FT-H35-M2</td><td></td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>850 33.465</td><td>1,300 51.181</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-H20W-M1</td><td></td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,200 47.244</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-H20-M1</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,500 137.795</td><td>2,000 78.740</td><td>1,600 62.992</td><td>500 19.685</td><td>1,000 39.370</td><td>3,500 137.795 (Note 2)</td></tr><tr><td>FT-H20-J50-S</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>FT-H20-J30-S</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>FT-H20-J20-S</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	Amplifier		FX-500 series					FX-100 series		Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	FT-43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,600 62.992	2,400 94.488	3,600 141.732 (Note 2)	FT-42		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,200 86.614	3,400 133.858	3,600 141.732 (Note 2)	FT-42W		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,500 59.055	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	FT-45X		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,900 74.803	3,100 122.047	3,600 141.732 (Note 2)	FT-R40		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,900 74.803	670 26.378	1,300 51.181	3,600 141.732 (Note 2)	FT-R43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,300 129.921	1,400 55.118	2,000 78.740	3,500 137.795 (Note 2)	FT-H35-M2		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	850 33.465	1,300 51.181	1,600 62.992 (Note 2)	FT-H20W-M1		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,200 47.244	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	FT-H20-M1		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795	2,000 78.740	1,600 62.992	500 19.685	1,000 39.370	3,500 137.795 (Note 2)	FT-H20-J50-S										FT-H20-J30-S										FT-H20-J20-S																			
			Amplifier		FX-500 series					FX-100 series																																																																																																																																														
			Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102																																																																																																																																												
			FT-43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,600 62.992	2,400 94.488	3,600 141.732 (Note 2)																																																																																																																																												
			FT-42		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,200 86.614	3,400 133.858	3,600 141.732 (Note 2)																																																																																																																																												
			FT-42W		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,500 59.055	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)																																																																																																																																												
			FT-45X		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,900 74.803	3,100 122.047	3,600 141.732 (Note 2)																																																																																																																																												
			FT-R40		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,900 74.803	670 26.378	1,300 51.181	3,600 141.732 (Note 2)																																																																																																																																												
			FT-R43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,300 129.921	1,400 55.118	2,000 78.740	3,500 137.795 (Note 2)																																																																																																																																												
FT-H35-M2		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	850 33.465	1,300 51.181	1,600 62.992 (Note 2)																																																																																																																																															
FT-H20W-M1		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,200 47.244	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)																																																																																																																																															
FT-H20-M1		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795	2,000 78.740	1,600 62.992	500 19.685	1,000 39.370	3,500 137.795 (Note 2)																																																																																																																																															
FT-H20-J50-S																																																																																																																																																								
FT-H20-J30-S																																																																																																																																																								
FT-H20-J20-S																																																																																																																																																								
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 4) • 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-500 series</th><th colspan="2">FX-100 series</th></tr><tr><th>Fiber</th><th>Mode</th><th>HYPR</th><th>U-LG</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SP</th><th>FX-101</th><th>FX-102</th></tr><tr><td>FT-43</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-42</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-42W</td><td></td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-45X</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-R40</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-R43</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-H35-M2</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,500 137.795 (Note 2)</td><td>3,500 137.795 (Note 2)</td></tr><tr><td>FT-H20W-M1</td><td></td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-H20-M1</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,500 137.795 (Note 2)</td><td>3,500 137.795 (Note 2)</td></tr><tr><td>FT-H13-FM2</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,500 137.795 (Note 2)</td><td>3,500 137.795 (Note 2)</td></tr><tr><td>FT-H20-J50-S</td><td></td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td><td>3,500 137.795 (Note 2)</td><td>3,500 137.795 (Note 2)</td></tr><tr><td>FT-H20-J30-S</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>FT-H20-J20-S</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	Amplifier		FX-500 series					FX-100 series		Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102	FT-43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	FT-42		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	FT-42W		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	FT-45X		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	FT-R40		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	FT-R43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	FT-H35-M2		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	FT-H20W-M1		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	FT-H20-M1		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	FT-H13-FM2		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	FT-H20-J50-S		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	FT-H20-J30-S										FT-H20-J20-S									
			Amplifier		FX-500 series					FX-100 series																																																																																																																																														
			Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102																																																																																																																																												
			FT-43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)																																																																																																																																												
			FT-42		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)																																																																																																																																												
			FT-42W		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)																																																																																																																																												
			FT-45X		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)																																																																																																																																												
			FT-R40		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)																																																																																																																																												
			FT-R43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)																																																																																																																																												
FT-H35-M2		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)																																																																																																																																															
FT-H20W-M1		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)																																																																																																																																															
FT-H20-M1		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)																																																																																																																																															
FT-H13-FM2		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)																																																																																																																																															
FT-H20-J50-S		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)																																																																																																																																															
FT-H20-J30-S																																																																																																																																																								
FT-H20-J20-S																																																																																																																																																								
Side-view lens	FX-SV1		Beam axis is bent by 90°. • Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 4) • Beam dia: ø2.8 mm ø0.110 in Sensing range (mm in) [Lens on both sides]																																																																																																																																																					
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Expansion lens for vacuum fiber (Note 1)	FV-LE1		Sensing range increases by 4 times or more. • Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4) • Beam dia: ø3.6 mm ø0.142 in Sensing range (mm in) [Lens on both sides] (Note 3)																																																																																																																																																					
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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 4) • Beam dia: ø3.7 mm ø0.146 in Sensing range (mm in) [Lens on both sides] (Note 3)																																																																																																																																																					
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- 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) The fiber cable length for the FT-H30-M1V-S is 1 m **3.28 ft**. The sensing ranges in HYPR, U-LG and LONG of **FX-500** series and in **FX-102** are specified considering the length of the FT-J8 atmospheric side fiber.
4) Refer to p.15, p.18, p.33 and p.35 for the ambient temperature of fibers to be used in combination.

FIBER OPTIONS

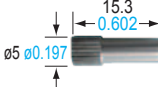









Refer to p.69~ for details of lens dimensions.

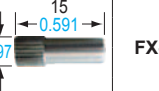
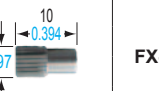
Lens (For reflective type fiber)

Designation	Model No.	Description														
For reflective type fiber	Pinpoint spot lens FX-MR1		Pinpoint spot of $\varnothing 0.5$ mm $\varnothing 0.020$ 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, FD-42GW • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note)													
	Zoom lens FX-MR2		The spot diameter is adjustable from $\varnothing 0.7$ to $\varnothing 2$ mm $\varnothing 0.028$ to $\varnothing 0.079$ in according to how much the fiber is screwed in. • Applicable fibers: FD-42G, FD-42GW • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note) • Accessory: MS-EX3 (mounting bracket)	Sensing range for FX-500 / FX-100 series <table><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>7 mm</td><td>18.5 mm approx.</td><td>$\varnothing 0.7$ mm</td></tr><tr><td>12 mm</td><td>27 mm approx.</td><td>$\varnothing 1.2$ mm</td></tr><tr><td>14 mm</td><td>43 mm approx.</td><td>$\varnothing 2.0$ mm</td></tr></table>	Screw-in depth	Distance to focal point	Spot diameter	7 mm	18.5 mm approx.	$\varnothing 0.7$ mm	12 mm	27 mm approx.	$\varnothing 1.2$ mm	14 mm	43 mm approx.	$\varnothing 2.0$ mm
	Screw-in depth	Distance to focal point	Spot diameter													
	7 mm	18.5 mm approx.	$\varnothing 0.7$ mm													
	12 mm	27 mm approx.	$\varnothing 1.2$ mm													
14 mm	43 mm approx.	$\varnothing 2.0$ mm														
Finest spot lens FX-MR3		Extremely fine spot of $\varnothing 0.15$ mm $\varnothing 0.006$ in approx. achieved. • Applicable fibers: FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GX • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note)	Sensing range for FX-500 / FX-100 series <table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG31</td><td>7.5 ± 0.5 mm</td><td>$\varnothing 0.15$ mm approx.</td></tr><tr><td>FD-EG30</td><td>7.5 ± 0.5 mm</td><td>$\varnothing 0.3$ mm approx.</td></tr><tr><td>FD-42G/42GW FD-32G/32GX</td><td>7.5 ± 0.5 mm</td><td>$\varnothing 0.5$ mm approx.</td></tr></table>	Fiber model No.	Distance to focal point	Spot diameter	FD-EG31	7.5 ± 0.5 mm	$\varnothing 0.15$ mm approx.	FD-EG30	7.5 ± 0.5 mm	$\varnothing 0.3$ mm approx.	FD-42G/42GW FD-32G/32GX	7.5 ± 0.5 mm	$\varnothing 0.5$ mm approx.	
Fiber model No.	Distance to focal point	Spot diameter														
FD-EG31	7.5 ± 0.5 mm	$\varnothing 0.15$ mm approx.														
FD-EG30	7.5 ± 0.5 mm	$\varnothing 0.3$ mm approx.														
FD-42G/42GW FD-32G/32GX	7.5 ± 0.5 mm	$\varnothing 0.5$ mm approx.														
Finest spot lens FX-MR6		Extremely fine spot of $\varnothing 0.1$ mm $\varnothing 0.004$ in approx. achieved. • Applicable fibers: FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GX • Ambient temperature: -20 to $+60$ °C -4 to $+140$ °F (Note)	Sensing range for FX-500 / FX-100 series <table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG31</td><td>7 ± 0.5 mm</td><td>$\varnothing 0.1$ mm approx.</td></tr><tr><td>FD-EG30</td><td>7 ± 0.5 mm</td><td>$\varnothing 0.2$ mm approx.</td></tr><tr><td>FD-42G/42GW FD-32G/32GX</td><td>7 ± 0.5 mm</td><td>$\varnothing 0.4$ mm approx.</td></tr></table>	Fiber model No.	Distance to focal point	Spot diameter	FD-EG31	7 ± 0.5 mm	$\varnothing 0.1$ mm approx.	FD-EG30	7 ± 0.5 mm	$\varnothing 0.2$ mm approx.	FD-42G/42GW FD-32G/32GX	7 ± 0.5 mm	$\varnothing 0.4$ mm approx.	
Fiber model No.	Distance to focal point	Spot diameter														
FD-EG31	7 ± 0.5 mm	$\varnothing 0.1$ mm approx.														
FD-EG30	7 ± 0.5 mm	$\varnothing 0.2$ mm approx.														
FD-42G/42GW FD-32G/32GX	7 ± 0.5 mm	$\varnothing 0.4$ mm approx.														
Zoom lens (side-view type) FX-MR5		FX-MR2 is converted into a side-view type and can be mounted in a very small space. • Applicable fibers: FD-42G, FD-42GW • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note)	Sensing range for FX-500 / FX-100 series <table><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>8 mm</td><td>13 mm approx.</td><td>$\varnothing 0.5$ mm</td></tr><tr><td>10 mm</td><td>15 mm approx.</td><td>$\varnothing 0.8$ mm</td></tr><tr><td>14 mm</td><td>30 mm approx.</td><td>$\varnothing 3.0$ mm</td></tr></table>	Screw-in depth	Distance to focal point	Spot diameter	8 mm	13 mm approx.	$\varnothing 0.5$ mm	10 mm	15 mm approx.	$\varnothing 0.8$ mm	14 mm	30 mm approx.	$\varnothing 3.0$ mm	
Screw-in depth	Distance to focal point	Spot diameter														
8 mm	13 mm approx.	$\varnothing 0.5$ mm														
10 mm	15 mm approx.	$\varnothing 0.8$ mm														
14 mm	30 mm approx.	$\varnothing 3.0$ mm														

Note: Refer to p.16 or p.26 for the ambient temperature of fibers to be used in combination.

Lens (For square head M3 reflective fiber)

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

Type	Spot diameter (mm in) (Note)	Sensing range (mm in) (Note)	Lens		Applicable fibers	
			Shape (mm in)	Model No.	Emitting fiber core (mm in)	Model No.
For Square head M3 reflective fiber	Zoom lens	$\varnothing 0.4$ to $\varnothing 2.0$ $\varnothing 0.016$ to $\varnothing 0.079$ approx.		FX-MR8	$\varnothing 0.125$ $\varnothing 0.005$	FD-R33EG, FD-EG31
		$\varnothing 0.4$ to $\varnothing 2.2$ $\varnothing 0.016$ to $\varnothing 0.087$ approx.			$\varnothing 0.175$ $\varnothing 0.007$	FD-R34EG
		$\varnothing 0.5$ to $\varnothing 2.5$ $\varnothing 0.020$ to $\varnothing 0.098$ approx.			$\varnothing 0.25$ $\varnothing 0.010$	FD-R32EG, FD-EG30
		$\varnothing 0.8$ to $\varnothing 3.5$ $\varnothing 0.031$ to $\varnothing 0.138$ approx.			$\varnothing 0.5$ $\varnothing 0.020$	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW
	Parallel light lens	$\varnothing 4.0$ $\varnothing 0.157$ approx.		FX-MR9	$\varnothing 0.125$ $\varnothing 0.005$	FD-R33EG, FD-EG31
					$\varnothing 0.175$ $\varnothing 0.007$	FD-R34EG
					$\varnothing 0.25$ $\varnothing 0.010$	FD-R32EG, FD-EG30
					$\varnothing 0.5$ $\varnothing 0.020$	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW

Note: Spot diameter, distance to focal point and sensing range are specified for **FX-500 / FX-100** series.

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FT/FD/FR

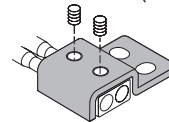
FIBER OPTIONS

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

- **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)

Model No. when ordering vacuum-resistant fibers individually as replacement 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)
- Mounting bracket for **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 **FD-H40Y/F41Y**)
- **FX-AT2** (Attachment for fixed-length fiber, Orange)
- **FX-AT3** (Attachment for $\varnothing 2.2$ mm $\varnothing 0.087$ in fiber, Clear orange)
- **FX-AT4** (Attachment for $\varnothing 1$ mm $\varnothing 0.039$ in fiber, Black)
- **FX-AT5** (Attachment for $\varnothing 1.3$ mm $\varnothing 0.051$ in fiber, Gray)
- **FX-AT6** (Attachment for $\varnothing 1$ mm $\varnothing 0.039$ in / $\varnothing 1.3$ mm $\varnothing 0.051$ in mixed fiber, Black / Gray)
- **MS-FD-2** (Fiber mounting bracket)

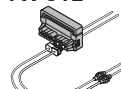
• RF-003



• RF-13



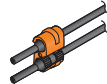
• FX-CT2



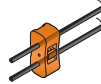
• FX-CT3



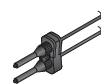
• FX-AT2



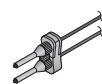
• FX-AT3



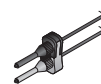
• FX-AT4



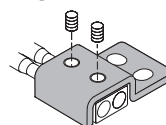
• FX-AT5



• FX-AT6



• MS-FD-2



FIBER OPTIONS

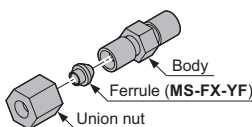
Others

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-61G 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				
	FDP-N500 (0.5 m 1.640 ft)					
	FDP-N1000 (1 m 3.281 ft)					
	FDP-N1500 (1.5 m 4.921 ft)					
Fiber bender	FB-1	The fiber bender bends the sleeve part of the fiber head at the proper radius. (Note 1)				
Universal sensor mounting stand (Note 2)	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 2)	MS-FX-01Y	Applicable fibers	FD-HF40Y FD-F41Y	This joint suppresses false operations due to liquid slip-in from the top of the protective tube.		
Protective tube extension joint (Note 2)	MS-FX-02Y			The protective tube can be extended.		
Fiber mounting joint (Note 2)	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.30 or p.41 for the sensing range of FR-Z50HW to be used in combination.				
	RF-220					
	RF-230					

Notes: 1) Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.
2) The joint internal ferrule (MS-FX-YF) is available as a spare part. A distorted ferrule may result in leakage.

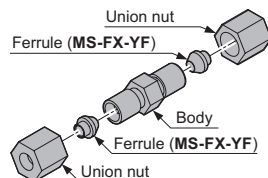
Liquid inflow prevention joint

• MS-FX-01Y



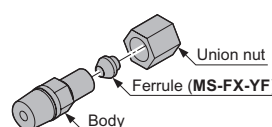
Protective tube extension joint

• MS-FX-02Y



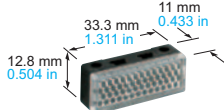
Fiber mounting joint

• MS-FX-03Y

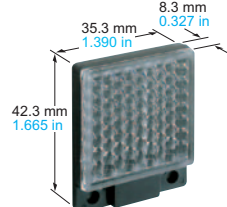


Reflector

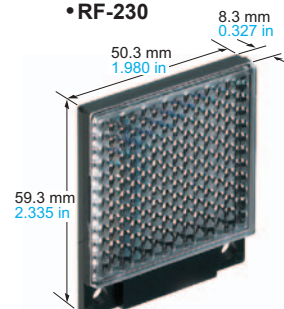
• RF-210



• RF-220

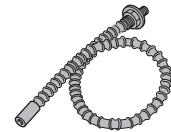


• RF-230



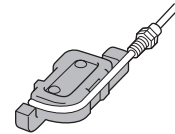
Protective tube

- FTP-□
- FDP-□



Fiber bender

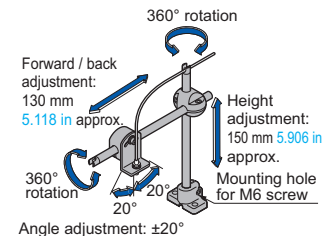
- FB-1



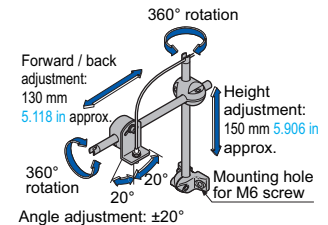
Universal sensor mounting stand

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



FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FT/FD/FR

Semi-custom fibers that flexibly meet diverse needs

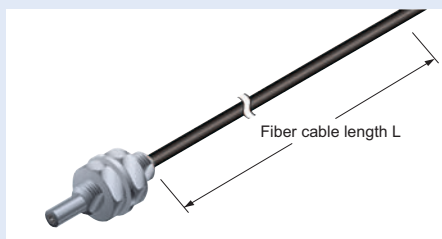
Guide to interchanging fiber length and sleeve length

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

Contact us more in formation.

Fiber length change

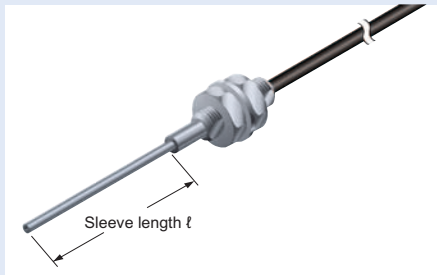
It is possible to extend up to 30 m **98.425 ft** in units of 1 m **3.281 ft**, varying depending on the model. Refer to the table on the next page for applicable models.



Note that the model number differs from previous models with changed lengths.

Sleeve length change

Extension is possible up to 120 mm **4.724 in** in units of 10 mm **0.394 in**. Applicable models are sleeve extension-type models indicated by ▲ in the table on the next page.

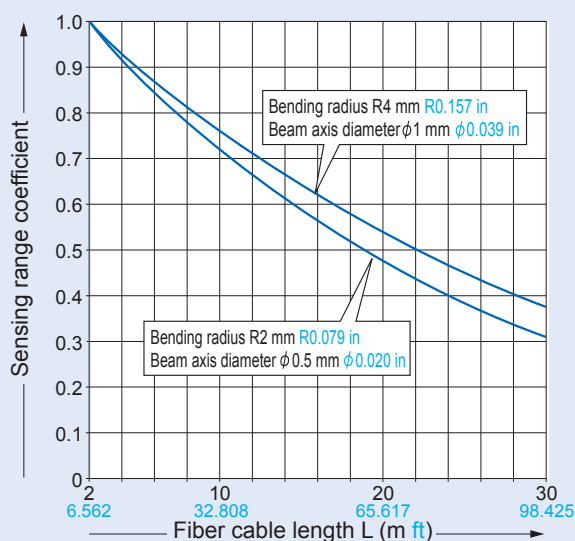


Note that the model number differs from previous models with changed lengths.

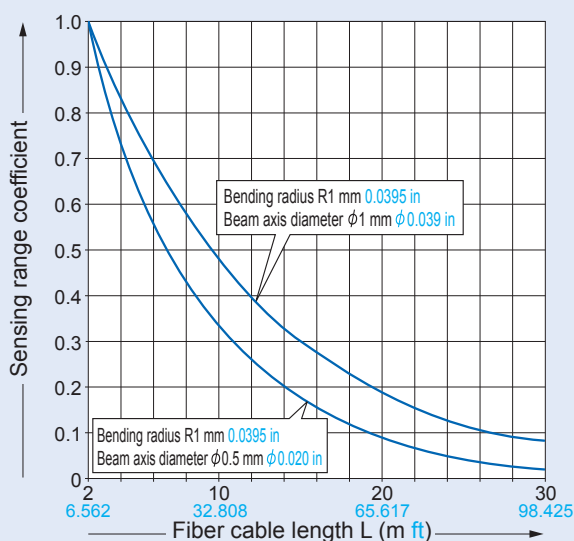
• Attenuation ratio characteristics for fiber cable length and sensing range

Note that the longer the fiber cable length, the shorter the sensing range.

Typical example: Bending radius R4 mm/R2 mm
(Tough fiber)



Typical example: Bending radius R1 mm
(Sharp bending fiber FT-□W / FD-□W)



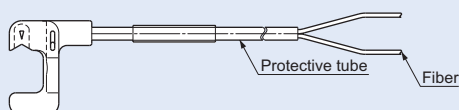
Note: Because infrared types are easily affected by humidity, please ask assistance when using them in a humid environment or in an environment with varying humidity.

Extended protective tube

The chemical-resistant cover and stainless jacket can be extended in accordance with the fiber cable length. Applicable models are indicated in the table as follows.

★: Models which can have extended protective tube (fluorine resin)

☆: Models which can have extended stainless jacket sheath



Applicable models

Thru-beam type

Basic specifications						Applicable fiber length	
Model No.	Fiber cable length Free-cut	Protective tube extension length	Sleeve length (mm)	Sensing range (mm) FX-500 series (STD)(Note 1)	Max. (m)	Unit (m)	
FT-140	10 m	—	—	19,600 (Note 2)	30	1	
FT-31	2 m	—	—	315	30	1	
▲FT-31S	2 m	—	40 (Note 3)	315	30	1	
FT-31W	2 m	—	—	260	20	1	
FT-42	2 m	—	—	1,130	30	1	
▲FT-42S	2 m	—	40 (Note 3)	1,130	30	1	
FT-42W	2 m	—	—	800	30	1	
FT-43	2 m	—	—	1,400	30	1	
FT-45X	1 m	—	—	1,200	10	0.5	
FT-A11	2 m	—	—	3,600 (Note 2)	10	1	
FT-A11W	2 m	—	—	3,600 (Note 2)	10	1	
FT-A32	2 m	—	—	3,600 (Note 2)	10	1	
FT-A32W	2 m	—	—	3,600 (Note 2)	10	1	
FT-AL05	2 m	—	—	860	20	1	
FT-E13	1 m	—	5	15	10	0.5	
FT-E23	1 m	—	5	75	10	0.5	
★FT-F93	2 m	1 m (Note 4)	—	—	30	1	
FT-H13-FM2	2 m	—	—	700	30	1	
FT-H20-J50-S	500 mm	—	—	470	6.5	0.1	
FT-H20-M1	1 m	—	—	540	6.5	0.1	
FT-H20-VJ80-S	800 mm	—	—	600	6.5	0.1	
FT-H20W-M1	1 m	—	—	470	6.5	0.1	
FT-H30-M1V-S	1 m	—	—	270	6.5	0.1	
FT-H35-M2	2 m	—	—	430	6.5	0.1	
FT-H35-M2S6	2 m	—	—	430	6.5	0.1	
★FT-HL80Y	2 m	1.5 m (Note 4)	—	3,600 (Note 2)	30	1	
FT-KS40	2 m	—	—	3,600 (Note 2)	10	1	
FT-KV26	2 m	—	—	710	10	1	
FT-KV40	2 m	—	—	3,600 (Note 2)	10	1	
FT-KV40W	2 m	—	—	3,600 (Note 2)	10	1	
★FT-L80Y	2 m	1.5 m (Note 4)	—	3,600 (Note 2)	30	1	
FT-R31	2 m	—	—	270	30	1	
FT-R43	2 m	—	—	720	30	1	
FT-R40	2 m	—	—	930	30	1	
FT-R41W	2 m	—	—	800	30	1	
FT-R42W	2 m	—	—	2,200	30	1	
FT-R44Y	2 m	—	—	720	30	1	
FT-R60Y	2 m	—	—	2,100	30	1	
FT-S11	500 mm	—	—	90	30	1	
FT-S21	2 m	—	—	315	30	1	
FT-S21W	2 m	—	—	260	20	1	
FT-S31W	2 m	—	—	800	30	1	
FT-S32	2 m	—	—	3,100	30	1	
FT-V23	2 m	—	20	450	30	1	
FT-V24W	2 m	—	15	110	10	1	
FT-V25	2 m	—	15	240	30	1	
FT-V30	2 m	—	20	680	30	1	
FT-V40	2 m	—	—	3,500	30	1	
★FT-V80Y	2 m	1.5 m (Note 4)	—	3,600 (Note 2)	30	1	
FT-Z20HBW	1 m	—	—	260	20	1	
FT-Z20W	1 m	—	—	620	20	1	
FT-Z30	2 m	—	—	2,100	30	1	
FT-Z30E	2 m	—	—	3,500	30	1	
FT-Z30EW	2 m	—	—	3,400	20	1	
FT-Z30H	2 m	—	—	3,500	30	1	
FT-Z30HW	2 m	—	—	3,500	20	1	
FT-Z30W	2 m	—	—	1,500	20	1	
FT-Z40HBW	2 m	—	—	800	20	1	
FT-Z40W	2 m	—	—	1,500	20	1	
FT-Z802Y	2 m	—	—	3,100	30	1	

Retroreflective type

Basic specifications						Applicable fiber length	
Model No.	Fiber cable length Free-cut	Protective tube extension length	Sleeve length (mm)	Sensing range (mm) FX-500 series (STD)(Note 1)	Max. (m)	Unit (m)	
FR-KZ22E	2 m	—	—	15 to 310	10	1	
FR-KZ50E	2 m	—	—	20 to 300	10	1	
FR-KZ50H	2 m	—	—	20 to 300	10	1	
FR-Z50HW	2 m	—	—	100 to 990	30	1	

▲: Models which can have extended sleeve

★: Models which can have extended protective tube (fluorine resin)

☆: Models which can have extended stainless jacket sheath

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) Applicable sleeve length is from 10 to 120 mm 0.394 to 4.724 in and in units of 10 mm 0.394 in.

4) Applicable protective length is up to 10 m 32.808 ft and in units of 0.5 m 1.640 ft. (however, FD-32GX is in units of 0.1 m 0.328 ft.)

5) Fiber length (fixed-length) for heat-resistant fiber side. Fiber length for ordinary temperature side is 2 m 6.562 ft (free-cut).

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

Reflective type

Basic specifications						Applicable fiber length	
Model No.	Fiber cable length Free-cut	Protective tube extension length	Sleeve length (mm)	Sensing range (mm) FX-500 series (STD)(Note 1)	Max. (m)	Unit (m)	
FD-31	2 m	—	—	125	30	1	
FD-31W	2 m	—	—	80	20	1	
FD-32G	2 m	—	—	200	30	1	
☆FD-32GX	1 m	300 mm (Note 4)	—	200	30	1	
FD-41	2 m	—	—	125	30	1	
▲FD-41S	2 m	—	40 (Note 3)	125	30	1	
▲FD-41SW	2 m	—	40 (Note 3)	80	20	1	
FD-41W	2 m	—	—	270	20	1	
FD-42G	2 m	—	—	200	30	1	
FD-42GW	2 m	—	—	150	20	1	
FD-61	2 m	—	—	450	30	1	
FD-61G	2 m	—	—	420	30	1	
▲FD-61S	2 m	—	40 (Note 3)	420	30	1	
FD-61W	2 m	—	—	270	30	1	
FD-62	2 m	—	—	520	30	1	
FD-64X	1 m	—	—	280	10	0.5	
FD-A16	2 m	—	—	200	30	1	
FD-AL11	2 m	—	—	320	20	1	
FD-E13	1 m	—	3	12	3	0.1	
FD-E23	1 m	—	5	55	3	0.1	
FD-EG30	500 mm	—	—	48	3	0.1	
FD-EG30S	1 m	—	15	50	3	0.1	
FD-EG31	500 mm	—	—	20	3	0.1	
FD-F4	2 m	—	—	—	10	1	
FD-F41	2 m	—	—	—	10	1	
★FD-F71	5 m	3 m (Note 4)	—	—	20	1	
FD-FA93	2 m	—	—	—	10	1	
FD-H13-FM2	2 m	—	—	350	30	1	
FD-H18-L31	2 m	—	—	16	5	1	
FD-H20-21	1 m	—	—	230	6.5	0.1	
FD-H20-M1	1 m	—	—	330	6.5	0.1	
FD-H25-L43	3 m	—	—	1.5 to 26	6.5	0.1	
FD-H25-L45	3 m	—	—	5 to 42	6.5	0.1	
FD-H30-KZ1V-S	1 m	—	—	20 to 200	6.5	0.1	
FD-H30-L32	2 m	—	—	17	5	1	
FD-H30-L32V-S	3 m	—	—	8	6.5	0.1	
FD-H35-20S	1 m	—	—	260	6.5	0.1	
FD-H35-M2	2 m	—	—	260	6.5	0.1	
FD-H35-M2S6	2 m	—	—	260	6.5	0.1	
FD-L10	2 m	—	—	0 to 5	5	1	
FD-L11	2 m	—	—	0 to 9.5	5	1	
FD-L12W	1 m	—	—	8	5	1	
FD-L20H	2 m	—	—	30	5	1	
FD-L21	2 m	—	—	1.5 to 16	5	1	
FD-L21W	2 m	—	—	3 to 14	5	1	
FD-L22A	2 m	—	—	0 to 24	5	1	
FD-L23	3 m	—	—	0 to 29	5	1	
FD-L30A	3 m	—	—	0 to 43	5	1	
FD-L31A	3 m	—	—	4 to 33	5	1	
FD-L32H	4 m	—	—	0 to 56	5	1	
FD-R31G	2 m	—	—	170	30	1	
FD-R32EG	500 mm	—	—	45	3	0.1	
FD-R33EG	500 mm	—	—	19	3	0.1	
FD-R34EG	500 mm	—	—	38	3	0.1	
FD-R41	2 m	—	—	210	30	1	
FD-R60	2 m	—	—	290	30	1	
FD-R61Y	2 m	—	—	280	30	1	
FD-S21	1 m	—	—	80	20	1	
FD-S31	2 m	—	—	125	30	1	
FD-S32	2 m	—	—	420	30	1	
FD-S32W	2 m	—	—	270	20	1	
FD-S33GW	2 m	—	—	150	20	1	
FD-S60Y	2 m	1.5 m (Note 4)	—	320	30	1	
FD-V30	2 m	—	15	65	30	1	
FD-V30W	2 m	—	15	20	10	1	
FD-V50	2 m	—	20	120	30	1	
FD-Z20HBW	1 m	—	—	2 to 85	20	1	
FD-Z20W	1 m	—	—	1 to 65	20	1	
FD-Z40HBW	2 m	—	—	260	20	1	
FD-Z40W	2 m	—	—	190	20	1	
FD-Z50HW	2 m	—	—	10 to 650	30	1	

DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

Thru-beam type fibers

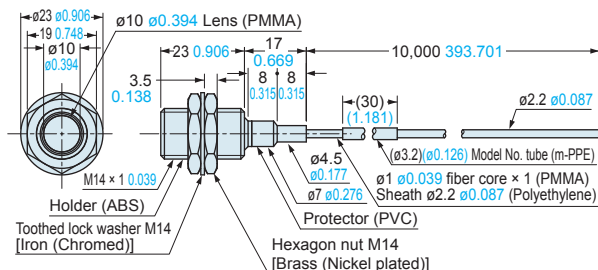


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FT-140

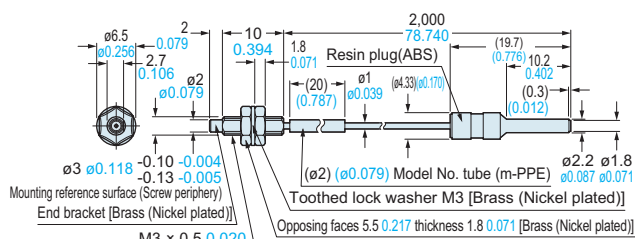
 Free-cut

<with **FX-AT3**>

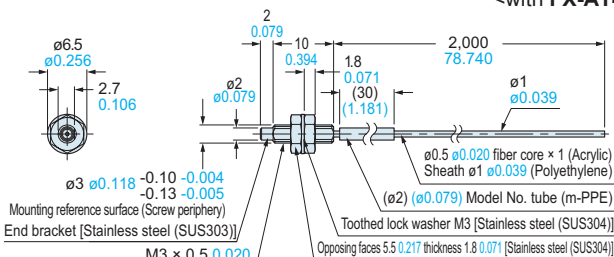
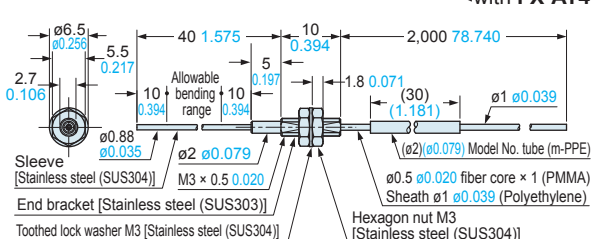


FT-30

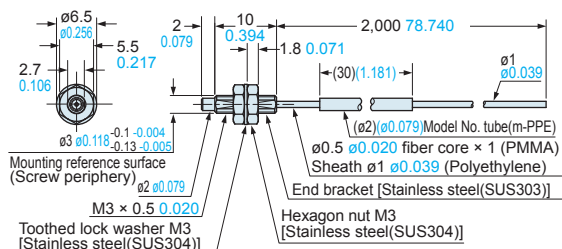
<with **FX-AT2**>



FT-31

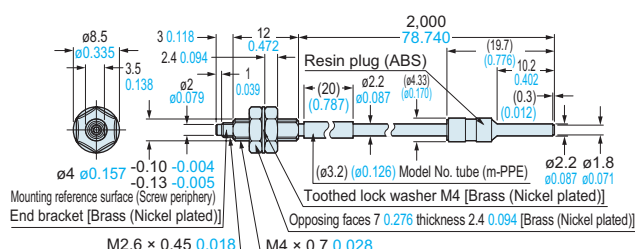
 Free-cut<with **FX-AT4**>**FT-31S** Free-cut<with **FX-AT4**>**FT-31W** Free-cut

<with **FX-AT4**>



FT-40

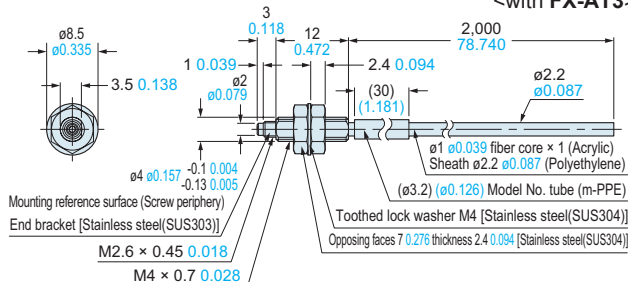
<with **FX-AT2**>



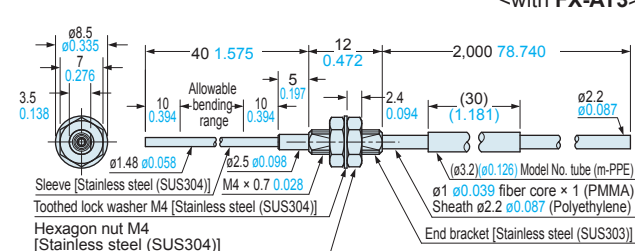
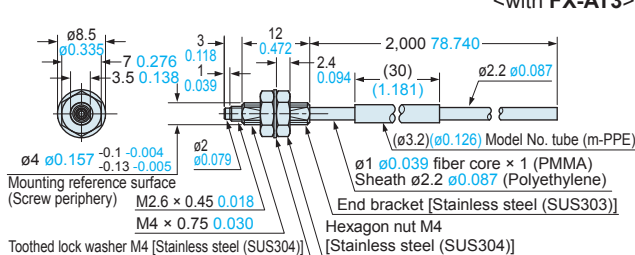
FT-42

 Free-cut

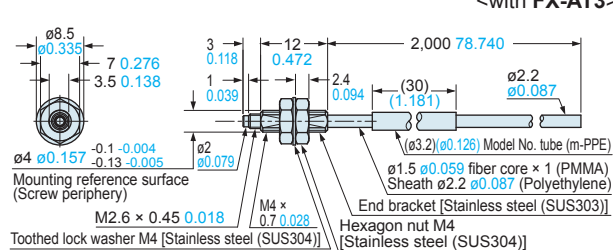
<with **FX-AT3**>



FT-42S

 Free-cut<with **FX-AT3**>**FT-42W** Free-cut<with **FX-AT3**>

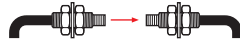
FT-43

 Free-cut<with **FX-AT3**>

DIMENSIONS (Unit: mm in)

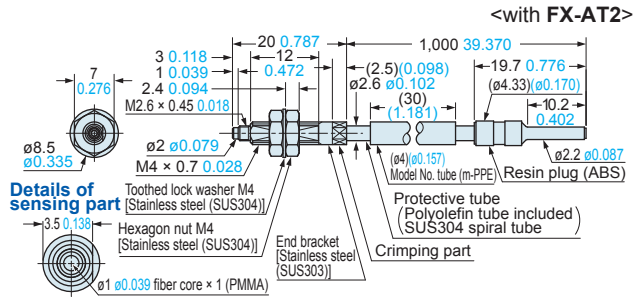
Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Thru-beam type fibers

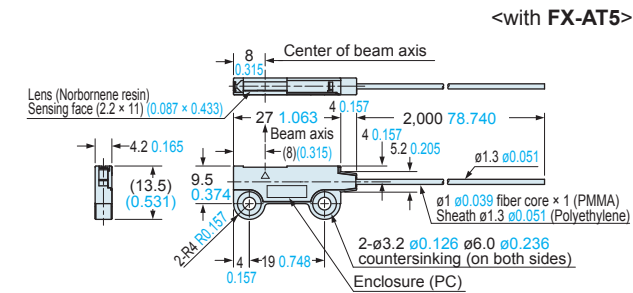


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

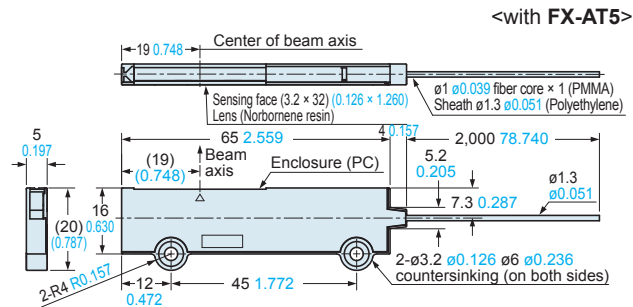
FT-45X



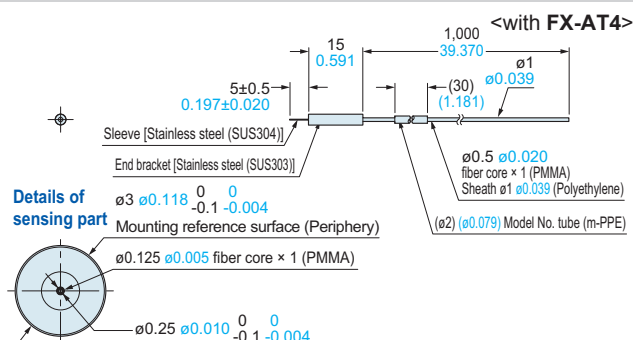
FT-A11W



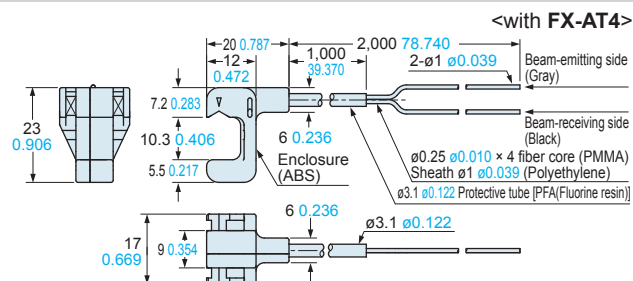
FT-A32W



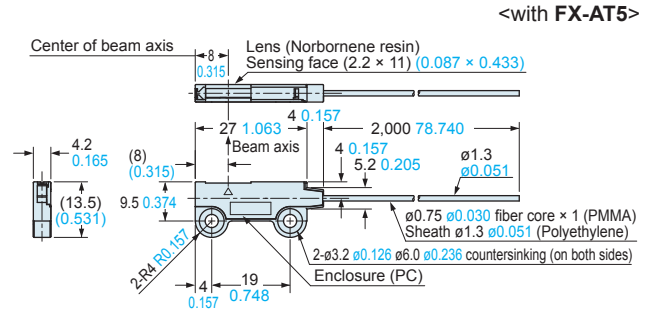
FT-E13



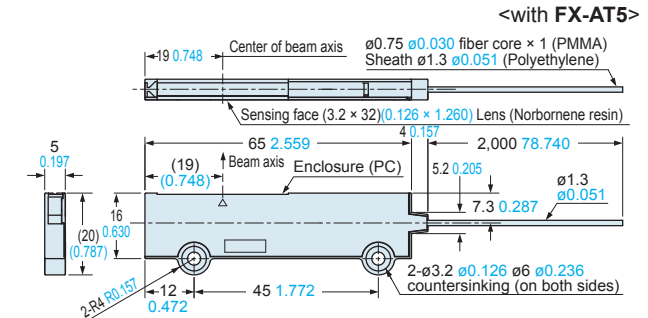
FT-F93



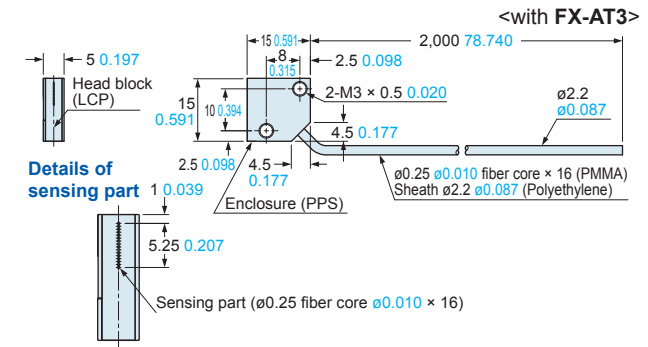
FT-A11



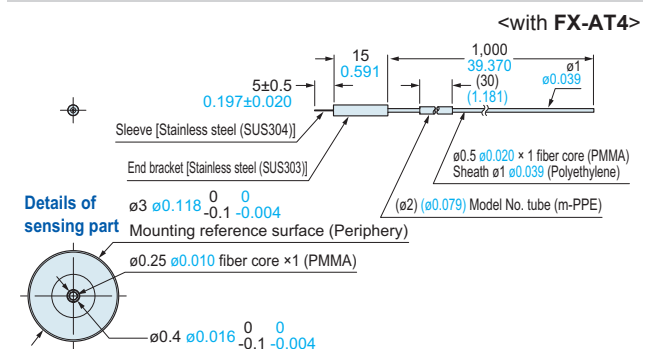
FT-A32



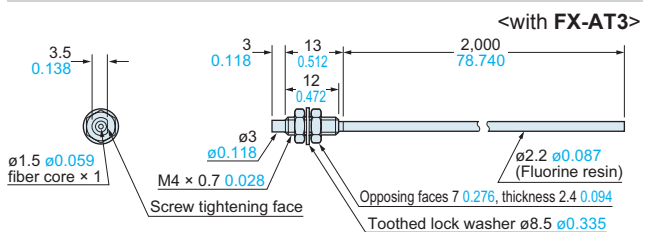
FT-AL05



FT-E23



FT-H13-FM2



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DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Thru-beam type fibers



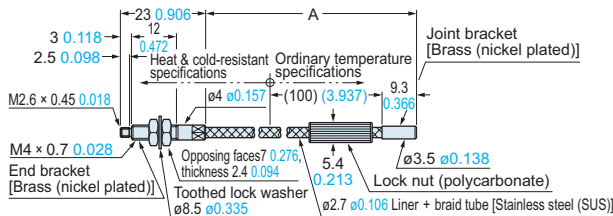
Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FT-H20-J20-S FT-H20-J30-S FT-H20-J50-S

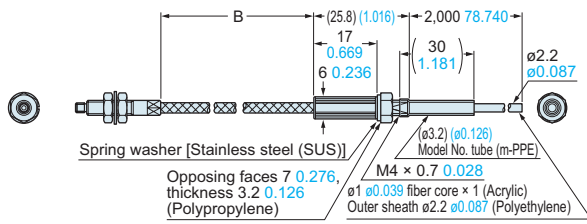
Free-cut (Note)

<with FX-AT3>

Heat-resistant side unit diagram (side view)



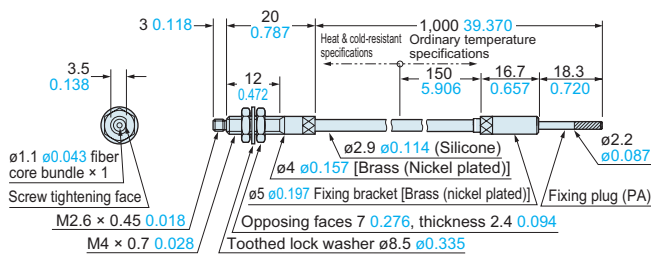
Ordinary temperature side fiber (FT-42) connection diagram (front view)



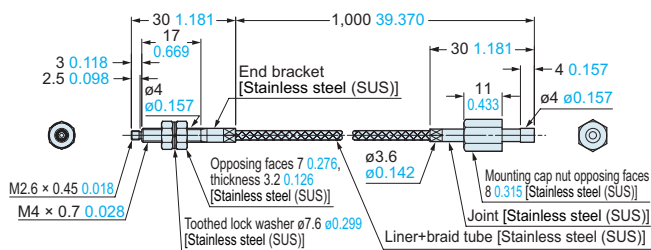
Model No.	A	B
FT-H20-J20-S	200 ⁺²⁵ / ₀ 7.874 ^{+0.984} / ₀	185 ⁺³⁰ / ₀ 7.284 ^{+1.181} / ₀
FT-H20-J30-S	300 ⁺²⁵ / ₀ 11.811 ^{+0.984} / ₀	285 ⁺³⁰ / ₀ 11.221 ^{+1.181} / ₀
FT-H20-J50-S	500 ⁺²⁵ / ₀ 19.685 ^{+0.984} / ₀	485 ⁺³⁰ / ₀ 19.095 ^{+1.181} / ₀

Note: Ordinary temperature side fiber (FT-42) only.

FT-H20-M1

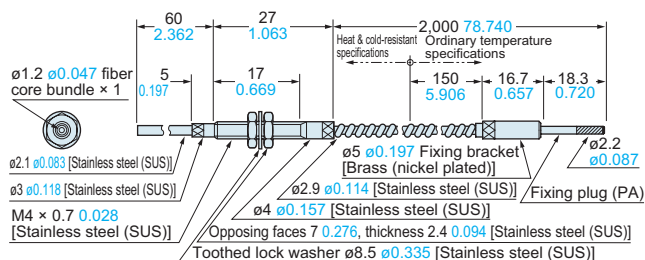


FT-H30-M1V-S



Note: The FT-H30-M1V-S is a set with the FT-H30-M1V, photo-terminal, and atmospheric side fiber. Refer to p.69 for dimensions of the atmospheric side fiber and photo-terminals.

FT-H35-M2S6

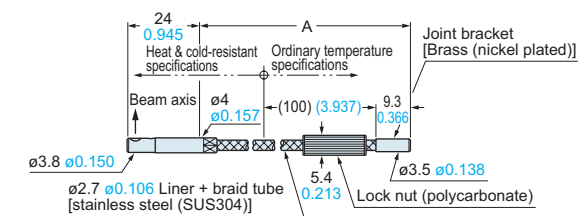


FT-H20-VJ50-S FT-H20-VJ80-S

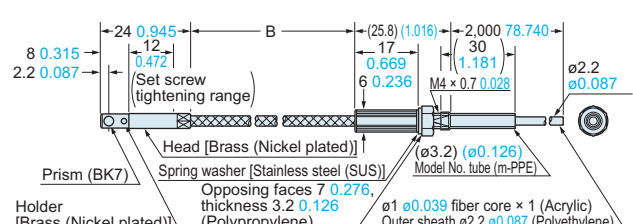
Free-cut (Note)

<with FX-AT3>

Heat-resistant side unit diagram (side view)



Ordinary temperature side fiber (FT-42) connection diagram (front view)

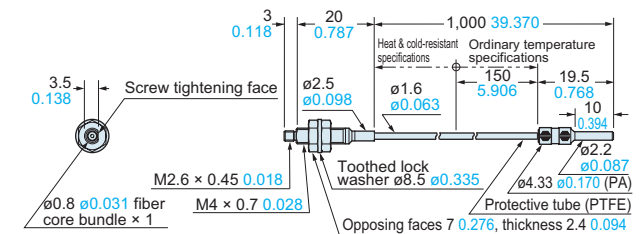


Model No.	A	B
FT-H20-VJ50-S	500 ⁺²⁵ / ₀ 19.685 ^{+0.984} / ₀	485 ⁺³⁰ / ₀ 19.095 ^{+1.181} / ₀
FT-H20-VJ80-S	800 ⁺⁵⁰ / ₀ 31.496 ^{+0.969} / ₀	785 ⁺⁵⁵ / ₀ 30.906 ^{+2.165} / ₀

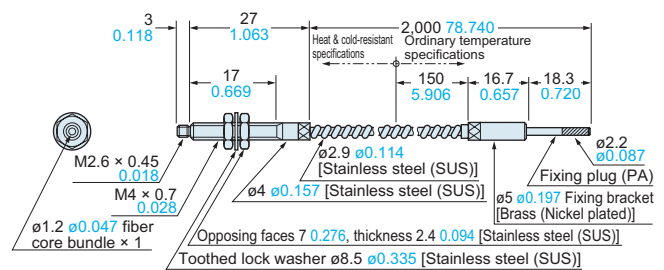
Note: Ordinary temperature side fiber (FT-42) only.

FT-H20W-M1

<with FX-AT2>



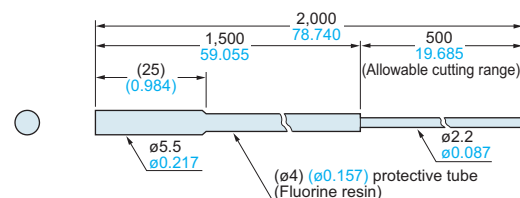
FT-H35-M2



FT-HL80Y

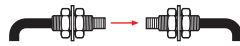
Free-cut

<with FX-AT3>



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

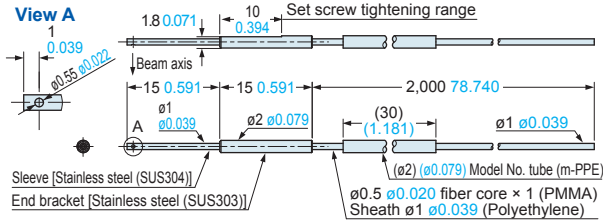
Thru-beam type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FT-V24W

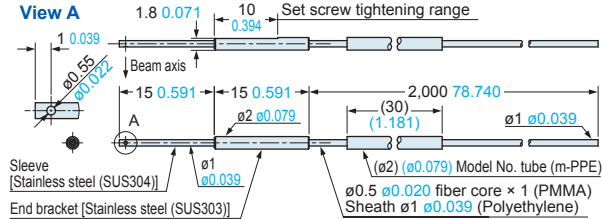
Free-cut

<with FX-AT4>

**FT-V25**

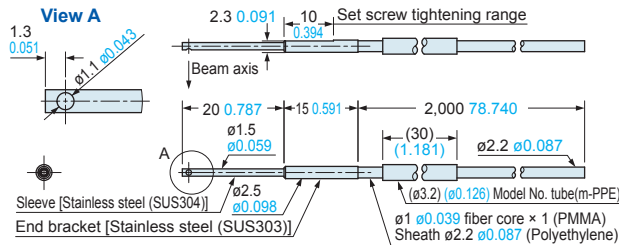
Free-cut

<with FX-AT4>

**FT-V30**

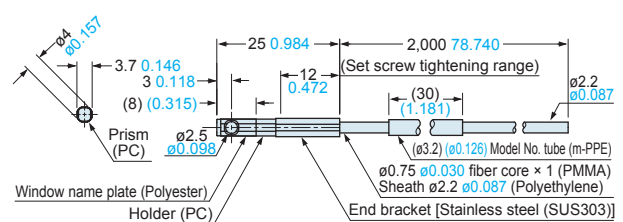
Free-cut

<with FX-AT3>

**FT-V40**

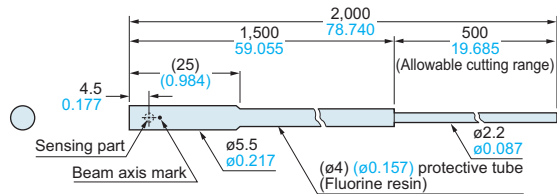
Free-cut

<with FX-AT3>

**FT-V80Y**

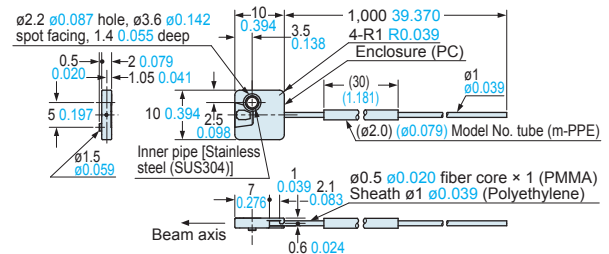
Free-cut

<with FX-AT3>

**FT-Z20HBW**

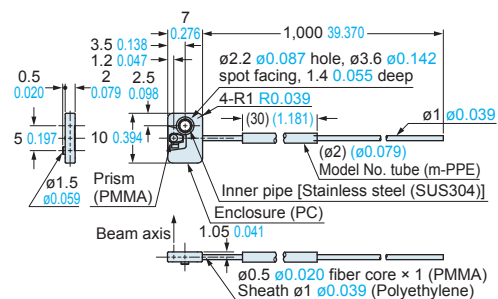
Free-cut

<with FX-AT4>

**FT-Z20W**

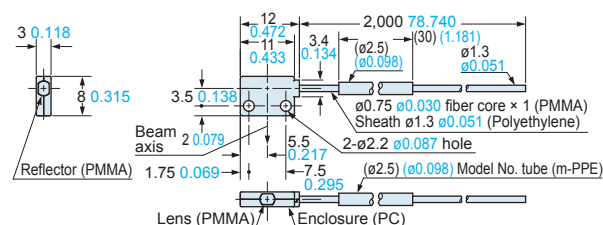
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**FT-Z30E**

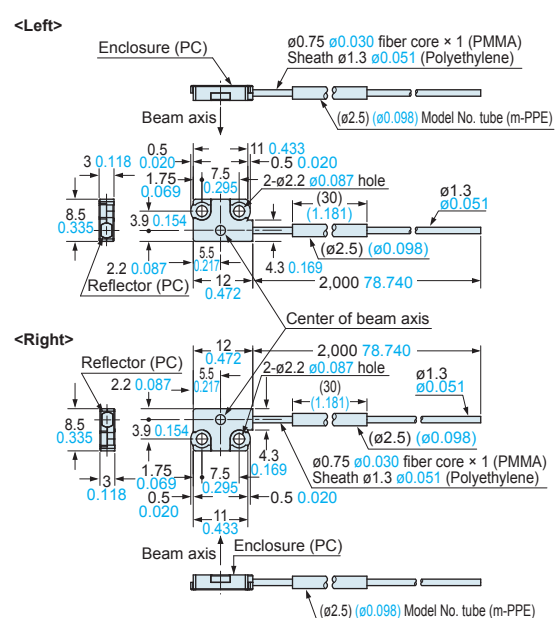
Free-cut

<with FX-AT5>

**FT-Z30**

Free-cut

<with FX-AT5>



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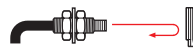
Fibers

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FT/FD/FR

Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

Retroreflective type fibers



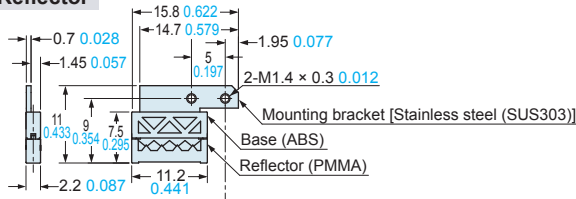
Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FR-KZ22E

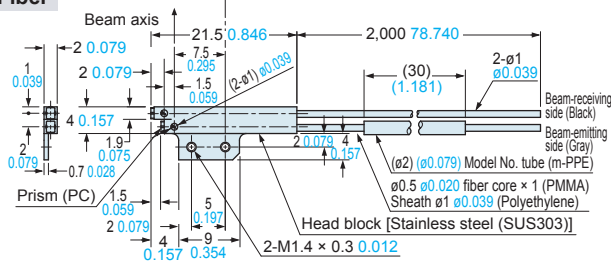


<with **FX-AT4**>

Reflector



Fiber

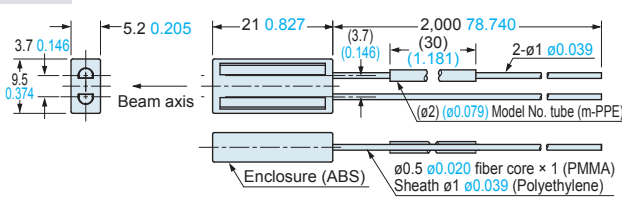


FR-KZ50H

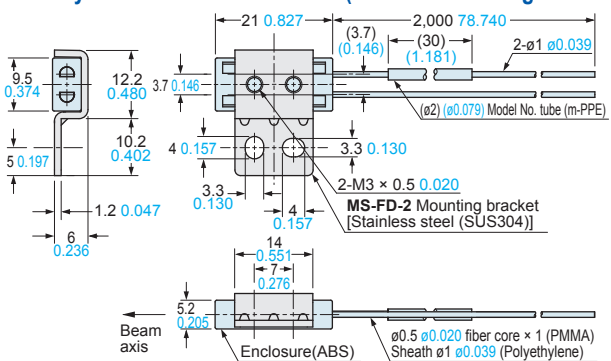


<with **FX-AT4**>

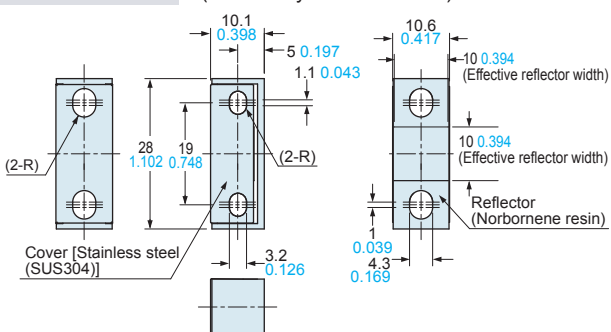
Fiber



Assembly dimensions with MS-FD-2 (attached mounting bracket)



Reflector RF-003 (Accessory for **FR-KZ50H**)

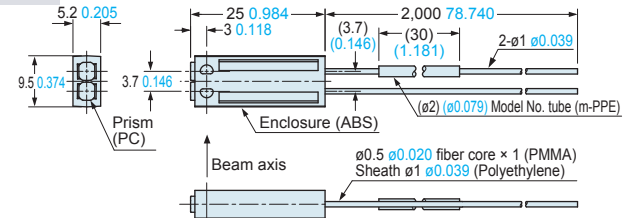


FR-KZ50E

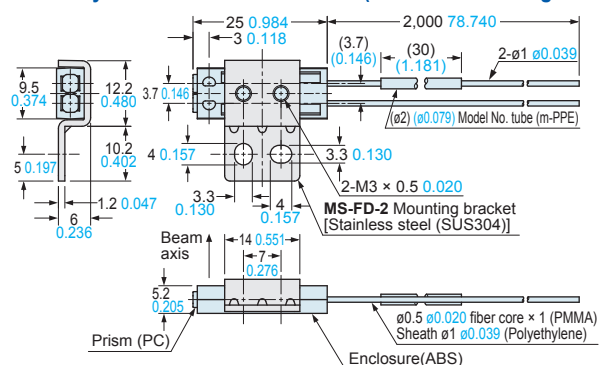


<with **FX-AT4**>

Fiber

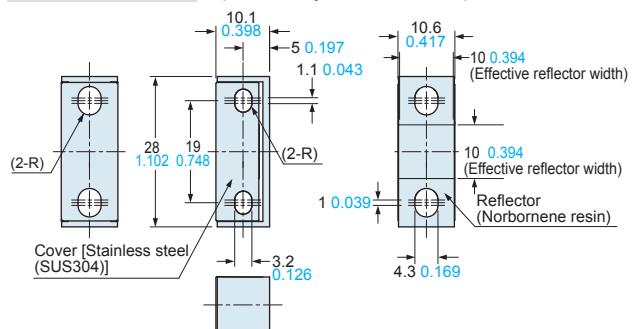


Assembly dimensions with MS-FD-2 (attached mounting bracket)



Reflector RF-003 (Accessory for **FR-KZ50E**)

(Accessory for **FR-KZ50E**)

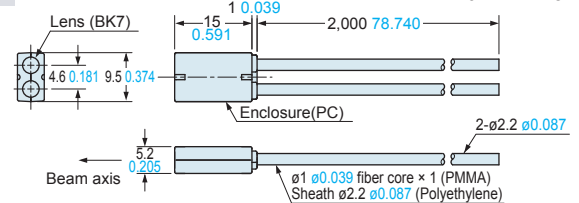


FR-Z50HW

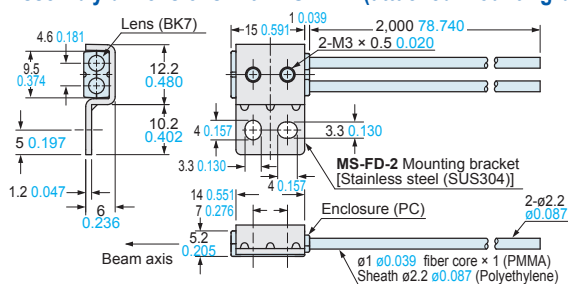


Fiber **<with FX-AT3>**

Fiber

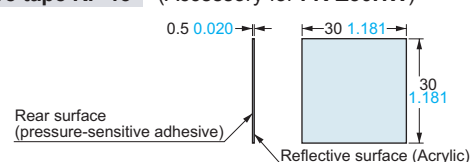


Assembly dimensions with MS-FD-2 (attached mounting bracket)



Reflective tape RF-13 (Accessory for **FR-Z50HW**)

(Accessory for **FR-Z50HW**)



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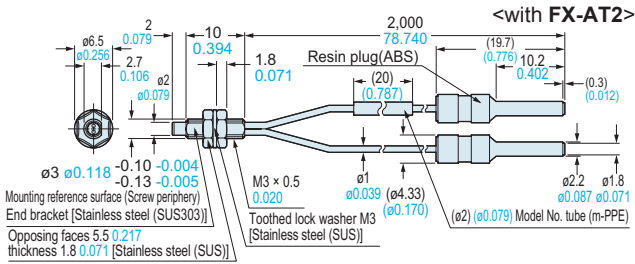
Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Reflective type fibers



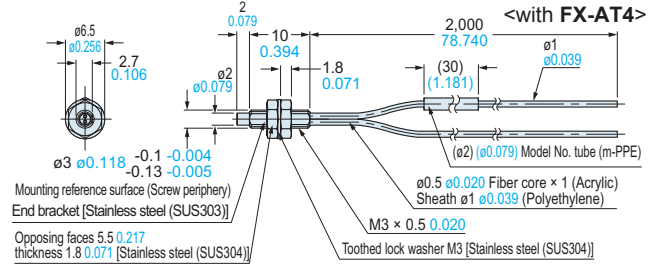
Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FD-30



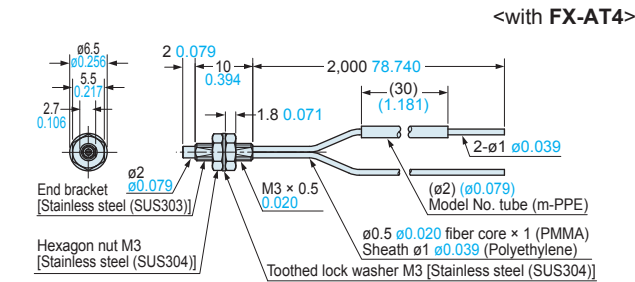
FD-31

Free-cut



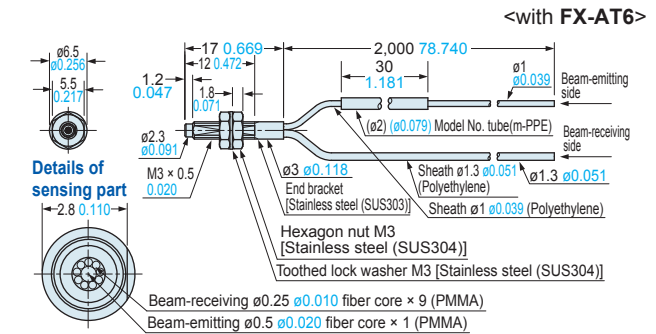
FD-31W

Free-cut



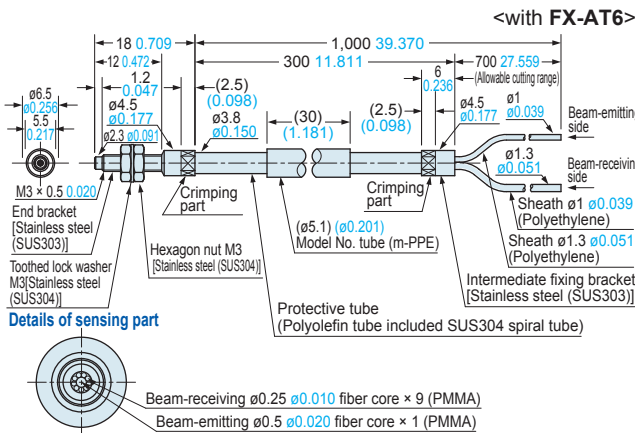
FD-32G

Free-cut



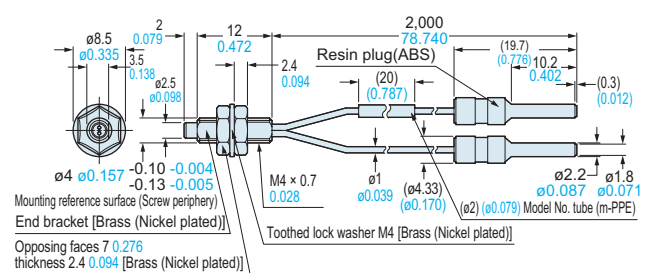
FD-32GX

Free-cut



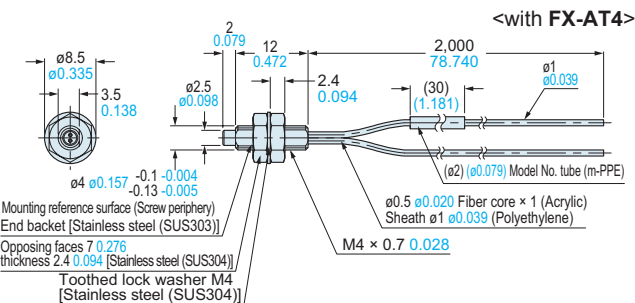
FD-40

<with FX-AT2>



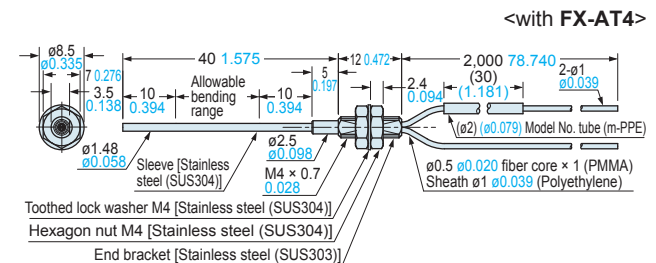
FD-41

Free-cut



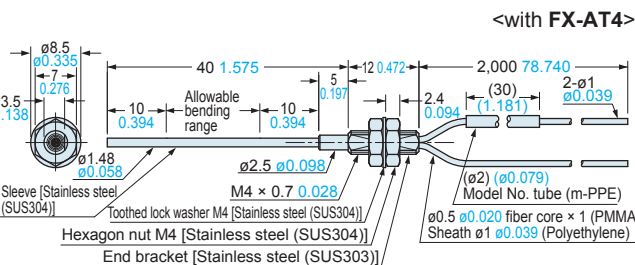
FD-41S

Free-cut



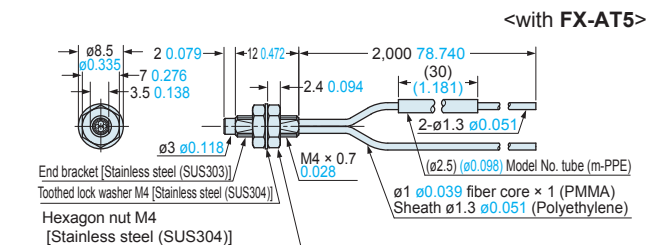
FD-41SW

Free-cut



FD-41W

Free-cut



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Reflective type fibers

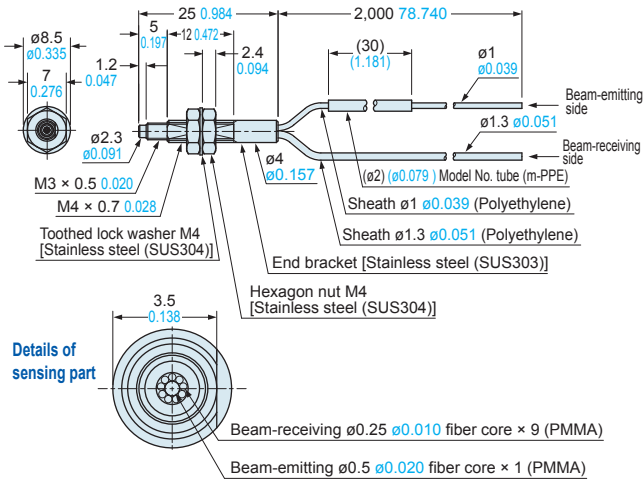


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FD-42G

Free-cut

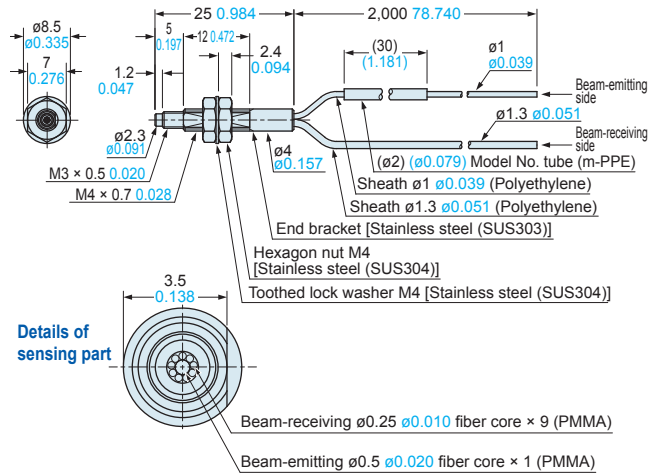
<with FX-AT6>



FD-42GW

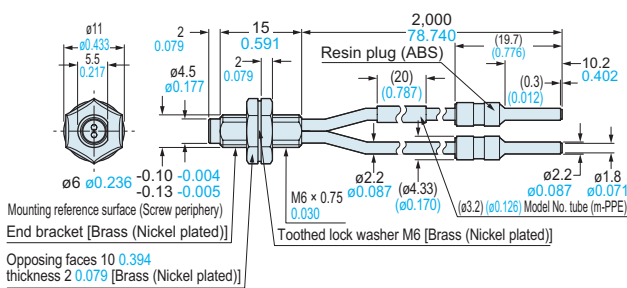
Free-cut

<with FX-AT6>



FD-60

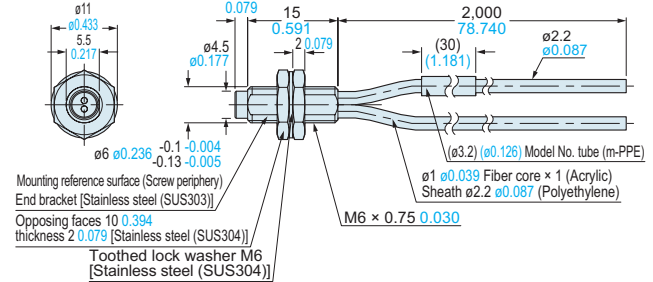
<with FX-AT2>



FD-61

Free-cut

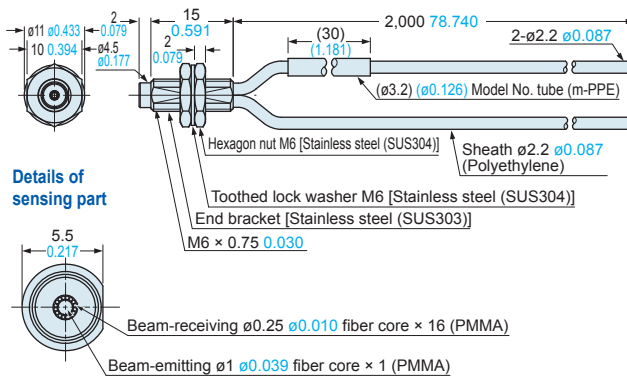
<with FX-AT3>



FD-61G

Free-cut

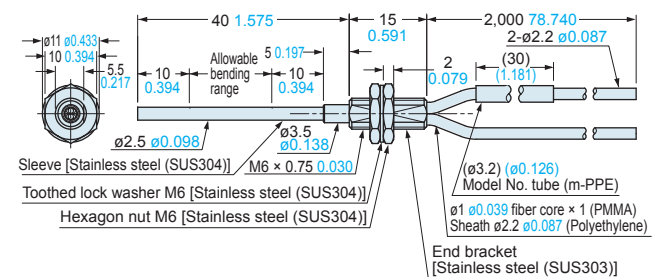
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FD-61S

Free-cut

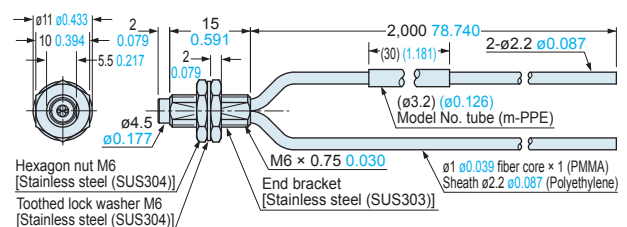
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FD-61W

Free-cut

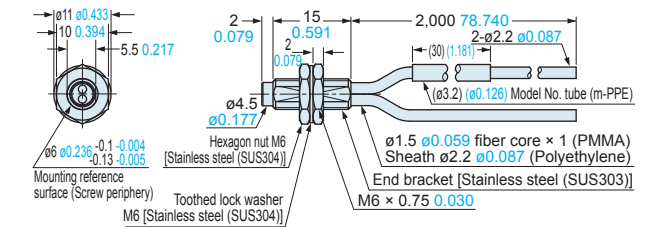
<with FX-AT3>



FD-62

Free-cut

<with FX-AT3>



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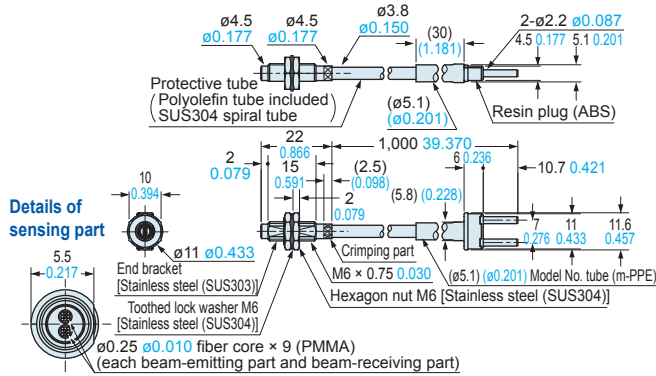
Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Reflective type fibers



Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

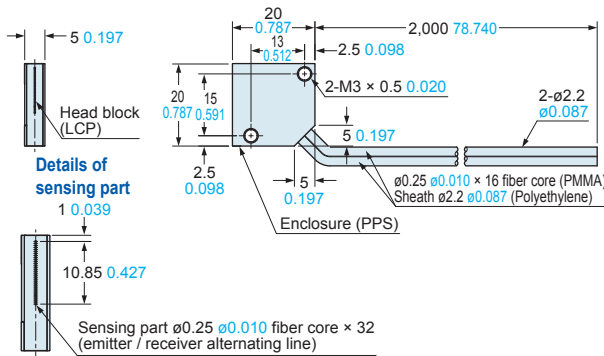
FD-64X



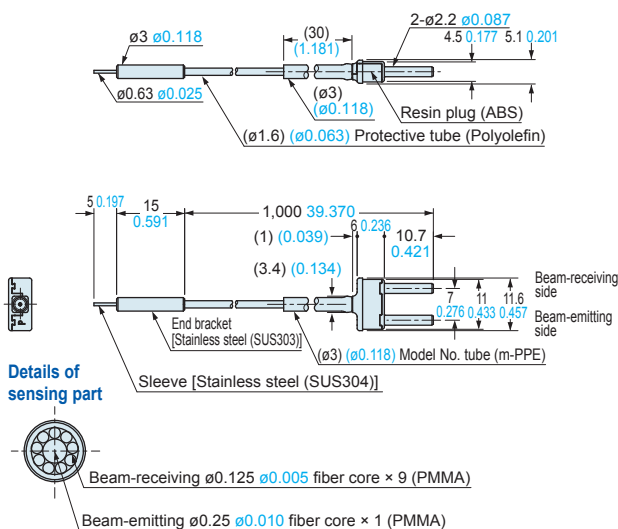
FD-AL11

Free-cut

<with FX-AT3>



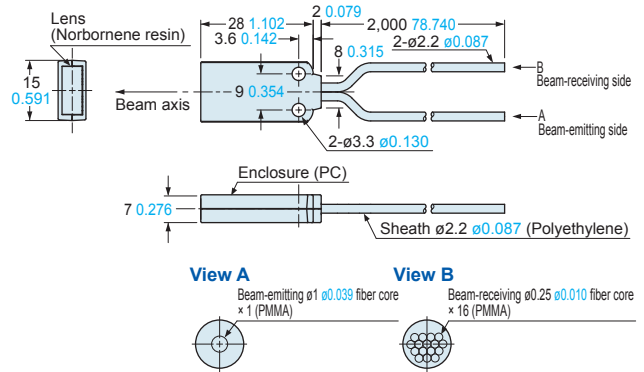
FD-E23



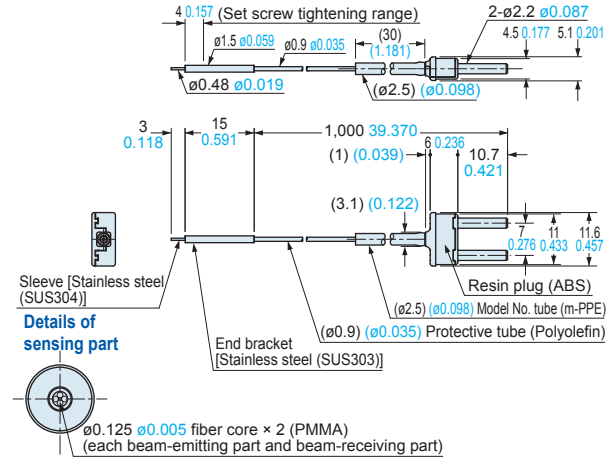
FD-A16

Free-cut

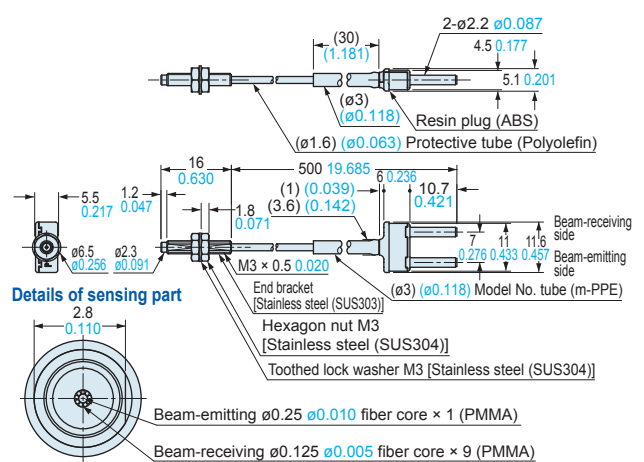
<with FX-AT3>



FD-E13



FD-EG30



DIMENSIONS (Unit: mm in)

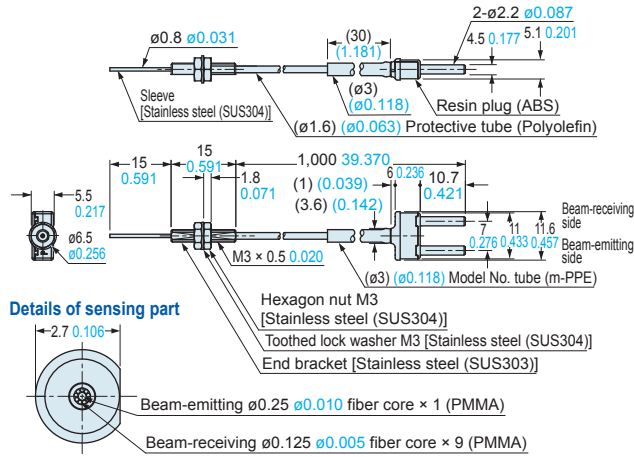
Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Reflective type fibers

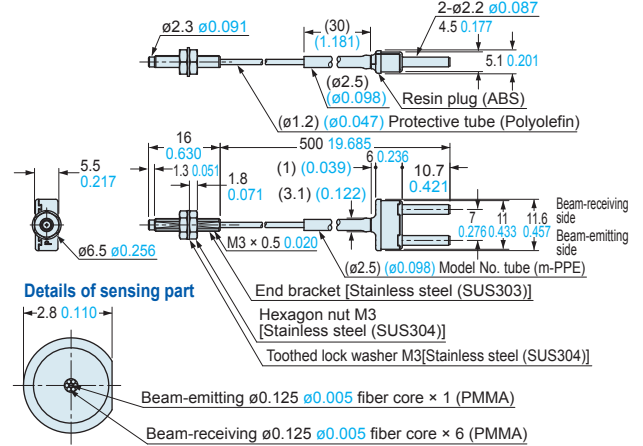


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FD-EG30S



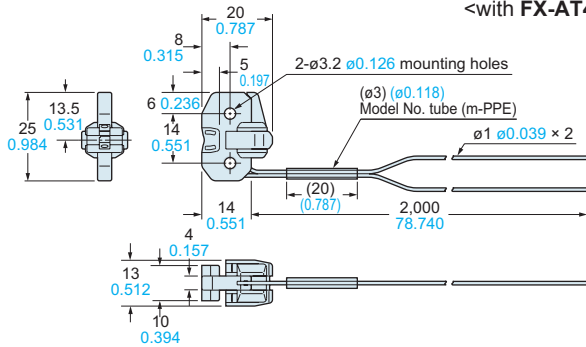
FD-EG31



FD-F4 FD-F41

Free-cut

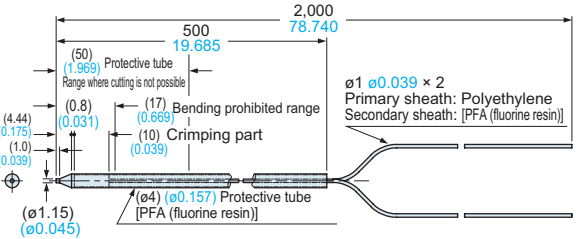
<with FX-AT4>



FD-F41Y

Free-cut

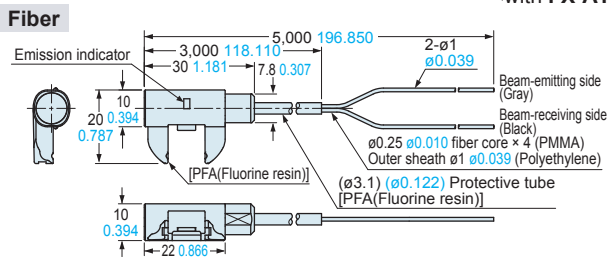
<with FX-AT4>



FD-F71

Free-cut

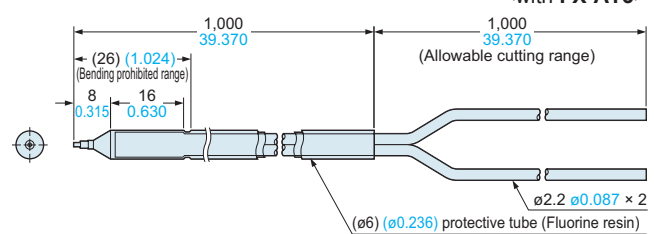
<with FX-AT4>



FD-F8Y

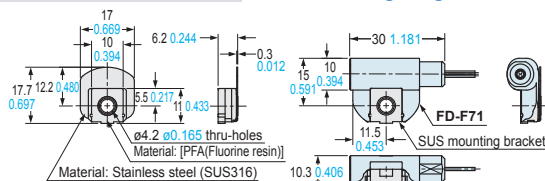
Free-cut

<with FX-AT3>



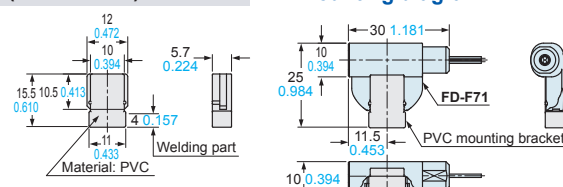
SUS mounting bracket (MS-FD-F7-1)

SUS mounting bracket (FD-71) mounting diagram



PVC mounting bracket (MS-FD-F7-2)

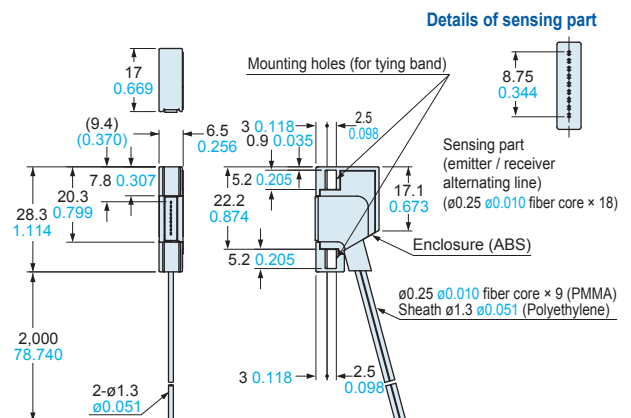
PVC mounting bracket (FD-71) mounting diagram



FD-FA93

Free-cut

<with fiber attachment>



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Reflective type fibers



Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

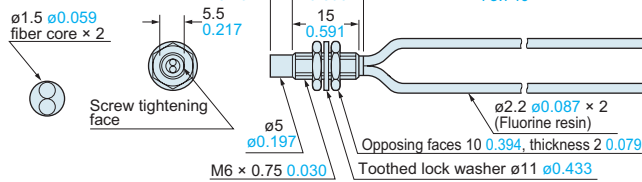
Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FD-H13-FM2



<with **FX-AT3**>

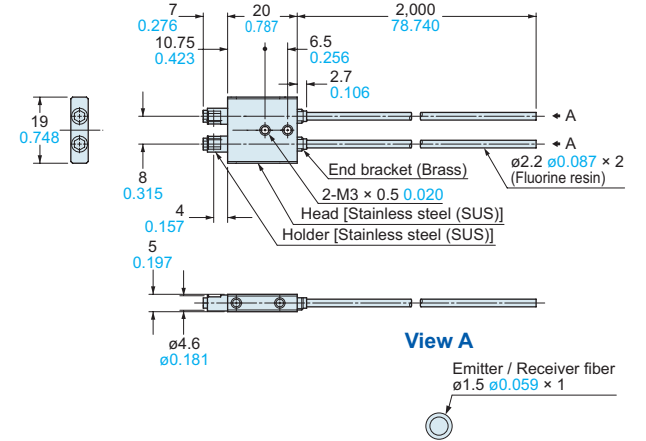
Details of sensing part



FD-H18-L31

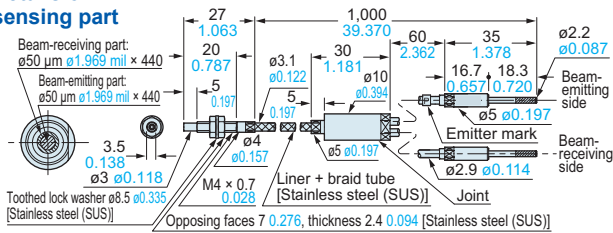


<with **FX-AT3**>



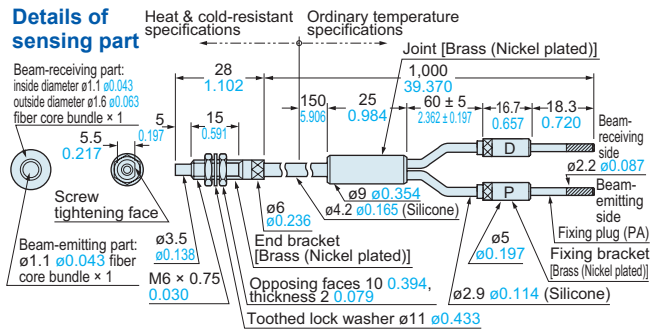
FD-H20-21

Details of sensing part



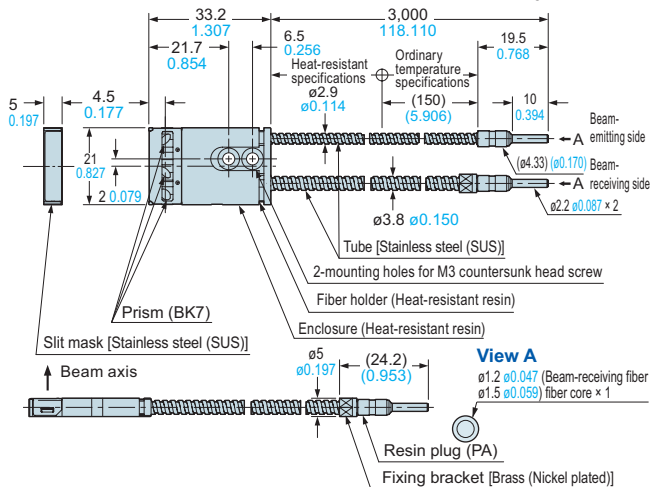
FD-H20-M1

Details of sensing part

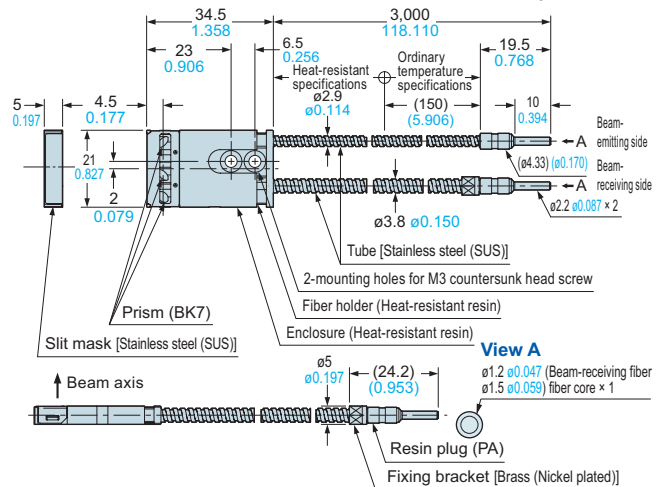


FD-H25-L43

<with **FX-AT2**>



FD-H25-L45

<with **FX-AT2**>

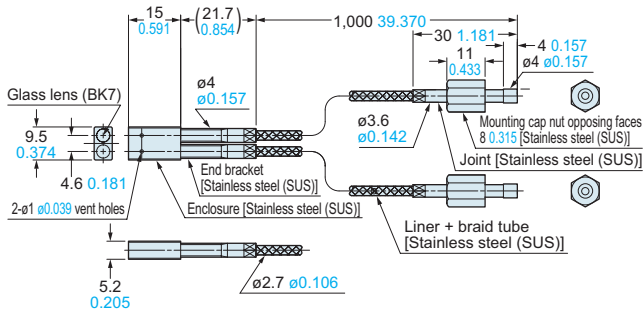
Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

Reflective type fibers

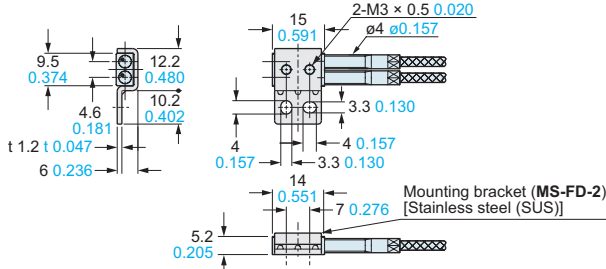


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FD-H30-KZ1V-S

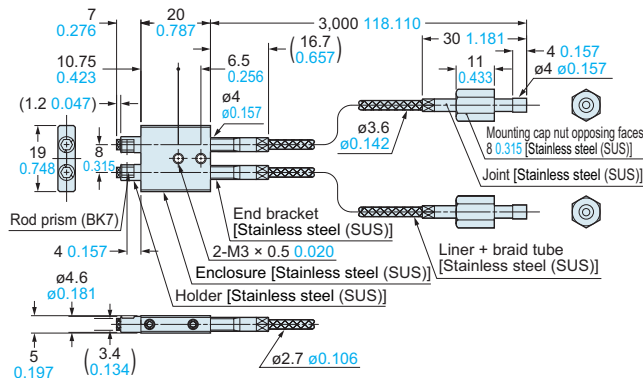


Assembly dimensions with MS-FD-2 (attached mounting bracket)



Note: The **FD-H30-KZ1V-S** is a set with the **FD-H30-KZ1V**, photo-terminal, and atmospheric side fiber. Refer to p.69 for dimensions of the atmospheric side fiber and photo-terminals.

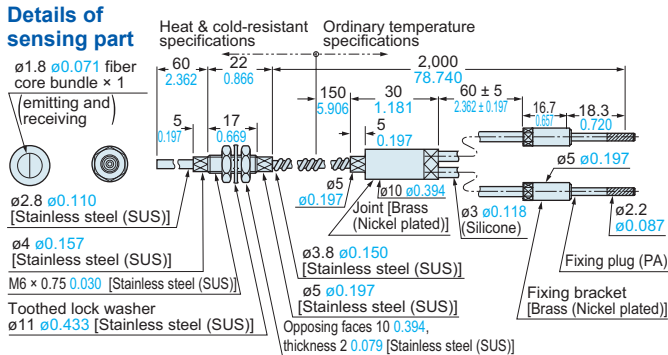
FD-H30-L32V-S



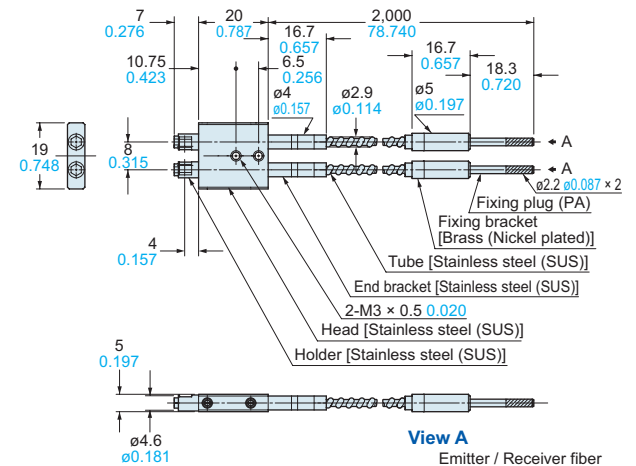
Note: The **FD-H30-L32V-S** is a set with the **FD-H30-L32V**, photo-terminal, and atmospheric side fiber. Refer to p.69 for dimensions of the atmospheric side fiber and photo-terminals.

FD-H35-M2S6

Details of sensing part

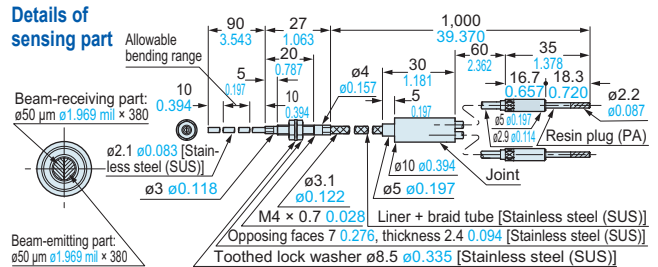


FD-H30-L32



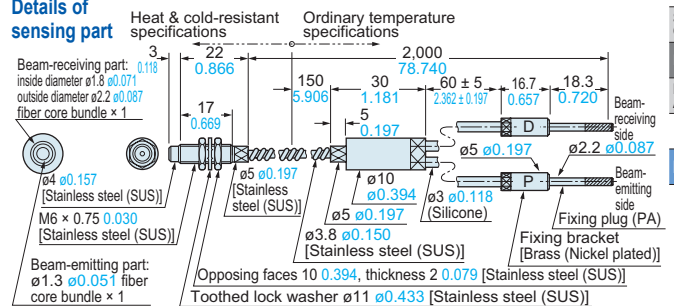
FD-H35-20S

Details of sensing p

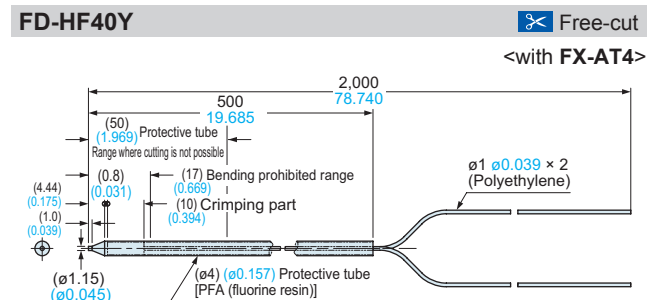


FD-H35-M2

Details of sensing part



FD-HF40Y



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Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Reflective type fibers

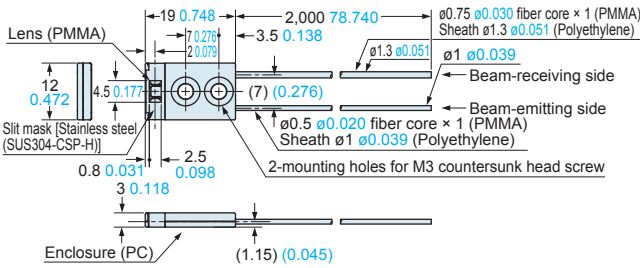


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FD-L10

Free-cut

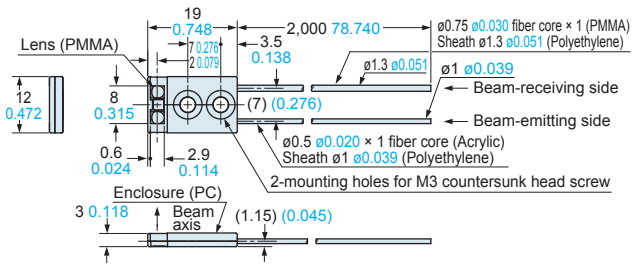
<with FX-AT6>



FD-L11

Free-cut

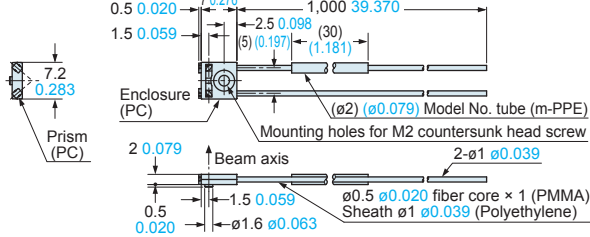
<with FX-AT6>



FD-L12W

Free-cut

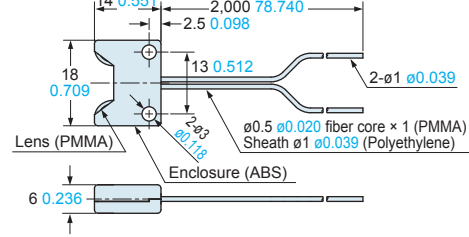
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FD-L20H

Free-cut

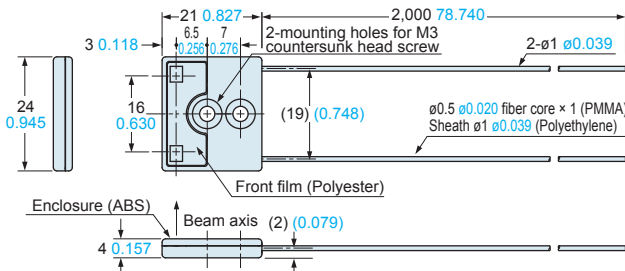
<with FX-AT4>



FD-L21

Free-cut

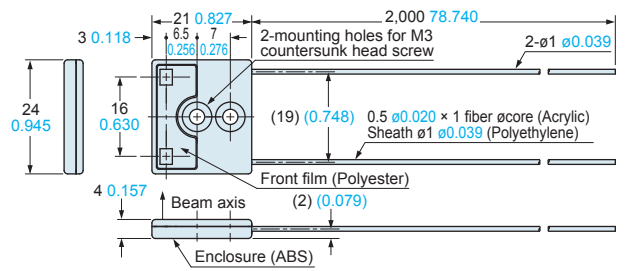
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FD-L21W

Free-cut

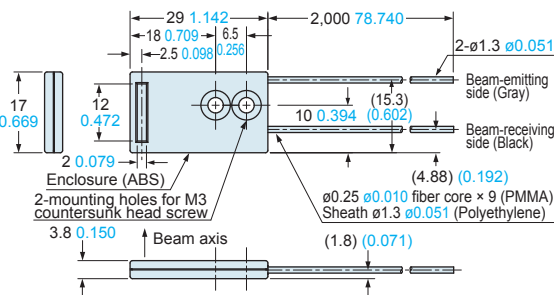
<with FX-AT4>



FD-L22A

Free-cut

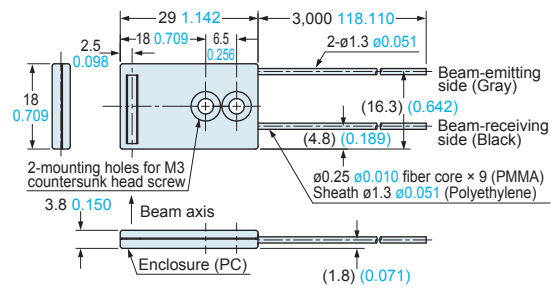
<with FX-AT5>



FD-L23

Free-cut

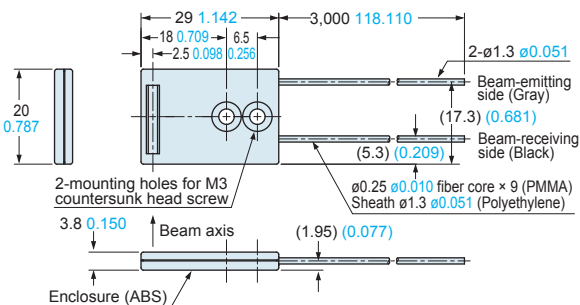
<with FX-AT5>



FD-L30A

Free-cut

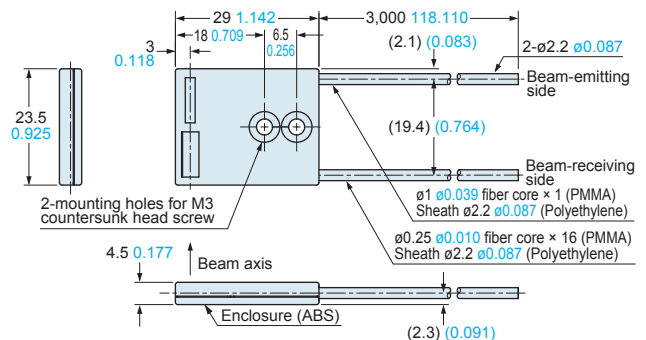
<with FX-AT5>



FD-L31A

Free-cut

<with FX-AT3>



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Reflective type fibers

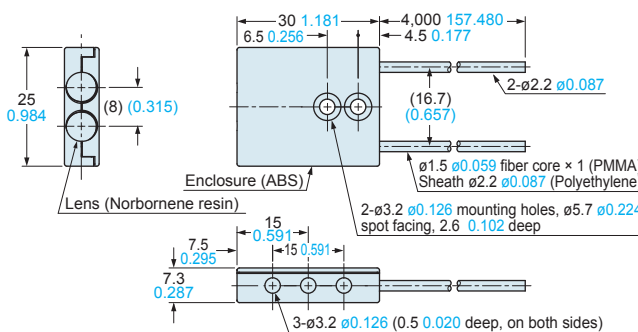


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

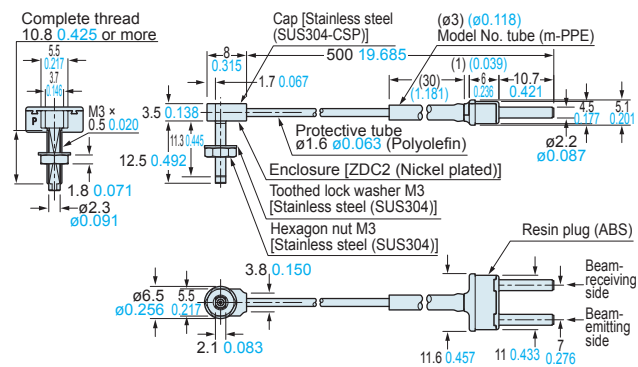
FD-L32H

Free-cut

<with FX-AT3>



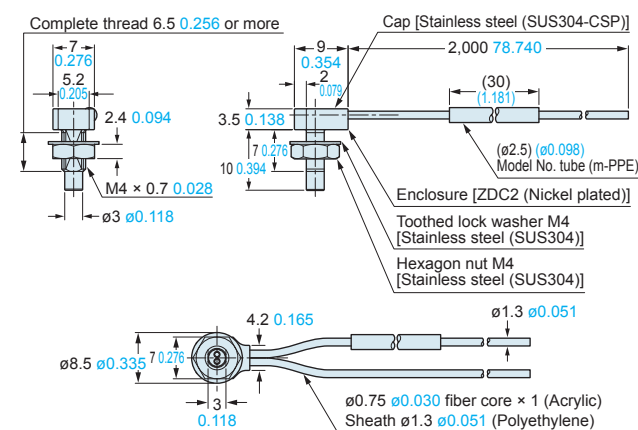
FD-R32EG FD-R34EG



FD-R41

Free-cut

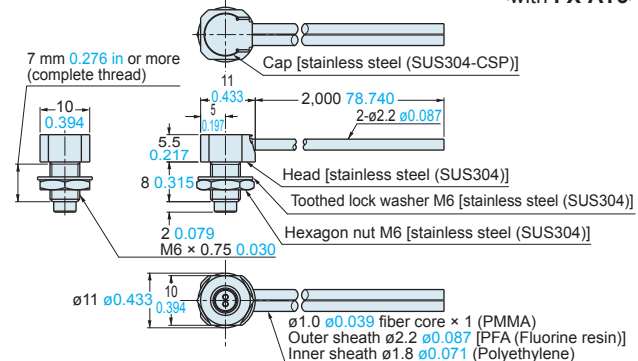
<with FX-AT5>



FD-R61Y

Free-cut

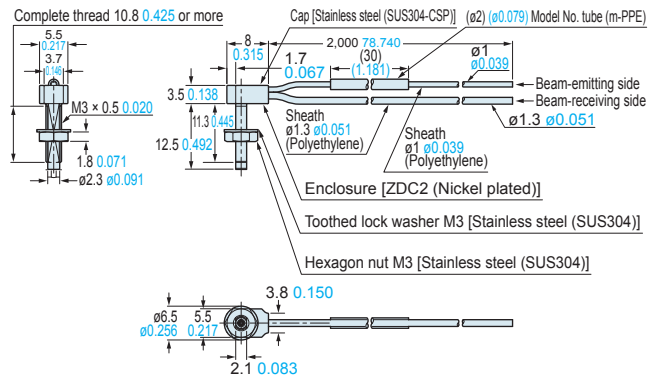
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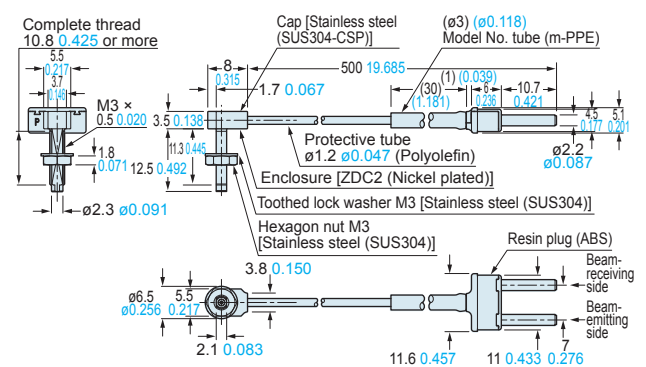
FD-R31G

Free-cut

<with FX-AT6>



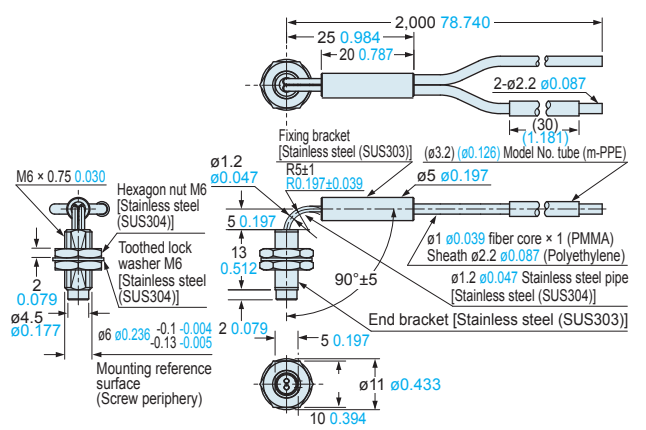
FD-R33EG



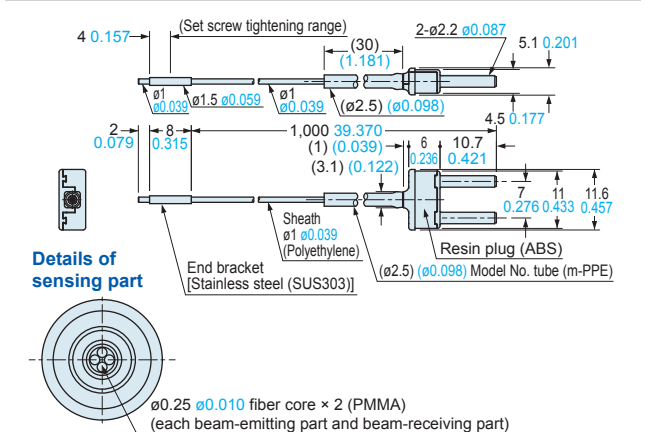
FD-R60

Free-cut

<with FX-AT3>



FD-S21



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Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Reflective type fibers

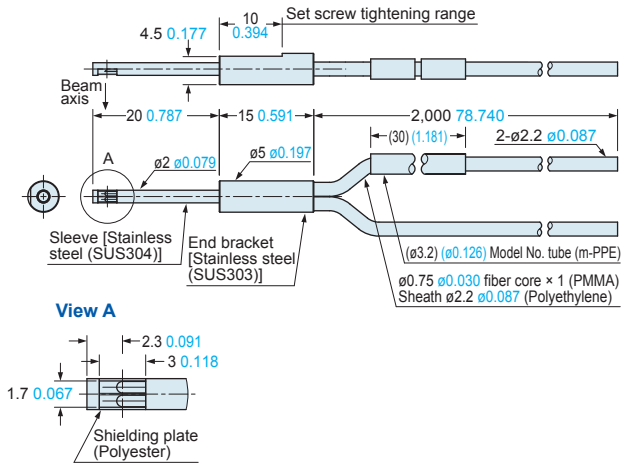


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FD-V50

Free-cut

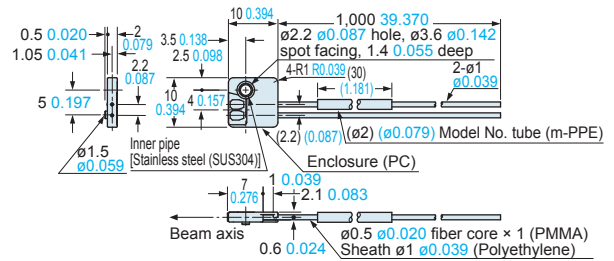
<with FX-AT3>



FD-Z20HBW

Free-cut

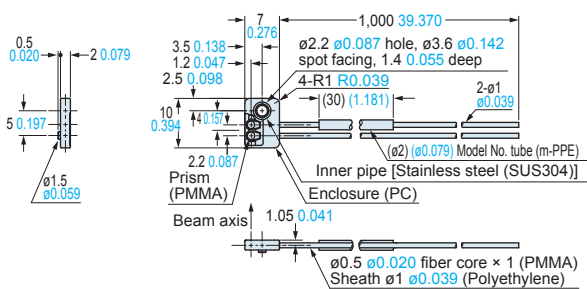
<with FX-AT4>



FD-Z20W

Free-cut

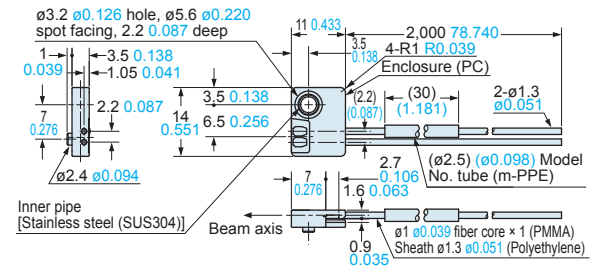
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FD-Z40HBW

Free-cut

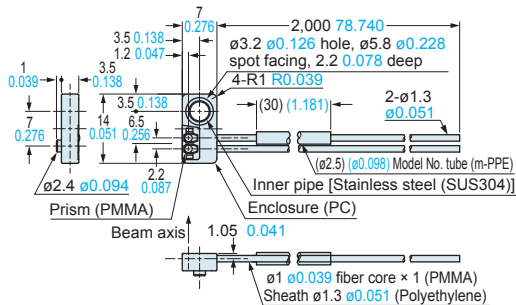
<with FX-AT5>



FD-Z40W

Free-cut

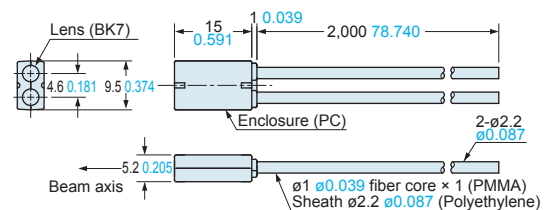
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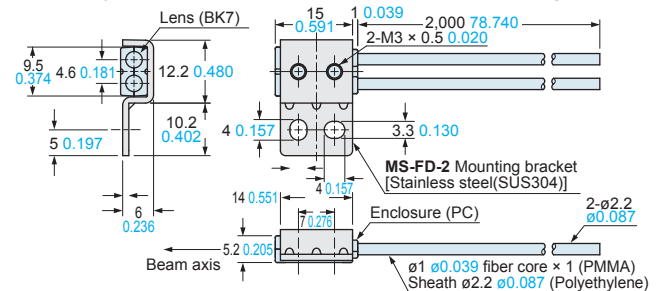
FD-Z50HW

Free-cut

<with FX-AT3>



Assembly dimensions with MS-FD-2 (attached mounting bracket)



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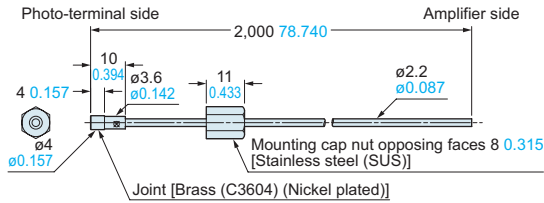
Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

Vacuum-resistant Atmospheric side fiber

FT-J8

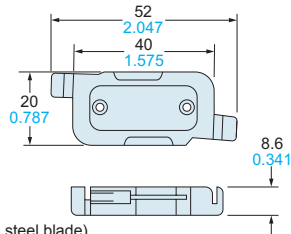
Free-cut

(Accessory for vacuum-resistant fiber) <with FX-AT3>



FB-1

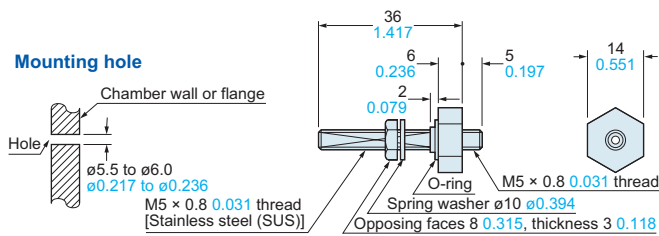
Fiber bender (Optional)



FV-BR1

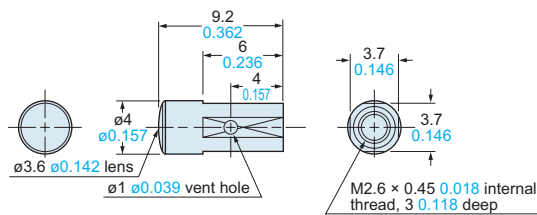
Photo-terminal (for vacuum-resistant) (with vacuum-resistant fiber)

Mounting hole



FV-LE1

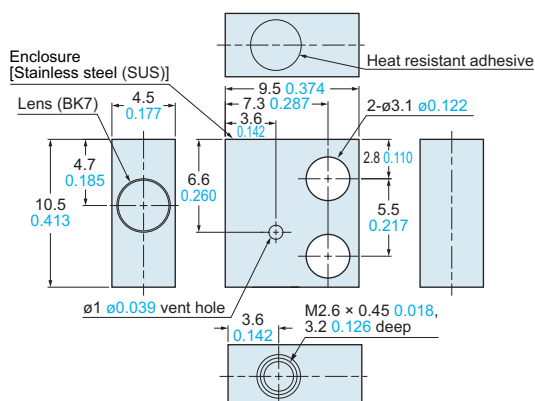
Vacuum-resistant expansion lens (Optional)



Material: Enclosure.....Aluminum alloy (A6061-T6)
Lens.....BK-7

FV-SV2

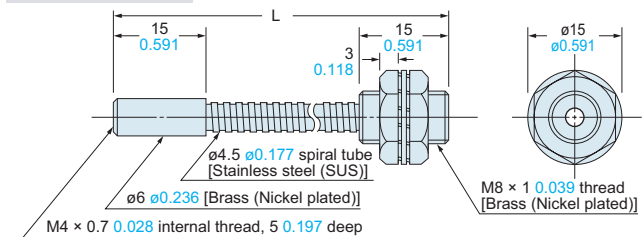
Vacuum-resistant side-view lens (Optional)



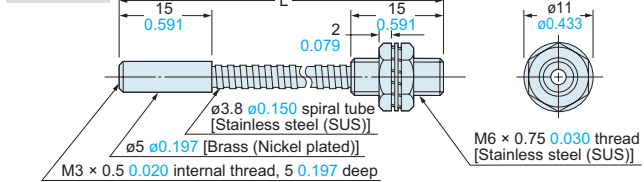
FTP-□ FDP-□

Protective tube (Optional)

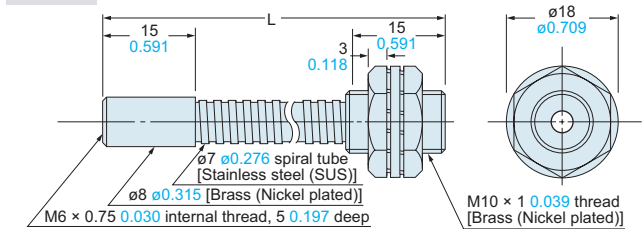
FTP-□ FDP-N□



FTP-N□



FDP-□



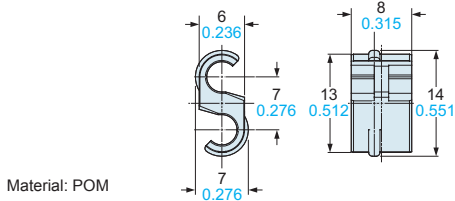
• Length L

Model No.	Length L
FTP-500, FTP-N500, FDP-N500, FDP-500	500 ⁺¹⁰ ₀ 19.685 ^{+0.394} ₀
FTP-1000, FTP-N1000, FDP-N1000, FDP-1000	1,000 ⁺¹⁰ ₀ 39.370 ^{+0.394} ₀
FTP-1500, FTP-N1500, FDP-N1500, FDP-1500	1,500 ⁺¹⁰ ₀ 59.055 ^{+0.394} ₀

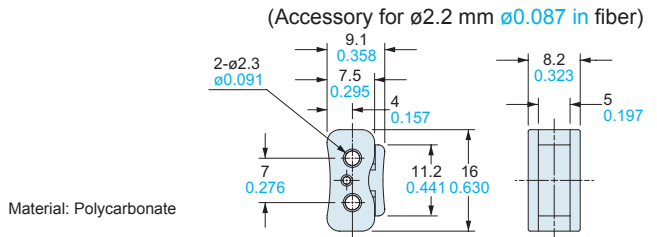
DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

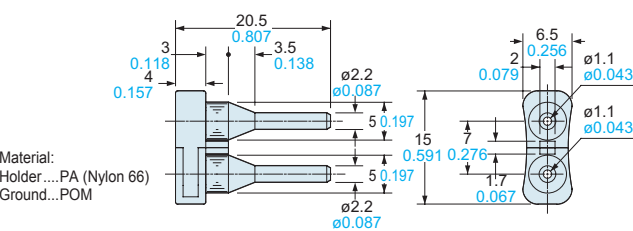
FX-AT2 Attachment for fixed-length fiber (Accessory for fixed-length fiber)



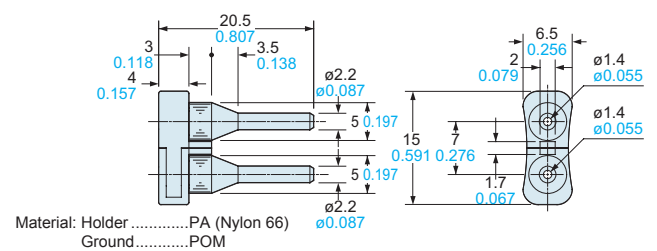
FX-AT3 Attachment for $\varnothing 2.2$ mm $\varnothing 0.087$ in fiber



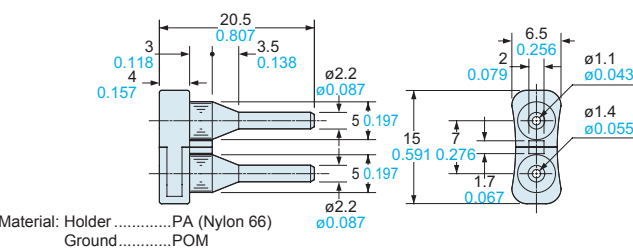
FX-AT4 Attachment for $\varnothing 1$ mm $\varnothing 0.039$ in fiber



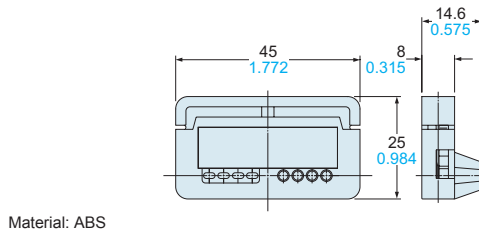
FX-AT5 Attachment for $\varnothing 1.3$ mm $\varnothing 0.051$ in fiber



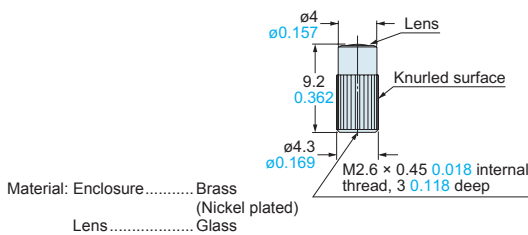
FX-AT6 Attachment for $\varnothing 1$ mm $\varnothing 0.039$ in / $\varnothing 1.3$ mm $\varnothing 0.051$ in mixed fiber



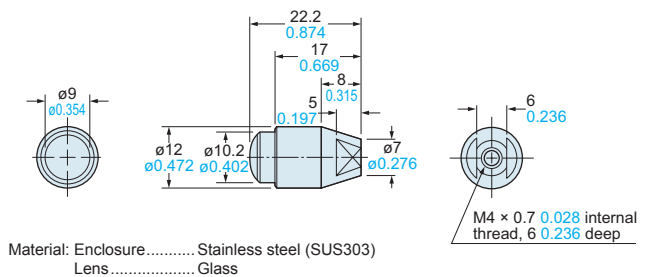
FX-CT2 Fiber cutter (Accessory for free-cut type fiber)



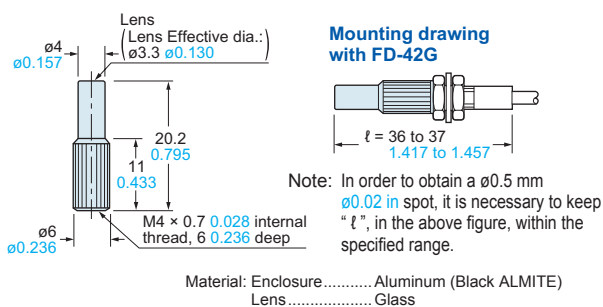
FX-LE1 Expansion lens (Optional)



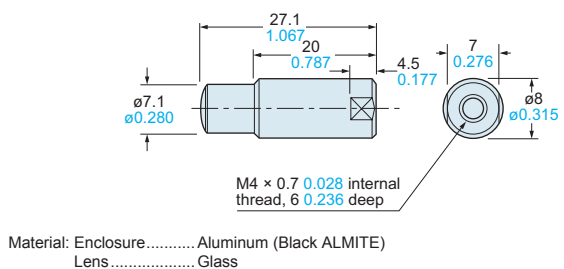
FX-LE2 Super-expansion lens (Optional)



FX-MR1 Pinpoint spot lens (Optional)



FX-MR2 Zoom lens (Optional)



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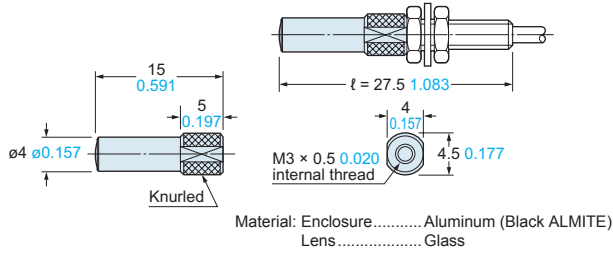
DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.118), **FX-100** series (p.138) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

FX-MR3

Finest spot lens (Optional)

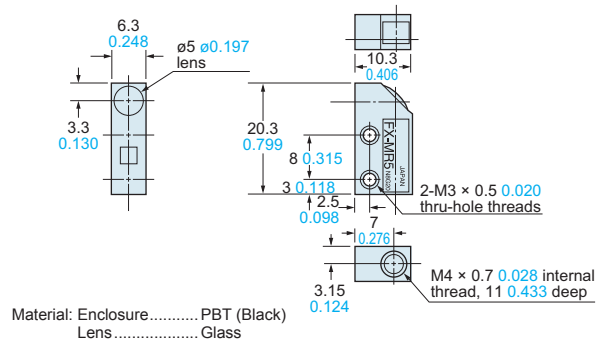
Mounting drawing with FD-EG30



Note: When inserting the fiber, insert fully till it stops.

FX-MR5

Zoom lens (Optional)

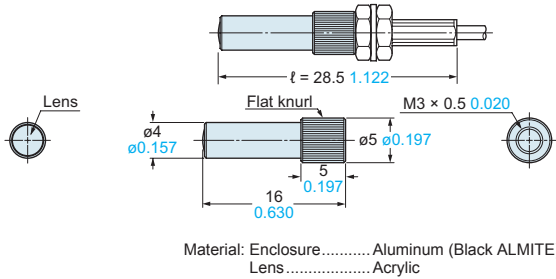


NT-FX-MR5 (exclusive nut) is attached.

FX-MR6

Finest spot lens (Optional)

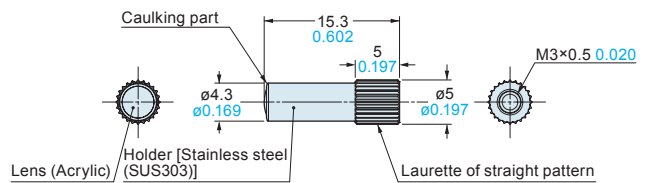
Mounting drawing with FD-EG31



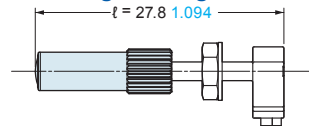
Note: When inserting the fiber, insert fully till it stops.

FX-MR7

Finest spot lens (Optional)

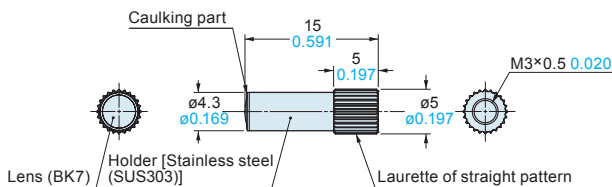


Mounting drawing with FD-R31G/R32EG/R33EG/R34EG

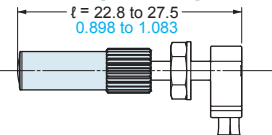


FX-MR8

Zoom lens (Optional)

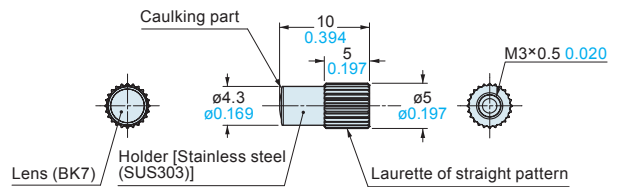


Mounting drawing with FD-R31G/R32EG/R33EG/R34EG

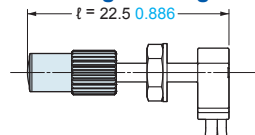


FX-MR9

Parallel light lens (Optional)

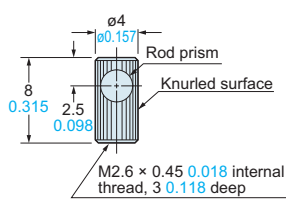


Mounting drawing with FD-R31G/R32EG/R33EG/R34EG

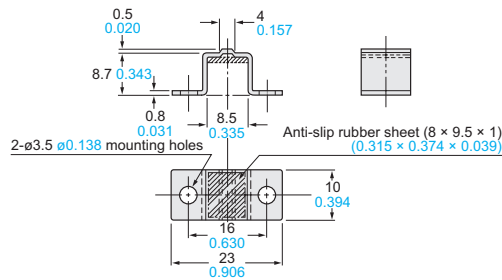


DIMENSIONS (Unit: mm in)

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FX-SV1 Side-view lens (Optional)

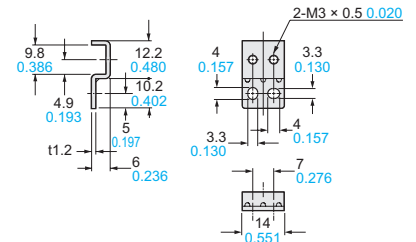
Material: Enclosure.....Brass (Nickel plated)
Lens.....Glass

MS-EX3 Mounting bracket for FX-MR2 (Accessory for FX-MR2)

Material: Brass (Nickel plated)

MS-FD-2 Fiber mounting bracket

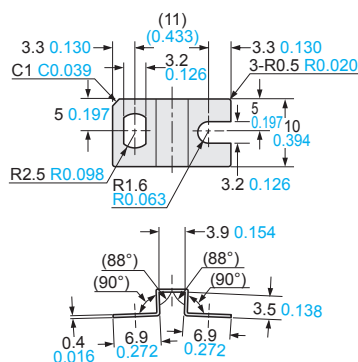
Accessory for FD-Z50HW, FR-KZ50E/KZ50H/Z50HW, FD-H30-KZ1V-S



Material: Stainless steel (SUS304)

MS-FD-3 Fiber mounting bracket

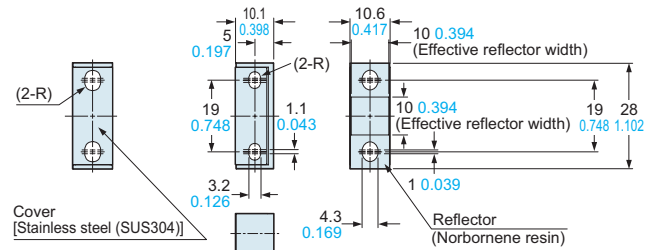
Accessory for FT-KV40/FT-KV40W



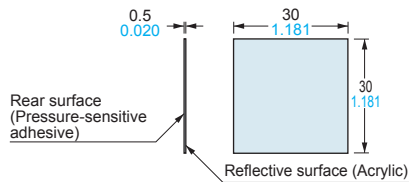
Material: Stainless steel (SUS304)

RF-003 Reflector for FR-KZ50E/KZ50H

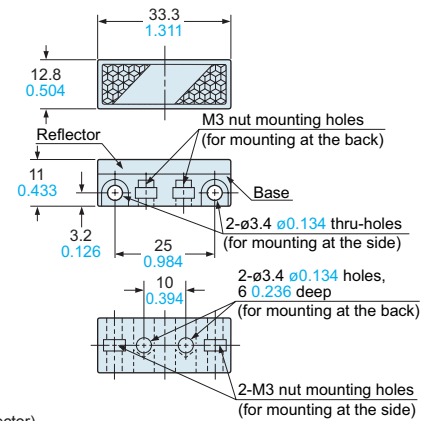
Accessory for FR-KZ50E/KZ50H

**RF-13** Reflective tape for FR-Z50HW

Accessory for FR-Z50HW

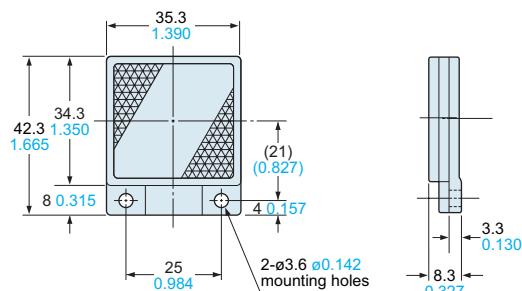


Material : Acrylic (Reflectivesurface)

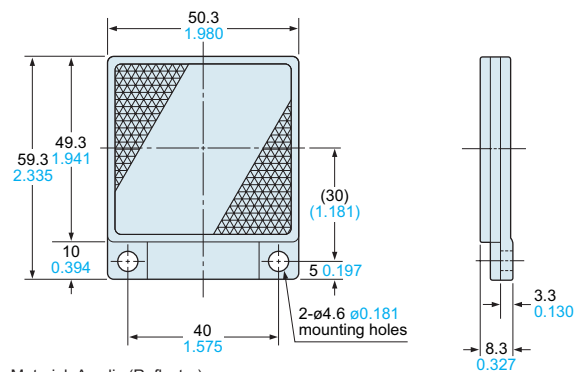
RF-210 Reflector (Optional)

Material: Acrylic (Reflector)
ABS (Base)

Two M3 (length 8 mm 0.315 in) screws with washers and two nuts are attached.

RF-220 Reflector (Optional)

Material: Acrylic (Reflector)
ABS (Base)

RF-230 Reflector (Optional)

Material: Acrylic (Reflector)
ABS (Base)

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■ Sensor selection guide..... P.3~

Related Information

■ Fiber selection..... P.5~

■ Glossary of terms..... P.1455~

■ General precautions P.1458~

Ver.2



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

panasonic.net/id/pidsx/global



Conforming to
EMC Directive



Listing



Certified



PNP output
type available



Timer



Interference
prevention



Light intensity
monitor



Automatic
sensitivity setting



Test input



External sync.

At the industry's leading edge

Improved the operability and visibility of the operation keys

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

Previous

Setting switch MODE key



Upgraded
(Ver. 2)

Setting switch MODE key



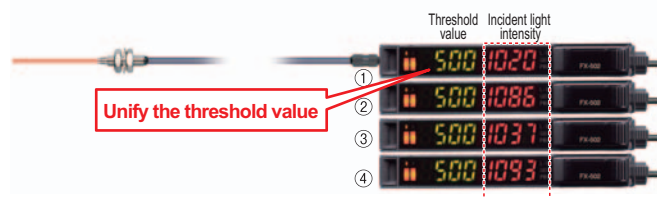
Clicking
touch!

High stability!

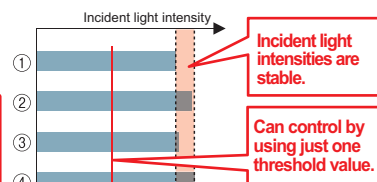
When the **FX-500** series is used together with our super quality fiber, the incident light intensity variation among units is decreased to only 1/4 of that of conventional models.

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

Super quality fiber + FX-500 series

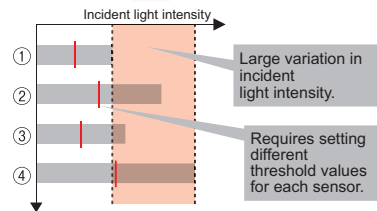
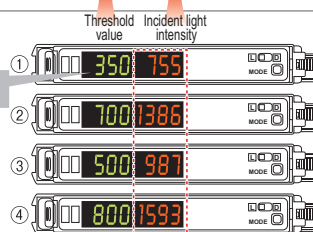


1/4
incident light
intensity variation
(from previous)



Previous amplifier

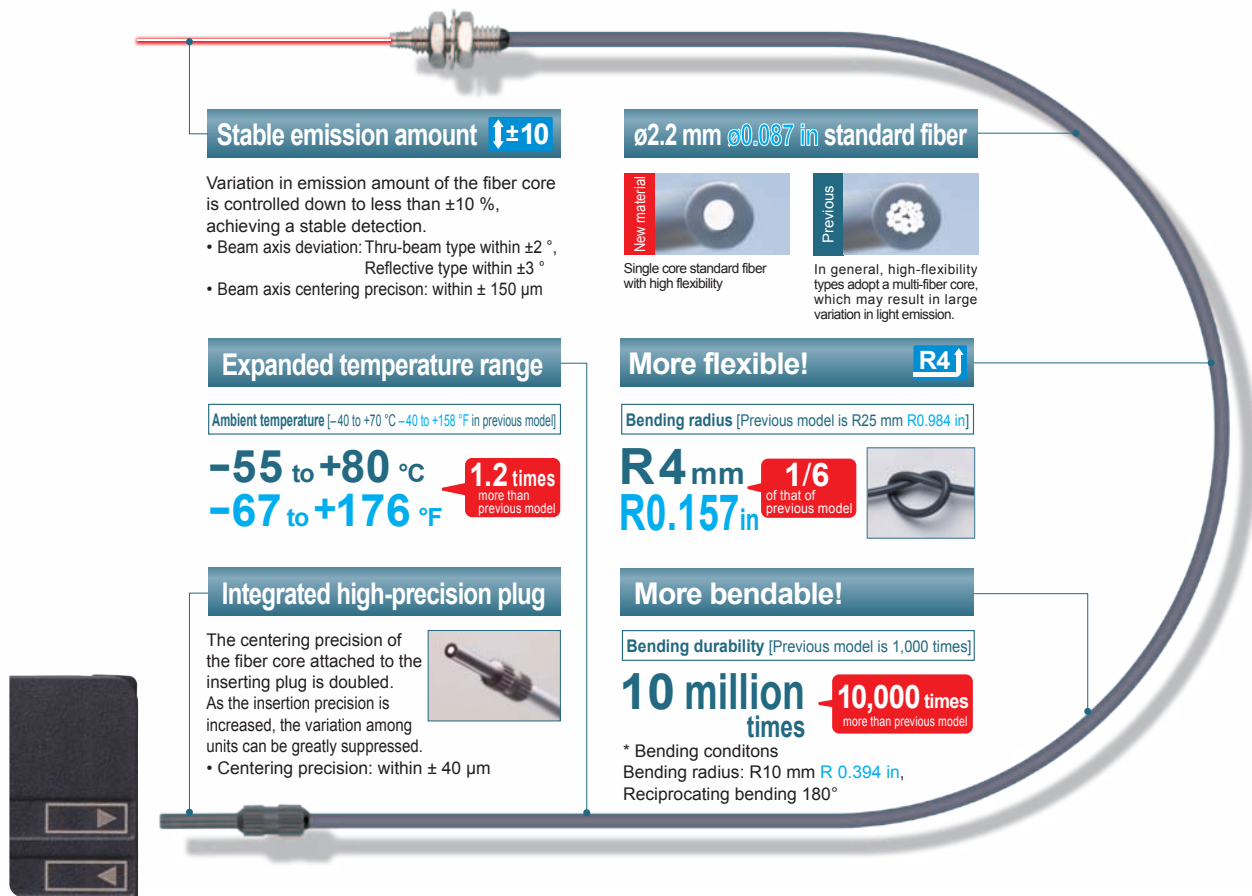
Variation in the threshold value



A quality that surpassed that of standard fibers!

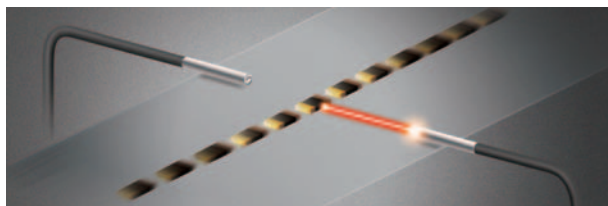
New fibers developed using a new manufacturing method adopted by our own factory along with a persistent quality control system.

The basic performance of a standard fiber is greatly enhanced!



Max. 25 μs response time

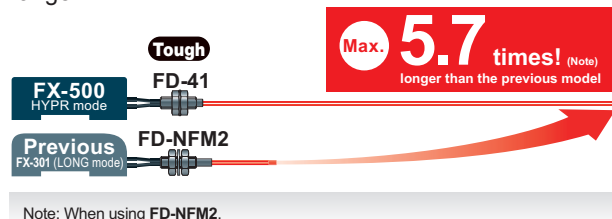
FX-500 with its high response time contributes to improve productivity.



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

Hyper **HYPR mode** incorporated

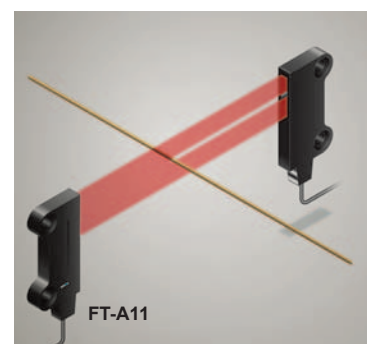
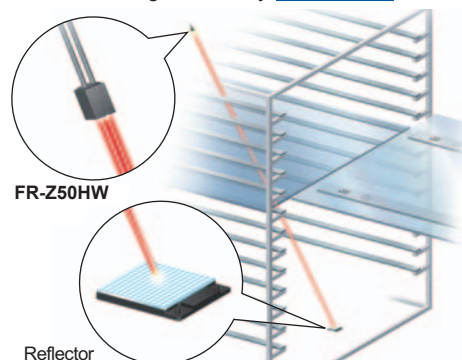
FX-500 in combination with small diameter fibers which can handle challenging detections, allows long sensing range.



So accurate! Sharp detection with suppressed hysteresis

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

- Long range detection of small objects with small difference in light intensity **H-02 mode**
- Highly accurate detection while avoiding saturation **H-01 mode**



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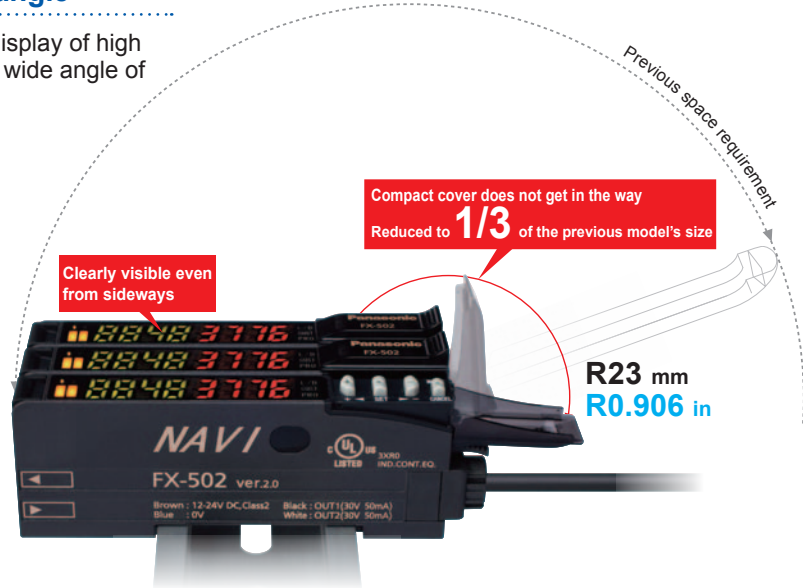
FX-300

FX-410

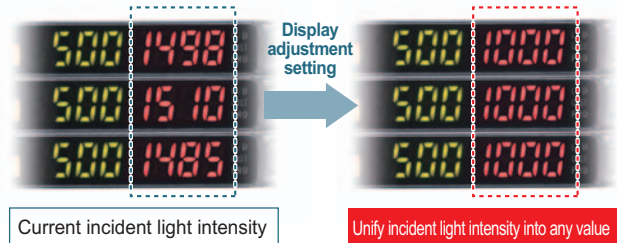
FX-311

FX-301-F7/
FX-301-F**Flat display with wide viewing angle**

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

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

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

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

The "four-chemical emitting element", which we are the first to incorporate to maintain a stable level of light emission, has now become an industry standard. **FX-500** series continues to adopt the same emitting element as well as the "APC (Auto Power Control) circuit" which improves stability in short periods such as when the power is turned on.

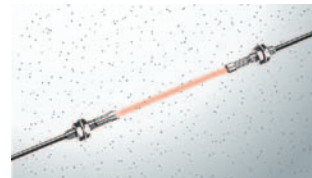
**Suitable for preventative maintenance
Self-diagnosis output****FX-502(P)
FX-505(P)-C2**

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

**Saves maintenance time
Threshold tracking function**

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

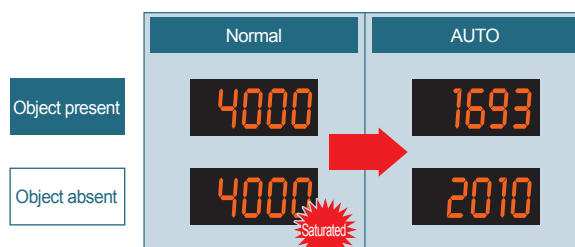
- Detect deterioration in light intensity (e.g. Useful in dusty environment)



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

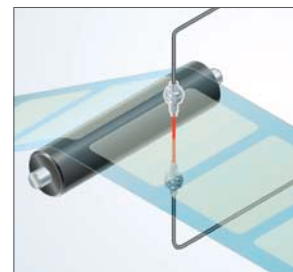
**Stable detection while being eco-friendly
Emission power & gain setting**

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



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

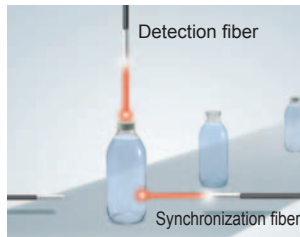
- Detecting a transparent sheet



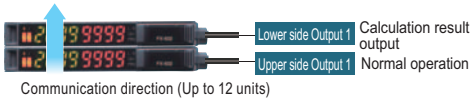
Built-in logic functions No PLC necessary, saving material and programming costs

Logical calculation functions

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



Calculation of two neighboring amplifiers



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

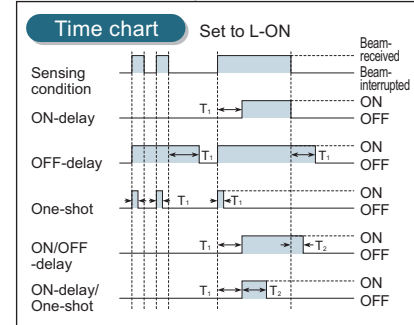


Calculation of one amplifier and external input **FX-502(P) / 505(P)-C2**



Equipped with 5 timer types

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

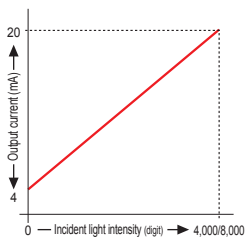


Timer period: 0.05 ms to 32 s
Output 1 has ON / OFF-delay and ON-delay / One-shot timers are available.

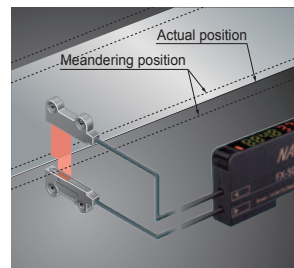
Analog output cable type

FX-505(P)-C2

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



Edge tracking of film or sheet



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

Smooth setup changes by 8 data banks

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

Remote control improves work efficiency by external input

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

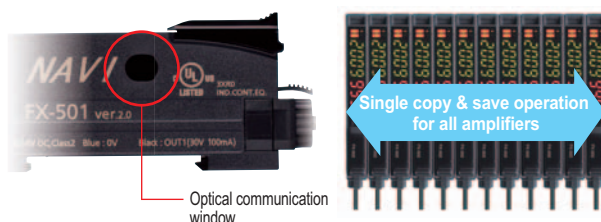
Work efficiency can be improved by operating via PLC output or other external signal. (**FX-502(P)** can operate via external signal when switching from Output 2 to external input.)

Functions operable by external input

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

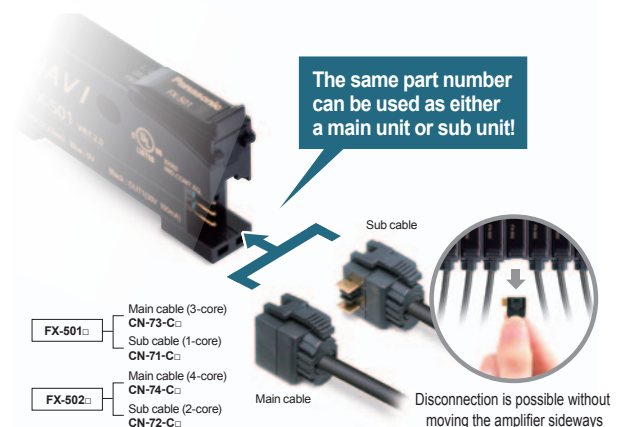
An optical communication function allows sensors to be adjusted simultaneously

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



No need to specify a main unit or sub unit

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



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

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

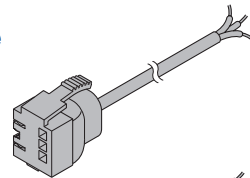
Quick-connection cables

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

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

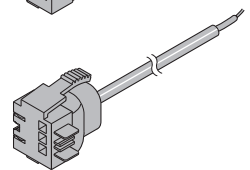
Main cable

• **CN-73-C□**



Sub cable

• **CN-71-C□**

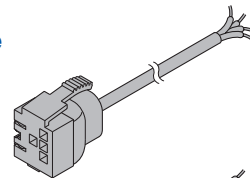


For FX-502(P) Quick-connection cable is not supplied with the amplifier. Please order it separately.

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

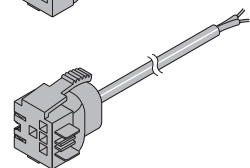
Main cable

• **CN-74-C□**



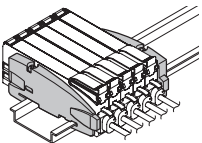
Sub cable

• **CN-72-C□**



End plates

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

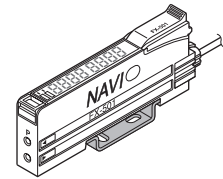
Appearance	Model No.	Description
	MS-DIN-E	When amplifiers are mounted in cascade, or when an amplifier moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. <div>Two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

OPTIONS

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

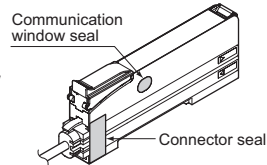
Amplifier mounting bracket

- **MS-DIN-2**



Accessory

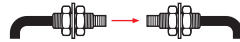
- **FX-MB1** (Amplifier protection seal)
10 sets of 2 communication window seals and 1 connector seal



LIST OF FIBERS

Super quality

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in)		Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP						
Threaded	M3	Tough FT-30	R2 Bending durability	2 m	STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	0.5	150 μm / ±2°	±10 %	IP67	-55 to +80 °C	P.51
	M4	Tough FT-40	R4 Bending durability		STD 1,200 47.244 HYPR (Note) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	1					
Cylindrical	ø1.5	Tough FT-S20	R2 Bending durability		STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	0.5					P.55
	ø3	Tough FT-S30	R4 Bending durability		STD 1,200 47.244 HYPR (Note) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	1					

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

Reflective type



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

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

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

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LIST OF FIBERS

Threaded type

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP					
Threaded	M3	Tough FT-31	R2 Bending durability	2 m	STD 315 12.402 HYPR 1,350 53.150	770 30.315 550 21.654 210 8.268 70 2.756	ø0.5	150 µm / ±2°	IP67	-55 to +80 °C	P.51
		FT-31W	R1		STD 260 10.236 HYPR 990 38.976	590 23.228 440 17.323 150 5.906 53 2.087		150 µm / ±3°		-40 to +60 °C	
	M4	Lens mountable FT-43	R4 Bending durability	2 m	STD 1,400 55.118 HYPR (Note 2) 3,600 141.732	2,800 110.236 2,100 82.677 770 30.315 240 9.449	ø1.5	150 µm / ±2°		-55 to +80 °C	P.51
		Tough FT-42			STD 1,130 44.488 HYPR (Note 2) 3,600 141.732	2,050 80.709 1,600 62.992 530 20.866 190 7.480		150 µm / ±3°		-40 to +60 °C	
		Lens mountable FT-42W	R1		STD 800 31.496 HYPR 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299		150 µm / ±3°		-40 to +60 °C	P.52
		Lens mountable, Stainless-jacketed FT-45X	R4		STD 1,200 47.244 HYPR (Note 2) 1,600 62.992	1,600 62.992 (Note 2) 1,600 62.992 (Note 2) 630 24.803 200 7.874		150 µm / ±2°		-55 to +80 °C	
		Lens mountable FT-R40	R4		STD 930 36.614 HYPR (Note 2) 3,600 141.732	1,750 68.898 1,500 59.055 500 19.685 160 6.299		150 µm / ±2°		-55 to +80 °C	P.54
		With expansion lens FT-140			STD (Note 2) 19,600 771.654 HYPR (Note 2) 19,600 771.654	19,600 771.654 (Note 2) 19,600 771.654 (Note 2) 16,000 629.921 6,300 248.031		—		-40 to +70 °C	P.51
	M14 Long range			10 m			ø10				

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

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

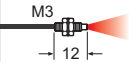
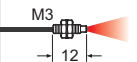

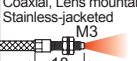
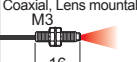


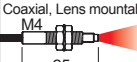
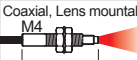
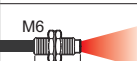
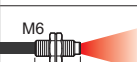

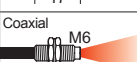


Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

LIST OF FIBERS

Threaded type

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)		Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG LONG FAST H-SP					
M3		Tough FD-31	R2 Bending durability	2 m	STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	150 μm / ±3°	IP67	-55 to +80 °C	P.59	
		FD-31W	R1		STD 80 3.150 HYPR 330 12.992	180 7.087 140 5.512 45 1.772 12 0.472	—		-40 to +60 °C		
		Tough FD-32G	R2 Bending durability		STD 200 7.874 HYPR 650 25.591	380 14.961 270 10.630 95 3.740 27 1.063	—	IP40	-55 to +80 °C		
		FD-32GX	R2		STD 200 7.874 HYPR 630 24.803	410 16.142 360 14.173 100 3.937 30 1.181	—		-55 to +80 °C		
		FD-EG30	R4		STD 48 1.890 HYPR 170 6.693	130 5.118 110 4.331 30 1.181 9 0.354	—		-40 to +70 °C		P.61
		FD-EG31			STD 20 0.787 HYPR 85 3.346	45 1.772 35 1.378 12 0.472 3.5 0.138	—		-20 to +60 °C		P.62
Threaded	M4		Tough FD-41	R2 Bending durability	2 m	STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	150 μm / ±3°	IP67	-55 to +80 °C	P.59
			FD-41W	R1		STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	—		-40 to +60 °C	
			Tough FD-42G	R2 Bending durability		STD 200 7.874 HYPR 650 25.591	380 14.961 270 10.630 95 3.740 27 1.063	—	IP40	-55 to +80 °C	
			FD-42GW	R1		STD 150 5.906 HYPR 670 26.378	340 13.386 280 11.024 90 3.543 25 0.984	—		-40 to +60 °C	
	M6		FD-62	R4 Bending durability	2 m	STD 520 20.472 HYPR 1,500 59.055	1,000 39.370 940 37.008 340 13.386 110 4.331	150 μm / ±3°	IP67	-55 to +80 °C	P.60
			Tough FD-61			STD 450 17.717 HYPR 1,400 55.118	840 33.071 670 26.378 200 7.874 70 2.756				
		FD-61W	R1	STD 270 10.630 HYPR 900 35.433		630 24.803 430 16.929 150 5.906 45 1.772	—	-40 to +60 °C			
		Tough FD-61G	R4 Bending durability	STD 420 16.535 HYPR 1,100 43.307		800 31.496 650 25.591 200 7.874 60 2.362	—	IP40	-55 to +80 °C		
		FD-64X	R4	STD 280 11.024 HYPR 670 26.378		500 19.685 410 16.142 160 6.299 50 1.969	—			-55 to +80 °C	
Elbow		Tough FD-R60	R4 Bending durability	2 m	STD 290 11.417 HYPR 1,100 43.307	600 23.622 550 21.654 190 7.480 65 2.559	150 μm / ±3°	IP67		P.66	

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

2) The sensing range is specified for white non-glossy paper.

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

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

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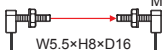

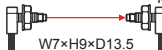
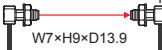
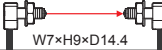
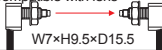
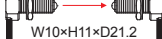
FX-301-F7/ FX-301-F

LIST OF FIBERS

Square head type

Thru-beam type (one pair set)



Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions
						FX-500 series	U-LG LONG FAST H-SP				
Square head	M3		Tough FT-R31	R2 Bending durability	 2m	STD 270 10.630 HYPR 1,000 39.370	580 22.835 440 17.323 160 6.299 55 2.165	ø0.5	IP67	-55 to +80 °C	P.54
	M4	Lens mountable 	Tough FT-R43	R4 Bending durability		STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118	ø1			
			FT-R41W	R1		STD 800 31.496 HYPR 3,200 125.984	1,800 70.866 1,400 55.118 460 18.110 150 5.906	ø1	IP40	-40 to +60 °C	
		With expansion lens 	FT-R42W			STD 2,200 86.614 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,500 137.795 1,300 51.181 460 18.110	ø2.2			
		Cable-protection type Compatible with lens 	Tough NEW FT-R44Y	R4		STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118	ø1	IP67 (Note 3)	-55 to +80 °C	
	Full-protection type 	Tough NEW FT-R60Y	Bending durability	STD 2,100 82.677 HYPR (Note2) 3,600 141.732		3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,260 49.606 400 15.748	ø3.5	IP68G	P.55		

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

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

3) The fiber part is oil-resistant.

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)		Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP				
Square head	M3	Tough FD-R31G	R2 Bending durability	2m	STD 170 6.693 HYPR 530 20.866	310 12.205 260 10.236 85 3.346 27 1.063	Emitter ø0.5	IP40	-55 to +80 °C	P.66
		Coaxial, Lens mountable M3 W5.5×H8×D16	FD-R32EG		STD 45 1.772 HYPR 170 6.693	110 4.331 92 3.622 30 1.181 9 0.354	Emitter ø0.25			
		Coaxial, Lens mountable M3 W5.5×H8×D16	FD-R34EG		STD 38 1.496 HYPR 130 5.118	90 3.543 70 2.756 23 0.906 7 0.276	Emitter ø0.175			
		Coaxial, Lens mountable M3 W5.5×H8×D16	FD-R33EG		STD 19 0.748 HYPR 84 3.307	44 1.732 33 1.299 11 0.433 3 0.118	Emitter ø0.125		-20 to +60 °C	
	M4	Tough FD-R41	R2 Bending durability	2m	STD 210 8.268 HYPR 710 27.953	430 16.929 320 12.598 100 3.937 34 1.339	ø0.75	IP67	-55 to +80 °C	
	M6	Tough NEW FD-R61Y	R4 Bending durability		STD 280 11.024 HYPR 990 38.976	610 24.016 435 17.126 160 6.299 50 1.969	—	IP67 (Note 3)		

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

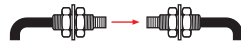
2) The sensing range is specified for white non-glossy paper.






3) The fiber part is oil-resistant.

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

LIST OF FIBERS**Cylindrical type**

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  : Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions				
					FX-500 series	U-LG FAST LONG H-SP									
Cylindrical	ø1	Tough FT-S11	R2	500 mm	STD 90 3.543 HYPR 350 13.780	210 8.268 160 6.299 60 2.362 19 0.748	ø0.25	—	IP67	-55 to +80 °C	P.55				
	ø1.5	Tough FT-S21	Bending durability	2 m	STD 315 12.402 HYPR 1,350 53.150	770 30.315 550 21.654 210 8.268 70 2.756	150 µm / ±2°	150 µm / ±3°							
		FT-S21W			STD 260 10.236 HYPR 990 38.976	590 23.228 440 17.323 150 5.906 53 2.087									
	ø2.5	With lens, Long sensing range ø2.5 8	FT-S32	R10 Bending durability		STD 3,100 122.047 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,800 70.866 600 23.622	ø2	—	IP40		-40 to +70 °C			
	ø3	FT-S31W	R1	STD 800 31.496 HYPR 3,300 129.921		1,900 74.803 1,400 55.118 490 19.291 160 6.299	ø1	150 µm / ±3°	-40 to +60 °C						
	Ultra-small diameter	ø3	Narrow beam ø0.125mm ø0.25 ø3 5 15	Tough FT-E13	R2 Bending durability		STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	ø0.125	—		IP67	-40 to +70 °C		
			Narrow beam ø0.25mm ø0.4 ø3 5 15	Tough FT-E23			STD 75 2.953 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512	ø0.25	—					
			Side-view	ø4			 25	Tough FT-V40	R4 Bending durability			2 m	STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 850 33.465	ø2.5

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

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)		Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG FAST LONG H-SP					
Cylindrical	ø1.5	Tough FD-S21	R2 Bending durability	1 m	STD 80 3.150 HYPR 190 7.480	130 5.118 110 4.331 37 1.457 11 0.433	—	IP40	-55 to +80 °C	P.66	
	ø3	Tough FD-S32	R4 Bending durability	2 m	STD 420 16.535 HYPR 1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953	150 μm / ±3°	IP67			
		FD-S32W	R1		STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	—				
		Tough FD-S31	R2 Bending durability		STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	150 μm / ±3°				
		Coaxial FD-S33GW	R1		STD 150 5.906 HYPR 670 26.378	340 13.386 280 11.024 90 3.543 25 0.984	—				
	ø5.5	Tough NEW FD-S60Y	Protective tube R30 mm Fiber R4 Bending durability	2 m (Note 4)	STD 320 12.598 HYPR 600 23.622	590 23.228 420 16.535 200 7.874 75 2.953	—	IP68G	-40 to +70 °C	P.61	
	Ultra-small diameter	ø1.5	FD-E13	R4	1 m	STD 12 0.472 HYPR 50 1.969	29 1.142 25 0.984 7 0.276 2 0.079	—	IP40		-40 to +60 °C
		ø3	FD-E23			STD 55 2.165 HYPR 170 6.693	120 4.724 80 3.150 30 1.181 9 0.354	—			-40 to +70 °C

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

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

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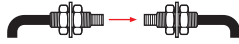
FX-500**FX-100****FX-300****FX-410****FX-311**

FX-301-F / FX-301-F

LIST OF FIBERS

Sleeve

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length (m) Free-cut	Sensing range (mm in) (Note 1, 2)		Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP				
Threaded	M3 Sleeve 40mm ø0.88 10	Tough FT-31S	R2 Bending durability (Note 3)	2 m	STD 315 12.402 HYPR 1,220 48.031	740 29.134 550 21.654 195 7.677 63 2.480	ø0.5	IP67	-55 to +80 °C	P.51
	M4 Sleeve 40mm ø1.48 12	Tough FT-42S	R4 Bending durability (Note 3)	2 m	STD 1,130 44.488 HYPR 3,600 141.732 (Note 2)	2,050 80.709 1,600 62.992 530 20.866 190 7.480	ø1			
Cylindrical	Ultra-small diameter ø3 Narrow beam ø0.125mm Sleeve part cannot be bent.	Tough FT-E13	R2 Bending durability	1 m	STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	ø0.125	IP67	-40 to +70 °C	P.52
		Tough FT-E23	R2 Bending durability	1 m	STD 160 6.299 HYPR 125 4.921	125 4.921 42 1.654 13 0.512	ø0.25			
	Side-view ø2 Sleeve part cannot be bent.	Tough FT-V23	R4 Bending durability	2 m	STD 450 17.717 HYPR 1,800 70.866	1,000 39.370 880 34.646 280 11.024 90 3.543	ø0.75	IP30	-55 to +80 °C	P.55
		Tough FT-V25	R2 Bending durability	2 m	STD 240 9.449 HYPR 900 35.433	550 21.654 480 18.898 140 5.512 45 1.772	ø0.5			
		Tough FT-V24W	R1	2 m	STD 110 4.331 HYPR 380 14.961	230 9.055 200 7.874 60 2.362 20 0.787	ø0.5			
	ø2.5 Sleeve part cannot be bent.	Tough FT-V30	R4 Bending durability	2 m	STD 680 26.772 HYPR 2,200 86.614	1,200 47.244 1,000 39.370 340 13.386 100 3.937	ø1.0	IP30	-40 to +60 °C	P.56
									-55 to +80 °C	

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range. 3) Bending radius of sleeve part is R10 mm R0.394 in or more.

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length (m) Free-cut	Sensing range (mm in) (Note 1, 2)		Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP			
Threaded	Ultra-small diameter M3 Sleeve 15 mm ø0.8 15 Sleeve part cannot be bent.	FD-EG30S	R4	1 m	STD 150 1.969 HYPR 170 6.693	110 4.331 80 3.150 30 1.181 9 0.354	IP40	-40 to +70 °C	P.62
	M4 Sleeve 40 mm ø1.48 12	Tough FD-41S	R2 Bending durability (Note 3)	2 m	STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	IP67	-55 to +80 °C	P.59
	M6 Sleeve 40 mm ø2.5 15	Tough FD-61S	R4 Bending durability (Note 3)	2 m	STD 420 16.535 HYPR 1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953		-55 to +80 °C	P.60
Cylindrical	Ultra-small diameter ø1.5 Sleeve part cannot be bent.	FD-E13	R4	1 m	STD 12 0.472 HYPR 50 1.969	29 1.142 25 0.984 7 0.276 2 0.079	IP40	-40 to +60 °C	P.61
	ø3 Sleeve part cannot be bent.	FD-E23	R4	1 m	STD 120 4.724 HYPR 55 2.165	120 4.724 80 3.150 30 1.181 9 0.354		-40 to +70 °C	
	Small diameter ø3 Sleeve part cannot be bent.	Tough FD-V30	R2 Bending durability	2 m	STD 65 2.559 HYPR 240 9.449	130 5.118 120 4.724 35 1.378 14 0.551	IP30	-55 to +80 °C	P.67
	ø3 Sleeve part cannot be bent.	FD-V30W	R1	2 m	STD 20 0.787 HYPR 80 3.150	40 1.575 30 1.181 10 0.394 2 0.079		-40 to +60 °C	
	ø5 Sleeve part cannot be bent.	Tough FD-V50	R4 Bending durability	2 m	STD 120 4.724 HYPR 370 14.567	220 8.661 210 8.268 75 2.953 25 0.984		-55 to +80 °C	P.68

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

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

LIST OF FIBERS

Flat type

Thru-beam type (one pair set)









Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG LONG FAST H-SP					
Flat	Top sensing W3 × H8 × D12	Tough FT-Z30H	R2 Bending durability	2 m	STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,600 102.362 810 31.890	2 × 3	IP40	-40 to +60 °C	P.57	
	Top sensing W3 × H8 × D12	FT-Z30HW	R1		STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 740 29.134				P.56	
	Side sensing W3 × H12 × D8	Tough FT-Z30E	R2 Bending durability		STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 740 29.134				P.57	
	Side sensing W3 × H12 × D8	FT-Z30EW	R1		STD 3,400 133.858 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,000 78.740 630 24.803				P.56	
	Front sensing W8.5 × H12 × D3	Tough FT-Z30	R2 Bending durability	1 m	STD 2,100 82.677 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244 410 16.142	ø2			P.57	
	Front sensing W8.5 × H12 × D3	FT-Z30W	R1		STD 1,500 59.055 HYPR (Note 2) 3,600 141.732	3,300 129.921 3,200 125.984 1,000 39.370 280 11.024				P.56	
	Front sensing W10 × H7 × D2	FT-Z20W	R1		STD 620 24.409 HYPR (Note 2) 1,600 62.992	1,500 59.055 1,100 43.307 420 16.535 130 5.118				ø1.5	P.57
	Fiber bending type W2 × H10 × D10	FT-Z20HBW			STD 260 10.236 HYPR 1,100 43.307	670 26.378 570 22.441 180 7.087 55 2.165					P.56
	With boss	Front sensing W14 × H7 × D3.5	FT-Z40W	2 m	STD 1,500 59.055 HYPR (Note 2) 3,600 141.732	3,300 129.921 2,300 90.551 900 35.433 290 11.417	ø1.5			IP40	P.57
		Fiber bending type W3.5 × H14 × D11	FT-Z40HBW		STD 800 31.496 HYPR 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299					

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

Reflective type



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

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

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

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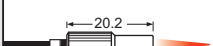
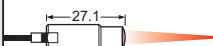

FX-410

FX-311

FX-301-F7/

FX-301-F

LIST OF FIBERS**Small spot****High precision fiber & spot lens**

Designation	Shape of head (mm) Dimensions	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens		Applicable fibers					
				Model No.	Ambient temp.	Model No.	Fiber cable length ✂: Free-cut	Bending radius (mm)	Protection	Ambient temp.	Dimensions
Finest spot lens		ø0.1 ø0.004	7 ±0.5 0.276 ±0.020	FX-MR6	-20 to +60 °C	FD-EG31	500 mm	R4	IP40	-20 to +60 °C	P.62
		ø0.2 ø0.008				FD-EG30				-40 to +70 °C	P.61
		ø0.4 ø0.016				Tough FD-42G	2 m	R2 Bending durability		-55 to +80 °C	P.60
						FD-42GW		R1		-40 to +60 °C	
						Tough FD-32G		R2 Bending durability		-55 to +80 °C	P.59
			FD-32GX	✂ 1 m	R2						
						FD-EG31	500 mm	R4		-20 to +60 °C	P.62
						FD-EG30				-40 to +70 °C	P.61
						Tough FD-42G	2 m	R2 Bending durability		-55 to +80 °C	P.60
						FD-42GW		R1		-40 to +60 °C	
						Tough FD-32G		R2 Bending durability		-55 to +80 °C	P.59
					FD-32GX	✂ 1 m	R2				
Pinpoint spot lens		ø0.5 ø0.020	6 ±1 0.236 ±0.039	FX-MR1	-40 to +70 °C	Tough FD-42G		R2 Bending durability		-55 to +80 °C	
					FD-42GW	R1		-40 to +60 °C			
Zoom lens		ø0.7 to ø2.0 ø0.028 to ø0.079	18.5 to 43 approx. 0.728 to 1.693 approx.	FX-MR2	-40 to +70 °C	Tough FD-42G	2 m	R2 Bending durability		-55 to +80 °C	P.60
					FD-42GW	R1		-40 to +60 °C			
Zoom lens (Side-view type)		ø0.5 to ø3.0 ø0.020 to ø0.118	13 to 30 approx. 0.512 to 1.181 approx.	FX-MR5	-40 to +70 °C	Tough FD-42G		R2 Bending durability		-55 to +80 °C	
					FD-42GW			R1	-40 to +60 °C		

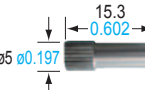










Note: Spot diameter, distance to focal point and sensing range are specified for FX-500 series.

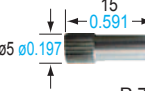
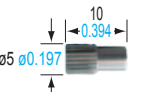
Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

LIST OF FIBERS

Small spot

Square head type M3, reflective type fiber & spot lens

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

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

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

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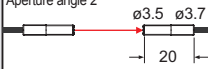

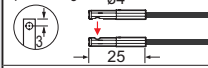
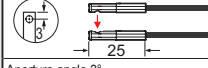
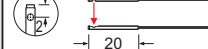
FX-301-F7/
FX-301-F

LIST OF FIBERS

Narrow beam

Thru-beam type (one pair set)



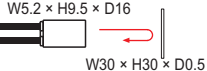



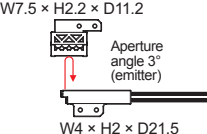


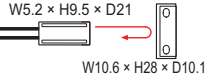


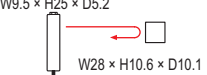
Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂️: Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP					
Narrow beam Side-view	Aperture angle 2° 	Tough FT-KS40	R2 Bending durability	 2 m	STD (Note 2) 3,600 141.732	3,600 141.732 (Note 2)	ø2.2	—	IP40	-40 to +60 °C	P.54
		HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2)								
	Aperture angle 2° 	Tough FT-KV40	R1 Bending durability		STD (Note 2) 3,600 141.732	3,600 141.732 (Note 2)	ø2.5	±0.8°	IP30		
		HYPR (Note 2) 3,600 141.732			3,600 141.732 (Note 2)						
	Aperture angle 2° 	FT-KV40W	STD (Note 2) 3,600 141.732		3,600 141.732 (Note 2)	ø1	X ±1° Z ±0.5°				
		HYPR (Note 2) 3,600 141.732	3,100 122.047 940 37.008								
	Aperture angle 3° 	Tough FT-KV26	R2 Bending durability		STD 710 27.953	1,600 62.992					
					HYPR 2,500 98.425	1,200 47.244 440 17.323 160 6.299					

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

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

Retroreflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂ : Free-cut	Sensing range (mm in) (Note 1, 2)		Protection	Ambient temp.	Dimensions				
					FX-500 series	U-LG LONG FAST H-SP							
With polarizing filter		FR-Z50HW	R1	 2 m	STD  100 to 990 3.937 to 38.976 HYPR  100 to 1,900 3.937 to 74.803	100 to 1,400 3.937 to 55.118 100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291	IP40	-25 to +55 °C	P.58				
Wafer mapping		Tough FR-KZ22E	R2 Bending durability		STD  15 to 310 0.591 to 12.205 HYPR  15 to 570 0.591 to 22.441	15 to 460 0.591 to 18.110 15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937	IP30	-40 to +60 °C					
Narrow beam	Top sensing 	Tough FR-KZ50H			STD  20 to 300 0.787 to 11.811 HYPR  20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874							
	Side sensing 	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. Refer to p.90 for the sensing range when **FR-Z50HW** is used in combination with a reflector (optional).

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)		Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP			
Long range	W5.2 × H9.5 × D16	FD-Z50HW	R1	2 m	STD 10 to 650 0.394 to 25.591 HYPR 10 to 2,500 0.394 to 98.425	10 to 1,100 0.394 to 43.307 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	P.68

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

2) The sensing range is specified for white non-glossy paper.

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

LIST OF FIBERS

Wide beam

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂️ : Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Protection	Ambient temp.	Dimension
					FX-500 series	U-LG LONG FAST H-SP				
Wide beam	 W5 × H69 × D20	Tough FT-A32	R2 Bending durability	✂️ 2 m	STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,100 82.677	3.2 × 32	IP40	-40 to +60 °C	P.52
	Allows flexible wiring W5 × H69 × D20	FT-A32W	R1		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,000 118.110				
	 W4.2 × H31 × D13.5	Tough FT-A11	R2 Bending durability		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,100 43.307	2.2 × 11		-40 to +70 °C	
	Allows flexible wiring W4.2 × H31 × D13.5	FT-A11W	R1		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,300 51.181			-40 to +55 °C	
Array	 W5 × H15 × D15	Tough FT-AL05	R2 Bending durability		STD 860 33.858 HYPR 2,300 90.551	1,550 61.024 1,500 59.055 500 19.685 170 6.693	0.25 × 5.5		-55 to +80 °C	

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

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)		Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP			
Wide beam	 W7 × H15 × D30	Tough FD-A16	R4 Bending durability	2 m	STD 200 7.874 HYPR 140 5.512 Cannot use 75 2.953	200 7.874 200 7.874 140 5.512 75 2.953	IP40	-40 to +60 °C	P.61
Array	 W5 × H20 × D20	Tough FD-AL11	R2 Bending durability		STD 320 12.598 HYPR 670 26.378	530 20.866 510 20.079 180 7.087 50 1.969			

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

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

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FX-100

FX-300

FX-410

FX-311

FX-301-F7/ FX-301-F

LIST OF FIBERS

Convergent reflective type

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)		Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP			
Glass substrate detection	Mapping W25 × H7.3 × D30	FD-L32H	R4 Bending durability	4 m	STD 0 to 56 0 to 2.205 HYPR 0 to 110 0 to 4.331	0 to 87 0 to 3.425 0 to 74 0 to 2.913 1 to 38 0.039 to 1.496 Cannot use	IP40	-40 to +60 °C	P.66
	Alignment W20 × H29 × D3.8	Tough FD-L30A	R2 Bending durability	3 m	STD 0 to 43 0 to 1.693 HYPR 0 to 43 0 to 1.693	0 to 43 0 to 1.693 0 to 43 0 to 1.693 0 to 42 0 to 1.654 0 to 29 0 to 1.142		0 to +70 °C	P.65
	Alignment W23.5 × H29 × D4.5	Tough FD-L31A	R4 Bending durability	2 m	STD 4 to 33 0.157 to 1.299 HYPR 3 to 35 0.118 to 1.378	4 to 33 0.157 to 1.299 4 to 33 0.157 to 1.299 4 to 32 0.157 to 1.260 5 to 25 0.197 to 0.984		-20 to +70 °C	
	Alignment W17 × H29 × D3.8	Tough FD-L22A	R2 Bending durability	3 m	STD 0 to 29 0 to 1.142 HYPR 0 to 30 0 to 1.181	0 to 28 0 to 1.102 0 to 27 0 to 1.063 0 to 24 0 to 0.945 0 to 18 0 to 0.709		-40 to +60 °C	
	Seating confirmation W18 × H29 × D3.8	Tough FD-L23	Bending durability	2 m	STD 0 to 16 0.059 to 0.630 HYPR 1 to 19 0.039 to 0.748	0 to 10.5 0 to 0.413 0 to 10 0 to 0.394 0 to 9 0 to 0.354 0 to 8 0 to 0.315		-40 to +60 °C	
	Seating confirmation W12 × H19 × D3	Tough FD-L11	R4 Bending durability	2 m	STD 0 to 5 0 to 0.197 HYPR 0 to 6 0 to 0.236	0 to 5.5 0 to 0.217 0 to 5 0 to 0.217 0 to 4.5 0 to 0.177 0 to 4 0 to 0.157		-40 to +60 °C	
	Seating confirmation W12 × H19 × D3	Tough FD-L10	Bending durability	1 m	STD 8 0.315 HYPR 14 0.551	12.5 0.492 12 0.472 0.5 to 7 0.020 to 0.276 0.5 to 4 0.020 to 0.157		-40 to +60 °C	
	Seating confirmation W24 × H21 × D4	Tough FD-L21	R2 Bending durability	1 m	STD 23 0.906 HYPR 45 1.772	35 1.378 32 1.260 2 to 15 0.079 to 0.591 5 to 9 0.197 to 0.354		-40 to +60 °C	
	Seating confirmation W24 × H21 × D4	FD-L21W	R1					-40 to +60 °C	
	General purpose W6 × H18 × D14	Tough FD-L20H	R2 Bending durability					-40 to +60 °C	
Ultra-small	 W7.2 × H7.5 × D2	FD-L12W	R1	1 m			IP30	-40 to +60 °C	

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

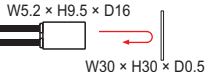



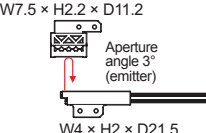


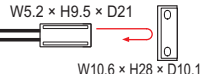


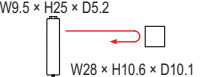
2) The sensing range is specified for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in (FD-L32H: R edge, FD-L21 and FD-L21W: t2 mm t0.079 in) (FD-L20H: white non-glossy paper, FD-L10: silicon wafers 100 × 100 mm 3.937 × 3.937 in).

LIST OF FIBERS

Retroreflective type

Retroreflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂ : Free-cut	Sensing range (mm in) (Note 1, 2)		Protection	Ambient temp.	Dimension
					FX-500 series	U-LG LONG FAST H-SP			
With polarizing filters	 W5.2 × H9.5 × D16 W30 × H30 × D0.5	FR-Z50HW	R1	 2 m	STD  100 to 990 3.937 to 38.976 HYPR  100 to 1,900 3.937 to 74.803	100 to 1,400 3.937 to 55.118 100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291	IP40	-25 to +55 °C	P.58
Water mapping	 W7.5 × H2.2 × D11.2 W4 × H2 × D21.5 Aperture angle 3° (emitter)	Tough FR-KZ22E	R2		STD  15 to 310 0.591 to 12.205 HYPR  15 to 570 0.591 to 22.441	15 to 460 0.591 to 18.110 15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937	IP30	-40 to +60 °C	
Narrow beam	 W5.2 × H9.5 × D21 W10.6 × H28 × D10.1	Tough FR-KZ50H	Bending durability		STD  20 to 300 0.787 to 11.811 HYPR  20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874			
	Side sensing	 W9.5 × H25 × D5.2 W28 × H10.6 × D10.1					Tough FR-KZ50E		

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

The sensing range of **FR-KZ22E** is specified for the attached reflector.

The sensing range of **FR-KZ50E** and **FR-KZ50H** is specified for the attached reflector **RF-003**.

The sensing range of **FR-Z50HW** is specified for the **RF-13**.

2) The sensing range is the possible setting range for the attached reflector.

The fiber can detect an object less than setting range for the reflector.

However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head.

If this occurs, adjust the threshold value of the amplifier unit before use.

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

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

Note: The sensing range is the possible setting range for the reflector. The fiber can detect an object less than 100 mm **3.937 in**. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.

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

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LIST OF FIBERS

Chemical / oil-resistant

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP				
Oil-resistant	Oil-resistant type									
	Full-protection type									
Chemical-resistant	Flat type									
	Cylindrical type									

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.
4) The fiber part is oil-resistant.

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)		Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP				
Oil-resistant	Oil-resistant type									
	Full-protection type									
Chemical-resistant	Flat type									
	Cylindrical type									

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






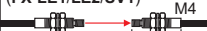


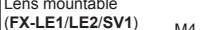


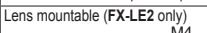











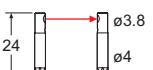



Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

LIST OF FIBERS

Heat-resistant

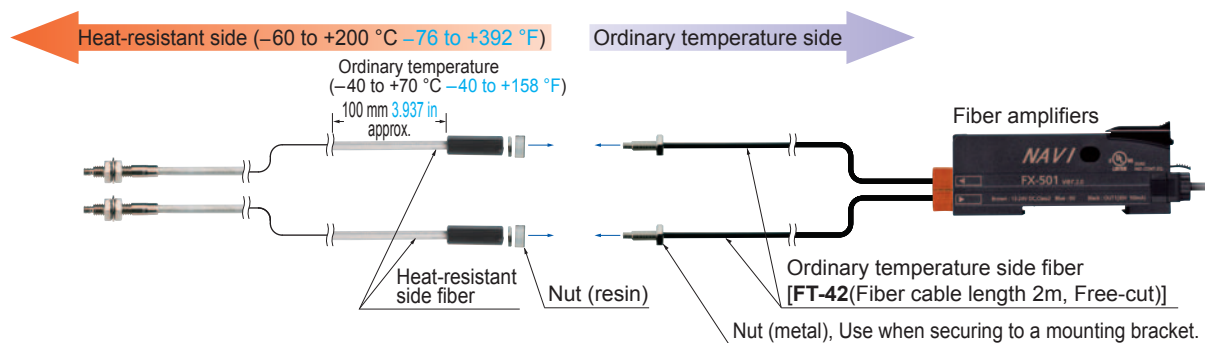
Thru-beam type (one pair set)



Type	Heat-resistant temp.	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  : Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Ambient temp.	Dimensions
						FX-500 series	U-LG LONG FAST H-SP			
Heat-resistant	350 °C	 Lens mountable (FX-LE1/LE2/SV1)	FT-H35-M2	R25	2 m	STD  430 16.929 HYPR  1,200 47.244	880 34.646 670 26.378 250 9.843 80 3.150	ø1.2	-60 to +350 °C	P.53
		 Sleeve 60 mm	FT-H35-M2S6	Fiber R25 Sleeve R10						
	200 °C	 Allows flexible wiring Lens mountable (FX-LE1/LE2/SV1)	FT-H20W-M1	R10	1 m	STD  470 18.504 HYPR  (Note 2) 1,600 62.992	1,000 39.370 840 33.071 300 11.811 90 3.543	ø0.8	-60 to +200 °C	
		 Lens mountable (FX-LE1/LE2/SV1)	FT-H20-M1	R25		STD  540 21.260 HYPR  (Note 2) 1,600 62.992	1,300 51.181 960 37.795 330 12.992 110 4.331			
	130 °C	 Lens mountable (FX-LE2 only)	FT-H13-FM2	R25	 2 m	STD  700 27.559 HYPR  (Note 2) 3,300 129.921	1,900 74.803 1,300 51.181 410 16.142 140 5.512	ø1.5	-60 to +130 °C	P.52
	Heat-resistant (joint)	200 °C	 Lens mountable (FX-LE1/LE2/SV1)	FT-H20-J20-S (Note 5)	Heat-resistant side R18 (Note 4)	 200 mm (Note 3)	STD  470 18.504 HYPR  1,600 62.992	1,000 39.370 790 31.102 300 11.811 90 3.543	ø1.2	-60 to +200 °C
 Lens mountable (FX-LE1/LE2/SV1)			FT-H20-J30-S (Note 5)	 300 mm (Note 3)						
 Lens mountable (FX-LE1/LE2/SV1)			FT-H20-J50-S (Note 5)	 500 mm (Note 3)						
Side-view 			FT-H20-VJ50-S (Note 5)	 800 mm (Note 3)		STD  600 23.622 HYPR  (Note 2) 2,100 82.677	1,300 51.181 980 38.583 390 15.354 120 4.724			
			FT-H20-VJ80-S (Note 5)							

- Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
 2) The fiber cable length practically limits the sensing range.
 3) Fiber length (fixed-length) for heat-resistant fiber side. Fiber length for ordinary temperature side is 2 m 6.562 ft (free-cut).
 4) Bending durable fiber R4 mm R0.157 in or more for ordinary temperature side.
 5) Heat-resistant joint fibers and ordinary-temperature fibers (FT-42) are sold as a set.

Heat-resistant joint fiber set contents



Model No. when ordering individually as spare parts

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

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MICRO PHOTO-ELECTRIC SENSORS

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LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

WIRE-SAVING UNITS

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Fiber Amplifiers

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FX-100

FX-300

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FX-311

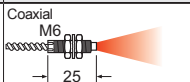
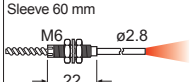
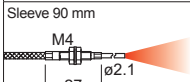
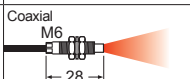
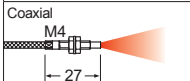
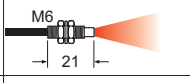
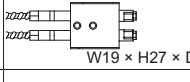
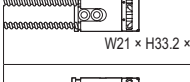
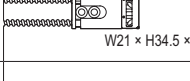

FX-301-F7/
FX-301-F

LIST OF FIBERS

Heat-resistant

Reflective type



Type	Heat-resistant temp.	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2)		Ambient temp.	Dimensions
						FX-500 series	U-LG LONG FAST H-SP		
Heat-resistant	350 °C		FD-H35-M2	R25	2 m	STD 260 10.236 HYPR 150 5.906 720 28.346	540 21.260 460 18.110 150 5.906 45 1.772	-60 to +350 °C	P.64
			FD-H35-M2S6	Fiber R25 Sleeve R10					
			FD-H35-20S			STD 260 10.236 HYPR 840 33.071	550 21.654 440 17.323 140 5.512 45 1.772		
	200 °C		FD-H20-M1	R25	1 m	STD 330 12.992 HYPR 840 33.071	550 21.654 500 19.685 200 7.874 55 2.165	-60 to +200 °C	P.63
			FD-H20-21			STD 230 9.055 HYPR 770 30.315	500 19.685 380 14.961 130 5.118 45 1.772		
	130 °C		FD-H13-FM2		✂ 2 m	STD 350 13.780 HYPR 880 34.646	640 25.197 600 23.622 200 7.874 65 2.559	-60 to +130 °C	
	250 °C		FD-H30-L32		2 m	STD 17 0.669 HYPR 40 1.575	30 1.181 25 0.984 12 0.472 1.5 to 6 0.059 to 0.236	-60 to +300 °C	P.64
			FD-H25-L43		3 m	STD 1.5 to 26 0.059 to 1.024 HYPR 1 to 31 0.039 to 1.220	1 to 30 0.039 to 1.181 1 to 28 0.039 to 1.102 1.5 to 24 0.059 to 0.945 2 to 18 0.079 to 0.709	-20 to +250 °C (Ordinary temp. side: -20 to +70 °C)	P.63
			FD-H25-L45			STD 5 to 42 0.197 to 1.654 HYPR 4 to 43.5 0.157 to 1.713	4 to 43 0.157 to 1.693 4.5 to 43 0.177 to 1.693 5 to 40 0.197 to 1.575 6.5 to 34 0.256 to 1.339		
	180 °C		FD-H18-L31		✂ 2 m	STD 16 0.630 HYPR 60 2.362	32 1.260 24 0.945 13 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.

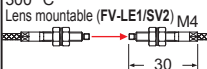
2) The sensing range of reflective type is the value for white non-glossy paper (50 × 50 mm 1.969 × 1.969 in glass substrate for FD-H30-L32 and FD-H18-L31, transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in for FD-H25-L43 and FD-H25-L45).

LIST OF FIBERS

Vacuum-resistant

Thru-beam type (one pair set)

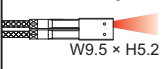
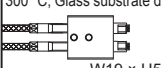


Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in)		Beam axis dia. (mm)	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP			
Vacuum-resistant Thru-beam	300 °C Lens mountable (FV-LE1/SV2) M4 	FT-H30-M1V-S (Note)	R18	1 m	STD 270 10.630 HYPR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

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

Reflective type

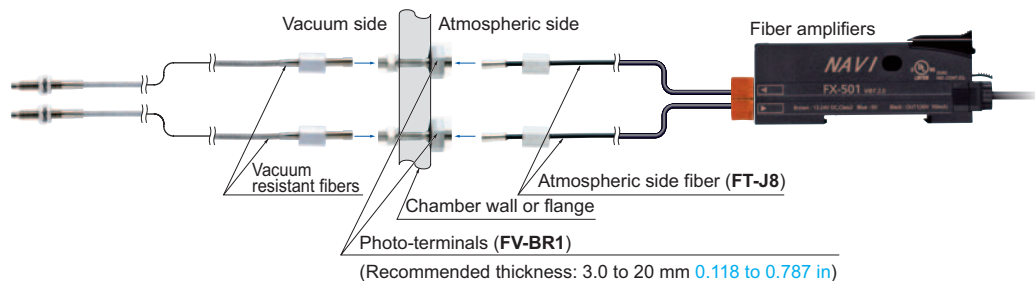


Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in)(Note 2)		Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP		
Vacuum-resistant Reflective	300 °C, Rectangular head 	FD-H30-KZ1V-S (Note 1)	R18	1 m	STD 20 to 200 0.787 to 7.874 HYPR 5 to 500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

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

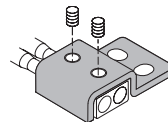
2) The sensing range of reflective type is the value for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.

Vacuum-resistant fiber set contents



Model No. when ordering individually as spare parts

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



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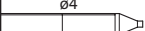
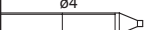

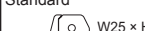

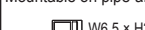

FX-311

FX-301-F7/ FX-301-F

LIST OF FIBERS

Liquid leak / Liquid detection

Reflective type / Thru-beam type

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

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

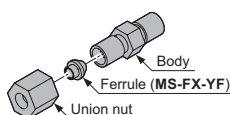
2) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint is available.

Designation	Model No.	Description	
Liquid inflow prevention joint (Note)	MS-FX-01Y	Applicable fibers	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.

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

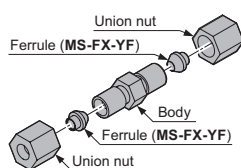
Liquid inflow prevention joint

• MS-FX-01Y



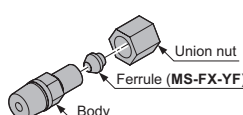
Protective tube extension joint

• MS-FX-02Y



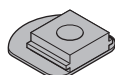
Fiber mounting joint

• MS-FX-03Y

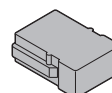


Accessories for additional supply

• MS-FD-F7-1

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

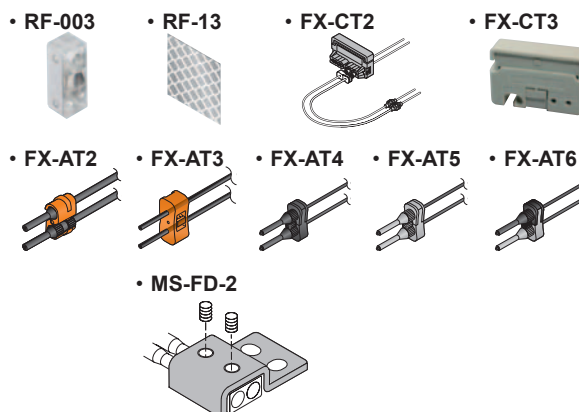
• MS-FD-F7-2

(PVC mounting bracket for **FD-F71**)**Tough** : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm **R0.394 in**, reciprocating bending: 180°) and more flexible (bending radius: R4 mm **R0.157 in** or less) features.

LIST OF FIBERS

Model No. when ordering accessories additionally


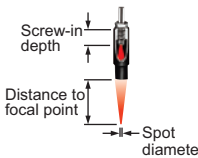
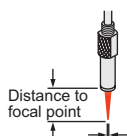
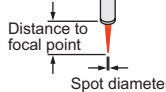
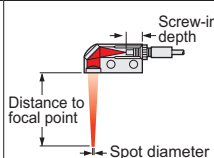
- **RF-003** (Reflector for **FR-KZ50E/KZ50H**)
- **RF-13** (Reflective tape for **FR-Z50HW**)
- **FX-CT2** (Fiber cutter)
- **FX-CT3** (Fiber cutter for **FD-H40Y/F41Y**)
- **FX-AT2** (Attachment for fixed-length fiber, Orange)
- **FX-AT3** (Attachment for $\phi 2.2$ mm $\phi 0.087$ in fiber, Clear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



FIBER OPTIONS

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

Lens (For reflective type fiber)

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

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

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Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

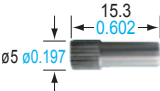









FX-311

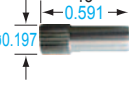
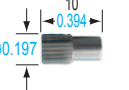
FX-301-F7/ FX-301-F

FIBER OPTIONS

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

Lens (For square head M3 reflective fiber)

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


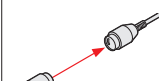


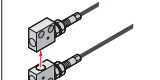
Type		Spot diameter (mm in)(Note)	Sensing range (mm in)(Note)	Lens		Applicable fibers	
				Shape (mm in)	Model No.	Emitting fiber core (mm in)	Model No.
For Square head M3 reflective fiber	Zoom lens	ø0.4 to ø2.0 ø0.016 to ø0.079 approx.	10 to 30 0.394 to 1.181		FX-MR8	ø0.125 ø0.005	FD-R33EG, FD-EG31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

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

FIBER OPTIONS

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

Lens (For thru-beam type fiber)

Designation	Model No.	Description									
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 4) • Beam dia: ø3.6 mm ø0.142 in	Sensing range (mm in) [Lens on both sides]							
				Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP
				FT-43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,600 62.992
				FT-42		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,200 86.614
				FT-42W		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,500 59.055
				FT-45X		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,900 74.803
				FT-R40		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	670 26.378
				FT-R43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	1,400 55.118
				FT-H35-M2		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	850 33.465
				FT-H20W-M1		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,200 47.244
FT-H20-M1		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	500 19.685				
FT-H20-J50-S		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,500 137.795	2,000 78.740	1,600 62.992					
FT-H20-J30-S											
FT-H20-J20-S											
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 4) • Beam dia: ø9.8 mm ø0.386 in	Sensing range (mm in) [Lens on both sides]							
				Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP
				FT-43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)
				FT-42		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)
				FT-42W		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)
				FT-45X		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)
				FT-R40		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)
				FT-R43		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)
				FT-H35-M2		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)
				FT-H20W-M1		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)
FT-H20-M1		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)				
FT-H13-FM2		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)				
FT-H20-J50-S		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)				
FT-H20-J30-S											
FT-H20-J20-S											
Side-view lens	FX-SV1		Beam axis is bent by 90°. • Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 4) • Beam dia: ø2.8 mm ø0.110 in	Sensing range (mm in) [Lens on both sides]							
				Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP
				FT-43		3,600 141.732 (Note 2)	3,400 133.858	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)	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)	3,500 137.795	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)	1,600 62.992 (Note 2)	1,400 55.118	800 31.496	210 8.268
				FT-R43		3,200 125.984	1,800 70.866	1,300 51.181	950 37.402	510 20.079	160 6.299
				FT-H35-M2		3,500 137.795	1,600 62.992	1,200 47.244	780 30.709	500 19.685	150 5.906
				FT-H20W-M1		1,600 62.992 (Note 2)	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)	1,600 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)	960 37.795	740 29.134	450 17.717	290 11.417	80 3.150				
FT-H20-J30-S											
FT-H20-J20-S											
Expansion lens for vacuum fiber (Note 1)	FV-LE1		Sensing range increases by 4 times or more. • Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4) • Beam dia: ø3.6 mm ø0.142 in	Sensing range (mm in) [Lens on both sides] (Note 3)							
				Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP
				FT-H30-M1V-S		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,400 133.858	1,500 59.055	900 35.433	370 14.567
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 4) • Beam dia: ø3.7 mm ø0.146 in	Sensing range (mm in) [Lens on both sides] (Note 3)							
				Fiber	Mode	HYPR	U-LG	LONG	STD	FAST	H-SP
				FT-H30-M1V-S		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,400 133.858	1,500 59.055	900 35.433	370 14.567

- 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) The fiber cable length for the **FT-H30-M1V-S** is 1 m 3.28 ft. The sensing ranges in HYPR, U-LG and LONG of **FX-500** series are specified considering the length of the **FT-J8** atmospheric side fiber.
4) Refer to p.79, p.81, p.92, and p.94 for the ambient temperature of fibers to be used in combination.

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FX-301-F

FIBER OPTIONS

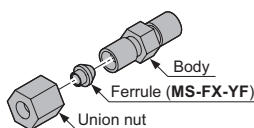
Others

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-61G 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					
	FDP-N500 (0.5 m 1.640 ft)						
	FDP-N1000 (1 m 3.281 ft)			FD-41 FD-41W	FD-41S FD-41SW		
	FDP-N1500 (1.5 m 4.921 ft)						
Fiber bender	FB-1	The fiber bender bends the sleeve part of the fiber head at the proper radius. (Note 1)					
Universal sensor mounting stand (Note 2)	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 2)	MS-FX-01Y	Applicable fibers		FD-HF40Y FD-F41Y	This joint suppresses false operations due to liquid slip-in from the top of the protective tube.		
Protective tube extension joint (Note 2)	MS-FX-02Y		The protective tube can be extended.				
Fiber mounting joint (Note 2)	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.90 for the sensing range when FR-Z50HW is used in combination with a reflector.					
	RF-220						
	RF-230						

Notes: 1) Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.
2) The joint internal ferrule (**MS-FX-YF**) is available as a spare part. A distorted ferrule may result in leakage.

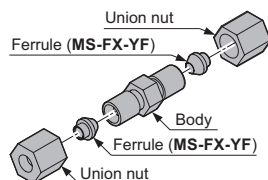
Liquid inflow prevention joint

• MS-FX-01Y



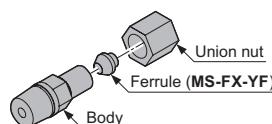
Protective tube extension joint

• MS-FX-02Y



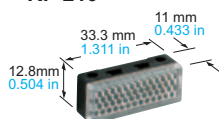
Fiber mounting joint

• MS-FX-03Y

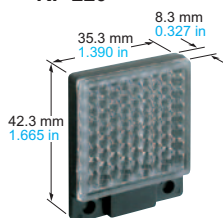


Reflector

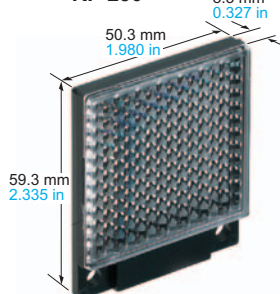
• RF-210



• RF-220

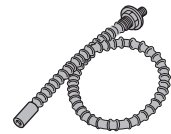


• RF-230



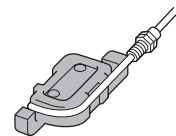
Protective tube

- FTP-□
- FDP-□



Fiber bender

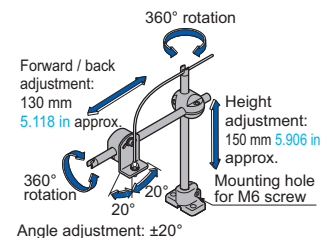
- FB-1



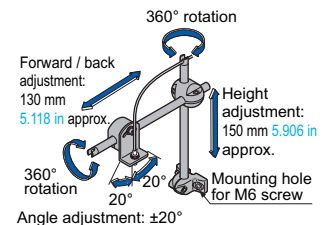
Universal sensor mounting stand

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



SPECIFICATIONS

Item	Model No.	Type	Standard type	2-output type	Cable type (Analog output type)	
		NPN output	FX-501	FX-502	FX-505-C2	
		PNP output	FX-501P	FX-502P	FX-505P-C2	
Supply voltage			12 to 24 V DC ⁺¹⁰ ₋₁₅ % Ripple P-P 10 % or less			
Power consumption			Normal operation: 960 mW or less (current consumption 40 mA or less at 24 V supply voltage, excluding analog output of cable type) ECO mode: 680 mW or less (current consumption 28 mA or less at 24 V supply voltage, excluding analog output of cable type)			
Output (2-output type and cable type: Output 1, Output 2)			<NPN output type> NPN open-collector transistor • Maximum sink current: 100 mA (2-output type and cable type are 50 mA) (Note 2) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (Note 3) (at maximum sink current)			<PNP output type> PNP open-collector transistor • Maximum source current: 100 mA (2-output type and cable type are 50 mA) (Note 2) • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (Note 3) (at maximum source current)
			Output points	1 point	2 points	
			Output operation	Switchable either Light-ON or Dark-ON by L/D mode		
			Short-circuit protection	Incorporated		
Response time			H-SP: 25 μs or less, FAST: 60 μs or less, STD: 250 μs or less, LONG: 2 ms or less, U-LG: 4 ms or less, HYPR: 24 ms or less, selectable			
Analog output (Cable type only)			Output current: 4 to 20 mA approx. [H-SP, FAST, STD: At 0 to 4,000 digits, LONG: At 0 to 8,000 digits (Note 4)], Response time: 2 ms or less, Zero point: Within 4 mA ±1 % F.S., Span: Within 16 mA ±5 % F.S., Linearity: Within ±3 % F.S., Load resistance: 0 to 250 Ω			
External input (2-output type only, switchable with Output 2)			_____	<NPN output type> NPN non-contact input • Signal condition High: +8 V to +V DC or Open Low: 0 to +1.2 V DC (at 0.5 mA source current) • Input impedance: 10 kΩ approx.	<PNP output type> PNP non-contact input • Signal condition High: +4 V to +V DC (at 3 mA sink current) Low: 0 to +0.6 V DC or Open • Input impedance: 10 kΩ approx.	
Possible external input function			_____	Emission halt / Teaching (Full-auto, Limit, 2-point) / Logic operation setting / Copy lock / Display adjustment / Data bank load / Data bank save, selectable		
Sensitivity setting			2-point teaching / Limit teaching / Full-auto teaching / Manual adjustment			
Incident light intensity display range			H-SP / FAST / STD: 0 to 4,000, LONG: 0 to 8,000, U-LG / HYPR: 0 to 9,999			
Timer function			Incorporated with variable OFF-delay / ON-delay /One-shot / ON OFF-delay / ON-delay • One-shot timer, switchable either effective or ineffective	<Output 1> Incorporated with variable OFF-delay / ON-delay /One-shot / ON OFF-delay / ON-delay • One-shot timer, switchable either effective or ineffective		
				<Output 2> Incorporated with variable OFF-delay / ON-delay /One-shot timer, switchable either effective or ineffective		
Timer period			Timer range "ms": 0.5 ms approx., 1 to 9,999 ms approx., 1 ms approx., Timer range "sec.": 0.5 s approx., 1 to 32 s approx., 1 s approx., Timer range "1/10 ms": 0.05 ms approx., 0.1 to 999.9 ms approx., 0.1 ms approx., each output is set individually			
Light emitting amount selection function			Incorporated, 3 levels (each level 25 to 100 %) + Auto setting [1 level (25 to 100 %) when using H-SP mode]			
Interference prevention function			Incorporated (Note 5), selectable either automatic interference prevention or different frequency			
Various settings			Hysteresis setting / Shift amount setting / Emission power setting / Display turning setting / ECO setting / Data bank loading saving setting / Copying setting / Code setting / Reset setting / Logical calculation setting / Threshold tracking setting, etc.			
Protection			IP40 (IEC)			
Ambient temperature			-10 to +55 °C +14 to +131 °F [If 4 to 7 units are mounted in cascade: -10 to +50 °C +14 to +122 °F or if 8 to 16 units (cable type: 8 to 12 units) are mounted in cascade: -10 to +45 °C +14 to +113 °F] (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F			
Emitting element (modulated)			Red LED (Peak emission wavelength: 643 nm 0.025 mil)			
Material			Enclosure, Case cover: Polycarbonate, Switch: TPEE			
Cable			_____	0.2 mm ² 6-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 12 V DC)		
Weight			Net weight: 15 g approx., Gross weight: 70 g approx.		Net weight: 60 g approx., Gross weight: 100 g approx.	
Accessory			FX-MB1 (Amplifier protection seal): 1 set			

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C **+73.4 °F**.

2) 50 mA max. if 5 or more standard types are connected together. (25 mA in case of 2-output type and cable type)

3) In case of using the quick-connection cable (cable length 5 m **16.404 ft**) (optional).

4) If display adjustment was conducted, it is not in this range.

5) Number of sensor heads which is possible to be mounted closely in auto interference prevention function depends on response time as shown in table below.
Number of sensor heads which is possible to be mounted closely in different frequency Interference prevention function is up to 3 units.

• Number of sensor heads mountable closely (Unit: set)

Response time	H-SP	FAST	STD	LONG	U-LG	HYPR
IP-1	0	2	4	8	8	12

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-
SAVING
UNITSWIRE-
SAVING
SYSTEMSMEASURE-
MENT
SENSORSSTATIC
ELECTRICITY
PREVENTION
DEVICESLASER
MARKERS

PLC

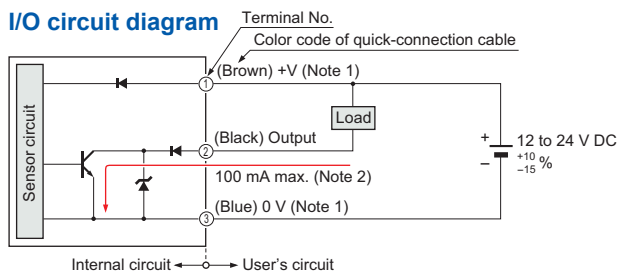
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MACHINE
INTERFACESENERGY
CONSUMPTION
VISUALIZATION
COMPONENTSFA
COMPONENTSMACHINE
VISION
SYSTEMSUV
CURING
SYSTEMSSelection
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Fibers

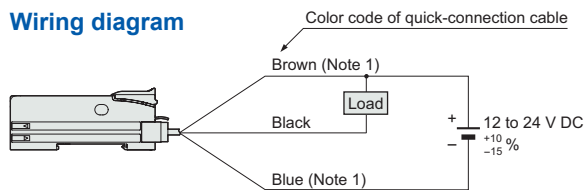
Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/
FX-301-F**

I/O CIRCUIT AND WIRING DIAGRAMS**FX-501**

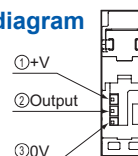
NPN output type



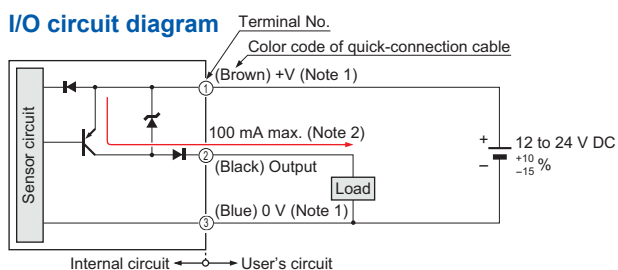
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers or more, are connected together.

Wiring diagram

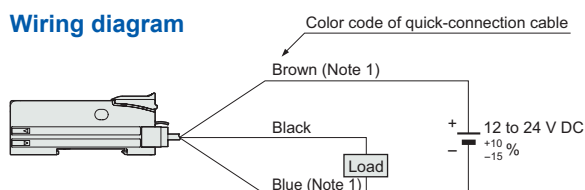
Note: The quick-connection sub cable does not have a brown and a blue lead wire.

Terminal arrangement diagram**FX-501P**

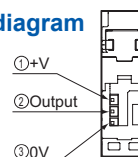
PNP output type



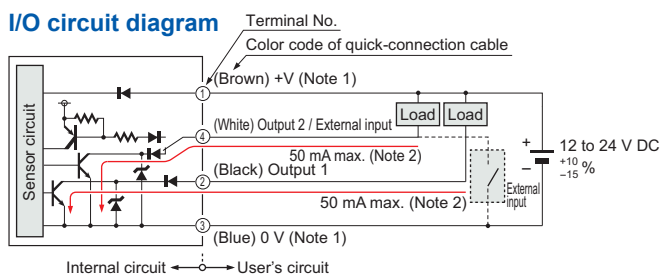
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers or more, are connected together.

Wiring diagram

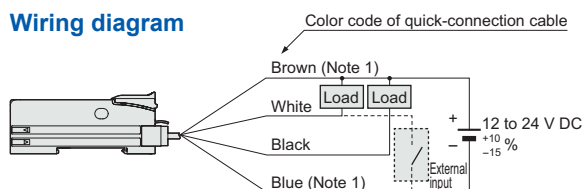
Note: The quick-connection sub cable does not have a brown and a blue lead wire.

Terminal arrangement diagram**FX-502**

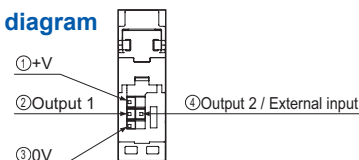
NPN output type



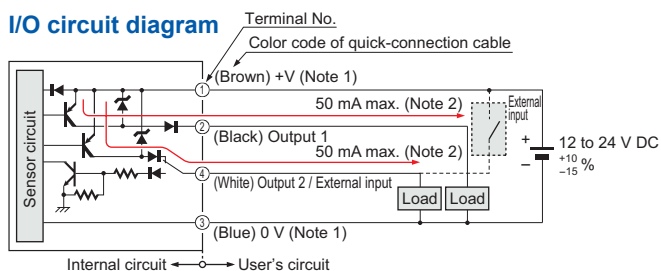
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers or more, are connected together.

Wiring diagram

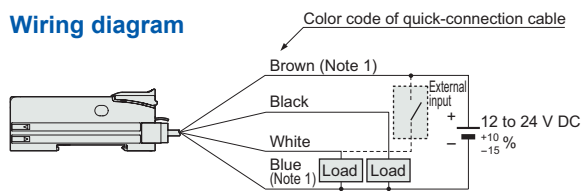
Note: The quick-connection sub cable does not have a brown and a blue lead wire.

Terminal arrangement diagram**FX-502P**

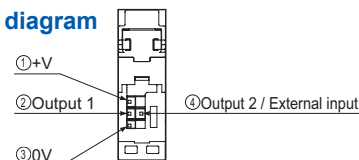
PNP output type



Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers or more, are connected together.

Wiring diagram

Note: The quick-connection sub cable does not have a brown and a blue lead wire.

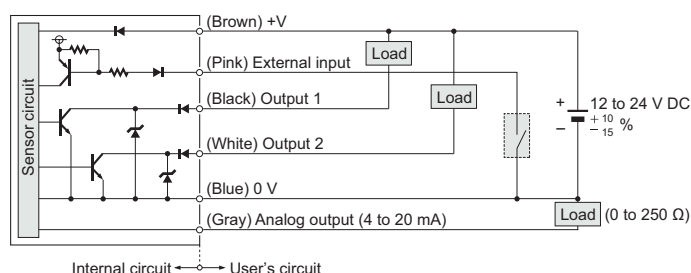
Terminal arrangement diagram

I/O CIRCUIT AND WIRING DIAGRAMS

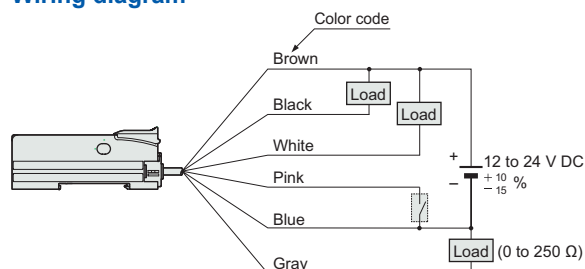
FX-505-C2

NPN output type

I/O circuit diagram



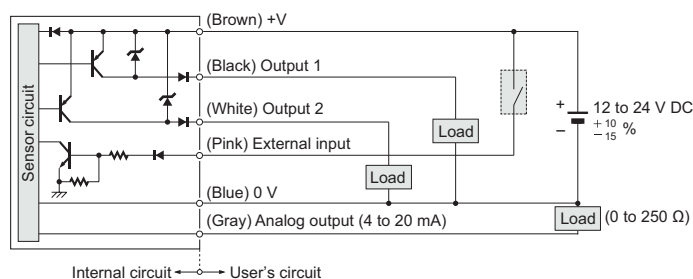
Wiring diagram



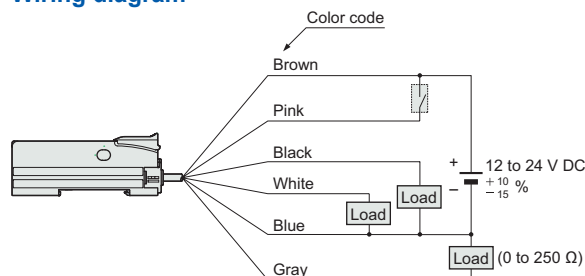
FX-505P-C2

PNP output type

I/O circuit diagram



Wiring diagram

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
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FX-100

FX-300

FX-410

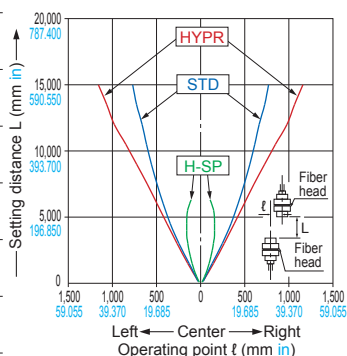
FX-311

FX-301-F7/
FX-301-F

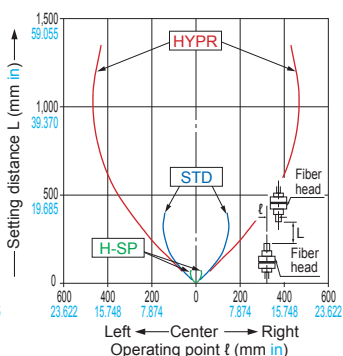
SENSING CHARACTERISTICS (TYPICAL)

Thru-beam type Parallel deviation Sensing characteristics are listed in the alphabetic order of Model No.

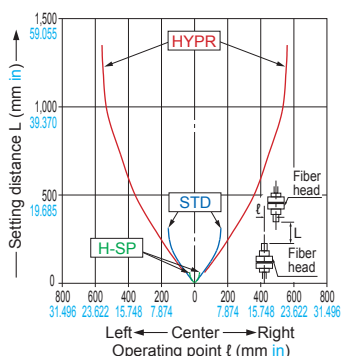
FT-140 Thru-beam type



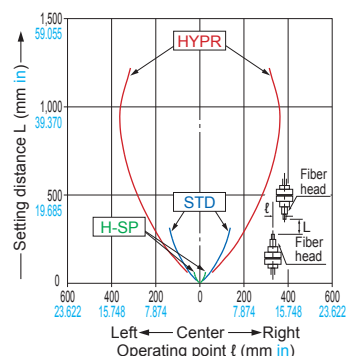
FT-30 Thru-beam type



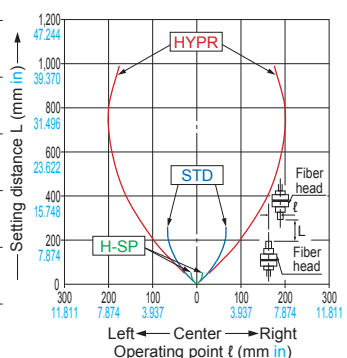
FT-31 Thru-beam type



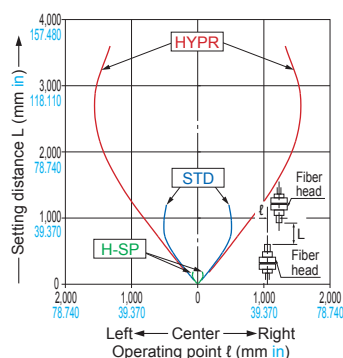
FT-31S Thru-beam type



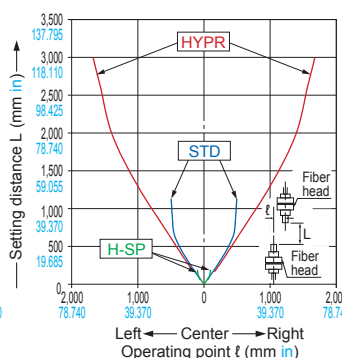
FT-31W Thru-beam type



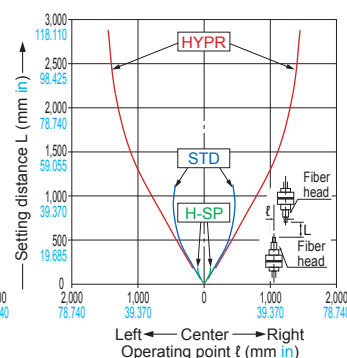
FT-40 Thru-beam type



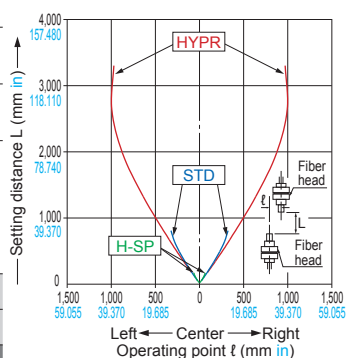
FT-42 Thru-beam type



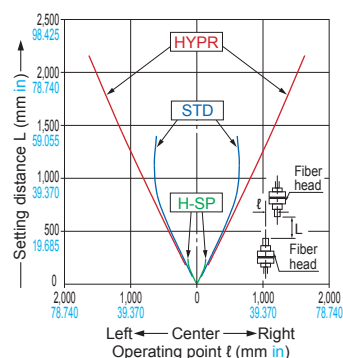
FT-42S Thru-beam type



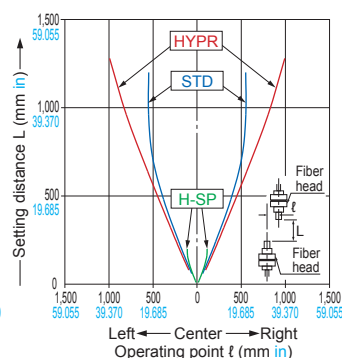
FT-42W Thru-beam type



FT-43 Thru-beam type

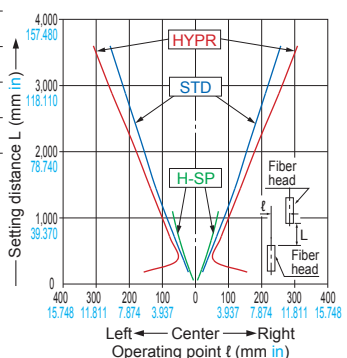


FT-45X Thru-beam type

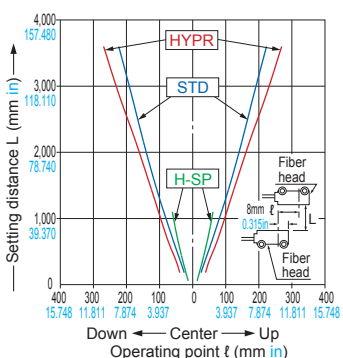


FT-A11 Thru-beam type

Horizontal direction

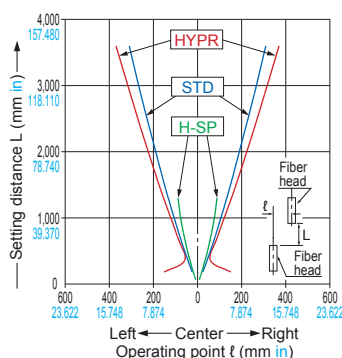


Vertical direction

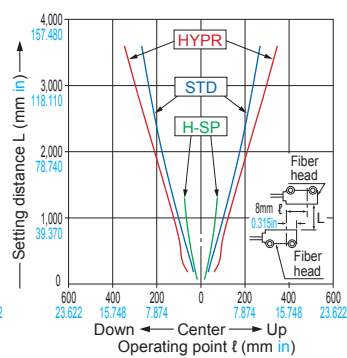


FT-A11W Thru-beam type

Horizontal direction



Vertical direction



FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

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WIRE-SAVING SYSTEMS

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FX-100

FX-300

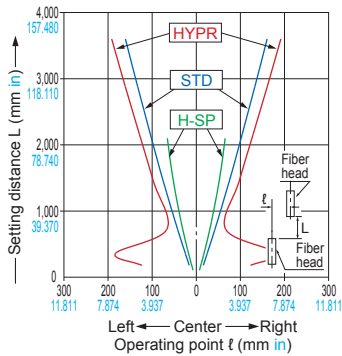
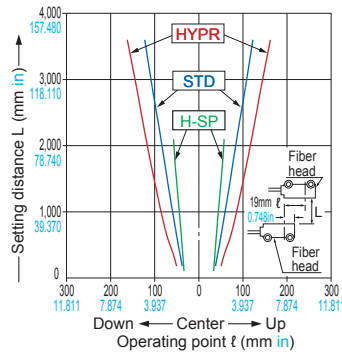
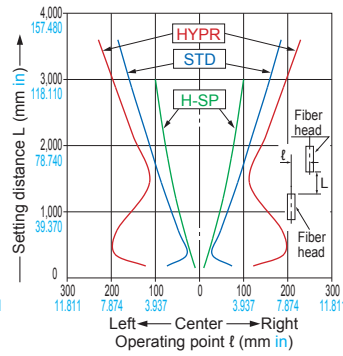
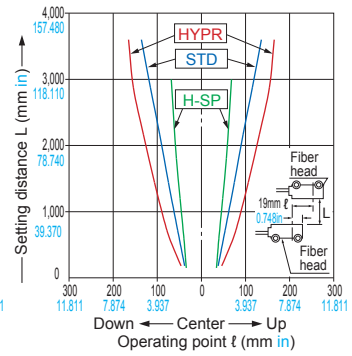
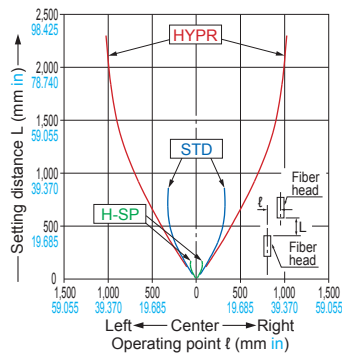
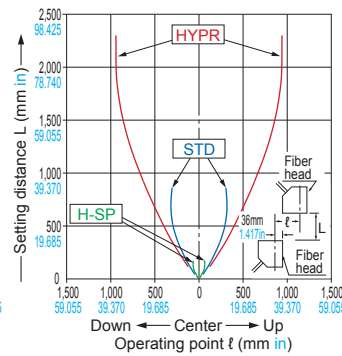
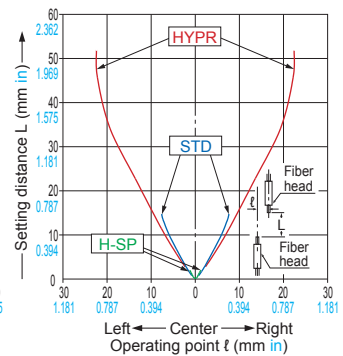
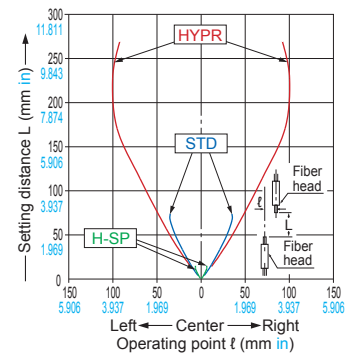
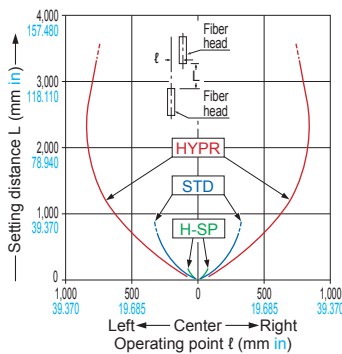
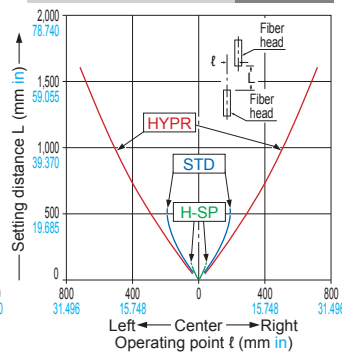
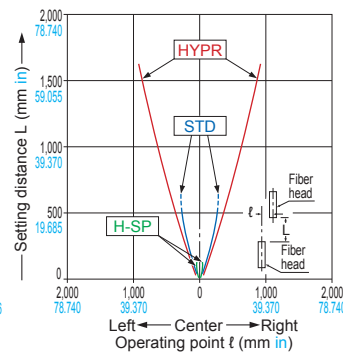
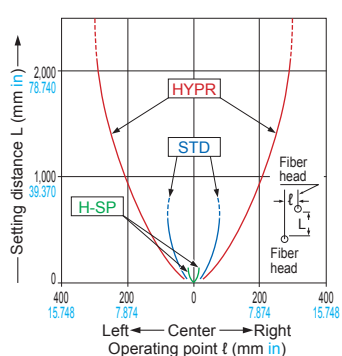
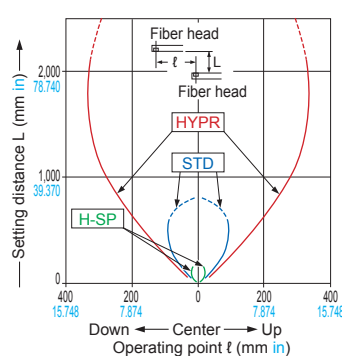
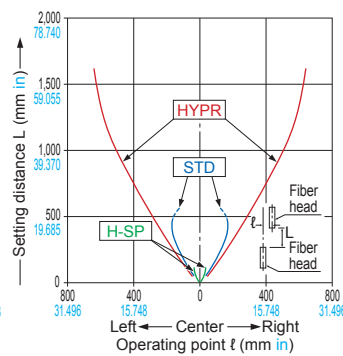
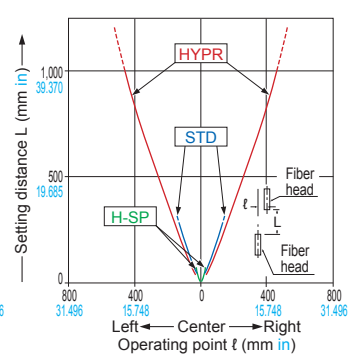
FX-410

FX-311

FX-301-F7 / FX-301-F

SENSING CHARACTERISTICS (TYPICAL)**Thru-beam type Parallel deviation**

Sensing characteristics are listed in the alphabetic order of Model No. (Models with same sensing characteristics are grouped together.)

FT-A32**Thru-beam type****Horizontal direction****Vertical direction****FT-A32W****Thru-beam type****Horizontal direction****Vertical direction****FT-AL05****Thru-beam type****Horizontal direction****Vertical direction****FT-E13****Thru-beam type****FT-E23****Thru-beam type****FT-H13-FM2****Thru-beam type****FT-H20-J20-S FT-H20-J30-S FT-H20-J50-S****Thru-beam type****FT-H20-M1****Thru-beam type****FT-H20-VJ50-S FT-H20-VJ80-S****Thru-beam type****Horizontal direction****Vertical direction****FT-H20W-M1****Thru-beam type****FT-H30-M1V-S****Thru-beam type**

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

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FA COMPONENTS

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UV CURING SYSTEMS

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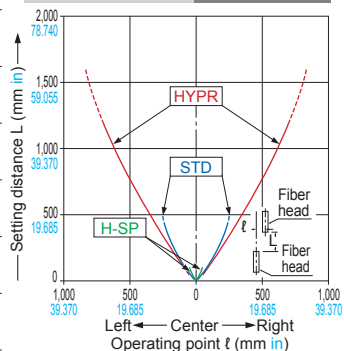
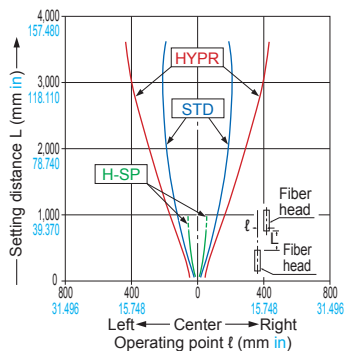
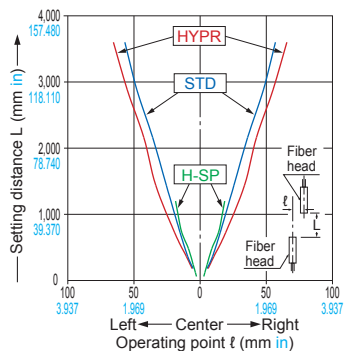
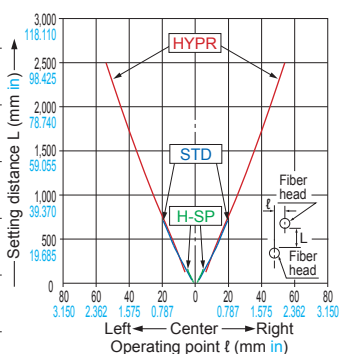
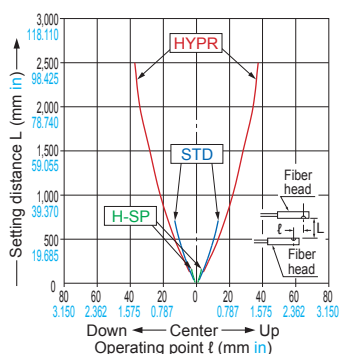
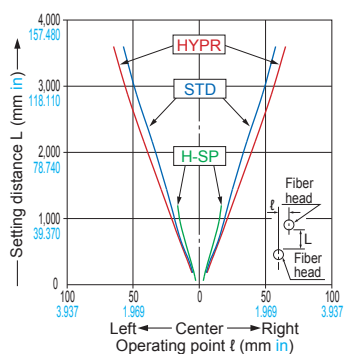
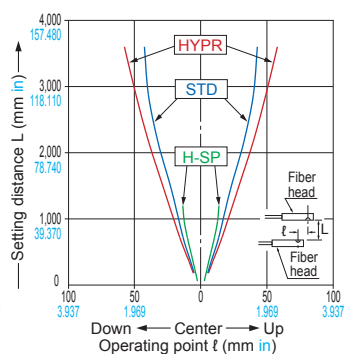
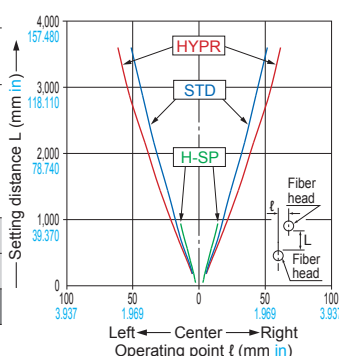
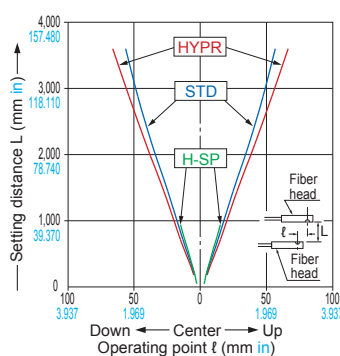
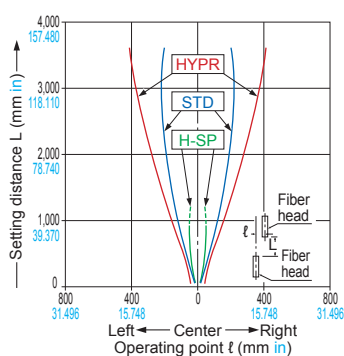
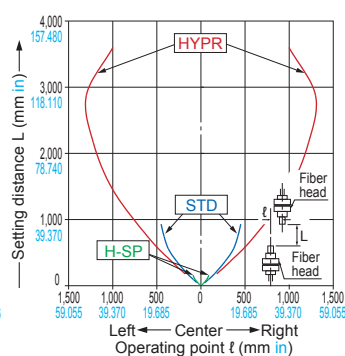
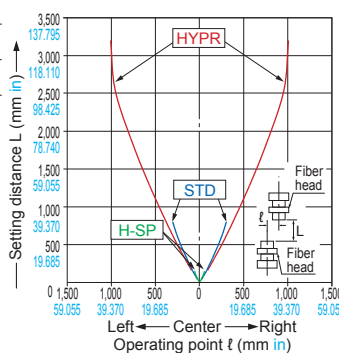
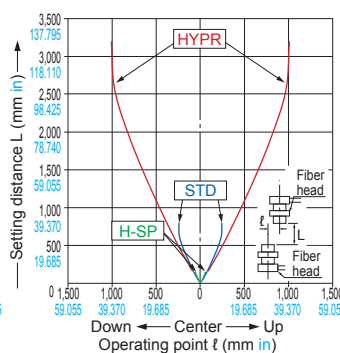
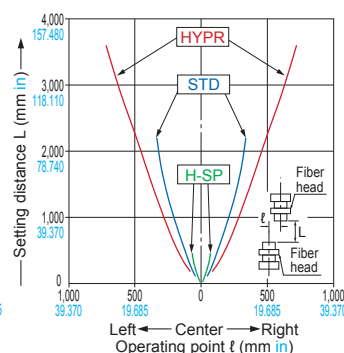
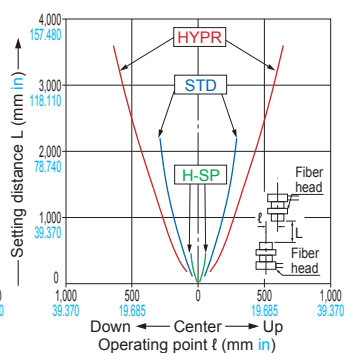
Fibers

Fiber Amplifiers

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

SENSING CHARACTERISTICS (TYPICAL)**Thru-beam type Parallel deviation**

Sensing characteristics are listed in the alphabetic order of Model No. (Models with same sensing characteristics are grouped together.)

FT-H35-M2
FT-H35-M2S6 Thru-beam type**FT-HL80Y** Thru-beam type**FT-KS40** Thru-beam type**FT-KV26** Thru-beam type**Horizontal direction****Vertical direction****FT-KV40** Thru-beam type**Horizontal direction****Vertical direction****FT-KV40W** Thru-beam type**Horizontal direction****Vertical direction****FT-L80Y** Thru-beam type**FT-R40** Thru-beam type**FT-R41W** Thru-beam type**Horizontal direction****Vertical direction****FT-R42W** Thru-beam type**Horizontal direction****Vertical direction**

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS/SAFETY COMPONENTS

PRESSURE/FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F7/

FX-301-F

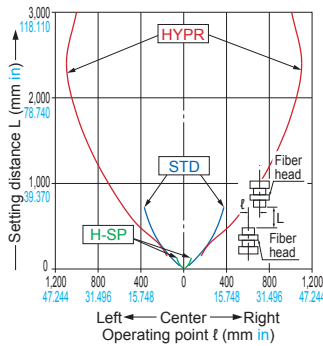
SENSING CHARACTERISTICS (TYPICAL)

Thru-beam type Parallel deviation Sensing characteristics are listed in the alphabetic order of Model No.

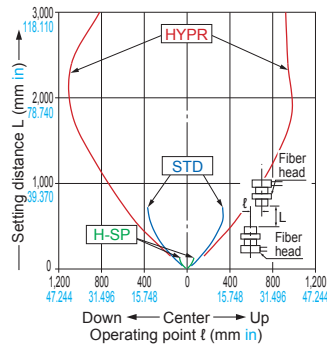
FT-R44Y

Thru-beam type

Horizontal direction

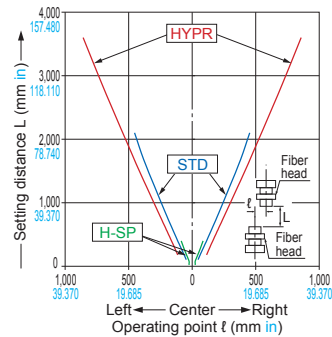


Vertical direction

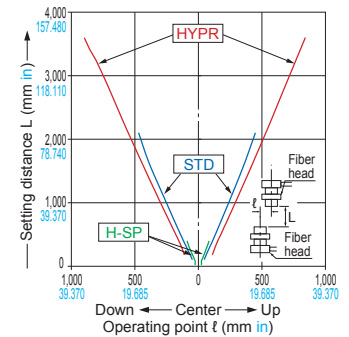
**FT-R60Y**

Thru-beam type

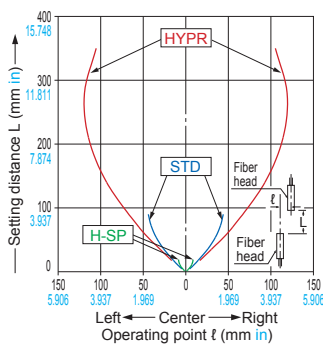
Horizontal direction



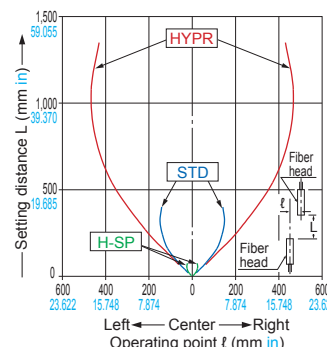
Vertical direction

**FT-S11**

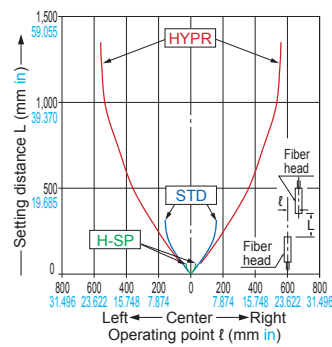
Thru-beam type

**FT-S20**

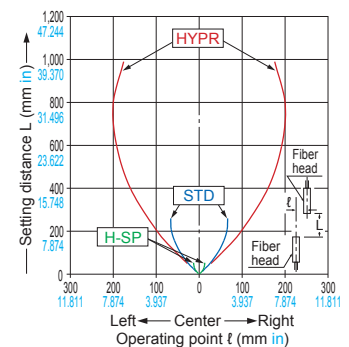
Thru-beam type

**FT-S21**

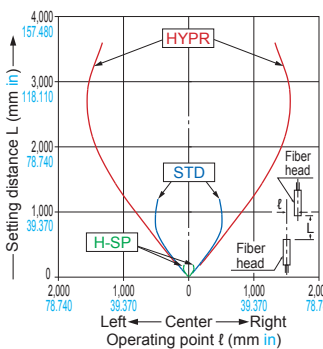
Thru-beam type

**FT-S21W**

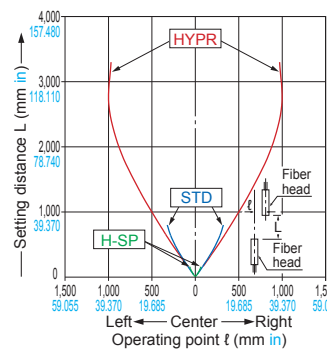
Thru-beam type

**FT-S30**

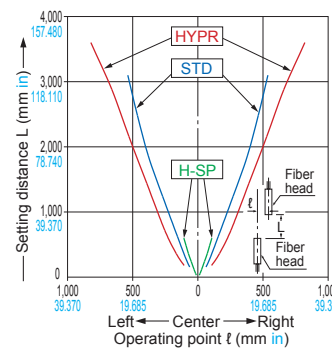
Thru-beam type

**FT-S31W**

Thru-beam type

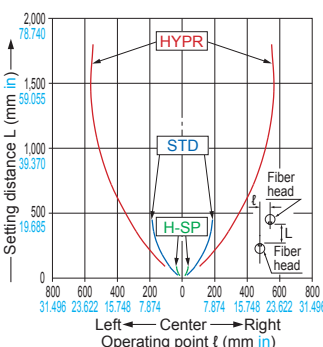
**FT-S32**

Thru-beam type

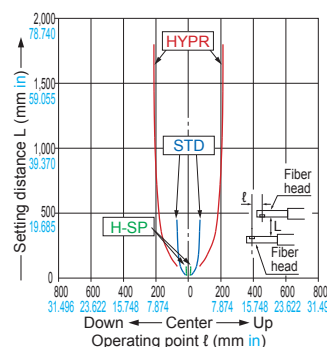
**FT-V23**

Thru-beam type

Horizontal direction

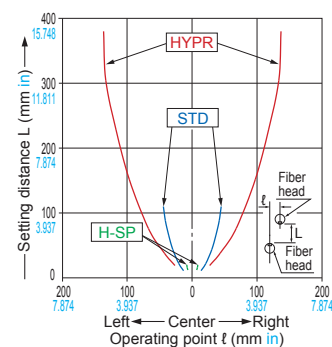


Vertical direction

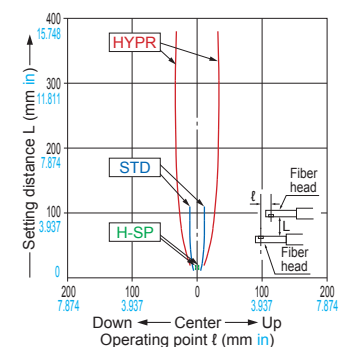
**FT-V24W**

Thru-beam type

Horizontal direction



Vertical direction

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-SAVING
UNITSWIRE-SAVING
SYSTEMSMEASURE-
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CONSUMPTION
VISUALIZATION
COMPONENTSFA
COMPONENTSMACHINE
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SYSTEMSUV
CURING
SYSTEMSSelection
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Fibers

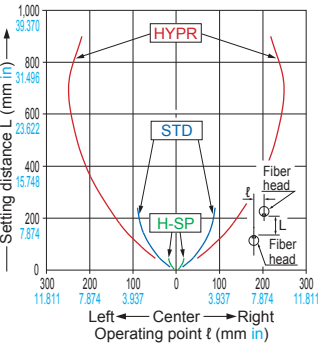
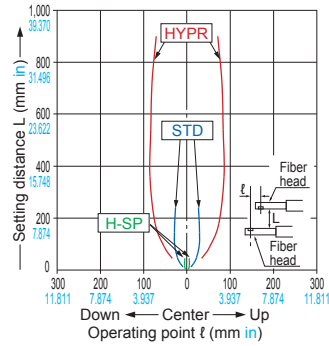
Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F/
FX-301-F**

SENSING CHARACTERISTICS (TYPICAL)

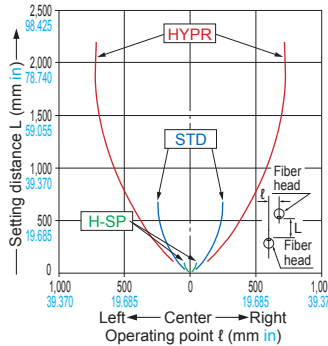
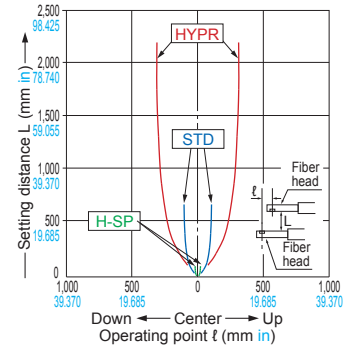
Thru-beam type Parallel deviation Sensing characteristics are listed in the alphabetic order of Model No.

FT-V25

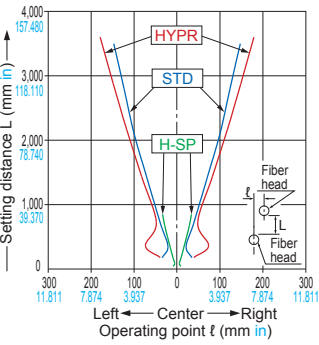
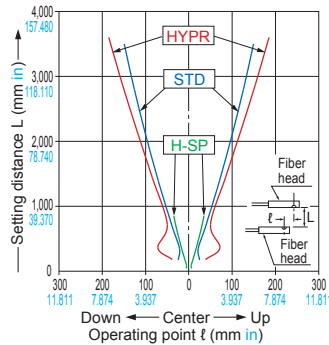
Thru-beam type

Horizontal direction**Vertical direction****FT-V30**

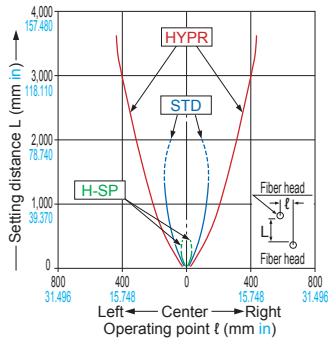
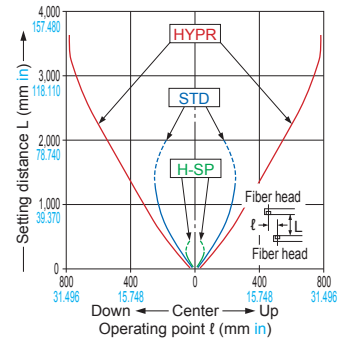
Thru-beam type

Horizontal direction**Vertical direction****FT-V40**

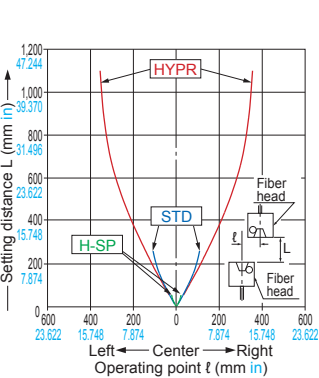
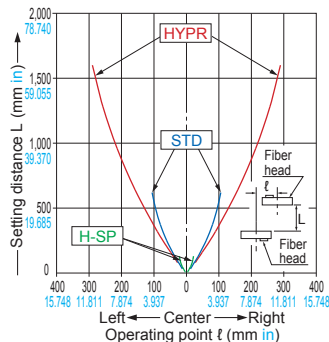
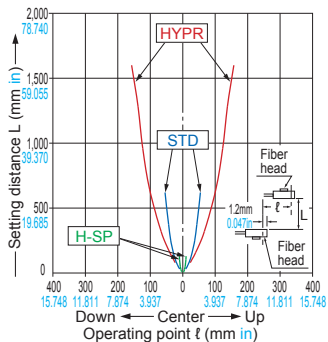
Thru-beam type

Horizontal direction**Vertical direction****FT-V80Y**

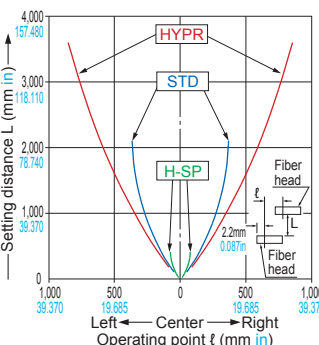
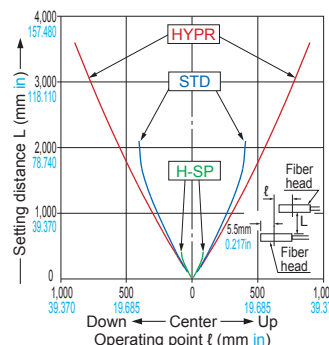
Thru-beam type

Horizontal direction**Vertical direction****FT-Z20HBW**

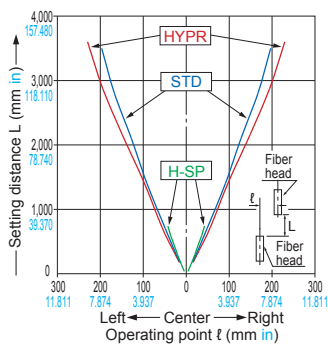
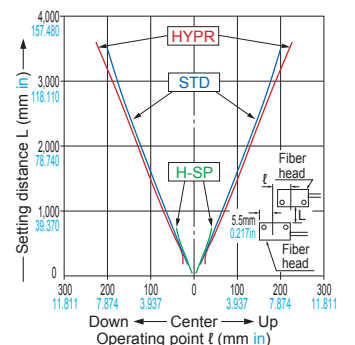
Thru-beam type

**Horizontal direction****Vertical direction****FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/****FX-301-F****FT-Z30**

Thru-beam type

Horizontal direction**Vertical direction****FT-Z30E**

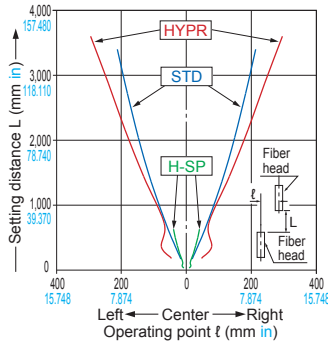
Thru-beam type

Horizontal direction**Vertical direction**

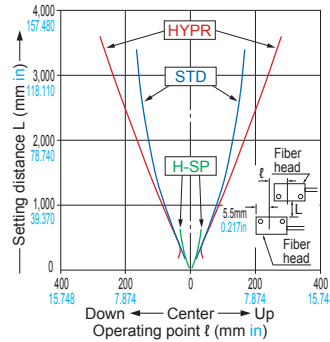
SENSING CHARACTERISTICS (TYPICAL)**Thru-beam type Parallel deviation** Sensing characteristics are listed in the alphabetic order of Model No.**FT-Z30EW**

Thru-beam type

Horizontal direction

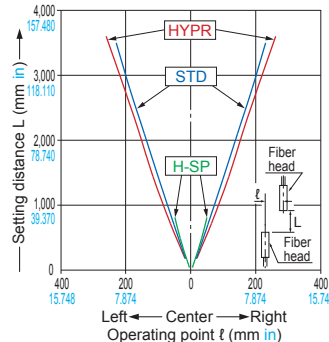


Vertical direction

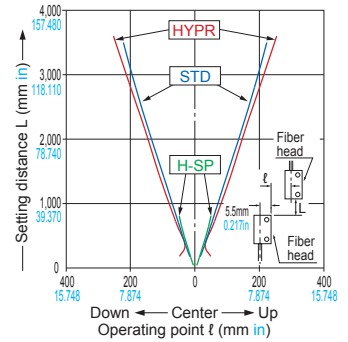
**FT-Z30H**

Thru-beam type

Horizontal direction

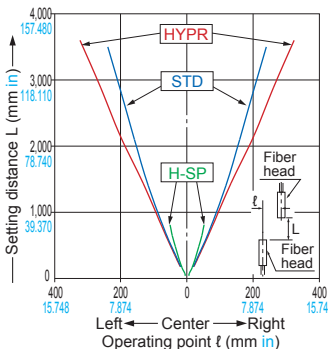


Vertical direction

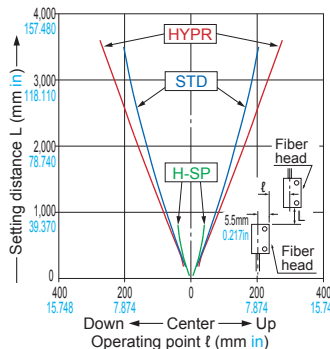
**FT-Z30HW**

Thru-beam type

Horizontal direction

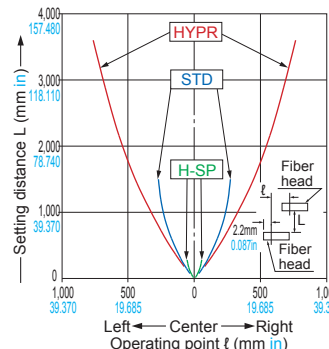


Vertical direction

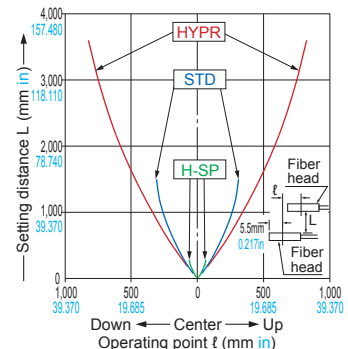
**FT-Z30W**

Thru-beam type

Horizontal direction

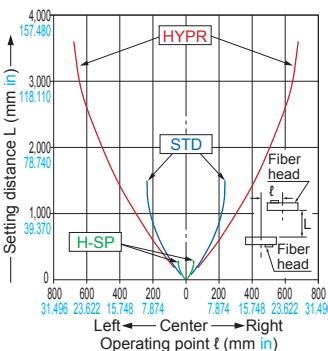


Vertical direction

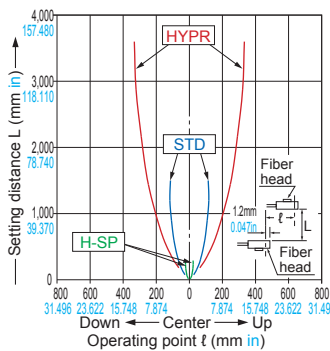
**FT-Z40W**

Thru-beam type

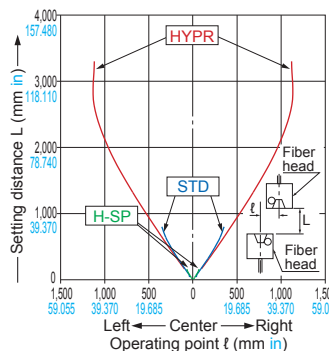
Horizontal direction



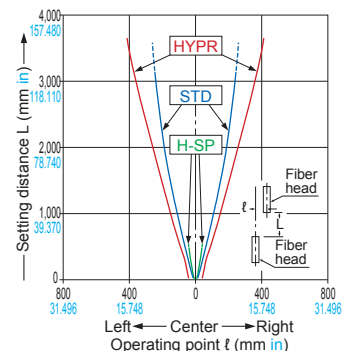
Vertical direction

**FT-Z40HBW**

Thru-beam type

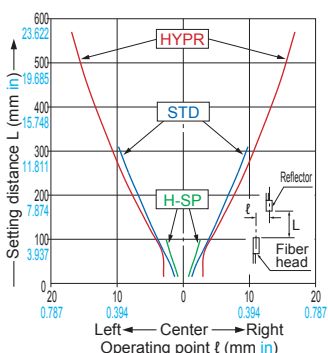
**FT-Z802Y**

Thru-beam type

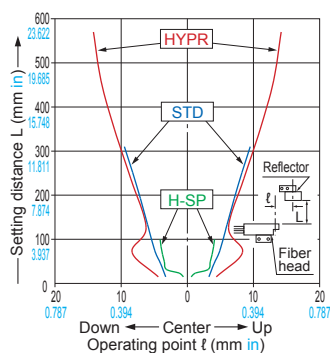
**Retroreflective type Parallel deviation** Sensing characteristics are listed in the alphabetic order of the Model No.**FR-KZ22E**

Retroreflective type

Horizontal direction

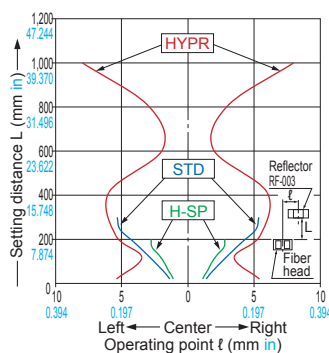


Vertical direction

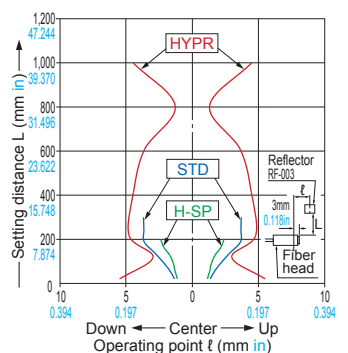
**FR-KZ50E**

Retroreflective type

Horizontal direction



Vertical direction



FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

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SIMPLE WIRE-SAVING UNITS

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Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F7/
FX-301-F

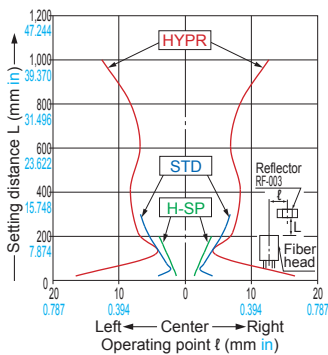
SENSING CHARACTERISTICS (TYPICAL)

Retroreflective type Parallel deviation Sensing characteristics are listed in the alphabetic order of the Model No.

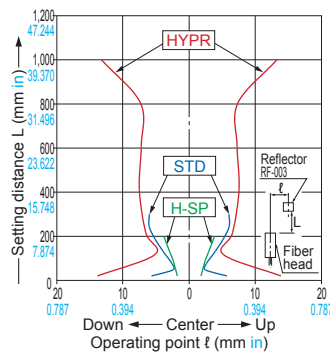
FR-KZ50H

Retroreflective type

Horizontal direction



Vertical direction

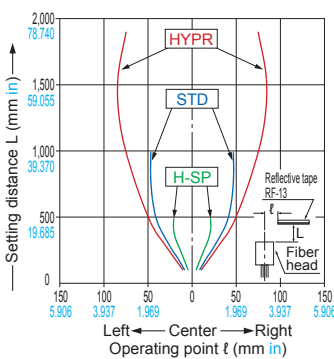


FR-Z50HW

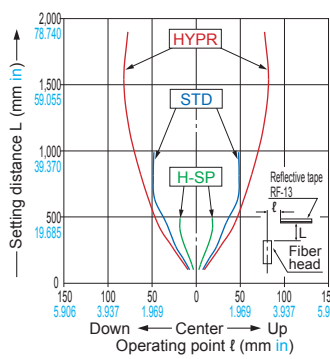
Retroreflective type

With Reflective tape **RF-13** (attached)

Horizontal direction



Vertical direction



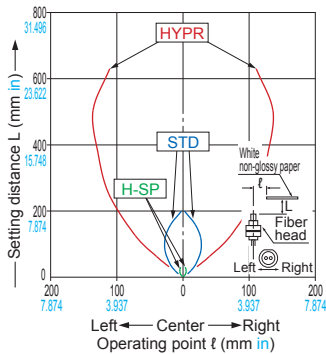
With reflector **RF-230** (optional)

SENSING CHARACTERISTICS (TYPICAL)**Reflective type Sensing field**

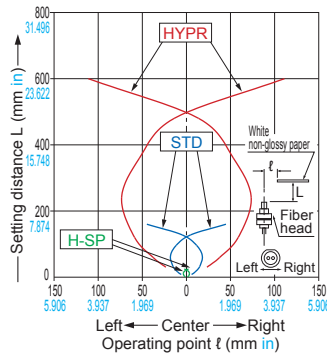
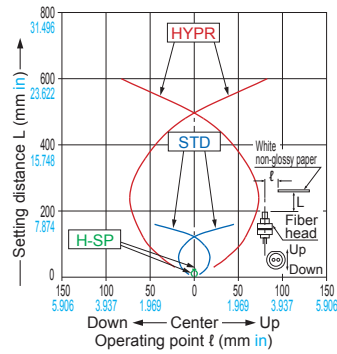
Sensing characteristics are listed in the alphabetic order of the Model No.

FD-32GX

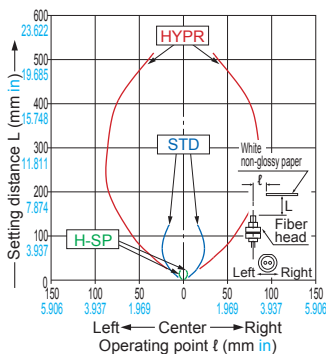
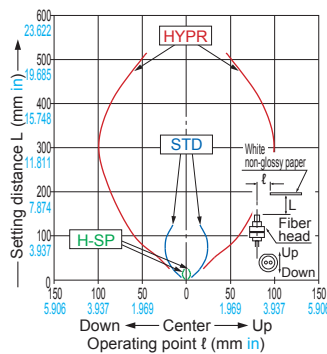
Reflective type

**FD-40**

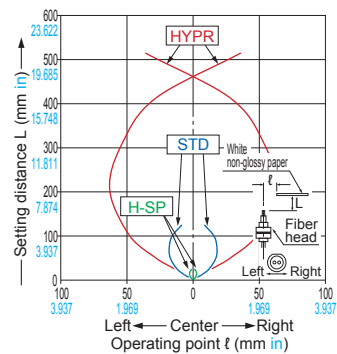
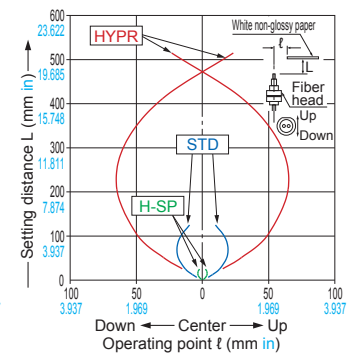
Reflective type

Horizontal direction**Vertical direction****FD-41**

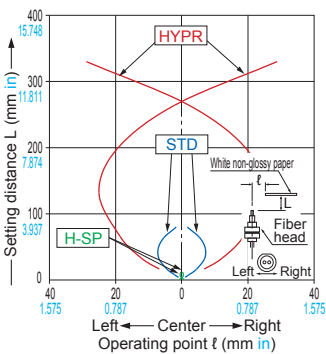
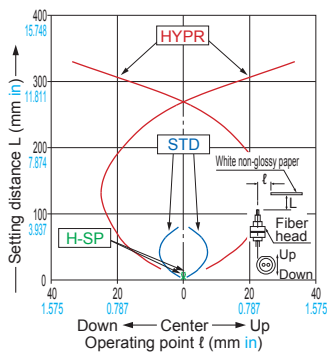
Reflective type

Horizontal direction**Vertical direction****FD-41S**

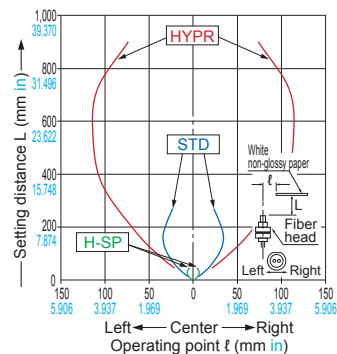
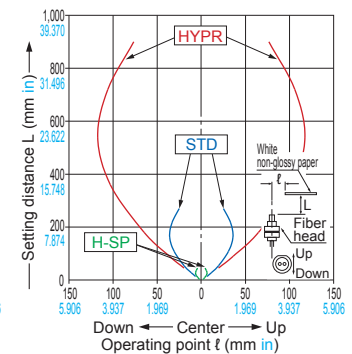
Reflective type

Horizontal direction**Vertical direction****FD-41SW**

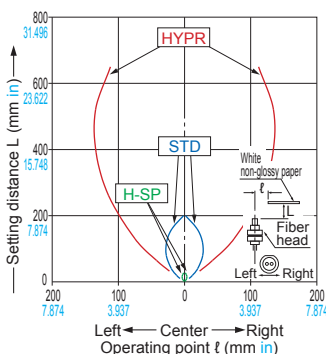
Reflective type

Horizontal direction**Vertical direction****FD-41W**

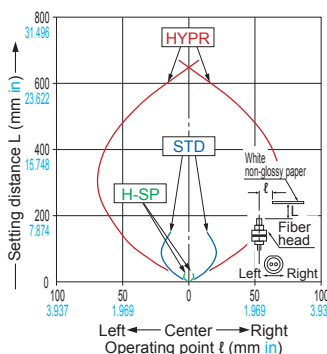
Reflective type

Horizontal direction**Vertical direction****FD-42G**

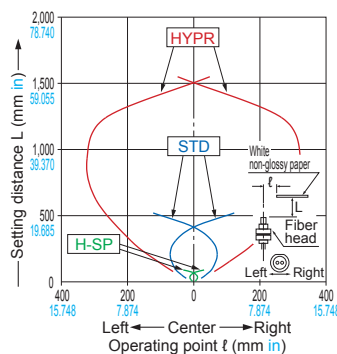
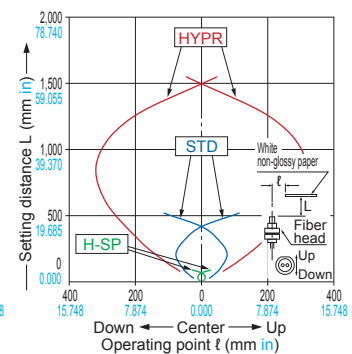
Reflective type

**FD-42GW**

Reflective type

**FD-60**

Reflective type

Horizontal direction**Vertical direction**FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-SAVING
UNITSWIRE-SAVING
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Fibers

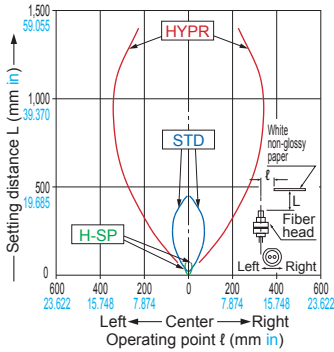
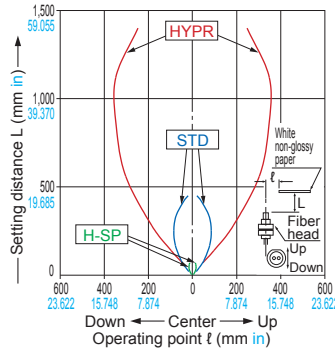
Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F /**
FX-301-F

SENSING CHARACTERISTICS (TYPICAL)**Reflective type Sensing field**

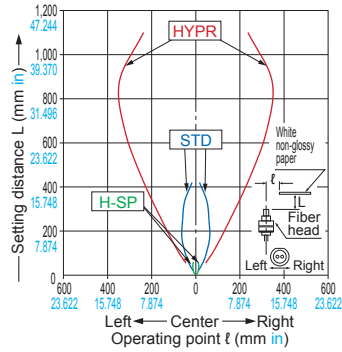
Sensing characteristics are listed in the alphabetic order of the Model No.

FD-61

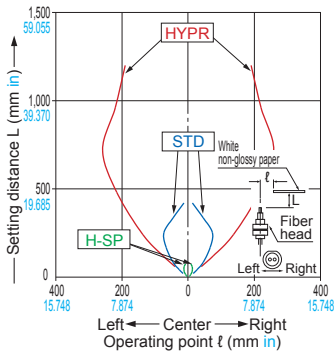
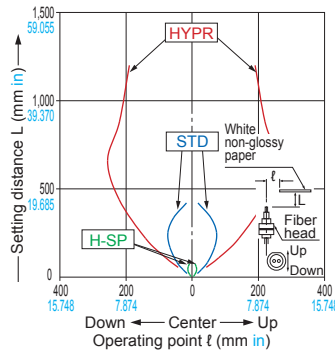
Reflective type

Horizontal direction**Vertical direction****FD-61G**

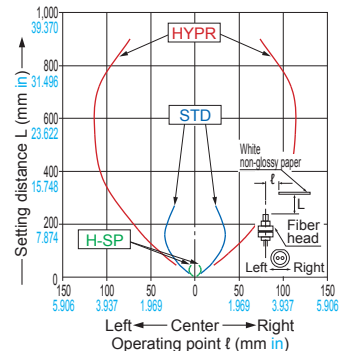
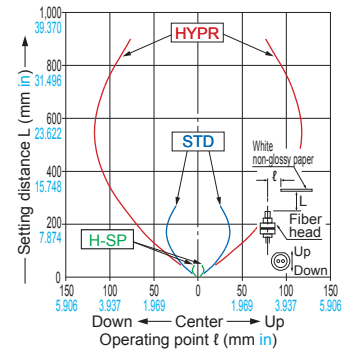
Reflective type

**FD-61S**

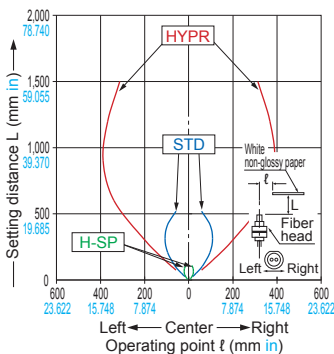
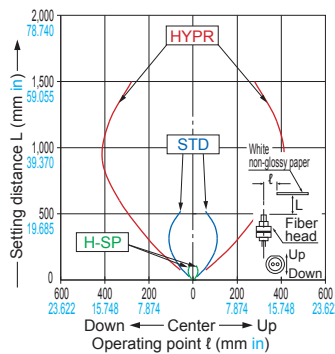
Reflective type

Horizontal direction**Vertical direction****FD-61W**

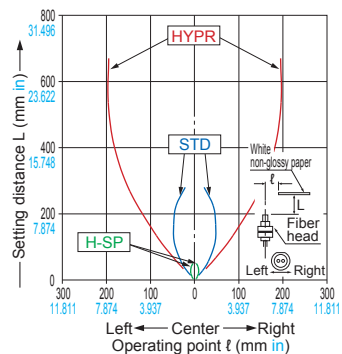
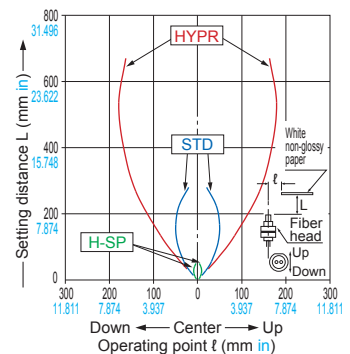
Reflective type

Horizontal direction**Vertical direction****FD-62**

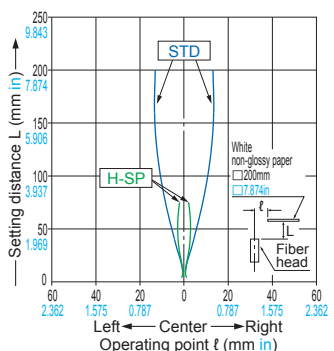
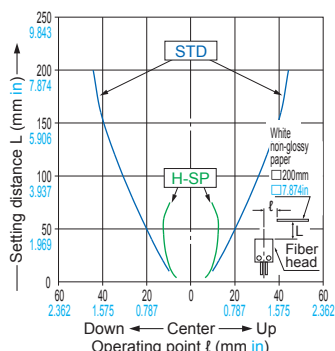
Reflective type

Horizontal direction**Vertical direction****FD-64X**

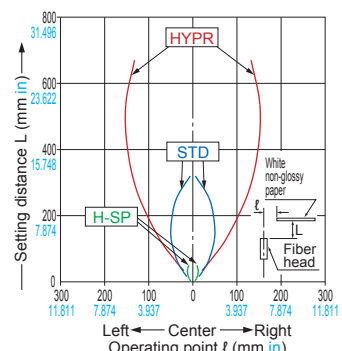
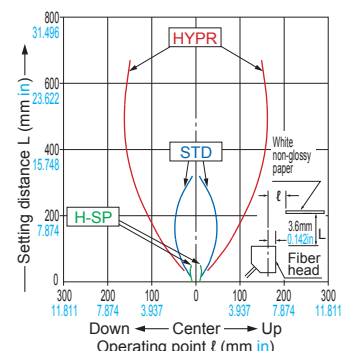
Reflective type

Horizontal direction**Vertical direction****FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/****FX-301-F****FD-A16**

Reflective type

Horizontal direction**Vertical direction****FD-AL11**

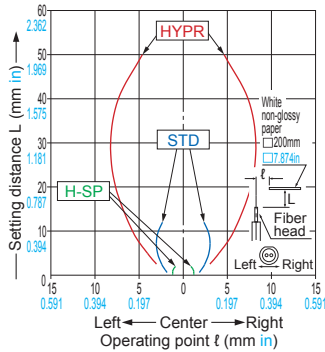
Reflective type

Horizontal direction**Vertical direction**

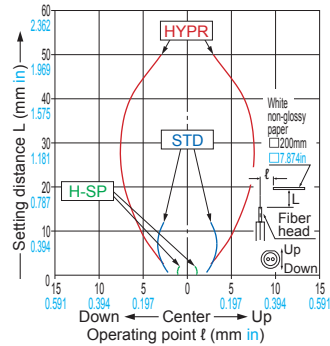
SENSING CHARACTERISTICS (TYPICAL)**Reflective type Sensing field** Sensing characteristics are listed in the alphabetic order of the Model No.**FD-E13**

Reflective type

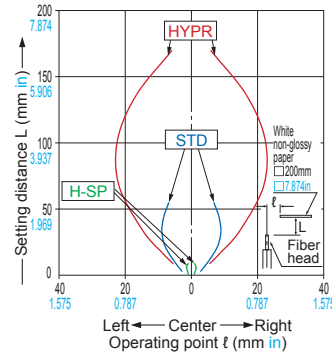
Horizontal direction



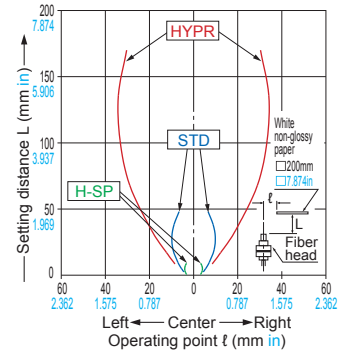
Vertical direction

**FD-E23**

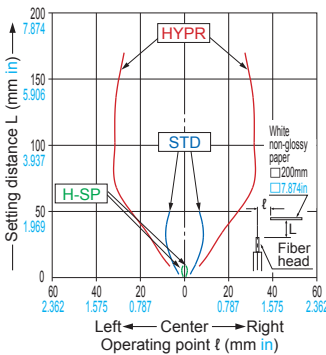
Reflective type

**FD-EG30**

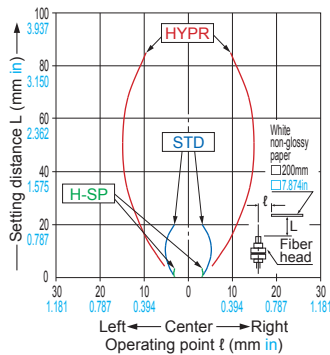
Reflective type

**FD-EG30S**

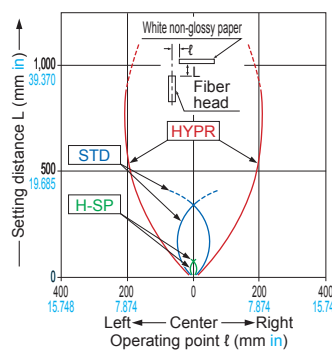
Reflective type

**FD-EG31**

Reflective type

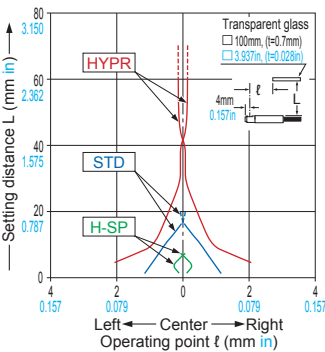
**FD-H13-FM2**

Reflective type

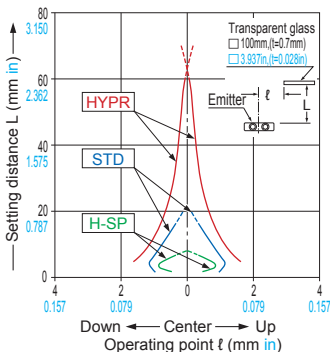
**FD-H18-L31**

Reflective type

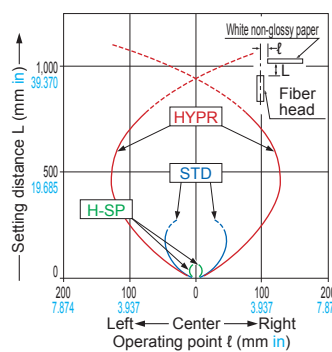
Horizontal direction



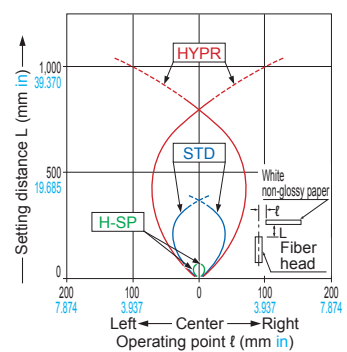
Vertical direction

**FD-H20-21**

Reflective type

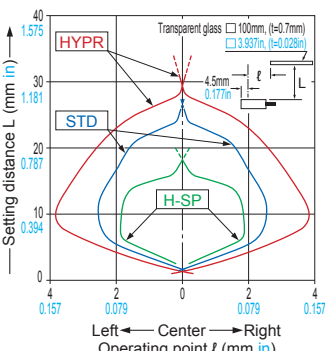
**FD-H20-M1**

Reflective type

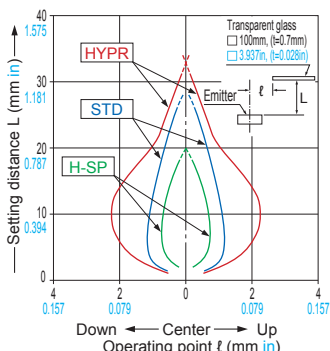
**FD-H25-L43**

Reflective type

Horizontal direction



Vertical direction

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-SAVING
UNITSWIRE-SAVING
SYSTEMSMEASURE-
MENT
SENSORSSTATIC
ELECTRICITY
PREVENTION
DEVICESLASER
MARKERS

PLC

HUMAN
MACHINE
INTERFACESENERGY
CONSUMPTION
VISUALIZATION
COMPONENTSFA
COMPONENTSMACHINE
VISION
SYSTEMSUV
CURING
SYSTEMSSelection
Guide

Fibers

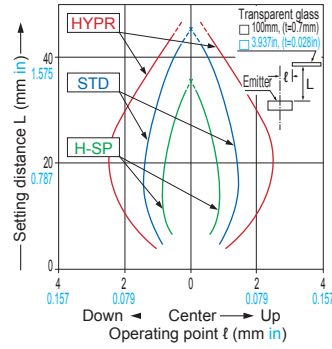
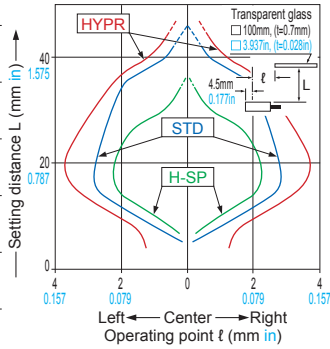
Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F/
FX-301-F**

SENSING CHARACTERISTICS (TYPICAL)**Reflective type Sensing field**

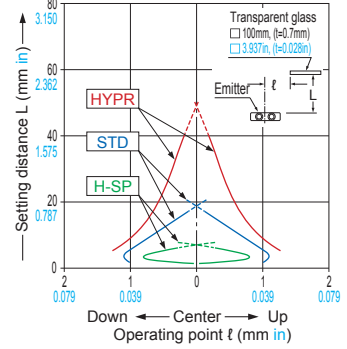
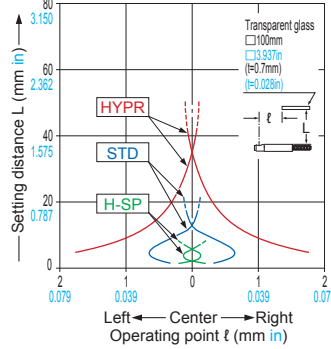
Sensing characteristics are listed in the alphabetic order of the Model No. (Models with same sensing characteristics are grouped together.)

FD-H25-L45

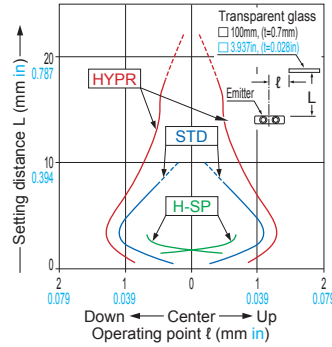
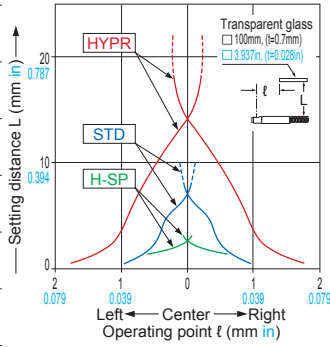
Reflective type

Horizontal direction**Vertical direction****FD-H30-L32**

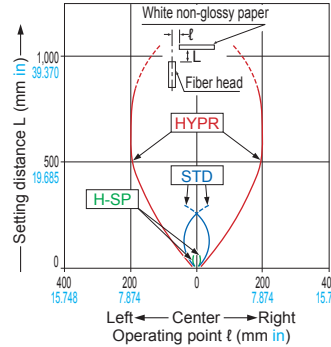
Reflective type

Horizontal direction**Vertical direction****FD-H30-L32V-S**

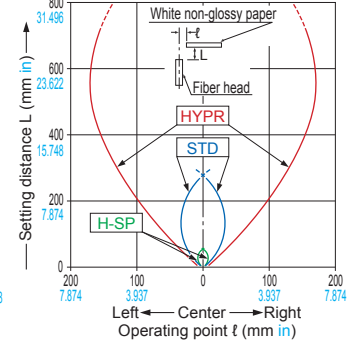
Reflective type

Horizontal direction**Vertical direction****FD-H35-20S**

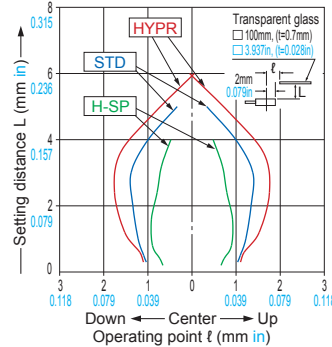
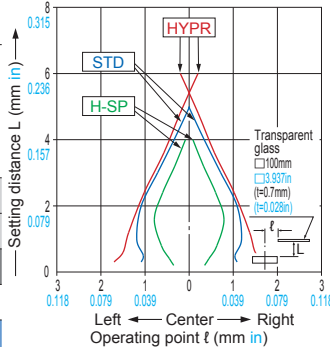
Reflective type

**FD-H35-M2
FD-H35-M2S6**

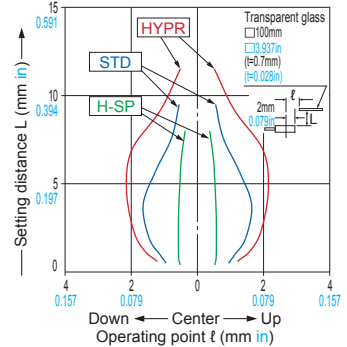
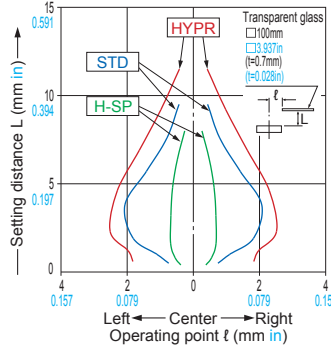
Reflective type

**FD-L10**

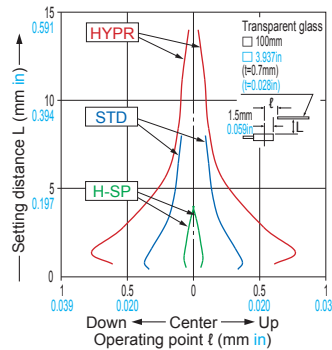
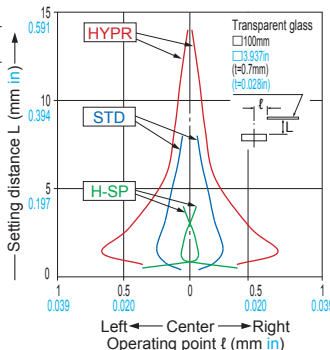
Reflective type

Horizontal direction**Vertical direction****FD-L11**

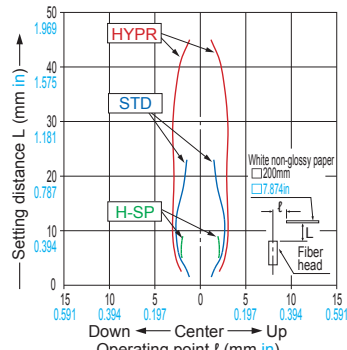
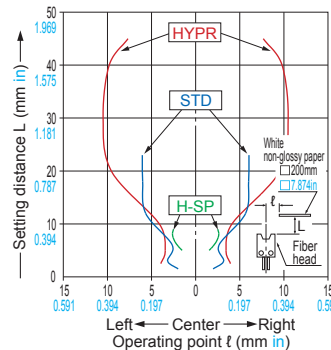
Reflective type

Horizontal direction**Vertical direction****FD-L12W**

Reflective type

Horizontal direction**Vertical direction****FD-L20H**

Reflective type

Horizontal direction**Vertical direction**

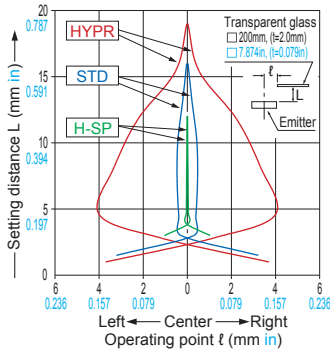
SENSING CHARACTERISTICS (TYPICAL)

Reflective type Sensing field Sensing characteristics are listed in the alphabetic order of the Model No.

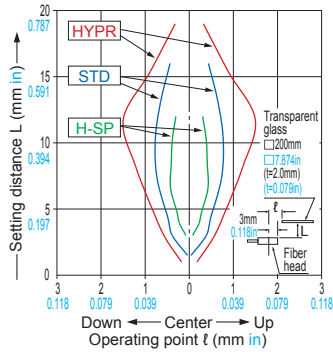
FD-L21

Reflective type

Horizontal direction

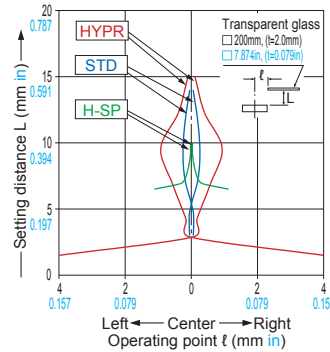


Vertical direction

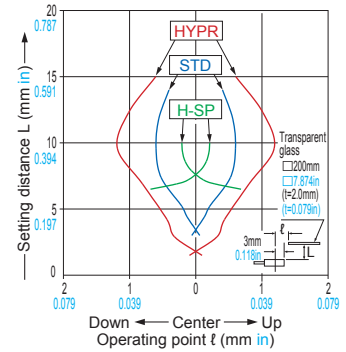
**FD-L21W**

Reflective type

Horizontal direction

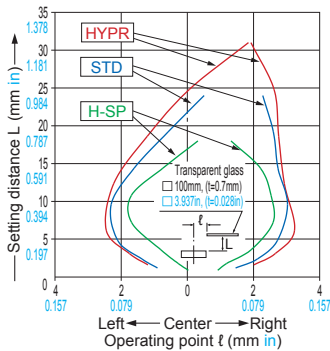


Vertical direction

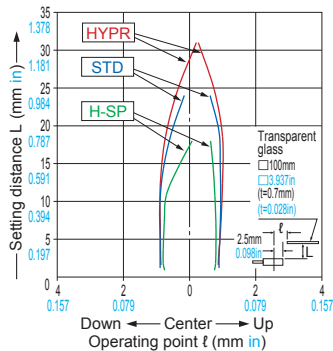
**FD-L22A**

Reflective type

Horizontal direction

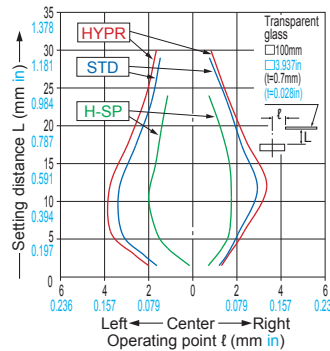


Vertical direction

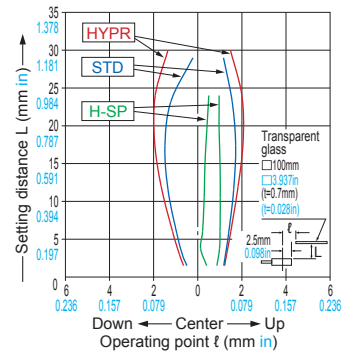
**FD-L23**

Reflective type

Horizontal direction

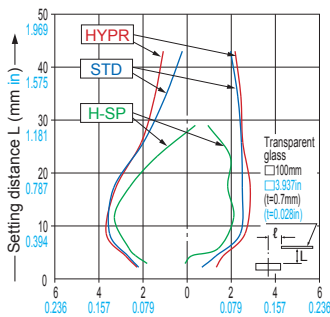


Vertical direction

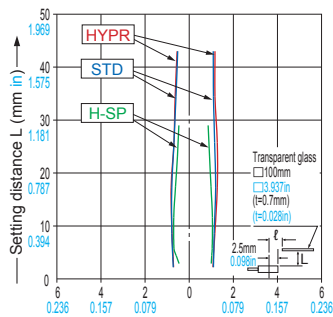
**FD-L30A**

Reflective type

Horizontal direction

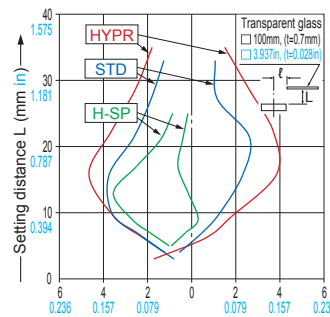


Vertical direction

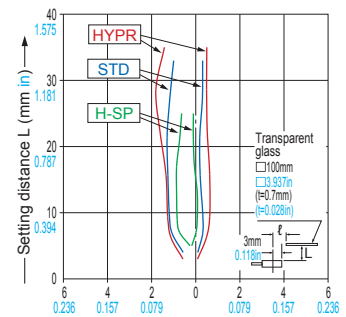
**FD-L31A**

Reflective type

Horizontal direction

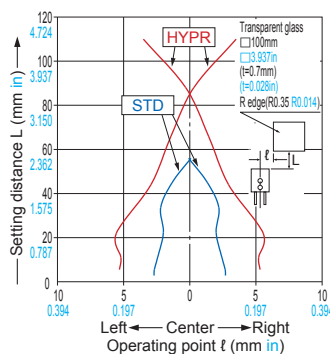


Vertical direction

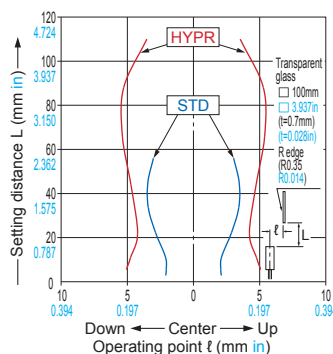
**FD-L32H**

Reflective type

Horizontal direction

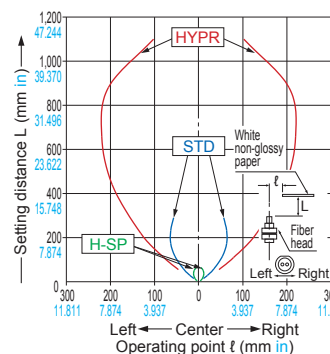


Vertical direction

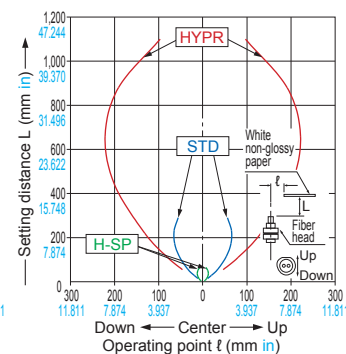
**FD-R60**

Reflective type

Horizontal direction



Vertical direction



FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

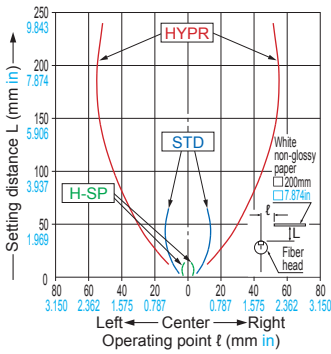
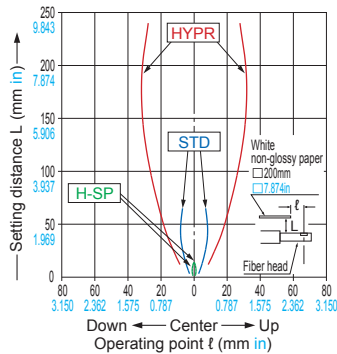
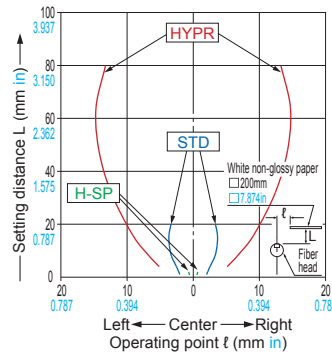
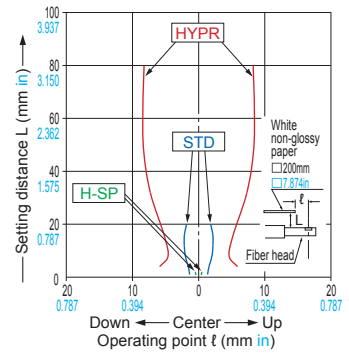
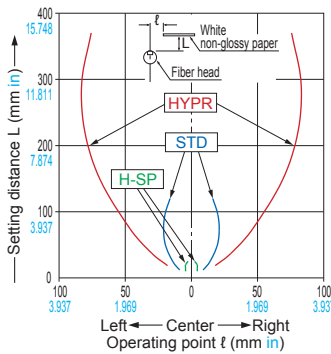
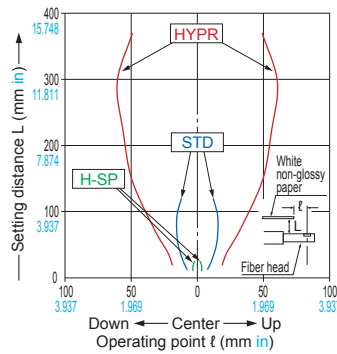
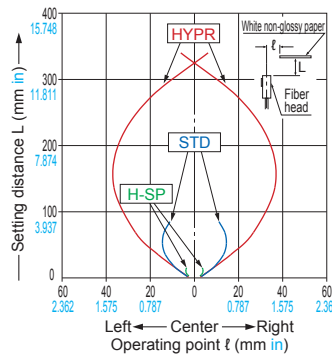
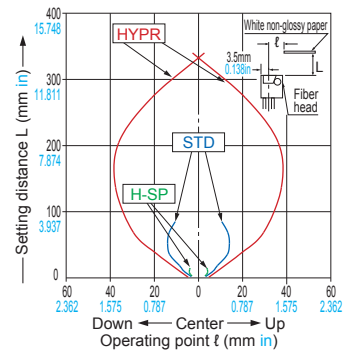
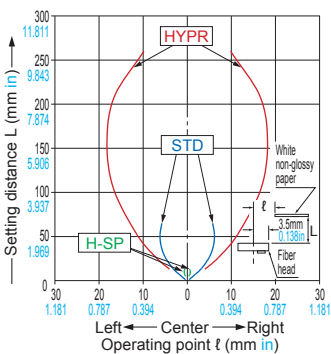
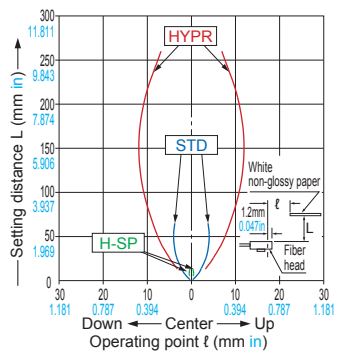
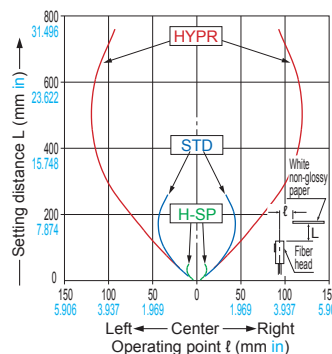
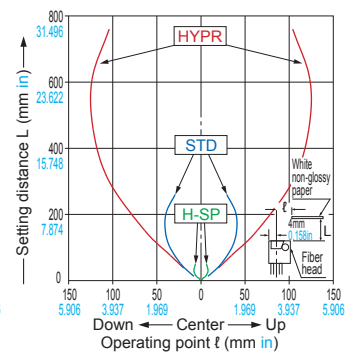
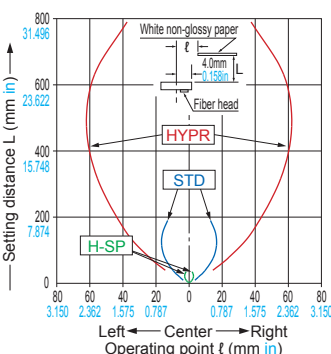
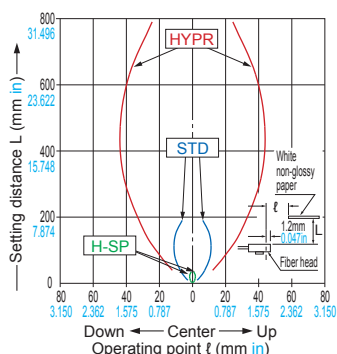
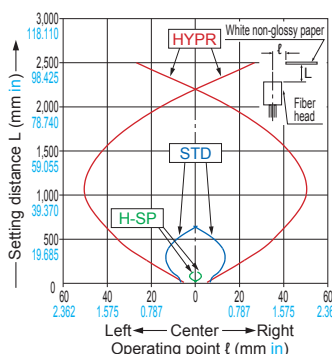
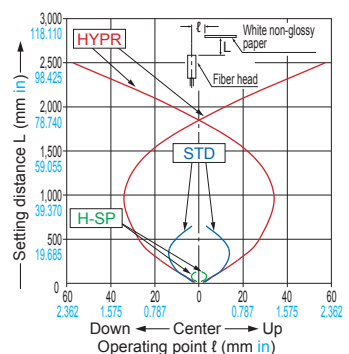
UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

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

SENSING CHARACTERISTICS (TYPICAL)**Reflective type Sensing field** Sensing characteristics are listed in the alphabetic order of the Model No.**FD-V30****Reflective type****Horizontal direction****Vertical direction****FD-V30W****Reflective type****Horizontal direction****Vertical direction****FD-V50****Reflective type****Horizontal direction****Vertical direction****FD-Z20HBW****Reflective type****Horizontal direction****Vertical direction****FD-Z20W****Reflective type****Horizontal direction****Vertical direction****FD-Z40HBW****Reflective type****Horizontal direction****Vertical direction****FD-Z40W****Reflective type****Horizontal direction****Vertical direction****FD-Z50HW****Reflective type****Horizontal direction****Vertical direction**FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-
SAVING
UNITSWIRE-
SAVING
SYSTEMSMEASURE-
MENT
SENSORSSTATIC
ELECTRICITY
PREVENTION
DEVICESLASER
MARKERS

PLC

HUMAN
MACHINE
INTERFACESENERGY
CONSUMPTION
VISUALIZATION
COMPONENTSFA
COMPONENTSMACHINE
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Fibers

Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F/
FX-301-F**

PRECAUTIONS FOR PROPER USE

Refer to the "PRO mode operation manual" on our website for details.



- 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.
- Make sure to use the quick-connection cable (optional) for the connection of the controller. Extension up to total 100 m **328.084 ft** is possible with 0.3 mm² or more, cable. However, in order to reduce noise, make the wiring as short as possible.
- Make sure that stress by forcible bending or pulling is not applied to the sensor cable joint and fiber cable.

Others

- Our products have been developed / produced for industrial use only.
- The specification may not be satisfied in a strong magnetic field.
- The ultra long distance (U-LG, HYPR) mode is more likely to be affected by extraneous noise since the sensitivity of that is higher than the other modes. Make sure to check the environment before use.
- Do not use during the initial transient time (H-SP, FAST, STD: 0.5 sec., LONG, U-LG, HYPR: 1 sec.) after the power supply is switched ON.
- 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.

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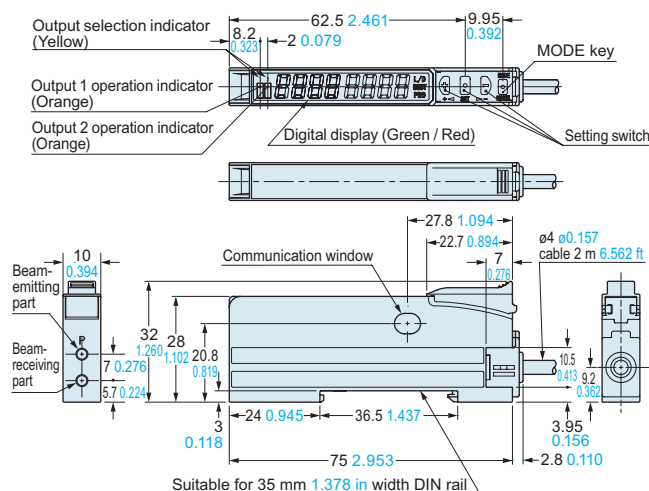
FX-410

FX-311

FX-301-F7/
FX-301-F

The CAD data in the dimensions can be downloaded from our website.

Amplifier

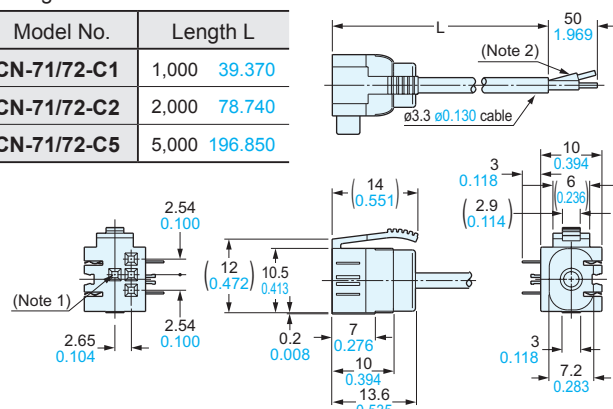


CN-71-C□	CN-72-C□	Sub cable (Optional)
----------	----------	----------------------

CN-71-C□	CN-72-C□	Sub cable (Optional)
----------	----------	----------------------

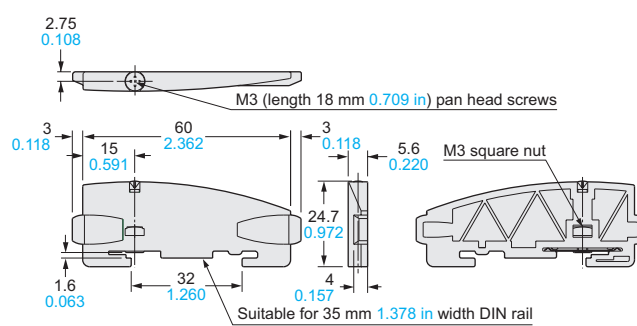
- Length L

Model No.	Length L
CN-71/72-C1	1,000 39.370
CN-71/72-C2	2,000 78.740
CN-71/72-C5	5,000 196.850



Notes: 1) **CN-72-C** only
2) **CN-71-C**: 1-core

End plate (Optional)



Material: Polycarbonate

FX-301-F

Digital Fiber Sensor

FX-100 SERIES

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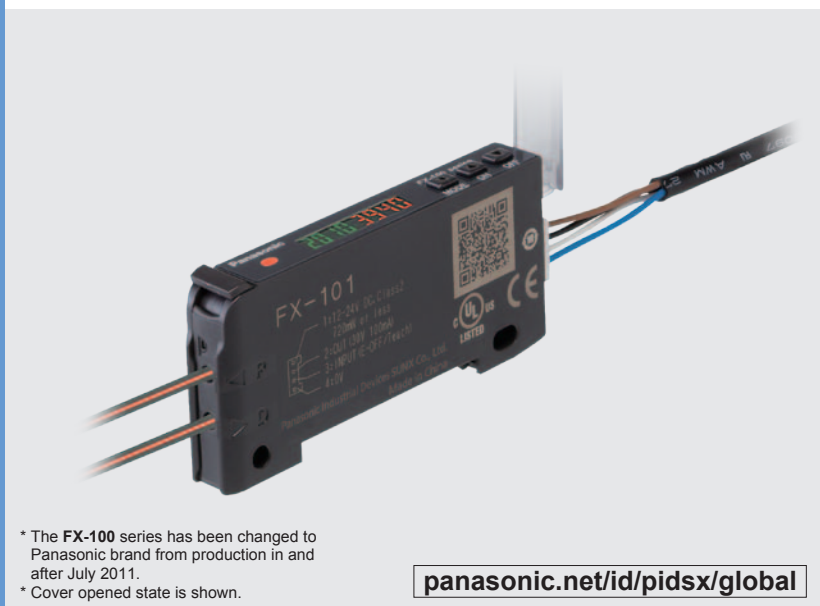
Related Information

■ General terms and conditions..... F-7

■ Glossary of terms / General precautions..... P.1455~ / P.1501

■ Sensor selection guide..... P.3~

■ Fiber selection..... P.5~



* The FX-100 series has been changed to Panasonic brand from production in and after July 2011.
* Cover opened state is shown.

panasonic.net/id/pidsx/global



PNP output type available



Timer



Interference prevention



Light intensity monitor



Automatic sensitivity setting



Test input

Taking fiber sensors to the next level

Good dual digital display

The threshold value and incident light intensity can be both confirmed at the same time, bringing good operability when making changes of each setting.



Threshold value

Incident light intensity

Commercially-available connectors reduce lead time and spare part numbers

Compatible with commercially-available connectors, so that processing costs and lead time required for processing after purchase can be greatly reduced. The connection parts same as the DP-100 series digital pressure sensors and the PM-64 series micro photoelectric sensors can be commonly used.



Commercially-available connector

Commercially-available crimping connectors are used, so that the processing costs for connection cables can be greatly reduced.

Conventional (cable type)



- ① Purchase and preparation of sensor
- ② Harness processing by outside order
- ③ Sensor installation

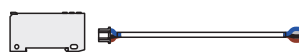
Conventional lead time

• Harness processing by outside order is needed after sensor preparation.

Customer ① Sensor preparation ③ Sensor installation

Harness processor ② Harness processing

From now on (built-in connector type)



- ① Purchase and preparation of sensor
- ② Harness processing by outside order
- ③ Sensor installation

Lead time from now on

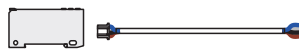
• Harness processing can be done by outside order at the same time of sensor preparation. No need junction connector.

Customer ① Sensor preparation ③ Sensor installation

Harness processor ② Harness processing

Reduced

Using cables with connectors



- ① Purchase and preparation of sensors and cable with connectors
- ② Sensor installation

Lead time further reduced

• Harness processing by outside order is not needed. Lead time and spare part numbers can be reduced.

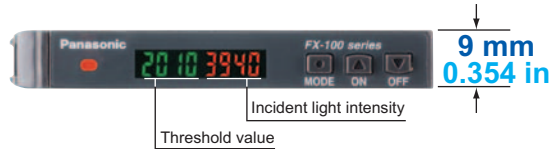
Customer ① Sensor preparation ② Sensor installation

Reduced

Reduced lead time

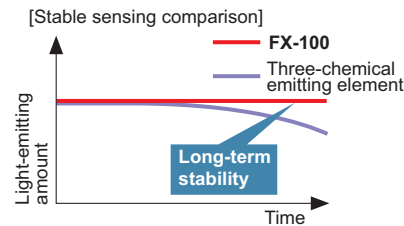
Saving-space with a width of 9 mm 0.354 in

Very slim body at only 9 mm 0.354 in. This is much thinner than existing fiber sensors. This makes a very large difference when using many units, even if the difference of one unit is small.



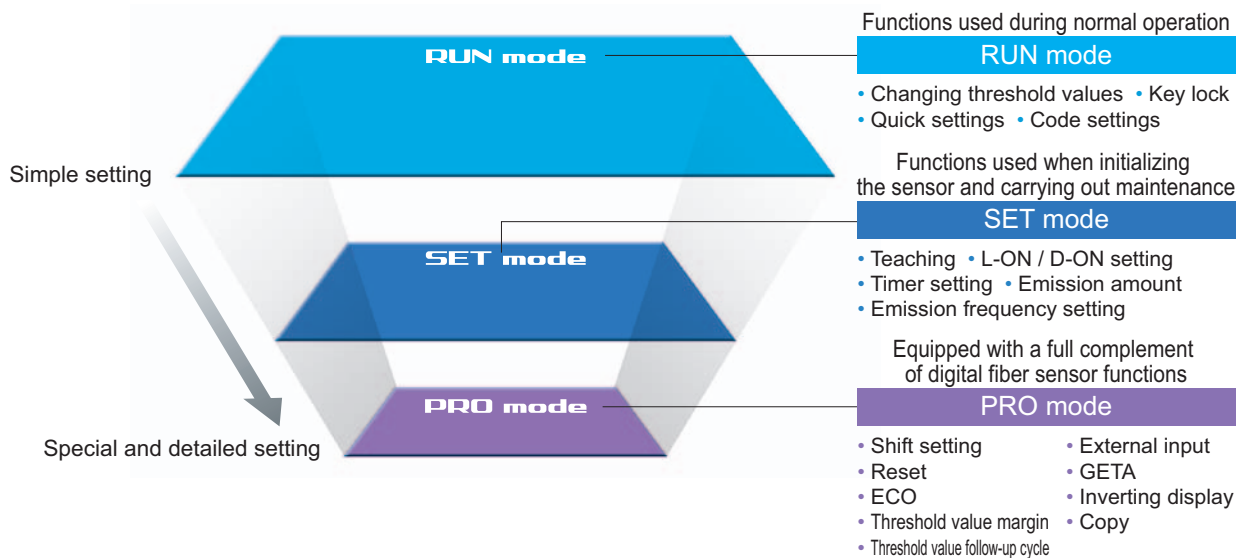
Improved stability over long terms

Utilizes "Four-chemical emitting element" for light emission. The light emission is guaranteed to be stable over long periods of time.



Simple operation due to clear configuration system

Continued to use the configuration system of digital pressure sensor **DP-100** series, which has received high popularity since its release. We have separated the settings into three levels: RUN mode, SET mode, and PRO mode, making operation simpler and easier.



Quick code input function

Simply inputting the default setting "code (number)" will enable sensor settings. Even if the settings are accidentally changed, inputting the code will restore the default settings.

Confirmation can be carried out smoothly via telephone by simply quoting numbers. This can be of great assistance when dealing with foreign country customers.



Quick setting: Press and simultaneously for 2 sec.

Code setting: Press and simultaneously for 4 sec.

Quick setting numbers (abstract)

No	Output operation	Timer	Emission amount setting
-00-	Dark-ON	None	OFF
-01-	Dark-ON	None	ON
-02-	Dark-ON	OFF-delay 10 ms	OFF
-03-	Dark-ON	OFF-delay 10 ms	ON
-10-	Light-ON	ON-delay 40 ms	ON
-11-	Light-ON	ON-delay 40 ms	OFF
-12-	Light-ON	ON-delay 10 ms	ON
-13-	Light-ON	ON-delay 10 ms	OFF

Refer to "Quick setting function" and "Code setting function" in "PRECAUTIONS FOR PROPER USE" for details.

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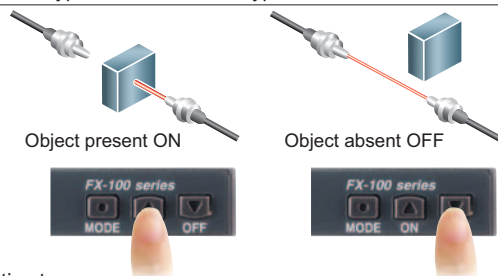
FX-301-F

Teaching with ON / OFF keys**SET mode**

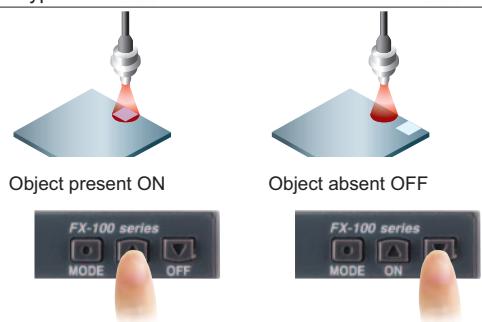
Simply press the ON key when an object is present, and OFF when it is not, and teaching is completed. There is no need to consider difference between Light-ON and Dark-ON.

<Setting example>

Thru-beam type / Retroreflective type



Reflective type

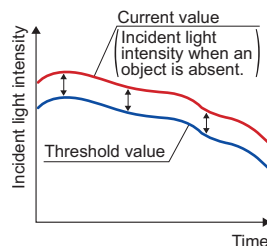
**Teaching even without an object — Limit teaching function**

Threshold value can be set by performing teaching only when an object is absent (when the incident light amount is stable). This is useful when there are other objects in the background also when detecting a minute objects. Teaching can also be carried out using external input.

Threshold value follow-up cycle setting function**PRO mode**

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

* Effective when the output operation is set to Dark-ON, and when using thru-beam type or retroreflective type fibers.

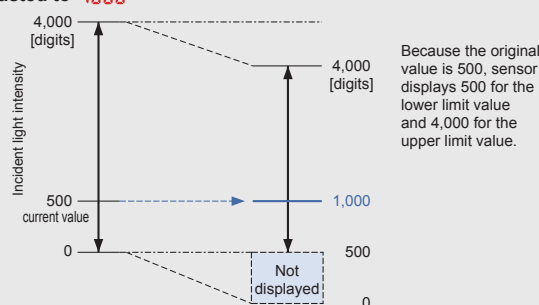
**Resolves variation in incident light intensity display GETA function****PRO mode**

Even when performing the same sensing operation, there may be variances in the digital values of the fiber amp. There is no problem with the sensor itself, but the operator may find it troubling.

Given value can be corrected with the GETA function, so the apparent variation can be eliminated and the creation of operation manuals can proceed smoothly.

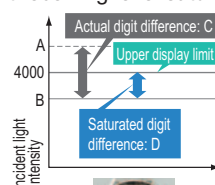
Variations in the amount of light received

Unify at 500 using the GETA function

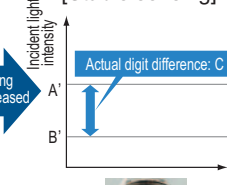
**Example of current incident light intensity display of '500' is adjusted to '1000'****Emission amount setting function****SET mode**

Emission amount can be reduced in order to achieve stable detection when the receiving light level is saturated, such as detection at close range and detection of transparent or minute objects. Previously, the emission amount level was only one, but from production in December 2007, four level setting (three level + auto setting) has become available. This function brings easier settings than before.

[Light receiving level saturated]



[Stable sensing]

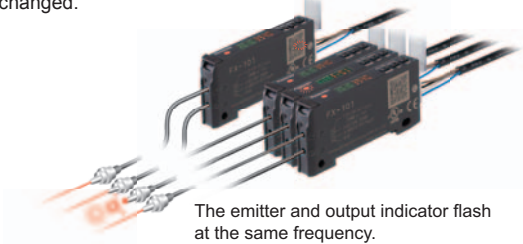


Emission frequency setting mode SET mode

Mutual interference is prevented for max. 3 units for standard type **FX-101** and max. 4 units in case of long sensing range type **FX-102**.

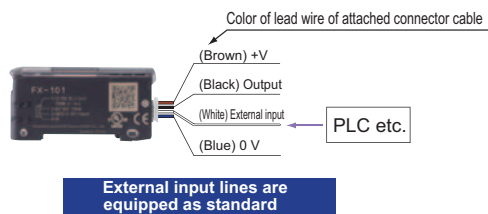
During setting of interference prevention, emitter and output indicator both flash, so it is convenient to confirm which fiber is in the setting process at a glance. Emitter flashes even when an amplifier is not installed close together.

* When the emission frequency is changed, a response time is also changed.

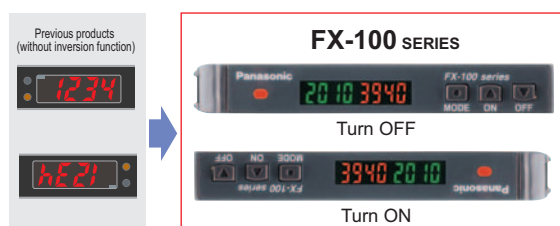
**External input setting mode** PRO mode

External input can be selected from emission halt, limit teaching / full-auto teaching / 2-level teaching, ECO or emission amount test. Threshold value set at each teaching is also memorized.

* 2-level teaching, emission amount test and threshold value storing setting are available in amplifiers manufactured after December 2007.

**Digital display inversion setting** PRO mode

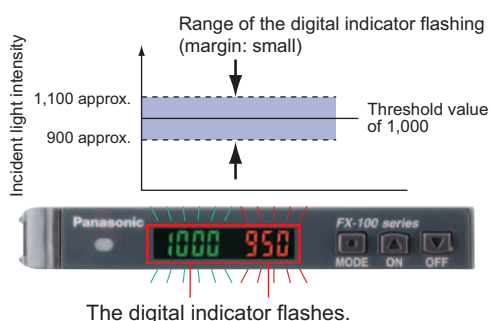
The viewing orientation of the digital display can be inverted in accordance with the setting direction of the amplifier.

**Alert function** PRO mode

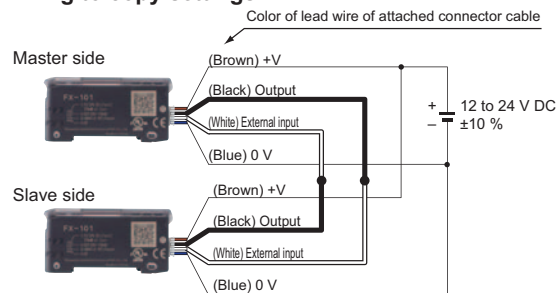
When the amount light received approaches the threshold value, the display can be made to blink in order to alert the operator.

<When using at a shift amount of 20% and a threshold value of 1,000>

The amount of light received ranges from about 900 to 1,100 when the digital indicator flashes.

**Setting copy function to reduce man-hours and human error** PRO mode

By connecting a fiber sensor to the master fiber sensor, the master sensor settings can be copied along with data communications. When the same settings are input to several units, trouble from setting errors can be prevented, also changes to the work order will be small when equipment design is changed.

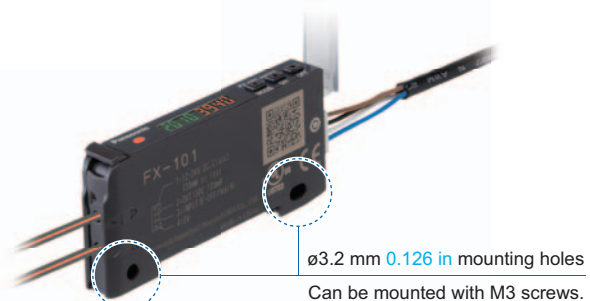
<Wiring to copy settings>**These settings can be copied**

Threshold value, output operation, timer operation, timer emission amount, shift, external input, threshold value-storing, ECO inverting digital display, and threshold value margin

Without mounting bracket

Selectable either mounting on DIN rail or direct mounting with through hole.

Direct mounting brings stability even on a movable parts or installation of a single unit.

**Available from standard type or long sensing range type**

Standard type and long sensing range type are available which has various response time and sensing range. The model best meet application needs can be selected.

Model No.	Type	Sensing range (FT-43)	Response time
FX-101	Standard type	350 mm 13.780 in	Max. 250 μs
FX-102	Long sensing range type	970 mm 38.189 in	Max. 2.5 ms



Power consumption saving with ECO mode

When there is no key operations in approximately 20 seconds, digital display turns off and power consumption can be reduced to 600mW or less (720mW in normal mode).

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FX-301-F**

ORDER GUIDE

Amplifiers

Type	Appearance	Model No.	Emitting element	Output
Standard type		FX-101 (Note 2)	Red LED	NPN open-collector transistor
		FX-101-Z (Note 3)		NPN open-collector transistor
		FX-101P (Note 2)		PNP open-collector transistor
		FX-101P-Z (Note 3)		PNP open-collector transistor
		FX-101-CC2		NPN open-collector transistor
Long sensing range type		FX-101P-CC2		PNP open-collector collector transistor
		FX-102 (Note 2)		NPN open-collector transistor
		FX-102-Z (Note 3)		NPN open-collector transistor
		FX-102P (Note 2)		PNP open-collector transistor
		FX-102P-Z (Note 3)		PNP open-collector transistor
		FX-102-CC2		NPN open-collector transistor
		FX-102P-CC2		PNP open-collector transistor

Notes: 1) The connector attached cable 2 m **6.562 ft** **CN-14A-C2** is supplied with the amplifier.

2) Make sure to use the optional connector attached cable **CN-14A(-R)-C□** or the connector **CN-14A**, or a connector manufactured by J.S.T. Mfg. Co., Ltd. (contact: SPHD-001T-P0.5, housing: PAP-04V-S)

3) Make sure to use the optional M8 connector attached cable **CN-24A-C□**.

OPTIONS

Designation	Model No.	Description
Connector attached cable	CN-14A-C1	1 m 3.281 ft
	CN-14A-C2 (Note)	2 m 6.562 ft
	CN-14A-C3	3 m 9.843 ft
	CN-14A-C5	5 m 16.404 ft
Connector attached cable (Flexible type)	CN-14A-R-C1	1 m 3.281 ft
	CN-14A-R-C2	2 m 6.562 ft
	CN-14A-R-C3	3 m 9.843 ft
	CN-14A-R-C5	5 m 16.404 ft
M8 connector attached cable	CN-24A-C2	2 m 6.562 ft
	CN-24A-C5	5 m 16.404 ft
Connector	CN-14A	Set of 10 housings and 40 contacts
Amplifier mounting bracket	MS-DIN-4	Mounting bracket for amplifier
End plates	MS-DIN-E	When it moves depending on the way it is installed on a DIN rail, these end plates ensure that all amplifiers are mounted together in a secure and fully connected manner.

Note: The connector attached cable **CN-14A-C2** is supplied with the cable set type **FX-10□-CC2**.

Recommended connector

Contact: SPHD-001T-P0.5, Housing: PAP-04V-S (Manufactured by J.S.T. Mfg. Co., Ltd.)

Note: Contact the manufacturer for details of the recommended products.

Recommended crimping tool

Model No.: YC-610R (Manufactured by J.S.T. Mfg. Co., Ltd.)

Note: Contact the manufacturer for details of the recommended products.

Accessory

• CN-14A-C2

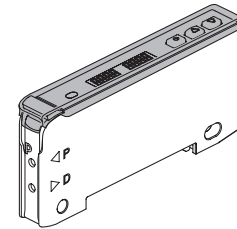
(Connector attached cable 2 m **6.562 ft**)

* Only include cable set type



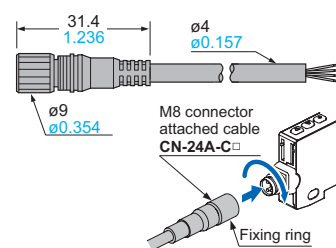
• FC-FX-1 (Protection cover)

* It have been attached from the production at July, 2011.



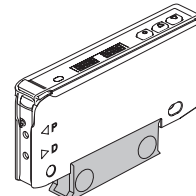
M8 connector attached cable

• CN-24A-C□



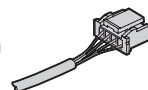
Amplifier mounting bracket

• MS-DIN-4



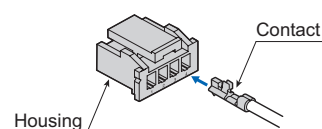
Connector attached cable

• CN-14A(-R)-C□



Connector

• CN-14A



LIST OF FIBERS**Thru-beam type (one pair set)**

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)		Type / Ambient temperature	Fiber cable length ✂: Free-cut	Dimensions
	Standard type FX-101 □	Long sensing range type FX-102 □			
FT-140	14,000 551.180	19,600 771.652 (Note 2)	Threaded, M14, Long sensing range, -40 to +70 °C -40 to 158 °F	✂ 10 m 32.808 ft	P.51
FT-30	135 5.315	400 15.748	Super quality, Threaded, M3, -55 to +80 °C -67 to 176 °F	2 m 6.562 ft	P.51
FT-31	130 5.118	340 13.386	Threaded, M3, -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.51
FT-31S	130 5.118	340 13.386	Sleeve, Threaded, M3, -55 to +80 °C -67 to 176 °F		P.51
FT-31W	80 3.150	240 9.449	Threaded, M3, -40 to +60 °C -40 to 140 °F	2 m 6.562 ft	P.51
FT-40	320 12.598	870 34.252	Super quality, Threaded, M4, -55 to +80 °C -67 to 176 °F		P.51
FT-42	300 11.811	800 31.496	Threaded, M4, -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.51
FT-42S	300 11.811	800 31.496	Sleeve, Threaded, M4, -55 to +80 °C -67 to 176 °F		P.51
FT-42W	260 10.236	720 28.346	Threaded, M4, -40 to +60 °C -40 to 140 °F		P.51
FT-43	350 13.780	970 38.189	Threaded, M4, -55 to +80 °C -67 to 176 °F	1 m 3.281 ft	P.51
FT-45X	340 13.386	920 36.220	Threaded, M4, -55 to +80 °C -67 to 176 °F		P.52
FT-A11	1,900 74.803	3,600 141.732 (Note 2)	Wide beam, -40 to +70 °C -40 to 158 °F	✂ 2 m 6.562 ft	P.52
FT-A11W	1,700 66.929	3,400 133.858	Wide beam, -40 to +55 °C -40 to 131 °F		P.52
FT-A32	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	Wide beam, -40 to +60 °C -40 to 140 °F		P.52
FT-A32W	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	Wide beam, -40 to +55 °C -40 to 131 °F		P.52
FT-AL05	250 9.843	660 25.984	Wide beam, -55 to +80 °C -67 to 176 °F	P.52	P.52
FT-E13	6 0.236	19 0.748	Cylindrical, Ultra-small dia., ø3 0.118 , -40 to +70 °C -40 to 158 °F	✂ 1 m 3.281 ft	P.52
FT-E23	22 0.866	80 3.150	Cylindrical, Ultra-small dia., ø3 0.118 , -40 to +70 °C -40 to 158 °F		P.52
FT-H13-FM2	250 9.843	700 27.559	Heat-resistant, -60 to +130 °C -76 to 266 °F	✂ 2 m 6.562 ft	P.52
FT-H20-J20-S (Note 3)	135 5.315	420 16.535	Heat-resistant (joint), -60 to +200 °C -76 to 392 °F	✂ 200 mm 7.874 in (Note 4)	P.53
FT-H20-J30-S (Note 3)	135 5.315	420 16.535	Heat-resistant (joint), -60 to +200 °C -76 to 392 °F	✂ 300 mm 11.811 in (Note 4)	P.53
FT-H20-J50-S (Note 3)	135 5.315	420 16.535	Heat-resistant (joint), -60 to +200 °C -76 to 392 °F	✂ 500 mm 19.685 in (Note 4)	P.53
FT-H20-M1	210 8.268	540 21.260	Heat-resistant, -60 to +200 °C -76 to 392 °F	1 m 3.281 ft	P.53
FT-H20-VJ50-S (Note 3)	150 5.906	500 19.685	Heat-resistant (joint), -60 to +200 °C -76 to 392 °F	✂ 500 mm 19.685 in (Note 4)	P.53
FT-H20-VJ80-S (Note 3)	150 5.906	500 19.685	Heat-resistant (joint), -60 to +200 °C -76 to 392 °F	✂ 800 mm 31.496 in (Note 4)	P.53
FT-H20W-M1	100 3.937	300 11.811	Heat-resistant, -60 to +200 °C -76 to 392 °F	1 m 3.281 ft	P.53
FT-H30-M1V-S (Note 5)	110 4.331	280 11.024	Vacuum-resistant, -30 to +300 °C -22 to 572 °F		P.53
FT-H35-M2	170 6.693	490 19.291	Heat-resistant, -60 to +350 °C -76 to 572 °F	2 m 6.562 ft	P.53
FT-H35-M2S6	170 6.693	490 19.291	Heat-resistant, -60 to +350 °C -76 to 572 °F		P.53
FT-HL80Y	990 38.976	2,340 92.126	Chemical-resistant, Metal-free, -40 to +115 °C -76 to 239 °F	✂ 2 m 6.562 ft (Note 6)	P.53

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) Heat-resistant joint fibers and ordinary-temperature fibers (**FT-42**) are sold as a set.

4) This is the fiber length (fixed length) for heat-resistant fibers. The ordinary-temperature fibers are free-cut to 2 m **6.562 ft**.

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

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

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-
SAVING
UNITSWIRE-
SAVING
SYSTEMSMEASURE-
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SENSORSSTATIC
ELECTRICITY
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HUMAN
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Fibers

Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/
FX-301-F**

LIST OF FIBERS

Thru-beam type (one pair set)



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)		Type / Ambient temperature	Fiber cable length ✂ : Free-cut	Dimensions
	Standard type FX-101 □	Long sensing range type FX-102 □			
FT-KS40	2,200 86.614	3,600 141.732 (Note 2)	Narrow Beam, -40 to +60 °C -40 to 140 °F	✂ 2 m 6.562 ft	P.54
FT-KV26	135 5.315	560 22.047	Narrow Beam, Side-view, -40 to +60 °C -40 to 140 °F		P.54
FT-KV40	2,200 86.614	3,600 141.732 (Note 2)	Narrow Beam, Side-view, -40 to +60 °C -40 to 140 °F		P.54
FT-KV40W	2,200 86.614	3,600 141.732 (Note 2)	Narrow Beam, Side-view, -40 to +60 °C -40 to 140 °F	✂ 2 m 6.562 ft	P.54
FT-L80Y	1,100 43.307	2,600 102.362	Chemical-resistant, Metal-free, -40 to +70 °C -40 to 158 °F	✂ 2 m 6.562 ft (Note 3)	P.54
FT-R31	100 3.937	340 13.386	Square head, M3, -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.54
FT-R40	270 10.630	740 29.134	Threaded, M4, Elbow, -55 to +80 °C -67 to 176 °F		P.54
FT-R41W	250 9.843	710 27.953	Square head, M4, -40 to +60 °C -40 to 140 °F		P.54
FT-R42W	510 20.079	2,000 78.740	Square head, M4, -40 to +60 °C -40 to 140 °F		P.54
FT-R43	210 8.268	640 25.197	Square head, M4, -55 to +80 °C -67 to 176 °F		P.54
FT-R44Y	210 8.268	640 25.197	Oil-resistant, Square head, M4, Cable-protection type, -55 to +80 °C -67 to 176 °F		P.55
FT-R60Y	690 27.165	1,890 74.409	Oil-resistant, Square head, M6, Full-protection type, -55 to +80 °C -67 to 176 °F		P.55
FT-S11	40 1.575	90 3.543	Cylindrical, $\phi 1$ 0.039 , -55 to +80 °C -67 to 176 °F	500 mm 19.685 in	P.55
FT-S20	135 5.315	400 15.748	Super quality, Cylindrical, $\phi 1.5$ 0.059 , -55 to +80 °C -67 to 176 °F	2 m 6.562 ft	P.55
FT-S21	130 5.118	340 13.386	Cylindrical, $\phi 1.5$ 0.059 , -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.55
FT-S21W	80 3.150	240 9.449	Cylindrical, $\phi 1.5$ 0.059 , -40 to +60 °C -40 to 140 °F		P.55
FT-S30	320 12.598	870 34.252	Super quality, Cylindrical, $\phi 3$ 0.118 , -55 to +80 °C -67 to 176 °F	2 m 6.562 ft	P.55
FT-S31W	260 10.236	720 28.346	Cylindrical, $\phi 3$ 0.118 , -40 to +60 °C -40 to 140 °F	✂ 2 m 6.562 ft	P.55
FT-S32	1,100 43.307	3,000 118.110	Cylindrical, $\phi 2.5$ 0.098 , -40 to +70 °C -40 to 158 °F		P.55
FT-V23	160 6.299	400 15.748	Sleeve, Cylindrical, Side-view, $\phi 2$ 0.079 , -55 to +80 °C -67 to 176 °F		P.55
FT-V24W	35 1.378	90 3.543	Sleeve, Cylindrical, Side-view, $\phi 2$ 0.079 , -40 to +60 °C -40 to 140 °F		P.56
FT-V25	95 3.740	260 10.236	Sleeve, Cylindrical, Side-view, $\phi 2$ 0.079 , -55 to +80 °C -67 to 176 °F		P.56
FT-V30	180 7.087	480 18.898	Sleeve, Cylindrical, Side-view, $\phi 2.5$ 0.098 , -55 to +80 °C -67 to 176 °F		P.56
FT-V40	1,000 39.370	3,100 122.047	Cylindrical, Side-view, $\phi 4$ 0.157 , -40 to +60 °C -40 to 140 °F		P.56
FT-V80Y	340 13.386	800 31.496	Chemical-resistant, Metal-free -40 to +70 °C -40 to 158 °F	✂ 2 m 6.562 ft (Note 3)	P.56
FT-Z20HBW	100 3.937	320 12.598	Flat with boss, -40 to +60 °C -40 to 140 °F	✂ 1 m 3.281 ft	P.56
FT-Z20W	280 11.024	730 28.740	Flat with boss, -40 to +60 °C -40 to 140 °F		P.56
FT-Z30	710 27.953	2,300 90.551	Flat, -40 to +60 °C -40 to 140 °F	✂ 2 m 6.562 ft	P.56
FT-Z30E	1,200 47.244	3,200 125.984	Flat, -40 to +60 °C -40 to 140 °F		P.56
FT-Z30EW	1,400 55.118	2,600 102.362	Flat, -40 to +60 °C -40 to 140 °F		P.57
FT-Z30H	1,400 55.118	3,200 125.984	Flat, -40 to +60 °C -40 to 140 °F		P.57
FT-Z30HW	1,400 55.118	3,200 125.984	Flat, -40 to +60 °C -40 to 140 °F		P.57
FT-Z30W	540 21.260	1,800 70.866	Flat, -40 to +60 °C -40 to 140 °F		P.57
FT-Z40HBW	260 10.236	720 28.346	Flat with boss, -40 to +60 °C -40 to 140 °F		P.57
FT-Z40W	410 16.142	1,200 47.244	Flat with boss, -40 to +60 °C -40 to 140 °F		P.57
FT-Z802Y	520 20.472	3,100 122.047	Chemical-resistant, 0 to +60 °C 32 to 140 °F		P.57

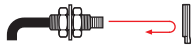
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

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

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

LIST OF FIBERS

Retroreflective type



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1) (Note 2)		Type / Ambient temperature	Fiber cable length ✂: Free-cut	Dimensions
	Standard type FX-101 □	Long sensing range type FX-102 □			
FR-KZ22E	15 to 200 0.591 to 7.874	15 to 360 0.591 to 14.173	Wafer mapping, -40 to +60 °C -40 to 140 °F	✂ 2 m 6.562 ft	P.58
FR-KZ50E	20 to 200 0.787 to 7.874	20 to 350 0.787 to 13.780	Narrow Beam, Side sensing, -40 to +60 °C -40 to 140 °F		P.58
FR-KZ50H	20 to 200 0.787 to 7.874	20 to 350 0.787 to 13.780	Narrow Beam, Top sensing, -40 to +60 °C -40 to 140 °F		P.58
FR-Z50HW	100 to 550 3.937 to 21.654	100 to 830 3.937 to 32.677	With polarizing filter, -25 to +55 °C -13 to 131 °F		P.58

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

The sensing range of **FR-KZ22E** is specified for the attached reflector. The sensing range of **FR-KZ50E** and **FR-KZ50H** is specified for the attached reflector **RF-003**. The sensing range of **FR-Z50HW** is specified for the **RF-13**.

2) The sensing range is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.

Reflective type



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1) (Note 2) / Description		Type / Ambient temperature	Fiber cable length ✂: Free-cut	Dimensions
	Standard type FX-101 □	Long sensing range type FX-102 □			
FD-30	45 1.772	155 6.102	Super quality, Threaded, M3, -55 to +80 °C -67 to 176 °F	2 m 6.562 ft	P.59
FD-31	35 1.378	140 5.512	Threaded, M3, -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.59
FD-31W	15 0.591	60 2.362	Threaded, M3, -40 to +60 °C -40 to 140 °F		P.59
FD-32G	70 2.756	190 7.480	Threaded, M3, -55 to +80 °C -67 to 176 °F		P.59
FD-32GX	75 2.953	210 8.268	Threaded, M3, -55 to +80 °C -67 to 176 °F	✂ 1 m 3.281 ft (Note 3)	P.59
FD-40	45 1.772	155 6.102	Super quality, Threaded, M4, -55 to +80 °C -67 to 176 °F	2 m 6.562 ft	P.59
FD-41	35 1.378	140 5.512	Threaded, M4, -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.59
FD-41S	35 1.378	140 5.512	Sleeve, Threaded, M4, -55 to +80 °C -67 to 176 °F		P.59
FD-41SW	15 0.591	60 2.362	Sleeve, Threaded, M4, -40 to +60 °C -40 to 140 °F		P.59
FD-41W	80 3.150	230 9.055	Threaded, M4, -40 to +60 °C -40 to 140 °F		P.59
FD-42G	70 2.756	190 7.480	Threaded, M4, -55 to +80 °C -67 to 176 °F	2 m 6.562 ft	P.60
FD-42GW	45 1.772	140 5.512	Threaded, M4, -40 to +60 °C -40 to 140 °F		P.60
FD-60	140 5.512	420 16.535	Super quality, Threaded, M6, -55 to +80 °C -67 to 176 °F		P.60
FD-61	120 4.724	410 16.142	Threaded, M6, -55 to +80 °C -67 to 176 °F		P.60
FD-61G	120 4.724	350 13.780	Threaded, M6, -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.60
FD-61S	130 5.118	360 14.173	Sleeve, Threaded, M6, -55 to +80 °C -67 to 176 °F		P.60
FD-61W	80 3.150	230 9.055	Threaded, M6, -40 to +60 °C -40 to 140 °F		P.60
FD-62	170 6.693	450 17.717	Threaded, M6, -55 to +80 °C -67 to 176 °F		P.60
FD-64X	75 2.953	220 8.661	Threaded, M6, -55 to +80 °C -67 to 176 °F	1 m 3.281 ft	P.61
FD-A16	120 4.724	240 9.449	Wide beam, -40 to +60 °C -40 to 140 °F	✂ 2 m 6.562 ft	P.61
FD-AL11	100 3.937	285 11.220	Array, -55 to +80 °C -67 to 176 °F		P.61
FD-E13	5 0.197	15 0.591	Cylindrical, Ultra-small dia., ø1.5 0.059 , -40 to +60 °C -40 to 140 °F		P.61
FD-E23	20 0.787	70 2.756	Cylindrical, Ultra-small dia., ø3 0.118 , -40 to +70 °C -40 to 158 °F		P.61
FD-EG30	20 0.787	70 2.756	Threaded, M3, Ultra-small dia., -40 to +70 °C -40 to 158 °F	500 mm 19.685 in	P.61
FD-EG30S	20 0.787	70 2.756	Sleeve, Threaded, Ultra-small dia., M3, -40 to +70 °C -40 to 158 °F	1 m 3.281 ft	P.62
FD-EG31	7 0.276	25 0.984	Threaded, M3, Ultra-small dia., -20 to +60 °C -4 to 140 °F	500 mm 19.685 in	P.62
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 interrupted		Pipe-mountable type, Liquid level sensing, -40 to +100 °C -40 to 212 °F	✂ 2 m 6.562 ft	P.62
FD-F41	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 interrupted		Pipe-mountable type, Liquid level sensing, -40 to +100 °C -40 to 212 °F		P.62

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

2) The sensing range is specified for white non-glossy paper.

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

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F / FX-301-F

LIST OF FIBERS

Reflective type



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1) (Note 2) / Description		Type / Ambient temperature	Fiber cable length ✂: Free-cut	Dimensions
	Standard type FX-101 □	Long sensing range type FX-102 □			
FD-F41Y (Note 3)	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 interrupted		Contact type, Liquid level sensing, Metal-free, -40 to +70 °C -40 to 158 °F	✂ 2 m 6.562 ft	P.62
FD-F8Y	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 interrupted		Contact type, Liquid level sensing, -40 to +125 °C -40 to 257 °F	✂ 2 m 6.562 ft (Note 6)	P.62
FD-FA93	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 interrupted		Pipe-mountable type, Liquid sensing, -40 to +70 °C -40 to 158 °F	✂ 2 m 6.562 ft	P.62
FD-H13-FM2	100 3.937	280 11.024	Heat-resistant, Threaded, -60 to +130 °C -76 to 266 °F		P.63
FD-H18-L31	0 to 10 0 to 0.394	0 to 25 0 to 0.984	Heat-resistant, Glass substrate detection convergent reflective, -60 to +180 °C -76 to 356 °F		P.63
FD-H20-21	90 3.543	280 11.024	Heat-resistant, Threaded, -60 to +200 °C -76 to 392 °F	1 m 3.281 ft	P.63
FD-H20-M1	120 4.724	300 11.811	Heat-resistant, Threaded, -60 to +200 °C -76 to 392 °F		P.63
FD-H25-L43 (Note 4)	4 to 16 0.157 to 0.630	4 to 23 0.157 to 0.906	Heat-resistant, Glass substrate detection convergent reflective, -20 to +250 °C -4 to 482 °F (Ordinary temp. side: -20 to +70 °C -4 to 158 °F)	3 m 9.843 ft	P.63
FD-H25-L45 (Note 4)	7 to 35 0.276 to 1.378	7 to 38 0.276 to 1.496	Heat-resistant, Glass substrate detection convergent reflective, -20 to +250 °C -4 to 482 °F (Ordinary temp. side: -20 to +70 °C -4 to 158 °F)		P.63
FD-H30-KZ1V-S (Note 4, 5)	25 to 80 0.984 to 3.150	10 to 220 0.394 to 8.661	Vacuum-resistant, Reflective, -30 to +300 °C -22 to 572 °F	1 m 3.281 ft	P.64
FD-H30-L32	2 to 9 0.079 to 0.354	0 to 17 0 to 0.669	Heat-resistant, Glass substrate detection convergent reflective, -60 to +300 °C -76 to 572 °F	2 m 6.562 ft	P.64
FD-H30-L32V-S (Note 4, 5)	2.5 to 6.5 0.098 to 0.256	0 to 11 0 to 0.433	Vacuum-resistant, Convergent reflective, -30 to +300 °C -22 to 572 °F	3 m 9.843 ft	P.64
FD-H35-20S	85 3.346	200 7.874	Heat-resistant, Threaded, -60 to +350 °C -76 to 662 °F	1 m 3.281 ft	P.64
FD-H35-M2	75 2.953	280 11.024	Heat-resistant, Threaded, -60 to +350 °C -76 to 662 °F	2 m 6.562 ft	P.64
FD-H35-M2S6	75 2.953	280 11.024	Heat-resistant, Threaded, -60 to +350 °C -76 to 662 °F		P.64
FD-HF40Y (Note 3)	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		Contact type, Liquid level sensing, Metal-free, -40 to +105 °C -40 to 221 °F	✂ 2 m 6.562 ft	P.64
FD-L10 (Note 4)	0 to 4.5 0 to 0.177	0 to 5.5 0 to 0.217	Glass substrate detection, -40 to +60 °C -40 to 140 °F		P.65
FD-L11 (Note 4)	0 to 8 0 to 0.315	0 to 9 0 to 0.354	Glass substrate detection, -40 to +60 °C -40 to 140 °F		P.65
FD-L12W (Note 4)	1 to 4.5 0.039 to 0.177	0.5 to 7 0.020 to 0.276	Ultra-small, -40 to +60 °C -40 to 140 °F	✂ 1 m 3.281 ft	P.65
FD-L20H	5 to 15 0.197 to 0.591	1 to 30 0.039 to 1.181	General purpose, -40 to +70 °C -40 to 158 °F		P.65
FD-L21 (Note 4)	3 to 15 0.118 to 0.591	1.5 to 16 0.059 to 0.630	Glass substrate detection, -40 to +60 °C -40 to 140 °F	✂ 2 m 6.562 ft	P.65
FD-L21W (Note 4)	7 to 12 0.276 to 0.472	3 to 14 0.118 to 0.551	Glass substrate detection, -40 to +60 °C -40 to 140 °F		P.65
FD-L22A (Note 4)	0 to 19 0 to 0.748	0 to 25 0 to 0.984	Glass substrate detection, 0 to +70 °C 32 to 158 °F		P.65
FD-L23 (Note 4)	0 to 28 0 to 1.102	0 to 30 0 to 1.181	Glass substrate detection, -20 to +70 °C -4 to 158 °F		P.65
FD-L30A (Note 4)	0 to 40 0 to 1.575	0 to 50 0 to 1.969	Glass substrate detection, 0 to +70 °C 32 to 158 °F	✂ 3 m 9.843 ft	P.65
FD-L31A (Note 4)	5 to 30 0.197 to 1.181	4 to 33 0.157 to 1.299	Glass substrate detection, 0 to +70 °C 32 to 158 °F		P.65
FD-L32H (Note 4)	16 to 30 0.630 to 1.181	0 to 50 0 to 1.969	Glass substrate detection, -40 to +60 °C -40 to 140 °F	✂ 4 m 13.123 ft	P.66

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

2) The sensing range of reflective type is the value for white non-glossy paper (as for **FD-H30-L32** and **FD-H18-L31** 50 × 50 mm **1.969 × 1.969 in** glass substrate).

3) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

4) 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-L10**: silicon wafers 100 × 100 mm **3.937 × 3.937 in**].

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

6) The allowable cutting range is 1,000 mm **39.370 in** from the end that is inserted to the amplifier.

LIST OF FIBERS

Reflective type



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1) (Note 2)		Type / Ambient temperature	Fiber cable length ✂: Free-cut	Dimensions
	Standard type FX-101 □	Long sensing range type FX-102 □			
FD-R31G	45 1.772	150 5.906	Square head, M3, -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.66
FD-R32EG	20 0.787	68 2.677	Square head, M3, -40 to +70 °C -40 to 158 °F	500 mm 19.685 in	P.66
FD-R33EG	7 0.276	22 0.866	Square head, M3, -20 to +60 °C -4 to 140 °F		P.66
FD-R34EG	17 0.669	60 2.362	Square head, M3, -40 to +70 °C -40 to 158 °F		P.66
FD-R41	60 2.362	170 6.693	Square head, M4, -55 to +80 °C -67 to 176 °F		P.66
FD-R60	110 4.331	240 9.449	Threaded, M6, Elbow, -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.66
FD-R61Y	85 3.346	185 7.283	Oil-resistant, Square head, M6, Cable-protection type, -55 to +80 °C -67 to 176 °F		P.66
FD-S21	25 0.984	70 2.756	Cylindrical, ø1.5 0.059 , -55 to +80 °C -67 to 176 °F	1 m 3.281 ft	P.66
FD-S30	45 1.772	155 6.102	Super quality, Cylindrical, ø3 0.118 , -55 to +80 °C -67 to 176 °F	2 m 6.562 ft	P.67
FD-S31	35 1.378	140 5.512	Cylindrical, ø3 0.118 , -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.67
FD-S32	120 4.724	345 13.583	Cylindrical, ø3 0.118 , -55 to +80 °C -67 to 176 °F		P.67
FD-S32W	80 3.150	230 9.055	Cylindrical, ø3 0.118 , -40 to +60 °C -40 to 140 °F		P.67
FD-S33GW	45 1.772	140 5.512	Cylindrical, ø3 0.118 , -40 to +60 °C -40 to 140 °F		P.67
FD-S60Y	140 5.512	300 11.811	Chemical-resistant, Cylindrical, Metal-free, ø5.5 0.217 , -40 to +70 °C -40 to 158 °F	✂ 2 m 6.562 ft (Note 3)	P.67
FD-V30	25 0.984	75 2.953	Sleeve, Cylindrical, Side-view, ø3 0.118 , -55 to +80 °C -67 to 176 °F	✂ 2 m 6.562 ft	P.67
FD-V30W	6 0.236	20 0.787	Sleeve, Cylindrical, Side-view, ø3 0.118 , -40 to +60 °C -40 to 140 °F		P.67
FD-V50	40 1.575	100 3.937	Sleeve, Cylindrical, Side-view, ø5 0.197 , -55 to +80 °C -67 to 176 °F		P.68
FD-Z20HBW	2 to 30 0.079 to 1.181	1 to 90 0.039 to 3.543	Flat with boss, -40 to +60 °C -40 to 140 °F	✂ 1 m 3.281 ft	P.68
FD-Z20W	2 to 32 0.079 to 1.260	1 to 80 0.039 to 3.150	Flat with boss, -40 to +60 °C -40 to 140 °F		P.68
FD-Z40HBW	1 to 90 0.039 to 3.543	0.5 to 240 0.020 to 9.449	Flat with boss, -40 to +60 °C -40 to 140 °F	✂ 2 m 6.562 ft	P.68
FD-Z40W	1 to 74 0.039 to 2.913	200 7.874	Flat with boss, -40 to +60 °C -40 to 140 °F		P.68
FD-Z50HW	10 to 200 0.394 to 7.874	10 to 530 0.394 to 20.866	Narrow Beam, Long range, -40 to +60 °C -40 to 140 °F		P.68

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

2) The sensing range is specified for white non-glossy paper.

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

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

Reflector Model No.	Sensing range (mm in)	
	Standard type FX-101 □	Long sensing range type FX-102 □
RF-230	100 to 2,400 3.937 to 94.488	100 to 5,000 3.937 to 196.850
RF-220	100 to 1,300 3.937 to 51.181	100 to 2,600 3.937 to 102.362
RF-210	100 to 980 3.937 to 38.583	100 to 1,300 3.937 to 51.181

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.

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410


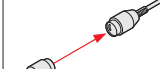


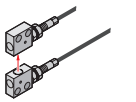
FX-311

FX-301-F7/ FX-301-F

FIBER OPTIONS

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

Lens (For thru-beam type fiber)

Designation	Model No.	Description																												
Expansion lens (Note 1)	FX-LE1		<p>Increases the sensing range by 5 times or more.</p> <ul style="list-style-type: none">Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4)Beam dia: ø3.6 mm ø0.142 in	Sensing range (mm in) [Lens on both sides]																										
				<table><tr><th>Fiber \ Mode</th><th>FX-101□</th><th>FX-102□</th></tr><tr><td>FT-43</td><td>2,400 94.488</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-42 FT-42W</td><td>3,400 133.858</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-45X</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-R40</td><td>3,100 122.047</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-R43</td><td>1,300 51.181</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-H35-M2</td><td>2,000 78.740</td><td>3,500 137.795 (Note 2)</td></tr><tr><td>FT-H20W-M1</td><td>1,300 51.181</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-H20-M1</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S</td><td>1,000 39.370</td><td>3,500 137.795 (Note 2)</td></tr></table>	Fiber \ Mode	FX-101□	FX-102□	FT-43	2,400 94.488	3,600 141.732 (Note 2)	FT-42 FT-42W	3,400 133.858	3,600 141.732 (Note 2)	FT-45X	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	FT-R40	3,100 122.047	3,600 141.732 (Note 2)	FT-R43	1,300 51.181	3,600 141.732 (Note 2)	FT-H35-M2	2,000 78.740	3,500 137.795 (Note 2)	FT-H20W-M1	1,300 51.181	1,600 62.992 (Note 2)	FT-H20-M1	1,600 62.992 (Note 2)
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FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S	1,000 39.370	3,500 137.795 (Note 2)																												
Super-expansion lens (Note 1)	FX-LE2		<p>Tremendously increases the sensing range with large diameter lenses.</p> <ul style="list-style-type: none">Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4)Beam dia: ø9.8 mm ø0.386 in	Sensing range (mm in) [Lens on both sides]																										
				<table><tr><th>Fiber \ Mode</th><th>FX-101□</th><th>FX-102□</th></tr><tr><td>FT-43 FT-42 FT-42W</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-45X</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-R40</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-R43</td><td>3,600 141.732 (Note 2)</td><td>3,600 141.732 (Note 2)</td></tr><tr><td>FT-H35-M2</td><td>3,500 137.795 (Note 2)</td><td>3,500 137.795 (Note 2)</td></tr><tr><td>FT-H20W-M1 FT-H20-M1</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-H13-FM2</td><td>3,500 137.795 (Note 2)</td><td>3,500 137.795 (Note 2)</td></tr><tr><td>FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S</td><td>3,500 137.795 (Note 2)</td><td>3,500 137.795 (Note 2)</td></tr></table>	Fiber \ Mode	FX-101□	FX-102□	FT-43 FT-42 FT-42W	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	FT-45X	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	FT-R40	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	FT-R43	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	FT-H35-M2	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	FT-H20W-M1 FT-H20-M1	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	FT-H13-FM2	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S	3,500 137.795 (Note 2)
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FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)																												
Side-view lens	FX-SV1		<p>Beam axis is bent by 90°.</p> <ul style="list-style-type: none">Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 4)Beam dia: ø2.8 mm ø0.110 in	Sensing range (mm in) [Lens on both sides]																										
				<table><tr><th>Fiber \ Mode</th><th>FX-101□</th><th>FX-102□</th></tr><tr><td>FT-43</td><td>510 20.079</td><td>1,400 55.118</td></tr><tr><td>FT-42</td><td>500 19.685</td><td>1,700 66.929</td></tr><tr><td>FT-42W</td><td>480 18.898</td><td>1,300 51.181</td></tr><tr><td>FT-45X</td><td>540 21.260</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-R43</td><td>310 12.205</td><td>930 36.614</td></tr><tr><td>FT-H35-M2</td><td>280 11.024</td><td>800 31.496</td></tr><tr><td>FT-H20W-M1</td><td>140 5.512</td><td>400 15.748</td></tr><tr><td>FT-H20-M1</td><td>280 11.024</td><td>840 33.071</td></tr><tr><td>FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S</td><td>150 5.906</td><td>410 16.142</td></tr></table>	Fiber \ Mode	FX-101□	FX-102□	FT-43	510 20.079	1,400 55.118	FT-42	500 19.685	1,700 66.929	FT-42W	480 18.898	1,300 51.181	FT-45X	540 21.260	1,600 62.992 (Note 2)	FT-R43	310 12.205	930 36.614	FT-H35-M2	280 11.024	800 31.496	FT-H20W-M1	140 5.512	400 15.748	FT-H20-M1	280 11.024
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FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S	150 5.906	410 16.142																												
Expansion lens for vacuum fiber (Note 1)	FV-LE1		<p>Sensing range increases by 4 times or more.</p> <ul style="list-style-type: none">Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4)Beam dia: ø3.6 mm ø0.142 in	Sensing range (mm in) [Lens on both sides] (Note 3)																										
Vacuum-resistant side-view lens (Note 1)	FV-SV2		<p>Beam axis is bent by 90°.</p> <ul style="list-style-type: none">Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 4)Beam dia: ø3.7 mm ø0.146 in	Sensing range (mm in) [Lens on both sides] (Note 3)																										
				<table><tr><th>Fiber \ Mode</th><th>FX-101□</th><th>FX-102□</th></tr><tr><td>FT-H30-M1V-S</td><td>450 17.717</td><td>1,600 62.992</td></tr></table>	Fiber \ Mode	FX-101□	FX-102□	FT-H30-M1V-S	450 17.717	1,600 62.992																				
Fiber \ Mode	FX-101□	FX-102□																												
FT-H30-M1V-S	450 17.717	1,600 62.992																												

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) The fiber cable length for the FT-H30-M1V-S is 1 m 3.28 ft. The sensing ranges in FX-102□ are specified considering the length of the FT-J8 atmospheric side fiber.


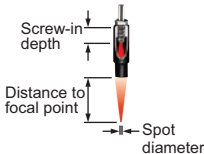

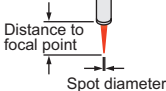
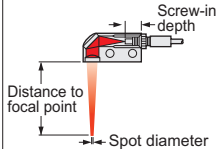
4) Refer to "LIST OF FIBERS (p.124~)" for the ambient temperature of fibers to be used in combination.

FIBER OPTIONS

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

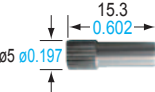










Lens (For reflective type fiber)

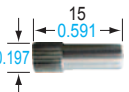
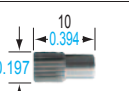
For reflective type fiber

Designation	Model No.	Description													
Pinpoint spot lens	FX-MR1		Pinpoint spot of $\varnothing 0.5$ mm $\varnothing 0.020$ 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, FD-42GW • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note)												
Zoom lens	FX-MR2		The spot diameter is adjustable from $\varnothing 0.7$ to $\varnothing 2$ mm $\varnothing 0.028$ to $\varnothing 0.079$ in according to how much the fiber is screwed in. • Applicable fibers: FD-42G, FD-42GW • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note) • Accessory: MS-EX3 (mounting bracket) Sensing range for FX-100 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 0.728 in approx.</td><td>$\varnothing 0.7$ mm $\varnothing 0.028$ in</td></tr><tr><td>12 mm 0.472 in</td><td>27 mm 1.063 in approx.</td><td>$\varnothing 1.2$ mm $\varnothing 0.047$ in</td></tr><tr><td>14 mm 0.551 in</td><td>43 mm 1.693 in approx.</td><td>$\varnothing 2.0$ mm $\varnothing 0.079$ in</td></tr></table>	Screw-in depth	Distance to focal point	Spot diameter	7 mm 0.276 in	18.5 mm 0.728 in approx.	$\varnothing 0.7$ mm $\varnothing 0.028$ in	12 mm 0.472 in	27 mm 1.063 in approx.	$\varnothing 1.2$ mm $\varnothing 0.047$ in	14 mm 0.551 in	43 mm 1.693 in approx.	$\varnothing 2.0$ mm $\varnothing 0.079$ in
Screw-in depth	Distance to focal point	Spot diameter													
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12 mm 0.472 in	27 mm 1.063 in approx.	$\varnothing 1.2$ mm $\varnothing 0.047$ in													
14 mm 0.551 in	43 mm 1.693 in approx.	$\varnothing 2.0$ mm $\varnothing 0.079$ in													
Finest spot lens	FX-MR3		Extremely fine spot of $\varnothing 0.15$ mm $\varnothing 0.006$ in approx. achieved. • Applicable fibers: FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GX • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note) Sensing range for FX-100 series <table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG31</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.15$ mm $\varnothing 0.006$ in approx.</td></tr><tr><td>FD-EG30</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.3$ mm $\varnothing 0.012$ in approx.</td></tr><tr><td>FD-42G/42GW, FD-32G/32GX</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.5$ mm $\varnothing 0.020$ in approx.</td></tr></table>	Fiber model No.	Distance to focal point	Spot diameter	FD-EG31	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.15$ mm $\varnothing 0.006$ in approx.	FD-EG30	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.3$ mm $\varnothing 0.012$ in approx.	FD-42G/42GW, FD-32G/32GX	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.5$ mm $\varnothing 0.020$ in approx.
Fiber model No.	Distance to focal point	Spot diameter													
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FD-42G/42GW, FD-32G/32GX	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.5$ mm $\varnothing 0.020$ in approx.													
Finest spot lens	FX-MR6		Extremely fine spot of $\varnothing 0.1$ mm $\varnothing 0.004$ in approx. achieved. • Applicable fibers: FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GX • Ambient temperature: -20 to $+60$ °C -4 to $+140$ °F (Note) Sensing range for FX-100 series <table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG31</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.1$ mm $\varnothing 0.004$ in approx.</td></tr><tr><td>FD-EG30</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.2$ mm $\varnothing 0.008$ in approx.</td></tr><tr><td>FD-42G/42GW, FD-32G/32GX</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.4$ mm $\varnothing 0.016$ in approx.</td></tr></table>	Fiber model No.	Distance to focal point	Spot diameter	FD-EG31	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.1$ mm $\varnothing 0.004$ in approx.	FD-EG30	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.2$ mm $\varnothing 0.008$ in approx.	FD-42G/42GW, FD-32G/32GX	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.4$ mm $\varnothing 0.016$ in approx.
Fiber model No.	Distance to focal point	Spot diameter													
FD-EG31	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.1$ mm $\varnothing 0.004$ in approx.													
FD-EG30	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.2$ mm $\varnothing 0.008$ in approx.													
FD-42G/42GW, FD-32G/32GX	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.4$ mm $\varnothing 0.016$ 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, FD-42GW • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note) Sensing range for FX-100 series <table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>8 mm 0.315 in</td><td>13 mm 0.512 in approx.</td><td>$\varnothing 0.5$ mm $\varnothing 0.020$ in</td></tr><tr><td>10 mm 0.394 in</td><td>15 mm 0.591 in approx.</td><td>$\varnothing 0.8$ mm $\varnothing 0.031$ in</td></tr><tr><td>14 mm 0.551 in</td><td>30 mm 1.181 in approx.</td><td>$\varnothing 3.0$ mm $\varnothing 0.118$ in</td></tr></table>	Fiber model No.	Distance to focal point	Spot diameter	8 mm 0.315 in	13 mm 0.512 in approx.	$\varnothing 0.5$ mm $\varnothing 0.020$ in	10 mm 0.394 in	15 mm 0.591 in approx.	$\varnothing 0.8$ mm $\varnothing 0.031$ in	14 mm 0.551 in	30 mm 1.181 in approx.	$\varnothing 3.0$ mm $\varnothing 0.118$ in
Fiber model No.	Distance to focal point	Spot diameter													
8 mm 0.315 in	13 mm 0.512 in approx.	$\varnothing 0.5$ mm $\varnothing 0.020$ in													
10 mm 0.394 in	15 mm 0.591 in approx.	$\varnothing 0.8$ mm $\varnothing 0.031$ in													
14 mm 0.551 in	30 mm 1.181 in approx.	$\varnothing 3.0$ mm $\varnothing 0.118$ in													

Note: Refer to p.126 for the ambient temperature of fibers to be used in combination.

Lens (For square head M3 reflective fiber)

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

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

Note: Spot diameter, distance to focal point and sensing range are specified for **FX-100** series.

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

SPECIFICATIONS

		Type	Standard type		Long sensing range type	
				Cable set		Cable set
Item	Model No.	NPN output	FX-101(-Z) (Note 5)	FX-101-CC2	FX-102(-Z) (Note 5)	FX-102-CC2
		PNP output	FX-101P(-Z) (Note 5)	FX-101P-CC2	FX-102P(-Z) (Note 5)	FX-102P-CC2
Supply voltage		12 to 24 V DC $\pm 10\%$ Ripple P-P 10 % or less				
Power consumption		Normal operation: 720 mW or less (Current consumption 30 mA or less at 24 V supply voltage) ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)				
Output		<NPN output type> NPN open-collector transistor <ul style="list-style-type: none">Maximum sink current: 100 mAApplied voltage: 30 V DC or less (between output and 0 V)Residual voltage: 1.5 V or less (at 100 mA sink current)		<PNP output type> PNP open-collector transistor <ul style="list-style-type: none">Maximum source current: 100 mAApplied voltage: 30 V DC or less (between output and +V)Residual voltage: 1.5 V or less (at 100 mA source current)		
		Output operation				
		Short-circuit protection				
		Selectable either Light-ON or Dark-ON, at SET mode				
		Incorporated				
External input		<NPN output type> NPN non-contact input <ul style="list-style-type: none">Signal condition High: +8 V to +V DC or Open Low: 0 to +2 V DC (Source current 0.5 mA or less)Input impedance: 10 kΩ approx.		<PNP output type> PNP non-contact input <ul style="list-style-type: none">Signal condition High: +4 V to +V DC (Sink current 0.5 to 3 mA) Low: 0 to +0.6 V DC or OpenInput impedance: 10 kΩ approx.		
Response time		Emission frequency 0: 250 μ s or less (factory default setting) Emission frequency 1: 450 μ s or less Emission frequency 2: 500 μ s or less Emission frequency 3: 600 μ s or less		Emission frequency 1: 2.5 ms or less (factory default setting) Emission frequency 2: 2.8 ms or less Emission frequency 3: 3.2 ms or less Emission frequency 4: 5.0 ms or less		
Sensitivity setting		2-point teaching / Limit teaching / Full-auto teaching				
Operation indicator		Orange LED (lights up when the output is ON)				
Digital display		4 digits (green) + 4 digits (red) LCD display				
Fine sensitivity adjustment function		Incorporated				
Timer function		ON-delay / OFF-delay timer, switchable either effective or ineffective [Timer period: 1 ms, 5 ms, 10 ms, 20 ms, 40 ms, 50 ms, 100 ms, 500 ms, 1,000 ms]				
Emission amount setting function		3-level + Auto setting (from production in December 2007)				
Interference prevention function		Incorporated Emission frequency selection method (Note 2) (Functions at emission frequency 1, 2 or 3)		Incorporated Emission frequency selection method (Note 2) (Functions at emission frequency 1, 2, 3 or 4)		
Environmental resistance	Ambient temperature	-10 to +55 °C +14 to +131 °F (If 4 to 7 units are mounted close together: -10 to +50 °C +14 to +122 °F , if 8 to 16 units are mounted close together: -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: 3,000 lx 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 amplitude in X, Y and Z directions for two hours each				
	Shock resistance	98 m/s ² acceleration (10 G approx.) in X, Y and Z directions for five times each				
Emitting element (modulated)		Red LED (Peak emission wavelength: 643 nm 0.025 mil)				
Material		Enclosure: Polycarbonate, Key switch: Polycarbonate, Fiber lock lever: PBT				
Connecting method		Connector (Note 4)				
Cable length		Total length up to 100 m 328.084 ft is possible with 0.3 mm ² , or more, cable.				
Weight		Net weight: 15 g approx. Gross weight: 35 g approx.	Net weight: 15 g approx. Gross weight: 75 g approx.	Net weight: 15 g approx. Gross weight: 35 g approx.	Net weight: 15 g approx. Gross weight: 75 g approx.	
Accessory		FC-FX-1 (Protection cover): 1 pc. (Note 6)	FC-FX-1 (Protection cover): 1 pc. (Note 6) CN-14A-C2 (Connector attached cable, 2 m 6.562 ft long): 1 pc.	FC-FX-1 (Protection cover): 1 pc. (Note 6)	FC-FX-1 (Protection cover): 1 pc. (Note 6) CN-14A-C2 (Connector attached cable, 2 m 6.562 ft long): 1 pc.	

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 using the interference prevention function, set the emission frequencies for the amplifiers to be covered by the interference prevention function to different frequency values.

However, the interference prevention function does not operate at emission frequency 0 (factory default setting) for the **FX-101(P)(-Z)** / **FX-101(P)-CC2**.

3) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.

4) Connector attached cable **CN-14A-C2** is not attached to the models that have no "-CC2" at the end of the model Nos.

Make sure to use the optional connector attached cable **CN-14A(-R)-C** or the connector **CN-14A**, or a connector manufactured by J.S.T. Mfg., Ltd. (contact: SPHD-001T-P0.5, housing: PAP-04V-S).

5) Model Nos. having the suffix "-Z" are M8 plug-in connector type. Make sure to use the optional M8 attached connector cable **CN-24A-C**.

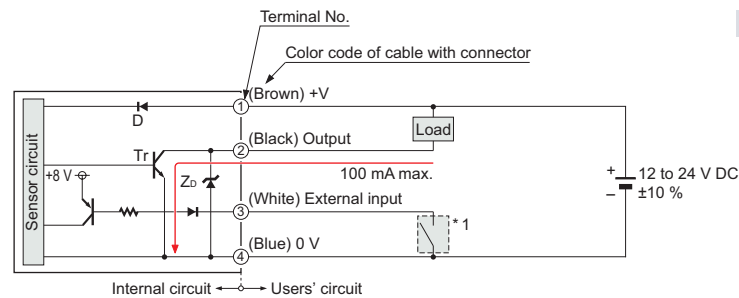
6) Protection cover **FC-FX-1** has been attached from production in July, 2011.

I/O CIRCUIT AND WIRING DIAGRAMS

FX-10□(-Z/-CC2)

NPN output type

I/O circuit diagram



Symbols ... D : Reverse supply polarity protection diode
Zd: Surge absorption zener diode
Tr : NPN output transistor

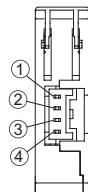
* 1

Non-voltage contact or NPN open-collector transistor

High (+8 V to +V DC, or open): Ineffective
Low [0 to +2 V DC (source current 0.5 mA or less)]: Effective

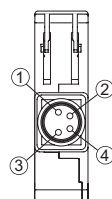
Terminal arrangement diagram

Connector type



Terminal No.	Function
①	+V
②	Output
③	External input
④	0 V

M8 plug-in connector type

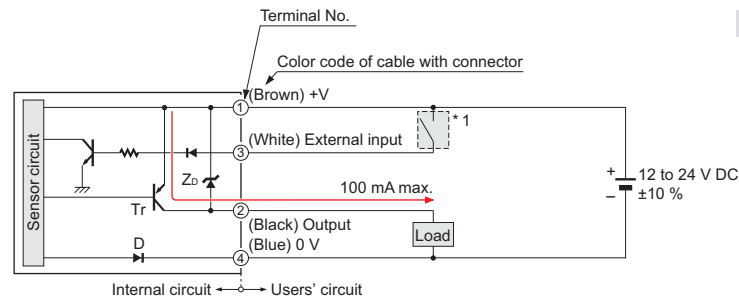


Terminal No.	Function
①	+V
②	Output
③	External input
④	0 V

FX-10□P(-Z/-CC2)

PNP output type

I/O circuit diagram



Symbols ... D : Reverse supply polarity protection diode
Zd: Surge absorption zener diode
Tr : PNP output transistor

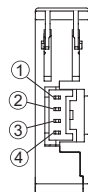
* 1

Non-voltage contact or PNP open-collector transistor

High [+4 V to +V DC (sink current 0.5 to 3 mA)]: Effective
Low (0 to +0.6 V DC, or open): Ineffective

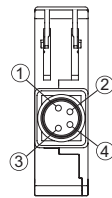
Terminal arrangement diagram

Connector type



Terminal No.	Function
①	+V
②	Output
③	External input
④	0 V

M8 plug-in connector type



Terminal No.	Function
①	+V
②	Output
③	External input
④	0 V

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FX-410

FX-311

**FX-301-F7/
FX-301-F**

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SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
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SAFETY
COMPONENTSPRESSURE/
FLOW
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PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
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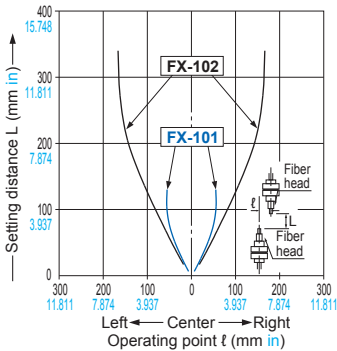
FX-300

FX-410

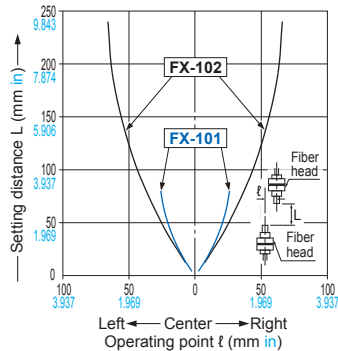
FX-311

FX-301-F7/
FX-301-F**FT-31S**

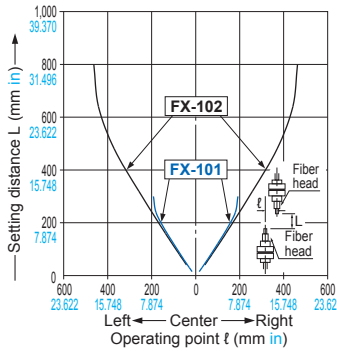
Thru-beam type

Parallel deviation**FT-31W**

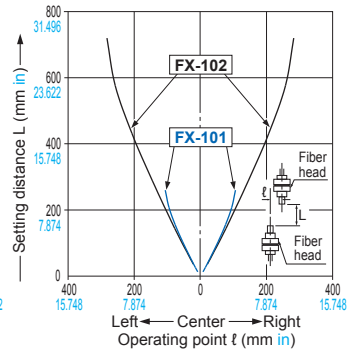
Thru-beam type

Parallel deviation**FT-42S**

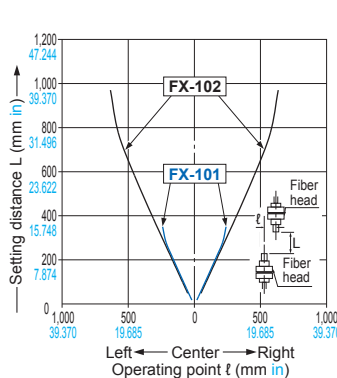
Thru-beam type

Parallel deviation**FT-42W**

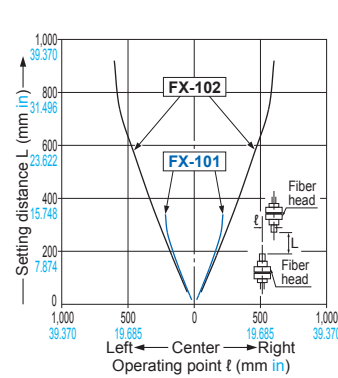
Thru-beam type

Parallel deviation**FT-43**

Thru-beam type

Parallel deviation**FT-45X**

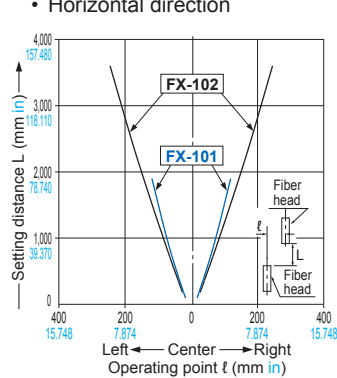
Thru-beam type

Parallel deviation**FT-A11**

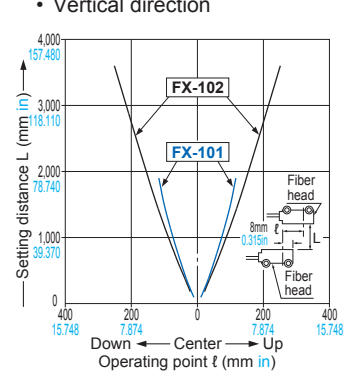
Thru-beam type

Parallel deviation

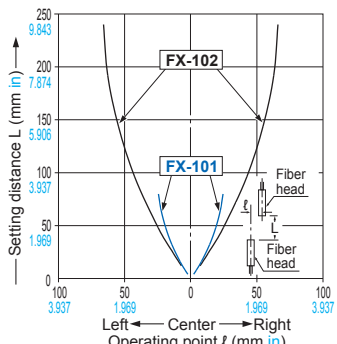
• Horizontal direction



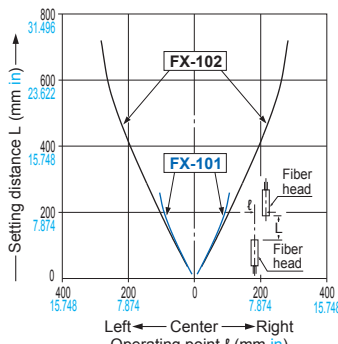
• Vertical direction

**FT-S21W**

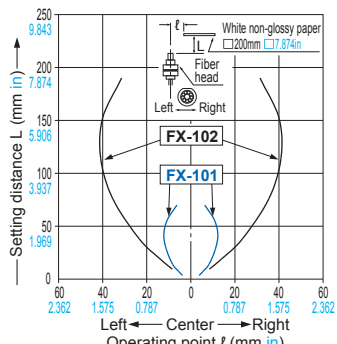
Thru-beam type

Parallel deviation**FT-S31W**

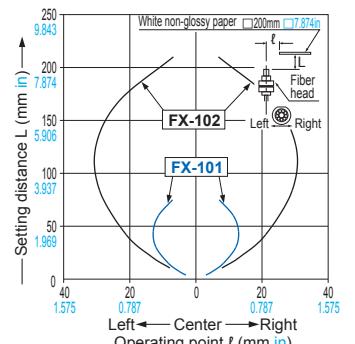
Thru-beam type

Parallel deviation**FD-32G**

Reflective type

Sensing field**FD-32GX**

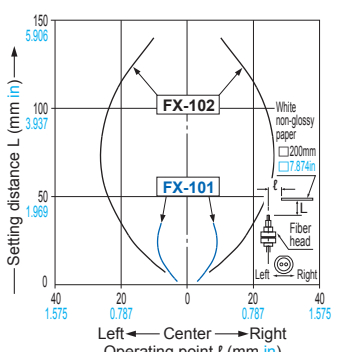
Reflective type

Sensing field**FD-41S**

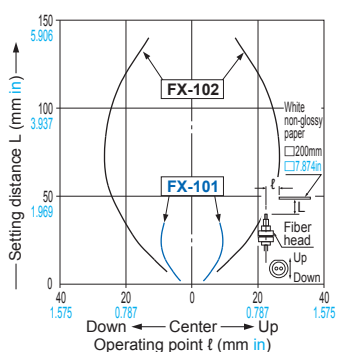
Reflective type

Sensing field

• Horizontal direction



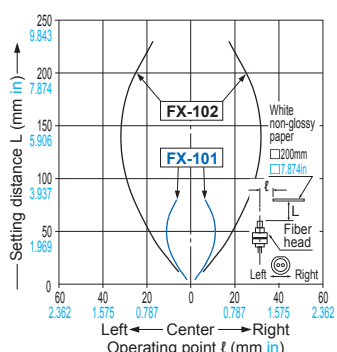
• Vertical direction

**FD-41W**

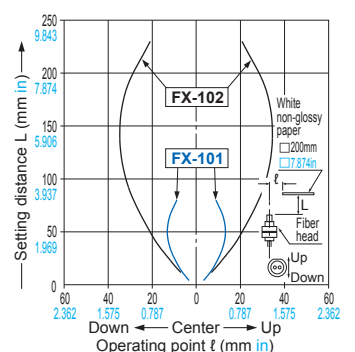
Reflective type

Sensing field

• Horizontal direction

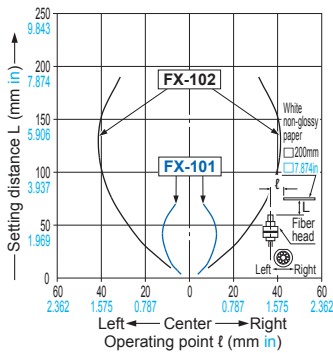


• Vertical direction

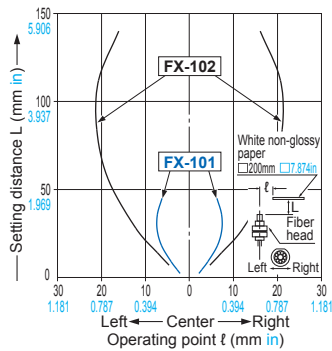


SENSING CHARACTERISTICS (TYPICAL)**FD-42G** Reflective type

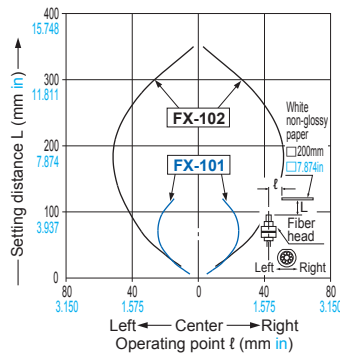
Sensing field

**FD-42GW** Reflective type

Sensing field

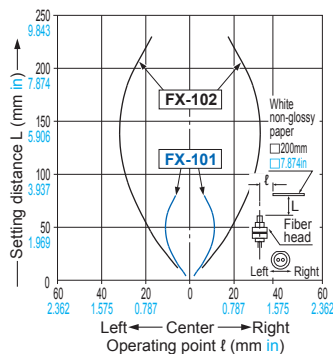
**FD-61G** Reflective type

Sensing field

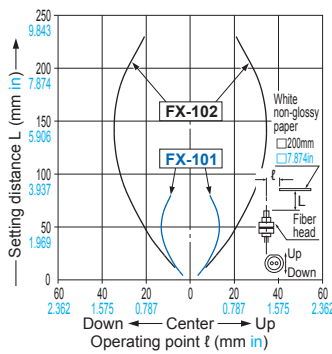
**FD-61W** Reflective type

Sensing field

- Horizontal direction

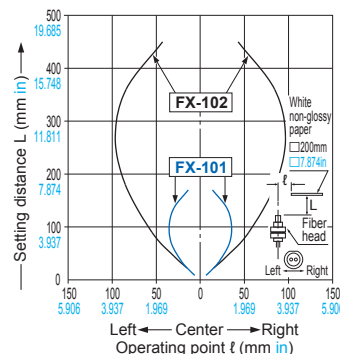


- Vertical direction

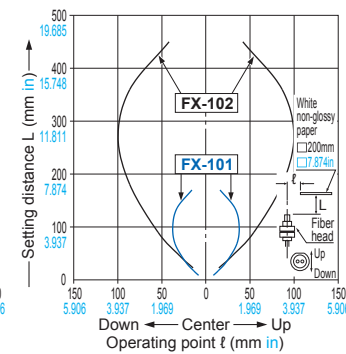
**FD-62** Reflective type

Sensing field

- Horizontal direction

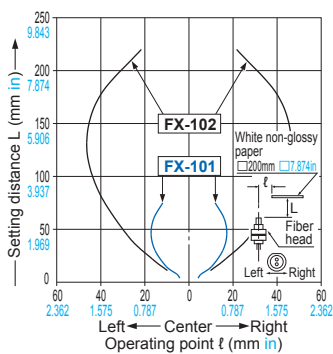


- Vertical direction

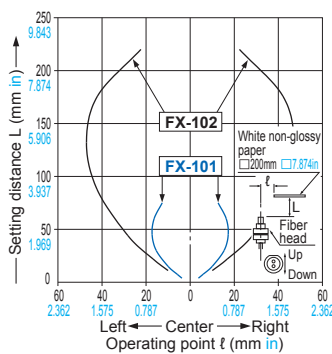
**FD-64X** Reflective type

Sensing field

- Horizontal direction

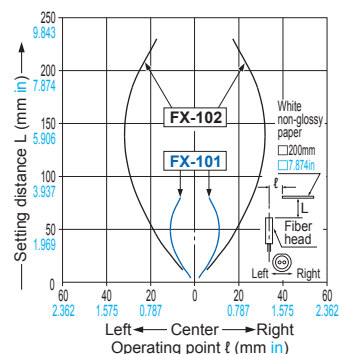


- Vertical direction

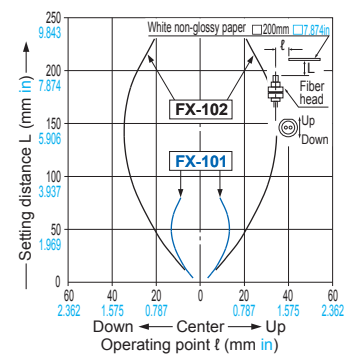
**FD-S32W** Reflective type

Sensing field

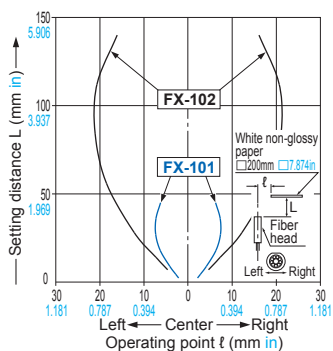
- Horizontal direction



- Vertical direction

**FD-S33GW** Reflective type

Sensing field

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
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FLOW
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SENSORSLIGHT
CURTAINS/
SAFETY
COMPONENTSPRESSURE /
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SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
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Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311**FX-301-F7/
FX-301-F**PRECAUTIONS FOR PROPER USE**

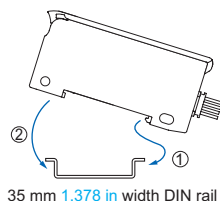
- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

Using in combination with the FX-300 / FX-410 series

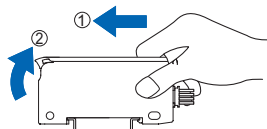
- The **FX-100** series does not use the horizontal connectors that are used with the **FX-300 / FX-410** series. Please note that horizontal connection cannot be performed using a connector attached cable. In addition, the optical communication function is not equipped on the **FX-100** series, so it is unable to perform interference prevention for use with the **FX-300 / FX-410** series. If using the **FX-100** series together with the **FX-300 / FX-410** series side-by-side, please set the same models together in groups.

Mounting**<When using a DIN rail>****How to mount the amplifier**

- ① Fit the rear part of the mounting section of the amplifier on a 35 mm **1.378 in** width DIN rail.
- ② Press down the rear part of the mounting section of the unit on the 35 mm **1.378 in** width DIN rail and fit the front part of the mounting section to the DIN rail.

**How to remove the amplifier**

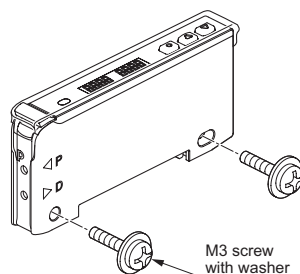
- ① Push the amplifier forward.
- ② Lift up the front part of the amplifier to remove it.



Note: Take care that if the front part is lifted without pushing the amplifier forward, the hook on the rear portion of the mounting section is likely to break.

<When using screws with washers>

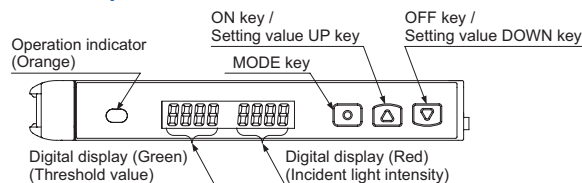
- Use M3 screws with washers for mounting. The tightening torque should be 0.5 N·m or less.



Refer to General precautions, and to the "Operation Guide" on our website for details pertaining to operating instructions for the amplifier.

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.
- Make sure to use the quick-connection cable (optional) for the connection of the controller. Extension up to total 100 m **328.084 ft** is possible with 0.3 mm² or more, cable. However, in order to reduce noise, make the wiring as short as possible.

Part description**Setting mode**

- Setting mode appears after the MODE key is pressed for 2 sec. in RUN mode.




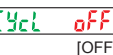


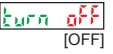
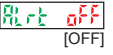


Setting item	Factory setting	Description
Teaching mode	TEACH	Threshold value can be set in 2-point teaching, limit teaching, or full-auto teaching.
Output operation setting	L_d d-on [Dark-ON]	Light-ON or Dark-ON can be set.
Timer operation setting	dELy non [Without timer]	Without timer, ON delay timer, or OFF delay timer can be set.
Timer delays setting	ond 10 [ON-delay timer: 10 ms] off 10 [OFF-delay timer: 10 ms]	When setting ON delay timer or OFF delay timer in the timer operation setting mode, timer delays can be set. • When timer is not set, this mode is not displayed.
Emission amount setting	PctL 1000 * [Level 3]	In case incident light intensity is saturated, emission amount can be reduced.
Emission frequency setting	FX-101 FrEQ F-0 [0 (Response time: 250 μs or less)] FX-102 FrEQ F-01 [1 (Response time: 2.5 ms or less)]	When using the fiber heads in parallel, interference can be prevented by setting different emission frequency. However, when emission frequency 0 is set, interference cannot be prevented. Response time corresponds to emission frequency.

* Indicated as "**PctL** **oFF**" before production in November 2007.

PRECAUTIONS FOR PROPER USE

PRO mode

- PRO mode appears after the MODE key is pressed for 4 sec. in RUN mode.

Setting item	Factory setting	Description
Shift setting	 [Shift amount 15 %]	Shift amount can be selected from 0 to 80 % in the limit teaching. Select 0 % when it is desired to set the present incident light intensity as a threshold value.
External input setting	 [Emission halt]	External input can be selected from emission halt, limit teaching [+], limit teaching [-], full-auto teaching, ECO (Note 1), 2-point teaching or emission amount test. When setting the incident light intensity test "E5t", output turns ON / OFF every 100ms when the rate of incident light intensity and threshold value is less than half of the set shift amount (for example, when the rate of incident light intensity and threshold value is within ± 10 % for 20 % of shift amount) at external input.
Threshold value-storing setting mode (Note 2)	 [OFF]	Threshold value set at the limit teaching, full-auto teaching or 2-point teaching by external input is stored. When selecting Auto in the emission amount setting mode, the set emission amount level is also stored.
Threshold value follow-up cycle setting (Note 3)	 [OFF]	When incident light intensity exceeds threshold value, this mode can change the threshold value with each set cycle depending on variations of the incident light intensity. The follow-up shift amount is same as the one set in the shift setting mode. However, the threshold value is not stored.
GETA function setting (Note 4, 5)	 [OFF]	Variations can be reduced by correcting the present incident light intensity in each amplifier to a target value. Target value to offset incident light intensity can be selected from 0 to 2,000 by 100 unit each. For example, if the target value is set to 2,000 when the incident light intensity is 1,500, the incident light intensity becomes 2,000.
ECO setting	 [OFF]	It is possible to light up / turn off the digital display. When ECO setting mode is ON, the display turns off in 20 sec. approx. in RUN mode. To light up the display again, press any key for 2 sec. or more.
Digital display inversion setting	 [OFF]	Digital display can be inverted.
Threshold value margin setting	 [OFF]	Margin for threshold value to the present incident light intensity can be checked. When there is no margin, it is possible to make the digital display blink. off : Set to "OFF": does not function. Grt : Green blinks. Red : Red blinks. Rlt : Red and green blink. In-t : When conducting limit teaching or 2-point teaching by external input, in case the rate of reference incident light intensity and threshold value after teaching is 200% or more, or in case it is less than half of the shift amount, output turns ON / OFF every 100 ms. (Note 6)
Setting copy	 [NO]	The settings of the master side amplifier can be copied to the slave side amplifier. For details, refer to "Setting copy function".
Reset	 [NO]	Returns to default settings (factory settings.)

- Notes: 1) When ECO is selected at the external input setting mode, key operation on the main body is invalid during external input.
- 2) This mode is not indicated unless any of "LtcP", "Ltc-", "Ruto" or "2-Pl" is set at the external input setting mode. (Incorporated from production in December 2007.)
- 3) If the incident light intensity becomes "300" or less, the follow-up operation stops. In that condition, threshold value [digital display (green)] blinks. This function can be used when thru-beam type or retroreflective type fiber is applied to this product. If reflective type fiber is applied, the function cannot be used depending on use conditions.
- 4) If MODE key is pressed in RUN mode when GETA function is used, the incident light intensity before setting GETA function is displayed on the red digital display for 2 sec. approx.
- 5) When GETA function is used in saturation of incident light intensity (4,000 or more,) "Hrd" is indicated on the red digital display. Correction value is up to 4,000.
- 6) This mode does not operate unless any of "LtcP", "Ltc-" or "2-Pl" is set at the external input setting mode. (Incorporated from production in December 2007.)

Refer to General precautions, and to the "Operation Guide" on our website for details pertaining to operating instructions for the amplifier.

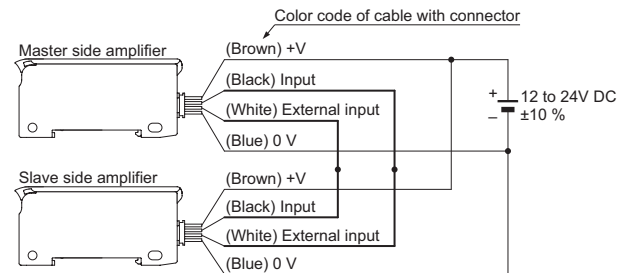
Setting copy function

- This can copy the settings of the master side amplifier to the slave side amplifier.

- Be sure to use the setting copy function between the identical models (Between FX-101□ models or FX-102□ models). This function cannot be used between different models.
- Only one sensor can be connected on slave side with a master side sensor for the setting copy function.
- Threshold value, output operation setting, timer operation setting, timer setting, light-emitting amount setting, shift setting, external input setting, threshold value margin setting, ECO setting, digital display inversion setting, and threshold value margin setting can be copied.

<Setting procedures>

- Set the setting copy mode of the master side amplifier to "Copy sending ON", and press the MODE key so that "COPY rEdy" is shown on the digital display and the sensor is in copy ready state. For the setting method, refer to "Operation guide".
- Turn off the master side amplifier.
- Connect the master side amplifier with the slave side amplifier as shown below.



- Turn on the master side amplifier and the slave side amplifier at the same time. (Note)
- "COPY" is shown on the green digital display of the master side amplifier and 4-digit code is shown on the red digital display of it, then the copying starts. During copy communication, "COPY" is shown on the green digital display of the slave side amplifier, and the ongoing copy communication indicator ("I" → "H" → "III" → "IIII" → "IIII" → "IIII" → "IIII" → "IIII") is displayed on the red digital display.
- When the copying is completed, "Good" is shown on the green digital display of the slave side amplifier, while the 4-digit code (the same code as the master side amplifier) is shown on the red digital display of it.
- Turn off the power of the master side amplifier and the slave side amplifier and disconnect the wire.

* If copying the settings to another amplifier repeatedly, follow the steps ③ to ⑦.

Note: Take care that if the power is not turned on at the same time, the setting contents may not be copied.

<To cancel the setting copy mode of the master side amplifier>

- While the slave side amplifier is disconnected, turn on the power of the master side amplifier.
- Press the MODE key for 2 sec. approx.

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FX-301-F

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Others

- Our products have been developed / produced for industrial use only.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Take care that the product is not directly exposed to fluorescent lamp from a rapid-starter lamp, a high frequency lighting device or sunlight etc., as it may affect the sensing performance.
- This product is suitable for indoor use only.
- Avoid dust, dirt, and steam.
- Take care 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.
- EEPROM is adopted to this product. It is not possible to conduct teaching 100 thousand times or more, because of the EEPROM's lifetime.

Quick setting function

- The quick setting function makes it possible to set the content of the SET Mode (output operation, timer operation, amount of light emitted, and frequency of light emitted) simply by selecting a setting number.
- While in the RUN Mode, pressing and holding both the ON key (ON) and OFF key (OFF) simultaneously for 2 seconds will switch to the quick setting function.

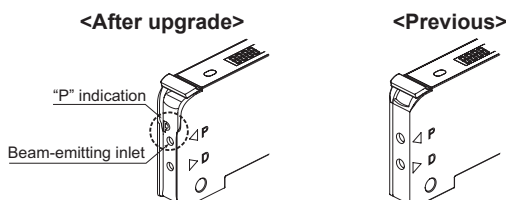
<Table of quick setting numbers>

No.	Output operation	Timer	Emission amount setting (Note)
-00-	D-ON	non	Level 3 (OFF)
-01-	D-ON	non	Level 2 (ON)
-02-	D-ON	ofd 10 ms	Level 3 (OFF)
-03-	D-ON	ofd 10 ms	Level 2 (ON)
-04-	D-ON	ofd 40 ms	Level 3 (OFF)
-05-	D-ON	ofd 40 ms	Level 2 (ON)
-06-	D-ON	ond 10 ms	Level 3 (OFF)
-07-	D-ON	ond 10 ms	Level 2 (ON)
-08-	D-ON	ond 40 ms	Level 3 (OFF)
-09-	D-ON	ond 40 ms	Level 2 (ON)
-10-	L-ON	ond 40 ms	Level 2 (ON)
-11-	L-ON	ond 40 ms	Level 3 (OFF)
-12-	L-ON	ond 10 ms	Level 2 (ON)
-13-	L-ON	ond 10 ms	Level 3 (OFF)
-14-	L-ON	ofd 40 ms	Level 2 (ON)
-15-	L-ON	ofd 40 ms	Level 3 (OFF)
-16-	L-ON	ofd 10 ms	Level 2 (ON)
-17-	L-ON	ofd 10 ms	Level 3 (OFF)
-18-	L-ON	non	Level 2 (ON)
-19-	L-ON	non	Level 3 (OFF)

Note: Until production in November 2007, OFF or ON was selectable. The emission amount of Level 2 (ON) is about 40% of that of Level 3 (OFF).

Difference between previous model and upgraded one

- For upgraded ones (production in and after December 2007), "P" is marked near the beam-emitting inlet. Previous ones have no marking. Appearance and functions have been changed.



Refer to General precautions, and to the "Operation Guide" on our website for details pertaining to operating instructions for the amplifier.

Code setting function

- The code setting function makes it possible to set the output operation, timer operation, amount of light emitted, frequency of light emitted, ECO setting, external input, and amount of shift by selecting a code of one's choice.
- While in the RUN Mode, pressing and holding both the ON key (ON) and OFF key (OFF) simultaneously for 4 seconds will switch to the code setting function.

<Code table>

Code 0002

Code	1st digit		2nd digit		3rd digit	4th digit
	Output operation	Timer (Note 1)	Emission amount setting (Note 2)	Emission frequency FX-101□ FX-102□		
0	D-ON	non	Level 3 (OFF)	0	OFF	Emission halt
1		ond 10 ms		1		Limit teaching [+]
2		ond 40 ms		2		Limit teaching [-]
3		ofd 10 ms		3		Full-auto teaching
4		ofd 40 ms		0		ECO
5	L-ON	non	Level 2 (ON)	1	ON	Emission halt
6		ond 10 ms		2		Limit teaching [+]
7		ond 40 ms		3		Limit teaching [-]
8		ofd 10 ms		0		Full-auto teaching
9		ofd 40 ms		1		ECO
A	Auto	Level 1	Level 1	2	OFF	2-point teaching
B				3		Incident light intensity test
C		Level 1	Level 1	0	ON	2-point teaching
D				1		Incident light intensity test
E				2	ON	2-point teaching
F				3		Incident light intensity test

Notes: 1) When the present setting is out of the code setting range, "-" is shown.

When "-" is selected, the set content of the digit is not changed.

2) Until production in November 2007, OFF or ON was selectable.

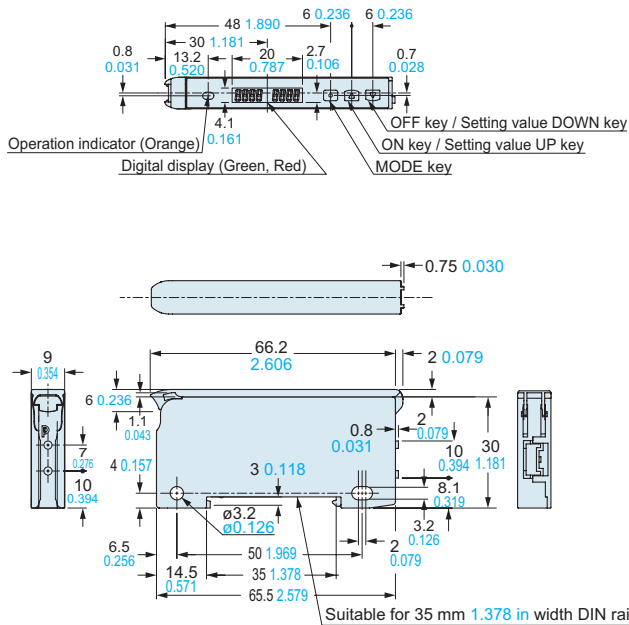
The emission amount of Level 2 is about 40% of that of Level 3.

The emission amount of Level 1 is about 20% of that of Level 3.

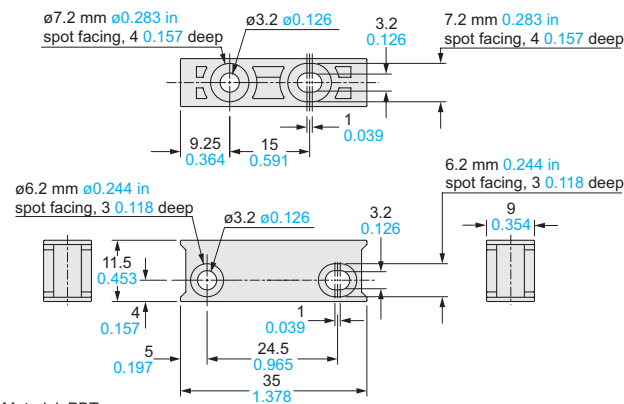
3) The factory setting is "0002".

DIMENSIONS (Unit: mm in)

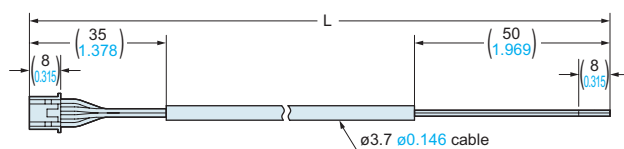
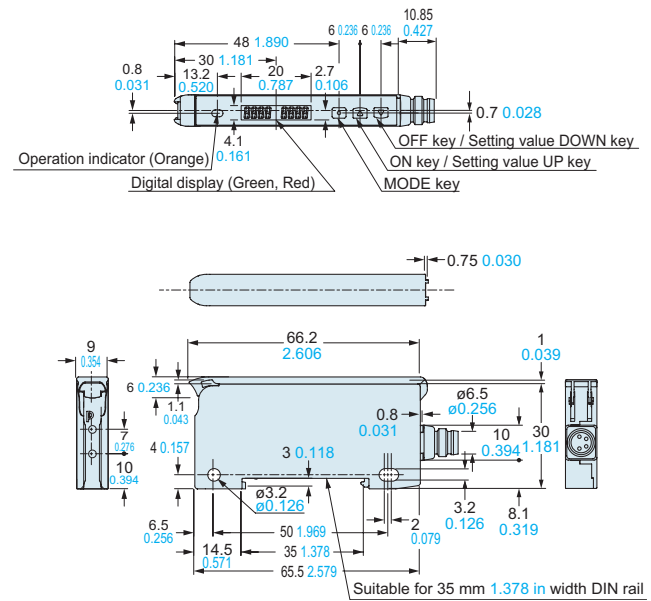
The CAD data in the dimensions can be downloaded from our website.

FX-101□ FX-102□**Amplifier**

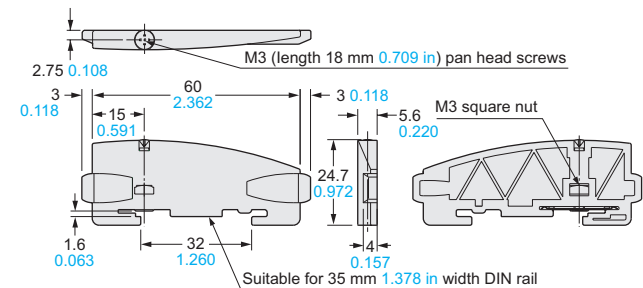
Note: The protection cover has been attached from the production at July, 2011.

MS-DIN-4**Amplifier mounting bracket (Optional)**

Material: PBT

CN-14A-C□ CN-14A-R-C□**Connector attached cable (Optional)****FX-101(P)-Z FX-102(P)-Z****Amplifier**

Note: The protection cover has been attached from the production at July, 2011.

MS-DIN-E**End plate (Optional)**

Material: Polycarbonate

CN-14A-C2 is attached FX-101(P)-CC2 / FX-102(P)-CC2

• Length L

Model No.	Length L
CN-14A(-R)-C1	1,000 39.370
CN-14A(-R)-C2	2,000 78.740
CN-14A(-R)-C3	3,000 118.110
CN-14A(-R)-C5	5,000 196.850

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
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SENSORSLIGHT
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■ General terms and conditions..... F-7

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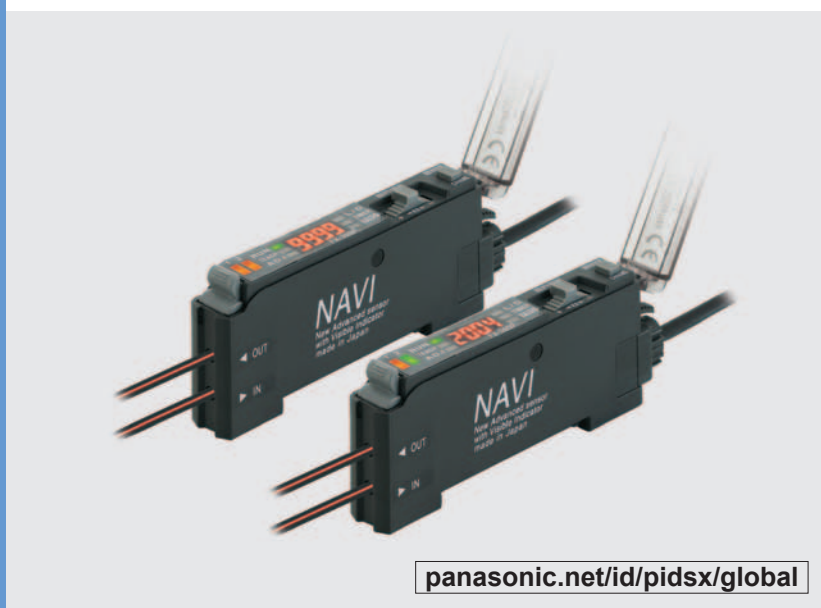
Related Information

■ SC-GU1-485..... P.1009~

■ Glossary of terms..... P.1455~

■ General precautions P.1458~

■ Korea's S-mark..... P.1506



* Passed the UL 991 Environment Test

* UL 61010C-1 compatible, Passed the UL 991 Environment Test based on SEMI S2-0200.
[Category applicable for semiconductor manufacturing: TWW2, Process Equipment]
[Applicable standards: UL 61010C-1]
[Additional test / evaluation standards as per intended use: UL 991, SEMI S2-0200]



PNP output type available



Timer



Interference prevention



Light intensity monitor



Automatic sensitivity setting

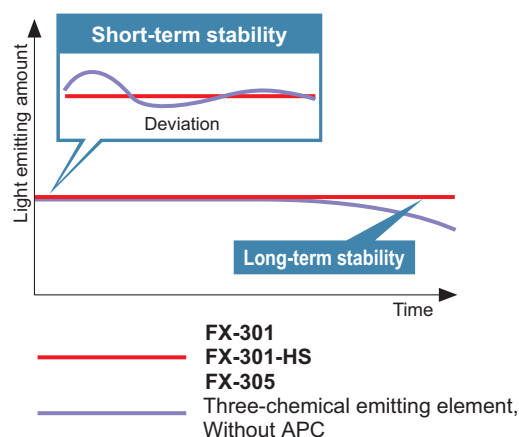
Constant advances achieving significant improvement of sensing performance

Stable sensing over long and short periods

FX-301 FX-301-HS FX-305

In addition to a “four-chemical emitting element” which suppresses changes in the light emitting element over time so that a stable level of light emission can be maintained over long periods, a “APC (Auto Power Control) circuit” has also been adopted afresh. The light emitting amount can be controlled in minute degrees so that even changes occurring over very short periods can be handled, allowing stable sensing performance by suppressing deviations in light emitting amounts caused by changes in the ambient environment that could not previously be suppressed.

• Stable sensing comparison

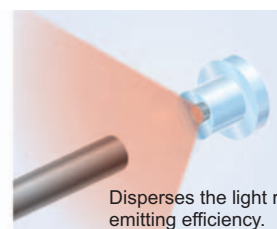


Even greater sensing range

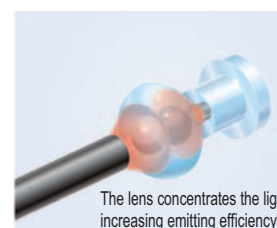
All models

Adoption of a “double coupling lens” that increases emission efficiency to its maximum limits and greatly increases sensing range. Sensing ranges with small diameter fibers and ultra-small diameter fibers, which have become very popular due to the miniaturization of chip components, have been increased by 50 % over previous values achieved with other amplifiers.

• Conventional fiber sensors (Without lens)



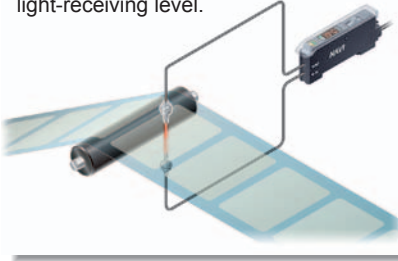
• Double coupling lens



APPLICATIONS

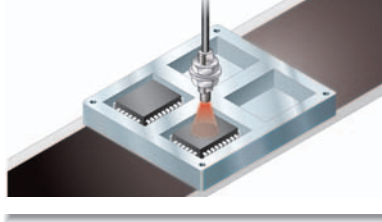
Detecting the presence or absence of labels

The light-emitting amount selection function can even stabilize detection of transparent labels that saturate the light-receiving level.



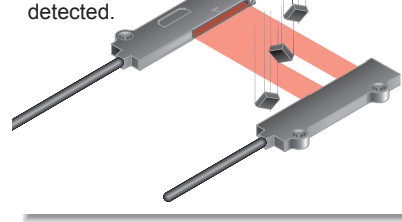
Detecting the presence or absence of ICs on a tray

You can set upper and lower limits for the threshold values using the window comparator mode and turn ON / OFF the incident light intensity within that limit.



Detecting the passage of small objects

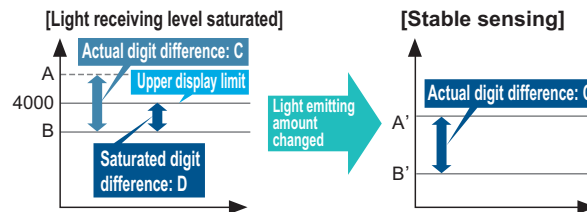
The differential sensing mode will only detect rapid changes in the amount of light, which makes it possible for small objects to be detected.



Light-emitting amount selection

FX-301 **FX-301-HS** **FX-305**

If the light receiving level becomes saturated during close-range sensing or when sensing transparent or minute objects, you can adjust the light emitting amount of the sensor to stabilize sensing **without needing to change the response time**. Sensing that previously required the response time or fibers to be changed can now be set much more easily using this function.



Light emitting amount can be changed without changing response time

Large display 9999

FX-305

Large display with 4 digits (9999). With a greater difference in digit value than previous models, threshold values can be set in units of 1 digit up to maximum 9999. Threshold setting can now be done more easily and accurately.

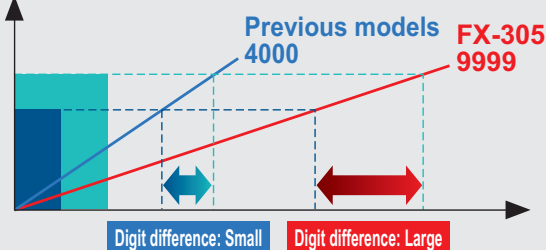


(During STDF, LONG and U-LG modes)

2.5 times previous models

Digit difference comparison

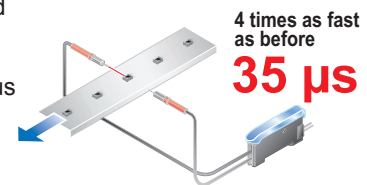
Example Digit difference between **object A** and **object B**



Ultra high-speed 35 μs response

FX-301-HS **FX-305**

Ultra high-speed 35 μs response. Even small objects moving at high speeds can be sensed. In addition, at 65 μs the **FX-301** standard type and **FX-305** high-function type is also twice as fast as previous models.



Ultra high-speed type FX-301-HS

(H-SP mode)

35 μs

Standard type FX-301, High-function type FX-305

(H-SP mode)

65 μs

Previous model

150 μs

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Simplified systems using new operating modes

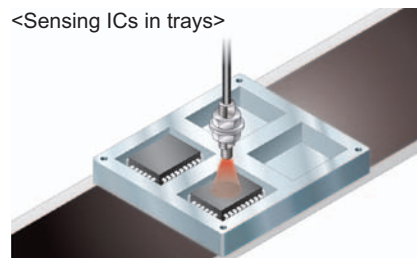
FX-305

A window comparator mode and differential sensing mode have been added. These modes make it easy to carry out sensing tasks that previously required multiple sensors or involved complex threshold settings.

• Window comparator mode

FX-305 → 0001 → 11

<Sensing ICs in trays>



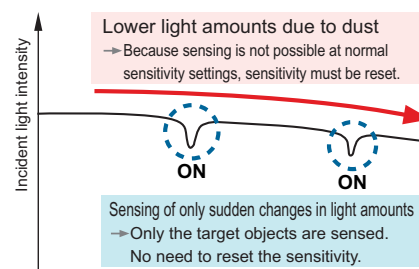
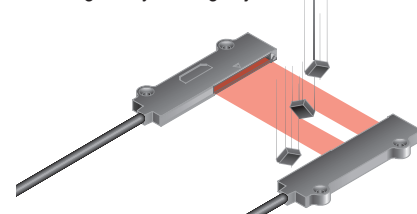
Tray absent	IC present	Tray present
OFF	ON	OFF

Upper and lower limits for threshold values can be set so that the incident light intensity can turn on and off within those ranges. Single output is used, so that only one cable is required, and no PLC processing is required either.

• Differential sensing mode

FX-305 → 0001 → 11

<Sensing of tiny moving objects>



Equipped with 5 types timers

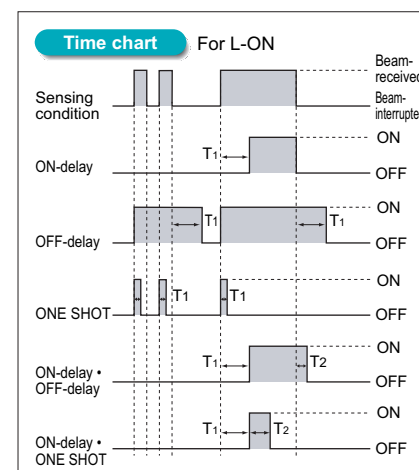
FX-305

The **FX-305** includes the same ON-delay / OFF-delay / ONE SHOT timer as the **FX-301(-HS)**, as well as an ON-delay • OFF-delay timer and an ON-delay • ONE SHOT timer. A wide variety of timer control operations can be carried out by these fiber sensors alone.

Timer period

Output 1: 0.5 to 9,999 ms (variable)

Output 2: 0.5 to 500 ms (variable)



Even beginners can quickly learn how to use the MODE NAVI

All models

MODE NAVI uses six indicators to display the amplifier's basic operations. The current operating mode can be confirmed at a glance, so even a first time user can easily operate the amplifier without becoming confused.

RUN	RUN →
TEACH	This is the sensing mode.
ADJ	Incident light level is displayed in the digital display.
RUN	TEACH →
TEACH	This mode is for setting the threshold value.
ADJ	ADJ →
	In this mode, the threshold value, once set, may be fine-tuned.

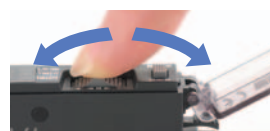


L/D	L/D ON →
TIMER	This mode allows the selection of output operation as either Light-ON or Dark-ON.
L/D	TIMER →
TIMER	This mode permits the choice of using or not using the timer.
L/D	PRO →
TIMER	This mode allows the selection of further advanced functions, such as the copying of individual settings and the memory functions.
PRO	

Easy confirming of threshold value settings

FX-301 FX-301-HS FX-305

The threshold value can be confirmed by turning the jog switch even during RUN mode.



Jog switch is turned
Left: FX-301(-HS) Right: Output 2 for FX-305



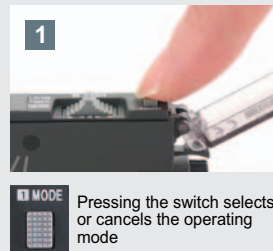
The threshold value is displayed

The use of only two switches makes for very simple operations

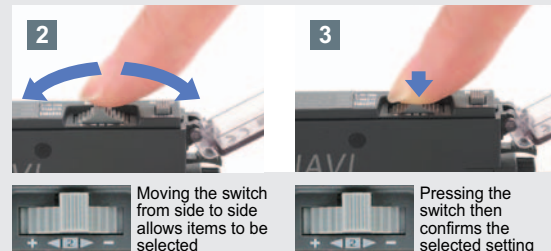
All models

Only two switches, the large jog switch and the large MODE key, are required for operation. You can operate it simply by the 3 steps shown on the right.

• Large MODE key



• Large jog switch

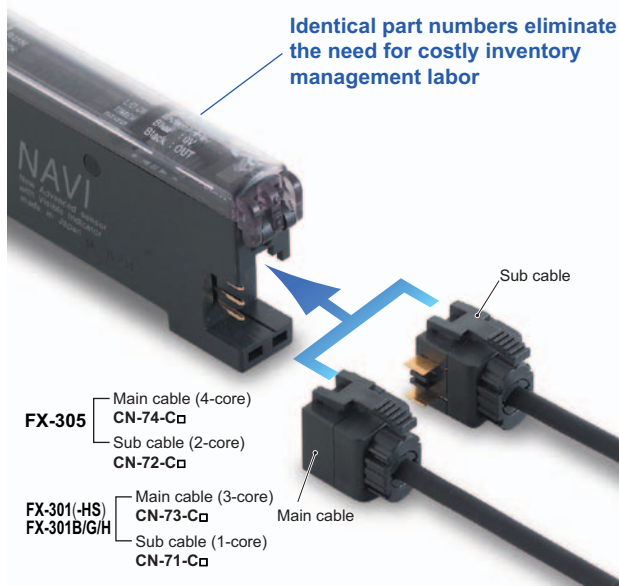


A quick-connection cable saves wiring and work-hours

Connector type

One unit can be used as either a main unit or sub unit

The amplifier unit can be used as either a main unit or a sub unit. This feature allows for easy mounting in the side-by-side configuration. The main and sub unit functions are distinguished only by the proper use of the main cable and the sub cable. Moreover, inventory management and maintenance is simplified.



An optical communication function allows up to *16 sensors to be adjusted simultaneously

FX-301 FX-305

The optical communication function allows the data that is currently set to be copied and saved all at once for all amplifiers connected together from the right side. This greatly reduces troublesome setup tasks and makes setup much smoother. In addition, troublesome adjustment operations at times such as when replacing sensors can also be carried out easily and data can also be copied and stored using the optical communication function.

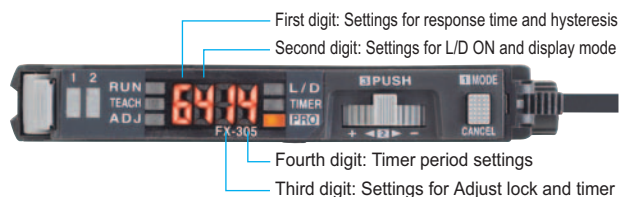


* Use the optical communication function for only the same types of sensors. Furthermore, the FX-301-HS is not equipped with optical communication function capability.

Settings can be entered directly using numerical input

All models

Every function can be directly set merely by the input of a four digit code (numbers) from the code table. This convenient feature is easy to set up. In the event that settings are accidentally changed at the operating site, merely entering the correct code can restore the original settings. This results in easy and quick maintenance.



Communication unit improves equipment starting up and maintenance

FX-301 FX-305

External input unit for digital sensor

FX-CH2

Teaching and changing settings can be performed by using the PLC and touch panel.

Various settings and switching of up to 16 units of digital fiber sensors can be accomplished at once without operating the actual sensors themselves, but via external signals, such as the PLC, touch panel, and push buttons.

<Main functions>

- Batch teaching
- Key lock setting
- Batch loading / saving of the data bank



Refer to our website for details

Upper communication unit for digital sensor

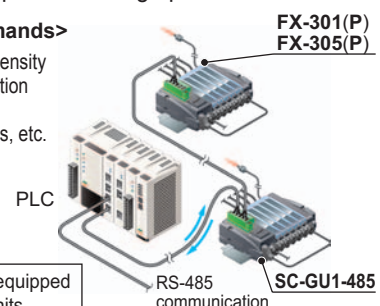
SC-GU1-485

We now offer remote maintenance for digital sensors!

The communication unit enables inputs to the digital fiber sensors (such as teaching and data bank switching) to be carried out via a PLC or a personal computer, and also allows confirming of the incident light intensity an output status for the fiber sensors. This greatly improves workability during equipment starting up and maintenance.

<Communicable commands>

- Sensor incident light intensity
- Sensor settings verification
- Sensor output status
- Threshold value settings, etc.



Compatible with all PLCs equipped with RS-485 compatible units

Refer to SC-GU1-485 pages for details

FIBER SENSORS

LASER SENSORS

PHOTOELECTRIC SENSORS

MICRO PHOTOELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

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UV CURING SYSTEMS

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Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F7/ FX-301-F

ORDER GUIDE**Amplifiers**

Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Appearance	Model No.	Emitting element	Output	Quick-connection cables		
					Type	Model No.	Length
Standard type		FX-301	Red LED	NPN open-collector transistor	Main cable (3-core)	CN-73-C1	1 m 3.281 ft
		FX-301P		PNP open-collector transistor		CN-73-C2	2 m 6.562 ft
		FX-301B	Blue LED	NPN open-collector transistor		CN-73-C5	5 m 16.404 ft
		FX-301BP		PNP open-collector transistor			
		FX-301G	Green LED	NPN open-collector transistor			
		FX-301GP		PNP open-collector transistor			
		FX-301H	Infrared LED	NPN open-collector transistor	Sub cable (1-core)	CN-71-C1	1 m 3.281 ft
		FX-301HP		PNP open-collector transistor		CN-71-C2	2 m 6.562 ft
		FX-301-HS	Red LED	NPN open-collector transistor			
		FX-301P-HS		PNP open-collector transistor		CN-71-C5	5 m 16.404 ft
High-function type		FX-305	Red LED	NPN open-collector transistor	Main cable (4-core)	CN-74-C1	1 m 3.281 ft
						CN-74-C2	2 m 6.562 ft
						CN-74-C5	5 m 16.404 ft
		FX-305P	Red LED	PNP open-collector transistor	Sub cable (2-core)	CN-72-C1	1 m 3.281 ft
						CN-72-C2	2 m 6.562 ft
						CN-72-C5	5 m 16.404 ft

ORDER GUIDE

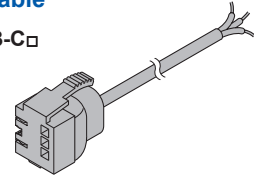
Quick-connection cables

For FX-301(-HS)/B/G/H Quick-connection cable is not supplied with the amplifier. Please order it separately.

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

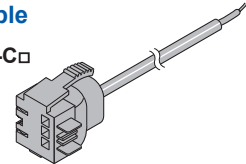
Main cable

• **CN-73-C□**



Sub cable

• **CN-71-C□**

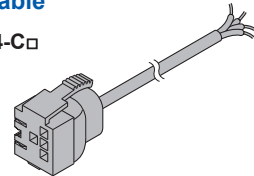


For FX-305 Quick-connection cable is not supplied with the amplifier. Please order it separately.

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

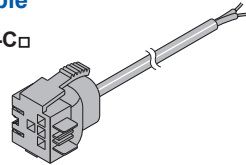
Main cable

• **CN-74-C□**

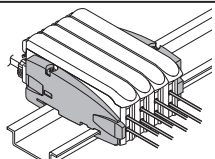


Sub cable

• **CN-72-C□**



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

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

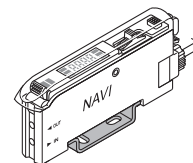
OPTIONS

Designation	Model No.	Description
Amplifier mounting bracket	MS-DIN-2	Mounting bracket for amplifier
Fiber amplifier protection seal	FX-MB1	10 sets of 2 communication window seals and 1 connector seal Communication window seal: It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier. Connector seal: It prevents contact of any metal, etc., with the pins of the quick-connection cable.

Note: Fiber amplifier protection seals are supplied with the **FX-301(P)** and **FX-305(P)**.

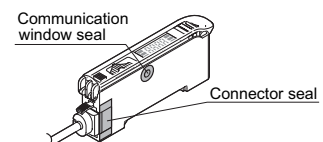
Amplifier mounting bracket

• **MS-DIN-2**



Fiber amplifier protection seal

• **FX-MB1**



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LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

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FX-100

FX-300

FX-410

FX-311

FX-301-F7/

FX-301-F

LIST OF FIBERS

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

Thru-beam type (one pair set)



The **FX-305** and **FX-301(-HS)** have different sensing modes.

FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)

FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 2)										Dimensions				
	Red LED														
	U-LG		LONG		STDF		STD		FAST			H-SP		S-D	
FT-140	19,600	771.654 (Note 3)	19,600	771.654 (Note 3)	19,600	771.654 (Note 3)	16,000	629.921	16,000	629.921	8,700	342.520	8,700	342.520	P.51
FT-30	450	17.717	310	12.205	210	8.268	150	5.906	110	4.331	60	2.362	60	2.362	P.51
FT-31	440	17.323	290	11.417	200	7.874	142	5.591	105	4.134	58	2.283	49	1.929	P.51
FT-31S	440	17.323	290	11.417	200	7.874	140	5.512	100	3.937	55	2.165	49	1.929	P.51
FT-31W	300	11.811	230	9.055	130	5.118	100	3.937	65	2.559	30	1.181	30	1.181	P.51
FT-40	1,300	51.181	900	35.433	600	23.622	450	17.717	330	12.992	180	7.087	180	7.087	P.51
FT-42	1,100	43.307	800	31.496	550	21.654	400	15.748	285	11.220	160	6.299	150	5.906	P.51
FT-42S	1,100	43.307	800	31.496	550	21.654	400	15.748	285	11.220	160	6.299	150	5.906	P.51
FT-42W	1,000	39.370	710	27.953	460	18.110	330	12.992	240	9.449	130	5.118	130	5.118	P.51
FT-43	1,900	74.803	1,400	55.118	800	31.496	610	24.016	440	17.323	240	9.449	250	9.843	P.51
FT-45X	1,600	62.992 (Note 3)	1,100	43.307	780	30.709	570	22.441	410	16.142	230	9.055	230	9.055	P.52
FT-A11	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	2,700	106.299	1,800	70.866	1,100	43.307	1,000	39.370	P.52
FT-A11W	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,100	122.047	2,300	90.551	1,200	47.244	1,200	47.244	P.52
FT-A32	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	2,900	114.173	2,900	114.173	P.52
FT-A32W	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	2,000	78.740	2,100	82.677	P.52
FT-AL05	760	29.921	680	26.772	340	13.386	330	12.992	230	9.055	130	5.118	130	5.118	P.52
FT-E13	20	0.787	13	0.512	9	0.354	6	0.236	5	0.197	2	0.079	2	0.079	P.52
FT-E23	95	3.740	65	2.559	42	1.654	31	1.220	22	0.866	12	0.472	12	0.472	P.52
FT-H13-FM2	1,200	47.244	880	34.646	550	21.654	440	17.323	300	11.811	150	5.906	155	6.102	P.52
FT-H20-J20-S (Note 4)	530	20.866	390	15.354	225	8.858	200	7.874	140	5.512	60	2.362	60	2.362	P.53
FT-H20-J30-S (Note 4)	530	20.866	390	15.354	225	8.858	200	7.874	140	5.512	60	2.362	60	2.362	P.53
FT-H20-J50-S (Note 4)	530	20.866	390	15.354	225	8.858	200	7.874	140	5.512	60	2.362	60	2.362	P.53
FT-H20-M1	750	29.528	550	21.654	320	12.598	280	11.024	200	7.874	85	3.346	90	3.543	P.53
FT-H20-VJ50-S (Note 4)	840	33.071	550	21.654	370	14.567	280	11.024	200	7.874	90	3.543	90	3.543	P.53
FT-H20-VJ80-S (Note 4)	840	33.071	550	21.654	370	14.567	280	11.024	200	7.874	90	3.543	90	3.543	P.53
FT-H20W-M1	420	16.535	310	12.205	180	7.087	140	5.512	100	3.937	40	1.575	50	1.969	P.53
FT-H30-M1V-S (Note 5)	350	13.78	250	9.843	150	5.906	125	4.921	90	3.543	50	1.969	40	1.575	P.53
FT-H35-M2	750	29.528	550	21.654	330	12.992	280	11.024	200	7.874	85	3.346	90	3.543	P.53
FT-H35-M2S6	750	29.528	550	21.654	330	12.992	280	11.024	200	7.874	85	3.346	90	3.543	P.53
FT-HL80Y	3,500	137.795 (Note 3)	3,500	137.795 (Note 3)	1,800	70.866	1,350	53.150	900	35.433	450	17.717	480	18.898	P.53
FT-KS40	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	2,700	106.299	1,900	74.803	1,000	39.370	850	33.465	P.54
FT-KV26	800	31.496	710	27.953	340	13.386	310	12.205	20	0.787	120	4.724	120	4.724	P.54
FT-KV40	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,200	125.984	2,500	98.425	1,800	70.866	1,000	39.370	1,000	39.370	P.54
FT-KV40W	3,600	141.732 (Note 3)	3,600	141.732 (Note 3)	3,200	125.984	2,000	78.740	1,400	55.118	790	31.102	810	31.890	P.54
FT-L80Y	3,500	137.795	3,500	137.795	2,000	78.740	1,500	59.055	1,000	39.370	500	19.685	530	20.866	P.54

Notes: 1) Please contact our office about the sensing ranges for **FX-301-HS** in H-SP mode.

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 fiber cable length practically limits the sensing range.

4) Heat-resistant joint fibers and ordinary-temperature fibers (**FT-42**) are sold as a set.

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

LIST OF FIBERS**FX-301 / FX-305 (Red LED type) sensing range (Note 1)****Thru-beam type (one pair set)**The **FX-305** and **FX-301(-HS)** have different sensing modes.**FX-305:** H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)**FX-301(-HS):** S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 2)												Dimensions		
	Red LED														
	U-LG		LONG		STDF		STD		FAST		H-SP			S-D	
FT-R31	340	13.386	290	11.417	150	5.906	130	5.118	95	3.740	49	1.929	49	1.929	P.54
FT-R40	1,000	39.370	710	27.953	470	18.504	330	12.992	240	9.449	130	5.118	130	5.118	P.54
FT-R41W	1,000	39.370	710	27.953	460	18.110	330	12.992	240	9.449	130	5.118	130	5.118	P.54
FT-R42W	2,800	110.236	1,600	62.992	890	35.039	770	30.315	560	22.047	310	12.205	320	12.598	P.54
FT-R43	1,000	39.370	710	27.953	450	17.717	290	11.417	210	8.268	110	4.331	110	4.331	P.54
FT-R44Y	1,000	39.370	710	27.958	450	17.717	290	11.417	210	8.268	110	4.330	110	4.330	P.55
FT-R60Y	2,650	104.330	1,800	70.866	1,200	47.244	830	32.677	610	24.016	335	13.189	350	13.780	P.55
FT-S11	100	3.937	80	3.150	50	1.969	31	1.220	22	0.866	13	0.512	14	0.551	P.55
FT-S20	450	17.717	310	12.205	210	8.268	150	5.906	110	4.331	60	2.362	60	2.362	P.55
FT-S21	440	17.323	290	11.417	200	7.874	142	5.591	105	4.134	58	2.283	49	1.929	P.55
FT-S21W	300	11.811	230	9.055	130	5.118	100	3.937	65	2.559	30	1.181	30	1.181	P.55
FT-S30	1,300	51.181	900	35.433	600	23.622	450	17.717	330	12.992	180	7.087	180	7.087	P.55
FT-S31W	1,000	39.370	710	27.953	460	18.110	330	12.992	240	9.449	130	5.118	130	5.118	P.55
FT-S32	3,600	141.732	2,400	94.488	1,500	59.055	1,100	43.307	840	33.071	460	18.110	510	20.079	P.55
FT-V23	590	23.228	380	14.961	270	10.630	170	6.693	125	4.921	60	2.362	63	2.480	P.55
FT-V24W	120	4.724	90	3.543	55	2.165	40	1.575	30	1.181	13	0.512	15	0.591	P.56
FT-V25	310	12.205	200	7.874	130	5.118	90	3.543	60	2.362	35	1.378	35	1.378	P.56
FT-V30	620	24.409	420	16.535	270	10.630	200	7.874	140	5.512	70	2.756	70	2.756	P.56
FT-V40	3,600 141.732 (Note 3)	3,600 141.732 (Note 3)	1,600	62.992	1,700	66.929	1,200	47.244	680	26.772	690	27.165			P.56
FT-V80Y	1,000	39.370	800	31.496	500	19.685	400	15.748	280	11.024	120	4.724	140	5.512	P.56
FT-Z20HBW	400	15.748	290	11.417	160	6.299	130	5.118	90	3.543	50	1.969	50	1.969	P.56
FT-Z20W	830	32.677	570	22.441	370	14.567	250	9.843	180	7.087	90	3.543	90	3.543	P.56
FT-Z30	2,600	102.362	1,900	74.803	1,100	43.307	850	33.465	620	24.409	330	12.992	340	13.386	P.56
FT-Z30E	3,600 141.732 (Note 3)	3,100	122.047	2,100	82.677	1,600	62.992	1,100	43.307	650	25.591	670	26.378		P.56
FT-Z30EW	3,600 141.732 (Note 3)	2,700	106.299	1,400	55.118	1,200	47.244	900	35.433	500	19.685	500	19.685		P.57
FT-Z30H	3,600 141.732 (Note 3)	3,100	122.047	2,200	86.614	1,600	62.992	1,100	43.307	650	25.591	670	26.378		P.57
FT-Z30HW	3,600 141.732 (Note 3)	3,100	122.047	2,200	86.614	1,500	59.055	1,000	39.370	590	23.228	610	24.016		P.57
FT-Z30W	2,000	78.740	1,400	55.118	890	35.039	640	25.197	460	18.110	250	9.843	260	10.236	P.57
FT-Z40HBW	1,000	39.370	710	27.953	460	18.110	330	12.992	240	9.449	130	5.118	130	5.118	P.57
FT-Z40W	1,900	74.803	1,300	51.181	900	35.433	630	24.803	460	18.110	240	9.449	260	10.236	P.57
FT-Z802Y	3,500	137.795	3,500	137.795	3,000	118.110	1,500	59.055	1,000	39.370	500	19.685	530	20.866	P.57

Notes: 1) Please contact our office about the sensing ranges for **FX-301-HS** in H-SP mode.

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 fiber cable length practically limits the sensing range.

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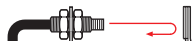
FX-311

FX-301-F7/ FX-301-F

LIST OF FIBERS

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

Retroreflective type



The **FX-305** and **FX-301(-HS)** have different sensing modes.

FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)

FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 2, 3)								Dimensions
	Red LED								
	U-LG	LONG	STDF	STD	FAST	H-SP	S-D		
FR-KZ22E	15 to 370 0.591 to 14.567	15 to 330 0.591 to 12.992	15 to 240 0.591 to 9.449	15 to 210 0.591 to 8.268	15 to 170 0.590 to 6.693	15 to 80 0.591 to 3.150	15 to 90 0.591 to 3.543	P.58	
FR-KZ50E	20 to 350 0.787 to 13.780	20 to 300 0.787 to 11.811	20 to 250 0.787 to 9.843	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	P.58	
FR-KZ50H	20 to 350 0.787 to 13.780	20 to 300 0.787 to 11.811	20 to 250 0.787 to 9.843	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	P.58	
FR-Z50HW	100 to 920 3.937 to 36.220	100 to 810 3.937 to 31.890	100 to 660 3.937 to 25.984	100 to 580 3.937 to 22.835	100 to 490 3.937 to 19.291	100 to 340 3.937 to 13.385	100 to 270 3.937 to 10.630	P.58	

Notes: 1) Please contact our office about the sensing ranges for **FX-301-HS** in H-SP mode.

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.

The sensing range of **FR-KZ22E** is specified for the attached reflector. The sensing range of **FR-KZ50E** and **FR-KZ50H** is specified for the attached reflector **RF-003**. The sensing range of **FR-Z50HW** is specified for the **RF-13**.

3) The sensing range is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.

Sensing range when using in combination with FR-Z50HW reflector (Optional)

The sensing ranges are the value for red LED types.

Reflector Model No.	Sensing range (mm in)							
	FX-301 / 305							FX-301-HS
	U-LG	LONG	STDF	STD	FAST	S-D	H-SP	H-SP
RF-230	100 to 7,500 3.937 to 295.276	100 to 3,200 3.937 to 125.984	100 to 2,900 3.937 to 114.173	100 to 2,000 3.937 to 78.740	100 to 1,600 3.937 to 62.992	100 to 1,000 3.937 to 39.370	100 to 900 3.937 to 35.433	100 to 700 3.937 to 27.559
RF-220	100 to 2,400 3.937 to 94.488	100 to 2,400 3.937 to 94.488	100 to 1,900 3.937 to 74.803	100 to 1,300 3.937 to 51.181	100 to 1,000 3.937 to 39.370	100 to 600 3.937 to 23.622	100 to 570 3.937 to 22.441	100 to 350 3.937 to 13.780
RF-210	100 to 2,100 3.937 to 82.677	100 to 1,700 3.937 to 66.929	100 to 1,300 3.937 to 51.181	100 to 910 3.937 to 35.827	100 to 710 3.937 to 27.953	100 to 460 3.937 to 18.110	100 to 440 3.937 to 17.323	—————

Note: The sensing range is the possible setting range for the reflector. The fiber can detect an object less than setting range for the reflector. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.

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

Reflective type



The **FX-305** and **FX-301(-HS)** have different sensing modes.

FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)

FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 2, 3) / Description										Dimensions
	Red LED										
	U-LG	LONG	STDF	STD	FAST	H-SP	S-D				
FD-30	170 6.693	110 4.331	70 2.756	50 1.969	40 1.575	20 0.787	18 0.709	P.59			
FD-31	150 5.906	95 3.740	63 2.480	45 1.772	35 1.378	17 0.669	16 0.630	P.59			
FD-31W	60 2.362	40 1.575	30 1.181	20 0.787	15 0.591	8 0.315	10 0.394	P.59			
FD-32G	210 8.268	120 4.724	100 3.937	60 2.362	42 1.654	20 0.787	20 0.787	P.59			
FD-32GX	240 9.449	140 5.512	100 3.937	70 2.756	50 1.969	25 0.984	25 0.984	P.59			
FD-40	170 6.693	110 4.331	70 2.756	50 1.969	40 1.575	20 0.787	18 0.709	P.59			
FD-41	150 5.906	95 3.740	63 2.480	45 1.772	35 1.378	17 0.669	16 0.630	P.59			
FD-41S	150 5.906	95 3.740	63 2.480	45 1.772	35 1.378	17 0.669	16 0.630	P.59			
FD-41SW	60 2.362	40 1.575	30 1.181	20 0.787	15 0.591	8 0.315	10 0.394	P.59			
FD-41W	300 11.811	220 8.661	140 5.512	95 3.740	70 2.756	35 1.378	40 1.575	P.59			
FD-42G	210 8.268	120 4.724	100 3.937	60 2.362	42 1.654	20 0.787	20 0.787	P.60			
FD-42GW	160 6.299	85 3.346	70 2.756	35 1.378	25 0.984	13 0.512	14 0.551	P.60			
FD-60	500 19.685	350 13.780	240 9.449	160 6.299	130 5.118	70 2.756	70 2.756	P.60			
FD-61	440 17.323	320 12.598	205 8.071	145 5.709	105 4.134	65 2.559	60 2.362	P.60			
FD-61G	460 18.110	200 7.874	210 8.268	90 3.543	65 2.559	35 1.378	40 1.575	P.60			
FD-61S	440 17.323	320 12.598	205 8.071	145 5.709	105 4.134	60 2.362	60 2.362	P.60			

Notes: 1) Please contact our office about the sensing ranges for **FX-301-HS** in H-SP mode.

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 sensing range is specified for white non-glossy paper.

LIST OF FIBERS**FX-301 / FX-305 (Red LED type) sensing range (Note 1)****Reflective type**

The **FX-305** and **FX-301(-HS)** have different sensing modes.

FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)

FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 2, 3) / Description											Dimensions			
	Red LED														
	U-LG	LONG	STDF	STD	FAST	H-SP	S-D								
FD-61W	300	11.811	220	8.661	140	5.512	95	3.740	70	2.756	35	1.378	40	1.575	P.60
FD-62	690	27.165	480	18.898	310	12.205	220	8.661	160	6.299	85	3.346	90	3.543	P.60
FD-64X	270	10.630	200	7.874	100	3.937	85	3.346	60	2.362	35	1.378	35	1.378	P.61
FD-A16	230	9.055	200	7.874	150	5.906	150	5.906	100	3.937	45	1.772	50	1.969	P.61
FD-AL11	360	14.173	250	9.843	160	6.299	110	4.331	80	3.150	40	1.575	40	1.575	P.61
FD-E13	15	0.591	11	0.433	7	0.276	6	0.236	4	0.157	2	0.079	2	0.079	P.61
FD-E23	65	2.559	45	1.772	28	1.102	19	0.748	14	0.551	7	0.276	7	0.276	P.61
FD-EG30	60	2.362	45	1.772	25	0.984	19	0.748	14	0.551	7	0.276	7	0.276	P.61
FD-EG30S	60	2.362	45	1.772	25	0.984	19	0.748	14	0.551	7	0.276	7	0.276	P.62
FD-EG31	20	0.787	15	0.591	9	0.354	8	0.315	5	0.197	2.5	0.098	3	0.118	P.62
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]														P.62
FD-F41	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]														P.62
FD-F41Y	ø4 mm ø0.157 in form Protective tube: fluorine resin, length 500 mm 19.685 in (cuttable) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam interrupted														P.62
FD-F8Y	————	————	————	————	————	————	————	————	————	————	————	————	————	————	P.62
FD-FA93	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 interrupted														P.62
FD-H13-FM2	410	16.142	310	12.205	200	7.874	140	5.512	100	3.937	55	2.165	47	1.850	P.63
FD-H18-L31	0 to 20	0 to 0.787	0 to 15	0 to 0.591	0 to 10	0 to 0.394	0 to 10	0 to 0.394	1 to 8	0.039 to 0.315	Cannot use	2 to 6	0.079 to 0.236	P.63	
FD-H20-21	300	11.811	270	10.630	150	5.906	140	5.512	100	3.937	35	1.378	47	1.850	P.63
FD-H20-M1	300	11.811	270	10.630	150	5.906	140	5.512	100	3.937	35	1.378	47	1.850	P.63
FD-H25-L43 (Note 5)	3 to 28	0.118 to 1.102	3 to 25	0.118 to 0.984	4 to 23	0.157 to 0.906	4 to 20	0.118 to 0.787	4 to 19	0.118 to 0.748	4 to 16	0.118 to 0.630	4 to 16	0.118 to 0.630	P.63
FD-H25-L45 (Note 5)	5 to 42	0.197 to 1.654	6 to 41	0.236 to 1.614	6 to 40	0.236 to 1.575	7 to 38	0.276 to 1.496	————	————	————	————	————	————	P.63
FD-H30-KZ1V-S (Note 5,6)	20 to 300	0.787 to 11.811	20 to 200	0.787 to 7.874	20 to 150	0.787 to 5.906	25 to 130	0.984 to 5.118	30 to 100	1.181 to 3.937	Cannot use	Cannot use	————	————	P.64
FD-H30-L32	0 to 20	0 to 0.787	0 to 15	0 to 0.591	0 to 10	0 to 0.394	0 to 10	0 to 0.394	1 to 8	0.039 to 0.315	Cannot use	2 to 6	0.079 to 0.236	P.64	
FD-H30-L32V-S (Note 5,6)	0 to 11	0 to 0.433	0 to 8	0 to 0.315	1.5 to 6	0.059 to 0.236	1.5 to 5	0.059 to 0.197	2 to 4	0.079 to 0.157	Cannot use	Cannot use	————	————	P.64
FD-H35-20S	190	7.480	160	6.299	80	3.150	80	3.150	57	2.244	20	0.787	26	1.024	P.64
FD-H35-M2	300	11.811	270	10.630	150	5.906	140	5.512	100	3.937	35	1.378	47	1.850	P.64
FD-H35-M2S6	300	11.811	270	10.630	150	5.906	140	5.512	100	3.937	35	1.378	47	1.850	P.64
FD-HF40Y (Note 4)	ø4 mm ø0.157 in form Protective tube: fluorine resin, length:500 mm 19.685 in (allowable cutting) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam interrupted														P.64
FD-L10 (Note 5)	0 to 4.7	0 to 0.185	0 to 4.5	0 to 0.177	0 to 4.5	0 to 0.177	0 to 4	0 to 0.157	0 to 3.8	0 to 0.150	0 to 3.5	0 to 0.138	0 to 3.5	0 to 0.138	P.65
FD-L11 (Note 5)	0 to 9	0 to 0.354	0 to 8	0 to 0.315	0 to 8	0 to 0.315	0 to 7	0 to 0.906	0 to 7	0 to 0.276	0 to 6	0 to 0.236	0 to 6	0 to 0.236	P.65
FD-L12W (Note 5)	0.5 to 9	0.020 to 0.354	0.5 to 8	0.019 to 0.315	1 to 6.5	0.039 to 0.256	1 to 5.5	0.039 to 0.217	1 to 5	0.039 to 0.197	————	————	————	————	P.65
FD-L20H	1 to 29	0.039 to 1.142	2 to 23	0.079 to 0.906	3 to 17	0.118 to 0.669	4 to 14	0.157 to 0.551	4.5 to 11	0.177 to 0.433	5 to 8.5	0.196 to 0.335	4.8 to 9.5	0.188 to 0.374	P.65
FD-L21 (Note 5)	2 to 19	0.079 to 0.748	2 to 18	0.079 to 0.709	2 to 16	0.079 to 0.748	3 to 16	0.118 to 0.630	3 to 15	0.118 to 0.591	4 to 11	0.157 to 0.433	5 to 11	0.197 to 0.433	P.65
FD-L21W (Note 5)	3 to 14.5	0.118 to 0.571	3 to 14	0.118 to 0.551	4 to 14	0.157 to 0.551	6 to 12	0.236 to 0.472	7 to 12	0.276 to 0.472	————	————	————	————	P.65
FD-L22A (Note 5)	0 to 26	0 to 1.024	0 to 23	0 to 0.906	0 to 23	0 to 0.906	0 to 23	0 to 0.906	0 to 19	0 to 0.748	1 to 17	0.039 to 0.669	1 to 17	0.039 to 0.669	P.65

Notes: 1) Please contact our office about the sensing ranges for **FX-301-HS** in H-SP mode.

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 sensing range of reflective type is the value for white non-glossy paper (as for **FD-H30-L32** and **FD-H18-L31** 50 × 50 mm 1.969 × 1.969 in glass substrate).

4) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

5) The sensing range is specified for transparent glass 100 × 100 × 0.7 mm 3.937 × 3.937 × 0.028 in (**FD-L21** and **FD-L21W**: t2 mm 0.079 in) [**FD-L10**: silicon wafers 100 × 100 mm 3.937 × 3.937 in].

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

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LIST OF FIBERS

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

Reflective type

The **FX-305** and **FX-301(-HS)** have different sensing modes.**FX-305**: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)**FX-301(-HS)**: S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 2, 3) / Description								Dimensions
	Red LED								
	U-LG	LONG	STDF	STD	FAST	H-SP	S-D		
FD-L23 (Note 4)	0 to 30 0 to 1.181	0 to 30 0 to 1.181	0 to 30 0 to 1.181	0 to 30 0.039 to 1.181	1 to 28 0.039 to 1.102	2 to 27 0.079 to 1.063	2 to 27 0.079 to 1.063	P.65	
FD-L30A (Note 4)	0 to 50 0 to 1.969	0 to 43 0 to 17.441	0 to 40 0 to 1.575	0 to 37 0 to 1.457	0 to 32 0 to 1.260	0 to 26 0 to 1.024	0 to 26 0 to 1.024	P.65	
FD-L31A (Note 4)	4 to 33 0 to 13.110	4 to 33 0.157 to 1.299	5 to 32 0 to 1.260	5 to 32 0.197 to 1.260	5 to 32 0.197 to 1.259	6 to 18 0.236 to 0.709	6 to 18 0.236 to 0.709	P.65	
FD-L32H (Note 4)	0 to 60 0 to 2.362	0 to 50 0 to 1.969	0 to 36 0 to 0.984	15 to 35 0.591 to 1.378	16 to 29 0.630 to 1.142	————	————	P.66	
FD-R31G	160 6.299	92 3.622	75 2.953	44 1.732	32 1.260	17 0.669	17 0.669	P.66	
FD-R32EG	60 2.362	45 1.772	25 0.984	19 0.748	13 0.512	7 0.276	7 0.276	P.66	
FD-R33EG	17 0.669	15 0.591	8 0.315	6 0.236	4 0.157	2 0.079	2 0.079	P.66	
FD-R34EG	51 2.008	38 1.496	21 0.827	16 0.630	11 0.433	6 0.236	6 0.236	P.66	
FD-R41	230 9.055	150 5.906	100 3.937	70 2.756	50 1.969	28 1.102	28 1.102	P.66	
FD-R60	310 12.205	240 9.449	170 6.693	120 4.724	90 3.543	45 1.772	45 1.772	P.66	
FD-R61Y	350 13.780	230 9.055	160 6.299	110 4.330	80 3.150	45 1.772	45 1.772	P.66	
FD-S21	80 3.150	50 1.969	40 1.575	25 0.984	19 0.748	9 0.354	9 0.354	P.66	
FD-S30	170 6.693	110 4.331	70 2.756	50 1.969	40 1.575	20 0.787	18 0.709	P.67	
FD-S31	150 5.906	95 3.740	63 2.480	45 1.772	35 1.378	17 0.669	16 0.630	P.67	
FD-S32	440 17.323	270 10.630	200 7.874	140 5.512	100 3.937	55 2.165	55 2.165	P.67	
FD-S32W	300 11.811	220 8.661	140 5.512	95 3.740	70 2.756	35 1.378	40 1.575	P.67	
FD-S33GW	160 6.299	85 3.346	70 2.756	35 1.378	25 0.984	13 0.512	14 0.551	P.67	
FD-S60Y	410 16.142	360 14.173	250 9.843	170 6.693	120 4.724	65 2.559	70 2.756	P.67	
FD-V30	80 3.150	45 1.772	30 1.181	20 0.787	15 0.591	6 0.236	7 0.276	P.67	
FD-V30W	25 0.984	15 0.591	10 0.394	7 0.276	5 0.197	————	————	P.67	
FD-V50	170 6.693	100 3.937	55 2.165	45 1.772	32 1.260	15 0.591	16 0.630	P.68	
FD-Z20HBW	1 to 70 0.039 to 2.756	1 to 70 0.039 to 2.756	1 to 32.2 0.039 to 1.268	2 to 30 0.079 to 1.181	2.5 to 20 0.098 to 0.787	3 to 10 0.118 to 0.394	3 to 10 0.118 to 0.394	P.68	
FD-Z20W	1 to 87 0.039 to 3.425	1 to 59 0.9 to 2.323	2 to 39 0.079 to 1.535	3 to 27 0.118 to 1.063	3 to 19 0.118 to 0.748	————	————	P.68	
FD-Z40HBW	350 13.780	0.5 to 230 0.02 to 9.055	1 to 160 0.039 to 6.299	1 to 100 0.039 to 3.937	1 to 70 0.039 to 2.756	1 to 40 0.039 to 1.575	1 to 40 0.039 to 1.575	P.68	
FD-Z40W	270 10.630	180 7.087	120 4.724	1 to 87 0.039 to 3.425	1 to 63 0.039 to 2.480	2.5 to 32 0.098 to 1.260	2.5 to 32 0.098 to 1.260	P.68	
FD-Z50HW	10 to 870 0.394 to 34.252	10 to 540 0.394 to 21.260	10 to 400 0.394 to 15.748	10 to 250 0.393 to 9.843	10 to 190 0.394 to 7.480	15 to 100 0.196 to 3.937	15 to 100 0.591 to 3.937	P.68	

Notes: 1) Please contact our office about the sensing ranges for **FX-301-HS** in H-SP mode.

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 sensing range of reflective type is the value for white non-glossy paper.

4) The sensing range is specified for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in (**FD-L32H**: R edge).

SENSING RANGE OF BLUE LED / GREEN LED / INFRARED LED**Thru-beam type (One pair set)**

Fibers are listed in alphabetic order. Refer to p.5~ for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)									Dimensions
	FX-301B / 311B			FX-301G / 311G			FX-301H (Note 2)			
	LONG	STD	FAST	LONG	STD	FAST	LONG	STD	FAST	
FT-140	8,100 318.898	4,000 157.480	3,100 122.047	5,000 196.850	2,400 94.488	1,600 62.992	3,700 145.669	2,000 78.740	1,400 55.118	P.51
FT-30	55 2.165	28 1.102	18 0.709	28 1.102	13 0.512	9 0.354	25 0.984	13 0.512	9 0.354	P.51
FT-31	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	23 0.906	11 0.433	8 0.315	P.51
FT-31S	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	23 0.906	11 0.433	8 0.315	P.51
FT-31W	31 1.220	15 0.591	10 0.394	15 0.591	8 0.315	5 0.197	18 0.709	8 0.315	5 0.197	P.51
FT-40	155 6.102	76 2.992	45 1.772	90 3.543	40 1.575	26 1.024	80 3.150	43 1.693	27 1.063	P.51
FT-42	150 5.906	75 2.953	40 1.575	80 3.150	35 1.378	24 0.945	75 2.953	40 1.575	25 0.984	P.51
FT-42S	150 5.906	75 2.953	40 1.575	70 2.756	35 1.378	24 0.945	75 2.953	40 1.575	25 0.984	P.51
FT-42W	110 4.331	50 1.969	30 1.181	56 2.205	28 1.102	20 0.787	64 2.520	32 1.260	21 0.827	P.51
FT-43	220 8.661	110 4.331	75 2.953	120 4.724	61 2.402	43 1.693	140 5.512	74 2.913	48 1.890	P.51
FT-45X	130 5.118	65 2.559	45 1.772	70 2.756	34 1.339	25 0.984	160 6.299	79 3.110	53 2.087	P.52
FT-A11	880 34.646	420 16.535	270 10.630	430 16.929	220 8.661	120 4.724	500 19.685	220 8.661	120 4.724	P.52
FT-A11W	820 32.283	420 16.535	280 11.024	460 18.110	220 8.661	140 5.512	520 20.472	240 9.449	140 5.512	P.52
FT-A32	1,800 70.866	710 27.953	400 15.748	970 38.189	320 12.598	180 7.087	910 35.827	340 13.386	150 5.906	P.52
FT-A32W	2,000 78.740	830 32.677	420 16.535	1,000 39.370	350 13.780	180 7.087	910 35.827	340 13.386	150 5.906	P.52
FT-AL05	100 3.937	48 1.890	32 1.260	56 2.205	27 1.063	18 0.709	54 2.126	27 1.063	18 0.709	P.52
FT-E13	2 0.079	1 0.039	————	1 0.039	————	————	2 0.079	1 0.039	————	P.52
FT-E23	8 0.315	4 0.157	3 0.118	4 0.157	2 0.079	1 0.039	10 0.394	5 0.197	3 0.118	P.52
FT-H13-FM2	72 2.835	36 1.417	26 1.024	32 1.260	16 0.630	10 0.394	70 2.756	35 1.378	25 0.984	P.52
FT-H20-J20-S (Note 3)	60 2.362	20 0.787	————	35 1.378	————	————	20 0.787	————	————	P.53
FT-H20-J30-S (Note 3)	60 2.362	20 0.787	————	35 1.378	————	————	20 0.787	————	————	P.53
FT-H20-J50-S (Note 3)	60 2.362	20 0.787	————	35 1.378	————	————	20 0.787	————	————	P.53
FT-H20-M1	100 3.937	50 1.969	35 1.378	50 1.969	25 0.984	18 0.709	550 21.654	280 11.024	160 6.299	P.53
FT-H20-VJ50-S (Note 3)	85 3.346	30 1.181	————	50 1.969	————	————	30 1.181	————	————	P.53
FT-H20-VJ80-S (Note 3)	85 3.346	30 1.181	————	50 1.969	————	————	30 1.181	————	————	P.53
FT-H20W-M1	44 1.732	22 0.866	14 0.551	22 0.866	11 0.433	7 0.276	220 8.661	100 3.937	70 2.756	P.53
FT-H30-M1V-S (Note 4)	40 1.575	20 0.787	————	20 0.787	————	————	20 0.787	————	————	P.53
FT-H35-M2	100 3.937	50 1.969	35 1.378	50 1.969	25 0.984	18 0.709	550 21.654	280 11.024	160 6.299	P.53
FT-H35-M2S6	100 3.937	50 1.969	35 1.378	50 1.969	25 0.984	18 0.709	550 21.654	280 11.024	160 6.299	P.53
FT-HL80Y	80 3.150	40 1.575	25 0.984	110 4.331	55 2.165	40 1.575	1,100 43.307	550 21.654	350 13.780	P.53
FT-KS40	740 29.134	280 11.024	220 8.661	420 16.535	180 7.087	81 3.189	460 18.110	190 7.480	95 3.740	P.54
FT-KV26	81 3.189	36 1.417	21 0.827	44 1.732	8 0.315	————	53 2.087	19 0.748	————	P.54
FT-KV40	710 27.953	270 10.630	210 8.268	420 16.535	180 7.087	100 3.937	290 11.417	120 4.724	53 2.087	P.54
FT-KV40W	860 33.858	400 15.748	260 10.236	420 16.535	210 8.268	140 5.512	490 19.291	240 9.449	140 5.512	P.54
FT-L80Y	160 6.299	80 3.150	50 1.969	160 6.299	80 3.150	50 1.969	400 15.748	200 7.874	150 5.906	P.54
FT-R31	45 1.772	23 0.906	15 0.591	24 0.945	12 0.472	8 0.315	23 0.906	11 0.433	8 0.315	P.54
FT-R40	110 4.331	54 2.126	36 1.417	55 2.165	26 1.024	20 0.787	58 2.283	30 1.181	20 0.787	P.54
FT-R41W	110 4.331	50 1.969	30 1.181	56 2.205	28 1.102	20 0.787	64 2.520	32 1.260	21 0.827	P.54
FT-R42W	280 11.024	130 5.118	90 3.543	140 5.512	70 2.756	47 1.850	140 5.512	70 2.756	47 1.850	P.54

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) Because infrared types are easily affected by humidity, please ask assistance when using them in a humid environment or in an environment with varying humidity.

3) Heat-resistant joint fibers and ordinary-temperature fibers (**FT-42**) are sold as a set.

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

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F7/ FX-301-F

SENSING RANGE OF BLUE LED / GREEN LED / INFRARED LED

Thru-beam type (One pair set)



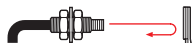
Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)									Dimensions
	FX-301B / 311B			FX-301G / 311G			FX-301H (Note 2)			
	LONG	STD	FAST	LONG	STD	FAST	LONG	STD	FAST	
FT-R43	96 3.780	50 1.969	33 1.299	53 2.087	25 0.984	17 0.669	55 2.165	27 1.063	18 0.709	P.54
FT-R44Y	96 3.780	50 1.969	33 1.299	53 2.087	25 0.984	17 0.669	55 5.165	27 1.063	18 0.709	P.55
FT-R60Y	250 9.843	120 4.724	80 3.150	140 5.512	70 2.756	50 1.969	60 2.362	90 3.543	170 6.693	P.55
FT-S11	12 0.472	5 0.197	4 0.157	5 0.197	2.5 0.098	1.5 0.059	21 0.827	10 0.394	7 0.276	P.55
FT-S20	55 2.165	28 1.102	18 0.709	28 1.102	13 0.512	9 0.354	25 0.984	13 0.512	9 0.354	P.55
FT-S21	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	23 0.906	11 0.433	8 0.315	P.55
FT-S21W	31 1.220	15 0.591	10 0.394	15 0.591	8 0.315	5 0.197	18 0.709	8 0.315	5 0.197	P.55
FT-S30	155 6.102	76 2.992	45 1.772	90 3.543	40 1.575	26 1.024	80 3.150	43 1.693	27 1.063	P.55
FT-S31W	110 4.331	50 1.969	30 1.181	56 2.205	28 1.102	20 0.787	64 2.520	32 1.260	21 0.827	P.55
FT-S32	420 16.535	200 7.874	130 5.118	220 8.661	100 3.937	72 2.835	210 8.268	100 3.937	67 2.638	P.55
FT-V23	65 2.559	26 1.024	18 0.709	26 1.024	13 0.512	8 0.315	29 1.142	13 0.512	9 0.354	P.55
FT-V24W	6 0.236	2 0.079	————	3 0.118	————	————	3 0.118	————	————	P.56
FT-V25	25 0.984	12 0.472	9 0.354	16 0.630	7 0.276	5 0.197	15 0.591	8 0.315	4 0.157	P.56
FT-V30	80 3.150	40 1.575	22 0.866	40 1.575	14 0.551	8 0.315	47 1.850	19 0.748	9 0.354	P.56
FT-V40	400 15.748	200 7.874	130 5.118	200 7.874	100 3.937	65 2.559	290 11.417	140 5.512	92 3.622	P.56
FT-V80Y	120 4.724	60 2.362	35 1.378	80 3.150	40 1.575	25 0.984	75 2.953	38 1.496	24 0.945	P.56
FT-Z20HBW	39 1.535	19 0.748	12 0.472	20 0.787	10 0.394	6 0.236	40 1.575	15 0.591	12 0.472	P.56
FT-Z20W	82 3.228	37 1.457	23 0.906	44 1.732	18 0.709	11 0.433	100 3.937	50 1.969	32 1.260	P.56
FT-Z30	120 4.724	60 2.362	40 1.575	96 3.780	45 1.772	30 1.181	140 5.512	72 2.835	47 1.850	P.56
FT-Z30E	540 21.260	250 9.843	170 6.693	270 10.630	130 5.118	91 3.583	280 11.024	140 5.512	88 3.465	P.56
FT-Z30EW	540 21.260	260 10.236	170 6.693	260 10.236	120 4.724	88 3.465	290 11.417	140 5.512	92 3.622	P.57
FT-Z30H	650 25.591	310 12.205	200 7.874	340 13.386	160 6.299	110 4.331	330 12.992	160 6.299	100 3.937	P.57
FT-Z30HW	540 21.260	260 10.236	170 6.693	260 10.236	120 4.724	88 3.465	290 11.417	140 5.512	92 3.622	P.57
FT-Z30W	83 3.268	40 1.575	25 0.984	73 2.874	36 1.417	25 0.984	100 3.937	52 2.047	34 1.339	P.57
FT-Z40HBW	110 4.331	50 1.969	30 1.181	56 2.205	28 1.102	20 0.787	64 2.520	32 1.260	21 0.827	P.57
FT-Z40W	180 7.087	90 3.543	60 2.362	90 3.543	50 1.969	35 1.378	100 3.937	50 1.969	30 1.181	P.57
FT-Z802Y	320 12.598	160 6.299	120 4.724	160 6.299	80 3.150	60 2.362	320 12.598	160 6.299	120 4.724	P.57

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) Because infrared types are easily affected by humidity, please ask assistance when using them in a humid environment or in an environment with varying humidity.

Retroreflective type



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2)									Dimensions
	FX-301B / 311B			FX-301G / 311G			FX-301H			
	LONG	STD	FAST	LONG	STD	FAST	LONG	STD	FAST	
FR-KZ22E	————	————	————	————	————	————	————	————	————	P.58
FR-KZ50E	20 to 160 0.787 to 6.299	20 to 100 0.787 to 3.937	20 to 60 0.787 to 2.362	20 to 110 0.787 to 4.331	20 to 54 0.787 to 2.126	————	20 to 100 0.787 to 3.937	20 to 33 0.787 to 1.299	————	P.58
FR-KZ50H	20 to 140 0.787 to 5.512	20 to 70 0.787 to 2.76	20 to 52 0.787 to 2.047	20 to 90 0.787 to 3.543	20 to 40 0.787 to 1.575	————	20 to 80 0.787 to 3.150	20 to 43 0.787 to 1.693	————	P.58
FR-Z50HW	————	————	————	————	————	————	100 to 410 3.937 to 16.142	————	————	P.58

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

SENSING RANGE OF BLUE LED / GREEN LED / INFRARED LED**Reflective type**

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2) / Description									Dimensions
	FX-301B / 311B			FX-301G / 311G			FX-301H			
	LONG	STD	FAST	LONG	STD	FAST	LONG	STD	FAST	
FD-30	19 0.748	9 0.354	6 0.236	9 0.354	4.5 0.177	2.5 0.098	8 0.315	4 0.157	2.5 0.098	P.59
FD-31	18 0.709	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	7 0.276	3 0.118	2 0.079	P.59
FD-31W	7 0.276	4 0.157	1 to 2.5 0.039 to 0.098	5 0.197	1 to 2 0.039 to 0.079	————	6 0.236	3 0.118	————	P.59
FD-32G	22 0.866	11 0.433	8 0.315	15 0.591	6 0.236	4 0.157	11 0.433	6 0.236	2 0.079	P.59
FD-32GX	25 0.984	11 0.433	8 0.315	16 0.630	6 0.236	4 0.157	14 0.551	7 0.276	4 0.157	P.59
FD-40	19 0.748	9 0.354	6 0.236	9 0.354	4.5 0.177	2.5 0.098	8 0.315	4 0.157	2.5 0.098	P.59
FD-41	18 0.709	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	7 0.276	3 0.118	2 0.079	P.59
FD-41S	18 0.709	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	7 0.276	3 0.118	2 0.079	P.59
FD-41SW	9 0.354	1 to 4 0.039 to 0.157	1 to 2.5 0.039 to 0.098	1 to 4 0.039 to 0.157	1 to 2 0.039 to 0.079	————	6 0.236	1 to 3 0.039 to 0.118	————	P.59
FD-41W	32 1.260	1 to 15 0.039 to 0.591	1 to 9 0.039 to 0.354	17 0.669	1 to 7.5 0.039 to 0.295	1.5 to 4.5 0.059 to 0.177	18 0.709	1 to 9 0.039 to 0.354	1.5 to 5 0.059 to 0.197	P.59
FD-42G	22 0.866	11 0.433	8 0.315	15 0.591	6 0.236	4 0.157	11 0.433	6 0.236	2 0.079	P.60
FD-42GW	14 0.551	7 0.276	5 0.197	6 0.236	4 0.157	2 0.079	9 0.354	5 0.197	2 0.079	P.60
FD-60	55 2.165	28 1.102	18 0.709	30 1.181	15 0.591	10 0.394	30 1.181	15 0.591	10 0.394	P.60
FD-61	48 1.890	24 0.945	16 0.630	26 1.024	13 0.512	8 0.315	27 1.063	12 0.472	8 0.315	P.60
FD-61G	46 1.811	23 0.906	15 0.591	26 1.024	12 0.472	8 0.315	25 0.984	12 0.472	8 0.315	P..60
FD-61S	48 1.890	24 0.945	16 0.630	26 1.024	13 0.512	8 0.315	27 1.063	12 0.472	8 0.315	P.60
FD-61W	32 1.260	1 to 15 0.039 to 0.591	1 to 9 0.039 to 0.354	17 0.669	1 to 7.5 0.039 to 0.295	1.5 to 4.5 0.059 to 0.177	18 0.709	1 to 9 0.039 to 0.354	1.5 to 5 0.059 to 0.197	P.60
FD-62	80 3.150	1 to 40 0.039 to 1.575	1 to 27 0.039 to 1.063	1 to 42 0.039 to 1.654	1 to 21 0.039 to 0.827	1 to 14 0.039 to 0.551	54 2.126	1 to 26 0.039 to 1.024	1 to 17 0.039 to 0.669	P.60
FD-64X	32 1.260	0.5 to 16 0.020 to 0.630	0.5 to 10 0.020 to 0.394	0.5 to 16 0.020 to 0.630	0.5 to 8 0.020 to 0.315	0.5 to 5 0.020 to 0.197	27 1.063	22 0.866	14 0.551	P.61
FD-A16	19 0.748	14 0.551	————	20 0.787	13 0.512	————	18 0.709	15 0.591	————	P.61
FD-AL11	33 1.299	16 0.630	10 0.394	18 0.709	8 0.315	4.5 0.177	12 0.472	10 0.394	6 0.236	P.61
FD-E13	2 0.079	0.8 0.031	0.5 0.020	0.8 0.031	————	————	2 0.079	1 0.039	————	P.61
FD-E23	6 0.236	3 0.118	2 0.079	3 0.118	1.5 0.059	1 0.039	8 0.315	4 0.157	2.5 0.098	P.61
FD-EG30	6 0.236	3 0.118	2 0.079	3 0.118	1.5 0.059	1 0.039	8 0.315	4 0.157	2.5 0.098	P.61
FD-EG30S	6 0.236	3 0.118	2 0.079	3 0.118	1.5 0.059	1 0.039	8 0.315	4 0.157	2.5 0.098	P.62
FD-EG31	2 0.079	1 0.039	0.5 0.020	1 0.039	————	————	4 0.157	2 0.079	1 0.039	P.62
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 interrupted									P.62
FD-F41	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 interrupted									P.62
FD-F41Y (Note 3)	ø4 mm ø0.157 in form Protective tube: fluorine resin, length 500 mm 19.685 in (cuttable) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam interrupted									P.62
FD-F8Y	————	————	————	————	————	————	————	————	————	P.62
FD-FA93	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 interrupted									P.62
FD-H13-FM2	20 0.787	11 0.433	7 0.276	20 0.787	11 0.433	7 0.276	25 0.984	12 0.472	8 0.315	P.63
FD-H18-L31	————	————	————	————	————	————	————	————	————	P.63
FD-H20-21	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	140 5.512	70 2.756	45 1.772	P.63
FD-H20-M1	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	140 5.512	70 2.756	45 1.772	P.63
FD-H25-L43 (Note 4)	————	————	————	————	————	————	————	————	————	P.63
FD-H25-L45 (Note 4)	————	————	————	————	————	————	————	————	————	P.63

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. (**FP-H18-L31** 50 × 50 mm **1.969 × 1.969 in.** glass substrate).

3) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

4) The sensing range is specified for transparent glass 100 × 100 × t0.7 mm **3.937 × 3.937 × t0.028 in**

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F7/ FX-301-F

SENSING RANGE OF BLUE LED / GREEN LED / INFRARED LED**Reflective type**

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2) / Description									Dimensions
	FX-301B / 311B			FX-301G / 311G			FX-301H			
	LONG	STD	FAST	LONG	STD	FAST	LONG	STD	FAST	
FD-H30-KZ1V-S (Note 3,4)	30 to 40 1.181 to 1.575	————	————	————	————	————	————	————	————	P.64
FD-H30-L32	————	————	————	————	————	————	————	————	————	P.64
FD-H30-L32V-S (Note 3,4)	————	————	————	————	————	————	————	————	————	P.64
FD-H35-20S	22 0.866	11 0.433	7 0.276	12 0.472	6 0.236	4 0.157	80 3.150	40 1.575	28 1.102	P.64
FD-H35-M2	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	140 5.512	70 2.756	45 1.772	P.64
FD-H35-M2S6	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	140 5.512	70 2.756	45 1.772	P.64
FD-HF40Y (Note 5)	ø4 mm ø0.157 in form Protective tube: fluorine resin, length:500 mm 19.685 in (allowable cutting) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam interrupted									P.64
FD-L10 (Note 6)	0 to 3.5 0 to 0.138	0 to 3 0 to 0.118	0.5 to 2.5 0.020 to 0.098	0 to 3 0 to 0.118	1 to 2 0.039 to 0.079	————	0 to 3 0 to 0.118	1 to 2 0.039 to 0.079	————	P.65
FD-L11 (Note 6)	7 0.276	6.5 0.256	0.5 to 5.5 0.020 to 0.217	6.5 0.256	1 to 4 0.039 to 0.157	————	6.5 0.256	1 to 4.5 0.039 to 0.177	————	P.65
FD-L12W (Note 6)	————	————	————	————	————	————	————	————	————	P.65
FD-L20H	4.5 to 10 0.177 to 0.394	5 to 9 0.197 to 0.354	5.5 to 8 0.217 to 0.315	5 to 9 0.197 to 0.354	5.5 to 8 0.217 to 0.315	————	4.9 to 8.5 0.193 to 0.335	————	————	P.65
FD-L21 (Note 6)	————	————	————	————	————	————	————	————	————	P.65
FD-L21W (Note 6)	————	————	————	————	————	————	————	————	————	P.65
FD-L22A (Note 6)	————	————	————	————	————	————	————	————	————	P.65
FD-L23 (Note 6)	————	————	————	————	————	————	————	————	————	P.65
FD-L30A (Note 6)	————	————	————	————	————	————	————	————	————	P.65
FD-L31A (Note 6)	————	————	————	————	————	————	————	————	————	P.65
FD-L32H (Note 6)	————	————	————	————	————	————	————	————	————	P.66
FD-R31G	17 0.669	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	9 0.354	4 0.157	2 0.079	P.66
FD-R32EG	6 0.236	3 0.118	1.5 0.059	2 0.079	1 0.039	————	8 0.315	4 0.157	2.5 0.098	P.66
FD-R33EG	2 0.079	0.8 0.031	0.5 0.020	1 0.039	————	————	3 0.118	1.5 0.059	————	P.66
FD-R34EG	5 0.197	2 0.079	1.5 0.059	2 0.079	1 0.039	————	6 0.236	3 0.118	2 0.079	P.66
FD-R41	24 0.945	1 to 13 0.039 to 0.512	1 to 9 0.039 to 0.354	1 to 15 0.039 to 0.591	1 to 8 0.039 to 0.315	3 to 6 0.118 to 0.236	14 0.551	1 to 6 0.039 to 0.236	1 to 3 0.039 to 0.118	P.66
FD-R60	42 1.654	20 0.787	0.5 to 13 0.020 to 0.512	21 0.827	0.5 to 10 0.020 to 0.394	0.5 to 7 0.020 to 0.276	27 1.063	12 0.472	8 0.315	P.66
FD-R61Y	36 1.417	17 0.669	0.5 to 11 0.020 to 0.433	19 0.748	0.5 to 9 0.020 to 0.354	1 to 6 0.039 to 0.236	19 0.748	0.5 to 10 0.020 to 0.394	0.5 to 6 0.020 to 0.236	P.66
FD-S21	8 0.315	3.5 0.138	2 0.079	5 0.197	2 0.079	1.3 0.051	9 0.354	4 0.157	3 0.118	P.66
FD-S30	19 0.749	9 0.354	6 0.236	9 0.354	4.5 0.177	2.5 0.098	8 0.315	4 0.157	2.5 0.098	P.67
FD-S31	18 0.709	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	7 0.276	3 0.118	2 0.079	P.67
FD-S32	48 1.890	24 0.945	16 0.630	26 1.024	13 0.512	8 0.315	27 1.063	12 0.472	8 0.315	P.67
FD-S32W	32 1.260	1 to 15 0.039 to 0.591	1 to 9 0.039 to 0.354	17 0.669	1 to 7.5 0.039 to 0.295	1.5 to 4.5 0.059 to 0.177	18 0.709	1 to 9 0.039 to 0.354	1.5 to 5 0.059 to 0.197	P.67
FD-S33GW	14 0.551	7 0.276	5 0.197	6 0.236	4 0.157	2 0.079	9 0.354	5 0.197	2 0.079	P.67
FD-S60Y	50 1.969	20 0.787	3 to 12 0.118 to 0.472	28 1.102	3 to 9 0.118 to 0.354	————	30 1.181	2 to 13 0.079 to 0.512	5 to 6.5 0.197 to 0.256	P.67
FD-V30	9 0.354	————	————	————	————	————	————	————	————	P.67
FD-V30W	————	————	————	————	————	————	————	————	————	P.67
FD-V50	12 0.472	————	————	6 0.236	————	————	6 0.236	————	————	P.68
FD-Z20HBW	4 to 10 0.157 to 0.394	————	————	————	————	————	3 to 11 0.118 to 0.433	4 to 6 0.157 to 0.236	————	P.68
FD-Z20W	————	————	————	————	————	————	5 to 8 0.197 to 0.315	————	————	P.68
FD-Z40HBW	1 to 36 0.039 to 1.417	3 to 17 1.181 to 0.669	3 to 11 1.181 to 0.433	2 to 19 0.079 to 0.748	3 to 8 0.118 to 0.315	4 to 5 0.157 to 0.197	2 to 20 0.079 to 0.787	3 to 10 0.118 to 0.394	4 to 5.5 0.157 to 0.217	P.68
FD-Z40W	4 to 20 0.157 to 0.787	————	————	4 to 14 0.157 to 0.551	————	————	5 to 10 0.197 to 0.394	————	————	P.68
FD-Z50HW	————	————	————	————	————	————	————	————	————	P.68

Notes: 1) The standard sensing objects of the sensing ranges vary depending on the fibers.

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 sensing range of reflective type is the value for white non-glossy paper.

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


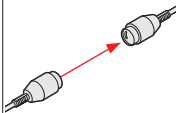


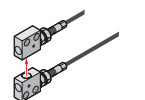
5) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

6) The sensing range is specified for transparent glass 100 × 100 × t.0.07 mm 3.937 × 3.937 × t.0.028 in, (FD-L32H: R-edge, FD-L21 and FD-L21W: 12 mm t.0.079 in) [FD-L10: silicon wafers 100 × 100 mm 3.937 × 3.937 in]

FIBER OPTIONS

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

Lens (for thru-beam type fiber)

Designation		Model No.	Description																																																																																
For thru-beam type fiber	Expansion lens (Note 1)	FX-LE1		<p>Increases the sensing range by 5 times or more.</p> <ul style="list-style-type: none">Ambient temperature: −60 to +350 °C −76 to +662 °F (Note 5)Beam dia: ø3.6 mm ø0.142 in	Sensing range for red LED type (mm) [Lens on both sides] (Note 2)																																																																														
					<table><tr><th>Fiber \ Mode</th><th>U-LG</th><th>LONG</th><th>STDF</th><th>STD</th><th>FAST</th><th>S-D</th><th>H-SP</th></tr><tr><td>FT-43</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>2,900</td><td>2,100</td><td>1,300</td><td>1,200</td></tr><tr><td>FT-42</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>2,800</td><td>1,600</td><td>1,600</td></tr><tr><td>FT-45X</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,500</td></tr><tr><td>FT-R40</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,500</td><td>3,400</td><td>2,700</td><td>1,500</td><td>1,500</td></tr><tr><td>FT-H35-M2</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>2,500</td><td>2,000</td><td>1,500</td><td>750</td><td>700</td></tr><tr><td>FT-H20W-M1</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,300</td><td>900</td><td>500</td><td>400</td></tr><tr><td>FT-H20-M1</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,100</td><td>900</td><td>600</td></tr></table>	Fiber \ Mode	U-LG	LONG	STDF	STD	FAST	S-D	H-SP	FT-43	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	2,900	2,100	1,300	1,200	FT-42	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	2,800	1,600	1,600	FT-45X	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,500	FT-R40	3,600 (Note 3)	3,600 (Note 3)	3,500	3,400	2,700	1,500	1,500	FT-H35-M2	3,500 (Note 3)	3,500 (Note 3)	2,500	2,000	1,500	750	700	FT-H20W-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,300	900	500	400	FT-H20-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,100	900	600														
					Fiber \ Mode	U-LG	LONG	STDF	STD	FAST	S-D	H-SP																																																																							
					FT-43	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	2,900	2,100	1,300	1,200																																																																							
					FT-42	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	2,800	1,600	1,600																																																																							
FT-45X	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,500																																																																												
FT-R40	3,600 (Note 3)	3,600 (Note 3)	3,500	3,400	2,700	1,500	1,500																																																																												
FT-H35-M2	3,500 (Note 3)	3,500 (Note 3)	2,500	2,000	1,500	750	700																																																																												
FT-H20W-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,300	900	500	400																																																																												
FT-H20-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,100	900	600																																																																												
Super-expansion lens (Note 1)	FX-LE2		<p>Tremendously increases the sensing range with large diameter lenses.</p> <ul style="list-style-type: none">Ambient temperature: −60 to +350 °C −76 to +662 °F (Note 5)Beam dia: ø9.8 mm ø0.386 in	Sensing range for red LED type (mm) [Lens on both sides] (Note 2)																																																																															
				<table><tr><th>Fiber \ Mode</th><th>U-LG</th><th>LONG</th><th>STDF</th><th>STD</th><th>FAST</th><th>S-D</th><th>H-SP</th></tr><tr><td>FT-43</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td></tr><tr><td>FT-42</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td></tr><tr><td>FT-45X</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td></tr><tr><td>FT-R40</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td><td>3,600 (Note 3)</td></tr><tr><td>FT-H35-M2</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td></tr><tr><td>FT-H20W-M1</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,500</td><td>1,600 (Note 3)</td></tr><tr><td>FT-H20-M1</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td></tr><tr><td>FT-H13-FM2</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td><td>3,500 (Note 3)</td></tr></table>	Fiber \ Mode	U-LG	LONG	STDF	STD	FAST	S-D	H-SP	FT-43	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	FT-42	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	FT-45X	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	FT-R40	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	FT-H35-M2	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	FT-H20W-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,500	1,600 (Note 3)	FT-H20-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	FT-H13-FM2	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)							
				Fiber \ Mode	U-LG	LONG	STDF	STD	FAST	S-D	H-SP																																																																								
				FT-43	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)																																																																								
				FT-42	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)																																																																								
FT-45X	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)																																																																												
FT-R40	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)	3,600 (Note 3)																																																																												
FT-H35-M2	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)																																																																												
FT-H20W-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,500	1,600 (Note 3)																																																																												
FT-H20-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)																																																																												
FT-H13-FM2	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)																																																																												
Side-view lens	FX-SV1		<p>Beam axis is bent by 90°.</p> <ul style="list-style-type: none">Ambient temperature: −60 to +300 °C −76 to +572 °F (Note 5)Beam dia: ø2.8 mm ø0.110 in	Sensing range for red LED type (mm) [Lens on both sides] (Note 2)																																																																															
				<table><tr><th>Fiber \ Mode</th><th>U-LG</th><th>LONG</th><th>STDF</th><th>STD</th><th>FAST</th><th>S-D</th><th>H-SP</th></tr><tr><td>FT-43</td><td>1,900</td><td>1,200</td><td>840</td><td>580</td><td>420</td><td>250</td><td>240</td></tr><tr><td>FT-42</td><td>2,100</td><td>1,400</td><td>870</td><td>640</td><td>440</td><td>210</td><td>210</td></tr><tr><td>FT-45X</td><td>1,600 (Note 3)</td><td>1,600 (Note 3)</td><td>840</td><td>650</td><td>450</td><td>220</td><td>220</td></tr><tr><td>FT-H35-M2</td><td>840</td><td>550</td><td>370</td><td>280</td><td>200</td><td>90</td><td>90</td></tr><tr><td>FT-H20W-M1</td><td>400</td><td>310</td><td>180</td><td>140</td><td>100</td><td>50</td><td>50</td></tr><tr><td>FT-H20-M1</td><td>840</td><td>550</td><td>370</td><td>280</td><td>200</td><td>90</td><td>90</td></tr></table>	Fiber \ Mode	U-LG	LONG	STDF	STD	FAST	S-D	H-SP	FT-43	1,900	1,200	840	580	420	250	240	FT-42	2,100	1,400	870	640	440	210	210	FT-45X	1,600 (Note 3)	1,600 (Note 3)	840	650	450	220	220	FT-H35-M2	840	550	370	280	200	90	90	FT-H20W-M1	400	310	180	140	100	50	50	FT-H20-M1	840	550	370	280	200	90	90																							
				Fiber \ Mode	U-LG	LONG	STDF	STD	FAST	S-D	H-SP																																																																								
				FT-43	1,900	1,200	840	580	420	250	240																																																																								
				FT-42	2,100	1,400	870	640	440	210	210																																																																								
FT-45X	1,600 (Note 3)	1,600 (Note 3)	840	650	450	220	220																																																																												
FT-H35-M2	840	550	370	280	200	90	90																																																																												
FT-H20W-M1	400	310	180	140	100	50	50																																																																												
FT-H20-M1	840	550	370	280	200	90	90																																																																												
Expansion lens for vacuum fiber (Note 1)	FV-LE1		<p>Sensing range increases by 4 times or more.</p> <ul style="list-style-type: none">Ambient temperature: −60 to +350 °C −76 to +662 °F (Note 5)Beam dia: ø3.6 mm ø0.142 in	Sensing range for red LED type (mm) [Lens on both sides] (Note 2, 4)																																																																															
				<table><tr><th>Fiber \ Mode</th><th>U-LG</th><th>LONG</th><th>STDF</th><th>STD</th><th>FAST</th><th>S-D</th><th>H-SP</th></tr><tr><td>FT-H30-M1V-S</td><td>1,600</td><td>1,200</td><td>650</td><td>450</td><td>300</td><td>150</td><td>200</td></tr></table>	Fiber \ Mode	U-LG	LONG	STDF	STD	FAST	S-D	H-SP	FT-H30-M1V-S	1,600	1,200	650	450	300	150	200																																																															
				Fiber \ Mode	U-LG	LONG	STDF	STD	FAST	S-D	H-SP																																																																								
				FT-H30-M1V-S	1,600	1,200	650	450	300	150	200																																																																								
				Vacuum resistant side-view lens (Note 1)	FV-SV2		<p>Beam axis is bent by 90°.</p> <ul style="list-style-type: none">Ambient temperature: −60 to +300 °C −76 to +572 °F (Note 5)Beam dia: ø3.7 mm ø0.146 in	Sensing range for red LED type (mm) [Lens on both sides] (Note 2, 4)																																																																											
<table><tr><th>Fiber \ Mode</th><th>U-LG</th><th>LONG</th><th>STDF</th><th>STD</th><th>FAST</th><th>S-D</th><th>H-SP</th></tr><tr><td>FT-H30-M1V-S</td><td>1,600</td><td>1,200</td><td>650</td><td>450</td><td>300</td><td>150</td><td>200</td></tr></table>	Fiber \ Mode	U-LG	LONG					STDF	STD	FAST	S-D	H-SP	FT-H30-M1V-S	1,600	1,200	650	450	300	150	200																																																															
Fiber \ Mode	U-LG	LONG	STDF					STD	FAST	S-D	H-SP																																																																								
FT-H30-M1V-S	1,600	1,200	650					450	300	150	200																																																																								

- 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 sensing ranges are the values for red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifiers.
- 3) The fiber cable length practically limits the sensing range.
- 4) The fiber cable length for the FT-H30-M1V-S is 1 m 3.281 ft. The sensing ranges in U-LG and LONG modes take into account the length of the FT-J8 atmospheric side fiber.
- 5) Refer to p.15, p18, p.33 and p.35 for the ambient temperatures of fibers to be used in combination.

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311


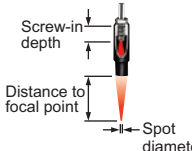


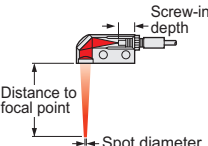
FX-301-F7/

FX-301-F

FIBER OPTIONS

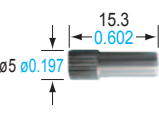










Refer to p. 69~ for details of lens dimensions.


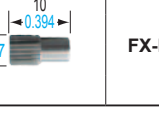
Lens (for reflective type fiber)

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

Notes: 1) The sensing ranges are the values when used in combination with a red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifier.
 2) Refer to p.16 or p.26 for the ambient temperatures of fibers to be used in combination.

Lens (For square head M3 reflective fiber)

Type	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens	Fiber
			Shape (mm in)	Model No.
For Square head M3 reflective fiber	Finest spot lens	7 ± 0.5 0.276 ± 0.020		 $\phi 0.125$ $\phi 0.005$ FD-R33EG
				 $\phi 0.125$ $\phi 0.005$ FD-EG31
				 $\phi 0.175$ $\phi 0.007$ FD-R34EG
				 $\phi 0.25$ $\phi 0.010$ FD-R32EG
				 $\phi 0.25$ $\phi 0.010$ FD-EG30
				 $\phi 0.5$ $\phi 0.020$ FD-R31G
				 $\phi 0.5$ $\phi 0.020$ FD-32G
				 $\phi 0.5$ $\phi 0.020$ FD-32GX
				 $\phi 0.5$ $\phi 0.020$ FD-42G
				 $\phi 0.5$ $\phi 0.020$ FD-42GW

Type	Spot diameter (mm in) (Note)	Sensing range (mm in) (Note)	Lens	Applicable fibers
			Shape (mm in)	Model No.
For Square head M3 reflective fiber	Zoom lens	10 to 30 0.394 to 1.181		$\phi 0.125$ $\phi 0.005$ FD-R33EG, FD-EG31
				$\phi 0.175$ $\phi 0.007$ FD-R34EG
				$\phi 0.25$ $\phi 0.010$ FD-R32EG, FD-EG30
				$\phi 0.5$ $\phi 0.020$ FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW
	Parallel light lens	0 to 30 0 to 1.181		$\phi 0.125$ $\phi 0.005$ FD-R33EG, FD-EG31
				$\phi 0.175$ $\phi 0.007$ FD-R34EG
				$\phi 0.25$ $\phi 0.010$ FD-R32EG, FD-EG30
				$\phi 0.5$ $\phi 0.020$ FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW

Note: Spot diameter, distance to focal point and sensing range are specified for a red LED type amplifier.

FIBER OPTIONS

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

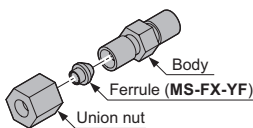
Others

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-61G 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				
	FDP-N500 (0.5 m 1.640 ft)					
	FDP-N1000 (1 m 3.281 ft)					
	FDP-N1500 (1.5 m 4.921 ft)					
Fiber bender	FB-1	The fiber bender bends the sleeve part of the fiber head at the proper radius. (Note 1)				
Universal sensor mounting stand (Note 2)	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 2)	MS-FX-01Y	Applicable fibers	FD-HF40Y FD-F41Y	This joint suppresses false operations due to liquid slip-in from the top of the protective tube.		
Protective tube extension joint (Note 2)	MS-FX-02Y			The protective tube can be extended.		
Fiber mounting joint (Note 2)	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.30 or p.41 for the sensing range of FR-Z50HW to be used in combination.				
	RF-220					
	RF-230					

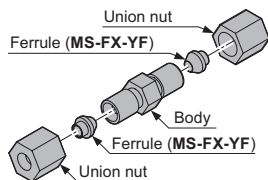
Notes: 1) Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.
 2) The joint internal ferrule (MS-FX-YF) is available as a spare part. A distorted ferrule may result in leakage.

Liquid inflow prevention joint

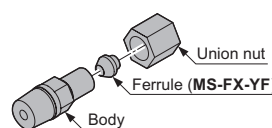
• MS-FX-01Y

**Protective tube extension joint**

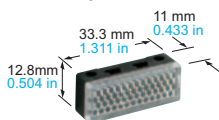
• MS-FX-02Y

**Fiber mounting joint**

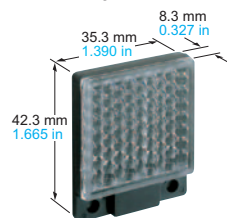
• MS-FX-03Y

**Reflector**

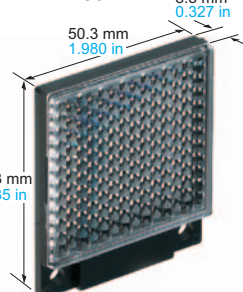
• RF-210



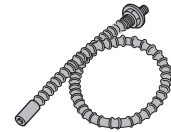
• RF-220



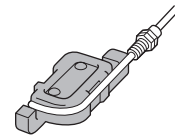
• RF-230

**Protective tube**

- FTP-□
- FDP-□

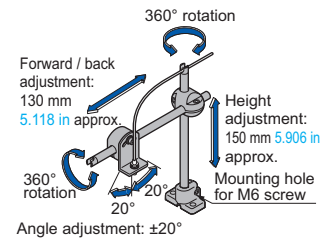
**Fiber bender**

- FB-1

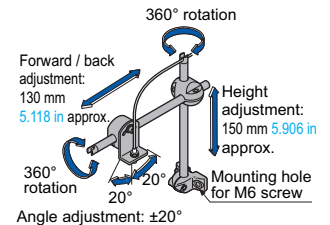
**Universal sensor mounting stand**

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

**FIBER SENSORS****LASER SENSORS****PHOTO-ELECTRIC SENSORS****MICRO PHOTO-ELECTRIC SENSORS****AREA SENSORS****LIGHT CURTAINS / SAFETY COMPONENTS****PRESSURE / FLOW SENSORS****INDUCTIVE PROXIMITY SENSORS****PARTICULAR USE SENSORS****SENSOR OPTIONS****SIMPLE WIRE-SAVING UNITS****WIRE-SAVING SYSTEMS****MEASURE-MENT SENSORS****STATIC ELECTRICITY PREVENTION DEVICES****LASER MARKERS****PLC****HUMAN MACHINE INTERFACES****ENERGY CONSUMPTION VISUALIZATION COMPONENTS****FA COMPONENTS****MACHINE VISION SYSTEMS****UV CURING SYSTEMS****Selection Guide****Fibers****Fiber Amplifiers****FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/ FX-301-F**

SPECIFICATIONS

		Type	Standard type				High-speed type	High-function type
			Red LED	Blue LED	Green LED	Infrared LED		
Item	Model No.	NPN output	FX-301	FX-301B	FX-301G	FX-301H	FX-301-HS	FX-305
		PNP output	FX-301P	FX-301BP	FX-301GP	FX-301HP	FX-301P-HS	FX-305P
Supply voltage			12 to 24 V DC ±10 %				Ripple P-P 10 % or less	
Power consumption			<Red LED / Infrared LED type> Normal operation: 960 mW or less (Current consumption 40 mA or less at 24 V supply voltage) ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)				<Blue LED / Green LED type> Normal operation: 720 mW or less (Current consumption 30 mA or less at 24 V supply voltage) ECO mode: 430 mW or less (Current consumption 18 mA or less at 24 V supply voltage)	
Output			<NPN output type> NPN open-collector transistor • Maximum sink current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less [at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) sink current.]				<NPN output type> NPN open-collector transistor 2 outputs • Maximum sink current: 50 mA each (Note 2) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less [at 50 mA (Note 2)]	
			<PNP output type> PNP open-collector transistor • Maximum source current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.) • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1.5 V or less [at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) source current.]				<PNP output type> PNP open-collector transistor 2 outputs • Maximum source current: 50 mA each (Note 2) • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1.5 V or less [at 50 mA (Note 2)]	
	Output operation		Selectable either Light-ON or Dark-ON, with jog switch					
	Short-circuit protection		Incorporated					
Response time			65 μs or less [H-SP (Red LED type only)], 150 μs or less (FAST), 250 μs or less [STD / S-D (Red LED type only)], 2 ms or less (LONG), selectable with jog switch				35 μs or less (H-SP), 150 μs or less (FAST), 250 μs or less (STD / S-D), 2 ms or less (LONG), selectable with jog switch	65 μs or less (H-SP), 150 μs or less (FAST), 250 μs or less (STD), 700 μs or less (STDF), 2.5 ms or less (LONG), 4.5 ms or less (U-LG), selectable with jog switch
Sensitivity setting			2-point teaching / Limit teaching / Manual adjustment / Full-auto teaching / Max. sensitivity teaching				Normal mode: 2-point teaching / Limit teaching / Full-auto teaching / Max. sensitivity teaching / Manual adjustment Window comparator mode: Teaching (1-point / 2-point / 3-point) / Manual adjustment	
Operation indicator			Orange LED (lights up when the output is ON)					
Stability indicator			Green LED (lights up under stable light received condition or stable dark condition)				_____	
MODE indicator			RUN: Green LED, TEACH • ADJ • L/D ON • TIMER • PRO: Yellow LED					
Digital display			4 digit red LED display					
Fine sensitivity adjustment function			Incorporated					
Timer function			Incorporated with variable ON-delay / OFF-delay / ONE SHOT timer, switchable either effective or ineffective. [Timer period: Red LED type; 0.5 ms approx., 1 to 9,999 ms (Blue LED, Green LED, Infrared LED type; approx. 0.5 to 500 ms)]				Incorporated with variable ON-delay / OFF-delay / ONE SHOT / ON-delay • OFF-delay / ON-delay • ONE SHOT timer, switchable either effective or ineffective. (Timer period: Output 1; 0.5 ms, 1 to 9,999 ms, Output 2; 0.5 ms, 1 to 500 ms)	
Light emitting amount selection function			Incorporated (Red LED type only) (Note 3) FAST, STD, LONG: 4 level, H-SP: 3 level, S-D: 2 level				Incorporated (Note 3) FAST, STD, LONG: 4 level H-SP, S-D: 2 level	Incorporated (Note 3) FAST, STD, STDF, LONG, U-LG: 4 level H-SP: 3 level
Automatic interference prevention function			Incorporated (Up to four sets of fiber heads can be mounted close together. However, 2 fiber heads in H-SP mode.) (Note 4)				_____	Incorporated [Up to four sets of fiber heads can be mounted close together. (However, 8 fiber heads in U-LG mode, 2 fiber heads in H-SP mode.)] (Note 5)
Environmental resistance	Ambient temperature		-10 to +55 °C +14 to +131 °F (If 4 to 7 units are connected in cascade: -10 to +50 °C +14 to +122 °F, if 8 to 16 units are connected in cascade: -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: 3,000 lx at the light-receiving face					
	Voltage withstandability		1,000 V AC for one min. between all supply terminals connected together and enclosure (Note 6)					
	Insulation resistance		20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure (Note 6)					
	Vibration resistance		10 to 150 Hz frequency, 0.75 mm 0.030 in amplitude in X, Y and Z directions for two hours each					
	Shock resistance		98 m/s ² acceleration (10 G approx.) in X, Y and Z directions for five times each					
Emitting element (modulated)			Red LED	Blue LED	Green LED	Infrared LED	Red LED	Red LED
	Peak emission wavelength		650 nm 0.026 mil	470 nm 0.019 mil	525 nm 0.021 mil	940 nm 0.037 mil	650 nm 0.026 mil	650 nm 0.026 mil
Material			Enclosure: Heat-resistant ABS, Case cover: Polycarbonate, MODE key: Acrylic, Jog switch: Heat-resistant ABS (FX-301B/G/H: Acrylic)					
Connecting method			Connector (Note 7)					
Cable length			Total length up to 100 m 328.084 ft (50 m 164.042 ft for 5 to 8 units, 20 m 65.617 ft for 9 to 16 units) is possible with 0.3 mm ² , or more, cable.					
Weight			Net weight: 20 g approx., Gross weight: 25 g approx.					
Accessory			FX-MB1 (amplifier protection seal): 1 set				FX-MB1 (amplifier protection seal): 1 set	

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.

2) 50 mA per output. 25 mA if five, or more, amplifiers are connected in cascade.

3) The light emitting amount can be zero (emission halt) in all modes.

4) When the power supply is switched on, the light emission timing is automatically set for interference prevention.

5) When the interference prevention function "IP-2" is set, the number of mountable fiber heads becomes double.

Furthermore, take care that the response time also becomes double.

6) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.

7) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cables given below.

Main cable (3-core) for FX-301(P)(-HS): CN-73-C1 (Cable length 1 m 3.281 ft), CN-73-C2 (Cable length 2 m 6.562 ft), CN-73-C5 (Cable length 5 m 16.404 ft)

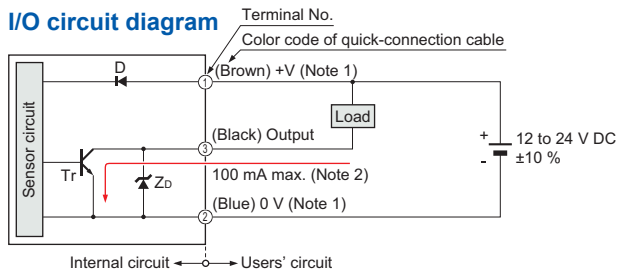
Sub cable (1-core) for FX-301(P)(-HS): CN-71-C1 (Cable length 1 m 3.281 ft), CN-71-C2 (Cable length 2 m 6.562 ft), CN-71-C5 (Cable length 5 m 16.404 ft)

Main cable (4-core) for FX-305(P): CN-74-C1 (Cable length 1 m 3.281 ft), CN-74-C2 (Cable length 2 m 6.562 ft), CN-74-C5 (Cable length 5 m 16.404 ft)

Sub cable (2-core) for FX-305(P): CN-72-C1 (Cable length 1 m 3.281 ft), CN-72-C2 (Cable length 2 m 6.562 ft), CN-72-C5 (Cable length 5 m 16.404 ft)

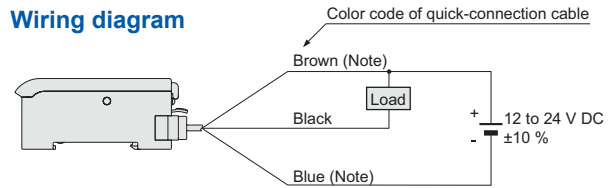
I/O CIRCUIT AND WIRING DIAGRAMS**FX-301(-HS)**

NPN output type

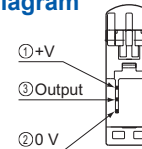
I/O circuit diagram

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected together.

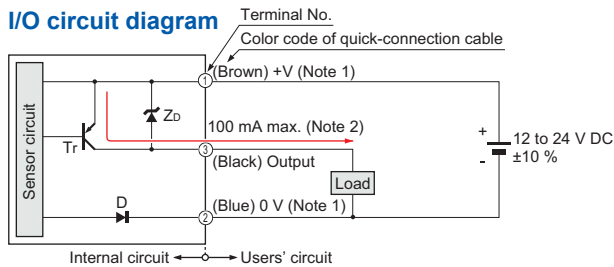
Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : NPN output transistor

Wiring diagram

Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

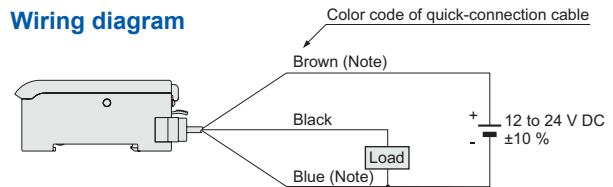
Terminal arrangement diagram**FX-301P(-HS)**

PNP output type

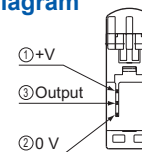
I/O circuit diagram

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected together.

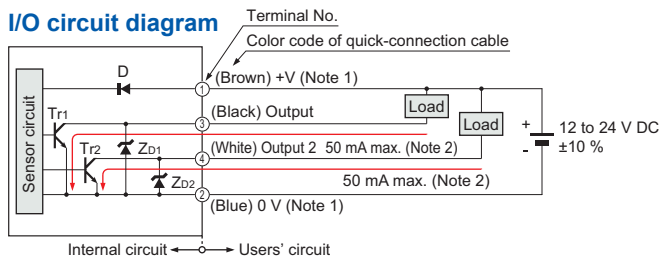
Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : PNP output transistor

Wiring diagram

Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

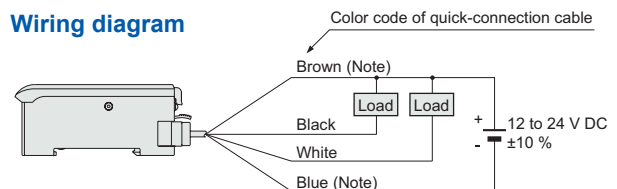
Terminal arrangement diagram**FX-305**

NPN output type

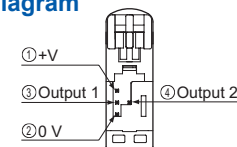
I/O circuit diagram

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers, or more, are connected together.

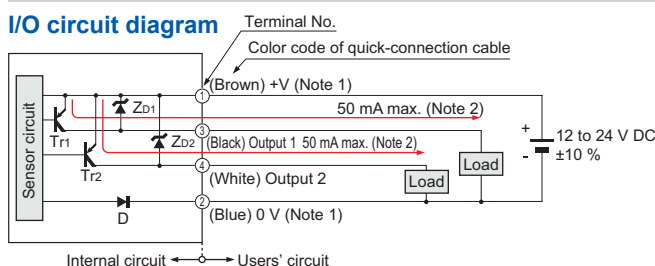
Symbols ... D: Reverse supply polarity protection diode
ZD1, ZD2: Surge absorption zener diode
Tr1, Tr2 : NPN output transistor

Wiring diagram

Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

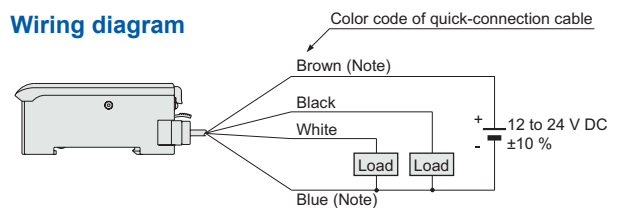
Terminal arrangement diagram**FX-305P**

PNP output type

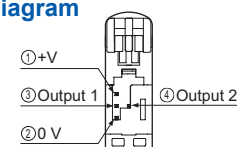
I/O circuit diagram

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers, or more, are connected together.

Symbols ... D: Reverse supply polarity protection diode
ZD1, ZD2: Surge absorption zener diode
Tr1, Tr2 : PNP output transistor

Wiring diagram

Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

Terminal arrangement diagramFIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-SAVING
UNITSWIRE-SAVING
SYSTEMSMEASURE-
MENT
SENSORSSTATIC
ELECTRICITY
PREVENTION
DEVICESLASER
MARKERS

PLC

HUMAN
MACHINE
INTERFACESENERGY
CONSUMPTION
VISUALIZATION
COMPONENTSFA
COMPONENTSMACHINE
VISION
SYSTEMSUV
CURING
SYSTEMSSelection
Guide

Fibers

Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/
FX-301-F**

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS/
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SYSTEMSSelection
Guide

Fibers

Fiber
Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

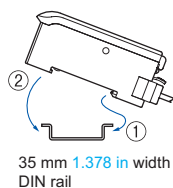
FX-301-F7/
FX-301-F**PRECAUTIONS FOR PROPER USE**

- 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.

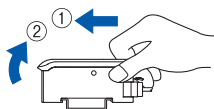
- The digital fiber sensor **FX-301(P)** has been modified since its production in June 2004. The explanations below are about the modified product.

Mounting**How to mount the amplifier**

- ① Fit the rear part of the mounting section of the amplifier on a 35 mm **1.378 in** width DIN rail.
- ② Press down the rear part of the mounting section of the unit on the 35 mm **1.378 in** width DIN rail and fit the front part of the mounting section to the 35 mm **1.378 in** width DIN rail.

**How to remove the amplifier**

- ① Push the amplifier forward.
- ② Lift up the front part of the amplifier to remove it.

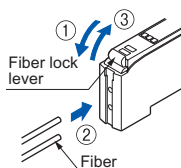


Note: Take care that if the front part is lifted without pushing the amplifier forward, the hook on the rear portion of the mounting section is likely to break.

Fiber installation

- Insert the fiber into the amplifier after attaching the attachment. Refer to the "Instruction Manual" included with the fiber for details.

- ① Push the fiber lock lever down.
- ② Slowly insert the fiber into the insertion slot until it stops. (Note 1)
- ③ Push the fiber lock lever back up until it stops.



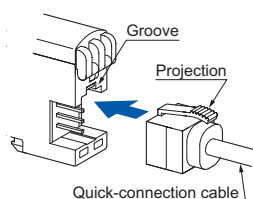
Notes: 1) Note that if the fiber is not fully inserted, the sensing distance will decrease. Also note that the flexible fiber may bend during insertion.
2) In case of coaxial reflective type fibers (**FD-G4**, **FD-FM2**, etc.), mount the central fiber (single-core) to the emitter part and the peripheral fiber (multi-core) to the receiver. Note that sensing precision will deteriorate when done in reverse.

Connection

- Make sure that the power supply is off while connecting or disconnecting the quick-connection cable.

Connection method

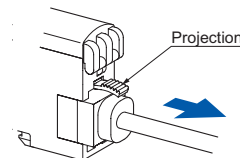
- ① Holding the connector of the quick-connection cable, align its projection with the groove at the top portion of the amplifier connector.
- ② Insert the connector till a click is felt.



Refer to p.1458~ for general precautions and to the "PRO mode operation guide" on our website for details pertaining to operating instructions for the amplifier.

Disconnection method

- ① Pressing the projection at the top of the quick-connection cable, pull out the connector.



Note: Take care that if the connector is pulled out without pressing the projection, the projection may break. Do not use a quick-connection cable whose projection has broken. Further, do not pull by holding the cable, as this can cause a cable-break.

Cascading

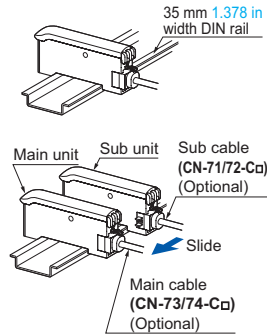
- Make sure that the power supply is off while adding or removing the amplifiers.
- Make sure to check the allowable ambient temperature, as it depends on the number of amplifiers connected in cascade.
- In case two, or more, amplifiers are connected in cascade, make sure to mount them on a DIN rail.
- When the amplifiers move on the DIN rail depending on the attaching condition or the amplifiers are mounted close to each other in cascade, fit them between the optional end plates (**MS-DIN-E**) mounted at the two ends.
- Up to maximum 15 amplifiers can be added (total 16 amplifiers connected in cascade.)
- When connecting more than two amplifiers in cascade, use the sub cable (**CN-71-C□** / **CN-72-C□**) as the quick-connection cable for the second amplifier onwards.
- When connecting amplifiers not close to each other in parallel, be sure to mount the optional end plate (**MS-DIN-E**) at both sides of each amplifier or affix the communication window seal of the accessory amplifier protection seal (**FX-MB1**) to the communication windows.
- The settings other than the interference prevention function cannot be transmitted between **FX-301(P)**, **FX-301B/G/H(P)**, **FX-305(P)**. Therefore, in case both models of amplifiers are mounted in cascade, be sure to mount identical models together. However, the interference prevention function is not incorporated in the **FX-301(P)-HS**. Take care when the sensors are mounted in cascade.
- If the **FX-301(P)** updated version unit or the **FX-305(P)** is mounted with the **FX-301(P)** previous version unit or the **FX-301B/G/H(P)** in cascade, place the **FX-301(P)** updated version units and the **FX-305(P)** units to the right side (seen from the connector side) of the previous version units. For details, refer to "**Cautions on sensor connection in cascade**".
For a difference between the updated version unit and the previous version unit, refer to "**A difference between the updated version unit and the previous version unit**".
- The communication function of this product and that of the **FX-301(P)-F** / **F7** is different. If these models are mounted in cascade, affix the accessory fiber amplifier protection seal (**FX-MB1**) included in the **FX-301(P)** and **FX-305(P)** to the communication windows of the amplifiers.

PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions and to the "PRO mode operation guide" on our website for details pertaining to operating instructions for the amplifier.

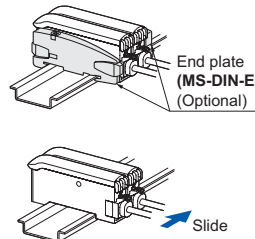
Cascading method

- Mount the amplifiers, one by one, on the 35 mm 1.378 in width DIN rail.
- Slide the amplifiers next to each other, and connect the quick-connection cables.
- Mount the optional end plates (**MS-DIN-E**) at both the ends to hold the amplifiers between their flat sides.
- Tighten the screws to fix the end plates.



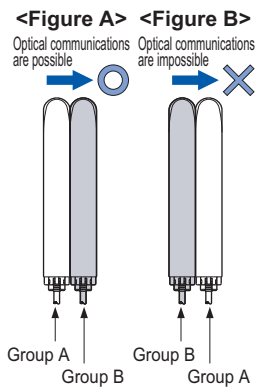
Dismantling

- Loosen the screws of the end plates.
- Remove the end plates.
- Slide the amplifiers and remove them one by one.



Cautions on sensor connection in cascade

- When the units in the group A and the group B shown in the table below are connected in cascade, connect them in cascade as **<Figure A>** shown below.



Group A	FX-301(P): Previous version unit (Note 1), FX-301G(P)/B(P)/H(P), FX-41□(P), LS-401(P) (Note 2)
Group B	FX-301(P): Updated version unit (Note 1), FX-305(P)

Notes: 1) For the difference between the updated version unit and the previous version unit, refer to "A difference between the updated version unit and the previous version unit".
 2) When LS-401(P) is connected with the digital fiber amplifier in cascade, be sure to locate LS-401(P) at the left-most position (when viewed from the connector side).

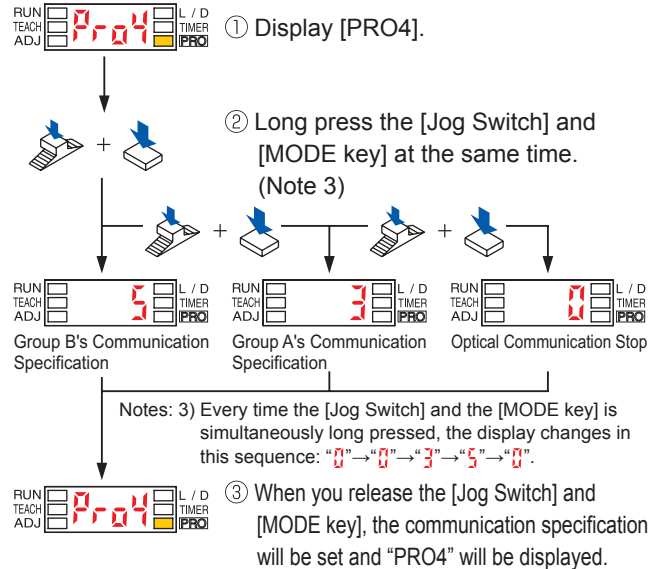
- When the units of the group A and the group B are connected in cascade as **<Figure B>** shown above, optical communications cannot be done. When the optical communications function is used, connect them as **<Figure A>** shown above. If the units cannot be placed as **<Figure A>**, the following measure ① or ② should be taken.

- Affix the communication window seal of the accessory fiber amplifier protection seal (**FX-MB1**) to the communication window of the **FX-301(P)** updated version unit or **FX-305(P)**.
- If the measure ① described above cannot be taken, change the optical communications spec. of the group B units.

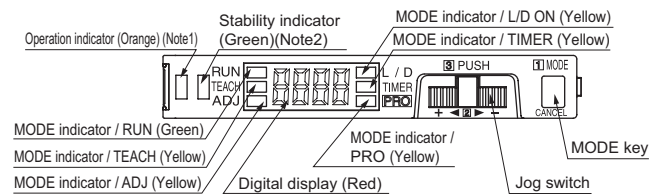
How to change the communication specification of Group B

- Change the communication specification of Group B according to the following procedures. Make sure to set the communication specification to "3" (Group A communication specification) or "0" (Optical Communication Stop).

<Changing Procedure>



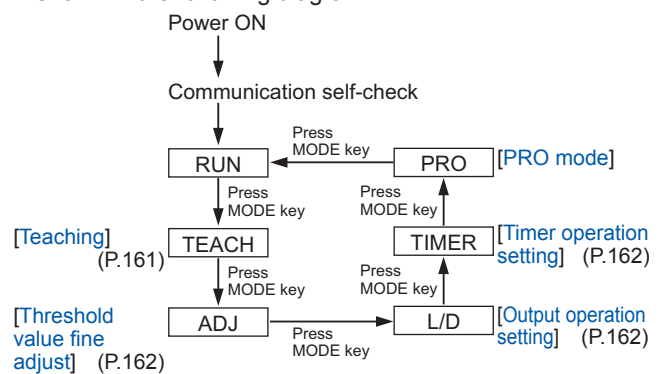
Part description



Notes: 1) **FX-305(P)**: Output 1 operation indicator (Orange)
 2) **FX-305(P)**: Output 2 operation indicator (Orange)

Operation procedure

- When the power supply is switched on, communication self-check is carried out and normal condition is displayed [MODE indicator / RUN (green)] lights up and the digital display shows the incident light intensity.
- When the MODE key is pressed, the mode will change as shown in the following diagram.



FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SYSTEMS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F7/ FX-301-F

PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions and to the "PRO mode operation guide" on our website for details pertaining to operating instructions for the amplifier.

For FX-305(P)

The **FX-305(P)** is equipped with two independent outputs, but the items that can be set in output 1 and output 2 respectively are only the following.

The items other than those are common.

- ① Threshold value ② Output operation
③ Timer operation and Timer period ④ Sensing mode

Teaching

- The threshold values can be set by 2-point teaching, limit teaching, full-auto teaching or window comparator mode (1-point, 2-point, 3-point teaching) [only for **FX-305(P)**], when the MODE indicator / TEACH (yellow) lights up.

In case of 2-point teaching

- This is the method of setting the threshold value by teaching two levels, corresponding to the object present and object absent conditions. Normally, setting is done by this method.

Step	Description	Display
①	Set the fiber within the sensing range. Press MODE key to light up MODE indicator / TEACH (yellow).	
②	For FX-305(P) , select either Output 1 "Out 1" or Output 2 "Out 2" beforehand, press jog switch in the object present condition. If the teaching is accepted, the read incident light intensity blinks in the digital display. 	
③	MODE indicator / TEACH (yellow) blinks. Press jog switch in the object absent condition. 	
④	If the teaching is accepted, the read incident light intensity blinks in the digital display and the threshold value is set at the mid-value between the incident light intensities in the object present and the object absent conditions. After this, the judgment on the stability of sensing is displayed. • In case stable sensing is possible: "Good" is displayed. • In case stable sensing is not possible: "Bad" blinks.	
⑤	The threshold value is displayed.	
⑥	"...." blinks in the digital display. (only FX-301B/G/H)	
⑦	The incident light intensity appears in the digital display and the setting is complete.	

Notes: 1) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

- 2) In case a reflective-type fiber is used, maximum sensitivity will be set if the jog switch is pushed while in no work status in procedure ② and ③.

In case of full auto-teaching

- Full auto-teaching is used when it is desired to set the threshold value without stopping the assembly line, with the object in the moving condition.

Step	Description	Display
①	Set the fiber within the sensing range. Press MODE key to light up MODE indicator / TEACH (yellow).	
②	For FX-305(P) , select either Output 1 "Out 1" or Output 2 "Out 2" beforehand, press the jog switch continuously for 0.5 sec. or more with the object moving on the assembly line. (The incident light intensity is displayed during sampling.)	
③	"Auto" is displayed on the digital display. Release the jog switch when the object has passed.	
④	If the teaching is accepted, the read incident light intensity blinks in the digital display and the threshold value is set at the mid-value between the incident light intensities in the object present and the object absent conditions. After this, the judgment on the stability of sensing is displayed. • In case stable sensing is possible: "Good" is displayed. • In case stable sensing is not possible: "Bad" blinks.	
⑤	The threshold value is displayed.	
⑥	"...." blinks in the digital display. (only FX-301B/G/H)	
⑦	The incident light intensity appears in the digital display and the setting is complete.	

- Notes: 1) The threshold value's shift amount can be selected in PRO mode. Refer to the "PRO Mode Operation Guide" for more details pertaining to setting instructions. (Increments of 5 % between -45 and 45 % for setting possible. 0 % default.)
2) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions and to the "PRO mode operation guide" on our website for details pertaining to operating instructions for the amplifier.

In case of limit teaching

- This is the method of setting the threshold value by teaching only the object absent condition (stable incident light condition). This is used for detection in the presence of a background body or for detection of small objects.

Step	Description	Display
①	Set the fiber within the sensing range. Press MODE key to light up MODE indicator / TEACH (yellow).	
②	For FX-305(P) , select either Output 1 "Out 1" or Output 2 "Out 2" beforehand, press jog switch in the object absent condition. If the teaching is accepted, the read incident light intensity blinks in the display. Thru-beam type Reflective type	
③	MODE indicator / TEACH (yellow) blinks. Turn jog switch to the "+" side or "-" side.	
④	If jog switch is turned to the "+" side, " " scrolls (twice) the display from right to left (Note 1), and the threshold level is shifted to a value approx. 15 % higher (lower sensitivity) than that set at ②. (Note 2) This is used in case of reflective type fibers. If jog switch is turned to the "-" side, " " scrolls (twice) the display from left to right, and the threshold level is shifted to a value approx. 15 % lower (higher sensitivity) than that set at ②. (Note 2) This is used in case of thru-beam type fibers. High Threshold value 100% 15% 15% Low 0 OFF ON Threshold value Incident light intensity with object absent Threshold value Turn to "+" side Turn to "-" side	
⑤	After this, the judgment on whether the setting shift amount can be shifted or not is displayed. • In case shifting is possible: "Good" blinks. • In case shifting is not possible: "Err" blinks.	
⑥	The threshold value is displayed.	
⑦	"..." blinks in the digital display. (only FX-301B/G/H)	
⑧	The incident light intensity appears in the digital display and the setting is complete.	

- Notes: 1) Scrolling display is not available in **FX-301B/G/H**.
2) The approx. 15 % amount of shift is the initial value. The amount of shift can be changed in the PRO mode from approx. 5 to 80 % (5 % step). Refer to the "PRO Mode Operation Guide" for more details pertaining to setting instructions.
3) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

Please download the instruction manual from our website for setting of threshold value when used in combination with liquid level sensing fiber **FD-F8Y** and with pipe-mountable liquid level sensing fiber **FD-F4**.

For the wind comparator mode teaching in **FX-305(P)**, refer to the separately prepared "PRO Mode Operation Guide".

Threshold value fine adjustment

Step	Description	Display
①	Press MODE key to light up MODE indicator / ADJ (yellow). MODE indicator / ADJ (yellow).	
②	For FX-305(P) , select either Output 1 "Out 1" or Output 2 "Out 2" beforehand, in case the threshold value is to be increased (sensitivity to be reduced), turn the jog switch to the "+" side to increase the threshold value slowly. If the jog switch is turned continuously to the "+" side, the threshold value increases rapidly. In case the threshold value is to be decreased (sensitivity to be increased), turn the jog switch to the "-" side to decrease the threshold value slowly. If the jog switch is turned continuously to the "-" side, the threshold value decreases rapidly. + - 1234 1235 or 1234 1233	 or
③	When jog switch is pressed, the threshold value is confirmed. MODE indicator / ADJ (yellow).	

Output operation setting

Step	Description	Display
①	Press MODE key to light up MODE indicator / L/D ON (yellow). MODE indicator / L/D ON (yellow).	 Displays present setting
②	For FX-305(P) , select either Output 1 "Out 1" or Output 2 "Out 2" beforehand, if the jog switch is turned to the "+" or "-" direction, the output operation setting will change. + - L-on d-on	 Light state Dark state
③	When jog switch is pressed, the threshold value is confirmed. MODE indicator / L/D ON (yellow).	 Displays selected setting

Timer operation setting

- The setting for whether the timer is used or not can be done when MODE indicator / TIMER (yellow) lights up. For **FX-301B/G/H**, the timer type can be set in PRO mode.
- Further, an OFF-delay (initial value) which is useful when the response of the connected device is slow, etc., an ON-delay which is useful to detect only objects taking a long time to travel, and ONE SHOT, which is useful when the input specifications of the connected device require a signal of a fixed width, are possible with the **FX-301(-HS)**. **FX-305(P)** is also equipped with ON-delay • OFF-delay and ON-delay • ONE SHOT timers. Refer to the "PRO Mode Operation Guide" for the setting method of the OFF-delay, ON-delay and ONE SHOT timer intervals.

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MICRO PHOTO-ELECTRIC SENSORS

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INDUCTIVE PROXIMITY SENSORS

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Refer to p.1458~ for general precautions and to the "PRO mode operation guide" on our website for details pertaining to operating instructions for the amplifier.

Wiring

- Make sure that the power supply is off while wiring.
- Verify that the supply voltage variation is within the rating.
- Take care 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.
- 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.
- Take care that short circuit of the load 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.
- Make sure to use an isolation transformer for the DC power supply. If an autotransformer (single winding transformer) is used, this product or the power supply may get damaged.
- Make sure to use the optional quick-connection cable for the connection of the amplifier. Extension up to total 100 m **328.084 ft** is possible with 0.3 mm², or more, cable. (5-8 unit expansion: 50 m **164.042 ft**, 9-16 unit expansion: 20 m **65.617 ft**) However, in order to reduce noise, make the wiring as short as possible.
- Note that the residual voltage will increase when the cable is extended.

Key-lock function

- If jog switch and MODE key are pressed for more than 2 sec. at the same time in 'RUN' mode condition, the key operations are locked, and only the threshold value confirmation function or the adjust function (valid only when the adjust lock function is canceled) is valid. To cancel the lock function, press both the keys for more than 2 sec. once again.

Note: 3 seconds or more for **FX-301B/G/H(P)**.

Others

- When the emission halt of the light emitting amount selection function is set from "OFF" to "ON", the output may be unstable. Do not use the output control for 0.5 sec. after starting emission.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Take care that the sensor is not directly exposed to fluorescent lamp from a rapid-starter lamp, a high frequency lighting device or sunlight etc., as it may affect the sensing performance.
- Do not use this sensor in places having excessive vapor, dust, etc., or where it may come in contact with corrosive gas.
- Take care that the product does not come in direct contact with water, oil, grease, or organic solvents, such as, thinner, etc.
- This sensor cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify the sensor.

Function table for FX-300 series

	Previous models			New models		
	Standard type	High-function type	High-speed type	Standard type	High-speed type	High-function type
	FX-301(P) (Previous version unit)	FX-302(P)	FX-303(P)	FX-301(P) (Updated version unit)	FX-301(P)-HS	FX-305(P)
Selection Guide	Four-chemical emitting element + APC circuit	No	No	Yes	Yes	Yes
Fibers	Four-chemical emitting element only	Yes (Note)	Yes	Yes	Yes	Yes
Fiber Amplifiers	Light emitting amount selection function	No	No	Yes	Yes	Yes
	Reduced intensity mode (S-D)	Yes (Note)	Yes	Yes	Yes	Yes
	9,999 digit display	No	No	No	No	Yes
FX-500	Response time (Max. speed)	150 μs	300 μs	65 μs	35 μs	65 μs
FX-100	Interference prevention function (Effective no. of units)	Incorporated (4)	Incorporated (8)	Incorporated (4)	Not incorporated (0)	Incorporated (16)
FX-300	Independent 2 outputs	No	No	No	No	Yes
FX-410	Alarm output function	No	No	No	No	Yes
FX-311	Error output function	No	No	No	No	Yes
FX-301-F7/ FX-301-F	Differential sensing	No	No	No	No	Yes
	Window comparator mode	No	Yes	No	No	Yes

Peripheral units that can be combined

Bank selection unit FX-CH(-P)	Yes	Yes	No	No	No	No
External input unit FX-CH2(-P)	No	No	No	Yes	No	Yes
Upper communication unit SC-GU1-485	No	No	No	Yes	No	Yes

Note: Except **FX-301B/G/H**.

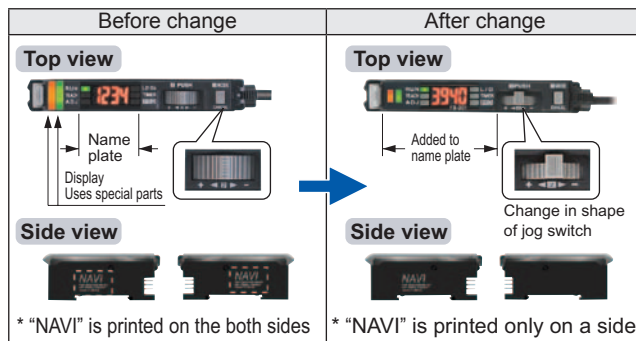
PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions and to the "PRO mode operation guide" on our website for details pertaining to operating instructions for the amplifier.

A difference between the updated version unit and the previous version unit for FX-301(P) (Red LED type)

- The product has been modified as shown below since its production in June 2004.

Changes in appearance



- Checking minor changes between previous and updated models can be done by checking whether the printing is on both sides or only one side.

Upgraded functions

1. Response times added

An ultra high-speed mode (H-SP) has been added to the existing 4 response time modes [high-speed (FAST), reduced intensity (S-D), standard (STD) and long range (LONG)].

This is changed using "Pro1" in "SPED"

Before change	After change
4 steps	5 steps
150 μs (FAST)	65 μs (added) (H-SP)
250 μs (S-D)	150 μs (FAST)
250 μs (STD)	250 μs (S-D)
2 ms (LONG)	250 μs (STD)
	2 ms (LONG)

2. Extension of timer period

The setting range for the timer period was previously 500 ms, but this has been extended to a new range of 9,999 ms.

3. Light emitting amount selection function

The light emitting amount can be changed to one of 4 levels (5 levels when emission halt is included).

4. Backup, copy lock and key lock functions added

Backup: This selects whether or not threshold values set by teaching are written to (stored in) an EEPROM.

Copy lock: This selects whether copy function and data bank function communication are possible or not.

Key lock: This disables input using switches to prevent accidental changing of settings.

Changes in operation

1. Timer selection method

Previous version unit: Timer type was changed using PRO1 mode. The "TIMER" setting in NAVI mode could only be turned on or off.

After change: The type of timer can be changed using the "TIMER" function in NAVI mode.

2. Checking threshold value in RUN mode

The threshold values can be checked by turning the jog switch.

Display changes

1. Checking blinking of sensitivity surplus

The stable surplus display method after teaching has been changed.

Previous version unit: Sensitivity surplus is indicated by the number of blinks of the stability indicator.

After change Digital display only

2. Initial direct code value changed

The factory default settings for the direct codes have been changed.

Previous version unit 0000 → After change 0004

* The default setting for the timer period is 10 ms, and the direct code for 10 ms is "4", so this has been changed.

Internal circuit changes

1. Addition of an APC circuit

A four-chemical emitting element which provides stable sensing over long periods has been added, as well as an APC (Auto Power Control) circuit that improves stability during short periods.

Cautions on sensor connection in cascade

When connecting the previous version unit (including FX-301B/G/H) and updated version unit to be used in a cascade, refer to "Cautions on sensor connection in cascade".

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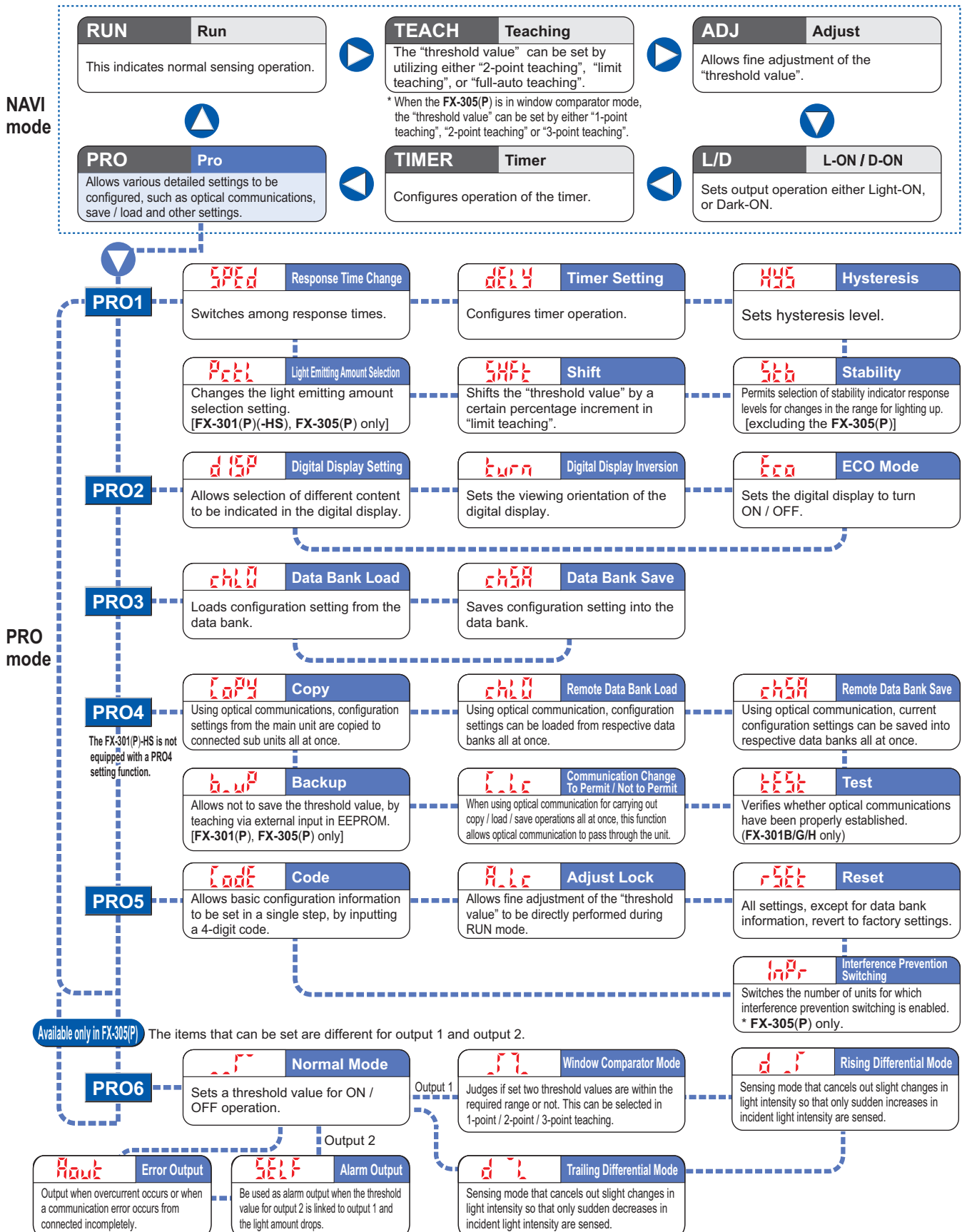
FX-301-F

PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions and to the "PRO mode operation guide" on our website for details pertaining to operating instructions for the amplifier.

Diagram of functions and settings

The amplifier features and settings are generally classified into two main modes; the "NAVI mode" for items and settings that are frequently reconfigured, and the "PRO mode" that contains more detailed settings.



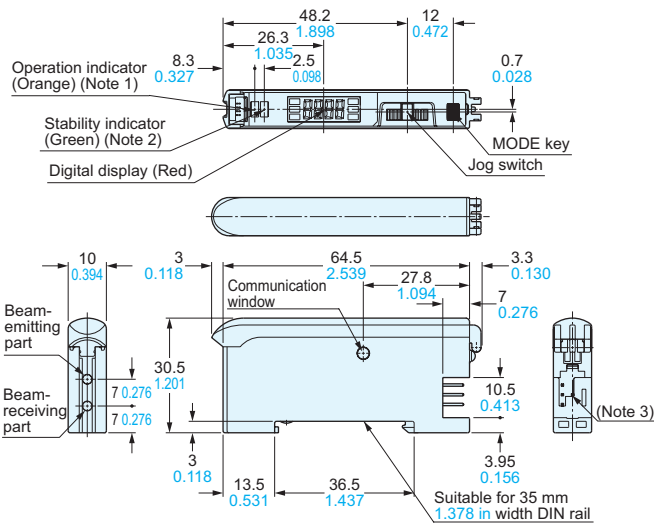
* The 0-ADJ setting function equipped on the **FX-301** and **FX-305(P)** has been deleted since the production in May 2005.

DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

FX-301□ FX-305(P)

Amplifier



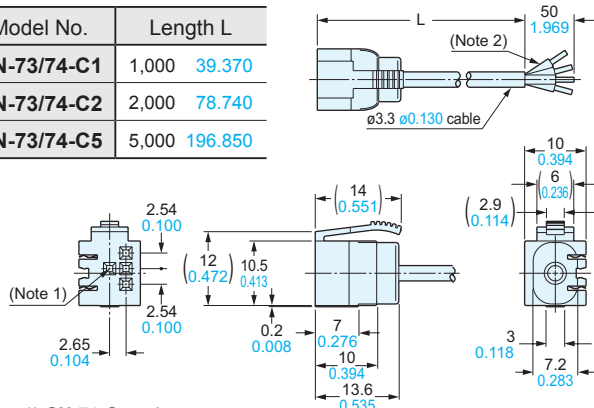
- Notes: 1) **FX-305□**; Output 1 operation indicator (Orange)
2) **FX-305□**; Output 2 operation indicator (Orange)
3) **FX-301□**; 3-pin, **FX-305□**; 4-pin

CN-73-C□ CN-74-C□

Main cable (Optional)

• Length L

Model No.	Length L
CN-73/74-C1	1,000 39.370
CN-73/74-C2	2,000 78.740
CN-73/74-C5	5,000 196.850



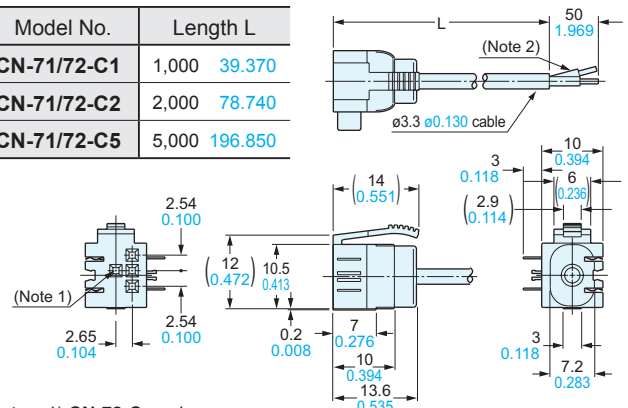
- Notes: 1) **CN-74-C□** only
2) **CN-73-C□**; 3-core

CN-71-C□ CN-72-C□

Sub cable (Optional)

• Length L

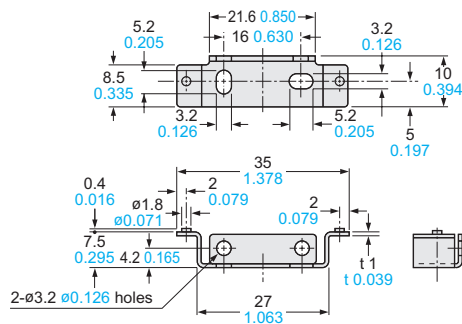
Model No.	Length L
CN-71/72-C1	1,000 39.370
CN-71/72-C2	2,000 78.740
CN-71/72-C5	5,000 196.850



- Notes: 1) **CN-72-C□** only
2) **CN-71-C□**; 1-core

MS-DIN-2

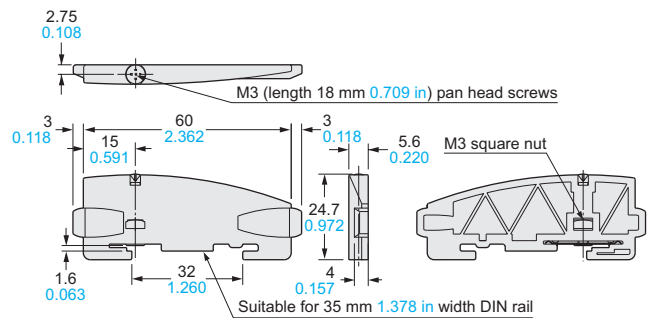
Amplifier mounting bracket (Optional)



Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

MS-DIN-E

End plate (Optional)



Material: Polycarbonate

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FX-301-F

Digital Fiber Sensor

FX-410 SERIES

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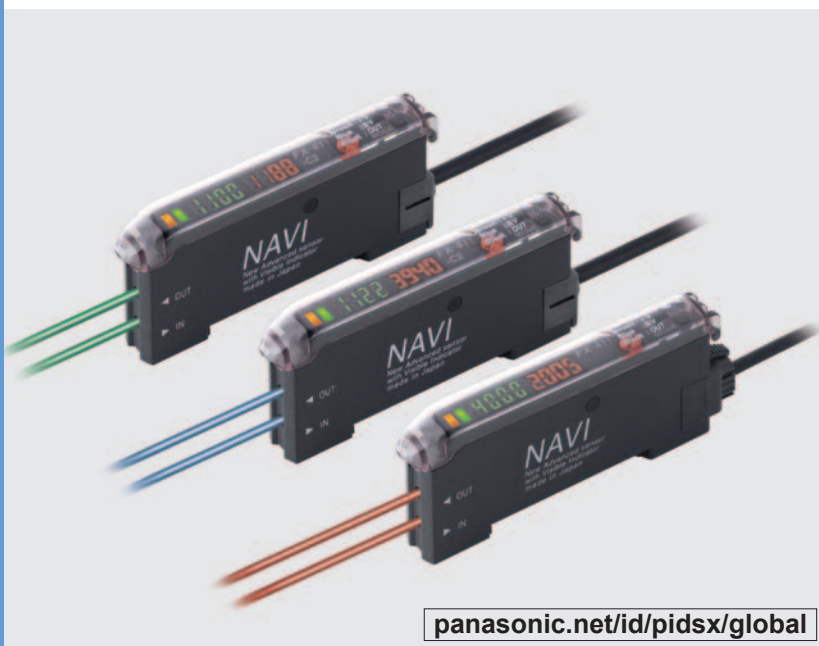
FX-311

FX-301-F7/ FX-301-F

Related Information

- General terms and conditions..... F-7
- Glossary of terms / General precautions..... P.1455~ / P.1458~

- Sensor selection guide P.3~
- Korea's S-mark..... P.1506



panasonic.net/id/pidsx/global



Just “Look” and “Turn”, Simple, easy-to-use fiber sensor

Incident light intensity and threshold value are displayed simultaneously

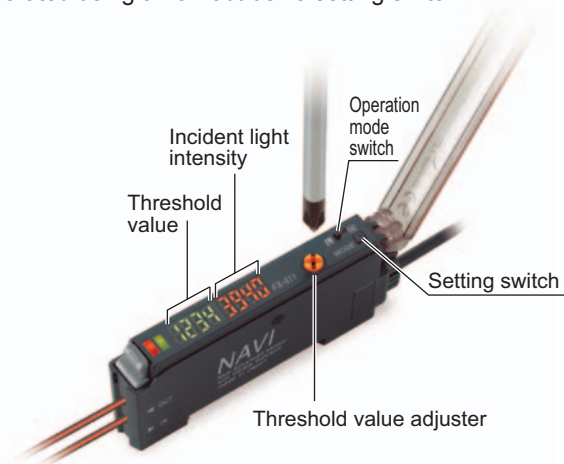
The incident light intensity and threshold value can be checked at the same time with no operations needed. In addition, no complex mode settings are needed when the values are adjusted.

Adjustment variations according to the individual have been eliminated

Accurate control of the adjuster threshold values by using numerical values is possible due to the digital display. This allows anybody to perform the same settings.

Easy-to-understand operating panel layout

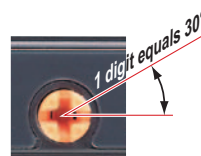
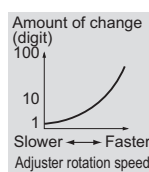
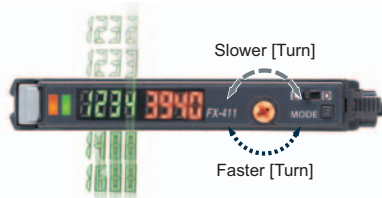
The threshold value adjuster and operation mode switch are large and easy to see, and they can be operated with the same sensitivity as general-purpose photoelectric sensors. Functions which are not commonly used can be operated using a non-obtrusive setting switch.



Threshold values can be changed smoothly

This sensor uses the R.S.S.* adjuster with a compact encoder inside. The sensitivity amount changes depending on the rotation speed of the adjuster, so that adjustment can be carried out speedily.

* Rotation Speed Sensitivity



Adjustment in units of 1 digit is also easy
No need for the fine changes in force required for photoelectric sensors.

Large endless adjuster**New concept**

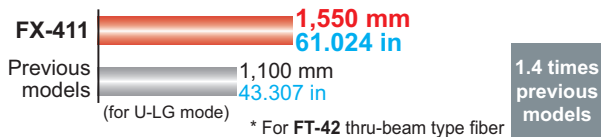
Standard screwdrivers can be used to turn the adjuster as well as precision screwdrivers. In addition, an “endless” mechanism is used which eliminates the possibility of any damage being caused by turning the adjuster too far.

**FX-412 can be turned by finger!****New concept**

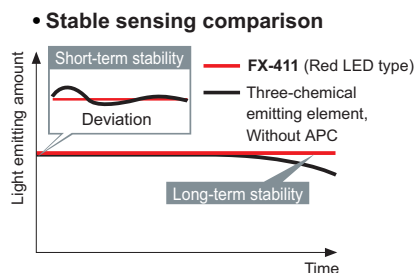
The adjuster can be turned directly by finger, without the need for a screwdriver.

**Beam power greatly increased to give strong performance under adverse environments****Red LED type**

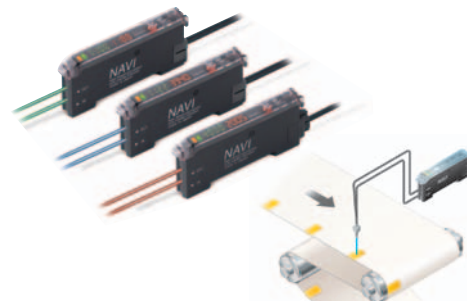
The beam power has been greatly increased. This means a longer sensing distance and less trouble from problems such as dust. These sensors have ample performance for workplace needs.

**Improved stability over both long and short terms****Red LED type**

The red LED type sensors have a “four-chemical emitting element” which maintains stability of light emissions for long-term operation. Furthermore, all models have an “APC (Auto Power Control) circuit” which improves stability at times such as when the power is turned on. These features improve overall stability compared to previous models.

**Three types are available, with red, blue and green light**

Different sensors can be selected to suit the application.



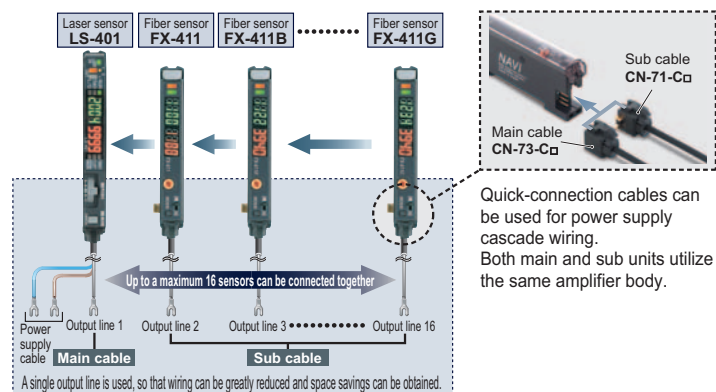
Color combinations that can be discerned during mark sensing

Mark color	White	Yellow	Orange	Red	Green	Blue	Black
Back-ground color							
White		•	•	•	•	•	•
Yellow	•		•	•	•	•	•
Orange	•	•		•	•	•	•
Red	•	•	•		•	•	•
Green	•	•	•	•		•	•
Blue	•	•	•	•	•		•
Black	•	•	•	•	•	•	

• Red LED type • Blue LED type • Green LED type

Excellent workability and ease of maintenance

The same quick-connection cable that is used for sensors such as the **FX-300** series of digital fiber sensors is used. This means that they can be used together with other types of sensors such as laser sensors, and the number of power supply cables can be reduced.

**Connector type****FIBER SENSORS****LASER SENSORS****PHOTOELECTRIC SENSORS****MICRO PHOTOELECTRIC SENSORS****AREA SENSORS****LIGHT CURTAINS / SAFETY COMPONENTS****PRESSURE / FLOW SENSORS****INDUCTIVE PROXIMITY SENSORS****PARTICULAR USE SENSORS****SENSOR OPTIONS****SIMPLE WIRE-SAVING UNITS****WIRE-SAVING SYSTEMS****MEASUREMENT SENSORS****STATIC ELECTRICITY PREVENTION DEVICES****LASER MARKERS****PLC****HUMAN MACHINE INTERFACES****ENERGY CONSUMPTION VISUALIZATION COMPONENTS****FA COMPONENTS****MACHINE VISION SYSTEMS****UV CURING SYSTEMS****Selection Guide****Fibers****Fiber Amplifiers****FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/ FX-301-F**

FIBER
SENSORSLASER
SENSORSPHOTOELECTRIC
SENSORSMICRO
PHOTOELECTRIC
SENSORSAREA
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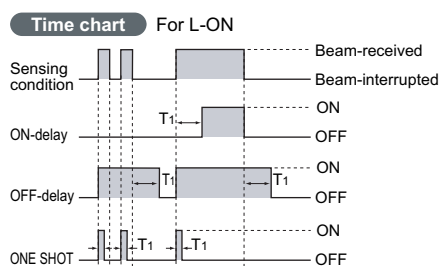
Fibers

Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/
FX-301-F****Contributing to device miniaturization**

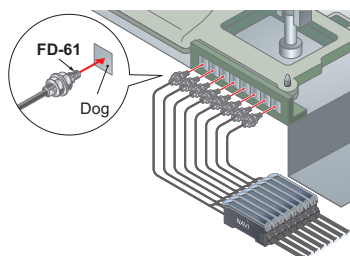
This fiber sensor is the smallest among the dual digital display types, contributing to device miniaturization.

**Equipped with 3 types timers**

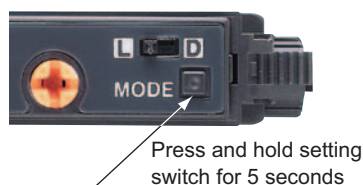
Equipped with OFF-delay / ON-delay / ONE SHOT timer. (Timer period: 1 ms to 3 sec. approx.)

**Interference prevention for up to 8 sets fiber heads (for U-LG)**

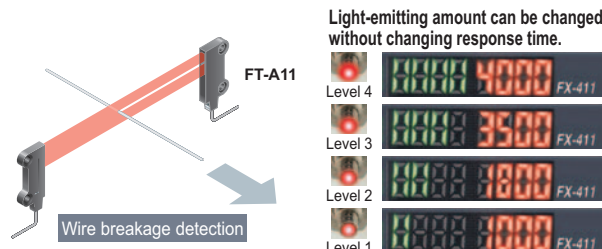
The optical communication function allows up to a maximum of eight sets of fiber heads (four sets for FAST and STD settings) to be installed in contact with each other without mutual interference occurring. (Set automatically when power is turned on.)

**Key lock function prevents wrong operation**

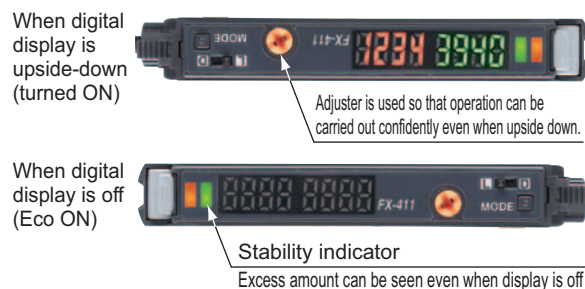
This prevents the operator from changing the threshold value by mistake.

**Ideal for dealing with saturation / Light-emitting amount selection function****Red LED type** **New concept**

In cases where the incoming light level can become saturated, such as during close-range sensing or when sensing transparent or minute objects, the sensor's light-emitting amount can be adjusted to provide more stable sensing without changing the response time.

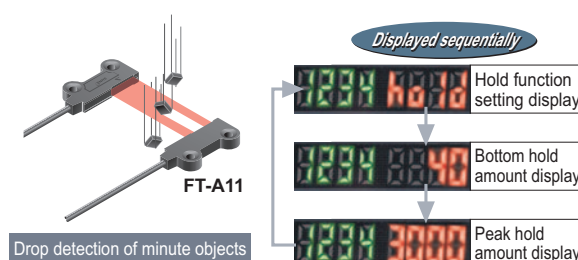
**Digital display upside-down / off function**

The digital display can be turned upside-down if required to suit the setup location. In addition, a stability indicator is also provided, so that the amount of light-receiving excess can be checked even when the display is turned off.

**Hold function**



Peak and bottom hold values for the incident light intensity can be displayed. This is useful for checking the incident light intensity during tasks such as drop detection.

In addition, the peak and bottom values can be checked while looking at the threshold value, which makes adjustment much easier.



ORDER GUIDE**Amplifiers**

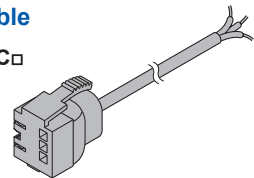
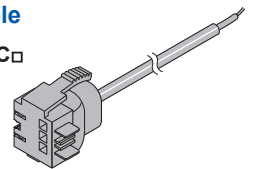
Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Appearance	Model No.	Emitting element	Output
NPN output		FX-411	Red LED	NPN open-collector transistor
		FX-411B	Blue LED	
		FX-411G	Green LED	
PNP output		FX-411P	Red LED	PNP open-collector transistor
		FX-411BP	Blue LED	
		FX-411GP	Green LED	
NPN output		FX-412 (Note)	Red LED	NPN open-collector transistor
		FX-412B (Note)	Blue LED	
		FX-412G (Note)	Green LED	

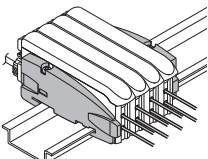
Note: The **FX-412**□ has a threshold value adjuster that can be adjusted with your fingers.**Quick-connection cables**

Quick-connection cable is not supplied with the amplifier. Please order it separately.

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

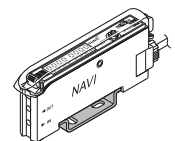
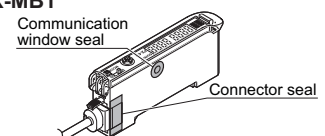
Main cable• **CN-73-C**□**Sub cable**• **CN-71-C**□**End plates**

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 cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. Two pcs. per set

OPTIONS

Designation	Model No.	Description
Amplifier mounting bracket	MS-DIN-2	Mounting bracket for amplifier
Fiber amplifier protection seal	FX-MB1	10 sets of 2 communication window seals and 1 connector seal Communication window seal: It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier. Connector seal: It prevents contact of any metal, etc., with the pins of the quick-connection cable.

Amplifier mounting bracket• **MS-DIN-2****Fiber amplifier protection seal**• **FX-MB1**

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MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

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Fiber Amplifiers

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FX-100

FX-300

FX-410

FX-311

FX-301-F7/
FX-301-F

LIST OF FIBERS

Thru-beam type (one pair set)



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)									Dimensions
	Red LED			Blue LED			Green LED			
	U-LG	STD	FAST	U-LG	STD	FAST	U-LG	STD	FAST	
FT-140	19,600 771.654 (Note 2)	16,000 629.921	15,000 590.551	14,000 551.181	3,300 129.921	2,200 86.614	9,500 374.016	2,500 98.425	1,800 70.866	P.51
FT-30	600 23.622	145 5.709	95 3.740	90 3.543	24 0.945	15 0.591	45 1.772	12 0.472	8 0.315	P.51
FT-31	540 21.260	140 5.512	85 3.346	85 3.346	20 0.787	14 0.551	38 1.496	10 0.394	7 0.276	P.51
FT-31S	540 21.260	140 5.512	85 3.346	85 3.346	20 0.787	14 0.551	38 1.496	10 0.394	7 0.276	P.51
FT-31W	380 14.961	80 3.150	55 2.165	53 2.087	16 0.630	9 0.354	28 1.102	7 0.276	4 0.157	P.51
FT-40	1,600 62.922	345 13.583	245 9.646	250 9.843	65 2.559	45 1.772	140 5.512	40 1.575	25 0.984	P.51
FT-42	1,550 61.024	340 13.386	240 9.449	230 9.055	60 2.362	40 1.575	125 4.921	33 1.299	22 0.866	P.51
FT-42S	1,550 61.024	340 13.386	240 9.449	230 9.055	60 2.362	40 1.575	125 4.921	33 1.299	22 0.866	P.51
FT-42W	1,300 51.181	290 11.417	210 8.268	220 8.661	57 2.244	33 1.299	110 4.331	32 1.260	19 0.748	P.51
FT-43	2,200 86.614	450 17.717	310 12.205	460 18.110	120 4.724	75 2.953	250 9.843	62 2.441	44 1.732	P.51
FT-45X	1,600 62.992	370 14.567	280 11.024	260 10.236	64 2.520	45 1.772	130 5.118	34 1.339	23 0.906	P.52
FT-A11	3,600 141.732 (Note 2)	2,400 94.488	1,800 70.866	1,300 51.181	350 13.780	220 8.661	770 30.315	190 7.480	120 4.724	P.52
FT-A11W	3,600 141.732 (Note 2)	2,500 98.425	2,000 78.740	1,300 51.181	350 13.780	220 8.661	550 21.654	150 5.906	130 5.118	P.52
FT-A32	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,500 98.425	750 29.528	380 14.961	1,500 59.055	220 8.661	130 5.118	P.52
FT-A32W	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,400 133.858	800 31.496	470 18.504	2,100 82.677	330 12.992	140 5.512	P.52
FT-AL05	1,100 43.307	240 9.449	180 7.087	220 8.661	55 2.165	35 1.378	125 4.921	30 1.181	20 0.787	P.52
FT-E13	30 1.181	7 0.276	5 0.197	2.5 0.098	————	————	1 0.039	————	————	P.52
FT-E23	110 4.331	20 0.787	15 0.591	12 0.472	3 0.118	2 0.079	6 0.236	1 0.039	————	P.52
FT-H13-FM2	1,100 43.307	280 11.024	200 7.874	50 1.969	13 0.512	9 0.354	150 5.906	16 0.630	10 0.394	P.52
FT-H20-J20-S (Note 3)	700 27.559	160 6.299	110 4.331	120 4.724	20 0.787	————	60 2.362	————	————	P.53
FT-H20-J30-S (Note 3)	700 27.559	160 6.299	110 4.331	120 4.724	20 0.787	————	60 2.362	————	————	P.53
FT-H20-J50-S (Note 3)	700 27.559	160 6.299	110 4.331	120 4.724	20 0.787	————	60 2.362	————	————	P.53
FT-H20-M1	550 21.654	150 5.906	100 3.937	100 3.937	25 0.984	20 0.787	65 2.559	17 0.669	12 0.472	P.53
FT-H20-VJ50-S (Note 3)	1,100 43.307	240 9.449	170 6.693	170 6.693	35 1.378	————	90 3.543	————	————	P.53
FT-H20-VJ80-S (Note 3)	1,100 43.307	240 9.449	170 6.693	170 6.693	35 1.378	————	90 3.543	————	————	P.53
FT-H20W-M1	400 15.748	110 4.331	80 3.15	75 2.953	19 0.748	13 0.512	58 2.283	13 0.512	9 0.354	P.53
FT-H30-M1V-S (Note 4)	390 15.354	100 3.937	70 2.756	75 2.953	20 0.787	15 0.591	55 2.165	13 0.512	10 0.394	P.53
FT-H35-M2	600 23.622	150 5.906	110 4.331	115 4.528	28 1.102	20 0.787	90 3.543	20 0.787	14 0.551	P.53
FT-H35-M2S6	600 23.622	150 5.906	110 4.331	115 4.528	28 1.102	20 0.787	90 3.543	20 0.787	14 0.551	P.53
FT-HL80Y	3,500 137.795 (Note 2)	800 31.496	550 21.654	150 5.906	35 1.378	20 0.787	200 7.874	55 2.165	35 1.378	P.53
FT-KS40	3,600 141.732 (Note 2)	2,000 78.740	1,900 74.803	1,000 39.370	270 10.630	190 7.480	590 23.228	130 5.118	53 2.087	P.54
FT-KV26	880 34.646	170 6.693	120 4.724	130 5.118	31 1.220	————	90 3.543	18 0.709	————	P.54
FT-KV40	3,600 141.732 (Note 2)	1,700 66.929	1,300 51.181	1,200 47.244	310 12.205	190 7.480	800 31.496	190 7.480	120 4.724	P.54
FT-KV40W	3,600 141.732 (Note 2)	1,600 62.992	1,100 43.307	900 35.433	270 10.630	140 5.512	420 16.535	100 3.937	65 2.559	P.54
FT-L80Y	3,500 137.795 (Note 2)	900 35.433	600 23.622	250 9.843	60 2.362	40 1.575	300 11.811	70 2.756	45 1.772	P.54
FT-R31	380 14.961	79 3.110	56 2.205	80 3.150	20 0.787	13 0.512	38 1.496	10 0.394	7 0.276	P.54
FT-R40	1,200 47.244	240 9.449	170 6.693	200 7.874	50 1.969	32 1.260	100 3.937	28 1.102	19 0.748	P.54
FT-R41W	1,200 47.244	290 11.417	200 7.874	220 8.661	57 2.244	33 1.299	100 3.937	26 1.024	18 0.709	P.54
FT-R42W	3,600 141.732 (Note 2)	990 38.976	740 29.134	310 12.205	75 2.953	58 2.283	270 10.630	70 2.756	50 1.969	P.54
FT-R43	1,200 47.244	230 9.055	160 6.299	200 7.874	50 1.969	32 1.260	100 3.937	26 1.024	18 0.709	P.54
FT-R44Y	1,200 47.244	230 9.055	160 6.299	200 7.874	50 1.969	32 1.260	100 3.937	26 1.024	18 0.709	P.55
FT-R60Y	3,600 141.732 (Note 2)	750 29.528	540 21.260	560 22.047	140 5.512	90 3.543	290 11.417	75 2.953	50 1.969	P.55
FT-S11	150 5.906	30 1.181	20 0.787	21 0.827	5 0.197	3.5 0.138	12 0.472	2 0.079	1.5 0.059	P.55
FT-S20	600 23.622	145 5.709	95 3.740	90 3.543	24 0.945	15 0.591	45 1.772	12 0.472	8 0.315	P.55
FT-S21	540 21.260	140 5.512	85 3.346	85 3.346	20 0.787	14 0.551	38 1.496	10 0.394	7 0.276	P.55

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) Heat-resistant joint fibers and ordinary-temperature fibers (**FT-42**) are sold as a set.

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

LIST OF FIBERS

Thru-beam type (one pair set)



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)										Dimensions
	Red LED			Blue LED			Green LED				
	U-LG	STD	FAST	U-LG	STD	FAST	U-LG	STD	FAST		
FT-S21W	380 14.961	80 3.150	55 2.165	53 2.087	16 0.630	9 0.354	28 1.102	7 0.276	4 0.157	P.55	
FT-S30	1,600 62.992	345 13.583	245 9.646	250 9.843	65 2.559	45 1.772	140 5.512	40 1.575	25 0.984	P.55	
FT-S31W	1,300 51.181	290 11.417	210 8.268	220 8.661	57 2.244	33 1.299	110 4.331	32 1.260	19 0.748	P.55	
FT-S32	3,600 141.732 (Note 2)	920 36.220	670 26.378	700 27.559	180 7.087	110 4.331	400 15.748	92 3.622	62 2.441	P.55	
FT-V23	720 28.346	140 5.512	100 3.937	120 4.724	30 1.181	20 0.787	65 2.559	16 0.630	9 0.354	P.55	
FT-V24W	140 5.512	25 0.984	20 0.787	18 0.709	2 0.079	————	5 0.197	————	————	P.56	
FT-V25	360 14.173	70 2.756	50 1.969	57 2.244	10 0.394	7 0.276	28 1.102	8 0.315	5 0.197	P.56	
FT-V30	770 30.315	160 6.299	120 4.724	210 8.268	47 1.850	28 1.102	100 3.937	22 0.866	10 0.394	P.56	
FT-V40	3,600 141.732 (Note 2)	950 37.402	730 28.740	810 31.890	190 7.480	130 5.118	500 19.685	115 4.528	81 3.189	P.56	
FT-V80Y	1,500 59.055	350 13.780	250 9.843	240 9.449	55 2.165	35 1.378	180 7.087	38 1.496	24 0.945	P.56	
FT-Z20HBW	390 15.354	80 3.150	55 2.165	64 2.520	16 0.630	10 0.394	30 1.181	7 0.276	5 0.197	P.56	
FT-Z20W	1,300 51.181	270 10.630	190 7.480	170 6.693	39 1.535	23 0.906	92 3.622	19 0.748	11 0.433	P.56	
FT-Z30	3,100 122.047	660 25.984	480 18.898	250 9.843	60 2.362	37 1.457	190 7.480	51 2.008	33 1.299	P.56	
FT-Z30E	3,600 141.732 (Note 2)	1,200 47.244	920 36.220	960 37.795	250 9.843	160 6.299	460 18.110	120 4.724	83 3.268	P.56	
FT-Z30EW	3,600 141.732 (Note 2)	590 23.228	430 16.929	940 37.008	180 7.087	110 4.331	400 15.748	85 3.346	56 2.205	P.57	
FT-Z30H	3,600 141.732 (Note 2)	1,300 51.181	950 37.402	1,100 43.307	290 11.417	170 6.693	580 22.835	150 5.906	100 3.937	P.57	
FT-Z30HW	3,600 141.732 (Note 2)	1,300 51.181	950 37.402	940 37.008	180 7.087	110 4.331	400 15.748	85 3.346	56 2.205	P.57	
FT-Z30W	2,400 94.488	540 21.260	390 15.354	180 7.087	45 1.772	28 1.102	160 6.299	34 1.339	21 0.827	P.57	
FT-Z40HBW	1,300 51.181	290 11.417	210 8.268	220 8.661	57 2.244	33 1.299	110 4.331	32 1.260	19 0.748	P.57	
FT-Z40W	2,200 86.614	460 18.110	340 13.386	380 14.961	90 3.543	63 2.480	170 6.693	45 1.772	30 1.181	P.57	
FT-Z802Y	3,500 137.795 (Note 2)	750 29.528	540 21.260	450 17.717	110 4.331	80 3.150	300 11.811	80 3.150	60 2.362	P.57	

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

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

Retroreflective type



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1,2)									Dimensions
	Red LED			Blue LED			Green LED			
	U-LG	STD	FAST	U-LG	STD	FAST	U-LG	STD	FAST	
FR-KZ22E	15 to 350 0.591 to 13.780	15 to 140 0.591 to 5.512	15 to 100 0.591 to 3.937	20 to 100 0.787 to 3.937	————	————	————	————	————	P.58
FR-KZ50E	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 200 0.787 to 7.874	20 to 84 0.787 to 3.307	20 to 45 0.787 to 1.771	20 to 180 0.787 to 7.087	20 to 55 0.787 to 1.969	————	P.58
FR-KZ50H	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 145 0.787 to 5.709	20 to 47 0.787 to 1.850	20 to 26 0.787 to 1.024	20 to 145 0.787 to 5.709	20 to 47 0.787 to 1.850	20 to 26 0.787 to 1.024	P.58
FR-Z50HW	100 to 1,000 3.937 to 39.370	100 to 540 3.937 to 21.260	100 to 460 3.937 to 18.110	100 to 490 3.937 to 19.291	————	————	————	————	————	P.58

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

The sensing range of **FR-KZ22E** is specified for the attached reflector.

The sensing range of **FR-KZ50E** and **FR-KZ50H** is specified for the attached reflector **RF-003**. The sensing range of **FR-Z50HW** is specified for the **RF-13**.

2) The sensing range is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.

Sensing range when using in combination with FR-Z50HW reflector (Optional)

The sensing ranges are the value for red LED types.

Reflector Model No.	Sensing range (mm in)		
	FX-411		
	U-LG	STD	FAST
RF-230	100 to 12,000 3.937 to 47.244	100 to 1,700 3.937 to 66.929	100 to 1,300 3.937 to 51.181
RF-220	100 to 2,200 3.937 to 8.661	100 to 950 3.937 to 37.402	100 to 730 3.937 to 28.740
RF-210	100 to 2,100 3.937 to 82.677	100 to 780 3.937 to 30.709	100 to 620 3.937 to 24.409

Note: The sensing range is the possible setting range for the reflector. The fiber can detect an object less than setting range for the reflector. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.

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FX-301-F7/ FX-301-F

LIST OF FIBERS

Reflective type



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2) / Description											Dimensions
	Red LED			Blue LED			Green LED					
	U-LG	STD	FAST	U-LG	STD	FAST	U-LG	STD	FAST			
FD-30	200 7.874	48 1.890	35 1.378	40 1.575	9 0.354	6 0.236	18 0.709	5 0.197	3 0.118		P.59	
FD-31	175 6.890	45 1.772	34 1.339	35 1.378	8 0.315	5 0.197	16 0.630	4 0.157	2 0.079		P.59	
FD-31W	120 4.724	20 0.787	15 0.591	16 0.630	3 0.118	1 to 2.5 0.039 to 0.098	7 0.276	1 to 2.5 0.039 to 0.098	————		P.59	
FD-32G	240 9.449	52 2.047	38 1.496	48 1.890	11 0.433	8 0.315	24 0.945	5 0.197	4 0.157		P.59	
FD-32GX	320 12.598	50 1.969	38 1.496	50 1.969	12 0.472	9 0.354	24 0.945	7 0.276	4 0.157		P.59	
FD-40	200 7.874	48 1.890	35 1.378	40 1.575	9 0.354	6 0.236	18 0.709	5 0.197	3 0.118		P.59	
FD-41	175 6.890	45 1.772	34 1.339	35 1.378	8 0.315	5 0.197	16 0.630	4 0.157	2 0.079		P.59	
FD-41S	175 6.890	40 1.575	30 1.181	35 1.378	8 0.315	5 0.197	16 0.630	4 0.157	2 0.079		P.59	
FD-41SW	120 4.724	20 0.787	15 0.591	18 0.709	1 to 4 0.039 to 0.157	1 to 2.5 0.039 to 0.098	12 0.472	1 to 2.5 0.039 to 0.098	————		P.59	
FD-41W	330 12.992	70 2.756	50 1.969	54 2.126	0.5 to 13 0.020 to 0.512	1 to 8 0.039 to 0.315	29 1.142	1.5 to 7 0.059 to 0.276	1.5 to 4.5 0.059 to 0.177		P.59	
FD-42G	240 9.449	52 2.047	38 1.496	48 1.890	11 0.433	8 0.315	24 0.945	5 0.197	4 0.157		P.60	
FD-42GW	240 9.449	40 1.575	30 1.181	30 1.181	7 0.276	5 0.197	15 0.591	4 0.157	2 0.079		P.60	
FD-60	600 23.622	150 5.906	100 3.937	130 5.118	30 1.181	20 0.787	70 2.756	20 0.787	13 0.512		P.60	
FD-61	510 20.079	140 5.512	90 3.543	105 4.134	27 1.063	18 0.709	65 2.559	16 0.630	11 0.433		P.60	
FD-61G	460 18.110	110 4.331	80 3.150	105 4.134	27 1.063	18 0.709	55 2.165	15 0.591	9 0.354		P.60	
FD-61S	500 19.685	140 5.512	95 3.740	105 4.134	27 1.063	18 0.709	65 2.559	16 0.630	11 0.433		P.60	
FD-61W	330 12.992	70 2.756	50 1.969	54 2.126	0.5 to 13 0.020 to 0.512	1 to 8 0.039 to 0.315	29 1.142	1.5 to 7 0.059 to 0.276	1.5 to 4.5 0.059 to 0.177		P.60	
FD-62	820 32.283	180 7.087	130 5.118	160 6.299	1 to 44 0.039 to 1.732	1 to 29 0.039 to 1.142	98 3.858	1 to 26 0.039 to 1.024	1 to 18 0.039 to 0.709		P.60	
FD-64X	380 14.961	80 3.150	55 2.165	54 2.126	0.5 to 14 0.020 to 0.551	0.5 to 9 0.020 to 0.354	27 1.063	0.5 to 7 0.020 to 0.276	0.5 to 4.5 0.020 to 0.177		P.61	
FD-A16	200 7.874	100 3.937	75 2.953	30 1.181	13 0.512	13 0.512	57 2.244	14 0.551	————		P.61	
FD-AL11	460 18.110	100 3.937	70 2.756	70 2.756	17 0.669	10 0.394	45 1.772	9 0.354	6 0.236		P.61	
FD-E13	20 0.787	4 0.157	3 0.118	2.5 0.098	0.7 0.028	————	1.5 0.059	————	————		P.61	
FD-E23	75 2.953	15 0.591	10 0.394	10 0.394	2.5 0.098	1.5 0.059	5 0.197	1.3 0.051	0.9 0.035		P.61	
FD-EG30	90 3.543	15 0.591	10 0.394	10 0.394	2.5 0.098	1.5 0.059	5 0.197	1.3 0.051	0.9 0.035		P.61	
FD-EG30S	85 3.346	15 0.591	10 0.394	10 0.394	2.5 0.098	1.5 0.059	5 0.197	1.3 0.051	0.9 0.035		P.62	
FD-EG31	25 0.984	5 0.197	4 0.157	4 0.157	1 0.039	0.5 0.020	2 0.079	————	————		P.62	
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 interrupted										P.62	
FD-F41	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 interrupted										P.62	
FD-F41Y (Note 3)	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 interrupted										P.62	
FD-F8Y	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 interrupted										P.62	
FD-FA93	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 interrupted										P.62	
FD-H13-FM2	430 16.929	100 3.937	70 2.756	40 1.575	10 0.394	7 0.276	40 1.575	10 0.394	7 0.276		P.63	
FD-H18-L31	0 to 25 0 to 0.984	0 to 10 0 to 0.394	0 to 8 0 to 0.315	————	————	————	————	————	————		P.63	
FD-H20-21	350 13.780	90 3.543	65 2.559	65 2.559	13 0.512	9 0.354	45 1.772	10 0.394	7 0.276		P.63	
FD-H20-M1	270 10.630	85 3.346	60 2.362	60 2.362	14 0.551	10 0.394	58 2.283	10 0.394	7 0.276		P.63	
FD-H25-L43 (Note 4)	2.5 to 29 0.098 to 1.142	4 to 20 0.157 to 0.787	4 to 16 0.157 to 0.630	————	————	————	————	————	————		P.63	
FD-H25-L45 (Note 4)	5 to 42 0.197 to 1.654	7 to 38 0.276 to 1.496	7 to 35 0.276 to 1.437	————	————	————	————	————	————		P.63	

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) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

4) The sensing range is specified for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in

LIST OF FIBERS**Reflective type**

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2) / Description									Dimensions
	Red LED			Blue LED			Green LED			
	U-LG	STD	FAST	U-LG	STD	FAST	U-LG	STD	FAST	
FD-H30-KZ1V-S (Note 3,4)	20 to 300 0.787 to 11.811	25 to 100 0.984 to 3.937	25 to 45 0.984 to 1.772	————	————	————	————	————	————	P.64
FD-H30-L32	0 to 20 0 to 0.787	1 to 8 0.039 to 0.315	1 to 6 0.039 to 0.236	————	————	————	————	————	————	P.64
FD-H30-L32V-S (Note 3,4)	0 to 11 0 to 0.433	1.5 to 5 0.059 to 0.197	2 to 4 0.079 to 0.157	————	————	————	————	————	————	P.64
FD-H35-20S	210 8.268	50 1.969	35 1.378	45 1.772	10 0.394	7 0.276	20 0.787	6 0.236	4 0.157	P.64
FD-H35-M2	300 11.811	83 3.268	60 2.362	50 1.969	12 0.472	9 0.354	50 1.969	10 0.394	7 0.276	P.64
FD-H35-M2S6	300 11.811	80 3.150	50 1.969	50 1.969	14 0.551	10 0.394	40 1.575	10 0.394	7 0.276	P.64
FD-HF40Y (Note 5)	ø4 mm ø0.157 in Protective tube: fluorine resin, length:500 mm 19.685 in (allowable cutting) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam interrupted									P.64
FD-L10 (Note 3)	0 to 4.4 0 to 0.173	0 to 4 0 to 0.157	0 to 3.8 0 to 0.150	3.5 0.138	2.5 0.098	2 0.079	0 to 3 0 to 0.118	1 to 2 0.039 to 0.079	————	P.65
FD-L11 (Note 3)	0 to 10 0 to 0.394	0 to 7 0 to 0.276	0 to 7 0 to 0.276	8.5 0.335	6 0.236	5.5 0.217	8 0.315	5 0.197	————	P.65
FD-L12W (Note 3)	0.5 to 10 0.020 to 0.394	1 to 4.5 0.039 to 0.177	1 to 3.5 0.039 to 0.137	————	————	————	————	————	————	P.65
FD-L20H	1 to 32 0.039 to 1.280	4 to 10 0.157 to 0.394	4.5 to 10 0.177 to 0.394	4 to 13 0.157 to 0.512	5 to 9 0.197 to 0.354	5.5 to 8.5 0.217 to 0.334	5 to 11 0.197 to 0.433	6 to 8.5 0.236 to 0.335	————	P.65
FD-L21 (Note 3)	1 to 18 0.039 to 0.709	3 to 14 0.118 to 0.551	3 to 13 0.118 to 0.512	————	————	————	————	————	————	P.65
FD-L21W (Note 3)	3 to 16 0.118 to 0.630	7 to 12 0.276 to 0.472	7 to 11 0.276 to 0.433	————	————	————	————	————	————	P.65
FD-L22A (Note 3)	0 to 26 0 to 1.024	0 to 23 0 to 0.906	0 to 19 0 to 0.748	————	————	————	————	————	————	P.65
FD-L23 (Note 3)	0 to 30 0 to 1.181	0 to 30 0 to 1.181	0 to 28 0 to 1.102	————	————	————	————	————	————	P.65
FD-L30A (Note 3)	0 to 50 0 to 1.969	0 to 36 0 to 1.417	0 to 30 0 to 1.181	————	————	————	————	————	————	P.65
FD-L31A (Note 3)	4 to 33 0.157 to 1.299	5 to 32 0.197 to 1.260	5 to 30 0.197 to 1.181	4 to 31 0.157 to 1.220	————	————	————	————	————	P.65
FD-L32H (Note 3)	0 to 65 0 to 2.559	15 to 30 0.591 to 1.181	20 to 25 0.787 to 0.984	15 to 30 0.591 to 1.181	————	————	————	————	————	P.66
FD-R31G	240 9.449	42 1.654	30 1.181	41 1.614	9 0.354	6 0.236	21 0.827	5 0.197	2 0.079	P.66
FD-R32EG	90 3.543	15 0.591	10 0.394	10 0.394	2.5 0.098	1.5 0.059	5 0.197	1.3 0.051	————	P.66
FD-R33EG	25 0.984	5 0.197	3 0.118	4 0.157	0.8 0.031	————	2 0.079	————	————	P.66
FD-R34EG	75 2.953	13 0.512	8 0.315	9 0.354	2 0.079	1 0.039	5 0.197	0.9 0.035	————	P.66
FD-R41	330 12.992	65 2.559	47 1.850	51 2.008	10 0.394	1 to 8 0.039 to 0.315	25 0.984	1 to 6 0.039 to 0.236	1 to 5 0.039 to 0.197	P.66
FD-R60	420 16.535	110 4.331	80 3.150	82 3.228	23 0.906	15 0.591	59 2.323	15 0.591	10 0.394	P.66
FD-R61Y	340 13.386	65 2.559	47 1.850	60 2.362	0.5 to 15 0.020 to 0.591	0.5 to 10 0.020 to 0.394	30 1.181	0.5 to 7 0.020 to 0.276	1 to 5 0.039 to 0.197	P.66
FD-S21	80 3.150	18 0.709	13 0.512	12 0.472	2.5 0.098	2 0.079	6.5 0.256	1.5 0.059	1 0.039	P.66
FD-S30	200 7.874	48 0.890	35 1.378	40 1.575	9 0.354	6 0.236	18 0.709	5 0.197	3 0.118	P.67
FD-S31	175 6.890	45 1.772	34 1.339	35 1.378	8 0.315	5 0.197	16 0.630	4 0.157	2 0.079	P.67
FD-S32	510 20.079	120 4.724	90 3.543	105 4.134	27 1.063	18 0.709	65 2.559	16 0.630	11 0.433	P.67
FD-S32W	330 12.992	70 2.756	50 1.969	54 2.126	0.5 to 13 0.020 to 0.512	1 to 8 0.039 to 0.315	29 1.142	1.5 to 7 0.059 to 0.276	1.5 to 4.5 0.059 to 0.177	P.67
FD-S33GW	240 9.449	40 1.575	30 1.181	30 1.181	7 0.276	5 0.197	15 0.591	4 0.157	2 0.079	P.67
FD-S60Y	410 16.142	130 5.118	100 3.937	120 4.724	25 0.984	17 0.669	65 2.559	10 0.394	————	P.67
FD-V30	110 4.331	19 0.748	14 0.551	18 0.709	————	————	10 0.394	————	————	P.67
FD-V30W	30 1.181	5 0.197	3 0.118	————	————	————	————	————	————	P.67
FD-V50	160 6.299	35 1.378	25 0.984	27 1.063	7 0.276	————	16 0.630	————	————	P.68
FD-Z20HBW	1 to 100 0.039 to 3.937	3 to 20 0.118 to 0.787	3 to 15 0.118 to 0.591	3 to 16 0.118 to 0.630	————	————	3 to 8 0.118 to 0.315	————	————	P.68
FD-Z20W	140 5.512	3 to 26 0.118 to 1.024	3 to 17 0.118 to 0.669	4 to 12 0.157 to 0.472	————	————	————	————	————	P.68
FD-Z40HBW	420 16.535	1 to 80 0.039 to 3.150	1 to 60 0.039 to 2.362	1 to 89 0.039 to 3.504	3 to 20 1.181 to 0.787	3 to 13 1.181 to 0.512	1 to 42 0.039 to 1.654	3 to 11 0.118 to 0.433	3 to 7 0.118 to 0.276	P.68
FD-Z40W	340 13.386	1 to 67 0.039 to 2.638	1 to 48 0.039 to 1.890	1 to 55 0.039 to 2.165	5 to 10 0.197-0.394	————	3 to 25 0.118 to 0.984	————	————	P.68
FD-Z50HW	10 to 890 0.394 to 35.039	15 to 210 0.591 to 8.268	15 to 160 0.591 to 6.299	20 to 100 0.787 to 3.937	————	————	20 to 55 0.787 to 2.165	————	————	P.68

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

2) The sensing range of reflective type is the value for white non-glossy paper (as for **FD-H30-L32** and **FD-H18-L31** 50 × 50 mm 1.969 × 1.969 in glass substrate).

3) 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 0.079 in) [**FD-L10**: silicon wafers 100 × 100 mm 3.937 × 3.937 in].

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

5) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

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LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

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Fiber Amplifiers

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FX-100

FX-300

FX-410

FX-311

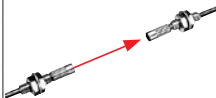
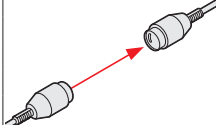
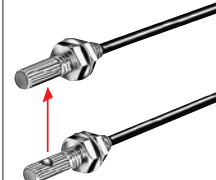
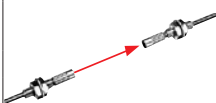
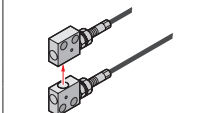
FX-301-F7/

FX-301-F

FIBER OPTIONS

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

Lens (for thru-beam type fiber)

Designation	Model No.	Description			
For thru-beam type fiber	Expansion lens (Note 1)		Increases the sensing range by 5 times or more.	Sensing range for red LED type (mm in) [Lens on both sides] (Note 2)	
	FX-LE1		<ul style="list-style-type: none"> Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 5) Beam dia: ø3.6 mm ø0.142 in 		
	Super-expansion lens (Note 1)		Tremendously increases the sensing range with large diameter lenses.	Sensing range for red LED type (mm in) [Lens on both sides] (Note 2)	
	FX-LE2		<ul style="list-style-type: none"> Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 5) Beam dia: ø9.8 mm ø0.386 in 		
	Side-view lens		Beam axis is bent by 90°.	Sensing range for red LED type (mm in) [Lens on both sides] (Note 2)	
	FX-SV1		<ul style="list-style-type: none"> Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 5) Beam dia: ø2.8 mm ø0.110 in 		
	Expansion lens for vacuum fiber (Note 1)		Sensing range increases by 4 times or more.	Sensing range for red LED type (mm in) [Lens on both sides] (Note 2, 4)	
	FV-LE1		<ul style="list-style-type: none"> Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 5) Beam dia: ø3.6 mm ø0.142 in 		
	Vacuum resistant side-view lens (Note 1)		Beam axis is bent by 90°.	Sensing range for red LED type (mm in) [Lens on both sides] (Note 2, 4)	
	FV-SV2		<ul style="list-style-type: none"> Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 5) Beam dia: ø3.7 mm ø0.146 in 		

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 sensing ranges are the values for red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifiers.

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

4) The fiber cable length for the **FT-H30-M1V-S** is 1 m 3.281 ft. The sensing ranges in U-LG mode take into account the length of the **FT-J8** atmospheric side fiber.

5) Refer to p.15, p.18, p.33 and p.35 for the ambient temperatures of fibers to be used in combination.

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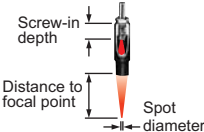
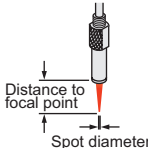
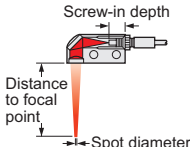
FX-301-F7/

FX-301-F

FIBER OPTIONS

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

Lens (for reflective type fiber)

Designation		Model No.	Description																
For reflective type fiber	Pinpoint spot lens	FX-MR1		<p>Pinpoint spot of $\varnothing 0.5$ mm $\varnothing 0.020$ in. Enables detection of minute objects or small marks.</p> <ul style="list-style-type: none">Distance to focal point: 6 ± 1 mm 0.236 ± 0.039 inApplicable fibers: FD-42G, FD-42GWAmbient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note 2)															
	Zoom lens	FX-MR2		<p>The spot diameter is adjustable from $\varnothing 0.7$ to $\varnothing 2$ mm $\varnothing 0.028$ to $\varnothing 0.079$ in according to how much the fiber is screwed in.</p> <ul style="list-style-type: none">Applicable fibers: FD-42G, FD-42GWAmbient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note 1)Accessory: MS-EX3 (mounting bracket) <table><tr><th colspan="3">Sensing range for red LED type (Note 1)</th></tr><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>$\varnothing 18.5$ mm $\varnothing 0.728$ in approx.</td><td>$\varnothing 0.7$ mm $\varnothing 0.028$ in</td></tr><tr><td>12 mm 0.472 in</td><td>$\varnothing 27$ mm $\varnothing 1.063$ in approx.</td><td>$\varnothing 1.2$ mm $\varnothing 0.047$ in</td></tr><tr><td>14 mm 0.551 in</td><td>$\varnothing 43$ mm $\varnothing 1.693$ in approx.</td><td>$\varnothing 2.0$ mm $\varnothing 0.079$ in</td></tr></table>	Sensing range for red LED type (Note 1)			Screw-in depth	Distance to focal point	Spot diameter	7 mm 0.276 in	$\varnothing 18.5$ mm $\varnothing 0.728$ in approx.	$\varnothing 0.7$ mm $\varnothing 0.028$ in	12 mm 0.472 in	$\varnothing 27$ mm $\varnothing 1.063$ in approx.	$\varnothing 1.2$ mm $\varnothing 0.047$ in	14 mm 0.551 in	$\varnothing 43$ mm $\varnothing 1.693$ in approx.	$\varnothing 2.0$ mm $\varnothing 0.079$ in
	Sensing range for red LED type (Note 1)																		
	Screw-in depth	Distance to focal point	Spot diameter																
	7 mm 0.276 in	$\varnothing 18.5$ mm $\varnothing 0.728$ in approx.	$\varnothing 0.7$ mm $\varnothing 0.028$ in																
12 mm 0.472 in	$\varnothing 27$ mm $\varnothing 1.063$ in approx.	$\varnothing 1.2$ mm $\varnothing 0.047$ in																	
14 mm 0.551 in	$\varnothing 43$ mm $\varnothing 1.693$ in approx.	$\varnothing 2.0$ mm $\varnothing 0.079$ in																	
Finest spot lens	FX-MR3		<p>Extremely fine spot of $\varnothing 0.15$ mm $\varnothing 0.006$ in approx. achieved.</p> <ul style="list-style-type: none">Applicable fibers: FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GXAmbient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note 2) <table><tr><th colspan="3">Sensing range for red LED type (Note 1)</th></tr><tr><th>Fiber</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG31</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.15$ mm $\varnothing 0.006$ in approx.</td></tr><tr><td>FD-EG30</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.3$ mm $\varnothing 0.012$ in approx.</td></tr><tr><td>FD-42G/42GW FD-32G/32GX</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.5$ mm $\varnothing 0.020$ in approx.</td></tr></table>	Sensing range for red LED type (Note 1)			Fiber	Distance to focal point	Spot diameter	FD-EG31	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.15$ mm $\varnothing 0.006$ in approx.	FD-EG30	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.3$ mm $\varnothing 0.012$ in approx.	FD-42G/42GW FD-32G/32GX	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.5$ mm $\varnothing 0.020$ in approx.	
Sensing range for red LED type (Note 1)																			
Fiber	Distance to focal point	Spot diameter																	
FD-EG31	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.15$ mm $\varnothing 0.006$ in approx.																	
FD-EG30	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.3$ mm $\varnothing 0.012$ in approx.																	
FD-42G/42GW FD-32G/32GX	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.5$ mm $\varnothing 0.020$ in approx.																	
Finest spot lens	FX-MR6	<p>Extremely fine spot of $\varnothing 0.1$ mm $\varnothing 0.004$ in approx. achieved.</p> <ul style="list-style-type: none">Applicable fibers: FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GXAmbient temperature: -20 to $+60$ °C -4 to $+140$ °F (Note 2) <table><tr><th colspan="3">Sensing range for red LED type (Note 1)</th></tr><tr><th>Fiber</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG31</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.1$ mm $\varnothing 0.004$ in approx.</td></tr><tr><td>FD-EG30</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.2$ mm $\varnothing 0.008$ in approx.</td></tr><tr><td>FD-42G/42GW FD-32G/32GX</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.4$ mm $\varnothing 0.016$ in approx.</td></tr></table>	Sensing range for red LED type (Note 1)			Fiber	Distance to focal point	Spot diameter	FD-EG31	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.1$ mm $\varnothing 0.004$ in approx.	FD-EG30	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.2$ mm $\varnothing 0.008$ in approx.	FD-42G/42GW FD-32G/32GX	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.4$ mm $\varnothing 0.016$ in approx.		
Sensing range for red LED type (Note 1)																			
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FD-42G/42GW FD-32G/32GX	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.4$ mm $\varnothing 0.016$ in approx.																	
Zoom lens (Side-view type)	FX-MR5		<p>FX-MR2 is converted into a side-view type and can be mounted in a very small space.</p> <ul style="list-style-type: none">Applicable fibers: FD-42G, FD-42GWAmbient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note 2) <table><tr><th colspan="3">Sensing range for red LED type (Note 1)</th></tr><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 0.512 in approx.</td><td>$\varnothing 0.5$ mm $\varnothing 0.020$ in</td></tr><tr><td>10 mm 0.394 in</td><td>15 mm 0.591 in approx.</td><td>$\varnothing 0.8$ mm $\varnothing 0.031$ in</td></tr><tr><td>14 mm 0.551 in</td><td>30 mm 1.181 in approx.</td><td>$\varnothing 3.0$ mm $\varnothing 0.118$ in</td></tr></table>	Sensing range for red LED type (Note 1)			Screw-in depth	Distance to focal point	Spot diameter	8 mm 0.315 in	13 mm 0.512 in approx.	$\varnothing 0.5$ mm $\varnothing 0.020$ in	10 mm 0.394 in	15 mm 0.591 in approx.	$\varnothing 0.8$ mm $\varnothing 0.031$ in	14 mm 0.551 in	30 mm 1.181 in approx.	$\varnothing 3.0$ mm $\varnothing 0.118$ in	
Sensing range for red LED type (Note 1)																			
Screw-in depth	Distance to focal point	Spot diameter																	
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14 mm 0.551 in	30 mm 1.181 in approx.	$\varnothing 3.0$ mm $\varnothing 0.118$ in																	

Notes: 1) The sensing ranges are the values when used in combination with red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifier.

2) Refer to p.16 or p.26 for the ambient temperatures of fibers to be used in combination.

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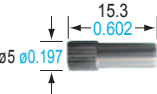










Fiber Amplifiers

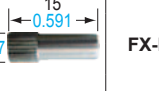
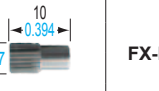
FX-500**FX-100****FX-300****FX-410****FX-311****FX-301-F7/****FX-301-F**

FIBER OPTIONS

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

Lens (For square head M3 reflective fiber)

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

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

Note: Spot diameter, distance to focal point and sensing range are specified for a red LED type amplifier.

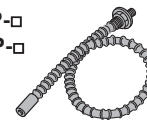
Others

Designation	Model No.	Description				
Protective tube (For thru-beam type fiber)	FTP-500 (0.5m 1.641 ft)	For M4 thread	Applicable fibers	FT-42 FT-42S FT-42W	FT-43 FT-H13-FM2	The protective tube, made of noncorrosive stainless steel, protects the inner fiber cable from any external forces.
	FTP-1000 (1m 3.281 ft)					
	FTP-1500 (1.5m 4.922 ft)					
	FTP-N500 (0.5m 1.641 ft)	For M3 thread		FT-31 FT-31S FT-31W	FD-31 FD-31W	
	FTP-N1000 (1m 3.281 ft)					
	FTP-N1500 (1.5m 4.922 ft)					
Protective tube (For reflective type fiber)	FDP-500 (0.5m 1.641 ft)	For M6 thread		FD-61 FD-61G FD-61S	FD-61W FD-62 FD-H13-FM2	
	FDP-1000 (1m 3.281 ft)					
	FDP-1500 (1.5m 4.922 ft)					
	FDP-N500 (0.5m 1.641 ft)	For M4 thread		FD-41 FD-41W	FD-41S FD-41SW	
	FDP-N1000 (1m 3.281 ft)					
	FDP-N1500 (1.5m 4.922 ft)					
Fiber bender	FB-1	The fiber bender bends the sleeve part of the fiber head at the proper radius. (Note 1)				
Universal sensor mounting stand (Note 2)	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				
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.				

Notes: 1) Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.
 2) Refer to the universal sensor mounting stand **MS-AJ** series pages for details.

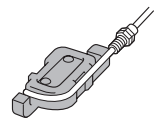
Protective tube

- FTP-□
- FDP-□



Fiber bender

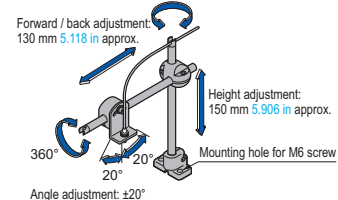
- FB-1



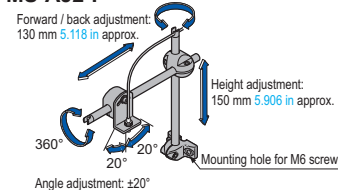
Universal sensor mounting stand

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

- MS-AJ1-F Swivel: 360° rotation



- MS-AJ2-F Swivel: 360° rotation



Single-core holder

- FX-AT15A



SPECIFICATIONS

Type		NPN output			PNP output		
		Red LED	Blue LED	Green LED	Red LED	Blue LED	Green LED
Item	Model No.	FX-411	FX-411B	FX-411G	FX-411P	FX-411BP	FX-411GP
	FX-412 (Note 2)	FX-412B (Note 2)	FX-412G (Note 2)				
Supply voltage		12 to 24 V DC ±10 % Ripple P-P 10 % or less					
Power consumption		<Red LED type> Normal operation: 960 mW or less (Current consumption 40 mA or less at 24 V supply voltage) ECO mode: 840 mW or less (Current consumption 35 mA or less at 24 V supply voltage) <Blue LED / Green LED type> Normal operation: 720 mW or less (Current consumption 30 mA or less at 24 V supply voltage) ECO mode: 580 mW or less (Current consumption 24 mA or less at 24 V supply voltage)					
Output		<NPN output type> NPN open-collector transistor • Maximum sink current: 100 mA 					

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C **+73.4 °F**.

2) The **FX-412** has a threshold value adjuster that can be adjusted with your fingers.

3) For models manufactured up until June 2005, the timer period is approx. 1 to 500 ms.

4) When the power supply is switched on, the light emission timing is automatically set for interference prevention.

5) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.

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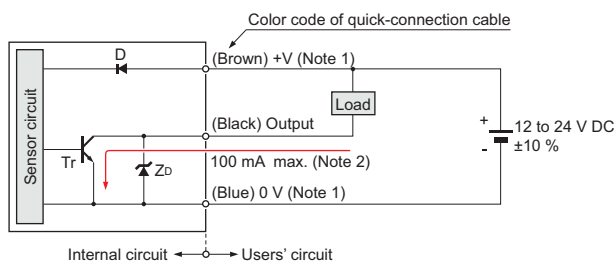
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FX-41□

NPN output type

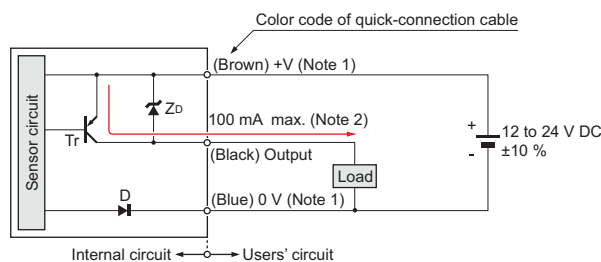


Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected together.

Symbols ... D : Reverse supply polarity protection diode
Zd: Surge absorption zener diode
Tr : NPN output transistor

FX-41□P

PNP output type



Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected together.

Symbols ... D : Reverse supply polarity protection diode
Zd: Surge absorption zener diode
Tr : PNP output transistor

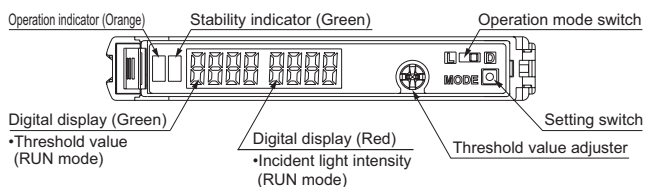
PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions.



- 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.

Part description



Wiring

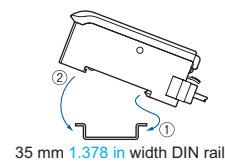
- Make sure that the power supply is off while wiring.
- Verify that the supply voltage variation is within the rating.
- Take care that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the product may get burnt or damaged.
- In case noise generating 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.
- 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.
- Take care that short circuit of the load 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.
- Extension up to total 100 m **328.084 ft** (if 5 to 8 units are connected in cascade: 50 m **164.042 ft**, if 9 to 16 units are connected in cascade: 20 m **65.617 ft**) is possible with 0.3 mm², or more, cable. However, in order to reduce noise, make the wiring as short as possible.
- Take care that cable extension increases the residual voltage.

Mounting

- Make sure that the power supply is off while connecting / disconnecting the amplifiers and the quick-connection cables.

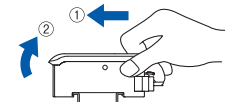
How to mount the amplifier

- ① Fit the rear part of the mounting section of the amplifier on a width DIN rail.
- ② Press down the rear part of the mounting section of the unit on the width DIN rail and fit the front part of the mounting section to the DIN rail.



How to remove the amplifier

- ① Push the amplifier forward.
- ② Lift up the front part of the amplifier to remove it.

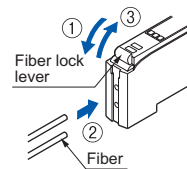


Note: Take care that if the front part is lifted without pushing the amplifier forward, the hook on the rear portion of the mounting section is likely to break.

Fiber installation

- Insert the fiber into the amplifier after attaching the attachment. Refer to the "Instruction Manual" included with the fiber for details.

- ① Push the fiber lock lever down.
- ② Slowly insert the fiber into the insertion slot until it stops. (Note 1)
- ③ Push the fiber lock lever back up until it stops.



Notes: 1) Note that if the fiber is not fully inserted, the sensing distance will decrease. Also note that the flexible fiber may bend during insertion.
2) In case of coaxial reflective type fibers, mount the central fiber (single-core) to the emitter part and the peripheral fiber (multi-core) to the receiver. Note that sensing precision will deteriorate when done in reverse.

PRECAUTIONS FOR PROPER USE

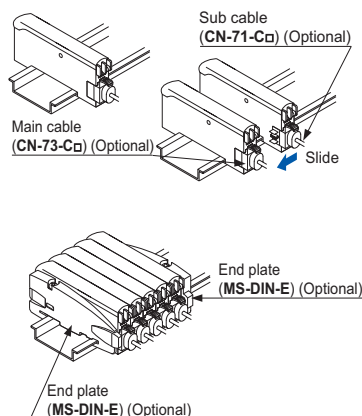
Refer to p.1458~ for general precautions.

Cascading

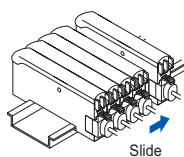
- Make sure that the power supply is off while adding or removing the amplifiers.
- Make sure to check the allowable ambient temperature, as it depends on the number of amplifiers connected in cascade.
- In case two, or more, amplifiers are connected in cascade, make sure to mount them on a DIN rail.
- When the amplifiers move on the DIN rail depending on the attaching condition or the amplifiers are mounted close to each other in cascade, fit them between the optional end plates (**MS-DIN-E**) mounted at the two ends.
- Up to maximum 15 amplifiers can be added (total 16 amplifiers connected in cascade.)
- When connecting more than two amplifiers in cascade, use the sub cable (**CN-71-C**) as the quick-connection cable for the second amplifier onwards.
- When connecting amplifiers not close to each other in parallel, be sure to mount the optional end plate (**MS-DIN-E**) at both sides of each amplifier or affix the communication window seal of the optional fiber amplifier protection seal (**FX-MB1**) to the communication windows. For details, refer to the instruction manual enclosed with the **FX-MB1**.
- When the different LED (red / blue / green) types are connected in cascade, mount the identical models together.
- When this product is used with the other digital fiber amplifiers, be sure to place this product to the left most position (When you look from the connector side). If this product is not placed to the leftmost position, this product may not operate properly.

Cascading method

- ① Mount the amplifiers, one by one, on the DIN rail.
- ② Slide the amplifiers next to each other, and connect the quick-connection cables.
- ③ Mount the optional end plates (**MS-DIN-E**) at both the ends to hold the amplifiers between their flat sides.
- ④ Tighten the screws to fix the end plates.

**Dismantling**

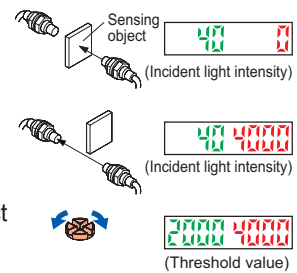
- ① Loosen the screws of the end plates.
- ② Remove the end plates.
- ③ Slide the amplifiers and remove them one by one.

**Switching output operation**

- The operation selection switch can be used to display different output operations (L-ON / D-ON) on the digital display.

When set to Dark-ON (D-ON)**When set to Light-ON (L-ON)****Threshold value (sensitivity) adjustment**

- ① Check the incident light intensity [in the digital display (red)] when a sensing object is placed in the sensing position.
- ② Check the incident light intensity [in the digital display (red)] when the sensing object is removed from the sensing position.
- ③ Turn the threshold value adjuster to the threshold value [in the digital display (green)] that is the value in between ① and ②. (The threshold value is automatically written to the EEPROM.)

**Threshold value setting method**

- When the threshold value adjuster is turned clockwise, the threshold value increases. When the threshold value adjuster is turned counterclockwise, the threshold value decreases.



- If there is a sufficient level of margin in the incident light intensity, the stability indicator (green) will light up.

Mode selection

- When the setting switch is pressed and held for 2 sec. or more, "SET" mode (mode setting screen) is activated.
- If the setting switch is pressed while in "SET" mode, the mode will change.
- If the threshold value adjuster is turned while a mode is active, the setting item will change and blink.
- When the setting switch is pressed at the item you would like to set, it blinks 3 times and then the setting is confirmed and the mode switches to the next mode.
- If the setting switch is pressed and held for 2 sec. or more or do not press any key for 15 sec. while "SET" mode is active, the mode will switch automatically to "RUN" mode.

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FX-301-F

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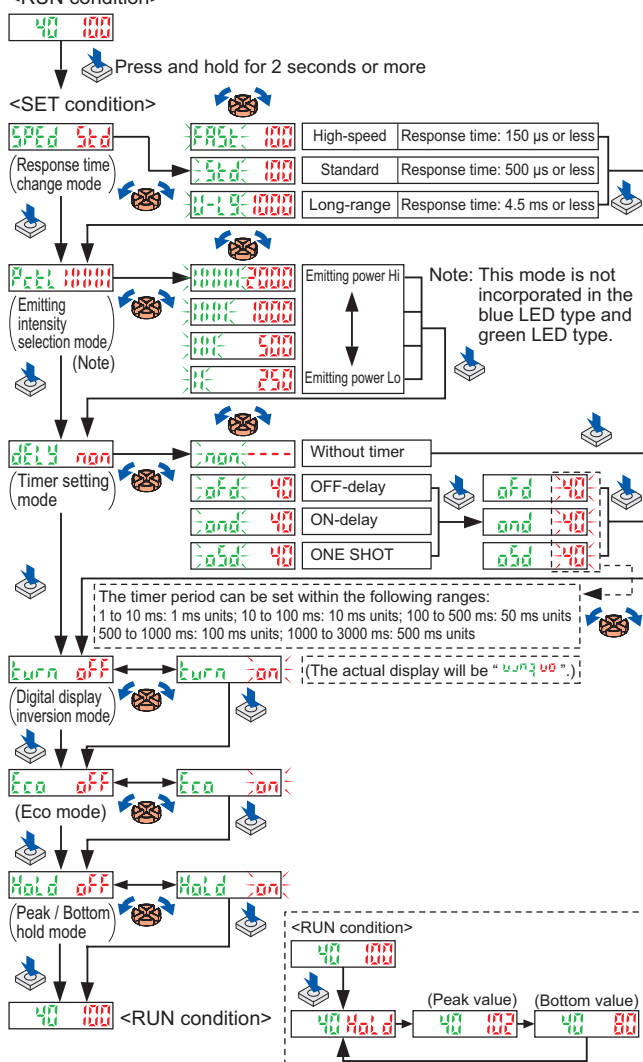
Refer to p.1458~ for general precautions.

Mode table

Mode	Factory setting	Description
Response time change mode	SPEd 5td	The response time can be set.
Light-emitting amount selection mode (Note 1)	PctL 0000	The light-emitting amount can be switched among four levels.
Timer setting mode	dELy non	Timer settings can be selected; Without timer / OFF-delay timer / ON-delay timer / ONE SHOT timer. Also the timer period can be set.
Digital display inversion mode	turn off	The display on the digital display can be inverted.
Eco mode (Note 2)	Eco off	If no key is pressed for 20 sec. approx. while in "RUN" mode, the digital display turns off automatically. Press the setting switch or move the operation mode switch to make the display light up again. The digital display will light up when the threshold value adjuster is turned, but note that this will also cause the threshold value to change.
Peak / Bottom hold mode	Hold off	If the setting switch is pressed while "RUN" mode is active, the display will alternate between the peak hold value and the bottom hold value. (The display will refresh every 2 sec.) The display will return to normal if any operation other than threshold value setting is carried out.

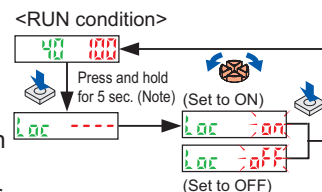
Notes: 1) This mode is not incorporated in the blue LED type and green LED type.
2) While the peak / bottom hold mode is ON, the digital display is not turned off even if the Eco mode is set to ON.

<RUN condition>



Key lock function

- When the setting switch is pressed and held for 5 sec. while in 'RUN' mode, the key lock function can be set / canceled.
- When the key lock function is set to ON, even if the threshold value adjuster or the setting switch is operated, "Loc" is displayed and the key operation cannot be carried out.



Note: Although the display changes to the indication of 'SET' condition 2 sec. after pressing the setting switch, keep pressing the switch. Furthermore, the sensor does not go into the key lock setting from 'SET' condition.

Factory setting

- When the setting switch is pressed and held for 10 sec., until "-----" is displayed while in 'RUN' mode, the all settings are returned to the factory setting. (For the factory setting, refer to 'Mode table' in 'Mode selection'.)

Error display indicator readings

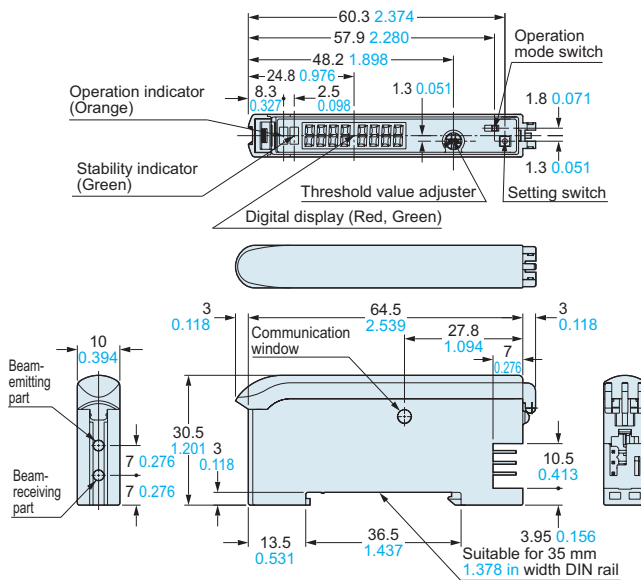
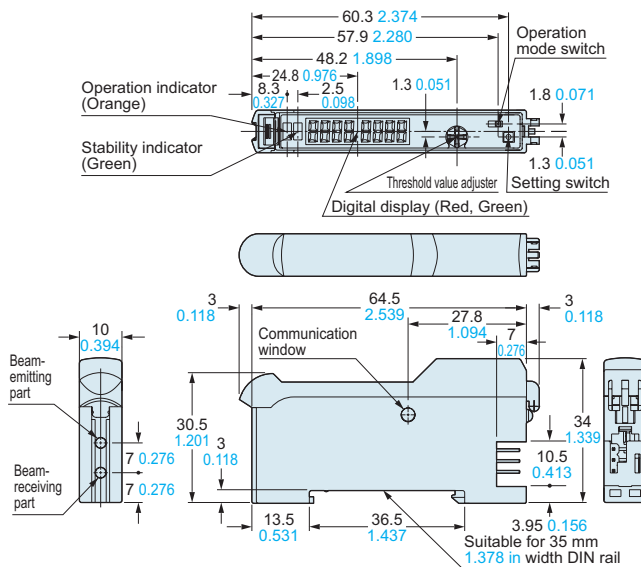
Display	Error description	Measures
E-1	The load has short-circuited and excess current is flowing.	Turn off the power, then check the load.
E-5	Communication error has occurred at time of connection.	Check if the mounted amplifiers are in close contact with each other.

Others

- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- This sensor is suitable for indoor use only.
- Do not use this sensor in places having excessive vapor, dust, etc., or where it may come in contact with corrosive gas.
- Take care that the sensor does not come in direct contact with oil, grease, organic solvents, such as, thinner etc., or strong acid, and alkaline.
- This sensor cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify the sensor.
- The changes to the settings are written to the EEPROM, but because the EEPROM has a limited service life, you should avoid changing the settings any more than 1 million times.

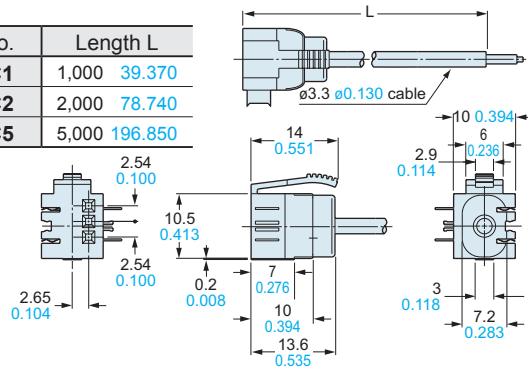
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

FX-411□ FX-411□P**Amplifier****FX-412□****Amplifier****CN-71-C1 CN-71-C2 CN-71-C5****Sub cable (Optional)**

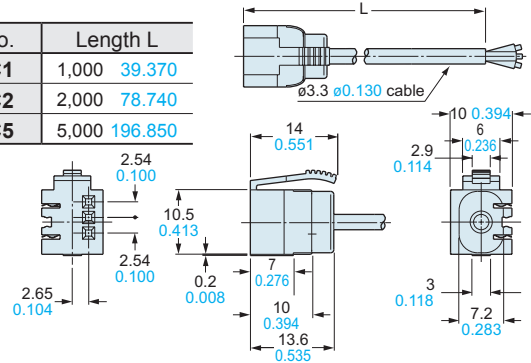
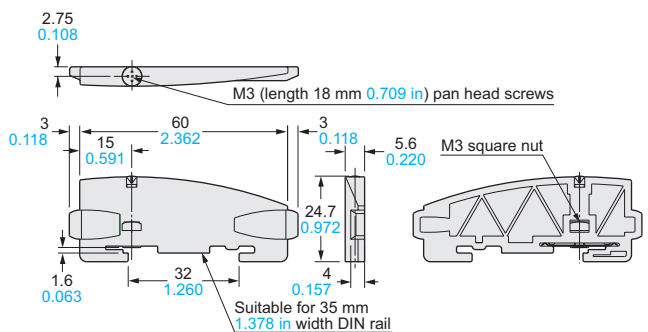
• Length L

Model No.	Length L
CN-71-C1	1,000 39.370
CN-71-C2	2,000 78.740
CN-71-C5	5,000 196.850

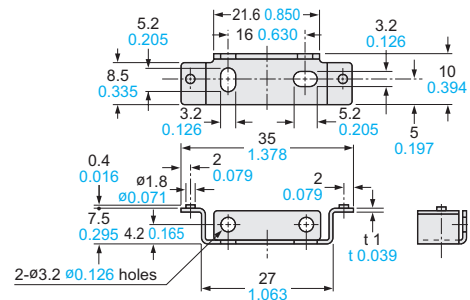
**CN-73-C1 CN-73-C2 CN-73-C5 Main cable (Optional)**

• Length L

Model No.	Length L
CN-73-C1	1,000 39.370
CN-73-C2	2,000 78.740
CN-73-C5	5,000 196.850

**MS-DIN-E****End plate (Optional)**

Material: Polycarbonate

MS-DIN-2**Amplifier mounting bracket (Optional)**

Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

FIBER SENSORS**LASER SENSORS****PHOTO-ELECTRIC SENSORS****MICRO PHOTO-ELECTRIC SENSORS****AREA SENSORS****LIGHT CURTAINS / SAFETY COMPONENTS****PRESSURE / FLOW SENSORS****INDUCTIVE PROXIMITY SENSORS****PARTICULAR USE SENSORS****SENSOR OPTIONS****SIMPLE WIRE-SAVING UNITS****WIRE-SAVING SYSTEMS****MEASURE-MENT SENSORS****STATIC ELECTRICITY PREVENTION DEVICES****LASER MARKERS****PLC****HUMAN MACHINE INTERFACES****ENERGY CONSUMPTION VISUALIZATION COMPONENTS****FA COMPONENTS****MACHINE VISION SYSTEMS****UV CURING SYSTEMS****Selection Guide****Fibers****Fiber Amplifiers****FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/ FX-301-F**

Manually Set Fiber Sensor

FX-311 SERIES

FIBER SENSORS

LASER SENSORS

PHOTOELECTRIC SENSORS

MICRO PHOTOELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE- SAVING UNITS

WIRE- SAVING SYSTEMS

MEASUREMENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F7 / FX-301-F

Related Information

■ General terms and conditions..... F-7

■ Fiber selection P.5~

■ Sensor selection guide..... P.3~

■ Glossary of terms / General precautions...P.1455~ / P.1458~



* Passed the UL 991 Environment Test

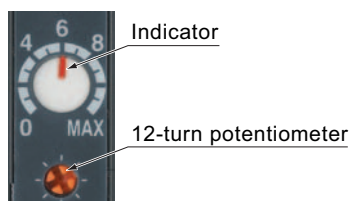
* UL 61010C-1 compatible, Passed the UL 991 Environment Test based on SEMI S2-0200. [Category applicable for semiconductor manufacturing: TWW2, Process Equipment] [Applicable standards: UL 61010C-1] [Additional test / evaluation standards as per intended use: UL 991, SEMI S2-0200]



Highly sensitive manual tuning made easy

12-turn potentiometer with visible indicator

12-turn potentiometer has been incorporated for fine adjustments. It enables detection of very fine differences. Moreover, since the pointer of indicator has a red backlight, you can confirm the position at a glance, even in a dark area.



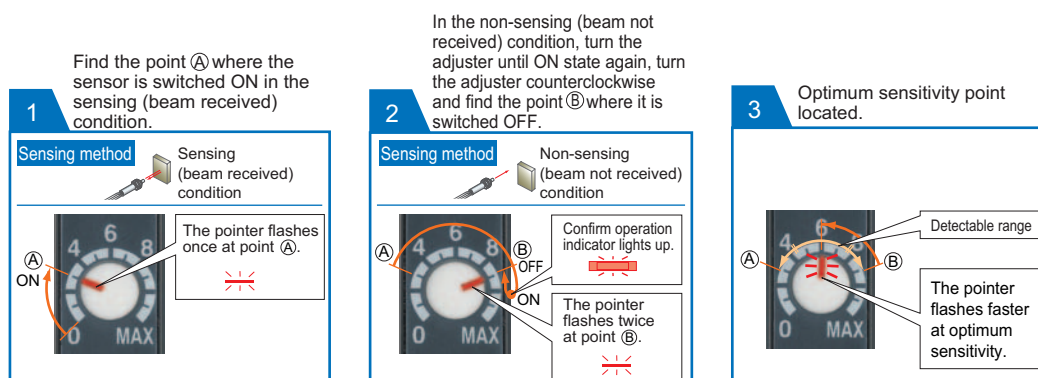
Long life and reduced maintenance work-hours

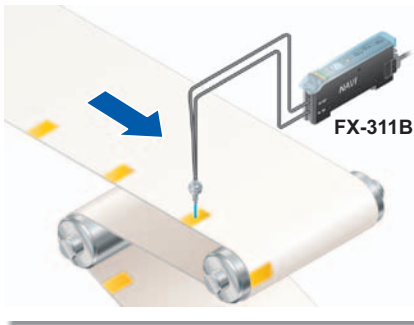
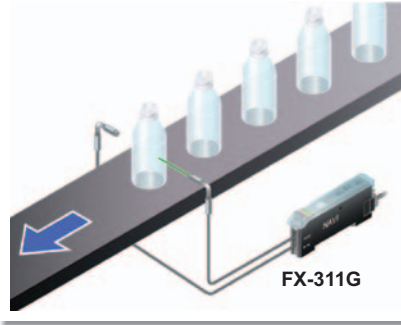
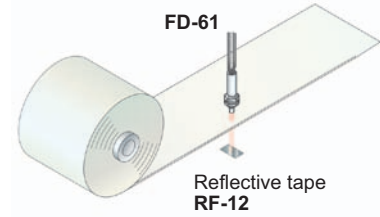
The light-emitting elements of conventional fiber sensors are affected by temperature and long-term use, changing their emission over time and requiring sensitivity readjustment. **FX-311** (red LED type) employs the new "four-chemical LED", first used in the **FX-301** (red LED type). This emitter greatly reduces adverse influences on emission performance, resulting in stable operation that almost never needs adjustment.

Rapid flashing "assist function" eases adjustment for optimum sensitivity

The **FX-311** series has a convenient built-in "assist function" which indicates the optimum sensitivity position by flashing rapidly when optimum sensitivity is reached. This enables easy and reliable sensitivity adjustment, which is convenient for a narrow sensing range requiring fine tuning.

* In order enable the "assist function", switch the operation selection switch from **L-ON→D-ON→L-ON** .

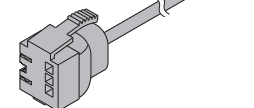
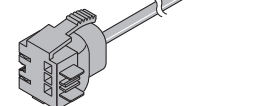


APPLICATIONS**Detecting register marks****Detecting transparent bottles****Sensing the presence of a translucent sheet****ORDER GUIDE****Amplifiers** Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Appearance	Model No.	Emitting element	Output
Manually set	NPN output	FX-311	Red LED	NPN open-collector transistor
		FX-311B	Blue LED	
		FX-311G	Green LED	
	PNP output	FX-311P	Red LED	PNP open-collector transistor
		FX-311BP	Blue LED	
		FX-311GP	Green LED	

Quick-connection cables Quick-connection cable is not supplied with the amplifier. Please order it separately.

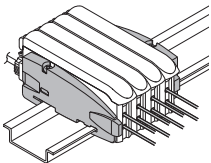
Type	Model No.	Description
Main cable (3-core)	CN-73-C1	Length: 1 m 3.281 ft
	CN-73-C2	Length: 2 m 6.562 ft
	CN-73-C5	Length: 5 m 16.404 ft
Sub cable (1-core)	CN-71-C1	Length: 1 m 3.281 ft
	CN-71-C2	Length: 2 m 6.562 ft
	CN-71-C5	Length: 5 m 16.404 ft

Main cable• **CN-73-C□****Sub cable**• **CN-71-C□****FIBER SENSORS****LASER SENSORS****PHOTO-ELECTRIC SENSORS****MICRO PHOTO-ELECTRIC SENSORS****AREA SENSORS****LIGHT CURTAINS / SAFETY COMPONENTS****PRESSURE / FLOW SENSORS****INDUCTIVE PROXIMITY SENSORS****PARTICULAR USE SENSORS****SENSOR OPTIONS****SIMPLE WIRE-SAVING UNITS****WIRE-SAVING SYSTEMS****MEASURE-MENT SENSORS****STATIC ELECTRICITY PREVENTION DEVICES****LASER MARKERS****PLC****HUMAN MACHINE INTERFACES****ENERGY CONSUMPTION VISUALIZATION COMPONENTS****FA COMPONENTS****MACHINE VISION SYSTEMS****UV CURING SYSTEMS****Selection Guide****Fibers****Fiber Amplifiers****FX-500****FX-100****FX-300****FX-410****FX-311****FX-301-F7/ FX-301-F**

ORDER GUIDE

End plates

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

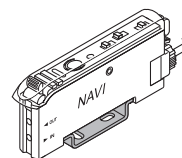
Appearance	Model No.	Description
	MS-DIN-E	When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. Two pcs. per set

OPTIONS

Designation	Model No.	Description
Amplifier mounting bracket	MS-DIN-2	Mounting bracket for amplifier
Hand-turned knob attached cover	FX-AJ1	Hand-turned knob allows easy adjustment of sensor sensitivity.
Fiber amplifier protection seal	FX-MB1	10 sets of 2 communication window seals and 1 connector seal Communication window seal: It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier. Connector seal: It prevents contact of any metal, etc., with the pins of the quick-connection cable.

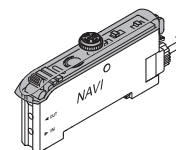
Amplifier mounting bracket

• MS-DIN-2



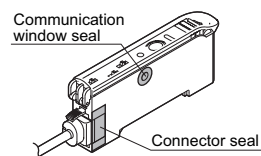
Hand-turned knob attached cover

• FX-AJ1



Fiber amplifier protection seal

• FX-MB1



LIST OF FIBERS**Thru-beam type (one pair set)**

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)										Dimensions
	Red LED			Blue LED			Green LED				
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST		
FT-140	19,600 771.654 (Note 2)	16,000 629.921	8,700 342.520	8,100 318.898	4,000 157.480	3,100 122.047	5,000 196.850	2,400 94.488	1,600 62.992	P.51	
FT-30	310 12.205	150 5.906	60 2.362	55 2.165	28 1.102	18 0.709	28 1.102	13 0.512	9 0.354	P.51	
FT-31	290 11.417	142 5.591	49 1.929	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	P.51	
FT-31S	290 11.417	140 5.512	49 1.929	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	P.51	
FT-31W	230 9.055	100 3.937	30 1.181	31 1.220	15 0.591	10 0.394	15 0.591	8 0.315	5 0.197	P.51	
FT-40	900 35.433	450 17.717	180 7.087	155 6.102	76 2.992	45 1.772	90 3.543	40 1.575	26 1.024	P.51	
FT-42	800 31.496	400 15.748	150 5.906	150 5.906	75 2.953	40 1.575	80 3.150	35 1.378	24 0.945	P.51	
FT-42S	800 31.496	400 15.748	150 5.906	150 5.906	75 2.953	40 1.575	70 2.756	35 1.378	24 0.945	P.51	
FT-42W	710 27.953	330 12.992	130 5.118	110 4.331	50 1.969	30 1.181	56 2.205	28 1.102	20 0.787	P.51	
FT-43	1,400 55.118	610 24.016	250 9.843	220 8.661	110 4.331	75 2.953	120 4.724	61 2.402	43 1.693	P.51	
FT-45X	1,100 43.307	570 22.441	230 9.055	130 5.118	65 2.559	45 1.772	70 2.756	34 1.339	25 0.984	P.52	
FT-A11	3,600 141.732 (Note 2)	2,700 106.299	1,000 39.370	880 34.646	420 16.535	270 10.630	430 16.929	220 8.661	120 4.724	P.52	
FT-A11W	3,600 141.732 (Note 2)	3,100 122.047	1,200 47.244	820 32.283	420 16.535	280 11.024	460 18.110	220 8.661	140 5.512	P.52	
FT-A32	3,600 141.732 (Note 2)	3,600 141.732	2,900 114.173	1,800 70.866	710 27.953	400 15.748	970 38.189	320 12.598	180 7.087	P.52	
FT-A32W	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,100 82.677	2,000 78.740	830 32.677	420 16.535	1,000 39.370	350 13.780	180 7.087	P.52	
FT-AL05	680 26.772	330 12.992	130 5.118	100 3.937	48 1.890	32 1.260	56 2.205	27 1.063	18 0.709	P.52	
FT-E13	13 0.512	6 0.236	2 0.079	2 0.079	1 0.039	————	1 0.039	————	————	P.52	
FT-E23	65 2.559	31 1.220	12 0.472	8 0.315	4 0.157	3 0.118	4 0.157	2 0.079	1 0.039	P.52	
FT-H13-FM2	880 34.646	440 17.323	155 6.102	72 2.835	36 1.417	26 1.024	32 1.260	16 0.630	10 0.394	P.52	
FT-H20-J20-S (Note 3)	390 15.354	200 7.874	60 2.362	60 2.362	20 0.787	————	35 1.378	————	————	P.53	
FT-H20-J30-S (Note 3)	390 15.354	200 7.874	60 2.362	60 2.362	20 0.787	————	35 1.378	————	————	P.53	
FT-H20-J50-S (Note 3)	390 15.354	200 7.874	60 2.362	60 2.362	20 0.787	————	35 1.378	————	————	P.53	
FT-H20-M1	550 21.654	280 11.024	90 3.543	100 3.937	50 1.969	35 1.378	50 1.969	25 0.984	18 0.709	P.53	
FT-H20-VJ50-S (Note 3)	550 21.654	280 11.024	90 3.543	85 3.346	30 1.181	————	50 1.969	————	————	P.53	
FT-H20-VJ80-S (Note 3)	550 21.654	280 11.024	90 3.543	85 3.346	30 1.181	————	50 1.969	————	————	P.53	
FT-H20W-M1	310 12.205	140 5.512	50 1.969	44 1.732	22 0.866	14 0.551	22 0.866	11 0.433	7 0.276	P.53	
FT-H30-M1V-S (Note 4)	250 9.843	125 4.922	50 1.969	————	————	————	————	————	————	P.53	
FT-H35-M2	550 21.654	280 11.024	90 3.543	100 3.937	50 1.969	35 1.378	50 1.969	25 0.984	18 0.709	P.53	
FT-H35-M2S6	550 21.654	280 11.024	90 3.543	100 3.937	50 1.969	35 1.378	50 1.969	25 0.984	18 0.709	P.53	
FT-HL80Y	3,500 137.795	1,350 53.150	480 18.898	80 3.150	40 1.575	25 0.984	110 4.331	55 2.165	40 1.575	P.53	
FT-KS40	3,600 141.732 (Note 2)	2,700 106.299	850 33.465	740 29.134	280 11.024	220 8.661	420 16.535	180 7.087	81 3.189	P.54	
FT-KV26	710 27.953	310 12.205	120 4.724	81 3.189	36 1.417	21 0.827	44 1.732	8 0.315	————	P.54	
FT-KV40	3,600 141.732 (Note 2)	2,500 98.425	1,000 39.370	710 27.953	270 10.630	210 8.268	420 16.535	180 7.087	100 3.937	P.54	
FT-KV40W	3,600 141.732 (Note 2)	2,000 78.740	810 31.890	860 33.858	400 15.748	260 10.236	420 16.535	210 8.268	140 5.512	P.54	
FT-L80Y	3,500 137.795 (Note 2)	1,500 59.055	530 20.866	160 6.299	80 3.150	50 1.969	160 6.299	80 3.150	50 1.969	P.54	
FT-R31	290 11.417	130 5.118	49 1.929	45 1.772	23 0.906	15 0.591	24 0.945	12 0.472	8 0.315	P.54	
FT-R40	710 27.953	330 12.992	130 5.118	110 4.331	54 2.126	36 1.417	55 2.165	26 1.024	20 0.787	P.54	
FT-R41W	710 27.953	330 12.992	130 5.118	110 4.331	50 1.969	30 1.181	56 2.205	28 1.102	20 0.787	P.54	
FT-R42W	1,600 62.992	770 30.315	320 12.598	280 11.024	130 5.118	90 3.543	140 5.512	70 2.756	47 1.850	P.54	
FT-R43	710 27.953	290 11.417	110 4.331	96 3.780	50 1.969	33 1.299	53 2.087	25 0.984	17 0.669	P.54	

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) Heat-resistant joint fibers and ordinary-temperature fibers (**FT-42**) are sold as a set.

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

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-SAVING
UNITSWIRE-SAVING
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Guide

Fibers

Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311**FX-301-F7/
FX-301-F

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS/
SAFETY
COMPONENTSPRESSURE /
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SENSORSPARTICULAR
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SENSORSSENSOR
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VISUALIZATION
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COMPONENTSMACHINE
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CURING
SYSTEMS

LIST OF FIBERS

Thru-beam type (one pair set)



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)										Dimensions
	Red LED			Blue LED			Green LED				
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST		
FT-R44Y	710 27.953	290 11.417	110 4.331	96 3.780	50 1.969	33 1.299	53 2.087	25 0.984	17 0.669	P.55	
FT-R60Y	1,800 70.866	830 32.677	350 13.780	250 9.843	120 4.724	80 3.150	140 5.512	70 2.756	50 1.969	P.55	
FT-S11	80 3.150	31 1.220	14 0.551	12 0.472	5 0.197	4 0.157	5 0.197	2.5 0.098	1.5 0.059	P.55	
FT-S20	310 12.205	150 5.906	60 2.362	55 2.165	28 1.102	18 0.709	28 1.102	13 0.512	9 0.354	P.55	
FT-S21	290 11.417	142 5.591	49 1.929	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	P.55	
FT-S21W	230 9.055	100 3.937	30 1.181	31 1.220	15 0.591	10 0.394	15 0.591	8 0.315	5 0.197	P.55	
FT-S30	900 35.433	450 17.717	180 7.087	155 6.102	76 2.992	45 1.772	90 3.543	40 1.575	26 1.024	P.55	
FT-S31W	710 27.953	330 12.992	130 5.118	110 4.331	50 1.969	30 1.181	56 2.205	28 1.102	20 0.787	P.55	
FT-S32	2,400 94.488	1,100 43.307	510 20.079	420 16.535	200 7.874	130 5.118	220 8.661	100 3.937	72 2.835	P.55	
FT-V23	380 14.961	170 6.693	63 2.480	65 2.559	26 1.024	18 0.709	26 1.024	13 0.512	8 0.315	P.55	
FT-V24W	90 3.543	40 1.575	15 0.591	6 0.236	2 0.079	————	3 0.118	————	————	P.56	
FT-V25	200 7.874	90 3.543	35 1.378	25 0.984	12 0.472	9 0.354	16 0.630	7 0.276	5 0.197	P.56	
FT-V30	420 16.535	200 7.874	70 2.756	80 3.150	40 1.575	22 0.866	40 1.575	14 0.551	8 0.315	P.56	
FT-V40	3,600 141.732 (Note 2)	1,700 66.929	690 27.165	400 15.748	200 7.874	130 5.118	200 7.874	100 3.937	65 2.559	P.56	
FT-V80Y	800 31.496	400 15.748	140 5.512	120 4.724	60 2.362	35 1.378	80 3.150	40 1.575	25 0.984	P.56	
FT-Z20HBW	290 11.417	130 5.118	50 1.969	39 1.535	19 0.748	12 0.472	20 0.787	10 0.394	6 0.236	P.56	
FT-Z20W	570 22.441	250 9.843	90 3.543	82 3.228	37 1.457	23 0.906	44 1.732	18 0.709	11 0.433	P.56	
FT-Z30	1,900 74.803	850 33.465	340 13.386	120 4.724	60 2.362	40 1.575	96 3.780	45 1.772	30 1.181	P.56	
FT-Z30E	3,100 122.047	1,600 62.992	670 26.378	540 21.260	250 9.843	170 6.693	270 10.630	130 5.118	91 3.583	P.56	
FT-Z30EW	2,700 106.299	1,200 47.244	500 19.685	540 21.260	260 10.236	170 6.693	260 10.236	120 4.724	88 3.465	P.57	
FT-Z30H	3,100 122.047	1,600 62.992	670 26.378	650 25.591	310 12.205	200 7.874	340 13.386	160 6.299	110 4.331	P.57	
FT-Z30HW	3,100 122.047	1,500 59.055	610 24.016	540 21.260	260 10.236	170 6.693	260 10.236	120 4.724	88 3.465	P.57	
FT-Z30W	1,400 55.118	640 25.197	260 10.236	83 3.268	40 1.575	25 0.984	73 2.874	36 1.417	25 0.984	P.57	
FT-Z40HBW	710 27.953	330 12.992	130 5.118	110 4.331	50 1.969	30 1.181	56 2.205	28 1.102	20 0.787	P.57	
FT-Z40W	1,300 51.181	630 24.803	260 10.236	180 7.087	90 3.543	60 2.362	90 3.543	50 1.969	35 1.378	P.57	
FT-Z802Y	3,500 137.795	1,500 59.055	530 20.866	320 12.598	160 6.299	120 4.724	160 6.299	80 3.150	60 2.362	P.57	

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

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

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Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2)									Dimensions
	Red LED			Blue LED			Green LED			
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST	
FR-KZ22E	15 to 330 0.591 to 12.992	15 to 210 0.591 to 8.268	15 to 90 0.591 to 3.543	————	————	————	————	————	————	P.58
FR-KZ50E	20 to 300 0.787 to 11.811	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 160 0.787 to 6.299	20 to 100 0.787 to 3.937	20 to 60 0.787 to 2.362	20 to 110 0.787 to 4.331	20 to 54 0.787 to 2.126	————	P.58
FR-KZ50H	20 to 300 0.787 to 11.811	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	20 to 140 0.787 to 5.512	20 to 70 0.787 to 2.756	20 to 52 0.787 to 2.047	20 to 90 0.787 to 3.543	20 to 40 0.787 to 1.575	————	P.58
FR-Z50HW	100 to 810 3.937 to 31.890	100 to 580 3.937 to 22.835	100 to 270 3.937 to 10.630	————	————	————	————	————	————	P.58

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

The sensing range of **FR-KZ22E** is specified for the attached reflector. The sensing range of **FR-KZ50E** and **FR-KZ50H** is specified for the attached reflector **RF-003**. The sensing range of **FR-Z50HW** is specified for the **RF-13**.

2) The sensing range is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.

Sensing range when using in combination with FR-Z50HW reflector (Optional)

The sensing ranges are the value for red LED types.

Reflector Model No.	Sensing range (mm in)		
	FX-311		
	LONG	STD	S-D
RF-230	100 to 3,200 3.937 to 125.984	100 to 2,000 3.937 to 78.740	100 to 1,000 3.937 to 39.370
RF-220	100 to 2,400 3.937 to 94.488	100 to 1,300 3.937 to 51.181	100 to 600 3.937 to 23.622
RF-210	100 to 1,700 3.937 to 66.929	100 to 910 3.937 to 35.827	100 to 460 3.937 to 18.110

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.

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Reflective type



Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2) / Description										Dimensions
	Red LED			Blue LED			Green LED				
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST		
FD-30	110 4.331	50 1.969	18 0.709	19 0.748	9 0.354	6 0.236	9 0.354	4.5 0.177	2.5 0.098	P.59	
FD-31	95 3.740	45 1.772	16 0.630	18 0.709	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	P.59	
FD-31W	40 1.575	20 0.787	10 0.394	7 0.276	4 0.157	1 to 2.5 0.039 to 0.098	5 0.197	1 to 2 0.039 to 0.079	————	P.59	
FD-32G	120 4.724	60 2.362	20 0.787	22 0.866	11 0.433	8 0.315	15 0.591	6 0.236	4 0.157	P.59	
FD-32GX	140 5.512	70 2.756	25 0.984	25 0.984	11 0.433	8 0.315	16 0.630	6 0.236	4 0.157	P.59	
FD-40	110 4.331	50 1.969	18 0.709	19 0.748	9 0.354	6 0.236	9 0.354	4.5 0.177	2.5 0.098	P.59	
FD-41	95 3.740	45 1.772	16 0.630	18 0.709	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	P.59	
FD-41S	95 3.740	45 1.772	16 0.630	18 0.709	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	P.59	
FD-41SW	40 1.575	20 0.787	10 0.394	9 0.354	1 to 4 0.039 to 0.157	1 to 2.5 0.039 to 0.098	1 to 4 0.039 to 0.157	1 to 2 0.039 to 0.079	————	P.59	
FD-41W	220 8.661	95 3.740	40 1.575	32 1.260	1 to 15 0.039 to 0.591	1 to 9 0.039 to 0.354	17 0.669	1 to 7.5 0.039 to 0.295	1.5 to 4.5 0.059 to 0.177	P.59	
FD-42G	120 4.724	60 2.362	20 0.787	22 0.866	11 0.433	8 0.315	15 0.591	6 0.236	4 0.157	P.60	
FD-42GW	85 3.346	35 1.378	14 0.551	14 0.551	7 0.276	5 0.197	6 0.236	4 0.157	2 0.079	P.60	
FD-60	350 13.780	160 6.299	70 2.756	55 2.165	28 1.102	18 0.709	30 1.181	15 0.591	10 0.394	P.60	
FD-61	320 12.598	145 5.709	60 2.362	48 1.890	24 0.945	16 0.630	26 1.024	13 0.512	8 0.315	P.60	
FD-61G	200 7.874	90 3.543	40 1.575	46 1.811	23 0.906	15 0.591	26 1.024	12 0.472	8 0.315	P.60	
FD-61S	320 12.598	145 5.709	60 2.362	48 1.890	24 0.945	16 0.630	26 1.024	13 0.512	8 0.315	P.60	
FD-61W	220 8.661	95 3.740	40 1.575	32 1.260	1 to 15 0.039 to 0.591	1 to 9 0.039 to 0.354	17 0.669	1 to 7.5 0.039 to 0.295	1.5 to 4.5 0.059 to 0.177	P.60	
FD-62	480 18.898	220 8.661	90 3.543	80 3.150	1 to 40 0.039 to 1.575	1 to 27 0.039 to 1.063	1 to 42 0.039 to 1.654	1 to 21 0.039 to 0.827	1 to 14 0.039 to 0.551	P.60	
FD-64X	200 7.874	85 3.346	35 1.378	32 1.260	0.5 to 16 0.020 to 0.630	0.5 to 10 0.020 to 0.394	0.5 to 16 0.020 to 0.630	0.5 to 8 0.020 to 0.315	0.5 to 5 0.020 to 0.197	P.61	
FD-A16	200 7.874	150 5.906	50 1.969	19 0.748	14 0.551	————	20 0.787	13 0.512	————	P.61	
FD-AL11	250 9.843	110 4.331	40 1.575	33 1.299	16 0.630	10 0.394	18 0.709	8 0.315	4.5 0.177	P.61	
FD-E13	11 0.433	6 0.236	2 0.079	2 0.079	0.8 0.031	0.5 0.020	0.8 0.031	————	————	P.61	
FD-E23	45 1.772	19 0.748	7 0.276	6 0.236	3 0.118	2 0.079	3 0.118	1.5 0.059	1 0.039	P.61	
FD-EG30	45 1.772	19 0.748	7 0.276	6 0.236	3 0.118	2 0.079	3 0.118	1.5 0.059	1 0.039	P.61	
FD-EG30S	45 1.772	19 0.748	7 0.276	6 0.236	3 0.118	2 0.079	3 0.118	1.5 0.059	1 0.039	P.62	
FD-EG31	15 0.591	8 0.315	3 0.118	2 0.079	1 0.039	0.5 0.020	1 0.039	————	————	P.62	
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]										P.62
FD-F41	Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe [PVC, fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm 0.039 to 0.118 in]										P.62
FD-F41Y (Note 3)	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 interrupted										P.62
FD-F8Y	————	————	————	————	————	————	————	————	————	P.62	
FD-FA93	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 interrupted										P.62
FD-H13-FM2	310 12.205	140 5.512	47 1.850	20 0.787	11 0.433	7 0.276	20 0.787	11 0.433	7 0.276	P.63	
FD-H18-L31	0 to 15 0 to 0.591	0 to 10 0 to 0.394	2 to 6 0.079 to 0.236	————	————	————	————	————	————	P.63	
FD-H20-21	270 10.630	140 5.512	47 1.850	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	P.63	
FD-H20-M1	270 10.630	140 5.512	47 1.850	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	P.63	
FD-H25-L43 (Note 4)	3 to 25 0.118 to 0.984	4 to 20 0.157 to 0.787	4 to 16 0.157 to 0.630	————	————	————	————	————	————	P.63	
FD-H25-L45 (Note 4)	6 to 41 0.236 to 1.614	7 to 38 0.276 to 1.496	————	————	————	————	————	————	————	P.63	
FD-H30-KZ1V-S (Note 4,5)	20 to 200 0.787 to 7.874	25 to 130 0.984 to 5.118	————	————	————	————	————	————	————	P.64	
FD-H30-L32	0 to 15 0 to 0.591	0 to 10 0 to 0.394	2 to 6 0.079 to 0.236	————	————	————	————	————	————	P.64	
FD-H30-L32V-S (Note 4,5)	0 to 8 0 to 0.315	1.5 to 5 0.059 to 0.197	————	————	————	————	————	————	————	P.64	

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 (as for **FD-H30-L32** and **FD-H18-L31** 50 × 50 mm 1.969 × 1.969 in glass substrate).

3) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

4) The sensing range is specified for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.

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

LIST OF FIBERS**Reflective type**

Fibers are listed in alphabetic order. Refer to p.5~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2) / Description											Dimensions
	Red LED			Blue LED			Green LED					
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST			
FD-H35-20S	160 6.299	80 3.150	26 1.024	22 0.866	11 0.433	7 0.276	12 0.472	6 0.236	4 0.157		P.64	
FD-H35-M2	270 10.630	140 5.512	47 1.850	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276		P.64	
FD-H35-M2S6	270 10.630	140 5.512	47 1.850	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276		P.64	
FD-HF40Y (Note 3)	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 interrupted											P.64
FD-L10 (Note 4)	0 to 4.5 0 to 0.177	0 to 4 0 to 0.157	0 to 3.5 0 to 0.138	0-3.5 0 to 0.138	0 to 3 0 to 0.118	0.5 to 2.5 0.020 to 0.098	0 to 3 0 to 0.118	1 to 2 0.039 to 0.079	————		P.65	
FD-L11 (Note 4)	0 to 8 0 to 0.315	0 to 7 0 to 0.906	0 to 6 0 to 0.236	7 0.276	6.5 0.256	0.5 to 5.5 0.020 to 0.217	6.5 0.256	1 to 4 0.039 to 0.157	————		P.65	
FD-L12W (Note 4)	0.5 to 8 0.019 to 0.315	1 to 5.5 0.039 to 0.217	————	————	————	————	————	————	————		P.65	
FD-L20H	2 to 23 0.079 to 0.906	4 to 14 0.157 to 0.551	4.8 to 9.5 0.188 to 0.374	4.5 to 10 0.177 to 0.394	5 to 9 0.197 to 0.354	5.5 to 8 0.217 to 0.315	5 to 9 0.197 to 0.354	5.5 to 8 0.217 to 0.315	————		P.65	
FD-L21 (Note 4)	2 to 18 0.079 to 0.709	3 to 16 0.118 to 0.630	5 to 11 0.197 to 0.433	————	————	————	————	————	————		P.65	
FD-L21W (Note 4)	3 to 14 0.118 to 0.551	6 to 12 0.236 to 0.472	————	————	————	————	————	————	————		P.65	
FD-L22A (Note 4)	0 to 23 0 to 0.906	0 to 23 0 to 0.906	1 to 17 0.039 to 0.669	————	————	————	————	————	————		P.65	
FD-L23 (Note 4)	0 to 30 0 to 1.181	0 to 30 0.039 to 1.181	2 to 27 0.079 to 1.063	————	————	————	————	————	————		P.65	
FD-L30A (Note 4)	0 to 43 0 to 17.441	0 to 37 0 to 1.457	0 to 26 0 to 1.024	————	————	————	————	————	————		P.65	
FD-L31A (Note 4)	4 to 33 0.157 to 1.299	5 to 32 0.197 to 1.260	6 to 18 0.236 to 0.709	————	————	————	————	————	————		P.65	
FD-L32H (Note 4)	0 to 50 0 to 1.969	15 to 35 0.591 to 1.378	————	————	————	————	————	————	————		P.66	
FD-R31G	92 3.622	44 1.732	17 0.669	17 0.669	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079		P.66	
FD-R32EG	45 1.772	19 0.748	7 0.276	6 0.236	3 0.118	1.5 0.059	2 0.079	1 0.039	————		P.66	
FD-R33EG	15 0.591	6 0.236	2 0.079	2 0.079	0.8 0.031	0.5 0.020	1 0.039	————	————		P.66	
FD-R34EG	38 1.496	16 0.630	6 0.236	5 0.197	2 0.079	1.5 0.059	2 0.079	1 0.039	————		P.66	
FD-R41	150 5.906	70 2.756	28 1.102	24 0.945	1 to 13 0.039 to 0.512	1 to 9 0.039 to 0.354	1 to 15 0.039 to 0.591	1 to 8 0.039 to 0.315	3 to 6 0.118 to 0.236		P.66	
FD-R60	240 9.449	120 4.724	45 1.772	42 1.654	20 0.787	0.5 to 13 0.020 to 0.512	21 0.827	0.5 to 10 0.020 to 0.394	0.5 to 7 0.020 to 0.276		P.66	
FD-R61Y	230 9.055	110 4.331	45 1.771	36 1.417	17 0.669	0.5 to 11 0.020 to 0.433	19 0.748	0.5 to 9 0.020 to 0.354	1 to 6 0.039 to 0.236		P.66	
FD-S21	50 1.969	25 0.984	9 0.354	8 0.315	3.5 0.138	2 0.079	5 0.197	2 0.079	1.3 0.051		P.66	
FD-S30	110 4.331	50 1.969	18 0.709	19 0.748	9 0.354	6 0.236	9 0.354	4.5 0.177	2.5 0.098		P.67	
FD-S31	95 3.740	45 1.772	16 0.630	18 0.709	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079		P.67	
FD-S32	270 10.630	140 5.512	55 2.165	48 1.890	24 0.945	16 0.630	26 1.024	13 0.512	8 0.315		P.67	
FD-S32W	220 8.661	95 3.740	40 1.575	32 1.260	1 to 15 0.039 to 0.591	1 to 9 0.039 to 0.354	17 0.669	1 to 7.5 0.039 to 0.295	1.5 to 4.5 0.059 to 0.177		P.67	
FD-S33GW	85 3.346	35 1.378	14 0.551	14 0.551	7 0.276	5 0.197	6 0.236	4 0.157	2 0.079		P.67	
FD-S60Y	360 14.173	170 6.693	70 2.756	50 1.969	20 0.787	3 to 12 0.118 to 0.472	28 1.102	3 to 9 0.118 to 0.354	————		P.67	
FD-V30	45 1.772	20 0.787	7 0.276	9 0.354	————	————	————	————	————		P.67	
FD-V30W	15 0.591	7 0.276	————	————	————	————	————	————	————		P.67	
FD-V50	100 3.937	45 1.772	16 0.630	12 0.472	————	————	6 0.236	————	————		P.68	
FD-Z20HBW	1 to 70 0.0 to 2.756	2 to 30 0.079 to 1.181	3 to 10 0.118 to 0.394	4 to 10 0.157 to 0.394	————	————	————	————	————		P.68	
FD-Z20W	1 to 59 0.0 to 2.323	3 to 27 0.118 to 1.063	————	————	————	————	————	————	————		P.68	
FD-Z40HBW	0.5 to 230 0.02 to 9.055	1 to 100 0.039 to 3.937	1 to 40 0.039 to 1.575	1 to 36 0.039 to 1.417	3 to 17 1.181 to 0.669	3 to 11 1.181 to 0.433	2 to 19 0.079 to 0.748	3 to 8 0.118 to 0.315	4 to 5 0.157 to 0.197		P.68	
FD-Z40W	180 7.087	1 to 87 0.039 to 3.425	2.5 to 32 0.098 to 1.260	4 to 20 0.157 to 0.787	————	————	4 to 14 0.157 to 0.551	————	————		P.68	
FD-Z50HW	10 to 540 0.394 to 21.260	10 to 250 0.393 to 9.843	15 to 100 0.591 to 3.937	————	————	————	————	————	————		P.68	

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

2) The sensing range of reflective type is the value for white non-glossy paper.

3) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint are available. Please refer to p.38 for details.

4) 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 0.079 in) [FD-L10: silicon wafers 100 × 100 mm 3.937 × 3.937 in].

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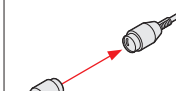


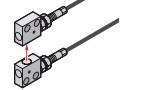
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Refer to p. 69~ for details of lens dimensions.

Lens (for thru-beam type fiber)


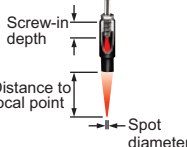
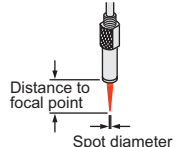
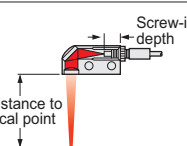
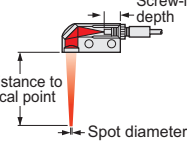
Designation		Model No.	Description																																						
For thru-beam type fiber	Expansion lens (Note 1)	FX-LE1		<p>Increases the sensing range by 5 times or more.</p> <ul style="list-style-type: none">Ambient temperature: -60 to $+350$ °C -76 to $+662$ °F (Note 5)Beam dia: $\phi 3.6$ mm $\phi 0.142$ in	<p>Sensing range for red LED type (mm) [Lens on both sides] (Note 2)</p> <table><tr><th>Mode Fiber</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-43</td><td>3,600 141.732</td><td>2,900 114.173</td><td>1,300 51.181</td></tr><tr><td>FT-42</td><td>3,600 141.732</td><td>3,600 141.732</td><td>1,600 62.992</td></tr><tr><td>FT-45X</td><td>1,600 62.992</td><td>1,600 62.992</td><td>1,600 62.992</td></tr><tr><td>FT-R40</td><td>3,600 141.732</td><td>3,400 133.858</td><td>1,500 59.055</td></tr><tr><td>FT-H35-M2</td><td>3,500 137.795 (Note 3)</td><td>2,000 78.740</td><td>750 29.528</td></tr><tr><td>FT-H20W-M1</td><td>1,600 62.992 (Note 3)</td><td>1,300 51.181</td><td>500 19.685</td></tr><tr><td>FT-H20-M1</td><td>1,600 62.992 (Note 3)</td><td>1,600 62.992 (Note 3)</td><td>900 35.433</td></tr></table>		Mode Fiber	LONG	STD	S-D	FT-43	3,600 141.732	2,900 114.173	1,300 51.181	FT-42	3,600 141.732	3,600 141.732	1,600 62.992	FT-45X	1,600 62.992	1,600 62.992	1,600 62.992	FT-R40	3,600 141.732	3,400 133.858	1,500 59.055	FT-H35-M2	3,500 137.795 (Note 3)	2,000 78.740	750 29.528	FT-H20W-M1	1,600 62.992 (Note 3)	1,300 51.181	500 19.685	FT-H20-M1	1,600 62.992 (Note 3)	1,600 62.992 (Note 3)	900 35.433			
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FT-H20-M1	1,600 62.992 (Note 3)	1,600 62.992 (Note 3)	900 35.433																																						
Super-expansion lens (Note 1)	FX-LE2		<p>Tremendously increases the sensing range with large diameter lenses.</p> <ul style="list-style-type: none">Ambient temperature: -60 to $+350$ °C -76 to $+662$ °F (Note 5)Beam dia: $\phi 9.8$ mm $\phi 0.386$ in	<p>Sensing range for red LED type (mm) [Lens on both sides] (Note 2)</p> <table><tr><th>Mode Fiber</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-43</td><td>3,600 141.732</td><td>3,600 141.732</td><td>3,600 141.732</td></tr><tr><td>FT-42</td><td>3,600 141.732</td><td>3,600 141.732</td><td>3,600 141.732</td></tr><tr><td>FT-45X</td><td>1,600 62.992</td><td>1,600 62.992</td><td>1,600 62.992</td></tr><tr><td>FT-R40</td><td>3,600 141.732</td><td>3,600 141.732</td><td>3,600 141.732</td></tr><tr><td>FT-H35-M2</td><td>3,500 137.795 (Note 3)</td><td>3,500 137.795 (Note 3)</td><td>3,500 137.795 (Note 3)</td></tr><tr><td>FT-H20W-M1</td><td>1,600 62.992 (Note 3)</td><td>1,600 62.992 (Note 3)</td><td>1,500 59.055</td></tr><tr><td>FT-H20-M1</td><td>1,600 62.992 (Note 3)</td><td>1,600 62.992 (Note 3)</td><td>1,600 62.992 (Note 3)</td></tr><tr><td>FT-H13-FM2</td><td>3,500 137.795 (Note 3)</td><td>3,500 137.795 (Note 3)</td><td>3,500 137.795 (Note 3)</td></tr></table>		Mode Fiber	LONG	STD	S-D	FT-43	3,600 141.732	3,600 141.732	3,600 141.732	FT-42	3,600 141.732	3,600 141.732	3,600 141.732	FT-45X	1,600 62.992	1,600 62.992	1,600 62.992	FT-R40	3,600 141.732	3,600 141.732	3,600 141.732	FT-H35-M2	3,500 137.795 (Note 3)	3,500 137.795 (Note 3)	3,500 137.795 (Note 3)	FT-H20W-M1	1,600 62.992 (Note 3)	1,600 62.992 (Note 3)	1,500 59.055	FT-H20-M1	1,600 62.992 (Note 3)	1,600 62.992 (Note 3)	1,600 62.992 (Note 3)	FT-H13-FM2	3,500 137.795 (Note 3)	3,500 137.795 (Note 3)	3,500 137.795 (Note 3)
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FT-H13-FM2	3,500 137.795 (Note 3)	3,500 137.795 (Note 3)	3,500 137.795 (Note 3)																																						
Side-view lens	FX-SV1		<p>Beam axis is bent by 90°.</p> <ul style="list-style-type: none">Ambient temperature: -60 to $+300$ °C -76 to $+572$ °F (Note 5)Beam dia: $\phi 2.8$ mm $\phi 0.110$ in	<p>Sensing range for red LED type (mm) [Lens on both sides] (Note 2)</p> <table><tr><th>Mode Fiber</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-43</td><td>1,200 47.244</td><td>580 22.835</td><td>250 9.843</td></tr><tr><td>FT-42</td><td>1,400 55.118</td><td>640 25.197</td><td>210 8.268</td></tr><tr><td>FT-45X</td><td>1,600 62.992</td><td>650 25.591</td><td>220 8.661</td></tr><tr><td>FT-H35-M2</td><td>550 21.654</td><td>280 11.024</td><td>90 3.543</td></tr><tr><td>FT-H20W-M1</td><td>310 12.205</td><td>140 5.512</td><td>50 1.969</td></tr><tr><td>FT-H20-M1</td><td>550 21.654</td><td>280 11.024</td><td>90 3.543</td></tr></table>		Mode Fiber	LONG	STD	S-D	FT-43	1,200 47.244	580 22.835	250 9.843	FT-42	1,400 55.118	640 25.197	210 8.268	FT-45X	1,600 62.992	650 25.591	220 8.661	FT-H35-M2	550 21.654	280 11.024	90 3.543	FT-H20W-M1	310 12.205	140 5.512	50 1.969	FT-H20-M1	550 21.654	280 11.024	90 3.543								
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Expansion lens for vacuum fiber (Note 1)	FV-LE1		<p>Sensing range increases by 4 times or more.</p> <ul style="list-style-type: none">Ambient temperature: -60 to $+350$ °C -76 to $+662$ °F (Note 5)Beam dia: $\phi 3.6$ mm $\phi 0.142$ in	<p>Sensing range for red LED type (mm) [Lens on both sides] (Note 2, 4)</p> <table><tr><th>Mode Fiber</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-H30-M1V-S</td><td>1,200 47.244</td><td>450 17.717</td><td>150 5.906</td></tr></table>		Mode Fiber	LONG	STD	S-D	FT-H30-M1V-S	1,200 47.244	450 17.717	150 5.906																												
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Vacuum resistant side-view lens (Note 1)	FV-SV2		<p>Beam axis is bent by 90°.</p> <ul style="list-style-type: none">Ambient temperature: -60 to $+300$ °C -76 to $+572$ °F (Note 5)Beam dia: $\phi 3.7$ mm $\phi 0.146$ in	<p>Sensing range for red LED type (mm) [Lens on both sides] (Note 2, 4)</p> <table><tr><th>Mode Fiber</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-H30-M1V-S</td><td>1,200 47.244</td><td>450 17.717</td><td>150 5.906</td></tr></table>		Mode Fiber	LONG	STD	S-D	FT-H30-M1V-S	1,200 47.244	450 17.717	150 5.906																												
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- 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 sensing ranges are the values for red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifiers.
- 3) The fiber cable length practically limits the sensing range.
- 4) The fiber cable length for the **FT-H30-M1V-S** is 1 m 3.281 ft. The sensing ranges in LONG modes take into account the length of the **FT-J8** atmospheric side fiber.
- 5) Refer to p.15, p.18, p.33 and p.35 for the ambient temperatures of fibers to be used in combination.

FIBER OPTIONS

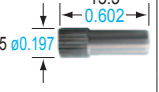




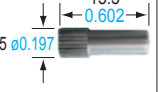








Refer to p. 69~ for details of lens dimensions.

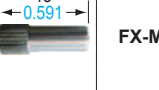
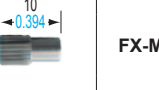
Lens (for reflective type fiber)

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

Notes: 1) The sensing ranges are the values when used in combination with a red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifier.
 2) Refer to p.16 or p.26 for the ambient temperatures of fibers to be used in combination.

Lens (For square head M3 reflective fiber)

Type	Spot diameter (mm in)	Distance to focal point (mm in)	Lens	Fiber
			Shape (mm in)	Model No.
For Square head M3 reflective fiber	$\phi 0.1$ $\phi 0.004$ approx.	7 ± 0.5 0.276 ± 0.020		 $\phi 0.125$ $\phi 0.005$ FD-R33EG
	$\phi 0.15$ $\phi 0.006$ approx.			 $\phi 0.125$ $\phi 0.005$ FD-EG31
	$\phi 0.2$ $\phi 0.008$ approx.			 $\phi 0.175$ $\phi 0.007$ FD-R34EG
	$\phi 0.4$ $\phi 0.016$ approx.			 $\phi 0.25$ $\phi 0.010$ FD-R32EG
For Square head M3 reflective fiber	$\phi 0.4$ $\phi 0.016$ approx.	7 ± 0.5 0.276 ± 0.020		 $\phi 0.25$ $\phi 0.010$ FD-EG30
				 $\phi 0.5$ $\phi 0.020$ FD-R31G
				 $\phi 0.5$ $\phi 0.020$ FD-32G
				 $\phi 0.5$ $\phi 0.020$ FD-32GX
				 $\phi 0.5$ $\phi 0.020$ FD-42G
				 $\phi 0.5$ $\phi 0.020$ FD-42GW
				 $\phi 0.5$ $\phi 0.020$ FD-42GW
				 $\phi 0.5$ $\phi 0.020$ FD-42GW

Type	Spot diameter (mm in)	Sensing range (mm in)	Lens	Applicable fibers
			Shape (mm in)	Model No.
For Square head M3 reflective fiber	$\phi 0.4$ to $\phi 2.0$ $\phi 0.016$ to $\phi 0.079$ approx.	10 to 30 0.394 to 1.181		$\phi 0.125$ $\phi 0.005$ FD-R33EG, FD-EG31
	$\phi 0.4$ to $\phi 2.2$ $\phi 0.016$ to $\phi 0.087$ approx.			$\phi 0.175$ $\phi 0.007$ FD-R34EG
	$\phi 0.5$ to $\phi 2.5$ $\phi 0.020$ to $\phi 0.098$ approx.			$\phi 0.25$ $\phi 0.010$ FD-R32EG, FD-EG30
	$\phi 0.8$ to $\phi 3.5$ $\phi 0.031$ to $\phi 0.138$ approx.			$\phi 0.5$ $\phi 0.020$ FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW
For Square head M3 reflective fiber	$\phi 4.0$ $\phi 0.157$ approx.	0 to 30 0 to 1.181		$\phi 0.125$ $\phi 0.005$ FD-R33EG, FD-EG31
				$\phi 0.175$ $\phi 0.007$ FD-R34EG
				$\phi 0.25$ $\phi 0.010$ FD-R32EG, FD-EG30
				$\phi 0.5$ $\phi 0.020$ FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW

Note: Spot diameter, distance to focal point and sensing range are specified for a red LED type amplifier.

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F / FX-301-F

FIBER OPTIONS

Others

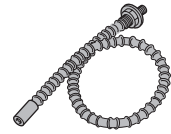
Designation	Model No.	Description						
Protective tube for thru-beam type fiber	FTP-500 (0.5 m 1.640 ft)	For M4 thread	Applicable fibers	FT-42 FT-42S FT-42W	FT-43 FT-H13-FM2	The protective tube, made of non-corrosive stainless steel, protects the inner fiber cable from any external forces.		
	FTP-1000 (1 m 3.281 ft)							
	FTP-1500 (1.5 m 4.921 ft)							
	FTP-N500 (0.5 m 1.640 ft)	For M3 thread					FT-31 FT-31S FT-31W	FD-31 FD-31W
	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-61G FD-61S FD-61W	FD-62 FD-H13-FM2			
	FDP-1000 (1 m 3.281 ft)							
	FDP-1500 (1.5 m 4.921 ft)							
	FDP-N500 (0.5 m 1.640 ft)	For M4 thread					FD-41 FD-41W	FD-41S FD-41SW
	FDP-N1000 (1 m 3.281 ft)							
	FDP-N1500 (1.5 m 4.921 ft)							
Fiber bender	FB-1	The fiber bender bends the sleeve part of the fiber head at the proper radius. (Note 1)						
Universal sensor mounting stand (Note 2)	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 2)	MS-FX-01Y	Applicable fibers	FD-HF40Y FD-F41Y	This joint suppresses false operations due to liquid slip-in from the top of the protective tube.				
Protective tube extension joint (Note 2)	MS-FX-02Y			The protective tube can be extended.				
Fiber mounting joint (Note 2)	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.30 or p.41 for the sensing range of FR-Z50HW to be used in combination.						
	RF-220							
	RF-230							

Notes: 1) Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.

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

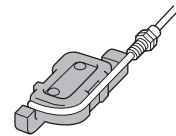
Protective tube

- FTP-□
- FDP-□



Fiber bender

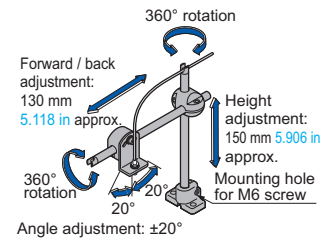
- FB-1



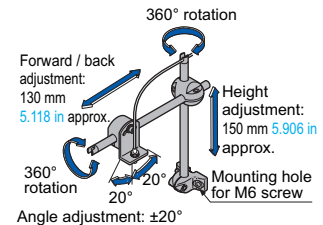
Universal sensor mounting stand

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



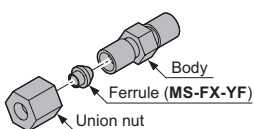
Single core holder

- FX-AT15A



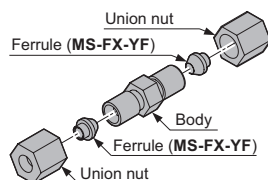
Liquid inflow prevention joint

- MS-FX-01Y



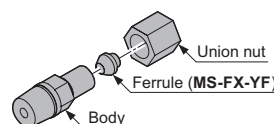
Protective tube extension joint

- MS-FX-02Y



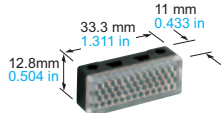
Fiber mounting joint

- MS-FX-03Y

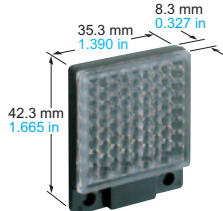


Reflector

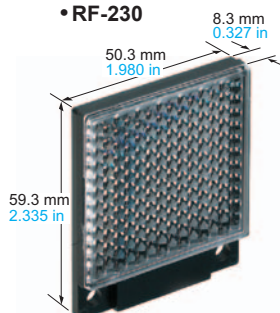
- RF-210



- RF-220



- RF-230



SPECIFICATIONS**Amplifiers**

Type		NPN output			PNP output		
		Red LED	Blue LED	Green LED	Red LED	Blue LED	Green LED
Item	Model No.	FX-311	FX-311B	FX-311G	FX-311P	FX-311BP	FX-311GP
Supply voltage		12 to 24 V DC ±10 % Ripple P-P 10 % or less					
Power consumption		840 mW or less (Current consumption 35 mA or less at 24 V supply voltage)					
Output		NPN open-collector transistor • Maximum sink current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less at 100 mA sink current (50 mA, if five, or more, amplifiers are connected in cascade)			PNP open-collector transistor • Maximum source current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade) • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1.5 V or less at 100 mA sink current (50 mA, if five, or more, amplifiers are connected in cascade)		
	Utilization category	DC-12 or DC-13					
	Output operation	Selectable either Light-ON or Dark-ON, with selection switch					
	Short-circuit protection	Incorporated					
Response time		<Red LED type> 250 μs or less (STD / S-D), 2 ms or less (LONG) selectable with selection switch			<Blue LED type / Green LED type> 150 μs or less (FAST), 250 μs or less (STD), 2 ms or less (LONG) selectable with selection switch		
Operation indicator		Orange LED (lights up when the output is ON)					
Stability indicator		Green LED (lights up under stable light received condition or stable dark condition)					
Sensitivity adjuster		12-turn potentiometer with indicator (Pointer part: red backlight) (Note 2)					
Timer function		Incorporated with OFF-delay timer, selectable either effective (approx. 10 ms or 40 ms) or ineffective					
Automatic interference prevention function		Incorporated (Up to 4 sets of fiber heads can be mounted close together.) (Note 3)					
Environmental resistance	Pollution degree	3 (Industrial environment)					
	Ambient temperature	-10 to +55 °C -14 to +131 °F (If 4 to 7 units are connected in cascade: -10 to +50 °C +14 to +122 °F ,) (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F (if 8 to 16 units are connected in cascade: -10 to +45 °C +14 to +113 °F)					
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH					
	Ambient illuminance	Incandescent light: 3,000 lx at the light-receiving face					
	EMC	EN 60947-5-2					
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure (Note 4)					
	Insulation resistance	20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure (Note 4)					
	Vibration resistance	10 to 150 Hz frequency, 0.75 mm 0.03 in amplitude in X, Y and Z directions for two hours each					
	Shock resistance	98 m/s ² acceleration (10 G approx.) in X, Y and Z directions for five times each					
Emitting element (modulated)		Red LED	Blue LED	Green LED	Red LED	Blue LED	Green LED
	Peak emission wavelength	650 nm 0.026 mil	470 nm 0.019 mil	525 nm 0.021 mil	650 nm 0.026 mil	470 nm 0.019 mil	525 nm 0.021 mil
Material		Enclosure: Heat-resistant ABS, Case cover: Polycarbonate					
Connecting method		Connector (Note 5)					
Cable length		Total length up to 100 m 328.084 ft is possible with 0.3 mm ² , or more, cable.					
Weight		Net weight: 15 g approx., Gross weight: 20 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) The red backlight of the pointer part lights up more brightly when the power is turned ON and when the sensitivity is adjusted.
3) When the power supply is switched on, the emission timing are automatically set for interference prevention.
4) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.
5) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.
Main cable (3-core): **CN-73-C1** (cable length 1 m **3.281 ft**), **CN-73-C2** (cable length 2 m **6.562 ft**), **CN-73-C5** (cable length 5 m **16.404 ft**)
Sub cable (1-core): **CN-71-C1** (cable length 1 m **3.281 ft**), **CN-71-C2** (cable length 2 m **6.562 ft**), **CN-71-C5** (cable length 5 m **16.404 ft**)

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-
SAVING
UNITSWIRE-
SAVING
SYSTEMSMEASURE-
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SENSORSSTATIC
ELECTRICITY
PREVENTION
DEVICESLASER
MARKERS

PLC

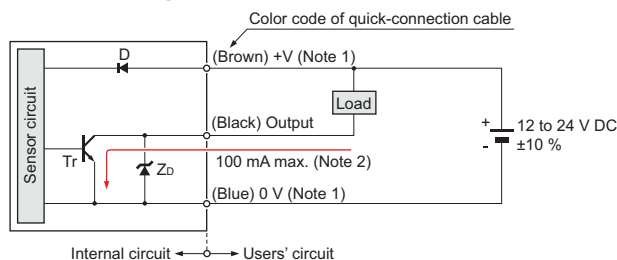
HUMAN
MACHINE
INTERFACESENERGY
CONSUMPTION
VISUALIZATION
COMPONENTSFA
COMPONENTSMACHINE
VISION
SYSTEMSUV
CURING
SYSTEMSSelection
Guide

Fibers

Fiber
Amplifiers**FX-500****FX-100****FX-300****FX-410****FX-311**FX-301-F7/
FX-301-F

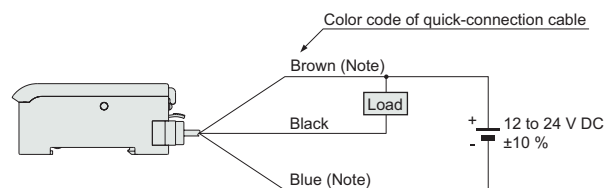
I/O CIRCUIT AND WIRING DIAGRAMS**FX-311□**

NPN output type

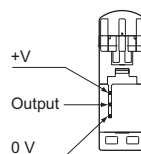
I/O circuit diagram

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected together.

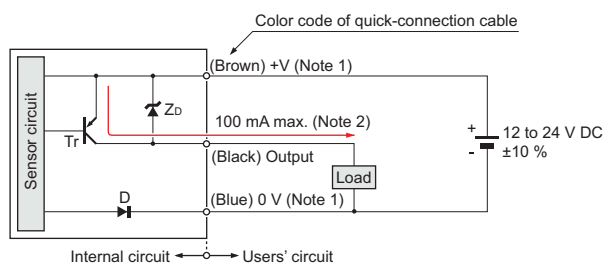
Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : NPN output transistor

Wiring diagram

Note: The quick-connection sub cable does not have brown lead wire and blue lead wire. The power is supplied from the connector of the main cable.

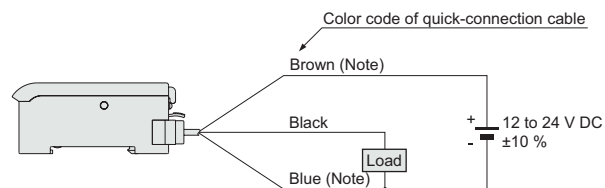
Terminal arrangement diagram**FX-311□P**

PNP output type

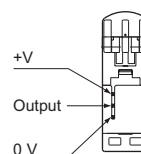
I/O circuit diagram

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected together.

Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : PNP output transistor

Wiring diagram

Note: The quick-connection sub cable does not have brown lead wire and blue lead wire. The power is supplied from the connector of the main cable.

Terminal arrangement diagram

PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions.

FIBER
SENSORSLASER
SENSORSPHOTO-
ELECTRIC
SENSORSMICRO
PHOTO-
ELECTRIC
SENSORSAREA
SENSORSLIGHT
CURTAINS /
SAFETY
COMPONENTSPRESSURE /
FLOW
SENSORSINDUCTIVE
PROXIMITY
SENSORSPARTICULAR
USE
SENSORSSENSOR
OPTIONSSIMPLE
WIRE-SAVING
UNITSWIRE-SAVING
SYSTEMSMEASURE-
MENT
SENSORSSTATIC
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COMPONENTSFA
COMPONENTSMACHINE
VISION
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Fibers

Fiber
Amplifiers

FX-500

FX-100

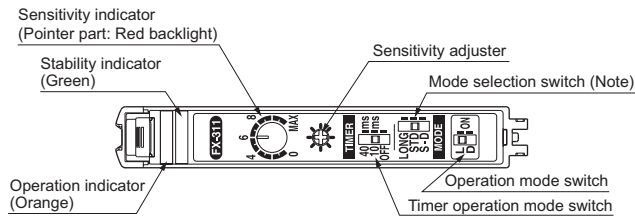
FX-300

FX-410

FX-311

FX-301-F7/
FX-301-F

- 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.

Part description

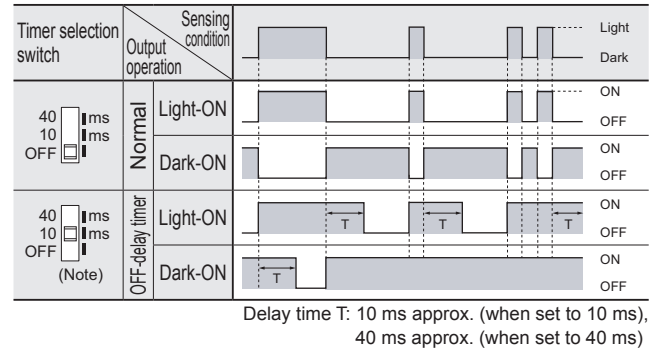
Note: The mode selected by the mode selection switch for **FX-311B(P)** and **FX-311G(P)** is 'LONG', 'STD' or 'FAST'.

Amplifier of cascading

- Make sure that the power supply is off while adding or removing the amplifiers.
- Make sure to check the allowable ambient temperature, as it depends on the number of amplifiers connected in cascade.
- In case two, or more, amplifiers are connected in cascade, make sure to mount them on a DIN rail.
- When the amplifiers move on the DIN rail depending on the attaching condition, fitting them between the optional end plates (**MS-DIN-E**) mounted at the two ends.
- When connecting in cascade, mount the amplifiers close to each other, fitting them between the optional end plates (**MS-DIN-E**) mounted at the two ends.
- Up to maximum 15 amplifiers can be added (total 16 amplifiers connected in cascade.)
- When connecting more than two amplifiers in cascade, use the sub cable (**CN-71-C□**) as the quick-connection cable for the second amplifier onwards.
- The settings other than the interference prevention function cannot be transmitted between this product and other digital fiber amplifiers. Therefore, in case both models of amplifiers are mounted in cascade, be sure to mount identical models together. For more details, refer to "**Cautions on sensor connection in cascade**" (p.159).

Timer function

- This product incorporates an OFF-delay timer function. The delay time can be selected as either 10 ms. approx. or 40 ms. approx. with the timer selection switch. Since the output is extended by a fixed period, it is useful when the connected device has a slow response time or when small objects are being sensed and the output signal width is small.



Note: The diagram shows the case when 10 ms delay time is selected.

Automatic interference prevention function

- This product incorporates an automatic interference prevention function. If the amplifiers are mounted in cascade, since a different emission timing is automatically set for up to 4 amplifiers, up to 4 sets of fibers can be mounted closely. Further, even if the amplifiers are mounted closely along with the digital fiber sensor **FX-300** series, the interference prevention function works. However, in case both models of amplifiers are mounted in cascade, mount identical models together.

Wiring

- Make sure that the power supply is off while wiring.
- Verify that the supply voltage variation is within the rating.
- Take care 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.
- 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.
- Take care that short circuit of the load 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.
- Make sure to use an isolation transformer for the DC power supply. If an autotransformer (single winding transformer) is used, this product or the power supply may get damaged.
- Make sure to use the optional quick-connection cable for the connection of the amplifier. Extension up to total 100 m **328.084 ft** is possible with 0.3 mm², or more, cable. However, in order to reduce noise, make the wiring as short as possible.

PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions.

Operation procedure

- For **FX-311(P)**, the most suitable sensing mode can be selected according to the application from LONG (long range distance), STD (standard) or S-D (reduced intensity). Furthermore, for **FX-311B(P)** and **FX-311G(P)**, the sensing mode can be selected from LONG (long range distance), STD (standard) or FAST (high speed sensing).

Mode selection switch		Applications	Response time
FX-311(P)	FX-311B(P)/311G(P)		
LONG STD S-D	LONG STD FAST	Used in case long distance sensing is required. (However, the response time is longer than in STD mode.)	2 ms
LONG STD S-D	LONG STD FAST	Used for general sensing application.	250 μs
—	LONG STD FAST	Used in case high speed sensing is required.	150 μs
LONG STD S-D	—	Since the emitted light amount is restricted in this mode, it is suitable for delicate sensing, such as when the received light is saturated due to too short a sensing distance or when detecting translucent objects, etc.	250 μs

Note: Make sure to carry out sensitivity adjustment after mode setting.

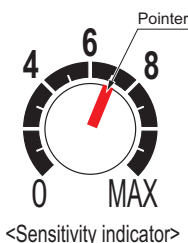
Sensitivity adjustment

- Adjust the sensitivity, observing the operation indicator (orange). However, since the condition for lighting up of the indicator depends on the combination of the sensing condition and the selected operation of L/D-ON, verify it from the table below.

☀ : Lights up ● : Turns off

Sensing condition	Operation	Operation indicator
Light	L-ON (Light-ON)	☀
	D-ON (Dark-ON)	●
Dark	L-ON (Light-ON)	●
	D-ON (Dark-ON)	☀

- The sensitivity adjuster is a 12-turn potentiometer. The maximum sensitivity is obtained by turning it fully clockwise.
- The pointer shows the present sensitivity level.



Assist function

- This product incorporates an "assist function", which helps to easily search the optimum sensitivity position by flashing of the pointer. In order to make "assist function" effective, switch the operation selection switch in the order L-ON (Light ON) → D-ON (Dark ON) → L-ON (Light ON).

Notes: 1) "Assist function" cannot be used when adjusting sensitivity for moving objects.
 2) "Assist function" turns off automatically once the sensitivity adjustment has been completed.
 3) In case "assist function" is not to be used, set the operation selection switch to D-ON (Dark ON) and wait for 2 sec., or more, to make "assist function" ineffective.

Step	Sensing method		Operation	Sensitivity indicator
	Reflective type	Thru-beam type		
①	Make sure that the operation selection switch is set to L-ON (Light ON). In case "assist function" is to be used, switch the operation selection switch in the order of L-ON (Light ON) → D-ON (Dark ON) → L-ON (Light ON).		Turn the sensitivity adjuster fully counterclockwise. (Minimum sensitivity)	
②	 Beam received	 Beam received	In the beam received condition, slowly turn the adjuster clockwise and find the point (A) where the sensor is switched ON. The pointer flashes once at the point (A). (Note 1)	
③	 Beam not received	 Beam not received	In the beam not received condition, slowly turn the adjuster further clockwise until the sensor goes into the ON state again. Once it is switched on, turn the adjuster counterclockwise a little and find the point (B) where it is switched OFF. The pointer flashes twice at the point (B). (Note 2) (If the sensor does not go into the ON state, MAX is the point (B).)	
④	—	—	Turn the adjuster towards the point (A) from the point (B) slowly. The pointer starts flashing when it approaches the optimum sensitivity point and flashes faster at the optimum sensitivity point for 3 sec. This point is the optimum sensitivity point. (Note 2)	
⑤	Select either L-ON (Light ON) or D-ON (Dark ON) according to your application.			

Notes: 1) When "assist function" is not used, the pointer does not flash.
 2) When "assist function" is not used, the middle point of (A) and (B) is regarded as the optimum sensitivity point.
 3) In order to protect the mechanism, the sensitivity adjuster idles when over turned, which may result in a backlash of 1 to 2 divisions.
 4) Depending upon the sensing conditions, stable sensing may be possible at a position which is slightly shifted from the optimum sensitivity point.
 5) Do not move or bend the fiber cable after the sensitivity adjustment. Detection may become unstable.

Others

- Do not use during the initial transient time (0.5 sec. approx.) after the power supply is switched on.
- Take care that the sensor is not directly exposed to fluorescent lamp from a rapid-starter lamp, a high frequency lighting device or sunlight etc., as it may affect the sensing performance.
- This sensor is suitable for indoor use only.
- Do not use this sensor in places having excessive vapor, dust, etc., or where it may come in contact with corrosive gas.
- Take care that the sensor does not come in contact with water, oil, grease, organic solvents, such as, thinner etc., or strong acid, and alkaline.
- This sensor cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify the sensor.

FX-301-F7 FX-301-F

FIBER SENSORS

LASER SENSORS

PHOTOELECTRIC SENSORS

MICRO PHOTOELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASUREMENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

FX-301-F7 / FX-301-F

Related Information

■ General terms and conditions..... F-7

■ **FD-F71 / FT-F93**..... P.38~

■ Sensor selection guide..... P.3~

■ Glossary of terms / General precautions...P.1455~ / P.1458~



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Conforming to EMC Directive



Recognition



Certified (FX-301-F only)

* Passed the UL 991 Environment Test

* UL 61010C-1 compatible, Passed the UL 991 Environment Test based on SEMI S2-0200. [Category applicable for semiconductor manufacturing: TWW2, Process Equipment] [Applicable standards: UL 61010C-1] [Additional test / evaluation standards as per intended use: UL 991, SEMI S2-0200]



PNP output type available



Light intensity monitor



Timer



Automatic sensitivity setting

Easy operation even for beginners! Optimum settings can be realized with simple operations

For use with leak detection or liquid detection fiber only

The **FX-301-F7** (Note 1) dedicated for the leak detection fiber **FD-F71** and the **FX-301-F** dedicated for the liquid detection fiber **FT-F93** are available. Optimal setting is possible with easy operation.

Note: The **FX-301-F** can be also used by setting it to leak detection mode. However, the functions are different from the **FX-301-F7** dedicated for the leak detection fiber, so it is recommended to use the **FX-301-F7** when using the leak detection fiber.

Leak detection fiber
FD-F71



Liquid detection fiber
FT-F93



Dedicated amplifier for the leak detection fiber
FX-301-F7



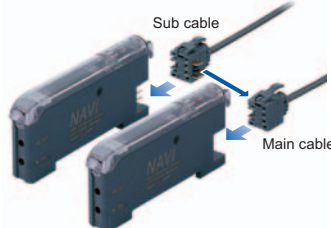
Dedicated amplifier for the liquid detection fiber
FX-301-F



Easy maintenance, as main and sub units are identical

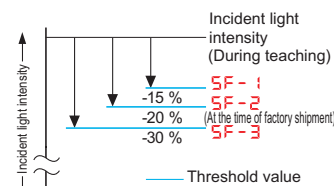
Both main and sub units utilize the same amplifier body. This feature allows for easy mounting in the side-by-side configuration. The main and sub unit functions are distinguished only by the proper use of 3-core main cable and the 1-core sub cable.

Moreover, by utilizing the same body for both main and sub units, inventory management and maintenance is simplified.



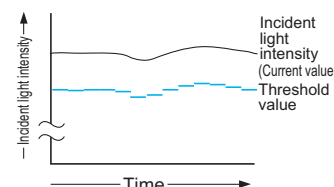
Sets the optimal threshold value **FX-301-F7**

Threshold value will be set automatically to -20 % of the incident light intensity during the teaching to steadily detect the leak. It is also possible to change the threshold value to -15 % or -30 %.



Threshold follow-up function **FX-301-F7**

Entry beam intensity is checked at regular time interval (10 min.), and threshold value is reset automatically.



*Function is set to OFF at the time of factory shipment.

Flashing function incorporated

When the leak detection fiber is connected (F7 mode), if a leak is detected, you will recognize which fiber detects the leak at a single glance because the emitter will start flashing.

Long life and stable operational settings due to the newly developed emitting element

The newly developed "four-chemical emitting element" used for **FX-301-F7 / FX-301-F** can suppress the secular change of the light emitting element to minimum, allowing stable detection for long period of time.

Easy to operate with individual / collective teaching mode

Individual teaching mode (TEACH)

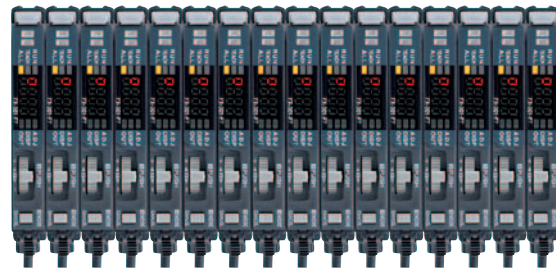
Optimal threshold value is set automatically on **FX-301-F7** just by setting the MODE indicator to "TEACH" and pressing the jog switch.

(The threshold value is set after selecting the liquid detection fiber for **FX-301-F**.)

Collective teaching mode (ALL)

Teaching is performed collectively for all the connected amplifiers with an optical communication function when the MODE indicator is set to "ALL". Each amplifier will be set with an optimal threshold value.

(At the same time, other setting in the master unit will be copied to the slave unit.)



Communication direction

Collective teaching mode is possible for 16 units max.

LEAK DETECTION FIBER (FD-F71)

Low profile liquid detection fiber with high chemical resistance



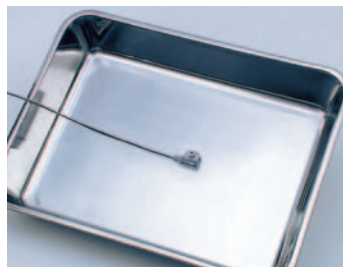
Tough

SEMI S2 compliant!

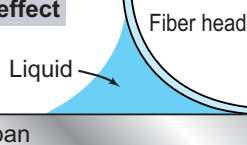
Leak detection fiber cannot be used in combination with the **FX-100/300/311/410** series.

Stable detection performance

The unique effect of capillarity enables reliable detection of small leaks and viscous liquids.



Capillarity effect



Compact, space-saving

This slim (10 mm 0.394 in) side-mounting fiber head is especially good for use in confined spaces.

Labor-saving design

- Because all you need to install is one screw, one-touch mounting of the fiber head is possible.
- Replacement parts even for resetting after a leak are unnecessary.
- Because the fiber head is simply designed, wiping off leaks is rendered easy.

Superb explosion resistance / chemical resistance

Explosion resistance is enhanced by adopting the fiber method (SEMI S2 compliant). The head unit made of fluorocarbon polymers also has superb chemical resistance.

Amplifier built-in type photoelectric sensor is also line-up

EX-F70 / EX-F60



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LIQUID DETECTION FIBER (PIPE-MOUNTABLE) (FT-F93)**Stably detect the liquid inside the pipe!****SEMI S2 compliant!**

Leak detection fiber cannot be used in combination with the **FX-100/300/311/410** series.

Superior explosion resistance compatible to SEMI S2

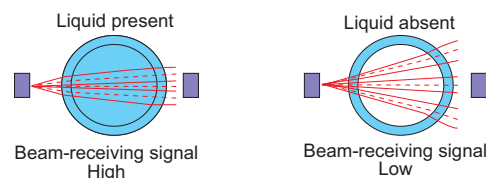
Because there is no electric circuitry in the fiber head, it boasts excellent explosion resistance.

Easy to use and reliable detection

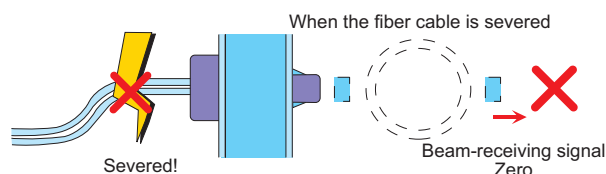
Even when the shape and thickness of the pipe vary, this fiber head uses a method where the beam axis follows the diameter of the pipe, and so when compared to conventional methods, the shape and thickness of the pipe have no influence over the performance of this fiber head.

Stable design that doesn't permit liquid-absent or sensor errors

- When liquid is present, its effect on the lens causes light to focus and enter.



- When abnormalities such as a severed or removed fiber or a cutoff cable occur, light does not enter and the sensor will output the same as "liquid-absent".

**Reliable detection not affected by bubbles or droplets**

Latest optical fiber techniques have solved problems caused by bubbles, droplets or liquid leakage that arise in conventional pipe-mountable fiber heads.

ORDER GUIDE**Amplifiers**

Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type		Appearance	Model No.	Emitting element	Output
Leak detection fiber only	NPN output		FX-301-F7	Red LED	NPN open-collector transistor
	PNP output		FX-301P-F7		PNP open-collector transistor
Liquid detection fiber only	NPN output		FX-301-F	Red LED	NPN open-collector transistor
	PNP output		FX-301P-F		PNP open-collector transistor

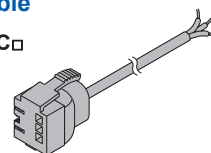
Quick-connection cables

Quick-connection cable is not supplied with the amplifier. Please order it separately.

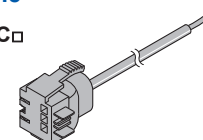
Type	Model No.	Description	
Main cable (3-core)	CN-73-C1	Length: 1 m 3.281 ft	0.2 mm ² 3-core cabtyre cable, with connector on one end Cable outer diameter: ø3.3 mm ø0.130 in
	CN-73-C2	Length: 2 m 6.562 ft	
	CN-73-C5	Length: 5 m 16.404 ft	
Sub cable (1-core)	CN-71-C1	Length: 1 m 3.281 ft	0.2 mm ² 1-core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

Main cable

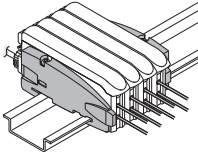
- **CN-73-C□**

**Sub cable**


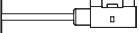



- **CN-71-C□**



ORDER GUIDE**End plates** End plates are not supplied with the amplifier. Please order it separately when the amplifiers are mounted in cascade.

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

Fiber heads

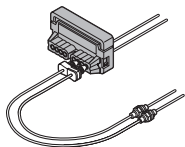
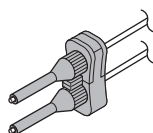
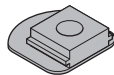
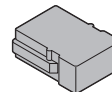
Designation	Shape of fiber head (mm)	Description (Note 3)	Sensing object	Fiber cable length  Free-cut	Bending radius (mm)	Model No.
Leak detection fiber	SEMI S2 compliant W20 × H30 × D10 	Liquid leak detection Leak absent: Beam received, Leak present: Beam interrupted	Liquid (Note 1)	 5m 16.405 ft	R4 Bending durability	Tough FD-F71
Liquid detection fiber	SEMI S2 compliant W23 × H20 × D17 	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 1.0 mm 0.012 to 0.039 in] Liquid absent: Beam interrupted, Liquid present: Beam received	Liquid (Note 2)	 2m 6.562 ft	Protective tube R20 Fiber R2 Bending durability	Tough FT-F93

Notes: 1) Highly viscous liquid may not be detected stably.
 2) Reliable detection may not be possible for unclear or heavily colored liquid.
 3) Liquid in an opaque pipe cannot be detected correctly.

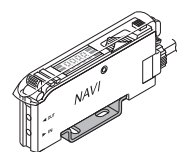
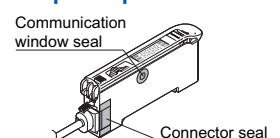
About the handling of the fiber length changed product

The type with fiber length changed is prepared as a semi-custom product with fast response.
 Please contact the sales regarding the model name, standard price, and delivery.

- Fiber length extension: Up to 30 m **98.43 ft**, in 1 m **3.281 ft** intervals.
- Protection tube length extension: Up to 10 m **32.81 ft**, in 0.5 m **1.641 ft** intervals.

Accessories**FX-CT2** (Fiber cutter)**FX-AT4** (Attachment for ø1 mm **ø0.039 in** fiber)**MS-FD-F7-1** (SUS mounting bracket for **FD-F71** fiber)**MS-FD-F7-2** (PVC mounting bracket for **FD-F71**)• **FX-CT2**• **FX-AT4**• **MS-FD-F7-1**
(SUS mounting bracket for **FD-F71**)• **MS-FD-F7-2**
(PVC mounting bracket for **FD-F71**)**OPTIONS**

Designation	Model No.	Description
Amplifier mounting bracket	MS-DIN-2	Mounting bracket for amplifier
Fiber sensor amplifier protection seal	FX-MB1	10 sets of 2 communication window seals and 1 connector seal Communication window seal: It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier. Connector seal: It prevents contact of any metal, etc., with the pins of the quick-connection cable.

Amplifier mounting bracket• **MS-DIN-2****Fiber sensor amplifier protection seal**• **FX-MB1**

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FX-301-F

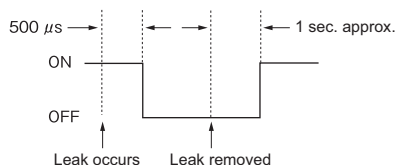
SPECIFICATIONS

Amplifiers

Item	Model No.	Type	For leak detection fiber	For liquid detection fiber	
		NPN output	FX-301-F7	FX-301-F	
		PNP output	FX-301P-F7	FX-301P-F	
Applicable fibers			FD-F71	FT-F93	
Supply voltage			12 to 24 V DC ±10 % Ripple P-P 10 % or less		
Power consumption			Normal operation: 960 mW or less (Current consumption 40 mA or less at 24 V supply voltage) ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)		
Output			NPN open-collector transistor <ul style="list-style-type: none">Maximum sink current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.)Applied voltage: 30 V DC or less (between output and 0 V)Residual voltage: 1.5 V or less [at 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.) sink current]	PNP open-collector transistor <ul style="list-style-type: none">Maximum source current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.)Applied voltage: 30 V DC or less (between output and +V)Residual voltage: 1.5 V or less [at 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.) source current]	
			Output operation	OFF when leak is detected	Liquid setting (F9 mode): Using the jog switch, choose the signal OFF condition between absence of liquid and presence of liquid. Leak setting (F7 mode): OFF with detection of leak
			Short-circuit protection	Incorporated	
Response time			500 μs or less (Note 2)	250 μs or less (Note 2)	
Sensitivity setting			Individual teaching / Collective teaching		
Operation indicator			Orange LED (lights up when the output is ON)		
Automatic follow-up function indicator			Green LED (lights up when automatic follow-up function is ON.)	_____	
Model indicator			_____	Green LED [lights up during liquid setting (F9 mode)]	
MODE indicator			RUN: Green LED, TEACH • ALL • ADJ • DISP • OUT: Yellow LED		
Digital display			4 digit red LED display		
Fine sensitivity adjustment function			Incorporated		
Timer function			_____	Delay timer [used only for liquid setting (F9 mode)] (Timer setting selectable from 10 ms, 100 ms, 1,000 ms, and none)	
Environmental resistance	Ambient temperature		0 to +50 °C +32 to +122 °F (If 8 to 16 units are connected in cascade: 0 to +45 °C +32 to +113 °F) (No dew condensation), Storage: -20 to +70 °C -4 to +158 °F		
	Ambient humidity		35 to 85 % RH, Storage: 35 to 85 % RH		
	Ambient illuminance		Incandescent light: 3,000 lx 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 MΩ, 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 amplitude in X, Y and Z directions for two hours each		
	Shock resistance		98 m/s ² acceleration (10 G approx.) in X, Y and Z directions for five times each		
Emitting element			Red LED (Peak emission wavelength: 650 nm 0.026 mil , modulated)		
Material			Enclosure: Heat-resistant ABS, Case cover: Polycarbonate, Switch: Acrylic		
Connecting method			Connector (Note 4)		
Cable length			Total length up to 100 m 328.084 ft is possible with 0.3 mm ² , or more, cable.		
Weight			Net weight: 20 g approx., Gross weight: 35 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 detecting leak (output OFF) during leak setting (F7 mode), since the sensor flashes the emitted light, only the response action for turning the signal back to ON is delayed (1 sec. approx.).



3) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.

4) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.

Main cable (3-core): **CN-73-C1** (cable length 1 m **3.281 ft**), **CN-73-C2** (cable length 2 m **6.562 ft**), **CN-73-C5** (cable length 5 m **16.404 ft**)

Sub cable (1-core): **CN-71-C1** (cable length 1 m **3.281 ft**), **CN-71-C2** (cable length 2 m **6.562 ft**), **CN-71-C5** (cable length 5 m **16.404 ft**)

SPECIFICATIONS

Leak detection fiber

Model No.		FD-F71
Item		
Applicable amplifiers		FX-301-F7, FX-301P-F7
Sensing object		Liquid (Note 2)
Fiber cable length		5 m 16.405 ft (Free-cut)
Protective tube length		3 m 9.843 ft
Allowable bending radius		Protective tube: R20 mm R0.787 in or more, Fiber cable: R2 mm R0.079 in or more
Bending durability		Fiber cable: 1,000,000 times or more (at R4 mm R0.157 in , load 35 g, reciprocating bending 180 °)
Emitting indicator		Incorporated
Peel strength		10N or less (PFA protective tube)
Ambient temperature		-20 to +60 °C -4 to +140 °F (No dew condensation or icing allowed) (Note 3), Storage: -20 to +60 °C -4 to +140 °F
Ambient humidity		35 to 85 % RH, Storage: 35 to 85 % RH
Material	Fiber cable	Fiber core: Acrylic, Fiber sheath: Polyethylene, Protective tube: Fluorine resin (PFA)
	Fiber head	Outer casing: Fluorine resin (PFA)
Accessories		MS-FD-F7-1 (SUS mounting bracket): 1 pc., MS-FD-F7-2 (PVC mounting bracket): 1 pc., FX-CT2 (Fiber cutter): 1 pc., FX-AT4 (ø1 mm ø0.039 in fiber attachment): 1 set for emitter and receiver

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C **+73.4 °F**.
 2) Highly viscous liquid may not be detected stably.
 3) Liquid being detected should also be kept within the rated ambient temperature range.

Liquid detection fiber

Model No.		FT-F93
Item		
Applicable amplifiers		FX-301-F, FX-301P-F
Sensing object		Liquid (Note 2)
Applicable pipe diameter (Note 3)		Outer dia ø3.0 to ø10.0 mm ø0.118 to ø0.394 in (PFA (fluorine resin) or equivalently transparent pipe, wall thickness 0.3 to 1.0 mm 0.012 to 0.039 in)
Fiber cable length		2 m 6.562 ft (Free-cut)
Protective tube length		1 m 3.281 ft
Allowable bending radius		Protective tube: R20 mm R0.787 in or more, Fiber cable: R2 mm R0.079 in or more
Bending durability		Fiber cable: 1,000,000 times or more (at R4 mm R0.157 in , load 35 g, reciprocating bending 180 °)
Ambient temperature (Note 4)		-40 to +60 °C -40 to +140 °F (No dew condensation or icing allowed) (Note 4), Storage: -40 to +60 °C -40 to +140 °F
Ambient humidity		35 to 85 % RH, Storage: 35 to 85 % RH
Material	Fiber cable	Fiber core: Acrylic, Fiber sheath: Polyethylene, Protective tube: Fluorine resin (PFA)
	Fiber head	Enclosure: Heat-resistant ABS, Lens: Acrylic
Accessories		Tying band: 2 Nos., Anti-slip tube: 2 Nos., FX-CT2 (Fiber cutter): 1 No. FX-AT4 (ø1 mm ø0.039 in fiber attachment): 1 set for emitter and receiver

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C **+73.4 °F**.
 2) Reliable detection may not be possible for unclear or heavily colored liquid.
 3) Liquid in an opaque pipe cannot be detected correctly.
 4) Liquid being detected should also be kept within the rated ambient temperature range.

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ELECTRIC
SENSORSAREA
SENSORSLIGHT
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SAFETY
COMPONENTSPRESSURE /
FLOW
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SENSORSSENSOR
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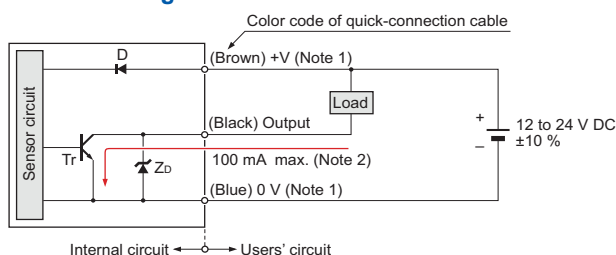
FX-301-F7/
FX-301-F

I/O CIRCUIT AND WIRING DIAGRAMS

FX-301-F7 FX-301-F

NPN output type

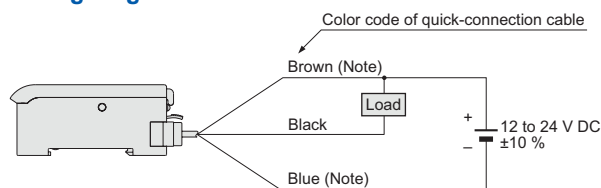
I/O circuit diagram



Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected in cascade.
3) Never connect several amplifiers in series (AND).

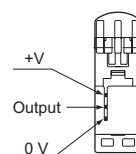
Symbols ... D : Reverse supply polarity protection diode
Zd: Surge absorption zener diode
Tr : NPN output transistor

Wiring diagram



Note: The quick-connection sub cable does not have brown lead wire and blue lead wire. The power is supplied from the connector of the main cable.

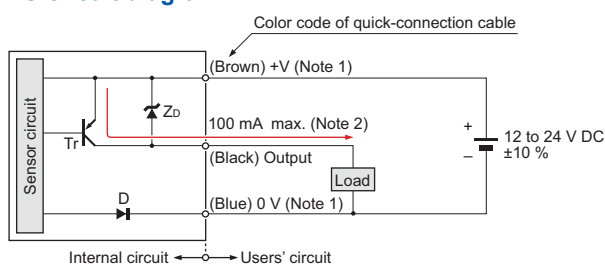
Terminal arrangement diagram



FX-301P-F7 FX-301P-F

PNP output type

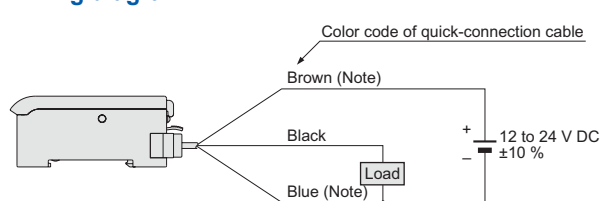
I/O circuit diagram



Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected in cascade.
3) Never connect several amplifiers in series (AND).

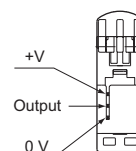
Symbols ... D : Reverse supply polarity protection diode
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Tr : PNP output transistor

Wiring diagram



Note: The quick-connection sub cable does not have brown lead wire and blue lead wire. The power is supplied from the connector of the main cable.

Terminal arrangement diagram



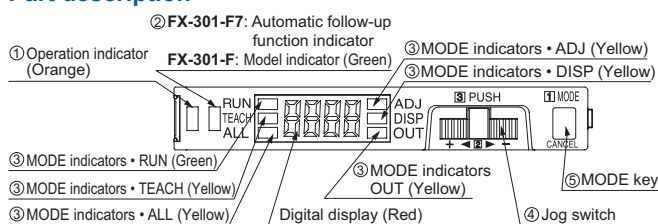
PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions.



- 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.

Part description



- ① Operation indicator (Orange)... Lights up when output is ON.
② **FX-301-F7**: Automatic follow-up function indicator (Green)... Lights up when automatic follow-up function is ON.
FX-301-F: Model indicator (Green)... Lights up during liquid setting (F9 mode).
③ MODE indicators... RUN (Green): Lights up during normal sensing operation.
TEACH (Yellow): Lights up when the individual teaching mode is selected.

- ALL (Yellow): Lights up when the collective teaching mode is selected.
ADJ (Yellow): Lights up when the threshold value fine adjustment mode is selected or the sensitivity switching function is activated.
DISP (Yellow): Lights up when the digital display setting mode is selected or the timer function (**FX-301-F** only) is activated.
OUT (Yellow): Lights up when the forced output mode is selected or the NO / NC switching function is activated.
④ Jog switch... Moving this switch in the "+" or "-" direction, allows different items to be viewed for selection and pressing the switch then confirms the selected setting.
⑤ MODE key... This key is used to select operating modes and to cancel settings during the configuration process.

PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions.

Setting items

RUN Run Normal sensing condition	TEACH Teaching Mode for teaching with one unit	ALL All Mode for teaching 2 or more units collectively
OUT Out Mode for turning the forced output ON or OFF regardless of the incident light intensity NO and NC can be selected (FX-301-F only)	DISP Display Mode for shifting the digital display and switching to ECO mode Timer can be set (FX-301-F only)	ADJ Adjust Fine-adjusts the threshold value Low, high, or automatic sensitivity can be selected

Individual teaching mode

- The sensitivity selection function is set to the automatic sensitivity setting (*Auto*) at the time of factory shipment. In case sensitivity selection setting is done, make sure to carry out "teaching" after the sensitivity selection setting.

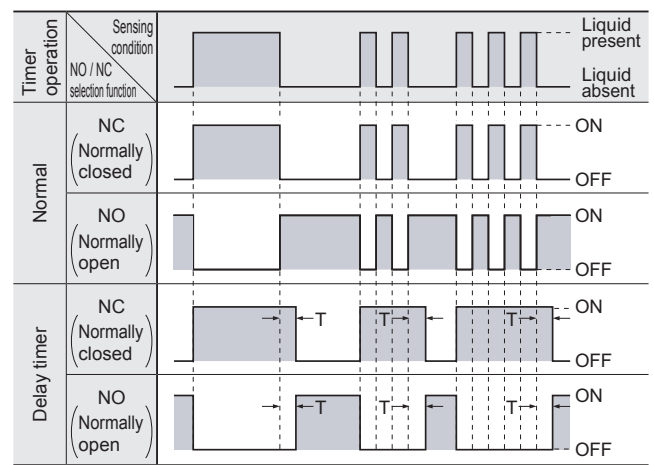
- When MODE indicator / TEACH (yellow) lights up, threshold value can be set on a single unit.

Step	Description	Display
①	Insert Leak detection fiber (FD-F71) or Liquid detection fiber (FT-F93). Press MODE key to light up MODE indicator / TEACH (yellow).	1234
②	<FX-301-F7> Shift amount of the threshold value can be changed by turning Jog switch to "+" or "-" side. While changing, the digital display (red) blinks. 5F-1: Shift approx. 15 % 5F-2: Shift approx. 20 % (At factory setting) 5F-3: Shift approx. 30 % <FX-301-F> Turn the jog switch to "+" or "-" side to set to Liquid (F9) mode (-F9-). (Note 1) In case Liquid (F9) mode (-F9-) is set, the model indicator (Green) lights up.	5F-2 -F9-
③	Press Jog switch in no-leak condition or no-liquid condition. Press Jog switch to start teaching.	0000
④	When teaching is accepted, the result of threshold value setting is displayed. • In case stable sensing is possible: "Good" on the display blinks three times. • In case stable sensing is not possible: "Er-3" on the display blinks. <FX-301-F7> The shift amount set in the ② will revert to the first shift amount before setting.	Good Er-3
⑤	If the teaching result is "Good", the sensor returns to RUN mode automatically and the incident light intensity is shown on the display. MODE indicator / RUN (green) lights up. The setting is complete.	1234

Notes: 1) The FX-301-F's initial setting at the time of factory shipment is Liquid (F9) mode (-F9-).
2) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

Timer function (FX-301-F only)

- This product incorporates a delay timer which reduces the effect of air bubbles, etc.
- The timer setting can be done by pressing the jog switch for 3 sec., or more, when Liquid (F9) mode (-F9-) has been set and MODE indicator / DISP (yellow) lights up. In case of Leak (F7) mode (-F7-), the display does not change to the timer function.

Time chart

Timer period: T = 10 ms, 100 ms, 1,000 ms

Wiring

- Wiring tasks and expansion tasks must be performed with the power off.
- Verify that the supply voltage variation is within the rating.
- Take care 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.
- 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.
- 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.
- Make sure to use an isolation transformer for the DC power supply. If an autotransformer (single winding transformer) is used, this product or the power supply may get damaged.
- When a surge occurs in the power used, absorb the surge with a surge absorber connected to the power source.
- Take care that short circuit of the load 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.
- Make sure to use the optional quick-connection cable for the connection of the amplifier. Extension up to total 100 m **328.084 ft** is possible with 0.3 mm², or more, cable. However, in order to reduce noise, make the wiring as short as possible.

Others

- Do not use during the initial transient time (0.5 sec. approx.) after the power supply is switched on.
- Take care that the sensor is not directly exposed to fluorescent lamp from a rapid-starter lamp, a high frequency lighting device or sunlight etc., as it may affect the sensing performance.
- Do not use this sensor in places having excessive vapor, dust, etc., or where it may come in contact with corrosive gas.
- When the fiber head gets dusty or dirty etc. the sensitivity deteriorates. To keep stable detection, wipe the fiber head to remove dust or dirt etc. and carry out sensitivity teaching periodically.
- These sensors are only for indoor use.
- Take care that the product does not come in contact with oil, grease, organic solvents, such as thinner, etc., strong acid or alkaline.
- This sensor cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify the sensor.
- EEPROM is adopted to this product. It is not possible to conduct teaching 100 thousand times or more, because of the EEPROM's lifetime.

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS
MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Fibers

Fiber Amplifiers

FX-500

FX-100

FX-300

FX-410

FX-311

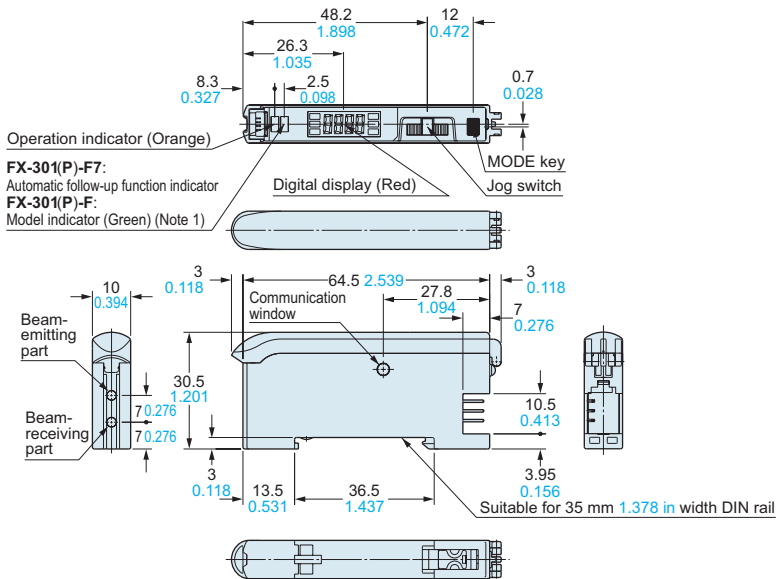
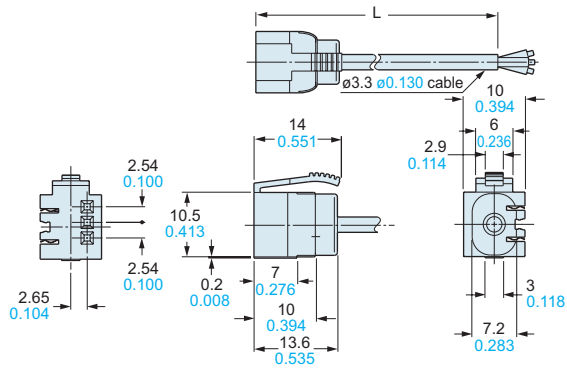
FX-301-F7/
FX-301-F

DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

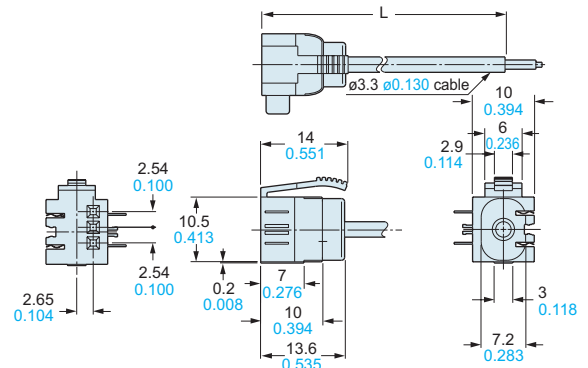
FX-301(P)-F7 FX-301(P)-F

Amplifier

Note: Above figure is an external dimension drawing of the **FX-301(P)-F7**. Shape of the indicator for **FX-301(P)-F** is little different.**CN-73-C1 CN-73-C2 CN-73-C5** Main cable (Optional)

• Length L

Model No.	Length L
CN-73-C1	1,000 39.390
CN-73-C2	2,000 78.740
CN-73-C5	5,000 196.850

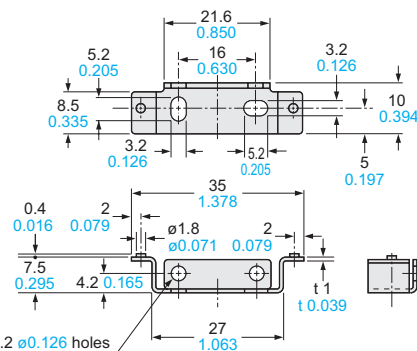
CN-71-C1 CN-71-C2 CN-71-C5 Sub cable (Optional)

• Length L

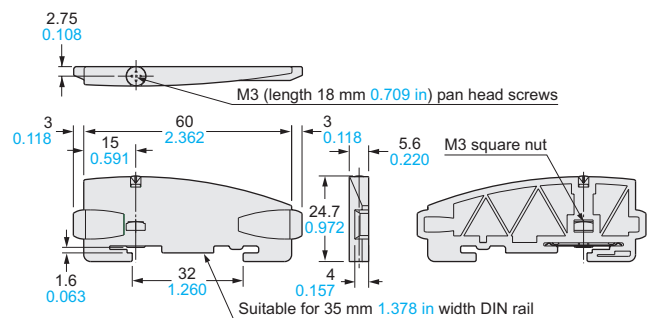
Model No.	Length L
CN-71-C1	1,000 39.390
CN-71-C2	2,000 78.740
CN-71-C5	5,000 196.850

MS-DIN-2

Amplifier mounting bracket (Optional)

Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)**MS-DIN-E**

End plates (Optional)



Material: Polycarbonate

DIMENSIONS (Unit: mm in)

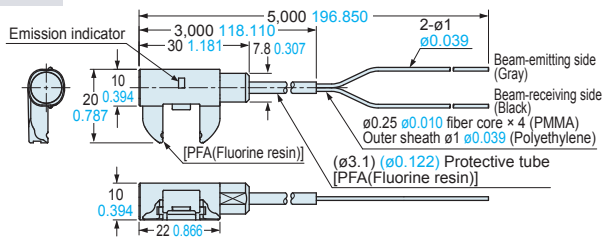
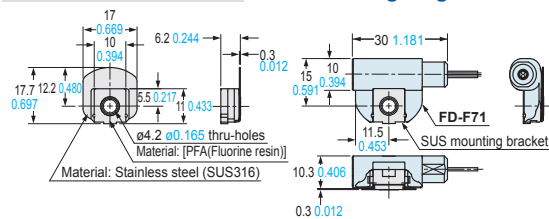
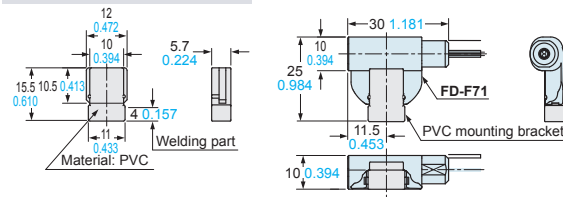
The CAD data in the dimensions can be downloaded from our website.

FD-F71

Free-cut

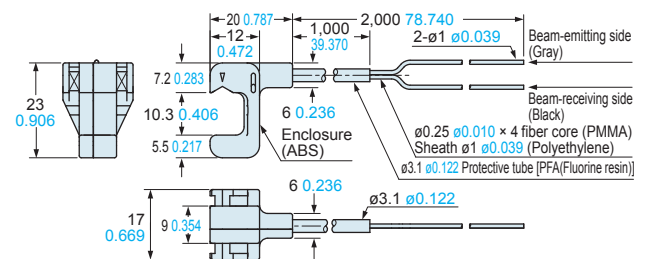
Fiber

<with FX-AT4>

**SUS mounting bracket (MS-FD-F7-1)****SUS mounting bracket (FD-71) mounting diagram****PVC mounting bracket (MS-FD-F7-2)****PVC mounting bracket (FD-71) mounting diagram****FT-F93**

Free-cut

<with FX-AT4>



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FX-301-F7/ FX-301-F