Panasonic

Fiber Sensor Guide Book

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GENERAL TERMS AND CONDITIONS

Please read this document carefully with respect to our product warranty policy before using our Panasonic Industrial Devices SUNX products ("Products"). If you have any questions or comments regarding do's and don'ts of the Products, please consult your local Panasonic Industrial Devices SUNX authorized dealer for the correct use and application of the Products.

1. PRODUCT MODIFICATION & DISCONTINUANCE:

Panasonic Industrial Devices SUNX expressly reserves the right to modify, including the right to discontinue, any of the Products, prior to their order, from time to time without notice.

2. WARRANTIES:

(1) Subject to the exclusions stated in 3 (EXCLUSIONS) herein below, Panasonic Industrial Devices SUNX warrants the Products to be free of defects in material and workmanship for a period of one (1) year from the date of shipment under normal usage in environments commonly found in manufacturing industry.

(2) Any Products found to be defective must be shipped to Panasonic Industrial Devices SUNX with all shipping costs paid by Purchaser or offered to Panasonic Industrial Devices SUNX for inspection and examination. Upon examination by Panasonic Industrial Devices SUNX, Panasonic Industrial Devices SUNX will, at its sole discretion, repair or replace at no charge, or refund the purchase price of, any Products found to be defective.

3. EXCLUSIONS

(1) This warranty does not apply to defects resulting from any cause:

(i) which was due to abuse, misuse, mishandling, improper installation, improper interfacing, or improper repair by Purchaser;
(ii) which was due to unauthorized modification by Purchaser, in part or in whole, whether in structure, performance or specification;
(iii) which was not discoverable by a person with the state-of-the-art scientific and technical knowledge at the time of manufacture;
(iv) which was due to an operation or use by Purchaser outside of the limits of operation or environment specified by Panasonic Industrial Devices SUNX;
(v) which was due to Force Majeure; and
(vi) which was due to any use or application expressly discouraged by Panasonic Industrial Devices SUNX in 5 (CAUTIONS FOR SAFE USE) hereunder.

(2) This warranty extends only to the first purchaser for application, and is not transferable to any person or entity which purchased from such purchaser for application.

(3) The performance data presented in this catalogue is only for guidance and shall not constitute any performance warranty by Panasonic Industrial Devices SUNX.

4. DISCLAIMERS

(1) Panasonic Industrial Devices SUNX's sole obligation and liability under this warranty is limited to the repair or replacement, or refund of the purchase price, of a defective Product, at Panasonic Industrial Devices SUNX's option.

(2) THE REPAIR, REPLACEMENT, OR REFUND IS THE EXCLUSIVE REMEDY OF THE PURCHASER, AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF PROPRIETARY RIGHTS, ARE HEREBY EXPRESSLY DISCLAIMED. IN NO EVENT SHALL PANASONIC INDUSTRIAL DEVICES SUNX AND ITS AFFILIATED ENTITIES BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCTS, OR FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND, OR ANY DAMANGES RESULTING FROM LOSS OF USE, BUSINESS INTERRUPTION, LOSS OF INFORMATION, LOSS OR INACCURACY OF DATA, LOSS OF PROFITS, LOSS OF SAVINGS, THE COST OF PROCUREMENT OF SUBSTITUTED GOODS, SERVICES OR TECHNOLOGIES, OR FOR ANY MATTER ARISING OUT OF OR IN CONNECTION WITH THE USE OR INABILITY TO USE THE PRODUCTS.

5. CAUTIONS FOR SAFE USE

(1) The applications shown in this catalogue are only suggestions, and it is Purchaser's sole responsibility to ascertain the fitness and suitability of the Products for any particular application, as well as to abide by Purchaser's applicable local laws and regulations, if any.

(2) Never use the Products NOT rated or designated as "SAFETY SENSOR" in any application involving risk to life or property. When such a use is made by Purchaser, such Purchaser shall indemnify and hold harmless Panasonic Industrial Devices SUNX from any liability or damage whatsoever arising out of or in relation to such use.

(3) In incorporating the Products to any equipment, facilities or systems, it is highly recommended to employ fail-safe designs, including but not limited to a redundant design, flame propagation prevention design, and malfunction prevention design so as not to cause any risk of bodily injury, fire accident, or social damage due to any failure of such equipment, facilities or systems.

(4) The Products are each intended for use only in environments commonly found in manufacturing industry, and, unless expressly allowed in this catalogue, specification or otherwise, shall not be used in, or incorporated into, any equipment, facilities or systems, such as those:

(a) which are used for the protection of human life or body parts;
(b) which are used outdoors or in environments subject to any likelihood of chemical contamination or electromagnetic influence;
(c) which are likely to be used beyond the limits of operations or environments specified by Panasonic Industrial Devices SUNX in this catalogue or otherwise;
(d) which may cause risk to life or property, such as nuclear energy control equipment, transportation equipment (whether on rail or land, or in air or at sea), and medical equipment;
(e) which are operated continuously each day for 24 hours; and
(f) which otherwise require a high level of safety performance similar to that required in those equipment, facilities or systems as listed in (a) through (e) above.

6. EXPORT CONTROL LAWS

In some jurisdictions, the Products may be subject to local export laws and regulations. If any diversion or re-export is to be made, Purchaser is advised to abide by such local export laws and regulations, if any, at its own responsibility.

7. PURCHASER'S TRASFER OBLIGATIONS

If Purchaser resell or deliver the Products to a third party, Purchaser must provide such third party with a copy of this document, all specifications, manuals, catalogs, leaflets and written information of any kind provided to Purchaser by Panasonic Industrial Devices SUNX or its authorized local representative from time to time regarding the Products.

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Fiber Selection Guide

Choose by model

Thru-beam type

Model No.	Page: Sensing range Specifications	Page: Dimensions
FT-140	P.12	P.48
FT-30	P.11	
FT-31	P.12	
FT-31S	P.19	
FT-31W	P.12	
FT-40	P.11	
FT-42	P.12	
FT-42S	P.19	
FT-42W	P.12	
FT-43		
FT-45X		P.49
FT-A11	P.25	
FT-A11W		
FT-A32		
FT-A32W		
FT-AL05		
FT-E13	P.16/P.19	
FT-E23		
FT-F93	P.35	
FT-H13-FM2	P.30	
FT-H20-J20-S		P.50
FT-H20-J30-S		
FT-H20-J50-S		
FT-H20-M1		
FT-H20-VJ50-S		
FT-H20-VJ80-S		
FT-H20W-M1		
FT-H30-M1V-S	P.32	
FT-H35-M2	P.30	
FT-H35-M2S6		
FT-HL80Y	P.29	
FT-KS40	P.24	P.51
FT-KV26		
FT-KV40		
FT-KV40W		
FT-L80Y	P.29	
FT-R31	P.15	
FT-R40	P.12	
FT-R41W	P.15	
FT-R42W		
FT-R43		
FT-R44Y	P.15/P.29	P.52
FT-R60Y		
FT-S11	P.16	
FT-S20	P.11	
FT-S21	P.16	
FT-S21W		
FT-S30	P.11	
FT-S31W	P.16	
FT-S32		
FT-V23	P.19	
FT-V24W		
FT-V25		
FT-V30		
FT-V40	P.16	P.53
FT-V80Y	P.29	
FT-Z20HBW	P.20	
FT-Z20W		

Model No.	Page: Sensing range Specifications	Page: Dimensions
FT-Z30	P.20	P.53
FT-Z30E		
FT-Z30EW		P.54
FT-Z30H		
FT-Z30HW		
FT-Z30W		
FT-Z40HBW		
FT-Z40W		
FT-Z802Y	P.29	

Retroreflective type

Model No.	Page: Sensing range Specifications	Page: Dimensions
FR-KZ22E	P.24/P.27	P.55
FR-KZ50E		
FR-KZ50H		
FR-Z50HW		

Reflective type

Model No.	Page: Sensing range Specifications	Page: Dimensions
FD-30	P.11	P.56
FD-31	P.13	
FD-31W		
FD-32G	P.13/P.23	
FD-32GX		
FD-40	P.11	
FD-41	P.13	
FD-41S	P.19	
FD-41SW		
FD-41W	P.13	
FD-42G	P.13/P.23	P.57
FD-42GW		
FD-60	P.11	
FD-61	P.13	
FD-61G		
FD-61S	P.19	
FD-61W	P.13	
FD-62		
FD-64X		P.58
FD-A16	P.25	
FD-AL11		
FD-E13	P.17/P.19	
FD-E23		
FD-EG30	P.13/P.23	
FD-EG30S	P.19	P.59
FD-EG31	P.13/P.23	
FD-F4	P.35	
FD-F41		
FD-F41Y		
FD-F71		
FD-F8Y		
FD-FA93		
FD-H13-FM2	P.31	P.60
FD-H18-L31		
FD-H20-21		
FD-H20-M1		
FD-H25-L43		
FD-H25-L45		

Model No.	Page: Sensing range Specifications	Page: Dimensions
FD-H30-KZ1V-S	P.32	P.61
FD-H30-L32	P.31	
FD-H30-L32V-S	P.32	
FD-H35-20S	P.31	
FD-H35-M2		
FD-H35-M2S6		
FD-HF40Y	P.35	
FD-L10	P.26	P.62
FD-L11		
FD-L12W		
FD-L20H		
FD-L21		
FD-L21W		
FD-L22A		
FD-L23		
FD-L30A		
FD-L31A		
FD-L32H		
FD-R31G	P.15/P.23	P.63
FD-R32EG		
FD-R33EG		
FD-R34EG		
FD-R41	P.15	
FD-R60	P.13	
FD-R61Y	P.15/P.29	
FD-S21	P.17	
FD-S30	P.11	P.64
FD-S31	P.17	
FD-S32		
FD-S32W		
FD-S33GW		
FD-S60Y	P.29	
FD-V30	P.19	
FD-V30W		
FD-V50		P.65
FD-Z20HBW	P.21	
FD-Z20W		
FD-Z40HBW		
FD-Z40W		
FD-Z50HW	P.24	

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Fiber Selection Guide

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.14

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

P.16

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

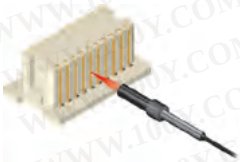
P.18

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

P.20

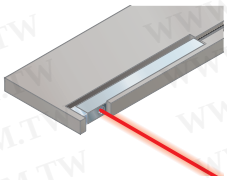
Choose by beam shape

Small Spot
- Senses minute objects using a spot lens.



P.22

Narrow Beam
- Not easily affected by surrounding obstacles.



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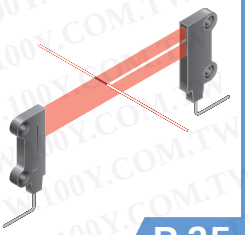
Wide Beam
- Senses in the beam band without missing a work.



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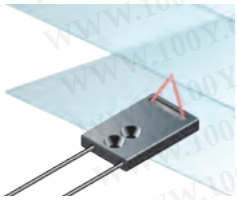
Convergent Reflective Type
- Senses in the limited range only.



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Retroreflective Type
- Ideal for sensing transparent objects

P.27

Choose by quality

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

P.10

Choose by environment / performance

Chemical / Oil-resistant
- Various kinds of liquids can be detected due to the fluorine contained resin case

P.28

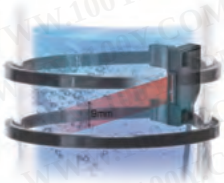
Heat-resistant
- Withstands at -60 °C -76 °F to 350 °C 662 °F

P.30

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

P.32

Liquid Leak / Liquid Detection
- Corresponds to various liquid events.



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Fiber sensor amplifiers guidance

Digital fiber sensor FX-500 series Ver. 2
- At the industry's leading edge

P.70

Digital fiber sensor FX-100 series
- Super functionality, yet, economical price

P.98

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Fiber Selection Guide

How to read Model No.

Applies to the fiber in (P.10~P.35)

F ② - ③ *1 ④ *1 ⑤ ⑥

② Series Name | ③ Type | ④ Shape, etc. | ⑤ ⑥ Functions / Features

*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 ④

Symbol	Details		Lead No.	Details
None	Treaded 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
V		Side-view	2	ø2 mm
			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

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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	Page: Dimensions
FT-A30	FT-A32	P.25	P.49
FT-A8	FT-A11		
FT-AFM2	FT-AL05		
FT-AFM2E			
FT-B8	FT-43	P.12	P.48
FT-E12	FT-E13	P.16/P.19	P.49
FT-E22	FT-E23		
FT-F902	FT-F93	P.35	
FT-FM10L	FT-140	P.12	P.48
FT-FM2	FT-42		
FT-FM2S	FT-42S	P.19	
FT-FM2S4			
FT-K8	FT-KS40	P.24	P.51
FT-KV1	FT-KV26		
FT-KV8	FT-KV40		
FT-NFM2	FT-31	P.12	P.48
FT-NFM2S	FT-31S	P.19	
FT-NFM2S4			
FT-P2	FT-S21	P.16	P.52
FT-P40	FT-31	P.12	P.48
FT-P60	FT-42		
FT-P80			
FT-P81X	FT-45X		P.49
FT-PS1	FT-S11	P.16	P.52
FT-R80	FT-R40	P.12	P.51
FT-SFM2	FT-S32	P.16	P.52
FT-SFM2L			
FT-SFM2SV2	FT-V30	P.19	P.53
FT-SNFM2	FT-S21	P.16	P.52
FT-T80	FT-42	P.12	P.48
FT-V10	FT-V40	P.16	P.53
FT-V22	FT-V23	P.19	P.52
FT-V41	FT-V25		P.53
FT-W4	FT-31	P.12	P.48
	FT-31W		
FT-W8	FT-42		
	FT-42W		
FT-WA30	FT-A32	P.25	P.49
	FT-A32W		
FT-WA8	FT-A11		
	FT-A11W		

Old fiber Model No.	New fiber Model No.	Page: Sensing range Specifications	Page: Dimensions
FT-WKV8	FT-KV40	P.24	P.51
	FT-KV40W		
FT-WR80	FT-R41W	P.15	
FT-WR80L	FT-R42W		
FT-WS3	FT-S31W	P.16	P.52
FT-WS4	FT-S21		
	FT-S21W		
FT-WS8	FT-S31W		
FT-WS8L	FT-S32		
FT-WV42	FT-V25	P.19	P.53
	FT-V24W		
FT-WZ4	FT-Z20W	P.20	
FT-WZ4HB	FT-Z20HBW		
FT-WZ7	FT-Z40W		P.54
FT-WZ7HB	FT-Z40HBW		
FT-WZ8	FT-Z30		P.53
	FT-Z30W		P.54
FT-WZ8E	FT-Z30E		P.53
	FT-Z30EW		P.54
FT-WZ8H	FT-Z30H		
	FT-Z30HW		
FT-Z8	FT-Z30		P.53
FT-Z8E	FT-Z30E		
FT-Z8H	FT-Z30H		P.54
———	FT-30	P.11	P.48
———	FT-40		
———	FT-S20		P.52
———	FT-S30		
———	FT-R31	P.15	P.51
———	FT-R43		

Retroreflective type

Old fiber Model No.	New fiber Model No.	Page: Sensing range Specifications	Page: Dimensions
FR-KV1	FR-KZ22E	P.24/P.27	P.55
FR-KZ21	FR-KZ50H		
FR-KZ21E	FR-KZ50E		
FR-WKZ11	FR-Z50HW		

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Reflective type

Old fiber Model No.	New fiber Model No.	Page: Sensing range Specifications	Page: Dimensions
FD-A15	FD-A16	P.25	P.58
FD-AFM2	FD-AL11		
FD-AFM2E			
FD-B8	FD-62	P.13	P.57
FD-E12	FD-E13	P.17/P.19	P.58
FD-E22	FD-E23		
FD-EG1	FD-EG30	P.13/P.23	P.59
FD-EG2	FD-EG31		
FD-EG3			
FD-EN500S1	FD-EG30S	P.19	
FD-ENM1S1			
FD-F705	FD-F71	P.35	
FD-FA90	FD-FA93		
FD-FM2	FD-61	P.13	P.57
	FD-61G		
FD-FM2S	FD-61S	P.19	
FD-FM2S4			
FD-G4	FD-42G	P.13/P.23	
FD-G6	FD-32G		P.56
FD-G6X	FD-32GX		
FD-L4	FD-L20H	P.26	P.62
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.63
FD-L47	FD-L23		P.62
FD-NFM2	FD-41	P.13	P.56
FD-NFM2S	FD-41S	P.19	
FD-NFM2S4			
FD-P2	FD-S21	P.17	P.63
FD-P40	FD-31	P.13	P.56
FD-P50	FD-S32	P.17	P.64
FD-P60	FD-41	P.13	P.56
FD-P80	FD-61		P.57
FD-P81X	FD-64X		P.58
FD-R80	FD-R60		P.63
FD-S80	FD-S32	P.17	P.64

Old fiber Model No.	New fiber Model No.	Page: Sensing range Specifications	Page: Dimensions
FD-SFM2SV2	FD-V50	P.19	P.65
FD-SNFM2	FD-S31	P.17	P.64
FD-T40	FD-31	P.13	P.56
FD-T80	FD-61		P.57
	FD-41		P.56
FD-V41	FD-V30	P.19	P.64
FD-W44	FD-41S		P.56
	FD-41SW		
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	FD-61W		
FD-WG4	FD-42G	P.13/P.23	
	FD-42GW		
FD-WKZ1	FD-Z50HW	P.24	P.65
FD-WL41	FD-L21	P.26	P.62
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FD-WL48	FD-L12W		
FD-WS8	FD-S32	P.17	P.64
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FD-WSG4	FD-S33GW		
FD-WT4	FD-31	P.13	P.56
	FD-31W		
FD-WT8	FD-41		
	FD-41W		
FD-WV42	FD-V30	P.19	P.64
	FD-V30W		
FD-WZ4	FD-Z20W	P.21	P.65
FD-WZ4HB	FD-Z20HBW		
FD-WZ7	FD-Z40W		
FD-WZ7HB	FD-Z40HBW		
———	FD-30	P.11	P.56
———	FD-40		
———	FD-60		P.57
———	FD-S30		P.64
———	FD-R31G	P.15/P.23	P.63
———	FD-R32EG		
———	FD-R33EG		
———	FD-R34EG		
———	FD-R41	P.15	

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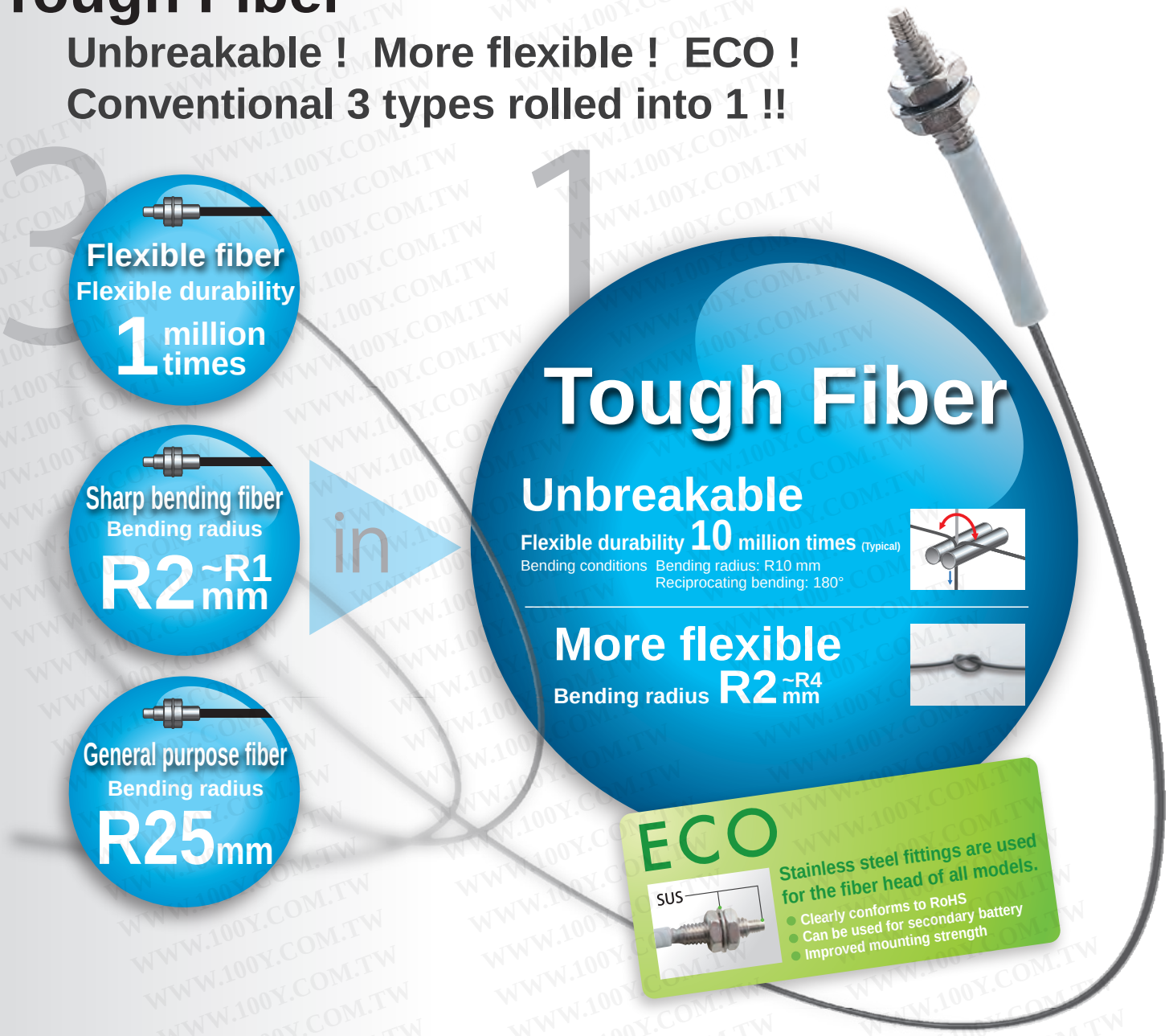
Tough Fiber

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



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.

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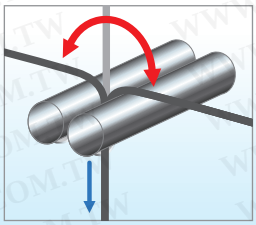
Unbreakable

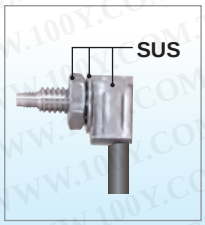
Bending conditions
Bending radius: R10 mm R0.394 in,
Reciprocating bending: 180°



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 registrating part numbers

For Designers — High-quality

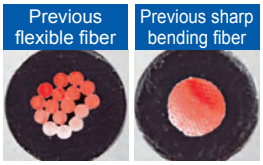
- High-quality in whichever tough fiber you choose!
- Easy selection!
- Reduces risk of breaking and bending during installation!

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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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.

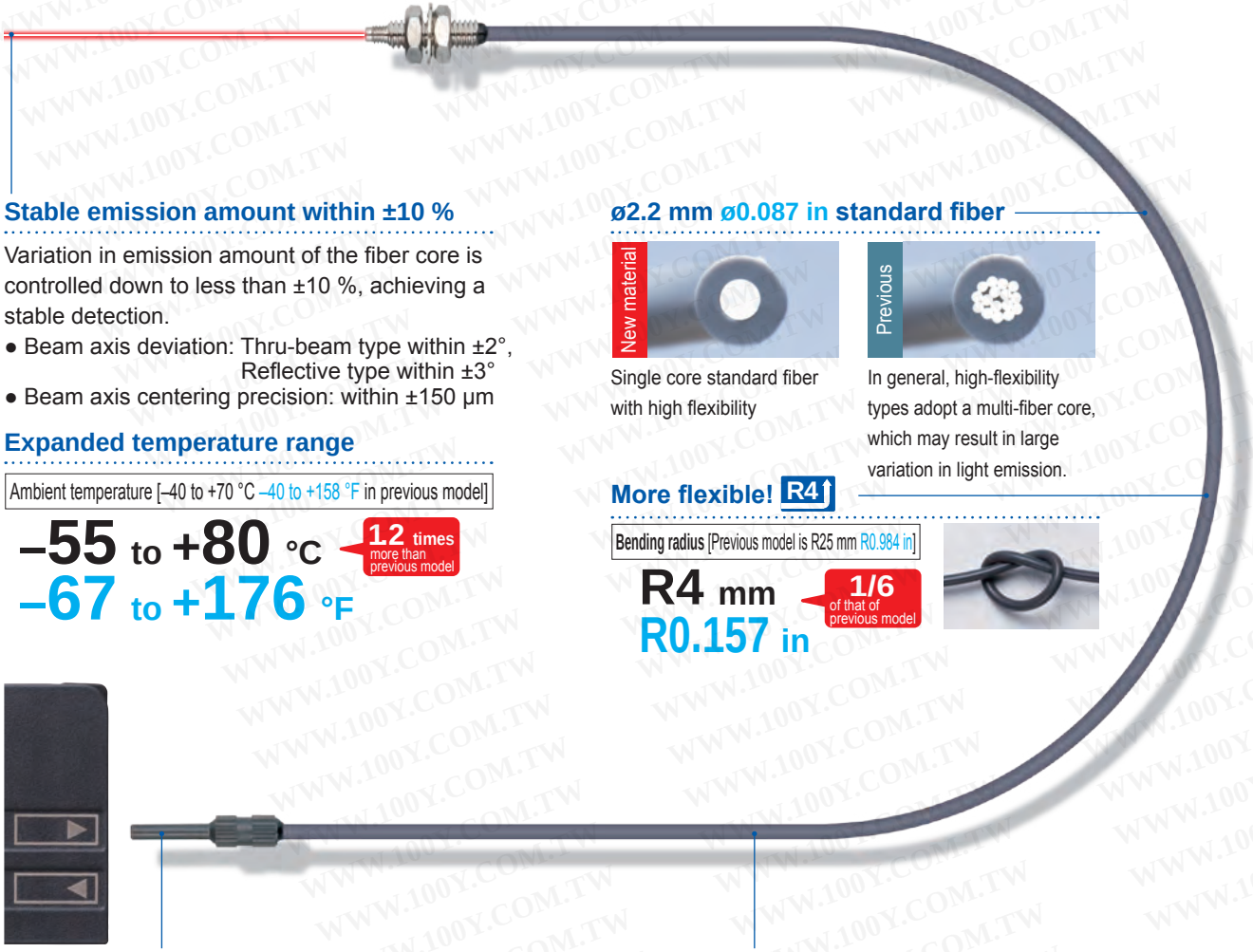
Digital management is simple due to small differences in body.

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 ±10 %

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

- Beam axis deviation: Thru-beam type within ±2°, Reflective type within ±3°
- Beam axis centering precision: within ±150 µm

Expanded temperature range

Ambient temperature [–40 to +70 °C –40 to +158 °F in previous model]

–55 to +80 °C — 1.2 times more than previous model

–67 to +176 °F

ø2.2 mm ø0.087 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 mm R0.984 in]

R4 mm
R0.157 in — 1/6 of that of previous model

Integrated high-precision plug

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

- Centering precision: within ±40 µm

More bendable!

Bending durability [Previous model is 1,000 times]

10 million times — 10,000 times more than previous model

* Bending conditions
Bending radius: R10 mm R0.394 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) FX-500 series	Sensing range (mm in) U-LG LONG FAST H-SP	Sensing range (mm in) FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Beam axis position/ Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.	Dimensions
Threaded	M3	M3 12	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.48
Threaded	M4	M4 15	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	320 12.598 870 34.252	ø1					
Cylindrical	ø1.5	ø1.5 10	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.52
Cylindrical	ø3	ø3 10	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	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) FX-500 series	Sensing range (mm in) (Note) U-LG LONG FAST H-SP	Sensing range (mm in) (Note) FX-101 (Upper value) FX-102 (Lower value)	Beam axis position/ Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.	Dimensions
Threaded	M3	M3 12	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.56
Threaded	M4	M4 14	Tough FD-40										
Threaded	M6	M6 17	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.57
Cylindrical	ø3	ø3 10	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.64

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

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

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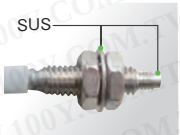
Threaded Type

- 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.

FT-42

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

- 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!

<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 ±3° and the beam axis centering accuracy is kept within ±150 µm.
(Within ±5° and ±90 µm 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.

LIST OF FIBERS

Thru-beam type (one pair set)

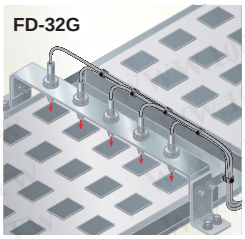
Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Beam axis position/ Inclination of beam axis	Protection	Ambient temp.	Dimensions
Threaded	M3	M3 / 12	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	150 µm /±2°	IP67	–55 to +80 °C	
Threaded	M3	M3 / 12	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	ø0.5	150 µm /±3°	IP67	–40 to +60 °C	
Threaded	M4	Lens mountable M4 / 15	FT-43	R4 Bending durability	✂ 2 m	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	ø1.5	150 µm /±2°	IP67	–55 to +80 °C	P.48
Threaded	M4	Lens mountable M4 / 15	Tough FT-42	R4 Bending durability	✂ 2 m	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	ø1	150 µm /±2°	IP67	–55 to +80 °C	P.48
Threaded	M4	Lens mountable M4 / 15	FT-42W	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	ø1	150 µm /±3°	IP67	–40 to +60 °C	P.48
Threaded	M4	Lens mountable, Stainless-jacketed M4 / 20	FT-45X	R4	1 m	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	ø1	150 µm /±2°	IP67	–55 to +80 °C	P.49
Threaded	M4 Elbow	Lens mountable 15 / M4	Tough FT-R40	R4	✂ 2 m	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	150 µm /±2°	IP67	–55 to +80 °C	P.51
Threaded	M14 Long range	With expansion lens M14 / 40	Tough FT-140	Bending durability	✂ 10 m	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.48

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.42

Lens (For reflective type fiber) ▸P.43

Protective tube ▸P.45

·FTP-□
·FDP-□

LIST OF FIBERS

Reflective type

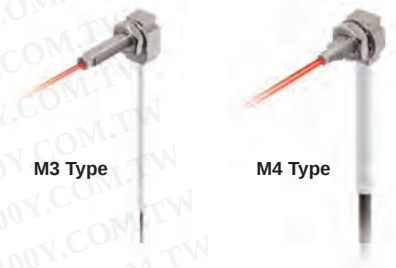
Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis position/ Inclination of beam axis	Protection	Ambient temp.	Dimensions
Threaded	M3	M3 / 12	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.56
Threaded	M3	M3 / 12	FD-31W	R1	2 m	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	—	IP67	–40 to +60 °C	P.56
Threaded	M3	Coaxial, Lens mountable M3 / 17	Tough FD-32G	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.56
Threaded	M3	Coaxial, Lens mountable, Stainless-jacketed M3 / 18	FD-32GX	R2	1 m (Note 3)	STD 200 7.874 / HYPR 630 24.803	410 16.142 / 360 14.173 / 100 3.937 / 30 1.181	75 2.953 / 210 8.268	—	IP40	–55 to +80 °C	P.56
Threaded	Ultra-small diameter	Coaxial, Lens mountable M3 / 16	FD-EG30	R4	500 mm	STD 48 1.890 / HYPR 170 6.693	130 5.118 / 110 4.331 / 30 1.181 / 9 0.354	20 0.787 / 70 2.756	—	IP40	–40 to +70 °C	P.58
Threaded	Ultra-small diameter	Coaxial, Lens mountable M3 / 16	FD-EG31	R4	500 mm	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	—	IP40	–20 to +60 °C	P.59
Threaded	M4	M4 / 14	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.56
Threaded	M4	M4 / 14	FD-41W	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	—	IP67	–40 to +60 °C	P.56
Threaded	M4	Coaxial, Lens mountable M4 / 25	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.56
Threaded	M4	Coaxial, Lens mountable M4 / 25	FD-42GW	R1	2 m	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	—	IP40	–40 to +60 °C	P.56
Threaded	M6	M6 / 17	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	170 6.693 / 450 17.717	150 µm /±3°	IP67	–55 to +80 °C	P.57
Threaded	M6	M6 / 17	Tough FD-61	R4 Bending durability	2 m	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	150 µm /±3°	IP67	–55 to +80 °C	P.57
Threaded	M6	M6 / 17	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	—	IP67	–40 to +60 °C	P.57
Threaded	M6	Coaxial M6 / 17	Tough FD-61G	R4 Bending durability	2 m	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	—	IP40	–55 to +80 °C	P.57
Threaded	M6	Stainless-jacketed M6 / 22	FD-64X	R4	1 m	STD 280 11.024 / HYPR 670 26.378	500 19.685 / 410 16.142 / 160 6.299 / 50 1.969	75 2.953 / 220 8.661	—	IP40	–55 to +80 °C	P.58
Threaded	Elbow	15 / M6	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	–55 to +80 °C	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) 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.

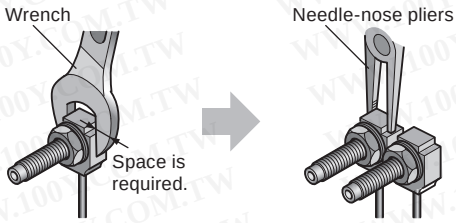
Square Head Type

- 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.28



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.

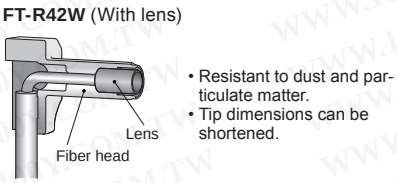


Compact installation

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.

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.



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

High environmental resistance

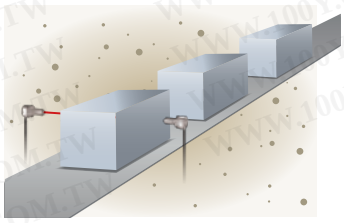
The head, nut, and washer are made from rust-resistant SUS304. The unbreakable tough fiber with high durability is covered in a fluorine resin tube. The fiber head is also covered with a fluorine resin component, achieving a high level of environmental resistance.

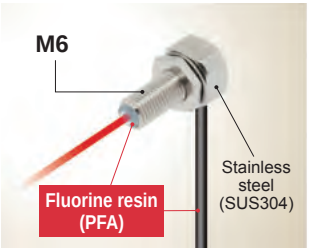
Less susceptibility to oil adhesion thanks to fluorine resin

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.

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.

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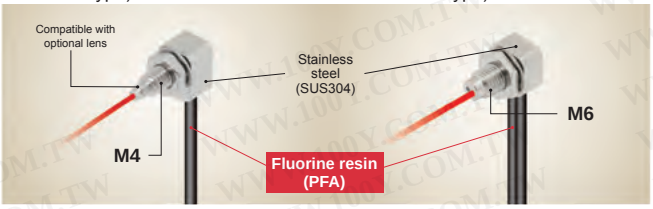
Cable-protection type FT-R44Y / FD-R61Y

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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions
Square head	M3	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.51
Square head	M4	Lens mountable M4 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			
Square head	M4	M4 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	
Square head	M4	With expansion lens M4 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			
Square head	M4	Cable-protection type Compatible with lens M4 W7×H9.5×D15.5	Tough NEW FT-R44Y	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	IP67 (Note 3)	−55 to +80 °C	P.52
Square head	M6	Full-protection type M6 W10×H11×D21.2	Tough NEW FT-R60Y			STD 2,100 82.677 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,260 49.606 400 15.748	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.

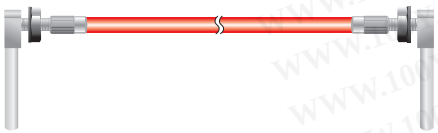
Reflective type

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions
Square head	M3	Coaxial, Lens mountable M3 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.63
Square head	M3	Coaxial, Lens mountable M3 W5.5×H8×D16	FD-R32EG	R4	500mm	STD 45 1.772 HYPR 170 6.693	110 4.331 92 3.622 30 1.181 9 0.354	20 0.787 68 2.677	Emitter ø0.25		−40 to +70 °C	
Square head	M3	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	17 0.669 60 2.362	Emitter ø0.175			
Square head	M3	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	7 0.276 22 0.866	Emitter ø0.125		−20 to +60 °C	
Square head	M4	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	
Square head	M6	Cable-protection type M6 W10×H11×D15.5	Tough NEW FD-R61Y	R4 Bending durability		STD 280 11.024 HYPR 990 38.976	610 24.016 435 17.126 160 6.299 50 1.969	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.42



Lens (For square head M3 reflective fiber) ▸P.43

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.

New product introduction
Tough Fiber
Fiber Selection Guide
Model
Choose by shape/ application
How to read Model No
Earlier models comparison table
Fibers
Super Quality
Threaded Type
Square Head Type
Cylindrical Type
Sleeve
Flat Type
Small Spot
Narrow Beam
Wide Beam
Convergent Reflective Type
Retroreflective Type
Chemical / Oil-resistant
Heat-resistant
Vacuum-resistant
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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 ø0.25 mm tips.

FT-S32

FD-S31

<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. ECO

- 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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Beam axis position/ Inclination of beam axis	Protection	Ambient temp.	Dimensions
Cylindrical	ø1	ø1, 6	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	ø0.25	—	IP67	–55 to +80 °C	P.52
Cylindrical	ø1·5	ø1.5, 10	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	ø0.5	150 µm /±2°	IP67	–55 to +80 °C	P.52
Cylindrical	ø1·5	ø1.5, 10	FT-S21W	R1	2 m	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	ø0.5	150 µm /±3°	IP67	–40 to +60 °C	P.52
Cylindrical	ø2·5	With lens, Long sensing range; ø2.5, 8	FT-S32	R10 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); 1,800 70.866; 600 23.622	1,100 43.307; 3,000 118.110	ø2	—	IP40	–40 to +70 °C	P.52
Cylindrical	ø3	ø3, 10	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	ø1	150 µm /±3°	IP67	–40 to +60 °C	P.52
Ultra-small diameter	ø3	Narrow beam ø0.125mm; ø0.25, ø3; Sleeve part cannot be bent.; 5, 15	Tough FT-E13	R2 Bending durability	1 m	STD 15 0.591; HYPR 52 2.047	30 1.181; 24 0.945; 8 0.315; 2 0.079	6 0.236; 19 0.748	ø0.125	—	IP67	–40 to +70 °C	P.49
Ultra-small diameter	ø3	Narrow beam ø0.25mm; ø0.4, ø3; Sleeve part cannot be bent.; 5, 15	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	ø0.25	—	IP67	–40 to +70 °C	P.49
Side-view	ø4	ø4, 3, 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	1,000 39.370; 3,100 122.047	ø2.5	—	IP50	–40 to +60 °C	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.

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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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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis position/ Inclination of beam axis	Protection	Ambient temp.	Dimensions
Cylindrical	ø1·5	ø1.5 / 10	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.63
Cylindrical	ø3	ø3 / 15	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	–55 to +80 °C	P.64
Cylindrical	ø3	ø3 / 15	FD-S32W	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	—	IP67	–40 to +60 °C	P.64
Cylindrical	ø3	ø3 / 10	Tough FD-S31	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.64
Cylindrical	ø3	Coaxial ø3 / 15	FD-S33GW	R1	✂ 2 m	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	—	IP67	–40 to +60 °C	P.64
Ultra-small diameter	ø1·5	ø1.5 ø0.48 / 15 3 / 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	–40 to +60 °C	P.58
Ultra-small diameter	ø3	ø3 ø0.63 / 15 5 / Sleeve part cannot be bent.	FD-E23	R4	1 m	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	—	IP40	–40 to +70 °C	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 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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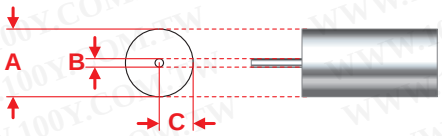
Sleeve

- It is suitable for sensing in narrow locations and sensing minute objects because the fiber tip is a thin sleeve.
- The 40 mm 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

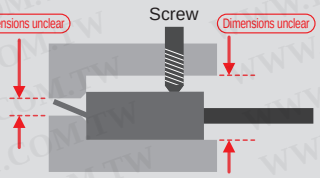
Ultra-small diameter fibers with a compact head ensure precision centering accuracy* to stably detect minute parts.



* Tolerance of A + Tolerance of B + Tolerance of C = ±0.09 mm

Dimensions UNCLEAR

Previous general fiber

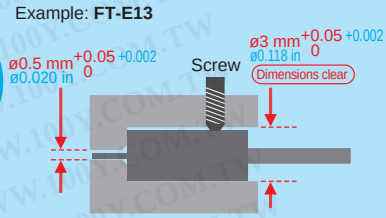


Extra clearance needs to be added when designing and machining the mounting hole due to unclear dimensions.
As a result, mounting variation increases and the beam axis deviates, resulting in a decrease in sensing accuracy or causing the sleeve to bend or break.

Dimensions CLEAR

New standard fiber

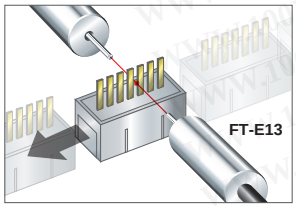
Example: **FT-E13**



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.

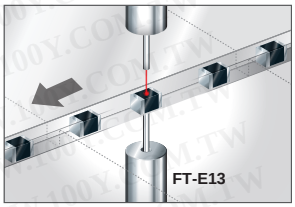
Minute sensing only possible with ultra small fiber

Detection of fine-pitch connector pins



Ultra-small diameter fiber with ø0.125 mm ø0.005 in beam axis is able to detect the insertion or bending of fine-pitch connector pins.

Detection of tiny chips

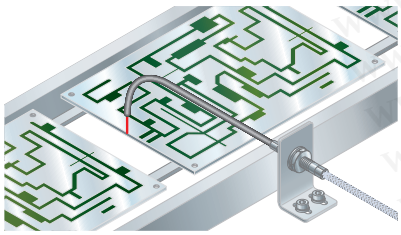


Fiber can be installed with only the ø0.25 mm ø0.010 in sleeve close to the minute section.

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

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

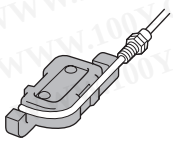
Application



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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
Threaded	M3	Sleeve 40mm, M3, ø0.88, 10	Tough FT-31S	R2 Bending durability (Note 3)	✂ 2 m	STD 315 12.402 HYPR 1,220 48.031	740 29.134 550 21.654 195 7.677 63 2.480	130 5.118 340 13.386	ø0.5	IP67	–55 to +80 °C	P.48
Threaded	M4	Sleeve 40mm, M4, ø1.48, 12	Tough FT-42S	R4 Bending durability (Note 3)	✂ 2 m	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	300 11.811 800 31.496	ø1	IP67	–55 to +80 °C	P.48
Ultra-small diameter ø3		Narrow beam ø0.125mm, ø0.25, ø3, Sleeve part cannot be bent., 5, 15	Tough FT-E13	R2 Bending durability	✂ 1 m	STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	6 0.236 19 0.748	ø0.125	IP67	–40 to +70 °C	P.49
Ultra-small diameter ø3		Narrow beam ø0.25mm, ø0.4, ø3, Sleeve part cannot be bent., 5, 15	Tough FT-E23	R2 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	ø0.25	IP67	–40 to +70 °C	P.49
Cylindrical Side-view ø2		ø1, ø2, Sleeve part cannot be bent., 20, 15	Tough FT-V23	R4 Bending durability	✂ 2 m	STD 450 17.717 HYPR 1,800 70.866	1,000 39.370 880 34.646 280 11.024 90 3.543	160 6.299 400 15.748	ø0.75	IP30	–55 to +80 °C	P.52
Cylindrical Side-view ø2		ø1, ø2, Sleeve part cannot be bent., 15, 15	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	95 3.740 260 10.236	ø0.5	IP30	–55 to +80 °C	P.53
Cylindrical Side-view ø2		ø1, ø2, Sleeve part cannot be bent., 15, 15	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	35 1.378 90 3.543	ø0.5	IP30	–40 to +60 °C	P.53
Cylindrical Side-view ø2·5		ø1.5, ø2.5, Sleeve part cannot be bent., 20, 15	Tough FT-V30	R4 Bending durability	✂ 2 m	STD 680 26.772 HYPR 2,200 86.614	1,200 47.244 1,000 39.370 340 13.386 100 3.937	180 7.087 480 18.898	ø1.0	IP30	–55 to +80 °C	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) 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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.	Dimensions
Ultra-small diameter M3		Sleeve 15 mm, M3, ø0.8, 15, Sleeve part cannot be bent.	FD-EG30S	R4	1 m	STD 50 1.969 HYPR 170 6.693	110 4.331 80 3.150 30 1.181 9 0.354	20 0.787 70 2.756	IP40	–40 to +70 °C	P.59
Threaded M4		Sleeve 40 mm, M4, 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	35 1.378 140 5.512	IP67	–55 to +80 °C	P.56
Threaded M4		Sleeve 40 mm, M4, ø1.48, 12	FD-41SW	R1 (Note 3)	✂ 2 m	STD 80 3.150 HYPR 330 12.992	180 7.087 140 5.512 45 1.772 12 0.472	15 0.591 60 2.362	IP67	–40 to +60 °C	P.56
Threaded M6		Sleeve 40 mm, M6, 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	130 5.118 360 14.173	IP67	–55 to +80 °C	P.57
Ultra-small diameter ø1·5		ø1.5, ø0.48, 15, 3, 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	–40 to +60 °C	P.58
Ultra-small diameter ø3		ø3, ø0.63, 15, 5, Sleeve part cannot be bent.	FD-E23	R4	1 m	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	IP40	–40 to +70 °C	P.58
Cylindrical Side-view ø3		Small diameter, 15, 15, ø3, ø1.5, 2, 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	25 0.984 75 2.953	IP30	–55 to +80 °C	P.64
Cylindrical Side-view ø3		15, 15, ø3, ø1.5, 2, 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	6 0.236 20 0.787	IP30	–40 to +60 °C	P.64
Cylindrical Side-view ø5		15, 20, ø5, ø2, 2.3, 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	40 1.575 100 3.937	IP30	–55 to +80 °C	P.65

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

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

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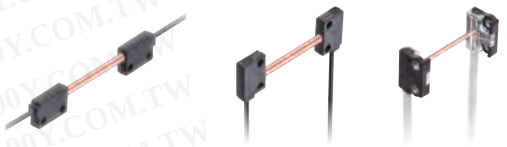
Flat Type

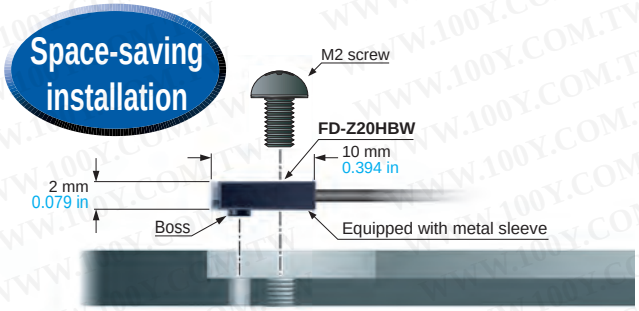
■ Since it has a thin, rectangular shape, it can be installed in narrow locations. It is also a fiber with good workability and can be mounted directly with screws.



FT-Z30H FT-Z30E FT-Z30

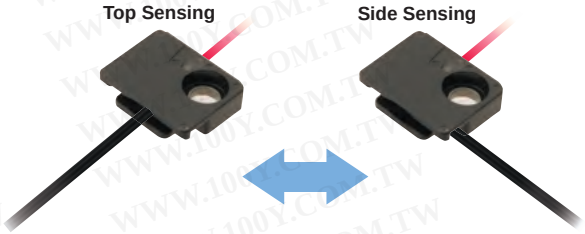
1 point mounting

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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
Flat	Top sensing W3 × H8 × D12	Tough FT-Z30H	R2 Bending durability	2 m	STD 3,500 137.795 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 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.54
Flat	Top sensing W3 × H8 × D12	FT-Z30HW	R1	2 m	STD 3,500 137.795 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 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.54
Flat	Side sensing W3 × H12 × D8	Tough FT-Z30E	R2 Bending durability	2 m	STD 3,500 137.795 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 740 29.134	1,200 47.244 3,200 125.984	2 × 3	IP40	–40 to +60 °C	P.53
Flat	Side sensing W3 × H12 × D8	FT-Z30EW	R1	2 m	STD 3,400 133.858 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,000 78.740 630 24.803	1,400 55.118 2,600 102.362	2 × 3	IP40	–40 to +60 °C	P.54
Flat	Front sensing W8.5 × H12 × D3	Tough FT-Z30	R2 Bending durability	2 m	STD 2,100 82.677 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244 410 16.142	710 27.953 2,300 90.551	ø2	IP40	–40 to +60 °C	P.53
Flat	Front sensing W8.5 × H12 × D3	FT-Z30W	R1	2 m	STD 1,500 59.055 HYPR (Note2) 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	ø2	IP40	–40 to +60 °C	P.54
Flat, With boss	Front sensing W10 × H7 × D2	FT-Z20W	R1	1 m	STD 620 24.409 HYPR (Note2) 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	IP40	–40 to +60 °C	P.53
Flat, With boss	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	–40 to +60 °C	P.53
Flat, With boss	Front sensing W14 × H7 × D3.5	FT-Z40W	R1	2 m	STD 1,500 59.055 HYPR (Note2) 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	–40 to +60 °C	P.54
Flat, With boss	Fiber bending type W3.5 × H14 × D11	FT-Z40HBW	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	ø1	IP67	–40 to +60 °C	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.

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.

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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.	Dimensions
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.65
		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.

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Small Spot

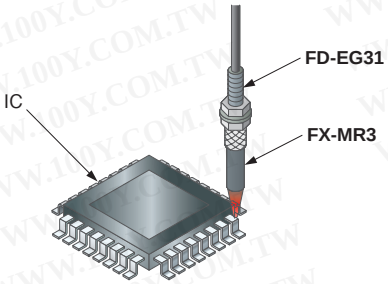
■ Sensing of minute objects can be performed by combining the fiber and spot lens. The spot diameter can also be changed.

Applications

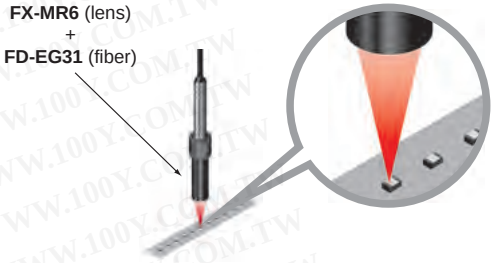
Packing detection

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.

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 ø0.4 to ø3.5 mm ø0.016 to ø0.138 in can be achieved by combining the lens with a variety of fibers.

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 ø4 mm ø0.157 in at a sensing range of 0 to 30 mm 0 to 1.181 in.

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 ø4.3 mm (ø0.169 in)

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

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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 Model No.	Lens Ambient temp.	Applicable fibers Model No.	Fiber cable length ✂: Free-cut	Bending radius (mm)	Protection	Ambient temp.	Dimensions
Finest spot lens	16, ø4 P.68	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.59
	P.68	ø0.2 ø0.008				FD-EG30				–40 to +70 °C	P.58
	P.68	ø0.4 ø0.016				Tough FD-42G	✂ 2 m	R2 Bending durability		–55 to +80 °C	P.57
						FD-42GW		R1		–40 to +60 °C	
						Tough FD-32G		R2 Bending durability		–55 to +80 °C	P.56
						FD-32GX	✂ 1 m	R2			
	15, ø4 P.68	ø0.15 ø0.006	7.5±0.5 0.295±0.020	FX-MR3	–40 to +70 °C	FD-EG31	500 mm	R4		–20 to +60 °C	P.59
	P.68	ø0.3 ø0.012				FD-EG30				–40 to +70 °C	P.58
	P.68	ø0.5 ø0.020				Tough FD-42G	✂ 2 m	R2 Bending durability		–55 to +80 °C	P.57
						FD-42GW		R1		–40 to +60 °C	
						Tough FD-32G		R2 Bending durability		–55 to +80 °C	P.56
						FD-32GX	✂ 1 m	R2			
Pinpoint spot lens	20.2, ø4 P.67	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	P.57
						FD-42GW		R1		–40 to +60 °C	
Zoom lens	27.1, ø7.1 P.67	ø0.7 to ø2.0 ø0.028 to ø0.079	Approx.18.5 to 43 Approx. 0.728 to 1.693	FX-MR2	–40 to +70 °C	Tough FD-42G	✂ 2 m	R2 Bending durability		–55 to +80 °C	
						FD-42GW		R1		–40 to +60 °C	
Zoom lens (Side-view type)	W6.3 × H20.3 × D10.3 P.68	ø0.5 to ø3.0 ø0.020 to ø0.118	Approx.13 to 30 Approx. 0.512 to 1.181	FX-MR5	–40 to +70 °C	Tough FD-42G		R2 Bending durability		–55 to +80 °C	
						FD-42GW		R1		–40 to +60 °C	

Square head type M3, Reflective type fiber & spot lens

Type	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens Shape (mm in) Dimensions	Lens Model No.	Fiber Shape	Fiber Emitting fiber core (mm in)	Fiber Model No.
Finest spot lens	ø0.1 ø0.004 approx.	7 ± 0.5 0.276 ± 0.020	15.3 0.602, ø5 ø0.197 P.68	FX-MR7		ø0.125 ø0.005	FD-R33EG
						ø0.125 ø0.005	FD-EG31
	ø0.15 ø0.006 approx.					ø0.175 ø0.007	FD-R34EG
	ø0.2 ø0.008 approx.					ø0.25 ø0.010	FD-R32EG
						ø0.25 ø0.010	FD-EG30
	ø0.4 ø0.016 approx.					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

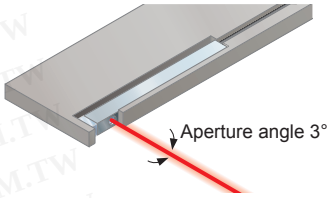
Type	Spot diameter (mm in) (Note)	Sensing range (mm in) (Note)	Lens Shape (mm in)	Lens Model No.	Applicable fibers Emitting fiber core (mm in)	Applicable fibers Model No.
Zoom lens	ø0.4 to ø2.0 ø0.016 to ø0.079 approx.	10 to 30 0.394 to1.181	15 0.591, ø5 ø0.197 P.68	FX-MR8	ø0.125 ø0.005	FD-R33EG, FD-EG31
	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	10 0.394, ø5 ø0.197 P.68	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/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.

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.

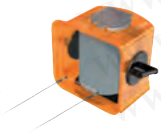


Applications

Detection of a transparent tube

FR-KZ50H

Mapping of a wafer



FT-KV40

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) FX-500 series	Sensing range (mm in) (Note 1) U-LG LONG FAST H-SP	Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Beam axis position/ Inclination of beam axis	Protection	Ambient temp.	Dimensions
Narrow beam / Side-view	Aperture angle 2°; ø3.5 ø3.7; 20	Tough FT-KS40	R2 Bending durability	✂ 2 m	STD (Note2) 3,600 141.732; HYPR (Note2) 3,600 141.732	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)	ø2.2	—	IP40	–40 to +60 °C	P.51
Narrow beam / Side-view	Aperture angle 2°; ø4; 25	Tough FT-KV40	Bending durability	✂ 2 m	STD (Note2) 3,600 141.732; HYPR (Note2) 3,600 141.732	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)	ø2.5	±0.8°	IP30		
Narrow beam / Side-view	Aperture angle 2°; ø4; 25	FT-KV40W	R1	✂ 2 m	STD (Note2) 3,600 141.732; HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2); 3,600 141.732 (Note 2); 3,100 122.047; 940 37.008						
Narrow beam / Side-view	Aperture angle 3°; 1.5 × 2; 20	Tough FT-KV26	R2 Bending durability	✂ 2 m	STD 710 27.953; HYPR 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) FX-500 series	Sensing range (mm in) (Note 1, 3) U-LG LONG FAST H-SP	Sensing range (mm in) (Note 1, 3) FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.	Dimensions
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.55
Ultra-narrow beam	W7.5 × H2.2 × D11.2; Aperture angle 3° (emitter); W4 × H2 × D21.5	Tough FR-KZ22E	R2 Bending durability	✂ 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	
Narrow beam / Top sensing	W5.2 × H9.5 × D21; W10.6 × H28 × D10.1	Tough FR-KZ50H			STD 20 to 300 0.787 to 11.811; 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			
Narrow beam / 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) (Note1) FX-500 series	Sensing range (mm in) (Note1) U-LG LONG FAST H-SP	Sensing range (mm in) (Note1) FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.	Dimensions
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.65

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.27 or 38 for the sensing range when **FR-Z50HW** is used in combination with a reflector (optional).

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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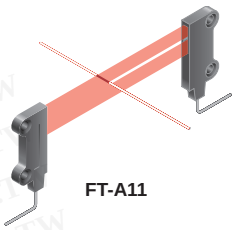
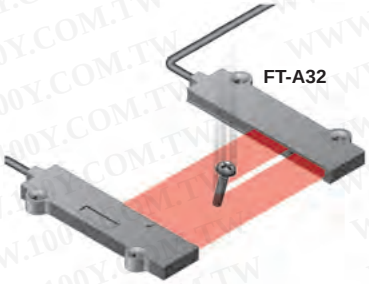
Wide Beam

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

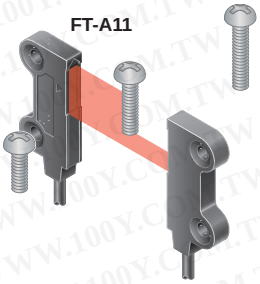


Applications

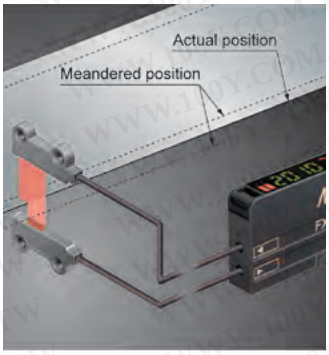
Sensing tiny moving objects



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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
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) 3,600 141.732 (Note 2) 2,100 82.677	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3.2 × 32	IP40	–40 to +60 °C	P.49
Wide beam	Allows flexible wiring; Sensing width 32mm; W5 × H69 × D20	FT-A32W	R1	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) 3,000 118.110	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3.2 × 32	IP40	–40 to +55 °C	P.49
Wide beam	Sensing width 11mm; W4.2 × H31 × D13.5	Tough FT-A11	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) 1,100 43.307	1,900 74.803 3,600 141.732 (Note 2)	2.2 × 11	IP40	–40 to +70 °C	P.49
Wide beam	Allows flexible wiring; Sensing width 11mm; W4.2 × H31 × D13.5	FT-A11W	R1	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) 1,300 51.181	1,700 66.929 3,400 133.858	2.2 × 11	IP40	–40 to +55 °C	P.49
Array	Sensing width 5.5mm; W5 × H15 × D15	Tough FT-AL05	R2 Bending durability	2 m	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	IP40	–55 to +80 °C	P.49

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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.	Dimensions
Wide beam	W7 × H15 × D30	Tough FD-A16	R4 Bending durability	2 m	STD 200 7.874 HYPR Cannot use	200 7.874 200 7.874 140 5.512 75 2.953	120 4.724 240 9.449	IP40	–40 to +60 °C	P.58
Array	W5 × H20 × D20	Tough FD-AL11	R2 Bending durability	2 m	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	IP40	–55 to +80 °C	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 specified for white non-glossy paper.

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

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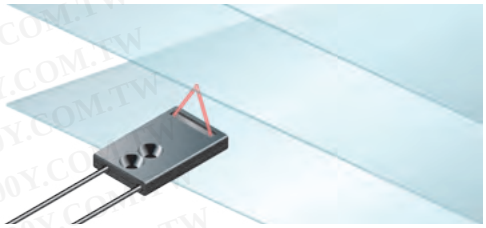
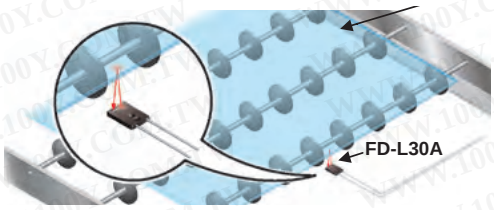
Convergent Reflective Type



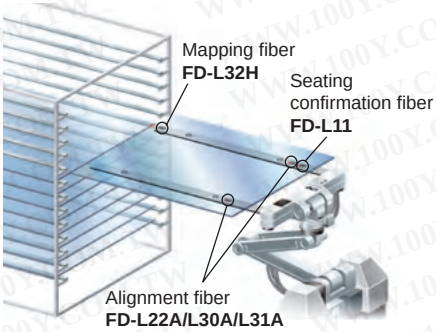
It is a fiber in which the sensing distance is limited to a specific range so it is not easily affected by the background. It is effective when a workpiece is accumulated or when the background is near.

Applications

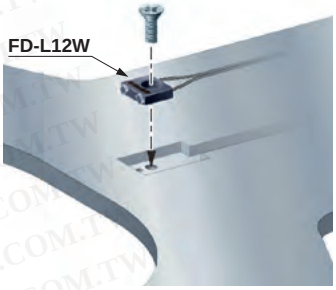
Detecting a passing glass



LCD transportation



Mounting in handling arms



LIST OF FIBERS

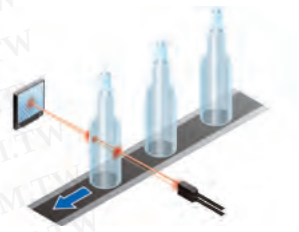
Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.	Dimensions
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.63
Glass substrate detection	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	IP40	0 to +70 °C	P.62
Glass substrate detection	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	IP40	0 to +70 °C	P.62
Glass substrate detection	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	IP40	0 to +70 °C	P.62
Glass substrate detection	Seating confirmation W18 × H29 × D3.8	Tough FD-L23	R2 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	IP40	–20 to +70 °C	P.62
Glass substrate detection	Seating confirmation W12 × H19 × D3	Tough FD-L11	R4 Bending durability	✂ 2 m	STD 0 to 9.5 0 to 0.374 HYPR 0 to 11.5 0 to 0.453	0 to 10.5 0 to 0.413 0 to 10 0 to 0.394 0 to 9 0 to 0.354 0 to 8 0 to 0.315	0 to 8 0 to 0.315 0 to 9 0 to 0.354	IP40	–40 to +60 °C	P.62
Glass substrate detection	Seating confirmation W12 × H19 × D3	Tough FD-L10	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 5.5 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	IP40	–40 to +60 °C	P.62
Glass substrate detection	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	IP40	–40 to +60 °C	P.62
Glass substrate detection	W24 × H21 × D4	FD-L21W	R1	✂ 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	IP40	–40 to +60 °C	P.62
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	IP40	–40 to +70 °C	P.62
Ultra-small	W7.2 × H7.5 × D2	FD-L12W	R1	✂ 1 m	STD 8 0.315 HYPR 14 0.551	12.5 0.492 12 0.472 0.5 to 7 0.020 to 0.276 0.5 to 4 0.020 to 0.157	1 to 4.5 0.039 to 0.177 0.5 to 7 0.020 to 0.276	IP30	–40 to +60 °C	P.62

Notes: 1) 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).
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.

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

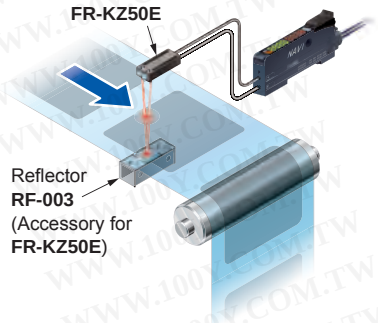


■ Compared with the thru-beam type, it is easier to arrange the fibers since one side is a reflector. Sensing transparent objects is also its advantage.

Applications

Detecting transparent film

Detecting 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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.	Dimensions
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	100 to 550 3.937 to 21.654 100 to 830 3.937 to 32.677	IP40	–25 to +55 °C	P.55
Ultra-narrow beam	W7.5 × H2.2 × D11.2 W4 × H2 × D21.5	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	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			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			
Narrow beam 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 HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102
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 of retroreflective type is the possible setting range for the attached 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.45

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.

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.

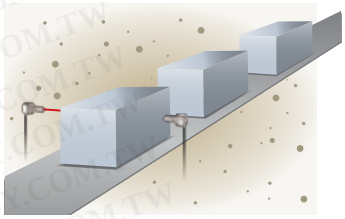
Full-protection type

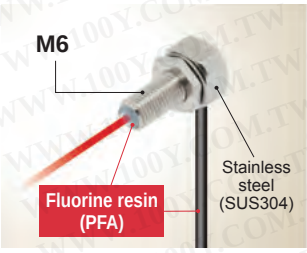
FT-R60Y (Square head type M6 / thru-beam type)

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.

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.





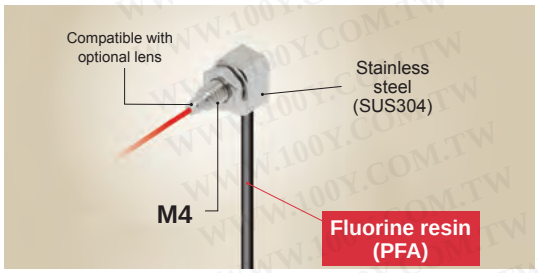
Test oil	Product
Lubricating oil	Velocite Oil No. 3
Non-water-soluble cutting oil	Yushiron Cut Abas KZ201
	Yushiron Cut UH75
Water-soluble cutting oil	Syntilo 9954 (10% diluted)
	Yushiroken S50N (2% diluted)
Alcohol-based neutral detergent	Super Teepol

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

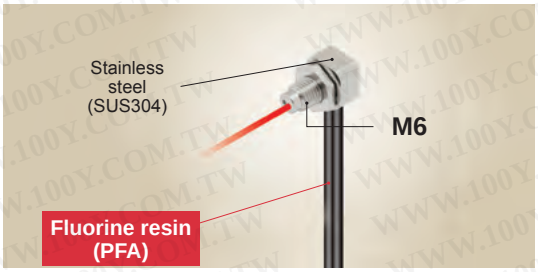
Cable-protection type

FT-R44Y / FD-R61Y

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



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



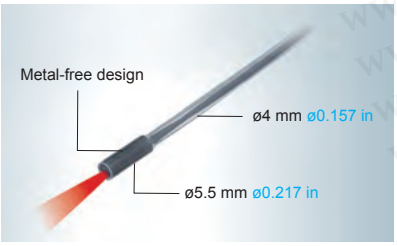
Full-protection type

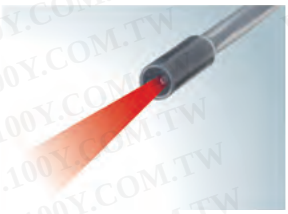
FD-S60Y (Cylindrical type / reflective type) **Metal-free**

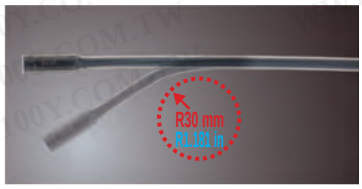
Metal-free design
Since no metal components are used, there is no need to worry about metal contamination, even if the protective tube is damaged. It is ideal for use in applications such as semiconductor front-end equipment where a clean environment is required.

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.







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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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
Oil-resistant	Square head type M4	Cable-protection type Compatible with lens W7×H9.5×D15.5	Tough NEW FT-R44Y	R4 Bending durability	✂ 2 m	STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118	210 8.268 640 25.197	ø1	IP67 (Note 4)	–55 to +80 °C	P.52
Oil-resistant	Square head type M6	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	IP68G	–55 to +80 °C	
Chemical-resistant	Flat type	Easy mounting • Rectangular head SEMI S2 compliant W7 × H15 × D13 Metal-free	Tough FT-Z802Y	R4 Bending durability	✂ 2 m	STD 3,100 122.047 HYPR (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	ø3.7		0 to +60 °C	P.54
Chemical-resistant	Cylindrical type	Heat-resistant 115 °C Metal-free ø5.5 (25)	FT-HL80Y	R30	✂ 2 m (Note 3)	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			–40 to +115 °C	P.50
Chemical-resistant	Cylindrical type	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.51
Chemical-resistant	Cylindrical type	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.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) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.
4) The fiber part is oil-resistant.

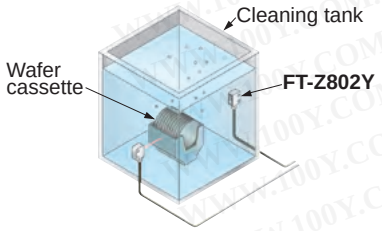
Reflective type

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions
Oil-resistant	Square head type M6	Cable-protection type W10×H11×D15.5	Tough NEW FD-R61Y	R4 Bending durability	✂ 2 m	STD 280 11.024 HYPR 990 38.976	610 24.016 435 17.126 160 6.299 50 1.969	85 3.346 185 7.283	—	IP67 (Note 3)	–55 to +80 °C	P.63
Chemical-resistant	Cylindrical type	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.64

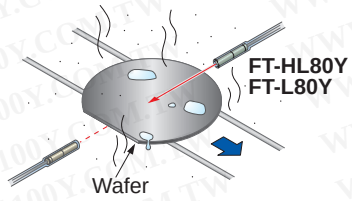
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending on how the fiber is cut.
2) The sensing range is specified for white, non-glossy paper.
3) The fiber part is oil-resistant.
4) The allowable cutting range is 500 mm 19.685 in from the end that is inserted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

Applications

Detecting wafer cassette in cleaning tank



Sensing a wafer in corrosive environment



Detecting a container at a chemical Piller

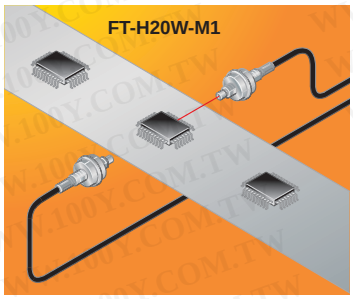
Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

Heat-resistant

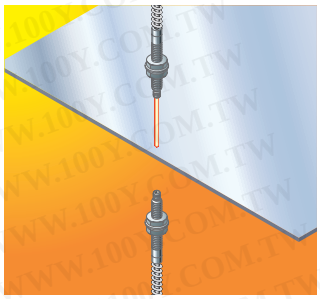
- It can be used under environments of -60 to +350 °C -76 to +662 °F.
- A joint type for wider workability is also available.

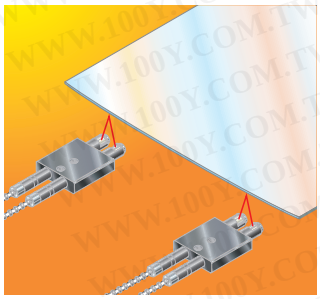
Applications

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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Ambient temp.	Dimensions
Heat-resistant	350 °C	Lens mountable (FX-LE1/LE2/SV1) M4 30	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.50
Heat-resistant	350 °C	Sleeve 60 mm M4 ø2.1 27	FT-H35-M2S6	Fiber R25 Sleeve R10	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.50
Heat-resistant	200 °C	Allows flexible wiring Lens mountable (FX-LE1/LE2/SV1) M4 23	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	P.50
Heat-resistant	200 °C	Lens mountable (FX-LE1/LE2/SV1) M4 23	FT-H20-M1	R25	1 m	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	–60 to +200 °C	P.50
Heat-resistant	130 °C	Lens mountable (FX-LE2 only) M4 16	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.49
Heat-resistant (joint)	200 °C	Lens mountable (FX-LE1/LE2/SV1) M4 23	FT-H20-J20-S (Note 5)	Heat-resistant side R18 (Note 4)	✂ 200 mm (Note 3)	STD 470 18.504 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	P.50
Heat-resistant (joint)	200 °C	Lens mountable (FX-LE1/LE2/SV1) M4 23	FT-H20-J30-S (Note 5)	Heat-resistant side R18 (Note 4)	✂ 300 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	P.50
Heat-resistant (joint)	200 °C	Lens mountable (FX-LE1/LE2/SV1) M4 23	FT-H20-J50-S (Note 5)	Heat-resistant side R18 (Note 4)	✂ 500 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	P.50
Heat-resistant (joint)	200 °C	Side-view 24 ø3.8 ø4	FT-H20-VJ50-S (Note 5)	Heat-resistant side R18 (Note 4)	✂ 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	ø1.2	–60 to +200 °C	P.50
Heat-resistant (joint)	200 °C	Side-view 24 ø3.8 ø4	FT-H20-VJ80-S (Note 5)	Heat-resistant side R18 (Note 4)	✂ 800 mm (Note 3)	STD 600 23.622 HYPR 2,100 82.677	1,300 51.181 980 38.583 390 15.354 120 4.724	150 5.906 500 19.685	ø1.2	–60 to +200 °C	P.50

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

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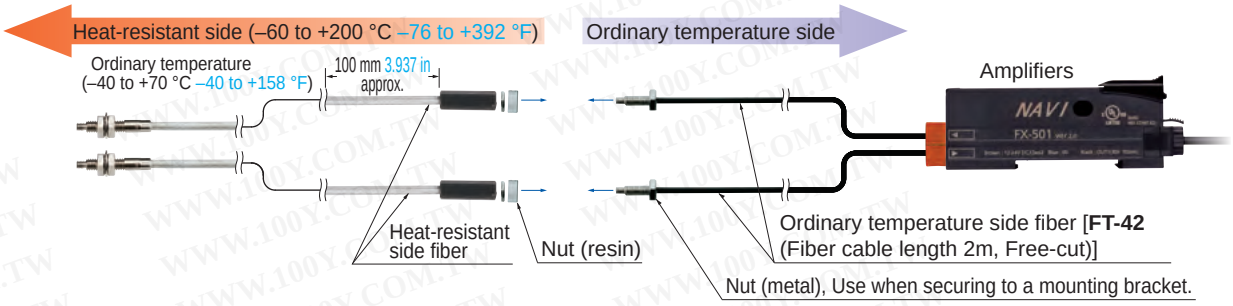
Heat-resistant joint fiber set contents



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) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Ambient temp.	Dimensions
Heat-resistant	Threaded	350 °C	Coaxial M6 25	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.61
			Sleeve 60 mm M6 ø2.8 22	FD-H35-M2S6	Fiber R25 Sleeve R10						
			Sleeve 90 mm M4 ø2.1 27	FD-H35-20S		1 m	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	Coaxial M6 28	FD-H20-M1	R25		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.60
			Coaxial M4 27	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	M6 21	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		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.61
		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.60
			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) 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**, **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**).
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.

FIBER OPTION

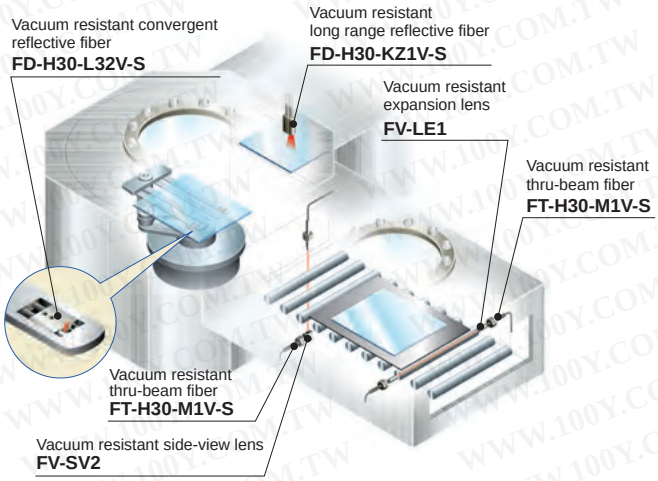
Lens (For thru-beam type fiber) ▸P.42

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 · m^3/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) FX-500 series	Sensing range (mm in) U-LG LONG FAST H-SP	Sensing range (mm in) FX-101 (Upper value) FX-102 (Lower value)	Beam axis dia. (mm)	Ambient temp.	Dimensions
Vacuum-resistant	Thru-beam	300 °C Lens mountable (FV-LE1/SV2) M4 30	**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.50

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) FX-500 series	Sensing range (mm in)(Note 2) U-LG LONG FAST H-SP	Sensing range (mm in)(Note 2) FX-101 (Upper value) FX-102 (Lower value)	Ambient temp.	Dimensions
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.61
Vacuum-resistant	Convergent reflective	300 °C, Glass substrate detection W19 × H5 × D27	**FD-H30-L32V-S** (Note 1)	R18	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 of reflective type is the value for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.

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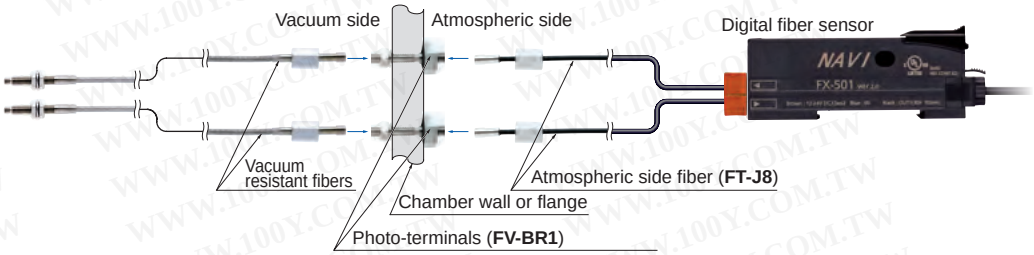
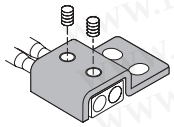
Vacuum-resistant fiber set contents



(Recommended thickness: 3.0 to 20 mm 0.118 to 0.787 in)

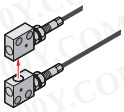
Model No. when ordering individually as spare parts

- 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**		Increases the sensing range 4 times or more. • Ambient temperature: –60 to +350 °C –76 to +662 °F (Note 3) • Beam axis dia: ø3.6 mm ø0.142 in Sensing range (mm in) [Lens on both sides] (Note 4)
For thru-beam type fiber	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 3) • Beam axis dia: ø3.7 mm ø0.146 in Sensing range (mm in) [Lens on both sides] (Note 4)

Fiber \ Amplifier / Mode	FX-500 series						FX-100 series	
	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102
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	450 17.717	1,600 62.992

Fiber \ Amplifier / Mode	FX-500 series						FX-100 series	
	HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101	FX-102
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	450 17.717	1,600 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.

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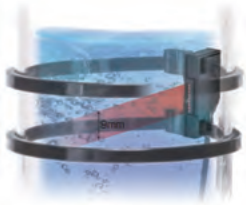
Liquid Leak / Liquid Detection



■ 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 ø8 mm ø0.315 in or more
(When used with the tying bands: ø8 to ø80 mm ø0.315 to ø3.150 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.

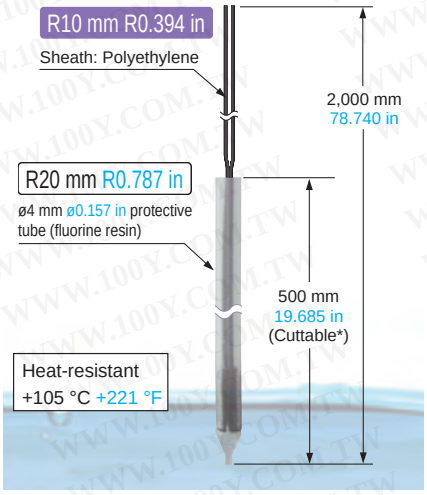
The sensor will turn OFF during abnormal conditions (insufficient liquid, fiber disconnection, etc.) !
Liquid present: Beam received (Output ON)
Liquid absent / fiber is cutoff: Beam not receired (Output OFF)

FT-F93 Thru-beam

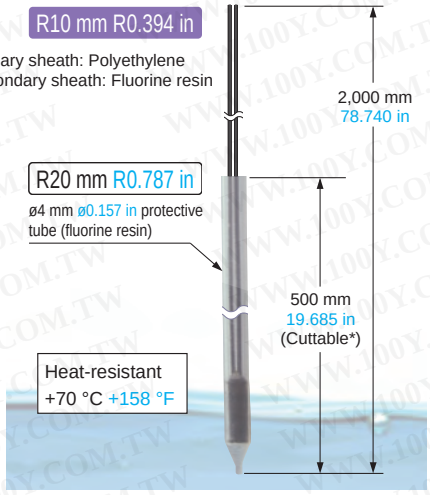
Full-protection type FD-HF40Y / FD-F41Y (Liquid level sensing) Metal-free

Small diameter type
(ø4 mm ø0.157 in)
Bends easily with its small bending radius, protective tube is cuttable and extendable

FD-HF40Y



FD-F41Y



* 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

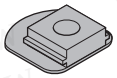
Reflective type / Thru-beam type

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Description: FX-500 series (STD mode)	Description: FX-101 FX-102	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.59
		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.61
		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	P.59
	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: **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	
		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	
		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: **FX500** series only			–40 to +60 °C	P.49

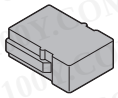
Notes: 1) The allowable cutting range is 1,000 mm 39.370 in from the end that the amplifier inserted.
2) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint is available.

Accessories for additional supply

- **MS-FD-F7-1**
  (SUS mounting bracket for **FD-F71**)



- **MS-FD-F7-2**
  (PVC mounting bracket for **FD-F71**)



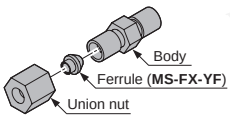
FIBER OPTIONS

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

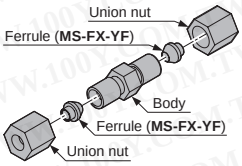
Liquid inflow prevention joint

- **MS-FX-01Y**



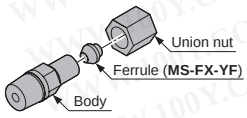
Protective tube extension joint

- **MS-FX-02Y**



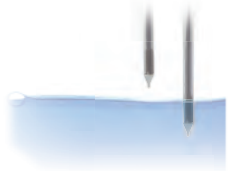
Fiber mounting joint

- **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.

SENSING RANGE

Fibers are listed in alphabetic order.
Refer to p. 2~ 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-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.48
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.48
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.48
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.48
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.48
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.48
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.48
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.48
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.48
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.48
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.49
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.49
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.49
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.49
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.49
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.49
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.49
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.49
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.49
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.49
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.50
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.50
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.50
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.50
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.50
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.50
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.50
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.50
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.50
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.50
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.50
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.51
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.51
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.51
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.51
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.51
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.51
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.51
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.51
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.51

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**).

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SENSING RANGE

Fibers are listed in alphabetic order.
Refer to p. 2~ 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.51
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.52
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.52
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.52
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.52
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.52
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.52
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.52
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.52
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.52
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.52
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.53
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.53
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.53
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.53
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.53
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.53
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.53
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.53
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.53
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.54
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.54
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.54
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.54
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.54
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.54
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.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.

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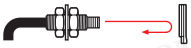
SENSING RANGE

Fibers are listed in alphabetic order.
Refer to p. 2~ for details of each fiber.

Retroreflective 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**	
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.55
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.55
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.55
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.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.
The sensing range of **FR-Z50HW** is specified for the **RF-13**. The sensing range of **FR-KZ50H** and **FR-KZ50E** is specified for the attached reflector **RF-003**. The sensing range of **FR-KZ22E** is specified for the attached reflector.
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: 1) The sensing range of retroreflective type is the possible setting range for the attached 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. 2~ 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-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.56
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.56
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.56
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.56
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.56
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.56
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.56
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.56
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.56
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.56
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.57
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.57
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.57
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.57
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.57
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.57
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.57
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.57
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.58
FD-A16	———	200 7.874	200 7.874	200 7.874	140 5.512	75 2.953	120 4.724	240 9.449	P.58
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.58
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.58
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.58
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.58
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.59
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.59
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.59
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.59
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.59
FD-F71	Liquid leak detection Leak absent: Beam received, Leak present: Beam interrupted Compatible amplifier: **FX-500** series only								P.59
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.59
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.59

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 page 35 for details.

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SENSING RANGE

Fibers are listed in alphabetic order.
Refer to p. 2~ 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-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.60
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.60
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.60
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.60
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.60
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.60
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 to120 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.61
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.61
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 to11 0 to 0.433	P.61
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.61
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.61
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.61
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.61
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.62
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.62
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.62
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.62
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.62
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.62
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 19 0 to 0.748	0 to 25 0 to 0.984	P.62
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.62
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.62
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.62
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.63
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.63
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.63
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.63
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.63
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.63
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.63
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.63
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.63
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.64
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.64
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.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) 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 page 35 for details.

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SENSING RANGE

Fibers are listed in alphabetic order.
Refer to p. 2~ 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.64
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.64
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.64
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.64
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.64
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.65
FD-Z20HBW	1 to 340 0.039 to 13.386	1 to 210 0.039 t 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.65
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.65
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.65
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.65
FD-Z50HW (Note 3)	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.65

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 (except for **FD-Z50HW**).
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.38 for the sensing range when **FR-Z50HW** is used in combination with a reflector (optional).

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FIBER OPTIONS

Refer to p.66~ for details of lens dimensions.

Lens (For thru-beam type fiber)

Designation	Model No.	Description

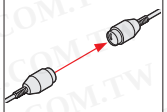
Expansion lens (Note 1) — FX-LE1

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 \ Amplifier / Mode	FX-500 series HYPR	U-LG	LONG	STD	FAST	H-SP	FX-100 series 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 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)	2,200 86.614	3,400 133.858	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)	1,500 59.055	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)	1,900 74.803	3,100 122.047	3,600 141.732 (Note 2)
FT-R42W	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-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)	1,900 74.803	670 26.378	1,300 51.181	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)	3,300 129.921	1,400 55.118	2,000 78.740	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)	850 33.465	1,300 51.181	1,600 62.992 (Note 2)
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)	1,200 47.244	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)
FT-H20-J50-S FT-H20-J30-S FT-H20-J20-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	500 19.685	1,000 39.370	3,500 137.795 (Note 2)

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 \ Amplifier / Mode	FX-500 series HYPR	U-LG	LONG	STD	FAST	H-SP	FX-100 series FX-101	FX-102
FT-43 FT-42 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)	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)	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)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)
FT-R42W	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 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)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (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 FT-H20-J30-S FT-H20-J20-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)

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 \ Amplifier / Mode	FX-500 series HYPR	U-LG	LONG	STD	FAST	H-SP	FX-100 series FX-101	FX-102
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	510 20.079	1,400 55.118
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	500 19.685	1,700 66.929
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	480 18.898	1,300 51.181
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	540 21.260	1,600 62.992 (Note 2)
FT-R42W	3,600 141.732 (Note 2)	3,500 137.795	2,700 106.299	1,800 70.866	990 38.976	320 12.598	1,400 55.118	1,000 39.370
FT-R43	3,200 125.984	1,800 70.866	1,300 51.181	950 37.402	510 20.079	160 6.299	310 12.205	930 36.614
FT-H35-M2	3,500 137.795	1,600 62.992	1,200 47.244	780 30.709	500 19.685	150 5.906	280 11.024	800 31.496
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	140 5.512	400 15.748
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	280 11.024	840 33.071
FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S	1,600 62.992 (Note 2)	960 37.795	740 29.134	450 17.717	290 11.417	80 3.150	150 5.906	410 16.142

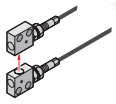
Expansion lens for vacuum fiber (Note 1) — FV-LE1

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 \ Amplifier / Mode	FX-500 series HYPR	U-LG	LONG	STD	FAST	H-SP	FX-100 series FX-101	FX-102
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	450 17.717	1,600 62.992

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 \ Amplifier / Mode	FX-500 series HYPR	U-LG	LONG	STD	FAST	H-SP	FX-100 series FX-101	FX-102
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	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 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.12, p.15, p.30 and p.32 for the ambient temperature of fibers to be used in combination.

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FIBER OPTIONS

Refer to p.66~ 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 ø0.5 mm ø0.020 in. Enables detection of minute objects or small marks. • Distance to focal point: 6 ± 1 mm 0.236 ± 0.039 in • Applicable fibers: **FD-42G**, **FD-42GW** • Ambient temperature: -40 to +70 °C -40 to +158 °F (Note)
	Zoom lens	**FX-MR2**	The spot diameter is adjustable from ø0.7 to ø2 mm ø0.028 to ø0.079 in according to how much the fiber is screwed in. • Applicable fibers: **FD-42G**, **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** Screw-in depth / Distance to focal point / Spot diameter
	Finest spot lens	**FX-MR3**	Extremely fine spot of ø0.15 mm ø0.006 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** Distance to focal point / Spot diameter
	Finest spot lens	**FX-MR6**	Extremely fine spot of ø0.1 mm ø0.004 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**
	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** Screw-in depth / Distance to focal point / Spot diameter

Sensing range for FX-500/FX-100 series (FX-MR2)

Screw-in depth	Distance to focal point	Spot diameter
7 mm	18.5 mm approx.	ø0.7 mm
12 mm	27 mm approx.	ø1.2 mm
14 mm	43 mm approx.	ø2.0 mm

Sensing range for FX-500/FX-100 series (FX-MR3)

Fiber model No.	Distance to focal point	Spot diameter
FD-EG31	7.5 ± 0.5 mm	ø0.15 mm approx.
FD-EG30	7.5 ± 0.5 mm	ø0.3 mm approx.
FD-42G/42GW **FD-32G/32GX**	7.5 ± 0.5 mm	ø0.5 mm approx.

Sensing range for FX-500/FX-100 series (FX-MR6)

Fiber model No.	Distance to focal point	Spot diameter
FD-EG31	7 ± 0.5 mm	ø0.1 mm approx.
FD-EG30	7 ± 0.5 mm	ø0.2 mm approx.
FD-42G/42GW **FD-32G/32GX**	7 ± 0.5 mm	ø0.4 mm approx.

Sensing range for FX-500/FX-100 series (FX-MR5)

Screw-in depth	Distance to focal point	Spot diameter
8 mm	13 mm approx.	ø0.5 mm
10 mm	15 mm approx.	ø0.8 mm
14 mm	30 mm approx.	ø3.0 mm

Note: Refer to p.13 or p.23 for the ambient temperature 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 Shape (mm in)	Lens Model No.	Fiber Shape	Fiber Emitting fiber core (mm in)	Fiber Model No.
For Square head M3 reflective fiber	Finest spot lens	ø0.1 ø0.004 approx.	7 ± 0.5 0.276 ± 0.020	15.3 0.602 ø5 ø0.197	**FX-MR7**		ø0.125 ø0.005	**FD-R33EG**
							ø0.125 ø0.005	**FD-EG31**
		ø0.15 ø0.006 approx.					ø0.175 ø0.007	**FD-R34EG**
		ø0.2 ø0.008 approx.					ø0.25 ø0.010	**FD-R32EG**
							ø0.25 ø0.010	**FD-EG30**
		ø0.4 ø0.016 approx.					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)	Sensing range (mm in)	Lens Shape (mm in)	Lens Model No.	Applicable fibers Emitting fiber core (mm in)	Applicable fibers 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 to1.181	15 0.591 ø5 ø0.197	**FX-MR8**	ø0.125 ø0.005	**FD-R33EG, FD-EG31**
		ø0.4 to ø2.2 ø0.016 to ø0.087 approx.				ø0.175 ø0.007	**FD-R34EG**
		ø0.5 to ø2.5 ø0.020 to ø0.098 approx.				ø0.25 ø0.010	**FD-R32EG, FD-EG30**
		ø0.8 to ø3.5 ø0.031 to ø0.138 approx.				ø0.5 ø0.020	**FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW**
	Parallel light lens	ø4.0 ø0.157 approx.	0 to 30 0 to 1.181	10 0.394 ø5 ø0.197	**FX-MR9**	ø0.125 ø0.005	**FD-R33EG, FD-EG31**
						ø0.175 ø0.007	**FD-R34EG**
						ø0.25 ø0.010	**FD-R32EG, FD-EG30**
						ø0.5 ø0.020	**FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW**

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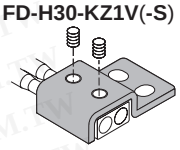
FIBER OPTIONS

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)
- Mouting bracket for **FD-H30-KZ1V(-S)**
  MS-FD-2



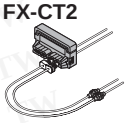
Model No. when ordering accessories additionally

- **RF-003** (**FR-KZ50E/KZ50H** exclusive reflector)
- **RF-13** (**FR-Z50HW** reflective tape)
- **FX-CT2** (Fiber cutter)
- **FX-CT3** (**FD-H40Y/F41Y** fiber cutter)
- **FX-AT2** (Attachment for fixed-length fiber, Orange)
- **FX-AT3** (Attachment for ø2.2 mm ø0.087 in fiber, Clear orange)
- **FX-AT4** (Attachment for ø1 mm ø0.039 in fiber, Black)
- **FX-AT5** (Attachment for ø1.3 mm ø0.051 in fiber, Gray)
- **FX-AT6** (Attachment for ø1 mm ø0.039 in / ø1.3 mm ø0.051 in mixed fiber, Black / Gray)
- **MS-FD-2** (Fiber mounting bracket)

- **RF-003**

- **RF-13**

- **FX-CT2**

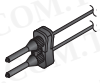


- **FX-CT3**

- **FX-AT2**

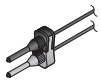
- **FX-AT3**

- **FX-AT4**

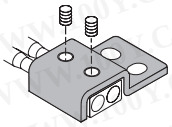


- **FX-AT5**

- **FX-AT6**



- **MS-FD-2**



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FIBER OPTIONS

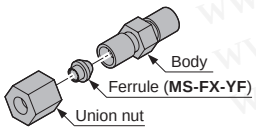
Others

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.27 or p.38 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.

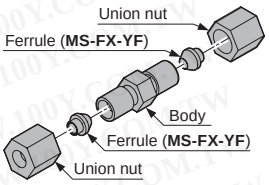
Liquid inflow prevention joint

• **MS-FX-01Y**



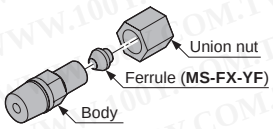
Protective tube extension joint

• **MS-FX-02Y**



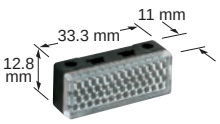
Fiber mounting joint

• **MS-FX-03Y**



Reflector

• **RF-210**

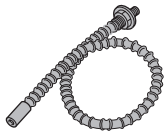


• **RF-220**

• **RF-230**

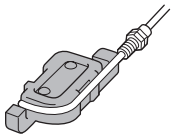
Protective tube

• **FTP-□**
• **FDP-□**



Fiber bender

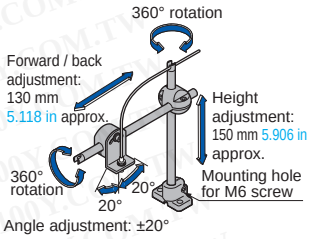
• **FB-1**



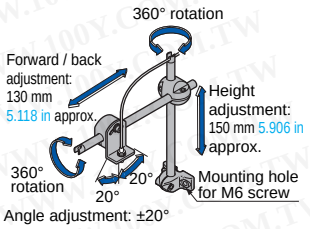
Universal sensor mounting stand

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**

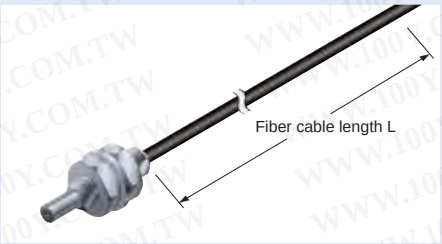
Semi-custom fibers that flexibly meet diverse needs

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

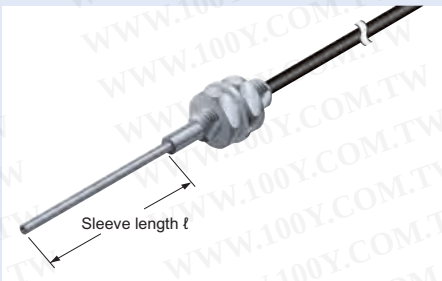
It is possible to extend up to 30 m 98.425 ft in units of 1 m 3.281 ft, varying depending on the model. Refer to the table on the next page for applicable models.



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.

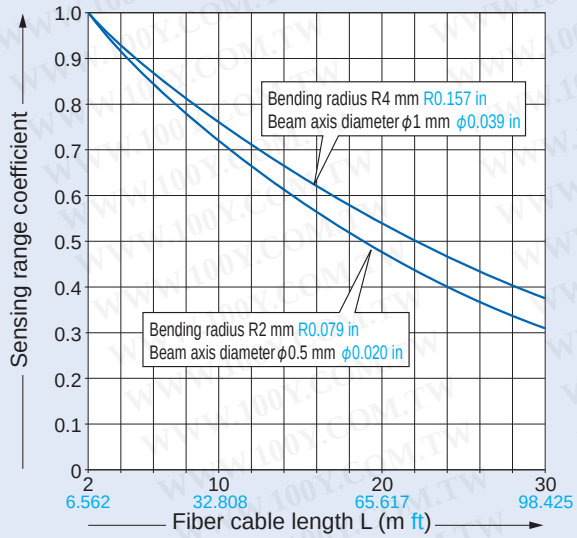


Note that the model number differs from previous models with changed lengths.

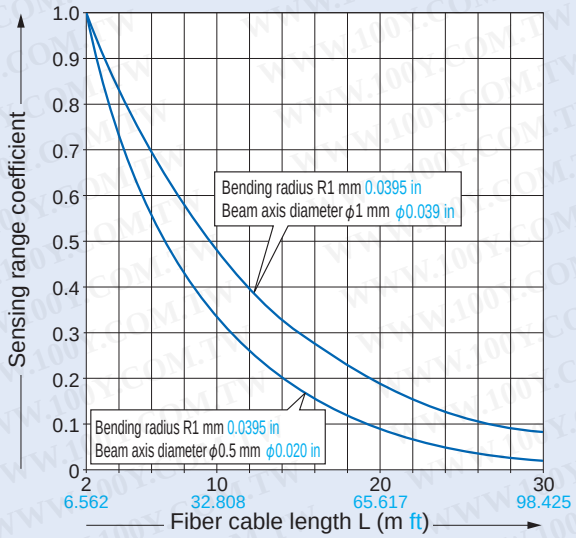
• Attenuation ratio characteristics for fiber cable length and sensing range

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

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



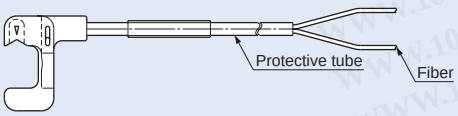
Typical example: Bending radius R1 mm (Sharp bending fiber **FT-□W/FD-□W**)



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



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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 ✂ (Note 5)	—	—	470	6.5	0.1
FT-H20-M1	1 m	—	—	540	6.5	0.1
FT-H20-VJ80-S	800 mm ✂ (Note 5)	—	—	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 ✂ (Note 6)	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 ✂ (Note 6)	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 ✂ (Note 6)	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

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 ✂ (Note 6)	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

▲: 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 lengh is from 10 to 120 mm 0.394 to 4.724 in and in units of 10 mm 0.394 in.
4) Applicable protective lengh 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.

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DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

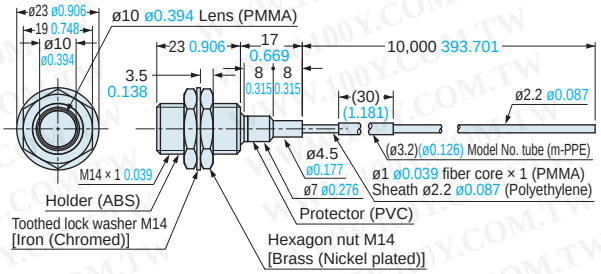
Thru-beam type fibers

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

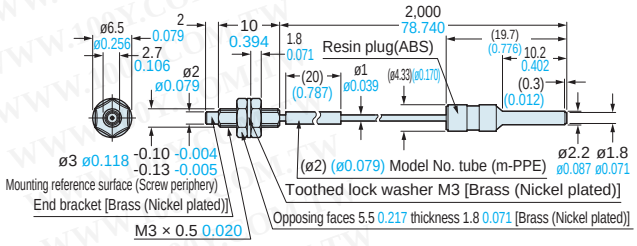
Free-cut

<with **FX-AT3**>



FT-30

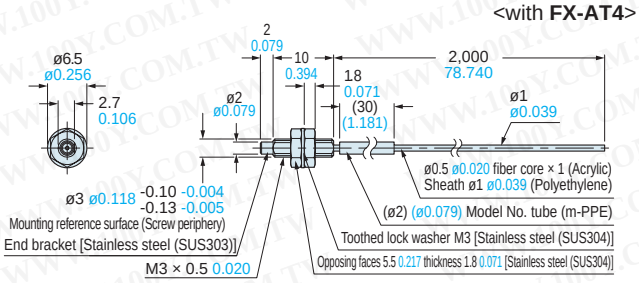
<with **FX-AT2**>



FT-31

Free-cut

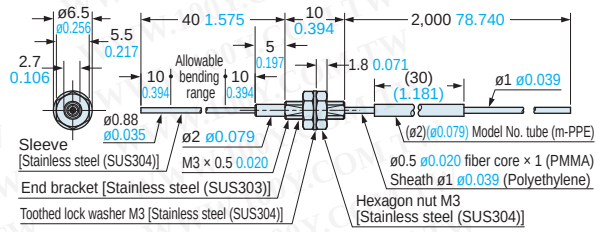
<with **FX-AT4**>



FT-31S

Free-cut

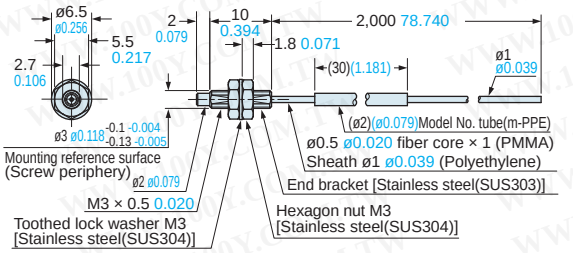
<with **FX-AT4**>



FT-31W

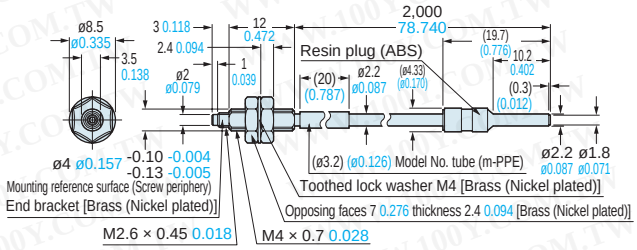
Free-cut

<with **FX-AT4**>



FT-40

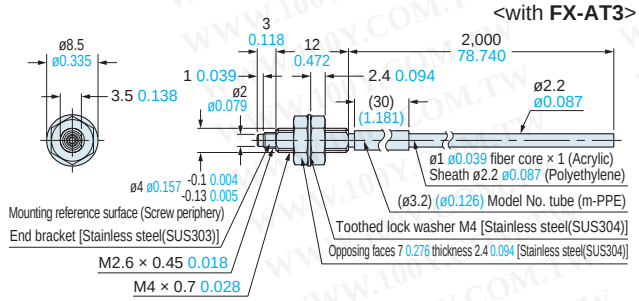
<with **FX-AT2**>



FT-42

Free-cut

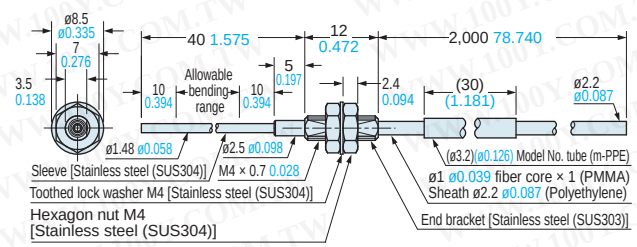
<with **FX-AT3**>



FT-42S

Free-cut

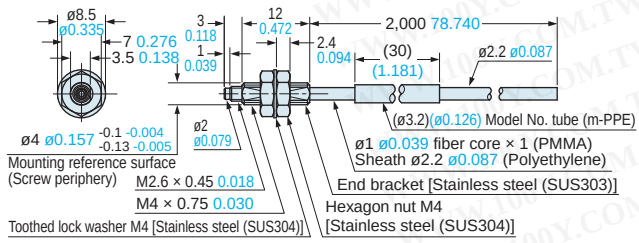
<with **FX-AT3**>



FT-42W

Free-cut

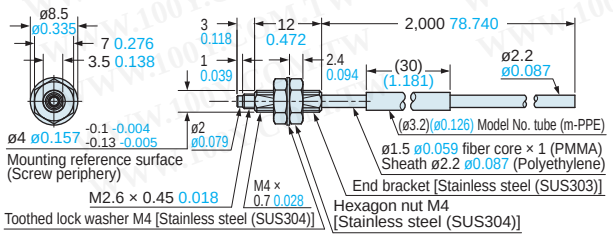
<with **FX-AT3**>



FT-43

Free-cut

<with **FX-AT3**>



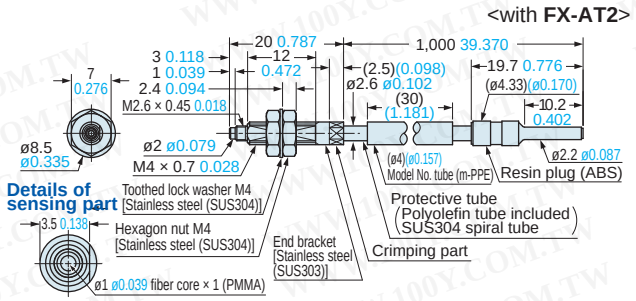
DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Thru-beam type fibers

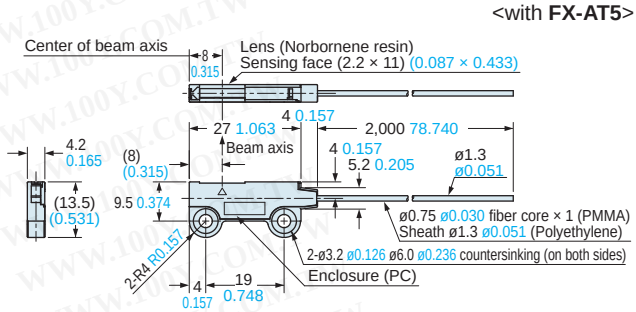
Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FT-45X



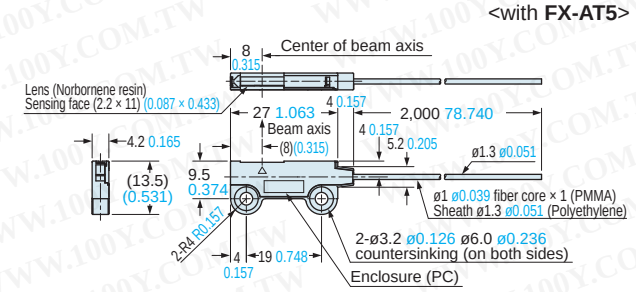
FT-A11

Free-cut



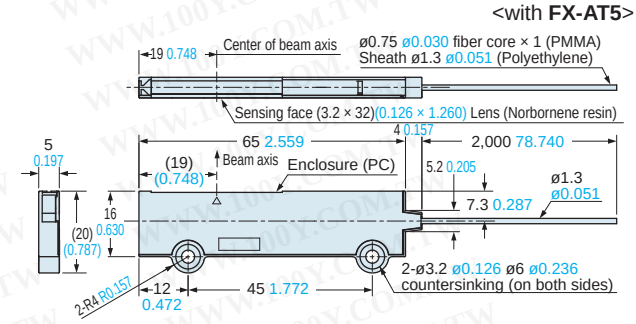
FT-A11W

Free-cut



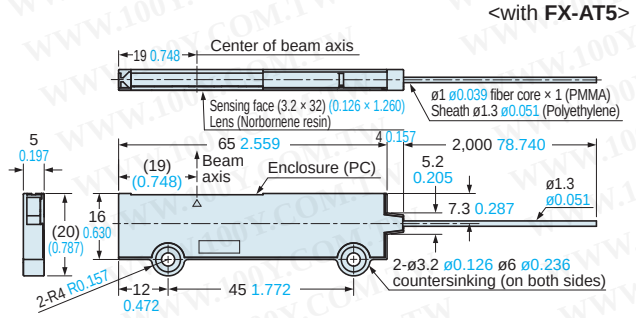
FT-A32

Free-cut



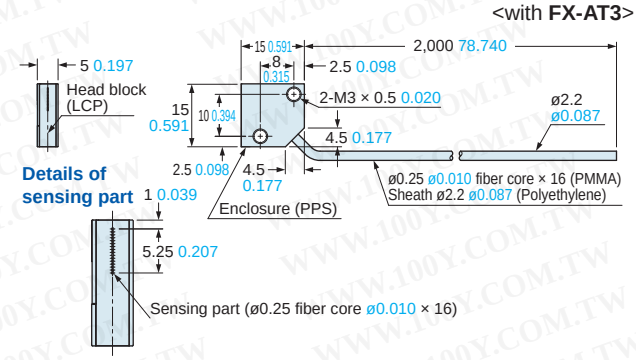
FT-A32W

Free-cut



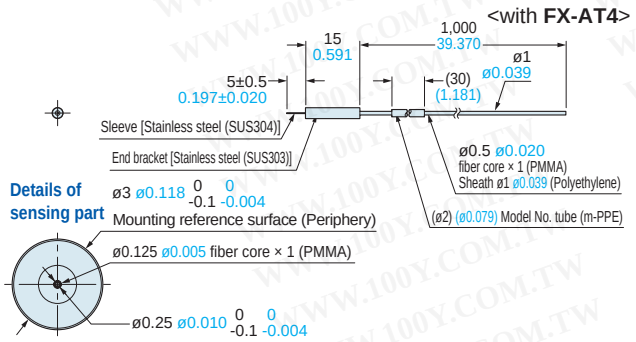
FT-AL05

Free-cut



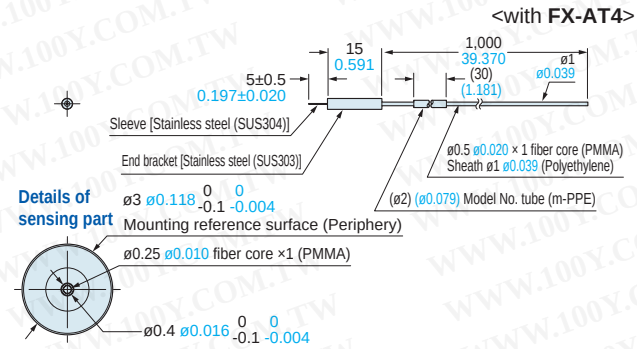
FT-E13

Free-cut



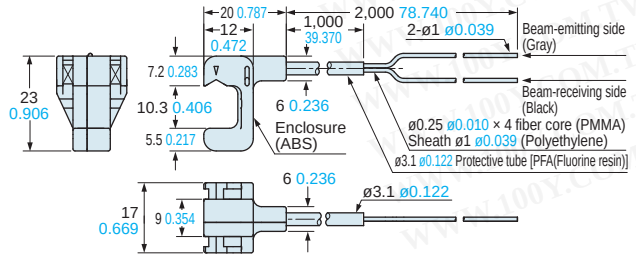
FT-E23

Free-cut



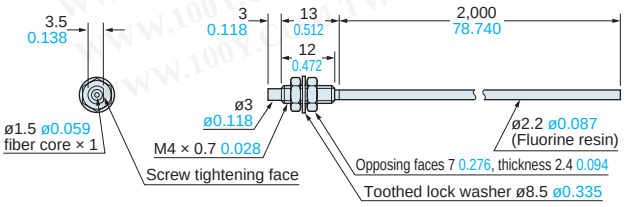
FT-F93

Free-cut



FT-H13-FM2

Free-cut



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

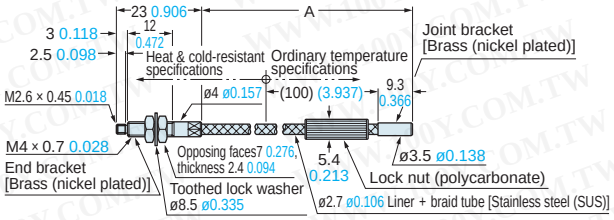
Thru-beam type fibers

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

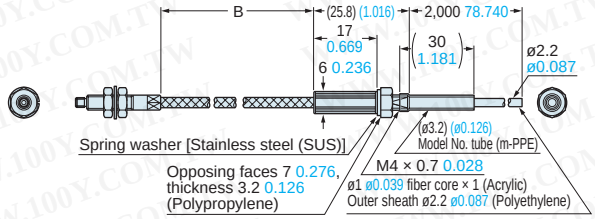
FT-H20-J20-S FT-H20-J30-S FT-H20-J50-S ✂ Free-cut (Note)

<with **FX-AT3**>

Heat-resistant side unit diagram (side view)



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



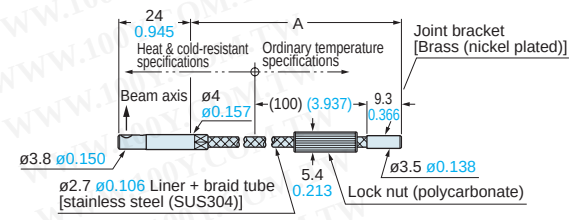
Model No.	A	B
FT-H20-J20-S	200 $^{+25}_{0}$ 7.874 $^{+0.984}_{0}$	185 $^{+30}_{0}$ 7.284 $^{+1.181}_{0}$
FT-H20-J30-S	300 $^{+25}_{0}$ 11.811 $^{+0.984}_{0}$	285 $^{+30}_{0}$ 11.221 $^{+1.181}_{0}$
FT-H20-J50-S	500 $^{+25}_{0}$ 19.685 $^{+0.984}_{0}$	485 $^{+30}_{0}$ 19.095 $^{+1.181}_{0}$

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

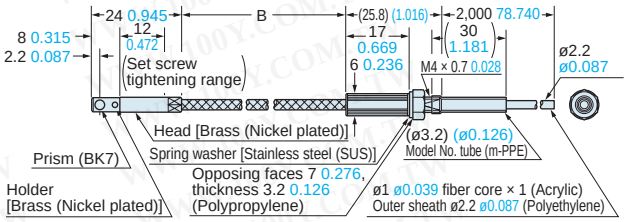
FT-H20-VJ50-S FT-H20-VJ80-S ✂ Free-cut (Note)

<with **FX-AT3**>

Heat-resistant side unit diagram (side view)



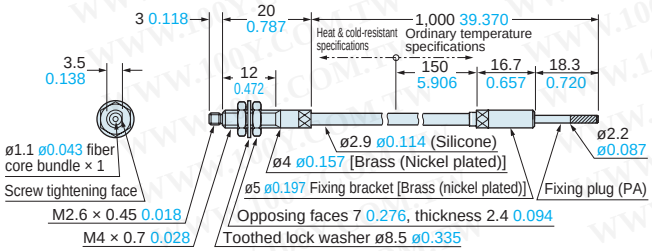
Ordinary temperature side fiber (FT-42) connection diagram (front view)



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 $^{+1.969}_{0}$	785 $^{+55}_{0}$ 30.906 $^{+2.165}_{0}$

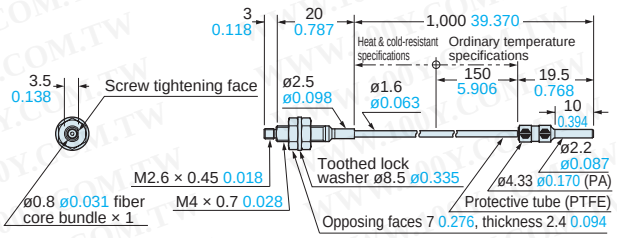
Note: Ordinary temperature side fiber (**FT-42**) only.

FT-H20-M1

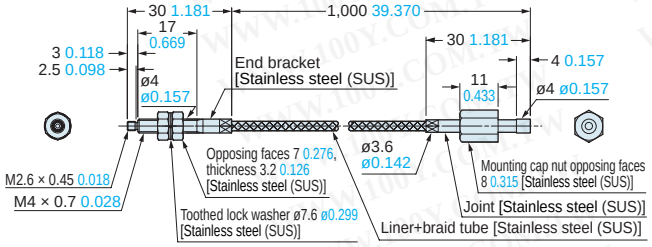


FT-H20W-M1

<with **FX-AT2**>

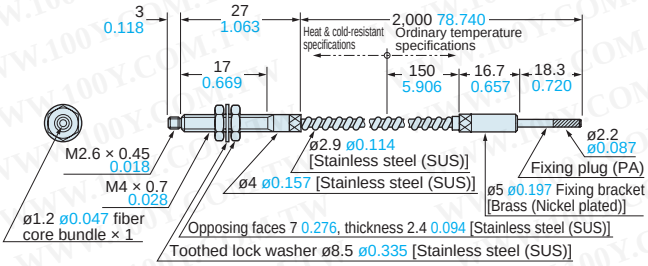


FT-H30-M1V-S

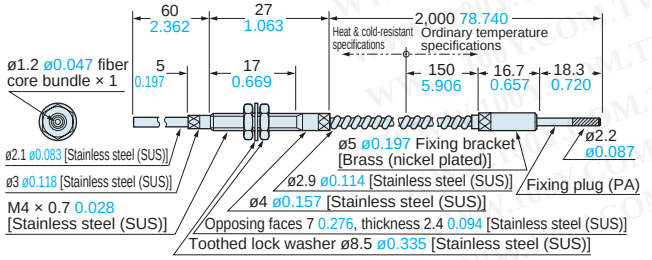


Note: The **FT-H30-M1V-S** is a set with the **FT-H30-M1V**, photo-terminal, and atmospheric side fiber. Refer to p.66 for dimensions of the atmospheric side fiber and photo-terminals.

FT-H35-M2

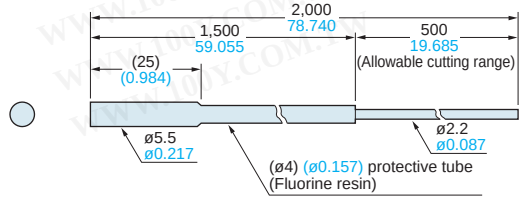


FT-H35-M2S6



FT-HL80Y ✂ Free-cut

<with **FX-AT3**>



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

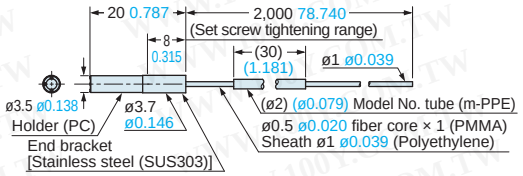
Thru-beam type fibers

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

FT-KS40

Free-cut

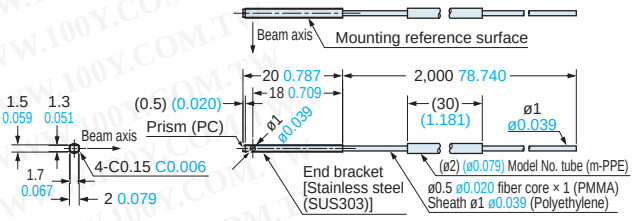
<with **FX-AT4**>



FT-KV26

Free-cut

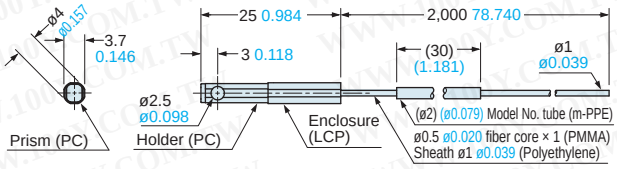
<with **FX-AT4**>



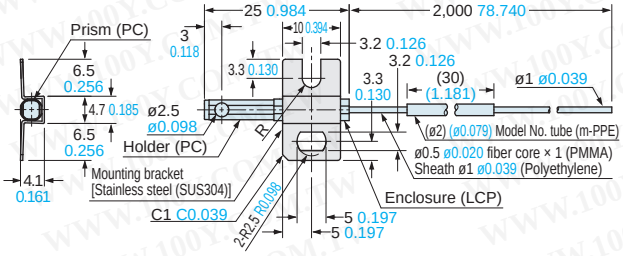
FT-KV40, FT-KV40W

Free-cut

<with **FX-AT4**>



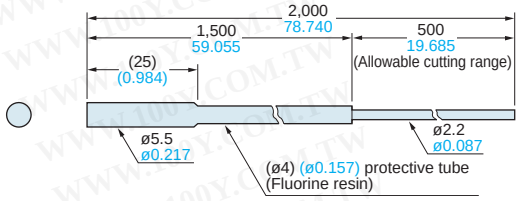
Assembly dimensions with MS-FD-3 (attached mounting bracket)



FT-L80Y

Free-cut

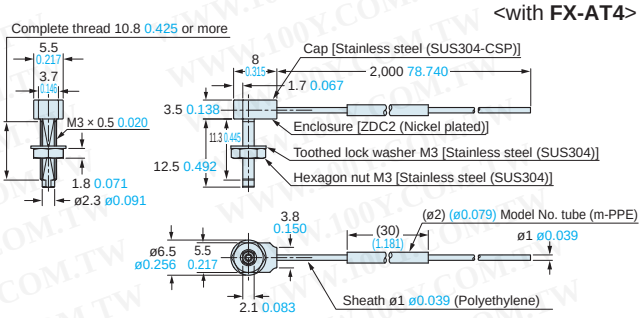
<with **FX-AT3**>



FT-R31

Free-cut

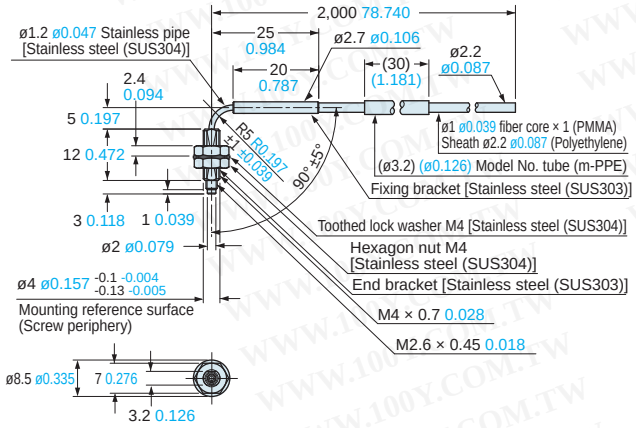
<with **FX-AT4**>



FT-R40

Free-cut

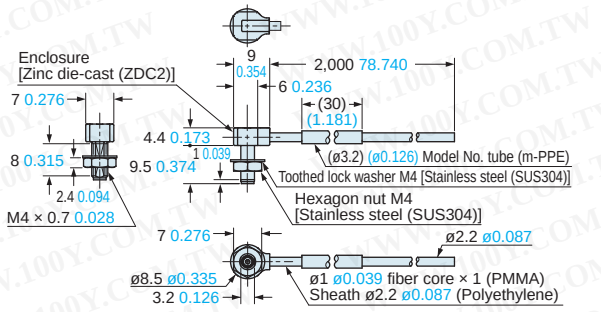
<with **FX-AT3**>



FT-R41W

Free-cut

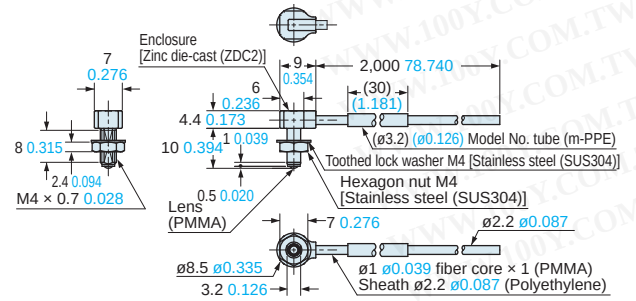
<with **FX-AT3**>



FT-R42W

Free-cut

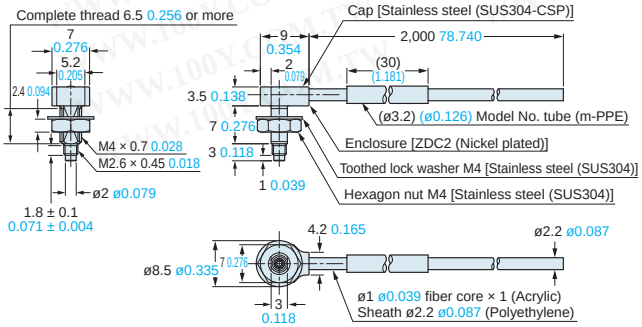
<with **FX-AT3**>



FT-R43

Free-cut

<with **FX-AT3**>



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

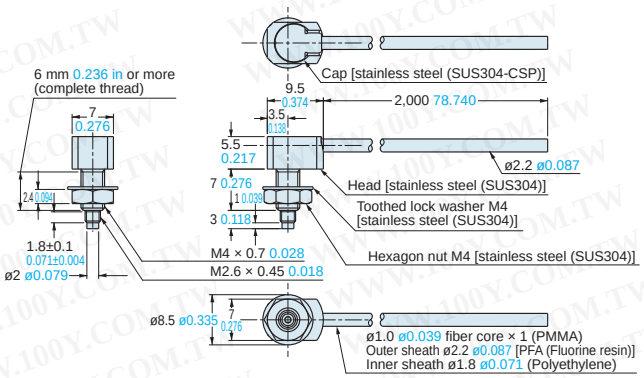
Thru-beam type fibers

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

FT-R44Y

Free-cut

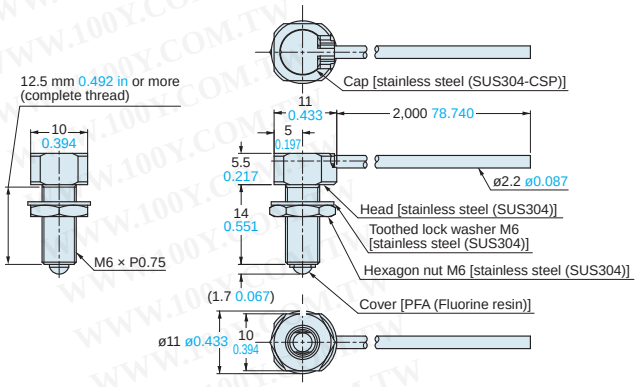
<with **FX-AT3**>



FT-R60Y

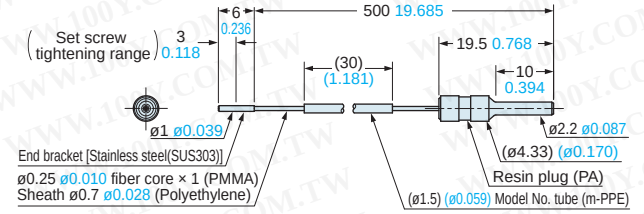
Free-cut

<with **FX-AT3**>



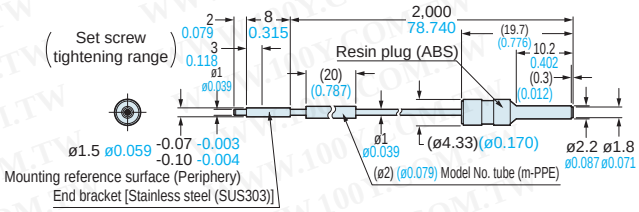
FT-S11

<with **FX-AT2**>



FT-S20

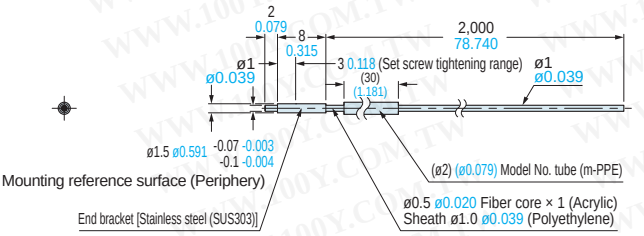
<with **FX-AT2**>



FT-S21

Free-cut

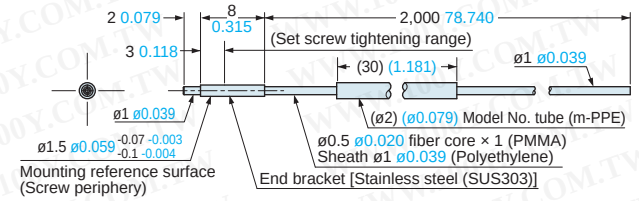
<with **FX-AT4**>



FT-S21W

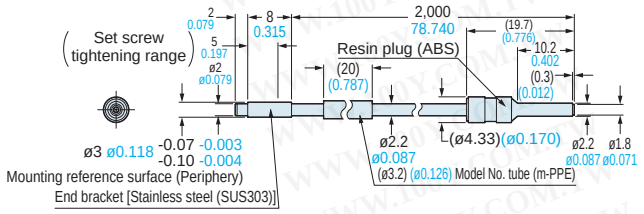
Free-cut

<with **FX-AT4**>



FT-S30

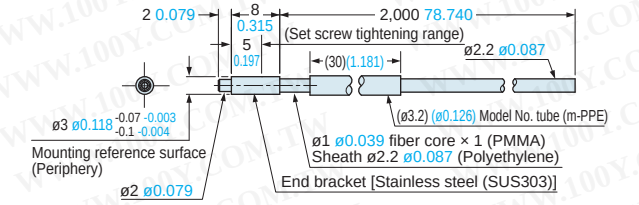
<with **FX-AT2**>



FT-S31W

Free-cut

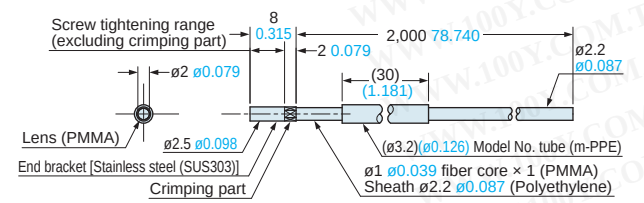
<with **FX-AT3**>



FT-S32

Free-cut

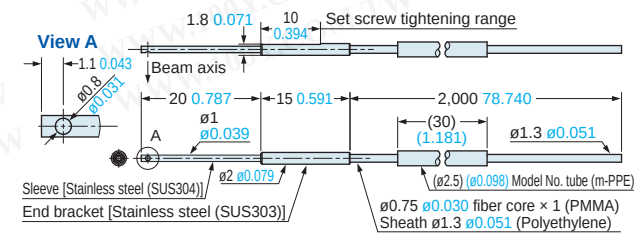
<with **FX-AT3**>



FT-V23

Free-cut

<with **FX-AT5**>



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

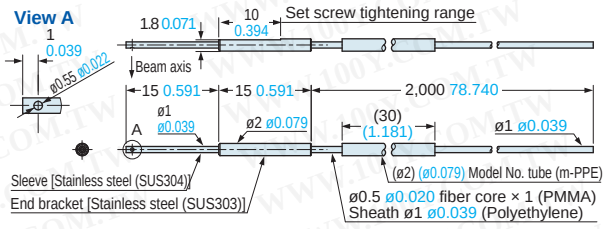
Thru-beam type fibers

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

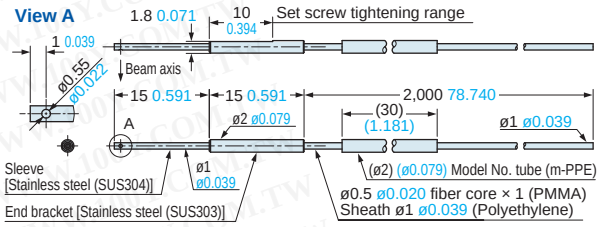
<with **FX-AT4**>



FT-V25

Free-cut

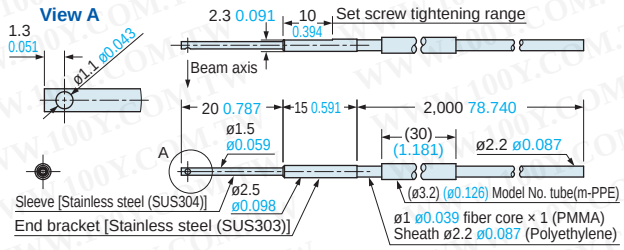
<with **FX-AT4**>



FT-V30

Free-cut

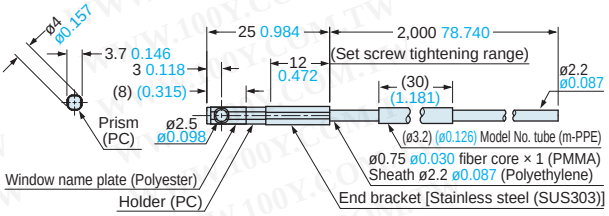
<with **FX-AT3**>



FT-V40

Free-cut

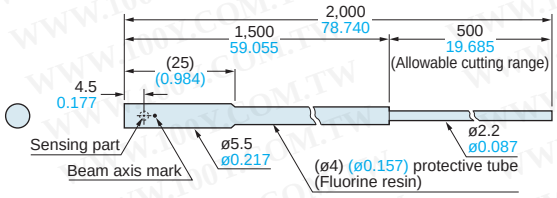
<with **FX-AT3**>



FT-V80Y

Free-cut

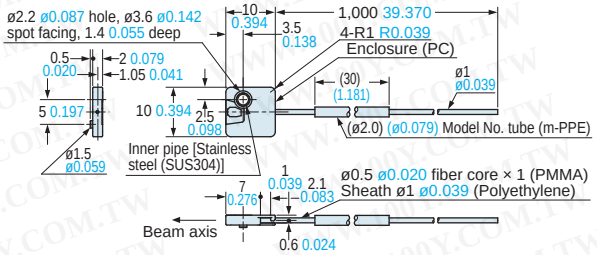
<with **FX-AT3**>



FT-Z20HBW

Free-cut

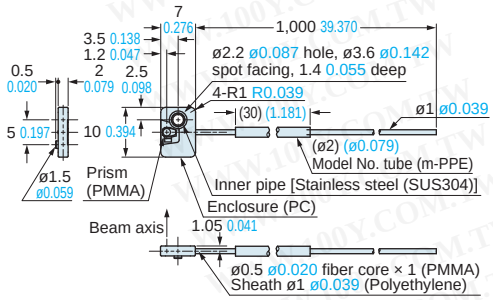
<with **FX-AT4**>



FT-Z20W

Free-cut

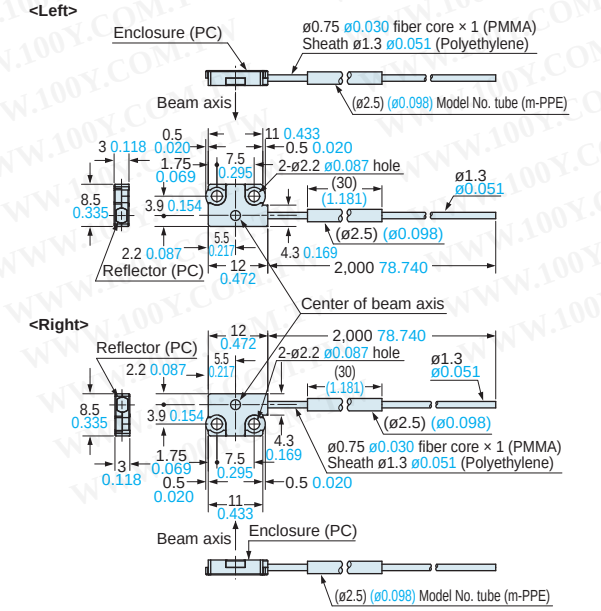
<with **FX-AT4**>



FT-Z30

Free-cut

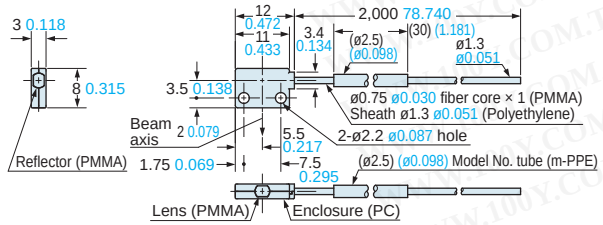
<with **FX-AT5**>



FT-Z30E

Free-cut

<with **FX-AT5**>



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

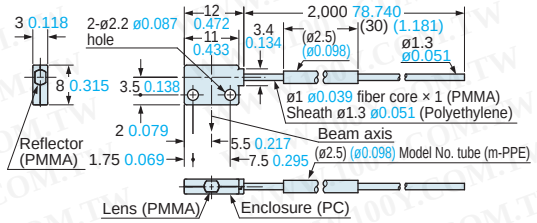
Thru-beam type fibers

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

FT-Z30EW

Free-cut

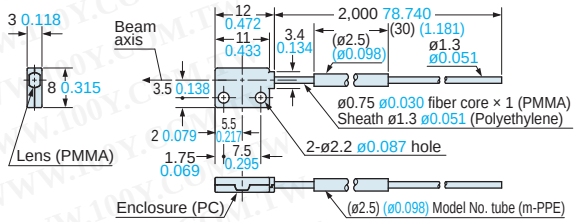
<with **FX-AT5**>



FT-Z30H

Free-cut

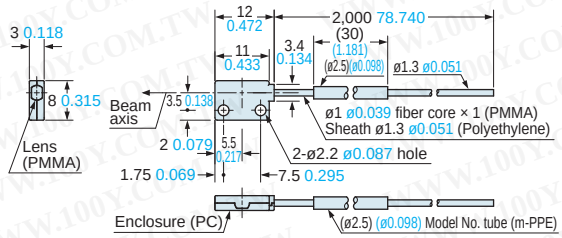
<with **FX-AT5**>



FT-Z30HW

Free-cut

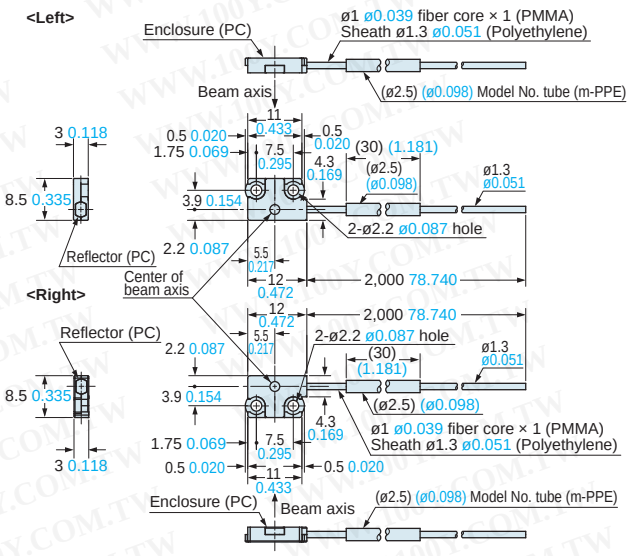
<with **FX-AT5**>



FT-Z30W

Free-cut

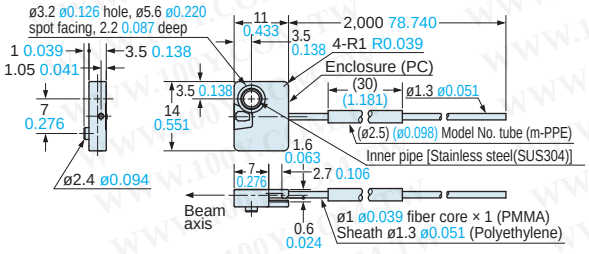
<with **FX-AT5**>



FT-Z40HBW

Free-cut

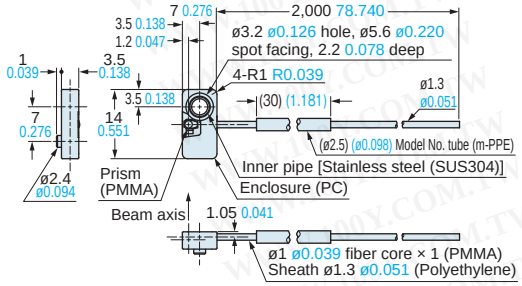
<with **FX-AT5**>



FT-Z40W

Free-cut

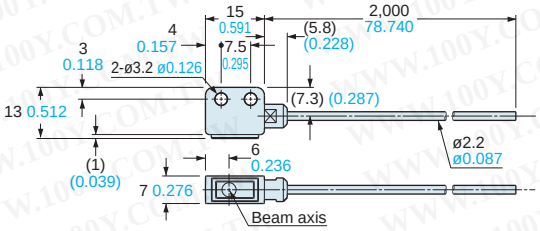
<with **FX-AT5**>



FT-Z802Y

Free-cut

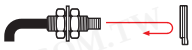
<with **FX-AT3**>



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Retroreflective type fibers



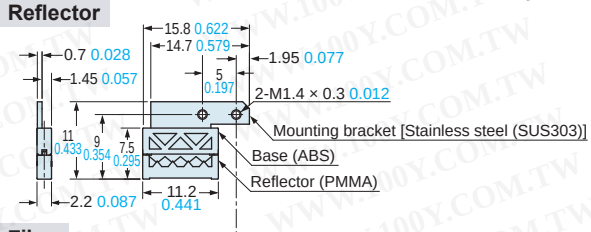
Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the Model No.

FR-KZ22E

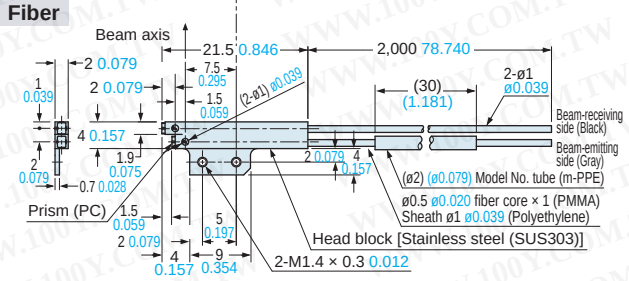
Free-cut

<with **FX-AT4**>

Reflector



Fiber

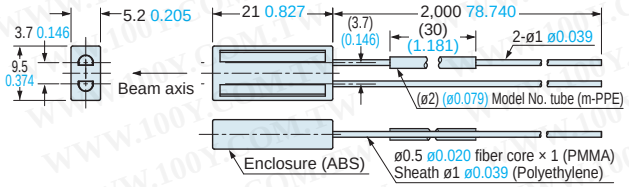


FR-KZ50H

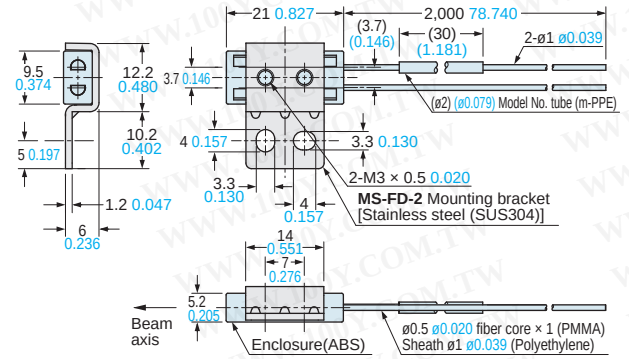
Free-cut

<with **FX-AT4**>

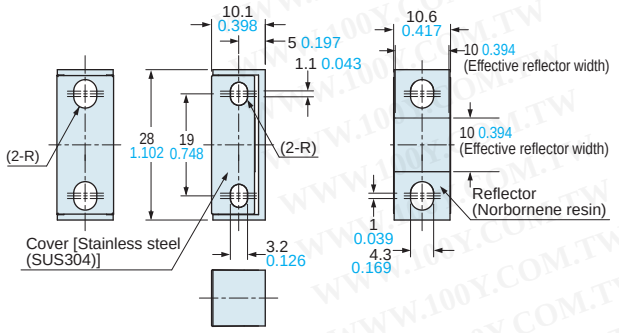
Fiber



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



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

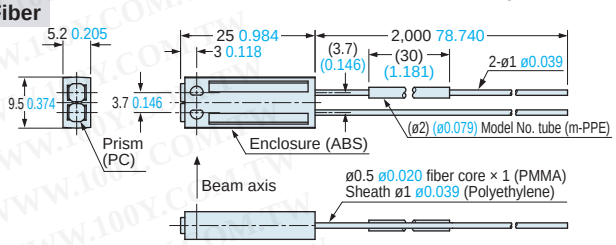


FR-KZ50E

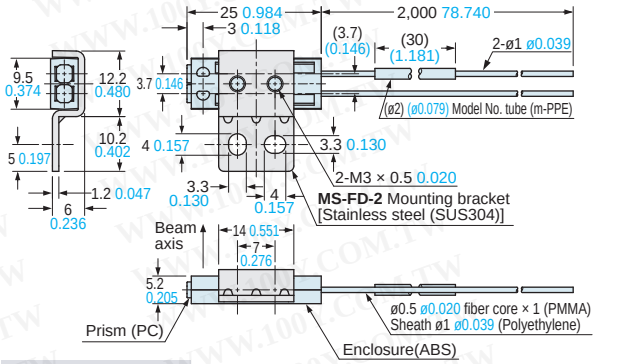
Free-cut

<with **FX-AT4**>

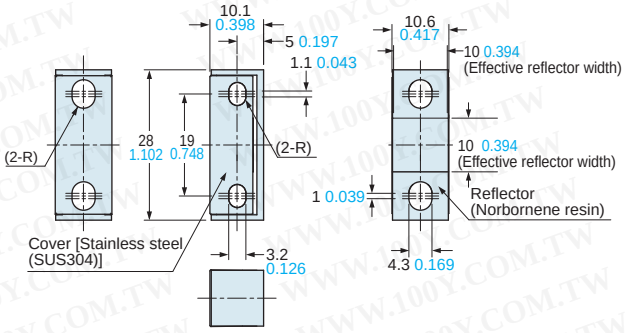
Fiber



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



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

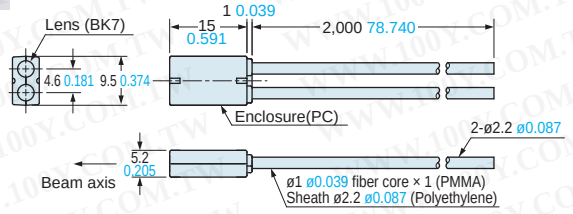


FR-Z50HW

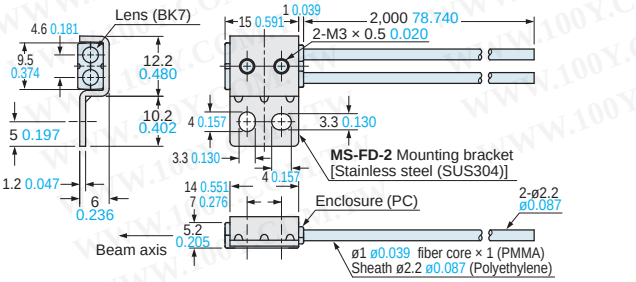
Free-cut

<with **FX-AT3**>

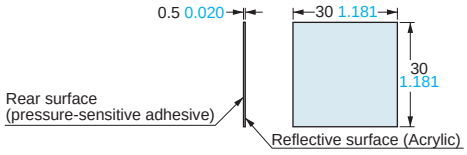
Fiber



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



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



DIMENSIONS (Unit: mm in)

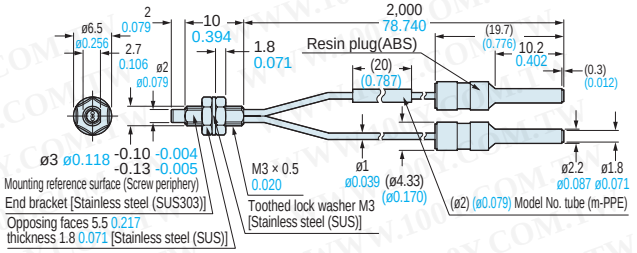
Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

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

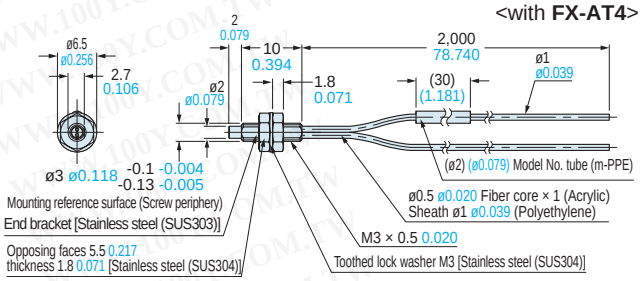
<with **FX-AT2**>



FD-31

Free-cut

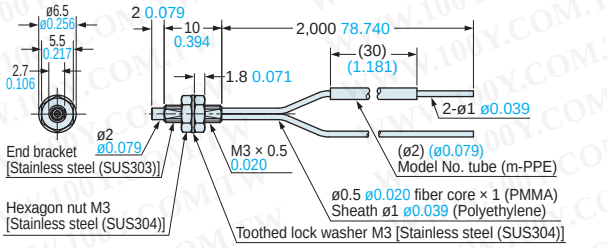
<with **FX-AT4**>



FD-31W

Free-cut

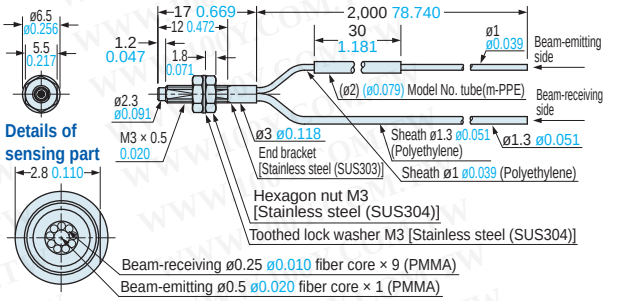
<with **FX-AT4**>



FD-32G

Free-cut

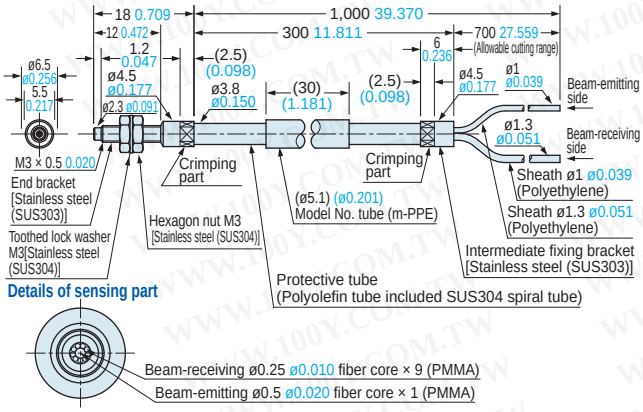
<with **FX-AT6**>



FD-32GX

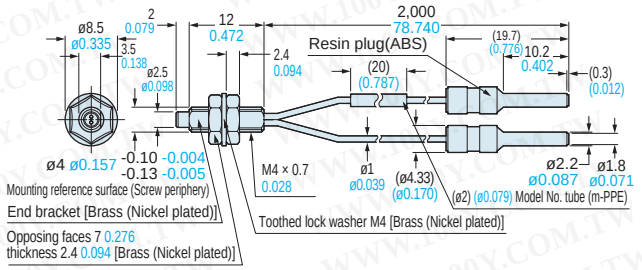
Free-cut

<with **FX-AT6**>



FD-40

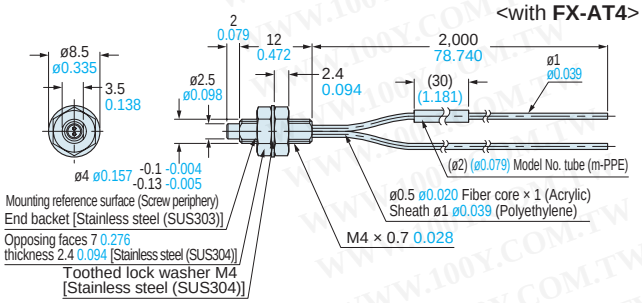
<with **FX-AT2**>



FD-41

Free-cut

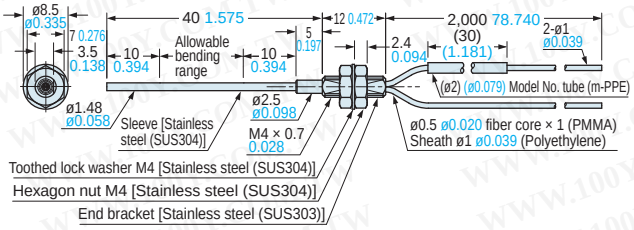
<with **FX-AT4**>



FD-41S

Free-cut

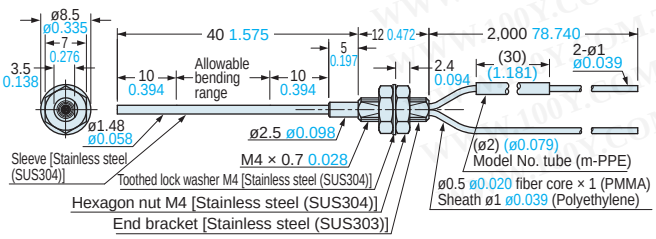
<with **FX-AT4**>



FD-41SW

Free-cut

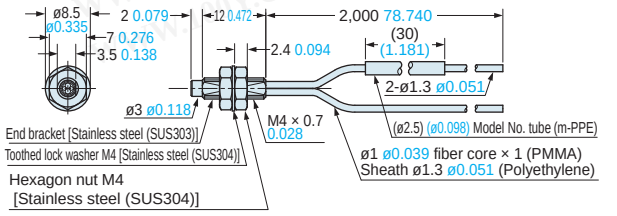
<with **FX-AT4**>



FD-41W

Free-cut

<with **FX-AT5**>



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

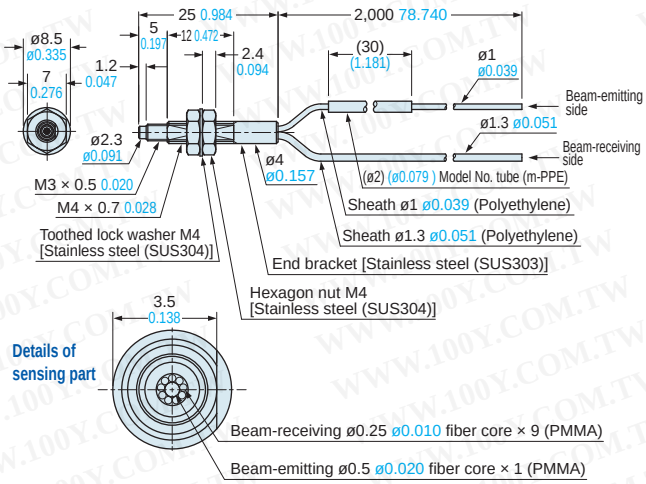
Reflective type fibers

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

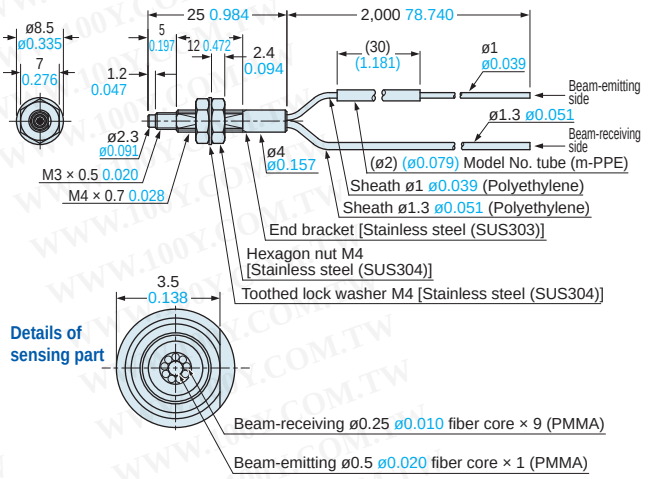
<with **FX-AT6**>



FD-42GW

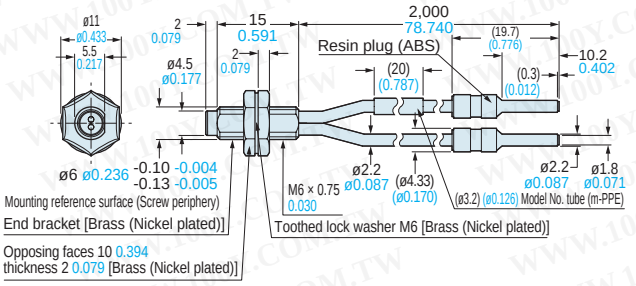
Free-cut

<with **FX-AT6**>



FD-60

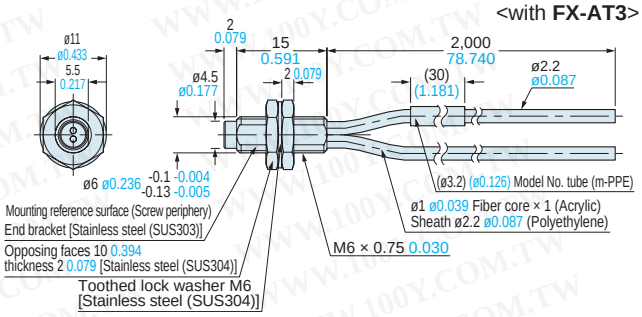
<with **FX-AT2**>



FD-61

Free-cut

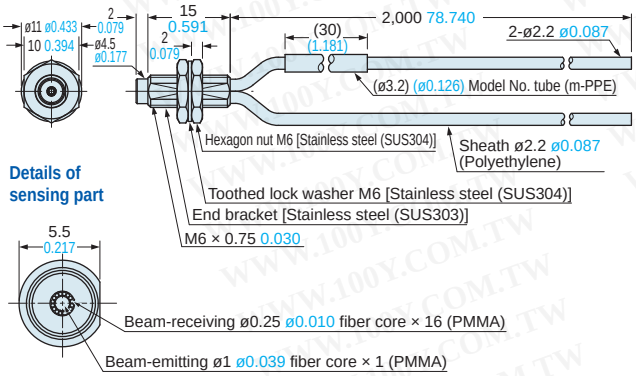
<with **FX-AT3**>



FD-61G

Free-cut

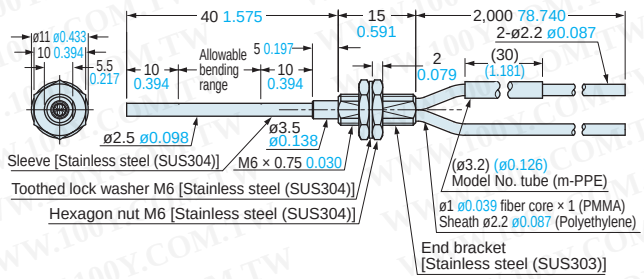
<with **FX-AT3**>



FD-61S

Free-cut

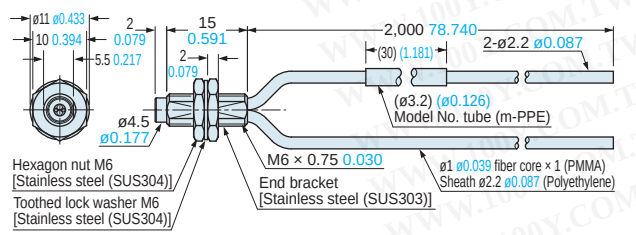
<with **FX-AT3**>



FD-61W

Free-cut

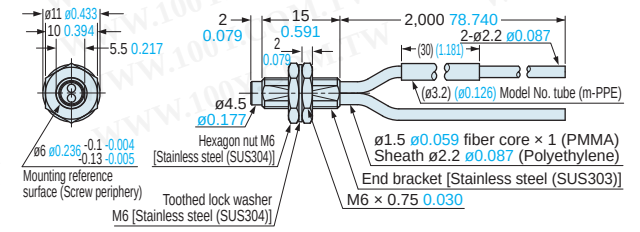
<with **FX-AT3**>



FD-62

Free-cut

<with **FX-AT3**>



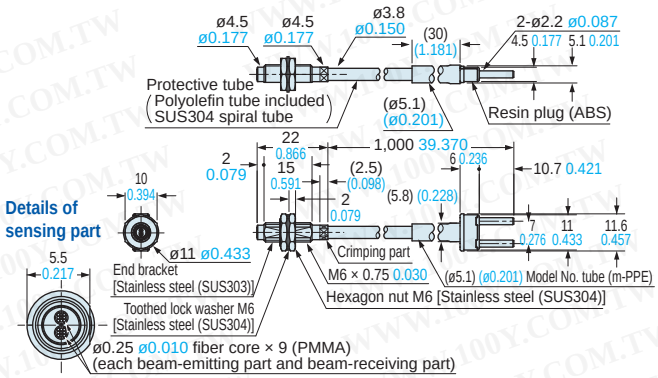
DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) 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.

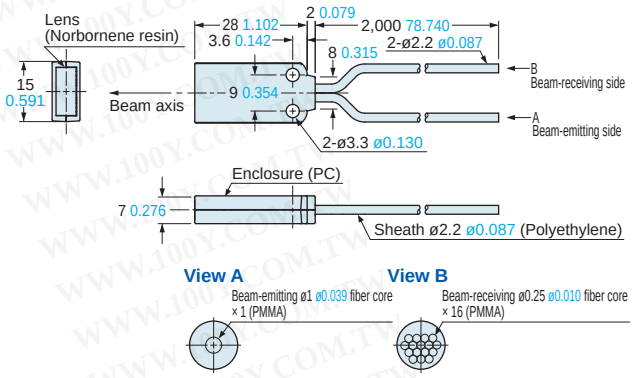
FD-64X



FD-A16

Free-cut

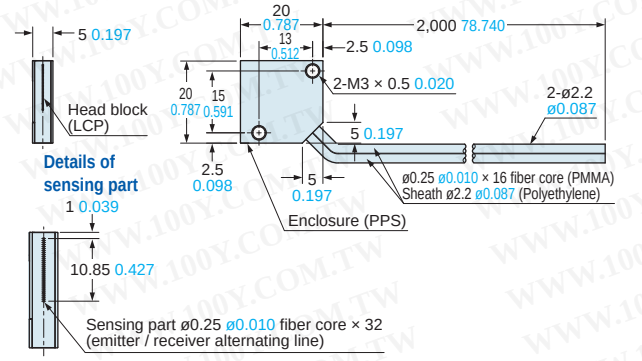
<with **FX-AT3**>



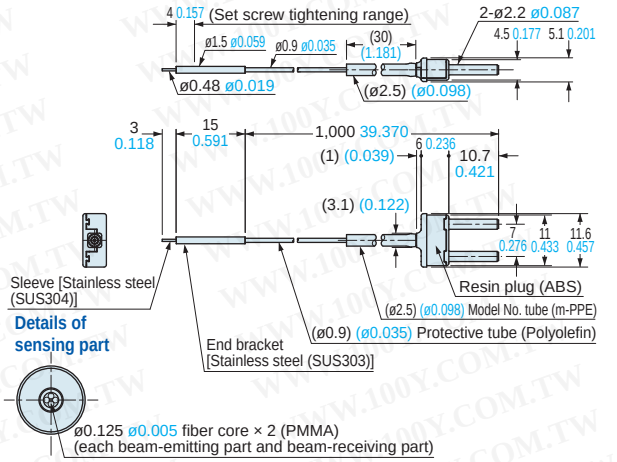
FD-AL11

Free-cut

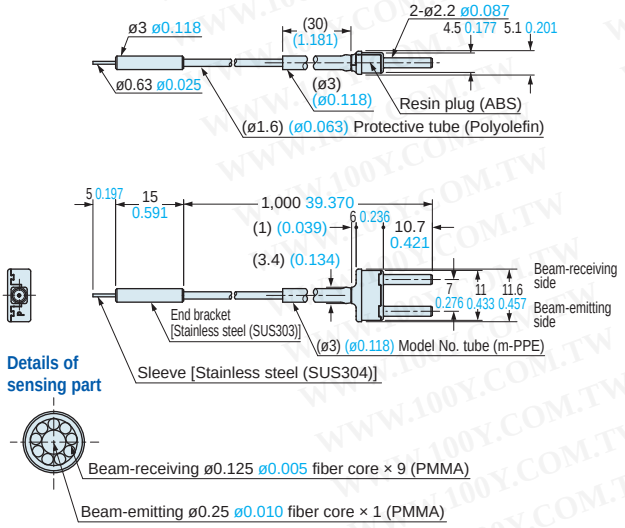
<with **FX-AT3**>



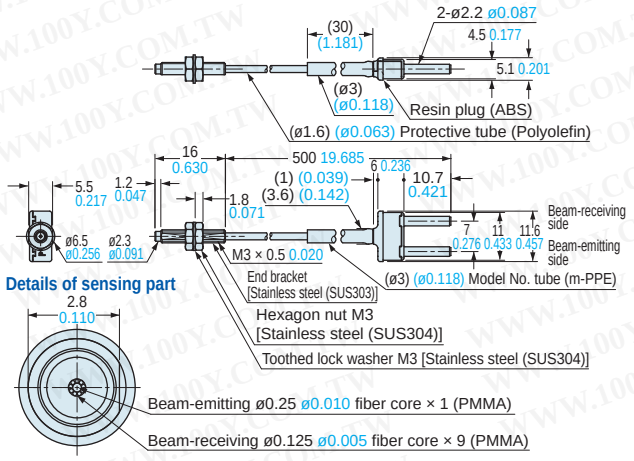
FD-E13



FD-E23



FD-EG30



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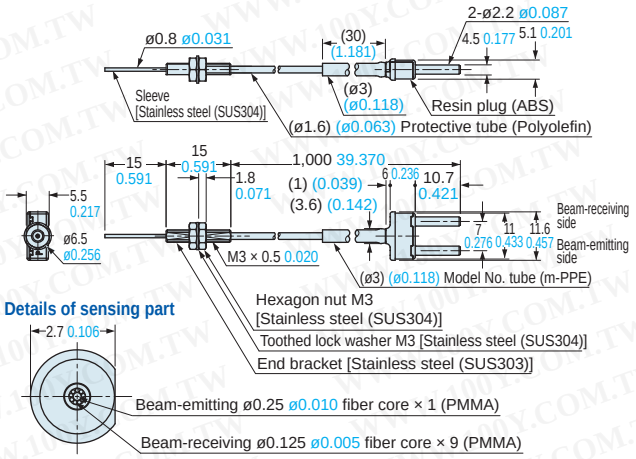
DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

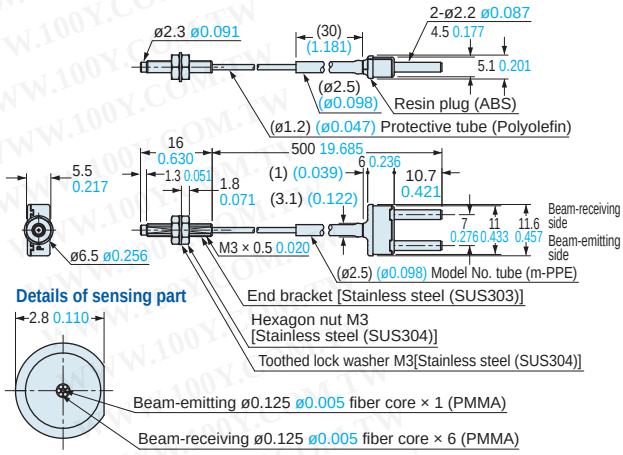
Reflective type fibers

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



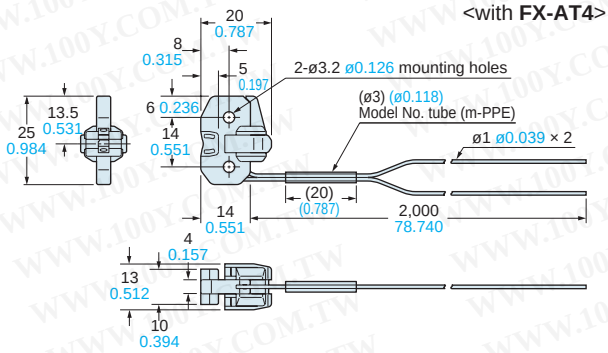
FD-EG31



FD-F4, FD-F41

Free-cut

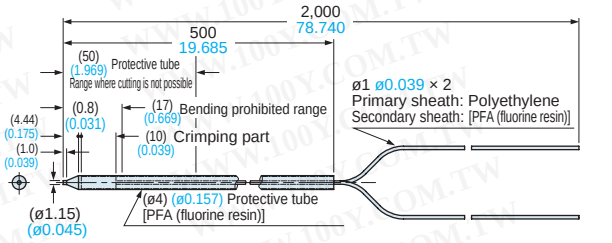
<with **FX-AT4**>



FD-F41Y

Free-cut

<with **FX-AT4**>

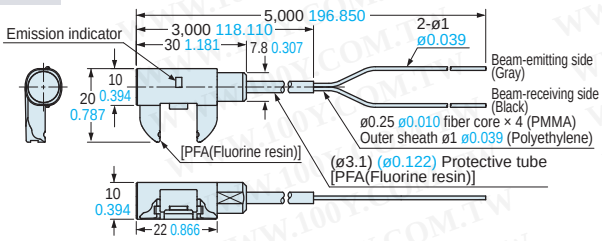


FD-F71

Free-cut

<with **FX-AT4**>

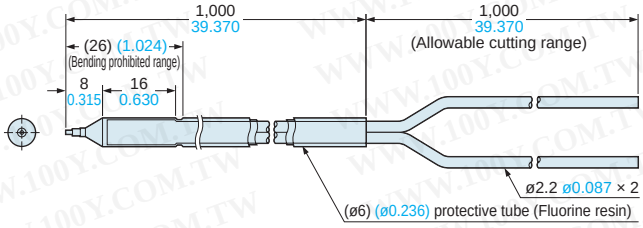
Fiber



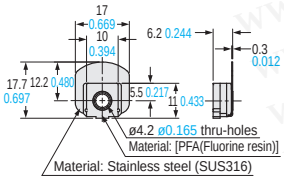
FD-F8Y

Free-cut

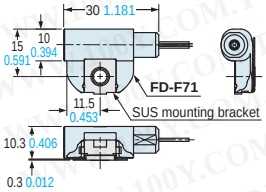
<with **FX-AT3**>



SUS mounting bracket



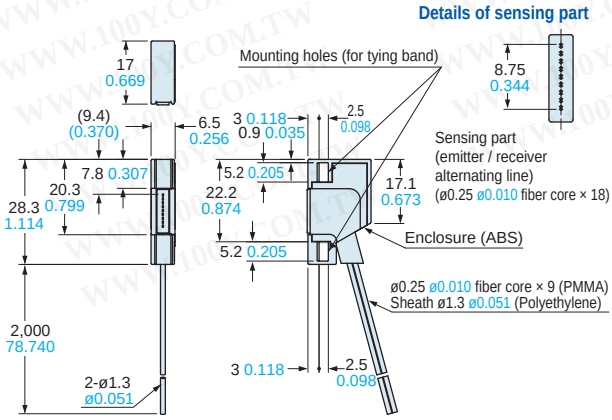
SUS mounting bracket (FD-71) mounting diagram



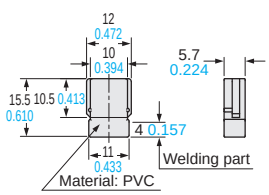
FD-FA93

Free-cut

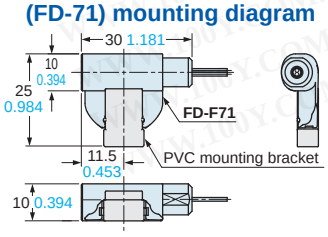
<with fiber attachment>



PVC mounting bracket



PVC mounting bracket (FD-71) mounting diagram



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

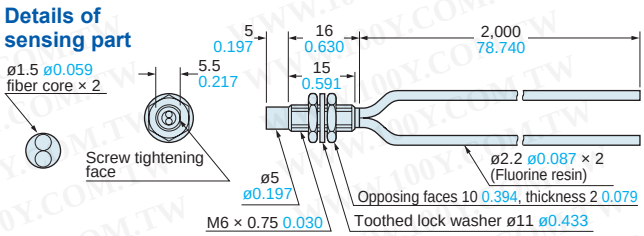
Reflective type fibers

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

FD-H13-FM2

Free-cut

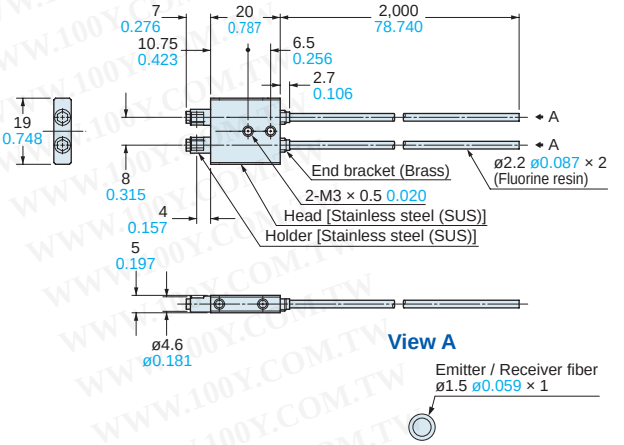
<with **FX-AT3**>



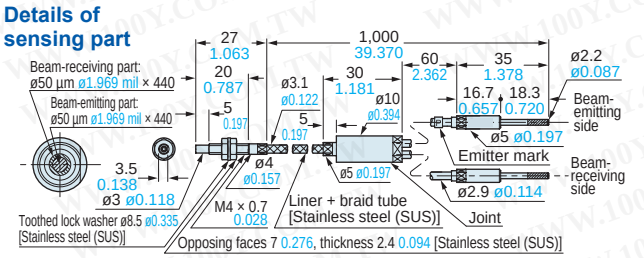
FD-H18-L31

Free-cut

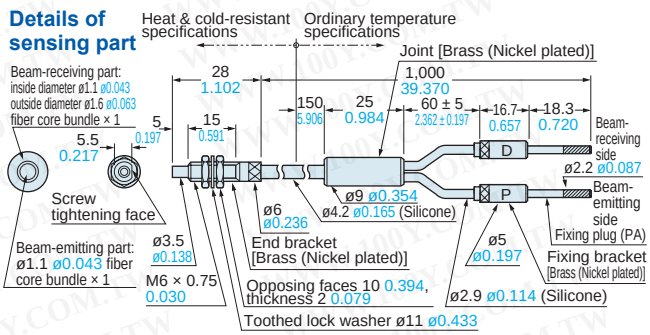
<with **FX-AT3**>



FD-H20-21

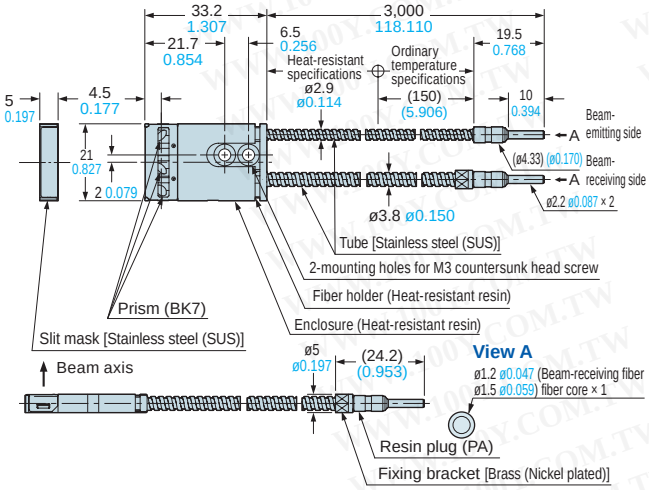


FD-H20-M1



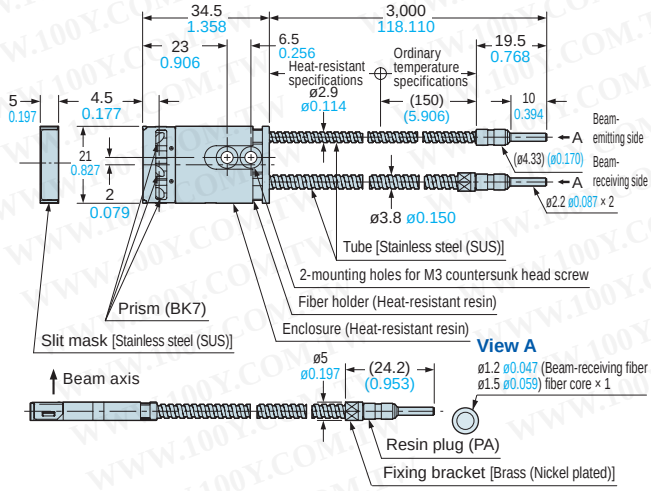
FD-H25-L43

<with **FX-AT2**>



FD-H25-L45

<with **FX-AT2**>



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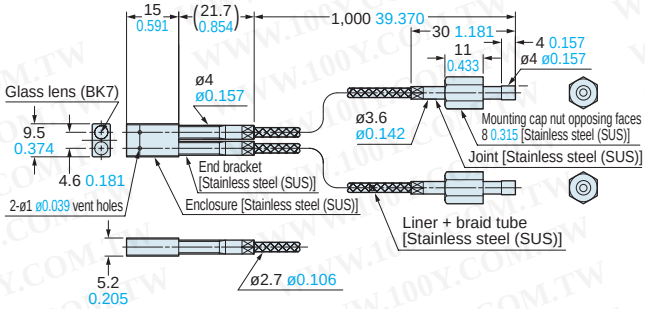
DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

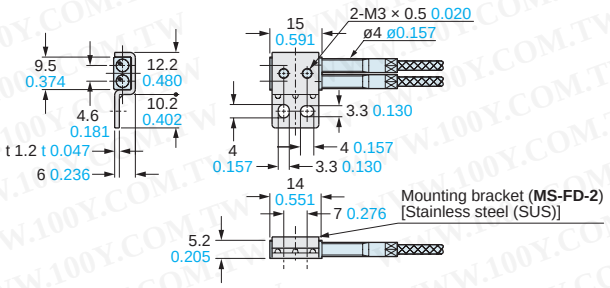
Reflective type fibers

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

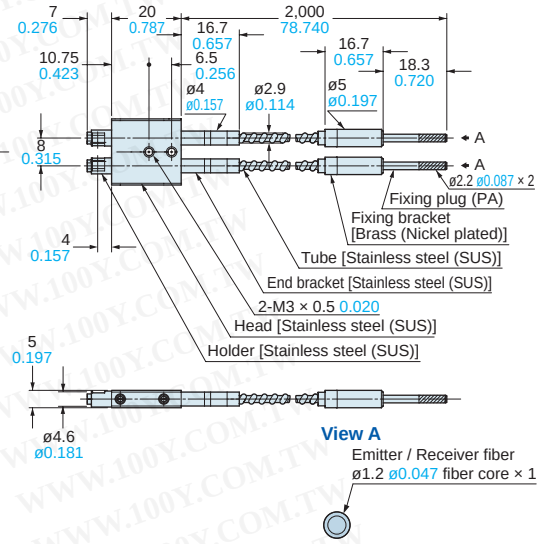


Assembly dimensions with MS-FD-2 (attached mounting bracket)

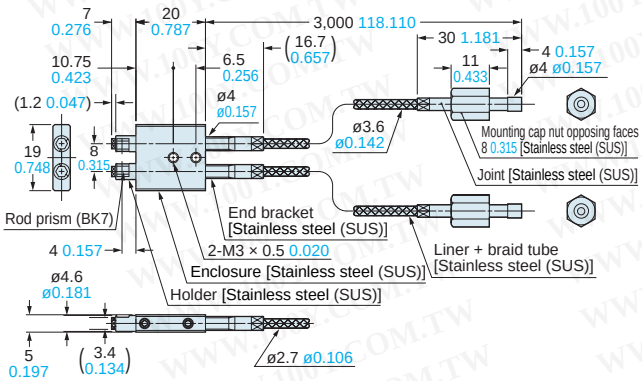


Note: The **FD-H30-KZ1V-S** is a set with the **FD-H30-KZ1V**, photo-terminal, and atmospheric side fiber. Refer to p.66 for dimensions of the atmospheric side fiber and photo-terminals.

FD-H30-L32

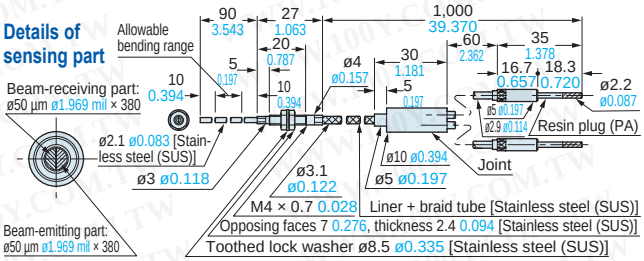


FD-H30-L32V-S

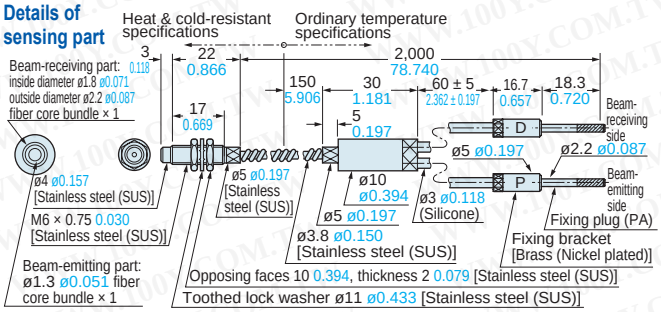


Note: The **FD-H30-L32V-S** is a set with the **FD-H30-L32V**, photo-terminal, and atmospheric side fiber. Refer to p.66 for dimensions of the atmospheric side fiber and photo-terminals.

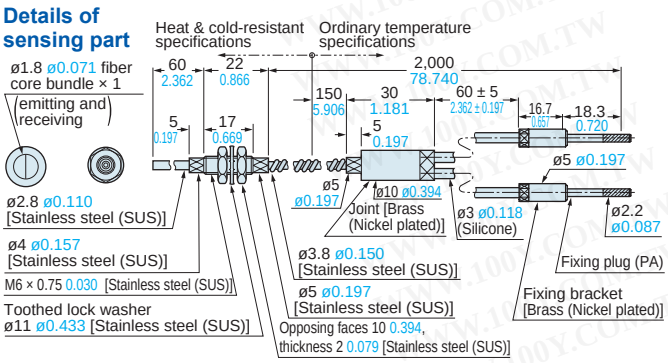
FD-H35-20S



FD-H35-M2



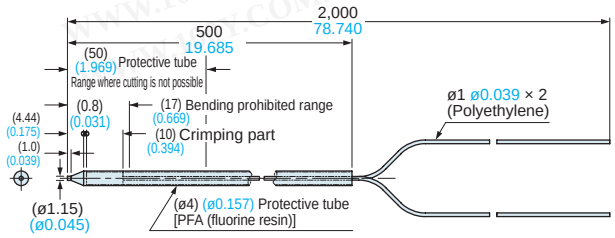
FD-H35-M2S6



FD-HF40Y

Free-cut

<with **FX-AT4**>



DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

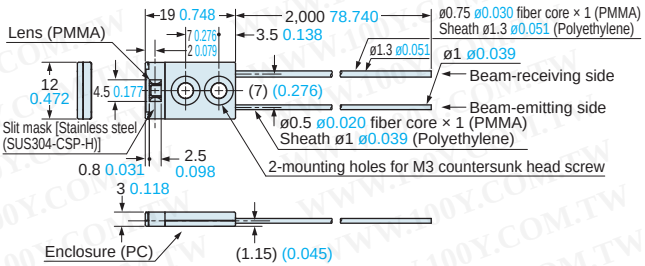
Reflective type fibers

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

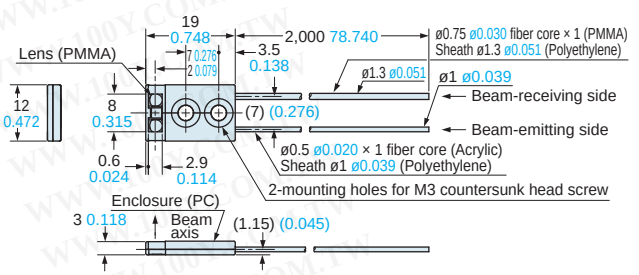
<with **FX-AT6**>



FD-L11

Free-cut

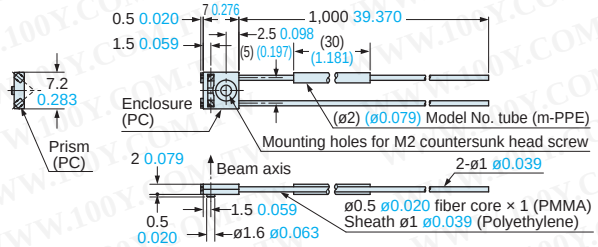
<with **FX-AT6**>



FD-L12W

Free-cut

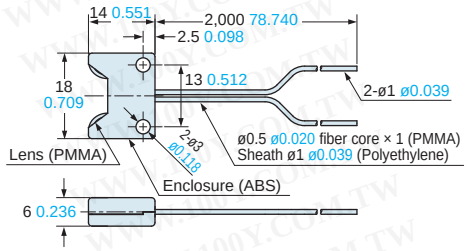
<with **FX-AT4**>



FD-L20H

Free-cut

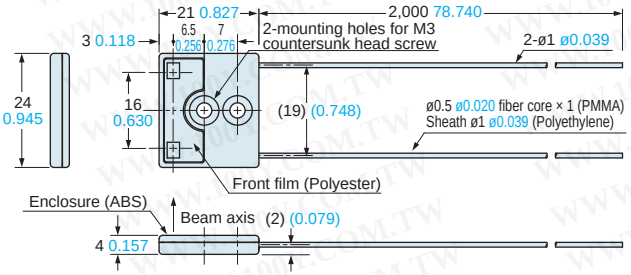
<with **FX-AT4**>



FD-L21

Free-cut

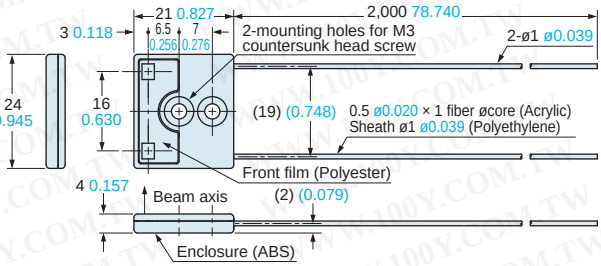
<with **FX-AT4**>



FD-L21W

Free-cut

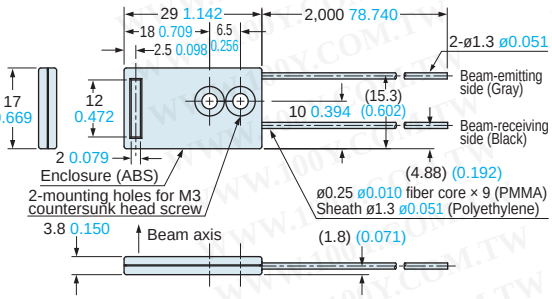
<with **FX-AT4**>



FD-L22A

Free-cut

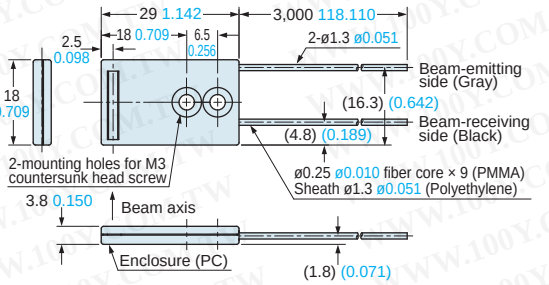
<with **FX-AT5**>



FD-L23

Free-cut

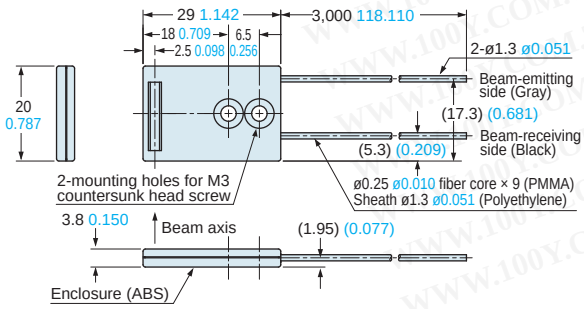
<with **FX-AT5**>



FD-L30A

Free-cut

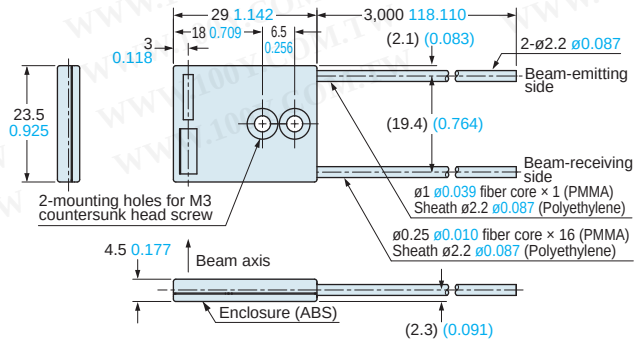
<with **FX-AT5**>



FD-L31A

Free-cut

<with **FX-AT3**>



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DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

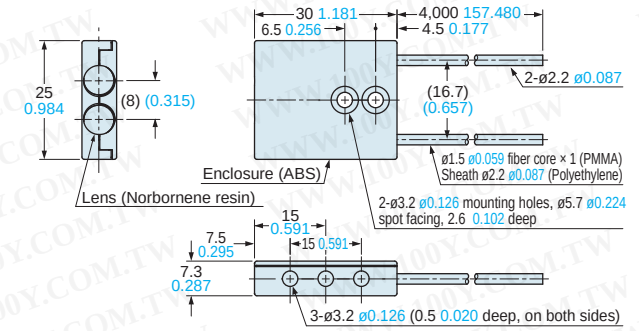
Reflective type fibers

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

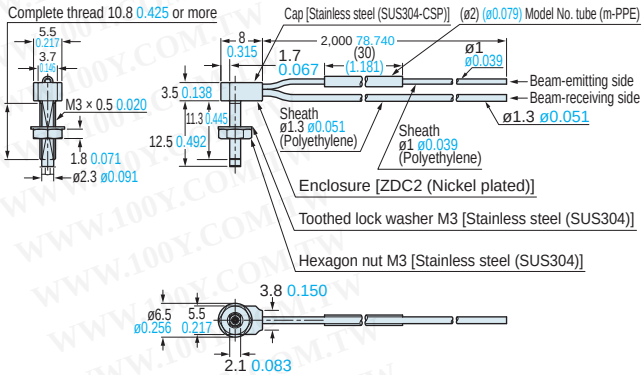
<with **FX-AT3**>



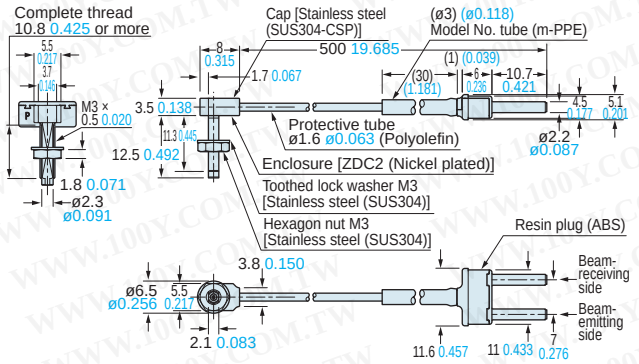
FD-R31G

Free-cut

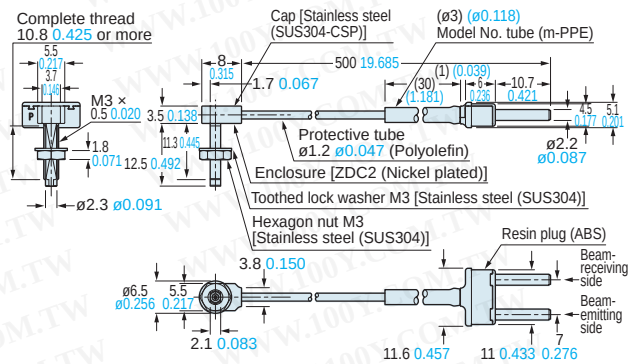
<with **FX-AT6**>



FD-R32EG, FD-R34EG



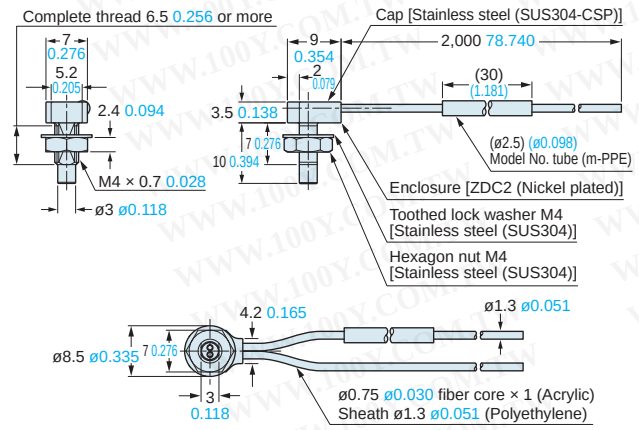
FD-R33EG



FD-R41

Free-cut

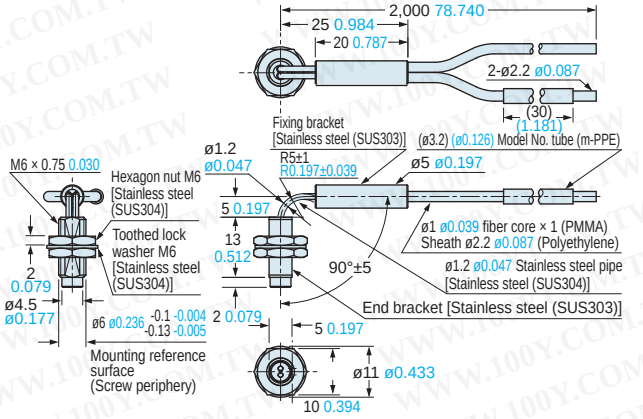
<with **FX-AT5**>



FD-R60

Free-cut

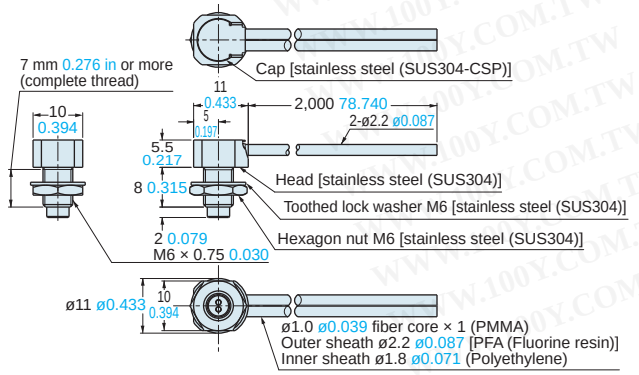
<with **FX-AT3**>



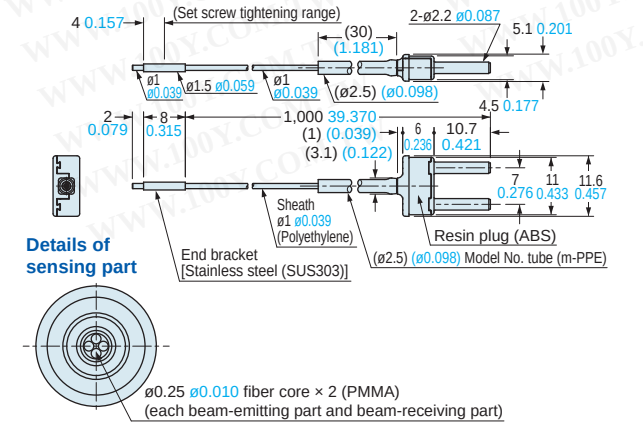
FD-R61Y

Free-cut

<with **FX-AT3**>



FD-S21



DIMENSIONS (Unit: mm in)

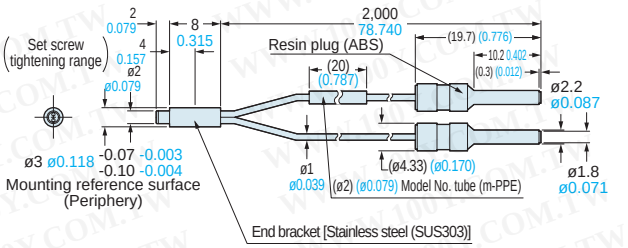
Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

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-S30

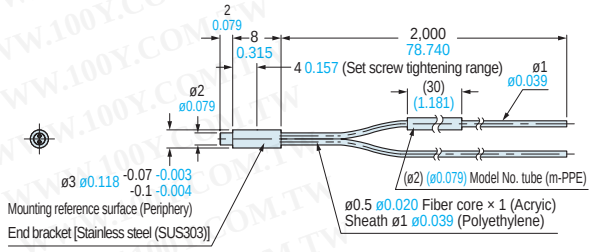
<with **FX-AT2**>



FD-S31

Free-cut

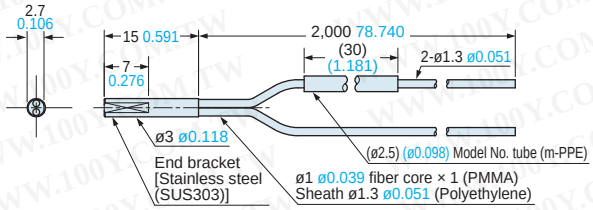
<with **FX-AT4**>



FD-S32

Free-cut

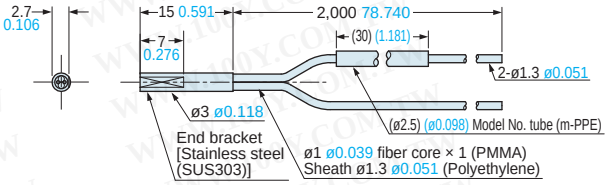
<with **FX-AT5**>



FD-S32W

Free-cut

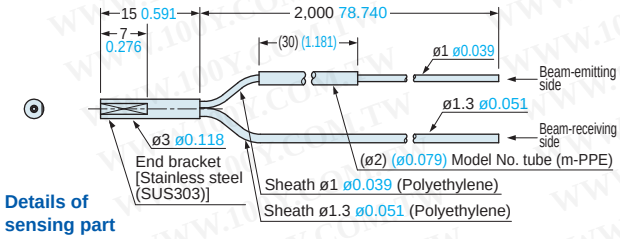
<with **FX-AT5**>



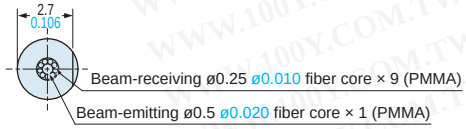
FD-S33GW

Free-cut

<with **FX-AT6**>



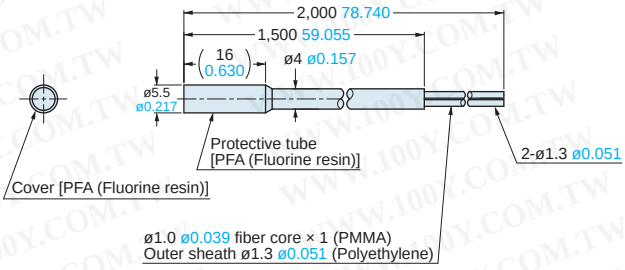
Details of sensing part



FD-S60Y

Free-cut

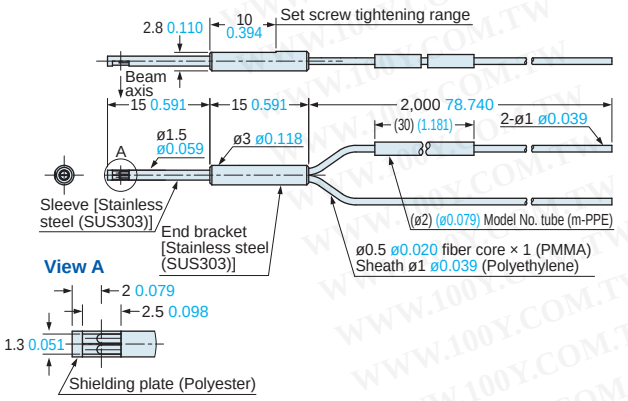
<with **FX-AT5**>



FD-V30

Free-cut

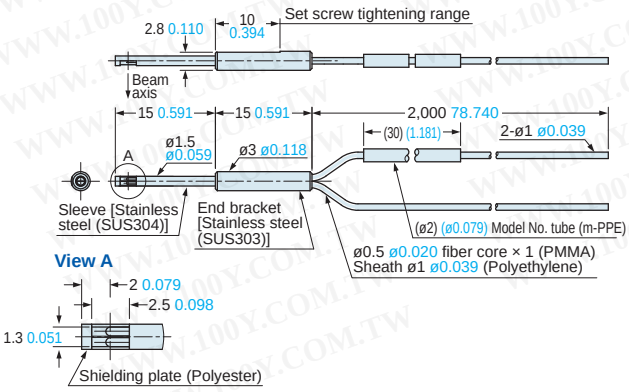
<with **FX-AT4**>



FD-V30W

Free-cut

<with **FX-AT4**>



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DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

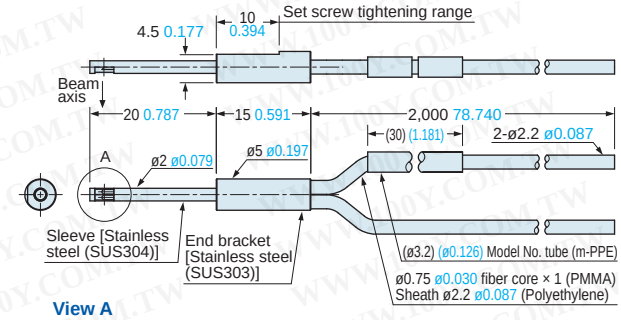
Reflective type fibers

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

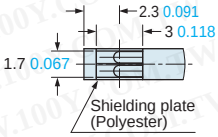
FD-V50

Free-cut

<with **FX-AT3**>



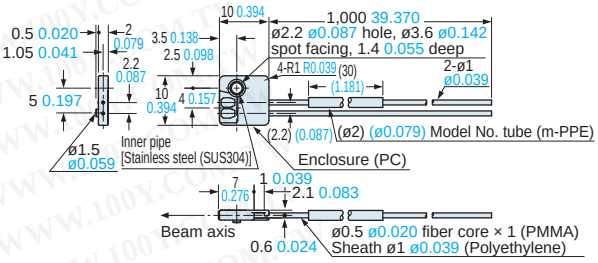
View A



FD-Z20HBW

Free-cut

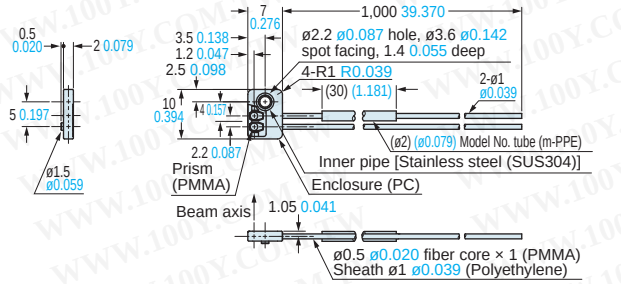
<with **FX-AT4**>



FD-Z20W

Free-cut

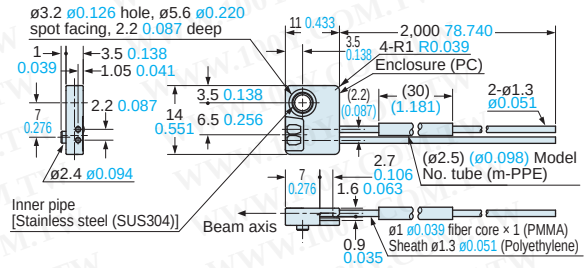
<with **FX-AT4**>



FD-Z40HBW

Free-cut

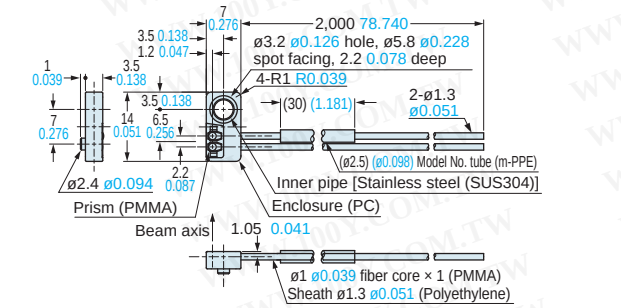
<with **FX-AT5**>



FD-Z40W

Free-cut

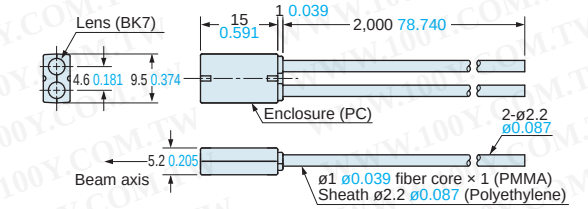
<with **FX-AT5**>



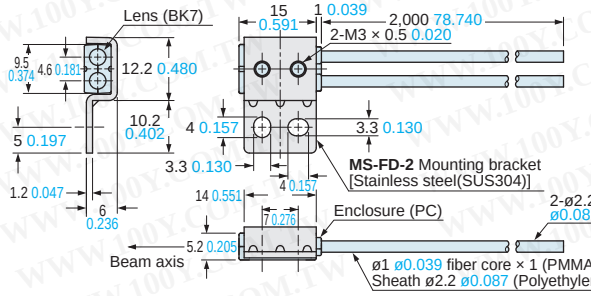
FD-Z50HW

Free-cut

<with **FX-AT3**>



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



DIMENSIONS (Unit: mm in)

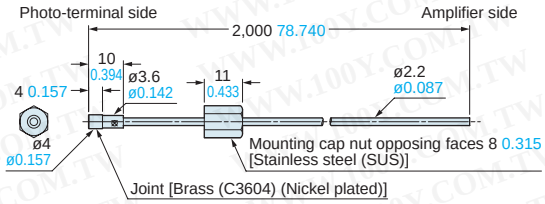
Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

Vacuum-resistant Atmospheric side fiber

FT-J8

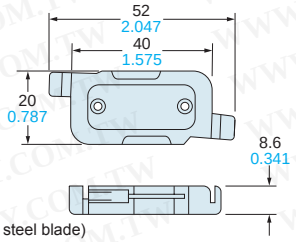
Free-cut

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



FB-1

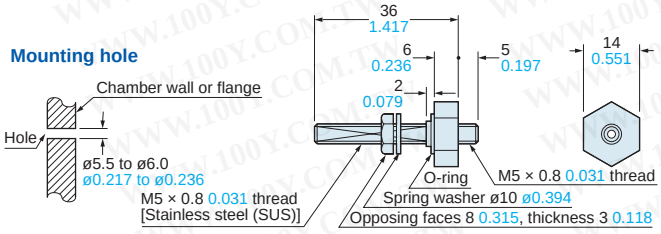
Fiber bender (Optional)



Material: PP (Containing steel blade)

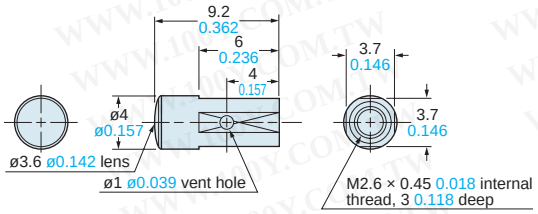
FV-BR1

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



FV-LE1

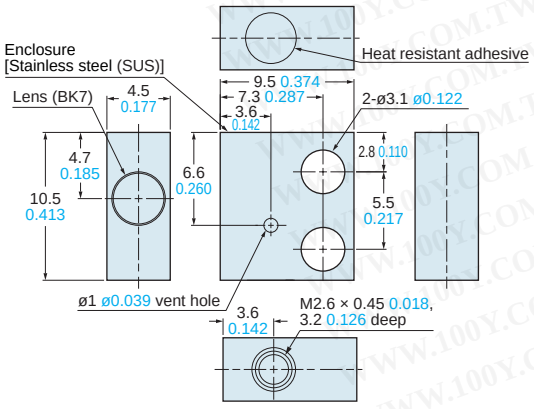
Vacuum-resistant expansion lens (Optional)



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

FV-SV2

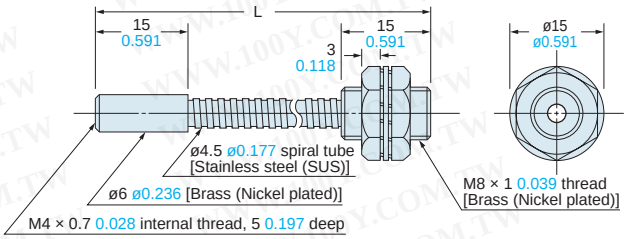
Vacuum-resistant side-view lens (Optional)



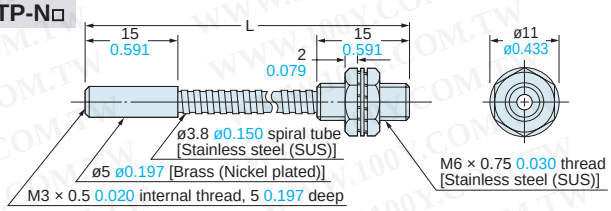
FTP-□ FDP-□

Protective tube (Optional)

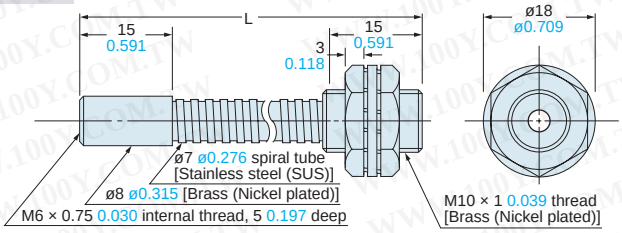
FTP-□, FDP-N□



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	$1{,}500^{+10}_{0}$ $59.055^{+0.394}_{0}$

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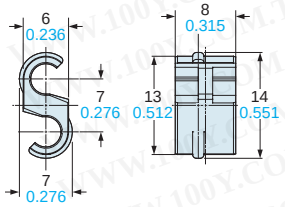
DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

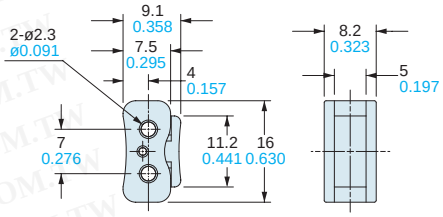
FX-AT2 Attachment for fixed-length fiber (Accessory for fixed-length fiber)



Material: POM

FX-AT3 Attachment for ø2.2 mm ø0.087 in fiber

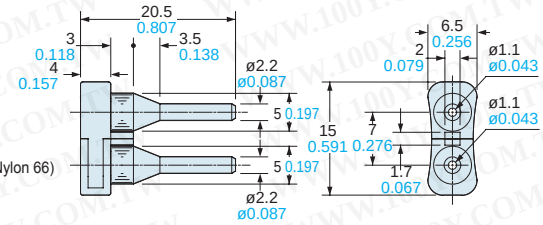
(Accessory for ø2.2 mm ø0.087 in fiber)



Material: Polycarbonate

FX-AT4 Attachment for ø1 mm ø0.039 in fiber

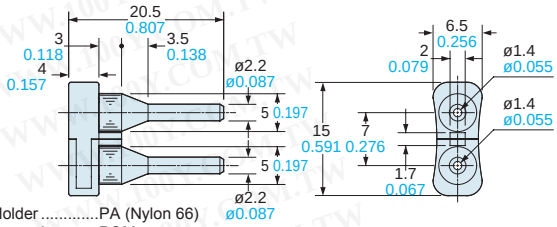
(Accessory for ø1 mm ø0.039 in fiber)



Material:
Holder....PA (Nylon 66)
Ground...POM

FX-AT5 Attachment for ø1.3 mm ø0.051 in fiber

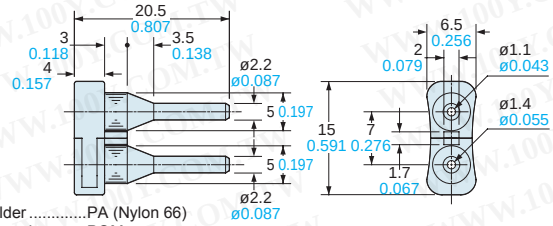
(Accessory for ø1.3 mm ø0.051 in fiber)



Material: Holder.....PA (Nylon 66)
Ground.....POM

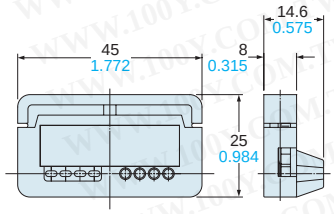
FX-AT6 Attachment for ø1 mm ø0.039 in / ø1.3 mm ø0.051 in mixed fiber

(Accessory for ø1 mm ø0.039 in / ø1.3 mm ø0.051 in mixed fiber)



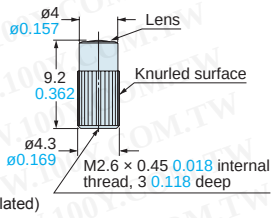
Material: Holder.....PA (Nylon 66)
Ground.....POM

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



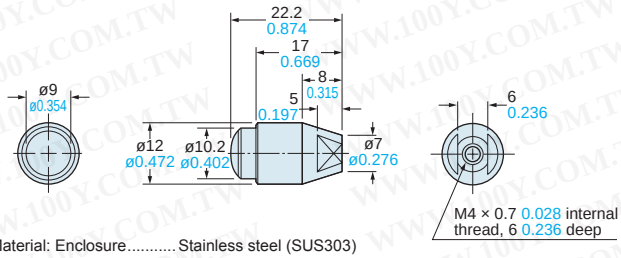
Material: ABS

FX-LE1 Expansion lens (Optional)



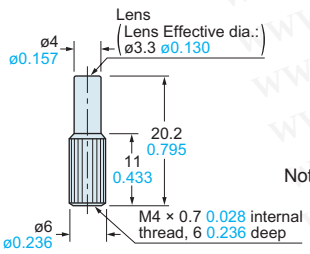
Material: Enclosure.....Brass
(Nickel plated)
Lens.....Glass

FX-LE2 Super-expansion lens (Optional)

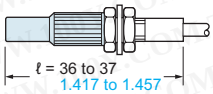


Material: Enclosure.....Stainless steel (SUS303)
Lens.....Glass

FX-MR1 Pinpoint spot lens (Optional)



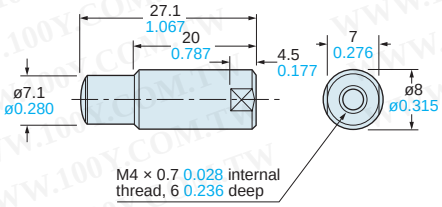
Mounting drawing with FD-42G



Note: In order to obtain a ø0.5 mm ø0.02 in spot, it is necessary to keep "ℓ", in the above figure, within the specified range.

Material: Enclosure.....Aluminum (Black ALMITE)
Lens.....Glass

FX-MR2 Zoom lens (Optional)



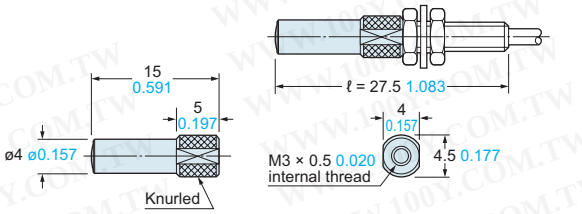
Material: Enclosure.....Aluminum (Black ALMITE)
Lens.....Glass

DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

FX-MR3 — Finest spot lens (Optional)

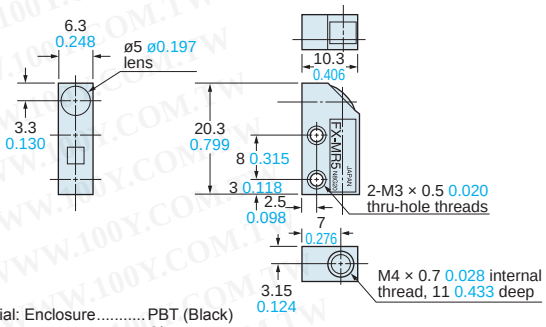
Mounting drawing with FD-EG30



Material: Enclosure..... Aluminum (Black ALMITE)
Lens..... Glass

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

FX-MR5 — Zoom lens (Optional)

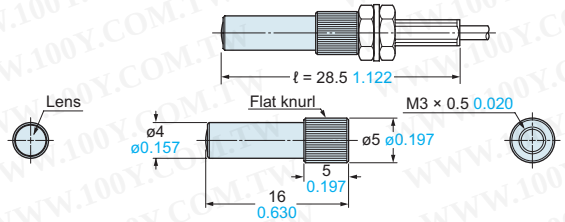


Material: Enclosure..... PBT (Black)
Lens..... Glass

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

FX-MR6 — Finest spot lens (Optional)

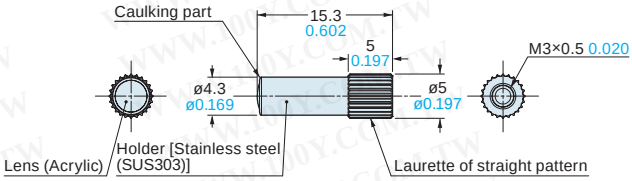
Mounting drawing with FD-EG31



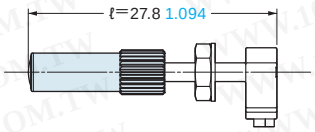
Material: Enclosure..... Aluminum (Black ALMITE)
Lens..... Acrylic

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

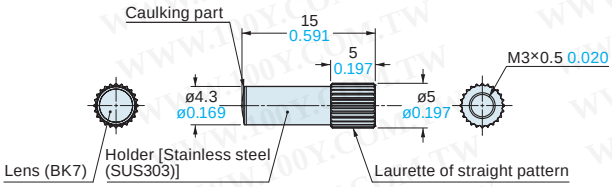
FX-MR7 — Finest spot lens (Optional)



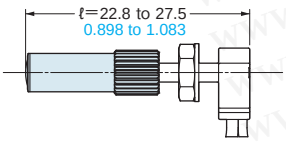
Mounting drawing with FD-R31G/R32EG/R33EG/R34EG



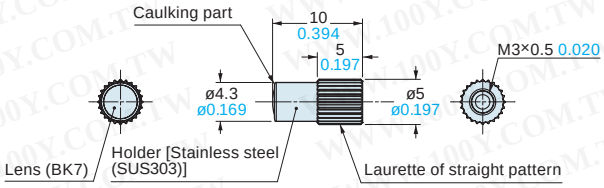
FX-MR8 — Zoom lens (Optional)



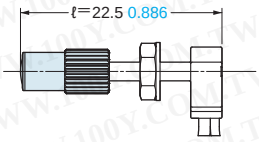
Mounting drawing with FD-R31G/R32EG/R33EG/R34EG



FX-MR9 — Parallel light lens (Optional)



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



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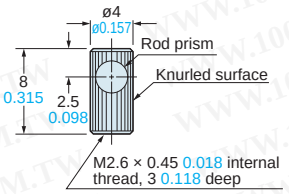
DIMENSIONS (Unit: mm in)

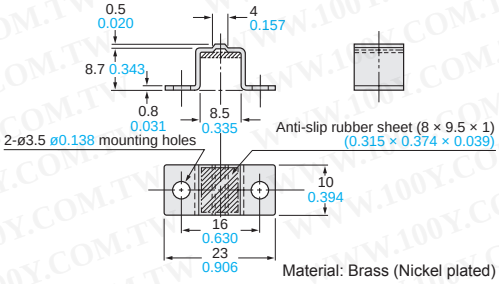
Refer to the **FX-500** series (p.96), **FX-100** series (p.110) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

FX-SV1 Side-view lens (Optional)



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

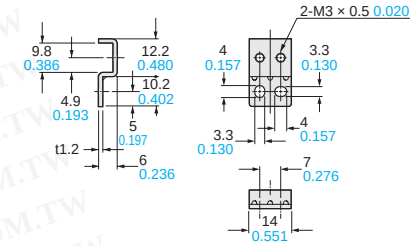
MS-EX3 Mounting bracket for FX-MR2 (Accessory for FX-MR2)



Material: Brass (Nickel plated)

MS-FD-2 Fiber mounting bracket

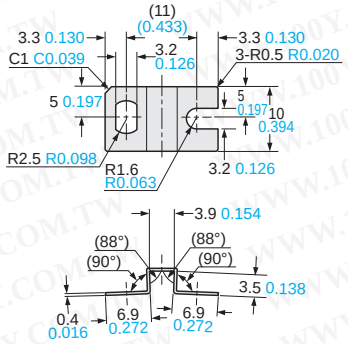
Accessory for **FD-Z50HW**, **FR-KZ50E/KZ50H/Z50HW**, **FD-H30-KZ1V-S**



Material: Stainless steel (SUS304)

MS-FD-3 Fiber mounting bracket

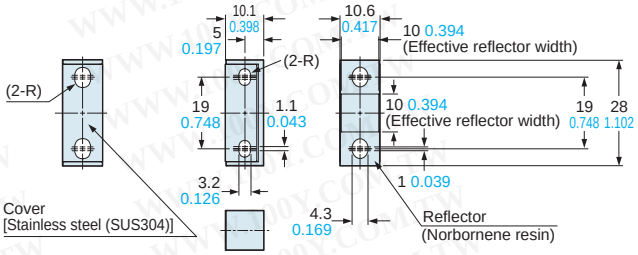
Accessory for **FT-KV40/FT-KV40W**



Material: Stainless steel (SUS304)

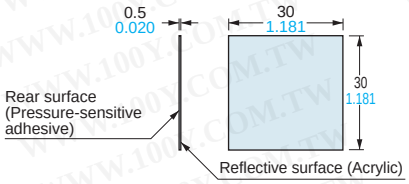
RF-003 Reflector for FR-KZ50E/KZ50H

Accessory for **FR-KZ50E/KZ50H**



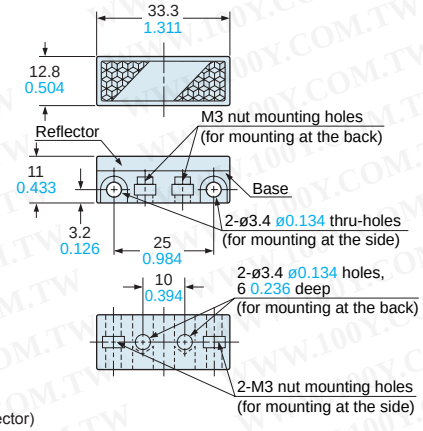
RF-13 Reflective tape for FR-Z50HW

Accessory for **FR-Z50HW**



Material : Acrylic (Reflective surface)

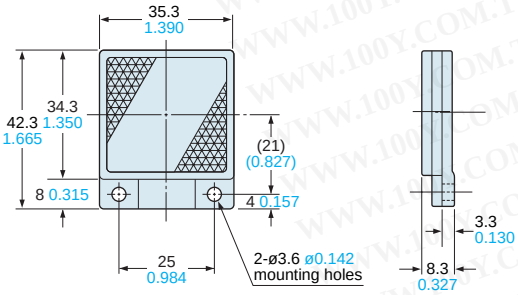
RF-210 Reflector (Optional)



Material: Acrylic (Reflector)
ABS (Base)

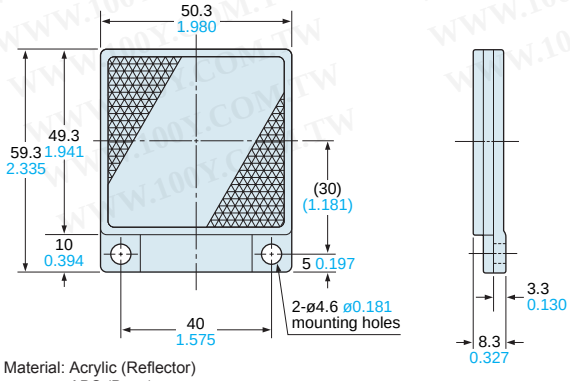
Two M3 (length 8 mm 0.315 in) screws with washers and two nuts are attached.

RF-220 Reflector (Optional)



Material: Acrylic (Reflector)
ABS (Base)

RF-230 Reflector (Optional)



Material: Acrylic (Reflector)
ABS (Base)

New product introduction
Tough Fiber
Fiber Selection Guide
Model
Choose by shape/ application
How to read Model No
Earlier models comparison table
Fibers
Super Quality
Threaded Type
Square Head Type
Cylindrical Type
Sleeve
Flat Type
Small Spot
Narrow Beam
Wide Beam
Convergent Reflective Type
Retroreflective Type
Chemical / Oil-resistant
Heat-resistant
Vacuum-resistant
Liquid Leak / Liquid Detection
Fiber Options
Semi-custom fibers
Fiber Dimensions
Thru-beam Type
Retroreflective Type
Reflective Type
Others
Amplifiers
FX-500 series
FX-100 series
INDEX

Digital Fiber Sensor

FX-500 SERIES Ver.2

At the industry's leading edge

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

Conforming to EMC Directive

Listing

Certified

PNP output type available

Timer

Interference prevention

Light intensity monitor

Automatic sensitivity setting

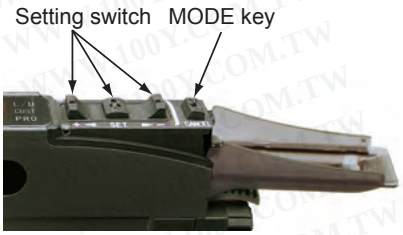
Test input

External sync.

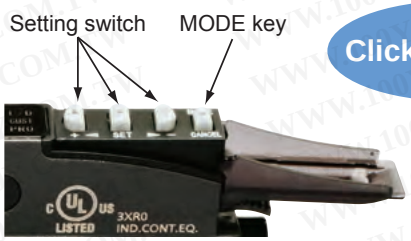
Improved the operability and visibility of the operation keys

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

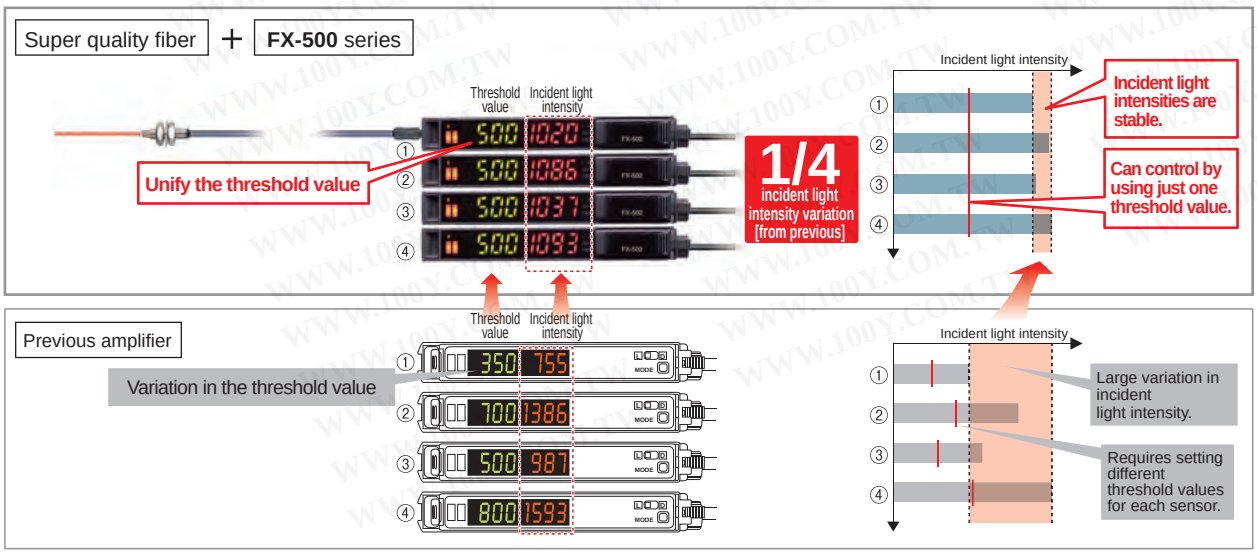


Upgraded (Ver. 2)



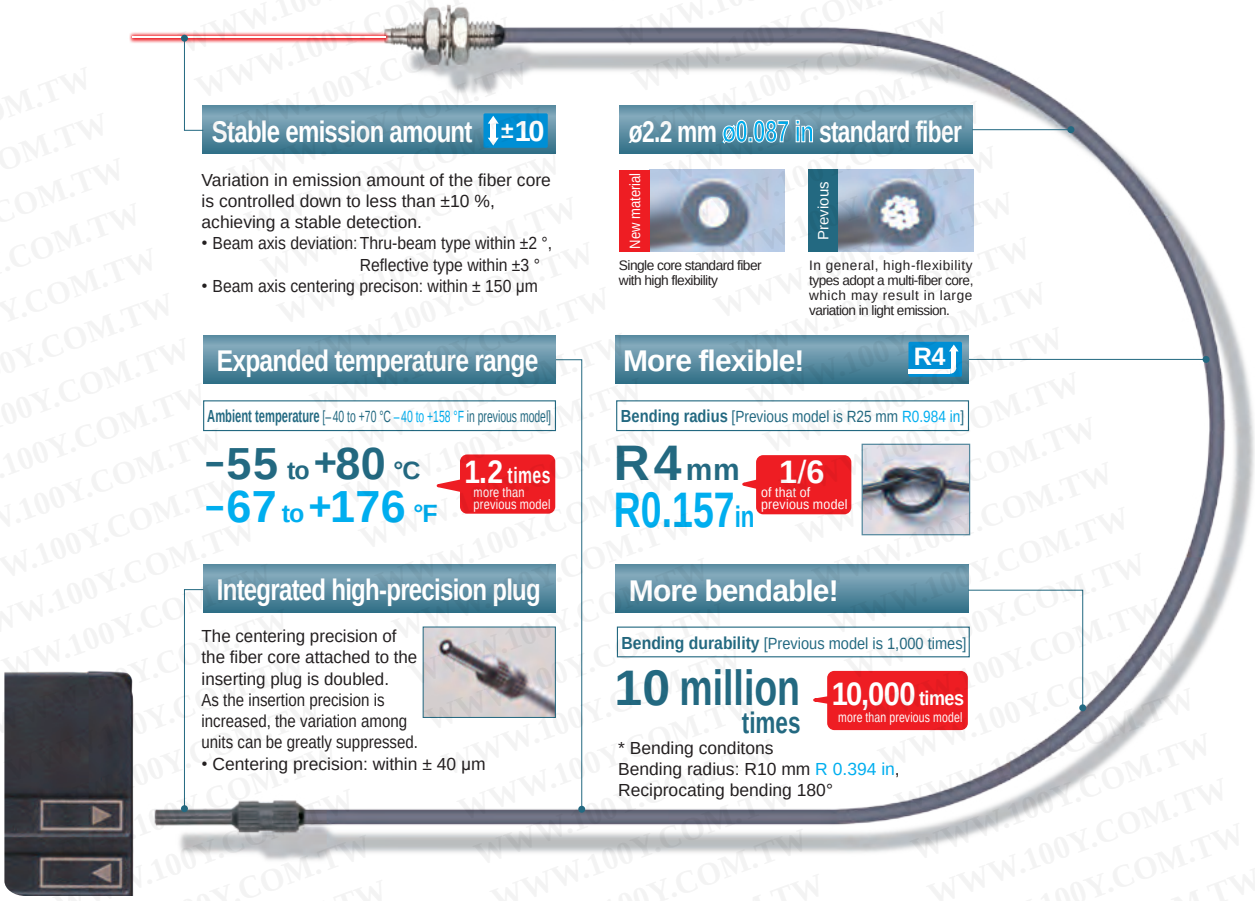
High stability!

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.



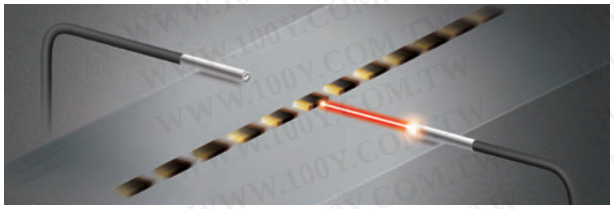
A quality that surpassed that of standard fibers!

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

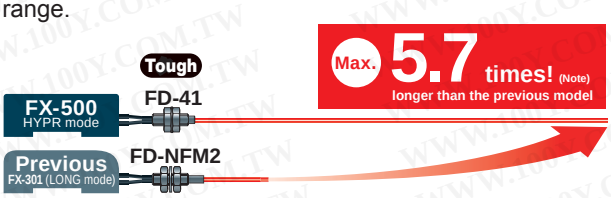
FX-500 with its high response time contributes to improve productivity.



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.

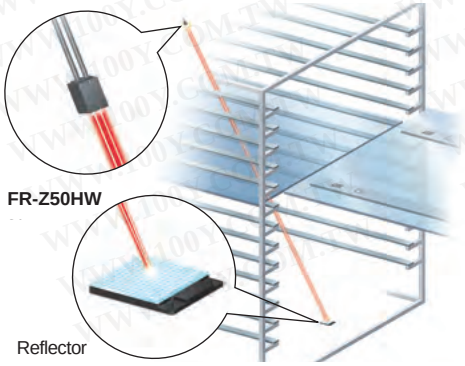


Note: When using **FD-NFM2**.

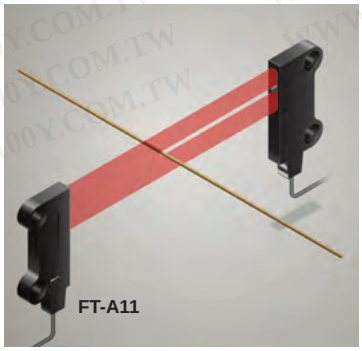
So accurate! Sharp detection with suppressed hysteresis

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

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

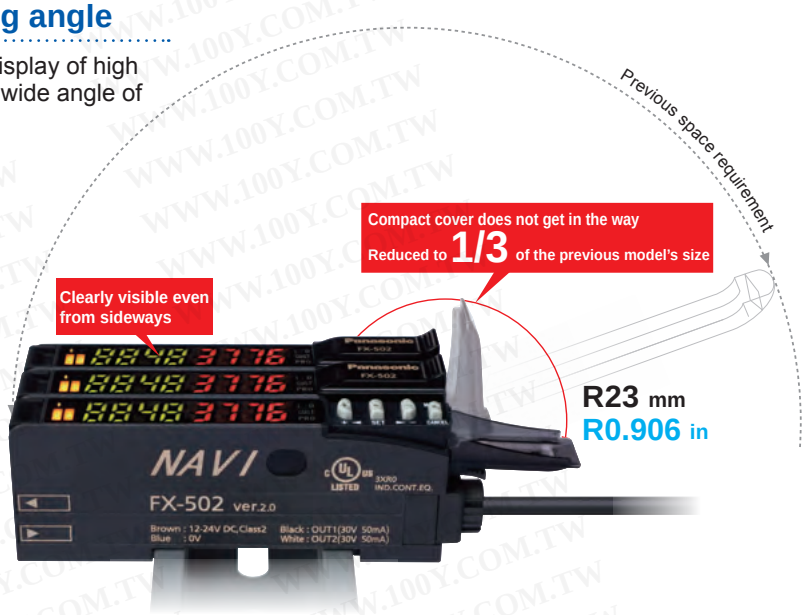


- Highly accurate detection while avoiding saturation **H-01 mode**



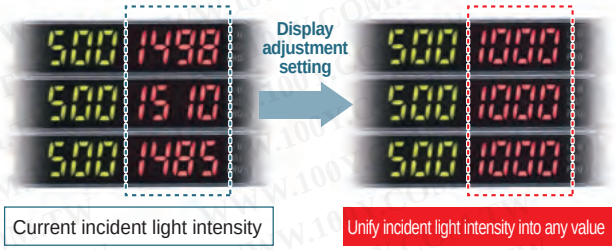
Flat display with wide viewing angle

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.

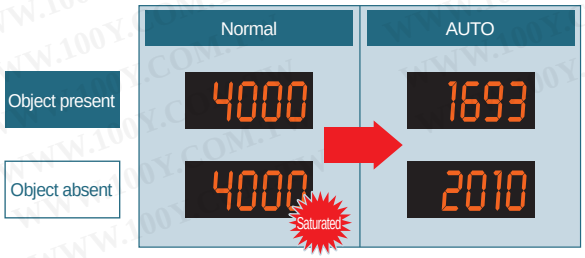
■ Detect deterioration in light intensity (e.g. Useful in dusty environment)

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

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

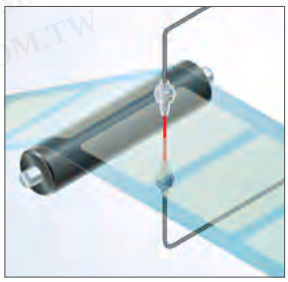
ECO

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



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

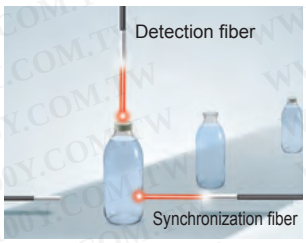
■ Detecting a transparent sheet



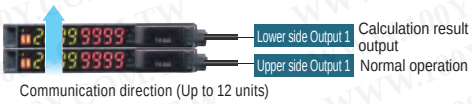
Built-in logic functions
No PLC necessary, saving material and programming costs

Logical calculation functions

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

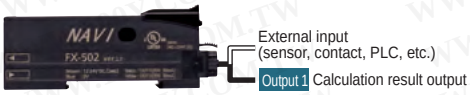


Calculation of two neighboring amplifiers



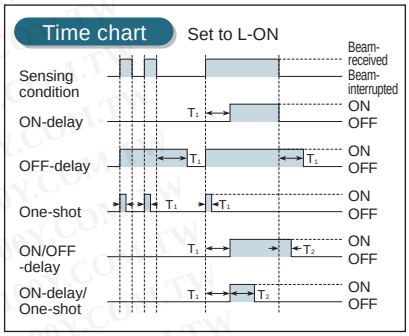
Calculation of two outputs in one amplifier FX-502(P) / 505(P)-C2

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



Equipped with 5 timer types

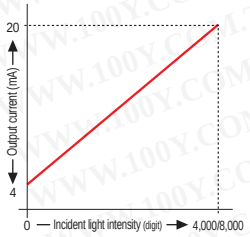
A wide variety of timer control operations can be carried out by fiber sensors only.



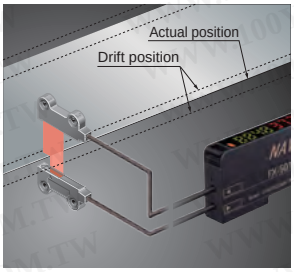
Timer period: 0.05 ms to 32 s
Output 1 has ON / OFF-delay and ON-delay / One-shot timers are available.

Analog output cable type FX-505(P)-C2

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



■ Edge tracking of film or sheet



The drifting 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 amplifirer 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

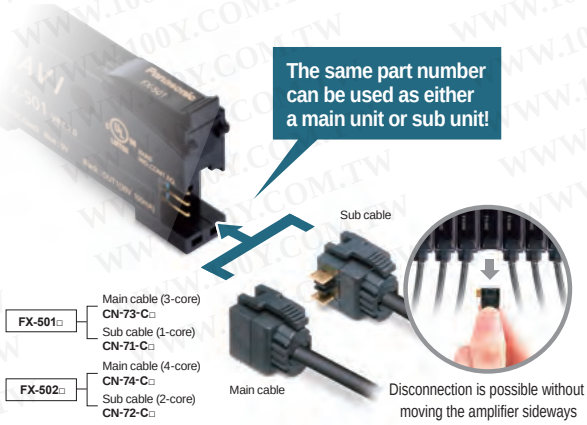
Full-auto / Limit / 2-point teaching	Display adjustment setting
Data bank load / save	Logical calculation (self-unit only)
Emission halt	Copying function lock (self-unit only)

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.



ORDER GUIDE

Amplifiers

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

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

Quick-connection cables

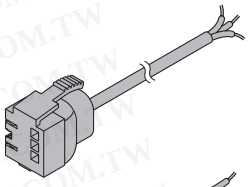
For FX-501(P)

Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Model No.		Description
Main cable (3-core)	**CN-73-C1**	Length: 1 m 3.281 ft	0.2 mm² 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 mm² 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	

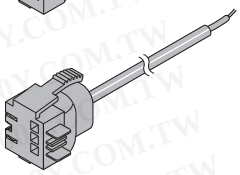
Main cable

• **CN-73-C□**



Sub cable

• **CN-71-C□**



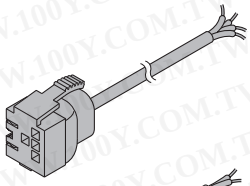
For FX-502(P)

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 mm² 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 mm² 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	

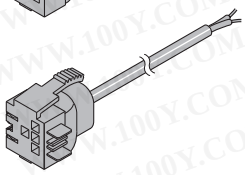
Main cable

• **CN-74-C□**



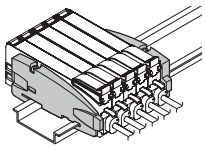
Sub cable

• **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. Two pcs. per set

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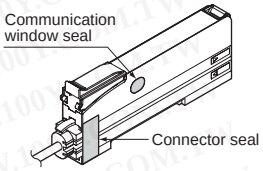
OPTIONS

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

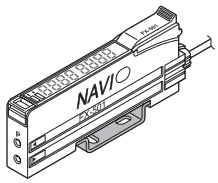
Accessory

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



Amplifier mounting bracket

- **MS-DIN-2**



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SPECIFICATIONS

Item \ Type	Standard type	2-output type	Cable type (Analog output type)
Model No. NPN output	**FX-501**	**FX-502**	**FX-505-C2**
Model No. 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 mm² 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 mm², 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

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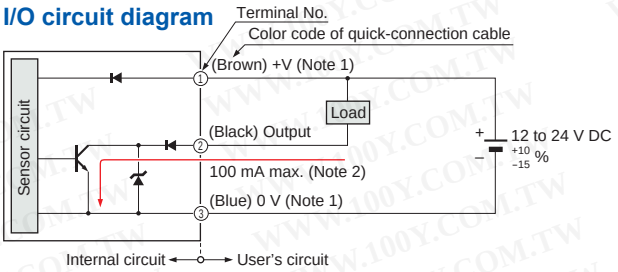
I/O CIRCUIT AND WIRING DIAGRAMS

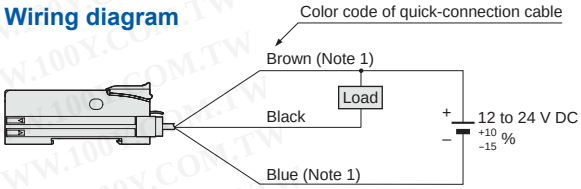
FX-501 — NPN output type

I/O circuit diagram



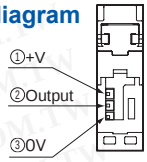
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers or more, are connected together.

Wiring diagram



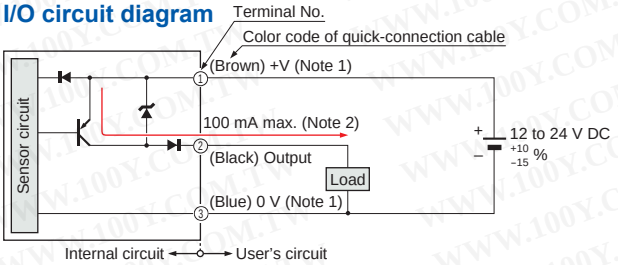
Note: The quick-connection sub cable does not have a brown and a blue lead wire.

Terminal arrangement diagram



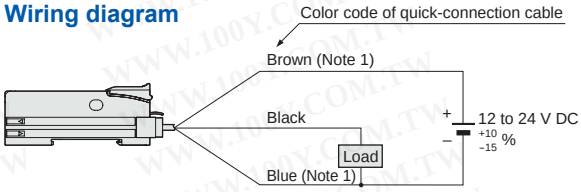
FX-501P — PNP output type

I/O circuit diagram



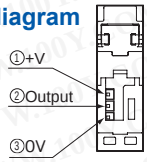
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers or more, are connected together.

Wiring diagram



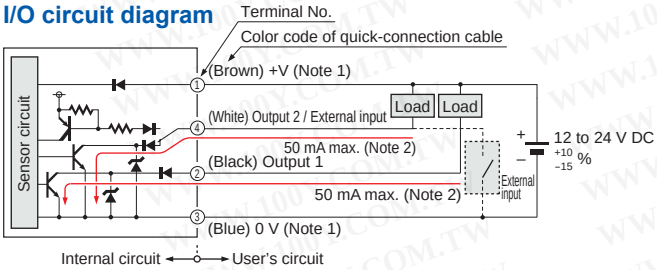
Note: The quick-connection sub cable does not have a brown and a blue lead wire.

Terminal arrangement diagram



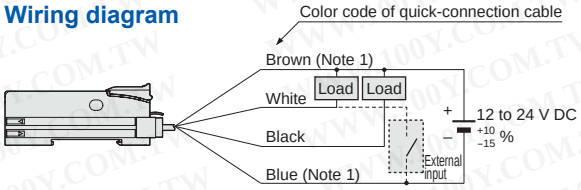
FX-502 — NPN output type

I/O circuit diagram



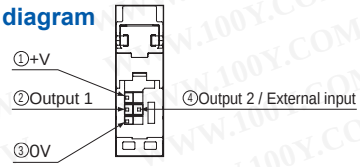
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers or more, are connected together.

Wiring diagram



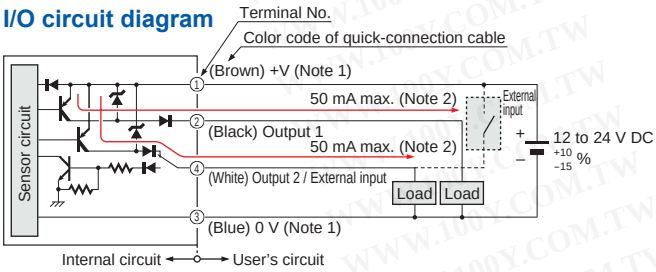
Note: The quick-connection sub cable does not have a brown and a blue lead wire.

Terminal arrangement diagram



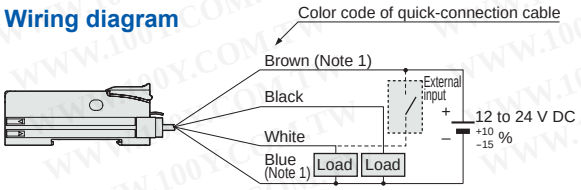
FX-502P — PNP output type

I/O circuit diagram



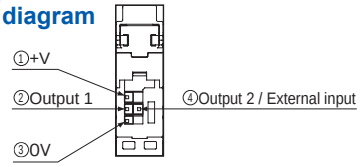
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers or more, are connected together.

Wiring diagram



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

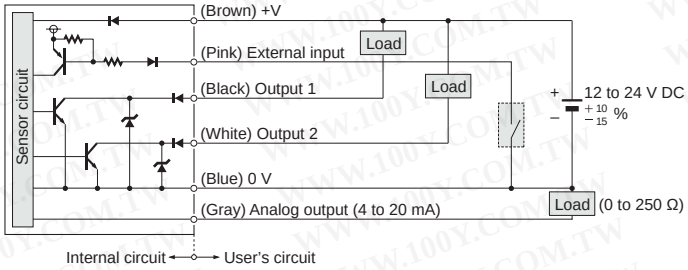
Terminal arrangement diagram



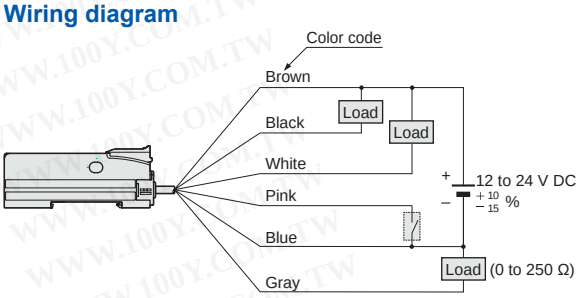
I/O CIRCUIT AND WIRING DIAGRAMS

FX-505-C2 — NPN output type

I/O circuit diagram

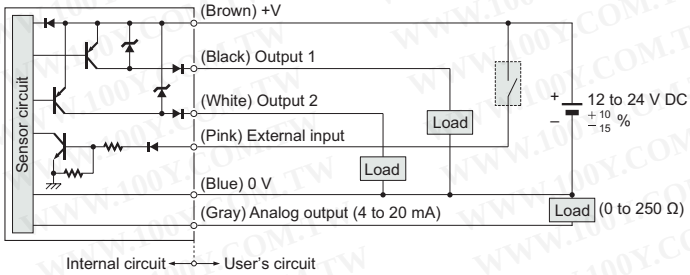


Wiring diagram

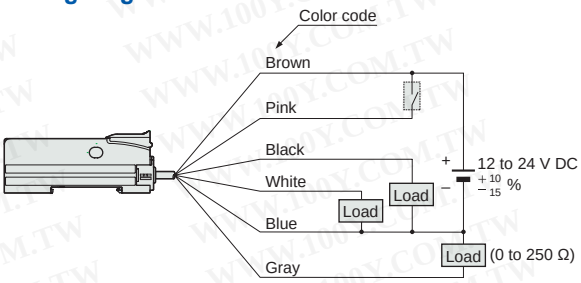


FX-505P-C2 — PNP output type

I/O circuit diagram



Wiring diagram



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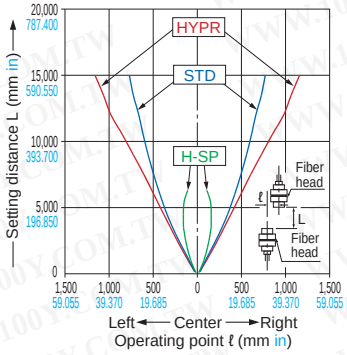
SENSING CHARACTERISTICS (TYPICAL)

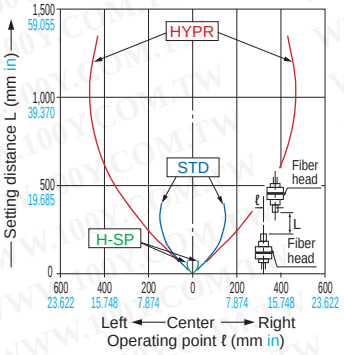
Thru-beam type Parallel deviation

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

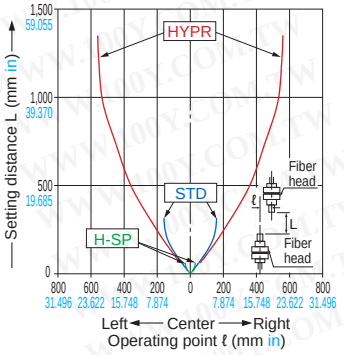
FT-140 Thru-beam type



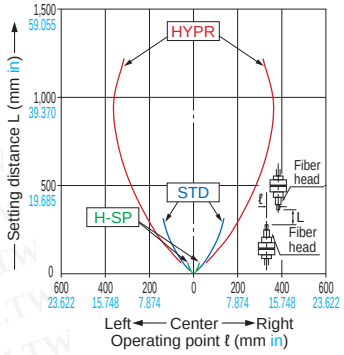
FT-30 Thru-beam type



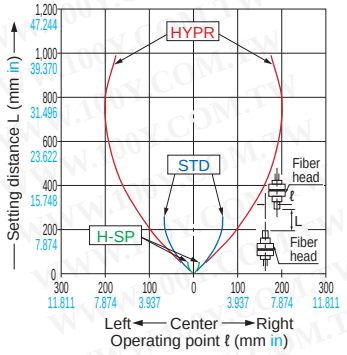
FT-31 Thru-beam type



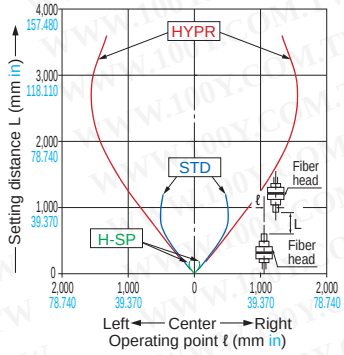
FT-31S Thru-beam type



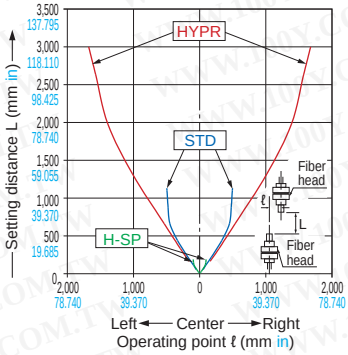
FT-31W Thru-beam type



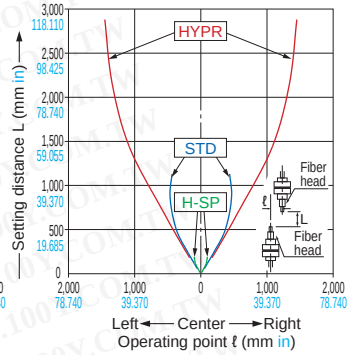
FT-40 Thru-beam type



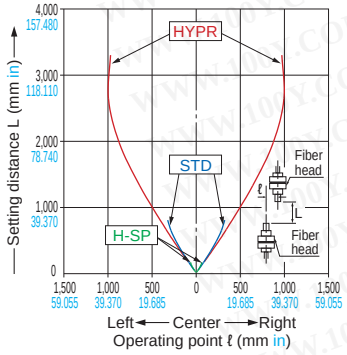
FT-42 Thru-beam type



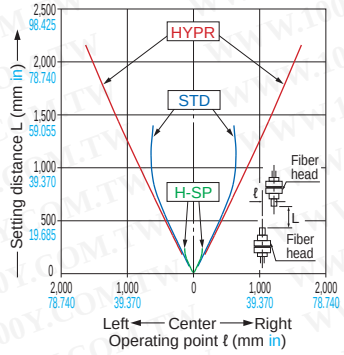
FT-42S Thru-beam type



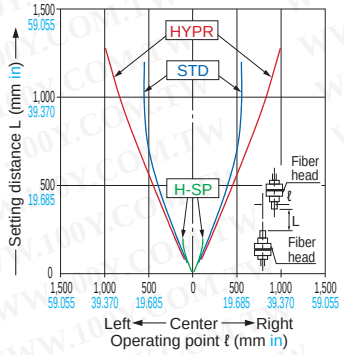
FT-42W Thru-beam type



FT-43 Thru-beam type

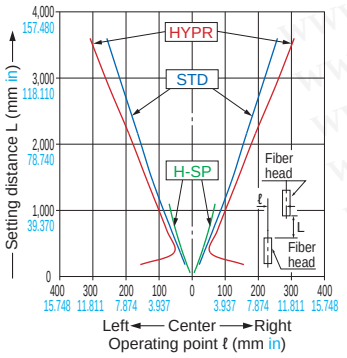


FT-45X Thru-beam type

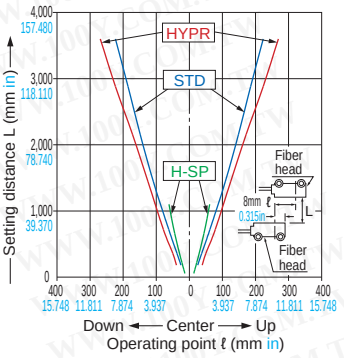


FT-A11 Thru-beam type

Horizontal direction

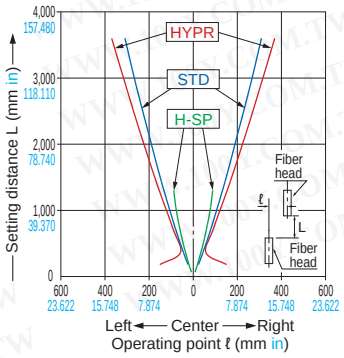


Vertical direction

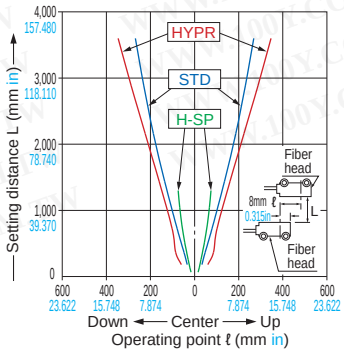


FT-A11W Thru-beam type

Horizontal direction



Vertical direction



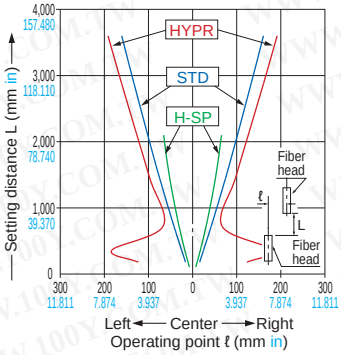
SENSING CHARACTERISTICS (TYPICAL)

Thru-beam type Parallel deviation

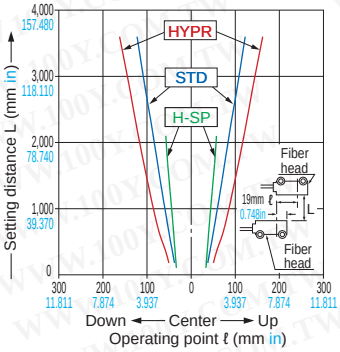
Sensing characteristics are listed in the alphabetic order of the Model No.
(Models with same sensing characteristics are grouped together.)

FT-A32 — Thru-beam type

Horizontal direction

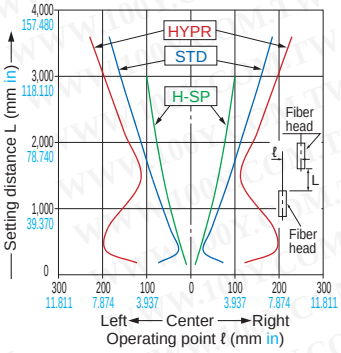


Vertical direction

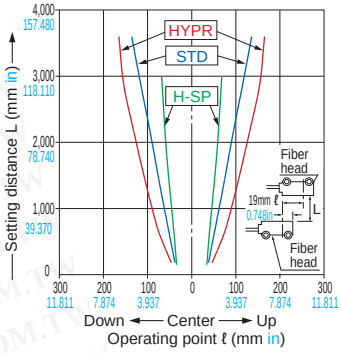


FT-A32W — Thru-beam type

Horizontal direction

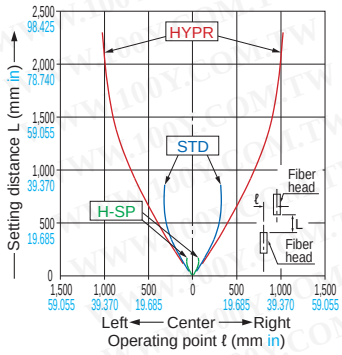


Vertical direction

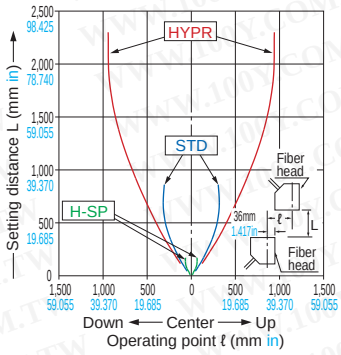


FT-AL05 — Thru-beam type

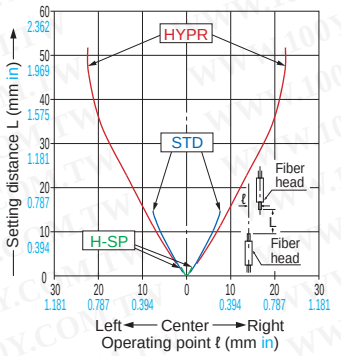
Horizontal direction



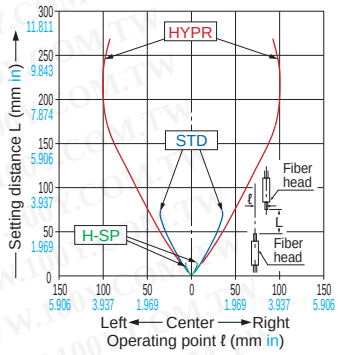
Vertical direction



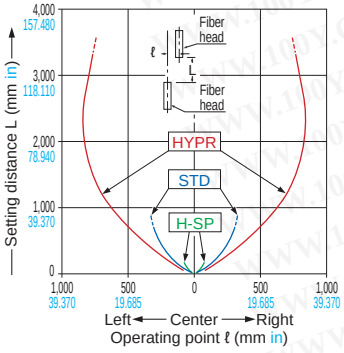
FT-E13 — Thru-beam type



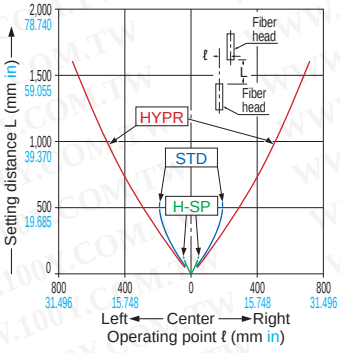
FT-E23 — Thru-beam type



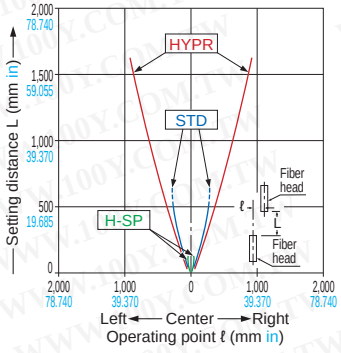
FT-H13-FM2 — Thru-beam type



FT-H20-J20-S FT-H20-J30-S FT-H20-J50-S — Thru-beam type

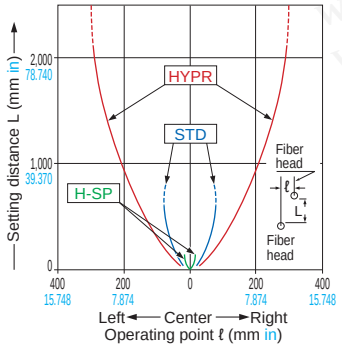


FT-H20-M1 — Thru-beam type

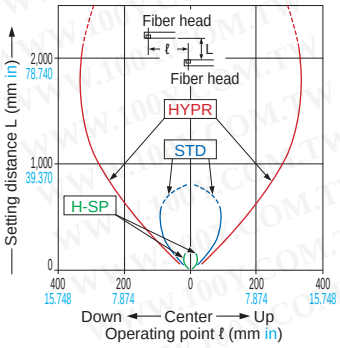


FT-H20-VJ50-S FT-H20-VJ80-S — Thru-beam type

Horizontal direction

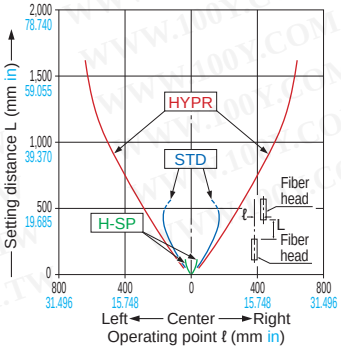


Vertical direction



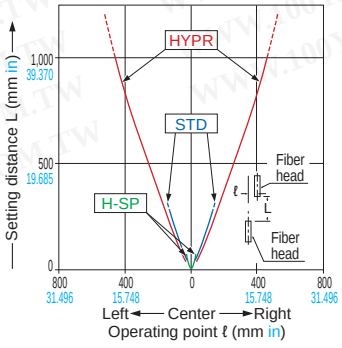
FT-H20W-M1 — Thru-beam type

Horizontal direction



FT-H30-M1V-S — Thru-beam type

Vertical direction



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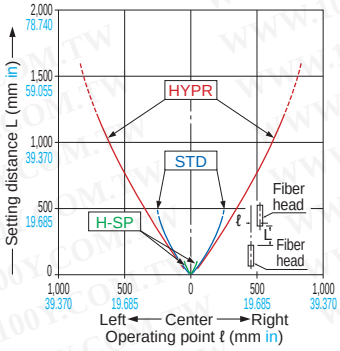
SENSING CHARACTERISTICS (TYPICAL)

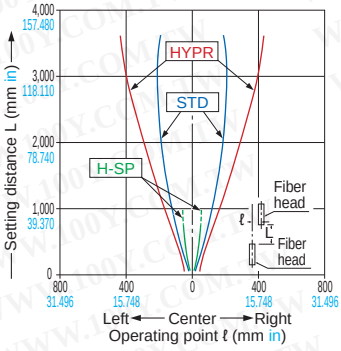
Thru-beam type Parallel deviation

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

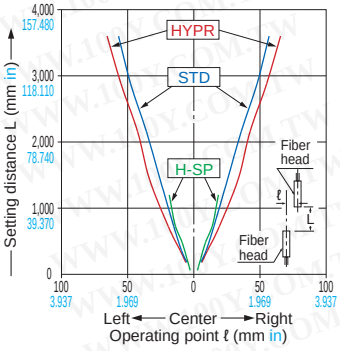
FT-H35-M2
FT-H35-M2S6 — Thru-beam type



FT-HL80Y — Thru-beam type

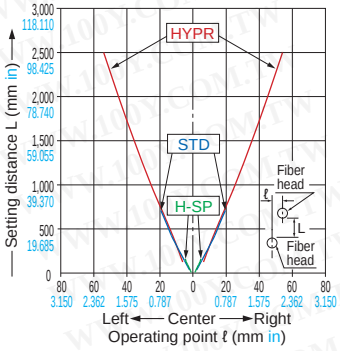


FT-KS40 — Thru-beam type

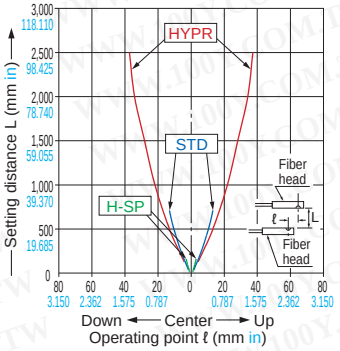


FT-KV26 — Thru-beam type

Horizontal direction

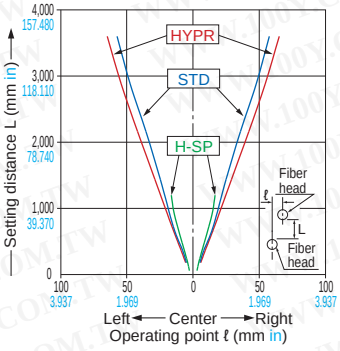


Vertical direction

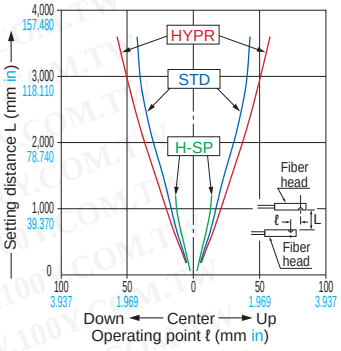


FT-KV40 — Thru-beam type

Horizontal direction

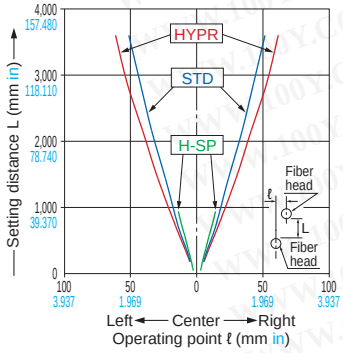


Vertical direction

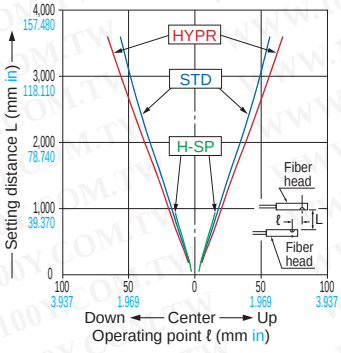


FT-KV40W — Thru-beam type

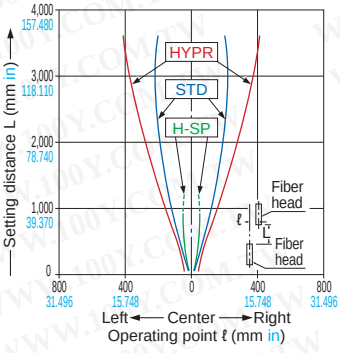
Horizontal direction



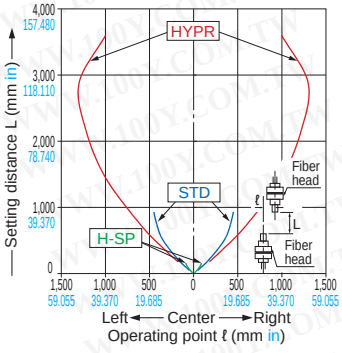
Vertical direction



FT-L80Y — Thru-beam type

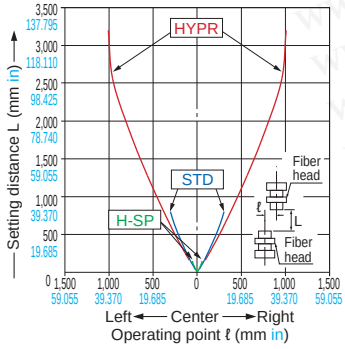


FT-R40 — Thru-beam type

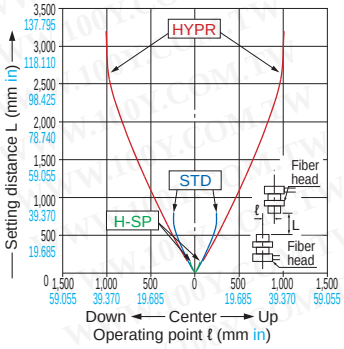


FT-R41W — Thru-beam type

Horizontal direction

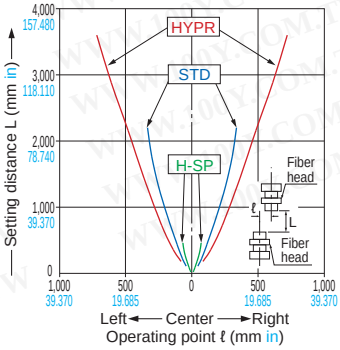


Vertical direction

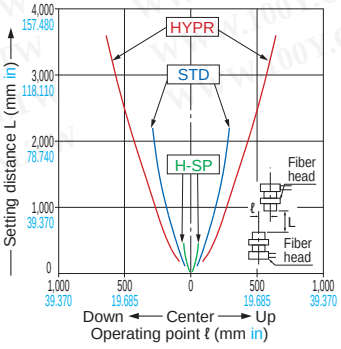


FT-R42W — Thru-beam type

Horizontal direction



Vertical direction



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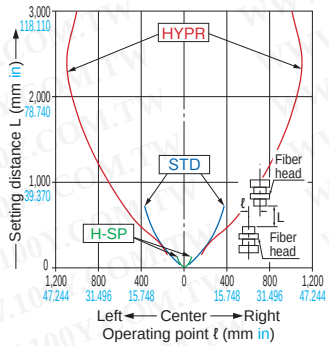
SENSING CHARACTERISTICS (TYPICAL)

Thru-beam type Parallel deviation

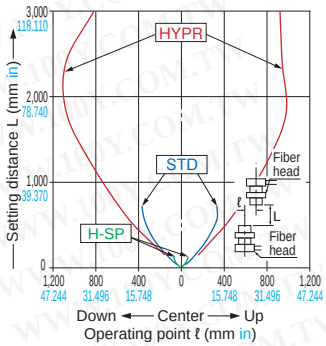
Sensing characteristics are listed in the alphabetic order of the Model No.

FT-R44Y — Thru-beam type

Horizontal direction

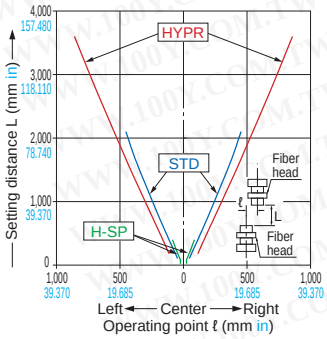


Vertical direction

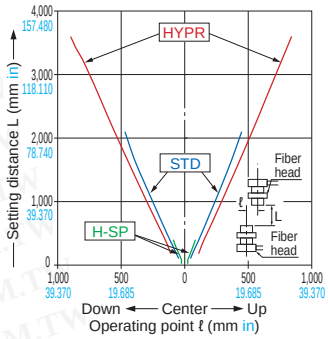


FT-R60Y — Thru-beam type

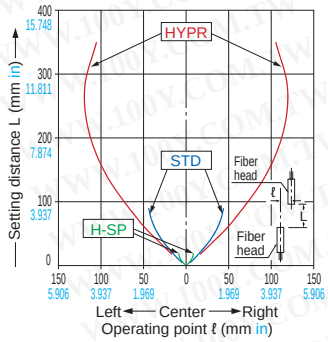
Horizontal direction



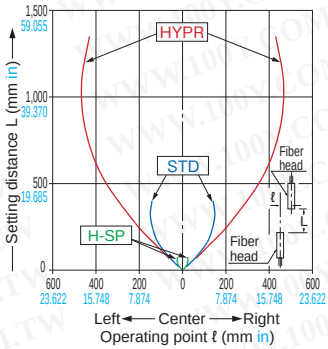
Vertical direction



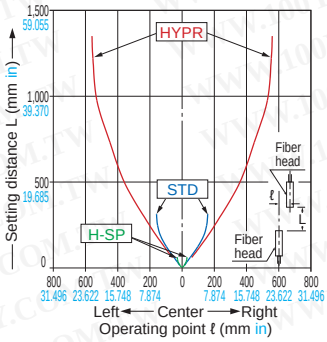
FT-S11 — Thru-beam type



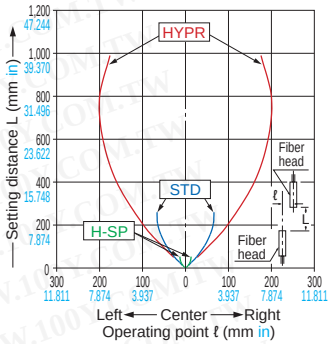
FT-S20 — Thru-beam type



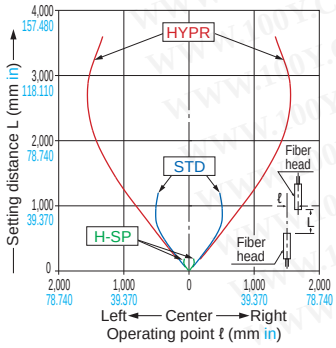
FT-S21 — Thru-beam type



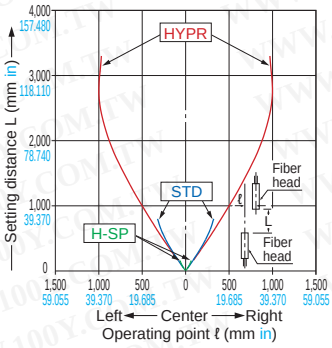
FT-S21W — Thru-beam type



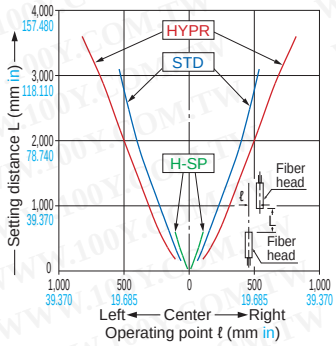
FT-S30 — Thru-beam type



FT-S31W — Thru-beam type

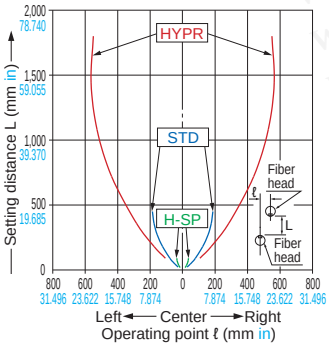


FT-S32 — Thru-beam type

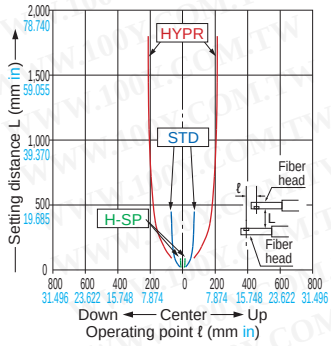


FT-V23 — Thru-beam type

Horizontal direction

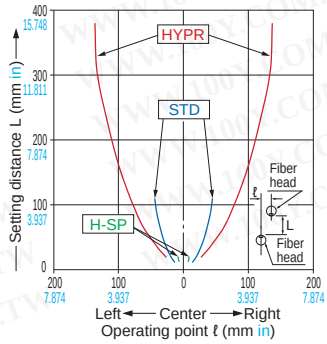


Vertical direction

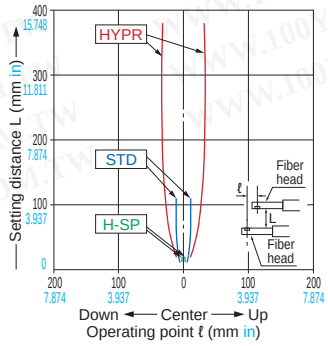


FT-V24W — Thru-beam type

Horizontal direction



Vertical direction



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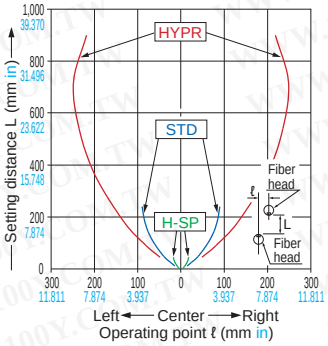
SENSING CHARACTERISTICS (TYPICAL)

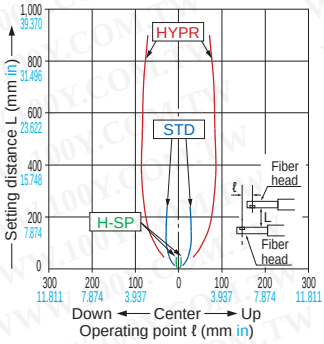
Thru-beam type Parallel deviation Sensing characteristics are listed in the alphabetic order of the Model No.

FT-V25 Thru-beam type

Horizontal direction

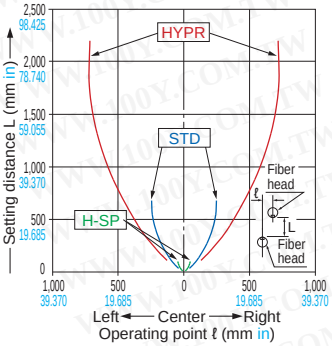


Vertical direction

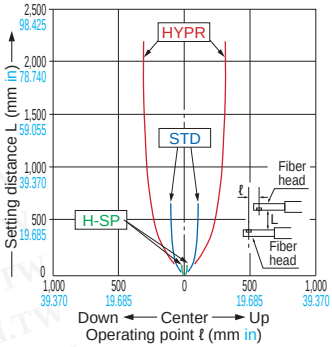


FT-V30 Thru-beam type

Horizontal direction

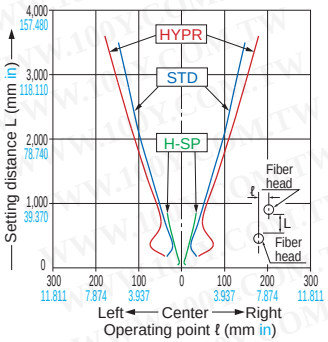


Vertical direction

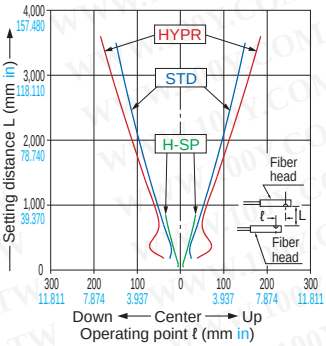


FT-V40 Thru-beam type

Horizontal direction

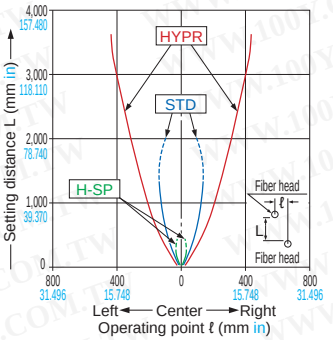


Vertical direction

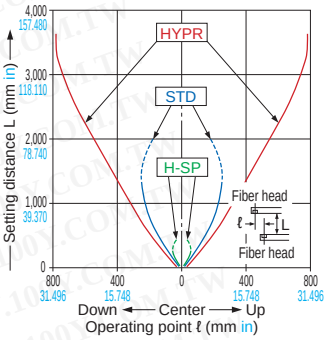


FT-V80Y Thru-beam type

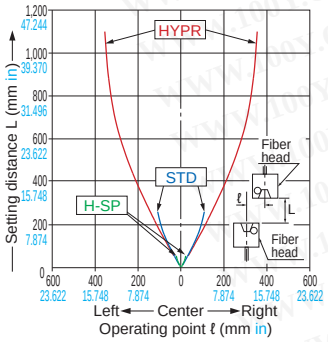
Horizontal direction



Vertical direction

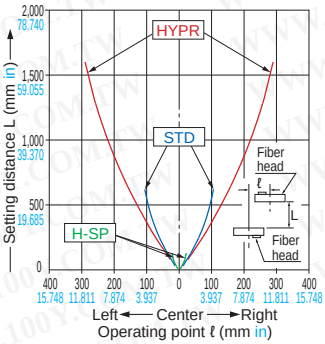


FT-Z20HBW Thru-beam type

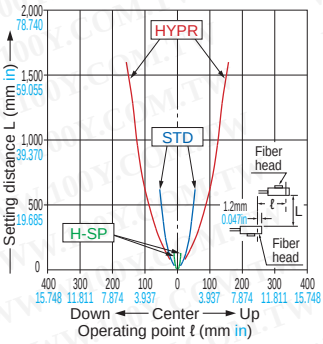


FT-Z20W Thru-beam type

Horizontal direction

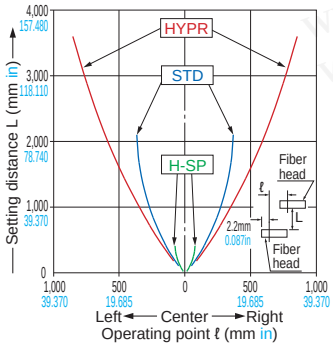


Vertical direction

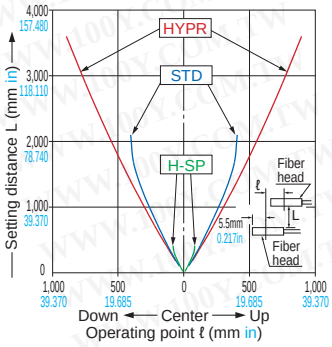


FT-Z30 Thru-beam type

Horizontal direction

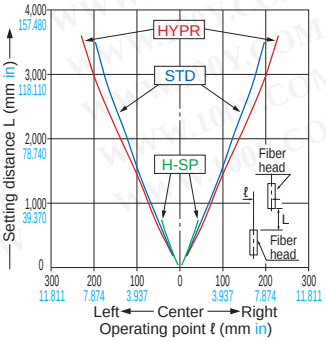


Vertical direction

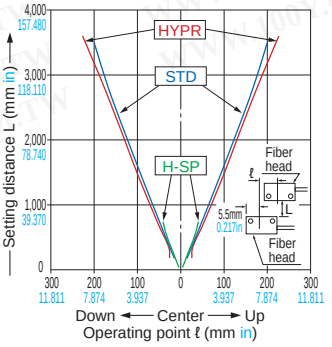


FT-Z30E Thru-beam type

Horizontal direction



Vertical direction



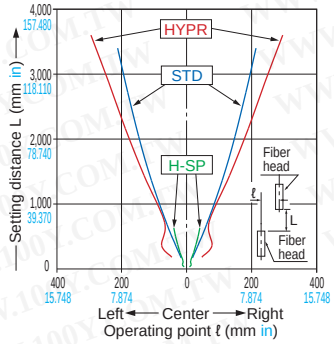
SENSING CHARACTERISTICS (TYPICAL)

Thru-beam type Parallel deviation

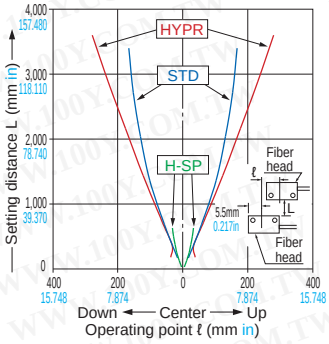
Sensing characteristics are listed in the alphabetic order of the Model No.

FT-Z30EW — Thru-beam type

Horizontal direction

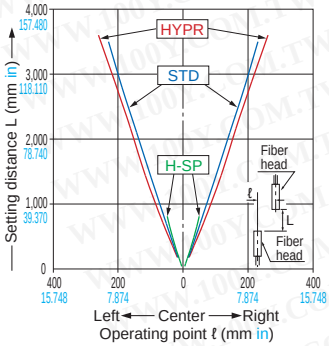


Vertical direction

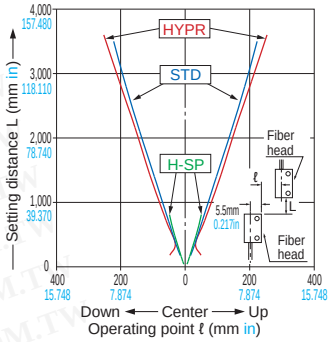


FT-Z30H — Thru-beam type

Horizontal direction

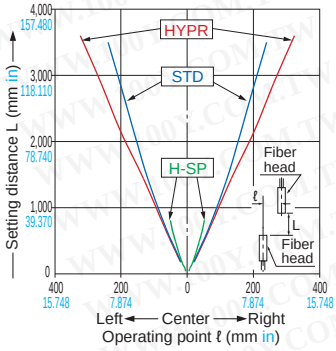


Vertical direction

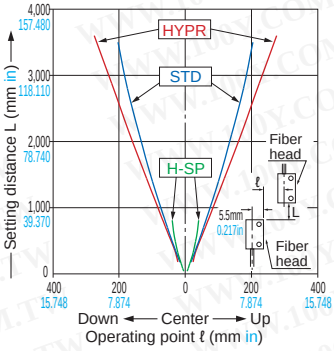


FT-Z30HW — Thru-beam type

Horizontal direction

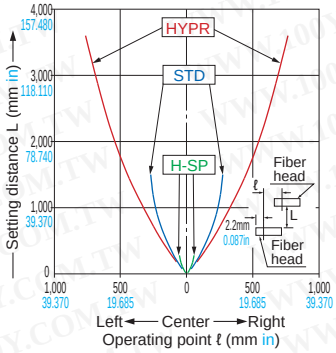


Vertical direction

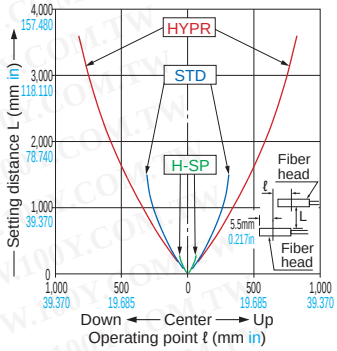


FT-Z30W — Thru-beam type

Horizontal direction

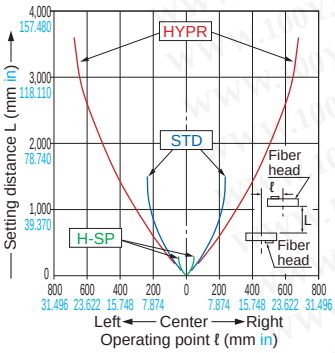


Vertical direction

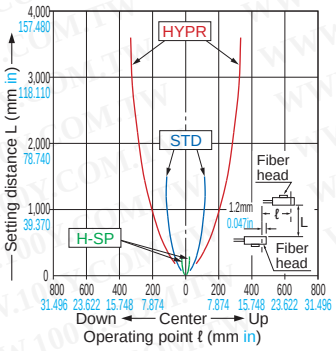


FT-Z40W — Thru-beam type

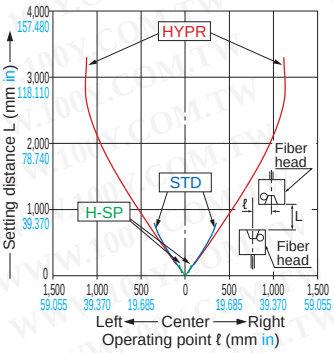
Horizontal direction



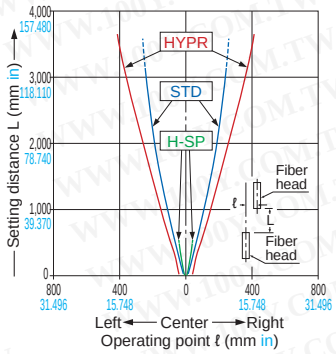
Vertical direction



FT-Z40HBW — Thru-beam type



FT-Z802Y — Thru-beam type

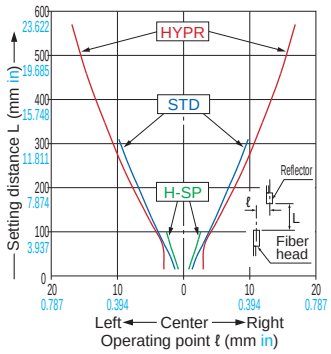


Retroreflective type Parallel deviation

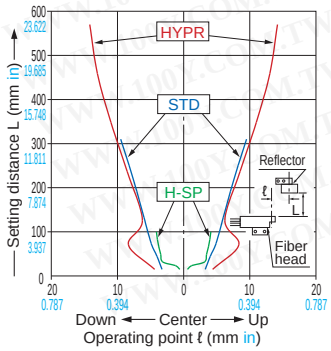
Sensing characteristics are listed in the alphabetic order of the Model No.

FR-KZ22E — Retroreflective type

Horizontal direction

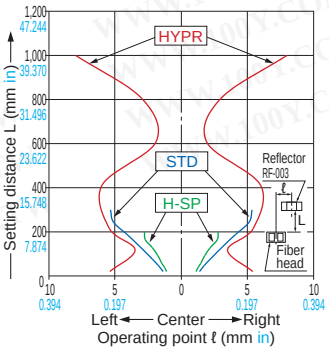


Vertical direction

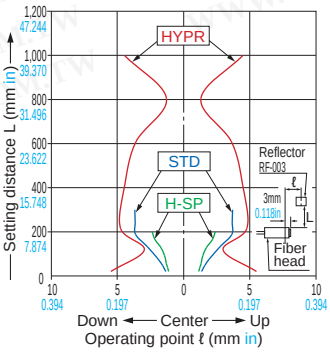


FR-KZ50E — Retroreflective type

Horizontal direction



Vertical direction



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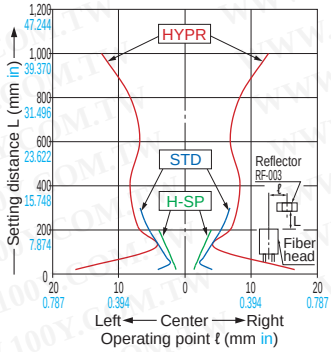
SENSING CHARACTERISTICS (TYPICAL)

Retroreflective type Parallel deviation

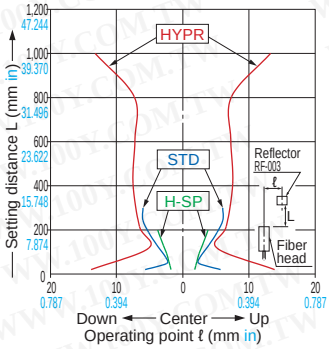
Sensing characteristics are listed in the alphabetic order of the Model No.

FR-KZ50H — Retroreflective type

Horizontal direction



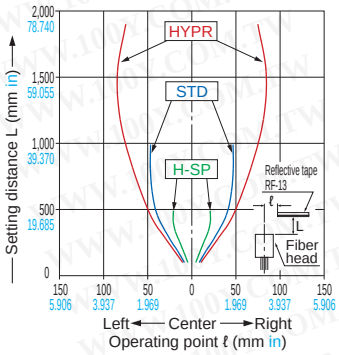
Vertical direction



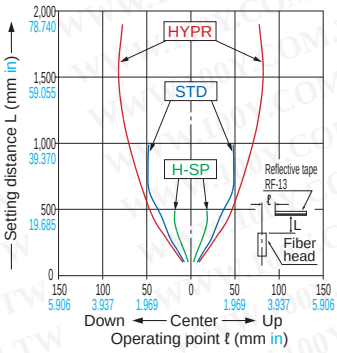
FR-Z50HW — Retroreflective type

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

Horizontal direction

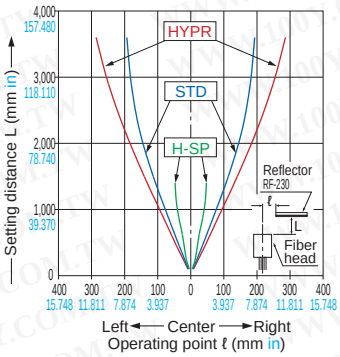


Vertical direction

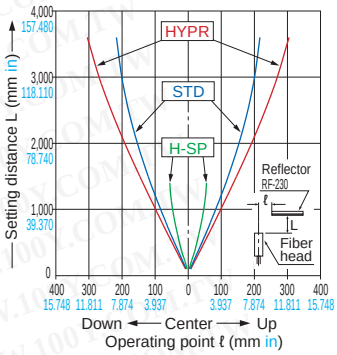


With reflector **RF-230** (optional)

Horizontal direction



Vertical direction

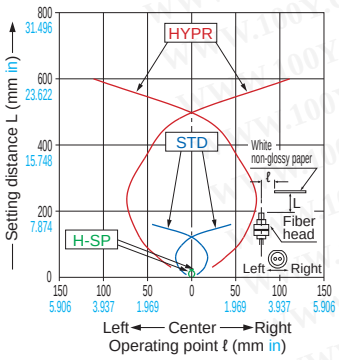


Reflective type Sensing field

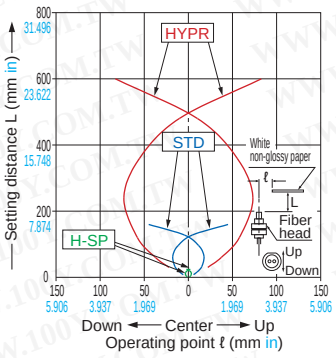
Sensing characteristics are listed in the alphabetic order of the Model No.

FD-30 — Reflective type

Horizontal direction

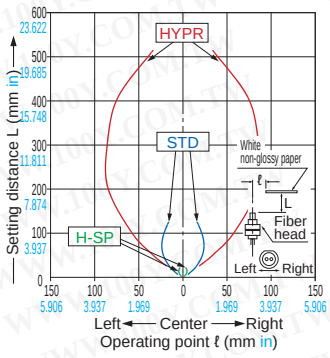


Vertical direction

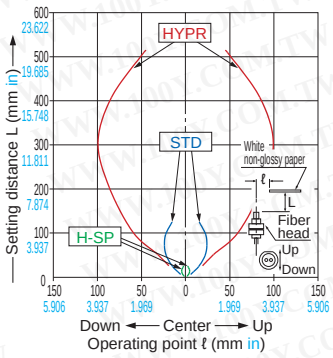


FD-31 — Reflective type

Horizontal direction

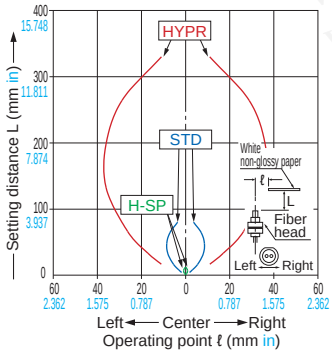


Vertical direction

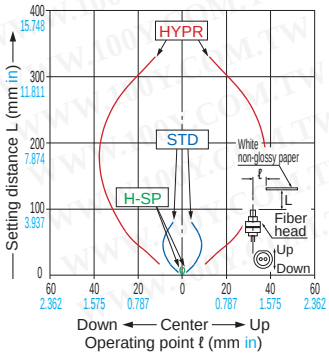


FD-31W — Reflective type

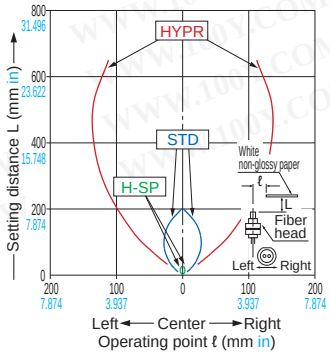
Horizontal direction



Vertical direction



FD-32G — Reflective type

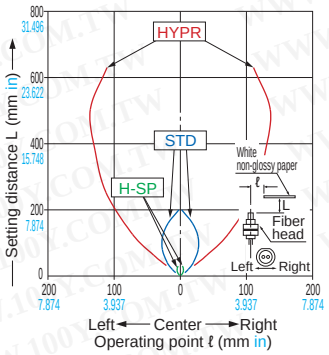


SENSING CHARACTERISTICS (TYPICAL)

Reflective type Sensing field

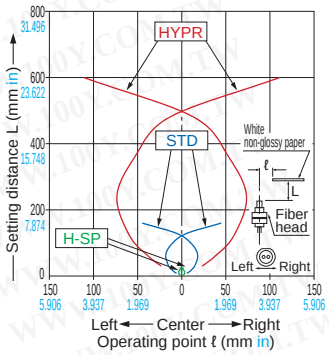
Sensing characteristics are listed in the alphabetic order of the Model No.

FD-32GX — Reflective type

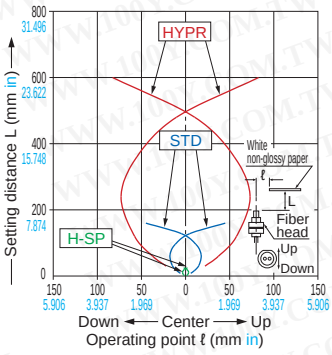


FD-40 — Reflective type

Horizontal direction

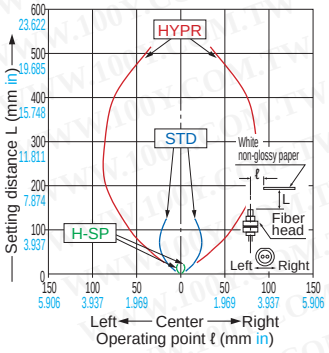


Vertical direction

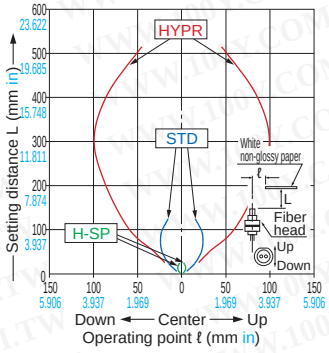


FD-41 — Reflective type

Horizontal direction

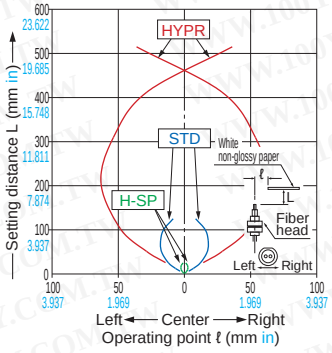


Vertical direction

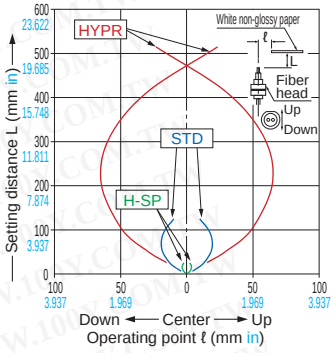


FD-41S — Reflective type

Horizontal direction

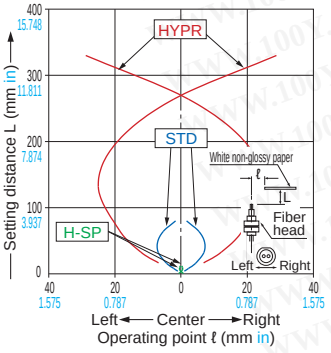


Vertical direction

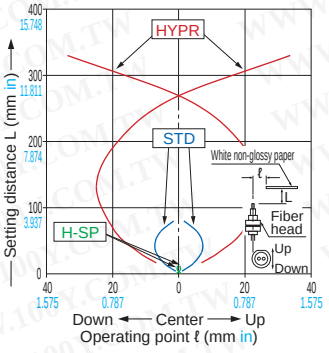


FD-41SW — Reflective type

Horizontal direction

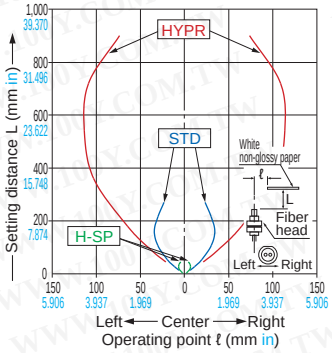


Vertical direction

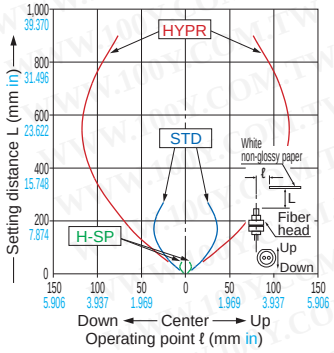


FD-41W — Reflective type

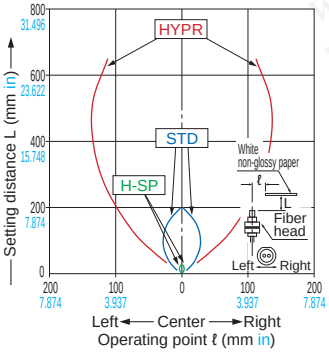
Horizontal direction



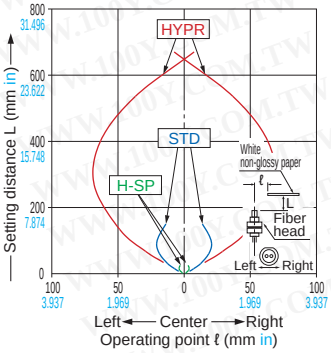
Vertical direction



FD-42G — Reflective type

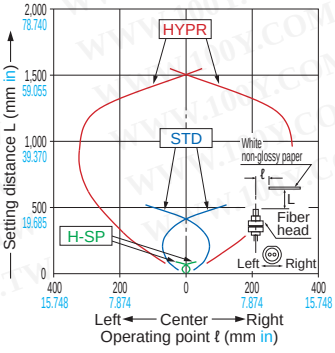


FD-42GW — Reflective type

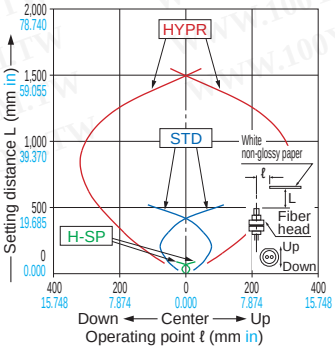


FD-60 — Reflective type

Horizontal direction



Vertical direction



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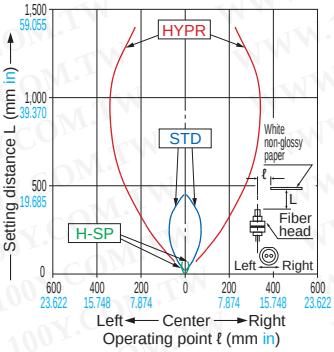
SENSING CHARACTERISTICS (TYPICAL)

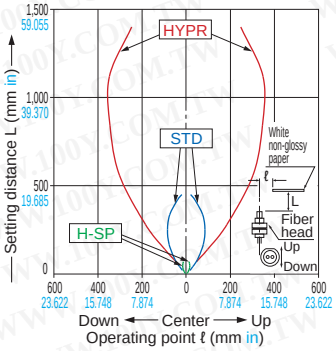
Reflective type Sensing field Sensing characteristics are listed in the alphabetic order of the Model No.

FD-61 Reflective type

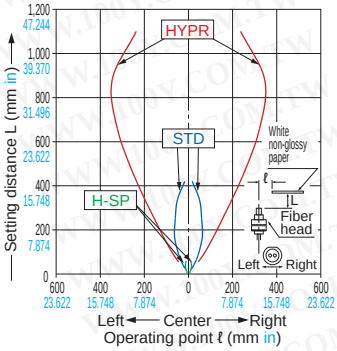
Horizontal direction



Vertical direction

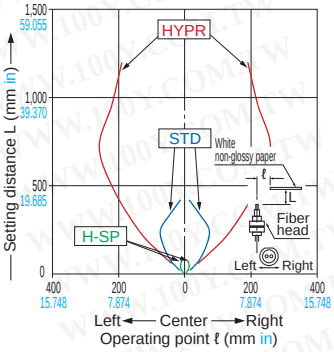


FD-61G Reflective type

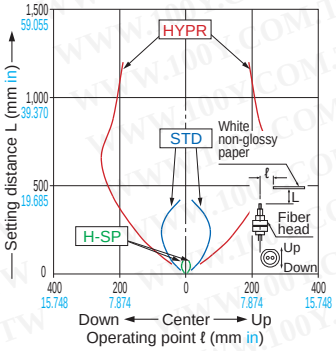


FD-61S Reflective type

Horizontal direction

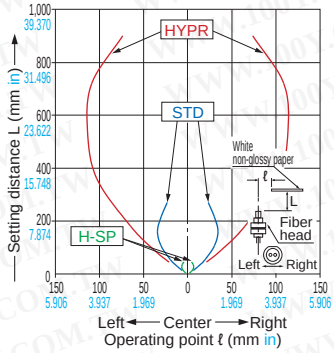


Vertical direction

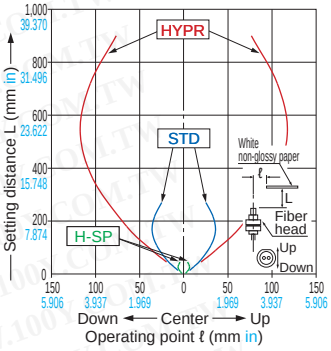


FD-61W Reflective type

Horizontal direction

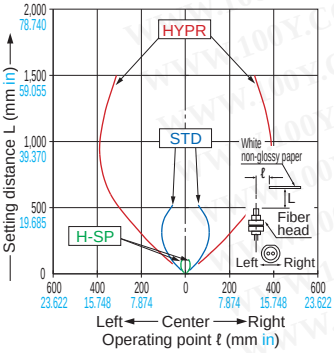


Vertical direction

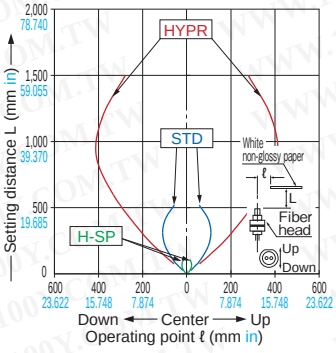


FD-62 Reflective type

Horizontal direction

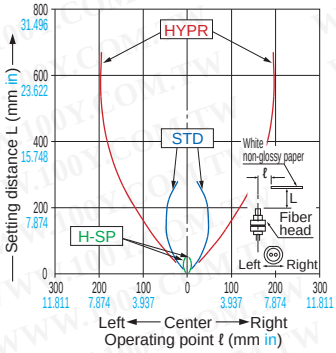


Vertical direction

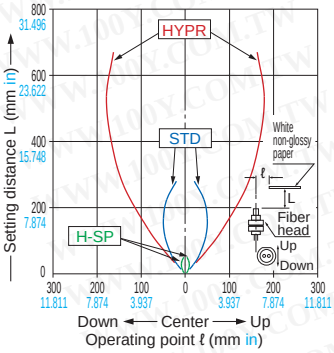


FD-64X Reflective type

Horizontal direction

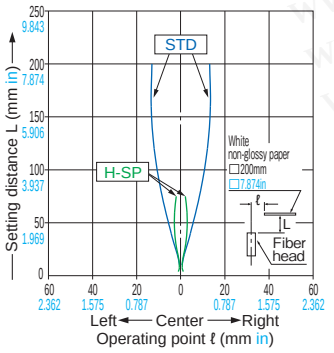


Vertical direction

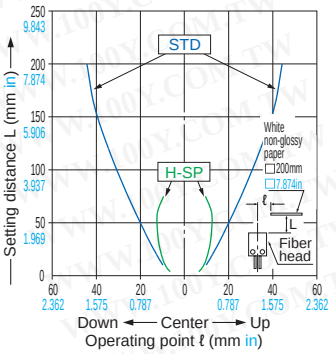


FD-A16 Reflective type

Horizontal direction

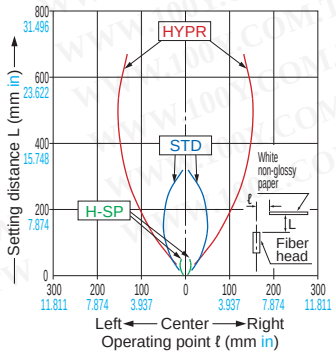


Vertical direction

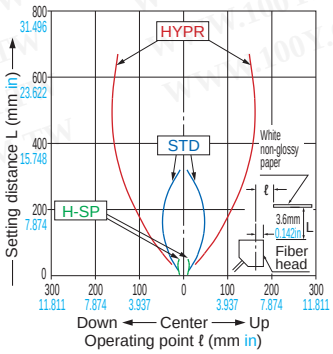


FD-AL11 Reflective type

Horizontal direction



Vertical direction



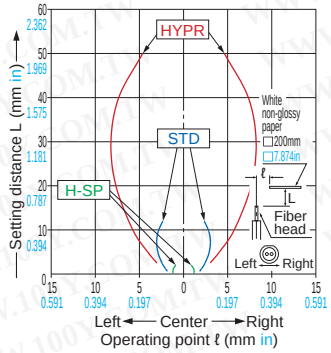
SENSING CHARACTERISTICS (TYPICAL)

Reflective type Sensing field

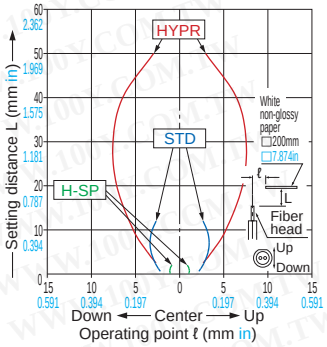
Sensing characteristics are listed in the alphabetic order of the Model No.

FD-E13 Reflective type

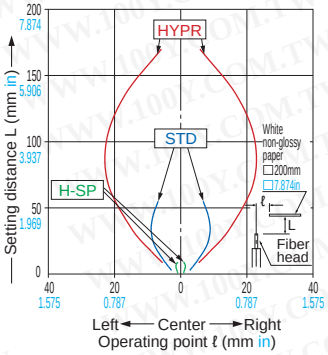
Horizontal direction



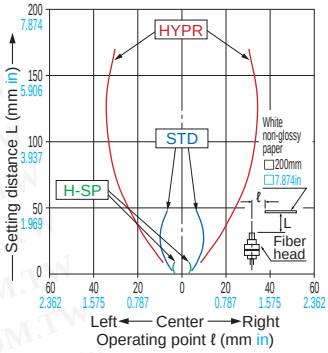
Vertical direction



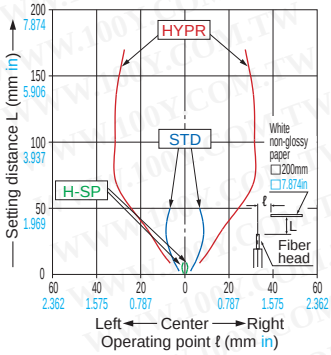
FD-E23 Reflective type



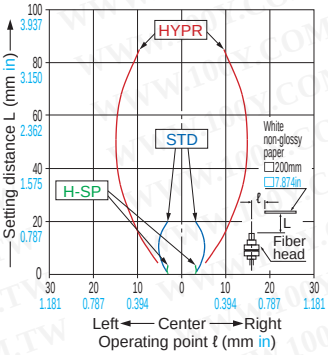
FD-EG30 Reflective type



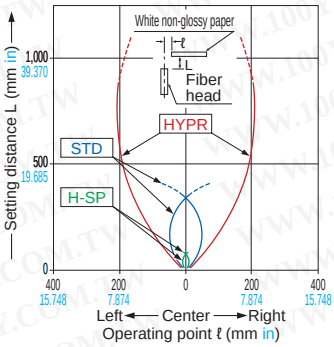
FD-EG30S Reflective type



FD-EG31 Reflective type

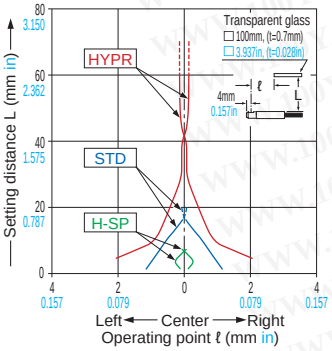


FD-H13-FM2 Reflective type

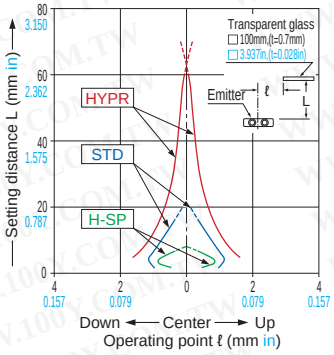


FD-H18-L31 Reflective type

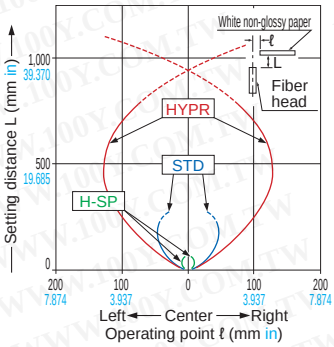
Horizontal direction



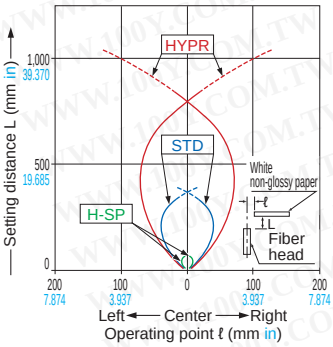
Vertical direction



FD-H20-21 Reflective type

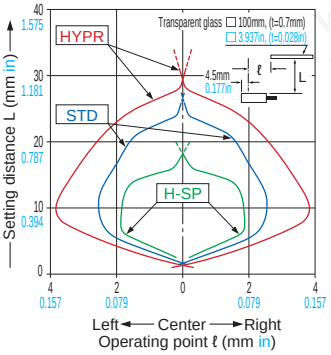


FD-H20-M1 Reflective type

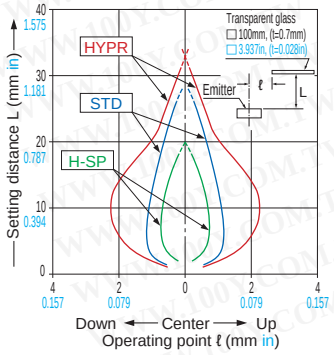


FD-H25-L43 Reflective type

Horizontal direction



Vertical direction



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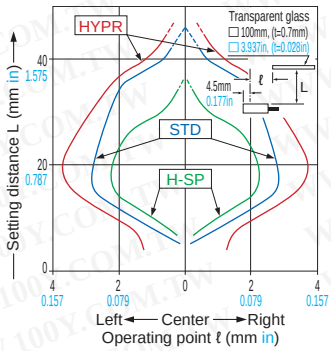
SENSING CHARACTERISTICS (TYPICAL)

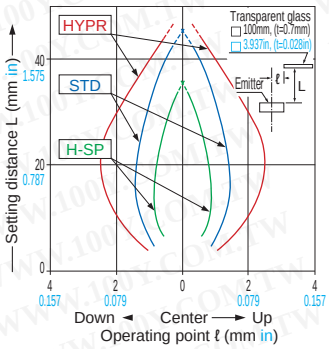
Reflective type Sensing field Sensing characteristics are listed in the alphabetic order of the Model No. (Models with same sensing characteristics are grouped together.)

FD-H25-L45 — Reflective type

Horizontal direction

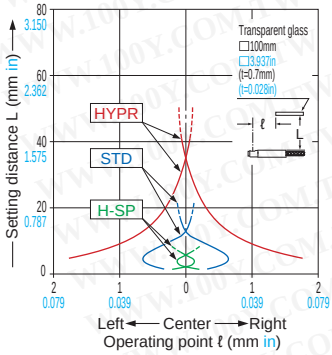


Vertical direction

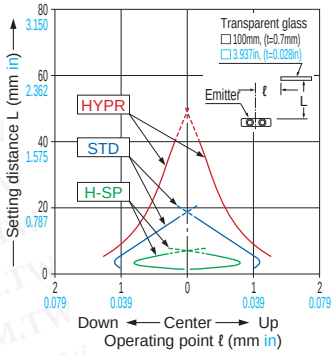


FD-H30-L32 — Reflective type

Horizontal direction

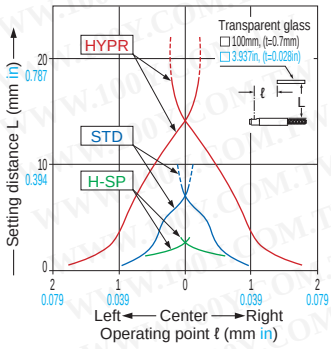


Vertical direction

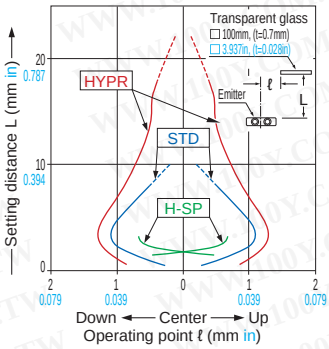


FD-H30-L32V-S — Reflective type

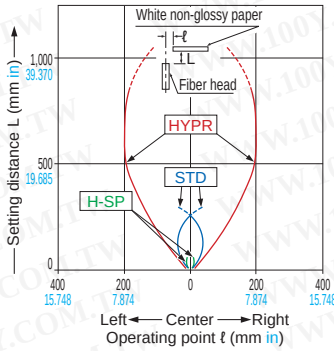
Horizontal direction



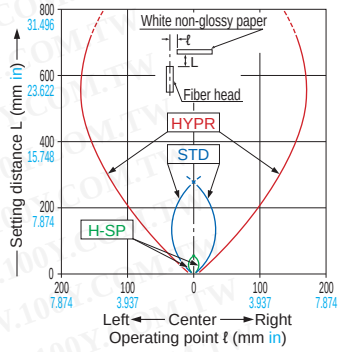
Vertical direction



FD-H35-20S — Reflective type

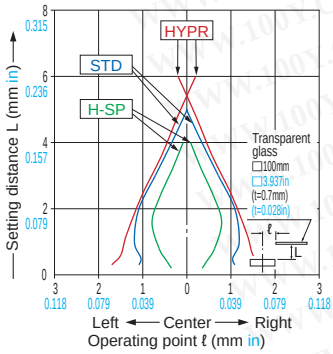


FD-H35-M2 / FD-H35-M2S6 — Reflective type

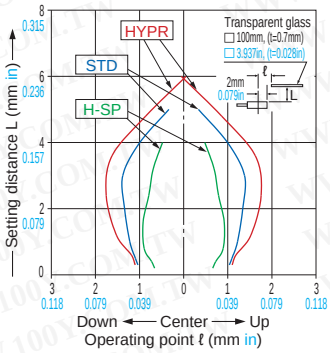


FD-L10 — Reflective type

Horizontal direction

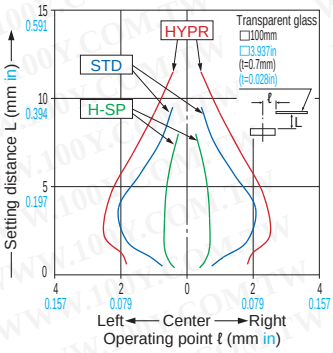


Vertical direction

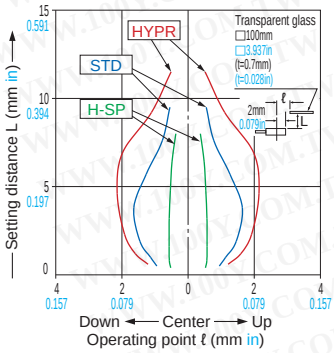


FD-L11 — Reflective type

Horizontal direction

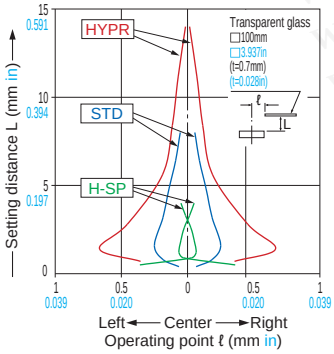


Vertical direction

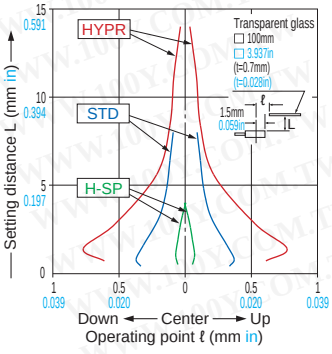


FD-L12W — Reflective type

Horizontal direction

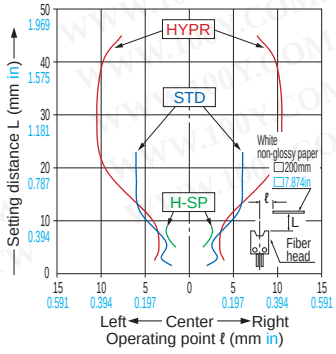


Vertical direction

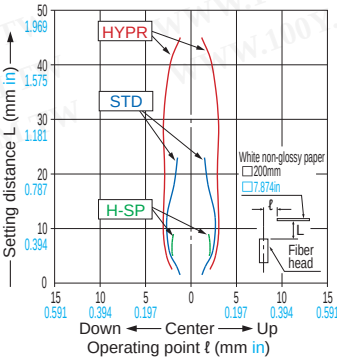


FD-L20H — Reflective type

Horizontal direction



Vertical direction



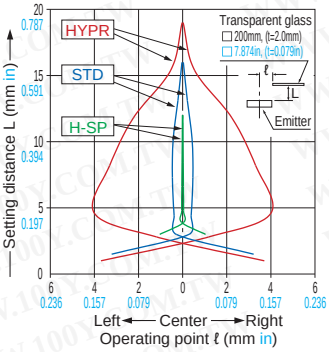
SENSING CHARACTERISTICS (TYPICAL)

Reflective type Sensing field

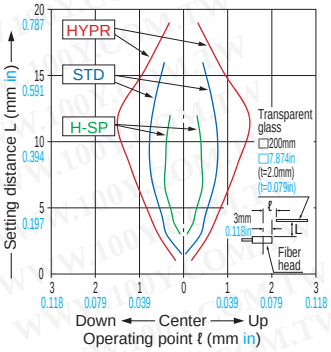
Sensing characteristics are listed in the alphabetic order of the Model No.

FD-L21 — Reflective type

Horizontal direction

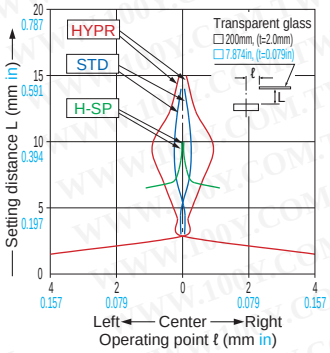


Vertical direction

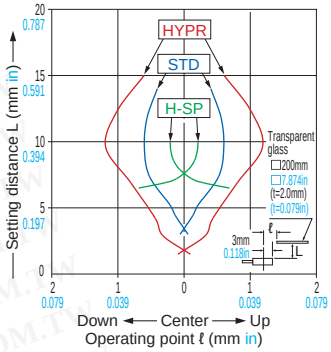


FD-L21W — Reflective type

Horizontal direction

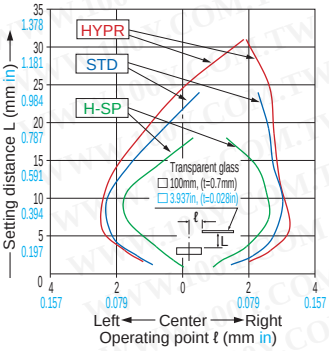


Vertical direction

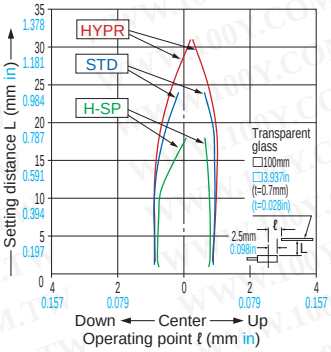


FD-L22A — Reflective type

Horizontal direction

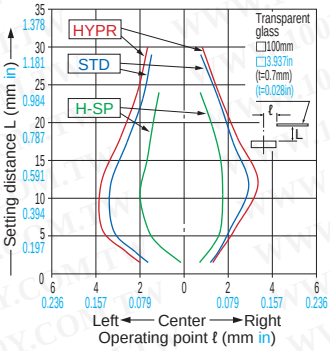


Vertical direction

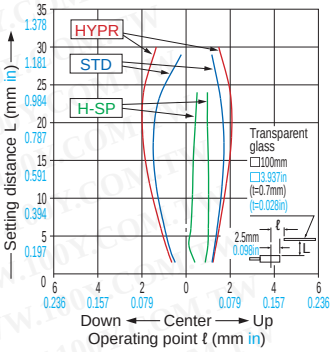


FD-L23 — Reflective type

Horizontal direction

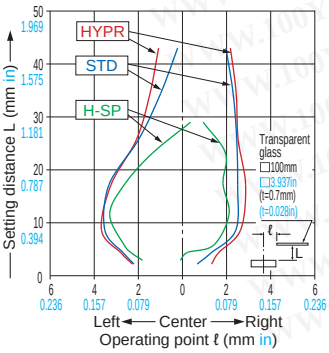


Vertical direction

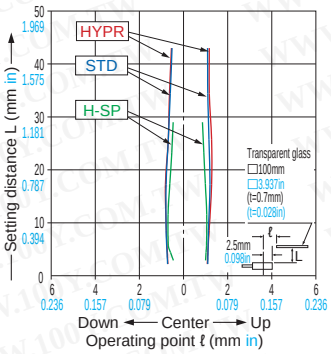


FD-L30A — Reflective type

Horizontal direction

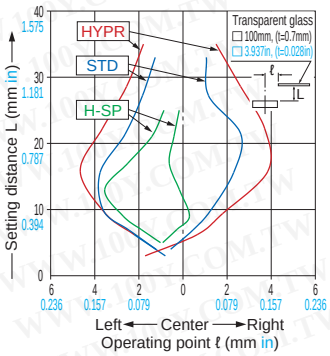


Vertical direction

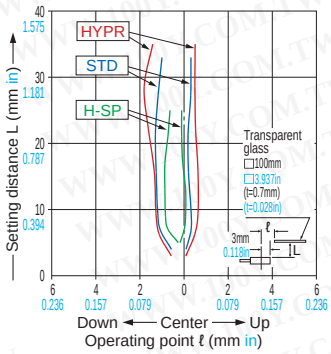


FD-L31A — Reflective type

Horizontal direction

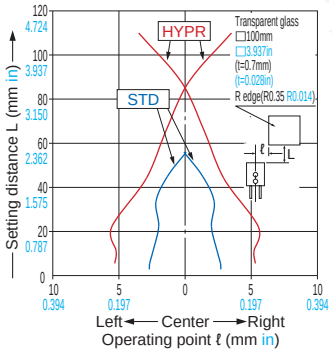


Vertical direction

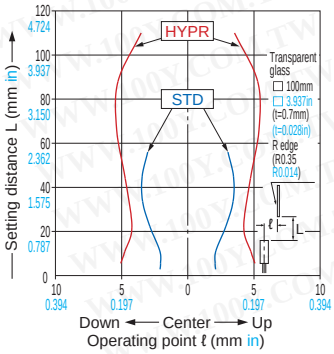


FD-L32H — Reflective type

Horizontal direction

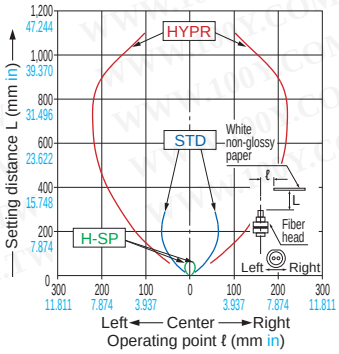


Vertical direction

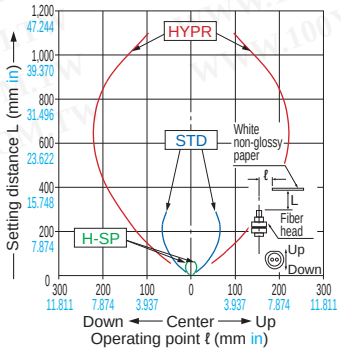


FD-R60 — Reflective type

Horizontal direction



Vertical direction

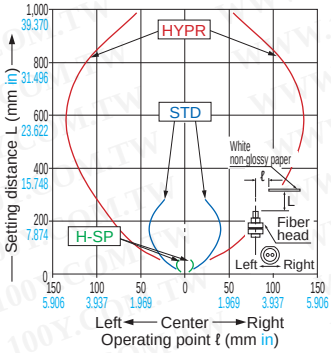


SENSING CHARACTERISTICS (TYPICAL)

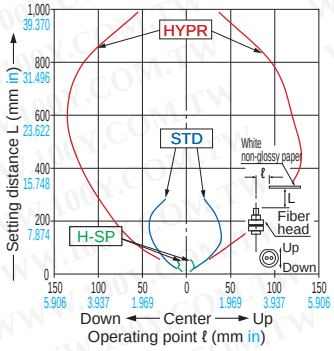
Reflective type Sensing field Sensing characteristics are listed in the alphabetic order of the Model No.

FD-R61Y — Reflective type

Horizontal direction

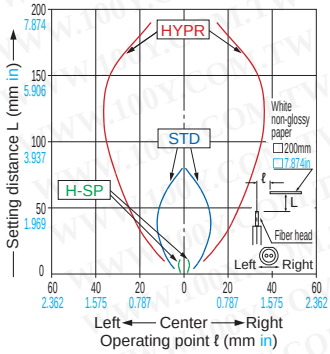


Vertical direction

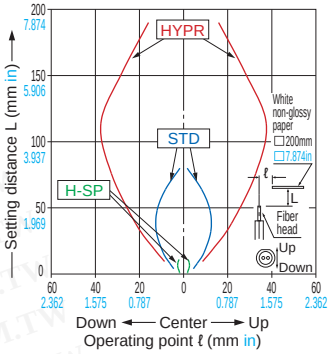


FD-S21 — Reflective type

Horizontal direction

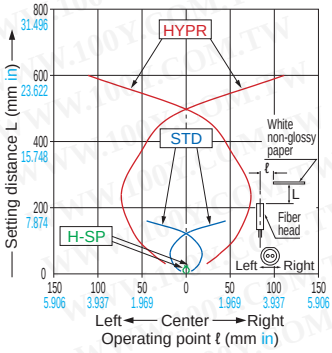


Vertical direction

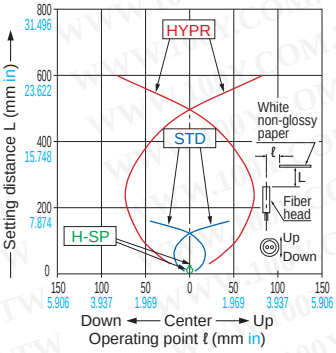


FD-S30 — Reflective type

Horizontal direction

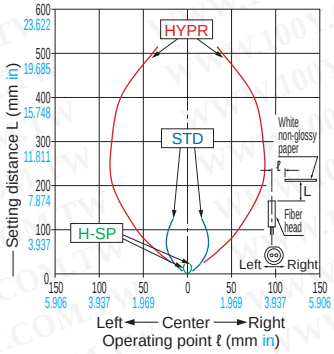


Vertical direction

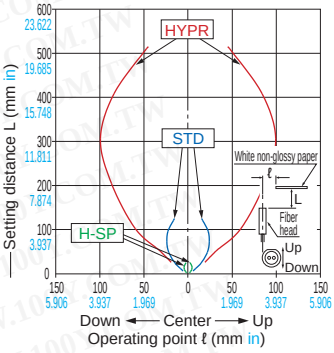


FD-S31 — Reflective type

Horizontal direction

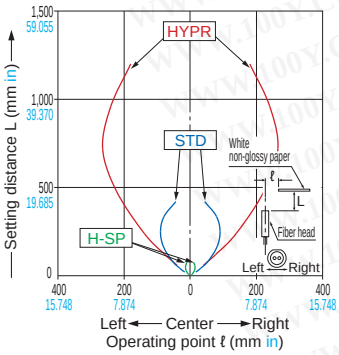


Vertical direction

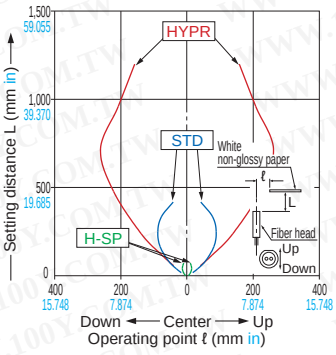


FD-S32 — Reflective type

Horizontal direction

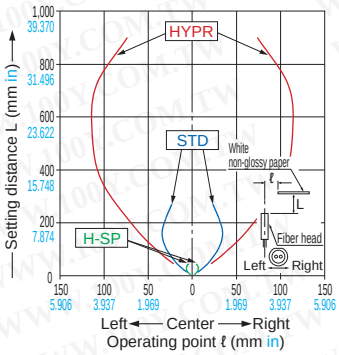


Vertical direction

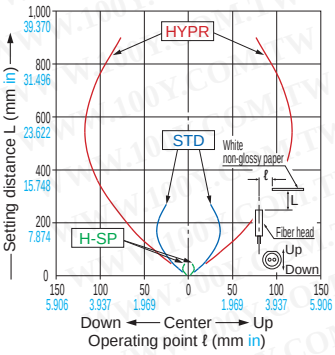


FD-S32W — Reflective type

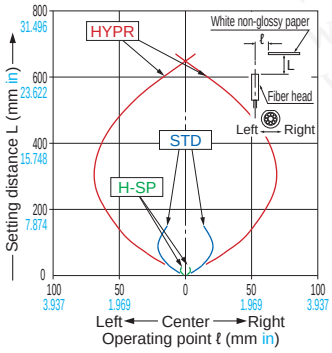
Horizontal direction



Vertical direction

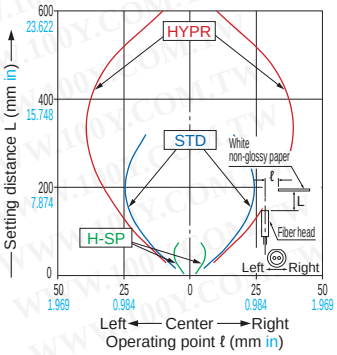


FD-S33GW — Reflective type

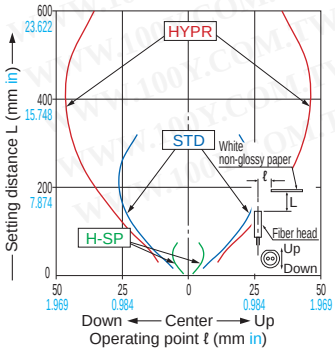


FD-S60Y — Reflective type

Horizontal direction



Vertical direction



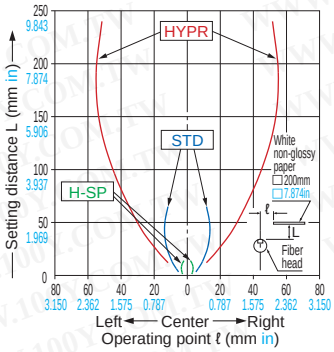
SENSING CHARACTERISTICS (TYPICAL)

Reflective type Sensing field

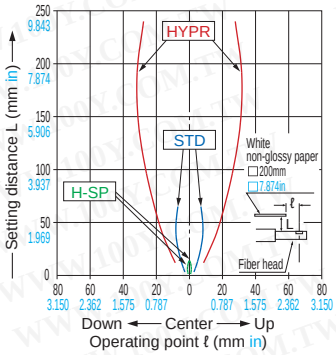
Sensing characteristics are listed in the alphabetic order of the Model No.

FD-V30 — Reflective type

Horizontal direction

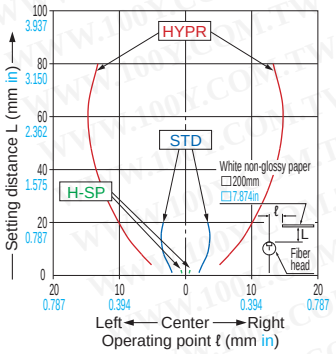


Vertical direction

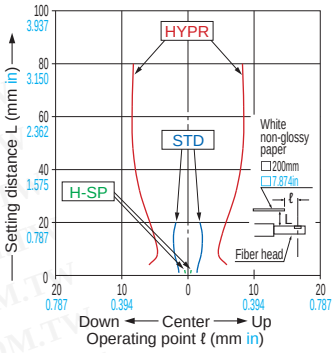


FD-V30W — Reflective type

Horizontal direction

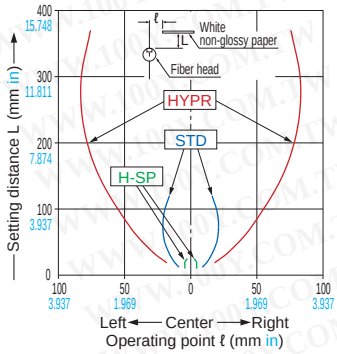


Vertical direction

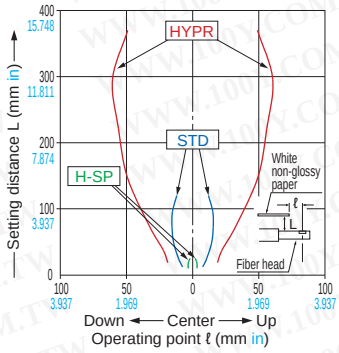


FD-V50 — Reflective type

Horizontal direction

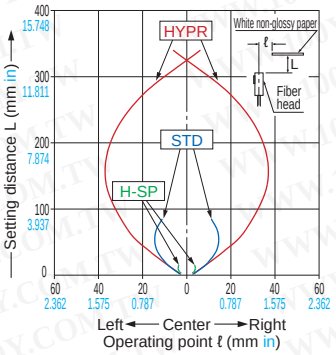


Vertical direction

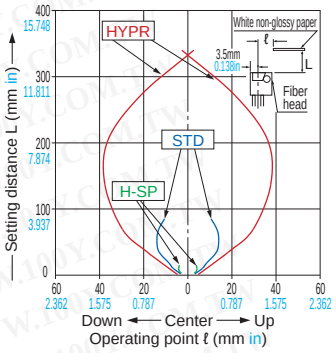


FD-Z20HBW — Reflective type

Horizontal direction

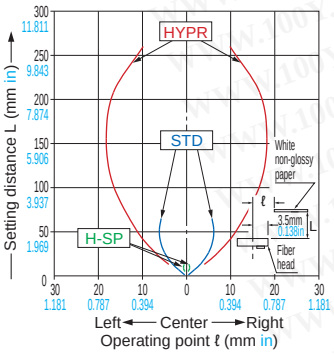


Vertical direction

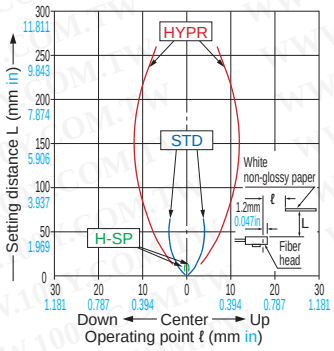


FD-Z20W — Reflective type

Horizontal direction

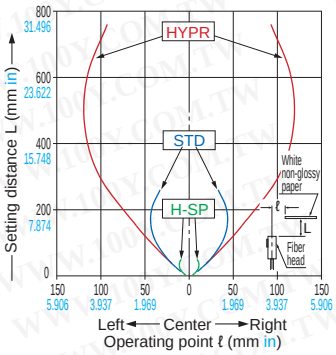


Vertical direction

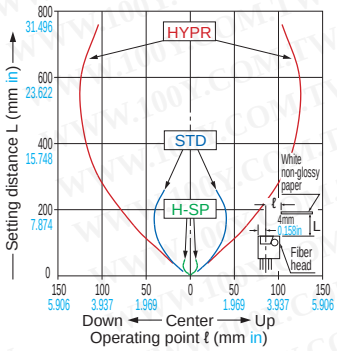


FD-Z40HBW — Reflective type

Horizontal direction

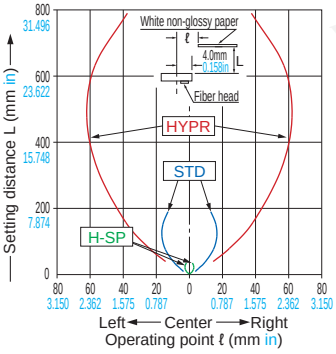


Vertical direction

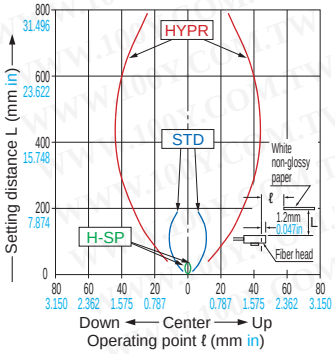


FD-Z40W — Reflective type

Horizontal direction

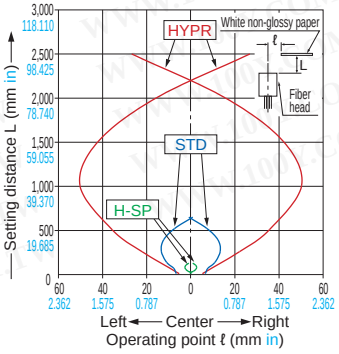


Vertical direction

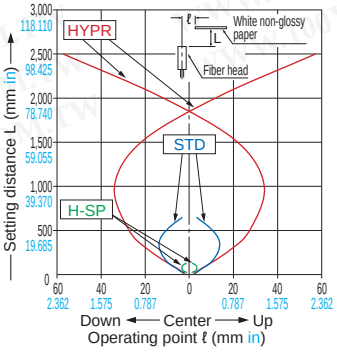


FD-Z50HW — Reflective type

Horizontal direction



Vertical direction



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 reted 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 mm^2 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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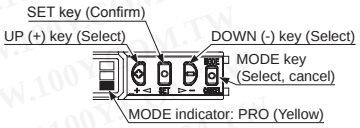
PRECAUTIONS FOR PROPER USE

Abstract from "PRO MODE OPERATION MANUAL"

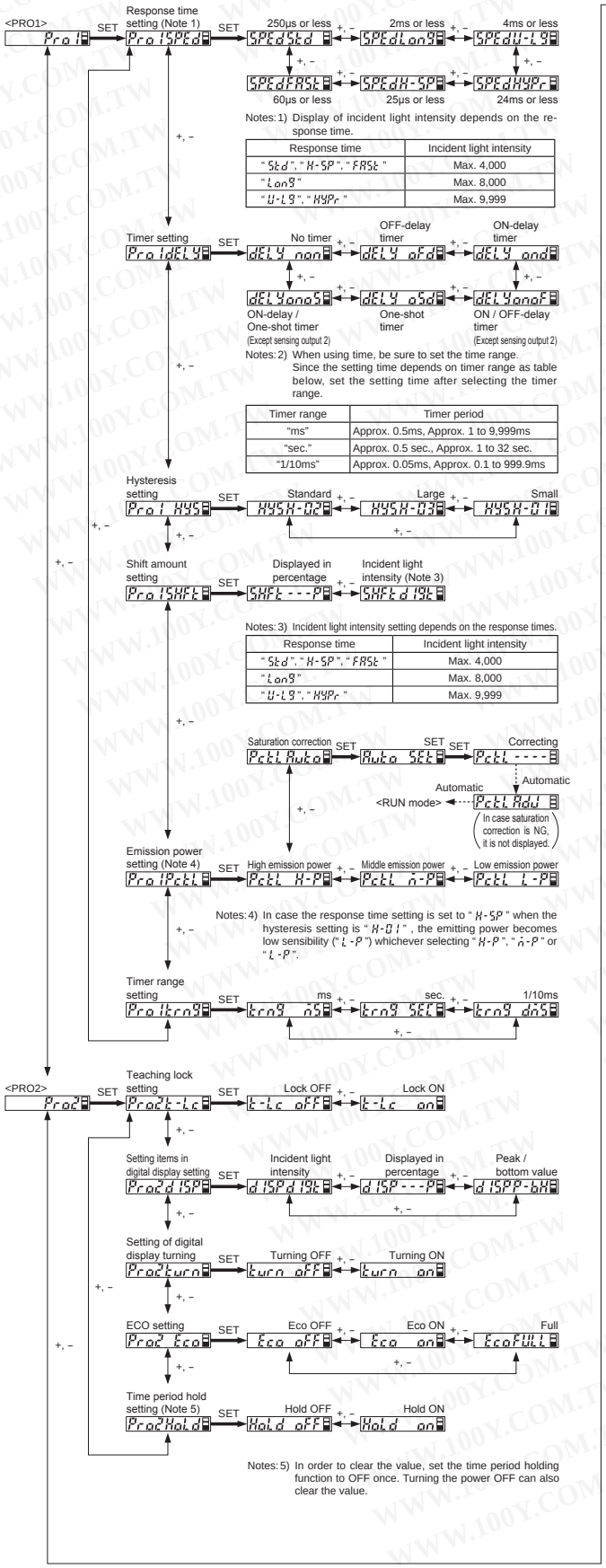
Part description

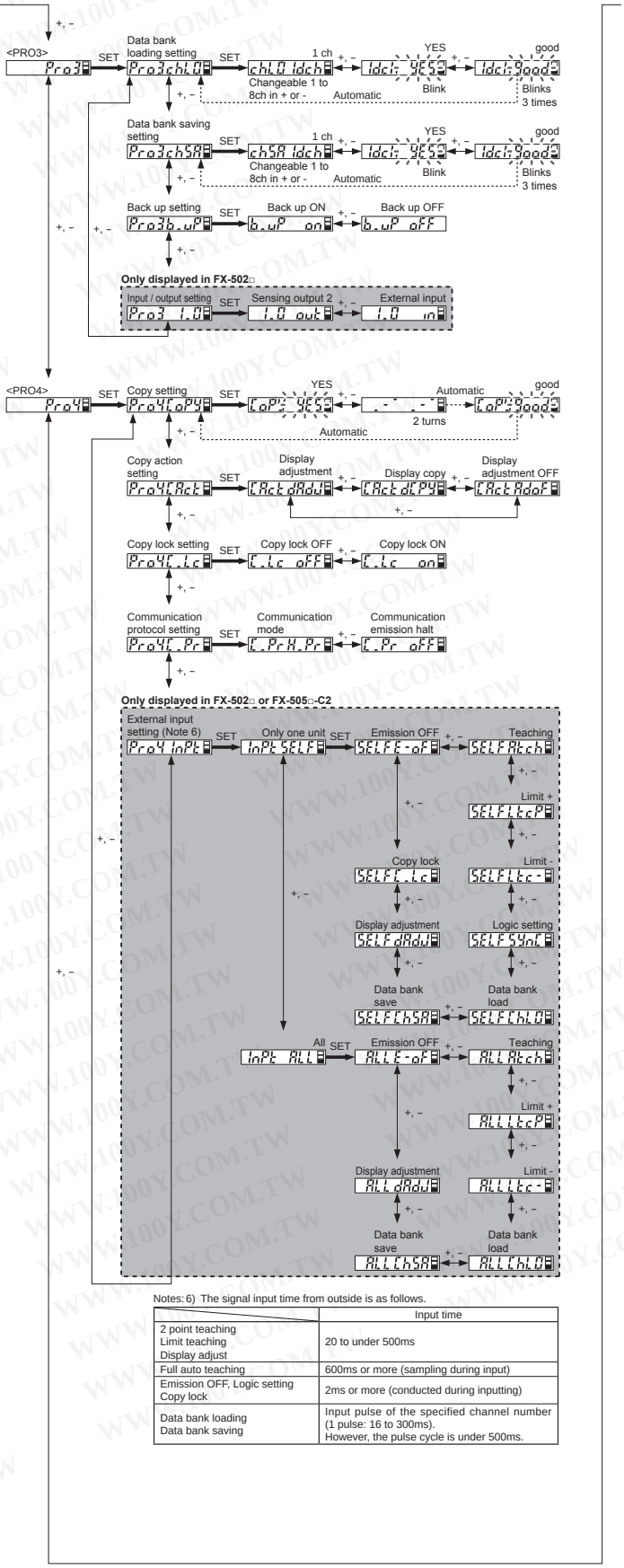


Symbol explanation

SET: Press the SET key.
+, −: Press the UP (+) key or DOWN (-) key.
Automatic: Automatically move to next

PRO mode





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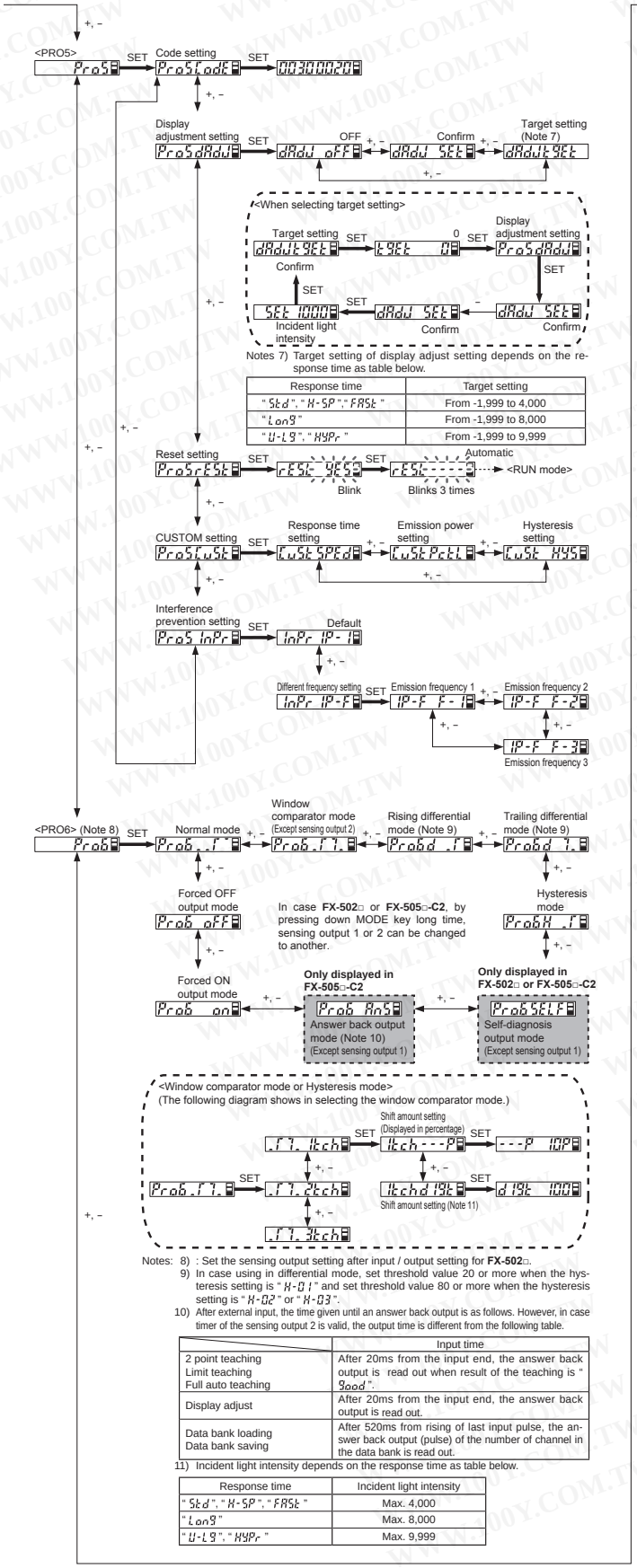
PRECAUTIONS FOR PROPER USE

Abstract from "PRO MODE OPERATION MANUAL"



Notes: 8) : Set the sensing output setting after input / output setting for **FX-502□**.

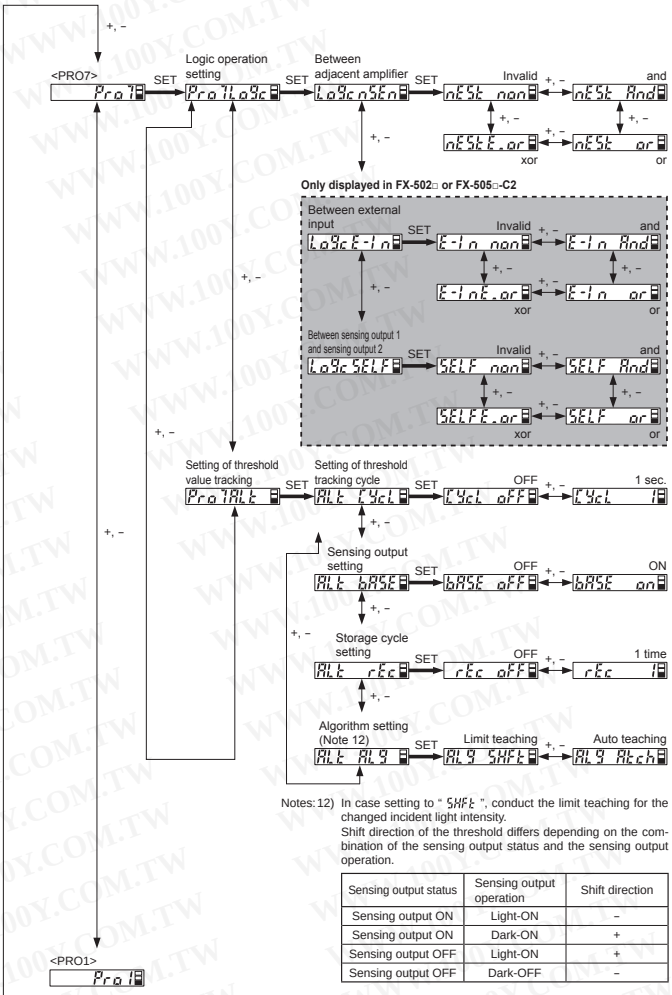
9) In case using in differential mode, set threshold value 20 or more when the hysteresis setting is "H-01" and set threshold value 80 or more when the hysteresis setting is "H-02" or "H-03".

10) After external input, the time given until an answer back output is as follows. However, in case timer of the sensing output 2 is valid, the output time is different from the following table.

	Input time
2 point teaching Limit teaching Full auto teaching	After 20ms from the input end, the answer back output is read out when result of the teaching is "Good".
Display adjust	After 20ms from the input end, the answer back output is read out.
Data bank loading Data bank saving	After 520ms from rising of last input pulse, the answer back output (pulse) of the number of channel in the data bank is read out.

11) Incident light intensity depends on the response time as table below.

Response time	Incident light intensity
"Std", "H-SP", "FAST"	Max. 4,000
"Long"	Max. 8,000
"U-LG", "HYPr"	Max. 9,999



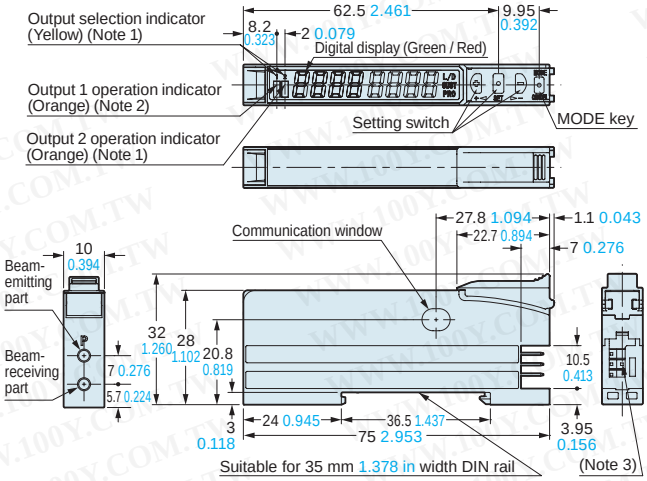
Notes: 12) In case setting to "SHFt", conduct the limit teaching for the changed incident light intensity.
Shift direction of the threshold differs depending on the combination of the sensing output status and the sensing output operation.

Sensing output status	Sensing output operation	Shift direction
Sensing output ON	Light-ON	–
Sensing output ON	Dark-ON	+
Sensing output OFF	Light-ON	+
Sensing output OFF	Dark-ON	–

DIMENSIONS (Unit: mm in)

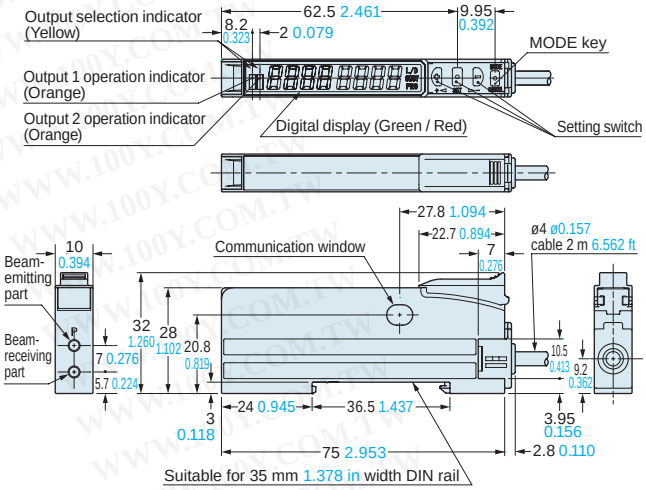
Refer to p.48 ~ for details of fiber dimensions.
The CAD data in the dimensions can be downloaded from our website.

FX-501(P) FX-502(P) — Amplifier



Notes: 1) **FX-502(P)** only
2) **FX-501(P)**: Operation indicator
3) **FX-501(P)**: 3-pin, **FX-502(P)**: 4-pin

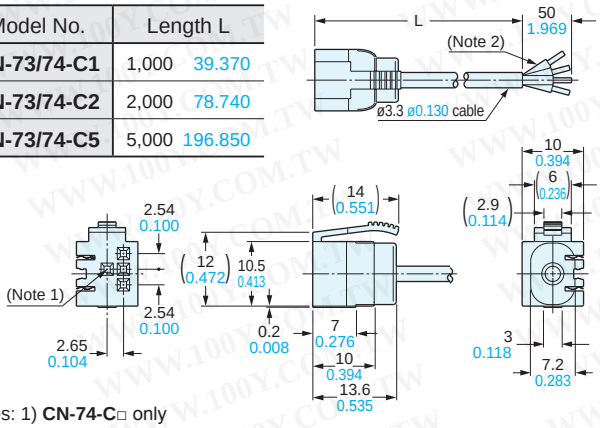
FX-505-C2 FX-505P-C2 — Amplifier



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

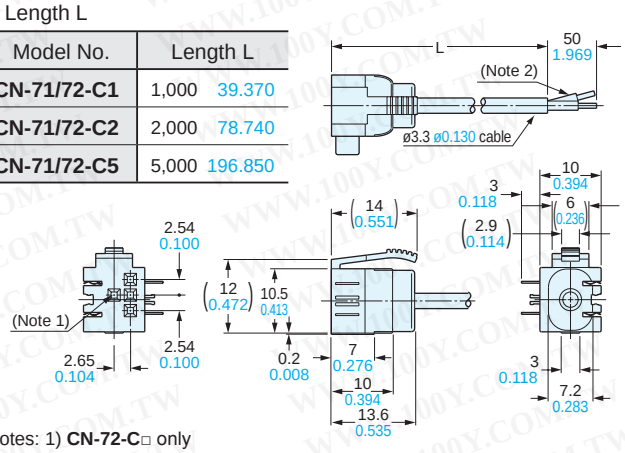


Notes: 1) **CN-74-C□** only
2) **CN-73-C□**: 3-core

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

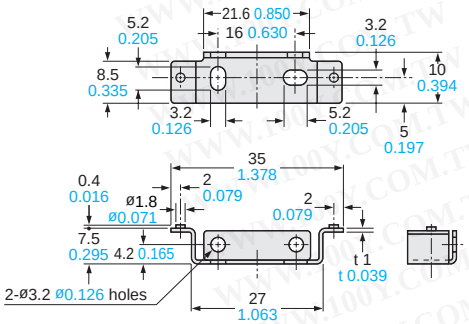
• Length L

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



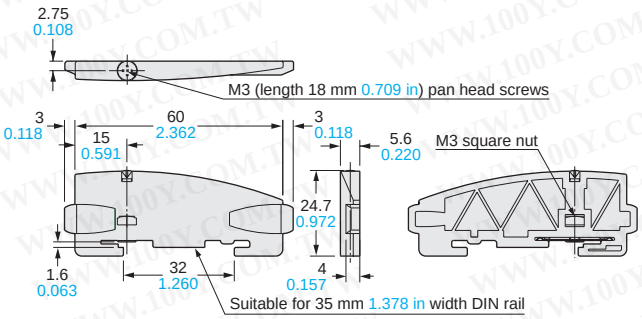
Notes: 1) **CN-72-C□** only
2) **CN-71-C□**: 1-core

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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MEMO

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Digital Fiber Sensor
FX-100 SERIES

Taking fiber sensors to the next level

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

Conforming to EMC Directive

Listing

PNP output type available | Timer | Interference prevention | Light intensity monitor

Automatic sensitivity setting | Test input

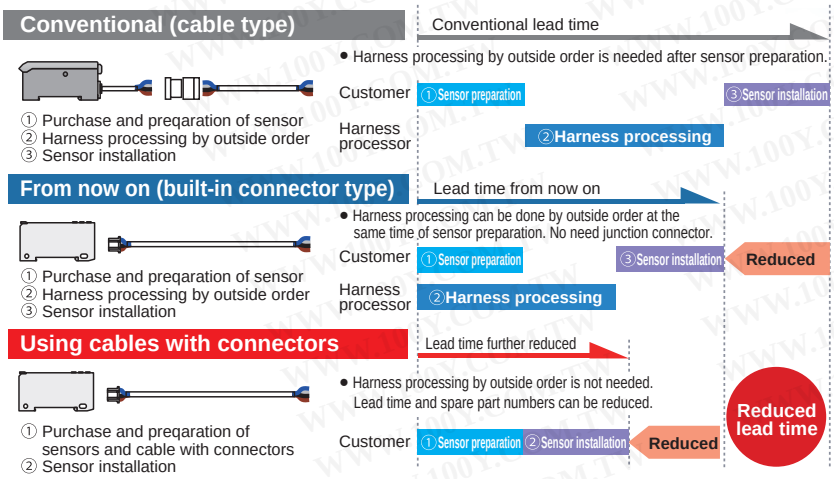
Good dual digital display

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

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

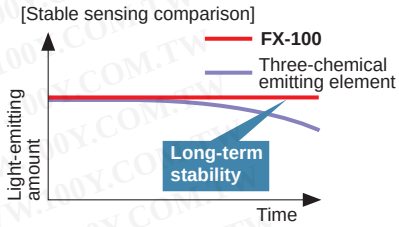


Saving-space with a width of 9 mm 0.354 in

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.

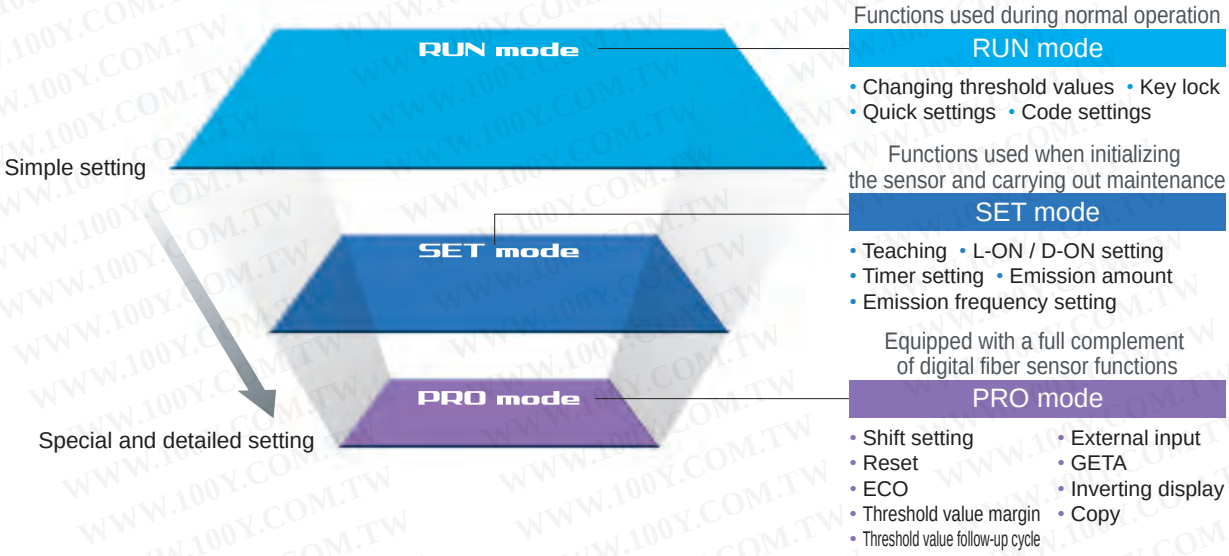
Improved stability over long terms

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

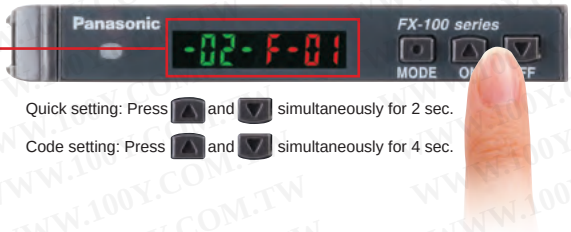
Continued to use the configuration system of digital pressure sensor **DP-100** series, which has received high popularity since its release. We have separated the settings into three levels: RUN mode, SET mode, and PRO mode, making operation simpler and easier.



Quick code input function

RUN mode

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

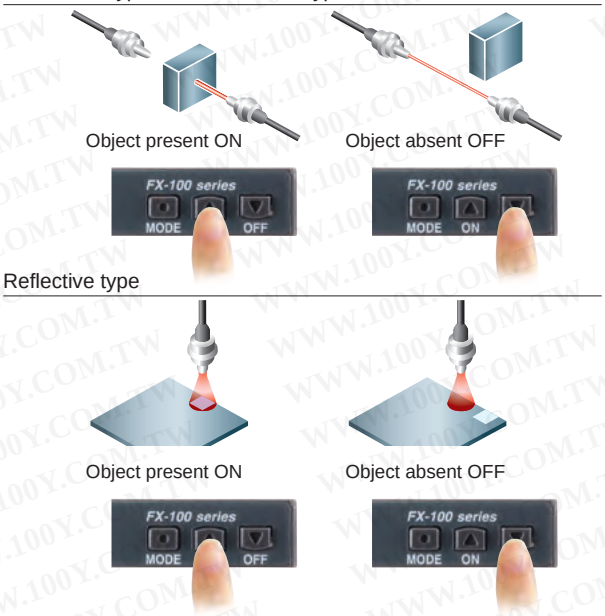
Teaching with ON / OFF keys

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



■ Teaching even without an object — Limit teaching function

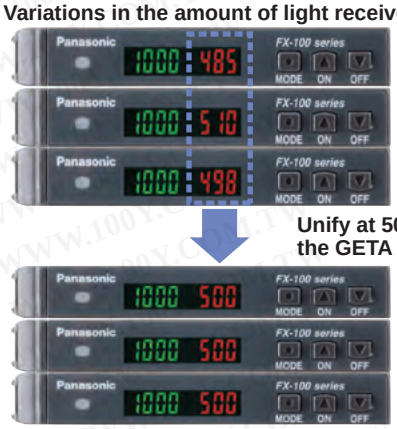
Threshold value can be set by performing teaching only when an object is absent (when the incident light amount is stable). This is useful when there are other objects in the background also when defecting a minute objects. Teaching can also be carried out using external input.

Resolves variation in incident light intensity display GETA function

PRO mode

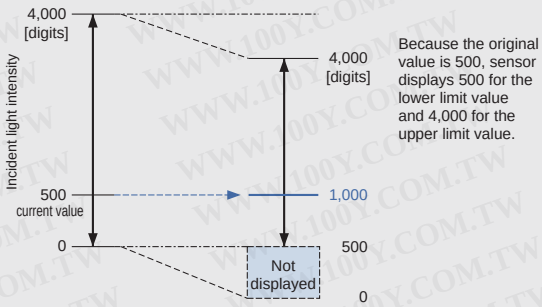
Even when performing the same sensing operation, there may be variances in the digital values of the fiber amp. There is no problem with the sensor itself, but the operator may find it troubling.
Given value can be corrected with the GETA function, so the apparent variation can be eliminated and the 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'

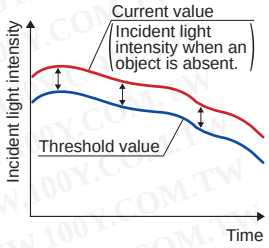


Threshold value follow-up cycle setting function

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.

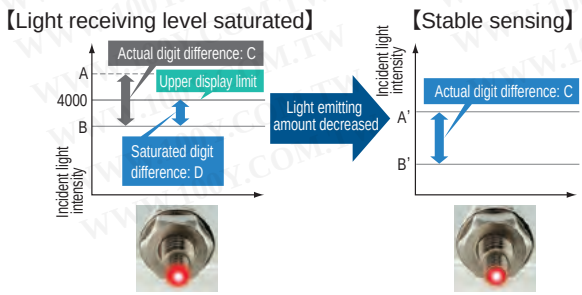
* Effective when the output operation is set to Dark-ON, and when using thru-beam type or retroreflective type fibers.



Emission amount setting function

SET mode

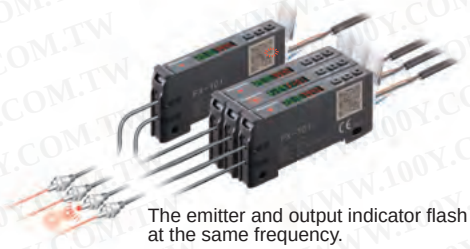
Emission amount can be reduced in order to achieve stable detection when the receiving light level is saturated, such as detection at close range and detection of transparent or minute objects. Previously, the emission amount level was only one, but from production in December 2007, four level setting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



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.

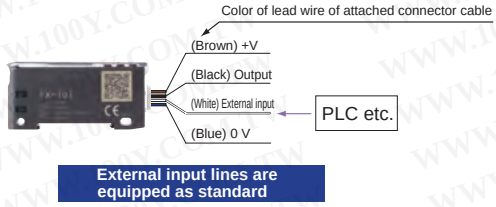
* When the emission frequency is changed, a response time is also changed.



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

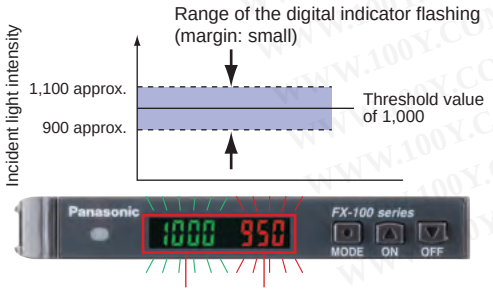
The viewing orientation of the digital display can be inverted in accordance with the setting direction of the amplifier.

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>

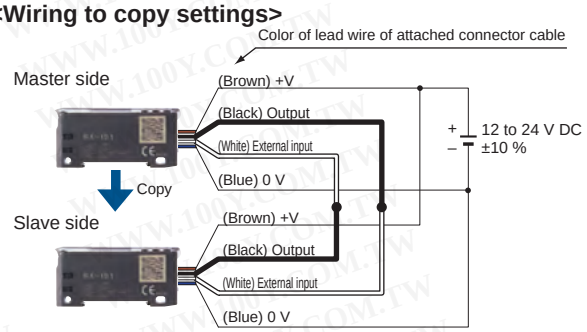
The amount of light received ranges from about 900 to 1,100 when the digital indicator flashes.



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-B8)	Response time
FX-101	Standard type	400 mm 15.748 in	Max. 250 µs
FX-102	Long sensing range type	1,150 mm 45.276 in	Max. 2.5 ms

Power consumption saving with ECO mode

ECO

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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ORDER GUIDE

Amplifiers

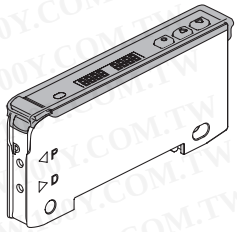
Type			Appearance	Model No.	Emitting element	Output
Standard type	M8 plug-in connector type			**FX-101** (Note 2)	Red LED	NPN open-collector transistor
				FX-101-Z (Note 3)		NPN open-collector transistor
				FX-101P (Note 2)		PNP open-collector transistor
	M8 plug-in connector type			**FX-101P-Z** (Note 3)		PNP open-collector transistor
	Cable set (Note 1)			**FX-101-CC2**		NPN open-collector transistor
				FX-101P-CC2		PNP open-collector collector transistor
Long sensing range type	M8 plug-in connector type			**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
	M8 plug-in connector type			**FX-102P-Z** (Note 3)		PNP open-collector transistor
	Cable set (Note 1)			**FX-102-CC2**		NPN open-collector transistor
				FX-102P-CC2		PNP open-collector transistor

Notes: 1) The connector attached cable 2 m **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□**.

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.



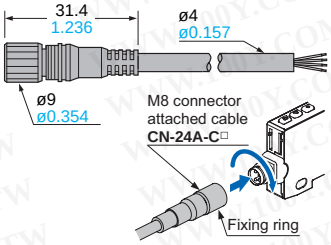
OPTIONS

Designation	Model No.	Description	
Connector attached cable	**CN-14A-C1**	1 m 3.281 ft	0.2 mm² 4-core cabtyre cable with connector on one end Cable outer diameter: ø3.7 mm ø0.146 in
	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	For M8 plug-in connector type The connector on one end Cable outer diameter: ø4 mm ø0.157 in
	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** Two pcs. per set	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**.

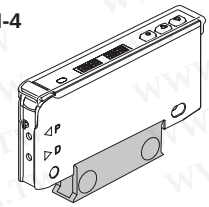
M8 connector attached cable

• **CN-24A-C□**



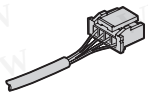
Amplifier mounting bracket

• **MS-DIN-4**



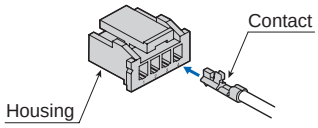
Connector attached cable

• **CN-14A(-R)-C□**



Connector

• **CN-14A**



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.

SPECIFICATIONS

Item	Type	Standard type		Long sensing range type	
			Cable set		Cable set
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 ±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 • Maximum sink current: 100 mA • Applied 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 • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1.5 V or less (at 100 mA source current)	
	Output operation	Selectable either Light-ON or Dark-ON, at SET mode			
	Short-circuit protection	Incorporated			
External input		<NPN output type> NPN non-contact input • 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 • Signal condition High: +4 V to +V DC (Sink current 0.5 to 3 mA) Low: 0 to +0.6 V DC or Open • Input impedance: 10 kΩ approx.	
Response time		Emission frequency 0: 250 µs or less (factory default setting) Emission frequency 1: 450 µs or less Emission frequency 2: 500 µs or less Emission frequency 3: 600 µs 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 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/s² 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 mm², 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.

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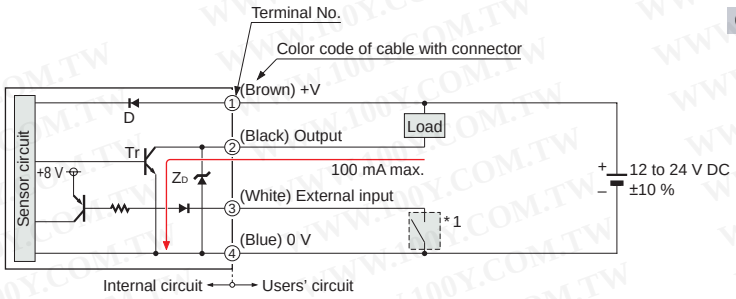
I/O CIRCUIT AND WIRING DIAGRAMS

FX-10□(-Z/-CC2) — NPN output type

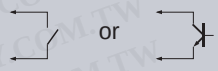
I/O circuit diagram



Symbols … D : Reverse supply polarity protection diode
Z_D: Surge absorption zener diode
Tr : NPN output transistor

*1

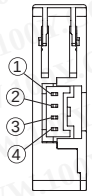
Non-voltage contact or NPN open-collector transistor



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

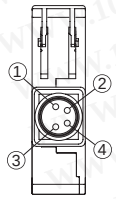
Terminal arrangement diagram

Connector type



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

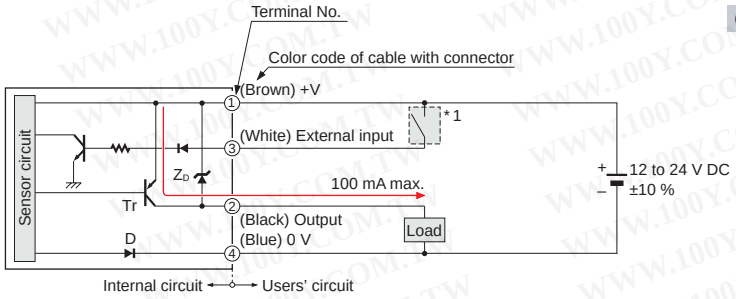
M8 plug-in connector type



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

FX-10□P(-Z/-CC2) — PNP output type

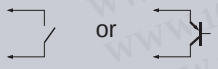
I/O circuit diagram



Symbols … D : Reverse supply polarity protection diode
Z_D: Surge absorption zener diode
Tr : PNP output transistor

*1

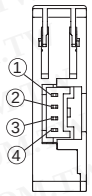
Non-voltage contact or PNP open-collector transistor



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

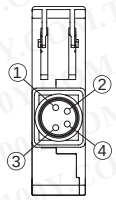
Terminal arrangement diagram

Connector type



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

M8 plug-in connector type

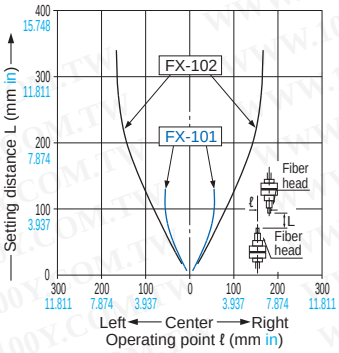


Terminal No.	Function
①	+V
②	Output
③	External input
④	0 V

SENSING CHARACTERISTICS (TYPICAL)

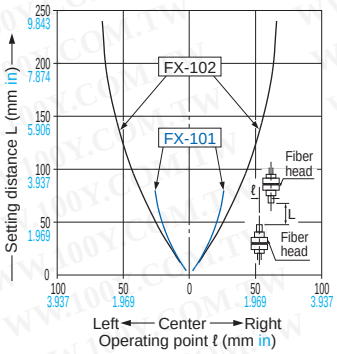
FT-31S — Thru-beam type

Parallel deviation



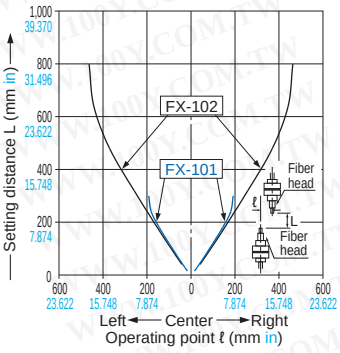
FT-31W — Thru-beam type

Parallel deviation



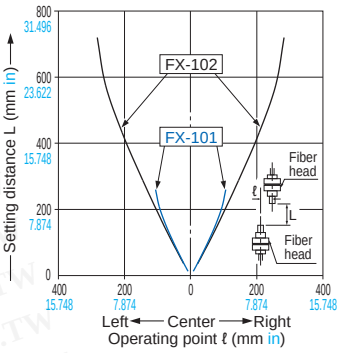
FT-42S — Thru-beam type

Parallel deviation



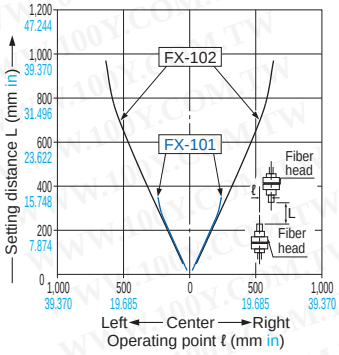
FT-42W — Thru-beam type

Parallel deviation



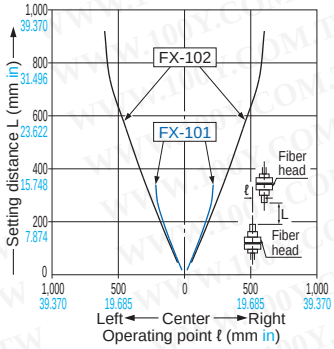
FT-43 — Thru-beam type

Parallel deviation



FT-45X — Thru-beam type

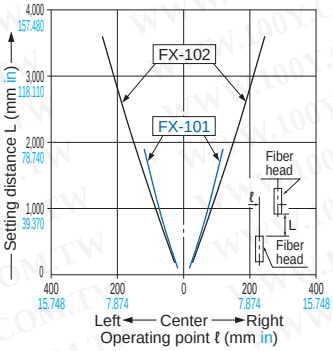
Parallel deviation



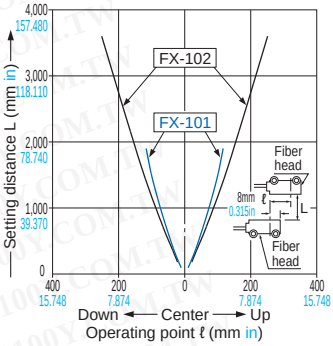
FT-A11 — Thru-beam type

Parallel deviation

- Horizontal direction

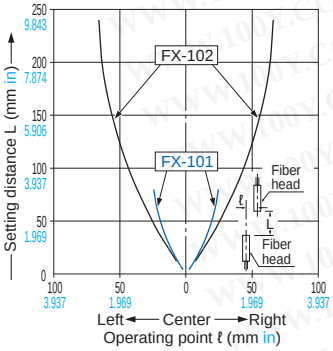


- Vertical direction



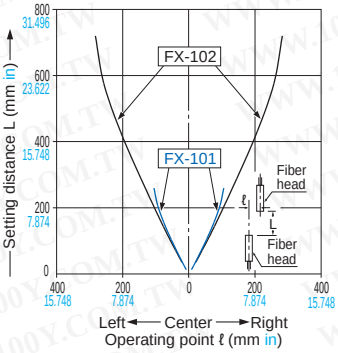
FT-S21W — Thru-beam type

Parallel deviation



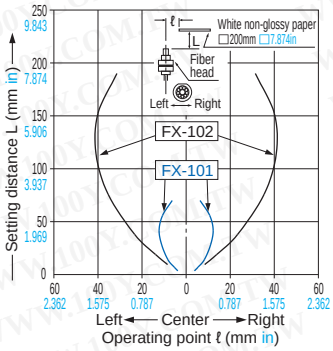
FT-S31W — Thru-beam type

Parallel deviation



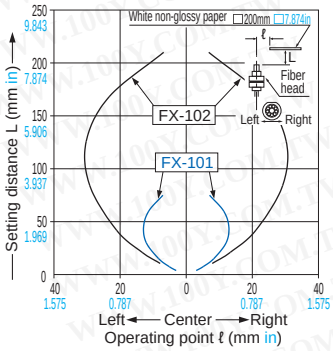
FD-32G — Reflective type

Sensing field



FD-32GX — Reflective type

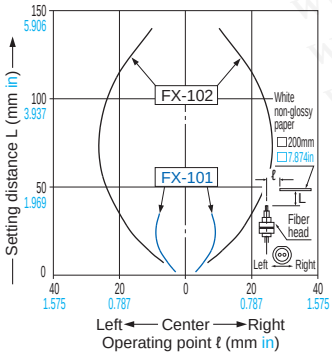
Sensing field



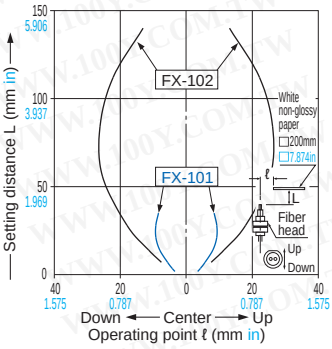
FD-41S — Reflective type

Sensing field

- Horizontal direction



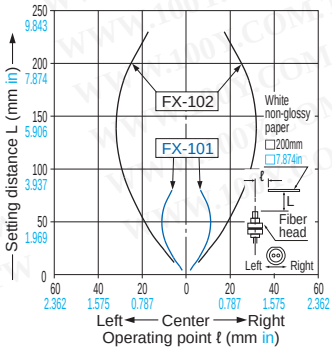
- Vertical direction



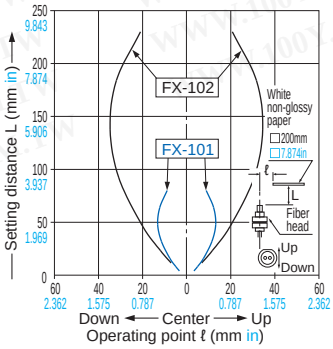
FD-41W — Reflective type

Sensing field

- Horizontal direction



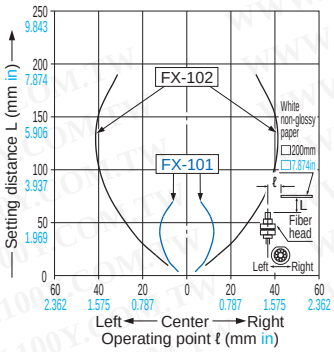
- Vertical direction



SENSING CHARACTERISTICS (TYPICAL)

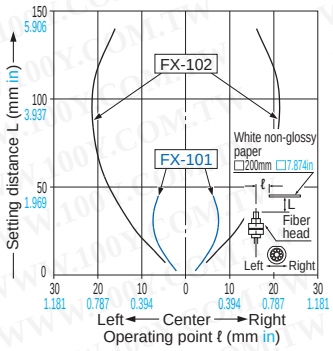
FD-42G Reflective type

Sensing field



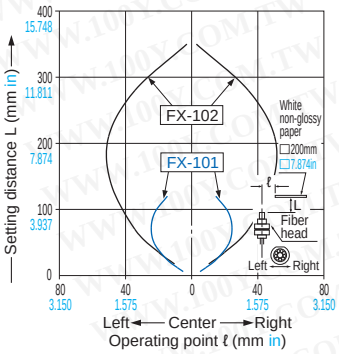
FD-42GW Reflective type

Sensing field



FD-61G Reflective type

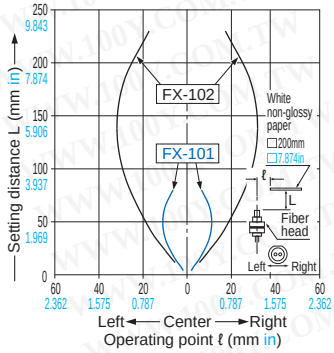
Sensing field



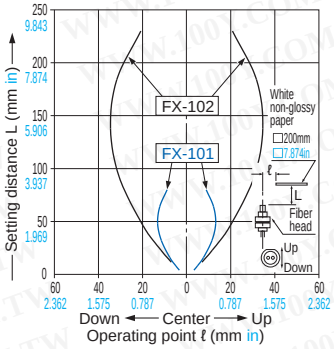
FD-61W Reflective type

Sensing field

• Horizontal direction



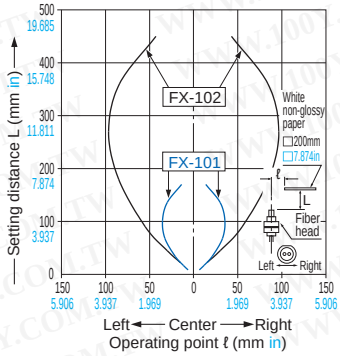
• Vertical direction



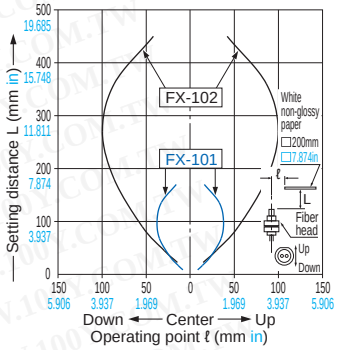
FD-62 Reflective type

Sensing field

• Horizontal direction



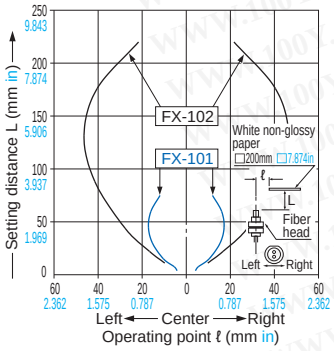
• Vertical direction



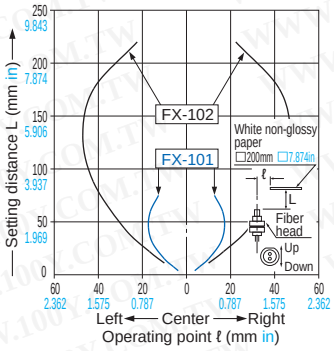
FD-64X Reflective type

Sensing field

• Horizontal direction



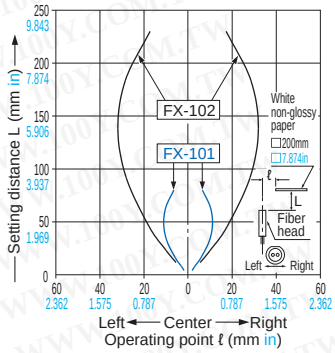
• Vertical direction



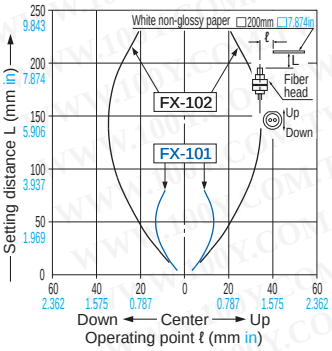
FD-S32W Reflective type

Sensing field

• Horizontal direction

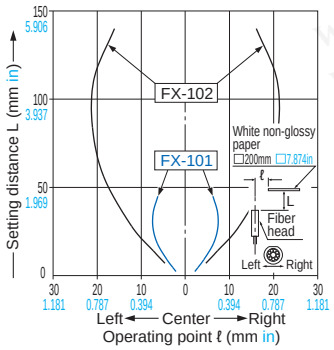


• Vertical direction



FD-S33GW Reflective type

Sensing field



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PRECAUTIONS FOR PROPER USE

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

- 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

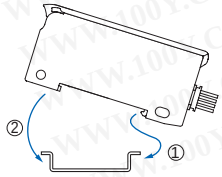
- The **FX-100** series does not use the horizontal connectors that are used with the **FX-300** / **FX-410** series. Please note that horizontal connection cannot be performed using a connector attached cable. In addition, the optical communication function is not equipped on the **FX-100** series, 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

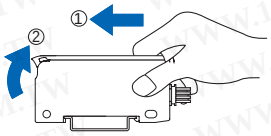
① Fit the rear part of the mounting section of the amplifier on a 35 mm 1.378 in width DIN rail.
② Press down the rear part of the mounting section of the unit on the 35 mm 1.378 in width DIN rail and fit the front part of the mounting section to the DIN rail.



35 mm 1.378 in width DIN rail

How to remove the amplifier

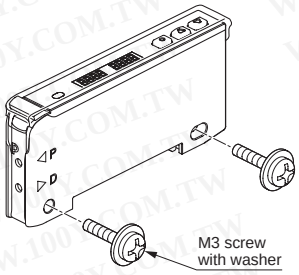
① Push the amplifier forward.
② Lift up the front part of the amplifier to remove it.



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.

<When using screws with washers>

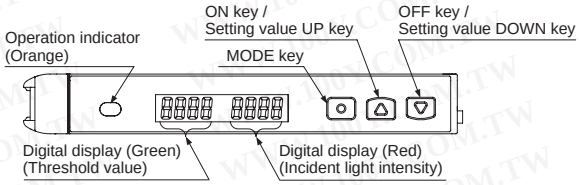
- Use M3 screws with washers for mounting. The tightening torque should be 0.5 N·m or less.



Wiring

- Make sure that the power supply is OFF while adding or removing the amplifiers.
- Note that if a voltage exceeding the reted 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	tAch	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] oFd 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

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

PRO mode

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

Setting item	Factory setting	Description
Shift setting	SHFt 15P [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	InPt t-oF [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 "tESt", 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)	b-uP oFF [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)	CYcL oFF [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)	GEtA oFF [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	Eco oFF [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	turn oFF [OFF]	Digital display can be inverted.
Threshold value margin setting	ALrt oFF [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 GrEn : Green blinks. rEd : Red blinks. ALL : Red and green blink. tn-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	CoPY no [NO]	The settings of the master side amplifier can be copied to the slave side amplifier. For details, refer to "**Setting copy function**".
Reset	rSEt no [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-", "Auto" or "2-Pt" 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,) "HArd" 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-Pt" is set at the external input setting mode. (Incorporated from production in December 2007.)

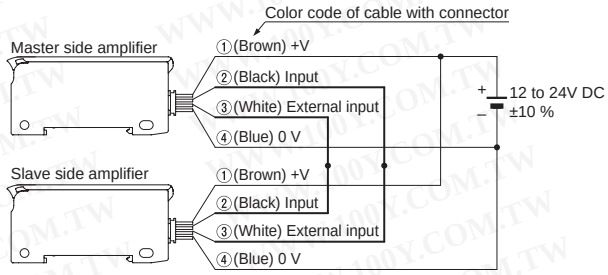
Setting copy function

- 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>

① 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".
② Turn off the master side amplifier.
③ Connect the master side amplifier with the slave side amplifier as shown below.



④ Turn on the master side amplifier and the slave side amplifier at the same time. (Note)
⑤ "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"→"II"→"III"→"IIII"→"IIIII"→"IIIIII"→"IIIIIII"→"IIIIIIII") is displayed on the red digital display.
⑥ 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.
⑦ 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>

① While the slave side amplifier is disconnected, turn on the power of the master side amplifier.
② Press the MODE key for 2 sec. approx.

PRECAUTIONS FOR PROPER USE

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

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 (△) and OFF key (▽) simultaneously for 2 seconds will switch to the quick setting function.

<Table of quick setting numbers>

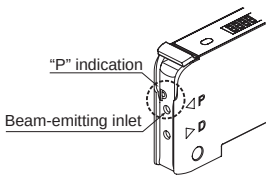
No.	Output operation	Timer	Emission amount setting (Note)
-00-	D-ON	non	Level 3 (OFF)
-01-	D-ON	non	Level 2 (ON)
-02-	D-ON	ofd 10 ms	Level 3 (OFF)
-03-	D-ON	ofd 10 ms	Level 2 (ON)
-04-	D-ON	ofd 40 ms	Level 3 (OFF)
-05-	D-ON	ofd 40 ms	Level 2 (ON)
-06-	D-ON	ond 10 ms	Level 3 (OFF)
-07-	D-ON	ond 10 ms	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).

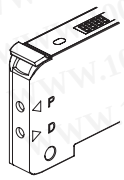
Difference between previous model and upgraded one

- 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.

<After upgrade>



<Previous>



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 (△) and OFF key (▽) simultaneously for 4 seconds will switch to the code setting function.

<Code table>

CodE 0002

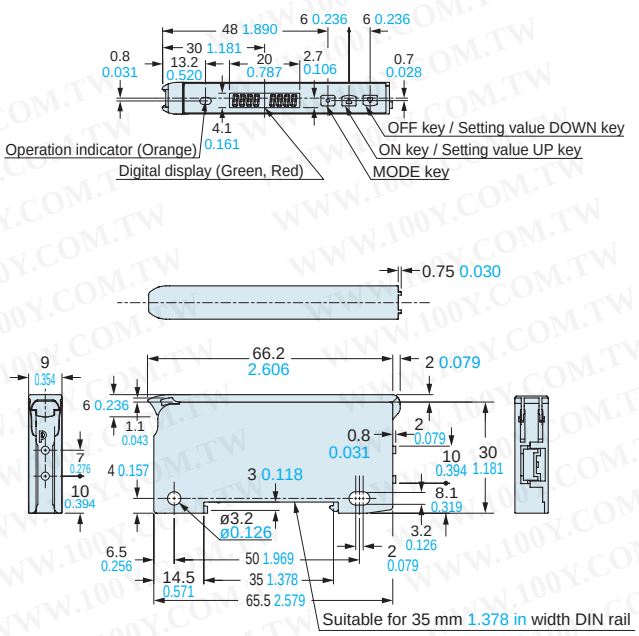
Code	1st digit: Output operation	1st digit: Timer (Note 1)	2nd digit: Emission amount setting (Note 2)	2nd digit: Emission frequency FX-101□	2nd digit: Emission frequency FX-102□	3rd digit: ECO	3rd digit: External input	4th digit: Shift (Note 1)
0	D-ON	non	Level 3 (OFF)	0	1	OFF	Emission halt	5 %
1	D-ON	ond 10 ms	Level 3 (OFF)	1	2	OFF	Limit teaching [+]	10 %
2	D-ON	ond 40 ms	Level 3 (OFF)	2	3	OFF	Limit teaching [-]	15 %
3	D-ON	ofd 10 ms	Level 3 (OFF)	3	4	OFF	Full-auto teaching	20 %
4	D-ON	ofd 40 ms	Level 2 (ON)	0	1	OFF	ECO	25 %
5	L-ON	non	Level 2 (ON)	1	2	ON	Emission halt	30 %
6	L-ON	ond 10 ms	Level 2 (ON)	2	3	ON	Limit teaching [+]	35 %
7	L-ON	ond 40 ms	Level 2 (ON)	3	4	ON	Limit teaching [-]	40 %
8	L-ON	ofd 10 ms	Level 1	0	1	ON	Full-auto teaching	45 %
9	L-ON	ofd 40 ms	Level 1	1	2	ON	ECO	50 %
A			Level 1	2	3	OFF	2-point teaching	
b			Level 1	3	4	OFF	Incident light intensity test	
c			Auto	0	1	ON	2-point teaching	
d			Auto	1	2	ON	Incident light intensity test	
E			Auto	2	3			
F			Auto	3	4			

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)

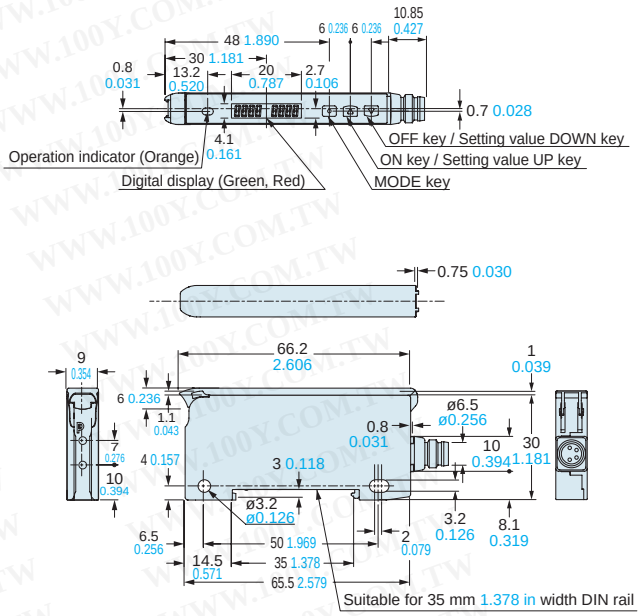
Refer to p.48~ for details of fiber dimensions.
The CAD data in the dimensions can be downloaded from our website.

FX-101□ FX-102□ — Amplifier



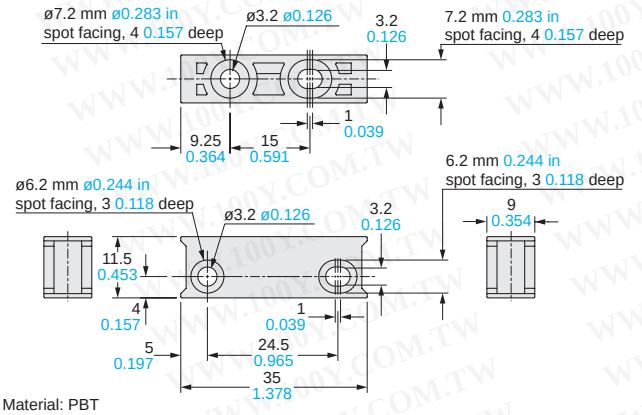
Note: The protection cover has been attached from the production at July, 2011.

FX-101(P)-Z FX-102(P)-Z — Amplifier



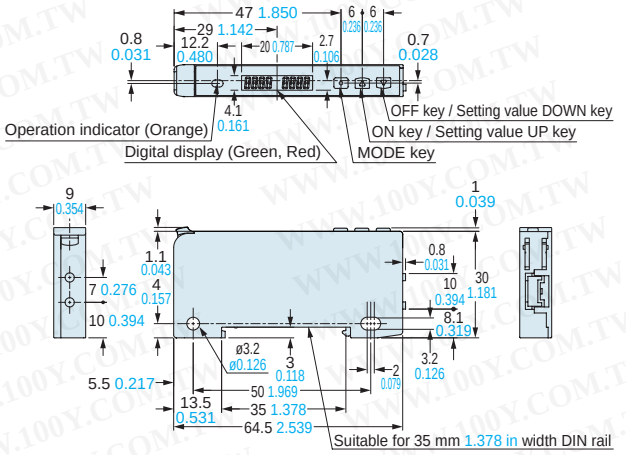
Note: The protection cover has been attached from the production at July, 2011.

MS-DIN-4 — Amplifier mounting bracket (Optional)

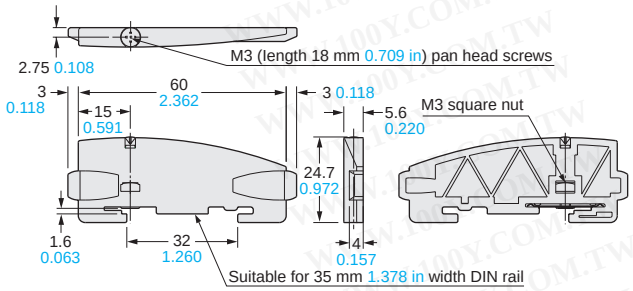


Material: PBT

Previous dimensions (production before November 2007)



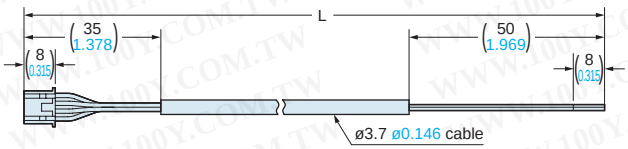
MS-DIN-E — End plate (Optional)



Material: Polycarbonate

CN-14A-C□ CN-14A-R-C□ — Connector attached cable (Optional)

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

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CN-14A	**FX-100** Connector	p.102
CN-14A-C1	**FX-100** Connector Attached Cable	p.102/p.110
CN-14A-C2		p.102/p.103/p.110
CN-14A-C3		p.102/p.110
CN-14A-C5		
CN-14A-R-C1	**FX-100** Connector Attached Cable (Flexible)	
CN-14A-R-C2		
CN-14A-R-C3		
CN-14A-R-C5		
CN-71-C1	**FX-500** Quick-connection Cable	p.74/p.96
CN-71-C2		
CN-71-C5		
CN-72-C1		
CN-72-C2		
CN-72-C5		
CN-73-C1		
CN-73-C2		
CN-73-C5		
CN-74-C1		
CN-74-C2		
CN-74-C5		

F

FB-1	Fiber Bender	p.18/p.45/p.66
FC-FX-1	**FX-100** Protection Cover	p.102/p.103
FD-30	Super Quality Fiber	p.11/p.39/p.56/p.85
FD-31	Threaded Type Fiber	p.13/p.39/p.56/p.85
FD-31W		
FD-32G	Threaded / Small Spot Type Fiber	p.13/p.23/p.39/p.56/p.85/p.105
FD-32GX		p.13/p.32/p.39/p.56/p.86/p.105
FD-40	Super Quality Fiber	p.11/p.39/p.56/p.86
FD-41	Threaded Type Fiber	p.13/p.39/p.56/p.86
FD-41S	Sleeve Fiber	p.19/p.39/p.56/p.86/p.105
FD-41SW		p.19/p.39/p.56/p.86
FD-41W	Threaded Type Fiber	p.13/p.39/p.56/p.86/p.105
FD-42G	Threaded / Small Spot Type Fiber	p.13/p.23/p.39/p.57/p.86/p.106
FD-42GW		
FD-60	Super Quality Fiber	p.11/p.39/p.57/p.86
FD-61	Threaded Type Fiber	p.13/p.39/p.57/p.87
FD-61G		p.13/p.39/p.57/p.87/p.106
FD-61S	Sleeve Fiber	p.19/p.39/p.57/p.87
FD-61W	Threaded Type Fiber	p.13/p.39/p.57/p.87/p.106
FD-62		
FD-64X		p.13/p.39/p.58/p.87/p.106
FD-A16	Wide Beam Fiber	p.25/p.39/p.58/p.87
FD-AL11		
FD-E13	Cylindrical / Sleeve Fiber	p.17/p.19/p.39/p.58/p.88
FD-E23		
FD-EG30	Threaded / Small Spot Type Fiber	p.13/p.23/p.39/p.58/p.88
FD-EG30S	Sleeve Fiber	p.19/p.39/p.59/p.88
FD-EG31	Threaded / Small Spot Type Fiber	p.13/p.23/p.39/p.59/p.88
FD-F4	Liquid Leak / Liquid Detection Fiber	p.35/p.39/p.59
FD-F41		
FD-F41Y		
FD-F71		
FD-F8Y		
FD-FA93		
FD-H13-FM2	Heat-resistant Fiber	p.31/p.40/p.60/p.88
FD-H18-L31		
FD-H20-21		
FD-H20-M1		
FD-H25-L43		
FD-H25-L45		p.31/p.40/p.60/p.89
FD-H30-KZ1V	Vacuum-resistant Fiber	p.33/p.44
FD-H30-KZ1V-S		p.32/p.40/p.61
FD-H30-L32	Heat-resistant Fiber	p.31/p.40/p.61/p.89
FD-H30-L32V	Vacuum-resistant Fiber	p.33/p.44
FD-H30-L32V-S		p.32/p.40/p.61/p.89
FD-H35-20S	Heat-resistant Fiber	p.31/p.40/p.61/p.89
FD-H35-M2		
FD-H35-M2S6		
FD-HF40Y	Liquid Leak / Liquid Detection Fiber	p.35/p.40/p.61
FD-L10	Convergent Reflective Type Fiber	p.26/p.40/p.62/p.89
FD-L11		
FD-L12W		
FD-L20H		
FD-L21		p.26/p.40/p.62/p.90
FD-L21W		
FD-L22A		p.26/p.40/p.62/p.90
FD-L23		
FD-L30A		
FD-L31A		
FD-L32H		p.26/p.40/p.63/p.90
FD-R31G	Square Head / Small Spot Type Fiber	p.15/p.23/p.40/p.63
FD-R32EG		
FD-R33EG		
FD-R34EG		
FD-R41	Square Head type Fiber	p.15/p.40/p.63
FD-R60	Threaded Type Fiber	p.13/p.40/p.63/p.90
FD-R61Y	Square Head / Chemical / Oil-resistant Fiber	p.15/p.29/p.40/p.91
FD-S21	Cylindrical Fiber	p.17/p.40/p.63/p.91
FD-S30	Super Quality Fiber	p.11/p.40/p.64/p.91
FD-S31	Cylindrical Fiber	p.17/p.40/p.64/p.91
FD-S32		
FD-S32W		p.17/p.41/p.64/p.91/p.106
FD-S33GW		
FD-S60Y	Chemical / Oil-resistant Fiber	p.29/p.41/p.64/p.91

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FD-V30	Sleeve Fiber	p.19/p.41/p.64/p.92
FD-V30W		
FD-V50		p.19/p.41/p.65/p.92
FD-Z20HBW	Flat Type Fiber	p.21/p.41/p.65/p.92
FD-Z20W		p.21/p.41/p.65/p.92
FD-Z40HBW		
FD-Z40W		
FD-Z50HW	Narrow Beam Fiber	p.24/p.41/p.65/p.92
FDP-1000	Protective Tube (For Reflective Type Fiber)	p.45/p.67
FDP-1500		
FDP-500		
FDP-N1000		
FDP-N1500		
FDP-N500		
FR-KZ22E	Narrow Beam / Retroreflective Type Fiber	p.24/p.27/p.38/p.55/p.84
FR-KZ50E		
FR-KZ50H		p.24/p.27/p.38/p.55/p.85
FR-Z50HW		p.24/p.27/p.38/p.55/p.85
FT-140	Threaded Type Fiber	p.12/p.36/p.48/p.79
FT-30	Super Quality Fiber	p.11/p.36/p.48/p.79
FT-31	Threaded Type Fiber	p.12/p.36/p.48/p.79
FT-31S	Sleeve Fiber	p.19/p.36/p.48/p.79/p.105
FT-31W	Threaded Type Fiber	p.12/p.36/p.48/p.79/p.105
FT-40	Super Quality Fiber	p.11/p.36/p.48/p.79
FT-42	Threaded Type Fiber	p.12/p.31/p.36/p.48/p.79
FT-42S	Sleeve Fiber	p.19/p.36/p.48/p.79/p.105
FT-42W	Threaded Type Fiber	p.12/p.36/p.48/p.79/p.105
FT-43		
FT-45X		p.12/p.36/p.49/p.79/p.105
FT-A11	Wide Beam Fiber	p.25/p.36/p.49/p.79/p.105
FT-A11W		p.25/p.36/p.49/p.79
FT-A32		p.25/p.36/p.49/p.80
FT-A32W		
FT-AL05		
FT-E13	Cylindrical / Sleeve Fiber	p.16/p.19/p.36/p.49/p.80
FT-E23		
FT-F93	Liquid Leak / Liquid Detection Fiber	p.35/p.36/p.49
FT-H13-FM2	Heat-resistant Fiber	p.30/p.36/p.50/p.80
FT-H20-J20		p.31/p.44
FT-H20-J20-S		p.30/p.36/p.50/p.80
FT-H20-J30		p.31/p.44
FT-H20-J30-S		p.30/p.36/p.50/p.80
FT-H20-J50		p.31/p.44
FT-H20-J50-S		p.30/p.36/p.50/p.80
FT-H20-M1		
FT-H20-VJ50		p.31/p.44
FT-H20-VJ50-S		p.30/p.36/p.50/p.80
FT-H20-VJ80		p.31/p.44
FT-H20-VJ80-S		p.30/p.36/p.50/p.80
FT-H20W-M1		
FT-H30-M1V	Vacuum-resistant Fiber	p.33/p.44
FT-H30-M1V-S		p.32/p.36/p.50/p.80
FT-H35-M2	Heat-resistant Fiber	p.30/p.36/p.50/p.81
FT-H35-M2S6		
FT-HL80Y	Chemical / Oil-resistant Fiber	p.29/p.36/p.50/p.81
FT-J8	Fiber for Atmospheric Side	p.33/p.44/p.66
FT-KS40	Narrow Beam Fiber	p.24/p.36/p.51/p.81
FT-KV26		
FT-KV40		
FT-KV40W		
FT-L80Y	Chemical / Oil-resistant Fiber	p.29/p.36/p.51/p.81
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FT-R40	Threaded Type Fiber	p.12/p.36/p.51/p.81
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Other types of analog input sensors can also be connected!

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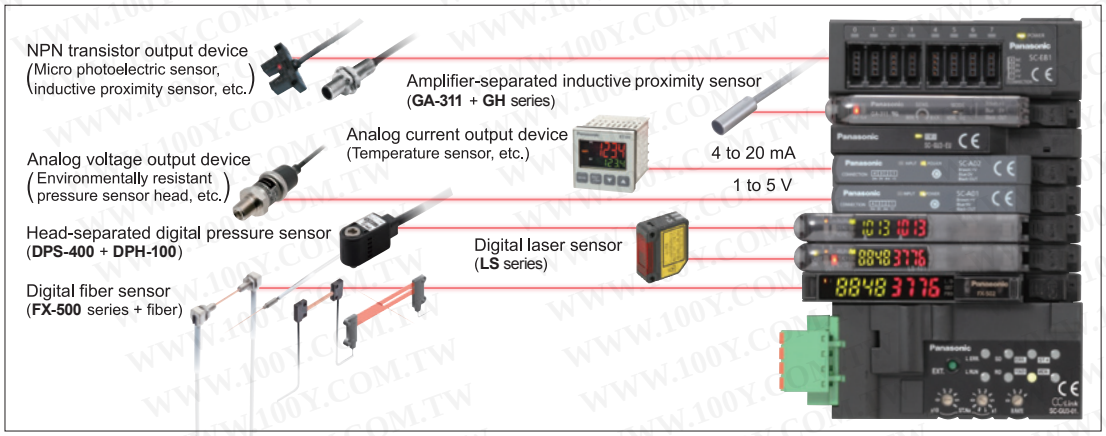
Scattered digital sensors can be centrally managed and set through an open network.

Applicable Digital Sensor	Digital Fiber Sensor	Digital Laser Sensor	Digital Pressure Sensor
	FX-501 FX-502	LS-501 LS-403	DPS-401 DPS-402



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