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With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

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Fiber Sensor Guide Book



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 DAMAGES 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.

INDEX

■ Fiber Selection Guide	Choose by model	2
	Choose by shape/application	3
	How to read Model No.	4
	Earlier model comparison table	6
■ New Product Introduction	Tough Fiber	8
■ Fibers	Super Quality	10
	Threaded Type	12
	Square Head Type	14
	Cylindrical Type	16
	Sleeve	18
	Flat Type	20
	Small Spot	22
	Narrow Beam	24
	Wide Beam	25
	Convergent Reflective Type	26
	Retroreflective Type	27
	Chemical / Oil-resistant	28
	Heat-resistant	30
	Vacuum-resistant	32
Liquid Leak / Liquid Detection	34	
■ Fiber Options		42
■ Semi-custom Fibers		46
■ Fiber Dimensions	Thru-beam Type	48
	Retroreflective Type	55
	Reflective Type	56
	Others	66
■ Amplifiers	FX-500 series Ver.2	70
	FX-100 series	98
■ INDEX		112

Fiber Selection Guide

Choose by model

Thru-beam type

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

Retroreflective type

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

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

Reflective type

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

Model No.	Page		
	Sensing range Specifications	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	P.62	
FD-H35-M2			
FD-H35-M2S6	P.35		
FD-HF40Y	P.26		
FD-L10			
FD-L11			
FD-L12W			
FD-L20H			
FD-L21			
FD-L21W			
FD-L22A			
FD-L23			
FD-L30A			
FD-L31A	P.15/P.23	P.63	
FD-L32H			
FD-R31G			
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		
FD-S31	P.17	P.64	
FD-S32			
FD-S32W			
FD-S33GW			
FD-S60Y			P.29
FD-V30	P.19		
FD-V30W			
FD-V50			
FD-Z20HBW	P.21		P.65
FD-Z20W			
FD-Z40HBW			
FD-Z40W			
FD-Z50HW		P.24	

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

Fiber Selection Guide

Choose by shape

Threaded Type


- Standard type which is mounted using nuts.



P.12

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

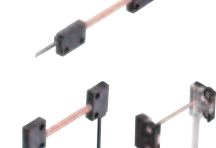
- Suitable for sensing in narrow locations and sensing minute objects.



P.18

Flat Type

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




P.20

Choose by beam shape

Small Spot

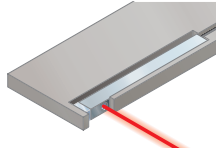
- Senses minute objects using a spot lens.



P.22

Narrow Beam

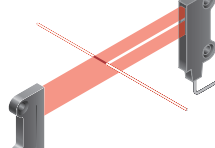
- Not easily affected by surrounding obstacles.



P.24

Wide Beam

- Senses in the beam band without missing a work.



P.25

Convergent Reflective Type

- Senses in the limited range only.



P.26

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

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

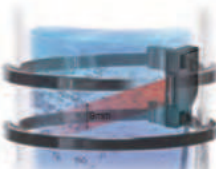
- Usable in high-temperatures of 300 °C 572 °F and vacuum



P.32

Liquid Leak / Liquid Detection

- Corresponds to various liquid events.




P.34

Choose by environment / performance

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

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

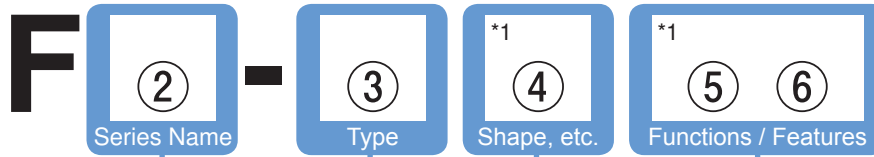
Amplifiers
FX-500 series
FX-100 series

INDEX

Fiber Selection Guide

How to read Model No.

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



*1: Excluding liquid leak / liquid detection fiber

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

Symbol	Details	Symbol	Details
None	General-purpose	None	General-purpose
G	Coaxial reflective	W	Sharp bending
S	Sleeve	X	Stainless-jacketed
H	Top sensing *	Y	Chemical-resistant
E	Side sensing *		
HB	Top sensing + Bent *		
A	Alignment		

*③ is for Flat type (Z and KZ) only

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
		2	ø2 mm
V	Side-view	3	ø2.5 or ø3 mm
		4	ø4 mm
		5	ø5 mm
KV	Narrow beam / Side-view	4	ø4 mm
		2	1.5 × 2 mm
E	Ultra small diameter	1	Fiber ø0.125 mm
		2	Fiber ø0.25 mm
EG	Coaxial	3	M3
Z	Flat type	2	Thickness 2 mm
		3	Thickness 3 mm
		4	Thickness 3.5 mm
		5	Thickness 5.2 mm
		2	Thickness 2.2 mm
KZ	Narrow beam	5	Thickness 5.2 mm
		3	Sensing width 32 mm
A	Wide beam	1	Sensing width 10 to 19 mm
		1	Sensing width 11.1 mm
AL	Array	0	Sensing width 5.5 mm
		1	Sensing range 0 to 10 mm (STD)
		2	Sensing range 11 to 30 mm (STD)
L	Convergent reflective type	3	Sensing range 31mm or more (STD)
		9	Mountable on pipe
		7	Liquid leak
F	Liquid leak / Liquid detection		

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

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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

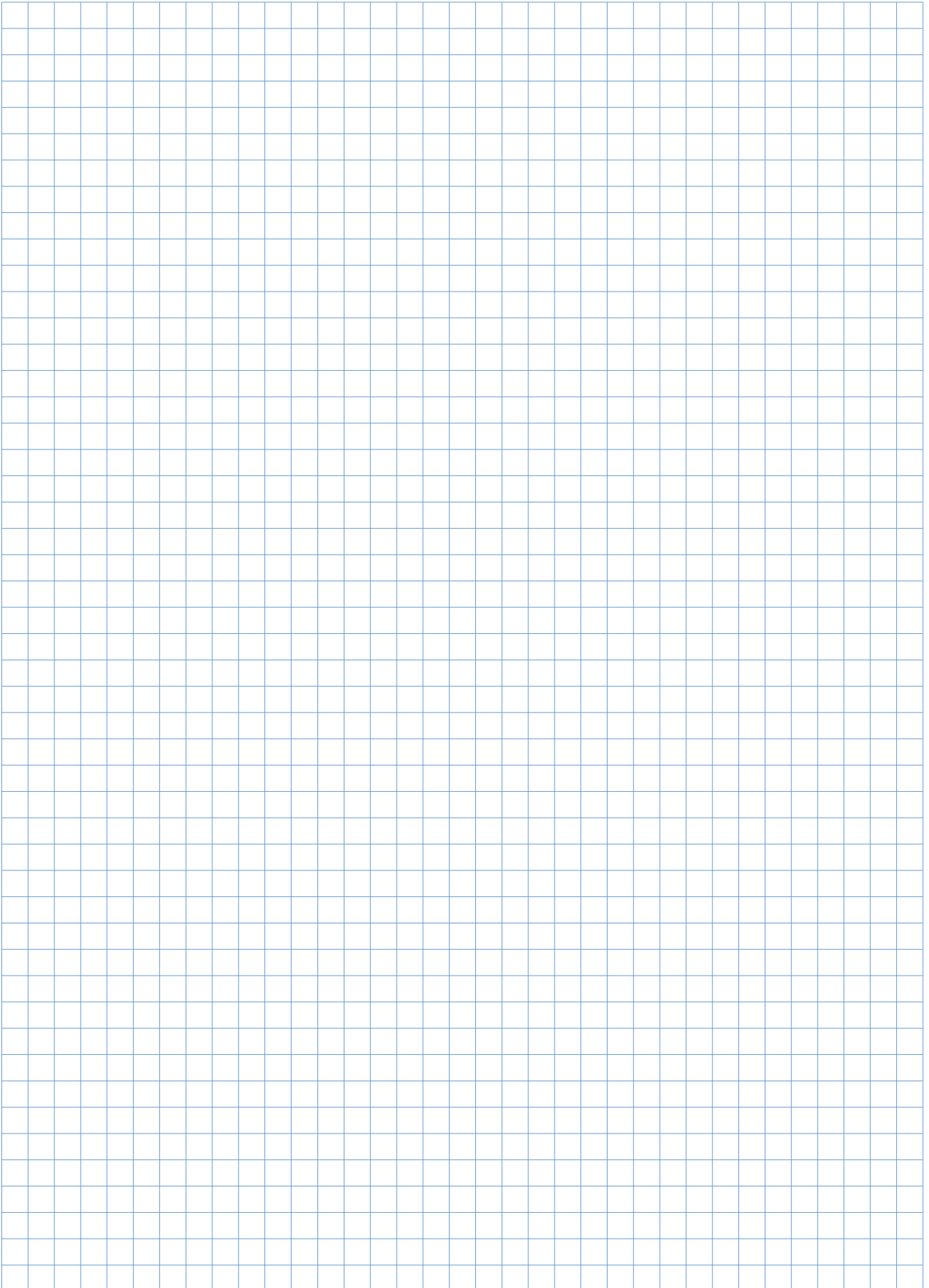
Amplifiers

FX-500 series

FX-100 series

INDEX

MEMO



Fiber Selection Guide

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

Thru-beam type

Old fiber Model No.	New fiber Model No.	Page	
		Sensing range Specifications	Dimensions
FT-A30	FT-A32	P.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	
FT-NFM2S	FT-31S	P.19	P.48
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	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	P.19	P.53
FT-WS8L	FT-S32		
FT-WV42	FT-V25	P.20	P.54
	FT-V24W		
FT-WZ4	FT-Z20W	P.53	P.54
FT-WZ4HB	FT-Z20HBW		
FT-WZ7	FT-Z40W	P.53	P.54
FT-WZ7HB	FT-Z40HBW		
FT-WZ8	FT-Z30	P.54	P.53
	FT-Z30W		
FT-WZ8E	FT-Z30E	P.54	P.53
	FT-Z30EW		
FT-WZ8H	FT-Z30H	P.53	P.54
	FT-Z30HW		
FT-Z8	FT-Z30		P.53
FT-Z8E	FT-Z30E		P.54
FT-Z8H	FT-Z30H	P.11	P.48
—————	FT-30		P.52
—————	FT-40	P.15	P.51
—————	FT-S20		
—————	FT-S30		
—————	FT-R31		
—————	FT-R43		

Retroreflective type

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

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

Fiber Selection Guide

Reflective type

Old fiber Model No.	New fiber Model No.	Page	
		Sensing range Specifications	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	P.59
FD-ENM1S1			
FD-F705	FD-F71	P.35	P.57
FD-FA90	FD-FA93		
FD-FM2	FD-61	P.13	P.57
	FD-61G		
FD-FM2S	FD-61S	P.19	P.56
FD-FM2S4			
FD-G4	FD-42G	P.13/P.23	P.62
FD-G6	FD-32G		
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		
FD-L47	FD-L23		
FD-L47	FD-L23		
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	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		
FD-W8	FD-61	P.13	P.57
	FD-61W		
FD-WG4	FD-42G	P.13/P.23	P.65
	FD-42GW		
FD-WKZ1	FD-Z50HW	P.24	P.65
FD-WL41	FD-L21	P.26	P.62
	FD-L21W		
FD-WL48	FD-L12W	P.17	P.64
FD-WS8	FD-S32		
	FD-S32W		
FD-WSG4	FD-S33GW	P.13	P.56
FD-WT4	FD-31		
	FD-31W		
FD-WT8	FD-41	P.19	P.64
	FD-41W		
FD-WV42	FD-V30	P.21	P.65
	FD-V30W		
FD-WZ4	FD-Z20W	P.15	P.63
FD-WZ4HB	FD-Z20HBW		
FD-WZ7	FD-Z40W		
FD-WZ7HB	FD-Z40HBW	P.11	P.56
—————	FD-30		
—————	FD-40		
—————	FD-60		
—————	FD-S30	P.15/P.23	P.63
—————	FD-R31G		
—————	FD-R32EG	P.15	P.64
—————	FD-R33EG		
—————	FD-R34EG	P.15	P.64
—————	FD-R41		

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

Tough Fiber

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

Flexible fiber
Flexible durability
1 million times

Sharp bending fiber
Bending radius
R2~R1 mm

General purpose fiber
Bending radius
R25 mm



Tough Fiber

Unbreakable
Flexible durability **10 million times** (Typical)
Bending conditions Bending radius: R10 mm
Reciprocating bending: 180°

More flexible
Bending radius **R2~R4 mm**

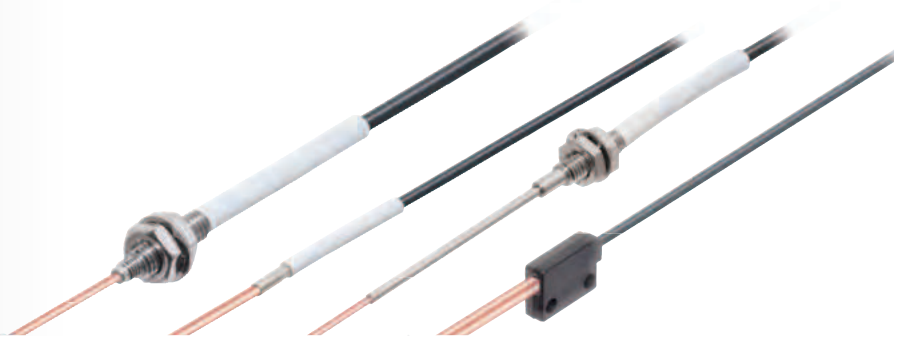
ECO

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

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

New tough fibers exceed normal optic fibers!

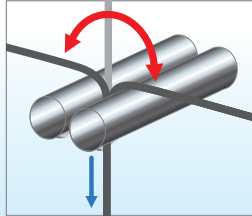
Tough fibers can be used on moving parts, can be bent with precision, and offer high quality for all purposes. They go beyond what was commonly thought to be possible.



Unbreakable

Bending conditions

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

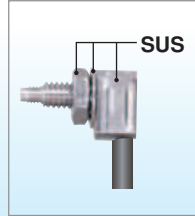


Flexible durability

10 million times
(Typical)

ECO

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



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

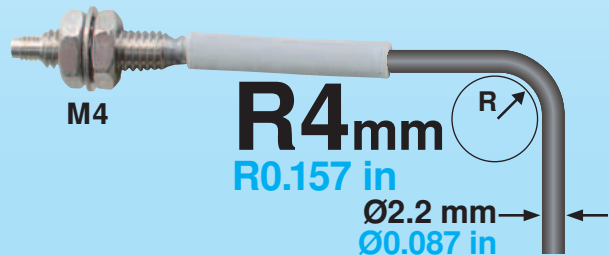
More flexible

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

Example: FT-31



Example: FT-42



Reduced the time in selecting fiber and in registering part numbers

For Designers

High-quality

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

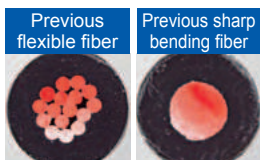
For Buyers

Low Price

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

Reduced variation in detection

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



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



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

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

New product introduction
Tough Fiber

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Cylindrical Type
Sleeve
Flat Type
Small Spot
Narrow Beam
Wide Beam
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Retroreflective Type
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Fiber Options

Semi-custom fibers

Fiber Dimensions

Thru-beam Type

Retroreflective Type

Reflective Type

Others

Amplifiers

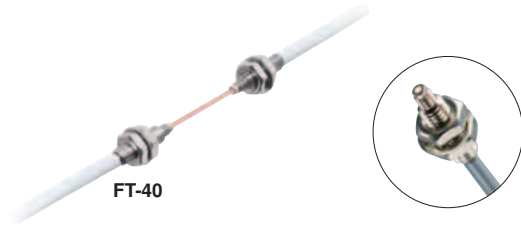
FX-500 series

FX-100 series

INDEX

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.

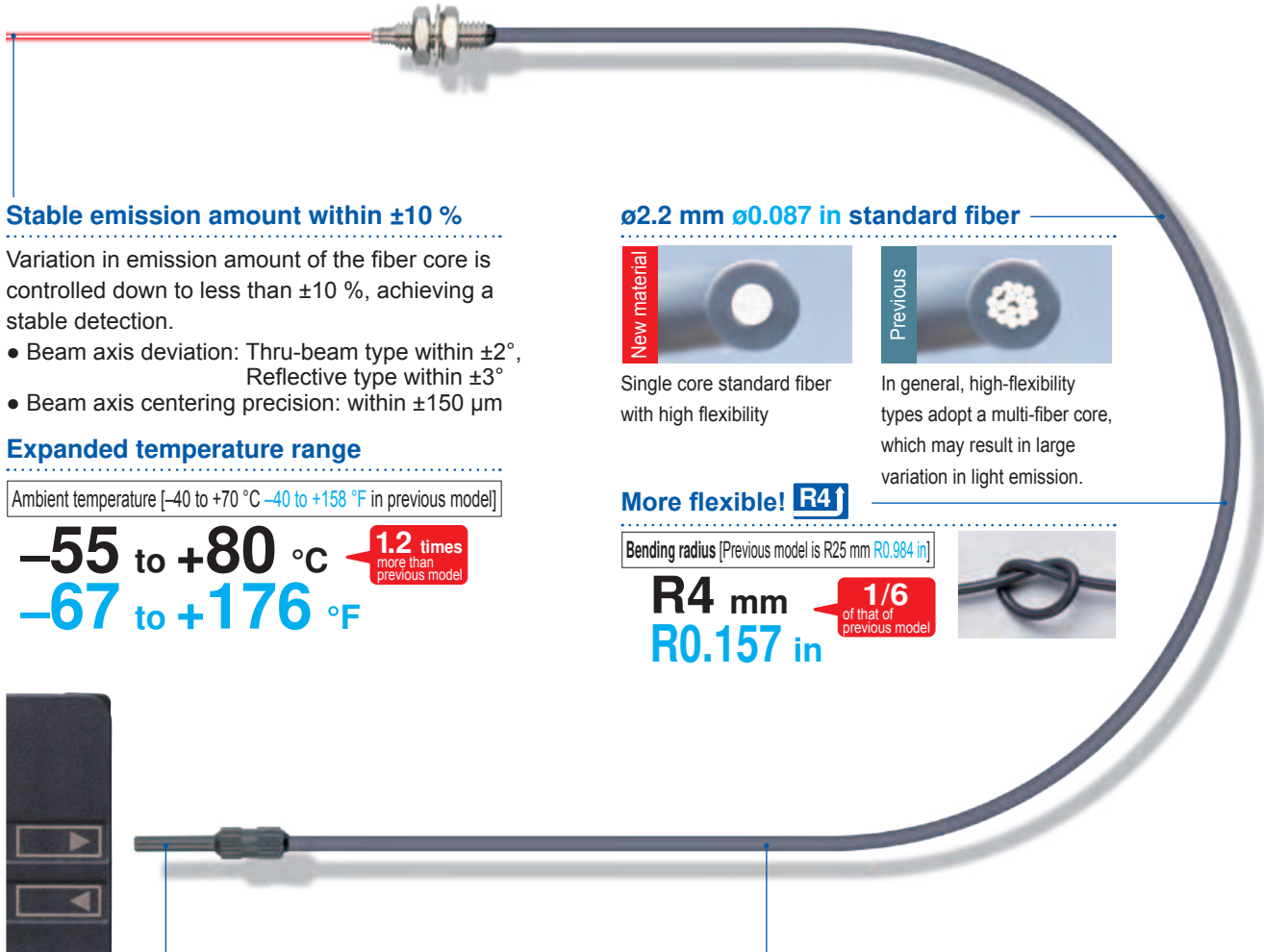
When connected with the **FX-500** series amplifiers, it has up to 4 times improved stability of incident light intensity compared with traditional fibers. Management is simple even when replacing amplifiers because the digital display shows the approximate value.

Super quality fiber + **FX-500** series

"Stabilized incident light intensities" even in multiple units



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



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

ø2.2 mm ø0.087 in standard fiber



New material
Single core standard fiber with high flexibility



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

Expanded temperature range

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

-55 to +80 °C 1.2 times more than previous model
-67 to +176 °F

More flexible! **R4**

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

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



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)			Beam axis dia. (mm)	Beam axis position/Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)						
Threaded	M3	Tough FT-30	R2 Bending durability	2 m	STD 400 15.748	810 31.890 650 25.91 210 8.268 75 2.953	135 5.315 400 15.748	∅0.5	150 μm ±2°	±10 %	IP67	-55 to +80 °C	P.48
	M4	Tough FT-40	R4 Bending durability		STD 1,200 47.244 HYPR (Note) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	320 12.598 870 34.252	∅1					
Cylindrical	∅1.5	Tough FT-S20	R2 Bending durability		STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.91 210 8.268 75 2.953	135 5.315 400 15.748	∅0.5					
	∅3	Tough FT-S30	R4 Bending durability		STD 1,200 47.244 HYPR (Note) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	320 12.598 870 34.252	∅1					

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

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in) (Note)			Beam axis position/Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)					
Threaded	M3	Tough FD-30	R2 Bending durability	2 m	STD 160 6.299 HYPR 600 23.622	330 12.992 250 9.843 80 3.150 25 0.984	45 1.772 155 6.102	150 μm ±3°	±10 %	IP67	-55 to +80 °C	P.56
	M4	Tough FD-40	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					
	M6	Tough FD-60			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					
Cylindrical	∅3	Tough FD-S30	R4 Bending durability									P.64

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

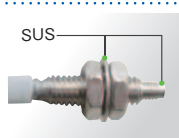
Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

Threaded Type

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

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

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



* Some models not included (FT-140)

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

It is a coaxial fiber that encloses the circumference of the emitter fiber at the center with the receiver fiber.

This is suitable for high-precision positioning. It can perform sensing without affecting the approach direction of the work.



Supports spot lenses and zoom lenses!

LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length (m)	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Beam axis position/Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)					
Threaded	M3	Tough FT-31	R2	Free-cut	STD 315 12.402	770 30.315	130 5.118	0.5	150 μm /±2°	IP67	-55 to +80 °C	P.48
		HYPR 1,350 53.150	550 21.654		340 13.386							
		FT-31W	R1		STD 260 10.236	590 23.228	80 3.150	150 μm /±3°	-40 to +60 °C			
	HYPR 990 38.976	440 17.323	240 9.449									
		FT-43	R4	2 m	STD 1,400 55.118	2,800 110.236	350 13.780	0.5	150 μm /±2°	-55 to +80 °C		
	Lens mountable	FT-42	R4		HYPR (Note 2) 3,600 141.732	2,100 82.677	970 38.189					
		FT-42W	R1		STD 1,130 44.488	2,050 80.709	300 11.811	150 μm /±3°	-40 to +60 °C			
	Lens mountable	FT-45X	R4	HYPR (Note 2) 3,600 141.732	1,600 62.992	800 31.496	530 20.866					
		FT-R40	R4	2 m	STD 800 31.496	1,900 74.803	260 10.236	0.1	150 μm /±2°	-55 to +80 °C		
	Lens mountable, Stainless-jacketed	FT-140	R4		HYPR 3,300 129.921	1,400 55.118	720 28.346					
	FT-140	R4	10 m	STD 1,200 47.244	1,600 62.992 (Note 2)	340 13.386	0.1	150 μm /±2°	-40 to +70 °C			
With expansion lens				HYPR (Note 2) 1,600 62.992	1,600 62.992 (Note 2)	920 36.220						
	Elbow			STD 930 36.614	1,750 68.898	270 10.630	0.1	150 μm /±2°	-55 to +80 °C			
			HYPR (Note 2) 3,600 141.732	1,500 59.055	740 29.134							
	Long range			STD (Note 2) 19,600 771.654	19,600 771.654 (Note 2)	14,000 551.181	0.1	—	-40 to +70 °C			
			HYPR (Note 2) 19,600 771.654	16,000 629.921	6,300 248.031							

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

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

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



FT-42

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

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

More user-friendly, high quality fiber

Improved centering accuracy

The beam axis deviation of each unit is kept within ±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

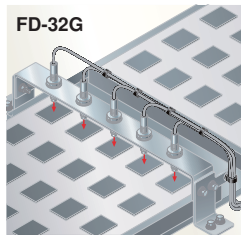
High precision polishing is accomplished by using the PCTC polishing technique.

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

- Light intensity is increased, enabling stable sensing.

Application

Detecting a presence of a workpiece



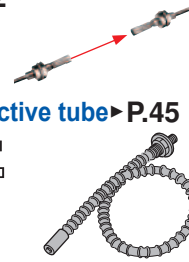
FIBER OPTIONS

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)			Beam axis position/ Inclination of beam axis	Protection	Ambient temp.	Dimensions		
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)						
M3		Tough FD-31	R2 Bending durability	2 m	STD 125 4.921	290 11.417	35 1.378	150 μm ±3°	IP67	-55 to +80 °C	P.56		
					HYPR 515 20.276	220 8.661						140 5.512	
		FD-31W	R1	2 m	STD 80 3.150	180 7.087	15 0.591	—	—	-40 to +60 °C			
					HYPR 330 12.992	140 5.512						60 2.362	
		Tough FD-32G	R2 Bending durability	1 m	STD 200 7.874	380 14.961	70 2.756	—	—	-55 to +80 °C			
					HYPR 650 25.591	270 10.630						190 7.480	
		FD-32GX	R2	1 m (Note 3)	STD 200 7.874	410 16.142	75 2.953	—	—	-55 to +80 °C			
					HYPR 630 24.803	360 14.173						210 8.268	
	Ultra-small diameter		FD-EG30	R4	500 mm	STD 48 1.890	130 5.118	20 0.787	—	-40 to +70 °C			
						HYPR 170 6.693	110 4.331					70 2.756	
Ultra-small diameter		FD-EG31	R4	500 mm	STD 20 0.787	45 1.772	7 0.276	—	-20 to +60 °C				
					HYPR 85 3.346	35 1.378				25 0.984			
Threaded		Tough FD-41	R2 Bending durability	2 m	STD 125 4.921	290 11.417	35 1.378	150 μm ±3°	IP67	-55 to +80 °C	P.56		
					HYPR 515 20.276	220 8.661						140 5.512	
		FD-41W	R1	2 m	STD 270 10.630	630 24.803	80 3.150	—	—	-40 to +60 °C			
					HYPR 900 35.433	430 16.929						230 9.055	
		Tough FD-42G	R2 Bending durability	2 m	STD 200 7.874	380 14.961	70 2.756	—	—	-55 to +80 °C			
					HYPR 650 25.591	270 10.630						190 7.480	
		FD-42GW	R1	2 m	STD 150 5.906	340 13.386	45 1.772	—	—	-40 to +60 °C			
					HYPR 670 26.378	280 11.024						140 5.512	
	M6		FD-62	R4 Bending durability	2 m	STD 520 20.472	1,000 39.370	170 6.693	150 μm ±3°	IP67		-55 to +80 °C	P.57
						HYPR 1,500 59.055	940 37.008						
		Tough FD-61	R4 Bending durability	2 m	STD 450 17.717	840 33.071	120 4.724	—	—	-40 to +60 °C			
					HYPR 1,400 55.118	670 26.378					410 16.142		
		FD-61W	R1	2 m	STD 270 10.630	630 24.803	80 3.150	—	—	-40 to +60 °C			
	HYPR 900 35.433				430 16.929	230 9.055							
	Tough FD-61G	R4 Bending durability	2 m	STD 420 16.535	800 31.496	120 4.724	—	—	-55 to +80 °C				
				HYPR 1,100 43.307	650 25.591					350 13.780			
Elbow		Tough FD-R60	R4 Bending durability	2 m	STD 280 11.024	500 19.685	75 2.953	—	—	-55 to +80 °C	P.58		
					HYPR 670 26.378	410 16.142						220 8.661	
Elbow		FD-R60	R4 Bending durability	2 m	STD 290 11.417	600 23.622	110 4.331	150 μm ±3°	IP67	-55 to +80 °C	P.63		
					HYPR 1,100 43.307	550 21.654						240 9.449	

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.

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

New product introduction
Tough Fiber

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Model

Choose by shape/application

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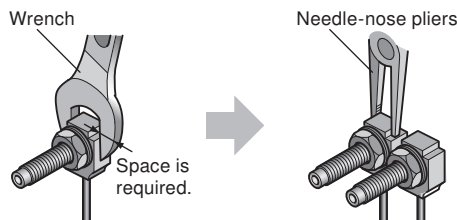
INDEX

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

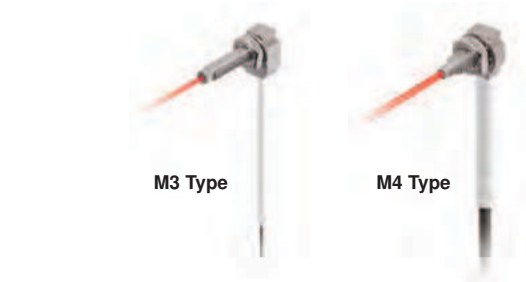
Compact, space-saving

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.



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

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.



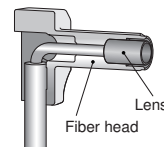
Compact installation

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



FT-R41W/R42W

FT-R42W (With lens)



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

Full-protection type

High environmental resistance

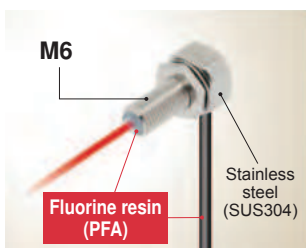
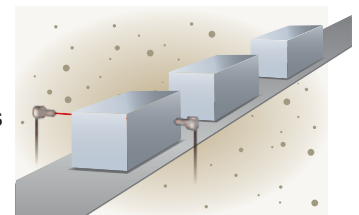
The head, nut, and washer are made from rust-resistant SUS304. The unbreakable tough fiber with high durability is covered in a fluorine resin tube. The fiber head is also covered with a fluorine resin component, achieving a high level of environmental resistance.

Less susceptibility to oil adhesion thanks to fluorine resin

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

Resistant to oil and coolant

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



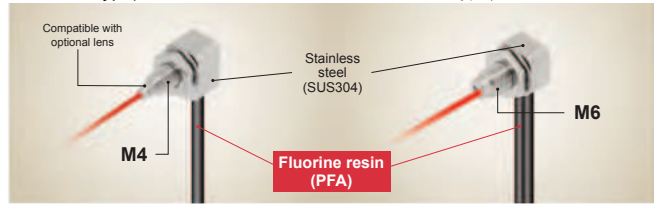
Test oil	Product
Lubricating oil	Velocite Oil No. 3
Non-water-soluble cutting oil	Yushiron Cut Abas KZ201
	Yushiron Cut UH75
Water-soluble cutting oil	Syntilo 9954 (10% diluted)
	Yushiroken S50N (2% diluted)
Alcohol-based neutral detergent	Super Teepol

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

Cable-protection type FT-R44Y / FD-R61Y

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

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



Even stronger than tough fiber

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



Protective structure IP67

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



LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Square head	M3 W5.5xH8xD16 Lens mountable	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	∅0.5	IP67	-55 to +80 °C	P.51
		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	∅1			
	M4 W7xH9xD13.5 With expansion lens	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	∅2.2	IP40	-40 to +60 °C	
		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				
	M4 W7xH9xD15.5 Cable-protection type Compatible with lens	Tough NEW FT-R44Y	R4		STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118	210 8.268 640 25.197	∅1	IP67 (Note 3)	-55 to +80 °C	
M6 W10xH11xD21.2 Full-protection type	Tough NEW FT-R60Y	R4 Bending durability	STD 2,100 82.677 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,260 49.606 400 15.748	690 27.165 1,890 74.409	∅3.5	IP68G				

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

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)			Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Square head	M3 W5.5xH8xD16 Coaxial, Lens mountable	Tough FD-R31G	R2 Bending durability	500mm	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 ∅0.5	IP40	-55 to +80 °C	P.63
		FD-R32EG	R4		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 ∅0.25			
		FD-R34EG	R4		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 ∅0.175			
		FD-R33EG	R4		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 ∅0.125			
	M4 W7xH9xD13.5 Coaxial, Lens mountable	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	∅0.75	IP67	-55 to +80 °C	
M6 W10xH11xD15.5 Cable-protection type	Tough NEW FD-R61Y	R4 Bending durability	2m	STD 280 11.024 HYPR 990 38.976	610 24.016 435 17.126 160 6.299 50 1.969	85 3.346 185 7.283	—	IP67 (Note 3)			

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

FIBER OPTIONS

Lens (For thru-beam type fiber) ▶P.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

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

Cylindrical Type

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



<Thru-beam type> FT-S21/S21W/S31W <Reflective type> FD-S32/S31

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

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

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

LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Beam axis position/Inclination of beam axis	Protection	Ambient temp.	Dimensions		
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)							
Cylindrical	$\phi 1$	Tough FT-S11	R2	500 mm	STD 190 3.543 HYPR 350 13.780	210 8.268 160 6.299 60 2.362 19 0.748	40 1.575 90 3.543	$\phi 0.25$	—	—	-55 to +80 °C	P.52		
	$\phi 1.5$	Tough FT-S21	R1	2 m	STD 315 12.402 HYPR 1,350 53.150	770 30.315 550 21.654 210 8.268 70 2.756	130 5.118 340 13.386	$\phi 0.5$	150 μ m / $\pm 2^\circ$	IP67	-40 to +60 °C			
		FT-S21W			STD 260 10.236 HYPR 990 38.976	590 23.228 440 17.323 150 5.906 53 2.087	80 3.150 240 9.449		150 μ m / $\pm 3^\circ$					
	$\phi 2.5$	With lens, Long sensing range $\phi 2.5$	FT-S32	R10	2 m	STD 3,100 122.047 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 1,800 70.866 600 23.622	1,100 43.307 3,000 118.110	$\phi 2$	—	IP40		-40 to +70 °C	
	$\phi 3$		FT-S31W	R1	2 m	STD 800 31.496 HYPR 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299	260 10.236 720 28.346	$\phi 1$	150 μ m / $\pm 3^\circ$	—		-40 to +60 °C	
	Side-view Ultra-small diameter	Narrow beam $\phi 0.125$ mm	Tough FT-E13	R2	1 m	STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	6 0.236 19 0.748	$\phi 0.125$	—	IP67		-40 to +70 °C	P.49
		Sleeve part cannot be bent.				STD 75 2.953 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512	22 0.866 80 3.150	$\phi 0.25$	—	—		-40 to +70 °C	
		Narrow beam $\phi 0.25$ mm	Tough FT-E23	R4	2 m	STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 850 33.465	1,000 39.370 3,100 122.047	$\phi 2.5$	—	IP50		-40 to +60 °C	

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

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
 Liquid Leak / Liquid Detection

Fiber Options
 Semi-custom fibers

Fiber Dimensions
 Thru-beam Type
 Retroreflective Type
 Reflective Type

Amplifiers
 FX-500 series
 FX-100 series

INDEX

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)			Beam axis position/ Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)				
Cylindrical	ø1.5	Tough FD-S21	R2 Bending durability	1 m	STD 80 3.150 HYPR 190 7.480	130 5.118 110 4.331 37 1.457 11 0.433	25 0.984 70 2.756	—	IP40	-55 to +80 °C	P.63
	ø3	Tough FD-S32	R4 Bending durability	2 m	STD 420 16.535 HYPR 1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953	120 4.724 345 13.583	150 μm /±3°	IP67	-40 to +60 °C	P.64
		FD-S32W	R1		STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	80 3.150 230 9.055	—			
		Tough FD-S31	R2 Bending durability		STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	35 1.378 140 5.512	150 μm /±3°			
		Coaxial FD-S33GW	R1		STD 150 5.906 HYPR 670 26.378	340 13.386 280 11.024 90 3.543 25 0.984	45 1.772 140 5.512	—			
Ultra-small diameter	ø1.5	FD-E13	R4	1 m	STD 12 0.472 HYPR 50 1.969	29 1.142 25 0.984 7 0.276 2 0.079	5 0.197 15 0.591	IP40	-40 to +60 °C	P.58	
ø3	FD-E23	STD 55 2.165 HYPR 170 6.693		120 4.724 80 3.150 30 1.181 9 0.354	20 0.787 70 2.756	—					

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

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.

Sleeve

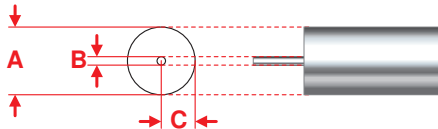
- It is suitable for sensing in narrow locations and sensing minute objects because the fiber tip is a thin sleeve.
- The 40 mm sleeve type can be bent in any direction.



<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

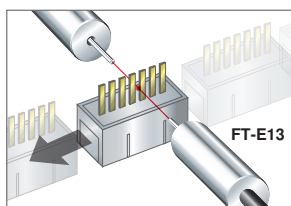
Example: FT-E13

New standard fiber

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.

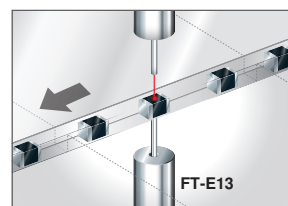
Minute sensing only possible with ultra small fiber

Detection of fine-pitch connector pins



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

Detection of tiny chips

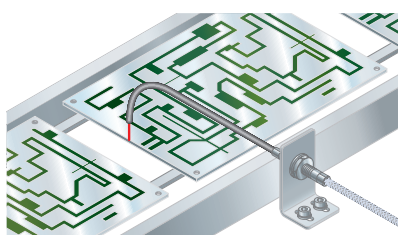


Fiber can be installed with only the $\varnothing 0.25 \text{ mm } \varnothing 0.010 \text{ in}$ sleeve close to the minute section.

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

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

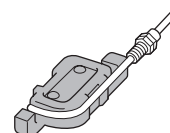
Application



FIBER OPTION

Fiber bender

·FB-1



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

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

LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)			Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)					
Threaded	M3 	Tough FT-31S	R2 Bending durability (Note 3)	2 m	STD 315 12.402 HYPR 1,220 48.031	740 29.134 550 21.654 195 7.677 63 2.480	130 5.118 340 13.386	ø0.5	IP67	-55 to +80 °C	P.48	
	M4 	Tough FT-42S	R4 Bending durability (Note 3)		STD 1,130 44.488 HYPR (Note 2) 3,600 141.732	2,050 80.709 1,600 62.992 530 20.866 190 7.480	300 11.811 800 31.496					ø1
Cylindrical	Ultra-small diameter ø3 	Tough FT-E13	R2 Bending durability	1 m	STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	6 0.236 19 0.748	ø0.125	IP67	-40 to +70 °C	P.49	
		Tough FT-E23	R2 Bending durability		STD 175 2.953 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512	22 0.866 80 3.150					ø0.25
	Side-view ø2		Tough FT-V23	R4 Bending durability	2 m	STD 450 17.717 HYPR 1,800 70.866	1,000 39.370 880 34.646 280 11.024 90 3.543	160 6.299 400 15.748	ø0.75	IP30	-55 to +80 °C	
			Tough FT-V25	R2 Bending durability		STD 240 9.449 HYPR 900 35.433	550 21.654 480 18.898 140 5.512 45 1.772	95 3.740 260 10.236				
			FT-V24W	R1		STD 110 4.331 HYPR 380 14.961	230 9.055 200 7.874 60 2.362 20 0.787	35 1.378 90 3.543				
			Tough FT-V30	R4 Bending durability		STD 680 26.772 HYPR 2,200 86.614	1,200 47.244 1,000 39.370 340 13.386 100 3.937	180 7.087 480 18.898				ø1.0
	ø2.5 											

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

Reflective type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)			Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)			
Threaded	Ultra-small diameter M3 	FD-EG30S	R4	1 m	STD 50 1.969 HYPR 170 6.693	110 4.331 80 3.150 30 1.181 9 0.354	20 0.787 70 2.756	IP40	-40 to +70 °C	P.59
	M4 	Tough FD-41S	R2 Bending durability (Note 3)		STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	35 1.378 140 5.512			
			FD-41SW		R1 (Note 3)	STD 80 3.150 HYPR 330 12.992	180 7.087 140 5.512 45 1.772 12 0.472	15 0.591 60 2.362		
	M6 	Tough FD-61S	R4 Bending durability (Note 3)		STD 420 16.535 HYPR 1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953	130 5.118 360 14.173	IP67	-55 to +80 °C	P.57
Cylindrical	Ultra-small diameter ø1.5 	FD-E13	R4	1 m	STD 12 0.472 HYPR 50 1.969	29 1.142 25 0.984 7 0.276 2 0.079	5 0.197 15 0.591			
		FD-E23			STD 55 2.165 HYPR 170 6.693	120 4.724 80 3.150 30 1.181 9 0.354	20 0.787 70 2.756			
	Side-view ø3 	Tough FD-V30	R2 Bending durability	2 m	STD 65 2.559 HYPR 240 9.449	130 5.118 120 4.724 35 1.378 14 0.551	25 0.984 75 2.953	IP30	-55 to +80 °C	P.64
		FD-V30W	R1		STD 20 0.787 HYPR 80 3.150	40 1.575 30 1.181 10 0.394 2 0.079	6 0.236 20 0.787			
			Tough FD-V50		R4 Bending durability	STD 120 4.724 HYPR 370 14.567	220 8.661 210 8.268 75 2.953 25 0.984			
ø5 										

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.

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

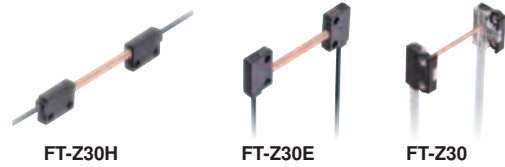
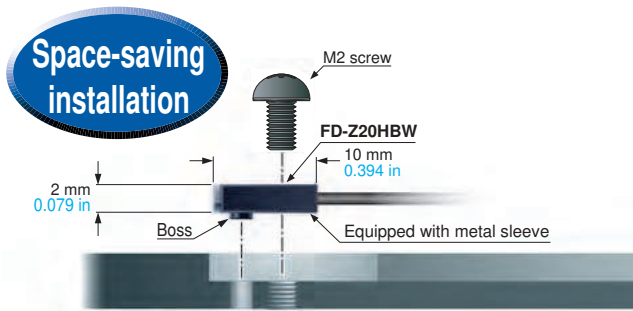
INDEX

Flat Type

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

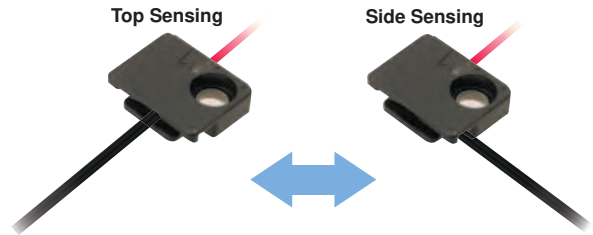
1 point mounting

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



Fiber guide system contributes to space-saving

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



LIST OF FIBERS

Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)			Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)					
Flat	Top sensing W3 × H8 × D12	Tough FT-Z30H	R2	2 m	STD 3,500 137.795	3,600 141.732 (Note 2)	1,400 55.118	2 × 3	IP40	-40 to +60 °C	P.54	
	Top sensing W3 × H8 × D12	FT-Z30HW	R1		HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2)	2,600 102.362 810 31.890					3,200 125.984
	Side sensing W3 × H12 × D8	Tough FT-Z30E	R2		STD 3,500 137.795	3,600 141.732 (Note 2)	1,200 47.244					2,600 102.362
	Side sensing W3 × H12 × D8	FT-Z30EW	R1		HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2)	2,400 94.488 740 29.134					
	Front sensing W8.5 × H12 × D3	Tough FT-Z30	R2		STD 2,100 82.677	3,600 141.732 (Note 2)	710 27.953					ø2
	Front sensing W8.5 × H12 × D3	FT-Z30W			HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2)	1,200 47.244 410 16.142					
	Front sensing W10 × H7 × D2	FT-Z20W			STD 620 24.409	1,500 59.055	280 11.024	ø1.5				
	Fiber bending type W2 × H10 × D10	FT-Z20HBW	R1		HYPR (Note 2) 1,600 62.992	1,100 43.307	420 16.535 130 5.118		730 28.740			
	Front sensing W14 × H7 × D3.5	FT-Z40W			STD 1,500 59.055	3,300 129.921	410 16.142	ø1.5				
	Fiber bending type W3.5 × H14 × D11	FT-Z40HBW			HYPR (Note 2) 3,600 141.732	3,300 129.921	900 35.433 290 11.417		1,200 47.244			
							STD 800 31.496	1,900 74.803	260 10.236	ø1	IP67	P.54
							HYPR (Note 2) 3,300 129.921	1,400 55.118 490 19.291 160 6.299	720 28.346			

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.

New product
introductionTough
FiberFiber
Selection
Guide

Model

Choose
by shape/
applicationHow to read
Model No.Earlier models
comparison
table

Fibers

Super
QualityThreaded
TypeSquare Head
TypeCylindrical
Type

Sleeve

Flat
TypeSmall
SpotNarrow
BeamWide
BeamConvergent
Reflective
TypeRetroreflective
TypeChemical / Oil-
resistant

Heat-resistant

Vacuum-
resistantLiquid Leak /
Liquid DetectionFiber
OptionsSemi-custom
fibersFiber
DimensionsThru-beam
TypeRetroreflective
TypeReflective
Type








Others

Amplifiers

FX-500
seriesFX-100
series

INDEX

Reflective type

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

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

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

Small Spot

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



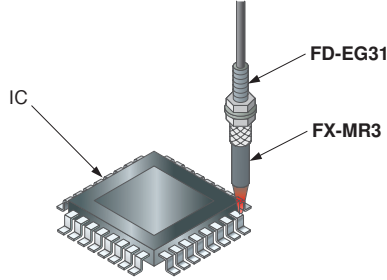
Applications

Packing detection

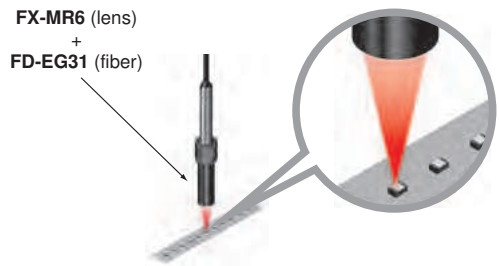


Because it's a side-view type, it can be mounted even in narrow spaces.

Number of IC pins checking



Discrimination of 0603 chip direction



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

FX-MR7 / MR8 / MR9

Finest spot lens FX-MR7

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

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



Parallel light lens FX-MR9

Long-range parallel light

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



Typical FX-501 performance (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 $\varnothing 0.4$ to $\varnothing 3.5 \text{ mm } \varnothing 0.016$ to $\varnothing 0.138 \text{ in}$ can be achieved by combining the lens with a variety of fibers.



All models

Tightening torque 5 times (compared to previous models)















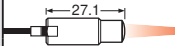
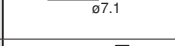

The standard aluminum body has been changed to stainless steel (SUS 303) to reduce the likelihood of damage from over-tightening.

Standard lens outer diameter of $\varnothing 4.3 \text{ mm } (\varnothing 0.169 \text{ in})$

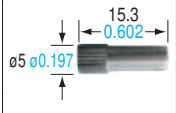










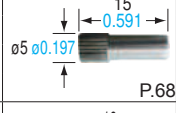




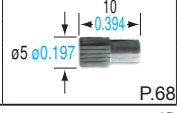




Use of the same mounting hardware across the product line means less inventory and lower costs.

LIST OF FIBERS

High precision fiber & spot lens

Designation	Shape of head (mm) Dimensions	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens		Applicable fibers									
				Model No.	Ambient temp.	Model No.	Fiber cable length ∞: Free-cut	Bending radius (mm)	Protection	Ambient temp.	Dimensions				
Finest spot lens		∅0.1 ∅0.004	7±0.5 0.276±0.020	FX-MR6	-20 to +60 °C	FD-EG31	500 mm	R4	IP40		-20 to +60 °C	P.59			
		∅0.2 ∅0.008				FD-EG30					-40 to +70 °C	P.58			
		∅0.4 ∅0.016	Tough FD-42G			2 m	R2 Bending durability	-55 to +80 °C			P.57				
		∅0.4 ∅0.016	FD-42GW				R1	-40 to +60 °C							
		∅0.4 ∅0.016	Tough FD-32G			1 m	R2 Bending durability	-55 to +80 °C			P.56				
		∅0.4 ∅0.016	FD-32GX				R2	-55 to +80 °C							
		∅0.15 ∅0.006	7.5±0.5 0.295±0.020			FX-MR3	-40 to +70 °C	FD-EG31			500 mm	R4		-20 to +60 °C	P.59
		∅0.3 ∅0.012						FD-EG30						-40 to +70 °C	P.58
		∅0.3 ∅0.012	Tough FD-42G					2 m			R2 Bending durability	-55 to +80 °C		P.57	
		∅0.3 ∅0.012	FD-42GW								R1	-40 to +60 °C			
	∅0.5 ∅0.020	Tough FD-32G	1 m	R2 Bending durability	-55 to +80 °C			P.56							
	∅0.5 ∅0.020	FD-32GX		R2	-55 to +80 °C										
Pinpoint spot lens		∅0.5 ∅0.020	6±1 0.236±0.039	FX-MR1	-40 to +70 °C			Tough FD-42G	2 m	R2 Bending durability	-55 to +80 °C	P.57			
		∅0.5 ∅0.020	6±1 0.236±0.039					FD-42GW		-40 to +60 °C					
Zoom lens		∅0.7 to ∅2.0 ∅0.028 to ∅0.079	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	P.57			
		∅0.7 to ∅2.0 ∅0.028 to ∅0.079	Approx. 18.5 to 43 Approx. 0.728 to 1.693					FD-42GW		-40 to +60 °C					
Zoom lens (Side-view type)		∅0.5 to ∅3.0 ∅0.020 to ∅0.118	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		Fiber			
			Shape (mm in) Dimensions	Model No.	Shape	Emitting fiber core (mm in)	Model No.	
Finest spot lens	∅0.1 ∅0.004 approx.	7 ± 0.5 0.276 ± 0.020		FX-MR7	P.68		∅0.125 ∅0.005	FD-R33EG
	∅0.15 ∅0.006 approx.						∅0.125 ∅0.005	FD-EG31
	∅0.2 ∅0.008 approx.						∅0.175 ∅0.007	FD-R34EG
							∅0.25 ∅0.010	FD-R32EG
	∅0.4 ∅0.016 approx.						∅0.25 ∅0.010	FD-EG30
							∅0.5 ∅0.020	FD-R31G
							∅0.5 ∅0.020	FD-32G
							∅0.5 ∅0.020	FD-32GX
							∅0.5 ∅0.020	FD-42G
							∅0.5 ∅0.020	FD-42GW
Zoom lens	∅0.4 to ∅2.0 ∅0.016 to ∅0.079 approx.	10 to 30 0.394 to 1.181		FX-MR8	P.68		∅0.125 ∅0.005	FD-R33EG, FD-EG31
	∅0.4 to ∅2.2 ∅0.016 to ∅0.087 approx.						∅0.175 ∅0.007	FD-R34EG
	∅0.5 to ∅2.5 ∅0.020 to ∅0.098 approx.						∅0.25 ∅0.010	FD-R32EG, FD-EG30
	∅0.8 to ∅3.5 ∅0.031 to ∅0.138 approx.						∅0.5 ∅0.020	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW
Parallel light lens	∅4.0 ∅0.157 approx.	0 to 30 0 to 1.181		FX-MR9	P.68		∅0.125 ∅0.005	FD-R33EG, FD-EG31
							∅0.175 ∅0.007	FD-R34EG
							∅0.25 ∅0.010	FD-R32EG, FD-EG30
							∅0.5 ∅0.020	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW

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

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

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