Digital Fiber Sensor
FX-100 SERIES

Related Information
■ General terms and conditions..... F-17
■ Glossary of terms / General precautions..... P.1359~ / P.1405
■ Sensor selection guide..... P.3~
■ Fiber selection..... P.5~

panasonic-electric-works.net/sunx

Conforming to EMC Directive

Listing

FX-100 series has been modificated from July 2011 production. The color of enclosure has been changed from white to dark gray and the protection cover has been attached.

PNP output type available
Timer
Interference prevention
Light intensity monitor
Automatic sensitivity setting
Test input

Taking fiber sensors to the next level

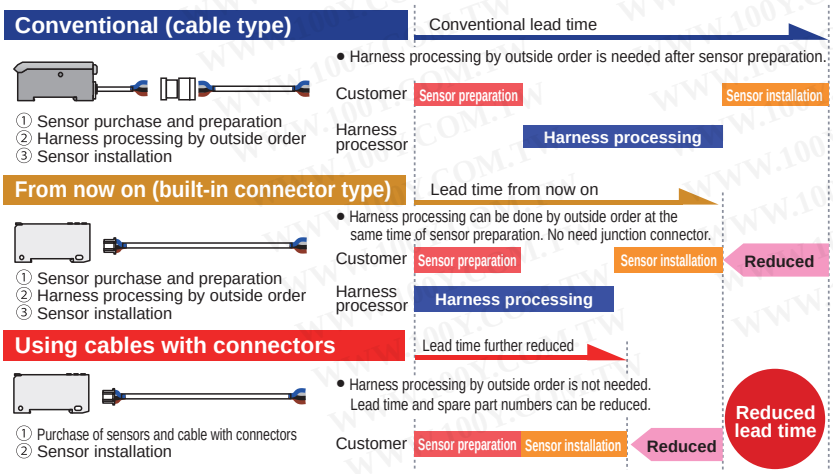
Setup is made simple, using a dual digital display

The dual digital display allows users to check both the threshold value and incident light intensity at the same time, allowing for clear and intuitive control of the sensor's functions.

Commercially-available connectors are used so that lead time and spare part numbers can both be reduced

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

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

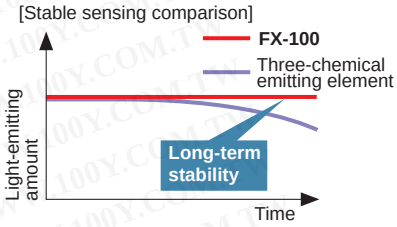


Saving-space with a width of 9 mm 0.354 in

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

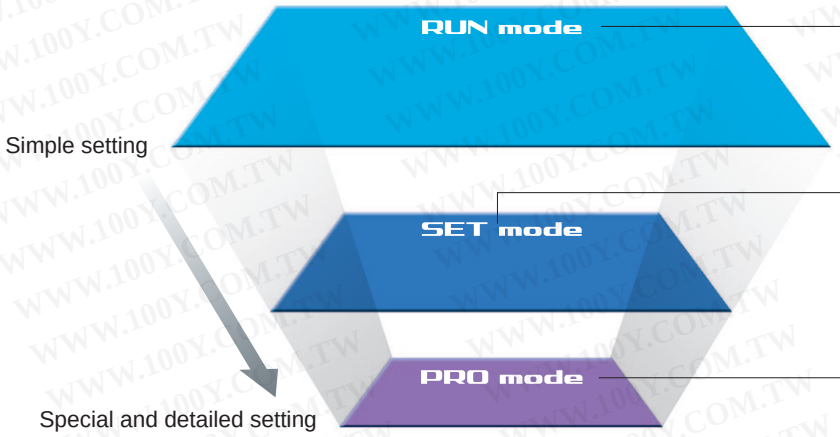
Improved stability over both long terms

Utilizes the standard Panasonic Electric Works SUNX digital fiber sensor element “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 operation system

We are using the operation system of digital pressure sensor **DP-100**, which has been highly praised since it went on sale. We have separated the settings levels into three levels: RUN mode, SET mode, and PRO mode, making operation simpler and easier.



Functions used during normal operation

RUN mode

- Changing threshold values • Key lock
- Quick settings • Code settings

Functions used when initializing the sensor and carrying out maintenance

SET mode

- Teaching • L-ON / D-ON setting
- Timer setting • Attenuation function
- Interference prevention function

Equipped with a full complement of digital fiber sensor functions

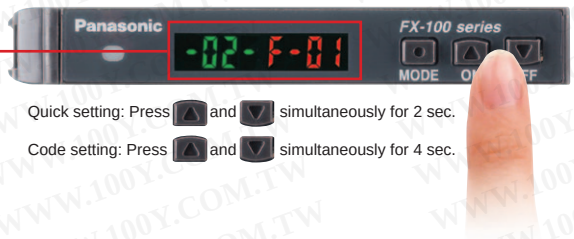
PRO mode

- Shift • External input • Reset
- GETA • ECO • Display reversing
- Surplus value display • Copy
- Threshold tracking

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 (summary)

No	Output operation	Timer	Light-emitting amount selection
-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

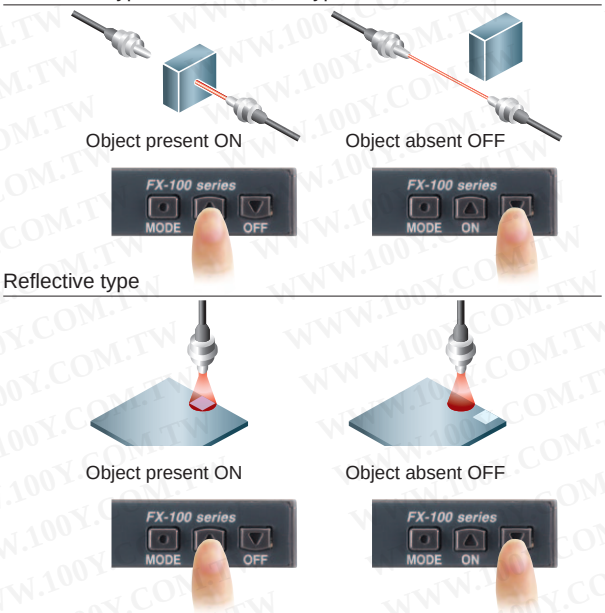
Refer to “**Quick setting function**” and “**Code setting function**” in “**PRECAUTIONS FOR PROPER USE**” for details.

Teaching using ON / OFF buttons SET mode

Simply press the ON button when an object is present and OFF when it is not. There is no need to switch settings or make judgments between Light-ON (L on) and Dark-ON (d on).

<Setting example>

Thru-beam type / Retroreflective type



Teaching is possible even without work.

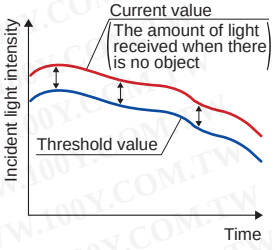
Limit teaching function

This carries out teaching and sets threshold values only when no object is present (when the incident light amount is stable). This is useful when sensing objects if there are other objects in the background and when sensing minute objects. Teaching can also be carried out using external input.

Save maintenance time Threshold tracking function PRO mode

This function seeks changes in the light emitting amount resulting from changes in the environment over long periods (such as dust levels), so that the incident light intensity can be checked at desired intervals and the threshold values can be reset automatically. Reduces the number of man-hours needed for maintenance.

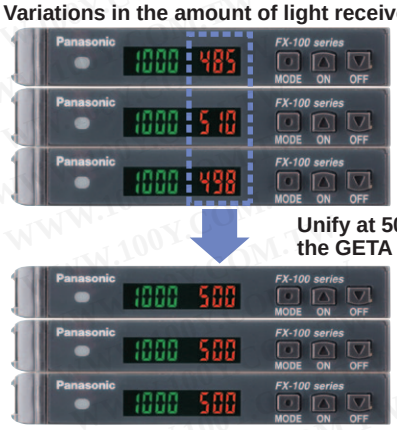
* Becomes active when the output operation is set to on, the beams are not received, and when using semi-transparent or mirrored reflective cable.



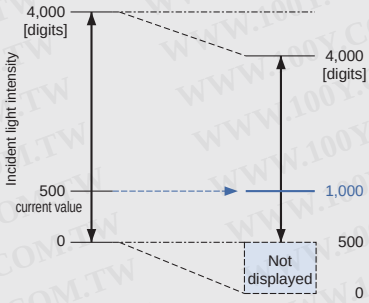
Resolves variation in incident light intensity display GETA function PRO mode

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

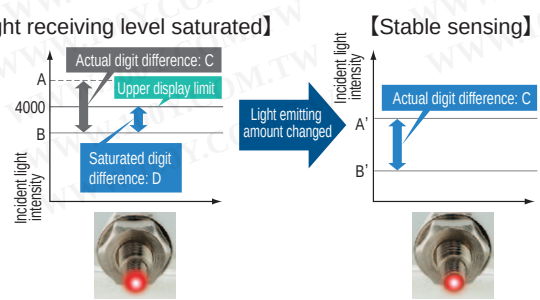


Correcting an incident light intensity display of ' 500 ' to display as ' 1000 '



Stable detection of minute objects or transparent objects Attenuation function SET mode

If the light receiving level becomes saturated when sensing over short distances or when sensing transparent objects or minute objects, the light emitting amount can be reduced so that stable sensing can be provided without needing to change the response time. On previous models, there was only one light reduction level, but now there are 3 levels plus an automatic mode. As before, even when the fiber and distance settings needed to be altered for proper sensing, this function can allow simple settings alterations.

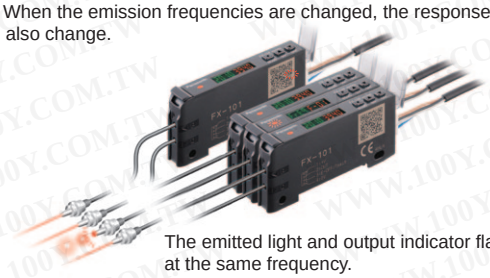


Interference prevention function SET mode

(**FX-101**□: Interference prevention for up to 3 units
FX-102□: Interference prevention for up to 4 units)

The emission frequencies can be set separately for each unit in order to avoid interference. The emitted light flashes while setting is in progress, so that you can see at a glance which fiber sensor is currently being set. There is no need to place the amplifiers close together like there was before, and so the amplifiers can be set up apart from each other.

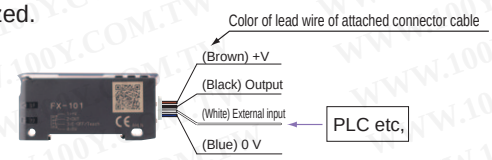
* When the emission frequencies are changed, the response times will also change.



The emitted light and output indicator flash at the same frequency.

Multi-function external input PRO mode

Settings such as emission halt, limit / auto teaching, 2-point teaching and ECO settings can be carried out via external input. Also, the threshold value can be memorized.



External input lines are equipped as standard

Digital display inversion setting PRO mode

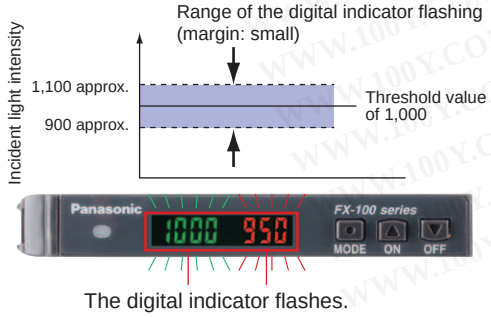
The viewing orientation of the digital display can be inverted in accordance with the setting direction of the amplifier.

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.

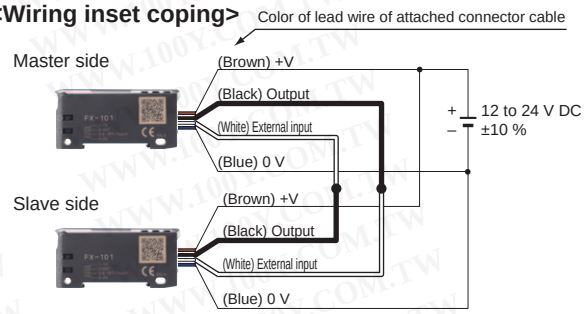


The digital indicator flashes.

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

By attaching a fiber sensor to each device that is to be the fiber sensor master, the master sensor settings can be copied along with data transmissions. By synchronizing the settings on all the devices, trouble from setting errors can be prevented, meaning fewer changes to the instruction manuals even when equipment design is changed.

<Wiring inset coping>



Copiable setting

Threshold value, output operation setting, timer operation setting, timer period setting, light-emitting amount selection setting (attenuation function), shift setting, ECO setting, digital display inversion setting, and threshold value margin setting (alert function)

Flexible mounting without bracket

You can choose either DIN rail mounting or mounting with M3 screws through penetrating holes on the side of the amplifier. When mounting directly or installing only one amplifier or installing to a moving part, there is no slippage.

Use normal or long distance varieties

Response time and sensing range differ with standard or long sensing range types.
Select the best type for your needs.

Model No.	Type	Sensing range (FT-B8)	Response time
FX-101	Standard type	400 mm 15.748 in	Fastest 250 µs
FX-102	Long sensing range type	1,150 mm 45.276 in	Fastest 2.5 ms

Electricity consumption saving possibilities ECO

After setting, if about 20 seconds go by without any key operations taking place the digital display will turn off and energy consumption is kept under 600 mW. (When illuminated it is under 720 mW)

ORDER GUIDE

Amplifiers

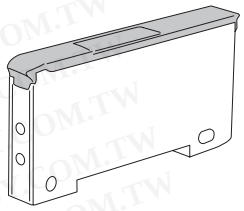
Type		Appearance	Model No.	Emitting element	Output
Standard type	M8 plug-in connector type		**FX-101** (Note 2)	Red LED	NPN open-collector transistor
			FX-101-Z (Note 3)		NPN open-collector transistor
			FX-101P (Note 2)		PNP open-collector transistor
			FX-101P-Z (Note 3)		PNP open-collector transistor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



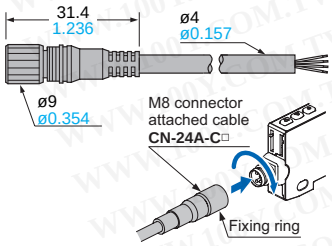
OPTIONS

Designation	Model No.	Description	
Connector attached cable	**CN-14A-C1**	1 m 3.281 ft	0.02 mm² 4-core cabtyre cable with connector on one end Cable outer diameter: ø3.7 mm ø0.146 in
	CN-14A-C2 (Note 1)	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.	
Copy unit (Note 2)	**SC-SU1**	Copy the controller settings to other controllers.	

Notes: 1) The connector attached cable **CN-14A-C2** is supplied with the cable set type **FX-10□-CC2**.
2) Refer to the copy unit **SC-SU1** pages for details.

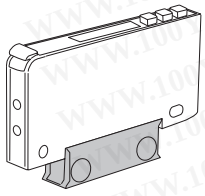
M8 connector attached cable

• **CN-24A-C□**



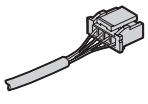
Amplifier mounting bracket

• **MS-DIN-4**



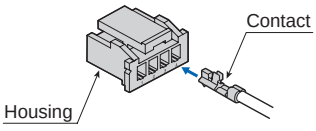
Connector attached cable

• **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.

LIST OF FIBERS

Thru-beam type (one pair set)

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

Model No.	Sensing range (mm in) (Note 1)		Type	Fiber cable length ✂: Free-cut	Dimensions
	Standard type **FX-101**□	Long sensing range type **FX-102**□			
FT-30	135 5.315	400 15.748	Super quality, ø0.5 mm ø0.020 in, Flexible	2 m 6.562 ft	P.90
FT-31	130 5.118	340 13.386	M3, Flexible	✂ 2 m 6.562 ft	P.90
FT-40	320 12.598	870 34.252	Super quality, ø1 mm ø0.039 in, Flexible	2 m 6.562 ft	P.90
FT-41	300 11.811	800 31.496	Metal-free	✂ 2 m 6.562 ft	P.90
FT-42	300 11.811	800 31.496	M4, Flexible		P.90
FT-A8	1,500 59.055	3,500 137.795 (Note 2)	Wide beam		P.90
FT-A30	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)			P.90
FT-AFM2	280 11.024	720 28.346	Array		P.90
FT-AFM2E	240 9.449	670 26.378			P.90
FT-B8	400 15.748	1,150 45.276	M4		P.90
FT-E12	6 0.236	19 0.748	Ultra-small dia.	500 mm 19.685 in	P.91
FT-E13	6 0.236	19 0.748	Ultra-small dia., Flexible	✂ 1 m 3.281 ft	P.91
FT-E22	15 0.591	60 2.362	Ultra-small dia.	1 m 3.281 ft	P.91
FT-E23	22 0.866	80 3.150	Ultra-small dia., Flexible	✂ 1 m 3.281 ft	P.91
FT-FM2	300 11.811	800 31.496	M4	✂ 2 m 6.562 ft	P.91
FT-FM2S	300 11.811	800 31.496	M4, Sleeve		P.91
FT-FM2S4	300 11.811	800 31.496			P.91
FT-FM10L	9,300 366.142	15,000 590.551	M14, Long sensing range	✂ 10 m 32.81 ft	P.91
FT-H13-FM2	250 9.843	700 27.559	Heat-resistant, 130 °C 266 °F	✂ 2 m 6.562 ft	P.91
FT-H20-J20-S (Note 3)	135 5.315	420 16.535	Heat-resistant, Joint 200 °C 392 °F	✂ 200 mm 7.874 in (Note 4)	P.92
FT-H20-J30-S (Note 3)	135 5.315	420 16.535		✂ 300 mm 11.811 in (Note 4)	P.92
FT-H20-J50-S (Note 3)	135 5.315	420 16.535		✂ 500 mm 19.685 in (Note 4)	P.92
FT-H20-M1	210 8.268	540 21.260	Heat-resistant, 200 °C 392 °F	1 m 3.281 ft	P.92
FT-H20-VJ50-S (Note 3)	150 5.906	500 19.685	Heat-resistant, Joint 200 °C 392 °F Side-view	✂ 500 mm19.685 in (Note 4)	P.92
FT-H20-VJ80-S (Note 3)	150 5.906	500 19.685		✂ 800 mm 31.496 in (Note 4)	P.92
FT-H20W-M1	100 3.937	300 11.811	Heat-resistant, 200 °C 392 °F	1 m 3.281 ft	P.92
FT-H30-M1V-S (Note 5)	110 4.331	280 11.024	Vacuum-resistant, Heat-resistant		P.92
FT-H35-M2	170 6.693	490 19.291	Heat-resistant, 350 °C 662 °F	2 m 6.562 ft	P.92
FT-H35-M2S6	170 6.693	490 19.291	Sleeve		P.92
FT-HL80Y	990 38.976	2,340 92.126	Chemical-resistant, Heat-resistant	✂ 2 m 6.562 ft (Note 6)	P.92
FT-K8	1,000 39.370	3,000 118.110	Narrow beam	✂ 2 m 6.562 ft	P.93
FT-KV1	135 5.315	500 19.685	Side-view		P.93
FT-KV8	1,000 39.370	3,000 118.110			P.93
FT-L80Y	1,100 43.307	2,600 102.362	Chemical-resistant	✂ 2 m 6.562 ft (Note 6)	P.93
FT-NFM2	130 5.118	280 11.024	M3	✂ 2 m 6.562 ft	P.93
FT-NFM2S	130 5.118	280 11.024	M3, Sleeve		P.93
FT-NFM2S4	130 5.118	280 11.024			P.93
FT-P2	120 4.724	330 12.992	ø1.5 mm ø0.059 in, Flexible	1 m 3.281 ft	P.93
FT-P40	80 3.150	240 9.449	M3, Flexible	✂ 2 m 6.562 ft	P.93
FT-P60	130 5.118	300 11.811	M4, Flexible		P.93
FT-P80	230 9.055	650 25.591			P.93
FT-P81X	260 10.236	800 31.496	M4, Tough flexible	1 m 3.281 ft	P.94

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 to 3,500 mm 137.795 in long.
3) Heat-resistant joint fibers and ordinary-temperature fibers (**FT-FM2**) are sold as a set.
4) This is the fiber length (fixed length) for heat-resistant fibers. The ordinary-temperature fibers are free-cut to 2 m 6.562 ft.
5) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).
6) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.

LIST OF FIBERS

Thru-beam type (one pair set)

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

Model No.	Sensing range (mm in) (Note 1)		Type	Fiber cable length ✂: Free-cut	Dimensions
	Standard type **FX-101□**	Long sensing range type **FX-102□**			
FT-PS1	40 1.575	90 3.543	ø1 mm ø0.039 in, Flexible	500 mm 19.685 in	P.93
FT-R80	180 7.087	430 16.929	M4, Elbow	✂ 2 m 6.562 ft	P.94
FT-S20	135 5.315	400 15.748	Super quality, ø0.5 mm ø0.020 in, Flexible	2 m 6.562 ft	P.94
FT-S21	130 5.118	340 13.386	ø1.5 mm ø0.059 in, Flexible	✂ 2 m 6.562 ft	P.94
FT-S30	320 12.598	870 34.252	Super quality, ø1 mm ø0.039 in, Flexible	2 m 6.562 ft	P.94
FT-SFM2	300 11.811	800 31.496	ø2.5 mm ø0.098 in	✂ 2 m 6.562 ft	P.94
FT-SFM2L	760 29.921	2,400 94.488	ø2.5 mm ø0.098 in, Long sensing range		P.94
FT-SFM2SV2	180 7.087	470 18.504	Side-view		P.94
FT-SNFM2	130 5.118	280 11.024	ø1.5 mm ø0.059 in		P.95
FT-T80	300 11.811	800 31.496	M3		P.95
FT-V10	1,000 39.370	2,350 92.520	Side-view	✂ 2 m 6.562 ft	P.95
FT-V22	140 5.512	380 14.961		1 m 3.281 ft	P.95
FT-V41	40 1.575	120 4.724		✂ 2 m 6.562 ft	P.95
FT-V80Y	340 13.386	800 31.496	Chemical-resistant, Side-view	✂ 2 m 6.562 ft (Note 3)	P.95
FT-W4	80 3.150	220 8.661	M3, Sharp bending	✂ 2 m 6.562 ft	P.95
FT-W8	260 10.236	650 25.591	M4, Sharp bending		P.95
FT-WA8	1,500 59.055	3,500 137.795 (Note 2)	Wide beam		P.95
FT-WA30	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)			P.95
FT-WKV8	700 27.559	2,200 86.614	Narrow beam, Sharp bending		P.96
FT-WR80	215 8.465	570 22.441	M4, Square head, Sharp bending		P.96
FT-WR80L	430 16.929	1,150 45.276			P.96
FT-WS3	150 5.906	600 23.622	ø3 mm ø0.118 in, Sharp bending		P.96
FT-WS4	80 3.150	220 8.661	ø1.5 mm ø0.059 in, Sharp bending		P.96
FT-WS8	260 10.236	650 25.591	ø2.5 mm ø0.098 in, Sharp bending		P.96
FT-WS8L	600 23.622	1,500 59.055	ø3 mm ø0.118 in, Sharp bending		P.96
FT-WV42	30 1.181	80 3.150	Side-view, Sharp bending		P.96
FT-WZ4	230 9.055	670 26.378	Rectangular, Compact, Sharp bending	✂ 1 m 3.281 ft	P.96
FT-WZ4HB	80 3.150	230 9.055			P.97
FT-WZ7	330 12.992	1,000 39.370		✂ 2 m 6.562 ft	P.97
FT-WZ7HB	190 7.480	580 22.835			P.97
FT-WZ8	330 12.992	950 37.402			P.97
FT-WZ8E	700 27.559	2,100 82.677			P.97
FT-WZ8H	1,200 47.244	2,800 110.236			P.97
FT-Z8	360 14.173	1,000 39.370	Rectangular, Flexible		P.97
FT-Z8E	800 31.496	1,850 72.835			P.97
FT-Z8H	1,400 55.118	3,100 122.047			P.97
FT-Z802Y	520 20.472	3,100 122.047	Chemical-resistant, Rectangular		P.97

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 to 3,500 mm 137.795 in long.
3) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.

LIST OF FIBERS

Retroreflective type

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

Model No.	Sensing range (mm in) (Note 1) (Note 2)		Type	Fiber cable length ✂: Free-cut	Dimensions
	Standard type **FX-101**□	Long sensing range type **FX-102**□			
FR-KV1	15 to 200 0.591 to 7.874	15 to 360 0.591 to 14.173	Wafer mapping	✂ 2 m 6.562 in	P.98
FR-KZ21	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	Narrow beam, Top sensing		P.98
FR-KZ21E	20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874	Narrow beam, Side sensing		P.98
FR-WKZ11	100 to 550 3.937 to 21.654	100 to 830 3.937 to 32.677	Sharp bending		P.98

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-WKZ11** is specified for the **RF-13**. The sensing range of **FR-KZ21**, **FR-KZ21E** is specified for the attached reflector **RF-003**.
The sensing range of **FR-KV1** is specified for the attached reflector.
Refer to p.166 for sensing range when **FR-WKZ11** is used in combination with a reflector (optional).
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.

Reflective type

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

Model No.	Sensing range (mm in) (Note 1) (Note 2)		Type	Fiber cable length ✂: Free-cut	Dimensions
	Standard type **FX-101**□	Long sensing range type **FX-102**□			
FD-30	45 1.772	155 6.102	Super quality, M3, Flexible	2 m 6.562 ft	P.99
FD-31	35 1.378	140 5.512	M3, Flexible	✂ 2 m 6.562 ft	P.99
FD-40	45 1.772	155 6.102	Super quality, M4, Flexible	2 m 6.562 ft	P.99
FD-41	35 1.378	140 5.512	M4, Flexible	✂ 2 m 6.562 ft	P.99
FD-60	140 5.512	420 16.535	Super quality, M6, Flexible	2 m 6.562 ft	P.99
FD-61	120 4.724	410 16.142	M6, Flexible	✂ 2 m 6.562 ft	P.99
FD-A15	125 4.921	250 9.843	Wide beam		P.99
FD-AFM2	105 4.134	285 11.220	Array, Top sensing		P.99
FD-AFM2E	85 3.346	245 9.646	Array, Side sensing		P.99
FD-B8	170 6.693	440 17.323	M6		P.99
FD-E12	3.5 0.138	13 0.512	Ultra-small dia.	1 m 3.281 ft	P.100
FD-E22	16 0.630	45 1.772			P.100
FD-EG1	18 0.709	50 1.969	M3, High precision	500 mm 19.685 in	P.100
FD-EG2	10 0.394	30 1.181			P.100
FD-EG3	7 0.276	22 0.866			P.100
FD-EN500S1	1 0.039	4 0.157	M3, Sleeve		P.100
FD-ENM1S1	15 0.591	48 1.890		1 m 3.281 ft	P.100
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 sensing, Mountable on pipe	✂ 2 m 6.562 ft	P.100
FD-F41	Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe (PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm 0.039 to 0.118 in)				P.100
FD-F41Y	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		Liquid/Liquid leak sensing		P.101
FD-F8Y	—		Liquid sensing	✂ 2 m 6.562 ft (Note 3)	P.101
FD-FA90	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		Liquid/Liquid leak sensing	✂ 2 m 6.562 ft	P.101
FD-FM2	100 3.937	410 16.142	M6		P.101

Notes: 1) The standard sensing objects of the sensing ranges vary depending on the fibers.
2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
3) The allowable cutting range is 1,000 mm 39.370 in from the end that the amplifier inserted.

LIST OF FIBERS

Reflective type

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

Model No.	Sensing range (mm in) (Note 1) (Note 2)		Type	Fiber cable length ✂: Free-cut	Dimensions
	Standard type **FX-101**□	Long sensing range type **FX-102**□			
FD-FM2S	100 3.937	345 13.583	M6, Sleeve	✂ 2 m 6.562 ft	P.101
FD-FM2S4	100 3.937	345 13.583	M6, Sleeve	✂ 2 m 6.562 ft	P.101
FD-G4	50 1.969	120 4.724	M4, High precision	✂ 2 m 6.562 ft	P.101
FD-G6	50 1.969	120 4.724	M3, High precision	✂ 2 m 6.562 ft	P.102
FD-G6X	45 1.772	160 6.299	Tough flexible	✂ 1 m 3.281 ft (Note 3)	P.102
FD-G40	50 1.969	120 4.724	Metal-free	✂ 2 m 6.562 ft	P.101
FD-G60	100 3.937	410 16.142	Metal-free	✂ 2 m 6.562 ft	P.102
FD-H13-FM2	100 3.937	280 11.024	Heat-resistant, 130 °C 266 °F	✂ 2 m 6.562 ft	P.102
FD-H18-L31	0 to 10 0.000 to 0.394	0 to 25 0.000 to 0.984	Heat-resistant, 180 °C 356 °F	✂ 2 m 6.562 ft	P.102
FD-H20-21	90 3.543	280 11.024	Heat-resistant, 200 °C 392 °F / M4	1 m 3.281 ft	P.102
FD-H20-M1	120 4.724	300 11.811	Heat-resistant, 200 °C 392 °F / M6	1 m 3.281 ft	P.102
FD-H25-L43	4 to 16 0.157 to 0.630	4 to 23 0.157 to 0.906	Heat-resistant, Convergent reflective	3 m 9.843 ft	P.103
FD-H25-L45	7 to 35 0.276 to 1.378	7 to 38 0.276 to1.496	Heat-resistant, Convergent reflective	3 m 9.843 ft	P.103
FD-H30-KZ1V-S (Note 4)	25 to 80 0.984 to 3.150	10 to 220 0.394 to 8.661	Vacuum-resistant, Heat-resistant	1 m 3.281 ft	P.103
FD-H30-L32	2 to 9 0.079 to 0.354	0 to 17 0.000 to 0.669	Heat-resistant, 300 °C 572 °F	2 m 6.562 ft	P.103
FD-H30-L32V-S (Note 4)	2.5 to 6.5 0.098 to 0.256	0 to 11 0.000 to 0.433	Vacuum-resistant, Convergent reflective	3 m 9.843 ft	P.103
FD-H35-20S	85 3.346	200 7.874	M4, Sleeve	1 m 3.281 ft	P.104
FD-H35-M2	75 2.953	280 11.024	Heat-resistant, 350 °C 662 °F	2 m 6.562 ft	P.104
FD-H35-M2S6	75 2.953	280 11.024	M6, Sleeve	2 m 6.562 ft	P.104
FD-HF40Y	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		Liquid/Liquid leak sensing		P.104
FD-L4	5 to 8 0.197 to 0.315 (Convergent point 6 0.236)	1 to 17 0.039 to 0.669 (Convergent point 6 0.236)	Convergent reflective	✂ 2 m 6.562 ft	P.104
FD-L41	3 to 14 0.118 to 0.551 (Convergent point 8 0.315)	1.5 to 16 0.059 to 0.630 (Convergent point 8 0.315)	Convergent reflective	✂ 2 m 6.562 ft	P.104
FD-L43	0 to 19 0.000 to 0.748	0 to 25 0.000 to 0.984	Convergent reflective	✂ 2 m 6.562 ft	P.104
FD-L44	0 to 6 0.000 to 0.236	0 to 8 0.000 to 0.315	Convergent reflective	✂ 2 m 6.562 ft	P.104
FD-L44S	0 to 4.5 0.000 to 0.177	0 to 5.5 0.000 to 0.217	Convergent reflective	✂ 2 m 6.562 ft	P.104
FD-L45	0 to 40 0.000 to 1.575	0 to 50 0.000 to 1.969	Convergent reflective	✂ 3 m 9.843 ft	P.104
FD-L45A	———	10 to 33 0.394 to 1.299 (Note 5)	Convergent reflective	✂ 3 m 9.843 ft	P.105
FD-L46	16 to 30 0.630 to 1.181	12 to 50 0.472 to 1.969	Convergent reflective	✂ 4 m 13.124 ft	P.105
FD-L47	28 1.102	30 1.181	Convergent reflective	✂ 3 m 9.843 ft	P.105
FD-NFM2	35 1.378	100 3.937	M4	✂ 2 m 6.562 ft	P.105
FD-NFM2S	35 1.378	100 3.937	M4, Sleeve	✂ 2 m 6.562 ft	P.105
FD-NFM2S4	35 1.378	100 3.937	M4, Sleeve	✂ 2 m 6.562 ft	P.105
FD-P2	25 0.984	65 2.559	ø1.5 mm ø0.059 in, Flexible	1 m 3.281 ft	P.105
FD-P40	8 0.315	30 1.181	M3, Flexible	✂ 2 m 6.562 ft	P.105
FD-P50	45 1.772	150 5.906	ø3 mm ø0.118 in, Flexible	✂ 2 m 6.562 ft	P.105
FD-P60	45 1.772	150 5.906	M4, Flexible	✂ 2 m 6.562 ft	P.105
FD-P80	90 3.543	200 7.874	M6, Flexible	✂ 2 m 6.562 ft	P.105
FD-P81X	70 2.756	220 8.661	M6, Tough flexible	1 m 3.281 ft	P.106
FD-R80	70 2.756	180 7.087	M6, Elbow	✂ 2 m 6.562 ft	P.106
FD-S30	45 1.772	155 6.102	Super quality, ø3 mm ø0.118 in, Flexible	2 m 6.562 ft	P.106
FD-S31	35 1.378	140 5.512	ø3 mm ø0.118 in, Flexible	✂ 2 m 6.562 ft	P.106

Notes: 1) The standard sensing objects of the sensing ranges vary depending on the fibers.
2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
3) The allowable cutting range is 700 mm 27.559 in from the end that the amplifier inserted.
4) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).
5) The sensing range is changed due to tilt of senseing object.

LIST OF FIBERS

Reflective type

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

Model No.	Sensing range (mm in) (Note 1) (Note 2)		Type	Fiber cable length ✂: Free-cut	Dimensions
	Standard type **FX-101□**	Long sensing range type **FX-102□**			
FD-S80	100 3.937	345 13.583	ø3 mm ø0.118 in		P.106
FD-SFM2SV2	30 1.181	90 3.543	Side-view		P.106
FD-SNFM2	35 1.378	100 3.937	ø2.5 mm ø0.098 in		P.106
FD-T40	35 1.378	100 3.937	M3		P.106
FD-T80	110 4.331	345 13.583	M4		P.106
FD-V41	25 0.984	70 2.756	Side-view		P.106
FD-W8	80 3.150	230 9.055	M6, Sharp bending	✂ 2 m 6.562 ft	P.107
FD-W44	15 0.591	40 1.575	M4, Sharp bending		P.107
FD-WG4	28 1.102	75 2.953	M4, High precision		P.107
FD-WKZ1	20 to 180 0.787 to 7.087	20 to 480 0.787 to 18.898	Long sensing range, Rectangular		P.107
FD-WL41	7 to 12 0.276 to 0.472 (Convergent point 8 0.315)	6 to 13.5 0.236 to 0.531 (Convergent point 8 0.315)	Convergent reflective		P.107
FD-WL48	1 to 4.5 0.039 to 0.177	0.5 to 6.5 0.020 to 0.256		✂ 1 m 3.281ft	P.107
FD-WS8	80 3.150	230 9.055	ø3 mm ø0.118 in, Sharp bending		P.107
FD-WSG4	28 1.102	75 2.953	ø3 mm ø0.118 in, High precision	✂ 2 m 6.562 ft	P.107
FD-WT4	15 0.591	40 1.575	M3, Sharp bending		P.107
FD-WT8	80 3.150	230 9.055	M4, Sharp bending		P.107
FD-WV42	6 0.236	20 0.787	Side-view, Sharp bending		P.108
FD-WZ4	2 to 20 0.079 to 0.787	1 to 70 0.039 to 2.756	Rectangular, Compact Sharp bending	✂ 1 m 3.281ft	P.108
FD-WZ4HB	2 to 20 0.079 to 0.787	1 to 70 0.039 to 2.756			P.108
FD-WZ7	1 to 55 0.039 to 2.165	160 6.299		✂ 2 m 6.562 ft	P.108
FD-WZ7HB	1 to 60 0.039 to 2.362	0.5 to 180 0.020 to 7.087			P.108

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

Sensing ranges (mm in) when using in combination with the FR-WKZ11 reflector (optional)

Reflector \ Amplifier	**FX-101□**	**FX-102□**
FR-WKZ11 + RF-210	100 to 700 3.937 to 27.559	100 to 1,100 3.937 to 43.307
FR-WKZ11 + RF-220	100 to 1,300 3.937 to 51.181	100 to 2,600 3.937 to 102.362
FR-WKZ11 + RF-230	100 to 2,000 3.937 to 78.740	100 to 4,000 3.937 to 157.480

FIBER OPTIONS

Lens (For thru-beam type fiber)

For thru-beam type fiber

Expansion lens (Note 1) — FX-LE1

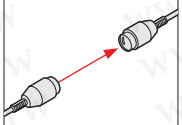
Increases the sensing range by 5 times or more.

- Ambient temperature: –60 to +350 °C –76 to +662 °F (Note 4)

Sensing range (mm in) [Lens on both sides]

Fiber \ Amplifier	FX-101□	FX-102□
FT-B8	2,200 86.614	3,500 137.795 (Note 2)
FT-FM2, FT-T80	3,000 118.110	3,500 137.795 (Note 2)
FT-R80	1,900 74.803	3,500 137.795 (Note 2)
FT-W8	3,000 118.110	3,500 137.795 (Note 2)
FT-P80, FT-P60	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)
FT-P81X	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)
FT-H35-M2	2,000 78.740	3,500 137.795 (Note 2)
FT-H20W-M1	1,300 51.181	1,600 62.992 (Note 2)
FT-H20-M1	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)
FT-H20-J20-S, FT-H20-J30-S, FT-H20-J50-S	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)

Sensing range (mm in) [Lens on both sides]

Fiber \ Amplifier	FX-101□	FX-102□
FT-B8, FT-FM2, FT-R80, FT-W8, FT-P80, FT-P60	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)
FT-P81X	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)
FT-H35-M2	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)
FT-H20W-M1, FT-H20-M1	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)
FT-H13-FM2	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)
FT-H20-J20-S, FT-H20-J30-S, FT-H20-J50-S	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)

Sensing range (mm in) [Lens on both sides]

Fiber \ Amplifier	FX-101□	FX-102□
FT-B8	530 20.866	1,450 57.087
FT-FM2, FT-T80	550 21.654	1,700 66.929
FT-W8	450 17.717	1,300 51.181
FT-P80	420 16.535	1,400 55.118
FT-P60	300 11.811	850 33.465
FT-P81X	550 21.654	1,700 66.929
FT-H35-M2	280 11.024	800 31.496
FT-H20W-M1	140 5.512	400 15.748
FT-H20-M1	280 11.024	840 33.071
FT-H20-J20-S, FT-H20-J30-S, FT-H20-J50-S	150 5.906	410 16.142

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

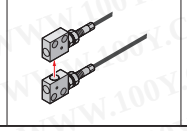
Sensing range increases by 4 times or more.

- Ambient temperature: –60 to +350 °C –76 to +662 °F (Note 4)

Sensing range (mm in) [Lens on both sides] (Note 3)

Fiber \ Amplifier	FX-101□	FX-102□
FT-H30-M1V-S	450 17.717	1,600 62.992

Side-view lens for vacuum-resistant fiber — FV-SV2



Beam axis is bent by 90°.

- Ambient temperature: –60 to +300 °C –76 to +572 °F (Note 4)

Sensing range (mm in) [Lens on both sides] (Note 3)

Fiber \ Amplifier	FX-101□	FX-102□
FT-H30-M1V-S	450 17.717	1,600 62.992

Notes: 1) Be careful when installing the thru-beam type fiber equipped with the expansion lens, as the beam envelope becomes narrow and alignment is difficult. Especially when installing a fiber with many cores (sharp bending fibers and heat-resistant glass fiber), please be sure to use it only after you have adjusted it sufficiently.
2) The fiber cable length practically limits the sensing range to 3,500 mm 137.795 in long (**FT-H20W-M1**, **FT-P81X** and **FT-H20-M1**: 1,600 mm 62.992 in).
3) The fiber cable length for the **FT-H30-M1V-S** is 1 m 3.281 ft. The sensing ranges in **FX-102**□ (long sensing range type) take into account the length of the **FT-J8** atmospheric side fiber.
4) For details on the ambient temperatures for the fibers which being combined, refer to p.76~.

FIBER OPTIONS

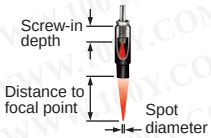
Lens (For reflective type fiber)

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-WG4**, **FD-G4**
• Ambient temperature: –40 to +70 °C –40 to +158 °F (Note 2)

Zoom lens — FX-MR2

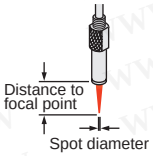


The spot diameter is adjustable from ø0.7 to ø2 mm ø0.028 to ø0.079 in according to how much the fiber is screwed in.
• Applicable fibers: **FD-WG4**, **FD-G4**
• Ambient temperature: –40 to +70 °C –40 to +158 °F (Note 2)
• Accessory: **MS-EX-3** (mounting bracket)

Sensing range for FX-101□ (mm in) (Note 1)

Screw-in depth	Distance to focal point	Spot diameter
7 mm 0.276 in	18.5 0.728 approx.	ø0.7 ø0.028
12 mm 0.472 in	27 1.063 approx.	ø1.2 ø0.047
14 mm 0.551 in	43 1.693 approx.	ø2.0 ø0.079

Finest spot lens — FX-MR3



Extremely fine spot of ø0.3 mm ø0.012 in approx. achieved.
• Applicable fibers: **FD-WG4**, **FD-G4**, **FD-EG1**, **FD-EG2**, **FD-EG3**, **FD-G6X**, **FD-G6**
• Ambient temperature: –40 to +70 °C –40 to +158 °F (Note 2)

Sensing range for FX-101□ (mm in) (Note 1)

Fiber model No.	Distance to focal point	Spot diameter
FD-EG3	7.5 ± 0.5 0.295 ± 0.020	ø0.15 ø0.006 approx.
FD-EG2	7.5 ± 0.5 0.295 ± 0.020	ø0.2 ø0.008 approx.
FD-EG1	7.5 ± 0.5 0.295 ± 0.020	ø0.3 ø0.012 approx.
FD-WG4/G4, FD-G6X/G6	7.5 ± 0.5 0.295 ± 0.020	ø0.5 ø0.020 approx.

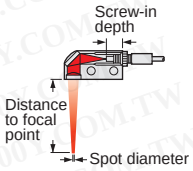
Finest spot lens — FX-MR6

Extremely fine spot of ø0.1 mm ø0.004 in approx. achieved.
• Applicable fibers: **FD-WG4**, **FD-G4**, **FD-EG1**, **FD-EG2**, **FD-EG3**, **FD-G6X**, **FD-G6**
• Ambient temperature: –20 to +60 °C –4 to +140 °F (Note 2)

Sensing range for FX-101□ (mm in) (Note 1)

Fiber model No.	Distance to focal point	Spot diameter
FD-EG3	7 ± 0.5 0.276 ± 0.020	ø0.1 ø0.004 approx.
FD-EG2	7 ± 0.5 0.276 ± 0.020	ø0.15 ø0.006 approx.
FD-EG1	7 ± 0.5 0.276 ± 0.020	ø0.2 ø0.008 approx.
FD-WG4/G4, FD-G6X/G6	7 ± 0.5 0.276 ± 0.020	ø0.4 ø0.016 approx.

Zoom lens (Side-view type) — FX-MR5



FX-MR2 is converted into a side-view type and can be mounted in a very small space.
• Applicable fibers: **FD-WG4**, **FD-G4**
• Ambient temperature: –40 to +70 °C –40 to +158 °F (Note 2)

Sensing range for FX-101□ (mm in) (Note 1)

Screw-in depth	Distance to focal point	Spot diameter
8 mm 0.315 in	13 0.512 approx.	ø0.5 ø0.020
10 mm 0.394 in	15 0.591 approx.	ø0.8 ø0.031
14 mm 0.551 in	30 1.181 approx.	ø3.0 ø0.118

Notes: 1) The sensing ranges are the values when used in combination with **FX-101**□ (standard type). Please contact our office for details on sensing ranges for other types of amplifier.
2) For details on the ambient temperatures for the fibers which being combined, refer to p.76~.

SPECIFICATIONS

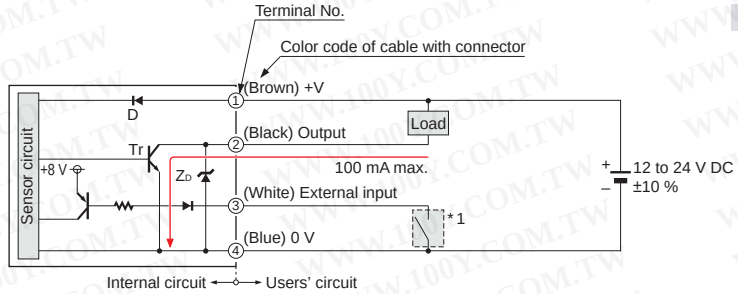
Item	Model No.	Standard type		Long sensing range type	
Type			Cable set		Cable set
	NPN output	**FX-101**(**-Z**) (Note 5)	**FX-101-CC2**	**FX-102**(**-Z**) (Note 5)	**FX-102-CC2**
	PNP output	**FX-101P**(**-Z**) (Note 5)	**FX-101P-CC2**	**FX-102P**(**-Z**) (Note 5)	**FX-102P-CC2**
Supply voltage		12 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]			
Attenuation function		3–level + Auto setting			
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: 632 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		———	**CN-14A-C2** (Connector attached cable, 2 m 6.562 ft long): 1pc.	———	**CN-14A-C2** (Connector attached cable, 2 m 6.562 ft long): 1pc.

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**□.

I/O CIRCUIT AND WIRING DIAGRAMS

FX-10□(-Z/-CC2) — NPN output type

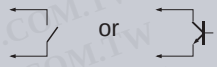
I/O circuit diagram



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

*1

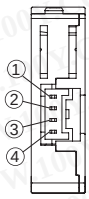
Non-voltage contact or NPN open-collector transistor



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

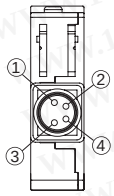
Terminal arrangement diagram

Connector type



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

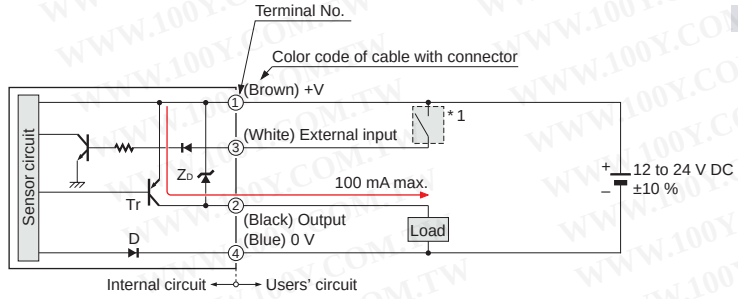
M8 plug-in connector type



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

FX-10□P(-Z/-CC2) — PNP output type

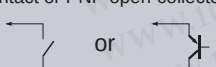
I/O circuit diagram



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

*1

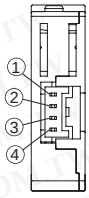
Non-voltage contact or PNP open-collector transistor



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

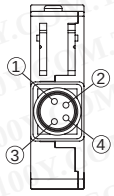
Terminal arrangement diagram

Connector type



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

M8 plug-in connector type



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

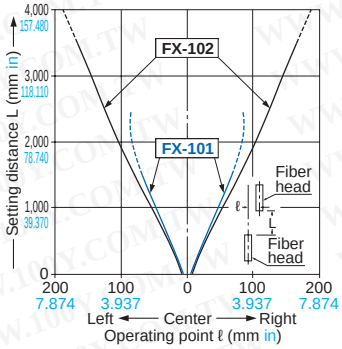
SENSING CHARACTERISTICS (TYPICAL)

Contact our office for sensing characteristics that are not contained here.

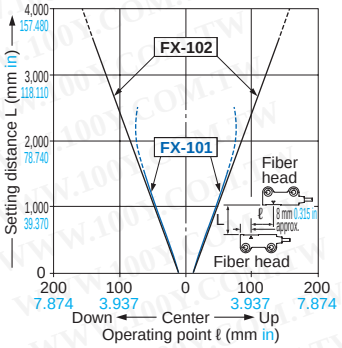
FT-A8 Thru-beam type

Parallel deviation

• Horizontal direction

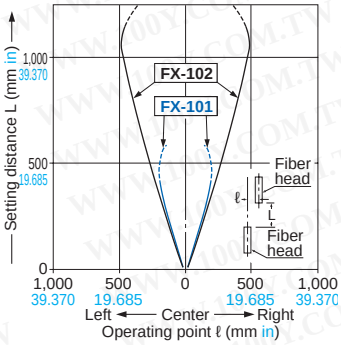


• Vertical direction



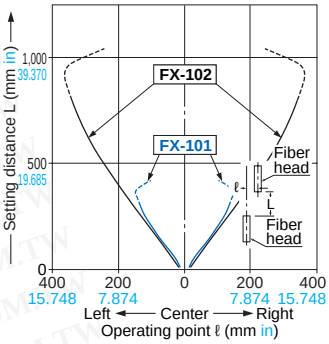
FT-B8 Thru-beam type

Parallel deviation



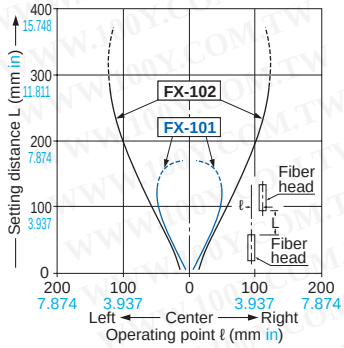
FT-FM2 FT-FM2S FT-FM2S4 FT-SFM2 FT-T80 Thru-beam type

Parallel deviation



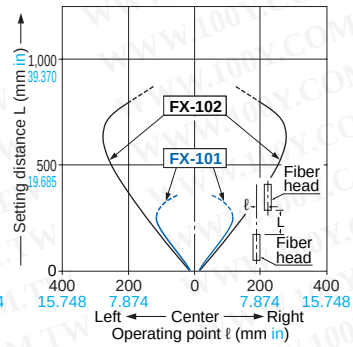
FT-NFM2 FT-NFM2S FT-NFM2S4 FT-SNFM2 Thru-beam type

Parallel deviation



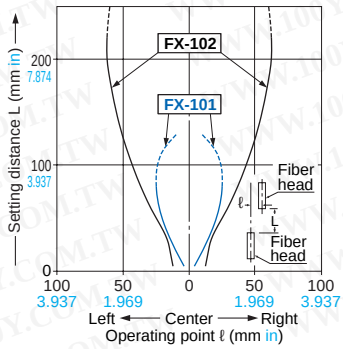
FT-P81X Thru-beam type

Parallel deviation



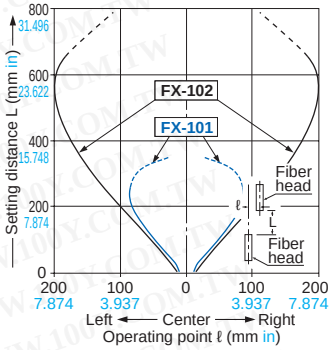
FT-W4 FT-WS4 Thru-beam type

Parallel deviation



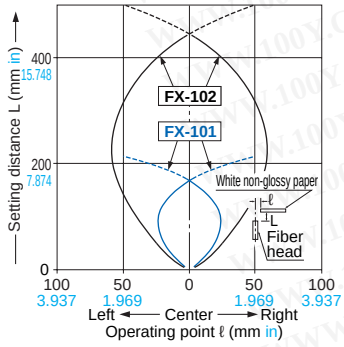
FT-W8 FT-WS8 Thru-beam type

Parallel deviation



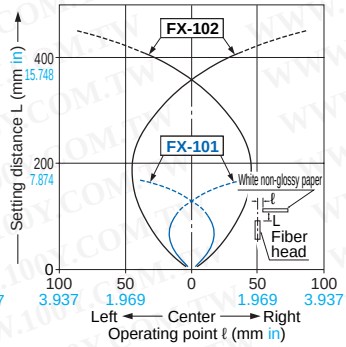
FD-B8 Reflective type

Sensing field



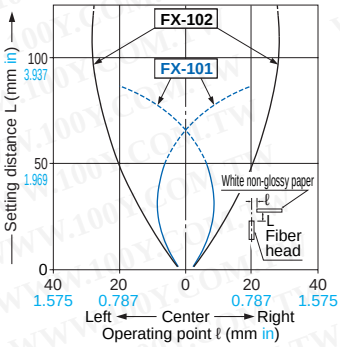
FD-FM2 Reflective type

Sensing field



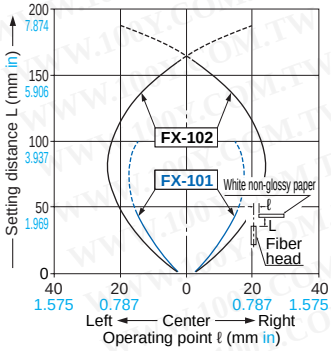
FD-G4 Reflective type

Sensing field



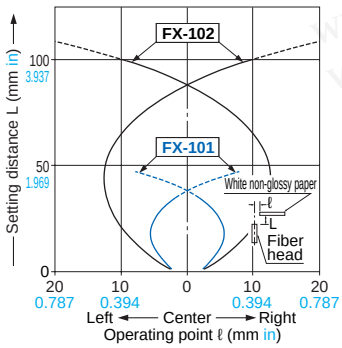
FD-G6X Reflective type

Sensing field



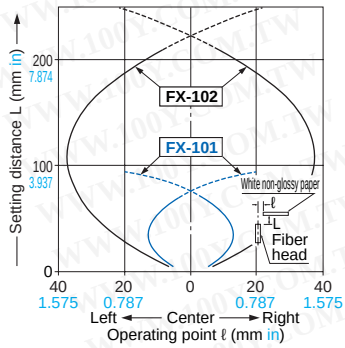
FD-NFM2 FD-NFM2S FD-NFM2S4 FD-SNFM2 FD-T40 Reflective type

Sensing field



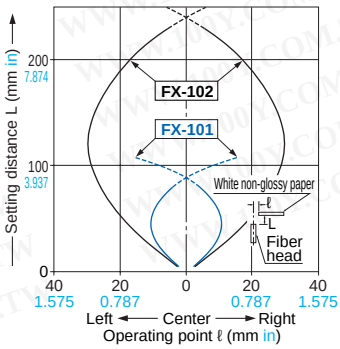
FD-P81X Reflective type

Sensing field



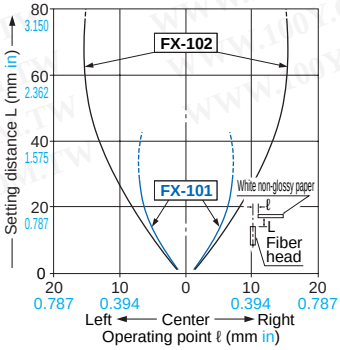
FD-W8 FD-WS8 FD-WT8 Reflective type

Sensing field



FD-WG4 FD-WSG4 Reflective type

Sensing field



PRECAUTIONS FOR PROPER USE

Refer to General precautions, and 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

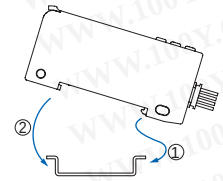
- The **FX-100** series does not use the horizontal connectors that are used with the **FX-300** / **FX-410** series. Please note that horizontal connection cannot be performed using a connector attached cable. In addition, the optical communication function is not equipped on the **FX-100** series,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

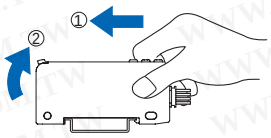
① Fit the rear part of the mounting section of the amplifier on a 35 mm 1.378 in width DIN rail.
② Press down the rear part of the mounting section of the unit on the 35 mm 1.378 in width DIN rail and fit the front part of the mounting section to the DIN rail.



35 mm 1.378 in width DIN rail

How to remove the amplifier

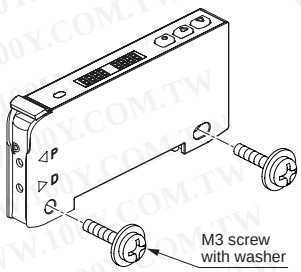
① Push the amplifier forward.
② Lift up the front part of the amplifier to remove it.



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>

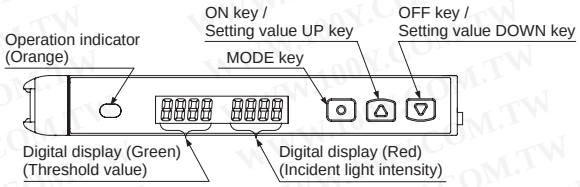
- Use M3 screws with washers for mounting. The tightening torque should be 0.5 N·m or less.



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 mm^2 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 setting	ond 10 [ON-delay timer: 10 ms] oFd 10 [OFF-delay timer: 10 ms]	In case of setting ON-delay timer or OFF-delay timer in the timer operation setting mode, timer can be set. When timer is not set, this mode is not displayed.
Emission amount setting	PctL 1000 Level 3	Setting for reduced intensity of emission amount is possible when the incident light intensity is saturated.
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)]	In case of 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.

PRECAUTIONS FOR PROPER USE

Refer to General precautions, and 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 E-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 Grn : Green blinks. rEd : Red blinks. ALL : Red and green blink. In-t : When conducting limit teaching or 2-point teaching by external input, in case the rate of reference incident light intensity and threshold value after teaching is 200% or more, or in case it is less than half of the shift amount, output turns ON / OFF every 100 ms. (Note 6)
Setting copy	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.
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.

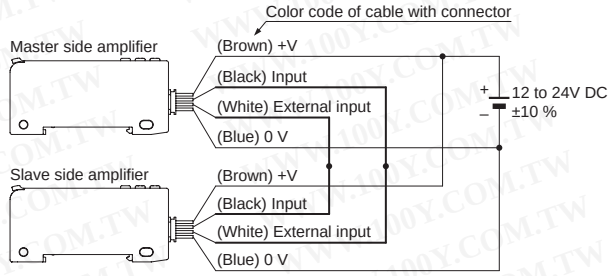
Setting copy function

• This can copy the settings of the master side amplifier to the slave side amplifier.
Refer to the copy unit **SC-SU1** for details.

• 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 (“ ' ”→“ '' ”→“ ''' ”→“ '''' ”→“ ''''' ”→“ '''''' ”→“ ''''''' ”) 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 General precautions, and to the “Operation Guide” on our website for details pertaining to operating instructions for the amplifier.

Others

- 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
-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)

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>

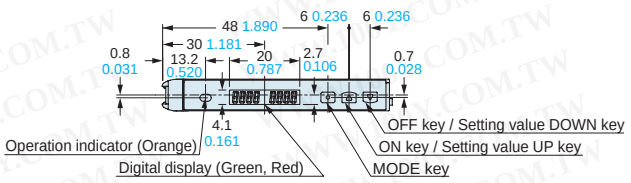
Code	1st digit		2nd digit			3rd digit		4th digit
	Output operation	Timer (Note 1)	Emission amount setting	Emission frequency FX-101□	Emission frequency FX-102□	ECO	External input	Shift (Note 1)
0	D-ON	non	Level 3 (OFF)	0	1	OFF	Emission halt	5 %
1	D-ON	ond 10 ms	Level 3 (OFF)	1	2	OFF	Limit teaching [+]	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			

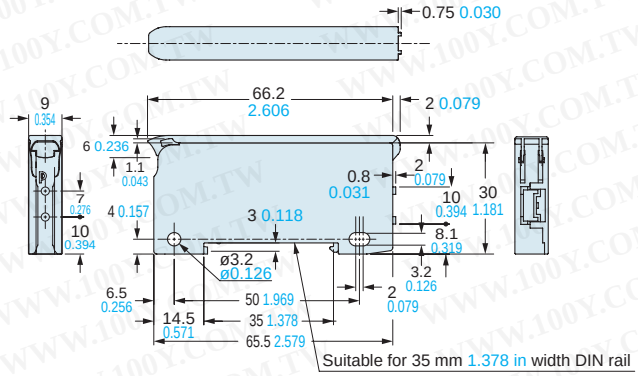
Notes: 1) When the present setting is out of the code setting range, “-” is shown. When “-” is selected, the set content of the digit is not changed.
2) The factory setting is “ 0002 ”.

DIMENSIONS (Unit: mm in)

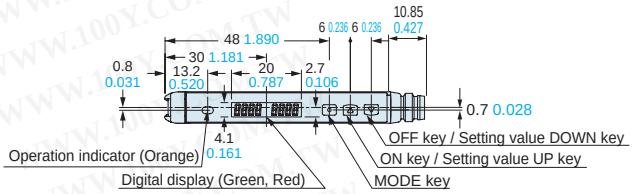
The CAD data in the dimensions can be downloaded from our website.

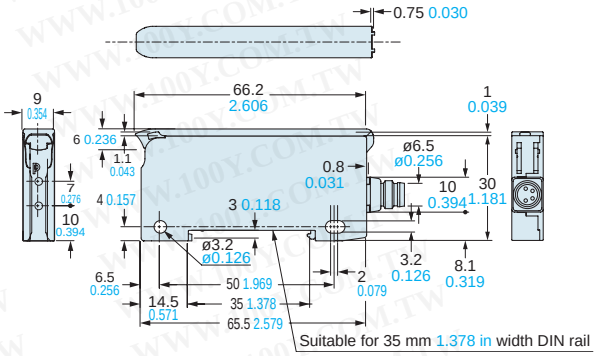
FX-101□ FX-102□ Amplifier



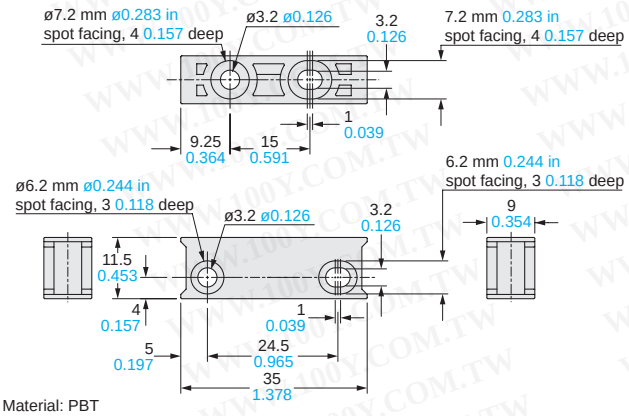


FX-101(P)-Z FX-102(P)-Z Amplifier



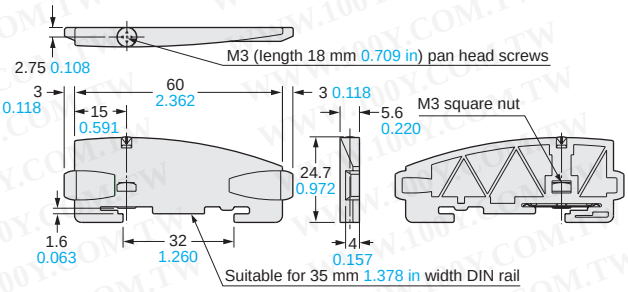


MS-DIN-4 Amplifier mounting bracket (Optional)



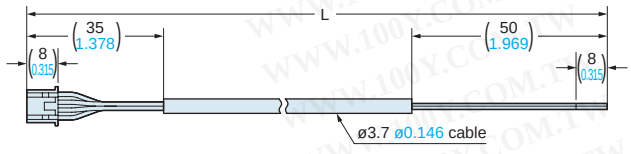
Material: PBT

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