

Manually Set Fiber Sensor

FX-311 SERIES

FIBER SENSORS

LASER SENSORS

PHOTOELECTRIC SENSORS

MICRO PHOTOELECTRIC SENSORS

AREA SENSORS

SAFETY COMPONENTS

PRESSURE SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

WIRE-SAVING SYSTEMS

MEASUREMENT SENSORS

STATIC CONTROL DEVICES

LASER MARKERS

Related Information

■ General terms and conditions..... P.1

■ Fiber Selection..... P.63~

■ Sensor selection guide..... P.11~ / P.61~

■ Glossary of terms / General precautions P.983~ / P.986~



SUNX website <http://www.sunx.com>



* Passed the UL 991 Environment Test

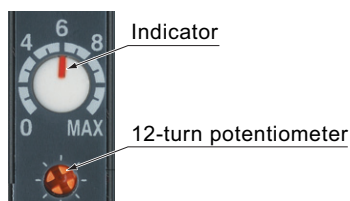
* UL 61010C-1 compatible, Passed the UL 991 Environment Test based on SEMI S2-0200. [Category applicable for semiconductor manufacturing: TWW2, Process Equipment] [Applicable standards: UL 61010C-1] [Additional test / evaluation standards as per intended use: UL 991, SEMI S2-0200]



Highly sensitive manual tuning made easy

12-turn potentiometer with visible indicator

12-turn potentiometer has been incorporated for fine adjustments. It enables detection of very fine differences. Moreover, since the pointer of indicator has a red backlight, you can confirm the position at a glance, even in a dark area.



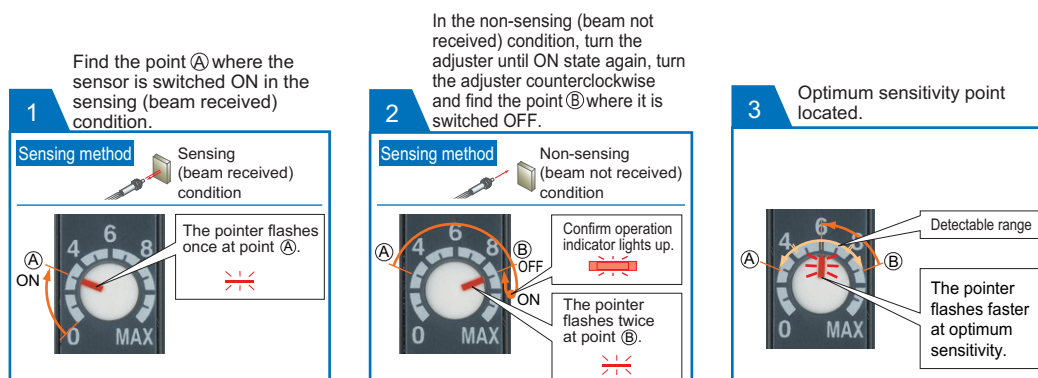
Long life and reduced maintenance work-hours

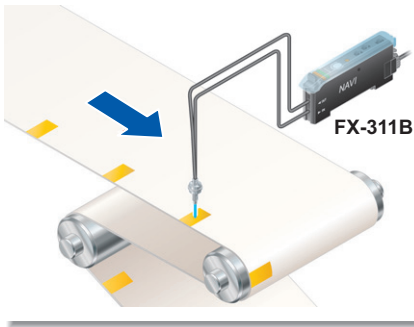
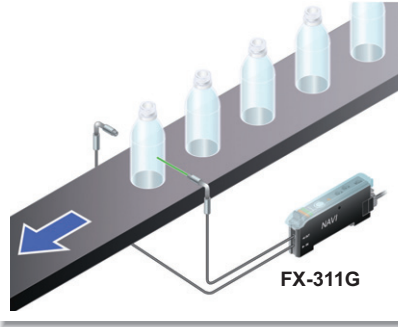
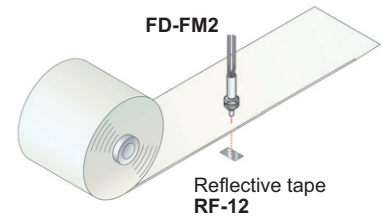
The light-emitting elements of conventional fiber sensors are affected by temperature and long-term use, changing their emission over time and requiring sensitivity readjustment. **FX-311** (red LED type) employs the new "four-chemical LED", first used in the **FX-301** (red LED type). This emitter greatly reduces adverse influences on emission performance, resulting in stable operation that almost never needs adjustment.

Rapid flashing "assist function" eases adjustment for optimum sensitivity

The **FX-311** series has a convenient built-in "assist function" which indicates the optimum sensitivity position by flashing rapidly when optimum sensitivity is reached. This enables easy and reliable sensitivity adjustment, which is convenient for a narrow sensing range requiring fine tuning.

* In order enable the "assist function", switch the operation selection switch from **L-ON→D-ON→L-ON**.



ORDER GUIDE
P.172~LIST OF FIBERS
P.174~SPECIFICATIONS
P.180I/O CIRCUIT DIAGRAMS
P.181SENSING CHARACTERISTICS
P.181PRECAUTIONS FOR PROPER USE
P.181DIMENSIONS
P.182**APPLICATIONS****Detecting register marks****Detecting transparent bottles****Sensing the presence of a translucent sheet****ORDER GUIDE****Amplifiers**

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

Type	Appearance	Model No.	Emitting element	Output
Manually set		FX-311	Red LED	NPN open-collector transistor
		FX-311B	Blue LED	
		FX-311G	Green LED	
		FX-311P	Red LED	PNP open-collector transistor
		FX-311BP	Blue LED	
		FX-311GP	Green LED	

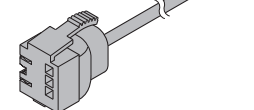
Quick-connection cables

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

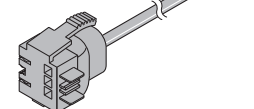
Type	Model No.	Description	
Main cable (3-core)	CN-73-C1	Length: 1 m 3.281 ft	0.15 mm ² 3-core cabtyre cable, with connector on one end Cable outer diameter: $\varnothing$ 3.0 mm $\varnothing$ 0.118 in
	CN-73-C2	Length: 2 m 6.562 ft	
	CN-73-C5	Length: 5 m 16.404 ft	
Sub cable (1-core)	CN-71-C1	Length: 1 m 3.281 ft	0.15 mm ² 1-core cabtyre cable, with connector on one end Cable outer diameter: $\varnothing$ 3.0 mm $\varnothing$ 0.118 in
	CN-71-C2	Length: 2 m 6.562 ft	
	CN-71-C5	Length: 5 m 16.404 ft	

Main cable

• CN-73-C□

**Sub cable**

• CN-71-C□

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Fibers

FT / FD / FR

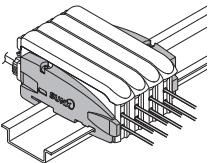
Fiber Sensor Amplifiers

FX-100**FX-300****FX-410****FX-311****FX-11A****FX-301-F**

Other Products

ORDER GUIDE

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

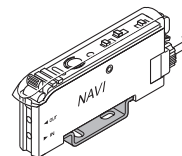
Appearance	Model No.	Description
	MS-DIN-E	When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. Two pcs. per set

OPTIONS

Designation	Model No.	Description
Amplifier mounting bracket	MS-DIN-2	Mounting bracket for amplifier
Hand-turned knob attached cover	FX-AJ1	Hand-turned knob allows easy adjustment of sensor sensitivity.
Fiber amplifier protection seal	FX-MB1	10 sets of 2 communication window seals and 1 connector seal Communication window seal: It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier. Connector seal: It prevents contact of any metal, etc., with the pins of the quick-connection cable.

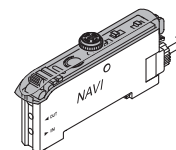
Amplifier mounting bracket

• MS-DIN-2



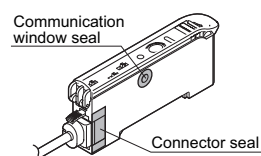
Hand-turned knob attached cover

• FX-AJ1



Fiber amplifier protection seal

• FX-MB1



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

Fibers are listed in alphabetic order. Refer to p.63~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)									Dimensions
	Red LED			Blue LED			Green LED			
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST	
FT-A8	3,500 137.795 (Note 2)	1,500 59.055	750 29.528	600 23.622	300 11.811	220 8.661	300 11.811	150 5.906	110 4.331	P.106
FT-A30	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	2,400 94.488	1,200 47.244	700 27.559	1,200 47.244	600 23.622	350 13.780	P.106
FT-AFM2	650 25.591	330 12.992	115 4.528	120 4.724	60 2.362	40 1.575	60 2.362	30 1.181	20 0.787	P.106
FT-AFM2E	590 23.228	290 11.417	100 3.937	120 4.724	60 2.362	40 1.575	60 2.362	30 1.181	20 0.787	P.106
FT-B8	1,100 43.307	530 20.866	180 7.087	220 8.661	110 4.331	75 2.953	110 4.331	55 2.165	40 1.575	P.106
FT-E12	18 0.709	10 0.394	3 0.118	3 0.118	2 0.079	1 0.039	1 0.039	————	————	P.106
FT-E22	80 3.150	50 1.969	15 0.591	14 0.551	7 0.276	4 0.157	6 0.236	3 0.118	2 0.079	P.106
FT-FM2	780 30.709	400 15.748	130 5.118	150 5.906	75 2.953	40 1.575	70 2.756	35 1.378	24 0.945	P.106
FT-FM2S	780 30.709	400 15.748	130 5.118	150 5.906	75 2.953	40 1.575	70 2.756	35 1.378	24 0.945	P.106
FT-FM2S4	780 30.709	400 15.748	130 5.118	150 5.906	75 2.953	40 1.575	70 2.756	35 1.378	24 0.945	P.106
FT-FM10L	19,500 767.715	14,000 551.180	3,800 149.606	5,400 212.598	2,700 106.299	1,900 74.803	2,800 110.236	1,400 55.118	1,000 39.370	P.106
FT-H13-FM2	880 34.646	440 17.323	155 6.102	72 2.835	36 1.417	26 1.024	32 1.260	16 0.630	10 0.394	P.106
FT-H20-J20-S (Note 3)	390 15.354	200 7.874	60 2.362	60 2.362	20 0.787	————	35 1.378	————	————	P.107
FT-H20-J30-S (Note 3)	390 15.354	200 7.874	60 2.362	60 2.362	20 0.787	————	35 1.378	————	————	P.107
FT-H20-J50-S (Note 3)	390 15.354	200 7.874	60 2.362	60 2.362	20 0.787	————	35 1.378	————	————	P.107
FT-H20-M1	550 21.654	280 11.024	90 3.543	100 3.937	50 1.969	35 1.378	50 1.969	25 0.984	18 0.709	P.107
FT-H20-VJ50-S (Note 3)	550 21.654	280 11.024	90 3.543	85 3.346	30 1.181	————	50 1.969	————	————	P.107
FT-H20-VJ80-S (Note 3)	550 21.654	280 11.024	90 3.543	85 3.346	30 1.181	————	50 1.969	————	————	P.107
FT-H20W-M1	310 12.205	140 5.512	50 1.969	44 1.732	22 0.866	14 0.551	22 0.866	11 0.433	7 0.276	P.107
FT-H30-M1V-S (Note 4)	250 9.843	125 4.922	50 1.969	————	————	————	————	————	————	P.107
FT-H35-M2	550 21.654	280 11.024	90 3.543	100 3.937	50 1.969	35 1.378	50 1.969	25 0.984	18 0.709	P.107
FT-H35-M2S6	550 21.654	280 11.024	90 3.543	100 3.937	50 1.969	35 1.378	50 1.969	25 0.984	18 0.709	P.107
FT-HL80Y	3,500 137.795	1,350 53.150	480 18.898	80 3.150	40 1.575	25 0.984	110 4.331	55 2.165	40 1.575	P.107
FT-K8	2,000 78.740	1,000 39.370	350 13.780	400 15.748	200 7.874	130 5.118	200 7.874	100 3.937	65 2.559	P.108
FT-KV1	500 19.685	250 9.843	100 3.937	————	————	————	————	————	————	P.108
FT-KV8	2,000 78.740	1,000 39.370	350 13.780	400 15.748	200 7.874	130 5.118	200 7.874	100 3.937	65 2.559	P.108
FT-L80Y	3,500 137.795	1,500 59.055	530 20.866	160 6.299	80 3.150	50 1.969	160 6.299	80 3.150	50 1.969	P.108
FT-NFM2	270 10.630	140 5.512	49 1.929	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	P.108
FT-NFM2S	270 10.630	140 5.512	49 1.929	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	P.108
FT-NFM2S4	270 10.630	140 5.512	49 1.929	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	P.108
FT-P2	280 11.024	120 4.724	42 1.654	36 1.417	18 0.709	14 0.551	20 0.787	10 0.394	8 0.315	P.108
FT-P40	250 9.843	100 3.937	35 1.378	32 1.260	16 0.630	12 0.472	18 0.709	9 0.354	7 0.276	P.108
FT-P60	400 15.748	190 7.48	80 3.150	50 1.969	25 0.984	18 0.709	26 1.024	13 0.512	8 0.315	P.108
FT-P80	650 25.591	320 12.598	110 4.331	130 5.118	65 2.559	45 1.772	70 2.756	35 1.378	25 0.984	P.108
FT-P81X	650 25.591	320 12.598	110 4.331	130 5.118	64 2.520	45 1.772	64 2.520	32 1.260	22 0.866	P.108
FT-PS1	80 3.150	40 1.575	17 0.669	14 0.551	7 0.276	4 0.157	6 0.236	3 0.118	2 0.079	P.109
FT-R80	530 20.866	230 9.055	80 3.150	85 3.346	42 1.654	28 1.102	44 1.732	22 0.866	16 0.630	P.109
FT-SFM2	780 30.709	400 15.748	130 5.118	150 5.906	75 2.953	40 1.575	70 2.756	35 1.378	24 0.945	P.109
FT-SFM2L	1,600 62.992	800 31.496	280 11.024	400 15.748	200 7.874	130 5.118	200 7.874	100 3.937	65 2.559	P.109
FT-SFM2SV2	400 15.748	200 7.874	70 2.756	80 3.150	40 1.575	28 1.102	40 1.575	20 0.787	14 0.551	P.109
FT-SNFM2	270 10.630	140 5.512	49 1.929	50 1.969	25 0.984	16 0.630	24 0.945	12 0.472	8 0.315	P.109

Notes: 1) Please take care 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. Please refer to p.93~ for details.

4) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**). Please refer to p.91~ for details.

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Fiber Sensor Amplifiers

FX-100**FX-300****FX-410****FX-311****FX-11A****FX-301-F**

Other Products

LIST OF FIBERS

Thru-beam type (one pair set)



Fibers are listed in alphabetic order. Refer to p.63~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1)									Dimensions
	Red LED			Blue LED			Green LED			
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST	
FT-T80	780 30.709	400 15.748	130 5.118	150 5.906	75 2.953	40 1.575	70 2.756	35 1.378	24 0.945	P.109
FT-V10	2,000 78.740	1,000 39.370	350 13.780	400 15.748	200 7.874	130 5.118	200 7.874	100 3.937	65 2.559	P.109
FT-V22	390 15.354	180 7.087	63 2.480	50 1.969	25 0.984	16 0.630	26 1.024	13 0.512	8 0.315	P.109
FT-V41	175 6.890	80 3.150	27 1.063	28 1.102	14 0.551	10 0.394	14 0.551	7 0.276	5 0.197	P.109
FT-V80Y	800 31.496	400 15.748	140 5.512	120 4.724	60 2.362	35 1.378	80 3.150	40 1.575	25 0.984	P.109
FT-W4	160 6.299	80 3.150	28 1.102	16 0.630	8 0.315	5 0.197	10 0.394	5 0.197	3 0.118	P.109
FT-W8	570 22.441	290 11.417	100 3.937	90 3.543	45 1.772	30 1.181	56 2.205	28 1.102	20 0.787	P.110
FT-WA8	3,500 137.795 (Note 2)	1,500 59.055	750 29.528	600 23.622	300 11.811	220 8.661	300 11.811	150 5.906	110 4.331	P.110
FT-WA30	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	3,500 137.795 (Note 2)	2,400 94.488	1,200 47.244	700 27.559	1,200 47.244	600 23.622	350 13.780	P.110
FT-WKV8	1,700 66.929	700 27.559	300 11.811	300 11.811	150 5.906	100 3.937	160 6.299	80 3.150	60 2.362	P.110
FT-WR80	570 22.441	290 11.417	100 3.937	90 3.543	45 1.772	30 1.181	56 2.205	28 1.102	20 0.787	P.110
FT-WR80L	1,200 47.244	600 23.622	210 8.268	240 9.449	120 4.724	90 3.543	120 4.724	60 2.362	40 1.575	P.110
FT-WS3	570 22.441	290 11.417	100 3.937	90 3.543	45 1.772	30 1.181	56 2.205	28 1.102	20 0.787	P.110
FT-WS4	160 6.299	80 3.150	28 1.102	16 0.630	8 0.315	5 0.197	10 0.394	5 0.197	3 0.118	P.110
FT-WS8	570 22.441	290 11.417	100 3.937	90 3.543	45 1.772	30 1.181	56 2.205	28 1.102	20 0.787	P.110
FT-WS8L	1,200 47.244	600 23.622	210 8.268	240 9.449	120 4.724	90 3.543	120 4.724	60 2.362	40 1.575	P.110
FT-WV42	90 3.543	40 1.575	15 0.591	————	————	————	————	————	————	P.110
FT-WZ4	200 7.874	100 3.937	40 1.575	35 1.378	15 0.591	9 0.354	18 0.709	8 0.315	4.8 0.189	P.110
FT-WZ4HB	150 5.906	75 2.953	30 1.181	32 1.260	15 0.591	9.6 0.378	16 0.630	9 0.354	5.4 0.213	P.111
FT-WZ7	440 17.323	220 8.661	80 3.150	80 3.150	40 1.575	24 0.945	54 2.126	27 1.063	16.2 0.638	P.111
FT-WZ7HB	580 22.835	290 11.417	110 4.331	100 3.937	50 1.969	30 1.181	56 2.205	28 1.102	16.8 0.662	P.111
FT-WZ8	700 27.559	330 12.992	120 4.724	80 3.150	40 1.575	25 0.984	40 1.575	20 0.787	13 0.512	P.111
FT-WZ8E	1,500 59.055	700 27.559	210 8.268	240 9.449	120 4.724	80 3.150	120 4.724	60 2.362	40 1.575	P.111
FT-WZ8H	2,500 98.425	1,200 47.244	410 16.142	400 15.748	200 7.874	140 5.512	200 7.874	100 3.937	70 2.756	P.111
FT-Z8	800 31.496	400 15.748	140 5.512	120 4.724	60 2.362	40 1.575	60 2.362	30 1.181	22 0.866	P.111
FT-Z8E	1,600 62.992	800 31.496	280 11.024	400 15.748	200 7.874	140 5.512	200 7.874	100 3.937	65 2.559	P.111
FT-Z8H	2,700 106.299	1,400 55.118	490 19.291	560 22.047	280 11.024	200 7.874	200 7.874	100 3.937	65 2.559	P.111
FT-Z802Y	3,500 137.795	1,500 59.055	530 20.866	320 12.598	160 6.299	120 4.724	160 6.299	80 3.150	60 2.362	P.111

Notes: 1) Please take care 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.

LIST OF FIBERS**Retroreflective type**

Fibers are listed in alphabetic order. Refer to p.63~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2)									Dimensions
	Red LED			Blue LED			Green LED			
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST	
FR-KV1	15 to 330 0.591 to 12.992	15 to 210 0.591 to 8.268	15 to 90 0.591 to 3.543	————	————	————	————	————	————	P.112
FR-KZ21	200 7.874	200 7.874	200 7.874	200 7.874	120 4.724	90 3.543	130 5.118	80 3.150	50 1.969	P.112
FR-KZ21E	200 7.874	200 7.874	200 7.874	160 6.299	100 3.937	60 2.362	110 4.331	————	————	P.112
FR-WKZ11	100 to 730 3.937 to 28.740	100 to 520 3.937 to 20.472	————	————	————	————	————	————	————	P.112

- Notes: 1) Please take care 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** and **FR-KZ21E** is specified for the attached reflector **RF-003**.
 The sensing range of **FR-KV1** is specified for the attached reflector.
- 2) The sensing range of **FR-KV1** is the possible setting range for the reflector. The fiber can detect an object less than 15 mm 0.591 in away.
 The sensing range of **FR-KZ21** and **FR-KZ21E** is the possible setting range for the reflector. However, if setting the fiber to detect objects passing within 0 to 20 mm 0 to 0.787 in from the fiber head, unstable detection may result.
 The sensing range of **FR-WKZ11** is the possible setting range for the reflective tape. The fiber can detect an object less than 100 mm 3.937 in away.
 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.63~ "Fiber Selection" for details of each fiber.

Model No.	Sensing range (mm in) (Note 1, 2)									Dimensions
	Red LED			Blue LED			Green LED			
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST	
FD-A15	200 7.874	150 5.906	50 1.969	25 0.984	15 0.591	————	————	————	————	P.113
FD-AFM2	220 8.661	110 4.331	39 1.535	40 1.575	20 0.787	13 0.512	18 0.709	9 0.354	5 0.197	P.113
FD-AFM2E	220 8.661	110 4.331	39 1.535	40 1.575	20 0.787	13 0.512	18 0.709	9 0.354	5 0.197	P.113
FD-B8	480 18.898	220 8.661	75 2.953	80 3.150	40 1.575	26 1.024	42 1.654	21 0.827	14 0.551	P.113
FD-E12	11 0.433	6 0.236	1 0.039	2 0.079	1 0.039	————	1 0.039	————	————	P.113
FD-E22	45 1.772	23 0.906	7 0.276	6 0.236	3 0.118	2 0.079	3 0.118	1.5 0.059	1 0.039	P.113
FD-EG1	38 1.496	18 0.709	6 0.236	6 0.236	3 0.118	2 0.079	3 0.118	1.5 0.059	1 0.039	P.113
FD-EG2	25 0.984	12 0.472	5 0.197	5 0.197	2 0.079	1 0.039	2 0.079	1 0.039	————	P.113
FD-EG3	15 0.591	8 0.315	3 0.118	2 0.079	1 0.039	————	1 0.039	————	————	P.113
FD-EN500S1	5 0.197	3 0.118	————	————	————	————	————	————	————	P.113
FD-ENM1S1	38 1.496	18 0.709	6 0.236	6 0.236	3 0.118	2 0.079	3 0.118	1.5 0.059	1 0.039	P.114
FD-F4	Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 toø1.024 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in]									P.114
FD-F41	Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe [PVC, fluorine resin, Polycarbonate, acrylic, glass, wall thickness 1 to 3 mm 0.039 to 0.118 in]									P.114
FD-F8Y	————	————	————	————	————	————	————	————	————	P.114
FD-FM2	310 12.205	140 5.512	47 1.850	46 1.811	23 0.906	15 0.591	24 0.945	12 0.472	8 0.315	P.114
FD-FM2S	270 10.630	110 4.331	39 1.535	46 1.811	23 0.906	15 0.591	24 0.945	12 0.472	8 0.315	P.114
FD-FM2S4	270 10.630	110 4.331	39 1.535	46 1.811	23 0.906	15 0.591	24 0.945	12 0.472	8 0.315	P.114
FD-G4	110 4.331	55 2.165	19 0.748	22 0.866	11 0.433	8 0.315	12 0.472	6 0.236	4 0.157	P.114
FD-G6	110 4.331	55 2.165	19 0.748	22 0.866	11 0.433	8 0.315	12 0.472	6 0.236	4 0.157	P.114
FD-G6X	90 3.543	45 1.772	20 0.787	22 0.866	11 0.433	6 0.236	12 0.472	6 0.236	4 0.157	P.114
FD-H13-FM2	310 12.205	140 5.512	47 1.850	20 0.787	11 0.433	7 0.276	20 0.787	11 0.433	7 0.276	P.114
FD-H18-L31	0 to 15 0 to 0.591	0 to 10 0 to 0.394	2 to 6 0.079 to 0.236	————	————	————	————	————	————	P.115
FD-H20-21	270 10.630	140 5.512	47 1.850	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	P.115
FD-H20-M1	270 10.630	140 5.512	47 1.850	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	P.115
FD-H30-KZ1V-S (Note 3)	20 to 200 0.787 to 7.874	25 to 130 0.984 to 5.118	————	————	————	————	————	————	————	P.115
FD-H30-L32	0 to 15 0 to 0.591	0 to 10 0 to 0.394	2 to 6 0.079 to 0.236	————	————	————	————	————	————	P.115
FD-H30-L32V-S (Note 3)	0 to 8 0 to 0.315	1.5 to 5 0.059 to 0.197	————	————	————	————	————	————	————	P.115
FD-H35-20S	160 6.299	80 3.150	26 1.024	22 0.866	11 0.433	7 0.276	12 0.472	6 0.236	4 0.157	P.116

- Notes: 1) The standard sensing objects of the sensing ranges vary depending on the fibers. Refer to p.71~ for details.
 2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
 3) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**). Please refer to p.91~ for details.

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

SAFETY COMPONENTS

PRESSURE SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

WIRE- SAVING SYSTEMS

MEASURE- MENT SENSORS

STATIC CONTROL DEVICES

LASER MARKERS

Selection Guide

Fibers

FT / FD / FR

Fiber Sensor Amplifiers

FX-100

FX-300

FX-410

FX-311

FX-11A

FX-301-F

Other Products

LIST OF FIBERS

Reflective type



Fibers are listed in alphabetic order. Refer to p.63~ "Fiber Selection" for details of each fiber.

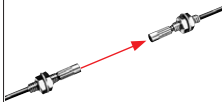
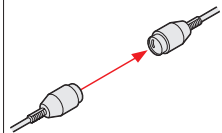
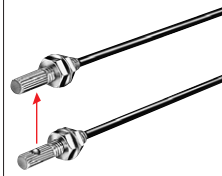
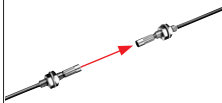
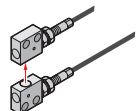
Model No.	Sensing range (mm in) (Note 1, 2)									Dimensions
	Red LED			Blue LED			Green LED			
	LONG	STD	S-D	LONG	STD	FAST	LONG	STD	FAST	
FD-H35-M2	270 10.630	140 5.512	47 1.850	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	P.116
FD-H35-M2S6	270 10.630	140 5.512	47 1.850	36 1.417	18 0.709	12 0.472	20 0.787	10 0.394	7 0.276	P.116
FD-L4	2.5 to 18 0.098 to 0.709 (Convergent point 6 0.236)	4 to 12 0.157 to 0.472 (Convergent point 6 0.236)	4.8 to 9.5 0.189 to 0.374 (Convergent point 6 0.236)	4.5 to 9.5 0.177 to 0.374 (Convergent point 6 0.236)	5 to 9 0.197 to 0.354 (Convergent point 6 0.236)	5.5 to 8 0.217 to 0.315 (Convergent point 6 0.236)	5 to 9 0.197 to 0.354 (Convergent point 6 0.236)	5.5 to 8 0.217 to 0.315 (Convergent point 6 0.236)	————	P.116
FD-L41	2.5 to 18 0.098 to 0.709 (Convergent point 8 0.315)	3 to 16 0.118 to 0.630 (Convergent point 8 0.315)	————	————	————	————	————	————	————	P.116
FD-L43	————	0 to 23 0 to 0.906	————	————	————	————	————	————	————	P.116
FD-L44	0 to 7 0 to 0.276	0 to 6 0 to 0.236	0 to 5.2 0 to 0.205	————	————	————	————	————	————	P.116
FD-L44S	0 to 4.5 0 to 0.177	0 to 4 0 to 0.157	0 to 3.5 0 to 0.138	————	————	————	————	————	————	P.116
FD-L45	0 to 36 0 to 1.417	0 to 30 0 to 1.181	0 to 21 0 to 0.827	————	————	————	————	————	————	P.116
FD-L46	12.5 to 37.5 0.492 to 1.476	15 to 35 0.591 to 1.378	————	————	————	————	————	————	————	P.116
FD-NFM2	90 3.543	45 1.772	16 0.630	16 0.630	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	P.117
FD-NFM2S	90 3.543	45 1.772	16 0.630	16 0.630	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	P.117
FD-NFM2S4	90 3.543	45 1.772	16 0.630	16 0.630	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	P.117
FD-P2	50 1.969	25 0.984	9 0.354	8 0.315	4 0.157	2.5 0.098	4 0.157	2 0.079	1.5 0.059	P.117
FD-P40	36 1.417	18 0.709	6 0.236	5 0.197	2.5 0.098	1.5 0.059	3 0.118	1.5 0.059	1 0.039	P.117
FD-P50	90 3.543	45 1.772	16 0.630	20 0.787	10 0.394	6 0.236	10 0.394	5 0.197	3 0.118	P.117
FD-P60	90 3.543	45 1.772	16 0.630	20 0.787	10 0.394	6 0.236	10 0.394	5 0.197	3 0.118	P.117
FD-P80	220 8.661	100 3.937	35 1.378	40 1.575	20 0.787	13 0.512	20 0.787	10 0.394	7 0.276	P.117
FD-P81X	185 7.283	80 3.150	35 1.378	32 1.260	16 0.630	10 0.394	16 0.630	8 0.315	5 0.197	P.117
FD-R80	185 7.283	85 3.346	30 1.181	32 1.260	16 0.630	10 0.394	16 0.630	8 0.315	5 0.197	P.117
FD-S80	270 10.630	110 4.331	39 1.535	46 1.811	23 0.906	15 0.591	24 0.945	12 0.472	8 0.315	P.117
FD-SFM2SV2	100 3.937	45 1.772	16 0.630	14 0.551	7 0.276	4 0.157	7 0.276	3.5 0.138	————	P.117
FD-SNFM2	90 3.543	45 1.772	16 0.630	16 0.630	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	P.118
FD-T40	90 3.543	45 1.772	16 0.630	16 0.630	8 0.315	5 0.197	8 0.315	4 0.157	2 0.079	P.118
FD-T80	270 10.630	110 4.331	39 1.535	46 1.811	23 0.906	15 0.591	24 0.945	12 0.472	8 0.315	P.118
FD-V41	55 2.165	25 0.984	9 0.354	6 0.236	3 0.118	————	3 0.118	————	————	P.118
FD-W8	190 7.480	90 3.543	32 1.260	23 0.906	11 0.433	8 0.315	14 0.551	7 0.276	4 0.157	P.118
FD-W44	30 1.181	15 0.591	5 0.197	5 0.197	2.5 0.098	1.5 0.059	3 0.118	1.5 0.059	1 0.039	P.118
FD-WG4	65 2.559	32 1.260	11 0.433	11 0.433	5 0.197	3 0.118	6 0.236	3 0.118	2 0.079	P.118
FD-WKZ1	20 to 480 0.787 to 18.898	20 to 230 0.787 to 9.055	25 to 100 0.984 to 3.937	————	————	————	————	————	————	P.118
FD-WL41	6.5 to 14 0.256 to 0.551 (Convergent point 8 0.315)	7 to 12 0.276 to 0.472 (Convergent point 8 0.315)	————	————	————	————	————	————	————	P.118
FD-WL48	0.5 to 7.5 0.020 to 0.295	1 to 5.5 0.039 to 0.217	————	————	————	————	————	————	————	P.119
FD-WS8	190 7.480	90 3.543	32 1.260	23 0.906	11 0.433	8 0.315	14 0.551	7 0.276	4 0.157	P.119
FD-WSG4	65 2.559	32 1.260	11 0.433	11 0.433	5 0.197	3 0.118	6 0.236	3 0.118	2 0.079	P.119
FD-WT4	30 1.181	15 0.591	5 0.197	5 0.197	2.5 0.098	1.5 0.059	3 0.118	1.5 0.059	1 0.039	P.119
FD-WT8	190 7.480	90 3.543	32 1.260	23 0.906	11 0.433	8 0.315	14 0.551	7 0.276	4 0.157	P.119
FD-WV42	15 0.591	7 0.276	————	————	————	————	————	————	————	P.119
FD-WZ4	1.5 to 3.4 0.059 to 0.134	3 to 17 0.118 to 0.669	————	————	————	————	————	————	————	P.119
FD-WZ4HB	1 to 46 0.039 to 1.811	2.5 to 23 0.098 to 0.906	3 to 7 0.118 to 0.276	4 to 9 0.157 to 0.354	————	————	————	————	————	P.119
FD-WZ7	120 4.724	1 to 60 0.039 to 2.362	2.5 to 18 0.098 to 0.709	4 to 15 0.157 to 0.591	————	————	————	————	————	P.119
FD-WZ7HB	0.5 to 180 0.020 to 7.087	1 to 90 0.039 to 3.543	1 to 35 0.039 to 1.378	3 to 28 0.118 to 1.102	3 to 14 0.118 to 0.551	4 to 8.4 0.157 to 0.331	3 to 16 0.118 to 0.630	4 to 8 0.157 to 0.315	4.8 0.189	P.119

Notes: 1) The standard sensing objects of the sensing ranges vary depending on the fibers. Refer to p.71~ for details.

2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

LENS FOR FIBERS (OPTIONAL)**Lens (for thru-beam type fiber)**

The dimensions are on p.120~.

Designation		Model No.	Description																																																			
For thru-beam type fiber	Expansion lens (Note 1)	FX-LE1		Increases the sensing range by 5 times or more. • Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 5)	Sensing range for red LED type (mm in) [Lens on both sides] (Note 3) <table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-B8</td><td>3,500 137.759 (Note 2)</td><td>2,500 98.425</td><td>1,000 39.370</td></tr><tr><td>FT-FM2</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>1,300 51.181</td></tr><tr><td>FT-T80</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>1,300 51.181</td></tr><tr><td>FT-R80</td><td>3,500 137.759 (Note 2)</td><td>2,300 90.551</td><td>800 31.496</td></tr><tr><td>FT-W8</td><td>3,500 137.759 (Note 2)</td><td>2,900 114.173</td><td>1,000 39.370</td></tr><tr><td>FT-P80</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>1,100 43.307</td></tr><tr><td>FT-P60</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>900 35.433</td></tr><tr><td>FT-P81X</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,100 43.307</td></tr><tr><td>FT-H35-M2</td><td>3,500 137.759 (Note 2)</td><td>2,000 78.740</td><td>750 29.528</td></tr><tr><td>FT-H20W-M1</td><td>1,600 62.992 (Note 2)</td><td>1,300 51.181</td><td>500 19.685</td></tr><tr><td>FT-H20-M1</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>900 35.433</td></tr></table>		Fiber \ Mode	LONG	STD	S-D	FT-B8	3,500 137.759 (Note 2)	2,500 98.425	1,000 39.370	FT-FM2	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	1,300 51.181	FT-T80	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	1,300 51.181	FT-R80	3,500 137.759 (Note 2)	2,300 90.551	800 31.496	FT-W8	3,500 137.759 (Note 2)	2,900 114.173	1,000 39.370	FT-P80	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	1,100 43.307	FT-P60	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	900 35.433	FT-P81X	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,100 43.307	FT-H35-M2	3,500 137.759 (Note 2)	2,000 78.740	750 29.528	FT-H20W-M1	1,600 62.992 (Note 2)	1,300 51.181	500 19.685	FT-H20-M1	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	900 35.433
	Fiber \ Mode	LONG	STD	S-D																																																		
	FT-B8	3,500 137.759 (Note 2)	2,500 98.425	1,000 39.370																																																		
	FT-FM2	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	1,300 51.181																																																		
	FT-T80	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	1,300 51.181																																																		
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FT-H20-M1	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	900 35.433																																																			
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 5)	Sensing range for red LED type (mm in) [Lens on both sides] (Note 3) <table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-B8</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td></tr><tr><td>FT-FM2</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td></tr><tr><td>FT-R80</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td></tr><tr><td>FT-W8</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td></tr><tr><td>FT-P80</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td></tr><tr><td>FT-P60</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td></tr><tr><td>FT-P81X</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-H35-M2</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td></tr><tr><td>FT-H20W-M1</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,500 59.055</td></tr><tr><td>FT-H20-M1</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td><td>1,600 62.992 (Note 2)</td></tr><tr><td>FT-H13-FM2</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td><td>3,500 137.759 (Note 2)</td></tr></table>		Fiber \ Mode	LONG	STD	S-D	FT-B8	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	FT-FM2	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	FT-R80	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	FT-W8	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	FT-P80	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	FT-P60	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	FT-P81X	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	FT-H35-M2	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	FT-H20W-M1	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,500 59.055	FT-H20-M1	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	FT-H13-FM2	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	
Fiber \ Mode	LONG	STD	S-D																																																			
FT-B8	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)																																																			
FT-FM2	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)																																																			
FT-R80	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)																																																			
FT-W8	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)																																																			
FT-P80	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)																																																			
FT-P60	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)																																																			
FT-P81X	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)																																																			
FT-H35-M2	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)																																																			
FT-H20W-M1	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,500 59.055																																																			
FT-H20-M1	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)																																																			
FT-H13-FM2	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)	3,500 137.759 (Note 2)																																																			
Side-view lens	FX-SV1		Beam axis is bent by 90°. • Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 5)	Sensing range for red LED type (mm in) [Lens on both sides] (Note 3) <table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-B8</td><td>1,100 43.307</td><td>530 20.866</td><td>186 7.323</td></tr><tr><td>FT-FM2</td><td>1,200 47.244</td><td>600 23.622</td><td>210 8.268</td></tr><tr><td>FT-T80</td><td>1,200 47.244</td><td>600 23.622</td><td>210 8.268</td></tr><tr><td>FT-W8</td><td>900 35.433</td><td>450 17.717</td><td>160 6.299</td></tr><tr><td>FT-P80</td><td>1,200 47.244</td><td>600 23.622</td><td>210 8.268</td></tr><tr><td>FT-P60</td><td>650 25.591</td><td>300 11.811</td><td>130 5.118</td></tr><tr><td>FT-P81X</td><td>1,200 47.244</td><td>600 23.622</td><td>200 7.874</td></tr><tr><td>FT-H35-M2</td><td>550 21.654</td><td>280 11.024</td><td>90 3.543</td></tr><tr><td>FT-H20W-M1</td><td>310 2.205</td><td>140 5.512</td><td>50 1.969</td></tr><tr><td>FT-H20-M1</td><td>550 21.654</td><td>280 11.024</td><td>90 3.543</td></tr></table>		Fiber \ Mode	LONG	STD	S-D	FT-B8	1,100 43.307	530 20.866	186 7.323	FT-FM2	1,200 47.244	600 23.622	210 8.268	FT-T80	1,200 47.244	600 23.622	210 8.268	FT-W8	900 35.433	450 17.717	160 6.299	FT-P80	1,200 47.244	600 23.622	210 8.268	FT-P60	650 25.591	300 11.811	130 5.118	FT-P81X	1,200 47.244	600 23.622	200 7.874	FT-H35-M2	550 21.654	280 11.024	90 3.543	FT-H20W-M1	310 2.205	140 5.512	50 1.969	FT-H20-M1	550 21.654	280 11.024	90 3.543					
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Expansion lens for vacuum fiber (Note 1)	FV-LE1		Sensing range increases by 4 times or more. • Ambient temperature: -60 to +350 °C (Note 5) -76 to +662 °F	Sensing range for red LED type (mm in) [Lens on both sides] (Note 3, 4) <table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-H30-M1V</td><td>1,200 47.244</td><td>450 17.717</td><td>150 5.906</td></tr></table>		Fiber \ Mode	LONG	STD	S-D	FT-H30-M1V	1,200 47.244	450 17.717	150 5.906																																									
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Vacuum resistant side-view lens (Note 1)	FV-SV2		Beam axis is bent by 90°. • Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 5)	Sensing range for red LED type (mm in) [Lens on both sides] (Note 3, 4) <table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>S-D</th></tr><tr><td>FT-H30-M1V</td><td>1,200 47.244</td><td>450 17.717</td><td>150 5.906</td></tr></table>		Fiber \ Mode	LONG	STD	S-D	FT-H30-M1V	1,200 47.244	450 17.717	150 5.906																																									
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FT-H30-M1V	1,200 47.244	450 17.717	150 5.906																																																			

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-P81X, FT-H20W-M1 and FT-H20-M1: 1,600 mm 62.992 in).

3) The sensing ranges are the values for red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifiers.

4) The fiber cable length for the FT-H30-M1V is 1 m 3.281 ft. The sensing ranges in LONG mode take into account the length of the FT-J8 atmospheric side fiber.

5) Refer to p.101~ for the ambient temperatures of fibers to be used in combination.

FIBER SENSORS

LASER SENSORS

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MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

SAFETY COMPONENTS

PRESSURE SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

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MEASURE- MENT SENSORS

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Fibers

FT / FD / FR

Fiber Sensor Amplifiers

FX-100

FX-300

FX-410

FX-311

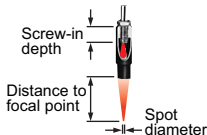
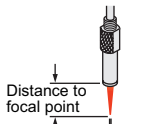
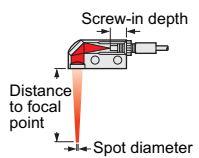
FX-11A

FX-301-F

Other Products

LENS FOR FIBERS (OPTIONAL)**Lens (for reflective type fiber)**

The dimensions are on p.121.

Designation		Model No.	Description																		
For reflective type fiber	Pinpoint spot lens	FX-MR1		Pinpoint spot of $\varnothing 0.5$ mm $\varnothing 0.020$ in. Enables detection of minute objects or small marks. - Distance to focal point: 6 ± 1 mm 0.236 ± 0.039 in - Applicable fibers: FD-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 $\varnothing 0.7$ to $\varnothing 2$ mm $\varnothing 0.028$ to 0.079 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-EX3 (Mounting bracket) <table><tr><th colspan="3">Sensing range for red LED type (Note 1)</th></tr><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>7 mm 0.276 in</td><td>$\varnothing 18.5$ mm $\varnothing 0.728$ in approx.</td><td>$\varnothing 0.7$ mm $\varnothing 0.028$ in</td></tr><tr><td>12 mm 0.472 in</td><td>$\varnothing 27$ mm $\varnothing 1.063$ in approx.</td><td>$\varnothing 1.2$ mm $\varnothing 0.047$ in</td></tr><tr><td>14 mm 0.551 in</td><td>$\varnothing 43$ mm $\varnothing 1.693$ in approx.</td><td>$\varnothing 2.0$ mm $\varnothing 0.079$ in</td></tr></table>	Sensing range for red LED type (Note 1)			Screw-in depth	Distance to focal point	Spot diameter	7 mm 0.276 in	$\varnothing 18.5$ mm $\varnothing 0.728$ in approx.	$\varnothing 0.7$ mm $\varnothing 0.028$ in	12 mm 0.472 in	$\varnothing 27$ mm $\varnothing 1.063$ in approx.	$\varnothing 1.2$ mm $\varnothing 0.047$ in	14 mm 0.551 in	$\varnothing 43$ mm $\varnothing 1.693$ in approx.	$\varnothing 2.0$ mm $\varnothing 0.079$ in		
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Finest spot lens	FX-MR3		Extremely fine spot of $\varnothing 0.3$ mm $\varnothing 0.012$ 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) <table><tr><th colspan="3">Sensing range for red LED type (Note 1)</th></tr><tr><th>Fiber</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG3</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.15$ mm $\varnothing 0.006$ in approx.</td></tr><tr><td>FD-EG2</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.2$ mm $\varnothing 0.008$ in approx.</td></tr><tr><td>FD-EG1</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.3$ mm $\varnothing 0.012$ in approx.</td></tr><tr><td>FD-WG4/G4/G6X/G6</td><td>7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\varnothing 0.5$ mm $\varnothing 0.020$ in approx.</td></tr></table>	Sensing range for red LED type (Note 1)			Fiber	Distance to focal point	Spot diameter	FD-EG3	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.15$ mm $\varnothing 0.006$ in approx.	FD-EG2	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.2$ mm $\varnothing 0.008$ in approx.	FD-EG1	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.3$ mm $\varnothing 0.012$ in approx.	FD-WG4/G4/G6X/G6	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.5$ mm $\varnothing 0.020$ in approx.
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FD-WG4/G4/G6X/G6	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\varnothing 0.5$ mm $\varnothing 0.020$ in approx.																			
Finest spot lens	FX-MR6	Extremely fine spot of $\varnothing 0.1$ mm $\varnothing 0.040$ 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) <table><tr><th colspan="3">Sensing range for red LED type (Note 1)</th></tr><tr><th>Fiber</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG3</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.1$ mm $\varnothing 0.004$ in approx.</td></tr><tr><td>FD-EG2</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.15$ mm $\varnothing 0.006$ in approx.</td></tr><tr><td>FD-EG1</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.2$ mm $\varnothing 0.008$ in approx.</td></tr><tr><td>FD-WG4/G4/G6X/G6</td><td>7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\varnothing 0.4$ mm $\varnothing 0.016$ in approx.</td></tr></table>	Sensing range for red LED type (Note 1)			Fiber	Distance to focal point	Spot diameter	FD-EG3	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.1$ mm $\varnothing 0.004$ in approx.	FD-EG2	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.15$ mm $\varnothing 0.006$ in approx.	FD-EG1	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.2$ mm $\varnothing 0.008$ in approx.	FD-WG4/G4/G6X/G6	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.4$ mm $\varnothing 0.016$ in approx.	
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FD-WG4/G4/G6X/G6	7 ± 0.5 mm 0.276 ± 0.020 in	$\varnothing 0.4$ mm $\varnothing 0.016$ in approx.																			
Zoom lens (Side-view type)	FX-MR5		FX-MR2 is converted into a side-view type and can be mounted in a very small space. - Applicable fibers: FD-WG4, FD-G4 - Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note 2) <table><tr><th colspan="3">Sensing range for red LED type (Note 1)</th></tr><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>8 mm 0.315 in</td><td>13 mm 0.512 in approx.</td><td>$\varnothing 0.5$ mm $\varnothing 0.020$ in</td></tr><tr><td>10 mm 0.394 in</td><td>15 mm 0.591 in approx.</td><td>$\varnothing 0.8$ mm $\varnothing 0.031$ in</td></tr><tr><td>14 mm 0.551 in</td><td>30 mm 1.181 in approx.</td><td>$\varnothing 3.0$ mm $\varnothing 0.118$ in</td></tr></table>	Sensing range for red LED type (Note 1)			Screw-in depth	Distance to focal point	Spot diameter	8 mm 0.315 in	13 mm 0.512 in approx.	$\varnothing 0.5$ mm $\varnothing 0.020$ in	10 mm 0.394 in	15 mm 0.591 in approx.	$\varnothing 0.8$ mm $\varnothing 0.031$ in	14 mm 0.551 in	30 mm 1.181 in approx.	$\varnothing 3.0$ mm $\varnothing 0.118$ in			
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Notes: 1) The sensing ranges are the values when used in combination with red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifier.

2) Refer to p.101~ for the ambient temperatures of fibers to be used in combination.

Refer to p.100 for other fiber options.

SPECIFICATIONS

Refer to p.101~ for specifications of fibers.

Amplifiers

Type		NPN output			PNP output			
		Red LED	Blue LED	Green LED	Red LED	Blue LED	Green LED	
Item	Model No.	FX-311	FX-311B	FX-311G	FX-311P	FX-311BP	FX-311GP	
Supply voltage		12 to 24 V DC ± 10 % Ripple P-P 10 % or less						
Power consumption		840 mW or less (Current consumption 35 mA or less at 24 V supply voltage)						
Output		NPN open-collector transistor • Maximum sink current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less [at 100 mA sink current (50 mA, if five, or more, amplifiers are connected in cascade)]			PNP open-collector transistor • Maximum source current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade) • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1.5 V or less [at 100 mA source current (50 mA, if five, or more, amplifiers are connected in cascade)]			
		Utilization category						DC-12 or DC-13
		Output operation						Selectable either Light-ON or Dark-ON, with selection switch
		Short-circuit protection						Incorporated
Response time		<Red LED type> 250 μs or less (STD / S-D), 2 ms or less (LONG) selectable with selection switch			<Blue LED type / Green LED type> 150 μs or less (FAST), 250 μs or less (STD), 2 ms or less (LONG) selectable with selection switch			
Operation indicator		Orange LED (lights up when the output is ON)						
Stability indicator		Green LED (lights up under stable light received condition or stable dark condition)						
Sensitivity adjuster		12-turn potentiometer with indicator (Pointer part: red backlight) (Note 2)						
Timer function		Incorporated with OFF-delay timer, selectable either effective (approx. 10 ms or 40 ms) or ineffective						
Automatic interference prevention function		Incorporated (Up to 4 sets of fiber heads can be mounted close together.) (Note 3)						
Environmental resistance	Pollution degree		3 (Industrial environment)					
	Ambient temperature		−10 to +55 °C −14 to +131 °F (If 4 to 7 units are connected in cascade: −10 to +50 °C +14 to +122 °F ,) (No dew condensation or icing allowed), Storage: −20 to +70 °C −4 to +158 °F (if 8 to 16 units are connected in cascade: −10 to +45 °C +14 to +113 °F)					
	Ambient humidity		35 to 85 % RH, Storage: 35 to 85 % RH					
	Ambient illuminance		Incandescent light: 3,000 lx at the light-receiving face					
	EMC		EN 60947-5-2					
	Voltage withstandability		1,000 V AC for one min. between all supply terminals connected together and enclosure (Note 4)					
	Insulation resistance		20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure (Note 4)					
	Vibration resistance		10 to 150 Hz frequency, 0.75 mm 0.03 in amplitude in X, Y and Z directions for two hours each					
	Shock resistance		98 m/s ² acceleration (10 G approx.) in X, Y and Z directions for five times each					
Emitting element (modulated)		Red LED	Blue LED	Green LED	Red LED	Blue LED	Green LED	
Peak emission wavelength		650 nm 0.026 mil	470 nm 0.019 mil	525 nm 0.021 mil	650 nm 0.026 mil	470 nm 0.019 mil	525 nm 0.021 mil	
Material		Enclosure: Heat-resistant ABS, Case cover: Polycarbonate						
Connecting method		Connector (Note 5)						
Cable length		Total length up to 100 m 328.084 ft is possible with 0.3 mm ² , or more, cable.						
Weight		Net weight: 15 g approx., Gross weight: 20 g approx.						

- Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of $+23\text{ }^{\circ}\text{C}$ $+73.4\text{ }^{\circ}\text{F}$.
 2) The red backlight of the pointer part lights up more brightly when the power is turned ON and when the sensitivity is adjusted.
 3) When the power supply is switched on, the emission timing are automatically set for interference prevention.
 4) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.
 5) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.
 Main cable (3-core): **CN-73-C1** (cable length 1 m 3.281 ft), **CN-73-C2** (cable length 2 m 6.562 ft), **CN-73-C5** (cable length 5 m 16.404 ft)
 Sub cable (1-core): **CN-71-C1** (cable length 1 m 3.281 ft), **CN-71-C2** (cable length 2 m 6.562 ft), **CN-71-C5** (cable length 5 m 16.404 ft)

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

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Fibers

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Fiber Sensor Amplifiers

FX-100**FX-300****FX-410****FX-311****FX-11A****FX-301-F**

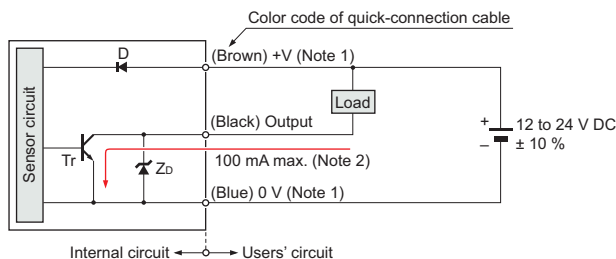
Other Products

I/O CIRCUIT AND WIRING DIAGRAMS

FX-311□

NPN output type

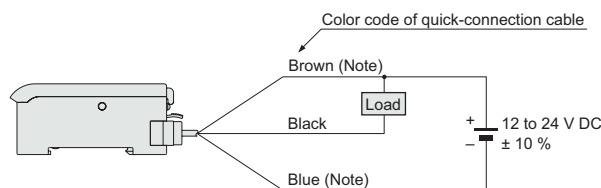
I/O circuit diagram



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

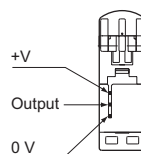
Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : NPN output transistor

Wiring diagram



Note: The quick-connection sub cable does not have brown lead wire and blue lead wire. The power is supplied from the connector of the main cable.

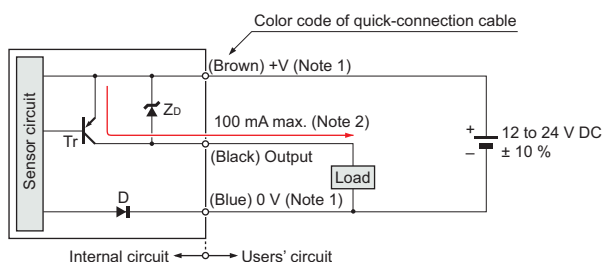
Terminal arrangement diagram



FX-311□P

PNP output type

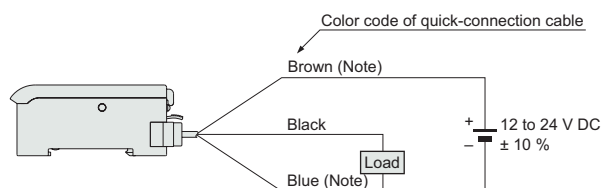
I/O circuit diagram



Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
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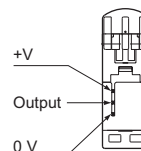
Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : PNP output transistor

Wiring diagram



Note: The quick-connection sub cable does not have brown lead wire and blue lead wire. The power is supplied from the connector of the main cable.

Terminal arrangement diagram



SENSING CHARACTERISTICS (TYPICAL)

Refer to p.104 for sensing characteristics. (STD mode only. Contact our office for information on other modes.)

PRECAUTIONS FOR PROPER USE

Refer to p.986~ for general precautions and p.105 for fiber precautions.



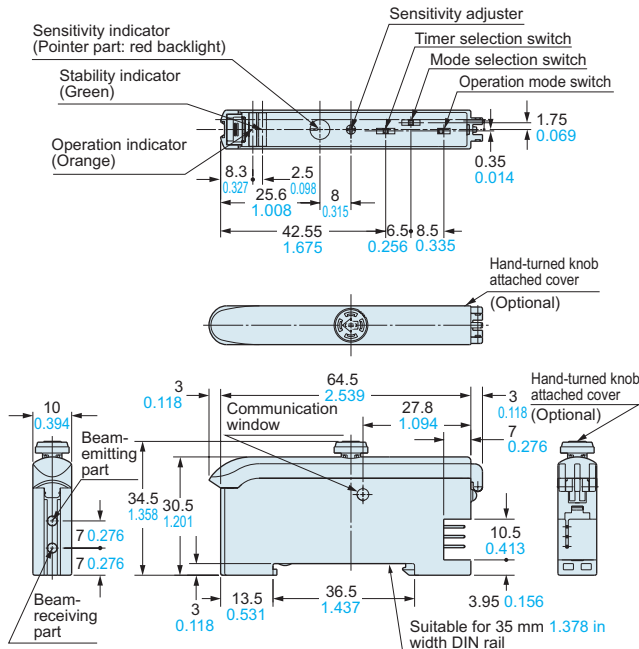
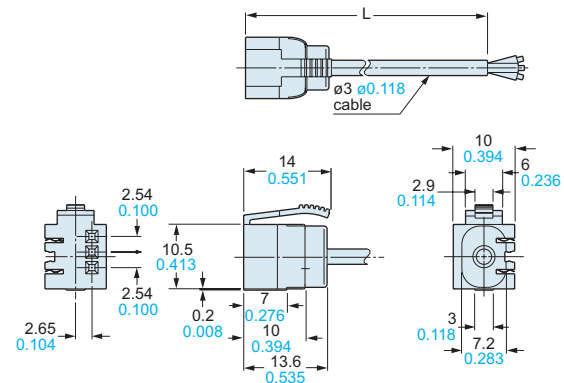
- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

Cascading amplifiers

- The settings other than the interference prevention function cannot be transmitted between this product and other digital fiber amplifiers. Therefore, in case both models of amplifiers are mounted in cascade, be sure to mount identical models together. Refer to "[Cautions on sensor connection in cascade](#)" (p.154) for details.

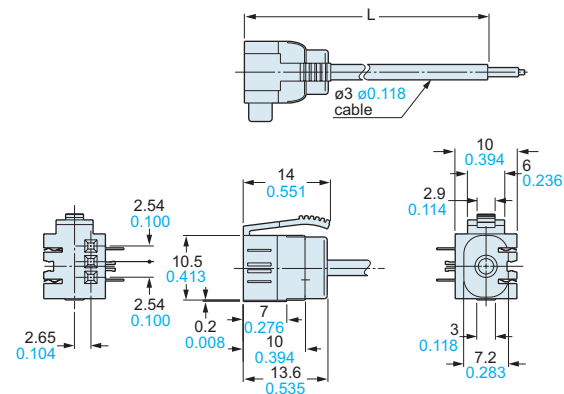
Others

- Do not use during the initial transient time (0.5 sec. approx.) after the power supply is switched on.

DIMENSIONS (Unit: mm in)The CAD data in the dimensions can be downloaded from the SUNX website: <http://www.sunx.com>**FX-311□ FX-311□P****Amplifier****Mounting drawing with a hand-turned knob attached cover FX-AJ1 (Optional)****CN-73-C1 CN-73-C2 CN-73-C5****Main cable (Optional)**

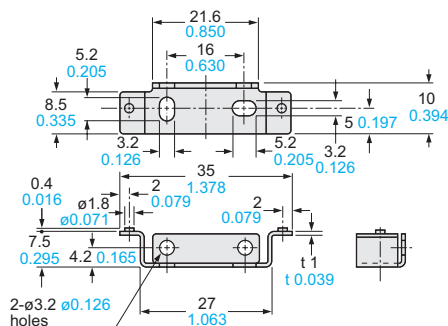
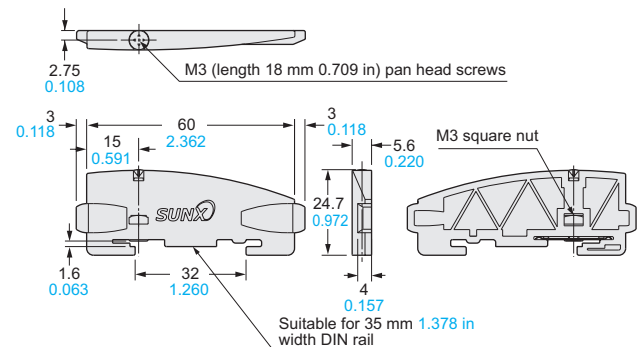
• Length L

Model No.	Length L
CN-73-C1	1,000 39.370
CN-73-C2	2,000 78.740
CN-73-C5	5,000 196.850

CN-71-C1 CN-71-C2 CN-71-C5**Sub cable (Optional)**

• Length L

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

MS-DIN-2**Amplifier mounting bracket (Optional)**Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)**MS-DIN-E****End plate (Optional)**

Material: Polycarbonate

FIBER SENSORS**LASER SENSORS****PHOTO-ELECTRIC SENSORS****MICRO PHOTO-ELECTRIC SENSORS****AREA SENSORS****SAFETY COMPONENTS****PRESSURE SENSORS****INDUCTIVE PROXIMITY SENSORS****PARTICULAR USE SENSORS****SENSOR OPTIONS****WIRE-SAVING SYSTEMS****MEASUREMENT SENSORS****STATIC CONTROL DEVICES****LASER MARKERS****Selection Guide****Fibers****FT / FD / FR****Fiber Sensor Amplifiers****FX-100****FX-300****FX-410****FX-311****FX-11A****FX-301-F****Other Products**