FX-D1/A1/M1 Slim Body Digital/Auto/Manual Setting Fiber Sensor



Simple Operation with Innovative Jog Switch



Uses an innovative highly operable jog switch.

Anyone can easily do the threshold value (sensitivity in case of the FX-A1 series) setting or fine adjustment by using a single jog switch.

each mode is set.

CX-30 **Amplifier Built-in Type**

CX-RVM5/D100/ND300R EX-10

EX-20

Threshold value (sensitivity Threshold value (sensitivity in in case of FX-A1 series) or

case of FX-A1 series) setting or fine adjustment, and selection of each mode is done

12-turn Potentiometer with Indicator FX-M1 series

12-turn potentiometer has been incorporated for unprecedent fine adjustments. It enables detection of very fine differences.

Moreover, the potentiometer position can be confirmed at a glance on the indicator.



Sensitivity level indicator

Digital Display

Since the incident light intensity and the threshold value can be confirmed on a digital display (4 digit LCD), the threshold value can be set by seeing the numerical values. Moreover, since the display has a backlight, the values can be read even in a dark place.

3 Types of Settings Are Possible FX-D1/A1 series

You can select from the following three

2) Limit teaching, which is highly suit-

able for threshold value (sensitivity

in case of the FX-A1 series) setting

in the object absent condition, or in

case a background body is present,

Full auto-teaching, which is suitable

for detecting a moving object, without stopping the production line.

or for minute difference detection.

types of settings:

3)

1) 2-level teaching

FX-D1 series

Level Indicators

Level indicators, comprising of 10 LEDs, enable confirmation of the set

(E Marked

Conforming to EMC Directive

FX-A1 series

sensitivity at one glance. Setting can be done while confirming the value on the level indicators.



Level indicators

Fine Adjustment Is Possible FX-D1/A1 series

Fine adjustment is possible after setting the threshold value (sensitivity in case of the FX-A1 series).

> Simply turn the jog switch to the or the side for fine adjustment.



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FX-D1/A1/M1

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Detection of a sheet's zigzag movement

Since the FX-D1 series incorporates two independent outputs. the sheet's presence/absence and its zigzag movement can be detected at the same time.

APPLICATIONS



Detection of wafers inside a cassette

Since the aperture angle is only 2° or less and the light beam is very narrow. thin wafers can be individually detected reliably.



Detection of upright position of a capacitor

Since the FX-D1 series incorporates two independent outputs, it can detect not only the presence/absence of a capacitor coming from a parts feeder, but also whether it stands upright.



Incorporates Two Independent Outputs FX-D1 series

Since two independent outputs are incorporated, one sensor suffices even in places where, so far, two sensors had to be used.

Detection of a sheet's zigzag movement



FD-EG1 FX-MR3

Detection of presence/absence of

It can reliably detect very small parts in

very small parts

a wrist watch.

Distinguishing top/bottom surface of a chip component

Due to the small spot size, the top surface can be distinguished from the bottom surface for small components, such as the 1005 chip.



Detection of presence/absence of glass sheets

It can reliably detect individual glass sheets which are normally difficult to detect



Incorporates a Convenient Timer Function

The FX-D1 series incorporates an ONdelay timer and an OFF-delay timer. The timer period can be selected from four values - 40ms, 100ms, 200ms and 500ms. Further, the FX-A1 series and the FX-M1 series incorporate an approx. 40ms fixed OFF-delay timer.

Close Mounting of Three Fibers Is Possible

Three fibers can be mounted closely by selecting three different emission frequencies with the jog switch (frequency selection switch in case of the FX-M1 series).

10mm Width Slim Size

Since the width is merely 10mm, it can be installed in a narrow space.



Plug-in connector Type Is Available

Besides the cable type, plug-in connector type sensors suitable for sensor and wire-saving link system S-LINK, or simple wire-saving using a sensor block and a connector attached cable, are available.



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OTOE		Ge	nera	al use fibers	[Thru-bean	n type (one pair set)]				
T T		Ту	/pe	Shape of fibe	er head (mm)	Sensing range (E: Red LED type (Note 1) : Green LED type	Min. sensing object under the optimum condition (Note 2)	Features	Fiber cable length	Model No.
X-D1/A1/M			Long sensing range	Lens mountable		650mm	 𝔅 ≠0.16mm opaque object 𝔅 ≠0.08mm opaque object 	• Twice the sensing range as before	Free Cut 2m	FT-B8
				Lens mountable						FT-FM2
-13	Ś	dard		With sleeve		380mm			Free Y Cut	FT-FM2S With sleeve 90mm
Î	nsor	Stan		←	18 18	60mm	$\bigcirc \phi 0.04$ mm opaque object	Free-cut type	2m	FT-FM2S4 With sleeve 40mm
	er Sel				¢2.5 ←					FT-SFM2
-11A	Fibe		Long sens- ing range			600mm 100mm	(B) $ \phi 0.16 \text{mm} $ opaque object (G) $ \phi 0.08 \text{mm} $ opaque object		Free Cut	NE₩ FT-NB8
Ê			ECON			350mm	ℝ	Low price & free-cut	2m (Note 3)	<i>NE₩</i> FT-N8
Z-10		Small fiber	head	Lens mountable	← ш∭™	380mm 60mm	 (€ ¢0.12mm opaque object (ⓒ ¢0.04mm opaque object 	• Miniature head but having the same sensing range as the standard type fiber	Free Cut 2m	FT-T80
					← □					FT-NFM2
0			lameter	With sleeve		100mm	ℝ	Suitable for detection in a concested equipment	Free Cut	FT-NFM2S With sleeve 90mm
CX-2		:	Small c	φ	0.88	15mm		• Free-cut type	2m	FT-NFM2S4 With sleeve 40mm
				¢1.5						FT-SNFM2
:X-30			Standard	Lens mountable		280mm 50mm	 𝑘 𝑘0.08mm opaque object 𝑘 𝑘0.03mm opaque object 	•The fiber can be bent		NEW FT-W8 NEW
	Type	irp benc	meter			00		 sharply, like an electric wire, to avoid space wastage in installation because of its 	Free Cut	NEW
ND300K	lt-in .	Sha	small dia			7mm	(a) ϕ 0.04mm opaque object (b) ϕ 0.02mm opaque object	small allowable bending radius of R1mm or more.	2111	NEW
M5/D100	r Bui		Vith lens S		¢3 ←	600mm	(R) ϕ 0.12mm opaque object (G) ϕ 0.12mm opaque object			NEW
CX-RV	plifie		×	Lens mountable	← m	320mm 60mm	R ϕ 0.12mm opaque object G ϕ 0.05mm opaque object		Free V Cut	FT-P80
10	Am	:	-lexible	Small diameter	← ∰ ^{M3}	100mm 10mm	 𝑘 𝑘 0.08mm opaque object 𝑘 𝑘 0.03mm opaque object 	Allowable bending radius: R4mm or more Bending durability:	2m	FT-P40
Ч			÷	Small diameter	¢1.5 ←	120mm 18mm	(R) ϕ 0.08mm opaque object (G) ϕ 0.08mm opaque object	1,000,000 times or more	1m	FT-P2
		Note	es: 1)	Please take car	e that the sensi	ng range of the free-cut type	fiber may be reduced by 20% r	hax. depending upon how the fi	ber is cut.	
20			2) The optime to light inc	um conditio ident opera	on is the condition w tion in the object abs	hen the sensitivity is s sent condition.	set so that the sensing	output jus	st changes
×			3)	Fiber cutter (FX	-CT1) is not sup	oplied as accessory along wi	th standard (economy) fibers. F	lease procure it separately.		

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Specia	Special use fibers [Thru-beam type (one pair set)]											
Туре	Shape of fiber head (mm)	Sensing range (II: Red LED type) (Note 1) I: Green LED type	Min. sensing object (under the optimum) (condition (Note 2)) (Condition (Note 2)) (Condition (Note 2))	Features	Fiber cable length	Model No.						
sensing e with lens		10,000mm	 Ø Ø0.5mm opaque object Ø Ø Ø	 Large lenses on the fiber heads increase the sensing range significantly. Fiber cable length 10m each 	Free Cut 10m	FT-FM10L						
Long	<i>∳</i> 2.5 ←	800mm 130mm	(R) ϕ 0.16mm opaque object (G) ϕ 0.16mm opaque object	 Long sensing range with small fiber heads of \u03c62.5mm 	Free Cut 2m	FT-SFM2L						
Wide beam	31×13.5		(Note 3)	• The wide beam detects an object at any place within the range.	Free Cut 2m	NEW FT-A8						
Array	Top sensing	320mm 50mm	 Horizontal \u03c6 0.05mm opaque object Vertical \u03c6 0.7mm opaque object Horizontal \u03c6 0.04mm opaque object Vertical \u03c6 0.2mm opaque object 	• The wide beam detects an	Free Y Cut	FT-AFM2						
	Side sensing	290mm 40mm	 R Horizontal	the range.	2m	FT-AFM2E						
Elbow	Lens mountable	270mm 45mm	 (8)	• The fiber head is bent at a right angle with 5mm bending radius.	Free Cut 2m	FT-R80						
_	Small diameter	175mm 18mm	(R) ϕ 0.08mm opaque object (G) ϕ 0.05mm opaque object		1m	FT-V22						
de-view	0.6 ↓ ¢2.5 (¢2 for FT-V22) Sleeve part cannot be bent.	70mm 10mm	(R) ϕ 0.08mm opaque object (G) ϕ 0.06mm opaque object	• The side-view sensing enables it to be used in a small space.	Free Cut	FT-V41						
Ω.	Sleeve part cannot be bent.	200mm 35mm	(R) $\phi 0.12$ mm opaque object (G) $\phi 0.05$ mm opaque object		2m	FT-SFM2SV2						
small eter		7mm		 Ultra-small diameter heads, very narrow beam	500mm	FT-E10						
Ultra- diame	Sleeve part cannot be bent.	30mm		 Ultra-small diameter heads, very narrow beam	1m	FT-E20						
	◆ ^{∅3}	700mm 90mm	(R) ϕ 0.3mm opaque object (G) ϕ 0.1mm opaque object	Aperture angle 4° or less Laser beam equivalent detection	1m	FT-K2						
eam		400mm		 Aperture angle 4° or less Side-view type 	1111	FT-KV2						
larrow t	(700mm		 Aperture angle 2° or less Side-view type 	Free Cut 2m	<i>NE₩</i> FT-KV8						
2	← ← M3 Sleeve part cannot be bent.	160mm 18mm	 <i>φ</i> 0.08mm opaque object <i>φ</i> 0.02mm opaque object 	• The narrow aperture angle, 1/6 of a conventional model, reduces interference.	1m	FT-KM1S2						

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 optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

3) The sensing width varies with the sensing object size and the sensing distance. Please refer to the graph given below.

Correlation between sensing width and setting distance with sensing object diameter as a parameter



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FX-D1/A1/M1 PHOTOELECTRIC SENSORS

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Amplifier Built-in Type

Fiber Sensors

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Environment resistant fibers [Thru-beam type (one pair set)]

	Туре	Shape of fiber head (mm)	Sensing range (II: Red LED type (Note 1) I: Green LED type	Min. sensing object (under the optimum) (condition (Note 2)	Features	Fiber cable length	Model No.
		Lens mountable M4	a		• Heat-resistant temp.: 350°C	200	FT-H35-M2
	sistant	With sleeve M4	280mm	(R) ϕ 0.08mm opaque object (G) ϕ 0.05mm opaque object	Cold-resistant temp.: - 60°C	2	FT-H35-M2S6 With sleeve 60mm
	Heat-re	Lens mountable			Flexible cable with silicone jacket Heat-resistant temp.: 200°C Cold-resistant temp.: - 60°C	1m	FT-H20-M1
S			440mm 80mm	(a) $\phi 0.16$ mm opaque object (c) $\phi 0.12$ mm opaque object	Heat-resistant temp.: 130°C Cold-resistant temp.: - 60°C Free-cut type	Free Cut 2m	FT-H13-FM2
nsor	nical- tant	¢5.5	1,500mm 180mm	(a) $\phi 0.5$ mm opaque object (c) $\phi 0.3$ mm opaque object	 Usable in chemical solvents Heat-resistant specification (115°C) Long sensing range with lens 	2m (Bending R:)	FT-L8Y
Fiber Se	Cher	¢5.5 [400mm 70mm	(R) ϕ 0.5mm opaque object (G) ϕ 0.3mm opaque object	 Usable in chemical solvents Heat-resistant specification (115°C) Side-view type 	(30mm)	FT-V8Y
	num	Lens mountable M4	230mm		• Usable in vacuum chamber	1m (Bending R:) 200mm)	FT-6V
	Vacı		100mm		• Heat-resistant temp.: 120°C	1m (Bending R: 30mm)	FT-60V

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 optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

The vacuum type fiber must be used with the following products as a set.

FT-J6: Fiber at atmospheric side (one pair set) **FV-BR1**: Photo-terminal (one pair set)

Semi-standard fibers (Custom-order made)

The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol 🖾) or the sleeve length (symbol 🖾) from the table below.

Туре		Basic model No.	Fiber cable length (Unit: m)	Sleeve length (Unit: cm		
Standard threaded head (free-cut)		FT-FM 🔀	3, 4, 5, 10, 15, 20, 25, 30			
With sleeve		FT-FM 🕁 -S 🛆	2 (Note), 3, 4, 5, 10, 15, 20, 25, 30	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12		
With large d	liameter lens	FT-FM 🕁 L	20, 30			
Small diameter threaded head with sleeve (free-cut)		FT-NFM2-S		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12		
200°C heat-resistant		FT-H20-M 🔀	2, 3			
350°C hea	at-resistant	FT-H35-M 🕁	3			

· Correlation between sensing range attenuation coefficient and fiber cable length

range.



Note: The standard fiber has a 2m fiber cable length and a 4cm or 9cm sleeve length.

FX-D1/A1/M1

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CX-RVM5/D100/ND300R

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Amplifier Built-in Type

ECTRIC SENSORS

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Ge	enera	al use fibers [Reflective	type]t						DTOE
т	уре	Shape of fiber head (mm)	Sensing range E: Red LED type	Min. sensing object at the maximum constitution (Mate a) (G): Green LED type	Features	Fiber cable	Model No.		Η
	Long sensing range	M6	210mm	(Setisturity (NUES)) $(0.01 \text{ MM exercises})$ ($0.01 \text{ mm gold wire}$) $\phi 0.05 \text{ mm copper wire}$	Long sensing range Free-cut type	Free Cut	FD-B8		K-D1/A1/M1
		Coaxial			Suitable for green LED type	500mm	FD-5		3
Standard		←∟┉┨₽┉━━	140mm	 𝑘 𝔅0.01mm gold wire 𝔅 𝔅0.02mm gold wire 		Free Cut	FD-FM2	nsors	FX-1
		With sleeve			• Free-cut type		FD-FM2S With sleeve 90mm FD-FM2S4 With sleeve 40mm	iber Sel	iber Ser IA
	nomy	⊷ ∎	120mm 18mm	(a) $\phi 0.01$ mm gold wire (b) $\phi 0.12$ mm copper wire	• Low price & free-cut		NEW FD-N8	Fil FX-11.	
	Eco	Small diameter	34mm 3mm	<pre></pre>		(Note 4)	FD-N4		-
	nead	← m∰m	20mm	<pre></pre>			FD-T80		9
all fiber h	all fiber	Small diameter	40mm 5mm		• Miniature head but having the same sensing range as the standard type fiber	Free Cut 2m	FD-T40		Ż
	Sma	<i>∳</i> 3 ← □	140mm 20mm	$(\mathbb{R} \ \phi 0.01 \text{ mm gold wire})$ $(\mathbb{G} \ \phi 0.02 \text{ mm gold wire})$			FD-S80		
Small diameter		With sleeve ϕ 1.48 ϕ 2.5	40mm 5mm	 (e) φ0.01mm gold wire (c) φ0.05mm copper wire 	 Suitable for detection in a congested equipment Free-cut type 	Free Cut 2m	FD-NFM2 FD-NFM2S With sleeve 90mm FD-NFM2S4 With sleeve 40mm		CX-20
	^g Standard		90mm 12mm	 (€) \$\not 0.01 mm gold wire (€) \$\not 0.03 mm gold wire 			NEW FD-W8	6 20	CX-30
	Small diamet with sleeve	With sleeve	14mm		_		NEW FD-W44	Tvp	2
arp bend	Small head		90mm 12mm	 𝔅 𝑘0.01mm gold wire 𝔅 𝑘0.03mm gold wire 	 The fiber can be bent sharply, like an electric wire, to avoid space wastage in installation because of its small allowable bending 	Free Cut	NEW FD-WT8 NEW FD-WS8	er Built-ir	/M5/D100/ND30(
Sh	Small diameter	← ∭	14mm		radius of R1mm or more (FD-WG4, FD-WSG4: R2mm or more, sleeve part of	2m	NEW FD-WT4	ulifie	CX-R
precision Sn	precision	Lens mountable M4 Coaxial	30mm	(a) $\phi 0.01$ mm gold wire	FD-W44: R10mm or more).		NEW FD-WG4	Am	X-10
	High	Coaxial $\phi 3$		G ¢0.02mm gold wire			NEW FD-WSG4		ш
			100mm 16mm	 <i>φ</i>0.01mm gold wire <i>φ</i>0.05mm copper wire 		Free X Cut	FD-P80		6
	Flexible	Small diameter	16mm		Bending durability: 1 000 000 times	2m	FD-P40	EX-20	
	Fle>	Small diameter	23mm 2.5mm		I,000,000 times or more	1m	FD-P2		

Notes: 1) The sensing range is specified for white non-glossy paper [100 × 100mm (**FD-B8**: 200 × 200mm)] as the object. 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.

The minimum sensing object is specified for maximum sensitivity. Also, note that the corresponding setting distance is different from the rated sensing distance.

4) Fiber cutter (FX-CT1) is not supplied as accessory along with standard (economy) fibers. Please procure it separately.

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	Spe	ecia	I use fibers [Reflective	type]t				
	Ту	pe	Shape of fiber head (mm)	Sensing range (II: Red LED type) (Note 1, 2)	Min. sensing object (at the maximum sensitivity (Note 3)) (C): Red LED type (C): Green LED type	Features	Fiber cable length	Model No.
	ective			4.5 to 12mm (Convergent point: 6mm)		Detection is not affected by object color.		FD-L4
	focus refl	Glass sheet detection		3 to 14mm (Convergent point: 8mm)		 Just 4mm thick Glass sheet is reliably detected. 	Free Cut 2m	FD-L41
	Fixed-	Specular object detection	15×19	1.3 to 3mm (Convergent point: 2mm)		Just 3mm thickWafer is reliably detected.		FD-L42
Fiber Sensors		ecision	Lens mountable Coaxial	50mm 7.5mm	(R) $\phi 0.01$ mm gold wire (G) $\phi 0.02$ mm gold wire	Precise position sensing with coaxial fiber	Free Cut 2m	FD-G4
		id ligin	Lens mountable M3	17mm		• Combination with the FX-MR3 lens gives an extremely small spot diameter of ϕ 0.3mm approx.	500mm	FD-EG1
		ay	Top sensing	110mm	R Horizontal ≠0.01mm gold wire Vertical ≠0.1mm copper wire	Its wide beam meets various	5 Free Cut	FD-AFM2
	~	IIA	Side sensing	17mm	G Horizontal ≠0.01mm gold wire Vertical ≠0.06mm copper wire	needs.	2m	FD-AFM2E
		EIDOW		85mm 13mm		• The fiber head is bent at a right angle with 5mm bend- ing radius at the neck.	Free Cut 2m	FD-R80
		view	Small diameter ϕ 1.5 ϕ Image: state stat	25mm	$(\mathbb{R} \neq 0.01 \text{mm gold wire})$	•The side view sensing	Free X Cut	FD-V41
		olde	Sleeve part cannot be bent.	45mm 5mm	(R) $\phi 0.01$ mm gold wire (G) $\phi 0.5$ mm copper wire	small space.	2m	FD-SFM2SV2
	small	eter		2mm		Suitable for detection in a very congested equipment	500mm	FD-EN500S1
	Ultra-	diame	Coaxial $\phi 0.8$ M3 Sleeve part cannot be bent.	17mm	$(\mathbb{R} \phi 0.01 \text{mm gold wire})$	Precise position sensing with coaxial fiber	1m	FD-ENM1S1
	Narrow-	view	Coaxial	15mm	R ϕ 0.01mm gold wire	• The narrow aperture angle, 1/6 of a conventional model, produces a small detecting area.	1m	FD-KM1S2
Type			¢6 ¢5		(Liquid)	Reduces malfunction due to liquid drop at the tip.	Free Cut 2m	FD-F8Y
t-in	ensing	dard		ϕ 6 to ϕ 26mm transparent pipe			Free Cut	NEW FD-F41
r Buil	l level Se	Stan	25×20	acrylic, glass, wall thickness 1 to 3mm	R (Liquid)	Liquid surface is reliably detected from outside the	Free Cut 5m	NE₩ FD-F91
Amplifier I	Liquic	A, wall ss 1mm		<pre> #6 to #26mm transparent pipe </pre>		pipe.	Free Cut 2m	FD-F4
		For PF, thickne		(PFA (fluorine resin), wall thickness 1mm			Free Cut 5m	FD-F9
	Note	es: 1)	The sensing range is specified for white	non-glossy paper [100 × 100mm (F	D-L42 and FD-V41 : 50 × 50mm, FD-K	M1S2: 10×10mm, FD-L41: glass shee	t 25 $ imes$ 25 $ imes$ t1.3m	m)] as the object.

tes: 1) The sensing range is specified for white non-glossy paper [100 × 100mm (FD-L42 and FD-V41: 50 × 50mm, FD-KM1S2: 10 × 10mm, FD-L41: glass sheet 25 × 25 × 11.3mm)] as the object.
 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) The minimum sensing object is specified for maximum sensitivity. Also, note that the corresponding setting distance is different from the rated sensing distance.

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Environment resistant fibers [Reflective type]												
Туре	Shape of fiber head (mm)	Sensing range (II: Red LED type (Note 1, 2) Creen LED type	Min. sensing object (at the maximum sensitivity (Note 3)) (© : Green LED type)	Features	Fiber cable length	Model No.						
	Coaxial M6		 (® ≠0.01mm gold wire (© ≠0.01mm gold wire 	• Heat-resistant temp.: 350°C	2m	FD-H35-M2						
istant	With sleeve $M6$ $\neq 2.8$	140mm		Cold-resistant temp.: - 60°C		FD-H35-M2S6 With sleeve 60mm						
Heat-res	Coaxial ← □			Flexible cable with silicone jacket Heat-resistant temp.: 200°C Cold-resistant temp.: - 60°C	1m	FD-H20-M1						
		150mm 26mm	$(\mathbb{R} \ \phi 0.01 \text{mm gold wire})$ $(\mathbb{G} \ \phi 0.06 \text{mm copper wire})$	 Heat-resistant temp.: 130°C Cold-resistant temp.: - 60°C Free-cut type 	Free Cut 2m	FD-H13-FM2						
Vacuum	← ∭∭ ^{M6}	75mm		Usable in vacuum chamber Heat-resistant temp.: 120°C	1m	FD-6V						

Notes: 1) The sensing range is specified for white non-glossy paper (100 × 100mm) as the object. 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) The minimum sensing object is specified for maximum sensitivity. Also, note that the corresponding setting distance is different from the rated sensing range.

The vacuum type fiber must be used with the following products as a set.

FT-J6: Fiber at atmospheric side (one pair set)

FV-BR1: Photo-terminal (one pair set)

Semi-standard fibers (Custom-order made)

The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol 🔛) or the sleeve length (symbol) from the table below.

Туре		Basic model No.	🖾 Fiber cable length (Unit: m)	Sleeve length (Unit: cm)
Standard threaded head (free-cut)		FD-FM 🕁	3, 4, 5, 10, 15, 20	
	With sleeve	FD-FM 🖾 -S 🖾	2 (Note), 3, 4, 5, 10, 15, 20	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Small diameter threaded head with sleeve (free-cut)		FD-NFM2-S		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
200°C heat-resistant		FD-H20-M 🕁	2, 3	
350°C heat-resistant		FD-H35-M 🔀	3	

Note: The standard fiber has a 2m fiber cable length and a 4cm or 9cm sleeve length.

Correlation between sensing range attenuation coefficient and fiber cable length

Longer the fiber cable, shorter is the sensing range.



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Amplifier Built-in Type

CX-RVM5/D100/ND300R

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Fiber Sensors

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Amplifiers

	Tv	ne	Арреа	irance	Model No	Emitting	Output
	, y	рс 		Display		element	
	Digital setting	Red LED type			FX-D1	Red I ED	NPN open-collector transistor (Output 1, Output 2)
	Digital Souring				FX-D1P		PNP open-collector transistor (Output 1, Output 2)
		Red LED type			FX-A1	Red I ED	NPN open-collector transistor (Sensing output, self-diagnosis output)
cincii	Auto-setting			i Marin Mira	FX-A1P		PNP open-collector transistor (Sensing output, self-diagnosis output)
nel de		Green LED type			FX-A1G	Green LED	NPN open-collector transistor (Sensing output, self-diagnosis output)
		Red LED type			FX-M1	Pod LED	NPN open-collector transistor (Sensing output, self-diagnosis output)
	Manual setting	TOULED type		III (■1 1 = IV * =	FX-M1P	Neu LED	PNP open-collector transistor (Sensing output, self-diagnosis output)
		Green LED type			FX-M1G	Green LED	NPN open-collector transistor (Sensing output, self-diagnosis output)

Plug-in connector type

Plug-in connector type is available. (Standard: cable type) When ordering the plug-in connector type, add suffix 'J' to the model No. (e.g.) Plug-in connector type of **FX-A1P** is '**FX-A1PJ**'.

Usable with the sensor & wire-saving link system S-LINK, the sensor block for simple wiring SL-BMW or SL-BW, or with the connector attached cable CN-54-C2

or CN-54-C5. However, if FX-D1 series is connected to the sensor & wire-saving link system S-LINK or the sensor block for simple wiring, Output 2 cannot be used.



 $\left(\begin{array}{c} \text{Refer to P.26} \sim \text{for} \\ \text{details.} \end{array}\right)$

PNP output type amplifier cannot be connected.



Sensor block for simple wiring SL-BMW, SL-BW

(Refer to P.54~ for) details.



Connector attached cable CN-54-C2 (2m long) CN-54-C5 (5m long)

FX-13

FX-11A

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

EX-10

EX-20

Amplifier Built-in Type

OPTIONS

Designation	Model No.			De	escription		
	FTP-500 (0.5m)	For		FT-B8	FT-P80		
	FTP-1000 (1m)	M4		FT-FM2 FT-FM2S	FT-H13-FM2		
Protective tube	FTP-1500 (1.5m)	thread		FT-FM2S4			
(type fiber	FTP-N500 (0.5m)	For		FT-T80	FT-P40		
	FTP-N1000 (1m)	M3	ers	FT-NFM2 FT-NFM2S	FD-T40 FD-P40	tube, made of	
	FTP-N1500 (1.5m)	thread	le fib	FT-NFM2S4	10140	non-corrosive stainless steel,	
	FDP-500 (0.5m)	For	licab	FD-B8	FD-P80	protects the	
	FDP-1000 (1m)	M6	App	FD-FM2 FD-FM2S	FD-H13-FM2	from any	
Protective tube	FDP-1500 (1.5m)	thread			FD-FM2S4		external lorces.
(type fiber	FDP-N500 (0.5m)	For		FD-T80			
	FDP-N1000 (1m)	M4	FD-NFM2				
	FDP-N1500 (1.5m)	thread		FD-NFM2S4			
Fiber bender	FB-1	The fib proper	iber head at the				
Universal sensor mounting stand (Note 2)	MS-AJ-F	Mounting stand assembly for fiber (For M3, M4 or M6 threaded head fibers)					
Fiber cutter	FX-CT1	The fre	e-cu	t type fiber can be	e easily cut.		

Notes: 1) Do not bend the sleeve part of any side-view type fiber, ultra-small diameter head type fiber, arrow beam type fiber, or narrow-view type fiber.
Refer to P.310~ for the universal sensor mounting stand.

Protective tube

Fiber bender



Universal sensor mounting stand

Using the arm which enables adjustment in the horizontal direction, sensing can also be done from above an assembly line.



Fiber cutter



OPTIONS

В											
PHOT		D	esignation	Model No.		De	escription				
M							Sensing range	e (mm) [Len	s on both s	ides]	
1						Increases the sensing range	Applicable am	plifier Red L	ED type	Gree	en I ED type
4						by 4.5 times or more.	Fiber			010	
5						Ambient temperature:	FI-B8	3,	(Note 1)		650
Y			Expansion		0	$-60 \text{ to } + 350^{\circ}\text{C}$		3,500	(Note 1)		600
Ê			lens	FX-LE1	-		F1-100	3,500			500
					all a start			2,	(Noto 1)		500
							FT-H25-M2	3,500			300
73							FT-H20-M1	1 600	(Note 1)		300
×	LS						FT-R80	1,000	400		400
ш	So							2,	100		100
	Sen						Sensing range	e (mm) [Len	s on both s	ides]	
-	er (Tremendously increases the sensing range with large	Applicable am Fiber	Red LED t	ype (Note 2)	Gre	en LED type
17	li:					aperture lenses.	FT-B8	3,500	(Note 1)	3,5	00 (Note 1)
5	-	er	Super-			Ambient temperature:	FT-FM2	3,500	(Note 1)		3,000
ř		e fib	expansion	FX-LE2		- 60 to + 350°C	FT-W8	3,500	(Note 1)		2,500
		ype	lens				FT-P80	3,500	(Note 1)		3,000
_		Ē			100 L		FT-H35-M2	3,500	(Note 1)		2,700
		pee					FT-H20-M1	1,600	(Note 1)	1,6	00 (Note 1)
0		-nr					FI-H13-FM2	3,500	(Note 1)		2,400
7		or th					F1-R80	3,500	(Note 1)		2,400
Ľ		Щ					Sensing range	e (mm) [Len	s on both s	ides]	
						Beam axis is bent by 90°.	Applicable am	plifier Red L	ED type	Gre	en LED type
						Ambient temperature:	FT-B8		50		120
						$-60 \text{ to } + 300^{\circ}\text{C}$	FT-FM2	6	500		100
50			Side-view	FX-SV1	C. C		FT-T80	6	500		100
×			lens				FT-W8	4	50		80
C					3)		FT-P80	6	600		100
					Canada		FT-H35-M2	4	50		75
							FT-H20-M1	2	280		75
0							Consinants		a an hath a		
- m			Expansion		0	Sensing range increases by	Sensing range	e (mm) [Len	is on both s	laes	
ö			lens for	EV-I E1	The second se	10 times or more.	Fiber	Red L	ED type	Gre	en LED type
Ŭ	be		vacuum		A and	Ambient temperature:	FT-6V	2,	700		
	Σ		Tiber			-40 to +120°C	-40 to + 120°C FT-60V 1,400		400		
00R	_										
<u>P</u>	Ţ.					Pinpoint spot of	bles detection of r	ninute objects	or small mark	s.	
100	lin		Pinpoint spot lens	FX-MR1		Applicable amplifiers: Red LE	D type	Distance to	focal point: 6 🗄	= 1mn	n
50	B		oportiono			Applicable fibers: FD-WG4, F	D-G4	 Ambient terr 	perature: - 40	0 to -	- 70°C
R	ier					The spot diameter is adjustable	o from 40.7 to		1		
З	ji				Screw-in		the fiber is	Screw-in depth	Distance to focal	point	Spot diameter
	du				depth	screwed in.		7mm	18.5mm app	rox.	¢0.7mm
	Ā	_	Zoom lens	FX-MR2	Distance	Applicable amplifiers: Red LE	D type	12mm	27mm app	rox.	¢1.2mm
-10		fibe			to focal point	Applicable fibers: FD-WG4, F	D-G4	14mm	43mm app	rox.	¢2.0mm
Ц		type.				• Ambient temperature: - 40 to	0 + 70 C				
		sctive				Extremely fine spot of $\phi 0.3$ mm	n achieved.	Screw-in depth	Distance to focal	point	Spot diameter
		efle	Finest spot	FX-MP3	↓ [[™]]	Applicable fibers: FD-WG4. F	D-EG1, FD-G4	FD-WG4	7.5±0.5m	m	¢0.5mm approx.
_		orr	lens	1 1-10163	Distance to	Ambient temperature: - 40 to	+ 70°C	FD-EG1	7.5±0.5m	m	¢0.3mm approx.
20		LĹ						FD-G4	7.5±0.5m	m	¢0.5mm approx.
×					Spot diameter						
ш					Screw-in I ← Screw-in depth	FX-MR2 is converted into a sid	le-view type and	Scrow in donth	Distance to feed	noint	Spot diamotor
			Zoom lens			can be mounted in a very small	Il space.	8mm	13mm appr	OX.	d 0.5mm
			Side-view	FX-MR5	Distance to focal	Applicable ampliners: Red LE Applicable fibers: FD-WG4. F	D type D-G4	10mm	15mm appr	ox.	¢0.8mm
			(type /		point	Ambient temperature: - 40 to	0 + 70°C	14mm	30mm appr	ox.	φ3.0mm
					Spot diameter						,

Notes: 1) The fiber cable length practically limits the sensing range to 3,500mm long (**FT-H20-M1**: 1,600mm). 2) A sensing distance of 8m is possible if combined with the semi-standard fiber **FT-FM10**, having a 10m fiber length.

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SPECIFICATIONS

Fibers

Iter	Type m	Standard, small fiber sensing range with le beam type of ultra-sn	head, small diameter, sharp bend, flexible, long ns, wide beam, array, elbow, high precision, thru- nall diameter	Fixed-focus reflective	Side-view, narrow beam, narrow-view, reflective type of ultra-small diameter			
Allo	wable bending radius	Sharp bend: R1mm or R4mm or more, Thru-t	R25mm or more more (FD-WG4, FD-WSG4: R2mm or more), Flexible: beam type of ultra-small diameter: R5mm or more	R10mm or more	R25mm or more (FT-K2 and FT-KV2: R10mm or more)			
Am	bient temperature	(Sharp bend:	- 40 to +70°C - 40 to +60°C, FD-EG1 : − 20 to +60°C)	$-40 \text{ to } +70^{\circ}\text{C}$ (FD-L41 and FD-L42: $-40 \text{ to } +60^{\circ}\text{C}$)	- 20 to +60°C (FT-V41, FD-V41, FT-KV8, FT-K2 and FT-KV2: - 40 to +60°C			
Am	bient humidity		35 to 85% RH (No dew condensation	n or icing allowed)	·			
	Fiber core		Acrylic					
Material	Sheath	(Polyethylene (Thru-beam type of ultra-small diameter and flexible, except for FD-P2 : Vinyl chloride) (Reflective type of narrow-view: Polyurethane					
	Fiber head	Brass (Nickel plated) Polycarbonate Stainless steel (SUS) Polyolefin ABS Acrylic Die-cast zinc alloy	 Threaded part of standard, threaded part of small diameter, threaded type of sharp bend, threaded part of thru-beam type ultra-small diameter, FT-P80, FD-P80, high precision, array, threaded part of FT-R80 FT-A8, lens of FT-WS8L FT-SFM2, small fiber head, non-threaded type of sharp bend, FT-SNFM2, FD-SNFM2, FT-SFM2L, FT-P40, FT-P2, FD-P40, FD-P2, sleeve part of sleeve-attached fiber Lens of FT-A8 FT-FM10L Threaded part of FD-R80 	ABS: FD-L4, FD-L41 Acrylic: Lens of FD-L4 Aluminum: FD-L42	Stainless steel (SUS) (FT-KV2, threaded part of FD-EN500S1·FD-ENM1S1· FT-KM1S2 and FD-KM1S2: Brass, Lens of FT-K2: Glass, Reflector of FT-KV8, Prism of FT-KV2: Acrylic, Holder of FT-KV8: Polycarbonate			
Accessories		Threaded head fiber: 2 Nos. of nuts (thru-beam type: 4 Nos.) and 1 No. of toothed lock washer (thru-beam type: 2 Nos.) Free-cut type fiber (except economy type): 1 No. of FX-CT1 (Fiber cutter) FD-N4, Small diameter free-cut type fiber, high precision free-cut type fiber: FX-AT10 (\$\phi\$ 1.3mm fiber attachment), FX-AT13 (\$\phi\$ 1.3mm fiber attachment) FT-WS4, FD-W44, FD-WT8, FD-WS8, FD-WT4, FD-WG4 or FD-WSG4: FX-AT10 (\$\phi\$ 1mm fiber attachment) FT-A8: 2 Nos. of 0.5 × 12mm seal type slit mask and 2 Nos. of 1 × 12mm seal type slit mask FD-L4: FX-AT10 (\$\phi\$ 1mm fiber attachment), FX-AT13 (\$\phi\$ 1.3mm fiber attachment), 2 Nos. of M2.6 (length 12mm) screws with washers and 2 Nos. of nuts Fixed-focus reflective type fiber: FX-AT10 (\$\phi\$ 1mm fiber attachment)						

Fibers

Туре		Liquid leve	el sensing	Vacuum	Heat-resistant			Chemical-	
Item			Mountable on pipe	vacuum	350°C type	200°C type	130°C type	resistant	
Allowable bending radius		Protective tube: R40mm or more Fiber cable: R15mm or more	R10mm or more	R200mm or more (FT-60V: R30mm or more)	R25mm or more		R30mm or more		
Ambient temperature		- 40 to +125°C (Note 1)	− 40 to +100°C (Note 1)	-40 to +120°C	- 60 to +350°C (Note 2, 3)	- 60 to +200°C (Note 3)	-60 to +130°C	- 40 to +115°C	
Am	pient humidity	35 to 85% RH (No dew condensation or icing allowed)							
Material	Fiber core	Acrylic		Quartz glass (Note 4)	Multi-component glass (Note 5)		Acr	Acrylic	
	Sheath	Protective tube: Fluorine resin	Polypropylene	Fluorine resin	Stainless steel	Silicone Inside stainless steel (SUS) spiral tube	Fluorine resin	Protective tube: Fluorine resin Fiber sheath:	
	Fiber head	Polypropylene	Polyetherimide	Aluminum	(888)	Brass (Nickel plated)	Brass (Nickel plated)	Polypropylene	
Accessories		Threaded head fil Free-cut type fibe FD-F4 and FD- FD-F4 and FD-	ber: 2 Nos. of nuts r, chemical-resista F9⊡: FX-AT-10 (<i>∳</i> F9⊡: 4 Nos. of tyir	(thru-beam type: 4 nt type fiber: 1 No. 1mm fiber attachm ng bands and 2 No	Nos.) and 1 No. o of FX-CT1 (Fiber nent) s. of anti-slip tubes	of toothed lock was cutter) s	her (thru-beam ty	be: 2 Nos.)	

Notes: 1) With the liquid level sensing fiber, make sure that the temperature of the liquid is also within the ambient temperature range.
2) If the fiber is used under - 30°C, its resistable maximum temperature drops to +200°C. If the side-view lens FX-SV1 is put on the fiber head, the allowable maximum temperature comes down to +300°C. (The ambient temperature range of the FX-SV1 is from -60 to +300°C.)
3) The ambient temperature of heat-resistant 350°C type and 200°C type fibers is the value in dry condition. In humid environment, the ambient temperature differs. (For a high humidity of 85% RH, the ambient temperature is 0 to 40°C.)

4) If the fiber material is quartz glass, keep it away from vibration or impact.

5) If the fiber material is multi-component glass, keep it away from vibration or impact.

FX-13

FX-11A

FZ-10

CX-20

CX-30

Amplifier Built-in Type CX-RVM5/D100/ND300R

Fiber Sensors

SPECIFICATIONS

Amplifiers

		•	NPN output				PNP output			
	Туре		Digital setting	Auto-s	settina	Manual setting		Digital setting Auto-setting M		Manual setting
		.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Red LED type	Red LED type	Green LED type	Red LED type	Green LED type		Red LED type	
	Iter	m Model No.	FX-D1	FX-A1	FX-A1G	FX-M1	FX-M1G	FX-D1P	FX-A1P	FX-M1P
	Suc	polv voltage			12 to 2	$4V DC \pm 10\%$	Ripple P-P 10%	or less		
	Cur	rent consumption	45mA or less	50mA	or less	45mA	or less	45mA or less	50mA or less	45mA or less
			NPN	open-collector tr	ansistor	1011.01	011000	PNP open-collector	transistor	1011#1011000
			• N	Maximum sink current: 100mA Maximum source current: 100mA						
	Ser	nsing output (Note 1)		pplied voltage. 3	between sensing	g output and 0V)	• Applied Voltage: 30V DC or less (between sensing output and +V)		
			Residual voltage: 1V or less (at 100mÅ sink current)			ent)	Residual voltage: 1V or less (at 100mA source current) 0.4V or less (at 45mA source current)			
rs		Litilization category	0.4V or less (at 16mA sink current)				0.4V or less (at 16mA source current)			
ISO		otilization category			DC-12 OF DC-13				Switchable either	
ber Ser		Output operation	Switchable e	either Light-ON o	or Dark-ON,	or Dark-ON,	with selection	Switchable ei	ither Light-ON	Light-ON or Dark- ON, with selection
			with jog swit			switch		of Bark ON,	with jog switch	switch
		Short-circuit protection				Incorp	orated			
Ē				NPN open-col	lector transistor				Maximum source	transistor ce current: 50mA
	0.1	· · · · · · · ·		Maximum Applied ve	oltage: 30V DC	or less			Applied voltage	: 30V DC or less
	Sel	r-diagnosis output			(betweer	self-diagnosis	output and 0V)		(between self-diag • Residual voltad	nosis output and + v) e:
				Residual	voltage: 1V or le 0.4V or	ess (at 50mA sin less (at 16mA s	k current) ink current)		1V or less (at 5	OmA source current)
							,	0.4V or less (at 16mA so		IbmA source current)
		Short-circuit protection								
	ne	Emission Frequency 1				0.5ms	orless			
	nse tii	Emission Frequency 2	0.5115 01 1855 0 65ms or less							
	Respo	Emission Frequency 3	0.75ms or less							
			2-level	eaching/Limit te	aching/	Potontiom	otor cotting	2-level teaching	g/Limit teaching/	Potentiometer
	361	Isitivity setting	Full aut	o-teaching		FOLEINIOIN	eter setting	Full auto-teaching	ng	setting
	Sensitivity adjuster					Incorporated potentiometer	with 12-turn r with indicator			Incorporated with 12-turn potentiometer
						with indicat		with indicator		
			Incorporated with ON-delay					Incorporated with ON-delay		
			timer/OFF-			dalau timar	timer/OFF-	Incorporated w	ith approx.	
	Timer function		switchable	timer, hable incorporated with approx. 40ms fixed OFF-delay timer, switchable either effective or ineffective effective			switchable	switchable either effective or ineffective		
e			either effective				either effective			
Ур			(Note 2)	ective 2)				(Note 2)		
L L	Inte	rference prevention function	Incorporated (Three units of sensors can be mounted closely.)							
Ŧ		Pollution degree	3 (Industrial environment)							
Sui			0 to $+50^{\circ}$ C					0 to $+50^{\circ}$ C		No dew con-
ш Б	ce	Ambient temperature	densation	-10 to $+5$	0°C (No dew co	ndensation or ic	ing allowed),	densation	$-10 \text{ to } +50^{\circ}$	C densation or
ifie	star		Storage:	Storage 2	2010 +70 C				Storage:	
ld	resi	Ambient humidity			35	to 85% RH St	orage: 35 to 85%	-2010 +70 C	Storage 20	10 + 70 C
Αu	ntal	Ambient illuminance	S	unlight: 10 000 <i>0</i>	x at the light-rec	ceiving face Inc	andescent light.	3000ℓ x at the l	ight-receiving fa	ce
	nme	EMC		unight ro,ooot	Emiss	ion: EN50081-2	. Immunity: EN5	0082-2	ight recenting ia	
	viro	Voltage withstandability		1,000V AC for c	ne min. betweer	n all supply term	inals connected	together and en	closure (Note 3)	
	En	Insulation resistance	20MΩ,	or more, with 25	0V DC megger	between all sup	ply terminals cor	nected together	and enclosure (Note 3)
		Vibration resistance		10 to 150H	Iz frequency, 0.7	5mm amplitude	in X, Y and Z di	rections for two	hours each	
		Shock resistance		98m/s	² acceleration (1	0G approx.) in λ	K, Y and Z direct	ions for five time	s each	
	Em	itting element	Red LED	Red LED	Green LED	Red LED	Green LED		Red LED	
	Mot	orial	(modulated)	(modulated)	(modulated)	(modulated)	(modulated)	to Fiber look lo	(modulated)	
	Cat			ENCIOSU		mm ² A-coro coh		ate, FIDEI IOCK IE	VEI. FEO	
	Cat	ble extension		F	vtension up to to	ntal 100m is nos	sible with 0 3mn	² or more cabl	e	
	We	ight		E		70a a	pprox.	. , e, odbr		
	A				MS-DIN-2	Amplifier mount	ing bracket): 1 N	lo.		
	ACC	60001162	Adjusting screwdriver (Manual setting type only): 1 No.							

Notes: 1) The digital setting type FX-D1 series is equipped with two independent outputs (Output 1, Output 2).
2) The time period of ON-delay timer and OFF-delay timer can be selected from 40ms, 100ms, 200ms and 500ms. Also, independent settings can be made for Output 1 and Output 2.
3) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.

SUNX

FX-13

FX-11A

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

EX-10

I/O CIRCUIT AND WIRING DIAGRAMS



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SENSING CHARACTERISTICS (TYPICAL)

Correlation between setting distance and excess gain



SENSING CHARACTERISTICS (TYPICAL)

Parallel deviation



FX-D1/A1/M1

FX-13

FX-11A

FZ-10

CX-20

CX-30

Amplifier Built-in Type

CX-RVM5/D100/ND300R

EX-10

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Fiber Sensors

SENSING CHARACTERISTICS (TYPICAL)

Parallel deviation



PHOTOELECTRIC SENSORS

FX-D1/A1/M1

FX-13

FX-11A

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

EX-10

EX-20

SENSING CHARACTERISTICS (TYPICAL)

Parallel deviation



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SENSING CHARACTERISTICS (TYPICAL)

Parallel deviation with FX-LE1 (expansion lens) applied on both sides



PHOTOELECTRIC SENSORS

FX-D1/A1/M1

FX-13

FX-11A

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

EX-10

EX-20

SENSING CHARACTERISTICS (TYPICAL)



Parallel deviation with FX-LE2 (super-expansion lens) applied on both sides

SENSING CHARACTERISTICS (TYPICAL)

Parallel deviation with FX-SV1 (side-view lens) applied on both sides



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EX-20



SENSING CHARACTERISTICS (TYPICAL)



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SENSING CHARACTERISTICS (TYPICAL)



SENSING CHARACTERISTICS (TYPICAL)

Sensing fields



ØSUNX

FX-D1/A1/M1

FX-13

FX-11A

FZ-10

CX-20

CX-30

Amplifier Built-in Type

CX-RVM5/D100/ND300R

EX-10

EX-20

Fiber Sensors

SENSING CHARACTERISTICS (TYPICAL)

Sensing fields



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SENSING CHARACTERISTICS (TYPICAL)

Sensing fields with FX-MR3 (finest spot lens) applied







Operating point ℓ (mm)



FZ-10

SENSING CHARACTERISTICS (TYPICAL)

Correlation between sensing object diameter and sensing field



SENSING CHARACTERISTICS (TYPICAL)

Correlation between sensing object diameter and sensing field



Amplifier Built-in Type EX-20 EX-10 CX-RVM5D100ND300R CX-30 CX-20

PHOTOELECTRIC SENSORS

FX-D1/A1/M1

FX-13

FX-11A

FZ-10

PRECAUTIONS FOR PROPER USE

Amplifier

How to mount the amplifier

35mm width DIN rail.

the DIN rail to fit it.

How to remove the amplifier 1) Push the amplifier forward.

(1) Fit the rear part of the amplifier

2 Press down the front part of the

amplifier on the amplifier

mounting bracket (MS-DIN-2) or

on the attached amplifier mounting bracket (MS-DIN-2) or a

Mounting

FX-D1/A1/M1

FX-13 Fiber Sensors

FX-11A

EX-10

EX-20





- (1) The self-diagnosis output transistor stays in the 'OFF' state during stable sensing.
- When the sensing output changes, if the incident light intensity does not reach the stable light received level or the stable dark level, the self-diagnosis output becomes ON. It automatically turns OFF after 40ms approx. (Emission Frequency 2 of the FX-A1 series: 50ms approx., Emission Frequency 3 of the FX-A1 series: 60ms approx.)

Further, the self-diagnosis output is generated at the time when the sensing output changes from ON to OFF or from OFF to ON.

(The operation of the sensing output is not affected.)

Interference prevention function

• Since the FX-D1/A1/M1 series is equipped with an interference prevention function, up to 3 Nos, of fiber sensors can be mounted close to each other by setting different emission frequencies. Please refer to 'Setting of each mode' for the setting method in case of the FX-D1/A1 series. For the FX-M1 series, the emission frequency can be set by the frequency selection switch.

Refer to P.820 \sim for general precautions.

However, note that the response time varies with the emission frequency as given below.

Emission frequency	Response time
1	0.5ms or less
2	0.65ms or less
3	0.75ms or less

Note: Do not set the sensitivity when interfering light is incident. Correct incident light intensity cannot be taught in this condition.

Timer function

• The FX-D1 series incorporates an ON-delay timer, which is useful when sensing only objects with a long passage time, and an OFF-delay timer, which is useful when the sensor is connected to devices having a slow response time. The timer period can be selected from four values: 40ms, 100ms, 200ms and 500ms.

The FX-A1/M1 series incorporate approx. 40ms fixed OFF-delay timer. Please refer to 'Setting of each mode' for the setting method in case of the FX-D1/A1 series. For the FX-M1 series, selection is by the mode switch.



Timer period: T = 40ms, 100ms, 200ms, 500ms (selectable at the time of MODE setting)

Timer period of FX-A1/M1 series: T = 40ms (OFF-delay timer)

Wiring

. The self-diagnosis output is not incorporated with a shortcircuit protection circuit. Do not connect it directly to a power supply or a capacitive load.

Others

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

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- **0 (م**ر Attached amplifier mounting bracket or 35mm width DIN rail
- (2) Lift up the front part of the amplifier to remove it.

This product is not a safety sensor. Its use is not

intended or designed to protect life and prevent body

injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

Note: Please take care that if the front part is lifted without pushing the amplifier forwards, the hooks on the rear portion of the mounting section are likely to break.

How to connect the fiber cables

- (1) Snap the fiber lock lever down.
- Insert fiber cables (2)slowly into the inlets Fiber lock leve until they stop. (Note)
- ③ Lock the fiber lock lever in the original position, till you feel a click.



<Time chart>

PRECAUTIONS FOR PROPER USE

PHOTOELECTRIC SENSORS

FX-D1/A1/M1

FX-13

FX-11A

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

EX-10

EX-20



Percentage display

· After setting the threshold value, the current incident light intensity can be expressed as a percentage of the threshold value so that the degree of margin can be confirmed at a glance. If the jog switch is pressed when the mode selection switch is set on 'RUN', the display changes from absolute value to percentage value, and 0 to 999% is displayed. However, % (percent) is expressed by 'P' and fractions are rounded off.

If the jog switch is pressed once again, the display returns to absolute value.

Further, in case percentage display is desired when the power supply is switched off, and then, on again, change the mode selection switch once to 'SET' or 'MODE', and then, set it back to 'RUN'



<Current incident light intensity>

<Percentage display>

- Percentage display = Current incident light intensity \div Threshold value \times 100 (%)
- The larger the difference between the numerical values in the Light state and the Dark state, more stable is the sensing.



Two outputs

 Since the FX-D1 series is equipped with two independent outputs, threshold value, output operation and timer can be set for each of the two outputs.

Please refer to 'Setting of threshold value' for the method of setting the threshold value.

Further, please refer to 'Setting of each mode' for the output selection and the method of setting the output operation and the timer.

Output	LCD display	Description
Output 1	1	Threshold value, output operation and timer can be set for Output 1.
Output 2	1	Threshold value, output operation and timer can be set for Output 2.

Setting of threshold value

In case of 2-level teaching

. This is the method of setting the threshold value by teaching two levels, corresponding to the object present and object absent conditions. Normally, setting is done as given below.

Step	Operation	LCD display	
1	Set the fiber within the sensing range.		
2	Set the mode selection switch to either 'RUN' or SET MODE'.		rs
3	Set to either Output 1 or Output 2 by turning the jog switch to the '+' or the '-' side.	Output 1 Output 2 1 1 1 2 2 2	Senso
4	Set the mode selection		Fiber
	Press the jog switch in the object present condition and release it within 3 sec. (Note 1)		_
	Thru-beam type Reflective type		
5			
	condition		
6	If teaching is accepted, the read incident light intensity is displayed for 0.5 sec. approx. Subsequently, ' <i>¿ng'</i> ' is displayed on the LCD display. (Note 2)	Incident light intensity display	
	The jog switch is pressed in the object absent		
	condition and released.		
7			
	Beam incident Background		
	If teaching is accepted, the read incident light intensity is displayed for 0.5 sec. approx., and the threshold value is set to the middle value of the incident light intensity levels in the object present and object absent conditions. After that, the judgment on the stability of sension is displayed for 2.5 sec. approx	Incident light intensity display	ype
8	 'g_{ad}' is displayed on the LCD display if there is sufficient difference between the incident light intensities in the object present and object absent 		lt-in T
	conditions and stable sensing is possible.	hin d	Buil
	small difference between the incident light intensities in the object present and object absent conditions and stable sensing is not possible. After this, the threshold value is displayed.	Threshold value display	plifier E
9	Set the mode selection switch to 'RUN'.		Am
Vote	s: 1) If the jog switch is pressed continuously for 3 sec., or more, full	auto-teaching is done.	
	 2) If the mode selection switch is changed to 'RUN' when 'Znd' on the LCD display, the incident light intensity taught at Step 3) When the mode selection switch is changed from 'SE' 'MODE' to 'RUN', the set threshold value or the contents of the set threshold value or the set thre	 f is being displayed (5) is not recorded. T' to 'RUN' or from of each mode setting 	
	are stored in an EEPROM. However, since the EEPROM	A has a lifetime, the	

threshold value setting cannot be done for more than 100,000 times 4) Do not move or bend the fiber cable after the sensitivity setting Detection may become unstable.

<Procedure for maximum sensitivity setting>

(1) Set the mode selection switch to either 'RUN' or 'MODE'

- Set to either Output 1 or Output 2 by turning the jog switch to the '+' or the '-' side. 2 Set the mode selection switch to 'SET
- $\widecheck{4}$ Press the jog switch in the condition when there is no object or background body.
- (5) If teaching is accepted, 'c'nd' is displayed on the LCD display
- 6 Once again, press the jog switch in the condition when there is no object or background body.
- (7) Set the mode selection switch to 'RUN'

Note: Please take care that, if the sensor is set to max, sensitivity, it becomes weak against extraneous light, noise and optical interference.



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PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.

Amplifier (FX-D1□)

In case of limit teaching

• This is the method of setting the threshold value by teaching only the object absent condition (stable incident beam condition). This is used for detection in presence of a background body or for detection of small objects.



Notes: 1) If the jog switch is pressed continuously for 3 sec., or more, full auto-teaching is done.

- 2) If the mode selection switch is changed to 'RUN' when '2nd' is being displayed on the LCD display, the incident light intensity taught at Step (5) is not recorded.
- 3) When the mode selection switch is changed from 'SET' to 'RUN' or from 'MODE' to 'RUN', the set threshold value or the contents of each mode setting are stored in an EEPROM. However, since the EEPROM has a lifetime, the threshold value setting cannot be done for more than 100,000 times.
- Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

Please refer to P.511 for setting of threshold value when used in combination with liquid level sensing fiber **FD-F8Y** and to P.504 for setting of threshold value when used in combination with pipe-mountable liquid level sensing fiber **FD-F4**, **FD-F9**.

In case of full auto-teaching

• Full auto-teaching is used when it is desired to set the threshold value without stopping the assembly line, with the object in the moving condition.



- Notes: 1) When the mode selection switch is changed from 'SET' to 'RUN' or from 'MODE' to 'RUN', the set threshold value or the contents of each mode setting are stored in an EEPROM. However, since the EEPROM has a lifetime, the threshold value setting cannot be done for more than 100,000 times.
 - Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

FX-13

FX-11A

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

EX-10



Refer to P.820~ for general precautions.

Amplifier (FX-D1

In case of fine adjustment

	-	
Step	Operation	LCD display
1	Set the mode selection switch to either 'RUN' or SET MODE'.	
2	Set to either Output 1 or Output 2 by turning the jog switch to the '+' or the '-' side.	Output 1 Output 2 1 1 1 2 2 2
3	Set the mode selection switch to 'SET'. The present SET MODE threshold value is displayed.	- 1234
4	In case the threshold value is to be increased (sensitivity to be reduced), turn the jog switch a little to the '+' side to increase the threshold value slowly. If the jog switch is turned fully to the '+' side, the threshold value increases rapidly. In case the threshold value is to be decreased (sensitivity to be increased), turn the jog switch a little to the '-' side to decrease the threshold value slowly. If the jog switch is turned fully to the '-' side, the threshold value decreases rapidly.	• 1234 & • 1235 • 1234 & • 1233
5	Set the mode selection switch to 'RUN'. The threshold value does SET MODE not change even if the jog RUN switch is operated.	

- Notes: 1) When the mode selection switch is changed from 'SET' to 'RUN' or from 'MODE' to 'RUN', the set threshold value or the contents of each mode setting are stored in an EEPROM. However, since the EEPROM has a lifetime, the threshold value setting cannot be done for more than 100,000 times.
 - 2) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

Setting of each mode





③ Press the jog switch at the output desired to be set.

Output operation setting

('L' or 'd' blinks.)

- ④ Turn the jog switch to either the '+ or the '-' side.
- ' L ' and ' d' are displayed alternately.

- (5) Press the jog switch at the output operation desired to be set.

Timer operation setting

(3 digits from the right side blink.)

#37

#1 **-**

(6) Turn the jog switch to either the '+' or the '-' side. The display of timer operation changes as given **ON-delay timer**

40ms

40ms



- C(Emission Frequency 2)

 N_{+}

Fr - 3 (Emission Frequency 3) (9) Press the jog switch at the emission frequency desired to be set. (10) After the modification of settings, the display returns to the initial display.

(f) Set the mode selection switch to 'RUN' after finishing the settings.

CX-RVM5/D100/ND300R EX-10

- EX-20

In case only a part of the settings are to be changed, set the mode selection switch to 'RUN', at the appropriate time, in the middle of the above procedure to make only the required changes.

given below.

71171

F-- (Emission Frequency 1)





CX-20

CX-30

FX-D1/A1/M1 PHOTOELECTRIC SENSORS

FX-13

FX-11A

PRECAUTIONS FOR PROPER USE

Amplifier (FX-A1□) Part description



Functions of level indicators

 If the mode selection switch is set to 'SET' or 'RUN', the level indicators show the position of the set sensitivity level. However, if the mode selection switch is set to 'MODE', the level indicators show the output operation/emission frequency/timer settings.

		Mode selection switch	Level indicators
			Hundreds position Tens position Image: Sensitivity level is displayed. Image: Hundreds position: Image: Sensitivity level is displayed. Image: Hundreds position: Image: Hundred position: <t< th=""></t<>
		MODE	Tens position : blinks 999 within the Units position : not shown sensor.
plifier Built-in Type			Hundreds position
	plifier Built-in Type		Output operation Emission frequency Timer
	Ampli		

Sensitivity setting

In case of 2-level teaching

• This is the method of setting the sensitivity by teaching two levels, corresponding to the object present and object absent conditions. Normally, setting is done as given below.

Step	Operation	Level indicators
1	Set the fiber within the sensing range.	
2	Set the mode selection switch to 'SET'. The present sensitivity setting is displayed.	
3	Press the jog switch in the object present condition. The level indicators '3' and '6' blink. Release the jog switch within 3 sec. The level indicators '4' and '5' blink and the incident light intensity in the object present condition is read. (Note 1) Thru-beam type Reflective type Beam blocked condition	
4	The jog switch is pressed in the object absent condition. Thru-beam type Reflective type Mark Beam incident Condition	
(ح)	The stability indicator (green) lights up and the sensitivity level is set at the middle value of the incident light intensity levels in the object absent conditions. The sensitivity level is then displayed on the level indicators. • Hundreds position: lights up continuously • Tens position : not shown (e.g.) The level indicators in the figure on the right show the the orange 720 to 720	₽₽₽₽₽₽₽₽₽₽₽
6	Set the mode selection switch to 'RUN'. (Note 2) The sensitivity level does not change even if the jog switch is operated.	

- Notes: 1) If the jog switch is pressed continuously for 3 sec., or more, full auto-teaching is done. Also, if the mode selection switch is changed to 'RUN' while level indicators '4' and '5' are blinking, the incident light intensity taught at Step ③ is not recorded.
 - 2) When the mode selection switch is set to 'SET' or 'MODE', the sensor is more susceptible to extraneous light. Hence, when sensing objects, ensure to set the mode selection switch to 'RUN'.
 - 3) When the mode selection switch is changed from 'SET' to 'RUN' or from 'MODE' to 'RUN', the set sensitivity or the contents of each mode setting are stored in an EEPROM. However, since the EEPROM has a lifetime, the sensitivity setting cannot be done for more than 100,000 times.
 - Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

<Procedure for maximum sensitivity setting>

① Set the mode selection switch to 'SET'.

- Press the jog switch in the condition when there is no object or background body.
- ③ The level indicators '4' and '5' blink after receiving the teaching.
- Once again, press the jog switch in the condition when there is no object or background body.
- 5 The level indicator '9' blinks.
- 6 Set the mode selection switch to 'RUN'.
- Note: Please take care that, if the sensor is set to max. sensitivity, it becomes weak against extraneous light, noise and optical interference.

Sensors

Fiber

FZ-10



Refer to P.820~ for general precautions.

Amplifier (FX-A1

In case of limit teaching

• This is the method of setting the sensitivity by teaching only the object absent condition (stable incident beam condition). This is used for detection in presence of a background body or for detection of small objects.

Step	Operation	Level indicators
1	Set the fiber within the sensing range.	
2	Set the mode selection switch to 'SET'. The present sensitivity setting is displayed.	
(3)	Press the jog switch in the object absent condition. The level indicators '3' and '6' blink. Release the jog switch within 3 sec. The level indicators '4' and '5' blink and the incident light intensity in the object absent condition is read. (Note1)	00000000000000000000000000000000000000
)	Beam incident	0000 0 40000 4
4	Turn the jog switch to either the '+' or the '-' side. '+' side The sensitivity is increased by 15% approx. with respect to that set at step ③. Used in case of thru- beam type fiber. '-' side The sensitivity is decreased by 15% approx. with respect to that set at step ③. Used in case of thru- beam type fiber. '-' side The sensitivity is decreased by 15% approx. with respect to that set at step ③. Used in case of thru- beam type fiber. '-' side The sensitivity is decreased by 15% approx. with respect to that set at step ③. Used in case of thru- beam type fiber. (e.g.) The level indicators in the figure on the right show that the sensitivity level is in the range 720 to 729.	
5	Set the mode selection switch to 'RUN'. (Note 2) The sensitivity level does not change even if the jog switch is operated.	

- Notes: 1) If the jog switch is pressed continuously for 3 sec., or more, full auto-teaching is done. Also, if the mode selection switch is changed to 'RUN' while level indicators '4' and '5' are blinking, the incident light intensity taught at Step (3) is not recorded.
 - 2) When the mode selection switch is set to 'SET' or 'MODE', the sensor is more susceptible to extraneous light. Hence, when sensing objects, ensure to set the mode selection switch to 'RUN'.
 - 3) When the mode selection switch is changed from 'SET' to 'RUN' or from 'MODE' to 'RUN', the set sensitivity or the contents of each mode setting are stored in an EEPROM. However, since the EEPROM has a lifetime, the sensitivity setting cannot be done for more than 100,000 times.
 - 4) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

OSUNX

Please refer to P.512 for sensitivity setting when used in combination with liquid level sensing fiber FD-F8Y and to P.505 for sensitivity setting when used in combination with pipe-mountable liquid level sensing fiber FD-F4, FD-F9

In case of full auto-teaching

• Full auto-teaching is used when it is desired to set the sensitivity without stopping the assembly line, with the object in the moving condition

	J		
Step	Operation	Level indicators	
1	Set the fiber within the sensing range.		
2	Set the mode selection switch to 'SET'. The present sensitivity setting is displayed.		ş
3	Press the jog switch continuously for 3 sec., or more, with the object moving on the assembly line. When the jog switch is pressed, the level indicators '3' and '6' blink and when it is pressed continuously for 3 sec., or more, they start blinking rapidly. Then, release the jog switch when the object has passed. Thru-beam type Reflective type Back- ground Beam blocked condition	,	Fiber Sensor
4	The stability indicator (green) lights up and the sensitivity level is set at the middle value of the levels in the object present and object absent conditions. The sensitivity level is then displayed on the level indicators. • Hundreds position : lights up continuously • Tens position : blinks • Units position : not shown (e.g.) The level indicators in the figure on the right show that the sensitivity level is in the range 720 to 729.		
5	Set the mode selection switch to 'RUN'. (Note 1) The sensitivity level does not change even if the jog switch is operated.		e
Note	 s: 1) When the mode selection switch is set to 'SET sensor is more susceptible to extraneous ligh sensing objects, ensure to set the mode selection 2) When the mode selection switch is changed from 'MODE' to 'RUN', the set sensitivity or the mode setting are stored in an EEPROM. How EEPROM has a lifetime, the sensitivity setting carmore than 100,000 times. 3) Do not move or bend the fiber cable after the sensitivity become unstable. 	" or 'MODE', the ht. Hence, when switch to 'RUN'. 'SET' to 'RUN' or contents of each wever, since the annot be done for sensitivity setting.	Amplifier Built-in Typ

FX-13

FX-11A

FZ-10

CX-20

CX-30

PRECAUTIONS FOR PROPER USE

Refer to P.820 \sim for general precautions.

Amplifier (FX-A1□)

In case of fine adjustment

Step	Operation	Level indicators
1	Set the mode selection switch to 'SET'. The present sensitivity setting is displayed.	
2	 In case the sensitivity is to be increased, turn the jog switch a little to the '+' side to increase the sensitivity slowly. If the jog switch is turned fully to the '+' side, the sensitivity increases rapidly. In case the sensitivity is to be decreased, turn the jog switch a little to the '-' side to decrease the sensitivity slowly. If the jog switch is turned fully to the '-' side, the sensitivity decreases rapidly. 	
3	Set the mode selection switch to 'RUN'. (Note 1) The sensitivity level does not change even if the jog switch is operated.	

- Notes: 1) When the mode selection switch is set to 'SET' or 'MODE', the sensor is more susceptible to extraneous light. Hence, when sensing objects, ensure to set the mode selection switch to 'RUN'.
 - 2) When the mode selection switch is changed from 'SET' to 'RUN' or from 'MODE' to 'RUN', the set sensitivity or the contents of each mode setting are stored in an EEPROM. However, since the EEPROM has a lifetime, the sensitivity setting cannot be done for more than 100,000 times.
 - Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.



In case only a part of the settings are to be changed, set the mode selection switch to 'RUN', at the appropriate time, in the middle of the above procedure to make only the required changes.

FX-13

Fiber Sensors

Refer to P.820~ for general precautions.

Fiber Sensors

EX-20

PRECAUTIONS FOR PROPER USE



Sensitivity adjustment

· Adjust the sensitivity while observing the operation Sensing indicator (Orange). However, since the light-Li ing up of the operation indicator depends upon the combination of the D sensing condition and the selected MODE, verify it from the table on the right.

	🗘 : Lights up	: Lights off
condition	MODE	Operation indicator
~ h.t	L-ON(Light-ON)	¢
gni	D-ON(Dark-ON)	•
o rik	L-ON(Light-ON)	•
агк	D-ON(Dark-ON)	¢

- The sensitivity adjuster is a 12-turn potentiometer. The maximum sensitivity is obtained by
- turning it fully clockwise. . The sensitivity level indicator shows the

present sensitivity level.

Stop	Sensing method		Operation	Sensitivity level	
Step	Reflective	Thru-beam	Operation	indicator	
1	Set the operation mode switch to Light- ON mode. (Initial setting)		Turn the sensitivity adjuster fully counterclockwise. (Minimum sensitivity)	MAX	
2	-d⊉ Beam received	-⊄∏≫≪∏>- Beam received	In the beam received condition, slowly turn the adjuster clockwise and find the point (A) where the sensor is switched ON.	ON MAX	
3	-	-¢)>-¢)>-	In the beam not received condition, turn the adjuster further clockwise until the sensor goes into the ON state again. Once it is switched on, turn the adjuster counterclockwise	OFF ®	
	Beam not received	Beam not received	a little and find the point ${}^{\textcircled{B}}$ where it is switched OFF. (If the sensor does not go into the) ON state, MAX is the point ${}^{\textcircled{B}}$.	MAX ON	
4			Set the adjuster at the center of points (Å) and (B). This is regarded as the optimum sensitivity point.	Optimum point A MAX	
(5)	Select the mode either Light-ON or Dark-ON according to your application			our application.	

Notes: 1) In order to protect the mechanism, the sensitivity adjuster idles

- when over turned, which may result in a backlash of 1 to 2 divisions. 2) Depending upon the sensing conditions, stable sensing may be possible at a position which is slightly shifted from the center point
- of points (A) and (B) 3) Do not move or bend the fiber cable after the sensitivity adjustment. Detection may become unstable.

Please refer to P.513 for sensitivity adjustment when used in combination with liquid level sensing fiber FD-F8Y and to P.506 for sensitivity adjustment when used in combination with pipe-mountable liquid level sensing fiber FD-F4, FD-F9.

Fiber

Mounting

• The tightening torque must not exceed the values given below.

Mounting with a nut (threaded head type)



Mounting with a set screw

Set screw (cup point) M3 or less

Tightening torque: 0.29N⋅m or less (FT-SFM2L: 0.19N·m)

 ℓ (mm) Tightening torque

0.29N·m

0.19N·m

· Fibers for which the tightening section has been specified should be fixed at ℓ mm from the tightening section tip. However, for FT-K2, FT-KV2 and FT-KV8 ℓ' indicates the range over which tightening cannot be done.

FT-WS4, FT-WS8

FT-WS8L FT-V22 FT-V41, FD-V41

ET.SEM2SV2

		(cup point	9
		M3 or less	s
\+	l-		
	~		
	Δ		
77777777			3
	1		
	2		
<ft-k2, ft-i<="" td=""><td>KV2</td><td>2, FT-KV</td><td>/8></td></ft-k2,>	KV2	2, FT-KV	/8>
	Tia	Intenina	
	Tig	htening	nae
Set screw	Tig pro	htening hibited rar	nge
Set screw (cup point) M3 o	Tig pro	htening hibited rar ⊢—ℓ—	nge
Set screw (cup point) M3 o	Tig pro	htening hibited rar	nge
Set screw (cup point) M3 o	Tig pro r les	htening bhibited rar ss	nge
Set screw (cup point) M3 o	Tig pro	htening phibited rar ss	ige
Set screw (cup point) M3 o	Tig pro	htening phibited rar ss	nge
Set screw (cup point) M3 o	Tig pro	htening bhibited rar $ - \ell - $	nge

1101112012		
FD-EG1	10	0.29N⋅m
FD-SFM2SV2	7	0.34N•m
FT-K2	10	0.211 m
FT-KV2, FT-KV8	13	0.314-00
tight-	Ŷ.	M3 screws

25

10

Mounting array fiber · Using M3 screws, the ening torque should be 0.58N·m or less.

Mounting FD-L4

• Using M2.6 (length 12mm) screws with washers (accessory), the tightening torque should be 0.3N m or less.

Mounting FD-L41 and FD-L42

• Using M3 counter-<FD-L41> sunk head screws, M3 countersu head screws the tightening torque Please arrar should be 0.3N·m or separately less.

	<fd-l42></fd-l42>
nk	M3 countersunk head screws
ge)	Please arrange separately.

M2.6 (length12mm) screws with washers (Accessory)

PRECAUTIONS FOR PROPER USE

Fiber

Mounting FT-KV2 and FT-KV8

 Take care that, since the aperture angle of this product is very narrow, the beam may not be received depending upon the setting.

At the time of installation, determine a reference plane, as shown in the figure below, and taking sufficient care against beam misalignment or tilt, install the emitting and receiving fibers so that they are parallel.

<FT-KV2> <FT-KV8> Œ $\overline{}$ *C* Ĥ σ Þ Parallel Beam axis Beam axis Parallel Reference Reference planes planes Emitter side Receiver side Emitter side Receive side 🖽 Beam Beam avis axis Refer-Reference ence Parallel Paralle planes planes

Mounting FT-A8

 Take care that, since the aperture angle of this product is very narrow, the beam may not be received depending upon the setting.

At the time of installation, determine a reference plane, as shown in the figure below, and taking sufficient care against beam misalignment or tilt, install the emitting and receiving fibers so that they are parallel.



 Install the fiber using M3 countersunk head screws. The tightening torque should be 0.3N·m or less.
 Further, when using the fiber at places having intense vibrations, use a screw-



Method of fixing fiber cable

locking adhesive, etc.

 If fixing the fiber cable in position, make sure that it is set in a manner as shown below, so that no load is applied on the fiber. (Excluding FT-H35-M2, FT-H35-M2S6, FD-H35-M2 and FD-H35-M2S6)





Connection with reflective coaxial type fiber

 With FD-5, FD-FM2, FD-WG4, FD-WSG4, FD-G4, FD-EG1, FD-ENM1S1 or FD-KM1S2, FD-H35-M2, FD-H20-M1, insert the center fiber cable (single-core) into the beam-emitting inlet and the outer fiber cable (multicore) into the beam-receiving inlet.

FD-H35-M2 or **FD-H20-M1** is marked 'P' on the beamemitting cable and 'D' on the beam-receiving cable.

FD-WG4, **FD-WSG4** and **FD-G4** are composed of beam-emitting and beam-receiving cables that are different in diameter.

FD-EG1, **FD-ENM1S1** is marked P on the beamemitting fiber cable.



- Notes: 1) In case the fiber cables are not inserted to a position where they stop, the sensing range reduces.
 - Before connecting fiber cables of FD-WG4, FD-WSG4 or FD-G4 to the amplifier, mount the fiber attachments on their ends.

Fiber cable bending radius

• Bending radius of fiber cable must be R25mm or more. Sharp bend type: R1mm or more (**FD-WG4**, **FD-WSG4**: R2mm or more), Flexible type: R4mm or more, Thrubeam of ultra-small diameter type: R5mm or more, Convergent reflective type, **FD-F4**, **FD-F9**, **FT-K2** and **FT-KV2**: R10mm or more, Chemical-resistant type: R30mm or more, **FD-F8Y**: R40mm or more (on protected part, but R15mm or more on unprotected part), Vacuum type: R200mm or more (**FT-60V**: R30mm or more)

If the fiber cable is bent at a smaller bending radius than that specified above, the sensing range decreases due to beam attenuation.



Note: The 350°C heat-resistant fiber cable is not bendable below R25mm. Neither the vacuum fiber cable nor the chemicalresistant cable must be bent below the values specified above.

How to bend sleeve

• The bending radius must be R10mm or more. Please bend gradually using the fiber bender (**FB-1**) or a round bar of ϕ 20mm or more.



Do not bend this part.

Note: Do not bend the sleeve of side-view type, narrow beam type, narrowview type and ultra-small diameter type fiber.

FX-D1/A1/M1

FX-13

FX-11A

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

EX-10

EX-20

Amplifier Built-in Type

Fiber Sensors

PHOTOELECTRIC SENSORS Refer to P.820~ for general precautions.

FX-D1/A1/M1

FX-13

FX-11A

Fiber Sensors

PRECAUTIONS FOR PROPER USE

Fiber

How to cut fiber cable

. The free-cut type fiber cable can be cut off at any length with the attached fiber cutter.

The chemical-resistant type fi	ber can be c	ut only within
the range illustrated in the right	figure.	Allowable cutting
/ Retain 10mm or more of the	\	range 0mml + +
cable for insertion into the) ————————————————————————————————————	
amplifier.	│ ── र् ─────	Fiber cable
	Protective	tube

Free-cut type fiber

cable, chemical resistant type fibe

<How to use fiber cutter>

- (1) Slide the blade (A) of fiber cutter FX-CT1 upward fully.
- (2) Insert a fiber cable into the hole which matches its diameter and set at prescribed length.
- (3) Slide the blade (A) down to cut the fiber cable.

The free-cut type fiber cables must be cut with a fiber cutter before insertion into the amplifier.

Notes: 1) The fiber cable should be cut in one stroke.

- 2) After it is cut off, mount the fiber attachment immediately and connect it to the amplifier.
- 3) Cut only one fiber cable at a time. Do not cut two or more fiber cables simultaneously. 4) Once a fiber cable is cut off at a hole, do not use the hole again.
- If used, it degrades the cut surface quality and the detectability may deteriorate.
- 5) The blade cannot be replaced. Please purchase an additional fiber cutter, if required.
- 6) Note that the sensing range may be reduced up to 20% depending on the cut condition

Use of heat-resistant type fiber

· Use by keeping 150mm, or more, of the heat-resistant fiber cable part at normal temperature.



Note: 0 to \pm 50°C for **FX-D1**

- Protect the amplifier from heat radiation or hot air.
- With the 350°C heat-resistant type fiber, the surface of the fiber head or the spiral may be discolored by heat. However, this does not affect its performance.

Fiber attachments for free-cut small-diameter type fiber cable

• The fiber attachments should be fixed at the ends of fiber cables to connect them with the amplifier. There are two sets of attachments, one is for FX-D1/FX-A1/FX-M1/FX-7/ FX-10 series and the other is for BFX4N/FX4E/FX4N series. They are different in length.

However, FT-WS4, FD-N4, FD-W44, FD-WT8, FD-WS8, FD-WT4, FD-WG4, FD-WSG4, FD-L41 and FD-L42 have fiber attachments only for FX-D1/FX-A1/FX-M1/FX-7/FX-10 series.

Used amplifier	Fiber diameter ϕ 1.0 mm	Fiber diameter ϕ 1.3 mm
FX-D1 series FX-A1 series FX-M1 series FX-7 series FX-10 series	Short (Black)	Short (Gray)
BFX4N series FX4E/FX4N series	Long (Black)	Long (Gray)
Note: The fiber cable end should protrude from the		

holder by 1mm approx.

Fiber with metal plug

• In FT-KV2. FT-KM1S2 the construction is such that the metal plug is at the same electric potential as the sensor earth (0V). If it is used at a place where the metal plug may come in contact with a charged body, insulate it with a heat-shrink tube, etc.

____1mm

FT-H35-M2, FT-H35-M2S6, FD-H35-M2 and FD-H35-M2S6 are already insulated.



Seal type slit mask for FT-A8

• Two types of slit masks are enclosed. Apply the enclosed slit mask when detecting small objects or for increasing the accuracy of sensing position.

However, the sensing range is reduced when the slit mask is mounted as shown in the table below.

As the slit mask is seal type, stick it by aligning the projection of the slit mask with the upper portion of the fiber, as shown in the figure below.



Sensing range when mounting slit mask

	0.5 imes 12mm slit mask	1×12 mm slit mask
Slit on one side	500mm	900mm
Slit on both sides	200mm	400mm

EX-10

₹

PRECAUTIONS FOR PROPER USE

Refer to P.820 \sim for general precautions.

Fiber

Vacuum type fiber Configuration Vacuum chamber Atmosphere →ш m mt Fiber Sensors , Atmospheric Vacuum type fibers side fibers Chamber wall or flange Photo-terminals



Mounting

- ② Mount the FV-BR1 photo-terminal on the vacuum tank wall.

Notes: 1) The attached O-ring must be mounted. 2) The O-ring must be used at the atmospheric side.

2) The O-ring must be used at the atmospheric side3) The tightening torque should be 0.58N·m or less.



- ③ Mount the **FT-J6** atmospheric side fibers on the atmospheric side of the **FV-BR1** photo-terminals.
- Notes: 1) The fixing nuts must be tightened securely. If not, the sensing range may decrease.
 2) The tightening torque should be 0.58N⋅m or less.



- ④ Mount the vacuum type fibers on the vacuum side of the FV-BR1 photo-terminals.
- Notes: 1) The fixings rings of the vacuum type fibers must be tightened securely. If not, the sensing range may decrease.2) The tightening torque should be 0.58N⋅m or less.
- (5) Fix the fiber head of the vacuum type fiber.





Chemical-resistant type fiber

- Do not use it in the following chemicals: Dissolved alkali metals (Natrium, Potassium or Lithium), Fluorine gas (F2), CIF3, OF2 (including gaseous state).
- The beam axis mark is indicated on the side-view fiber. Perform the beam alignment with the beam axis marks, on the receiver and the emitter, facing each other.



• Although the chemical-resistant type fiber is rated for use up to +115°C, place 100mm or more of the fiber in the normal temperature area to protect the amplifier.



Note: 0 to $+50^{\circ}$ C for **FX-D1**.

FD-F8Y liquid level sensing fiber Mounting

• Use a commercially available fluorine resin joint, etc., to install **FD-F8Y**.



Cautions

- Take care that unclear liquid may not be sensed stably.
- Take care that the tube may stretch by maximum 2% of the total length if it is used at a high temperature.
- Do not scratch the fiber jacket while cutting the fluorine resin tube.

FX-D1/A1/M1

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

Amplifier Built-in Type

EX-20 EX-10

PRECAUTIONS FOR PROPER USE

Refer to P.820 \sim for general precautions.

Fiber

FD-F4 and FD-F9 liquid level sensing fiber

• Mount the fiber head on a pipe with the attached tying bands and anti-slip tubes as shown in the figure below. Make sure that the release lever is retracted (position as

in the fig.) before mounting. Fasten two tying bands, as shown, and cut off the excess

portions. Anti-slip tube Tying band Release lever Lower side 2-#3.2mm mounting holes

 \bullet If other tying bands are to be used, the dimension (A) shown in the figure below should be 2.5mm or less.



 In case of mounting using the two mounting holes, use M3 screws, plain washers, and spring washers.

The tightening torque should be 0.5N m or less.

(Please arrange the M3 screws, plain washers, and) spring washers separately.

 In case of mounting on the pipe with tying bands, the fiber position can be easily adjusted.

Adjustment

① Unlock the release Release level lever (in the direction of the arrow).



Press the movable center holders forward to loosen the tying bands and adjust the position.



③ Lock the release lever to its original place.



- Notes: 1) Whenever the mounting position is changed, adjust the sensitivity again.
 - 2) The lever mechanism must be used only to adjust the position, and not for tightening the tying bands. If tying bands are tightened while the lever is open, and then the lever is locked, the fiber may be damaged.

Cautions

- Liquid in a pipe which is not transparent cannot be sensed correctly.
- Unclear or viscous liquid may not be sensed.
- Fit the fiber head to the pipe securely, otherwise the operation may be erroneous.
- Take care that no dew condenses on the pipe's sensing surface or the pipe's inside wall and no bubble attaches on the pipe's inside wall, since it can affect the operation.
- Neither the **FD-F4** or the **FD-F9** is waterproof or chemical-resistant. Installation should be avoided at any place where it could come in direct contact with water or chemicals.
- Do not apply excessive tensile force to the fiber cable.

Cautions for FX-MR2 zoom lens usage

• The spot diameter and the sensing range are adjustable by the screw-in depth as follows.



• After **FX-MR2** is set on the fiber head at the desired depth, tighten the attached nut securely.



• To mount **FX-MR2** with a set screw, use a M3 set screw. The tightening torque should be 0.29N•m or less.



Caution for FX-MR3 finest spot lens usage

• Screw **FX-MR3** on the fiber head until the fiber is fully inserted.

The tightening torque should be 0.29N·m or less.



FX-D1/A1/M1

FX-13

FX-11A

FZ-10

CX-20

CX-30

Amplifier Built-in Type

CX-RVM5/D100/ND300R

EX-10

EX-20

Fiber Sensors

PRECAUTIONS FOR PROPER USE

Fiber



. The spot diameter and the sensing range are adjustable by the screw-in depth as follows.



•After FX-MR5 is set on the fiber head at the desired depth, tighten the attached nut NT-FX-MR5 securely.

•The tightening torque should be 0.5N·m or less when tightening FX-MR5 with a screw.

Fitting protective tube

•The threaded head fiber cable can be fitted with a protective tube.

Fitting

(1) Insert the fiber cable into the protective tube from the sleeve side.



② Turn the fiber head to screw it on the inner thread of the sleeve.



Mounting

• The maximum tightening torque should be as given below.



Note: The fiber cable must be longer than the protective tube by 30mm or more to connect it to the amplifier. Make sure to measure the length required before cutting.

Others

Attached

- · Do not use the fiber at places having intense vibrations, as this can cause malfunction.
- Keep the fiber head surface intact. If it is scratched or spoiled, the detectability will deteriorate.
- · Do not expose the fiber cable to any organic solvents. Excluding chemical-resistant type \fiber



Organic solvents such as thinner. etc

- · Do not use the fiber head in places where it may come in direct contact with water. A water drop on the fiber head deteriorates the sensing
- · Ensure that any strong extraneous light is not incident on the receiving face of the fiber head.



- · Do not apply excessive tensile force to the fiber cable.
- Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.
- Since the sensing portion of FT-A8, FT-K2, FT-KV2, FT-KV8, is concave shaped, take care that dust or dirt does not collect on it. In case it does collect, wipe it with a dry soft cloth.

FX-D1/A1/M1

FZ-10

CX-20

EX-10

EX-20

104









ØSUNX



DIMENSIONS (Unit: mm) → ■∰⊅■ Thru-beam type fibers FT-6V **FT-60V** ¢3.8 (Alluminum alloy (A6061-T6) -1,000 |-11--| 1,000 ¢3.3 +10+ -21 -17 ------21 5.5 --- 11 (Fluorine resin) 6 (© [0] (0 (Fluorine resin) ¢1 fiber M2.6 × 0.45 ¢3.8 Opposing faces 7 thickness 3.2 ϕ 1 fiber core M2.6 × 0.45 bundle × 1 $core \times 1$ Alluminum alloy M4×0.7 Mounting cap nut opposing faces 8 [Alluminum alloy (A6061-T6)] Opposing faces 7 thickness 3.2 Spring lock washer Alluminum alloy (A6061-T6) Mounting cap nut opposing faces 8 (Alluminum alloy (A6061-T6) Alluminum alloy (A6061-T6) (Alluminum alloy) (A6061-T6)[Stainless steel (SUS)] Spring lock washer $\phi 0.5$ vent hole ¢7.6 [Stainless steel (SUS)]

PHOTOELECTRIC SENSORS

FX-D1/A1/M1

FX-13





WSUNX



ØSUNX



DIMENSIONS (Unit: mm)

PHOTOELECTRIC SENSORS

FX-D1/A1/M1

FX-13

FX-11A



EX-20 EX-10 CX-RVM5/D100ND300R CX-30 CX-20 FZ-10 Amplifier Built-in Type

FX-D1/A1/M1

FX-13

FX-11A

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

EX-10

EX-20





ØSUNX

DIMENSIONS (Unit: mm)



FX-D1/A1/M1

FX-13

FX-11A

FZ-10

CX-20

CX-30

CX-RVM5/D100/ND300R

EX-10

EX-20

FTP-1500, FTP-N1500, FDP-N1500, FDP-1500

1,500 + 10

DIMENSIONS (Unit: mm)

FX-D1 FX-A1 FX-A1

Assembly dimensions with attached amplifier mounting bracket

Amplifier



MS-DIN-2

Amplifier mounting bracket (Accessory for amplifier)





Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

Display part

FX-D1



FX-A1



FX-M1



PHOTOELECTRIC SENSORS

FX-D1/A1/M1

FX-13

FX-11A

Fiber Sensors