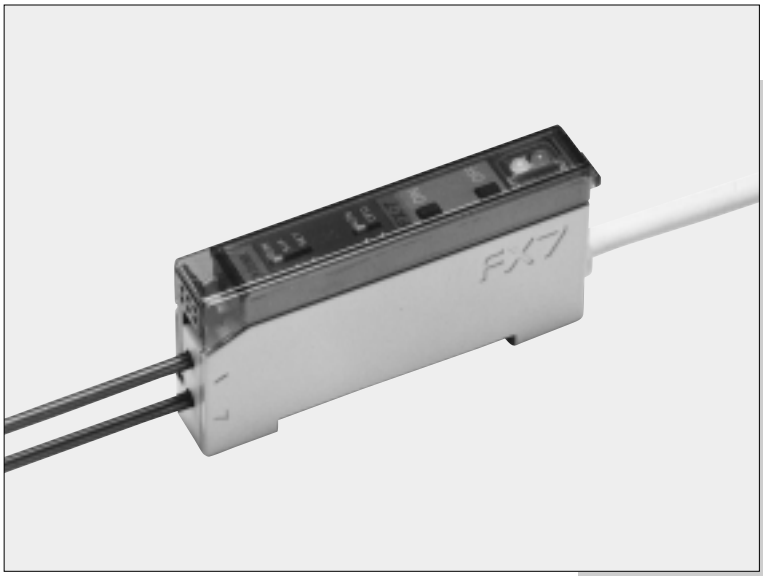
FX-7 SERIES

Slim Body Automatic Sensitivity Setting Fiber Sensor

Self-diagnosis | Test input | PNP output type available | Timer | External sync. | Interference prevention | Automatic sensitivity setting



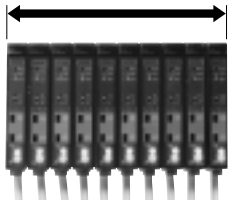
Compact size with advanced sensing technology

CE Conforming to EMC Directive

Thickness : 10 mm

Just 10 mm thick. Even a number of **FX-7** amplifiers save space.

Only 100 mm wide with 10 units



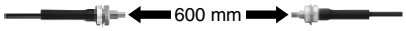
W10 × H31.5 × D59 mm

Long sensing range

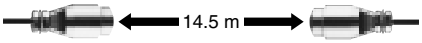
The standard M4 fiber offers the sensing range of 600 mm.

Thru-beam type

M4 standard • long sensing range fiber **FT-B8**



With lens attachments
(FX-LE2 + FT-FM10)



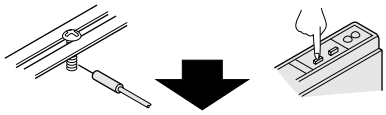
Reflective type

M6 standard • long sensing range fiber **FD-B8**

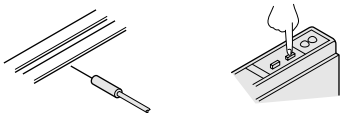
Automatic sensitivity setting

Anyone can set on optimum sensitivity by just pressing buttons. Even if its power is turned off, the EEPROM memory saves your set sensitivity.

Press the 'ON' button with an object

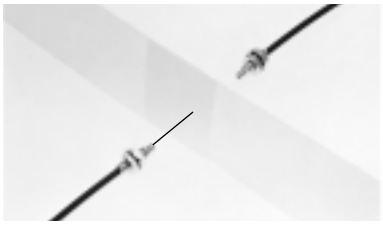


Press the 'OFF' button with no object



Sensitivity : 8 times higher than before

The **FX-7** amplifier performs precise and accurate sensing 8 times greater than a conventional model. It can be used not only to detect the presence of an object, but also to discriminate color, or find a thin film overlap. Complicated and sophisticated application needs are relied on the **FX-7**.
The **FX-7** series also provides the green LED amplifier that is eligible for applications much delicate.



Easily detects translucent film overlap.

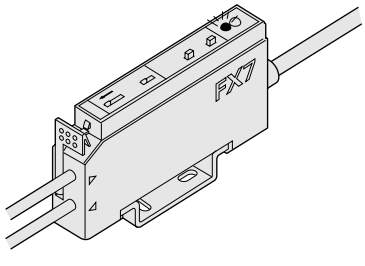
Sensitivity shift

If either one of the Light state or the Dark state is unstable but the other is stationary, the threshold level can be shifted from the center between the set ON and OFF levels to the stationary side.

Stability margin indication

The number of blinks of the stability indicator represents the stability margin that you have set the sensitivity.

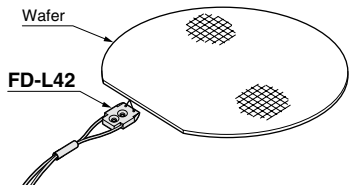
Number of blinks	0	1	2	3	4	5
Margin (%) (Margin near by threshold level)	Under 15	15 to 30	30 to 45	45 to 60	60 to 75	Over 75



APPLICATIONS

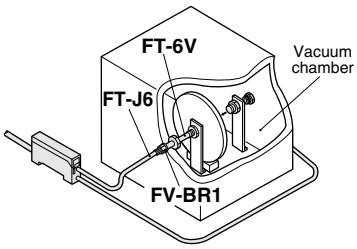
Detecting wafer

The **FD-L42** convergent sensing fiber securely detects a wafer without any affection of color or glossiness of the surface.



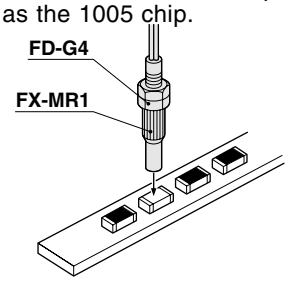
Wafer in vacuum chamber

The vacuum fiber kit composed of the inner fiber, the joint fiber, and the outer fiber detects a wafer inside a vacuum chamber with air-tightness.



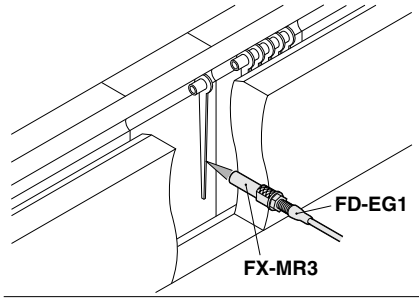
Distinguishing top / bottom surface of a chip component

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



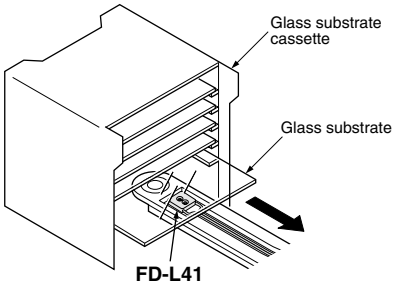
Detecting clock hands

The **FD-EG1** fiber and the **FX-MR3** spot lens produce the smallest projection area of 0.3 mm diameter.



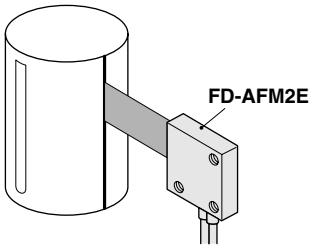
Presence of glass substrate

The **FD-L41** securely detects the nearest glass substrate only.



Seam on can

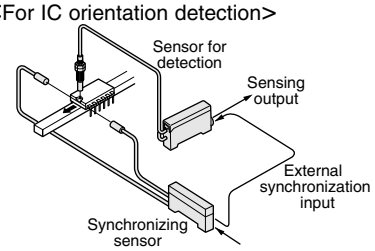
The **FD-AFM2E** array fiber accurately detects a seam on a can because of its line focusing.



External synchronization (FX-75 only)

FX-75 is incorporated with the trigger function, either gate or edge trigger is available.
With only a synchronizing sensor directly connected to **FX-75**, the synchronous detection is realized without any other controller.

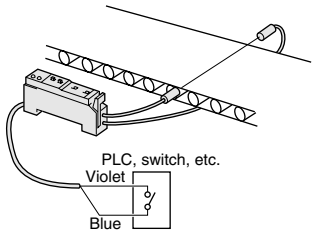
<For IC orientation detection>



Test input (emission halt input) (FX-75 only)

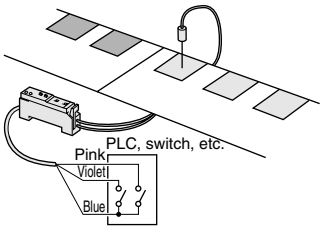
FX-75 is incorporated with the test input (emission halt input) that makes beam emission stop. It is useful to check for the operability before start-up.

<When using thru-beam fiber>



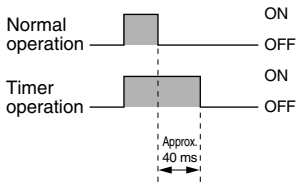
Remote sensitivity adjustment (FX-77 only)

As the sensitivity can be set with two remote switches from the amplifier, your production change-over becomes smooth.



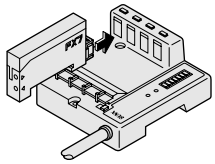
OFF-delay timer (FX-7 & FX-77 only)

Each of the **FX-7** and the **FX-77** is incorporated with the OFF-delay timer, for approx. 40 ms fixed.
It is useful when the output signals are so quick and short that a connected device can not take in, for example, by slow scanning time of a device or miniature object detection on a fast production line.



Plug-in connector type

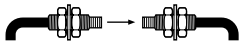
The **FX-7** amplifier with the plug-in connector on the tail can be connected with the **SL-BM** or the **SL-BX** of the sensor & wire-saving link system **S-LINK**; the **SL-BMW** or the **SL-BW** of the sensor block for simple wiring; or the **CN-54-C2** or the **CN-54-C5** mating cable at a touch.
Refer to the details of the **S-LINK** system on p.1030〜, the sensor block for simple wiring on p.882〜.



FX-7

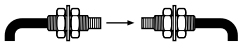
ORDER GUIDE

General purpose fibers [Thru-beam type (one pair of two fibers a set)]



Type	Shape of fiber head (mm)	Sensing range (Note 1) ■ : Red LED type □ : Green LED type	Min. sensing object [under the optimum condition (Note 2)] [Ⓡ : Red LED type Ⓖ : Green LED type]	Features	Fiber cable length	Model No.
Long sensing range	Lens applicable, M4	600 mm / 40 mm	Ⓡ ϕ0.16 mm opaque object Ⓖ ϕ0.16 mm opaque object	• Twice longer sensing range than before	Free Cut 2 m	**FT-B8**
Standard	Lens applicable, M4	320 mm / 25 mm	Ⓡ ϕ0.08 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Free-cut type	Free Cut 2 m	**FT-FM2**
Standard	With sleeve, M4, ϕ1.48	320 mm / 25 mm	Ⓡ ϕ0.08 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Free-cut type	Free Cut 2 m	**FT-FM2S** With sleeve 90 mm **FT-FM2S4** With sleeve 40 mm
Standard	ϕ2.5	320 mm / 25 mm	Ⓡ ϕ0.08 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Free-cut type	Free Cut 2 m	**FT-SFM2**
Small fiber head	Lens applicable, M3	320 mm / 25 mm	Ⓡ ϕ0.08 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Miniature but the same sensing range as the standard type	Free Cut 2 m	**FT-T80**
Small diameter	M3	80 mm / 7 mm	Ⓡ ϕ0.05 mm opaque object Ⓖ ϕ0.03 mm opaque object	• Mountable in a tight area or a narrow space • Free-cut type	Free Cut 2 m	**FT-NFM2**
Small diameter	With sleeve, M3, ϕ0.88	80 mm / 7 mm	Ⓡ ϕ0.05 mm opaque object Ⓖ ϕ0.03 mm opaque object	• Mountable in a tight area or a narrow space • Free-cut type	Free Cut 2 m	**FT-NFM2S** With sleeve 90 mm **FT-NFM2S4** With sleeve 40 mm
Small diameter	ϕ1.5	80 mm / 7 mm	Ⓡ ϕ0.05 mm opaque object Ⓖ ϕ0.03 mm opaque object	• Mountable in a tight area or a narrow space • Free-cut type	Free Cut 2 m	**FT-SNFM2**
Flexible	Lens applicable, M4	320 mm / 25 mm	Ⓡ ϕ0.08 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Allowable bending radius: R4 mm or more • Bending durability: One million times or more	Free Cut 2 m	**FT-P80**
Flexible	Small diameter, M3	100 mm / 6 mm	Ⓡ ϕ0.05 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Allowable bending radius: R4 mm or more • Bending durability: One million times or more	Free Cut 2 m	**FT-P40**
Flexible	Small diameter, ϕ1.5	120 mm / 7 mm	Ⓡ ϕ0.08 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Allowable bending radius: R4 mm or more • Bending durability: One million times or more	1 m	**FT-P2** (Note 3)

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



Type	Shape of fiber head (mm)	Sensing range (Note 1) ■ : Red LED type □ : Green LED type	Min. sensing object [under the optimum condition (Note 2)] [Ⓡ : Red LED type Ⓖ : Green LED type]	Features	Fiber cable length	Model No.
Heat-resistant	Lens applicable, M4	270 mm / 20 mm	Ⓡ ϕ0.12 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Heat-resistant: 350 °C • Cold-resistant: − 60 °C	2 m	**FT-H35-M2**
Heat-resistant	With sleeve, M4, ϕ2.1	270 mm / 20 mm	Ⓡ ϕ0.12 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Heat-resistant: 350 °C • Cold-resistant: − 60 °C	2 m	**FT-H35-M2S6** With sleeve 60 mm
Heat-resistant	Lens applicable, M4	270 mm / 20 mm	Ⓡ ϕ0.12 mm opaque object Ⓖ ϕ0.08 mm opaque object	• Flexible cable with silicone jacket • Heat-resistant: 200 °C • Cold-resistant: − 60 °C	1 m	**FT-H20-M1**
Heat-resistant	M4	320 mm / 37 mm	Ⓡ ϕ0.12 mm opaque object Ⓖ ϕ0.12 mm opaque object	• Heat-resistant: 130 °C • Cold-resistant: − 60 °C • Free-cut type	Free Cut 2 m	**FT-H13-FM2**
Chemical-resistant	ϕ5.5	1,500 mm	Ⓡ ϕ1 mm opaque object	• Applicable in chemical solvent • Heat-resistant specification (115 °C) • Long sensing range with lenses	2 m (Bending R: 30 mm)	**FT-L8Y**
Chemical-resistant	ϕ5.5	300 mm	Ⓡ ϕ1 mm opaque object	• Applicable in chemical solvent • Heat-resistant specification (115 °C) • Side-view type	2 m (Bending R: 30 mm)	**FT-V8Y**
Vacuum	Lens applicable, M4	200 mm	Ⓡ ϕ0.1 mm opaque object	• Applicable in vacuum chamber • Heat-resistant: 120 °C	1 m (Bending R: 200 mm)	**FT-6V**
Vacuum	M4	100 mm	Ⓡ ϕ0.1 mm opaque object	• Applicable in vacuum chamber • Heat-resistant: 120 °C	1 m (Bending R: 30 mm)	**FT-60V**

Notes: 1) The free-cut fibers may reduce the sensing ranges 20 % lower than the above specified according to how they are cut off.

2) The optimum condition is specified that the sensitivity is adjusted to have the operation indicator exactly light up at a certain distance in the Light-ON mode.

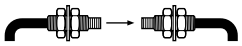
3) Its model No. has been changed because the shorter plug attachments are provided for the **FX-7** connection. The specifications including the sensing range are identical as before.

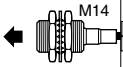
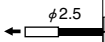
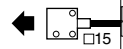
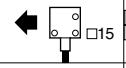
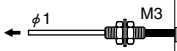
The vacuum fiber must be used with both the followings.

FT-J6 : Fiber at atmospheric side (one pair of two fibers a set)
FV-BR1: Photo-terminal (one pair of two joints a set)

ORDER GUIDE

Special use fibers [Thru-beam type (one pair of two fibers a set)]



Type	Shape of fiber head (mm)	Sensing range (Note 1) ■ : Red LED type □ : Green LED type	Min. sensing object [under the optimum condition (Note 2)] [(R) : Red LED type (G) : Green LED type]	Features	Fiber cable length	Model No.
Long sensing range with lenses		7,000 mm 1,000 mm	(R) ϕ0.5 mm opaque object (G) ϕ0.5 mm opaque object	• Large lenses on the tops of the fiber heads expand the sensing range significantly. • Fiber cable length 10 m each	Free Cut 10 m	**FT-FM10L**
		600 mm 60 mm	(R) ϕ0.1 mm opaque object (G) ϕ0.08 mm opaque object	• Small fiber heads of ϕ2.5 mm with lenses expand the sensing range.	Free Cut 2 m	**FT-SFM2L**
Array	Top sensing 	210 mm 20 mm	(R) Horizontal ϕ0.05 mm opaque object Vertical ϕ0.3 mm opaque object (G) Horizontal ϕ0.03 mm opaque object Vertical ϕ0.3 mm opaque object	• The wide beam stripe detects an object at any place within the area.	Free Cut 2 m	**FT-AFM2**
	Side sensing 	180 mm 20 mm	(R) Horizontal ϕ0.05 mm opaque object Vertical ϕ0.3 mm opaque object (G) Horizontal ϕ0.03 mm opaque object Vertical ϕ0.3 mm opaque object			**FT-AFM2E**
Elbow	Lens applicable 	210 mm 24 mm	(R) ϕ0.08 mm opaque object (G) ϕ0.08 mm opaque object	• The fiber head is bent at a right angle of 5 mm radius at the neck.	Free Cut 2 m	**FT-R80**
Side-view	Small diameter  Sleeve part can not be bent. (ϕ2 for **FT-V22**)	85 mm	(R) ϕ0.05 mm opaque object	• The side-view sensing enables to use in a tight space.	1 m	**FT-V22** (Note 3)
		45 mm	(R) ϕ0.05 mm opaque object		Free Cut 2 m	**FT-V41**
	 Sleeve part can not be bent.	120 mm 12 mm	(R) ϕ0.05 mm opaque object (G) ϕ0.08 mm opaque object			**FT-SFM2SV2**
Narrow beam	 Sleeve part can not be bent.	120 mm	(R) ϕ0.05 mm opaque object	• The narrow beam-opening angle, one-sixth of a conventional model, reduces mutual interference.	1 m	**FT-KM1S2**

Notes: 1) The free-cut fibers may reduce the sensing ranges 20 % lower than the above specified according to how they are cut off.

2) The optimum condition is specified that the sensitivity is adjusted to have the operation indicator exactly light up at a certain distance in the Light-ON mode.

3) Its model No. has been changed because the shorter plug attachments are provided for the **FX-7** connection. The specifications including the sensing range are identical as before.

Semi-standard fibers (Custom made per order)

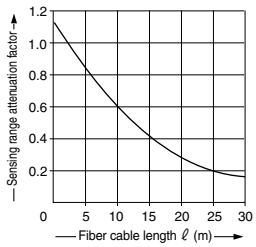
The standard fibers can be modified in fiber cable length or in sleeve length based on your request. Select the fiber cable length (symbolized with ☒) or the sleeve length (symbolized with △) you need from the below table.

Type	Basic model No.	☒ Fiber cable length (Unit : m)	△ Sleeve length (Unit : cm)
Standard of 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 diameter lens	**FT-FM** ☒ **L**	20, 30	————
Small diameter of 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 heat-resistant	**FT-H35-M** ☒	3	————

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

Correlation between sensing range attenuation coefficient and fiber cable length

The longer the fiber cable, the shorter the sensing range.



FX-7

ORDER GUIDE

General purpose fibers [Reflective type]

Type	Shape of fiber head (mm)	Sensing range (Note 1, 2) ■ : Red LED type □ : Green LED type	Min. sensing object [at the maximum sensitivity (Note 3)] [Ⓡ : Red LED type Ⓖ : Green LED type]	Features	Fiber cable length	Model No.
Standard (Long sensing range)	M6	160 mm / 14 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ0.16 mm copper wire	• Long sensing range	Free Cut 2 m	**FD-B8**
Standard	Coaxial M6			• Suitable for green LED type	500 mm	**FD-5** (Note 4)
Standard	With sleeve M6 ϕ2.5	130 mm / 8 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ0.08 mm copper wire	• Free-cut type	Free Cut 2 m	**FD-FM2** **FD-FM2S** With sleeve 90 mm **FD-FM2S4** With sleeve 40 mm
Small fiber head	M4	130 mm / 8 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ0.4 mm copper wire	• Miniature but the same sensing range as the standard type	Free Cut 2 m	**FD-T80**
Small fiber head	Small diameter M3	30 mm / 2.5 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ0.4 mm copper wire			**FD-T40**
Small fiber head	ϕ3	130 mm / 8 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ0.4 mm copper wire			**FD-S80**
Small diameter	M4					**FD-NFM2**
Small diameter	With sleeve M4 ϕ1.48	30 mm / 2 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ0.4 mm copper wire	• Mountable in a tight area or a narrow space • Free-cut type	Free Cut 2 m	**FD-NFM2S** With sleeve 90 mm **FD-NFM2S4** With sleeve 40 mm
Small diameter	ϕ2.5					**FD-SNFM2**
Flexible	M6	80 mm / 6 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ2.1 mm stainless steel bar	• Allowable bending radius: R4 mm or more • Bending durability: One million times or more	Free Cut 2 m	**FD-P80**
Flexible	Small diameter M3	8 mm	Ⓡ ϕ0.01 mm gold wire			**FD-P40**
Flexible	Small diameter ϕ1.5	15 mm / 1 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ0.4 mm copper wire		1 m	**FD-P2** (Note 4)

Environment resistant fibers [Reflective type]

Type	Shape of fiber head (mm)	Sensing range (Note 1, 2) ■ : Red LED type □ : Green LED type	Min. sensing object [at the maximum sensitivity (Note 3)] [Ⓡ : Red LED type Ⓖ : Green LED type]	Features	Fiber cable length	Model No.
Heat-resistant	Coaxial M6			• Heat-resistant: 350 °C • Cold-resistant: − 60 °C	2 m	**FD-H35-M2**
Heat-resistant	With sleeve M6 ϕ2.8	88 mm / 9 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ0.025 mm gold wire			**FD-H35-M2S6** With sleeve 60 mm
Heat-resistant	Coaxial M6			• Flexible cable with silicone jacket • Heat-resistant: 200 °C • Cold-resistant: − 60 °C	1 m	**FD-H20-M1**
Heat-resistant	M6	88 mm / 11 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ1.45 mm stainless steel bar	• Heat-resistant: 130 °C • Cold-resistant: − 60 °C • Free-cut type	Free Cut 2 m	**FD-H13-FM2**
Vacuum	M6	50 mm	Ⓡ ϕ0.01 mm copper wire	• Applicable in vacuum chamber • Heat-resistant: 120 °C	1 m	**FD-6V**

Notes: 1) The sensing range is specified with using white non-glossy paper (50 × 50 mm). (Standard·Long sensing range: 100 × 100 mm)
2) The free-cut fibers may reduce the sensing ranges 20 % lower than the above specified according to how they are cut off.

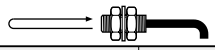
3) The minimum sensing object is obtainable with the maximum sensitivity, but at the ideal sensing distance within the rated sensing range.

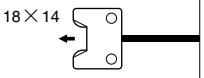
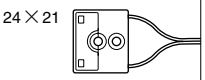
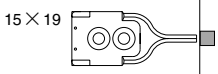
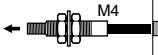
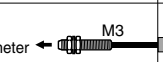
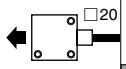
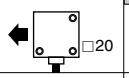
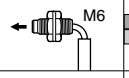
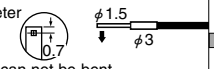
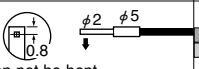
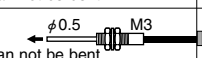
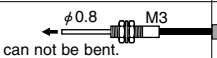
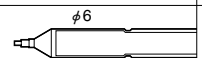
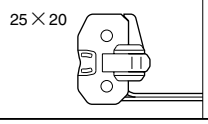
4) Its model No. has been changed because the shorter plug attachments are provided for the **FX-7** connection. The specifications including the sensing range are identical as before.

The vacuum fiber must be used with both the followings.
FT-J6 : Fiber at atmospheric side (one pair of two fibers a set)
FV-BR1: Photo-terminal (one pair of two joints a set)

ORDER GUIDE

Special use fibers [Reflective type]



Type	Shape of fiber head (mm)	Sensing range (Note 1, 2) ■ : Red LED type □ : Green LED type	Min. sensing object [at the maximum sensitivity (Note 3)] [Ⓡ : Red LED type Ⓖ : Green LED type]	Features	Fiber cable length	Model No.
Fixed-focus reflective		■ 4.5 to 8 mm (Center: 6 mm)	Ⓡ ϕ0.01 mm gold wire	• The optical system cancels affection by color or surface condition of an object.	Free Cut 2 m	**FD-L4**
Fixed-focus reflective / Glass substrate detection		■ 3 to 13 mm (Center: 8 mm)	Ⓡ ϕ0.2 mm copper wire	• Just 4 mm thick • Glass board is securely detected.		**FD-L41**
Fixed-focus reflective / Wafer or specular object detection		■ Center: 2 mm	Ⓡ ϕ0.5 mm copper wire	• Just 3 mm thick • Wafer is securely detected.		**FD-L42**
High precision	Lens applicable Coaxial 	■ 44 mm	Ⓡ ϕ0.01 mm gold wire	• The coaxial fiber gives precise and symmetrical sensing.	Free Cut 2 m	**FD-G4**
					500 mm	**FD-G500**
High precision	Lens applicable Coaxial • Small diameter 	■ 13 mm	Ⓡ ϕ0.01 mm gold wire	• The combination with the **FX-MR3** lens gives the small spot diameter of approx. ϕ0.3 mm.	500 mm	**FD-EG1**
Array	Top sensing 	■ 66 mm □ 4 mm	Ⓡ Horizontal ϕ0.01 mm gold wire Vertical ϕ0.05 mm copper wire Ⓖ Horizontal ϕ0.08 mm copper wire Vertical ϕ1.45 mm stainless steel bar	• Its wide and flat detection area enables to detect objects traveling through inexactly.	Free Cut 2 m	**FD-AFM2**
Array	Side sensing 					**FD-AFM2E**
Elbow		■ 66 mm □ 5 mm	Ⓡ ϕ0.01 mm gold wire Ⓖ ϕ2.1 mm stainless steel bar	• The fiber head is bent at a right angle of 5 mm radius at the neck.	Free Cut 2 m	**FD-R80**
Side-view	Small diameter  Sleeve part can not be bent.	■ 15 mm	Ⓡ ϕ0.02 mm gold wire	• The side view sensing enables to use in a tight space.	Free Cut 2 m	**FD-V41**
Side-view	 Sleeve part can not be bent.	■ 24 mm □ 2 mm	Ⓡ ϕ0.02 mm gold wire Ⓖ ϕ2.1 mm stainless steel bar			**FD-SFM2SV2**
Ultra-small diameter	 Sleeve part can not be bent.	■ 1.5 mm	Ⓡ ϕ0.01 mm gold wire	• Mountable in a complex area	500 mm	**FD-EN500S1**
Ultra-small diameter	Coaxial  Sleeve part can not be bent.	■ 13 mm	Ⓡ ϕ0.01 mm gold wire	• The coaxial fiber gives precise and symmetrical sensing.	1 m	**FD-ENM1S1**
Narrow-view	Coaxial  Sleeve part can not be bent.	■ 9 mm	Ⓡ ϕ0.02 mm gold wire	• The narrow beam-opening angle, one-sixth of a conventional model, makes a small detecting area.	1 m	**FD-KM1S2**
Liquid level detection		———	Ⓡ (Liquid)	• Liquid drop on the top never affects the sensing.	Free Cut 2 m	**FD-F8Y**
Liquid level detection / Mountable on pipe		Applicable pipe diameter: ϕ 6 to ϕ 26 mm [PFA (Fluorine resin) or the equivalent bearing the same transparency thickness 1 mm]	Ⓡ (Liquid)	• Liquid surface is securely detected from the outside of a pipe.	Free Cut 2 m	**FD-F4**
					Free Cut 2 m	**FD-F9**

Notes: 1) The sensing range is specified with using white non-glossy paper (50 × 50 mm). (Side-view · Small diameter: 30 × 30 mm, Narrow-view: 10 × 10 mm)
2) The free-cut fibers may reduce the sensing ranges 20 % lower than the above specified according to how they are cut off.

3) The minimum sensing object is obtainable with the maximum sensitivity, but at the ideal sensing distance within the rated sensing range.

Semi-standard fibers (Custom made per order)

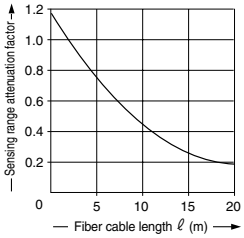
The standard fibers can be modified in fiber cable length or in sleeve length based on your request. Select the fiber cable length (symbolized with ☆) or the sleeve length (symbolized with △) you need from the below table.

Type	Basic model No.	☆ Fiber cable length (Unit : m)	△ Sleeve length (Unit : cm)
Standard of 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 of 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 features 2 m in fiber cable length and 4 cm or 9 cm in sleeve length.

Correlation between sensing range attenuation coefficient and fiber cable length

The longer the fiber cable, the shorter the sensing range.



FX-7

ORDER GUIDE

Amplifiers

Type	Appearance	Model No.	Functions (●: Incorporated)							Emitting element	Output
			Sensitivity shift	Stability margin indication	External synchro-nization	Test input (emission halt)	Remote sensitivity adjustment	OFF-delay timer	Interference prevention		
Standard type		**FX-7**	●	●	—	—	—	●	●	Red LED	NPN open-collector transistor
		FX-7P									PNP open-collector transistor
		FX-7G								Green LED	NPN open-collector transistor
		FX-7GP									PNP open-collector transistor
External synchronization input type		**FX-75**	●	●	●	●	—	—	●	Red LED	NPN open-collector transistor
		FX-75G								Green LED	
Remote sensitivity adjustment type		**FX-77**	●	●	—	—	●	●	●	Red LED	
		FX-77G								Green LED	

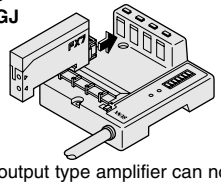
Plug-in connector type

Integrated plug-in connector is available on the standard type. (Standard: Cable type)

Model No.: **FX-7J, FX-7PJ** (Red LED type)
FX-7GJ, FX-7GPJ (Green LED type)

Applicable with the **SL-BM** or the **SL-BX** of the sensor & wire-saving link system **S-LINK**; the **SL-BMW** or the **SL-BW** of the sensor block for simple wiring; or the **CN-54-C2** or the **CN-54-C5** mating cable.

FX-7J
FX-7GJ

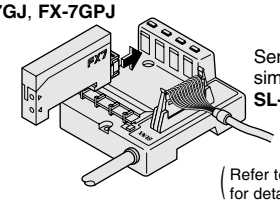


Sensor & wire-saving link system, **S-LINK**

(Refer to p.1030~ for details.)

PNP output type amplifier can not be connected.

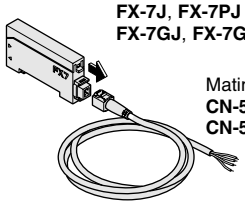
FX-7J, **FX-7PJ**
FX-7GJ, **FX-7GPJ**



Sensor block for simple wiring **SL-BMW** / **SL-BW**

(Refer to p.882~ for details.)

FX-7J, **FX-7PJ**
FX-7GJ, **FX-7GPJ**



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

Accessories

- **MS-DIN-2** (Amplifier mounting bracket)
- **FX-CT1** (Fiber cutter)
- **FX-CT2** (Fiber cutter)
- **FX-AT10** (ϕ1 mm fiber attachment)
- **FX-AT13** (ϕ1.3 mm fiber attachment)

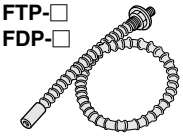
OPTION

Designation	Model No.	Description				
Protective tube (For thru-beam fiber)	**FTP-500** (0.5 m)	For M4 thread	Applicable fibers	**FT-B8** **FT-FM2** **FT-FM2S** **FT-FM2S4**	**FT-P80** **FT-H13-FM2**	The protective tube made of non-corrosive stainless steel protects the inner fiber cable from any stress.
	FTP-1000 (1 m)					
	FTP-1500 (1.5 m)					
	FTP-N500 (0.5 m)	For M3 thread		**FT-T80** **FT-NFM2** **FT-NFM2S** **FT-NFM2S4**	**FT-P40** **FD-T40** **FD-P40**	
	FTP-N1000 (1 m)					
	FTP-N1500 (1.5 m)					
Protective tube (For reflective fiber)	**FDP-500** (0.5 m)	For M6 thread		**FD-B8** **FD-FM2** **FD-FM2S** **FD-FM2S4**	**FD-P80** **FD-H13-FM2**	
	FDP-1000 (1 m)					
	FDP-1500 (1.5 m)					
	FDP-N500 (0.5 m)	For M4 thread		**FD-T80** **FD-NFM2** **FD-NFM2S** **FD-NFM2S4**		
	FDP-N1000 (1 m)					
	FDP-N1500 (1.5 m)					
Fiber bender	**FB-1**	The fiber bender curves the sleeve part of the fiber head at the proper radius. (Note 1)				
Universal sensor mounting stand (Note 2)	**MS-AJ1-F**	Horizontal mounting type	Mounting stand assembly for fiber (For M3, M4 or M6 threaded head fiber)			
	MS-AJ2-F	Vertical mounting type				

Notes: 1) Do not bend the sleeve part of any side-view fiber, ultra-small diameter head fiber, or narrow-view fiber.
2) Refer to p.332~ for details of the universal sensor mounting stand.

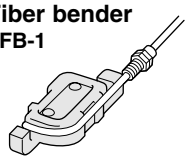
Protective tube

- **FTP-**□
- **FDP-**□



Fiber bender

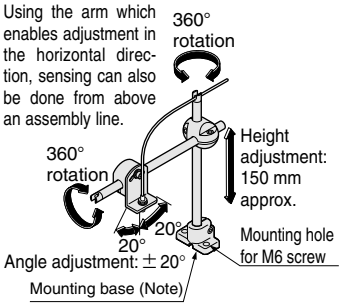
- **FB-1**



Universal sensor mounting stand

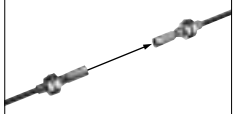
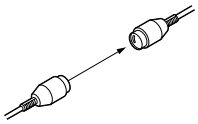
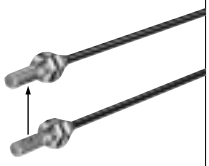
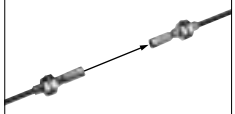
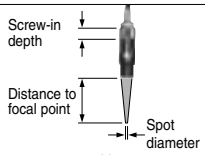
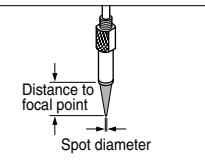
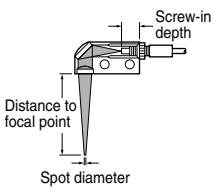
- **MS-AJ1-F**
- **MS-AJ2-F**

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



Note: The above figure is **MS-AJ1-F**. The mounting base of **MS-AJ2-F** has a different shape.

OPTION

<table>
<tr><th colspan="2">Designation</th><th>Model No.</th><th colspan="2">Description</th></tr>
<tr><td rowspan="6">For thru-beam fiber</td><td>Expansion lens
(Note 1)</td><td>FX-LE1</td><td>  </td><td>Six times longer or more
• Ambient temperature: −60 to +350 °C</td><td>Sensing range (mm) [Two lenses on both sides]
<table><tr><th>Applicable amplifier / Fiber</th><th>Red LED type</th><th>Green LED type</th></tr><tr><td>FT-B8</td><td>2,500</td><td>230</td></tr><tr><td>FT-FM2</td><td>2,000</td><td>200</td></tr><tr><td>FT-T80</td><td>2,000</td><td>200</td></tr><tr><td>FT-P80</td><td>2,000</td><td>200</td></tr><tr><td>FT-H35-M2</td><td>1,600</td><td>140</td></tr><tr><td>FT-H20-M1</td><td>1,600</td><td>140</td></tr><tr><td>FT-R80</td><td>1,600</td><td>190</td></tr></table></td></tr>
<tr><td>Super-expansion lens
(Note 1)</td><td>FX-LE2</td><td>  </td><td>Tremendously increases the sensing range with large diameter lenses.
• Ambient temperature: −60 to +350 °C</td><td>Sensing range (mm) [Two lenses on both sides]
<table><tr><th>Applicable amplifier / Fiber</th><th>Red LED type</th><th>Green LED type</th></tr><tr><td>FT-B8</td><td>3,500 (Note 2)</td><td>1,400</td></tr><tr><td>FT-FM2</td><td>3,500 (Note 2, 3)</td><td>1,700</td></tr><tr><td>FT-P80</td><td>3,500 (Note 2)</td><td>1,300</td></tr><tr><td>FT-H35-M2</td><td>3,500 (Note 2, 4)</td><td>800</td></tr><tr><td>FT-H20-M1</td><td>1,600 (Note 2)</td><td>900</td></tr><tr><td>FT-H13-FM2</td><td>3,500 (Note 2)</td><td>800</td></tr><tr><td>FT-R80</td><td>3,500 (Note 2)</td><td>1,400</td></tr></table></td></tr>
<tr><td>Side-view lens</td><td>FX-SV1</td><td>  </td><td>Beam axis is bent by 90°.
• Ambient temperature: −60 to +300 °C</td><td>Sensing range (mm) [Two lenses on both sides]
<table><tr><th>Applicable amplifier / Fiber</th><th>Red LED type</th><th>Green LED type</th></tr><tr><td>FT-B8</td><td>750</td><td>40</td></tr><tr><td>FT-FM2</td><td>400</td><td>35</td></tr><tr><td>FT-T80</td><td>400</td><td>35</td></tr><tr><td>FT-P80</td><td>400</td><td>35</td></tr><tr><td>FT-H35-M2</td><td>300</td><td>25</td></tr><tr><td>FT-H20-M1</td><td>300</td><td>25</td></tr></table></td></tr>
<tr><td>Expansion lens for vacuum fiber
(Note 1)</td><td>FV-LE1</td><td>  </td><td>Six times longer or more
• Ambient temperature: −40 to +120 °C</td><td>Sensing range (mm) [Two lenses on both sides]
<table><tr><th>Applicable amplifier / Fiber</th><th>Red LED type</th></tr><tr><td>FT-6V</td><td>1,200</td></tr><tr><td>FT-60V</td><td>600</td></tr></table></td></tr>
<tr><td rowspan="4">For reflective fiber</td><td>Pinpoint spot lens</td><td>FX-MR1</td><td>  </td><td colspan="2">Pinpoint spot of ϕ0.5 mm. Enables detection of minute objects or small marks.
• Applicable amplifiers: Red LED type • Distance to focal point: 6 ± 1 mm
• Applicable fibers: FD-G4 or FD-G500 • Ambient temperature: −40 to +70 °C</td></tr>
<tr><td>Zoom lens</td><td>FX-MR2</td><td> 
</td><td>The spot diameter is adjustable from ϕ0.7 to ϕ2 mm according to how much it is screwed in.
• Applicable amplifiers: Red LED type
• Applicable fibers: FD-G4 & FD-G500
• Ambient temperature: −40 to +70 °C
• Accessory: MS-EX-3 (Mounting bracket)</td><td>Sensing range
<table><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>7 mm</td><td>Approx.18.5 mm</td><td>ϕ0.7 mm</td></tr><tr><td>12 mm</td><td>Approx. 27 mm</td><td>ϕ1.2 mm</td></tr><tr><td>14 mm</td><td>Approx. 43 mm</td><td>ϕ2.0 mm</td></tr></table></td></tr>
<tr><td>Finest spot lens</td><td>FX-MR3</td><td> 
</td><td>Finest spot of ϕ0.3 mm (with FD-EG1)
• Applicable amplifiers: Red LED type
• Applicable fibers: FD-EG1 & FD-G4
• Ambient temperature: −40 to +70 °C</td><td>Sensing range
<table><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG1</td><td>7.5 ± 0.5 mm</td><td>Approx.ϕ0.3 mm</td></tr><tr><td>FD-G4</td><td>7.5 ± 0.5 mm</td><td>Approx.ϕ0.5 mm</td></tr></table></td></tr>
<tr><td>Zoom lens
(Side-view type)</td><td>FX-MR5</td><td> 
</td><td>FX-MR2 is converted into a side-view type and can be mounted in a very small space.
• Applicable amplifiers: Red LED type
• Applicable fibers: FD-G4 & FD-G500
• Ambient temperature: −40 to +70 °C</td><td>Sensing range
<table><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>8 mm</td><td>Approx.13 mm</td><td>ϕ0.5 mm</td></tr><tr><td>10 mm</td><td>Approx.15 mm</td><td>ϕ0.8 mm</td></tr><tr><td>14 mm</td><td>Approx.30 mm</td><td>ϕ3.0 mm</td></tr></table></td></tr>
</table>

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 (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 at 3,500 mm long (**FT-H20-M1**: 1,600 mm).
3) The sensing range can be expanded up to 14.5 m with fiber cables 10 m long each.
4) The sensing range can be expanded up to 5.5 m with fiber cables 3 m each.

FX-7

SPECIFICATIONS

Fibers

Item \ Type	Standard, Small fiber head, Small diameter, Flexible, Long sensing range with lenses, Array, Elbow, High precision, Thru-beam of ultra-small diameter	Heat-resistant			Chemical-resistant	Vacuum	Fixed-focus reflective	Side-view, Narrow beam, Narrow-view, Reflective of ultra-small diameter	Liquid level detection	
		350 °C type	200 °C type	130 °C type						Mountable on pipe
Allowable bending radius	R25 mm or more (Flexible: R4 mm or more, Thru-beam of ultra-small diameter: R5 mm or more)				R30 mm or more	R200 mm or more (**FT-60V**: R30 mm or more)	R10 mm or more	R25 mm or more	Protective tube: R40 mm or more Fiber cable: R15 mm or more	R10 mm or more
Ambient temperature	− 40 to + 70 °C (**FD-EG1**: − 20 to + 60 °C)	− 60 to + 350 °C (Note 1, 2)	− 60 to + 200 °C (Note 2)	− 60 to + 130 °C	− 40 to + 115 °C	− 40 to + 120 °C	− 40 to + 70 °C (**FD-L42**: − 40 to + 60 °C)	− 20 to + 60 °C (**FT-V41**, **FD-V41**: − 40 to + 60 °C)	− 40 to + 125 °C (Note 3)	− 40 to + 100 °C (Note 3)
Ambient humidity	35 to 85 %RH (No dew condensation nor icing allowed)									
Material: Fiber core	Acrylic	Multi-component glass (Note 4)		Acrylic		Quartz glass (Note 4)	Acrylic			
Material: Sheath	Polyethylene (Flexible: Vinyl chloride, **FD-P2**: Vinyl chloride·polyurethane)		Silicone (SUS spiral tube inside)	Fluorine resin		Fluorine resin	Polyethylene (Reflective of narrow-view type: Polyurethane)			Polypropylene
Material: Fiber head	Brass: Threaded part of standard, Threaded part of small diameter, High precision, Threaded part of thru-beam of ultra-small diameter, **FT-P80**, **FD-P80**, Array, Threaded part of **FT/FD-R80** (Nickel plated) Stainless steel (SUS): **FT-SFM2**, Small fiber head, **FT-SNFM2**, **FD-SNFM2**, **FT-SFM2L**, **FT-P40**, **FT-P2**, **FD-P40**, **FD-P2**, Sleeve part of sleeve-attached fiber ABS: **FT-FM10L** (Lens: Acrylic)	Stainless steel (SUS)	Brass (Nickel plated)	Brass (Nickel plated)	Protective tube: Fluorine resin Fiber sheath: Polypropylene	Aluminum	ABS: **FD-L4**, **FD-L41**, (Lens: Acrylic) Aluminum: **FD-L42** (Lens: Acrylic)	Stainless steel (SUS) (Threaded part of **FD-EN500S1**, **FD-ENM1S1**, **FT-KM1S2** and **FD-KM1S2**: Brass)	Protective tube: Fluorine resin Sheath: Polypropylene	Polyetherimido
Accessories	Threaded head fiber: 2 pcs. of nuts (thru-beam type: 4 pcs.) and 1 pc. of toothed lock washer (thru-beam type: 2 pcs.) Free-cut type, chemical-resistant fiber and liquid level detection fiber: 1 pc. of **FX-CT2** (**FT-P80**, **FD-P80**: **FX-CT1**)(Fiber cutter) Small diameter of free-cut fiber, Fixed-focus reflective fiber, high precision of free-cut fiber, **FD-F4** and **FD-F9**: 2 sets of plug attachments (**FD-L41**, **FD-L42**, **FD-F4** and **FD-F9**: 1 set of attachments) **FD-F4** and **FD-F9**: 4 pcs. of tying bands and 2 pcs. of anti-slip tubes **FD-L4**: 2 pcs. of M2.6 × 12 mm screws with washers and 2 pcs. of nuts									

Notes: 1) 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 **FX-SV1** is from − 60 to + 300 °C.)
2) 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.)
3) With the liquid level detection fiber, also make sure of the temperature of the liquid in which the fiber is immersed.
4) Keep the fiber composed of multi-component glass or quarts glass from vibration or impact.

SPECIFICATIONS

Amplifiers

Item \ Type / Model No.		NPN output						PNP output	
		Standard type		External synchronization input type		Remote sensitivity adjustment type		Standard type	
		FX-7	**FX-7G**	**FX-75**	**FX-75G**	**FX-77**	**FX-77G**	**FX-7P**	**FX-7GP**
Supply voltage		12 to 24 V DC ±10 % Ripple P-P 10 % or less							
Current consumption		30 mA or less							
Sensing output		NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less • Residual voltage: 1.0 V or less (at 100 mA sink current) 0.4 V or less (at 16 mA sink current)						PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less • Residual voltage: 2.0 V or less (at 100 mA source current) 1.0 V or less (at 16 mA source current)	
	Utilization category	DC-12 or DC-13							
	Output operation	Selectable either Light-ON or Dark-ON with the order of pressing ON and OFF buttons (Selectable with the external inputs on the **FX-77** or the **FX-77G**)							
	Short-circuit protection	Incorporated							
Self-diagnosis output		NPN open-collector transistor • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less • Residual voltage: 1.0 V or less (at 50 mA sink current) 0.4 V or less (at 16 mA sink current)						PNP open-collector transistor • Maximum source current: 50 mA • Applied voltage: 30 V DC or less • Residual voltage: 2.0 V or less (at 50 mA source current) 1.0 V or less (at 16 mA source current)	
	Output operation	ON under the unstable sensing condition and it is restored automatically after approx. 40 ms; also ON if the sensing output is short-circuited until it is removed (The remote sensitivity adjustment type makes it turned ON for approx. 40 ms after the remote sensitivity input is received.)							
	Short-circuit protection	—							
Response time		0.5 ms or less (0.7 ms or less when the interference prevention function is used)							
Operation indicator		Red LED (lights up when the sensing output is ON)							
Stability indicator		Green LED ('RUN' mode: Lights up at the stable Light condition or the stable Dark condition 'SET' mode : Blinks twice when the difference between ON and OFF levels is greater than the hysteresis, but 15 times when it is equal to or less than the hysteresis after the completion of the sensitivity setting. Also blinks twice after the interference prevention is set 'SET' mode→'SIF' or 'RUN' mode: Blinks from 0 to 5 times according to the operation margin)							
Test input (emission halt) function		—		Incorporated		—			
External synchronization function		—		Incorporated (Either gate or edge trigger is selectable)		—			
Remote sensitivity adjustment function		—				Incorporated		—	
Sensitivity shift function		Shifts the sensitivity setting level							
Interference prevention function		Incorporated							
Timer function		Fixed OFF-delay timer approx. 40 ms (switchable either effective or ineffective)		—		Fixed OFF-delay timer approx. 40 ms (switchable either effective or ineffective)			
Environmental resistance	Pollution degree	3 (Industrial environment)							
	Ambient temperature	−10 to +50 °C (No dew condensation or icing allowed), Storage: −20 to +70 °C							
	Ambient humidity	35 to 85 %RH, Storage: 35 to 85 % RH							
	Ambient illuminance	Sun light: 10,000 ℓx at the light-receiving face, Incandescent light: 3,000 ℓx at the light-receiving face							
	EMC	EN 50081-2, EN 50082-2, EN 60947-5-2							
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure (Note)							
	Insulation resistance	20 MΩ, or more, at 250 V DC Megger between all supply terminals connected together and enclosure (Note)							
	Vibration resistance	10 to 150 Hz frequency, 0.75 mm amplitude, and X, Y, and Z directions for two hours each							
	Shock resistance	98 m/s² acceleration (approx. 10 G), and X, Y, and Z directions for five times each							
Emitting element (modulated)		Red LED	Green LED	Red LED	Green LED	Red LED	Green LED	Red LED	Green LED
Material		Enclosure: Heat-resistant ABS, Case cover: Polycarbonate, Fiber lock lever: PPS							
Cable		0.15 mm² 6-core cabtyre cable, 2 m long (**FX-7**, **FX-7G**, **FX-7P** or **PX-7GP**: four 0.2 mm² conductors)							
Cable extension		Extension up to total 100 m is possible with 0.3 mm² or more, cable.							
Weight		65 g approx.							
Accessory		**MS-DIN-2** (Mounting bracket): 1 pc.							

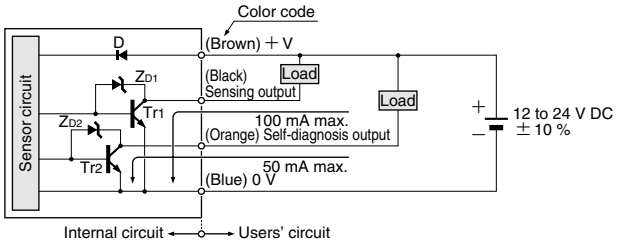
Note: The voltage withstandability and the insulation resistance described in the above table are inherent in the amplifier only.

FX-7

I/O CIRCUIT AND WIRING DIAGRAMS

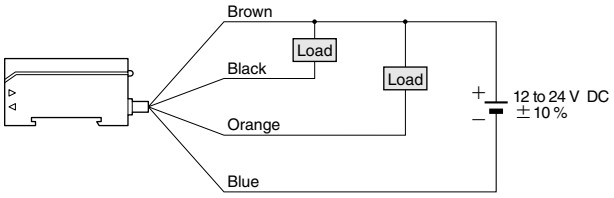
FX-7 FX-7G Standard type·NPN output

I/O circuit diagram



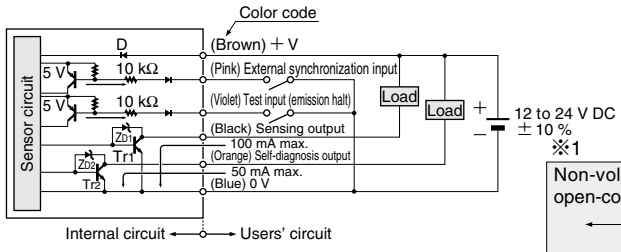
Symbol ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : NPN output transistor

Wiring diagram



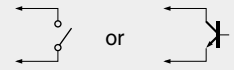
FX-75 FX-75G External synchronization input type

I/O circuit diagram



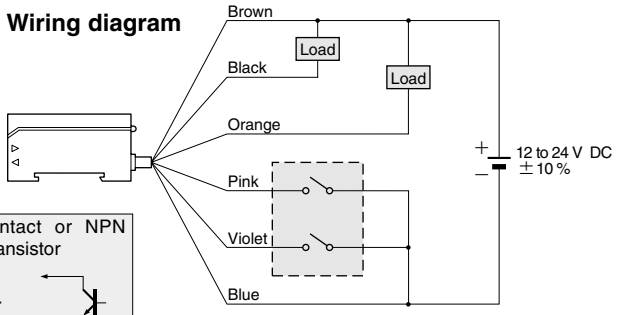
Symbol ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : NPN output transistor

Non-voltage contact or NPN open-collector transistor



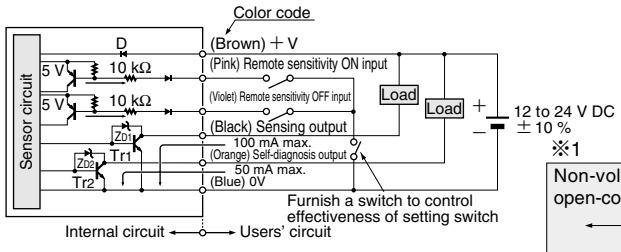
Low : 0 to 1 V
High : 4.5 to 30 V, or Open

Wiring diagram



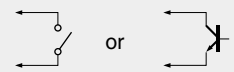
FX-77 FX-77G Remote sensitivity adjustment type

I/O circuit diagram



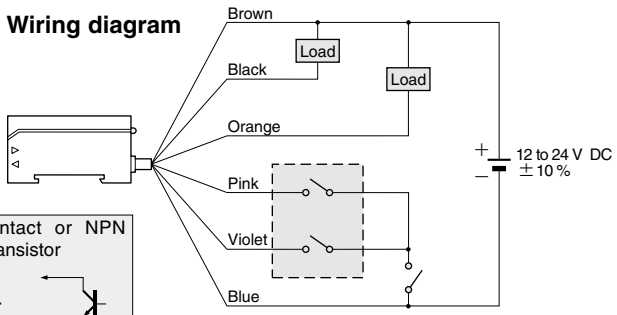
Symbol ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : NPN output transistor

Non-voltage contact or NPN open-collector transistor



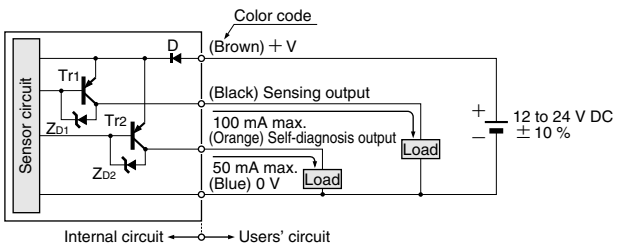
Low : 0 to 1 V
High : 4.5 to 30 V, or Open

Wiring diagram



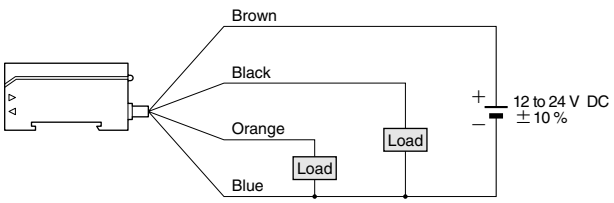
FX-7P FX-7GP Standard type·PNP output

I/O circuit diagram



Symbol ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : PNP output transistor

Wiring diagram



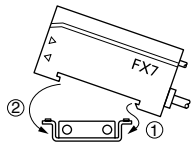
PRECAUTIONS FOR PROPER USE

Refer to p.1135～ for general precautions and p.94～ for fiber precautions.

Amplifier

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.

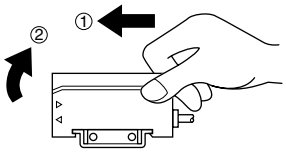
Mounting



DIN rail or the attached mounting bracket

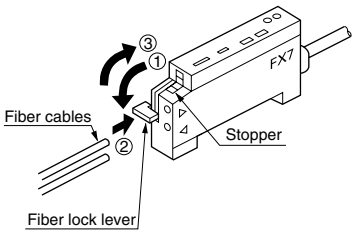
① Hook the rear part to the attached mounting bracket (**MS-DIN-2**) or DIN rail.
② Press the amplifier down on the bracket or DIN rail.

※ To remove the amplifier, push it forward and lift up the front side.



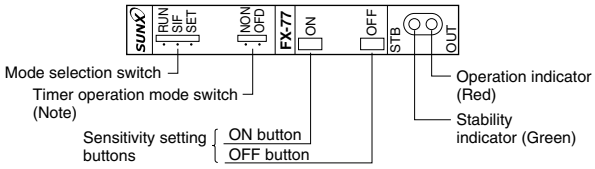
How to connect fiber cables

• The set of fiber cables is connected at a touch.



① Snap the fiber lock lever down.
② Insert both fiber cables into the inlets slowly until fully deepened.
③ Snap the fiber lock lever up until a 'click' is heard.

Designation



Note: The external synchronization selection switch is substituted for it on **FX-77** or **FX-77G**.

FX-7

PRECAUTIONS FOR PROPER USE

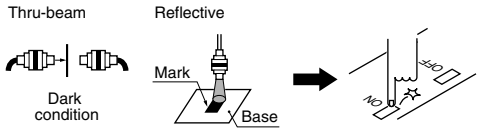
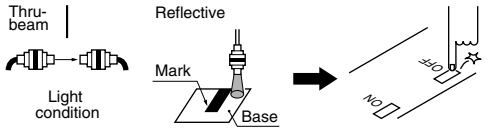
Refer to p.1135～ for general precautions and p.94～ for fiber precautions.

Amplifier

Sensitivity adjustment

• How to use the sensitivity setting buttons

Normally ON mode that the sensing output is turned ON with an object

Procedure	Operation
①	Set the fiber within the sensing range.
②	Set the mode selection switch to 'SET'. 
③	Press the ON button with an object placed in front of the fiber. 
④	When the sensor accepts it, the stability indicator (green) blinks. 
⑤	Press the OFF button with the object set aside. 
⑥	• The stability indicator blinks twice when the difference between the ON level and the OFF level is so sufficient as to detect the object securely. • The stability indicator blinks continuously if the difference is so diminutive as to detect the object. (Note 1)
⑦	Set the mode selection switch to 'RUN'. Then, the set sensitivity is registered. Even if the buttons are pressed by mistake under the 'RUN' mode, the registered sensitivity stays unchanged. 

Notes: 1) Regardless of the indication that the detection is marginal, setting of the sensitivity can be perfected, but remember it is severe detection.
2) Your set sensitivity is stored in the EEPROM memory that has the limited lifetime. The sensitivity allows to be reset until 100,000 times.

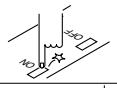
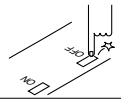
Reverse ON mode that the sensing output is turned ON without an object

• Follow the same procedure as the above except for;
Press the OFF button with an object placed in front of the fiber.
Press the ON button with the object set aside.

How to obtain the maximum sensitivity

① Set the mode selection switch to 'SET'.
② · **For the Light-ON operation mode**
Press the ON button followed by OFF button under the condition that beam is not received (or make the remote sensitivity ON input into Low as well as the OFF input).
· **For the Dark-ON operation mode**
Press the OFF button followed by the ON button under the condition that beam is not received (or make the remote sensitivity OFF input into Low as well as the ON input).
③ Set the mode selection switch to 'RUN'.
<Applications>
· To obtain the longest sensing range with the reflective fiber.
· To use the thru-beam fiber in a harsh environment.

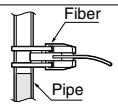
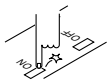
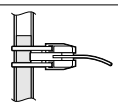
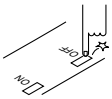
Combination with FD-F8Y

Procedure	Sensing condition		Operation
	Wet-ON	Dry-ON	
①	——	——	Set the mode selection switch to 'SET'. 
②			Press the ON button. 
③	——	——	When the sensor accepts it, the stability indicator (green) blinks. 
④			Press the OFF button. 
⑤	——	——	• The stability indicator blinks twice when the difference between the ON level and the OFF level is so sufficient as to detect the liquid level securely. • The stability indicator blinks continuously if the difference is so diminutive as to detect the liquid level. (Note 1)
⑥	——	——	Set the mode selection switch to 'RUN'. Then, the set sensitivity is registered. Even if the buttons are pressed by mistake under the 'RUN' mode, the registered sensitivity stays unchanged. 

Notes: 1) Regardless of the indication that the detection is marginal, setting of the sensitivity can be perfected, but remember it is severe detection.
2) Your set sensitivity is stored in the EEPROM memory that has the limited lifetime. The sensitivity allows to be reset until 100,000 times.

Combination with FD-F4 or FD-F9

• In High-Level-ON mode

Procedure	Sensing condition	Operation
①	——	Set the mode selection switch to 'SET'. 
②		Press the OFF button when the level is lower than the position the fiber head is installed. 
③	——	When the sensor accepts it, the stability indicator (green) blinks. 
④		Press the ON button when the level is higher than the position the fiber head is installed. 
⑤	——	• The stability indicator blinks twice when the difference between the ON level and the OFF level is so sufficient as to detect the liquid level securely. • The stability indicator blinks continuously if the difference is so diminutive as to detect the liquid level. (Note 1)
⑥	——	Set the mode selection switch to 'RUN'. Then, the set sensitivity is registered. Even if the buttons are pressed by mistake under the 'RUN' mode, the registered sensitivity stays unchanged. 

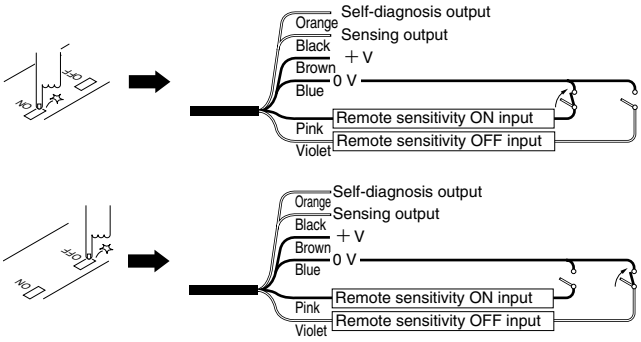
Notes: 1) Regardless of the indication that the detection is marginal, setting of the sensitivity can be perfected, but remember it is severe detection.
2) In Low-Level-ON mode, press the ON and the OFF buttons in the reverse order of the above procedure.
3) Your set sensitivity is stored in the EEPROM memory that has the limited lifetime. The sensitivity allows to be reset until 100,000 times.

PRECAUTIONS FOR PROPER USE

Refer to p.1135～ for general precautions and p.94～ for fiber precautions.

Amplifier

• **Remote sensitivity adjustment**
(Remote sensitivity adjustment type only)
The sensitivity adjustment using the remote sensitivity adjustment inputs takes the same procedure as the adjustment using the ON and the OFF buttons. Making the ON and the OFF inputs into Low substitutes for pressing the ON and the OFF buttons respectively.
Note: This function is operable also in RUN mode.



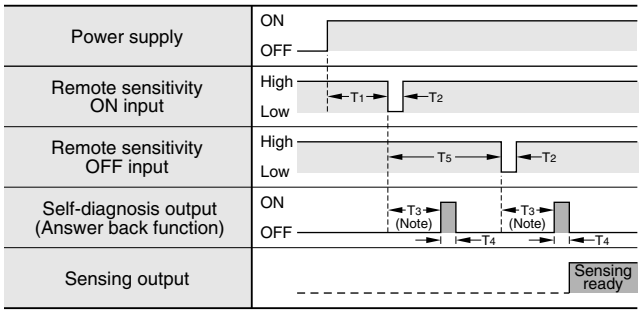
Signal condition

State	Signal condition
High	4.5 to 30 V or Open
Low	0 to 1 V

Input impedance: 10 kΩ

• The self-diagnosis output stays ON for 40 ms approx. after the ON input or the OFF input is recognized by the sensor. (Refer to '• **Time chart**'.)
(If the difference between the ON level and the OFF level is so small as to detect an object, it is not turned ON.)

• **Time chart**



$T_1 \geqq 1{,}000$ ms, $T_2 \geqq 5$ ms, $T_3 \fallingdotseq 310$ ms, $T_4 \fallingdotseq 40$ ms, $T_5 \geqq 500$ ms
Note: Do not change the incident beam intensity during the T_3.

Stability margin indication function

• After your setting sensitivity, the **FX-7** amplifier reveals the margin of the stability. Slide the mode selection switch from 'SET' to 'SIF' or 'RUN', and the stability indicator (green) blinks. The number of blinking represents the margin of the stability.

Number of blinks	0	1	2	3	4	5
Margin (%) (Margin near by threshold level)	Under 15	15 to 30	30 to 45	45 to 60	60 to 75	Over 75

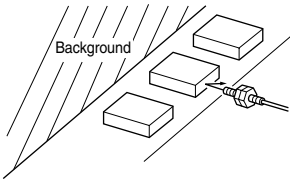
• The larger margin stability affirms the more secure detection.

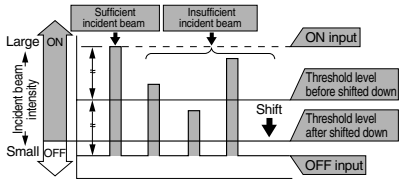
Sensitivity shift function

• If either one of the Light state or the Dark state is stationary, and the other is unsteady, the sensitivity shift function is useful to make your sensing secure by shifting the threshold level to the stationary side.
For example, to obtain the maximum sensitivity less than the background level in reflective mode, or minimum sensitivity more than the complete Dark level not to be affected by dirt or dust in thru-beam mode.

Reflective sensing with background

• Because the sensitivity is set at the maximum not to detect a background (the lowest threshold level above the background Dark level), the detection becomes durable and reliable even objects vary in color or reflection ratio, or the fiber head is spoiled.





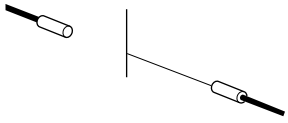
Setting

Procedure	Operation
①	Set the sensitivity according to the general method described on the front page.
②	Set the mode selection switch to 'SIF'. 
③	Press the sensitivity setting button that has been pressed under the Dark condition there is no object, but only a background. (With the above example, press the OFF button.)
④	Set the mode selection switch to 'RUN'. (The sensitivity shift function is perfected.) 

Note: The sensitivity shift function can not be effected by the remote sensitivity adjustment inputs on **FX-77** or **FX-77G**.

Limit sensitivity to detect minute object in thru-beam type

• It is useful to detect a tiny object like a fine thread with the thru-beam fiber. Any object is not needed to set the sensitivity.



Setting

Procedure	Operation
①	Set the mode selection switch to 'SET'. 
②	Press the OFF button (or the ON button) in the complete Light state. (There is no object between fiber heads.)
③	Press the ON button (or the OFF button) in the complete Dark state. (Shield the light-receiving part not to receive the beam.)
④	Set the mode selection switch to 'SIF'. 
⑤	Press the button again that has been pressed in the Light state.
⑥	Set the mode selection switch to 'RUN' 

Notes: 1) If your object can not be detected by the above sensitivity setting, try the general sensitivity setting with using the object or replace the set of the fiber cables with the small diameter fiber.
2) The sensitivity shift function cannot be effected by the remote sensitivity adjustment inputs on **FX-77** or **FX-77G**.

FX-7

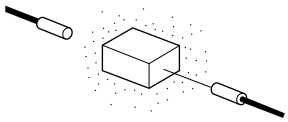
PRECAUTIONS FOR PROPER USE

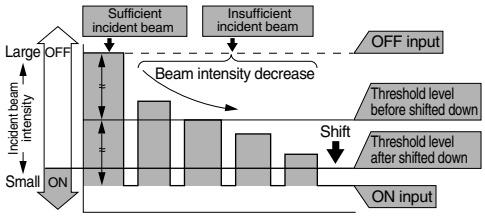
Refer to p.1135～ for general precautions and p.94～ for fiber precautions.

Amplifier

Thru-beam sensing in harsh environment

• Because the sensitivity is set at the maximum not to be affected by dirt or dust (the lowest threshold level above the Dark level), the detection becomes durable and reliable over the beam intensity comes down by dirt or dust.





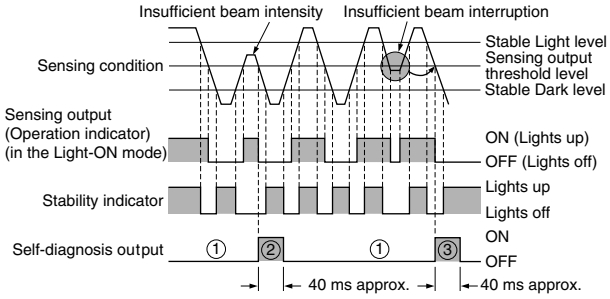
Setting

Procedure	Operation
①	Set the sensitivity according to the general method described on the front page.
②	Set the mode selection switch to 'SIF'. 
③	Press the sensitivity setting button that has been pressed under the Dark condition there is an object between the fiber heads. (With the above example, press the ON button.)
④	Set the mode selection switch to 'RUN'. (The sensitivity shift function is perfected.) 

Note: The sensitivity shift function cannot be effected by the remote sensitivity adjustment inputs on **FX-77** or **FX-77G**.

Self-diagnosis function

• The sensor diagnosis itself in the incident beam intensity. If the lens is foiled with dirt or dust, or the beam alignment is displaced, the output is generated.

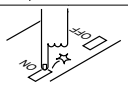
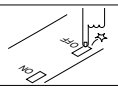


① The self-diagnosis output transistor stays in the 'OFF' state during the stable sensing.
② If the incident beam intensity does not reach the stable Light or Dark level, the self-diagnosis output is turned ON at the same time as the sensor goes from the Light state to the Dark state. It is automatically restored after 40 ms approx.
(The sensing output does not relate to it.)
③ The incomplete Light state introduces to generate the self-diagnosis output at the same time as the sensor changes the states.
However, the incomplete Dark state introduces to generate the self-diagnosis output half-cycle behind.

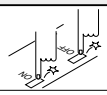
Interference prevention function

• Every **FX-7** amplifier is incorporated with the Interference prevention function. Two sensors operating with the distinct frequencies occur no mutual-interference. Their fiber heads can be mounted close together or face to face.

Setting

Procedure	Operation
①	Set the mode selection switch to 'SET'. 
②	Press both the 'ON' and the 'OFF' buttons simultaneously for 2 sec. or more. [The stability indicator (green) blinks.] 
③	Press the 'ON' button. (The stability indicator blinks twice.) [Response time: 0.5 ms or less (Note 1)] 
④	Set the mode selection switch to 'RUN'. (The first ends) 
⑤	Do the step 1 and 2 on the other sensor.
⑥	Press the 'OFF' button. (The stability indicator blinks twice.) [Response time: 0.7 ms or less (Note)] 
⑦	Set the mode selection switch to 'RUN'. (The second ends) 

Cancel

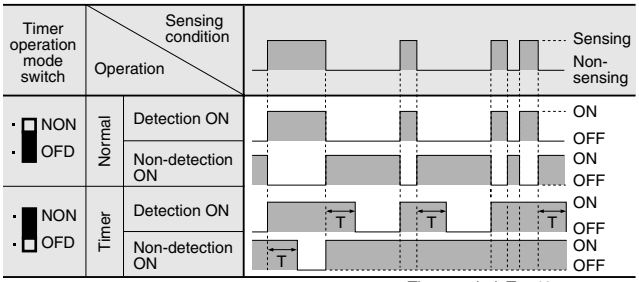
Procedure	Operation
①	Press both the 'ON' and the 'OFF' buttons simultaneously for the 2 sec.or more. [The stability indicator (green) blinks.] 
②	Press both the 'ON' and the 'OFF' buttons again. (The stability indicator blinks twice, then canceled.)

Note: The Interference prevention function enlarges the hysteresis and prolongs the response time. After it is set, the operability must be checked.

OFF-delay timer function

• Every amplifier in the series except for **FX-75** and **FX-75G** is incorporated with the OFF-delay timer fixed for 40 ms approx. The timer function is useful if the output signal responds so quickly that a connected device cannot take in.
To bring the timer in effect, set the timer operation mode switch to 'OFD'.

<Time chart>



Timer period: T = 40 ms approx.

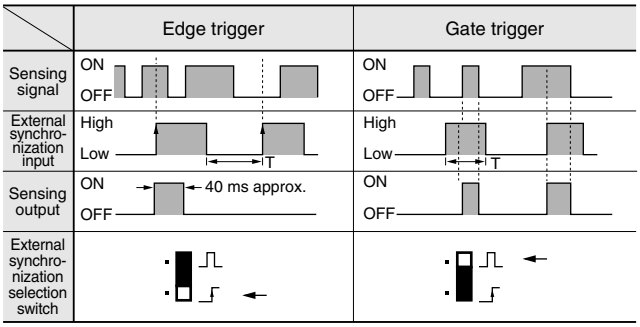
PRECAUTIONS FOR PROPER USE

Refer to p.1135～ for general precautions and p.94～ for fiber precautions.

Amplifier

External synchronization function (FX-75 and FX-75G only)

- The external synchronization function controls the timing to sense. The edge trigger or the gate trigger is available.

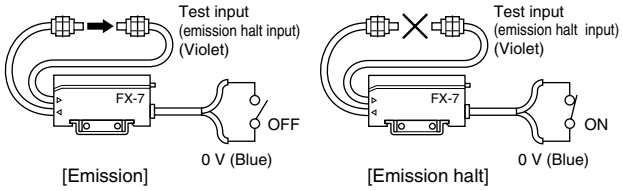


T≧0.5 ms (T≧0.7 ms when the Interference prevention function is used)

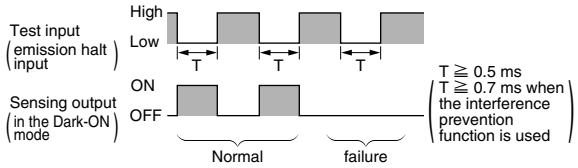
Note: To disable external synchronization, set the external synchronization selection switch to 'Gate trigger' side and open the external synchronization input (from 0 V).

Test input (emission halt) function (FX-75 or FX-75G only)

- When the test input (emission halt) function is short-circuited to 0 V (Low), the beam emission is halted. This function is useful for your start-up test of the sensor operability with no object existing.



- Close and open the input to 0 V repeatedly. If the sensing output responds it, the sensor is well operable. If not, the sensor is in an ill condition.



Wiring

- The **FX-7** series does not incorporate a short-circuit protection at the self-diagnosis output. Do not connect it directly to a power supply or a capacitive load.

Others

- The transient time duration is 0.5 sec. after power-up.

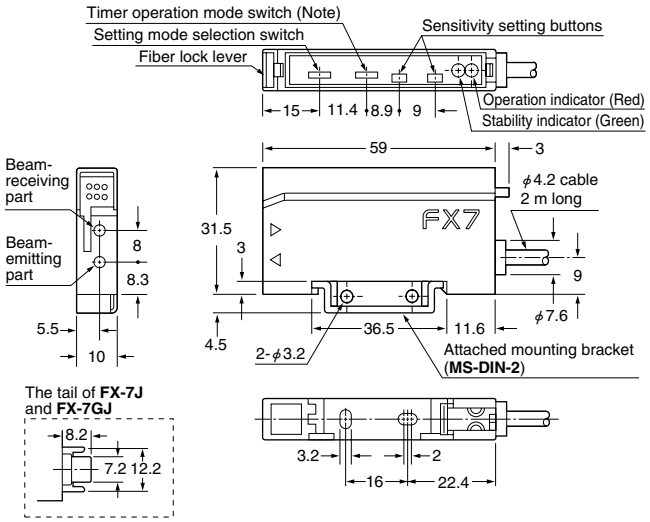
DIMENSIONS (Unit : mm)

The CAD data in the dimensions can be downloaded from the SUNX website: http://www.sunx.co.jp/

Refer to p.103～ for fiber dimensions.

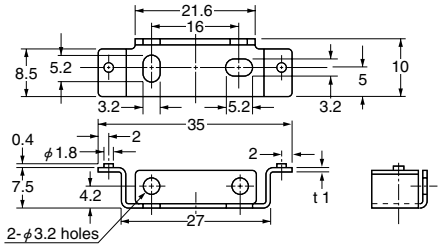
FX-7□ Amplifier

Assembled dimensions with attached mounting bracket



Note: It is substituted with the external synchronization selection switch on **FX-77** or **FX-77G**.

MS-DIN-2 Amplifier mounting bracket (Accessory for amplifier)



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