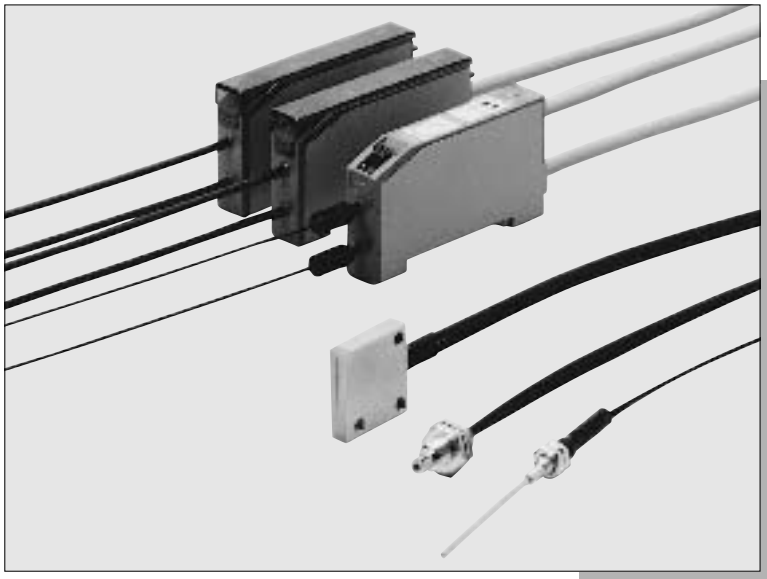
FX-11A

Slim Body Analog Fiber Sensor



Analog Output Type for Diverse Applications

Analog Voltage Output

It incorporates an analog voltage output of 1 to 5V.

Various Uses

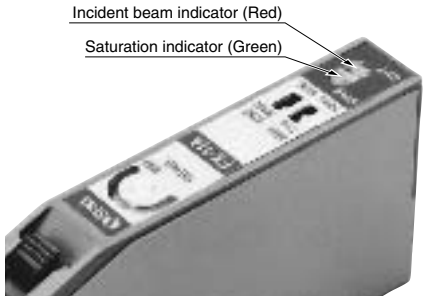
In combination with various types of fibers and the ultra-compact digital panel controller, **CA2** series, **FX-11A** can be used for various applications, such as, height eval-uation, level detection by differential sensing, etc.

CA2 series

Digital panel controller

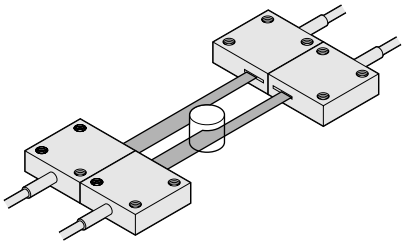
Saturation Indicator

The saturation indicator lights up when the output reaches 5V. Hence, the sensitivity can be easily adjusted even without using a tester.
Moreover, an incident beam indicator which brightens up in proportion to the amount of incident beam (output voltage) is also incorporated.



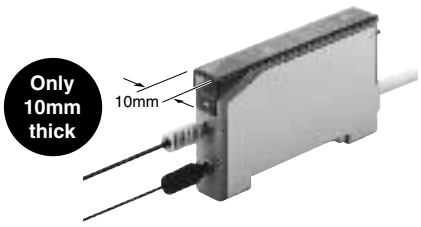
Interference Prevention Function

Two sets of fibers can be mounted close together or face to face.



Slim Size

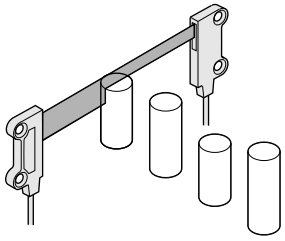
Being only 10mm thick, it can be mounted in a narrow space.



APPLICATIONS

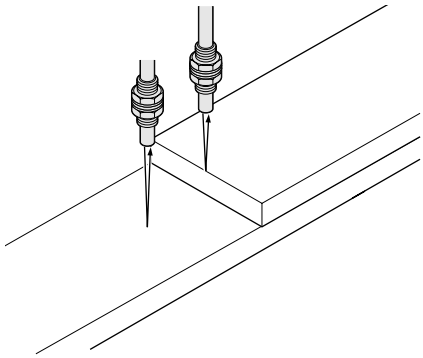
Evaluating height of traveling objects

Objects can be sorted according to their height.



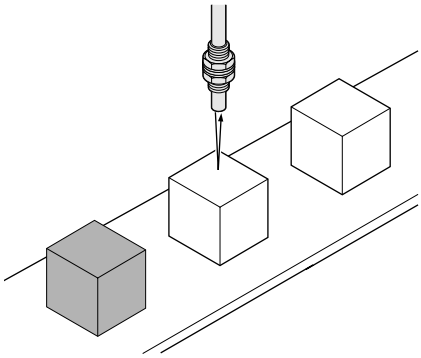
Detecting level difference

When differential sensing is used, no sensitivity readjustment is required even if the reflectivity of the objects changes.



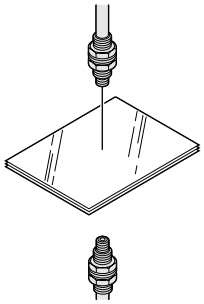
Detecting product mix-up

Mixed-up products that differ in color (reflectivity) can be sorted out from normal products.



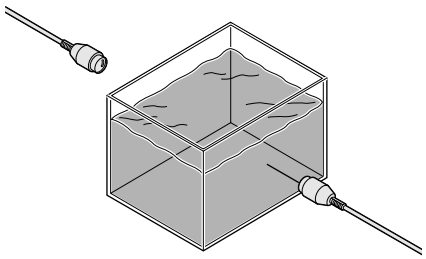
Ascertaining the number of translucent films

The number of overlapping translucent films can be ascertained.



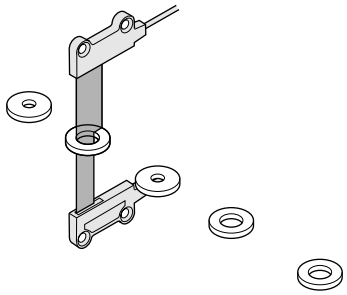
Sensing turbidity of liquid

The turbidity of a liquid inside a clear-wall tank can be sensed in an analog manner.



Measuring inner diameter of rings

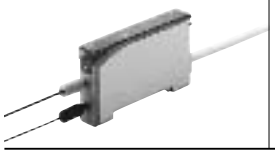
Rings can be sorted according to their inner diameter.



FX-11A

ORDER GUIDE

Amplifier

Appearance	Model No.	Supply voltage	Analog output
	**FX-11A**	12 to 24V DC ± 10%	Analog voltage • Output voltage: 1 to 5V

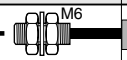
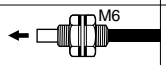
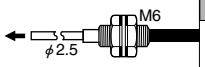
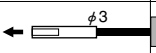
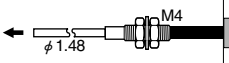
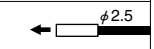
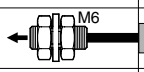
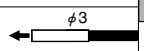
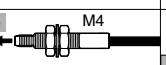
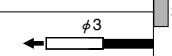
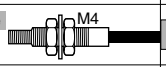
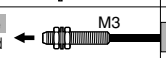
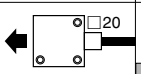
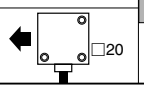
Fibers

Type		Shape of fiber head (mm)	Sensing range (Note 1)	Features	Fiber cable length	Model No.
Thru-beam	Long sensing range	Lens mountable M4	160mm	• Twice the sensing range for the same diameter	Free Cut 2m	**FT-B8**
	Standard	Lens mountable M4		• Free-cut type	Free Cut 2m	**FT-FM2**
		With sleeve M4 φ1.48	85mm			**FT-FM2S** With sleeve 90mm
						FT-FM2S4 With sleeve 40mm
		φ2.5				**FT-SFM2**
	Small fiber head	Lens mountable M3	85mm	• Miniature head but having the same sensing range as the standard type fiber	Free Cut 2m	**FT-T80**
	Small diameter	M3		• Suitable for detection in a congested equipment • Free-cut type	Free Cut 2m	**FT-NFM2**
		With sleeve M3 φ0.88	23mm			**FT-NFM2S** With sleeve 90mm
						FT-NFM2S4 With sleeve 40mm
		φ1.5				**FT-SNFM2**
	Sharp bend Standard	Lens mountable M4	35mm	• The fiber can be bent sharply, like an electric wire, to avoid space wastage in installation because of its small allowable bending radius of R1mm or more.	Free Cut 2m	NEW **FT-W8**
		φ2.5				NEW **FT-WS8**
	Sharp bend Small diameter	M3	8mm			NEW **FT-W4**
		φ1.5				NEW **FT-WS4**
	Sharp bend With lens	φ3	100mm			NEW **FT-WS8L**
	Long sensing range with lense	φ2.5	125mm	• Long sensing range with small fiber heads of φ2.5mm	Free Cut 2m	**FT-SFM2L**
	Wide beam	31 × 13.5	100mm	• The wide beam detects an object at any place within the range.	Free Cut 2m	NEW **FT-A8** (Note 2)
	Array	Top sensing □15	65mm	• The wide beam detects an object at any place within the range.	Free Cut 2m	**FT-AFM2**
		Side sensing □15				**FT-AFM2E**

Notes: 1) The sensing range is defined as the range until the saturation indicator lights up.
2) The sensing width differs with the sensing object size and the sensing distance. Please contact our office for details.

ORDER GUIDE

Fibers

Type	Shape of fiber head (mm)	Sensing range (Note)	Features	Fiber cable length	Model No.
Reflective — Long sensing range		31mm	• Long sensing range	Free Cut 2m	**FD-B8**
Reflective — Standard — Coaxial		22mm	• Free-cut type	Free Cut 2m	**FD-FM2**
Reflective — Standard — With sleeve		22mm	• Free-cut type	Free Cut 2m	**FD-FM2S** With sleeve 90mm **FD-FM2S4** With sleeve 40mm
Reflective — Small fiber head		22mm	• Miniature head but having the same sensing range as the standard type fiber	Free Cut 2m	**FD-T80**
Reflective — Small fiber head — Small diameter		7mm	• Miniature head but having the same sensing range as the standard type fiber	Free Cut 2m	**FD-T40**
Reflective — Small fiber head		22mm	• Miniature head but having the same sensing range as the standard type fiber	Free Cut 2m	**FD-S80**
Reflective — Small diameter		7mm	• Suitable for detection in a congested equipment • Free-cut type	Free Cut 2m	**FD-NFM2**
Reflective — Small diameter — With sleeve		7mm	• Suitable for detection in a congested equipment • Free-cut type	Free Cut 2m	**FD-NFM2S** With sleeve 90mm **FD-NFM2S4** With sleeve 40mm
Reflective — Small diameter		7mm	• Suitable for detection in a congested equipment • Free-cut type	Free Cut 2m	**FD-SNFM2**
Reflective — Sharp bend — Standard		8mm	• The fiber can be bent sharply, like an electric wire, to avoid space wastage in installation because of its small allowable bending radius of R1mm or more (**FD-WG4**, **FD-WSG4**: R2mm or more).	Free Cut 2m	NEW **FD-W8**
Reflective — Sharp bend — Small head		8mm	• The fiber can be bent sharply, like an electric wire, to avoid space wastage in installation because of its small allowable bending radius of R1mm or more (**FD-WG4**, **FD-WSG4**: R2mm or more).	Free Cut 2m	NEW **FD-WT8**
Reflective — Sharp bend — Small head		8mm	• The fiber can be bent sharply, like an electric wire, to avoid space wastage in installation because of its small allowable bending radius of R1mm or more (**FD-WG4**, **FD-WSG4**: R2mm or more).	Free Cut 2m	NEW **FD-WS8**
Reflective — Sharp bend — High precision — Lens mountable Coaxial		3mm	• The fiber can be bent sharply, like an electric wire, to avoid space wastage in installation because of its small allowable bending radius of R1mm or more (**FD-WG4**, **FD-WSG4**: R2mm or more).	Free Cut 2m	NEW **FD-WG4**
Reflective — Sharp bend — High precision — Coaxial		3mm	• The fiber can be bent sharply, like an electric wire, to avoid space wastage in installation because of its small allowable bending radius of R1mm or more (**FD-WG4**, **FD-WSG4**: R2mm or more).	Free Cut 2m	NEW **FD-WSG4**
Reflective — High precision — Lens mountable Coaxial		10mm	• Precise position sensing	Free Cut 2m	**FD-G4**
Reflective — High precision — Lens mountable Coaxial • Small head		3mm	• Combination with the **FX-MR3** lens gives an extremely small spot diameter of ϕ0.3mm approx.	500mm	**FD-EG1**
Reflective — Array — Top sensing		13mm	• Its wide beam meets various needs.	Free Cut 2m	**FD-AFM2**
Reflective — Array — Side sensing		13mm	• Its wide beam meets various needs.	Free Cut 2m	**FD-AFM2E**

Note: The sensing range is defined as the range until the saturation indicator lights up.
Further, for the reflective type fibers, it is specified for white non-glossy paper [50 × 50mm (**FD-B8**: 100 × 100mm)] as the object.

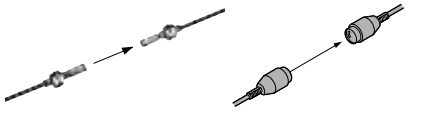
FX-11A

OPTIONS

Designation		Model No.	Description	
For thru-beam type fiber	Expansion lens	**FX-LE1**	Increases the sensing range by 6 times or more. • Sensing range (Lens on both sides) (Note 1): 900mm (**FT-B8**), 750mm (**FT-FM2**, **FT-T80**), 350mm (**FT-W8**)	
	Super-expansion lens	**FX-LE2**	Tremendously increases the sensing range with large aperture lenses. • Sensing range (Lens on both sides) (Note 1): 3,000mm (**FT-B8**), 2,500mm (**FT-FM2**), 3,000mm (**FT-W8**)	
	Side-view lens	**FX-SV1**	Beam axis is bent by 90°. • Sensing range (Lenses on both sides) (Note 1) : 220mm (**FT-B8**), 200mm (**FT-FM2**, **FT-T80**), 25mm (**FT-W8**)	
For reflective type fiber	Pinpoint spot lens	**FX-MR1**	Pinpoint spot of ϕ0.5mm. • Applicable fiber: **FD-WG4**, **FD-G4** • Distance to focal point: 6 ± 1mm	
	Zoom lens	**FX-MR2**	The spot diameter is adjustable from ϕ0.7 to ϕ2mm according to how much the fiber is screwed in. • Applicable fiber: **FD-WG4**, **FD-G4** • Distance to focal point: 18.5 to 43mm approx. (Screw-in depth: 7 to 14 mm) • Spot diameter: ϕ0.7 to ϕ2mm (Screw-in depth: 7 to 14mm)	
	Finest spot lens	**FX-MR3**	Extremely fine spot of ϕ0.3mm is achieved. • Applicable fiber: **FD-WG4**, **FD-EG1**, **FD-G4** • Distance to focal point: 7.5 ± 0.5mm • Spot diameter: ϕ0.3mm (**FD-EG1**), ϕ0.5mm (**FD-WG4**, **FD-G4**)	
Digital panel controller		**CA2-T2**	NPN open-collector transistor	This is a very small controller which allows two independent threshold level settings. • Supply voltage: 24V DC ± 10% • No. of inputs: 1 No. (sensor input) • Input range: 1 to 5V DC • Main functions: Threshold level setting function, zero-adjust function, scale setting function, hysteresis setting function, start/hold function, auto-reference function, power supply ON-delay function, etc.

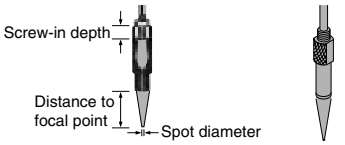
Notes: 1) The sensing range is defined as the range until the saturation indicator lights up.

Expansion lens **Super-expansion lens**



Side-view lens **Pinpoint spot lens**

Zoom lens **Finest spot lens**



Digital panel controller

• **CA2** series

SPECIFICATIONS

Fibers

Item \ Type	Standard, small fiber head, small diameter, sharp bend, long sensing range with lens, wide beam, array, high precision
Allowable bending radius	R25mm or more [Sharp bend: R1mm or more (**FD-WG4**, **FD-WSG4**: R2mm or more)]
Ambient temperature	−40 to +70°C (Sharp bend: −40 to +60°C, **FD-EG1**: −20 to +60°C) (No dew condensation or icing allowed), Storage: −40 to +70°C (Sharp bend: −40 to +60°C, **FD-EG1**: −20 to +60°C)
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH
Material	Fiber core: Acrylic Sheath: Polyethylene Fiber head: Brass (Nickel-plated) (Threaded part of standard, threaded part of small diameter, threaded type of sharp bend, high precision, array) Stainless steel (SUS) (**FT-SFM2**, small fiber head, **FT-SNFM2**, **FD-SNFM2**, non-threaded type of sharp bend, **FT-SFM2L**, sleeve part of sleeve-attached fiber) Polycarbonate (**FT-A8**, Lens of **FT-WS8L**), Polyolefin (Lens of **FT-A8**)
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: 1 No. of **FX-CT1** (Fiber cutter) **FD-WG4, FD-WSG4 or FD-G4:** ϕ1mm fiber attachment and ϕ1.3mm fiber attachement Small diameter free-cut type fiber: ϕ1mm fiber attachment **FT-T80, FD-T80 or FD-S80:** ϕ 1.3mm fiber attachment **FT-WS4, FD-WT8, FD-WS8: FX-AT10** (ϕ1mm fiber attachment) **FT-A8:** 2 Nos. of 0.5 X 12mm seal type slit mask and 2 Nos. of 1 X 12mm seal type slit mask

Amplifier

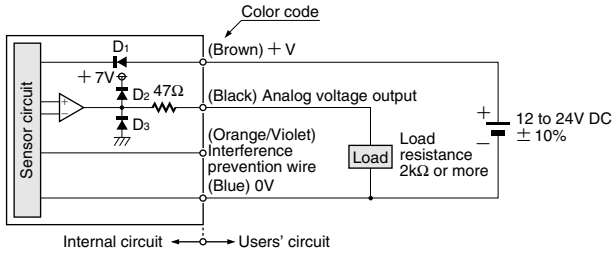
Item \ Model No.		**FX-11A**
Supply voltage		12 to 24V DC ± 10% Ripple P-P 10% or less
Current consumption		35mA or less
Analog output		Analog voltage • Output voltage: 1 to 5V (proportional to incident light intensity) • Output current: 5mA or less • Output impedance: 47Ω • Load resistance: 2kΩ or more • Temperature characteristics: 0.3% F.S. /°C or less
Response time		Switchable either 1ms or less, or 10ms or less
Incident beam indicator		Red LED (brightens up in proportion to analog output voltage)
Saturation indicator		Green LED (lights up when the analog output voltage reaches 5V)
Sensitivity adjuster		8-turn potentiometer with indicator
Interference prevention function		Incorporated
Environmental resistance	Ambient temperature	−10 to +55°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	Sunlight: 1,000 ℓx at the light-receiving face, Incandescent light: 1,000 ℓx at the light-receiving face
	Noise immunity	Power line: 240Vp, 10ms cycle, and 0.5 μs pulse width; Radiation: 300Vp, 10ms cycle, and 0.5 μs pulse width (with noise simulator)
	Voltage withstandability	1,000V AC for one min. between all supply terminals connected together and enclosure (Note 1)
	Insulation resistance	20MΩ, or more, with 250V DC megger between all supply terminals connected together and enclosure (Note 1)
	Vibration resistance	10 to 150Hz frequency, 0.75mm amplitude in X, Y and Z directions for two hours each
	Shock resistance	100m/s^2 acceleration (10G approx.) in X, Y and Z directions for five times each
Emitting element		Red LED (modulated)
Material		Enclosure: Heat-resistant ABS, Cover: Polycarbonate, Fiber lock lever: PES
Cable		0.2mm^2 4-core cabtyre cable, 2m long
Cable extension		Extension up to total 100m is possible with 0.3mm^2, or more, cable. (Note 2)
Weight		60g approx.
Accessories		**MS-DIN-2** (Amplifier mounting bracket): 1 No., Adjusting screwdriver: 1 No.

Notes: 1) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.
2) Take care that the output voltage drops when the cable is extended.

FX-11A

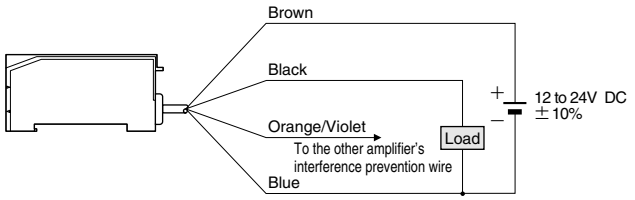
I/O CIRCUIT AND WIRING DIAGRAMS

I/O circuit diagram



Symbols ... D_1: Reverse supply polarity protection diode
D_2, D_3: Surge absorption diode

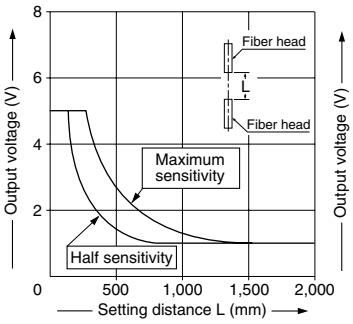
Wiring diagram



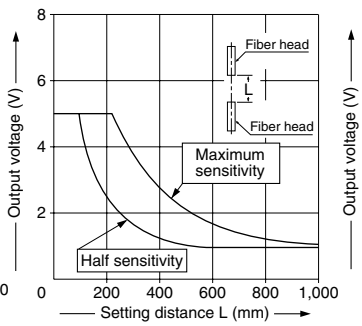
SENSING CHARACTERISTICS (TYPICAL)

Correlation between setting distance and output voltage

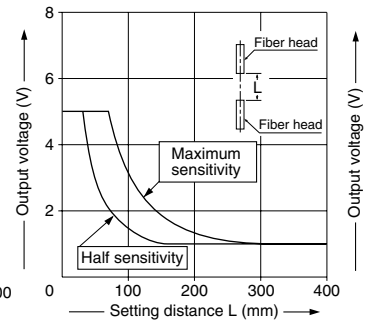
FT-B8 Thru-beam type



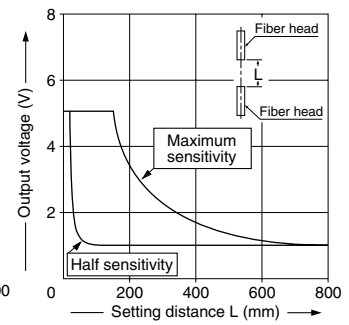
FT-FM2 FT-FM2S FT-FM2S4 FT-SFM2 FT-T80 Thru-beam type



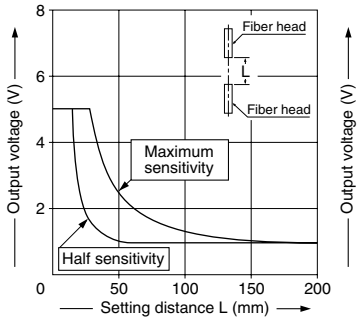
FT-NFM2 FT-NFM2S FT-NFM2S4 FT-SNFM2 Thru-beam type



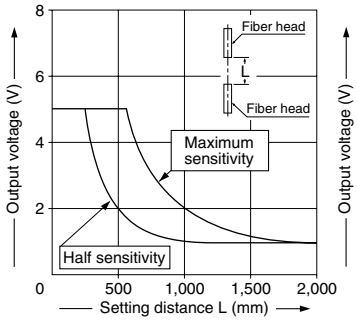
FT-W8 FT-WS8 Thru-beam type



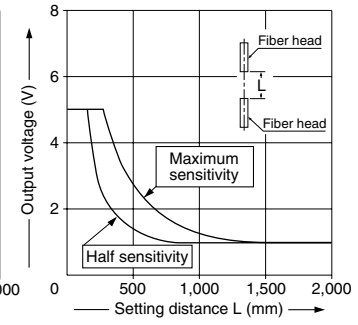
FT-W4 FT-WS4 Thru-beam type



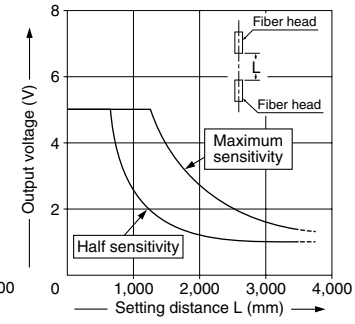
FT-WS8L Thru-beam type



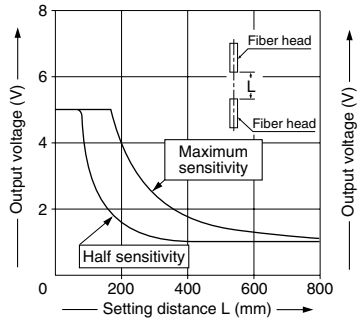
FT-SFM2L Thru-beam type



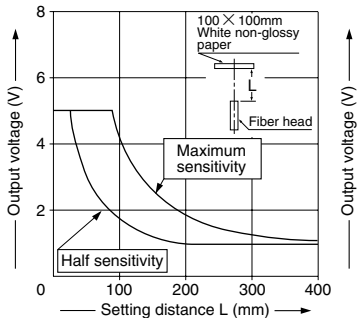
FT-A8 Thru-beam type



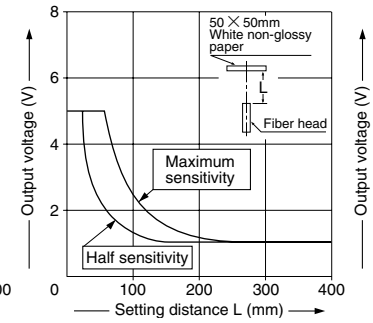
FT-AFM2 FT-AFM2E Thru-beam type



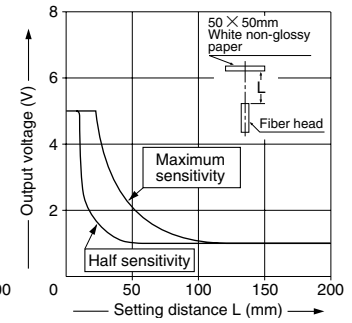
FD-B8 Reflective type



FD-FM2 FD-FM2S FD-FM2S4 FD-T80 FD-S80 Reflective type



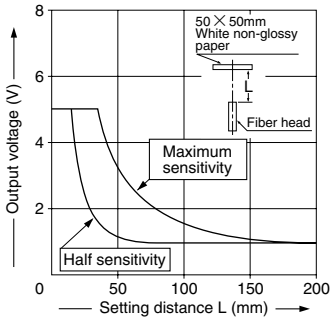
FD-NFM2 FD-NFM2S FD-T40 FD-NFM2S4 FD-SNFM2 Reflective type



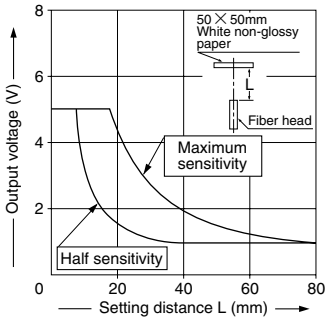
SENSING CHARACTERISTICS (TYPICAL)

Correlation between setting distance and output voltage

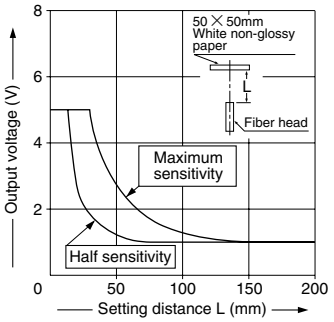
FD-W8 FD-WT8 FD-WS8 Reflective type



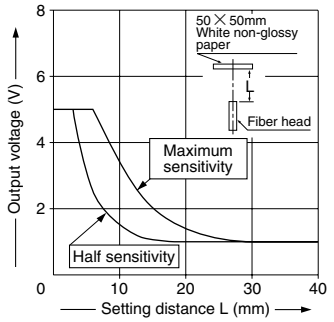
FD-WG4 FD-WSG4 Reflective type



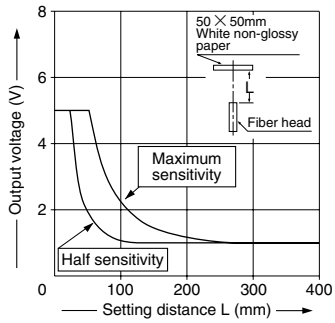
FD-G4 Reflective type



FD-EG1 Reflective type



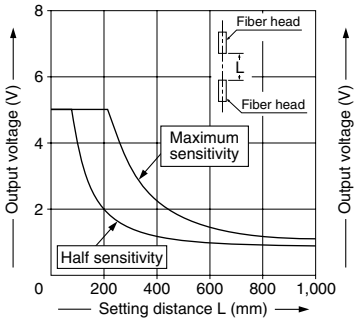
FD-AFM2 FD-AFM2E Reflective type



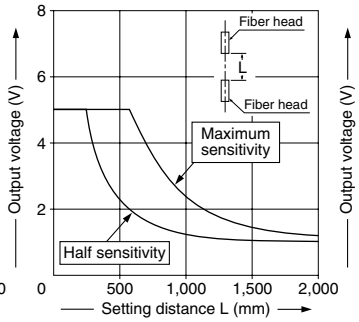
Correlation between setting distance and output voltage when using seal type slit masks

FT-A8 Thru-beam type

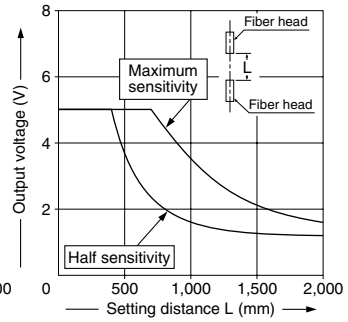
With slit mask (0.5 × 12mm) on one side



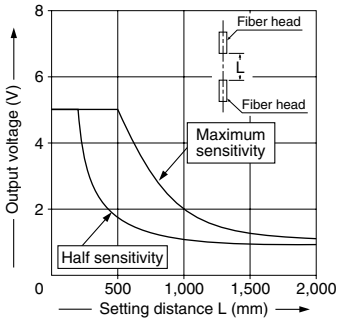
With slit masks (0.5 × 12mm) on both sides



With slit mask (1 × 12mm) on one side



With slit masks (1 × 12mm) on both sides



FX-11A

PRECAUTIONS FOR PROPER USE

Amplifier

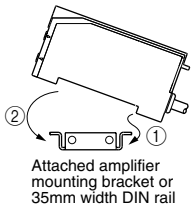
This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

Mounting

How to mount the amplifier

① Fit the rear part of the amplifier on the attached amplifier mounting bracket (**MS-DIN-2**) or a 35mm width DIN rail.

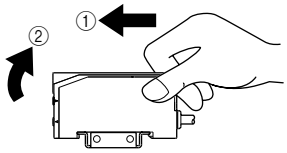
② Press down the front part of the amplifier on the amplifier mounting bracket (**MS-DIN-2**) or DIN rail to fit it.



How to remove the amplifier

① Push the amplifier forward.

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

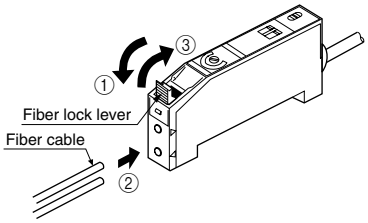


How to connect the fiber cables

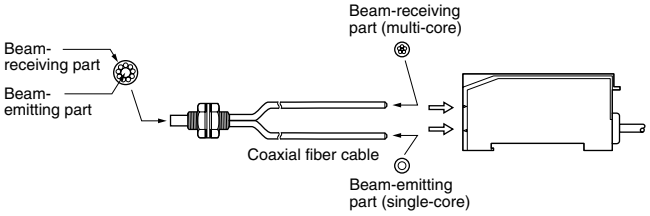
① Unlock the fiber lock lever.

② Insert the fiber cables slowly into the inlets until they stop.

③ Lock the fiber lock lever in the original position.

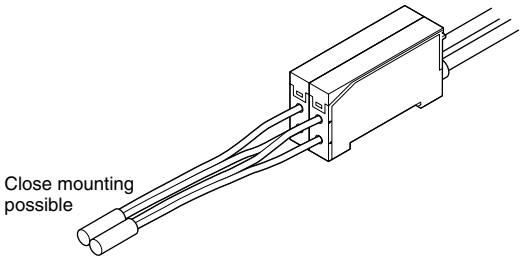


Notes: 1) In case the fiber cables are not inserted to a position where they stop, the sensing range reduces.
2) With the coaxial reflective type fiber, such as, **FD-G4** or **FD-FM2**, insert the center fiber cable (single-core) into the beam-emitting inlet and the outer fiber cable (multi-core) into the beam-receiving inlet. If they are inserted in reverse, the sensing accuracy will deteriorate.



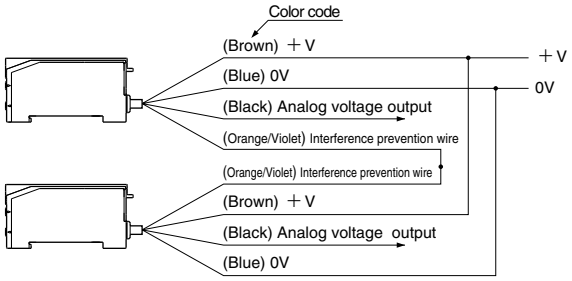
Interference prevention function

• Two sets of fibers can be mounted close together because an interference prevention function has been incorporated in **FX-11A**.
The wiring and the setting of the interference prevention selection switch should be done as follows.



① **Wiring**

• Connect together the interference prevention wires and the 0V wires of the two **FX-11A** amplifiers, respectively.



② **Interference prevention selection switch**

• Set the interference prevention selection switch to 'MAIN' for one amplifier and to 'SUB' for the other amplifier.

※ In case interference function is not used

• Make sure to set the interference prevention selection switch to 'MAIN'. If it is set to 'SUB', the sensor will not work.

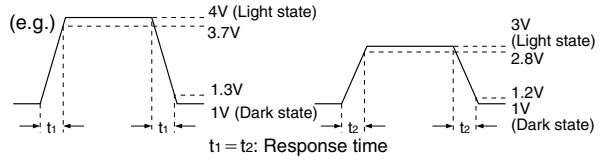
• Insulate the interference prevention wire.

PRECAUTIONS FOR PROPER USE

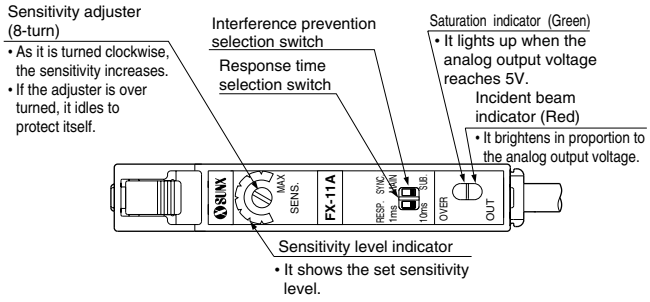
Amplifier

Response time selection

- The response time of **FX-11A** can be selected either '1ms' or '10ms'. If your detecting application does not need a quick response, '10ms' is recommended as it makes the detection secure against inductive noise and ambient light. If you choose '1ms', pay attention to electromagnetic noise and ambient light.
- The response time of **FX-11A** is the time required for the output voltage to rise from 1V (dark state voltage) to [90% of {light state voltage − 1V (dark state voltage)} + 1V (dark state voltage)] or the time required for the output voltage to fall from the light state voltage to [10% of {light state voltage − 1V (dark state voltage)} + 1V (dark state voltage)]. The response time of **FX-11A** is constant regardless of the amplitude of the output voltage.



Part description



Sensitivity adjustment

Step	Operation	Sensitivity adjuster
①	Turn the sensitivity adjuster fully counterclockwise (minimum sensitivity).	MAX. SENS.
②	Adjust the relative positions of the fiber heads or the fiber head and the object so as to receive as much incident beam as possible. **Thru-beam type** **Reflective type** Perfect beam-alignment Maximum reflected beam	———
③	Turn the sensitivity adjuster clockwise until the saturation indicator lights up. Once it lights up, turn the sensitivity adjuster counterclockwise until the saturation indicator lights off. This is the most sensitive point before saturation.	MAX. SENS.

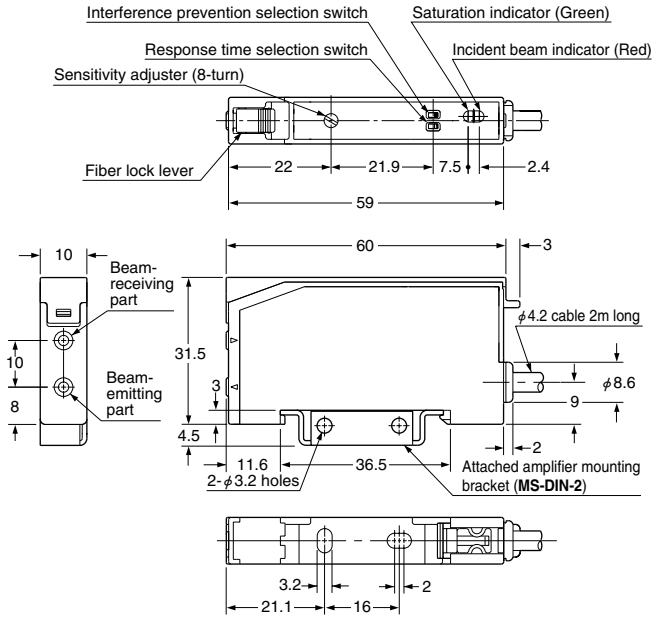
Others

- Do not use during the initial transient time (50ms) after the power supply is switched on.

DIMENSIONS (Unit: mm)

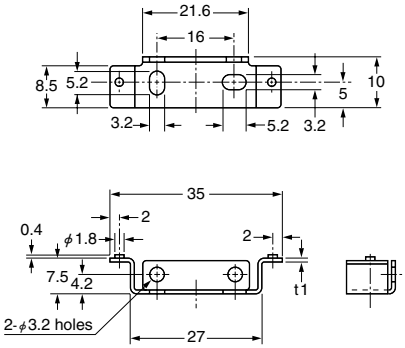
FX-11A Amplifier

Assembly dimensions with attached amplifier mounting bracket



Note: The top view is shown without the cover.

MS-DIN-2 Amplifier mounting bracket (Accessory for **FX-11A**)



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