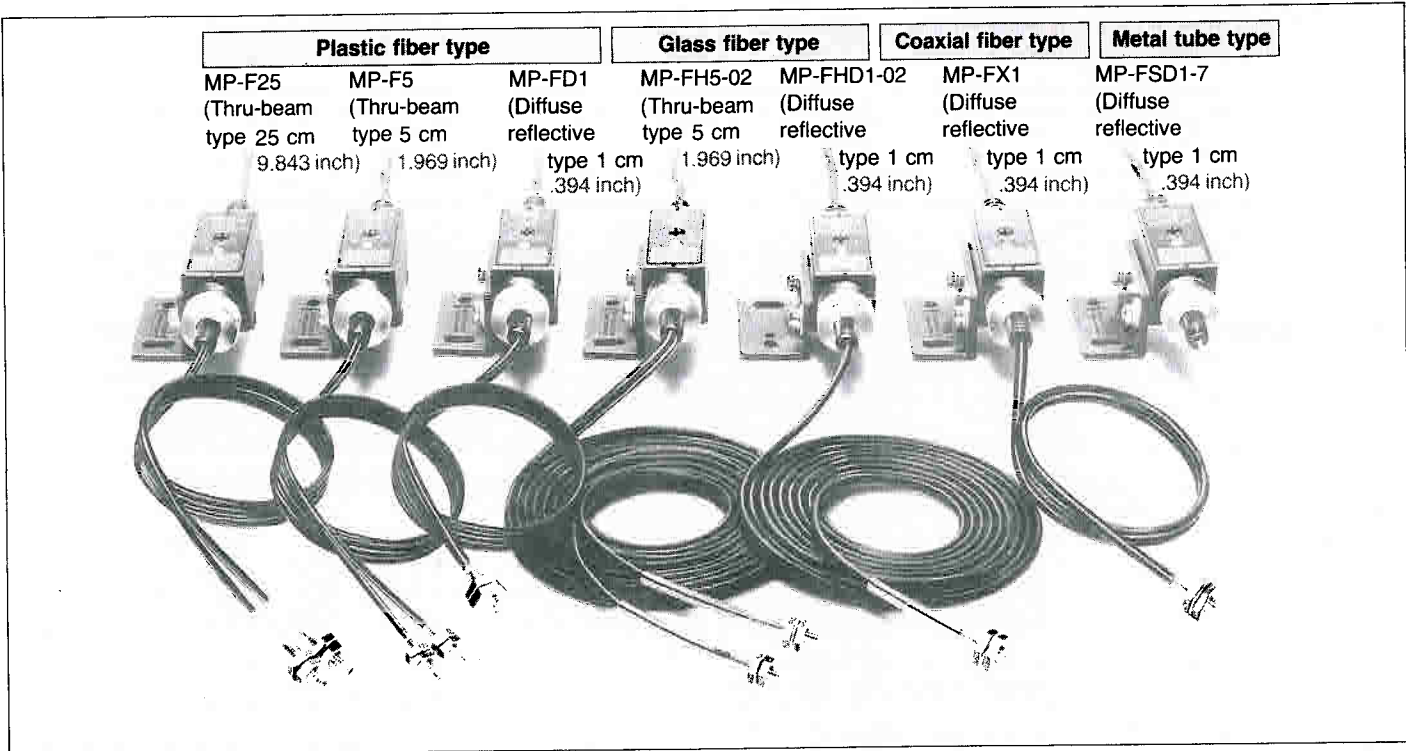




MP-F FIBER SELFCONTAINED-DC TYPE

Components for advanced technology

MP-F Photoelectric Sensors



- Complete line for easy selection
 - Plastic fiber as standard
 - Glass fiber for high temperature condition
 - Coaxial fiber for accurate detection
 - Metal tube type for easy setting
- Tiny target detection
- Environmental resistance (IEC IP66)
- No misoperation of output during power on or off condition
- Operation and adjustment indication with LED

PRODUCT TYPE

1. MP-F Amplifier unit

Load operation condition	Part No.	Packing	
		Inner	External
When light enters, output transistor ON	MP-F1A-DC12/24 V	1 pc	10 pcs
When light is blocked, output transistor ON	MP-F2A-DC12/24 V	1 pc	10 pcs

2. MP-F fiber unit

Type	Detection method	Max. sensing distance	Fiber length	Part No.	Packing		
					Inner	External	
Glass fiber type	Thru-beam type	5 cm approx. 2 inches	2 m 2.2 yards	MP-FH5-02	1 pc	10 pcs	
	Diffuse reflective type	1 cm approx. 0.4 inches	2 m 2.2 yards	MP-FHD1-02	1 pc	10 pcs	
Coaxial fiber type	Diffuse reflective type	1 cm approx. 0.4 inches	50 cm approx. 20 inches	MP-FX1	1 pc	10 pcs	
		1 cm approx. 0.4 inches	1 m 1.1 yards	MP-FX1-01	1 pc	10 pcs	
Metal tube type	Diffuse reflective type	1 cm approx. 0.4 inches	7 cm 2.8 inches	MP-FSD1-7	1 pc	10 pcs	
Plastic fiber type	Thru-beam type	5 cm approx. 2 inches	50 cm approx. 20 inches	MP-F5	1 pc	10 pcs	
			1 m 1.1 yards	MP-F5-01	1 pc	10 pcs	
			2 m 2.2 yards	MP-F5-02	1 pc	10 pcs	
			3 m 3.3 yards	MP-F5-03	1 pc	10 pcs	
			50 cm approx. 20 inches	MP-F25	1 pc	10 pcs	
			1 m 1.1 yards	MP-F25-01	1 pc	10 pcs	
	Diffuse reflective type	1 cm approx. 0.4 inches	25 cm 9.8 inches	2 m 2.2 yards	MP-F25-02	1 pc	10 pcs
				3 m 3.3 yards	MP-F25-03	1 pc	10 pcs
				50 cm approx. 20 inches	MP-FD1	1 pc	10 pcs
				1 m 1.1 yards	MP-FD1-01	1 pc	10 pcs
				2 m 2.2 yards	MP-FD1-02	1 pc	10 pcs
				3 m 3.3 yards	MP-FD1-03	1 pc	10 pcs

COMBINATION OF FIBER UNIT AND AMPLIFIER UNIT OPERATION

Fiber unit	Amplifier unit	Output circuit diagram,	Operating condition of output transistor		Operation indicator	Operating condition of load	
			Relay, etc.	MP-PC Control Pack			
Thru-beam type MP-F5 MP-F25 MP-FH5	Light input ON type (MP-F1A)		Light input ON (Light ON)	OFF when object detected (equivalent to a contact)	Lights with light input	Operates with light input	Output relay operates with light input
	Light interrupted ON type (MP-F2A)		Light interrupted ON (dark ON)	ON when object detected (equivalent to a contact)	Lights with light input	Operates with light interrupted	Output relay operates with light interrupted
Diffuse reflective type MP-FD1 MP-FHD1 MP-FX1 MP-FSD1	Light input ON type (MP-F1A)		Light input ON (Light ON)	ON when object detected (equivalent to a contact)	Lights with light input	Operates with light input	Output relay operates with light input
	Light interrupted ON type (MP-F2A)		Light interrupted ON (dark ON)	OFF when object detected (equivalent to a contact)	Lights with light input	Operates with light interrupted	Output relay operates with light interrupted

Notes: In order to improve resistance to noise, because the diecast case is the condenser ground, when installing, use the special bracket provided. When a different mounting bracket is used, insulation should be provided.

SPECIFICATIONS

1. Ratings

Item	Type	When used with MP-F1A amplifier unit	When used with MP-F2A amplifier unit
Operating side	Rated operating voltage	DC 12 to 24 V	DC 12 to 24 V
	Rated current consumption	Max. 40 mA (excluding load)	Max. 40 mA (excluding load)
Load side	Output current capacity	Max. 80 mA	Max. 80 mA
	Operating method	With light input, output transistor ON (light ON)	When light interrupted, output transistor ON (dark ON)

2. Performance outline

Fiber type	Detection method	Plastic fiber			Glass fiber		Coaxial fiber	Metal tube
		Thru-beam type		Diffuse reflective type	Thru-beam type	Diffuse reflective type	Diffuse reflective type	Diffuse reflective type
Combination	Fiber unit	MP-F5 MP-F5-01 MP-F5-02 MP-F5-03	MP-F25 MP-F25-01 MP-F25-02 MP-F25-03	MP-FD1 MP-FD1-01 MP-FD1-02 MP-FD1-03	MP-FH5-02	MP-FHD1-02	MP-FX1 MP-FX1-01	MP-FSD1-7
Item	Amplifier unit	MP-F1A-DC12/24V, MP-F2A-DC12/24V						
Standard target		2 mm .079 inch dia. metal plate (black frosted)	6 mm .236 inch dia. metal plate (black frosted)	White drawing paper (1 × 1 cm ²) (.394 × .394 inch ²)	2 mm .079 inch dia. metal plate (black frosted)	White drawing paper (1 × 1 cm ²) (.394 × .394 inch ²)		
Minimum detectable target		1 mm .039 inch dia. opaque target	2.5 mm .098 inch dia. opaque target	0.1 mm .004 inch dia. copper wire	1 mm .039 inch dia. opaque target	0.05 mm .002 inch dia. copper wire		
Detectable target		Opaque target		Opaque target transparent target	Opaque target	Opaque target, transparent target		
Operating voltage range		10.8 to 26.4 V DC (Including ripple (P-P))						
Max. setting distance**		5 cm approx. 2 inches	25 cm 9.8 inches	1 cm approx. 0.4 inches	5 cm approx. 2 inches	1 cm approx. 0.4 inches	1 cm approx. 0.4 inches	1 cm approx. 0.4 inches
Operating angle		Above 10°	Above 10°	—	Above 10°	—	—	—
Hysteresis**		—	—	Less than 2 mm (.79 inch at max. sensing distance)	—	Less than 2 mm .079 inch (at max. sensing distance)		
Detection speed		100 times/s						
Operation indicating method		With light input, indicator lights (visible red light)						
Vibration resistance	Functional	10 to 55 Hz (1 cycle/min)						
	Destructive	Oscillation amplitude 1.5 mm (2 h on 3 axes)						
Shock resistance	Functional	100 G (6 times on 3 axes)						
	Destructive	100 G (6 times on 3 axes)						
Protection construction		Diecast case (equivalent to IEC IP66)						
Ambient use conditions	Ambient light level		Incandescent lamp max. 3,000 lux					
			Daylight max. 10,000 lux					
	Ambient use temperature	Amplifier	-25°C—+55°C -13°F to +131°F					
		Fiber	-40°C—+70°C -40°F to +158°F	-40°C—+200°C -40°F to +392°F		-40°C—+70°C -40°F to +158°F	-40°C—+200°C -40°F to +392°F	
Ambient use humidity		Max. 85% RH						
Amplifier permissible bending radius		5 mm .197 inch		25 mm .984 inch		10 mm .394 inch		
Fiber material		Plastic fiber, polyethylene covering			Glass fiber, teflon covering		Plastic fiber, polyethylene covering	Glass fiber, annealed stainless tube
Fiber length		50 cm approx. 20 inches (1 m 1.1 yards, 2 m 2.2 yards, 3 m 3.3 yards available)		2 m 2.2 yards		50 cm approx. 20 inches (1 m 1.1 yards available)	7 cm 2.8 inches	

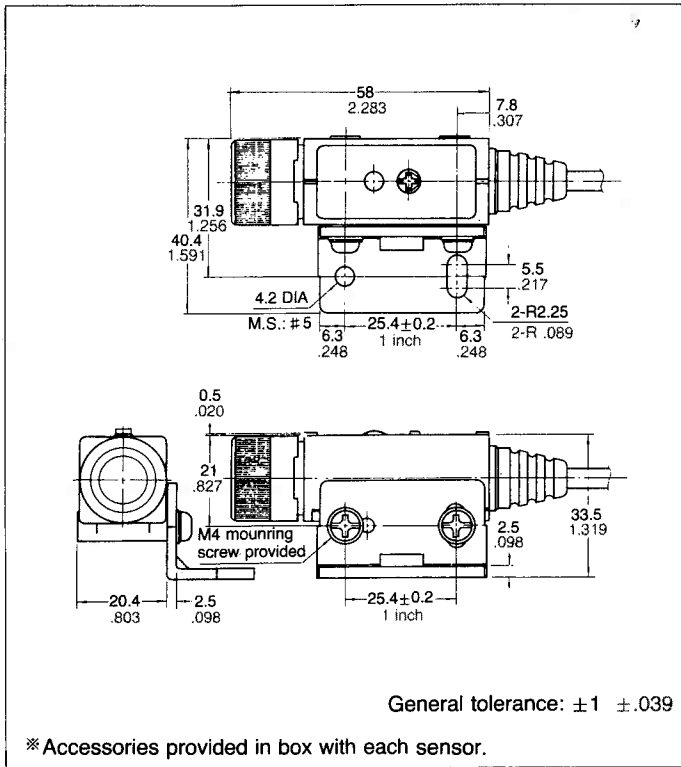
Notes: 1) Unless otherwise specified, the measurement conditions are: the rated operating voltage, battery power, ambient temperature of 20°C +68°F, standard target, light intensity at receiving surface of less than 200 lux.

**2) In the diffuse reflective type, because the max. sensing distance and hysteresis are the distance with a standard target, the distances will vary due to target's material, color, size, etc.

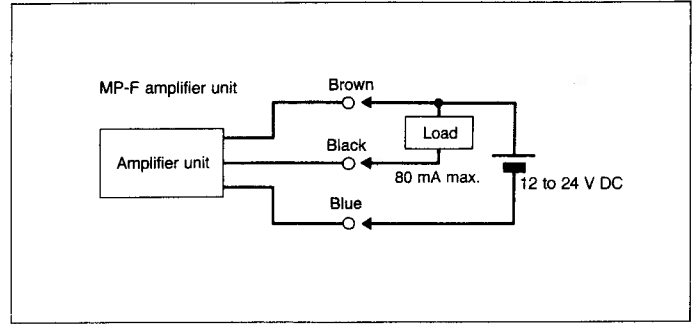
DIMENSIONS

When special bracket is used for mounting

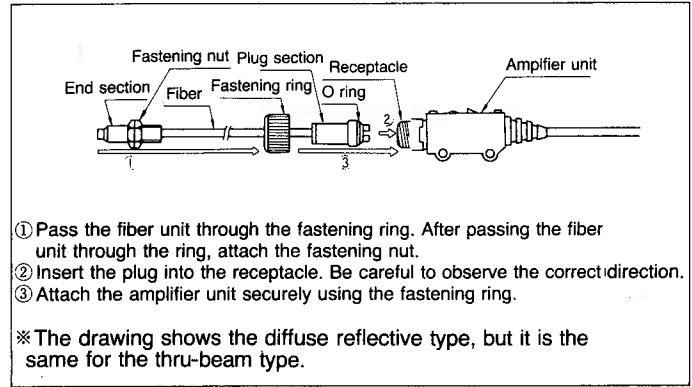
mm inch



WIRING DIAGRAM



METHOD FOR CONNECTING fiber unit to amplifier unit



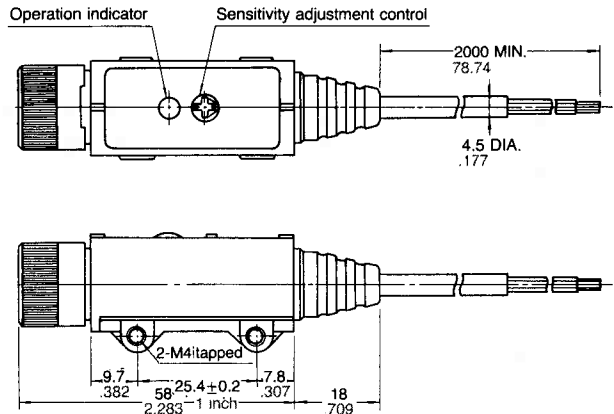
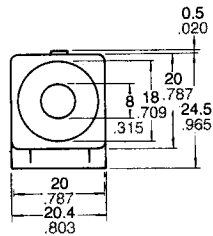
DIMENSIONS

MP-F amplifier unit

mm inch



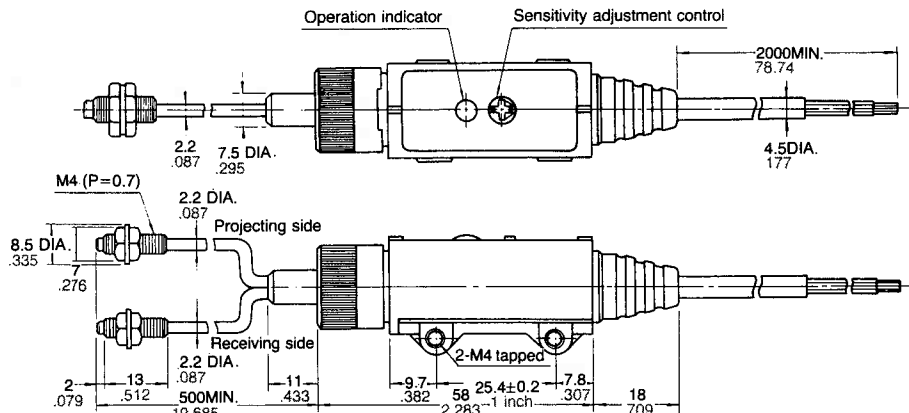
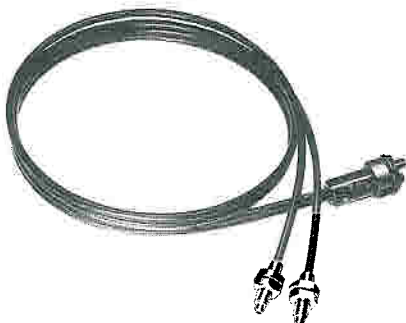
MP-F1A-DC12/24V
ON with light input
MP-F2A-DC12/24V
ON with light interrupted



General tolerance: $\pm 1 \pm .039$

MP-F5 fiber unit

(Plastic fiber thru-beam type)

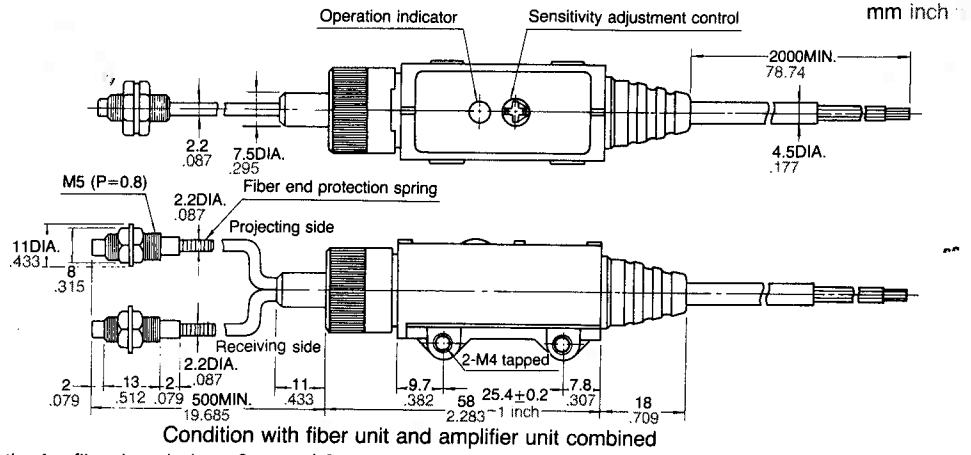
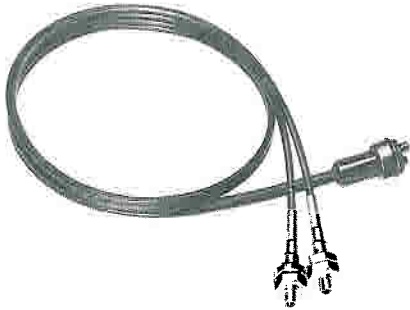


Condition with fiber unit and amplifier unit combined

*Dimensions are the same other than fiber lengths for fiber length 1 m, 2 m and 3 m types. 1.1 yards, 2.2 yards and 3.3 yards type.

General tolerance: $\pm 1 \pm .039$

MP-F25 fiber unit
(Plastic fiber thru-beam type)

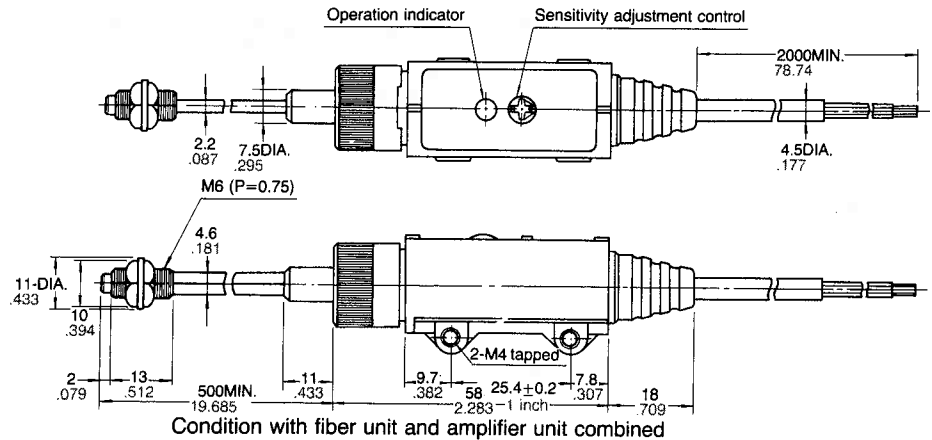


Condition with fiber unit and amplifier unit combined

※Dimensions are the same other than fiber lengths for fiber length 1 m, 2 m and 3 m types. 1.1 yards, 2.2 yards and 3.3 yards type.

General tolerance: $\pm 1 \pm .039$

MP-FD1 fiber unit
(Diffuse reflective type)

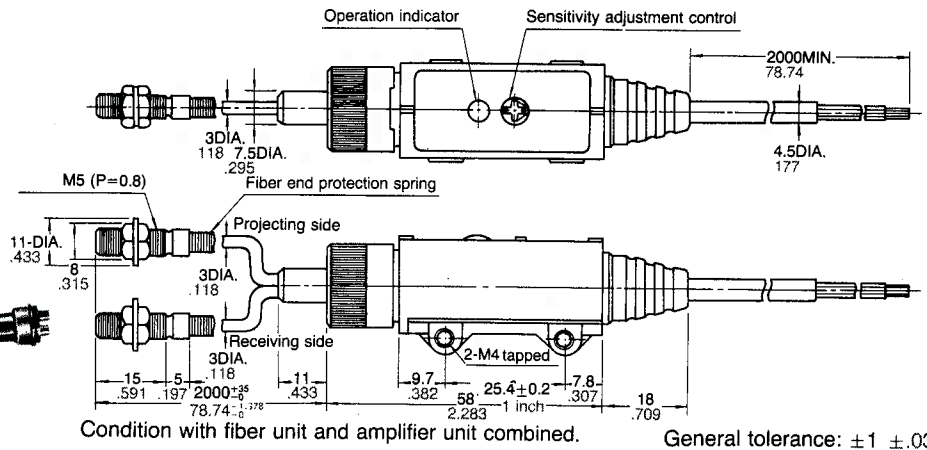
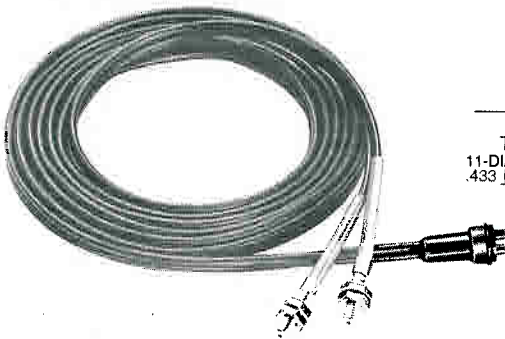


Condition with fiber unit and amplifier unit combined

※Dimensions are the same other than fiber lengths for fiber length 1 m, 2 m and 3 m types. 1.1 yards, 2.2 yards and 3.3 yards type.

General tolerance: $\pm 1 \pm .039$

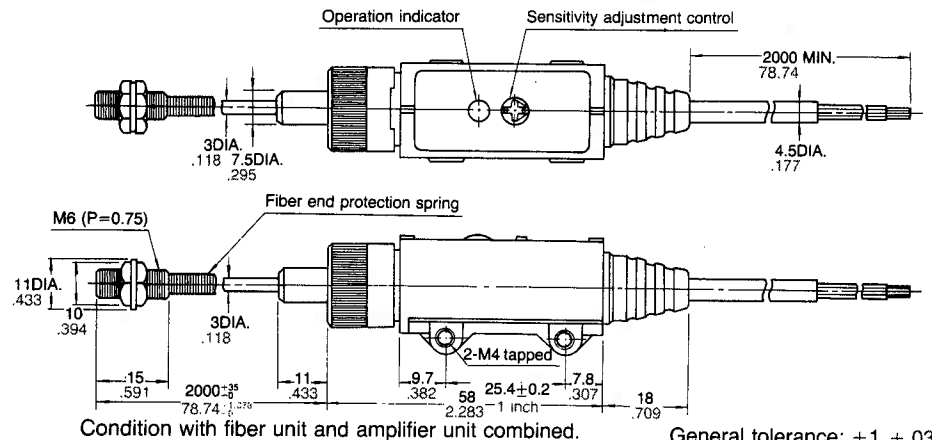
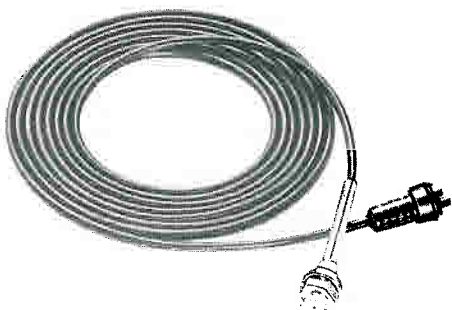
MP-FH5-02 fiber unit
(Glass fiber thru-beam type)



Condition with fiber unit and amplifier unit combined.

General tolerance: $\pm 1 \pm .039$

MP-FHD1-02 fiber unit
(Glass fiber diffuse reflective type)

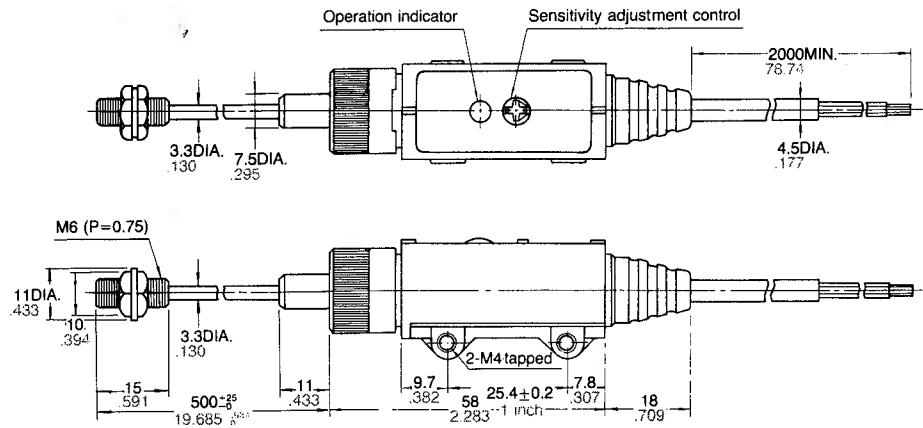


Condition with fiber unit and amplifier unit combined.

General tolerance: $\pm 1 \pm .039$

MP-FX1 fiber unit
(Coaxial fiber diffuse reflective type)

mm inch

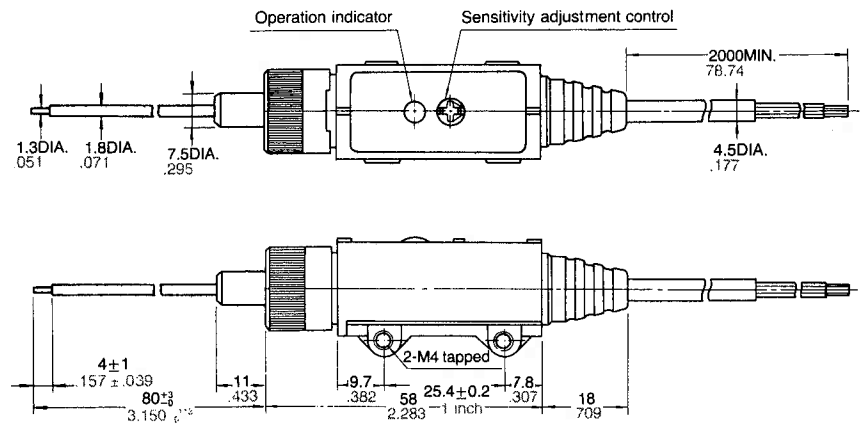
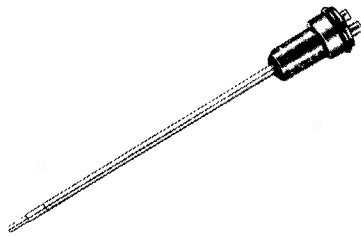


Condition with fiber unit and amplifier unit combined

* Dimensions are the same other than fiber length for MP-FX1-01 (fiber length 1 m 1.1 yard type).

General tolerance: ±1 ±.039

MP-FSD1-7 fiber unit
(Metal tube diffuse reflective type)



Condition with fiber unit and amplifier unit combined

General tolerance: ±1 ±.039

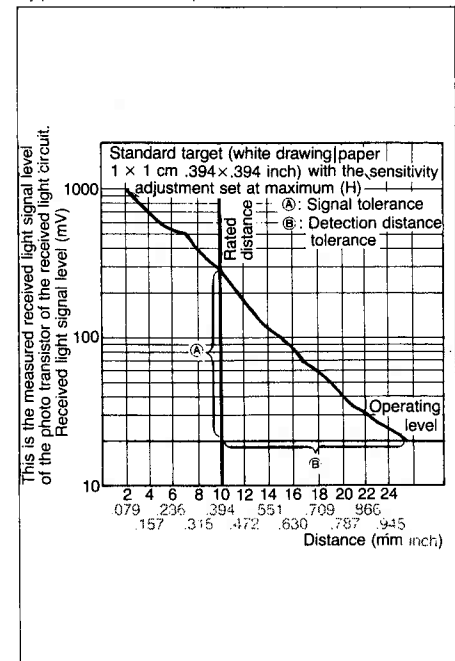
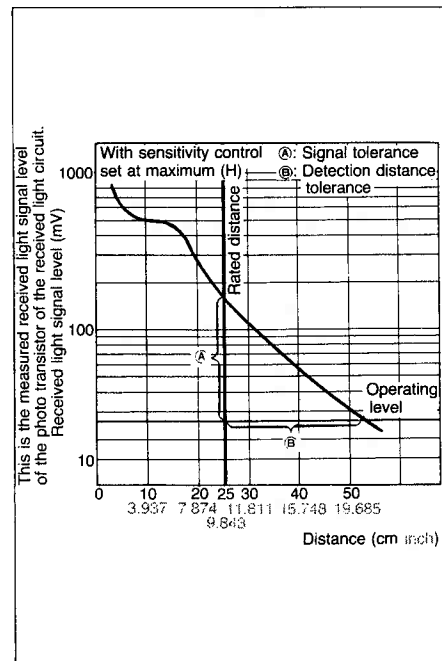
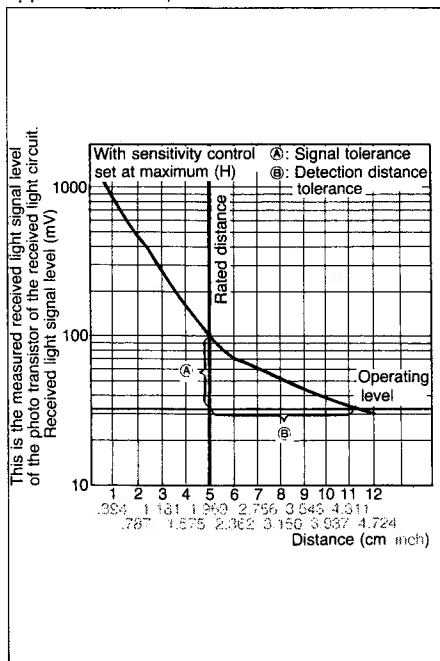
DATA

1. Characteristic of light level received vs distance

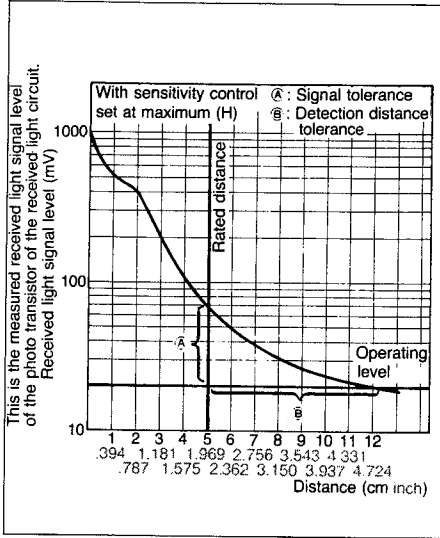
MP-F2A amplifier unit
MP-F5A fiber unit
(Plastic fiber thru-beam type 5 cm approx. 2 inches)

MP-F2A amplifier unit
MP-F25 fiber unit
(Plastic fiber thru-beam type 25 cm 9.8 inches)

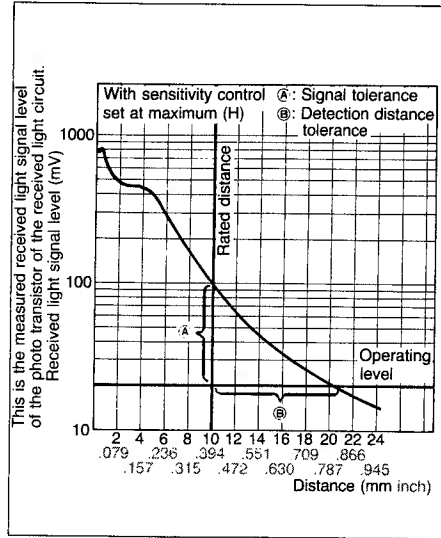
MP-F1A amplifier unit
MP-FD1 fiber unit
(Plastic fiber diffuse reflective type 1 cm approx. 0.4 inches)



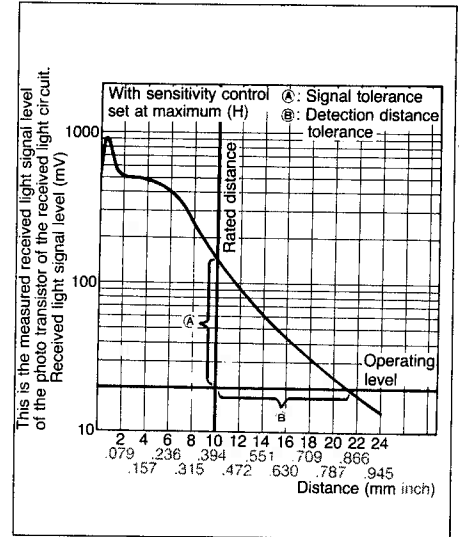
MP-F2A amplifier unit
MP-FH5-02 fiber unit
(Glass fiber thru-beam type 5 cm
approx. 2 inches)



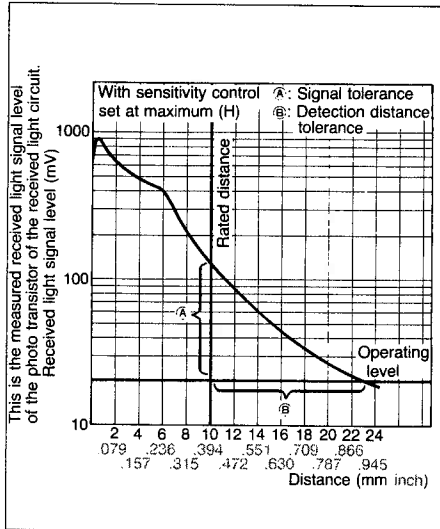
MP-F1A amplifier unit
MP-FHD1-02 fiber unit
(Glass fiber diffuse reflective type 1 cm
approx. 0.4 inches)



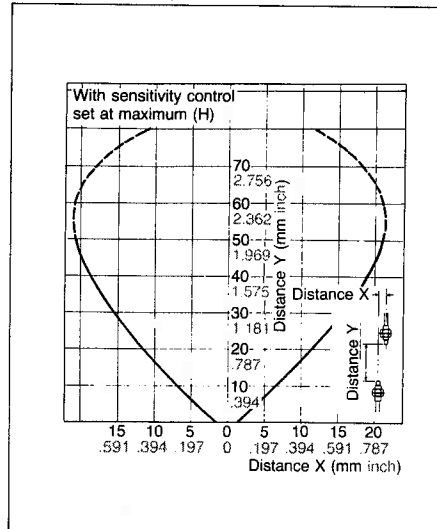
MP-F1A amplifier unit
MP-FX1 fiber unit
(Coaxial fiber diffuse reflective type 1 cm
approx. 0.4 inches)



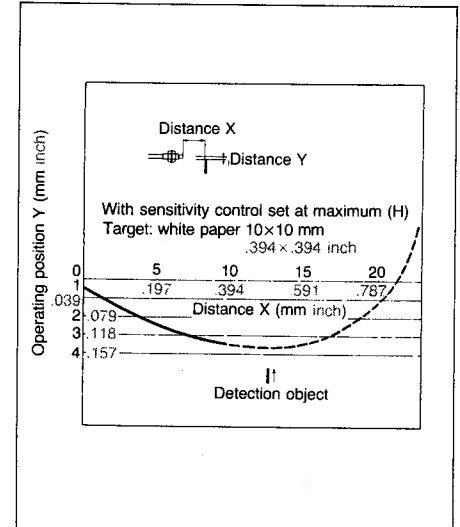
MP-F1A amplifier unit
MP-FSD1-7 fiber unit
(Metal tube diffuse reflective type 1 cm
approx. 0.4 inches)



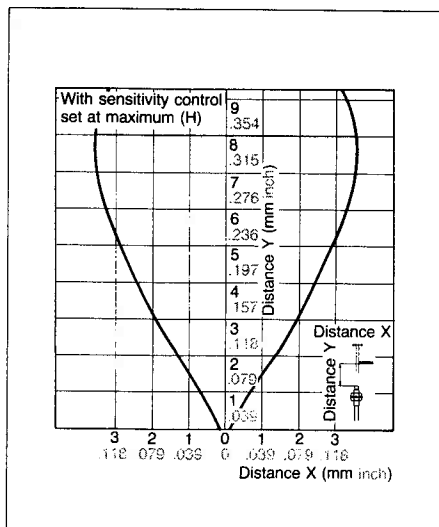
2. Operation range characteristics
MP-F2A amplifier unit
MP-F5 fiber unit
(Plastic fiber thru-beam type 5 cm
approx. 2 inches)



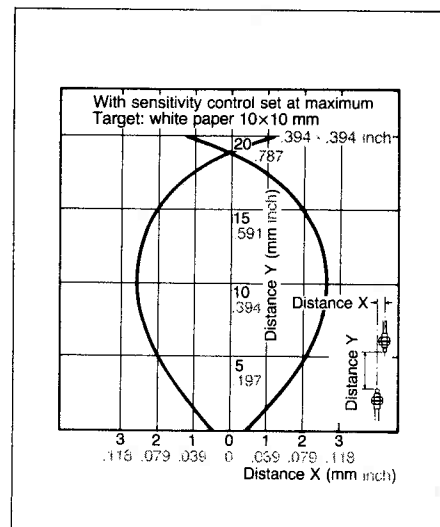
MP-F1A amplifier unit
MP-FD1 fiber unit
(Plastic fiber diffuse reflective type 1 cm
approx. 0.4 inches)



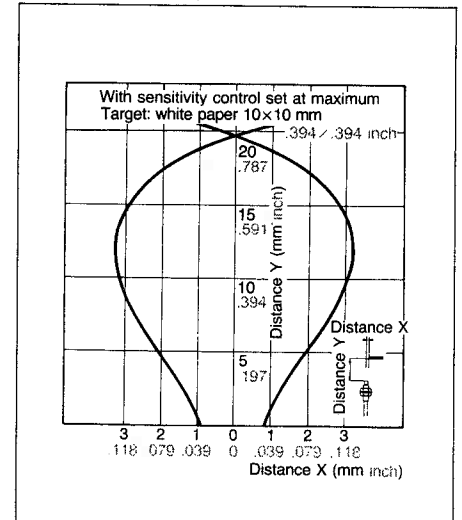
MP-F2A amplifier unit
MP-FH5-02 fiber unit
(Glass fiber thru-beam type 5 cm 2 inches)



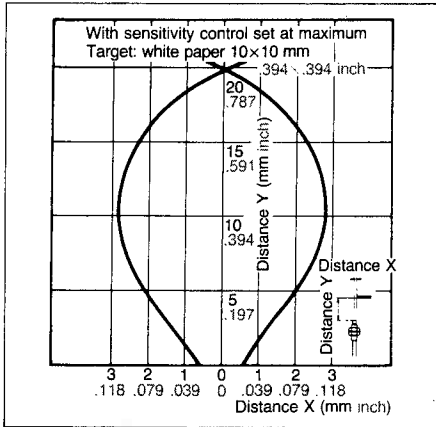
MP-F1A amplifier unit
MP-FHD1-02 fiber unit
(Glass fiber diffuse reflective type)



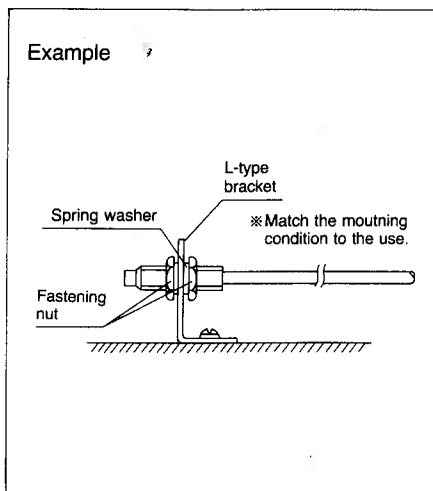
MP-F1A amplifier unit
MP-FX1 fiber unit
(Coaxial fiber diffuse reflective type 1 cm
approx. 0.4 inches)



MP-F1A amplifier unit
 MP-FSD1-7 fiber unit
 (Metal tube diffuse reflective type 1 cm
 approx. 0.4 inches)



ATTACHING FIBER UNIT END SECTION



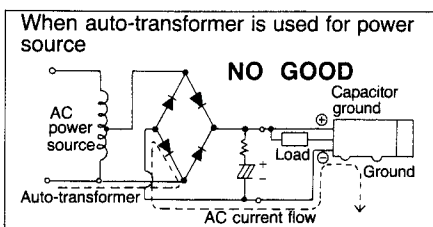
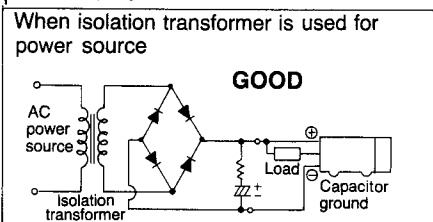
List of fastening nuts and spring washers (Unit: mm)

Fiber unit	Parts	Fastening nut	Spring washer
MP-F5 (Thru-beam type)		M4 (P = 0.7) 4 pcs.	M4 type 2 pcs.
MP-F25 (Thru-beam type)		M5 (P = 08) 4 pcs.	M5 type 2 pcs.
MP-FD1 (Diffuse reflective type)		M6 (P = 0.75) 2 pcs.	M6 type 1 pce.
MP-FH5-02		M5 (P = 0.8) 4 pcs.	M5 type 2 pcs.
MP-FHD1-02		M6 (P = 0.75) 4 pcs.	M6 type 1 pce.
MP-FX1		M6 (P = 0.75) 2 pcs.	M6 type 1 pce.
MP-FSD1-7		Not used	Not used

CAUTIONS

1. Regarding connection

- 1) Because of the possibility of damage to the internal circuit due to erroneous connections, before applying power, carefully check the wiring.
- 2) For load relay, use a unit whose rated operating voltage is 12 V or 24 V DC. Because of the internal voltage drop in the MP-F photoelectric sensor operating voltage, care should be taken with voltage variation for the impressed voltage to the load relay.
- 3) Due to the possibility of damage to the output section with loads greater than 80 mA, care should be taken not to overload the section. If wiring is run parallel to high voltage or power wiring, misoperation can occur from inductive noise, and this can be a cause of damage. For that reason, wiring should be done in separate conduit or channels.
- 4) For extension cables, wire of greater than 0.3 mm² AWG22 should be used in a length less than 100 m 110 yards.
- 5) During mounting, if the unit is struck with a hammer or other heavy tool, there is the possibility of damaging the water-protection of the case. Sufficient care should be taken.
- 6) An isolating transformer should absolutely be used with the DC power source. If an auto-transformer (single winding transformer) is used for the DC power source, because the capacitor is grounded to the MP-F fiber photoelectric sensor, there is the possibility of an AC current flowing through one line of the source, causing burnout damage to either the photoelectric sensor or the power source.



- 7) When used with an ultrasonic welder or other high frequency device, to avoid misoperation due to an inductive current, the accessory mounting plate should absolutely be used.
 - 8) In order to improve the noise resistance capability, when a capacitor is mounted in the diecast case, the special mounting bracket should be used. If a different bracket is used, it should be one that will provide insulation.
- ### 2. Regarding ambient environment
- For amplifier unit
 - 1) Use in the range of -25°C to +55°C -13°F to +131°F ambient temperature.
 - 2) Use in the range of 10.8 V to 26.4 V DC for operating voltage.
 - 3) If a surge voltage greater than 500 V [$\pm(1 \times 40) \mu\text{s}$ single polarity full wave voltage] occurs, there is the possibility of damage to the internal circuit. For that reason a surge suppressor should be used.

- For fiber unit
 - 1) Use in a light environment where the intensity is less than 1,000 lux for fluorescent lamp, less than 3,000 lux for an incandescent lamp, and less than 10,000 lux for daylight.
 - 2) Avoid use of the plastic fiber type in locations where there is steam, dust, high level of corrosive gas, or where there can be adhesion of organic solvents. (The fiber is made of methacrylate material.)
 - 3) Use the MP-FH5-02 and MP-FHD1-02 (glass fiber type) where the ambient temperature is within the range of -40°C to +200°C -40°F to +392°F. The fiber is made of glass and the protective covering is teflon resin. There is

sufficient durability against the following liquids for momentary contact, but if there is adhesion to the end section, the light level may change and there is the possibility of misoperation.

Hydrochloric acid (20%)	Sulfuric acid (10%)	Ammonia (30%)
Transmission oil	B grade heavy oil	Methanol

- 4) For the MP-FSD1-7 (metal tube type), use in an ambient temperature range of -40°C to +200°C -40°F to +392°F. The fiber is glass and the protective covering is stainless steel. There is sufficient durability against the following liquids for momentary contact, but if there is adhesion to the end section, the light level may change and there is the possibility of misoperation.

Hydrochloric acid (5%)	Sulfuric acid (10%)	Ammonia (30%)
Transmission oil	B grade heavy oil	Methanol

- 5) For MP-FX1 (Coaxial reflection type), use in the range of -40°C to +70°C -40°F to +158°F. The fiber is methacrylate resin with a protective covering of polyethylene, and for that reason adhesion of organic solvents should be avoided.
- 6) Both the fiber unit and amplifier unit are water-protected (IEC IP66), but object detection in water or where there is direct impingement of rain should be avoided.

3. Regarding adjustment of diffused reflection type sensitivity

- 1) Temporarily fasten the fiber unit with the detecting surface positioned in the direction of the object to be detected.
- 2) With the condition of no object being present, slowly turn the sensitivity control counterclockwise from the maximum position (H), and determine the position where the operation indicator light goes out. If the light is extinguished even in the maximum position, that position is set as the H position.

3) With a target in the position to be detected, turn the sensitivity control slowly counterclockwise and determine the position where the operation indicator light goes out.

4) Set the control midway between the position of 2) and the position of 3).

5) Fasten the head of the fiber unit.

When fastening, securely tighten the mounting so that there will be no shifting due to vibration or shock.

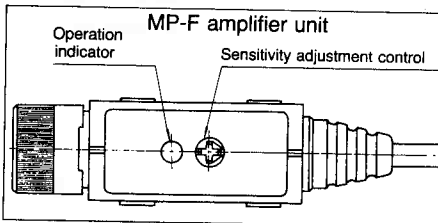
Note 1: If the position for 2) and 3) adjustments above are less than 2 graduations, change the detection surface position and repeat the steps 1) to 4), to suppress the external factors causing the variation due to ambient temperature change, or variation due to position change of the target.

Note 2: Because there is a difference in detection as a result of material, color, size, form, direction, and other ambient conditions, a check should be made with the actual target. Also, because there is a change in the light transmission due to the angle of bend of the fiber, avoid using close to the boundary limit of the operating region. Use the unit at about 2/3 the distance to the boundary limit.

4. Regarding adjustment of the light axis for the separate type

1) Set the projector and the receiver fiber unit in a straight line.

2) By means of adjusting the sensitivity control, it is possible to detect an opaque or translucent material. For an opaque material, set the adjustment to the maximum position (H) to increase the distance tolerance.



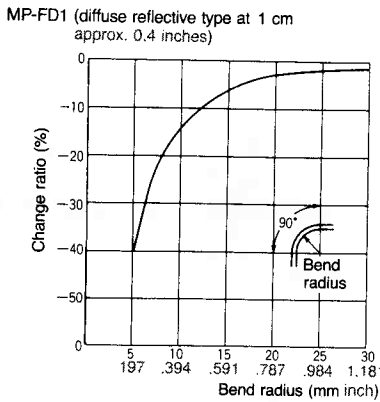
5. Regarding mounting of fiber unit

1) Securely mount the fiber unit to the amplifier unit.

2) Do not apply more than 5 kg tension to the fiber unit of the plastic fiber type.

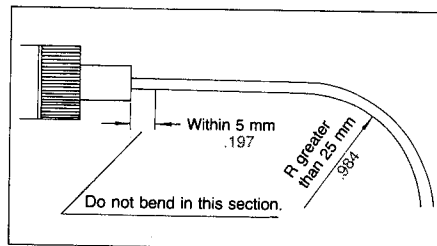
3) The bending radius of the light fiber of the plastic fiber type should be kept as large as possible. If the bending radius is less than 5 mm .197 inch there is the possibility of damage to the light fiber. (Because there is a reduction in the light transmission due to a small bending radius, the actual condition of use should be checked.)

Bending radius vs received light signal level (representative example)

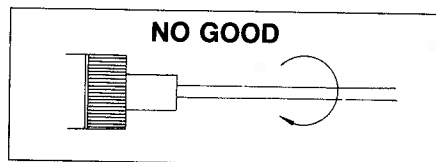


4) For the MP-FH5-02 and MP-FHD1-02 (glass fiber type), because the fiber material is a multicomponent material, to avoid a break in the fiber, the following points in particular should be given attention.

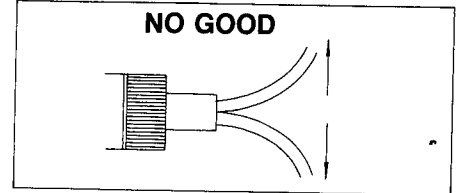
- Do not apply tension in excess of 5 kg to the fiber unit.
- Use a bend radius of greater than 25 mm .984 inch.
- Do not make a bend with 5 mm .197 inch of the base of the fiber of the cord.



Do not twist the fiber cord.

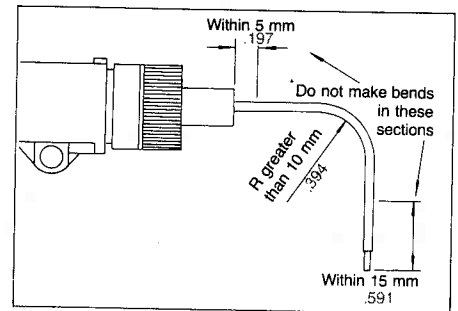


- For the MP-FH5-02 (thru-beam type), the fiber cord is divided into 2 fibers at the base section, and tension should not be applied.



5) For the MP-FSD1-7 (metal tube type), do not apply tension greater than 5 kg to the fiber unit. A flexible metal tubing is used for the protective covering of the metal tube to permit using the most suitable position by bending.

However, there should be no bending 15 mm .591 inch from the end or 5 mm .197 inch from the base section. Do not hold the tube with pliers to make the bend. Bend with the hand in a radius greater than 10 mm .394 inch. In addition take care not to cause a shift in the light axis due to resonance with machine vibration.



6) For the MP-FX1 (coaxial reflecting type), do not apply tension greater than 5 kg to the fiber unit. Make the bending radius as large as possible. If a bend less than 10 mm .394 inch is used, there is the possibility of damage to the fiber.

Installing the fiber unit

