

# FX-311 SERIES

**FX-311 realizes the ultimate in ease-of-operation. Its operation enables easy and full use of latest technology.**

Presenting a product which satisfies professionals using volume control. Besides featuring an operation which makes full use of the latest functions easy, it provides maximum flexibility in dealing with different situations. FX-311 is, indeed, a professional fiber sensor.

## Simple Realization of Ultimate in Easy-of-operation

**Operation indicator**

**Stability indicator**

**12-turn Potentiometer with Visible Indicator**  
12-turn potentiometer has been incorporated for fine adjustments. It enables detection of very fine differences. Moreover, since the pointer of indicator has a red backlight, its position can be confirmed at a glance even in a dark area.

**Selectable Timer Period of OFF-delay Timer**  
FX-311 incorporates an OFF-delay timer. It is useful when the connected device has a slow response time or when small objects are being sensed and the output signal width is small. The timer period can be selected not only 40ms but also 10ms. It is also suitable for increased PLC speeds.

**Selectable Between Three Modes According to Application**  
The most suitable sensing mode can be selected according to the application from three different modes with the mode selection switch.

**Selectable between three modes**

Long-range mode (LONG)	Used in case long distance sensing is required. (Response time: 2ms)
Standard mode (STD)	Used for general sensing application. (Response time: 250 $\mu$ s)
Reduced intensity mode (S-D)	Since the emitted light amount is restricted in this mode, it is suitable for delicate sensing, such as when the received light is saturated due to too short a sensing distance or when detecting translucent objects, etc. (Response time: 250 $\mu$ s)

**Applications**

- When using long-range mode
  - Detecting PCB rack  
FT-KV8
- When using reduced intensity mode
  - Sensing the presence of a translucent sheet  
FD-FM2  
Reflective tape RF-12

**Operation selection switch**  
(Selectable either L-ON (Light-ON) or D-ON (Dark-ON))

Digital fiber sensor FX-301 is now available also!

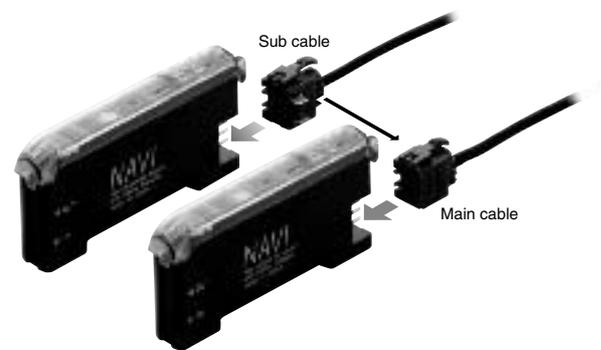


- Easy operation with MODE NAVI
- Super high-speed response (150 μs)
- Optional communication function enables copying and saving

## Specially Designed for Flexible Use and Simple Operation

### Maintenance Made Easy with Quick-connection Cables

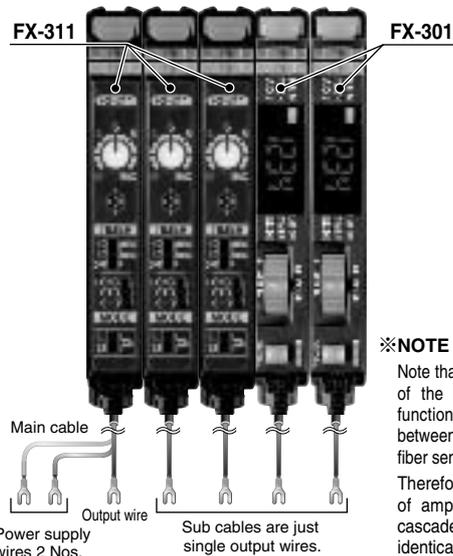
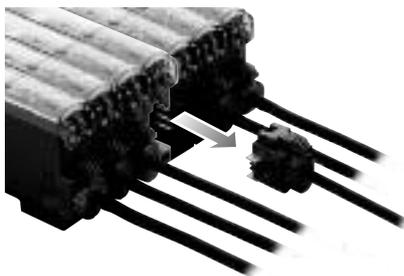
Both main and sub units utilize the same amplifier body. This feature allows for easy mounting in the side-by-side configuration, because main and sub unit functions are distinguished only by the proper use of 3-core main cable for the main unit and 1-core sub cable for each sub unit. Moreover, due to the utilization of the same main body for both main and sub units, inventory management and maintenance, is simplified.



### Side-by-side Connection with FX-301 Is also Possible for Wide-saving and Quick Installation

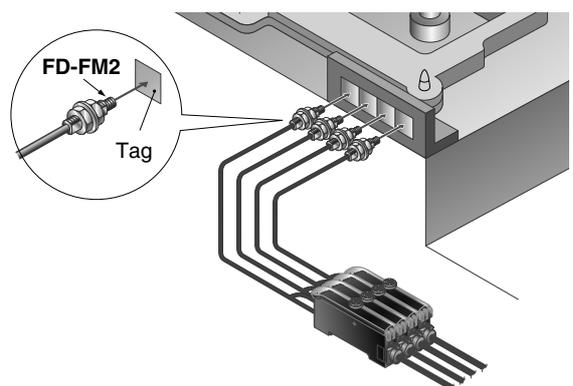
Each sub cable is a single output wire, reducing wiring and simplifying installation. Quick-connection cables are the same type as used on the FX-301, facilitating side-by-side connection. Further, the connectors are slide type, allowing removal without shifting amplifier positions. This eliminates the need to provide extra maintenance space around the amplifiers.

Sliding connectors are easy to insert and remove



## Close Mounting Is Possible for up to Four Fiber Heads

If amplifiers are mounted side-by-side in cascade, the optical communication function automatically sets different emission timing for the amplifiers, at the time of switching on the power supply. Up to four fiber heads can be mounted closely, without mutual interference. FX-301 units can also be used in these configurations.



# FX-311

## ORDER GUIDE

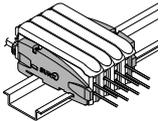
Amplifiers **Please order the quick-connection cable separately.**

Appearance	Model No.	Emitting element	Output
	FX-311	Red LED	NPN open-collector transistor
	FX-311P		PNP open-collector transistor

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

Type	Model No.	Description	
Main cable	CN-73-C1	Length: 1m 3.281ft	0.2mm <sup>2</sup> 3-core cabtyre cable, with connector on one end Cable outer diameter: $\phi$ 3.8mm $\phi$ 0.15in
	CN-73-C2	Length: 2m 6.562ft	
	CN-73-C5	Length: 5m 16.404ft	
Sub cable	CN-71-C1	Length: 1m 3.281ft	0.2mm <sup>2</sup> 1-core cabtyre cable, with connector on one end Cable outer diameter: $\phi$ 3.8mm $\phi$ 0.15in
	CN-71-C2	Length: 2m 6.562ft	
	CN-71-C5	Length: 5m 16.404ft	

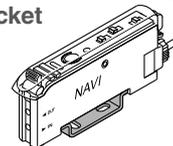
End plates **End plates are not supplied with the amplifier. Please order it separately when the amplifiers are mounted in cascade.**

Appearance	Model No.	Description
	MS-DIN-E	When connecting multiple amplifiers, these end plates ensure that all amplifiers are mounted together in a secure and fully connected manner. <b>Two Nos. per set</b>

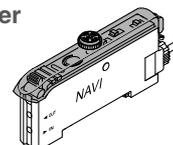
## OPTIONS

Designation	Model No.	Description	
Amplifier mounting bracket	MS-DIN-2	Mounting bracket for amplifier	
Hand-turned knob attached cover	FX-AJ1	For NPN output type	Hand-turned knob allows easy adjustment of sensor sensitivity.
	FX-AJ1P	For PNP output type	
Fiber sensor amplifier protection seal	FX-MB1	10 sets of 2 communication window seals and 1 connector seal Communication window seal: It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier. Connector seal: It prevents contact of any metal, etc., with the pins of the quick-connection cable.	

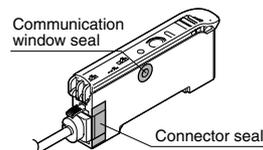
Amplifier mounting bracket



Hand-turned knob attached cover



Fiber sensor amplifier protection seal



## SPECIFICATIONS

Refer to Fiber Sensor Guide Book or Sensor General Catalog for fiber's specifications.

Item	Type	NPN output	PNP output
	Model No.	FX-311	FX-311P
Supply voltage	12 to 24V DC $\pm$ 10% Ripple P-P 10% or less		
Power consumption	840mW or less (Current consumption 35mA or less at 24V supply voltage)		
Output	NPN open-collector transistor • Maximum sink current: 100mA (Note 1) • Applied voltage: 30V DC or less (between output and 0V) • Residual voltage: 1.5V or less [at 100mA (Note 1) sink current]		PNP open-collector transistor • Maximum source current: 100mA (Note 1) • Applied voltage: 30V DC or less (between output and +V) • Residual voltage: 1.5V or less [at 100mA (Note 1) source current]
	Utilization category	DC-12 or DC-13	
	Output operation	Selectable either Light-ON or Dark-ON, with selection switch	
	Short-circuit protection	Incorporated	
Response time	250 $\mu$ s or less (STD / S-D), 2ms or less (LONG) selectable with selection switch		
Operation indicator	Orange LED (lights up when the output is ON)		
Stability indicator	Green LED (lights up under stable light received condition or stable dark condition)		
Sensitivity adjuster	12-turn potentiometer with indicator (Pointer part: red backlight) (Note 2)		
Timer function	Incorporated with OFF-delay timer, selectable either effective (approx. 10ms or 40ms) or ineffective		
Automatic interference prevention function	Incorporated (Up to 4 sets of fiber heads can be mounted closely.) (Note 3)		
Environmental resistance	Pollution degree	3 (Industrial environment)	
	Ambient temperature	- 10 to + 55°C + 14 to 131°F (if 4 to 7 units are connected in cascade: - 10 to + 50°C + 14 to 122°F, if 8 to 16 units are connected in cascade: - 10 to + 45°C + 14 to 113°F) (No dew condensation or icing allowed), Storage: - 20 to + 70°C - 4 to 158°F	
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH	
	Ambient illuminance	Sunlight: 10,000 $\ell$ x at the light-receiving face, Incandescent light: 3,000 $\ell$ x at the light-receiving face	
	EMC	Emission: EN50081-2, Immunity: EN50082-2	
	Voltage withstandability	1,000V AC for one min. between all supply terminals connected together and enclosure (Note 4)	
	Insulation resistance	20M $\Omega$ , or more, with 250V DC megger between all supply terminals connected together and enclosure (Note 4)	
	Vibration resistance	10 to 150Hz frequency, 0.75mm 0.03in in amplitude in X, Y and Z directions for two hours each	
Shock resistance	98m/s <sup>2</sup> acceleration (10G approx.) in X, Y and Z directions for five times each		
Emitting element	Red LED (modulated)		
Material	Enclosure: Heat-resistant ABS, Case cover: Polycarbonate		
Connecting method	Connector connection (Note 5)		
Cable extension	Extension up to total 100m 328.084ft is possible with 0.3mm <sup>2</sup> , or more, cable		
Weight	15g 0.529oz approx.		

Notes: 1) 50mA, if five, or more, amplifiers are connected in cascade.

2) The red backlight of the pointer part lights up more brightly when the power is turned ON and when the sensitivity is adjusted.

3) When the power supply is switched on, the emission timing are automatically set for interference prevention.

4) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.

5) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.

Main cable (3-core): **CN-73-C1** (cable length 1m 3.281ft), **CN-73-C2** (cable length 2m 6.562ft), **CN-73-C5** (cable length 5m 16.404ft)

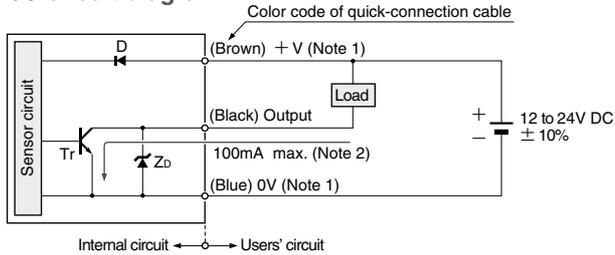
Sub cable (1-core): **CN-71-C1** (cable length 1m 3.281ft), **CN-71-C2** (cable length 2m 6.562ft), **CN-71-C5** (cable length 5m 16.404ft)

# FX-311

## I/O CIRCUIT AND WIRING DIAGRAMS

### FX-311 NPN output

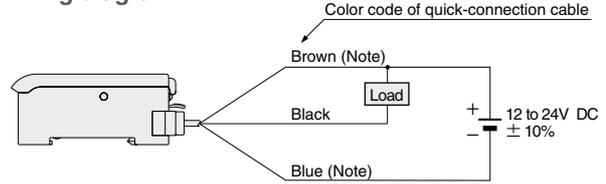
#### I/O circuit diagram



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

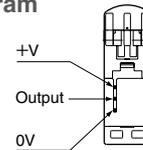
Symbols ... D: Reverse supply polarity protection diode  
Z<sub>D</sub>: Surge absorption zener diode  
Tr: NPN output transistor

#### Wiring diagram



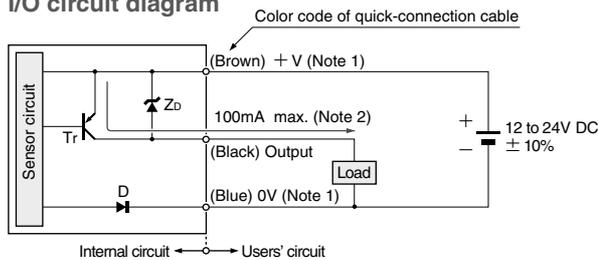
Note: The quick-connection sub cable does not have brown cable and blue cable.

#### Terminal arrangement diagram



### FX-311P PNP output

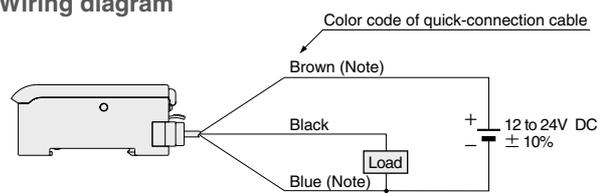
#### I/O circuit diagram



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

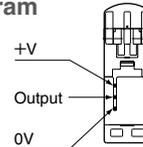
Symbols ... D: Reverse supply polarity protection diode  
Z<sub>D</sub>: Surge absorption zener diode  
Tr: PNP output transistor

#### Wiring diagram



Note: The quick-connection sub cable does not have brown cable and blue cable.

#### Terminal arrangement diagram



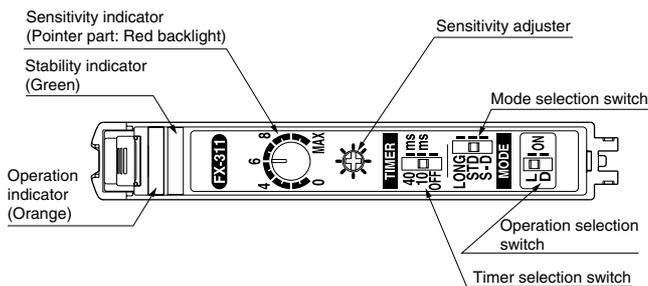
## PRECAUTIONS FOR PROPER USE

Refer to Sensor General Catalog for fiber's precautions.



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.

#### Part description



#### Mode selection switch

The most suitable sensing mode can be selected according to the application from LONG(long-range), STD (standard) or S-D (reduced intensity).

Mode selection switch	Application	Response time
LONG STD S-D	Used in case long distance sensing is required. (However, the response time is longer than in STD mode.)	2ms
LONG STD S-D	Used for general sensing application.	250 μs
LONG STD S-D	Since the emitted light amount is restricted in this mode, it is suitable for delicate sensing, such as when the received light is saturated due to too short a sensing distance or when detecting translucent objects, etc.	

Note: Make sure to carry out sensitivity adjustment after mode setting.

## PRECAUTIONS FOR PROPER USE

Refer to Sensor General Catalog for fiber's precautions.

### Sensitivity adjustment

☉ : Lights up   ● : Lights off

- Adjust the sensitivity, observing the operation indicator (orange). However, since the condition for lighting up of the indicator depends on the combination of the sensing condition and selected operation for L/D-ON, verify it from the table on the right.
- The sensitivity adjuster is a 12-turn potentiometer. The maximum sensitivity is obtained by turning it fully clockwise.
- The pointer shows the present sensitivity level.

Sensing condition	Operation	Operation indicator
Light	L-ON(Light ON)	☉
	D-ON(Dark-ON)	●
Dark	L-ON(Light ON)	●
	D-ON(Dark-ON)	☉



### Assist function

- This product incorporates an 'assist function', which helps to easily search the optimum sensitivity position by flashing of the pointer. In order to make 'assist function' effective, switch the operation selection switch in the order L-ON (Light-ON) → D-ON (Dark-ON) → L-ON (Light-ON).

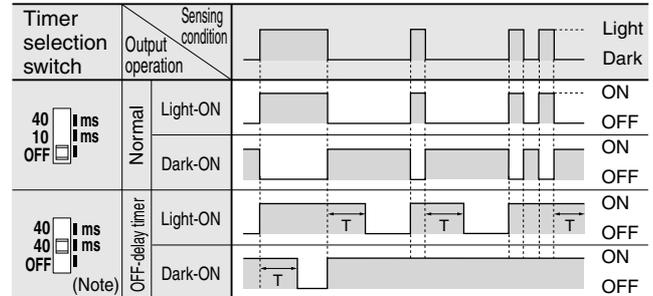
- Notes: 1) 'Assist function' cannot be used when adjusting sensitivity for moving objects.  
 2) 'Assist function' turns off automatically once the sensitivity adjustment has been completed.  
 3) In case 'assist function' is not to be used, set the operation selection switch to D-ON(Dark-ON) and wait for 2 sec., or more, to make 'assist function' ineffective.

Step	Sensing method		Operation	Sensitivity indicator
	Reflective type	Thru-beam type		
①	★Make sure that the operation selection switch is set to L-ON (Light-ON). In case 'assist function' is to be used, switch the operation selection switch in the order of L-ON (Light-ON) → D-ON (Dark-ON) → L-ON(Light-ON).		Turn the sensitivity adjuster fully counterclockwise. (Minimum sensitivity)	
②			In the beam received condition, slowly turn the adjuster clockwise and find the point A where the sensor is switched ON. The pointer flashes once at the point A. (Note 1)	
③			In the beam not received condition, slowly turn the adjuster further clockwise until the sensor goes into the ON state again. Once it is switched on, turn the adjuster counterclockwise a little and find the point B where it is switched OFF. The pointer flashes twice at the point B. (Note 2) (If the sensor does not go into the ON state, MAX is the point B.)	
④			Turn the adjuster towards the point A from the point B slowly. The pointer starts flashing when it approaches the optimum sensitivity point and flashes faster at the optimum sensitivity point for 3 sec. This point is the optimum sensitivity point. (Note 2)	
⑤	Select either L-ON (Light-ON) or D-ON(Dark-ON) according to your application.			

- Notes: 1) When 'assist function' is not used, the pointer does not flash.  
 2) When 'assist function' is not used, the middle point of A and B is regarded as the optimum sensitivity point.  
 3) In order to protect the mechanism, the sensitivity adjuster idles when over turned, which may result in a backlash of 1 to 2 divisions.  
 4) Depending upon the sensing conditions, stable sensing may be possible at a position which is slightly shifted from the optimum sensitivity point.  
 5) Do not move or bend the fiber cable after the sensitivity adjustment. Detection may become unstable.

### Timer function

- This product incorporates OFF-delay timer function. The timer period can be selected as either 10ms. approx. or 40ms. approx. with the timer selection switch. Since the output is extended by a fixed period, it is useful when the connected device has a slow response time or when small objects are being sensed and the output signal width is small.



Note: The diagram shows the case when 10ms time period is selected.  
 Timer period T: 10ms approx. (when set to 10ms)  
 40ms approx. (when set to 40ms)

### Interference prevention function

- This product incorporates an automatic interference prevention function. If the amplifiers are mounted in cascade, since a different emission timing is automatically set for up to 4 amplifiers, up to 4 sets of fiber heads can be mounted closely. Further, even if the amplifiers are mounted closely along with digital fiber sensor FX-301(P), the interference prevention function works. However, in case both models of amplifiers are mounted in cascade, mount identical models together.

### Wiring

- Make sure to carry out the wiring in the power supply off condition.
- Verify that the supply voltage variation is within the rating.
- Take care that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the sensor may get burnt or damaged.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Take care that short-circuit or wrong wiring of the load may burn or damage the sensor.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- Ensure that an isolation transformer is utilized for the DC power supply. If an autotransformer is utilized, the main amplifier or power supply may be damaged.
- Make sure to use the optional quick-connection cable for the connection of the amplifier. Extension up to total 100m is possible with 0.3mm<sup>2</sup>, or more, cable. However, in order to reduce noise, make the wiring as short as possible.

### Others

- Do not use during the initial transient time (0.5 sec. approx.) after the power supply is switched on.
- Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.
- This sensor is suitable for indoor use only.
- Avoid dust, dirt, and steam.
- Take care that the product does not come in direct contact with organic solvents, such as, thinner, etc.
- This sensor cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify the sensor.

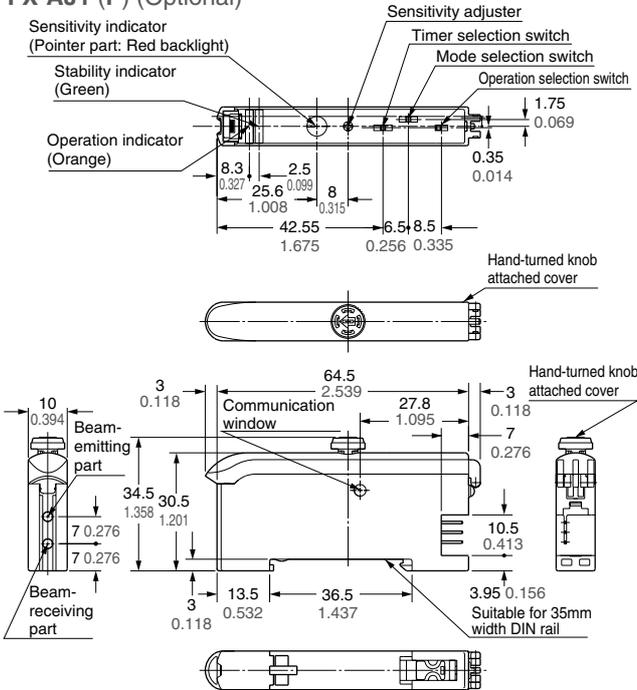
# FX-311

## DIMENSIONS (Unit: mm in)

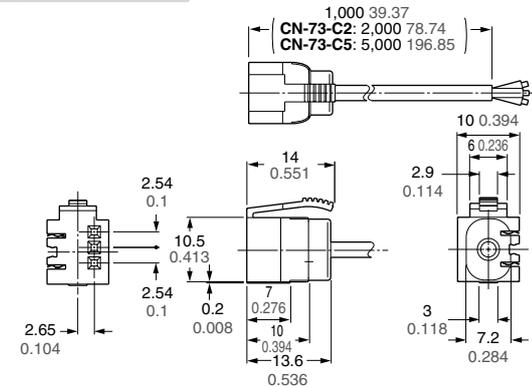
Refer to Fiber Sensor Guide Book or Sensor General Catalog for fiber's dimensions.

### FX-311 FX-311P Amplifier

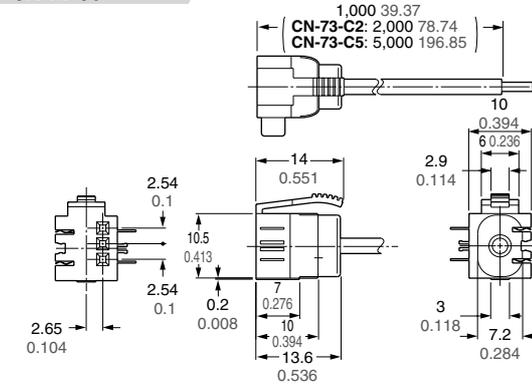
Mounting drawing with a hand-turned knob attached cover  
FX-AJ1 (P) (Optional)



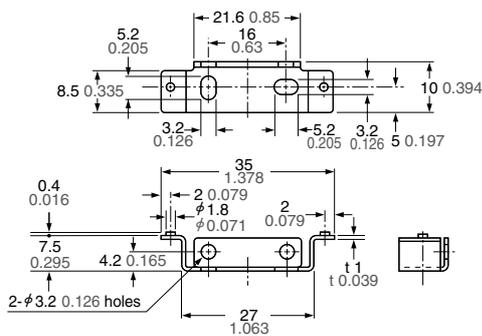
### CN-73-C1 CN-73-C2 CN-73-C5 Main cable (Optional)



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

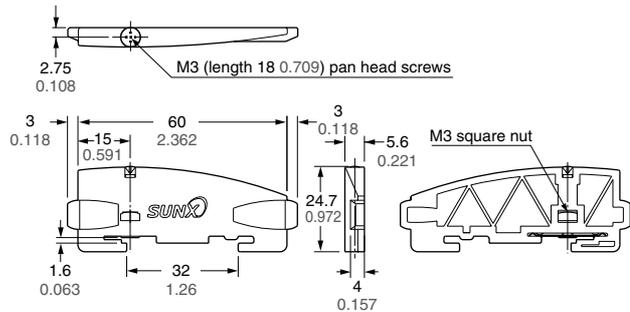


### MS-DIN-2 Amplifier mounting bracket (Optional)



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

### MS-DIN-E End plate (Optional)



Material: Polycarbonate