

# F70 series

Digital display  
Fiber optic sensors



- Digital indication of sensing information
- Various advanced functions provide for optimum use of the sensor
- Unparalleled “high resolution” allows highly accurate detection
- LCD with backlight for ease of reading
- Longer detecting distance  
(about 2-X that of a conventional Takex model)

## Variation

Type	Model		Light source	Output mode
	NPN output	PNP output		
Digital display high-performance type	<b>F70R</b>	<b>F70RPN</b>	Red LED	Open collector (NPN/PNP)
	<b>F70G</b>	<b>F70GPN</b>	Green LED	
	<b>F70B</b>	<b>F70BPN</b>	Blue LED	
	<b>F70W</b>	<b>F70WPN</b>	White LED	

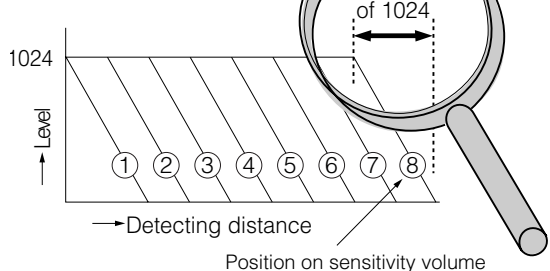
## Excellent detection performance

Built-in high-resolution provides highly accurate detection

Wide dynamic range and high resolution are achieved at the same time

High resolution is maintained even with a wide dynamic range. The provided electronic volume feature has both a wide dynamic range and high resolution.

The “electronic-volume” frequently switches the sensitivity range, each of which is divided into 1024 levels.



(6) 8-position sensing indication with electronic volume



Self-diagnosis stability indication

Function mode indicated

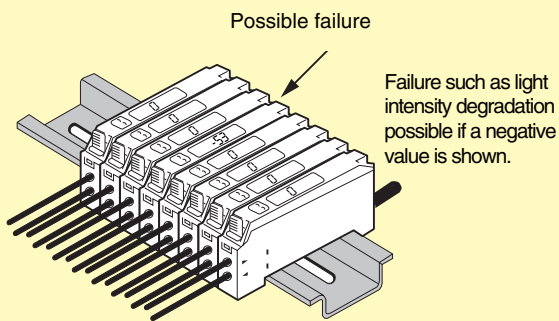
Operation/timer mode indicated

Light emission frequency channel switched for Anti Mutual Interference feature

## Display function :(beyond received light level)

### Displacement indication function

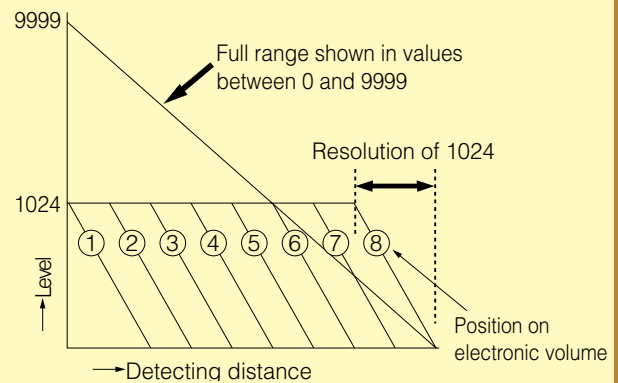
All amplifiers should show "0" with no work.



The value for a deviation (positive or negative) of received light level from the original level is shown at the time of detection, which allows central management of sensors.

### Absolute value indication

Received light level indication going beyond the



If the received light level at light blocking is 10 and the level at light reception is 6000, the light blocking / light reception ratio is calculated as 600 times.

supporting high resolution

### Enhanced teaching features (sensitivity setting)

- **Full auto teaching**

Simply pressing the button allows easy teaching of an object moving at a high speed. The teach hold feature allows indication of the maximum and minimum data.

- **Auto teaching**

2-point teaching with and without the presence of work, allows the detection of slight level differences such as the thickness of a piece of work and/or the presence of a film.

- **Positioning teaching**

This feature is ideal for high-accuracy positioning that requires accurate determination of a detecting point.

- **Maximum sensitivity setting**

For applications requiring a "maximum" sensitivity setting such as the detection of work with a through-beam type-fiber optic cable. The incorporated extra powerful light would allow use in an adverse environment.

- **Manual setting**

Arbitrary manual increase and decrease of a set-point level allows level setting while checking the operation.

### Auto sensing function compensates for adverse environment

The level of received light is constantly monitored and fluctuation is detected and automatically adjusts the activation/deactivation level.

Stable detection at optimum sensitivity is ensured even if the received light level frequently fluctuates due to dust or water drops.

### Manual hysteresis setting feature

The hysteresis can be arbitrarily set according to the application, allowing setting of a small hysteresis for severe, high-accuracy detection and a large hysteresis for detection of large variation and prevention of chattering.

### Timer functions

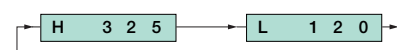
On-delay, off-delay and on-off delay timer functions are provided, which allows for a wide range of detecting and input conditions from the connected devices.

The delay time setting is variable between:

10 ms, 20 ms, 40 ms, 60 ms, 80 ms, 100 ms and 120 ms.

### Teach hold function

The sensor has the ability to hold instantaneous data for an object moving at a high rate of speed during full auto teaching. This data is displayed when the teaching has been completed.



(Data for light reception is 325 and for light blocking 120.)

# F70A • F70series

## ■ Type

- Amplifier (main unit)

Type	Model		Light source	Output mode	Connection
	NPN output	PNP output			
Digital display general-purpose type	<b>F70AR</b>	<b>F70ARPN</b>	Red LED	Open collector (NPN/PNP)	Permanently attached cord { M8 connector type also available }
	<b>F70AG</b>	<b>F70AGPN</b>	Green LED		
	<b>F70AB</b>	<b>F70ABPN</b>	Blue LED		
	<b>F70AW</b>	<b>F70AWPN</b>	White LED		
Digital display high-speed type	<b>F70R</b>	<b>F70RPN</b>	Red LED		
	<b>F70G</b>	<b>F70GPN</b>	Green LED		
	<b>F70B</b>	<b>F70BPN</b>	Blue LED		
	<b>F70W</b>	<b>F70WPN</b>	White LED		

- Fiber optic cable

For different types of fiber optic cables, see pp. 59-.

- M8 connector type

M8 connector connection type is separately available for all models, which is identified by “-J” following the model number. “-JE” and “-JS” are available depending on the input/output specification.

For connector specifications, see p. 23.

<Type of cords with M8 connector>

- Model : FBC-4R2S (equipped with straight M8 connector and 2-m cord)
- Model : FBC-4R2L (equipped with angled M8 connector and 2-m cord)



End unit



- Optional parts

Type	Model	Description
End unit	<b>FA7EU</b>	DIN rail mounting stopper
Mounting bracket*	<b>AC-BF2</b>	Amplifier unit mounting bracket

\*Accessory

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## Rating/Performance/Specification

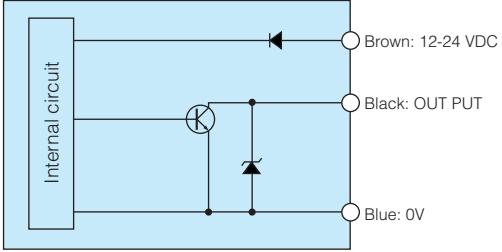
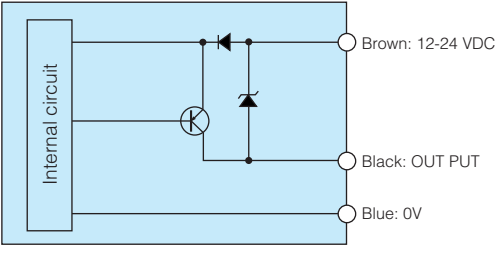
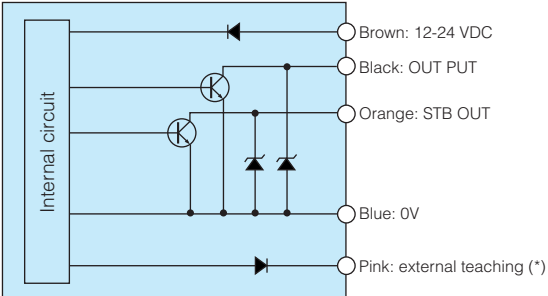
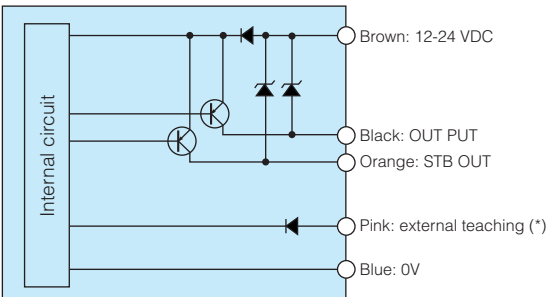
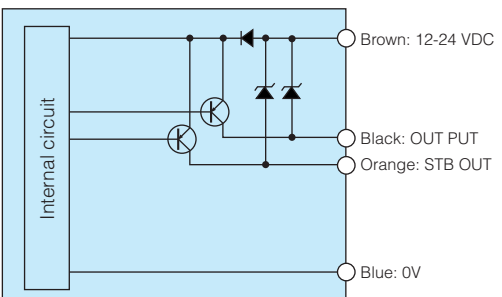
Model	NPN type	F70AR	F70AG	F70AB	F70AW	F70R	F70G	F70B	F70W	
	PNP type	F70ARPN	F70AGPN	F70ABPN	F70AWPN	F70RPN	F70GPN	F70BPN	F70WPN	
Rating/performance	Power supply	12-24V DC $\pm$ 10% / Ripple 10% max.								
	Current consumption	NPN type	39 mA max.							
		PNP type	50 mA max.							
	Output mode	Control output (*)	NPN type	Open collector output / Rating: sink current 100 mA (30 VDC max.) / Residual voltage: 1 V or less						
			PNP type	Open collector output / Rating: source current 100 mA (30 VDC max.) / Residual voltage: 2 V or less						
	Stability output (*)	NPN type					Open collector output / Rating: sink current 50 mA (30 VDC max.) / Residual voltage: 1 V or less			
		PNP type					Open collector output / Rating: source current 50 mA (30 VDC max.) / Residual voltage: 2 V or less			
	Operation mode	Light-ON/Dark-ON selectable								
	Timer	Off delay/disabled selectable Delay time: 40 ms fixed					On delay/off delay/on-off delay/disabled selectable Delay time: selectable between 10, 20, 40, 60, 80, 100 and 120 ms / Default: 40 ms			
		Response time								
Specification	Light source (wavelength)	Red LED (660nm)	Green LED (525nm)	Blue LED (470nm)	White LED	Red LED (660nm)	Green LED (525nm)	Blue LED (470nm)	White LED	
	Indicator	Operation indicator: orange LED / Stability (STB) indicator: green LED								
	Display	LCD display with backlight								
	Switch	2 set buttons / Mode selector switch: RUN/SET				2 set buttons / Mode selector switch: RUN/SELECT/MODE				
	Sensitivity setting	Full auto teaching / Auto teaching								
	Sensitivity setting input	Set button input				Set button input/external input				
	Sensitivity adjustment function	Provided (manual sensitivity adjustment)								
	Functions	<ul style="list-style-type: none"> <li>• Anti Mutual Interference feature</li> <li>• Short circuit protection feature</li> </ul>				<ul style="list-style-type: none"> <li>• Sensor function: AUTO/TEACH/LOCK</li> <li>• Auxiliary function:               <ul style="list-style-type: none"> <li>S for manual adjustment of sensitivity and activation level</li> <li>H for manual hysteresis setting</li> <li>V for displacement indication and absolute value indication modes</li> </ul> </li> <li>• Anti Mutual Interference feature</li> <li>• Self-diagnosis feature</li> <li>• Short circuit protection feature</li> </ul>				
	Material	Polycarbonate								
	Connection	Permanently attached cord (outer dimension: dia. 4.8) 0.2sq. 3 core 2 m length					Permanently attached cord (outer dimension: dia. 4.8) 0.2sq. 5 core 2 m length			
		For M8 connector specifications, see p. 23.								
	Mass	Approx. 80 g (including 2-m cord and mounting bracket)								
	Accessory	Mounting bracket / Operation manual								

(\*) Avoid the transient condition (0.5 seconds) immediately after power-up for output.

## Environmental Specification

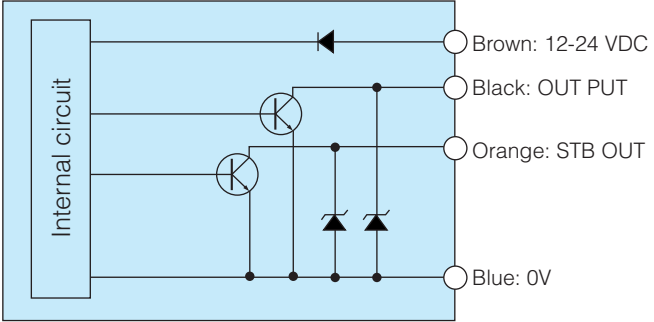
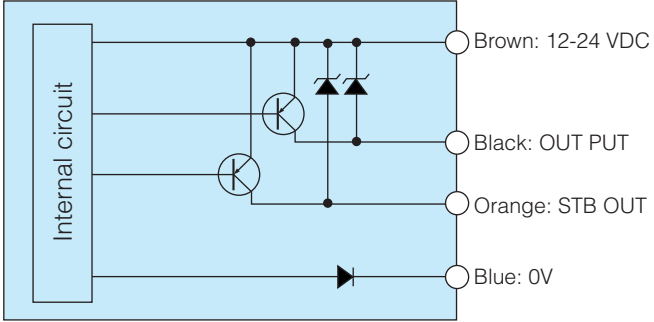
Environment	Ambient light	Incandescent lamp: 10,000 lx / Sunlight: 20,000 lx
	Ambient temperature	1-3 adjacent units in operation: $-25 - +55$ °C
		4-10 adjacent units in operation: $-25 - +50$ °C
		11-16 adjacent units in operation: $-25 - +45$ °C
	Ambient humidity	Storage: $-40 - +70$ °C (non-freezing)
	Protective structure	35-85%RH (non-condensing)
Vibration	IP40	
Shock	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction	
		500 m/s <sup>2</sup> / 3 times each in 3 directions

## Input/Output Circuit and Connection

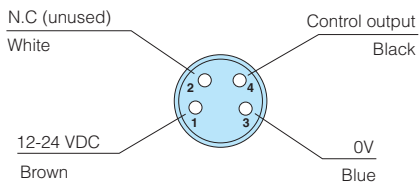
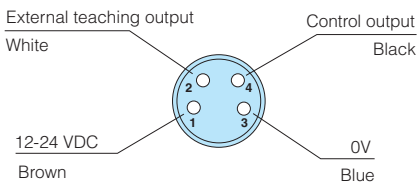
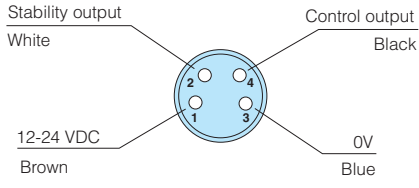
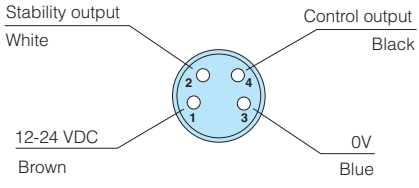
Model	Output circuit diagram
<p>NPN output type</p> <p><b>F70AR      F70ABK</b>  <b>F70AG      F70AWK</b>  <b>F70AB</b>  <b>F70AW</b>  <b>F70ARK</b>  <b>F70AGK</b></p>	 <p>Brown: 12-24 VDC  Black: OUT PUT  Blue: 0V</p>
<p>PNP output type</p> <p><b>F70ARPN      F70ABKPN</b>  <b>F70AGPN      F70AWKPN</b>  <b>F70ABPN</b>  <b>F70AWPN</b>  <b>F70ARKPN</b>  <b>F70AGKPN</b></p>	 <p>Brown: 12-24 VDC  Black: OUT PUT  Blue: 0V</p>
<p>NPN output type</p> <p><b>F70R</b>  <b>F70G</b>  <b>F70B</b>  <b>F70W</b></p>	 <p>Brown: 12-24 VDC  Black: OUT PUT  Orange: STB OUT  Blue: 0V  Pink: external teaching (*)</p>
<p>PNP output type</p> <p><b>F70RPN</b>  <b>F70GPN</b>  <b>F70BPN</b>  <b>F70WPN</b></p>	 <p>Brown: 12-24 VDC  Black: OUT PUT  Orange: STB OUT  Pink: external teaching (*)  Blue: 0V</p>
<p>PNP output type</p> <p><b>F70RKPN</b>  <b>F70GKPN</b>  <b>F70BKPN</b>  <b>F70WKPN</b></p>	 <p>Brown: 12-24 VDC  Black: OUT PUT  Orange: STB OUT  Blue: 0V</p>

(\*) When not using external teaching, cut the pink lead at the base or connect it to the positive terminal (for NPN type) or 0V (PNP type) of the power supply.

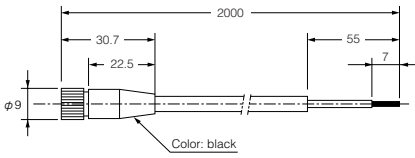
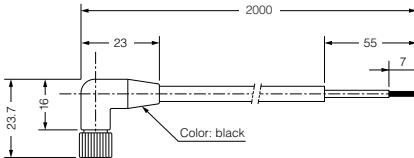
## Input/Output Circuit and Connection

Model	Output circuit diagram
<p><b>NPN output type</b></p> <p><b>F70RK F71R F71RK</b>  <b>F70GK F71G F71GK</b>  <b>F70BK F71B F71BK</b>  <b>F70WK F71W F71WK</b>  <b>F71RH F71RHK</b>  <b>F71GH F71GHK</b>  <b>F71BH F71BHK</b>  <b>F71WH F71WHK</b></p>	
<p><b>PNP output type</b></p> <p><b>F71RPN F71RKPN</b>  <b>F71GPN F71GKPN</b>  <b>F71BPN F71BKPN</b>  <b>F71WPN F71WKPN</b>  <b>F71RHPN F71RHKPN</b>  <b>F71GHPN F71GHKPN</b>  <b>F71BHPN F71BHKPN</b>  <b>F71WHPN F71WHKPN</b></p>	

## M8 Connector Type IO Specification/Pin Arrangement/Lead Colors

<p><b>F70A" -J"</b></p> 	<p><b>F70" -JE"</b></p> 
<p><b>F71" -J"</b></p> 	<p><b>F70" -JS"</b></p> 

- Dimensions of cord with M8 connector (optional) (in mm)

<p><b>FBC-4R2S (straight)</b></p> 	<p><b>FBC-4R2L (angled)</b></p> 
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# Common to F70A/F70/F71 Series

## For Correct Use

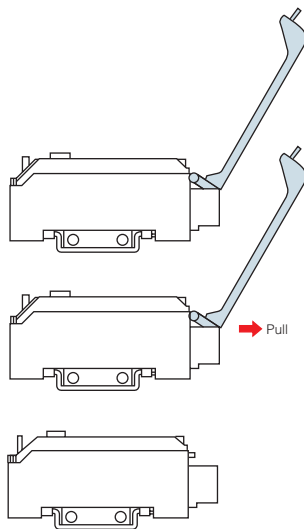
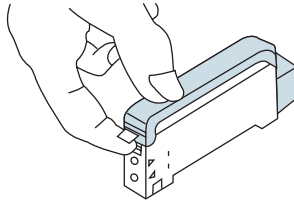
Be sure to follow the instructions in the operation manual provided for correct use of the product.

### ● Handling of amplifier case cover

#### ① Opening the case cover

While pressing down the front part of the case cover, lift the cover by pulling up the tab.

Just roughly pulling the case cover tab for opening may damage the cover. Be sure to press the front part of the cover when pulling the tab.



The cover opens up to the connector on the back and stays at the half-opened position.

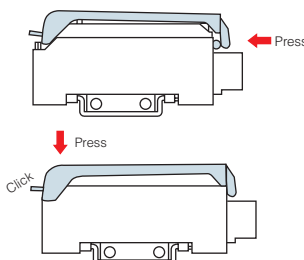
Pulling at the hinge with the cover half open allows removal of the cover.

Cover removed

#### ② Attaching the cover

Put the case cover on the amplifier as shown on the figure on the right and push in at the hinge.

Press down the front part of the cover until it clicks and make sure that the tab is hooked.

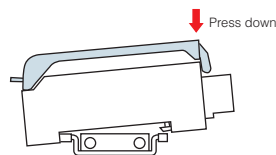


### ● Attaching amplifier on DIN rail or mounting bracket

The mounting bracket is optional. The amplifier cannot be side-mounted with a mounting bracket used.

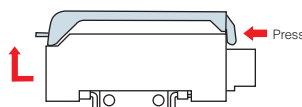
#### ① Attachment

Put the front hook of the amplifier on the rail (or mounting bracket) and press down the back of the amplifier.



#### ② Detachment

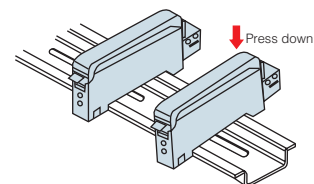
While pressing the amplifier forward, lift the front part and detach the front hook.



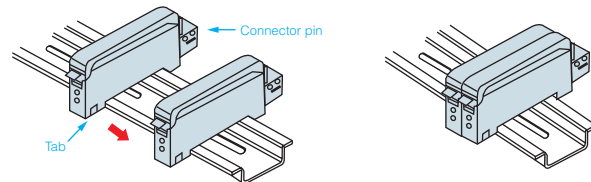
### ● Attachment of amplifiers for joined use

When using two or more amplifiers by joining them together, be sure to use a DIN rail for mounting. Up to 16 units can be joined for use. Be sure to cut the power supply before attempting to join or separate units.

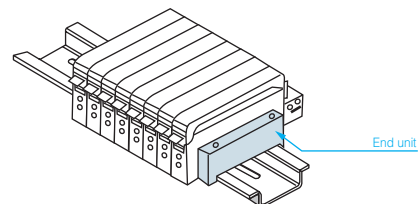
#### ① Mount one amplifier at a time on the DIN rail while keeping a certain space between amplifiers.



#### ② Slide the amplifiers so that the tabs on the front and the connector pins on the back are respectively joined together.



#### ③ To prevent the connections from coming loose due to vibration, etc., attach end units (optional) on the ends of the group of amplifiers to secure them.



#### ④ To detach the amplifiers, follow the steps in reverse order and remove one amplifier at a time.

Removing the amplifiers as they are joined together without sliding may damage the amplifiers.

# Common to F70A/F70/F71 Series

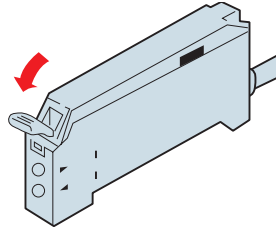
## For Correct Use

Be sure to follow the instructions in the operation manual provided for correct use of the product.

### Attachment of fiber optic cable

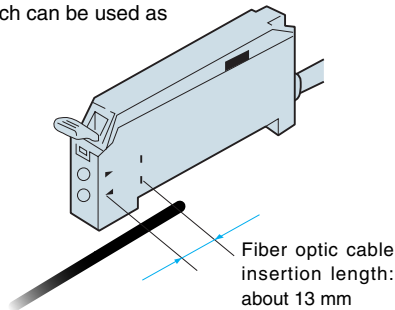
#### Attachment to amplifier

1. Open the case cover and press down the single-touch lock lever.

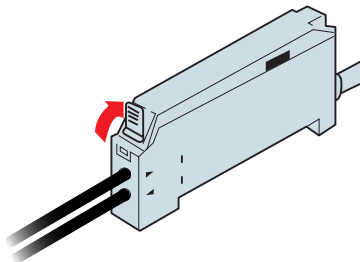


2. Insert the fiber optic cable all the way until it stops.

To prevent inadequate insertion of a fiber optic cable, marks to indicate the insertion length are provided on the case side, which can be used as gauges.

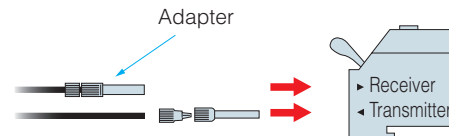


3. Lift the single-touch lock lever.



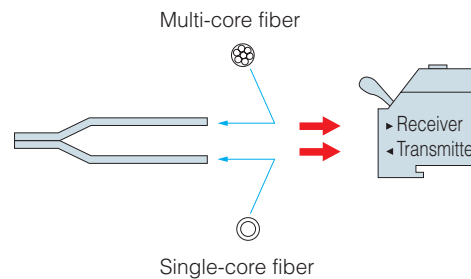
#### Attachment of small-diameter fiber optic cable

When attaching a small-diameter fiber optic cable, use the adapter that comes with the fiber optic cable.



#### Attachment of coaxial reflective fiber optic cable

Attach the multi-core fiber to the receiver and single-core fiber to the transmitter.



### Notes on usage

- When using two or more amplifiers joined together, be sure to use a DIN rail for mounting. Different ambient temperatures apply according to the number of joined amplifiers.

No. of amplifiers	Ambient temperature
1-3	-25 - +55 °C
4-10	-25 - +50 °C
11-16	-25 - +45 °C

- Be sure to turn off the power supply before wiring.
- To extend the cord, use wires of at least 0.3 mm<sup>2</sup> and limit the length to within 100 m.
- Using the same conduit for the amplifier wiring and power transmission or high-voltage lines may cause faulty operation

or damage due to noise. Be sure to route them separately.

- Make sure that the power fluctuation is within an allowable range so that the power input will not exceed the rating.
- When using a commercially-available switching regulator, use the frame ground or ground terminal.
- For output, avoid the transient condition (0.5 seconds) immediately after power-up.
- Do not use the sensor in a place subject to steam, large amount of dust or direct exposure to water or oil.
- Do not use the sensor outdoors or in a place subject to direct disturbing light on the light receiving surface.
- Use of a reflective-type fiber optic cable at the maximum sensitivity may cause inadequate light blocking. Be sure to use a work for sensitivity setting.

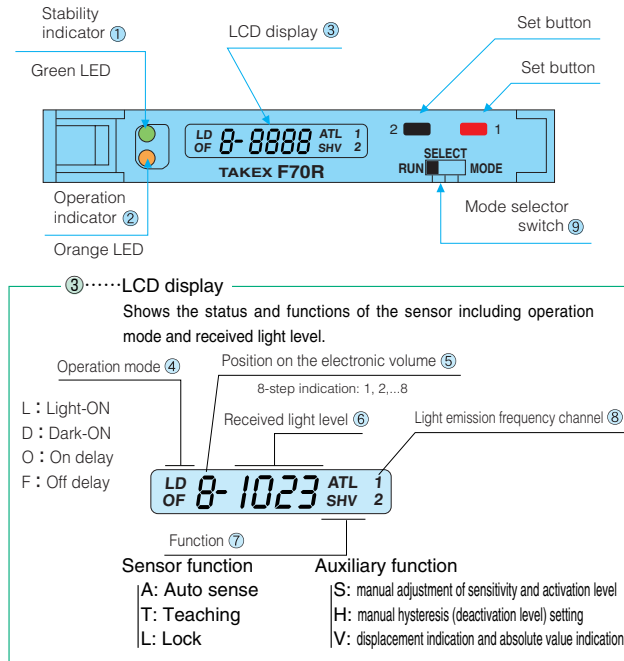


# F70Series

## For Correct Use

Be sure to follow the instructions in the operation manual provided for correct use of the product.

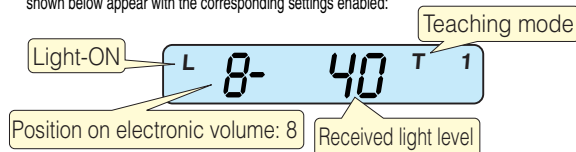
### Part names



- ①.....Stability indicator
- ②.....Operation indicator
- ③.....LCD display
- ④.....Operation mode
- ⑤.....Position on electronic volume
- ⑥.....Received light level
- ⑦.....Function
- ⑧.....Light emission frequency channel
- ⑨.....Mode selector switch

### Initial (factory) setting

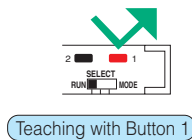
When a fiber optic sensor has been mounted and power supplied for the first time, indications as shown below appear with the corresponding settings enabled:



### Simple setting for immediate use

#### (For reflective type)

- Press Button 1 once with no work present. The orange and green indicators flash.
- With the work in place, press Button 1 once again.



#### (For through-beam type)

- Block the light beam with the work, etc. to set the light blocking state.
- Press Button 1 twice. The setting is complete.

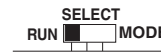


#### Note

Use of a reflective-type fiber optic cable at the maximum sensitivity may cause inadequate light blocking. Be sure work is present for auto or full auto teaching.

### Operation

#### Mode selector switch



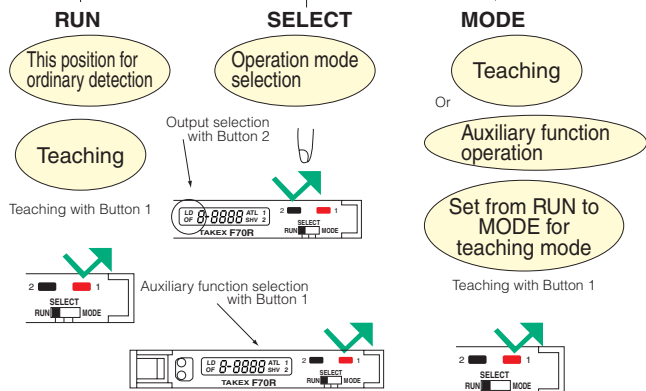
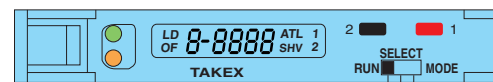
**Sensor function**  
Functions as an ordinary sensor.



**Select function**  
\* Selection of Light-ON/Dark-On and timer operation.  
\* Selection of sensor function.  
\* Selection of auxiliary function.



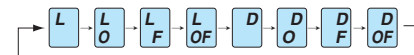
**Mode function**  
\* Sensitivity setting (teaching) in the lock mode  
\* Activates the auxiliary function selected in [SELECT]



#### Operation mode setting

Select between Light-ON and Dark-ON and timer operations.

- Set the switch from RUN to SELECT.
- Press Button 2. The indication rotates in the order shown below by one step every time the button is pressed.



Indication	Output operation	Timer operation
L	Light-ON	None
LO	Light-ON	On delay
LOF	Light-ON	On/Off delay
D	Dark-ON	None
DO	Dark-ON	On delay
DOF	Dark-ON	Off delay
DOF	Dark-ON	On/Off delay

- Select a desired mode and set the switch back to RUN, which enables the selected operation mode.

## For Correct Use

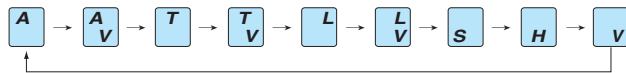
Be sure to follow the instructions in the operation manual provided for correct use of the product.

### Sensor function/auxiliary function setting

#### Sensor function selection

- 1) Set the switch to SELECT.
- 2) Press Button 1

The indication rotates in the order below by one step every time the button is pressed, allowing the selection of a "sensor function" and "auxiliary function".



- 3) Select a function and set the switch back to [RUN].  
The function selection is stored in the memory.

Sensor function	
A: Auto sense mode	Constantly monitors the level of received light and, if any variation is found, the on/off level is automatically adjusted.  • The adjusted on/off level is not stored in the memory. The initial data is applied when the power supply is cut off once and supplied again.
T: Teaching mode	Allows sensitivity setting. The setting method options include "auto teaching," "full auto teaching" and "external signal."
L: Lock mode	Prohibits sensitivity setting.
AV TV LV	Displacement indication mode — The level of received light with the work used is indicated in positive or negative value (displacement) with reference to the level of received light at the time of teaching.
A V	
T V	

#### Auxiliary function selection

Auxiliary function	
S:	Allows adjustment of the "sensitivity" and "activation level" already set.
H:	Allows adjustment of the hysteresis (deactivation level).
V:	Indicates the absolute value.

- Select one of these functions and set the switch to [MODE], which enables the auxiliary function selected.

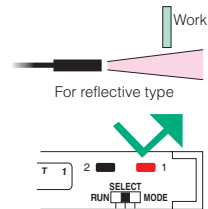
### LCD display

- The received light level displayed on the LCD shows an average value for a certain period of time and may contain an error of  $\pm 1-2$ .
- When the Anti Interference feature is enabled, the received light level indication on the LCD may show an incorrect value. For correct indication, eliminate the interference by blocking the light causing the interference or cutting of the power supply to the sensor causing the interference and read the value.

### Sensitivity setting (teaching)

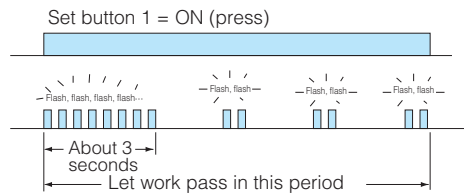
#### Auto teaching (with stationary work)

- 1) Press Button 1 with no work placed and release the button. The indicator flashes, showing that the sensor is ready for the next teaching input.
- 2) With the work in place, press Button 1 once and release it. The indicator stops flashing, showing that sensitivity setting is complete.



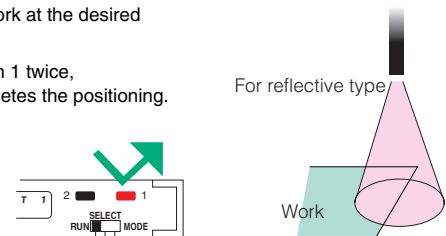
#### Full auto teaching (with moving work)

- 1) Press and hold down Button 1 for 3 seconds or longer. The orange and green indicators start flashing alternately and the flashing becomes slower a little later.
- 2) Let the work pass while holding down Button 1.
- 3) When the passing of work and the slow flashing of indicators have been confirmed, release Button 1.



#### Positioning teaching

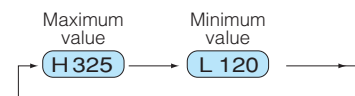
- 1) Place the work at the desired position.
- 2) Press Button 1 twice, which completes the positioning.



#### Teach hold function

Holds momentary data during full auto teaching.

Releasing Button 1 shows the maximum and minimum data during teaching (the maximum and minimum values are alternately shown for about 3 seconds).

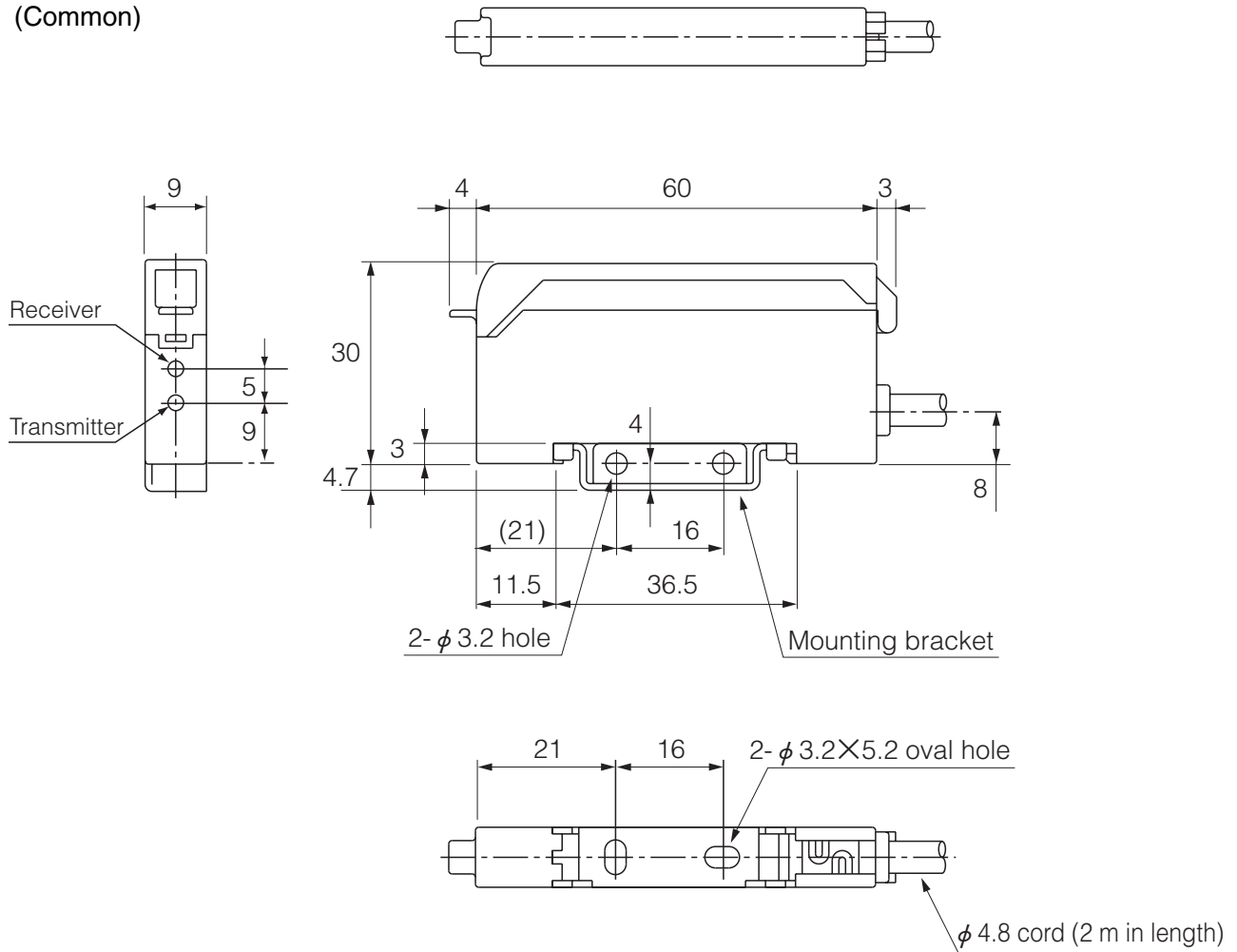


This hold function is not available with the external teaching function.

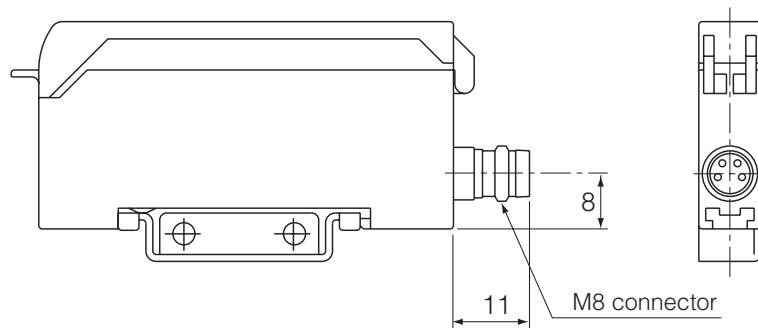
# Cord-Connected Type

## ■ Dimensions (in mm)

Amplifier  
F70A/F70 Series  
F 71 Series  
(Common)



M8 connector type



(For dimensions of connector cords, see p. 23.)

For dimensions of fiber optic cables, see pp. 67-.