

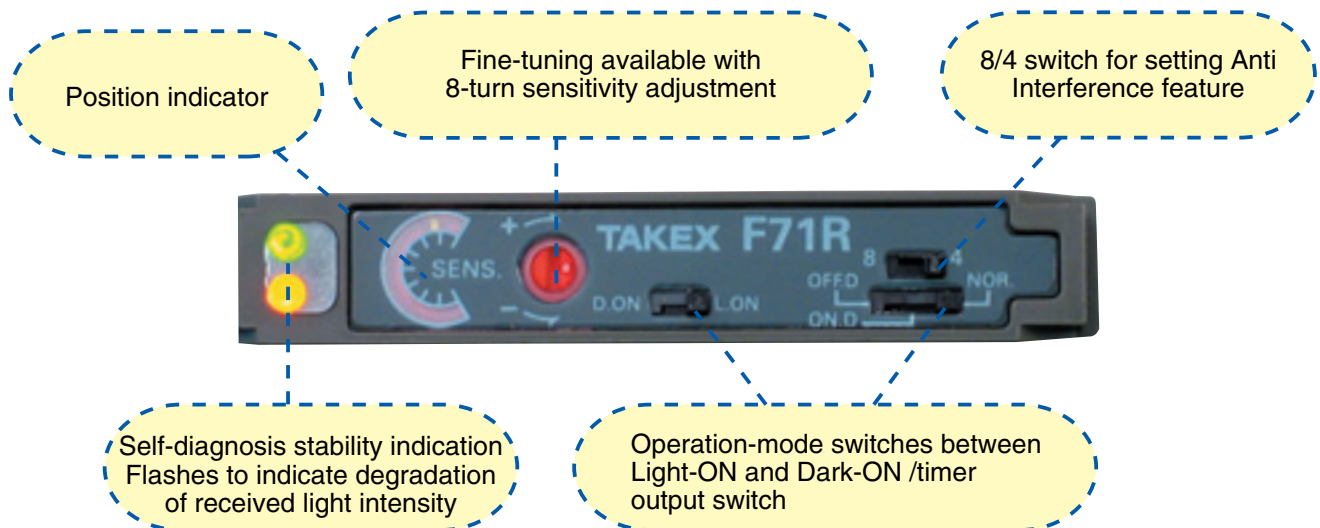
- Adjacent installation of up to 8 units
 - Proprietary Anti Interference feature is used -
- High-accuracy-8-turn sensitivity adjustment
 - Position indicator is provided -
- High-speed response of 30 μ s
 - H type sensor -

Variation

| Type | Model | | Light source | Output mode |
|---|--------------|----------------|--------------|-----------------------------|
| | NPN output | PNP output | | |
| Manual setting general-purpose type | F71R | F71RPN | Red LED | Open collector (NPN/PNP) |
| | F71G | F71GPN | Green LED | |
| | F71B | F71BPN | Blue LED | |
| | F71W | F71WPN | White LED | |
| Manual setting high-speed type | F71RH | F71RHPN | Red LED | |
| | F71GH | F71GHPN | Green LED | |
| | F71BH | F71BHPN | Blue LED | |
| | F71WH | F71WHPN | White LED | |

Manual high performance model

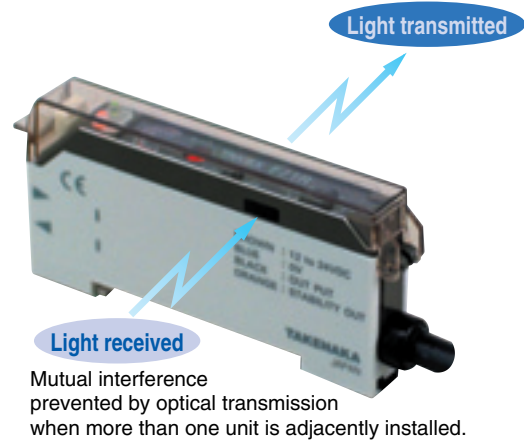
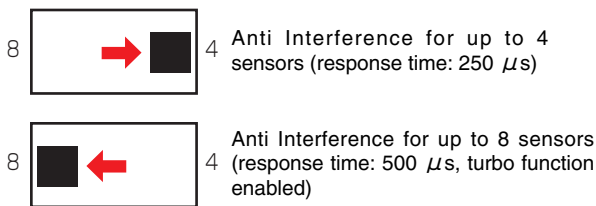
High-accuracy 8-turn adjustment is equipped with a position indicator, which allows direct reading of the adjustment position.



Useful 8-unit detection

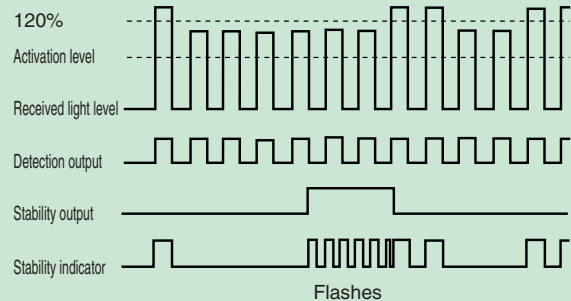
Optical transmission-type Anti Interference feature

The Anti Interference feature prevents false operation due to mutual interference even if up to 8 units are installed adjacently.



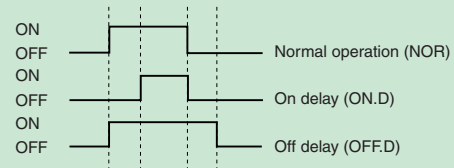
Easy-to-understand stability function

When four consecutive detections with a received light level of 120% or lower of the activation level have occurred, the stability output is activated. At the same time, the stability indicator flashes an alert.



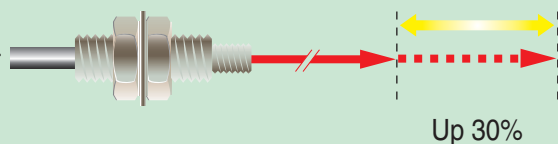
Timer operation

A delay timer of about 40 ms is provided to allow for a range of input conditions of the connected devices. The timer is also useful for stabilization of detection output such as canceling signal chattering.



Turbo function increases detecting distance by 30%

When it is desirable to increase the detecting distance for the current condition of use, enabling the turbo function allows a distance increase of about 30%.



F71 series

Type

- Amplifier (main unit)

| Type | Model | | Light source | Output mode | Connection |
|--|--------------|----------------|--------------|-----------------------------|---|
| | NPN output | PNP output | | | |
| Manual setting general-purpose type | F71R | F71RPN | Red LED | Open collector (NPN/PNP) | Permanently attached cord [M8 connector type also available] |
| | F71G | F71GPN | Green LED | | |
| | F71B | F71BPN | Blue LED | | |
| | F71W | F71WPN | White LED | | |
| Manual setting high-speed type | F71RH | F71RHPN | Red LED | | |
| | F71GH | F71GHPN | Green LED | | |
| | F71BH | F71BHPN | Blue LED | | |
| | F71WH | F71WHPN | White LED | | |

- Fiber optic cable

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

- M8 connector type

M8 connector connection type is separately available for all models.

For identification, “-J” follows the model number.

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 | FA7EU | DIN rail mounting stopper |
| Mounting bracket* | AC-BF2 | Amplifier unit mounting bracket |

*Accessory

Rating/Performance/Specification

| Model | NPN type | F71R | F71G | F71B | F71W | F71RH | F71GH | F71BH | F71WH | |
|---------------------------|--|--|------------------|---|----------------------|-------------------|------------------|-----------|---------|--|
| | PNP type | F71RPN | F71GPN | F71BPN | F71WPN | F71RHPN | F71GHPN | F71BHPN | F71WHPN | |
| Rating/performance | Power supply | 12-24V DC $\pm 10\%$ / Ripple 10% max. | | | | | | | | |
| | Current consumption | NPN type | 35 mA max. | | | | | | | |
| | | PNP type | 40 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: 1 V or less | | | | | | |
| | Output mode | Stability 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: 1 V or less | | | | | | |
| | Operation mode | Light-ON/Dark-ON selectable | | | | | | | | |
| | Timer | On delay/off delay/disabled selectable | | | | | | | | |
| | | Delay time: about 40 ms fixed | | | | | | | | |
| Response time | With switch at 4 (turbo function disabled): 250 μ s max. With switch at 8 (turbo function enabled): 500 μ s max. | | | | 30 μ s max. (*1) | | | | | |
| 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 | | | | | | | | | |
| Volume (VR) | SENS: sensitivity adjustment volume (8-turn without stopper equipped with indicator) | | | | | | | | | |
| Switch (SW) | <ul style="list-style-type: none"> Light-ON/Dark-ON selector switch: L.ON for Light-ON, D.ON for Dark-ON Timer selector switch: NOR. for ON/OFF operation, ON.D for on delay (40 ms), OFF.D for of delay (40 ms) | | | | | | | | | |
| | <ul style="list-style-type: none"> Anti Mutual Interference/turbo mode selector switch (common) | | | | | | | | | |
| Anti Mutual Interference | Provided | | | | | | | | | |
| Short circuit protection | Provided | | | | | | | | | |
| Material | Polycarbonate | | | | | | | | | |
| Connection | Permanently attached cord (outer dimension: dia. 4.8) 0.2sq. 4 core 2 m length (-J type: M8 connector *2) | | | | | | | | | |
| Mass | Approx. 90 g (including 2-m cord and mounting bracket) | | | | | | | | | |
| Accessory | Mounting bracket / Screwdriver for adjustment / Light shielding sticker (excluding H type) / Operation manual | | | | | | | | | |

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

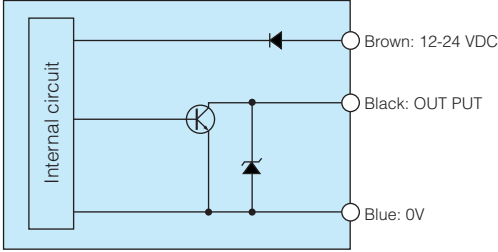
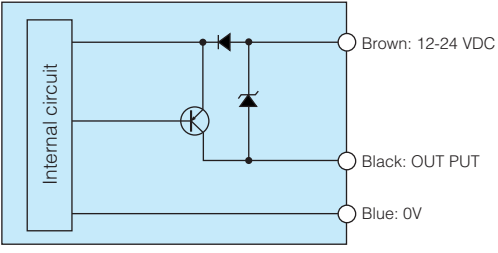
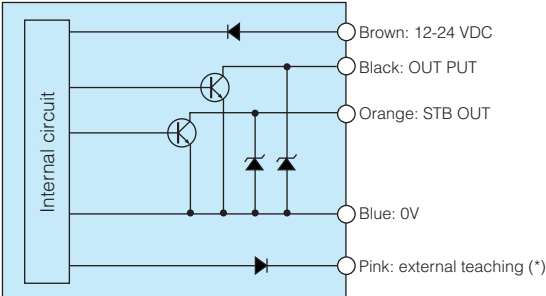
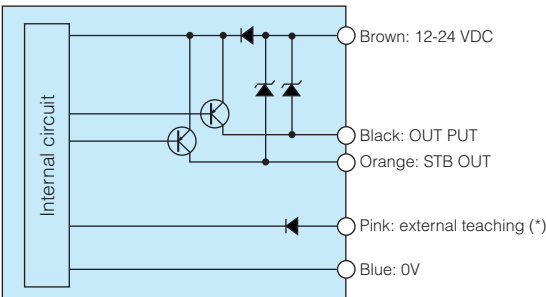
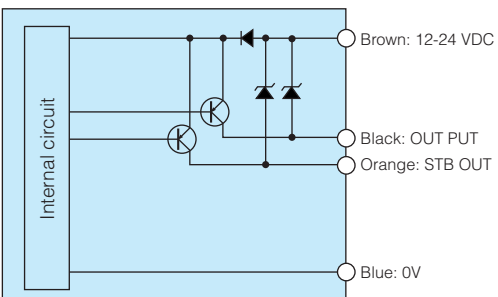
(*1) The detecting distance for high-speed response H type is reduced to roughly 30% of the ordinary type.

(*2) For details about -J (M8 connector type), see p. 23.

Environmental Specification

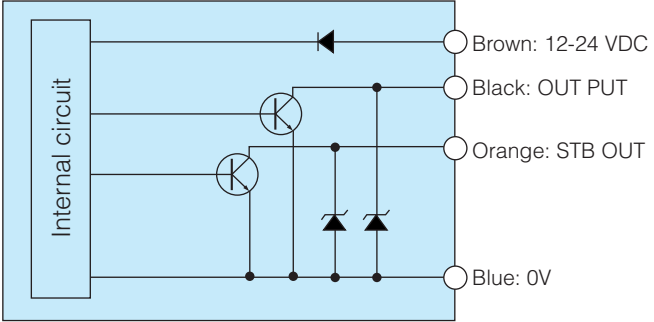
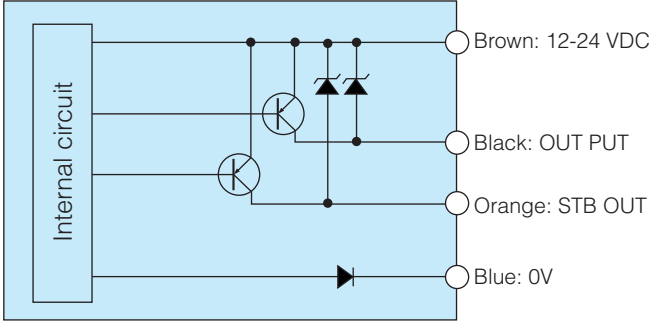
| | | |
|-------------------------|-----------------------------|---|
| Environment | Ambient light | Incandescent lamp: 10,000 lx max. / Sunlight: 20,000 lx max. |
| | Ambient temperature | 1-3 adjacent units in operation: -25 - +55 °C |
| | | 4-10 adjacent units in operation: -25 - +50 °C |
| | | 11-16 adjacent units in operation: -25 - +45 °C |
| | Ambient humidity | Storage: -40 - +70 °C (non-freezing) |
| | Protective structure | 35-85%RH (non-condensing) |
| | Noise | IP40 |
| | | Power supply line: 500 V / Cycle: 10 ms / Pulse duration: 1 μ s Radiation: 1 kV / Cycle: 10 ms / Pulse duration 1 μ s (with noise simulator) |
| | Vibration | 10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction |
| | Shock | 100 m/s ² / 3 times each in 3 directions |
| Dielectric withstanding | 1,000 VAC for 1 minute | |
| Insulation resistance | 500 VDC, 20 M Ω max. | |

Input/Output Circuit and Connection

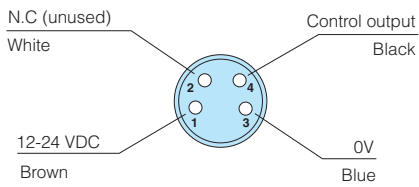
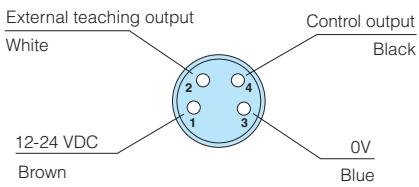
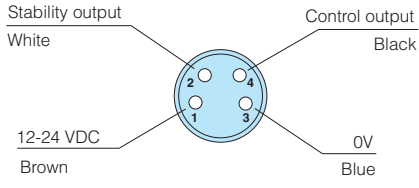
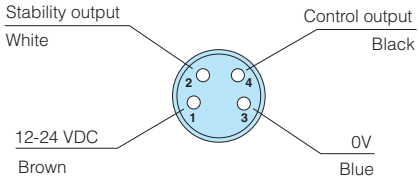
| Model | Output circuit diagram |
|--|--|
| <p>NPN output type</p> <p>F70AR F70ABK F70AG F70AWK F70AB F70AW F70ARK F70AGK</p> |  <p>Brown: 12-24 VDC Black: OUT PUT Blue: 0V</p> |
| <p>PNP output type</p> <p>F70ARPN F70ABKPN F70AGPN F70AWKPN F70ABPN F70AWPN F70ARKPN F70AGKPN</p> |  <p>Brown: 12-24 VDC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

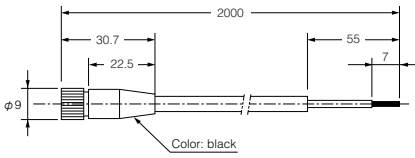
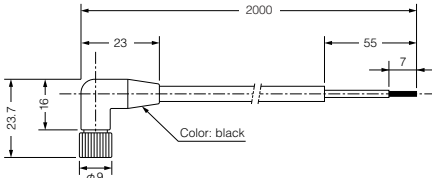
Input/Output Circuit and Connection

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

M8 Connector Type IO Specification/Pin Arrangement/Lead Colors

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

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

| | |
|---|--|
| <p>FBC-4R2S (straight)</p>  | <p>FBC-4R2L (angled)</p>  |
|---|--|

Common to F70A/F70/F71 Series

For Correct Use

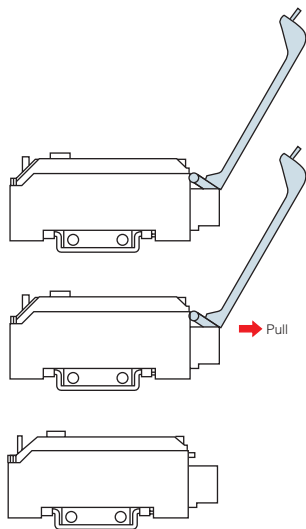
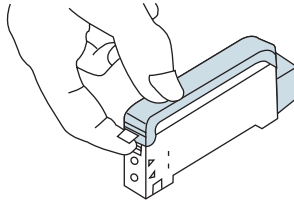
Be sure to follow the instructions in the operation manual provided for correct use of the product.

● 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.

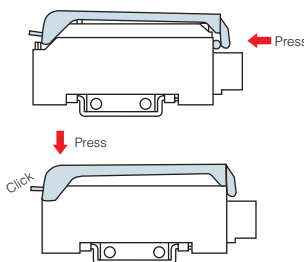
Pulling at the hinge with the cover half open allows removal of the cover.

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.

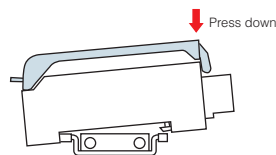


● Attaching amplifier on DIN rail or mounting bracket

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

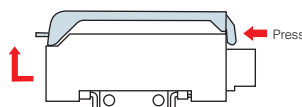
① Attachment

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



② Detachment

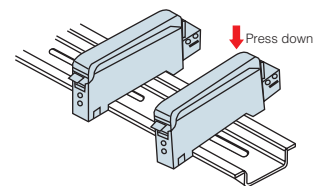
While pressing the amplifier forward, lift the front part and detach the front hook.



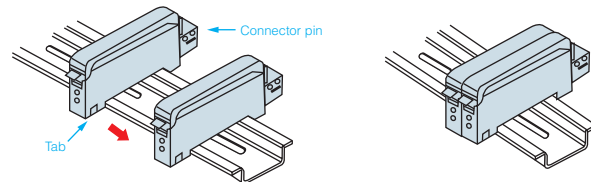
● Attachment of amplifiers for joined use

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.

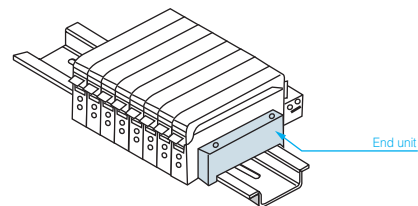
① Mount one amplifier at a time on the DIN rail while keeping a certain space between amplifiers.



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

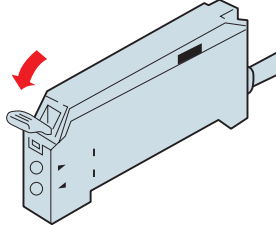
■ For Correct Use

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

● Attachment of fiber optic cable

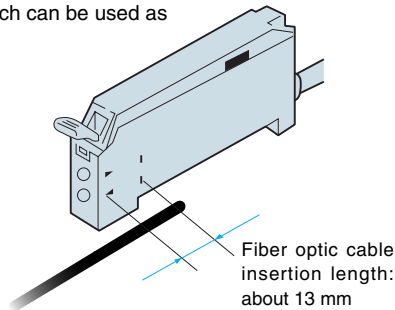
Attachment to amplifier

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

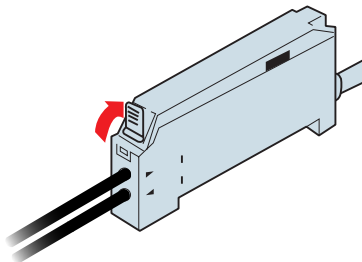


2. Insert the fiber optic cable all the way until it stops.

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.

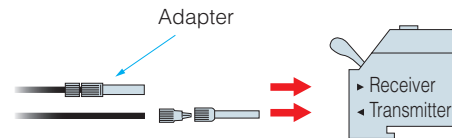


3. Lift the single-touch lock lever.



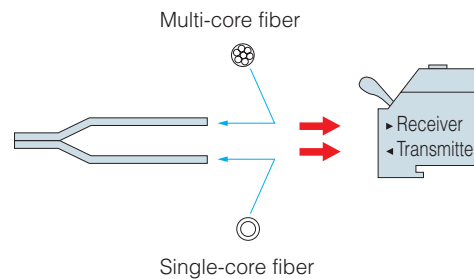
Attachment of small-diameter fiber optic cable

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 mm² 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.

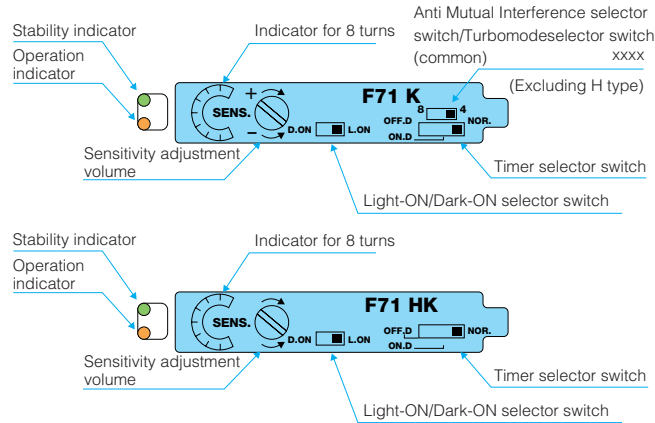
- Make sure that the power fluctuation is within an allowable range so that the power input will not exceed the rating.
- When using a commercially-available switching regulator, use the frame ground or ground terminal.
- For output, avoid the transient condition (0.5 seconds) immediately after power-up.
- 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.

F71 Series

For Correct Use

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

Part names



- SENS. : Sensitivity adjustment volume
- L.ON/D.ON : Light-ON (ON when light is received)/Dark-ON (ON when light is blocked) mode selector switch
- 4/8 (excluding H type) : Anti Mutual Interference selector switch (4: 4 units/8: 8 units)
- NOR/ON.D/ OFF.D : Turbo mode selector switch (4: turbo off/8: turbo on)
- Timer selector switch (4: turbo off/8: turbo on)
- Light-ON/Dark-ON selector switch (4: turbo off/8: turbo on)

Operation indicator

The orange LED is illuminated when the signal is activated.

Stability indicator

The green LED is illuminated when the received light level is well above (120% of) the activation level. As long as the stability indicator is illuminated when the light is received, the stability of the detection is ensured without being affected by variation of environment such as ambient temperature.

Anti Mutual Interference/turbo function (excluding H type)

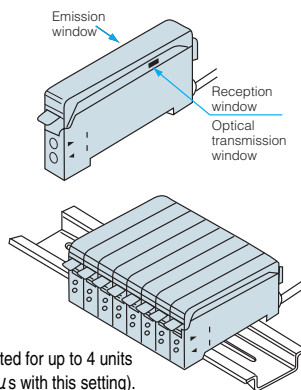
The Anti Mutual Interference selector switch doubles with turbo function selector switch.

Switch set to 8 : The Anti Mutual Interference feature is available for up to 8 units and the turbo function is enabled.

Switch set to 4: The Anti Mutual Interference feature is available for up to 4 units and the turbo function is disabled. The response time is 250 μ s.

Anti Mutual Interference

This product is equipped with the Anti Mutual Interference feature that takes advantage of optical transmission. The optical transmission system uses the transmission windows including emission and reception windows in the sides of an amplifier unit as a light path. For this reason, amplifiers must be mounted adjacently on a DIN rail so that the transmission windows of adjoining units are aligned for secure functioning of the Anti Mutual Interference feature.



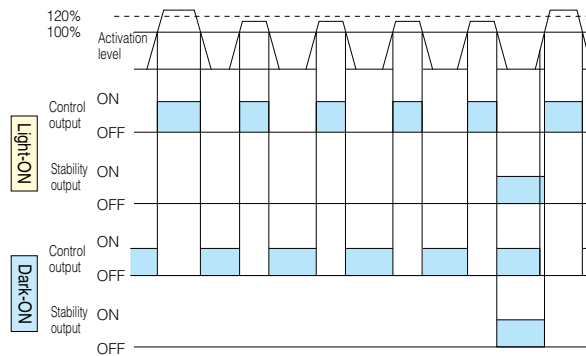
- Anti Mutual Interference selector switch
- 8 → 4 : Interference may be prevented for up to 4 units (the response time is 250 μ s with this setting).
- 8 ← 4 : Interference may be prevented for up to 8 units (the response time is 500 μ s with this setting).

Turbo function

Setting the turbo mode selector switch to "8" enables the turbo function. With this function enabled, the response time is increased to 500 μ s but the detecting distance is also increased by about 30% compared with that for the turbo function disabled (set to "4").

Stability output

The stability output can be used to check for reduction of the light intensity level along with any change in the operating environment or operation over time or to perform initial check of the operation. When four consecutive detections have occurred with the level of received light exceeding the operation level but not reaching 120 percent of the level (range not allowing stable operation), the stability signal is output when the control output is deactivated for Light-ON mode. The stability indicator starts flashing at the same time as the activation of the stability output. If the level of received light gains a margin, the stability output is deactivated and the stability indicator stops flashing and becomes illuminated (normal illumination).



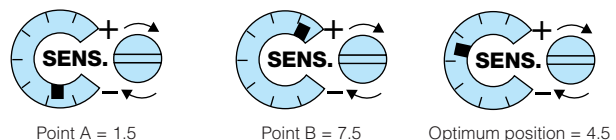
Sensitivity adjustment

Reflective type (adjustment for Light-ON mode)

- ① Place the object to be detected in a given position, turn up the sensitivity adjustment volume (SENS) gradually from Min. and find the point at which the operation indicator (orange LED) is illuminated (Point A).
- ② Remove the object, turn down the sensitivity adjustment volume gradually from Max. and find the point at which the operation indicator (orange LED) goes out (Point B). (If the operation indicator is not illuminated even at Max., Max. is regarded as Point B.)
- ③ Set the volume at midway between Points A and B.
- ④ With the object placed in a given position (light reception state), make sure that the stability indicator (green LED) is illuminated.

Through-beam type (adjustment for Light-ON mode)

- ① With the object to be detected removed, turn up the sensitivity adjustment volume (SENS) to Max. and make sure that the operation indicator (orange LED) and stability indicator (green LED) are illuminated. (If the stability indicator is not illuminated, the set distance may be too long or the light axis may not be aligned.)
- ② Turn down the sensitivity adjustment volume gradually from Max. and find the point at which the operation indicator (orange LED) goes out (Point A).
- ③ With the object placed in a given position, turn up the sensitivity adjustment volume gradually and find the point at which the operation indicator (orange LED) is illuminated (Point B). (If the operation indicator is not illuminated even at Max., Max. is regarded as Point B.)
- ④ Set the volume at midway between Points A and B.
- ⑤ With the object removed (light reception state), make sure that the stability indicator (green LED) is illuminated.



For Correct Use

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

Use the light shielding sticker (accessory) for grouping amplifiers into blocks when taking advantage of the Anti Mutual Interference features to use more than one sensor. The sticker can also be used when the transmission windows may be subject to strong ambient light. (If the detection allows no mutual interference, there is no need to use the sticker even if the amplifiers are mounted adjacently.)

● Detecting distance for -H type

For high-speed response models, the detecting distance is generally about 30% of normal models.

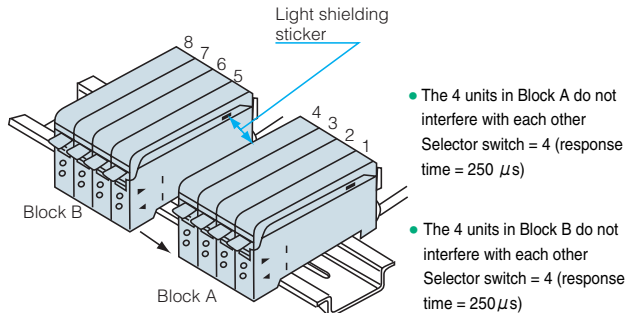
Typical example

| Detection method | Detection method | Detecting distance |
|------------------|------------------|--------------------|
| Reflective | FR5BC | 35mm |
| Through-beam | FT5BC | 95mm |

(With turbo function disabled)

Example 1

8 sensors used (4 units of Block A and 4 units of Block B)



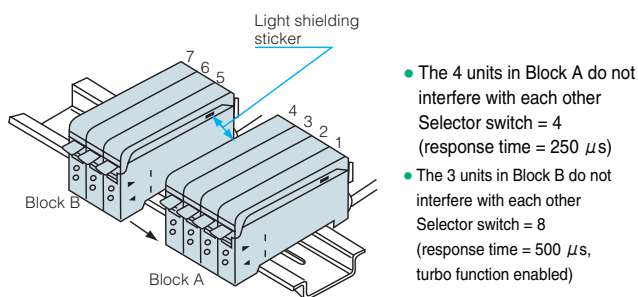
- The 4 units in Block A do not interfere with each other
Selector switch = 4 (response time = 250 μ s)

- The 4 units in Block B do not interfere with each other
Selector switch = 4 (response time = 250 μ s)

- Apply one light shielding sticker to each of the open transmission windows in the fourth and fifth units.
- After the stickers have been applied, slide one block of units until they come in contact with the other block.
- Note: There may be interference between the two blocks of sensors.

Example 2

7 sensors used (4 units of Block A and 3 units of Block B)



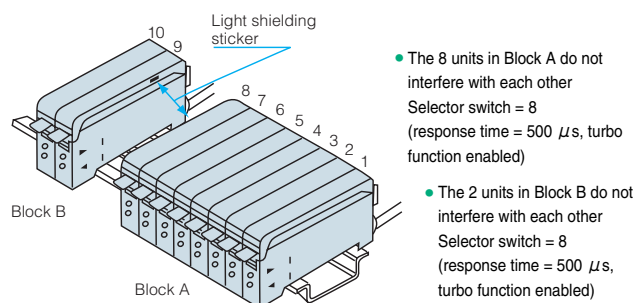
- The 4 units in Block A do not interfere with each other
Selector switch = 4 (response time = 250 μ s)

- The 3 units in Block B do not interfere with each other
Selector switch = 8 (response time = 500 μ s, turbo function enabled)

- Apply one light shielding sticker to each of the open transmission windows in the fourth and fifth units.
- After the stickers have been applied, slide one block of units until they come in contact with the other block.
- Note: There may be interference between the two blocks of sensors.

Example 3

10 sensors used (8 units of Block A and 2 units of Block B)



- The 8 units in Block A do not interfere with each other
Selector switch = 8 (response time = 500 μ s, turbo function enabled)

- The 2 units in Block B do not interfere with each other
Selector switch = 8 (response time = 500 μ s, turbo function enabled)

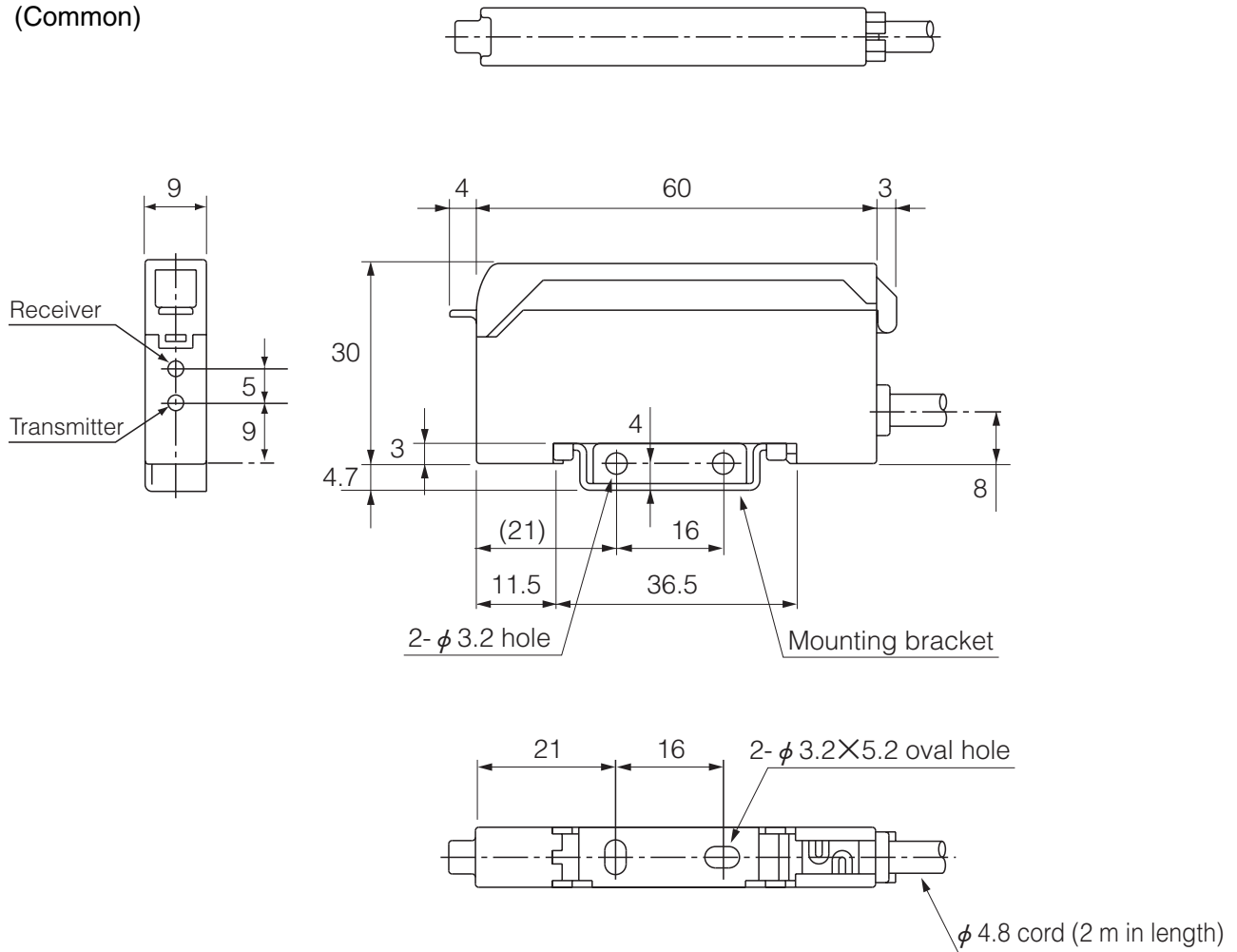
- Apply one light shielding sticker to each of the open transmission windows in the eighth and ninth units.
- After the stickers have been applied, slide one block of units until they come in contact with the other block.
- Note: There may be interference between the two blocks of sensors.

If the selector switch setting is mixed (both "4" and "8" settings are present) within one block, the Anti Mutual Interference feature does not work. Make sure that the selector switch settings are consistent (either "4" or "8") within one block.

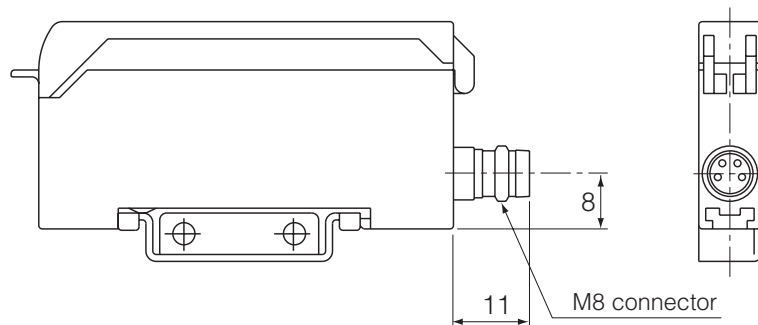
Cord-Connected Type

■ 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-.