

Single / Dual Display Fiber Optic Amplifiers



BF5 Series PRODUCT MANUAL

For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

Features

- Dual-display for light incident level and setting value (BF5□-D)
- Enables to detect the minute object with 1/10,000 high resolution
- Enables to detect with high-speed moving object (response time 50 μs)
- 5 response times
: ultra fast mode (50 μs), fast mode (150 μs), standard mode (500 μs), long distance mode (4 ms), ultra long distance mode (10 ms)
- Anti-saturation setting function prevents malfunction by saturated light
- Easy sensitivity setting
- Long lasting amplifier regardless of element's life degradation or temperature change
- Multiple sensitivity setting modes available
: auto-tuning, 1-point (maximum sensitivity), 2-point, positioning teaching
- Up to 8 units enable to connect with mutual interference prevention function using side connectors
- Auto channel setting function for multiple installations
- Adopts red, green, blue light sources
- Slim design with depth 10 mm (W 10 × H 30 × L 70 mm)

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ⚠ symbol indicates caution due to special circumstances in which hazards may occur.

⚠ Warning Failure to follow instructions may result in serious injury or death.

- 01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss.** (e.g., nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)
Failure to follow this instruction may result in personal injury, economic loss or fire.
- 02. Do not use the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.**
Failure to follow this instruction may result in explosion or fire.
- 03. Install the unit on DIN rail to use.**
Failure to follow this instruction may result in fire.
- 04. Do not disassemble or modify the unit.**
Failure to follow this instruction may result in fire.
- 05. Do not connect, repair, or inspect the unit while connected to a power source.**
Failure to follow this instruction may result in fire.
- 06. Check 'Connections' before wiring.**
Failure to follow this instruction may result in fire.

⚠ Caution Failure to follow instructions may result in injury or product damage.

- 01. Use the unit within the rated specifications.**
Failure to follow this instruction may result in fire or product damage.
- 02. Use a dry cloth to clean the unit, and do not use water or organic solvent.**
Failure to follow this instruction may result in fire.

Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
- When connecting an inductive load such as a DC relay, remove surge by using a diode or varistor.
- Use the product after 3 sec of the power input.
- The power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Wire as short as possible and keep it away from high voltage lines or power lines to prevent surge and inductive noise.
- When using switching mode power supply (SMPS), ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
- Since external disturbance light (sunlight, fluorescent lighting, etc.) can cause product malfunction, use the product with a light shield or slit.
- When sensing an object with the maximum sensitivity, an error of sensing distance can occur due to the deviation of each feature.
- Turn off the power of the fiber optic amplifier before installation or removal.
- When installing the fiber optic unit, check the bend radius of each unit written on the product manual. If the installed unit that has the bend radius under the rated range, causing optical loss so the sensing distance is shortened.
- Be sure not to scratch the surface of the fiber optic unit.
- Do not pull the cable of the fiber optic unit that is connected to the amplifier.
- This unit may be used in the following environments.
 - Indoors (in the environment condition rated in 'Specifications')
 - Altitude max. 2,000 m
 - Pollution degree 2
 - Installation category III

Ordering Information

This is only for reference, the actual product does not support all combinations. For selecting the specified model, follow the Autonics website.

BF5 ① - ② ③ - ④

① Light source

R: Red LED
G: Green LED
B: Blue LED

② Display part

D: Dual display
S: Single display

③ Function

1: General type

④ Control output

N: NPN open collector output
P: PNP open collector output

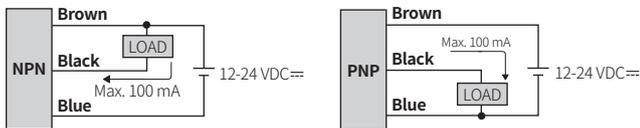
Product Components

- Product
- Connector cable
- Instruction manual
- Side connector

Sold Separately

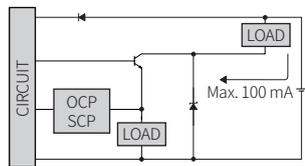
- Fiber optic units
- Communication converter: BFC Series

Connections

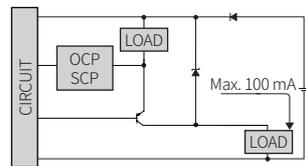


Circuit

■ NPN open collector output



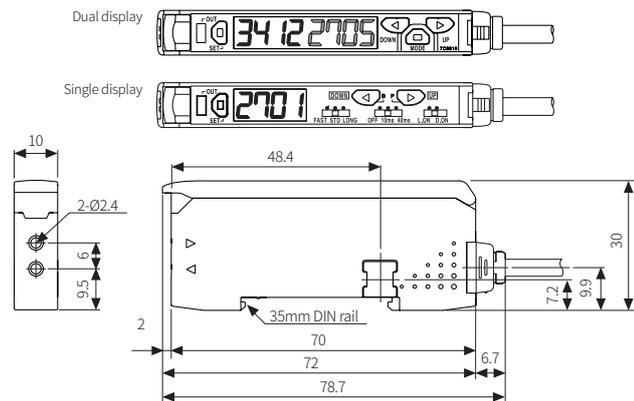
■ PNP open collector output



• OCP (over current protection), SCP (short circuit protection)

Dimensions

• Unit: mm, For the detailed drawings, follow the Autonics website.



Error

| Error | Cause | Troubleshooting |
|--------------|---|---|
| <i>E r r</i> | In RUN mode, the overcurrent has been detected from the output circuit. | Remove the overcurrent due to the overload. |
| <i>E r b</i> | - Slave fails to execute the Master's instructions such as 1:M copy, load all, save all, and group teaching due to unstable communication lines. - Another communication error occurs. | - Check the cascaded amplifiers. - Check the circuitry around the side connector and hardware condition. |

Specifications

| Model | BF5R-D1-□ | BF5G-D1-□ | BF5B-D1-□ |
|--------------------------------|--|-------------------|-------------------|
| Light source | Red LED | Green LED | Blue LED |
| Peak emission wavelength | 660 nm, modulated | 530 nm, modulated | 470 nm, modulated |
| Response time | Standard (500 μs), Long distance (4 ms), Ultra long distance (10 ms), Ultra fast (50 μs), Fast (150 μs) mode | | |
| Sensitivity setting | Manual, Teaching (Auto-tuning, 1-point, 2-point, positioning) | | |
| Operation mode | Light ON, Dark ON | | |
| Measured value display | 7-segment LCD, 4-digit (decimal, percentage) | | |
| Operation mode of the timer | OFF, OFF Delay, ON Delay, One-shot | | |
| Max. cascading units | ≤ 31 units | | |
| Mutual interference prevention | ≤ 8 units | | |
| Indicator | Operation indicator (red), display screen (PV display part: red LED, SV display part: green LED) | | |
| Approval | CE 标志 | CE 标志 | CE 标志 |
| Unit weight (packaged) | ≈ 20 g (≈ 138 g) | ≈ 20 g (≈ 138 g) | ≈ 20 g (≈ 138 g) |

| Model | BF5R-S1-□ |
|--------------------------------|---|
| Light source | Red LED |
| Peak emission wavelength | 660 nm, modulated |
| Response time | Standard (500 μs), Long distance (4 ms), Fast (150 μs) mode |
| Sensitivity setting | Manual, Teaching (Auto-tuning) |
| Operation mode | Light ON, Dark ON |
| Measured value display | 7-segment LCD, 4-digit (decimal, percentage) |
| Operation mode of the timer | OFF Delay (time range: OFF, 10 ms, 40 ms) |
| Mutual interference prevention | ≤ 8 units |
| Indicator | Operation indicator (red), display screen (PV / SV display part: red LED) |
| Approval | CE 标志 |
| Unit weight (packaged) | ≈ 20 g (≈ 138 g) |

| | |
|--|--|
| Power supply | 12-24 VDC≐ ±10% (ripple P-P: ≤ 10%) |
| Current consumption | ≤ 50 mA |
| Control output | NPN open collector output / PNP open collector output model |
| Load voltage | ≤ 24 VDC≐ |
| Load current | ≤ 100 mA |
| Residual voltage | NPN: ≤ 1 VDC≐, PNP: ≤ 3 VDC≐ |
| Protection circuit | Reverse power protection circuit, output short over current protection circuit, surge protection circuit |
| Insulation resistance | ≥ 20 MΩ (500 VDC≐ megger) |
| Dielectric strength | Between the charging part and the case: 1,000 VAC~ 50 / 60 Hz for 1 min |
| Vibration | 1 mm double amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours |
| Shock | 500 m/s ² (≈ 50 G) in each X, Y, Z direction for 3 times |
| Ambient illuminance (receiver) | Sunlight: ≤ 11,000 lx, incandescent lamp: ≤ 3,000 lx |
| Ambient temperature | -10 to 50 °C, storage: -20 to 70 °C (no freezing or condensation) |
| Ambient humidity | 35 to 85%RH, storage: 35 to 85%RH (no freezing or condensation) |
| Protection rating | IP40 (IEC standard) |
| Connection | Connector cable |
| Cable spec. | Ø 4 mm, 3-wire, 2 m |
| Wire spec. | AWG22 (0.08 mm, 60-core), insulator outer diameter: Ø 1.25 mm |
| Tightening torque for fiber optic unit | ≥ 2kgf |
| Material | Case: PBT, cover: PC |

Supporting Functions & Mode Settings

• For more detailed information on functions and settings, refer to the manual.

■ Dual display model

| | | | |
|----------------|--|------------------------------|-----|
| [MODE] 3 sec → | Program mode | [MODE] 3 sec → | |
| [SET] → | Teaching sensitivity setting | Auto → | |
| [SET] 3 sec → | Group teaching | Auto → | |
| [◀] or [▶] → | Manual sensitivity setting | Auto after 3 sec → | |
| [MODE] 5 sec → | Data bank mode | [MODE] 3 sec → | RUN |
| [SET] + [▶] → | Anti-saturation function | Auto → | |
| [MODE] → | Incident light level monitoring | [MODE] or auto after 1 min → | |
| [MODE] 7 sec → | Initialization | Auto → | |

■ Single display model

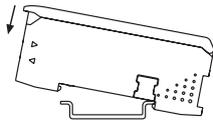
| | | | |
|---------------|--|---------------------------|--|
| [SET] → | Teaching sensitivity setting | Auto → | |
| [SET] 3 sec → | Group teaching | Auto → | |
| [◀] or [▶] → | Manual sensitivity setting | Auto after 3 sec → | |
| [SET] + [▶] → | Anti-saturation function | Auto → | |
| [▶] 3 sec → | Incident light level monitoring | [▶] or auto after 1 min → | |
| [◀] 3 sec → | Measured value display | Auto → | |

| Mode | Switch settings | Setting range |
|-------------------|-----------------|--|
| Response time | FAST STD LONG | FST: fast mode (150 μs) STD: standard mode (500 μs) LONG: long distance mode (4 ms) |
| Time of the timer | OFF 10ms 40ms | Timer operation mode: OFF Delay Time: OFF, 10 ms, 40 ms • Refer to the 'Timing Chart of the Timer.' |
| Operation mode | L.ON D.ON | L.ON (Light ON): when the light is received state, operation indicator turns ON. D.ON (Dark ON): when the light is interrupted state, operation indicator turns ON. |

DIN Rail Mount and Removal

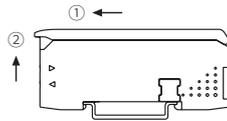
■ Mount

- Hang up the holder on the backside of the amplifier to the DIN rail (35 mm).
- Press the front side of the amplifier toward the DIN rail.



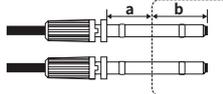
■ Removal

- Slide the amplifier to direction ①.
- Lift the front side of the amplifier to direction ②.



Insert Fiber Optic Unit

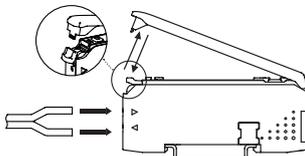
- Lift the protective cover and lower down the lever lock.
- Insert the cable of the fiber optic unit to the slot completely.
(▷ : receiver part, ◁ : emitter part)



| Length (mm) | Receiver part | Emitter part |
|------------------|---------------|--------------|
| a ⁰¹⁾ | | 8 |
| b | | 13 |

01) With the adaptor attached

- Lift the lever lock to fix the fiber optic unit and close the protective cover.



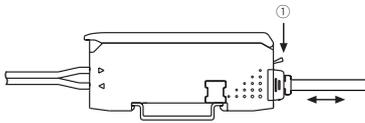
Connect and Remove Connector Cable

■ Connection

Insert the connector into the amplifier mounted to the DIN rail with a click.

■ Removal

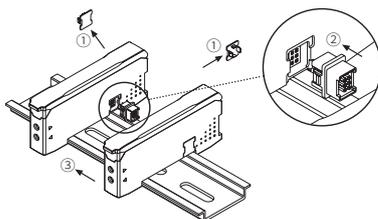
Press the connector part to direction ① and pull it.



Cascade the Amplifiers

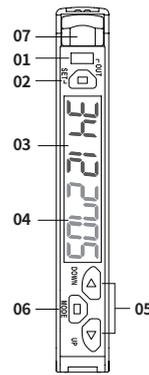
- Cascading multiple amplifiers is available via the side connector. (max. 31 units)
- Make sure that if you connect the side connector with excessive force, it may cause extruded pins.
- Be sure to mount the side connector to fit tightly. Otherwise, the communication connection and the function of mutual interference prevention may not normally work.
- All amplifiers share the supply power from the one.
- When power is supplied, assigning channels to the cascaded amplifiers automatically (direction: →, channel number: +1). Be aware that the channel number cannot be changed, and it is not saved when turning off the power.
 - Dual display model: it is available to check P-9. Channel in the program mode.
 - Single display model: it is only available when the power is supplied for the first time.
- The function of mutual interference prevention activates after cascading amplifiers with supplying power. (max. 8 units)

- Turn OFF the power of all amplifiers.
- Remove the side cover (①) on the amplifier and mount the side connector (②) to the socket.
- Hang up the amplifier to the DIN rail and push it to direction ③.
- Be sure to check the connection of the amplifiers and side connector.



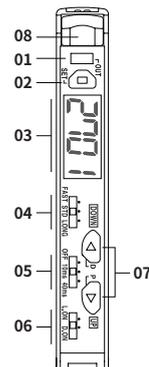
Unit Descriptions

■ Dual display model



- Operation indicator (red)**
- [SET] key**
Teaching sensitivity setting, group teaching, data back setting, incident light level monitoring, initialization
- PV display part (red 4-digit LED)**
RUN mode: it shows PV (present value).
Setting mode: it shows the parameter.
- SV display part (green 4-digit LED)**
RUN mode: it shows SV (setting value).
Setting mode: it shows the setting value, parameter value.
- [◀] [▶] key**
Manual sensitivity setting, select the setting value
- [MODE] key**
Enter mode, return to RUN mode, move parameter, save the setting value
- Lever lock**
It is used to fix the fiber optic unit.

■ Single display model



- Operation indicator (red)**
- [SET] key**
Teaching sensitivity setting, group teaching, incident light level monitoring
- PV / SV display part (red 4-digit LED)**
- Setting switch for the response time**
- Setting switch for the time of the timer**
- Setting switch for the operation mode**
- [◀] [▶] key**
Enter mode, manual sensitivity setting, select the setting value
- Lever lock**
It is used to fix the fiber optic unit.

Program Mode

■ Dual display model

- Activate or deactivate some of the parameters depending on other parameter settings. Refer to the detailed explanation of each mode.
- Return to the RUN mode for applying the setting.
- [MODE] key: saves the setting value and move to the next parameter
[◀], [▶] key: selects the setting value and time of the timer

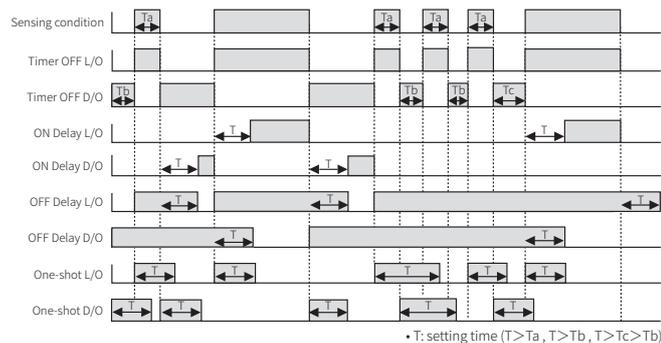
| Mode | Display | Factory defaults | Setting range |
|---|---------|------------------|--|
| | | PV | |
| P Program mode | P r o G | n o d E | • Entering method: in RUN mode, [MODE] key 3 sec |
| P-1 Response time | r s P d | 5 t d | STD: standard mode (500 μs) LONG: long distance mode (4 ms) ULOG: ultra long distance mode (10 ms) UFST: ultra fast mode (50 μs) FST: fast mode (150 μs) |
| P-2 Measured value display ⁰¹⁾ | d s P F | 4 0 0 0 | 4000: decimal 999P: percentage |
| P-3 Display direction | d i r | 1 2 3 4 | 1234: normal ƵEƵT: upside down |
| P-4 Operation mode of the timer | t n o d | o F F | OFF OND: delays OFF → ON timing of the control output (ON delay) OFD: delays ON → OFF timing of the control output (OFF delay) SHOT: maintains ON state of the control output during the setting time (One-shot) • Refer to the 'Timing Chart of the Timer.' |
| P-5 Time of the timer ⁰²⁾ | t i n E | 2 0 0 0 | 1 to 5,000 ms |
| P-6 Teaching mode | S E n S | A U t o | AUTO: auto-tuning 1PNT: 1-point teaching 2PNT: 2-point teaching PSTN: positioning teaching • Refer to the 'Teaching sensitivity setting.' |
| P-7 Energy saving mode | E S A u | n o r | NOR: not used 1SAV: OFF the SV display part without pressing the key over 1 min 2SAV: OFF the display screen without pressing the key over 1 min |
| P-8 Operation mode | L d o n | L - o n | L-ON (Light ON): when the light is received state, operation indicator turns ON. D-ON (Dark ON): when the light is interrupted state, operation indicator turns ON. |
| P-9 Channel | C H | - | When the power is supplied, automatically set : 1 to 32 channels |
| P-10 Communication | C o m m | E n A | ENA: enable DISA: disable • Refer to the 'Group Teaching, Data Bank Mode.' |
| P-11 Lock mode | L o c k | o F F | OFF LOC1 LOC2 • Refer to the [Table 1] below. |

01) Decimal range: 0 to 4000 (in case of the long-distance mode in the response time : 0 to 9999)
Percentage range: 0 to 999P (no decimal points)

02) Setting condition: all but OFF of P-4. Operation mode of the timer
• [Table 1]

| Parameter | LOC 1 | | LOC 2 | |
|--------------------------|-------|---------|-------|---------|
| | Check | Setting | Check | Setting |
| Sensitivity setting | ○ | X | ○ | X |
| Program mode | ○ | X | X | X |
| Data bank mode | X | X | X | X |
| Anti-saturation function | X | X | X | X |
| Initialization | X | X | X | X |

Timing Chart of the Timer



Teaching Selection

■ Auto-tuning

It is suitable for the sensing environment in which fast-moving objects make unstable incident light levels. Also, it is convenient because the object maintains its movement continuously during the teaching mode. It uses the average value of the incident light level estimated a certain period of time.

■ 1-point teaching

It is suitable for the sensing environment where much dust or pollutant makes the lower incident level. The teaching proceeds; through-beam type: with sensing target, reflective type: without sensing target

■ 2-point teaching

It is suitable for the sensing environment in which the object moves slowly or stops with stable incident light level. After the teaching 2 points (with/without sensing target), set the average value as a teaching value.

■ Positioning teaching

After placing the sensing target to the desired position, set 90% of the incident light level as a teaching value. Typically, it is available for detecting a small hole on the surface (through-beam type) or detecting moving object having a curve (reflective type).

Teaching Sensitivity Setting

■ Dual display model

- Before setting the sensitivity, select P-6. Teaching in the program mode suitable for the sensing environment.
- Refer to the detailed explanation of teaching mode.

| Mode | PV | SV | Descriptions | |
|---------------------------------|---------|---------|--|---|
| Auto-tuning | A U t o | 1 - 5 | Press [SET] key to proceed the teaching: 2 sec | |
| | | 2 - 5 | | |
| | | o E | | Flash twice (save a teaching value) and return to RUN mode |
| 1-point teaching ⁰¹⁾ | 1 P n t | 1 - 5 | Press [SET] key to proceed the teaching: 2 sec | |
| | | 2 - 5 | | |
| | | o E | | Flash twice (save the teaching value) and return to RUN mode |
| 2-point teaching ⁰²⁾ | 2 P n t | 1 P | Press [SET] key to enter 1-point teaching mode | |
| | | 1 - 5 | 1-point teaching : without sensing target | |
| | | 2 - 5 | | Press [SET] key to proceed the teaching : 2 sec |
| | | 1 P o E | | Cross-flashing twice (e.g., 1-point teaching value (P _{Min}) = 250) |
| | | 2 P | Standby 2-point the teaching | |
| | | 1 - 5 | 2-point teaching : with sensing target | |
| | | 2 - 5 | | Press [SET] key to proceed the teaching : 2 sec (without pressing key over 1 min: end teaching and return to RUN mode) |
| | | 2 P o E | | Cross-flashing twice (e.g., 2-point teaching value (P _{Max}) = 3400) |
| | | 3 4 0 0 | Completion | |
| | | 1 8 2 5 | | Cross-flashing twice (save the teaching value) and return to RUN mode (e.g., teaching value ($\frac{P_{Min} + P_{Max}}{2}$) = 1825) |
| Positioning teaching | P S t n | 1 - 5 | Press [SET] key to proceed the teaching: 2 sec | |
| | | 2 - 5 | | |
| | | o E | | Flash twice (save the teaching value) and return to RUN mode |

01) Adjust incident light level depending on the response time. Refer to the table below.

| Response time | Incident light level | |
|--------------------------|----------------------|------------|
| | 0 | Saturation |
| Ultra fast mode | 10 | 3980 |
| Fast mode | | |
| Standard (STD) mode | | |
| Long distance mode | | |
| Ultra long distance mode | 5 | 9980 |

02) Based on the reflective type.

■ Single display model

| Mode | PV / SV | Descriptions |
|-------------|---------|--|
| RUN mode | 3 0 0 0 | It shows the present incident light level, press [SET] key to proceed the teaching |
| Auto-tuning | 1 - 5 | Proceeding the teaching: 2 sec |
| | 2 - 5 | Cross-flashing twice (save the teaching value) and return to RUN mode |
| | o E | |
| | 1 8 0 0 | |

Group Teaching

- The command of Master sets the sensitivity settings of cascaded amplifiers at once.
- Channel range: ≤ 32 channels
- [◀], [▶] key: select the setting value

■ Dual display model

- Supporting teaching mode: auto-tuning, 1-point teaching, positioning teaching
- In the program mode, set P-10. Communication as ENA (enable).

| Amplifier | PV | SV | Descriptions |
|-----------|---------|---------|---|
| Master | E C H I | R L L | • Entering method: in RUN mode, press [SET] key for 3 sec Press [SET] key to proceed |
| | | n o | Press [SET] or [MODE] key to return to RUN mode |
| | | Y E 5 | Press [SET] key to proceed Group teaching |
| | C H □ | o E | Transmit the teaching command to each slave PV: channel number, SV: OK |
| Slave | E C H I | - - - - | Proceeding the teaching (0.5 sec per each progress bar) |
| | | E n d | Flash twice (teaching complete) and return to RUN mode |
| Master | E C H I | - - - - | Proceeding the teaching |
| | | E n d | Flash twice (teaching complete) and return to RUN mode |

■ Single display model

| Amplifier | PV / SV | Descriptions | |
|-----------|---------|-----------------------|---|
| Master | E C H I | Cross-flashing | • Entering method: in RUN mode, press [SET] key for 3 sec Press [SET] key to proceed |
| | R L L | Cross-flashing | |
| | E C H I | Cross-flashing | Press [SET] or [MODE] key to return to RUN mode |
| | n o | Cross-flashing | |
| | E C H I | Cross-flashing | Press [SET] key to proceed Group teaching |
| | Y E 5 | Cross-flashing | |
| | C H □ | Channel number/ OK | Transmit the teaching command to each slave |
| | o E | Cross-flashing | |
| Slave | E C H I | Cross-flashing twice | Proceeding the teaching |
| | R L L | Cross-flashing twice | |
| | - - - - | | |
| | E n d | Flash twice | Teaching complete |
| | 2 0 0 0 | Flash twice | Displaying the teaching value and return to RUN mode |
| Master | - - - - | | Proceeding the teaching |
| | E n d | Flash twice | Teaching complete |
| | 2 0 0 0 | Flash twice | Displaying the teaching value |
| | E C H I | Cross-flashing twice | Return to RUN mode |
| | E n d | Cross-flashing twice | |

Manual Sensitivity Setting

- You can set the sensitivity as the desired value. (factory defaults: 2000)
- You can adjust the teaching value from the teaching sensitivity setting.
- PV display part shows the present incident light level during the manual sensitivity setting.

■ Dual display model

| Mode | PV | SV | Descriptions |
|---------------------|---------|---------|---|
| RUN mode | 3 2 1 0 | 3 0 0 0 | Change the setting value using [◀], [▶] key (e.g., 3000 → 2500) |
| Sensitivity setting | 3 2 1 0 | 2 5 0 0 | Press [MODE] key or without pressing a key over 3 sec, flashing the setting value twice (save the setting value) and return to RUN mode |

■ Single display model

| Mode | PV / SV | Descriptions |
|---------------------|---------|---|
| RUN mode | 3 2 1 0 | Press [◀] or [▶] key once |
| | 2 0 0 0 | Flash the previous setting value twice, Change the setting value using [◀], [▶] key (e.g., 2000 → 2500) |
| Sensitivity setting | 2 5 0 0 | Without pressing the key for 3 sec: flash the setting value twice (save the setting value) and return to RUN mode |

Data Bank Function

Change the settings of amplifiers using the Master's command or adjust one amplifier, managing all the banks of cascaded amplifiers at once.

■ Data load

Loads one of the preset data banks (BAK 0, 1, 2) and applies it to the amplifier. The bank parameters can be read and changed.

■ Data save

Saves settings of the amplifier to one of the data banks.

■ Data copy

Selects one of the data banks currently saved in the amplifier, and copies it to the other amplifier (1:1) or all cascaded amplifiers (1:M).

■ Load all

Selects one of the data banks currently saved in the amplifier, and loads it to all cascaded amplifiers.

■ Save all

Batch saves the data banks selected from master to cascaded amplifiers.

Data Bank Mode

■ Dual display model

- In the program mode, set the P-10. Communication as ENA (enable) of all cascaded amplifiers.
- In the program mode, release P-11. Lock mode of all cascaded amplifiers.
- All cascaded amplifiers should be in RUN mode.
- Be sure to check whether the side connector is mounted correctly.
- [MODE] key: saves the setting value and move to the next parameter, returns to RUN mode after applying the input for 3 sec
- [SET] key: proceeds the mode, returns to the upper mode
- [◀], [▶] key: selects the setting value or the channel of the cascaded amplifier
- Return to the upper mode when pressing [SET] or [MODE] key after selecting NO.

| Mode | Amplifier | PV | SV | Descriptions | | | |
|------|--------------|--------|---------|--------------|--|--|--|
| 0 | Data bank | Master | d R E R | b R n E | • Entering method: in RUN mode, [MODE] key 5 sec | | |
| 1 | Data load | Master | L o R d | b R E D | BAK0, BAK1, BAK2 | | |
| 1-1 | Setting mode | Master | r S P d | S E d | Press [SET] key for the load / read / change the BAK data ⁰¹⁾ | | |
| 2 | Data save | Master | S R u E | b R E D | Data: BAK0, BAK1, BAK2 Press [SET] key to proceed | | |
| 2-1 | Setting mode | Master | S R u E | Y E 5 | Press [SET] key to proceed | | |
| | | | | E n d | After the completion, press [SET] key to return 2. Data save mode | | |
| 3 | Data copy | Master | C o P Y | S - - 5 | S - - 5 | Press [SET] key to proceed | |
| | | | | | C H 3 2 | Select the channel of the cascaded amplifier and press [SET] key to proceed | |
| | | | | | Y E 5 | • Press [SET] key to proceed After that, the flow is the same as 3-2. 1:M copy | |
| 3-1 | 1:1 copy | Master | C o P Y | S - - 5 | Press [SET] key to proceed | | |
| | | | | | C H 3 2 | Select the channel of the cascaded amplifier and press [SET] key to proceed | |
| | | | | | Y E 5 | • Press [SET] key to proceed After that, the flow is the same as 3-2. 1:M copy | |
| | | | | | S - - n | Press [SET] key to proceed | |
| | | | | | R L L | Press [SET] key to proceed | |
| | | | | | Y E 5 | Press [SET] key to proceed | |
| 3-2 | 1:M copy | Master | C H □ | o E | Send the command of Master to Slave PV display part: channel number, SV display part: OK | | |
| | | | | Slave | r h | o E | After the completion, return to RUN mode |
| | | | | Master | C o P Y | E n d | After the completion, press [SET] key to return 3. Data copy mode |
| 4 | Group load | Master | L d R L | b R E D | Data: BAK0, BAK1, BAK2 Press [SET] key to proceed | | |
| | | | | | Y E 5 | Press [SET] key to proceed | |
| | | | | | C H □ | o E | Send the command of Master to Slave PV display part: channel number, SV display part: OK |
| 4-1 | Setting mode | Slave | L d R L | E n d | After the completion, return to RUN mode | | |
| | | | | Master | L d R L | E n d | After the completion, press [SET] key to return 4. Group load mode |
| | | | | Master | L d R L | Y E 5 | Press [SET] key to proceed |
| 5 | Group save | Master | S u R L | b R E D | Data: BAK0, BAK1, BAK2 Press [SET] key to proceed | | |
| | | | | | Y E 5 | Press [SET] key to proceed | |
| | | | | | C H □ | o E | Send the command of Master to Slave PV display part: channel number, SV display part: OK |
| 5-1 | Setting mode | Slave | S u R L | E n d | After the completion, return to RUN mode | | |
| | | | | Master | S u R L | E n d | After the completion, press [SET] key to return 5. Group save mode |
| | | | | Master | S u R L | E n d | After the completion, press [SET] key to return 5. Group save mode |

01) It is the same as the setting values of program mode.
The factory defaults of SET parameter: 2000

Anti-saturation Function

- When the incident light level is saturated, optimize this value automatically (max. 10 levels).
- The anti-saturation function may change the operation of control output.

■ Dual display model

| Mode | PV | SV | Descriptions |
|----------|------|------|--|
| RUN mode | 4000 | 2000 | Press [SET] + [▶] key to activate the function |
| ON | 3500 | ---1 | Adjust the incident light level (e.g., 3 levels) |
| | 3000 | ---2 | |
| | 2000 | ---3 | |
| | 2000 | --oE | Flash twice and complete the setting ⁰¹⁾ , return to RUN mode |
| OFF | 2000 | 1500 | Press [SET] + [▶] key to deactivate the function |
| | 4000 | 5-oF | Flash twice and release the function, return to RUN mode |

■ Single display model

| Mode | PV / SV | Descriptions |
|----------|---------|--|
| RUN mode | 4000 | Press [SET] + [▶] key to activate the function |
| ON | ---1 | Adjust the incident light level (e.g., 3 levels) |
| | ---2 | |
| | ---3 | |
| | --oE | Flash twice |
| | 2000 | Complete the setting ⁰¹⁾ , return to RUN mode |
| OFF | 2100 | Press [SET] + [▶] key to deactivate the function |
| | 5-oF | Flash twice and release the function, return to RUN mode |

01) The condition for setting completion differs depending on the response time. If the value of saturation is too high so that the adjusted value does not reach the condition for the completion, it stops at level 10 and returns to RUN mode.

| Response time | Condition for the setting completion |
|--------------------------|--------------------------------------|
| Ultra fast mode | Incident light level ≤ 2,200 |
| Fast mode | |
| Standard (STD) mode | |
| Long distance mode | Incident light level ≤ 5,500 |
| Ultra long distance mode | |

Incident Light Level Monitoring

- You can check the high peak / low peak value of incident light level and change it to the currently measured value.
- Return to RUN mode without pressing key for 1 min.

■ Dual display model

| Mode | PV | SV | Descriptions |
|---------------------------------|---|------|---|
| Incident light level monitoring | • Entering method: in RUN mode, press [MODE] key once | | |
| Max. value (High peak) | HPEE | 4000 | Check max. incident light level and press [SET] key to change (e.g., 4000 → 3000) |
| | HPEE | 3000 | Press [MODE] key to move the parameter |
| Min. value (Low peak) | LPEE | 1000 | Check min. incident light level and press [SET] key to change (e.g., 1000 → 950) |
| | LPEE | 950 | Press [MODE] key and return to RUN mode |

■ Single display model

| Mode | PV / SV | Descriptions |
|---------------------------------|---|---|
| Incident light level monitoring | • Entering method: in RUN mode, press [▶] key for 3 sec | |
| Max. value (High peak) | HPEE | Cross-flashing Check max. incident light level and press [SET] key to change (e.g., 4000 → 3000) |
| | 4000 | |
| | HPEE | Press [▶] key to move the parameter |
| Min. value (Low peak) | LPEE | Cross-flashing Check min. incident light level and press [SET] key to change (e.g., 1000 → 950) |
| | 1000 | |
| | LPEE | Press [▶] key to return to RUN mode |
| | 950 | Cross-flashing |

Reset to Factory Settings

■ Dual display model

- Restore the setting value to the factory default settings. (except the incident light level monitoring)
- [◀], [▶] key: select the setting value

| Mode | PV | SV | Descriptions |
|----------------|--|--------|---|
| Initialization | • Entering method: in RUN mode, press [MODE] key for 7 sec | | |
| | Init E | no | Press [MODE] key and return to RUN mode |
| | | YES | Press [SET] key to proceed |
| | | Init E | Flash twice (initialization) and return to RUN mode |

Measured Value Display

■ Dual display model

- Refer to P-2. Measured value display in the program mode.

■ Single display model

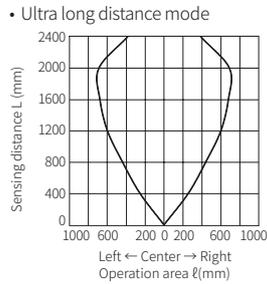
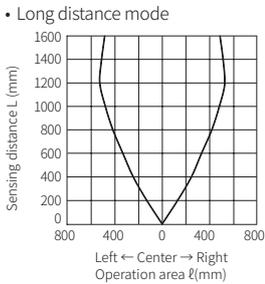
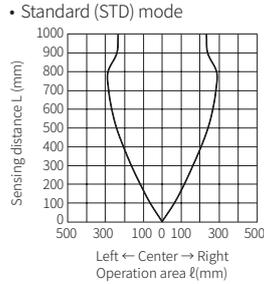
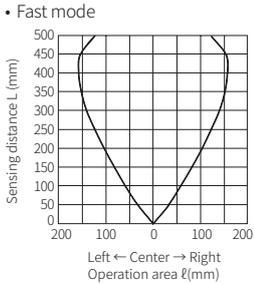
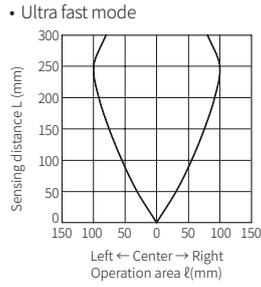
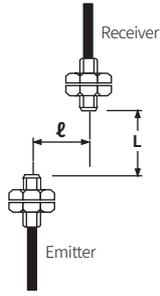
- You can set the display mode of the screen for current incident light level.
 - Decimal (display range: 0 to 4000, display range of the long distance mode: 0 to 9000)
 - Percentage (display range: 0 to 999P, no decimal points)

| Mode | PV / SV | Descriptions |
|------------|---|------------------------------------|
| RUN mode | • Entering method: in RUN mode, press [◀] key for 3 sec | |
| Decimal | 4000 | Flash twice and return to RUN mode |
| Percentage | 999P | Flash twice and return to RUN mode |

Characteristic Curves: Through-beam Type

Fiber optic unit model: FT-420-10

■ Sensing area



Segment Table

The segments displayed on the product indicate the following meanings. It may differ depending on the product.

| 7 segment | | | | 11 segment | | | | 12 segment | | | | 16 segment | | | |
|-----------|---|---|---|------------|---|---|---|------------|---|---|---|------------|---|---|---|
| 0 | 0 | l | l | 0 | 0 | l | l | 0 | 0 | l | l | 0 | 0 | l | l |
| 1 | 1 | u | J | 1 | 1 | u | J | 1 | 1 | u | J | 1 | 1 | u | J |
| 2 | 2 | h | K | 2 | 2 | h | K | 2 | 2 | h | K | 2 | 2 | h | K |
| 3 | 3 | L | L | 3 | 3 | L | L | 3 | 3 | L | L | 3 | 3 | L | L |
| 4 | 4 | n | M | 4 | 4 | n | M | 4 | 4 | n | M | 4 | 4 | n | M |
| 5 | 5 | n | N | 5 | 5 | n | N | 5 | 5 | n | N | 5 | 5 | n | N |
| 6 | 6 | o | O | 6 | 6 | o | O | 6 | 6 | o | O | 6 | 6 | o | O |
| 7 | 7 | P | P | 7 | 7 | P | P | 7 | 7 | P | P | 7 | 7 | P | P |
| 8 | 8 | q | Q | 8 | 8 | q | Q | 8 | 8 | q | Q | 8 | 8 | q | Q |
| 9 | 9 | r | R | 9 | 9 | r | R | 9 | 9 | r | R | 9 | 9 | r | R |
| A | A | S | S | A | A | S | S | A | A | S | S | A | A | S | S |
| b | B | t | T | b | B | t | T | b | B | t | T | b | B | t | T |
| c | C | u | U | c | C | u | U | c | C | u | U | c | C | u | U |
| d | D | v | V | d | D | v | V | d | D | v | V | d | D | v | V |
| E | E | w | W | E | E | w | W | E | E | w | W | E | E | w | W |
| F | F | x | X | F | F | x | X | F | F | x | X | F | F | x | X |
| G | G | y | Y | G | G | y | Y | G | G | y | Y | G | G | y | Y |
| H | H | z | Z | H | H | z | Z | H | H | z | Z | H | H | z | Z |

Characteristic Curves: Reflective Type

Fiber optic unit model: FD-620-10

■ Sensing area

