

# Autonics

## Digital Fiber Optic Sensor BF5 SERIES [Single Display]

M A N U A L



Thank you very much for selecting Autonics products.  
For your safety, please read the following before using.

### Caution for your safety

- × Please keep these instructions and review them before using this unit.
- × Please observe the cautions that follow.
- Warning** Serious injury may result if instructions are not followed.
- Caution** Product may be damaged, or injury may result if instructions are not followed.
- × The following is an explanation of the symbols used in the operation manual.
- Caution:** Injury or danger may occur under special conditions.

### Warning

- In case of using this unit with machinery (Ex: nuclear power control, medical equipment, ship, vehicle, train, airplane, combustion apparatus, safety device, crime/disaster prevention equipment, etc) which may cause damages to human life or property, it is required to install fail-safe device. It may cause a fire, human injury or damage to property.
- Do not disassemble the case. Please contact us if it is required. It may cause electric shock or a fire.

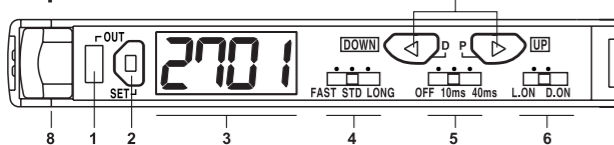
### Caution

- This unit shall not be used outdoors. It might shorten the life cycle of the product or cause electric shock.
- Do not use this unit where inflammable or explosive gas exists. It may cause a fire or explosion.
- Please observe the rated specifications. It may shorten the life cycle of the product.
- Do not use this unit over rated voltage and do not supply AC power to DC power type. It may cause product damage.
- Wire properly after checking the power polarity. It may cause product damage.
- Do not use this unit where severe shock or vibration exists. It may cause product damage.
- In cleaning unit, do not use water or organic solvent. It may cause electric shock or a fire.

### Ordering information

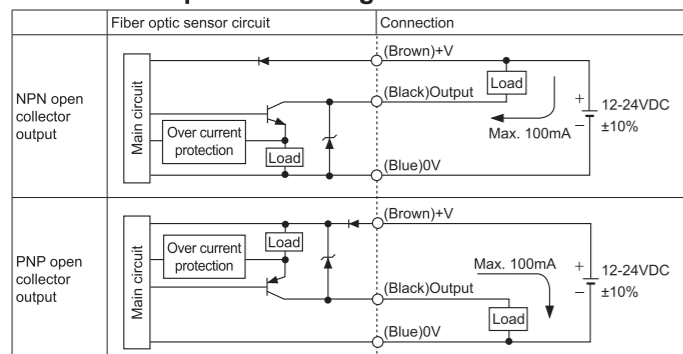
Model	Light source	Display part	Control output
BF5R-S1-N	Red LED	Single display type	NPN open collector output
BF5R-S1-P	Red LED	Single display type	PNP open collector output

### Front part identification



- Control output indicator (Red)**  
Used to indicate control output provided by comparing SV and actual incident light level.
- Sensitivity setting key**  
Used to execute each operation and to set sensing sensitivity.
- PV/SV display part (4digit, Red, 7-segment)**  
Used to indicate incident light level / SV and parameters
- Response time setting switch**  
FAST, STD, LONG
- Timer setting switch**  
Used to select OFF Delay time. (OFF, 10ms, 40ms)
- Operation mode setting switch**  
Used to select Light ON / Dark ON.
- Up/Down key**  
Used to up/down setting values  
• Used to enter into each mode (D key: selects display function, P key: monitoring mode)  
• Used to fine-adjust sensitivity
- Lock lever**

### Control output circuit diagram and connections



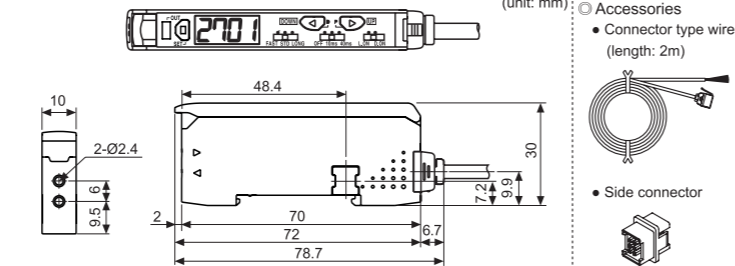
× The above specifications are subject to change and some models may be discontinued without notice.

### Specifications

Model	NPN output PNP output	BF5R-S1-N BF5R-S1-P
Light source	Red LED (660nm, modulated)	
Power supply	12-24VDC ±10%	
Current consumption	Max. 50mA	
Operation mode	Light ON/Dark ON Selectable	
Control output	NPN or PNP open collector output • Load voltage: Max. 24VDC • Load current: Max. 100mA • Residual voltage - NPN: Max. 1V, PNP: Max. 3V	
Protection circuit	Reverse polar protection, Overcurrent protection, Surge protection	
Response time	Fast: 150µs, STD: 500µs, Long: 4ms	
Display method	• Incident light level / SV: Red, 4digit, 7-segment • Main output indicator: Red LED	
Display function	Incident light level / SV display (4,000/10,000 resolution), Percentage display, High/Low peak value display	
Sensitivity setting	Manual sensitivity setting, teaching sensitivity setting (auto tuning)	
Mutual interference prevention	Max. 8 unit sets (Automatically set regardless of response time)	
Timer	OFF, 10ms OFF Delay timer, 40ms OFF Delay timer	
Insulation resistance	Min. 20MΩ (at 50VDC megger)	
Dielectric strength	1,000VAC 50/60Hz for 1min.	
Vibration	1.5 mm amplitude at frequency of 10 to 55Hz (for 1 min.) in each X, Y, Z direction for 2 hours	
Shock	500m/s <sup>2</sup> (approx. 50G) in X, Y, Z directions for 3 times	
Environment	Ambient illumination: Incandescent lamp: Max. 3,000lx, Sunlight: Max. 11,000lx (received illumination)	
Ambient temperature	-10 to 50°C, Storage: -20 to 70°C	
Ambient humidity	35 to 85%RH, Storage: 35 to 85%RH	
Protection	IP40 (IEC standard)	
Material	Case: PBT, Cover: PC	
Fiber cable tightening torque	Min. 2kgf	
Accessories	Connector type wire (ø4mm, 3-wire, 2m) (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: ø1.25mm), Side connector	
Approval	CE	
Weight**1	Approx. 138g (approx. 20g)	

×1: The weight with packaging and the weight in parentheses is only unit weight.  
× The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

### Dimensions

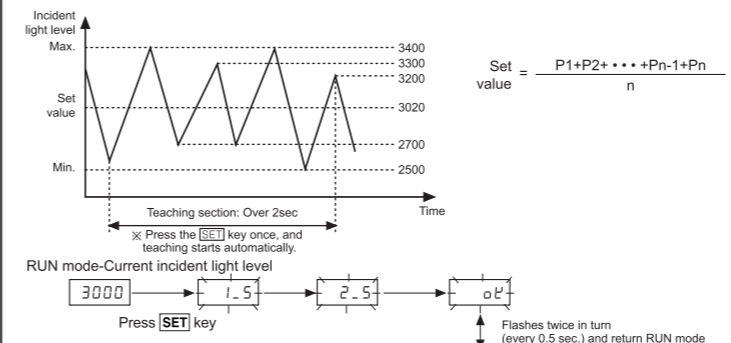


### Installations

- Amplifier unit mounting**
  - Installation: Hang up the backside holder on the DIN rail and press the unit toward the DIN rail.
  - Removal: Slide the back part of the unit as the ① figure and lift up the unit as the ② figure.
- Amplifier unit connection**
  - Remove the side cover at the connecting side as the figure ① and connect the side connector as the figure ②.
  - Be sure that if connecting a side connector with excessive force, it may cause extruded pins.
  - After mounting the unit on the DIN rail, push gently both units to fasten each other.
  - Make sure that connections between the unit case and connectors correctly.
  - Improper connection may cause malfunction of channel setting and mutual interference prevention functions.
  - Do not supply the power while connecting / disconnecting amplifier units.
- Fiber cable connection**
  - Lift up the protective cover to the ① direction and completely lower the lock lever to the direction of to the ② direction to release the lock setting.
  - Insert the cable to the ③ direction and adhere between the cable and the inside of the amplifier unit. (Insert depth: Approx. 13mm)
  - Place up the lock lever to lock the lock setting to the ① direction and close the protective cover to the ③ direction.
- Wire connector connection**
  - Insert the connector into the amplifier unit until it clicks into the right position.
  - When removing the connector, pull out the connector to the ① direction with pressing the lever downside to the ② direction.

### Sensitivity setting

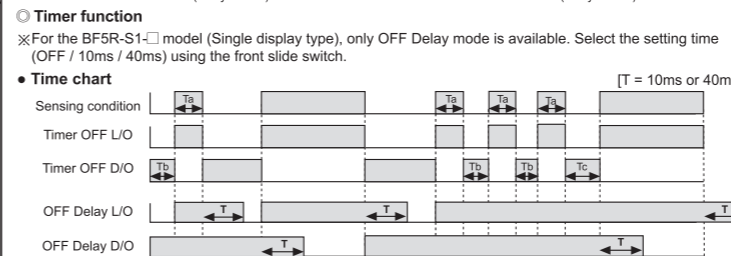
- × There are two methods available for sensitivity setting - manual/teaching sensitivity setting. Select the method most suitable for your application.
- Manual sensitivity setting (Fine-adjusting sensitivity)**
  - This setting is to set the sensitivity manually.
  - Used to fine-adjust sensitivity after the teaching sensitivity setting.
  - Incident light level is still displayed on the PV/SV display part during SV setting.
- Teaching sensitivity setting (Auto-tuning)**
  - For the BF5R-S1-□ model, teaching sensitivity setting mode is fixed to auto-tuning.
  - This mode is easy to set the sensitivity when incident light level of sensing object is not stable or moved fast.
  - One of teaching modes that sets the sensitivity using the average value of the max. and min. incident light level within a certain time period.



- ① In RUN mode, press the [SET] key once with placing the target.
- ② Press the [SET] key once and teaching starts automatically. Teaching progresses for 2 sec.
- ③ When teaching is complete, OK flashes twice every 0.5 sec. and it returns RUN mode.

### Function

- Response time setting**  
Use the front slide switch to set response time.
  - Fast (FAST) mode: 150µs
  - Standard (STD) mode: 500µs
  - Long distance (LONG) mode: 4ms
- Display function (Factory default: Standard display)**  
A function to select incident light level display on display part.
  - Display range of standard mode: 0 to 4000 (0 to 9999, in case of long distance mode)
  - Display range of percentage mode: 0P to 99.9P (Decimal point is not displayed)

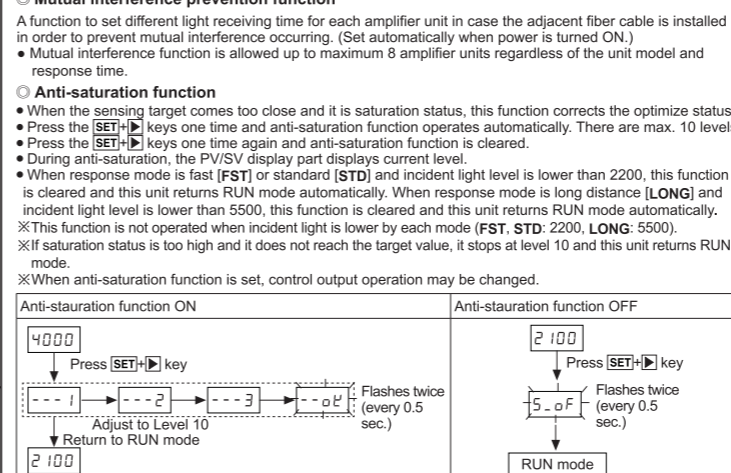


× Setting time: T > Ta, T > Tb, T > Tc

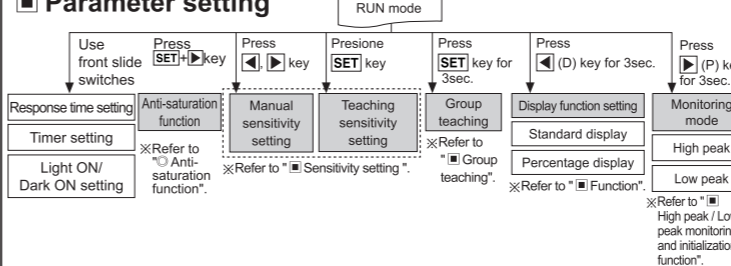
### Light ON / Dark ON switching function

A function to set Light ON - control output is ON when incident light level is higher than setting value and Dark ON - control output is ON when incident light level is lower than setting value. The BF5R-S1-□ (Single display type) model uses the front slide switch to set each mode.

- Amplifier units connection using side connector**  
In case multiple amplifier units are connected, supply the power for one unit and the power is also supplied to the other connected units.
- Auto channel setting function**
  - The channel for each amplifier unit - connected by side connector - is automatically set in a certain direction (-) as soon as power is supplied. Channel number is increasing one by one.
  - For the BF5R-S1-, the automatically set channel number can be checked only when initial power is supplied (Not possible to check afterwards).
  - Channel range: 1 to 32
  - Note that the automatically set channel cannot be changed and the channel number of each amplifier unit is not saved in case of power OFF.
- Mutual interference prevention function**  
A function to set different light receiving time for each amplifier unit in case the adjacent fiber cable is installed in order to prevent mutual interference occurring. (Set automatically when power is turned ON.)
  - Mutual interference function is allowed up to maximum 8 amplifier units regardless of the unit model and response time.
- Anti-saturation function**
  - When the sensing target comes too close and it is saturation status, this function corrects the optimize status.
  - Press the [SET] key one time and anti-saturation function operates automatically. There are max. 10 levels.
  - Press the [SET] key one time again and anti-saturation function is cleared.
  - During anti-saturation, the PV/SV display part displays current level.
  - When response mode is fast [FAST] or standard [STD] and incident light level is lower than 2200, this function is cleared and this unit returns RUN mode automatically. When response mode is long distance [LONG] and incident light level is lower than 5500, this function is cleared and this unit returns RUN mode automatically.
  - This function is not operated when incident light is lower by each mode (FAST, STD: 2200, LONG: 5500).
  - If saturation status is too high and it does not reach the target value, it stops at level 10 and this unit returns RUN mode.
  - When anti-saturation function is set, control output operation may be changed.

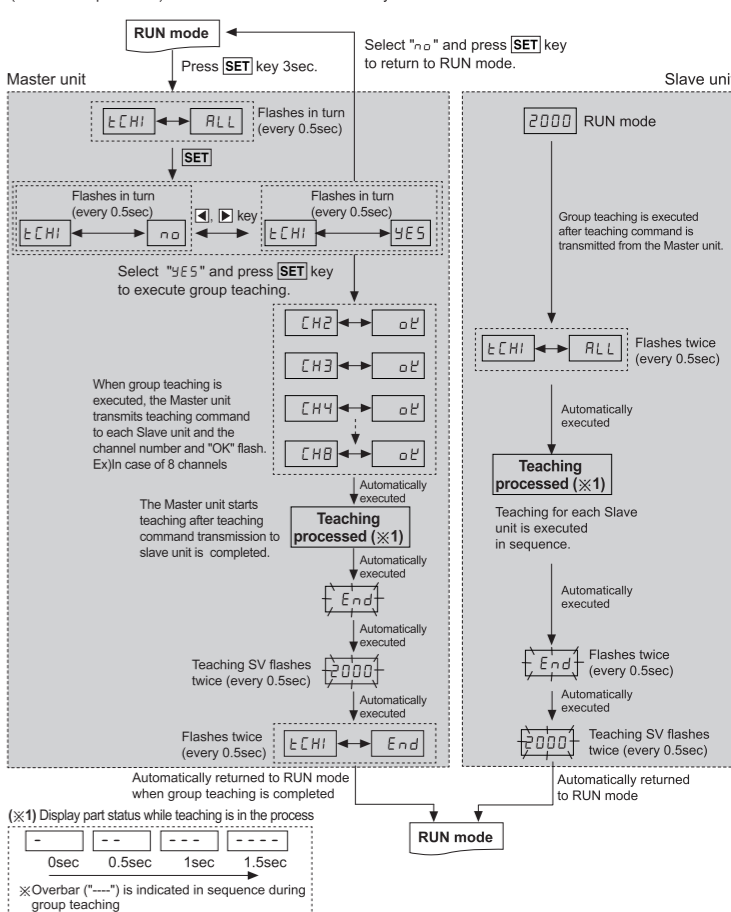


### Parameter setting



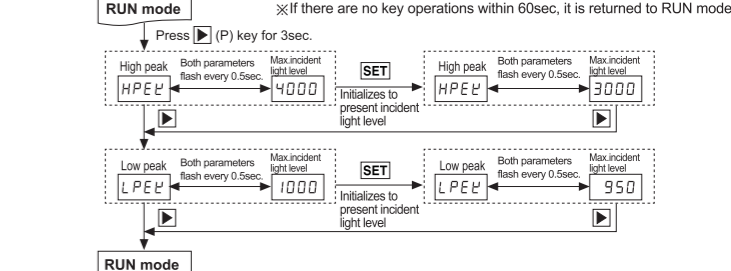
### Group teaching

A function to set the sensitivity of Slave amplifier units according to the command of the Master amplifier unit (a certain amplifier unit) in a successive and collective way.



### High peak / Low peak monitoring and initialization function

A function to monitor the high/low peak value of incident light level. The monitored high/low peak value can be initialized.



### Error code

Error code	Cause	Troubleshooting
Err	In case overcurrent inflow occurs into the output circuit.	Remove the overcurrent due to the overload.
Errb	<ul style="list-style-type: none"> <li>In case the Slave is failed to execute the Master's instructions due to unstable communication line</li> <li>Check the circuit and the hardware around the side connector.</li> <li>In case other communication errors occur.</li> </ul>	<ul style="list-style-type: none"> <li>Check the amplifier units' connection again.</li> <li>Check the circuit and the hardware around the side connector.</li> </ul>

### Caution for using

- When using switching power supply as the source of supplying power, Frame Ground (F.G.) terminal shall be grounded and a condenser for removing noise shall be installed between 0V and F.G. terminal.
- Avoid using the unit where there is severe dust and corrosion, or it may cause malfunction.
- Do not start operating during initial power supplying time. (3sec.)
- In case moving the unit from cold outside to a indoor room, start operating after removing moisture.
- When wiring the amplifier with high voltage line, power line in a same conduit, it may cause malfunction or mechanical problem. Please wire it separately or use different conduit.
- Do not use the unit outdoor or anywhere exposed to direct extraneous light. In case of max. sensitivity setting, there might exist slight sensing distance difference due to each feature deviation.

× It may cause malfunction if above instructions are not followed.

### Major products

- Photoelectric sensors
- Fiber optic sensors
- Door sensors
- Door side sensors
- Area sensors
- Proximity sensors
- Pressure sensors
- Rotary encoders
- Connector/Sockets
- Switching mode power supplies
- Control switches/Lamps/Buzzers
- I/O Terminal Blocks & Cables
- Stepper motors/drivers/motion controllers
- Graphic/Logic panels
- Field network devices
- Laser marking system (Fiber, CO<sub>2</sub>, Nd:YAG)
- Laser welding/isolating system
- Temperature controllers
- Temperature/Humidity transducers
- SSR/Power controllers
- Counters
- Timers
- Panel meters
- Tachometer/Pulse/Rate/meters
- Display units
- Sensor controllers

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