

# Autonics

## FIBER OPTIC SENSOR BF4R SERIES

### MANUAL



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.
- Injury or danger may occur under special conditions.

#### Warning

- In case of using this unit with machineries (Nuclear power control, medical equipment, vehicle, train, airplane, combustion apparatus, entertainment or safety device etc), it requires installing fail-safe device, or contact us for information on type required. It may result in serious damage, fire or human injury.
- Do not disassemble and modify this unit, when it requires. If needs, please contact us. It may give an electric shock and cause a fire.

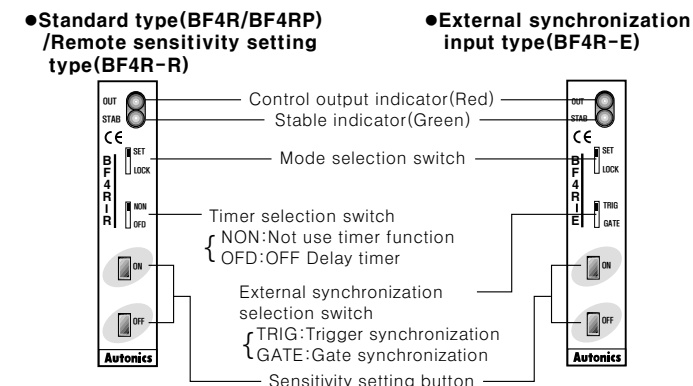
#### Caution

- This unit shall not be used outdoors. It might shorten the life cycle of the product or give an electric shock.
- Do not use this unit in place where there is flammable or explosive gas. It may cause a fire or explosion.
- Please observe voltage rating and do not supply AC power. It may result in damage to this unit.
- Please check the polarity of power and wrong wiring. It may result in damage to this unit.
- Do not use this unit in place where there is vibration or impact. It may result in damage to this unit.
- In cleaning the unit, do not use water or an oil-based detergent. It might cause an electric shock or fire that will result in damage to the product.

#### Ordering information

BF4	R	P	E
Function	E	External synchronization input type	Standard type
Control mode	P	PNP Open collector output	Standard type
Light source	R	Red LED	Standard type
Fiber sensor	BF4	Series name	

#### Part names



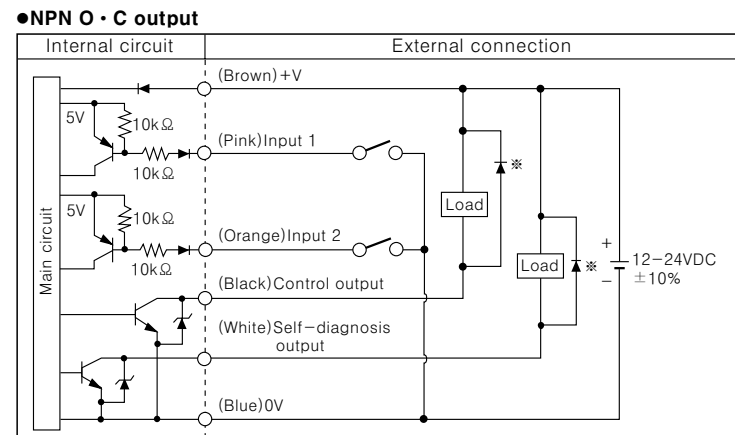
\*The above specifications are changeable without notice anytime.

#### Specification

Model	BF4R	BF4R-E	BF4R-R	BF4RP
Model	Standard type	External synchronization input type	Remote sensitivity setting type	Standard type
Power voltage	12-24VDC ±10%, Ripple p-p: Max. 10%			
Current consumption	Max. 45mA			
Control output	NPN O · C output		PNP O · C output	
	Applied voltage: Max. 30VDC Load current: Max. 100mA Residual voltage: Max. 1V (at 100mA load current), Max. 0.4V (at 16mA load current)		Applied voltage: Max. 30VDC Load current: Max. 100mA Output voltage: Min. power supply -2.5V	
Self-diagnosis output	ON state under unstable sensing (When the target stays for 300ms in unstable area) or ON state when control output short-circuited		Applied voltage: Max. 30VDC Load current: Max. 50mA Residual voltage: Max. 1V (at 50mA load current), Max. 0.4V (at 16mA load current)	
	ON state under unstable sensing (When the target stays for 300ms in unstable area) or ON state when control output short-circuited		Applied voltage: Max. 30VDC Load current: Max. 50mA Residual voltage: Max. 1V (at 50mA load current), Max. 0.4V (at 16mA load current)	
Operation mode	Selectable the sensitivity in front of this unit with ON/OFF button			
Protection circuit	Short-circuit protection, Reverse polarity protection circuit			
Light source	Red LED (Modulated)			
Response time	Max. 0.5ms (Note 1)			
Control output indication (OUT)	Red LED			
Stable indication (STAB)	Green LED flickers when the target stays in stable sensing area			
Emission disable input function	Built in		Built in	
External synchronization function	Built in (Gate/Trigger)		Built in	
Remote sensitivity setting function	Built in		Built in	
Interference prevention function	Built-in selectable FREQ.1 or FREQ.2 by ON/OFF button (Note 1)			
Timer function (Selectable)	OFF delay timer (Approx. 40ms fixed)		OFF delay timer (Approx. 40ms fixed)	
Ambient illumination	Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx			
Noise strength	±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength	1,000VAC 50/60Hz for 1 minute			
Insulation resistance	Min. 20MΩ (at 500VDC)			
Vibration	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours			
Shock	500m/s <sup>2</sup> (50G) X, Y, Z direction for 3 times			
Operating temperature	-10 to 50°C (at non-freezing state)			
Storage temperature	-20 to 70°C			
Ambient humidity	35 to 85%RH			
Material	Case : Heat-resistant ABS, Case cover : Polycarbonate			
Cable	φ4, 4P, Length: 2m		φ4, 6P, Length: 2m	
Weight	Approx. 65g			
Approval	CE			

\* (Note1) Frequency 1 (Normal mode): Max. 0.5ms, Frequency 2: Max. 0.7ms

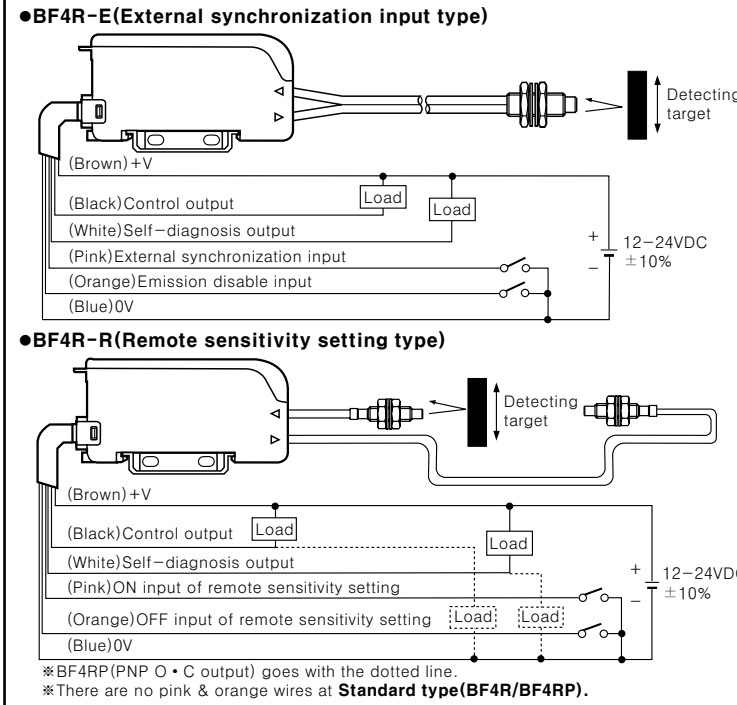
#### Control output circuit diagram



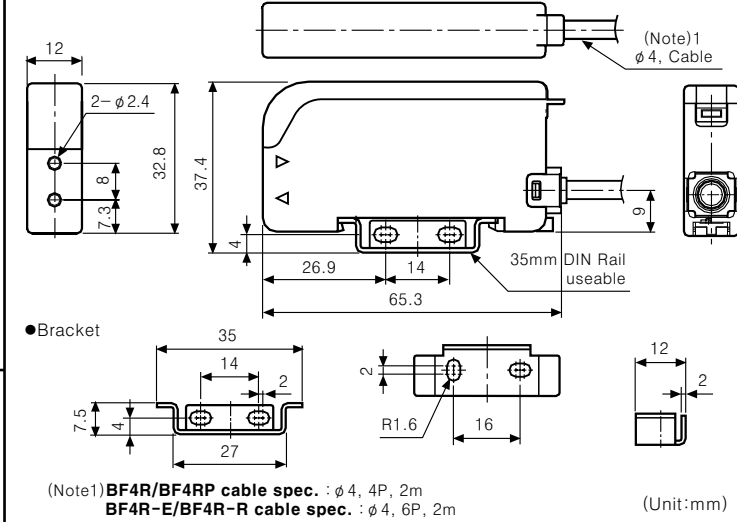
Model	BF4R/BF4RP (Standard type)	BF4R-E (External synchronization input type)	BF4R-R (Remote sensitivity setting type)
Input cable			
Input 1		External synchronization input	ON input of external sensitivity setting
Input 2		Emission disable input	OFF input of external sensitivity setting

\*Connect Diode at external terminal for inductive load.

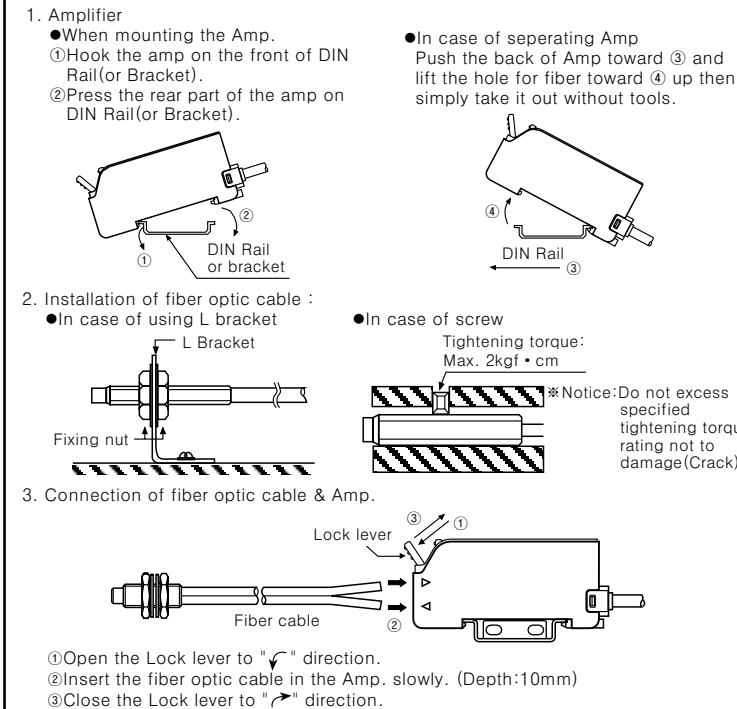
#### Connection



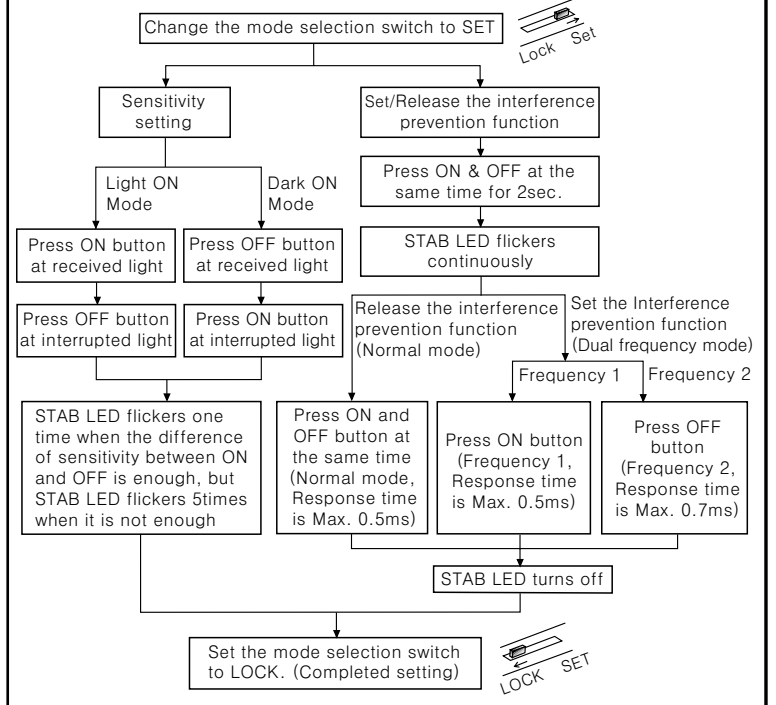
#### Dimension



#### Mounting



#### Mode setting



#### Accessories

Model	Dimension	Features
FTH-310	M3×0.5, φ6, φ4.6, φ3, 12, 1000, 8	
FTH-410	M4×0.7, φ7, φ5.8, φ4, 12, 1000, 8	Fiber optic cable protection pipe (Shock, Vibration, Cable cut)
FDH-610	M6×0.75, φ9, φ7, φ5.5, 11, 1000, 8	

#### Fiber optic cable model

- Fiber optic cable model name (All models)**  
 ●FD-320-05 ●FDS-320-05 ●FD-620-10H ●FTC-320-10 ●FT-420-10H  
 ●FD-420-05 ●FDS-420-05 ●FD-620-15H1 ●FTCS-220-05 ●FT-420-10H1  
 ●FD-620-10 ●FDS-620-10 ●FT-320-05 ●FTP-320-10 ●GT-420-14H2  
 ●FDC-320-05 ●FD-320-F ●FT-420-10 ●FTR-420-10  
 ●FDCS-320-05 ●FD-320-F2 ●FTS-320-05 ●FTS-420-10  
 ●FDP-320-10 ●FD-620-F2 ●FTC-220-05 ●FTS1-320-05

Model	Allowable band radius	Min. detecting object	Detecting distance (mm)	Dimension
FT-320-05	15R	φ0.5	150	Adapter, 12, 2000, φ0.5, M3X0.5, φ1
FT-420-10	30R	φ1	500	3, 12, 20, 2000, φ1, M4X0.7, φ2.2
FD-320-05	15R	φ0.03	40	Adapter, 12, 2000, 2-φ0.5, M3X0.5, 2-φ1
FD-620-10	30R	φ0.03	120	3, 15, 18, 2000, 2-φ1, M6X0.75, 2-φ2.2

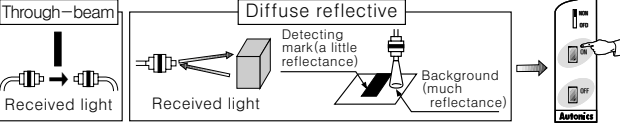
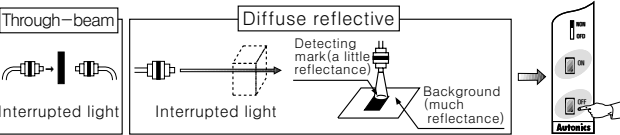
\*Specification of other models is indicated in our general catalog.  
\*Model with Adapter mark, it should be used with Adapter.

## Function

### Sensitivity adjustment

#### Adjustment by the sensitivity setting button(All models)

##### Light ON Mode

Order	Setting method
①	Mount the fiber optic cable within detecting distance.
②	Change the mode selection switch to SET.
③	Press <b>ON</b> button in state of installed the detecting target. (Press <b>ON</b> button without the detecting target for the through-beam type) 
④	The stable indicator flickers at ON state. (Check the target position)
⑤	Press <b>OFF</b> button in state of removed detecting target. (Press <b>OFF</b> button at state of installed the detecting target for the through-beam type) 
⑥	<ul style="list-style-type: none"> <li>When there is enough sensitivity difference between ON state and OFF state, the STAB indicator flickers one time only at stable sensing area.</li> <li>When there is not enough sensitivity difference between ON state and OFF state, the STAB indicator flickers five times at unstable sensing area. (Note)</li> </ul>
⑦	Change the mode selection switch to LOCK, even though somebody touches the sensitivity setting button, setting sensitivity shall not be changed.

(Note) The sensitivity can be set at unstable detecting area.

\*Setting sensitivity is memorized when power turns off.

\*Do not touch the fiber optic cable after adjusting the sensitivity.

##### Dark ON Mode(Diffuse reflective type)

Most of adjustments except ③ & ⑤ are same as Light ON mode.

- Press ON button without the detecting target. (③ state)
- Press OFF button with the detecting target. (⑤ state)

- Light ON Mode : The control output turns on at State(Received light) and turns off at State(Interrupted light).
- Dark ON Mode : The control output turns off at State(Received light) and turns on at State(Interrupted light).

##### In case of setting as max. sensitivity

①Set the mode selection switch to SET mode.

##### In case of Light ON mode

Press ON/OFF button from ON to OFF without the detecting target. (Or set ON input for remote sensitivity setting to Low level, and then set OFF input for remote sensitivity setting to Low level)

##### In case of Dark ON mode

Press ON/OFF button from OFF to ON without the detecting target. (Or set OFF input for remote sensitivity setting to Low level, and then set ON input for remote sensitivity setting to Low level)

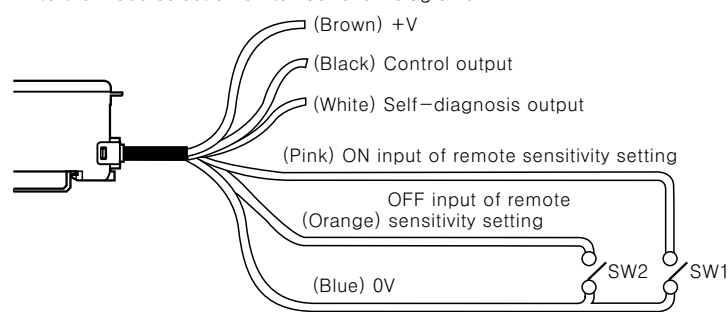
③Set the mode selection switch to LOCK mode.

##### Application

- In case of extend detecting distance as the diffusive reflection type.
- In case of use the through-beam type at bad environment.

##### Remote adjustment of sensitivity(BF4R-R only)

BF4R-R type can adjust the sensitivity with input signal lines in regardless to the mode selection switch as follow diagram;



##### Adjustment at Light ON Mode

- SW1(ON input of remote sensitivity setting):SW1 turns on and then turns off instead of ③ method by the sensitivity setting button.
- SW2(OFF input of remote sensitivity setting):SW2 turns on and then turns off instead of ⑤ method by the sensitivity setting button.

##### Adjustment at Dark ON Mode

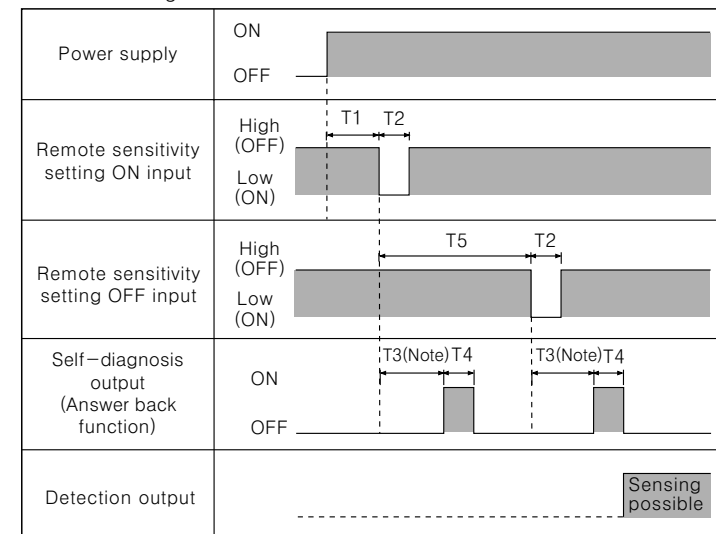
- SW2(OFF input of remote sensitivity setting):SW2 turns on and then turns off instead of ⑤ method by the sensitivity setting button.
- SW1(ON input of remote sensitivity setting):SW1 turns on and then turns off instead of ③ method by the sensitivity setting button.

##### Answer Back function(BF4R-R only)

When ON or OFF input of remote sensitivity setting is applied, after 300ms, self-diagnosis output turns on for 40ms and then the sensor keeps normal detecting state. (Note:Time chart)

\*Self-diagnosis output does not turn on if there is no difference of sensitivity between ON input and OFF input and stable sensing is not excited, but stable sensing operates after 340ms.

<Time Chart:Light ON Mode>

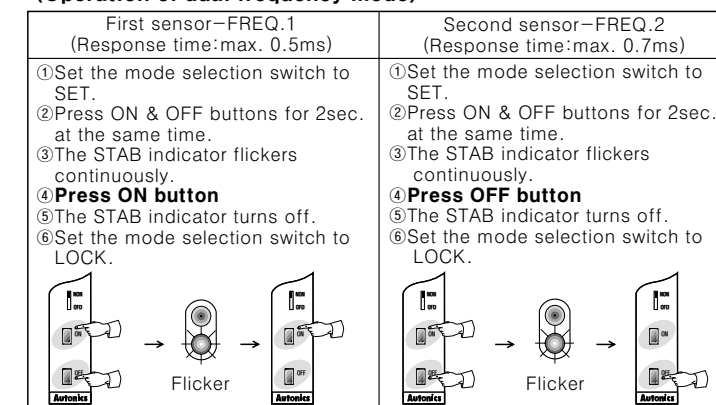


- $T1 \geq 1,000\text{ms}$ (After the power turns on, it can be set after 1sec.)
  - $T2 \geq 5\text{ms}$ (ON or OFF input time of remote sensitivity setting must be min. 5ms)
  - $T3 \approx 300\text{ms}$ (When ON or OFF input of remote sensitivity setting is applied, self-diagnosis output turns on after 300ms)
  - $T4 \approx 40\text{ms}$ (ON time of self-diagnosis output)
  - $T5 \geq 500\text{ms}$ (When ON input of remote sensitivity setting is applied and then apply OFF input of remote sensitivity setting after 500ms)
- (Note)During period T3(Approx. 300ms), do not change the received light value by moving the object, etc.

### Interference prevention function(All models)

BF4R series have a built-in interference prevention function, two fiber optic cables can be mounted very closely by setting different emission frequencies.

#### Interference prevention function (Operation of dual frequency mode)



#### Interference prevention function(Operation of normal mode)

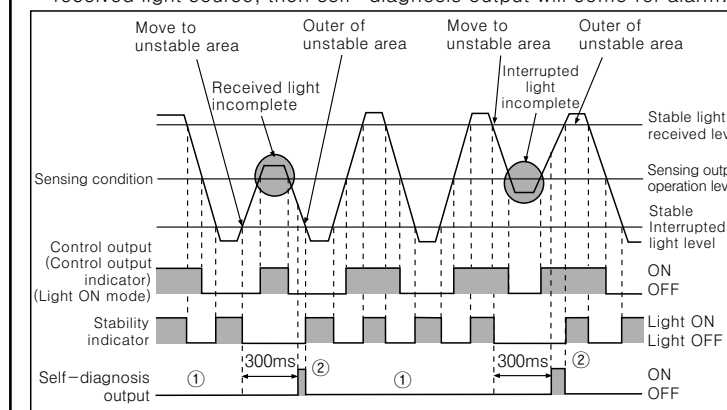
##### Response time : Max. 0.5ms

- Set the mode selection switch to SET.
- Press ON & OFF buttons for 2 sec. at the same time.
- The stable indicator flickers continuously.
- Press ON & OFF buttons at the same time.
- The STAB indicator turns off.
- Set the mode selection switch to LOCK.

\*In case of using interference prevention function, hysteresis & response time will be longer than normal operation.

### Self-diagnosis function(All models)

When Fiber hood is stained by dust, malfunction of the Emitter, reducing received light source, then self-diagnosis output will come for alarm.



- The self-diagnosis output turns off during stable sensing. (① position)
- When detecting state keeps for 300ms at unstable area between stable interrupted light level and stable received light level, self-diagnosis output turns on, self-diagnosis output turns off at lower than stable interrupted light level and upper than stable received light level. (② position)

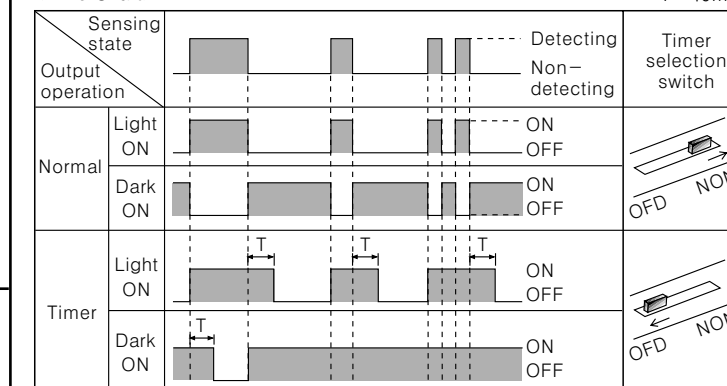
Under the control output turns on, if the over-current supplied in control output, then self-diagnosis output turns on.

### OFF Delay timer function(BF4R/BF4RP/BF4R-R only)

Standard type(BF4R/BF4RP) and Remote sensitivity setting type(BF4R-R) built-in approx. 40ms fixed OFF-delay timer.

The timer works when the timer selection switch is set to 'OFD'. The output turns off after turning on for 40ms at OFF position of the sensing output. It is useful when the response time of the connected device is slow or when the sensing signal from a tiny object is too short.

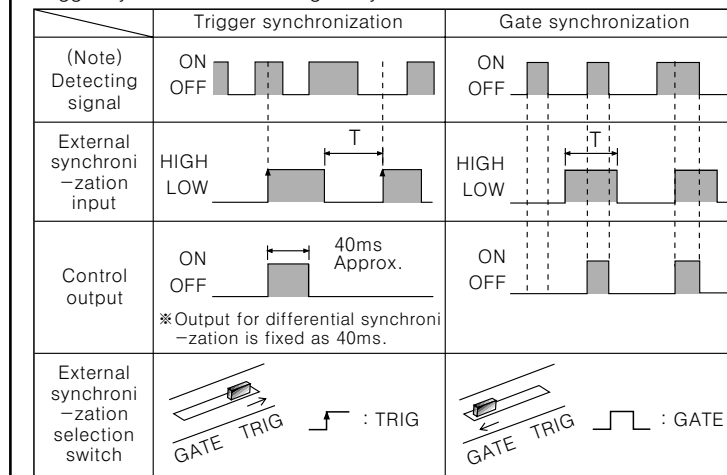
<Time Chart>



### External synchronization input function(BF4R-E)

By using external synchronization function, the time for making detection can be specified by External synchronization.

Trigger synchronization and gate synchronization are available.



\* $T \geq 0.5\text{ms}$ (When using interference prevention function: $T \geq 0.7\text{ms}$ )

<Input signal condition for External synchronization>

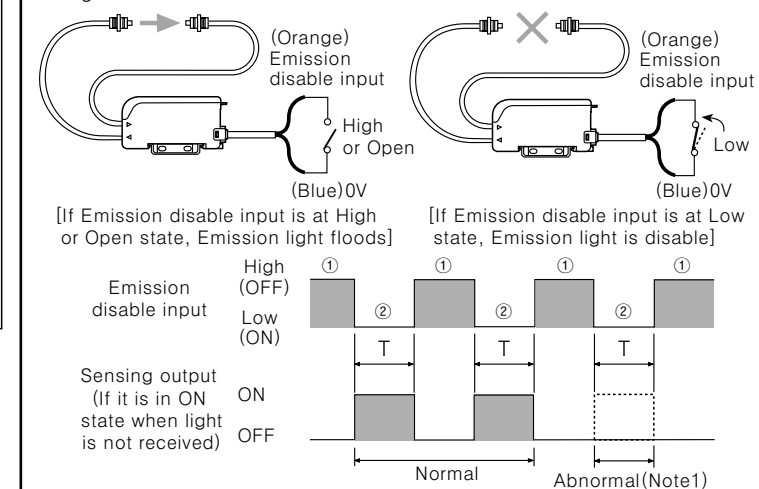
State	Signal condition
HIGH	4.5-30VDC or OPEN
LOW	0-1VDC

\* (Note) Inner signal state before sending as control output for detecting signal which the sensor detects.

### Emission disable function(BF4R-E only)

#### Operation Test

- Below test is available under Light ON state only.
- If Emission disable input is at Low state, Emission light will be disable.
- It can check normal or abnormal state of the sensor without moving the target.



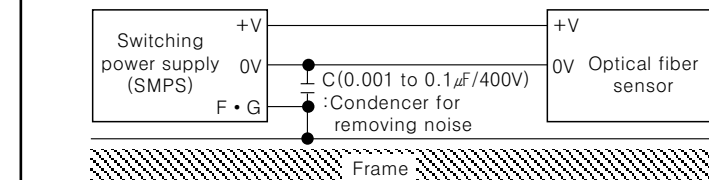
- ① : Emission area
- ② : Emission stopped area
- (Note1) If Emission stops, control output must turn on, but if control output does not turn on, it seems that sensor has some problems.
- $T \geq 0.5\text{ms}$ (When using interference prevention function  $T \geq 0.7\text{ms}$ )

<Input signal condition for Emission disable>

State	Signal condition
High	4.5-30VDC or Open
Low	0-1VDC

### Caution for using

- Do not scratch the section of fiber optic cable.
- Intercept a strong source of light as like sunlight, spotlight within inclination angle range of photoelectric sensor.
- Do not apply a strong tensile force to fiber optic cable.
- In case of installing the fiber optic cable, be sure not to curve the fiber optic cable over tolerance that mentioned in our catalog.
- When wire the photoelectric sensor with high voltage line, power line in the same conduit, it may cause malfunction or mechanical trouble. Therefore please wire separately or use different conduit.
- Avoid installing the unit as following place. Corrosive gas, oil or dust, strong flux, noise, sunlight, strong alkali, acid.
- In case of connecting inductive load such as DC relay at load, use shielded cable, diode and varistor in order to remove noise.
- The amp. cable shall be used shortly, because it might cause malfunction by noise through the cable.
- When it is stained by dirt at a detecting part of the fiber optic cable, please clean the detecting part with dry cloth softly. But don't use an organic materials such as alkali, acid, chromic acid.
- When the unit is supplied by switching power supply unit, as a power source, please earth Frame Ground(F.G) terminal, and connect condenser between 0V and F.G terminals to remove noise.



\*It may cause malfunction if above instructions are not followed.

### Main products

- COUNTER
- TIMER
- TEMPERATURE CONTROLLER
- PANEL METER
- TACHOMETER
- LINE SPEED METER
- DISPLAY UNIT
- PROXIMITY SWITCH
- PHOTOELECTRIC SENSOR
- FIBER OPTIC SENSOR
- PRESSURE SENSOR
- ROTARY ENCODER
- SENSOR CONTROLLER
- POWER CONTROLLER
- STEPPING MOTOR & DRIVER & CONTROLLER

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NO20020618-EP-E-08-0240B