

(B) Fiber Optic Sensor

Ordering information	B-1
Product overview	B-3
BF5 Series(Digital indicating type fiber optic amplifier)	NEW B-6
BFC Series(Communication converter)	NEW B-21
BF4 Series(High function fiber optic amplifier)	B-27
BF3 Series(General purpose fiber optic amplifier)	B-34
FD/FT/GD/GT Series(Fiber optic cable)	Line-up B-38
Application	B-44
Technical description	B-45

(A) Photo electric sensor
(B) Fiber optic sensor
(C) Door/Area sensor
(D) Proximity sensor
(E) Pressure sensor
(F) Rotary encoder
(G) Connector/ Socket
(H) Temp. controller
(I) SSR/ Power controller
(J) Counter
(K) Timer
(L) Panel meter
(M) Tacho/ Speed/ Pulse meter
(N) Display unit
(O) Sensor controller
(P) Switching power supply
(Q) Stepping motor & Driver & Controller
(R) Graphic/ Logic panel
(S) Field network device
(T) Production stoppage models & replacement

NEW

Fiber optic amplifier
BF5 Series



NEW

Communication converter
BFC Series



Ordering Information

■Ordering information(Fiber optic amplifier)

BF 5 R - D 1 - N

BF	Fiber Sensor
5	Series name
R	Red LED
D	Dual display type
1	Standard type
N	NPN open collector output

BF 4 R P - E

BF	Fiber Sensor
4	Series name
R	Red LED
P	PNP open collector output
E	External synchronization input type
Blank	NPN open collector output
Blank	Standard type

BF 3 RX - P

BF	Fiber Sensor
3	Series name
RX	Red LED
P	PNP open collector output
Blank	NPN open collector output

Ordering Information

■ Ordering information(Fiber optic cable)

F **T** - **4** **20** - **10**




Cable type	Blank	Standard type(-40 to 70℃)
	H	Heat-resistance(-40 to 105℃)
Fiber diameter	H1	Heat-resistance(-40 to 150℃)
	H2	Heat-resistance(-40 to 250℃)
Cable length	R	Flexible type(1R)
	B	Break-resistant type(5R)
Hood diameter	05	φ 0.5mm
	06	φ 0.6mm
Head form	10	φ 1.0mm
	13	φ 1.3mm
Sensing type	14	φ 1.4mm
	15	φ 1.5mm
Fiber material	20	φ 2.0mm
	F	φ 0.5mm, φ 0.25mm × 4(Coaxial type)
Fiber optic cable specification	F1	φ 0.5mm, φ 0.25mm × 9(Coaxial type)
	F2	φ 1.0mm, φ 0.25mm × 16(Coaxial type)
Through-beam type	20	2m
	15	φ 1.5mm
Diffuse reflective type	2	φ 2mm
	3	φ 3mm
Plastic Fiber cable	4	φ 4mm
	6	φ 6mm
Glass Fiber cable	Blank	Standard type(Bolt type)
	P	Plastic type
Stepping motor & Driver & Controller	S	SUS type(SUS length 90mm)
	S1	SUS type(SUS length 35mm)
Production stoppage models & replacement	S2	SUS type(SUS length 45mm)
	C	Cylinder type
Graphic/Logic panel	CS	Cylinder+SUS type(SUS length 15mm)
	LU	L type/Top view(Height 12.2mm)
Field network device	LU1	L type/Top view(Height 17.2mm)
	LU2	L type/Top view(Height 22.2mm)
Photo electric sensor	F	Flat type/Flat view
	FN	Flat type/Side view
Door/Area sensor	FU	Flat type/Top view(Up)
	FB	Flat type/Side view+top view(Bending)
Proximity sensor	T	Through-beam type
	D	Diffuse reflective type
Pressure sensor	F	Plastic Fiber cable
	G	Glass Fiber cable

※Please refer B-38 to 43 page(Fiber optic cable specification) for exact model name of fiber optic cable, or it might cause wrong model selection not existed in the above ordering information.

- (A) Photo electric sensor
- (B) Fiber optic sensor
- (C) Door/Area sensor
- (D) Proximity sensor
- (E) Pressure sensor
- (F) Rotary encoder
- (G) Connector/Socket
- (H) Temp. controller
- (I) SSR/Power controller
- (J) Counter
- (K) Timer
- (L) Panel meter
- (M) Tacho/Speed/Pulse meter
- (N) Display unit
- (O) Sensor controller
- (P) Switching power supply
- (Q) Stepping motor & Driver & Controller
- (R) Graphic/Logic panel
- (S) Field network device
- (T) Production stoppage models & replacement


Product Overview

■Fiber optic amplifier

Appearances	Characteristic	LED	Model	Power supply	Response speed	Control output	Reference	
	Dual display type	Red	BF5R-D1-N	12-24VDC	Ultra Fast:50 μ s, Fast:150 μ s, STD:500 μ s, Long:4ms	NPN open collector output	B-6 to 20	
	Single display type	Red	BF5R-S1-N		Fast:150 μ s, STD:500 μ s, Long:4ms			
	Standard type	Red	BF4R		Max. 0.5ms (Frequency 1) Max.0.7ms (Frequency 2)	NPN open collector output	B-27 to 33	
		Green	BF4G			PNP open collector output		
		Red	BF4RP			NPN open collector output		
		Green	BF4GP					
	External synchronization input type	Red	BF4R-E			NPN open collector output		
		Green	BF4G-E					
	Remote sensitivity setting type	Red	BF4R-R			NPN open collector output		
		Green	BF4G-R					
	Twin adjuster built-in	Red	BF3RX		Max. 1ms	NPN open collector output	B-34 to 37	
			BF3RX-P			PNP open collector output		

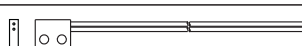


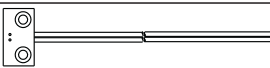




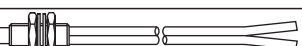





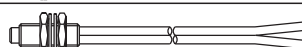

※Sensing type depends on the type of fiber cable.

■Fiber optic amplifier communication converter

Appearances	Characteristic	Model	Power supply	Communication speed	Control output	Reference
	Setting 32 fiber optic amplifier units simultaneously by communication converter	BFC-N	12-24VDC	1200, 2400, 4800, 9600, 19200, 38400bps	NPN open collector output	B-21 to 26
		BFC-P			PNP open collector output	












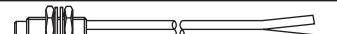



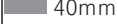




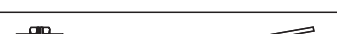



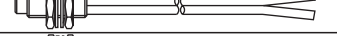

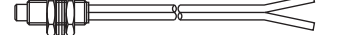
※Connectable fiber optic amplifier unit : BF5 Series

■Fiber optic cable(Diffuse reflective type)







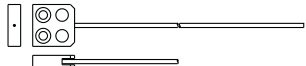







Type	Dimension	Feature	Model	※(Note1) Sensing distance(mm)	※(Note2) Cable length(L)	Reference
※(Note3) Flexible type	LINE-UP 	Flat type/ Top view(Up)	FDFU-210-05R	 30mm	1m Free cut	B-38 to 43
	LINE-UP 	Flat type/ Side view	FDFN-210-05R			
	LINE-UP 	Flat type/ Flat view	FDF-210-05R	 15mm		
	LINE-UP 	M3 Bolt	FD-320-05R	 25mm		
	LINE-UP 	M4 Bolt	FD-420-05R			
	LINE-UP 	M6 Bolt	FD-620-10R	 80mm		
※(Note3) Break-resistant type	LINE-UP 	M3 Bolt	FD-320-06B	 35mm	2m Free cut	
	LINE-UP 	ø 3 Cylinder type	FDC-320-06B			
	LINE-UP 	M4 Bolt	FD-420-06B			
	LINE-UP 	M6 Bolt	FD-620-13B	 100mm		

Product Overview

■ Fiber optic cable(Diffuse reflective type)

Type	Dimension	Feature	Model	※(Note1) Sensing distance(mm)	※(Note2) Cable length(L)	Reference
Standard type		M3 Bolt	FD-320-05	 40mm	2m Free cut	B-38 to 43
		M4 Bolt	FD-420-05			
		ø 3 Cylinder type	FDC-320-05			
		ø 3 Cylinder type SUS type (90mm)	FDCS-320-05			
		M3 Bolt SUS type (90mm)	FDS-320-05			
		M3 Bolt SUS type (45mm)	FDS2-320-05			
		M4 Bolt SUS type (90mm)	FDS-420-05	 120mm		
		M4 Bolt SUS type (45mm)	FDS2-420-05			
		M6 Bolt	FD-620-10			
		M6 Bolt SUS type (90mm)	FDS-620-10			
		M6 Bolt SUS type (45mm)	FDS2-620-10			
		Plastic type	FDP-320-10			
	Coaxial type		M3 Bolt	FD-320-F	 40mm	
		M3 Bolt	FD-320-F1	 60mm		
		M6 Bolt	FD-620-F2	 120mm		
Heat-resistant type		M6 Bolt	FD-620-10H	 120mm	2m	
		M6 Bolt	FD-620-15H1	 160mm		
		M4 Bolt Glass type	GD-420-20H2	 100mm		
		M6 Bolt Glass type	GD-620-20H2			







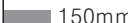
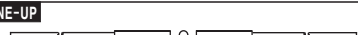
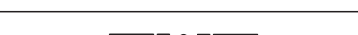




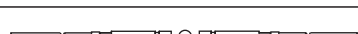
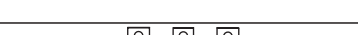


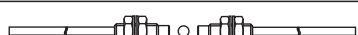



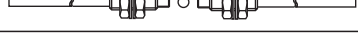

■ Fiber optic cable(Through-beam type)

Type	Dimension	Feature	Model	※(Note1) Sensing distance(mm)	※(Note2) Cable length(L)	Reference
※(Note3) Flexible type	LINE-UP 	Flat type/ Top view(Up)	FTFU-210-05R	 80mm	1m Free cut	B-38 to 43
	LINE-UP 	Flat type/ Side view	FTFN-210-05R	 75mm		
	LINE-UP 	Flat type/ Flat view	FTF-210-05R	 30mm		
	LINE-UP 	Flat type/ Side view+ top view	FTFB-210-05R	 90mm		
	LINE-UP 	Integrated bracket (L type)/ Top view(Up)	FTLU-310-10R FTLU1-310-10R FTLU2-310-10R	 250mm		
	LINE-UP 	M3 Bolt	FT-320-05R		85mm	
	LINE-UP 	ø2 Cylinder type	FTC-220-05R			
	LINE-UP 	M4 Bolt	FT-420-10R	 380mm		

- (A) Photo electric sensor
- (B) Fiber optic sensor
- (C) Door/Area sensor
- (D) Proximity sensor
- (E) Pressure sensor
- (F) Rotary encoder
- (G) Connector/Socket
- (H) Temp. controller
- (I) SSR/Power controller
- (J) Counter
- (K) Timer
- (L) Panel meter
- (M) Tacho/Speed/Pulse meter
- (N) Display unit
- (O) Sensor controller
- (P) Switching power supply
- (Q) Stepping motor & Driver & Controller
- (R) Graphic/Logic panel
- (S) Field network device
- (T) Production stoppage models & replacement

Product Overview

■ Fiber optic cable(Through-beam type)

Type	Dimension	Feature	Model	※ (Note1) Sensing distance(mm)	※ (Note2) Cable length (L)	Reference		
※ (Note3) Break- resistant type	LINE-UP 	M3 Bolt	FT-320-06B	 110mm	2m Free cut	B-38 to 43		
	LINE-UP 	ø 1.5 Cylinder type	FTC-1520-06B					
	LINE-UP 	M4 Bolt	FT-420-13B	 400mm				
Standard type		M3 Bolt	FT-320-05	 150mm				
	LINE-UP 	ø 1.5 Cylinder type	FTC-1520-05					
		ø 2 Cylinder type	FTC-220-05					
		ø 2 Cylinder type SUS type (90mm)	FTCS-220-05					
		M3 Bolt SUS type (90mm)	FTS-320-05					
		M3 Bolt SUS type (35mm)	FTS1-320-05					
		M3 Bolt SUS type (45mm)	FTS2-320-05					
		M4 Bolt	FT-420-10	 500mm				
		ø 3 Cylinder type	FTC-320-10					
		Plastic type	FTP-320-10					
		M4 Bolt SUS type (90mm)	FTS-420-10	 500mm				
		M4 Bolt SUS type (45mm)	FTS2-420-10					
Heat- resistant type		M4 Bolt	FT-420-10H	 300mm	2m			
		M4 Bolt	FT-420-15H1	 500mm				
		M4 Bolt Glass type	GT-420-13H2	 400mm				

※(Note1) The sensing distance is a standard for Red LED of BF4 Series and 10% of Red LED is applied when it is Green LED.
It is applied to 40% of sensing distance for BF3RX.

※(Note2) Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance (Note1).

※(Note3) ●Flexible optical fiber (Multi core)

A large number of ultrafine cores are all surrounded by cladding. Easy to install the many places where are bending areas because the change of the intensity of radiation by bending is small.

●Break-resistant optical fiber

The fiber units contain a large number of independent fine fibers, ensuring a high degree of flexibility. It can be used for moving parts(robot hand) and it is not easily broken.

※ Free cut The sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-2) should be used for cutting fiber cable.]

※ Glass type is for BF5R, BF4R Series.


※FT-420-13 was discontinued. FT-420-13B is replacement.

Digital indicating type fiber optic amplifiers

NEW


■ Features

- **Dual-display for light incident level and setting value(BF5R-D)**
- **Minute object sensing available with 1/10,000 high resolution**
- Ability to sense high-speed(20,000 times per sec.) moving objects
- 4 settings for response speed
: Ultra fast mode(50 μ s), high speed mode(150 μ s), standard mode(500 μ s), long distance mode(4ms)
- 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 ability to stack with mutual interference prevention function using side connector
- Auto channel setting function for multiple installations
- Slim design(W10×H30×L70mm)

 Please read "Caution for your safety" in operation manual before using.



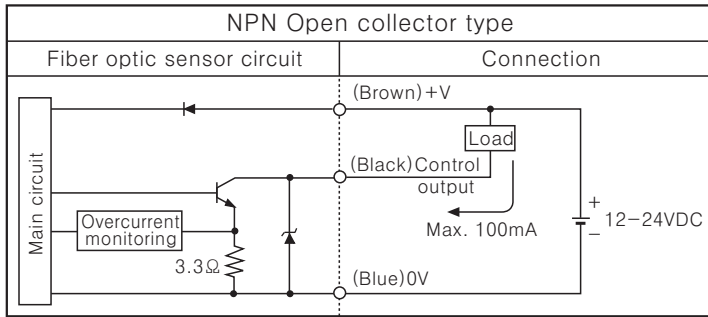
■ Specifications

Display type	Dual Display type	Single Display type
Model	BF5R-D1-N	BF5R-S1-N
Light source	Red LED(660nm, modulated)	
Power supply	12-24VDC \pm 10%	
Current consumption	Max. 50mA	
Control output	NPN open collector (Sink Current : Max. 100mA, Applied Voltage : Max. 24V, Residual voltage : Max. 1V)	
Protection circuit	Reverse polarity, Overcurrent, Surge	
Response time	Ultra Fast : 50 μ s, Fast : 150 μ s, STD : 500 μ s, Long : 4ms	Fast : 150 μ s, STD : 500 μ s, Long : 4ms
Display	<ul style="list-style-type: none"> ● Incident light level: Red, 4 Digit, 7Segment ● SV : Green, 4 Digit, 7Segment ● Main output indicator : Red LED 	<ul style="list-style-type: none"> ● Incident light level /SV : Red, 4 Digit, 7Segment ● Main output indicator : Red LED
Display function	Incident light level / SV display [4000/10000 resolution], Percentage display, Peak / Bottom value display, Normal / Reversed display	
Sensitivity setting	Auto tuning, 1 point teaching, 2 point teaching, Positioning teaching	Auto tuning
Mutual interference prevention	Max. 8 unit sets (Automatically set regardless of response time)	
Initializing	Initializing to factory mode	—
Energy saving	Normal / Energy saving 1 / Energy saving 2	—
Timer	OFF, OFF delay, ON delay, One shot	OFF, 10ms OFF delay timer, 40ms OFF delay timer
Ambient illumination	Incandescent lamp : Max. 3000lx, Sunlight : Max. 11000lx	
Ambient temperature	Operation : -10 to 50°C, Storage : -20 to 50°C (at non-freezing state)	
Ambient humidity	35 to 85% RH	
Insulation resistance	Min. 20M Ω (at 500VDC megger)	
Dielectric strength	1000VAC 50/60Hz for 1 min.	
Vibration resistance	1.5 mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours	
Shock	500m/s ² (Approx. 50G) in X, Y, Z directions for 3 times	
Protection	IP40(IEC standard)	
Material	Case : PBT, Cover : PC	
Fiber cable Tightening torque	Min. 2kgf/cm ²	
Accessory	Connector type wire (ϕ 4, 3P, 2m), Side connector	
Approval		
Unit weight	Approx. 20g	

(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

BF5 Series

Control output diagram and terminal connections



※Connect Diode at external terminal for inductive load.

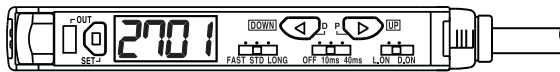
Dimensions

(Unit:mm)

BF5R-D1-N

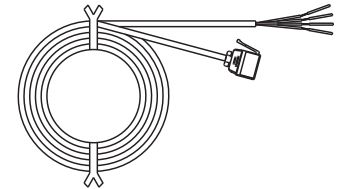


BF5R-S1-N

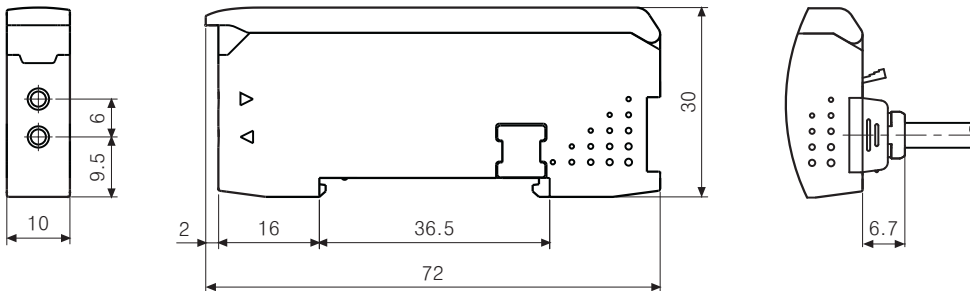


Accessories

Connector type wire



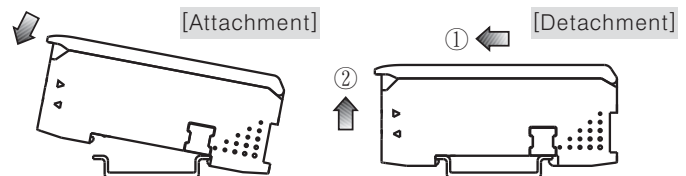
Side connector



Installations

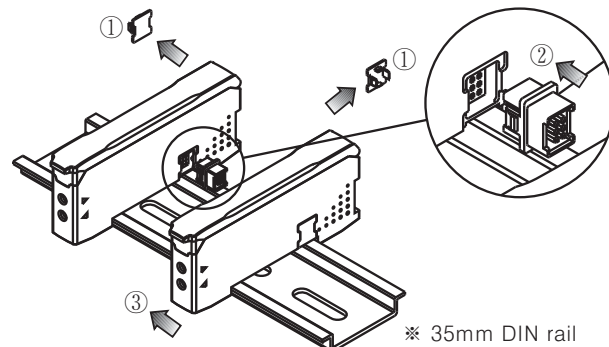
Amplifier unit mounting

- Attachment : Hang up the backside holder on DIN rail and press the unit toward the DIN rail.
- Detachment: Slide the back part and lift up the unit as shown in the figure ① and ②.



Amplifier unit connection

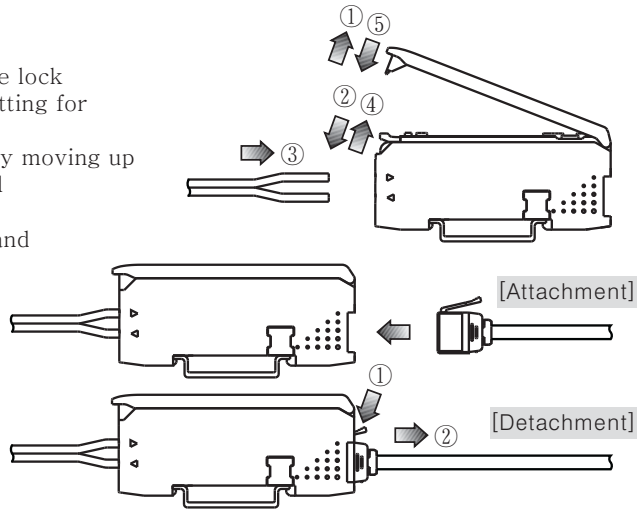
- After mounting one amplifier unit on DIN rail, remove the side cover and insert unit connector as shown in the figure ① and ②.
- Connect another unit through the connector as shown in the figure ③.
- ※Make sure that connections between unit case and connectors have made correctly. Improper connection may cause malfunctioning of channel setting and mutual interference prevention functions.
- ※Do not supply the power while connecting or disconnecting amplifier units.



Fiber Optic Amplifier

◎Fiber cable connection

- Lift up the protective cover ① and push down the lock lever to the direction of ② to release the lock setting for fiber optic cable insertion.
- Insert the cable to the direction of ③ with slightly moving up and down 15°, and gently press into the unit until the cable is completely inserted.
- Lift up the lock lever to lock the lock setting ④ and close the protective cover ⑤.



◎Wire connector connection

- Insert the connector into the amplifier unit until it clicks into right position.
- When removing the connector, pull out the connector pressing the lever down.

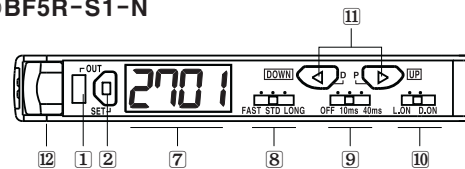
■Front part identification

◎BF5R-D1-N



- 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 display part (4 Digit, Red, 7 segments)
: Used to indicate incident light level and parameters.
- SV display part (4 Digit, Green, 7 segments)
: Used to indicate SV and setting data.
- Up/down key
●Used to up/down setting values
●Used to Fine-adjusting sensitivity
- MODE key
●Used to enter into program mode / data bank mode.
●Used to move each parameter.

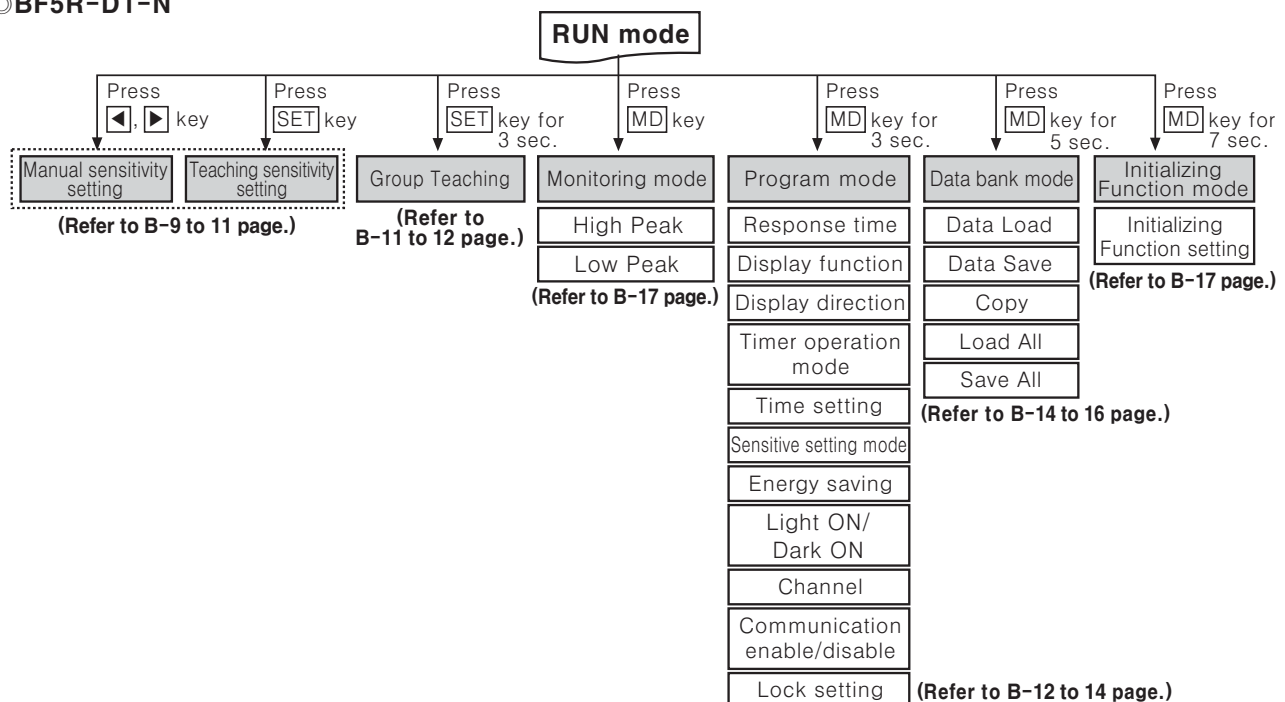
◎BF5R-S1-N



- PV/SV display part (4 Digit, Red, 7 segments)
: 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
●Used to Fine-adjusting sensitivity
- Lock lever

■Parameter setting

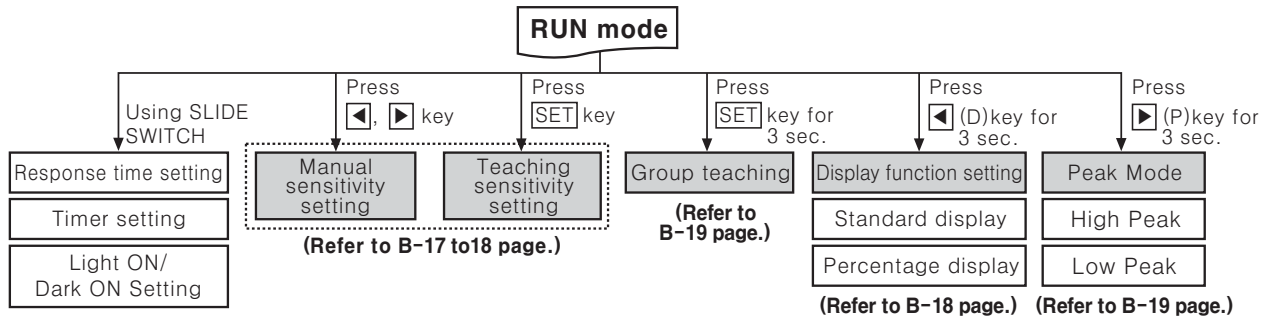
◎BF5R-D1-N



(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

BF5 Series

◎BF5R-S1-N



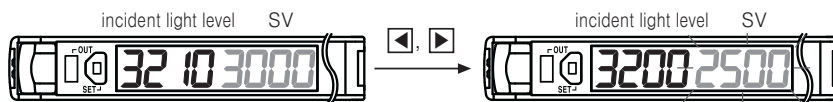
Dual display type (*Refer to B-9 to 17 page.)

■Sensitivity setting mode

※There are two methods available for sensitivity setting – manual or teach mode.
Select the method most suitable for your application.

◎Manual sensitivity setting (Fine-adjusting sensitivity)

- The setting value can be directly changed by pressing the manual button
- Used to fine-adjusting sensitivity after teaching.
- Incident light level is still displayed on PV display part during setting.



- ① Press ◀ and ▶ key to set the value.
- ② If there is no additional key input for 3 sec after completing setting, last set value will be flashing twice and automatically returned to RUN mode.

◎Teach sensitivity setting (Auto-tuning, One-point, Two-point, Positioning)

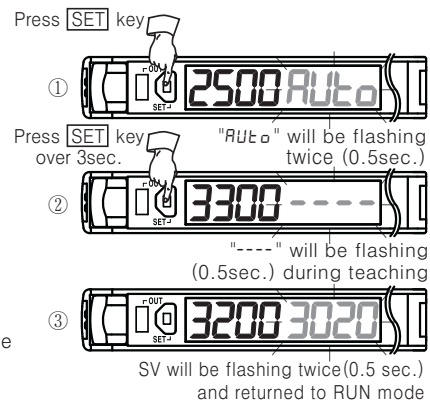
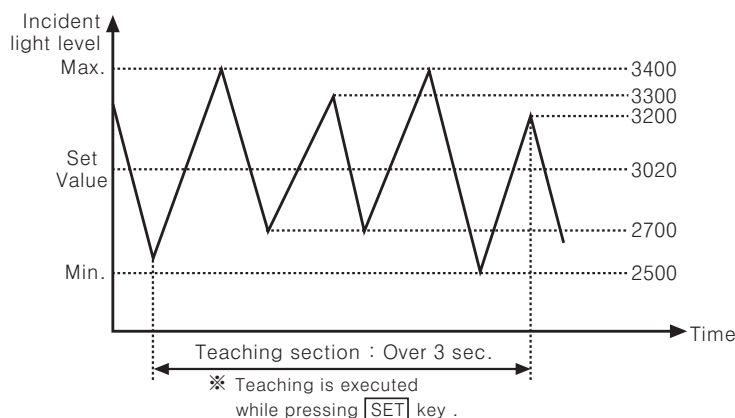
- How to enter into sensitivity setting mode in RUN mode
Press [SET] key once. Then, selected teaching mode parameter indicated by flashing twice on SV display part.
※Refer to [B-9 to 11] page for each teaching sensitivity setting.
- Teaching should be executed for over 3 sec.
※If teach mode is executed for less than 3 sec., teach mode parameter will flicker twice and be on standby to execute completion of teach mode.
- Current incident light level is indicated on PV display part while teaching is in the process.
- If incident light level is received under 10 DIGIT while teaching is in the process, it will be automatically returned to RUN mode and previous setting value will be retained after [ErrL] flashes twice.
※If there is no key operation for 60 sec. after entering into teaching mode, it will be automatically return to RUN mode.

1)Auto-tune teach mode

- ※Suitable when incident level of sensing object is not stable or when sensing fast moving objects.
- ※Auto-tune automatically sets the sensitivity using the average value of the incident light level within a certain time period.

$$\text{Set_value} = \frac{P1 + P2 + \dots + Pn-1 + Pn}{n}$$

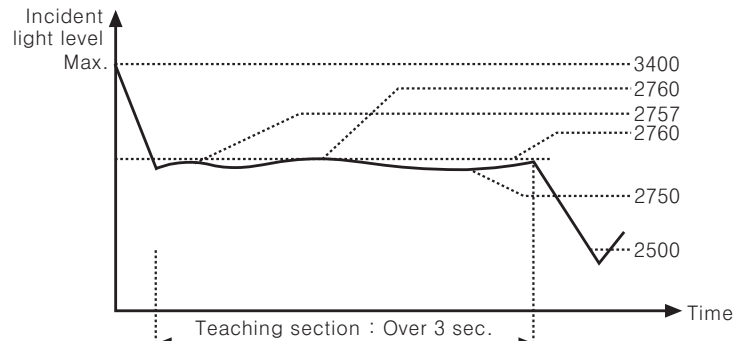
- Set Teaching mode parameter [SEn5] to "Auto".



2)One-point teach mode

※One of teaching modes that sets the maximum sensitivity by teaching one sensitivity setting point when setting the SV with no sensing object (Reflective) or when setting the SV with incident light level 0 (Through-beam) / Suitable for the applications where dust or back ground will not effect sensing.

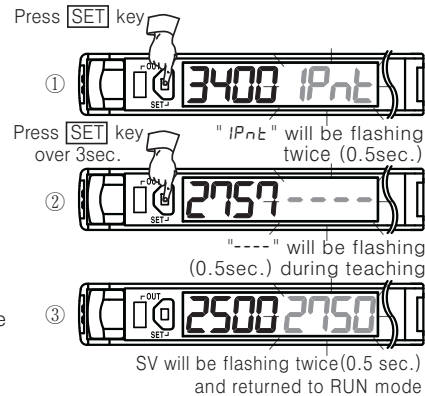
●Set Teaching mode parameter [5E_n5] to "IP_nt".



※ Teaching is executed while pressing [SET] key .

※SV range for sensing distance.

Response Time	Teaching when incident light level is 0	Teaching when incident light level is saturated
UF5t	In case incident light level is 0, set to 10 digit.	In case incident light level is saturated, set to 3980 digit.
F5t		
5td		
L0G	In case incident light level is 0, set to 5 digit.	In case incident light level is saturated, set to 9980 digit.

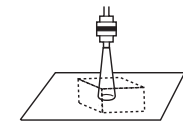
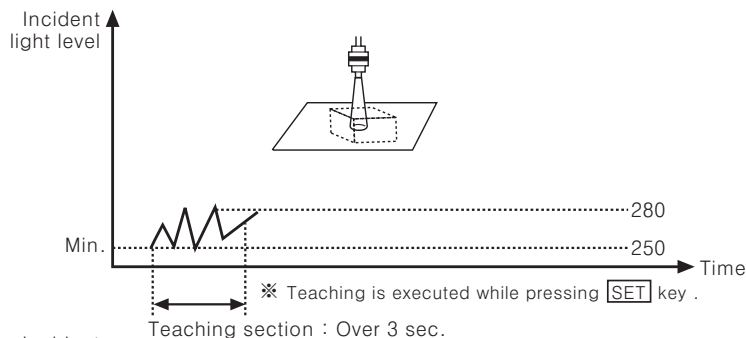


3)Two-point teach mode

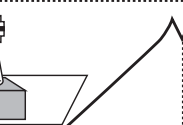
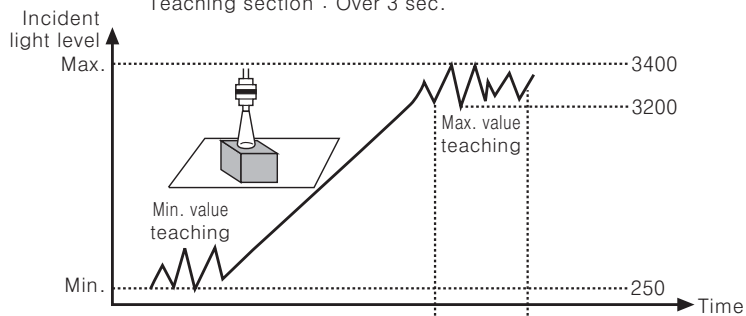
※Suitable when incident light level is stable or when sensing object is slow or at stopped position.

※One of teaching modes that sets the sensitivity using average value of two incident light levels obtained from two point teaching – one point with a sensing object and the other point without a sensing object.

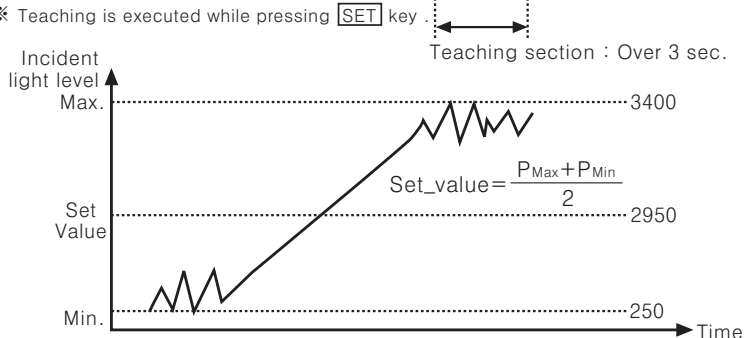
●Set teach mode parameter [5E_n5] to "2P_nt".



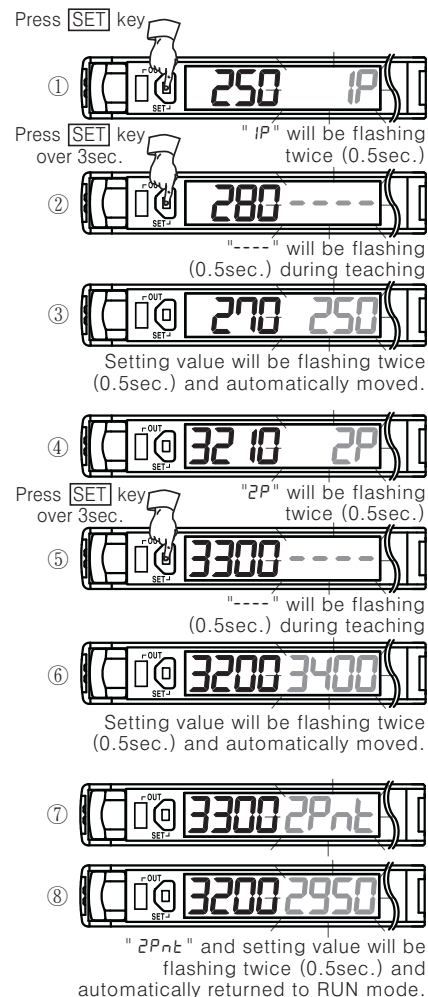
※ Teaching is executed while pressing [SET] key .



※ Teaching is executed while pressing [SET] key .



$$\text{Set_value} = \frac{P_{\text{Max}} + P_{\text{Min}}}{2}$$

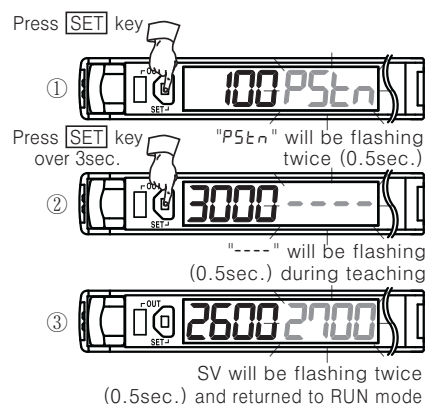
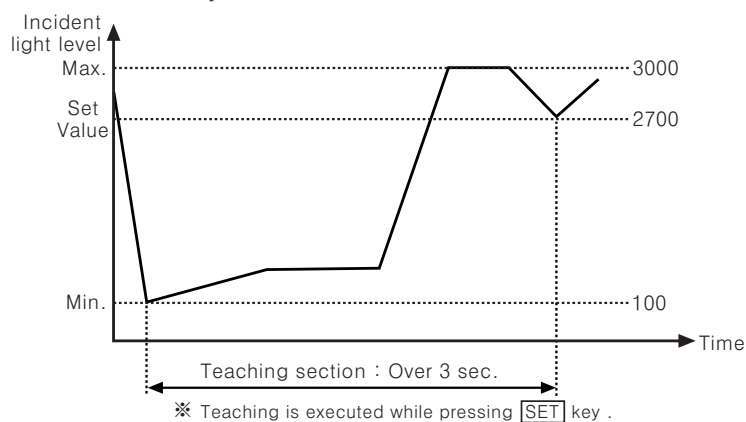


(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

4) Positioning teach mode

※One of teaching modes that sets the sensitivity to 90% of max. incident light level when sensing an object with a hole on the surface (Through-beam) or sensing a moving object having curve (Reflective).

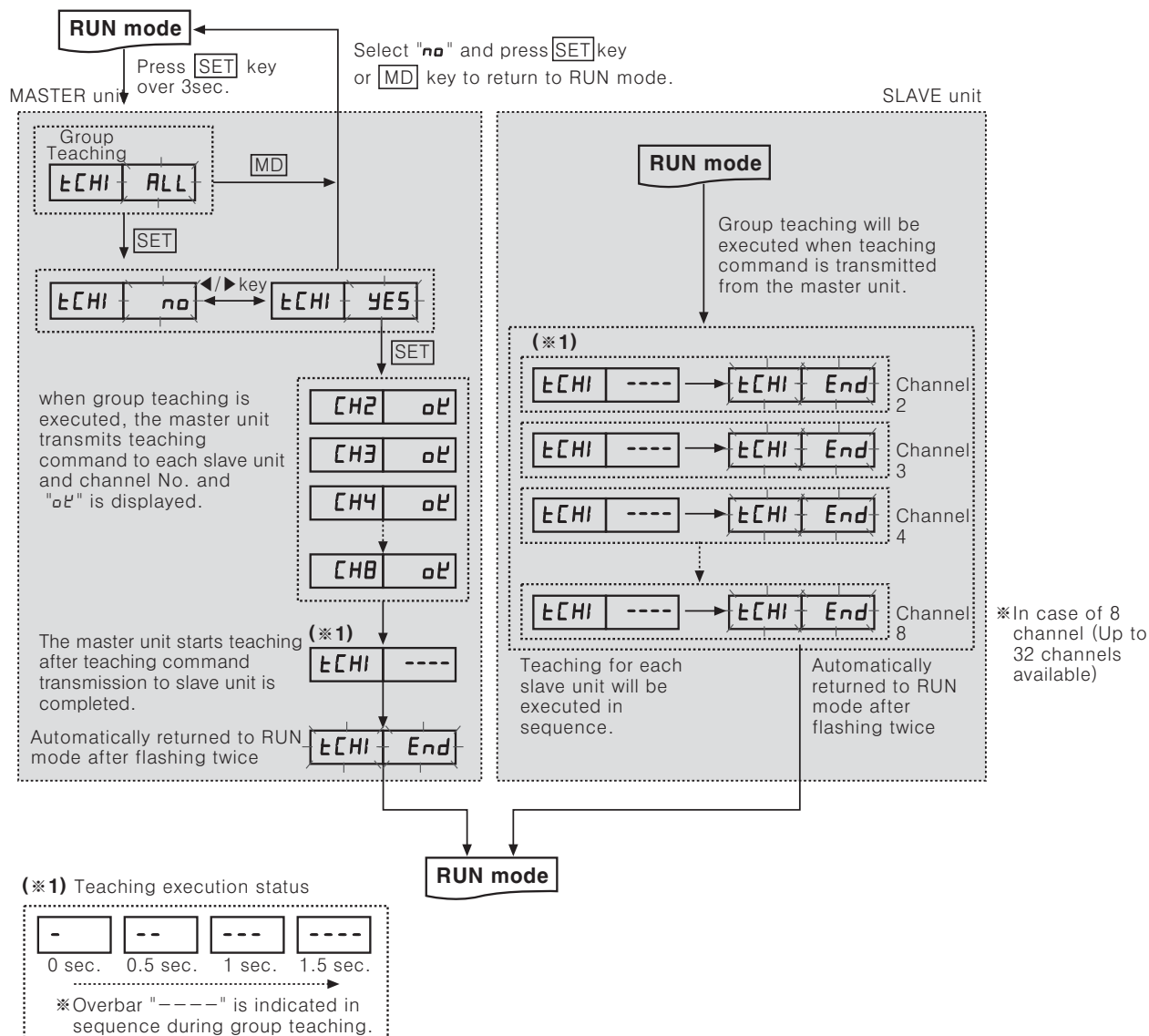
●Set teach mode parameter [5E75] to "P5En".



■ Ground teach mode

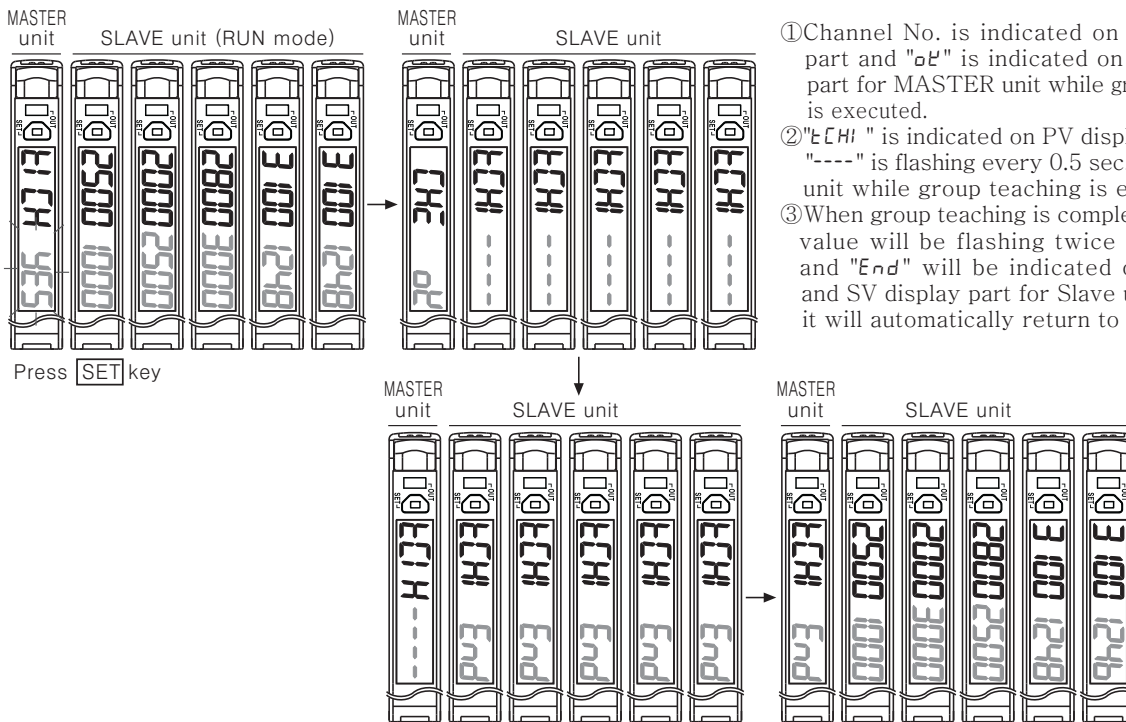
A function to set the sensitivity of slave amplifier units according to the command of master amplifier unit (certain amplifier unit) in a successive and collective way.

※In case of two-point teach mode, Group teaching is not applicable.



Fiber Optic Amplifier

●MASTER / SLAVE unit display during group teach mode

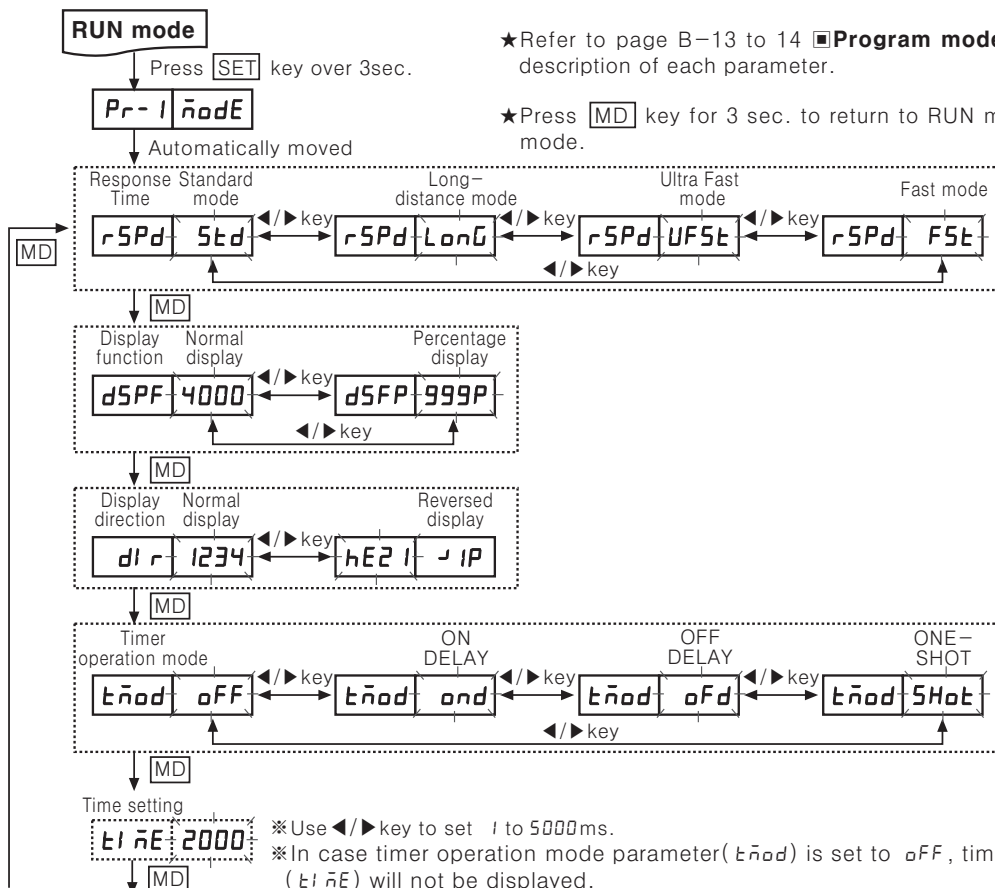


- ①Channel No. is indicated on PV display part and "CH" is indicated on SV display part for MASTER unit while group teaching is executed.
- ②"CH" is indicated on PV display part and "----" is flashing every 0.5 sec. for SLAVE unit while group teaching is executed.
- ③When group teaching is completed, setting value will be flashing twice and "CH" and "End" will be indicated on both PV and SV display part for Slave units. Then, it will automatically return to RUN mode.

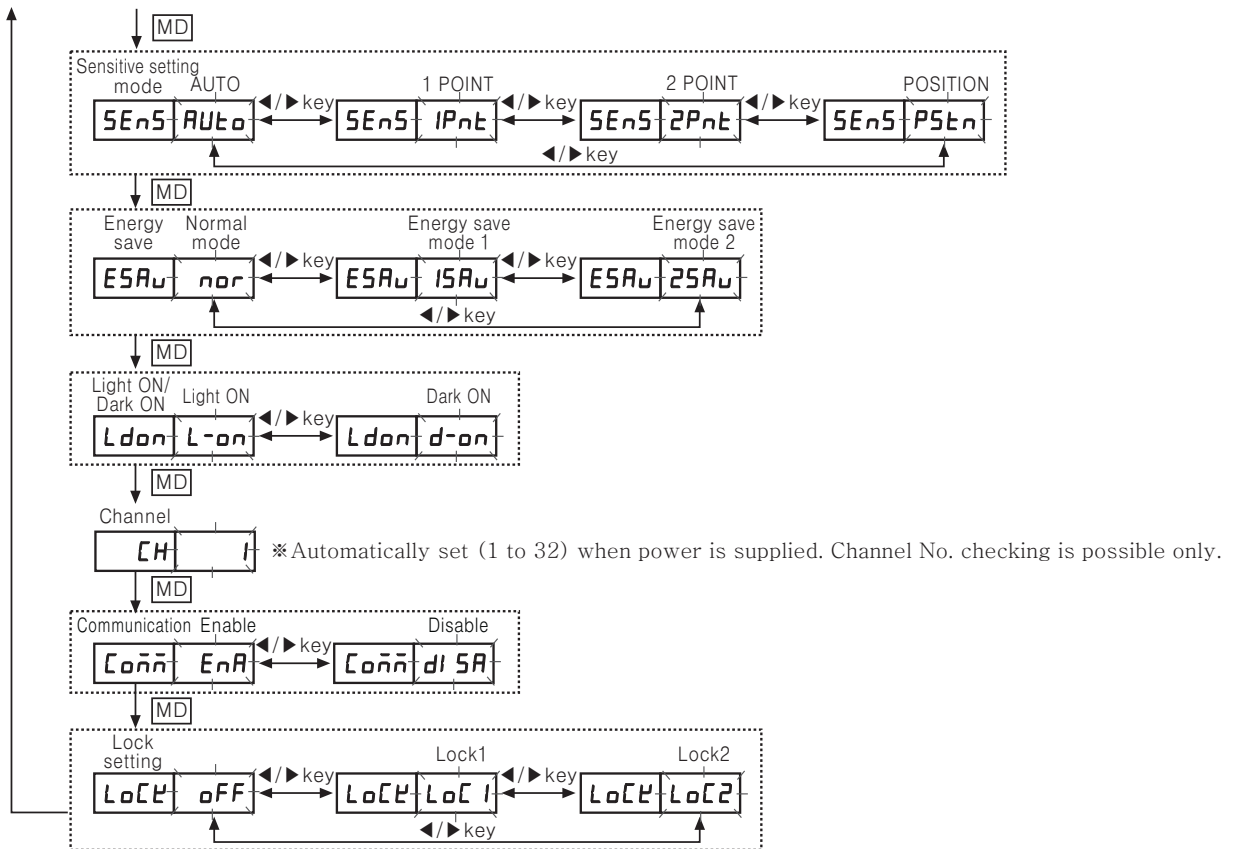
■Program mode setting

- When entering into program mode, parameters will light ON on PV display part and setting values will be flashing every 0.5 sec. on SV display part. Use **◀▶** key to set each setting value.
- Press **MD** key one time after setting each parameter to save each setting and enter into next mode.
- If the key lock is set (lock1 or lock2), unlock the key lock before setting parameters.

●Program mode flow



(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement



■ Program mode function

◎ Response time setting [rSPd]

A function to set the response time of control output – 4 response modes selectable.

- Ultra Fast (UF5t) mode : 50μs
- Fast (F5t) mode : 150μs
- Standard (5td) mode : 500μs
- Long distance (LonU) mode : 4 ms

◎ Display function [d5PF]

A function to select incident light level display mode on PV display window : Standard display (4000) / Percentage display (999P)

- Standard Mode Display Range : 0 to 4000 (0 to 9999, in case of long distance mode)
- Percentage Mode Display Range : 0P to 999P (No decimal point displayed)

◎ Display direction setting function [dl r]

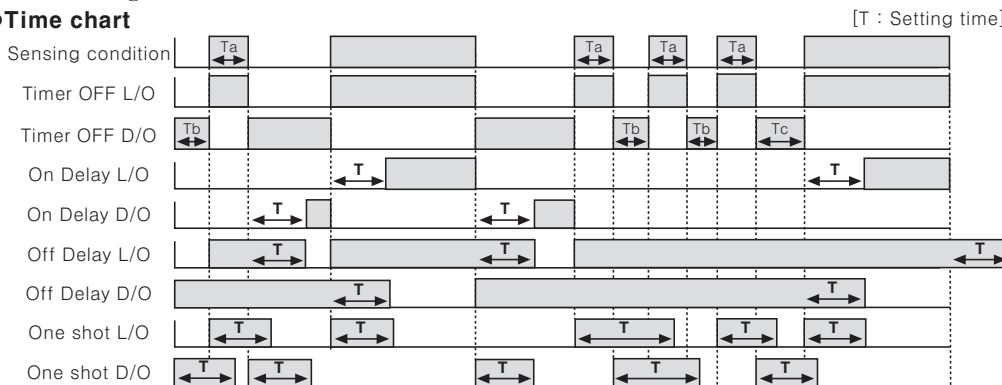
A function to reverse the display direction to suit the unit installation location. : Normal display / Reversed display selectable.
 ※ Reversed display is upside-down display of normal display.

◎ Timer function [Timer operation mode : tñod, Time setting : tññE]

Used when external device's response time is too late or when control output time is too short due to small sensing object – 3 modes available.

- Timer Off [oFF]
- On Delay [ond] : A mode in which control output ON time is delayed for a certain period of setting time.
- Off Delay [oFd] : A mode in which control output OFF time is delayed for a certain period of setting time.
- One Shot [SHot] : A mode in which control output becomes ON or OFF within a certain period of setting time.
- Time setting [tññE] : 1 to 5000ms

● Time chart



※ Setting time : $T > T_a$, $T > T_b$, $T > T_c > T_b$

◎Energy saving function [E5A]

A function to save unit's power consumption by reducing power supply to display parts in case of no setting input within 60 sec.

●Selectable from 2 power saving modes

- ☞ Normal mode [NOR] : Main output indicator (OUT), PV/SV display part ON
- ☞ Energy saving mode 1 [15A] : Main output indicator (OUT) and PV display part ON
- ☞ Energy saving mode 2 [25A] : Main output indicator (OUT) ON

◎Light ON / Dark ON switching function [Ldon]

A function to set Light ON – control output is ON when incident light level is higher than setting value Dark ON – control output is ON when incident light level is lower than setting value.

◎Communication enable / disable setting function [Lonn]

A function to set Slave amplifier unit's communication [enable (ENR) / disable (d15R)] while certain instructions (LOAD/SAVE/COPY) or group teaching is in progress by Master amplifier units.

◎Lock function [LOLL]

Two types of key lock setting available in order to prevent SV changes due to lack of care.

	OFF	LOL1	LOL2
Sensitivity setting	●	◐	◐
Data bank mode	●	○	○
Program mode	●	◐	○
Parameter Reset	●	○	○

※ ●:Check / Setting both available
◐:Check available
○:Check / Setting both unavailable

●In case of [LOL2] mode, it is required to disable the lock function first to enter into parameter mode.

■Data bank setting

A function to save settings for group amplifier units in each data bank by using master unit's command or by adjusting one amplifier unit's setting and to load required data bank when it is necessary without resetting for each unit's parameters and setting values.

●LOAD [LOAD] : Load preset databank (bAED, 1, 2) and apply it to the amplifier unit.

☞ Detailed bank parameters can be read and changed.

●SAVE [5AE] : Save one amplifier unit settings in one of databank (bAED, 1, 2).

●COPY [LOPY] : Select one databank according to MASTER's instructions and copy it in another unit (1:1) or entire group units (1: M).

●LOAD ALL [LdAL] : Select one databank according to MASTER's instructions load it to entire group units.

●SAVE ALL [5uAL] : Select one databank according to MASTER's instructions and save it in entire group units.

※Up to 3 databanks are available [bAED, 1, 2] and each bank can be read and changed.

It allows users to detect three different sensing objects using one amplifier unit without resetting each parameter.

※For BF5-D1-N, three data banks are available ([bAED], [bAE1] and [bAE2]) so that three different sensing object information can be saved. Each bank can be read and changed. It allows users to detect three different sensing objects with one amplifier unit without resetting each parameter.

※Databank function can be executed only if all amplifier units are in RUN mode.

※COPY/LOAD ALL/SAVE ALL functions are applicable only if multiple amplifier units are connected.

※If lock function is set (LOL1 / LOL2) on amplifier units or if the SLAVE unit is set to communication disable [d15R], LOAD and SAVE command for the unit will not be executed.

(A)
Photo
electric
sensor

(B)
Fiber
optic
sensor

(C)
Door/Area
sensor

(D)
Proximity
sensor

(E)
Pressure
sensor

(F)
Rotary
encoder

(G)
Connector/
Socket

(H)
Temp.
controller

(I)
SSR/
Power
controller

(J)
Counter

(K)
Timer

(L)
Panel
meter

(M)
Tacho/
Speed/
Pulse
meter

(N)
Display
unit

(O)
Sensor
controller

(P)
Switching
power
supply

(Q)
Stepping
motor &
Driver &
Controller

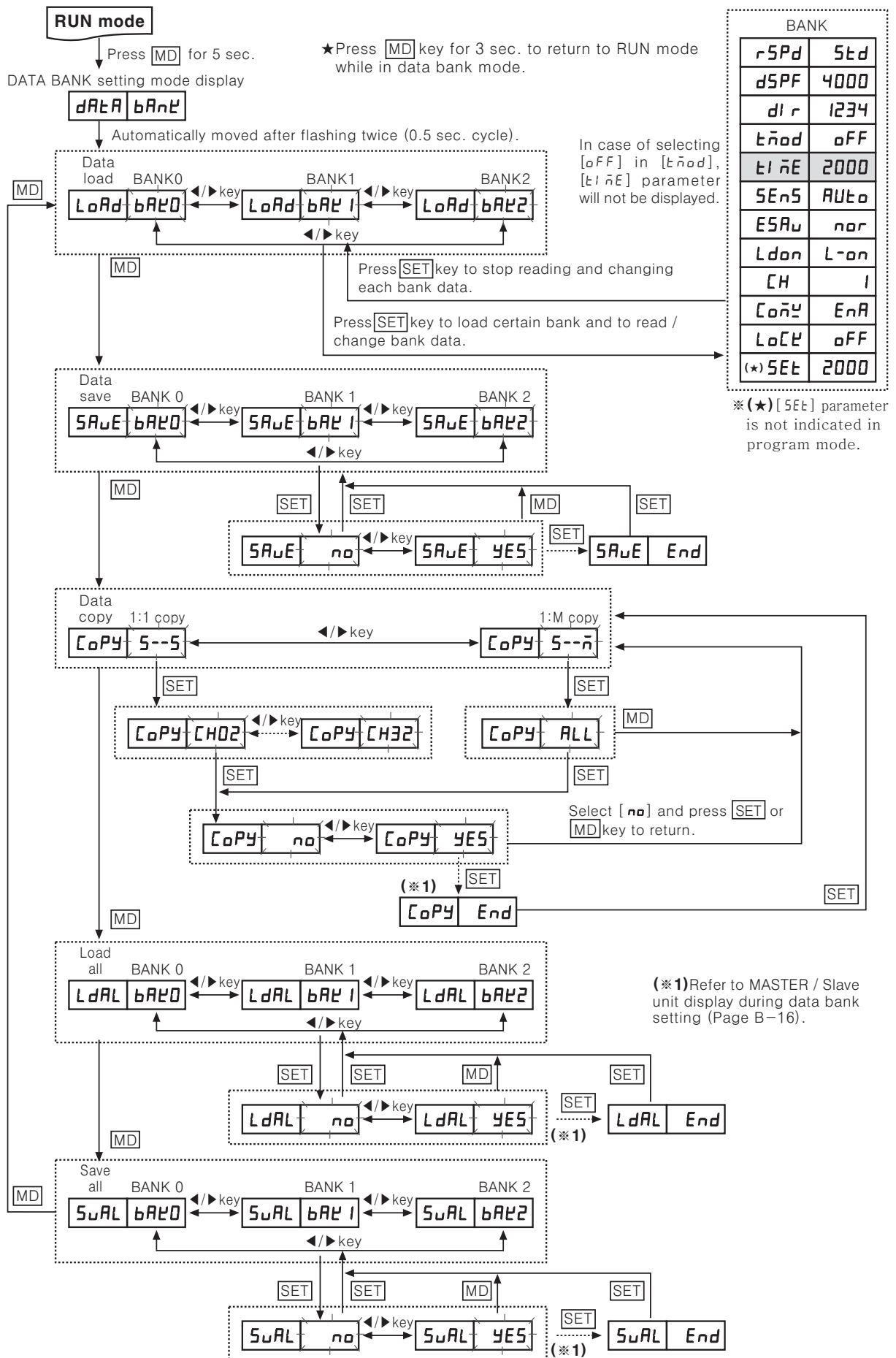
(R)
Graphic/
Logic
panel

(S)
Field
network
device

(T)
Production
stoppage
models &
replacement

BF5 Series

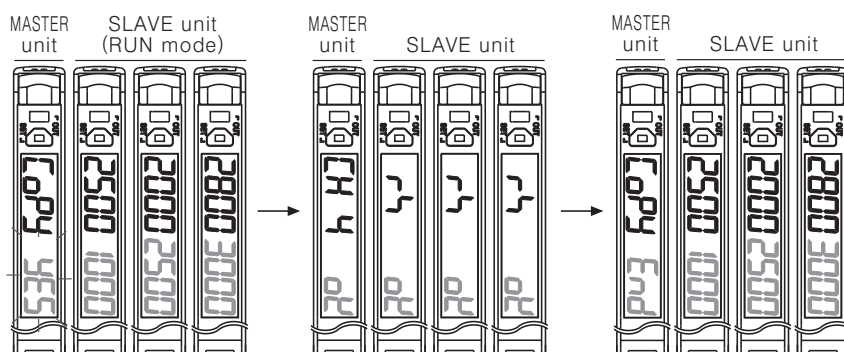
•Data bank mode flow



Fiber Optic Amplifier

●MASTER / SLAVE unit display during data bank setting

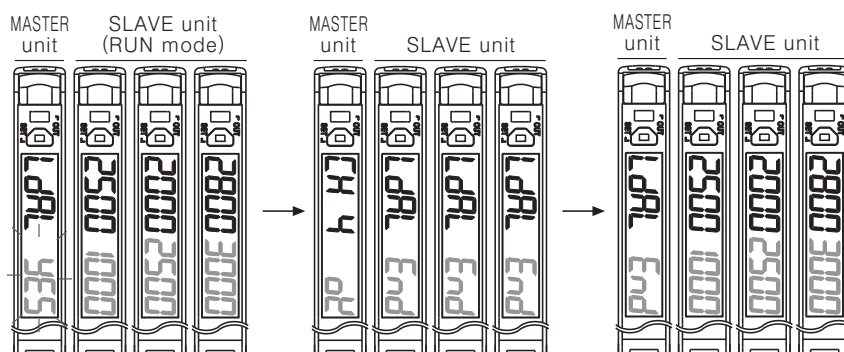
■COPY ALL



Press **SET** key

- ①Channel No. is indicated on PV display part and "00" is indicated on SV display part for master unit while COPY is executed.
- ②"CH 4" is indicated on PV display part and "00" is indicated on SV display part for slave units while COPY is executed. Then, it is returned to RUN mode.
- ③When Copy is completed, "COPY" is indicated on PV display part and "End" is indicated on SV display part for master unit. Press **SET** key to return to data copy mode.

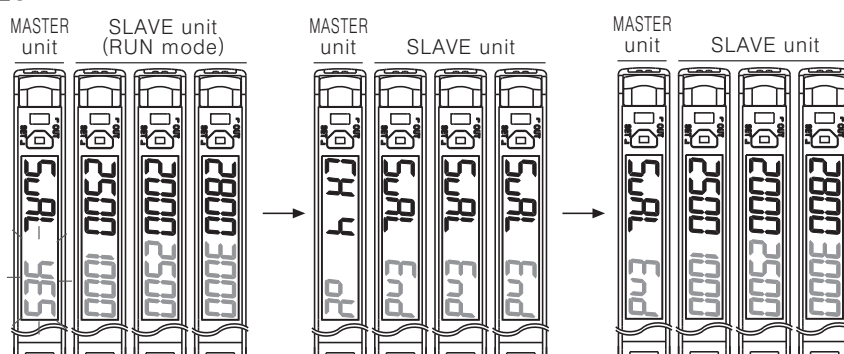
■LOAD ALL



Press **SET** key

- ①Channel No. is indicated on PV display part and "00" is indicated on SV display part for master unit while LOAD ALL is executed.
- ②"LDAL" is indicated on PV display part and "End" is indicated on SV display part for slave units while LOAD ALL is executed. Then, it is returned to RUN mode.
- ③When LOAD ALL is completed, "LDAL" is indicated on PV display part and "End" is indicated on SV display part for master unit. Press **SET** key to return to Load All mode.

■SAVE ALL



Press **SET** key

- ①Channel No. is indicated on PV display part and "00" is indicated on SV display part for master unit while SAVE ALL is executed.
- ②"SVAL" is indicated on PV display part and "End" is indicated on SV display part for slave units while SAVE ALL is executed. Then, it is returned to RUN mode.
- ③When SAVE ALL is completed, "SVAL" is indicated on PV display part and "End" is indicated on SV display part for master unit. Press **SET** key to return to Save All mode.

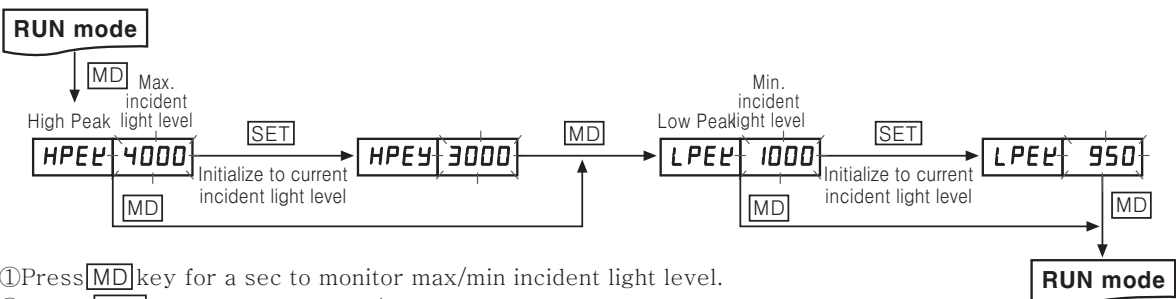
※If communication enable / disable parameter [C000] for SLAVE unit is set to communication disable while SAVE ALL, LOAD ALL or COPY is executed, Master unit displays Channel No. on PV display part and [di 5R] on SV display part.

(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

BF5 Series

High peak, Low peak function

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



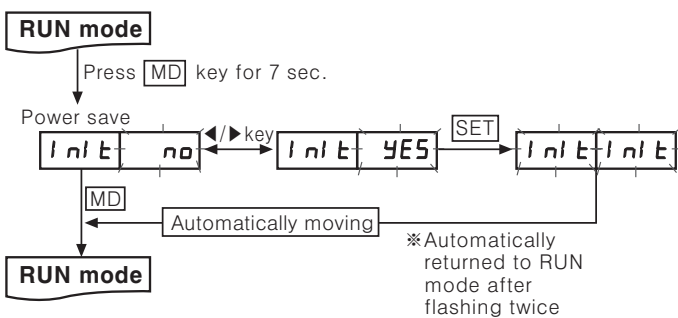
Initializing function

A function to initialize all parameters in memory to default value in case the possibility of missetting or misoperation.

※ Set lock function [**LoLk**] to **oFF** to execute Initializing Function.

※ High peak value [**HPEV**] and low peak value [**LPEV**] shall not be initialized.

○ Parameter initialize flow



○ Initializing function parameter value (Factory mode)

Parameter	Initializing value	Parameter	Initializing value	Parameter	Initializing value
rSPd	Std	tnod	oFF	Ldon	L-on
dSPF	4000	SEnS	RUto	Loan	EnR
dIr	1234	ESRu	nor	LoLk	oFF
SV : 2000, Bank 0 to 2 : Initialized					

Single display type (※Refer to B-17 to 19 page.)

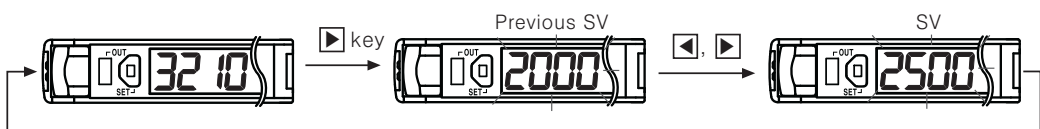
Sensitivity setting mode

※ There are two methods available for sensitivity setting – manual or teach mode.

Select the method most suitable for your application.

○ Manual sensitivity setting (Fine-adjusting sensitivity)

- The setting value can be directly changed by pressing the manual button
- Used to fine-adjusting sensitivity the sensitivity after teaching.
- Incident light level is still displayed during SV setting.



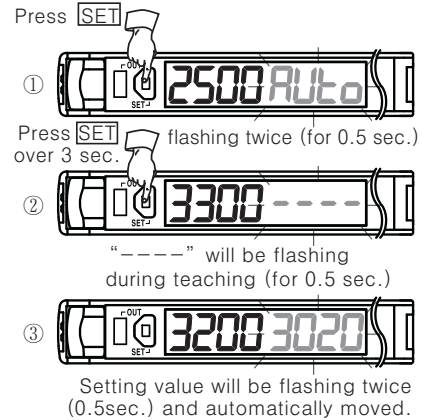
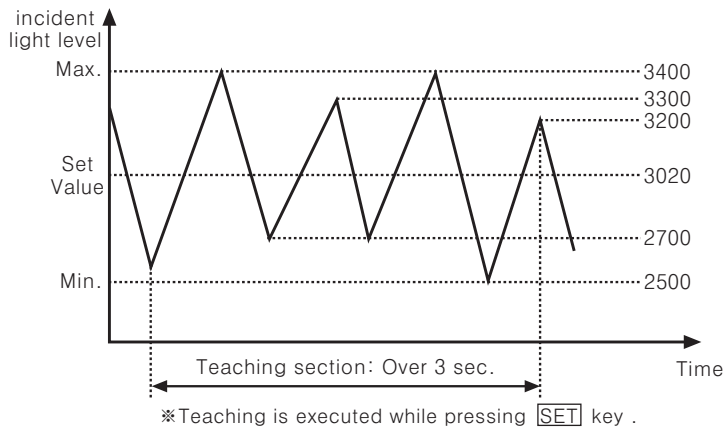
- ① Press **▶** key once in RUN mode, then previous SV will be flashing twice (0.5 sec.).
- ② Press **◀▶** key to set the value.
- ③ If there is no additional key input for 3 sec. after completing setting, newly set value will be flashing twice (0.5 sec. cycle) and automatically returned to RUN mode.

Teaching sensitivity setting(Auto tuning teaching)

- For BF5R-S1-N model, teaching sensitivity setting mode is fixed to auto-tuning teaching.
- ※Suitable when incident light level of sensing object is not stable or when sensing fast moving objects.
- ※One of teaching modes that sets the sensitivity using average value of the maximum and minimum incident light level within a certain time period.

$$\text{Set_value} = \frac{P1+P2+\dots+Pn-1+Pn}{n}$$

- In program mode, set Teaching mode parameter [5En5] to [Auto].



Function

Response time setting

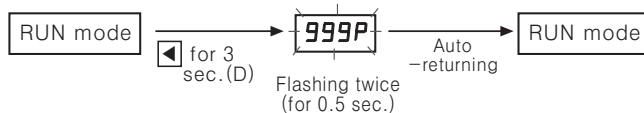
Use front slide switch to set response time.

- Fast mode : 150μs
- Standard mode : 500μs
- Long distance mode : 4ms

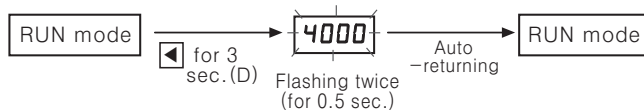
Display function (Factory mode: standard display)

A function to select incident light level display on display part.

- Standard mode display range : 0 to 4000 (0 to 9999, in case of long distance mode)
- Percentage mode display range : 0P to 99.9P (No decimal point displayed)
- When changing to standard display mode



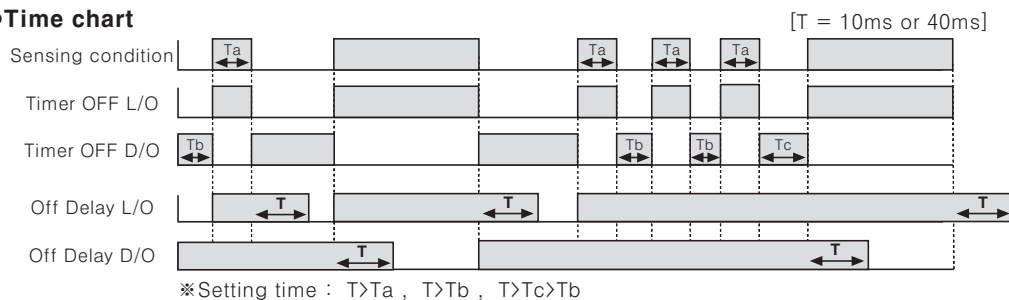
- When changing to percentage display mode



Timer function

- ※As for BF5R-S1-N type, off delay mode is provided only. Select setting time (Off / 10ms / 40ms) using front slide switch.

Time chart



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.

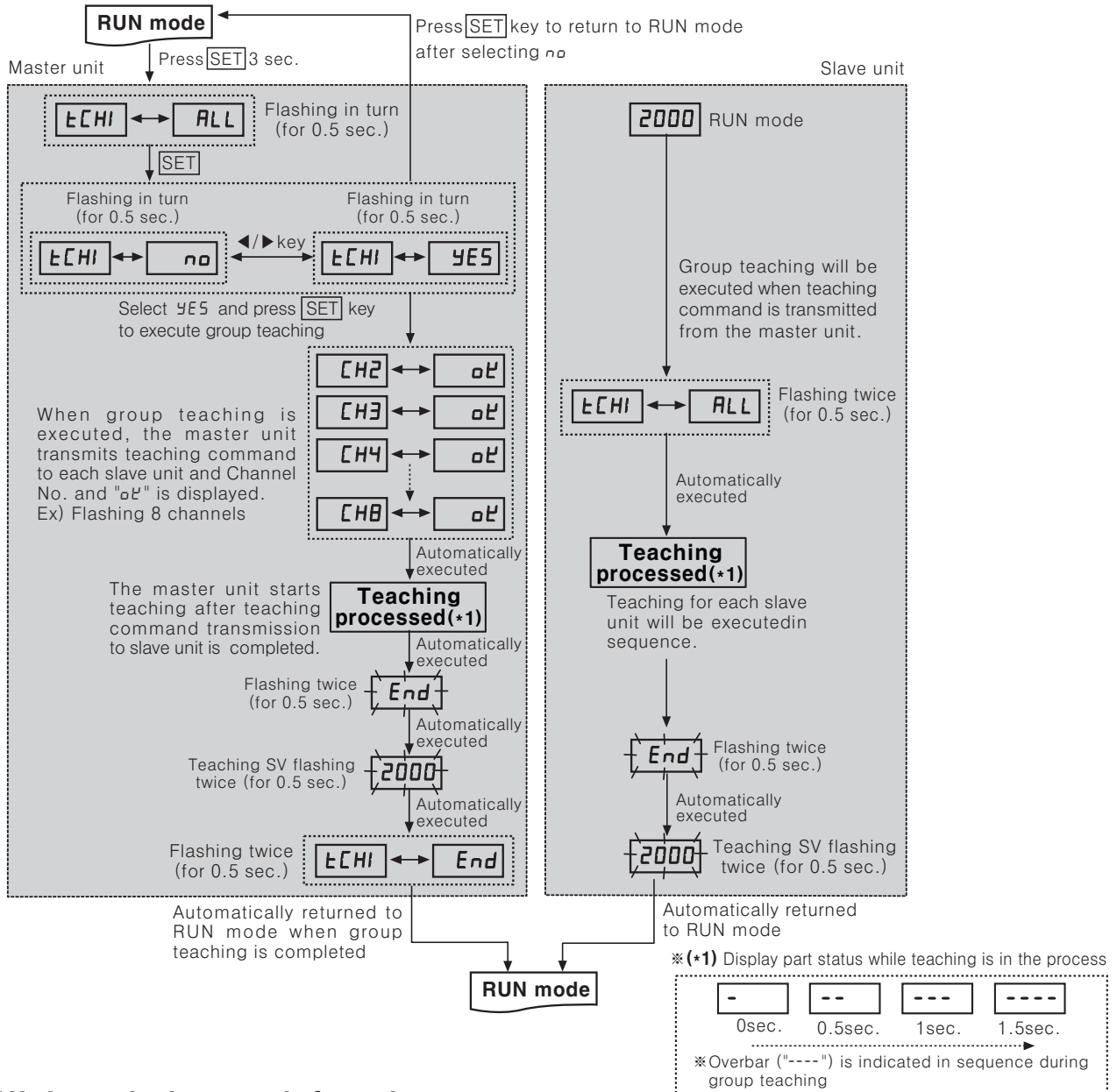
BF5R-S1-N(Single display type) use front slide switch to set each mode.

(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

BF5 Series

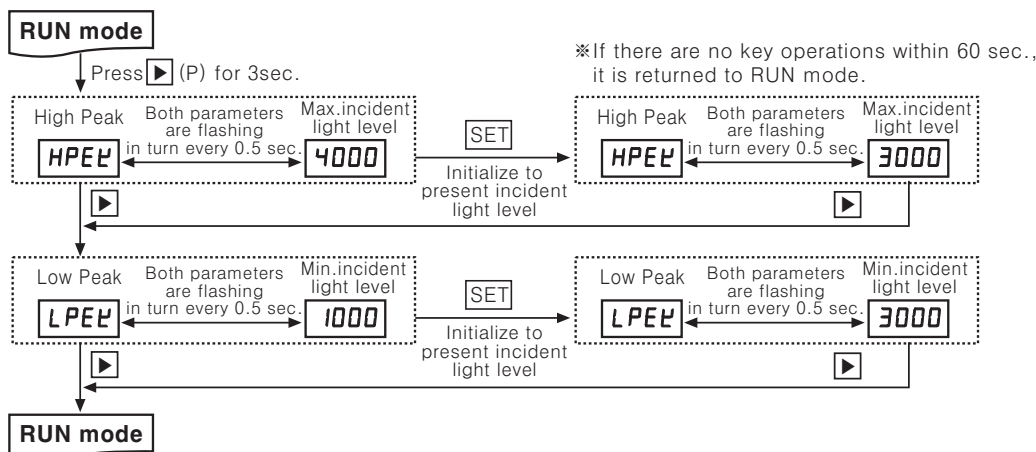
■ Group teaching

A function to set the sensitivity of slave amplifier units according to the command of master amplifier unit (certain amplifier unit) in a successive and collective way. *In case of two-point teaching mode, Group teaching is not applicable.



■ High peak, low peak function

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



Dual display / Single display common features

■ Program mode function

◎ Amplifier units connection using side connector

In case multiple amplifier units are connected, the power supply for one unit will feed all 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.
 - Auto set channel can be checked in channel parameter in program mode.
 - In case of BF5R-S1-N, auto set channel can be checked only when initial power is supplied. (Not available afterwards).
 - Channel range : 1 to 32 (applied the same to all models)
- ※ **Note that auto set channel cannot be changed and the channel No. 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 of adjacent fiber cable installations 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.

■ Error code

Error code	Cause	Troubleshooting
<i>ErrL</i>	In case incident light level is below the min. range when teaching	Increase the incident light level above min. range.
<i>Err</i>	In case overcurrent inflow occurs into output circuit.	Remove overcurrent due to overload.
<i>Er b</i>	<ul style="list-style-type: none"> ● In case Slave is failed to execute Master's instructions due to unstable communication line connection during Group Copy / Load / Save / Teaching. ● In case other communication errors occur 	<ul style="list-style-type: none"> ● Check amplifier unit's connection again. ● Check circuit and hardware around side connector.

(A)
Photo
electric
sensor

(B)
Fiber
optic
sensor

(C)
Door/Area
sensor

(D)
Proximity
sensor

(E)
Pressure
sensor

(F)
Rotary
encoder

(G)
Connector/
Socket

(H)
Temp.
controller

(I)
SSR/
Power
controller

(J)
Counter

(K)
Timer

(L)
Panel
meter

(M)
Tacho/
Speed/
Pulse
meter

(N)
Display
unit

(O)
Sensor
controller

(P)
Switching
power
supply

(Q)
Stepping
motor &
Driver &
Controller

(R)
Graphic/
Logic
panel

(S)
Field
network
device

(T)
Production
stoppage
models &
replacement


BFC Series

Digital fiber optic amplifier communication converter

NEW

■ Features

- Sets all Functional performance and parameters from external devices (PL, PLC)
- Supports various communications
: RS485 communication, Serial Communication, SW input
- Connect up to 32 amplifier units (BF5 Series)
- Slim design with depth 10mm(W10×H30×L70mm)

 Please read "Caution for your safety" in operation manual before using.



(acquiring certification)



■ User manual

- Visit our web site (www.autonics.com) to download user manual and communication manual.
- User manual describes for specifications and function, and communication manual describes for RS485 communication (Modbus RTU protocol) and parameter address map data.

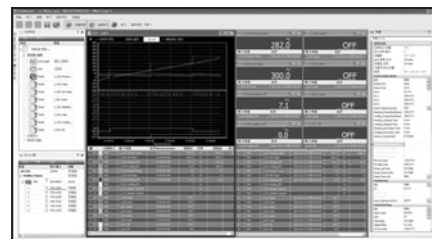
■ Integrated device management program(DAQMaster)

- DAQMaster is a integrated device management program for Autonics TK series providing GUI control for easy and convenient management of parameters and multiple device data monitoring.
- Visit our website (www.autonics.com) to download user manual and integrated device management program.

< Computer specification for using software >

Item	Recommended specification
Processor	IBM PC compatible computer with Intel Pentium III or above
Operating system	Windows 98 / NT / XP / Vista / 7
RAM	Over 256MB
Hard disk	Over 1GB of available space
VGA	Over 1024×768
Others	RS232 serial port, USB port

< DAQMaster screen >



■ Specifications

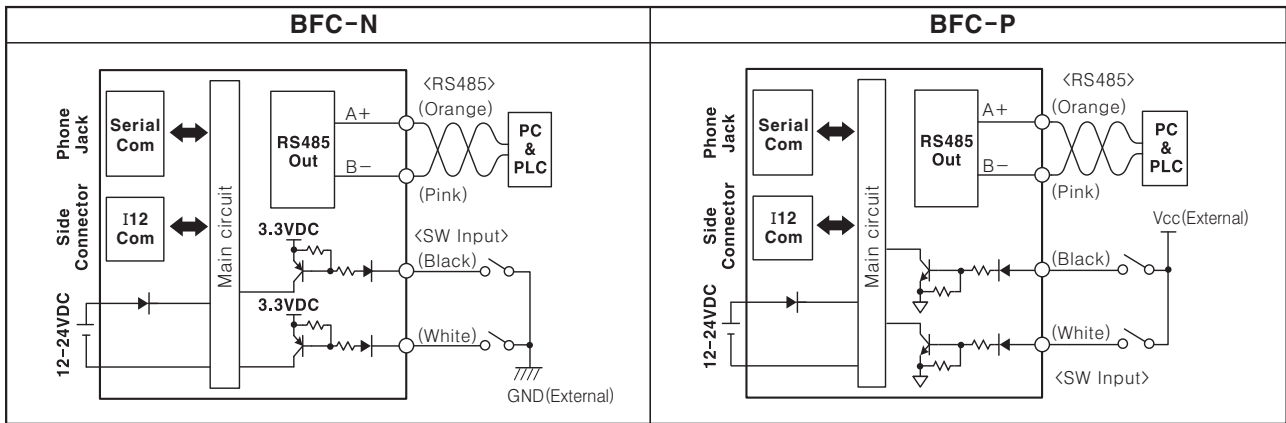
Model	NPN Solid-state input	PNP Solid-state input
	BFC-N	BFC-P
Power supply	(★1) 12-24VDC ±10%	
Current consumption	Max. 40mA	
SW input (SW1, SW2)	LOW : 0-1V, HIGH : 5-24V	
	SW1/SW2 - HH : Standby, HL : BANK0, LH : BANK1, LL : BANK2	SW1/SW2 - LL : Standby, LH : BANK0, HL : BANK1, HH : BANK2
Communication function	RS485 Communication, Serial Communication, SW input	
Communication speed	1200, 2400, 4800, 9600, 19200, 38400bps	
Indication	<ul style="list-style-type: none"> ●Parameter : Red 4digit 7segment ●Setting value : Green 4 digit 7 segment ●Indicator : TX indicator (Red), RX indicator (Green) 	
Function	<ul style="list-style-type: none"> ●Real-time monitoring (incident light level, on/off state) ●Executes every BF5 feature and sets parameter by external device (Master) 	
Ambient temperature	Operation : -10 to 50℃, Storage : -20 to 50℃ (at non-freezing state)	
Ambient humidity	35 to 85% RH(at non-freezing state)	
Vibration resistance	1.5 mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours	
Shock	500m/s ² (Approx. 50G) in X, Y, Z directions for 3 times	
Protection	IP40(IEC standard)	
Material	Case : PBT, Cover : PC	
Accessory	Connector type wire (φ 4, 3P, 2m, AWG 22, Insulator diameter : φ 1.25), Side connector	
Unit weight	Approx. 15g	

(★1) Powered by supply voltage of the amplifier unit connected by a side connector.

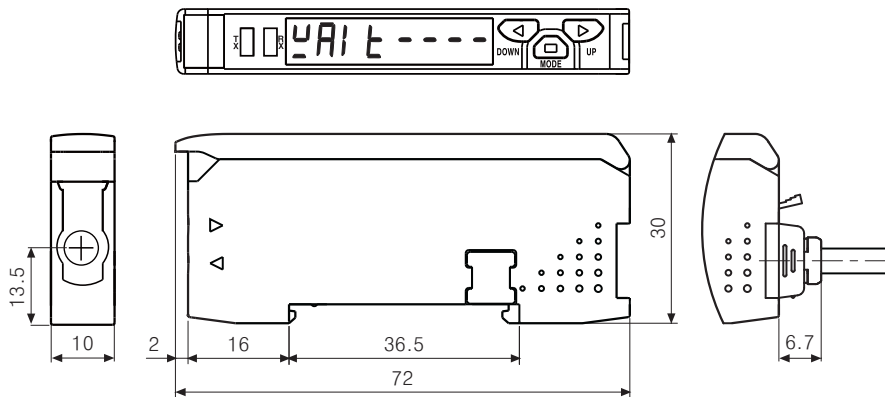
*Environment resistance is rated at no freezing or condensation.

Communication Converter

■ Control output diagram and terminal connections



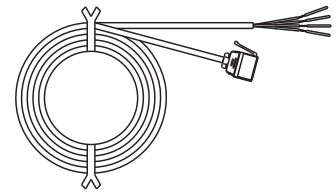
■ Dimensions



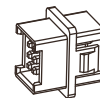
○ Accessories

(Unit:mm)

- Connector type wire (Length:2m)



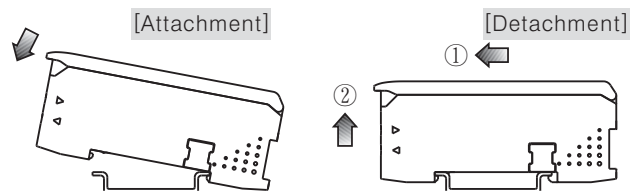
- Side connector



■ Installations

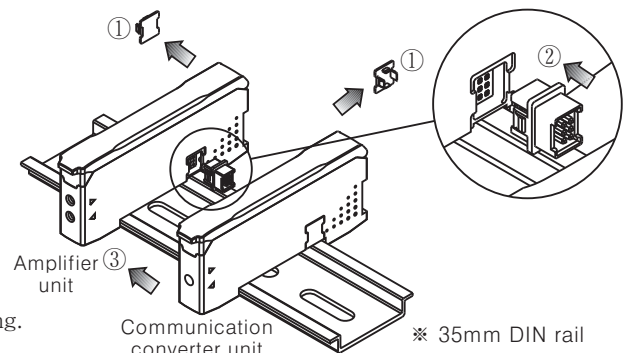
○ DIN rail installations

- Attachment : Hang up the backside holder on DIN rail and press the unit toward the DIN rail.
- Detachment : Slide the back part and lift up the unit as shown in the figure ① and ②.



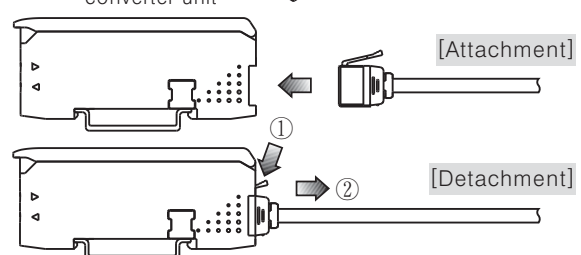
○ Communication converter unit(BFC Series) and Amplifier unit(BF5 Series) Connection

- Remove the side cover at the side of communication converter unit where amplifier unit will be connected.
- Attach the side connector to the socket on the side of the communication converter.
- After attaching the communication converter unit and the amplifier unit to the DIN rail, push gently to have both units fastened into each other.
- ※ Improper connection may cause malfunction.
- ※ Do not supply the power while connecting or disconnecting.



○ Connector cable attachment and detachment

- Attachment : Insert the connector cable into the installed communication converter unit on DIN rail until it clicks.
- Detachment : Pull out the connector cable with pressing the connector cable lever downside.



(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

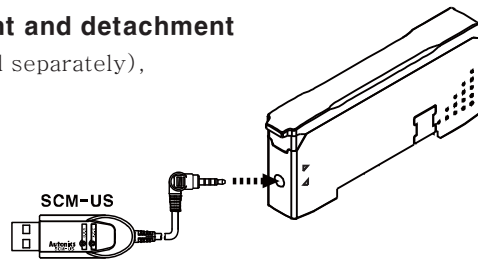
(S) Field network device

(T) Production stoppage models & replacement

BFC Series

◎USB to Serial converter(SCM-US) attachment and detachment

- Connect the USB to Serial converter, SCM-US(sold separately), to PC loader port.

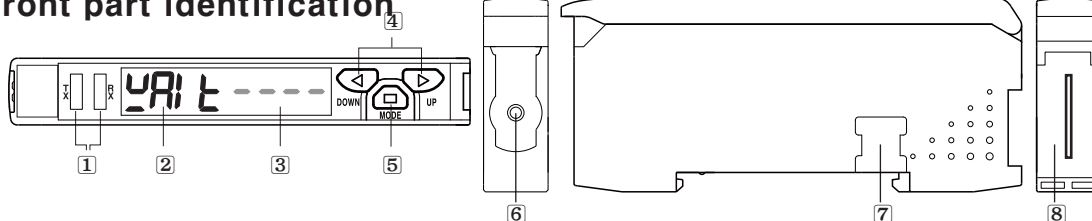


■Accessories [Sold separately]

- SCM-38I (RS232C to RS485 converter)
- SCM-US48I (USB to RS485 converter)
- SCM-US (USB to Serial converter)



■Front part identification

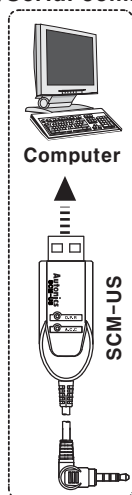


- 1 TX(Send)–Red LED, RX(Receive)–Green LED : Turns on when communicates and inputs SW.
- 2 Parameter indication(4digit Red 7segment) : Indicates parameter and processes of communication instruction/execution.
- 3 Setting value indication(4digit Green 7segment) : Indicates setting value and process of communication instruction/execution.
- 4 UP, DOWN key : To modify setting value.
- 5 MODE key : To shift or select parameter when entering parameter setting mode.
- 6 PC loader port : In case of PC communication, use USB to Serial converter(SCM-US, sold separately).
- 7 Side cover : To connect an amplifier unit, use a side connector(accessory).
Remove the side cover to connect the amplifier unit.
- 8 Connector cable port : The terminal for attaching a connector cable(accessory) is used for RS485 communication or SW input.

■Communication mode

This communication converter unit supports 2 communication modes and SW input mode.
You can use only 1 mode of 3 modes.

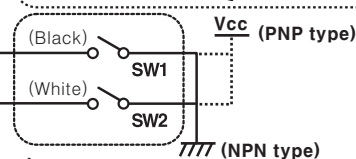
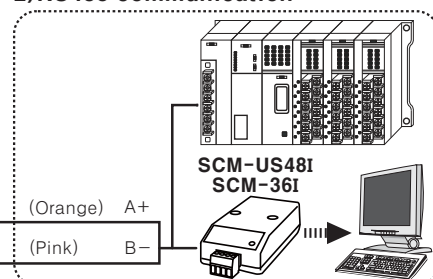
1)Serial communication



1)Serial communication

- ①Connect the USB to Serial converter(SCM-US, sold separately) to the PC loader port for communicating with PC.
- ②It is very easy to manage parameters and monitor data of connected amplifier units(BF5 Series) using the integrated management program DAQMaster(free).(Refer to DAQMaster and amplifier unit manuals)

2)RS485 communication



3)SW input

※Caution

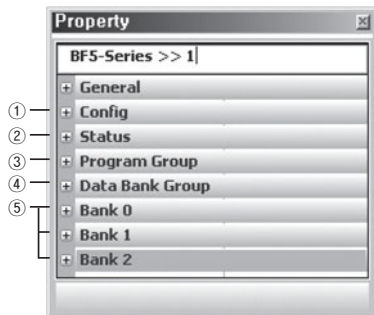
Do not connect a powered BF5 connector cable to a communication converter unit(BFC).
(It may cause damage the product.)

Communication Converter

2)RS485 communication

- PLC connection : ①Connect directly to a PLC using RS485 communication cable of the communication converter unit.
②Amplifier units(BF5 Series) can be controlled through PLC. (Refer to communication converter unit(BFC) communication manual)
- PC connection : ①Connect PC using Communication converter(SCM-38I or SCM-US48I, sold separately).
(Refer to Communication converter SCM series manual)
②Same as "1)Serial Communication information line ②".

※Following is a screen of DAQMaster properties window of a computer connected communication converter unit.



① Config

Indicates the number of amplifier units connected to the communication converter unit(BFC).

② Status

Indicates the information of the selected amplifier unit(Dual, Single) by channel, connected to communication converter unit(BFC).

③ Program Group

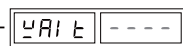
Setting values of the amplifier unit can be changed. When setting values of the amplifier unit changed, TX(Red) and RX(Green) LEDs on communication converter unit will flash indicating application of setting values to the amplifier unit.

④ Data Bank Group

Data bank and group teaching features of amplifier unit can be set. Amplifier unit can be initialized as well.

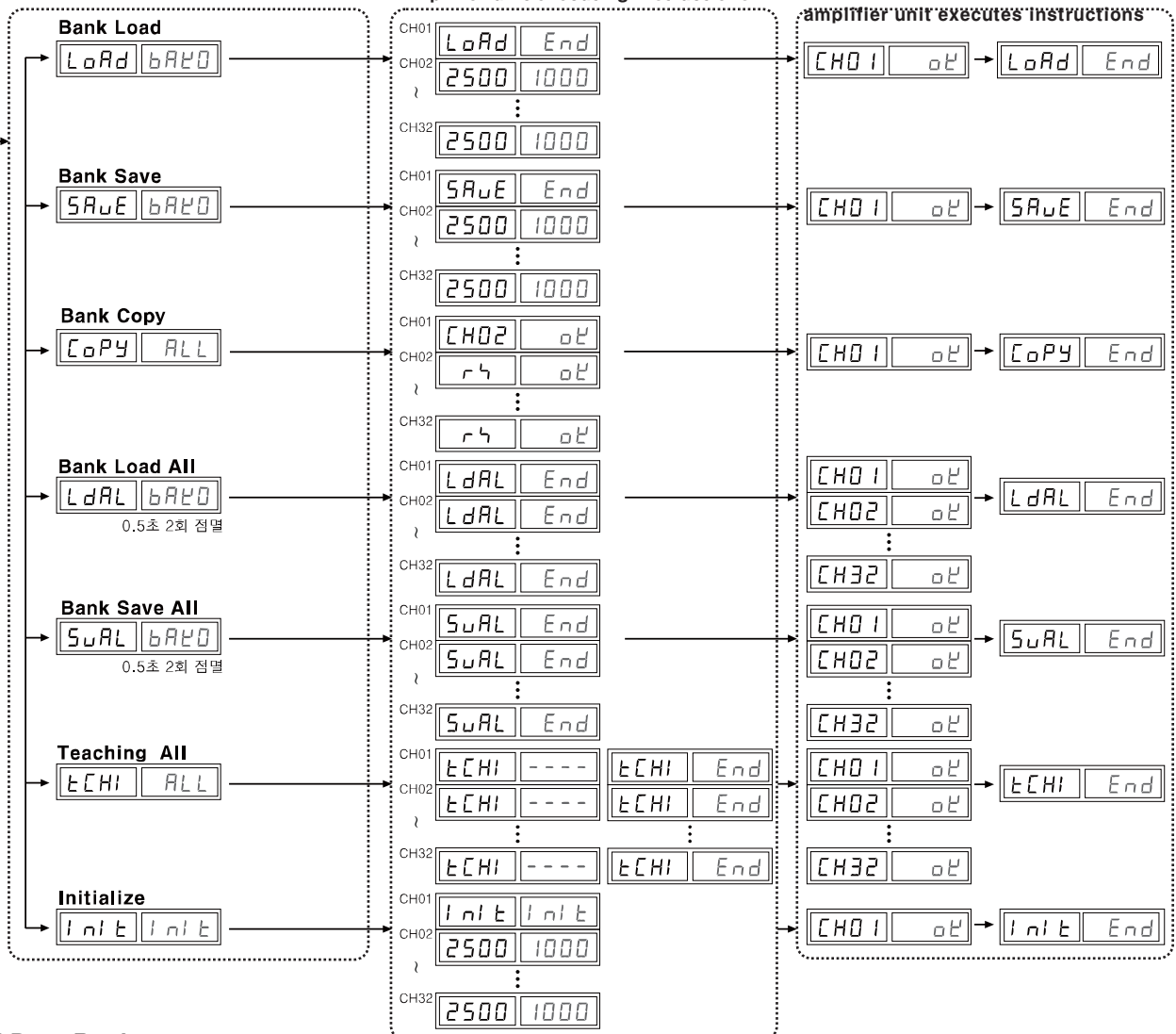
※Indications appear on communication converter and amplifier units depending on applied instruction are shown below.

Communication waiting state



This indicates the waiting state for instructions while preserving master unit(PC,PLC) and communication converter unit real time data transfer(incident light level of the amplifier unit).

Communication converter unit received an instruction from DAQMaster



④ Data Bank

Setting value of data bank(Bank 0, Bank 1, Bank 2) can be saved.

- (A) Photo electric sensor
- (B) Fiber optic sensor
- (C) Door/Area sensor
- (D) Proximity sensor
- (E) Pressure sensor
- (F) Rotary encoder
- (G) Connector/Socket
- (H) Temp. controller
- (I) SSR/Power controller
- (J) Counter
- (K) Timer
- (L) Panel meter
- (M) Tacho/Speed/Pulse meter
- (N) Display unit
- (O) Sensor controller
- (P) Switching power supply
- (Q) Stepping motor & Driver & Controller
- (R) Graphic/Logic panel
- (S) Field network device
- (T) Production stoppage models & replacement

3)SW input

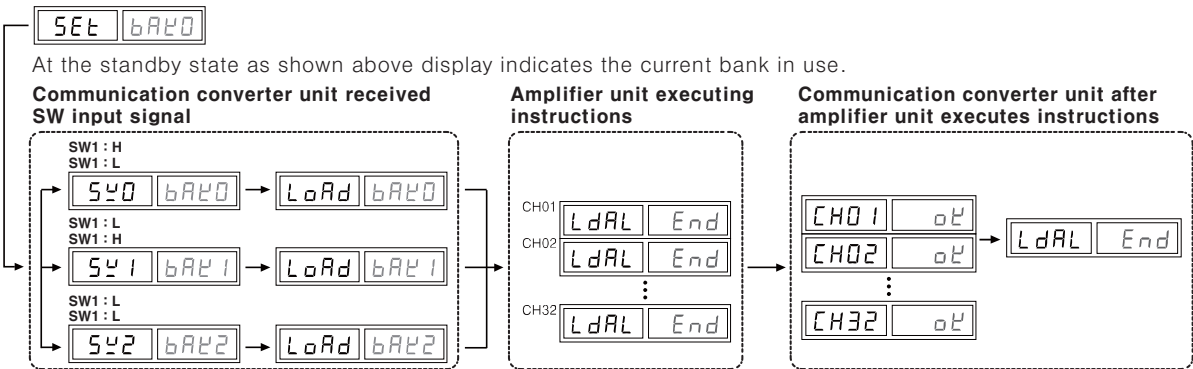
SW input is a feature which allows amplifier unit connected with the communication converter unit to load all banks. Applying signals to SW1(Black) and SW2(White) of the connector cables which is connected to the communication converter unit allows change of banks as shown in chart 1.(SW input signal duration should be longer than 3 seconds.)

[Chart1] Bank selection table based on SW input

	Bank	NPN		PNP	
		SW1	SW2	SW1	SW2
1	Standby signal(Using set Bank)	H	H	L	L
2	Bank 0	H	L	L	H
3	Bank 1	L	H	H	L
4	Bank 2	L	L	H	H

※Indications appear on communication converter and amplifier units depending on applied instruction are shown below.

SW input standby state



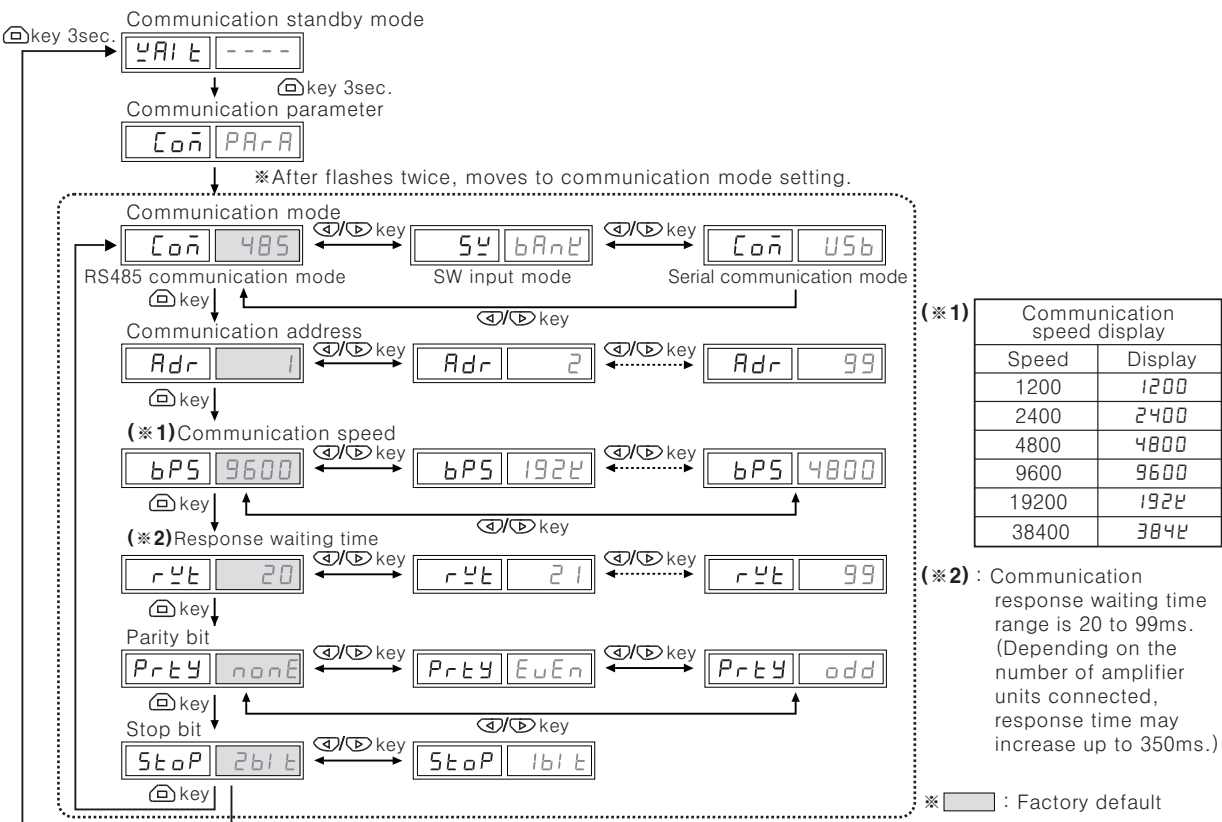
< Communication specification >

Standard	EIA RS485	Standard	EIA RS485
Maximum connections	31 (Address setting: 01 to 99)	Response waiting time	20 to 99ms
Communication method	2-wire half duplex	Start bit	1bit(Fixed)
Synchronization method	Asynchronous	Stop bit	1bit, 2bit
Effective communication distance	Max. 800m	Parity bit	None, Even, Odd
Communication speed	1200, 2400, 4800, 9600, 19200, 38400bps	Data bit	8bit(Fixed)
		Protocol	Modbus RTU

※It is not allowed to set overlapping communication address at the same communication line.

※Please use a proper twist pair for RS485 communication.

Parameter setting



Communication Converter

■ Error code

Error code	Cause	Troubleshooting
E_rA	Reading/Writing errors occur while processing data in EEPROM of amplifier unit.	Check the circuitry around EEPROM inside the product.
E_rB	<ul style="list-style-type: none"> ●Slave fails to execute Master's group instructions such as Copy/Load/Save/Teaching sent through communication line due to unstable communication line. ●Other communication problems. 	<ul style="list-style-type: none"> ●Check the connection status between communication unit and amplifier units. ●Check the circuitry around the side connector and hardware condition.

Solution methods for communication problems

1) Communication errors during Serial or RS485 connections

- Check if the communication mode selected in communication converter unit suits installation environment.
- Check and equalize the address of communication converter unit and address set in DAQMaster.
- Check and equalize the communication port of communication converter unit and the communication port number set in DAQMaster.

2) Communication errors during SW signal input

- Check if the communication mode set in communication converter unit is SW input mode(SW Bank).
- Check if the connections are made thoroughly depending on NPN or PNP input type.

(A)
Photo
electric
sensor

(B)
Fiber
optic
sensor

(C)
Door/Area
sensor

(D)
Proximity
sensor

(E)
Pressure
sensor

(F)
Rotary
encoder

(G)
Connector/
Socket

(H)
Temp.
controller

(I)
SSR/
Power
controller

(J)
Counter

(K)
Timer

(L)
Panel
meter

(M)
Tacho/
Speed/
Pulse
meter

(N)
Display
unit

(O)
Sensor
controller

(P)
Switching
power
supply

(Q)
Stepping
motor &
Driver &
Controller

(R)
Graphic/
Logic
panel

(S)
Field
network
device

(T)
Production
stoppage
models &
replacement

BF4R Series

High reliability of fiber optic amplifier for convenient mounting

■ Features

- High speed response : Max. 0.5ms
- Auto sensitivity setting (Button setting) / Remote sensitivity setting.
- External synchronization input, mutual interference protection, self-diagnosis.
- Reverse power polarity and short-circuit (Overcurrent) protection circuit
- Timer function : Selectable None / 40ms OFF delay timer (fixed) (Standard type, remote sensitivity setting type only)
- Automatically selectable Light ON / Dark ON mode.
- Precise detection of small target and complicated place to install.



⚠ Please read "Caution for your safety" in operation manual before using.



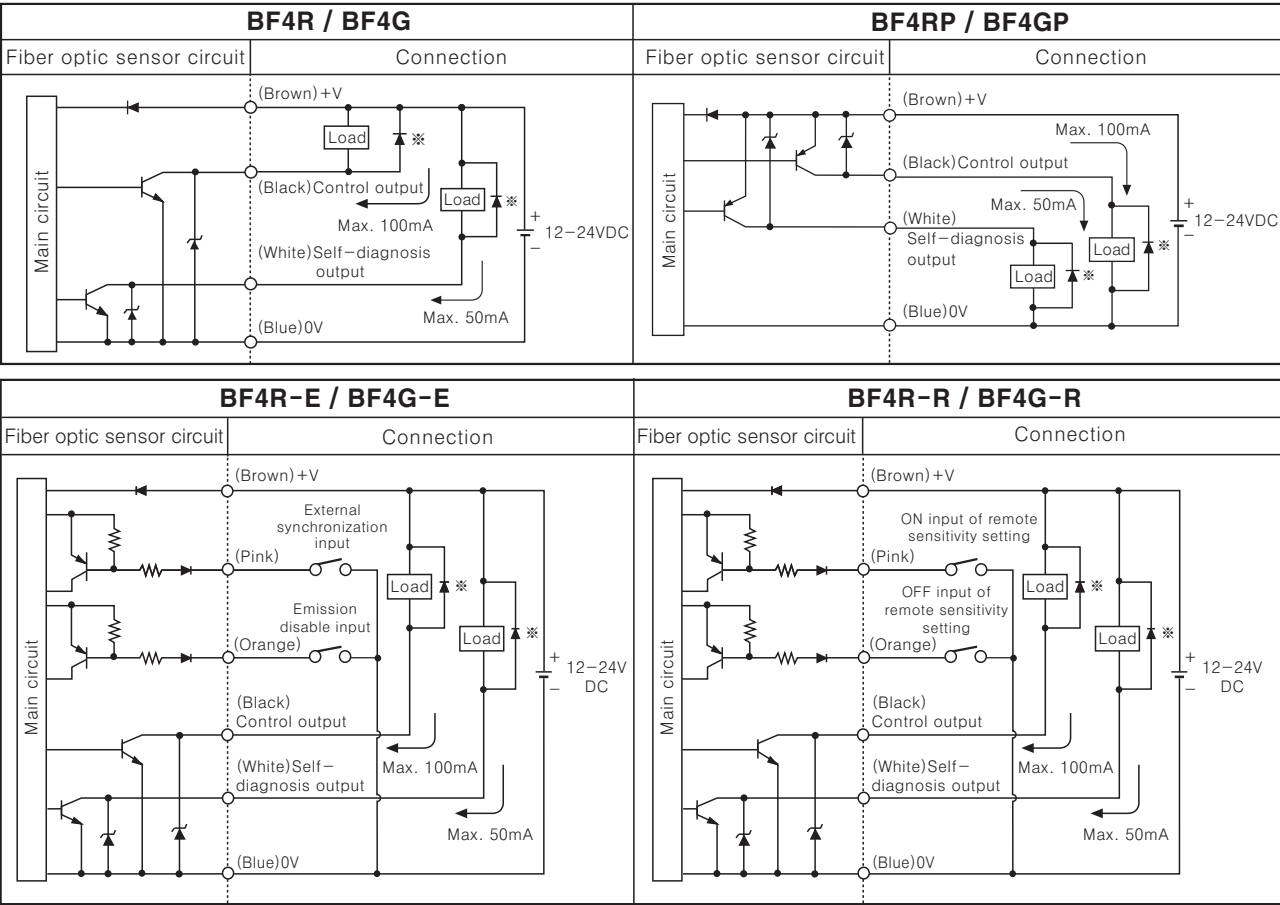
■ Specifications

Model	Standard type				External synchronization input type		Remote sensitivity setting type	
	BF4RP	BF4GP	BF4R	BF4G	BF4R-E	BF4G-E	BF4R-R	BF4G-R
Response Frequency	Max. 0.5ms(FREQ.1), Max. 0.7ms(FREQ.2)							
Power supply	12-24VDC ±10%, Ripple P-P:Max. 10%							
Current consumption	Max. 45mA							
Light source (Modulated light)	Red LED	Green LED	Red LED	Green LED	Red LED	Green LED	Red LED	Green LED
Sensitivity adjustment	Sensitivity adjustment button(ON/OFF)							
Operation mode	Automatic selection of Light ON/Dark ON accordance with button setting							
Control output	PNP open collector output		NPN open collector output					
	Load current:Max. 100mA Applied voltage:Max. 30VDC Output voltage: Min. (Power supply -2.5)V		Load current : Max. 100mA, Load voltage : Max. 30VDC Residual voltage : Max. 1V(at 100mA load current), Max. 0.4V(at 16mA load current)					
Self-diagnosis output	ON state under unstable sensing(When the target stays for 300ms in unstable area), ON state when control output short-circuited							
	Load current:Max. 50mA Applied voltage:Max. 30VDC Output voltage:Min. (Power supply -2.5V)		Load current : Max. 50mA, Load voltage : Max. 30VDC Residual voltage : Max. 1V(at 50mA load current), Max. 0.4V(at 16mA load current)					
Protection circuit	Reverse power polarity, Short-circuit(Overcurrent) protection circuit							
Indicator	Operation indicator : Red LED, Stability indicator : Green LED ON when the target stays in stable sensing level							
Input of stop transmission function	_____				Built-in		_____	
External synchroni- zation function	_____				Built-in (Gate/Trigger)		_____	
Remote sensitivity setting function	_____				_____		Built-in	
Interference prevention function	(Note1) Built-in selectable FREQ.1 or FREQ.2 by ON/OFF button							
Timer function (Selectable)	None / 40ms OFF delay timer (fixed)				_____		None / 40ms OFF delay timer (fixed)	
Insulation resistance	Min. 20MΩ (at 500VDC megger)							
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							
Vibration	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours							
Shock	500m/s² (50G) in X, Y, Z direction for 3 times							
Ambient temperature	Operation : -10 to 50℃, Storage : -20 to 70℃ (at non-freezing state)							
Ambient humidity	35 to 85%RH							
Material	Case : Heat-resistance ABS, Cover : PC							
Cable	ø 4, 4P, Length : 2m				ø 4, 6P, Length : 2m			
Approval	CE							
Unit weight	Approx. 65g							

※ **(Note1)** Frequency1 (Normal mode) : Max. 0.5ms, Frequency2 : Max. 0.7ms

Fiber Optic Amplifier

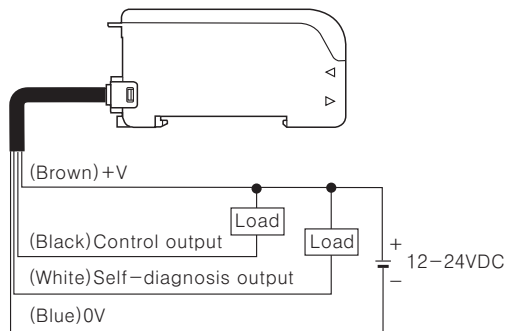
Control output diagram



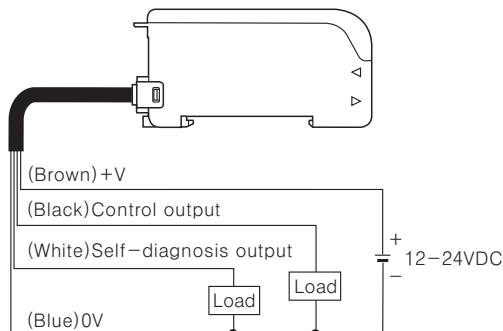
*Connect Diode at external terminal for inductive load.

Connections

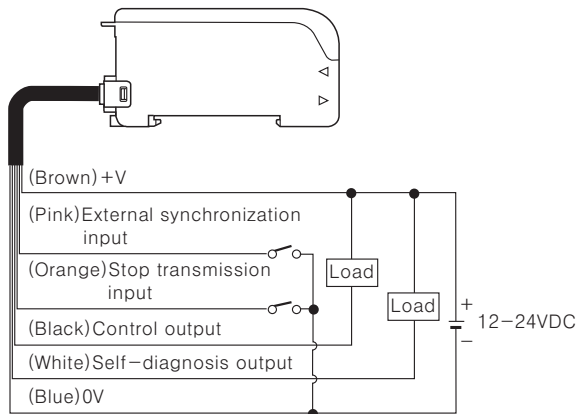
●BF4R/BF4G



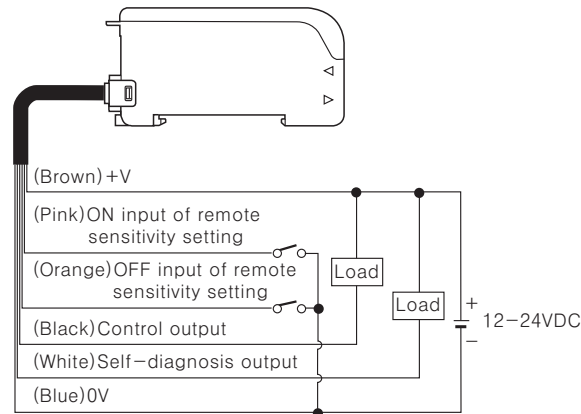
●BF4RP/BF4GP



●BF4R-E/BF4G-E



●BF4R-R/BF4G-R

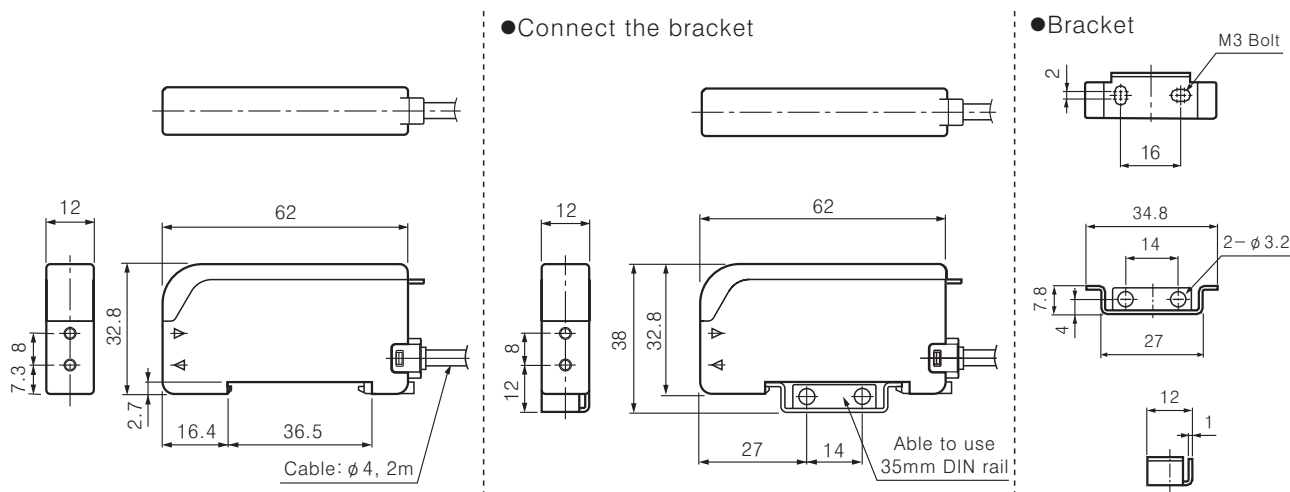


- (A) Photo electric sensor
- (B) Fiber optic sensor
- (C) Door/Area sensor
- (D) Proximity sensor
- (E) Pressure sensor
- (F) Rotary encoder
- (G) Connector/Socket
- (H) Temp. controller
- (I) SSR/Power controller
- (J) Counter
- (K) Timer
- (L) Panel meter
- (M) Tacho/Speed/Pulse meter
- (N) Display unit
- (O) Sensor controller
- (P) Switching power supply
- (Q) Stepping motor & Driver & Controller
- (R) Graphic/Logic panel
- (S) Field network device
- (T) Production stoppage models & replacement

BF4R Series

■ Dimensions

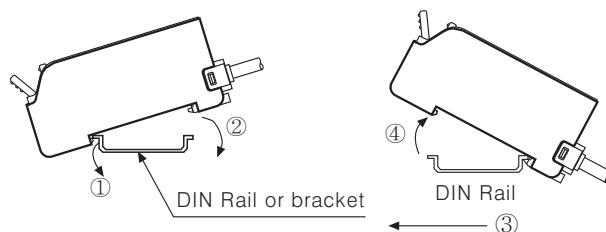
(Unit:mm)



■ Installations

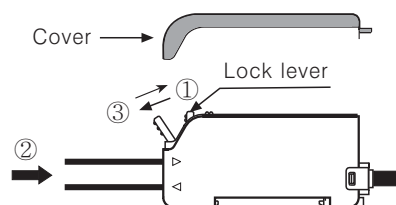
◎ Amplifier unit mounting

- ① Hook the amplifier on the front of DIN rail (or Bracket).
- ② Press the rear part of the amplifier on DIN rail (or Bracket).
- ③ In case of separating amplifier push the back of amplifier toward ③ and lift the hole for fiber toward ④ up then simply take it out without tools.
- ④



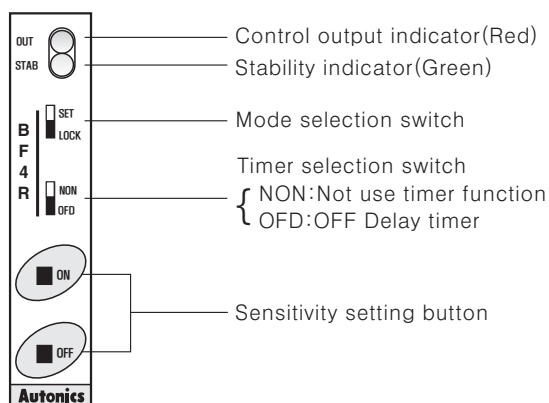
◎ Fiber cable connection

- ① Open the Lock lever to "↙" direction. (Unlock)
- ② Insert the fiber optic cable in the amplifier slowly. (Depth : 10mm)
- ③ Close the Lock lever to "↗" direction. (Lock)

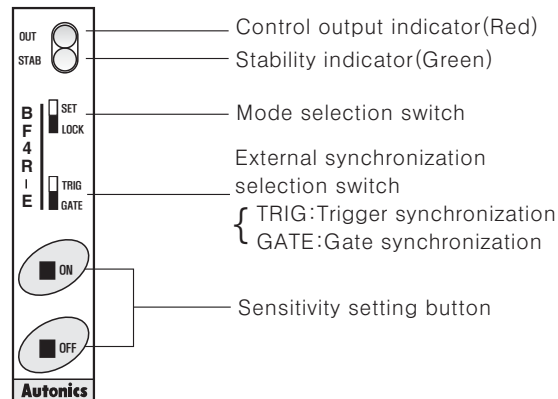


■ Front part identification

● BF4R / BF4G / BF4RP / BF4GP / BF4R-R / BF4G-R

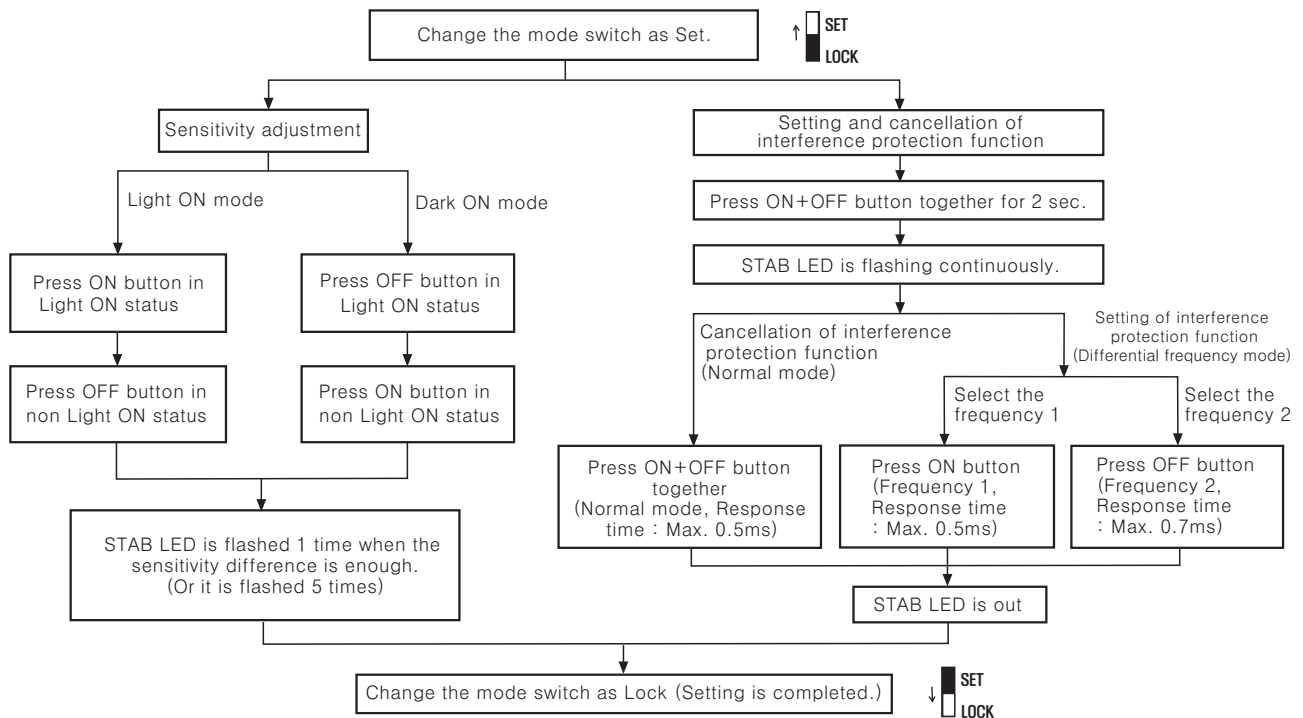


● BF4R-E / BF4G-E



Fiber Optic Amplifier

■ Setting mode



■ Sensitivity adjustment

◎ Adjustment by the sensitivity setting button(Common)

● Light ON mode

The control output turns on at Light ON status and turns off at Light OFF status.

Order	Setting method
①	Mount the fiber optic cable within sensing distance.
②	Change the mode selection switch to [SET].
③	Diffuse reflective: Press [ON] button with the sensing target in place. Transmitted beam: Press [ON] button without the sensing target.
④	Stability indicator flashes at ON state. (Check the target position)
⑤	Diffuse reflective: Press [OFF] button with the sensing target removed. Transmitted beam: Press [OFF] button with the sensing target in place.
⑥	• When there is enough sensitivity difference between ON state and OFF state, the STAB indicator flashes one time only at stable sensing level. • When there is not enough sensitivity difference between ON state and OFF state, the STAB indicator flashes five times at unstable sensing level. (Note)
⑦	Change the mode selection switch to [LOCK], even though the sensitivity setting button is touched, setting sensitivity shall not be changed.

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

● Dark ON mode

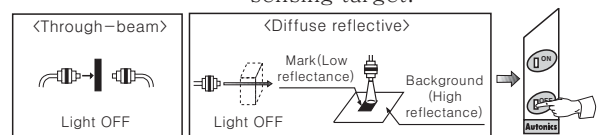
The control output turns off at Light ON status and turns on at Light OFF status.

<How to set sensitivity>

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

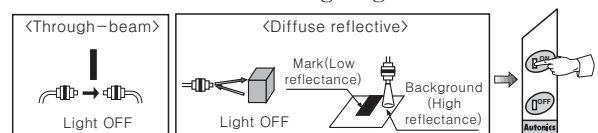
③ state

- Diffuse reflective : Press [ON] button without the sensing target.
- Through-beam : Press [ON] button with the sensing target.



⑤ state

- Diffuse reflective : Press [OFF] button with the sensing target.
- Through-beam : Press [OFF] button without the sensing target.



(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

(T) Production stoppage models & replacement

BF4R Series

◎To set as max. sensitivity(Common)

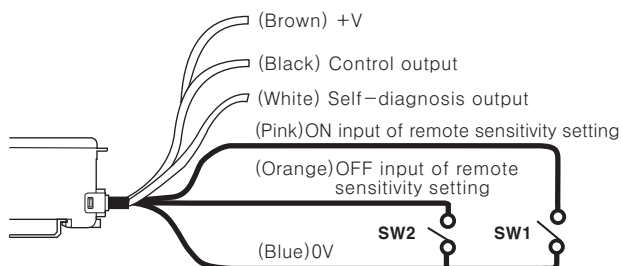
- ①Set the mode selection switch to [SET] mode.
 - ②If there is no sensing target,
Light ON mode : Press [ON → OFF] button
Dark ON mode : Press [OFF → ON] button
 - ③Set the mode selection switch to [LOCK] mode.
- ※External sensitivity setting
- Light ON Mode**(From above ③)
 External sensitivity setting **ON** input (High→Low→High),
 External sensitivity setting **OFF** input (High→Low→High)
 - Dark ON Mode**(From above ③)
 External sensitivity setting **OFF** input (High→Low→High),
 External sensitivity setting **ON** input (High→Low → High)

< Application >

- To extend sensing distance by the diffuse reflective type :
 If fiber optic sensor is used in place where there are targets with high reflectivity and low reflectivity, able to get stable detection by adjusting max. sensitivity.
- When it is used as transmitted beam type at bad environment :
 If fiber optic sensor is used in place where there is lots of dust or moisture it might cause malfunction. Please max. sensitivity then it can perform stable detection.

◎Remote adjustment of sensitivity [BF4R(G)-R]

BF4R-R/BF4G-R type can adjust the sensitivity with input signal lines regardless of the mode selection switch as following diagram ;



- ①SW1 (ON input of remote sensitivity setting) :
 SW1 turns on and then turns off instead of ③ method by the sensitivity setting button.
- ②SW2 (OFF input of remote sensitivity setting) :
 SW2 turns on and then turns off instead of ⑤ method by the sensitivity setting button.

<External sensitivity setting input signal condition>

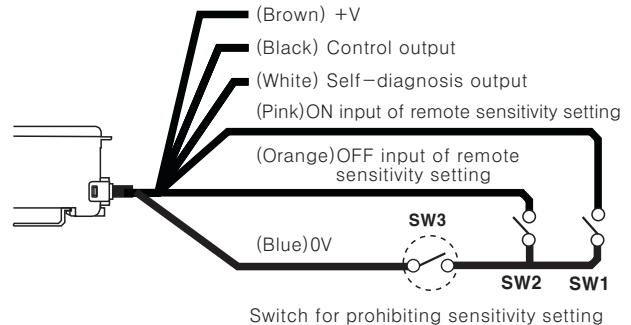
State	Signal condition
High	4.5-30VDC or Open
Low	0-1VDC

*Input impedance:10kΩ

◎Prohibition of inputting External sensitivity setting[BF4R(G)-R]

Even though mode switch is at Lock position, it is able to input external sensitivity setting when Switch1 and Switch2 are ON. Therefore please install Switch3 in order to prevent from malfunction as below.

- ※SW3 - OFF : Disable to set external sensitivity
- ※SW3 - ON : Enable to set external sensitivity

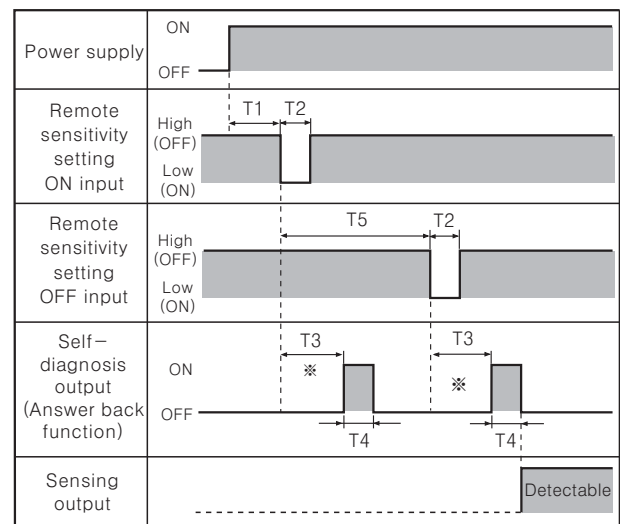


◎Answer Back function[BF4R(G)-R]

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 sensing 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 executed, but stable sensing operates after 340ms.

<Time Chart : Light ON mode >



- ※During period T3 (Approx. 300ms), do not change the light ON value by moving the object, etc.

1. T1 ≥ 1,000ms (After the power turns on, it can be set after 1sec.)
2. T2 ≥ 5ms (ON or OFF input time of remote sensitivity setting must be min. 5ms)
3. T3 ≈ 300ms (When ON or OFF input of remote sensitivity setting is applied, self-diagnosis output turns on after 300ms)
4. T4 ≈ 40ms (ON time of self-diagnosis output)
5. T5 ≥ 500ms (When ON input of remote sensitivity setting is applied and then apply OFF input of remote sensitivity setting after 500ms)

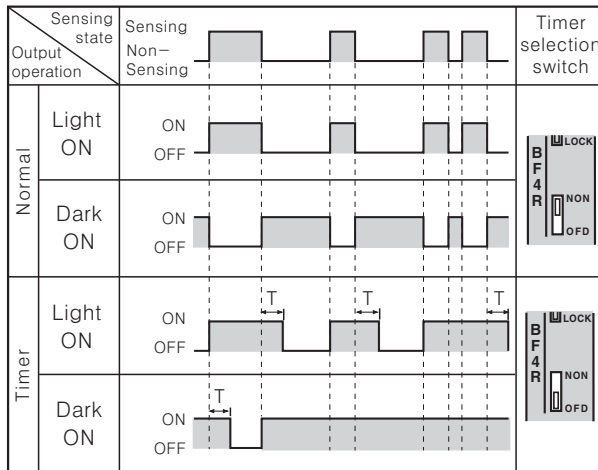
OFF delay timer function

(BF4R/BF4RP/BF4R-R/BF4G/BF4GP/BF4G-R)

Standard type and Remote sensitivity setting type both contain a built-in approx. 40ms fixed OFF-delay timer. The timer works when the timer selection switch is set to 'OFD'. The output is turned off after remaining on for additional 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.

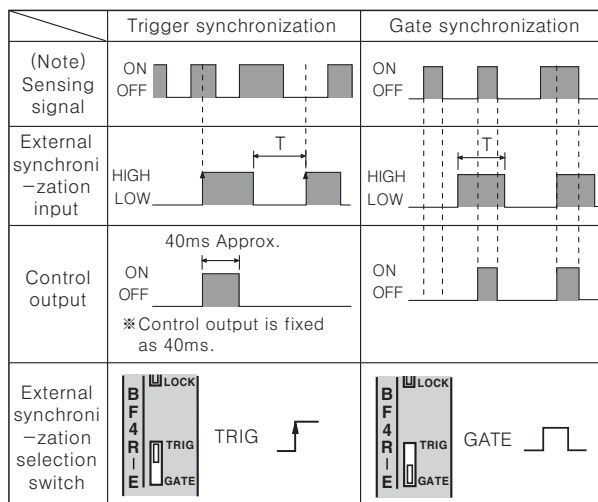
<Time chart>

$T \approx 40\text{ms}$



External synchronization input function[BF4R(G)-E]

By using external synchronization function, the time for making sensing can be specified by external synchronization. Trigger synchronization and gate synchronization are available.



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

* (Note) Actual signal detected by sensor.

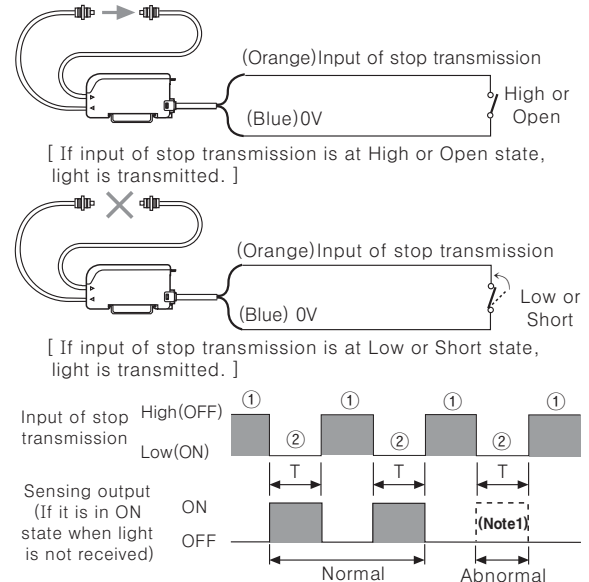
<Input signal condition for External synchronization>

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

Stop transmission function

[BF4R(G)-E]-Operation test

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



- * ① : Transmission area, ② : Stop transmission area
- * (Note1) If transmission is stopped control output must turn on, but if control output does not turn on, it seems that sensor has some problems.

* $T \geq 0.5\text{ms}$

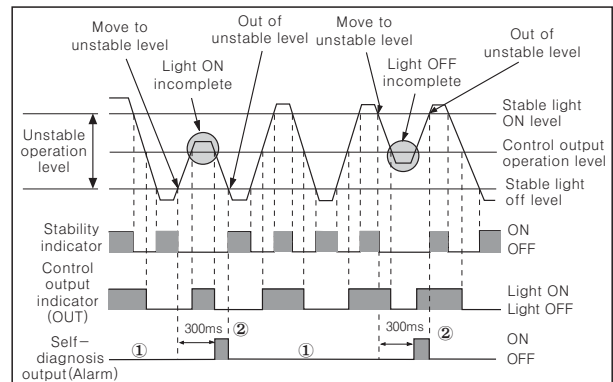
(When using interference prevention function $T \geq 0.7\text{ms}$)

* Input of stop transmission High: 4.5–30VDC or Open
Low: 0–1VDC or Short

Self-diagnosis function(Common)

When fiber hood is contaminated by dust, transmitted light is lowered by element ability loss or received light is lowered by missing of optical axis, the self-diagnosis output will turn on.

* Light ON mode



- The self-diagnosis output turns off during stable detection. (① position)
- When detecting state remains for 300ms at unstable level between stable light OFF level and stable light ON level, self-diagnosis output turns on, self-diagnosis output turns off at lower than stable light OFF level and upper than stable light ON level. (② position)
- When the control output turns on, if an overcurrent condition exists in control output, then self-diagnosis output turns on.

(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

BF4R Series

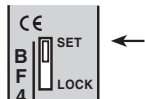
■ Interference prevention function (Common)

BF4R series has interference prevention function, two fiber optic cables can be mounted very closely by setting different transmission frequencies.

● Interference prevention function (Operation of differential frequency mode)

First sensor—FREQ.1 (Response time:Max. 0.5ms)

- ① Set the mode selection switch to [SET].

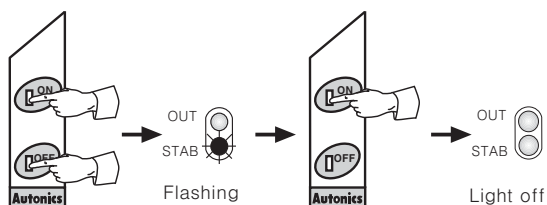


- ② Press [ON] & [OFF] buttons for 2sec. at the same time.

- ③ The [STAB] indicator flashes continuously.

- ④ Press [ON] button

- ⑤ The [STAB] indicator turns off.

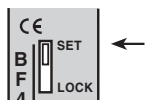


- ⑥ Set the mode selection switch to [LOCK].



Second sensor—FREQ.2 (Response time:Max. 0.7ms)

- ① Set the mode selection switch to [SET].

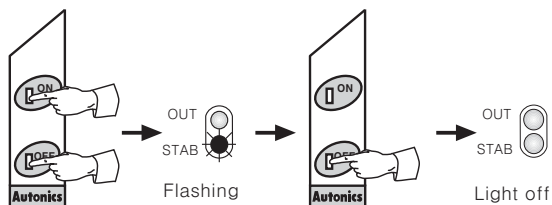


- ② Press [ON] & [OFF] buttons for 2sec. at the same time.

- ③ The [STAB] indicator flashes continuously.

- ④ Press [OFF] button

- ⑤ The [STAB] indicator turns off.



- ⑥ Set the mode selection switch to [LOCK].



● Interference prevention function (Operation of normal mode)

- ① Set the mode selection switch to [SET].

- ② Press [ON] & [OFF] buttons for 2 sec. at the same time.

- ③ The stable indicator flashes continuously.

- ④ Press [ON] & [OFF] buttons at the same time.

- ⑤ The [STAB] indicator turns off.

- ⑥ Set the mode selection switch to [LOCK].

※ When interference prevention function is used, hysteresis & response time will be longer than normal operation (Response time : Max. 0.5ms).

High accuracy fiber optic amplifier with twin adjuster

■ Features

- Convenient DIN rail mounting type
- Response time : Max. 1ms
- Able to adjust sensitivity with high accuracy by dual adjuster
- Selectable Light ON/Dark ON mode by control wire
- Reverse power polarity and short-circuit (Overcurrent) protection circuit
- Enable to use for explosion proof(Fiber part)
- Adjustable length with free cut type fiber optic cable



⚠ Please read "Caution for your safety" in operation manual before using.

■ Specifications

Model	BF3RX	BF3RX-P
Response time	Max. 1ms	
Power supply	12-24VDC $\pm 10\%$ (Ripple P-P : Max. 10%)	
Current consumption	Max. 40mA	
Light source	Red LED (Modulated)	
Sensitivity adjustment	VR (Dual adjustment : Coarse adjustment, Fine adjustment)	
Operation mode	Selectable Light ON/Dark ON by control wire	
Control output	● NPN open collector output Load voltage : Max. 30VDC, Load current : Max. DC200mA, Residual voltage : Max. 1V	● PNP open collector output Output voltage : Min. (Power supply-2.5)V Load current : Max. DC200mA
Protection circuit	Reverse power polarity, Output short-circuit (Overcurrent) protection circuit	
Indication	Operation indicator : Red LED	
Connection	Outgoing cable (2m)	
Insulation resistance	Min. 20M Ω (at 500VDC megger)	
Noise strength	$\pm 240V$ the square wave noise (pulse width : 1 μs) by the noise simulator	
Dielectric strength	1,000VAC 50/60Hz for 1minute	
Vibration	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours	
Shock	500m/s ² (50G) in X, Y, Z directions for 3 times	
Ambient illumination	Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx	
Ambient temperature	-10 to 50°C (at non-freezing status), Storage : -25 to 70°C	
Ambient humidity	35 to 85%RH, Storage : 35 to 85%RH	
Material	Case : ABS, Cover : PC	
Cable	4P, ϕ 5mm, Length : 2m	
Unit weight	Approx. 90g	

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

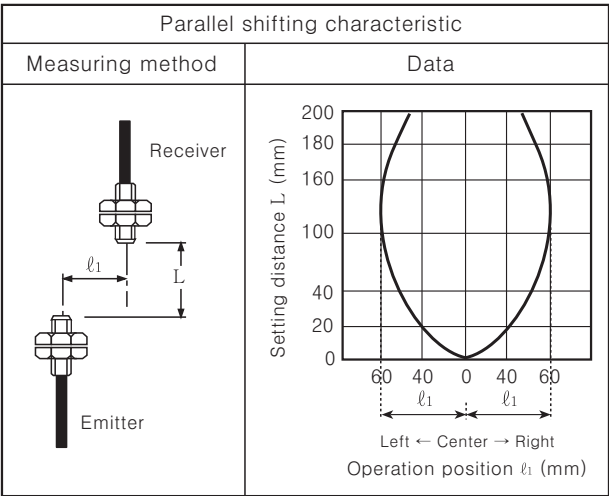
(T) Production stoppage models & replacement

BF3R Series

Feature data

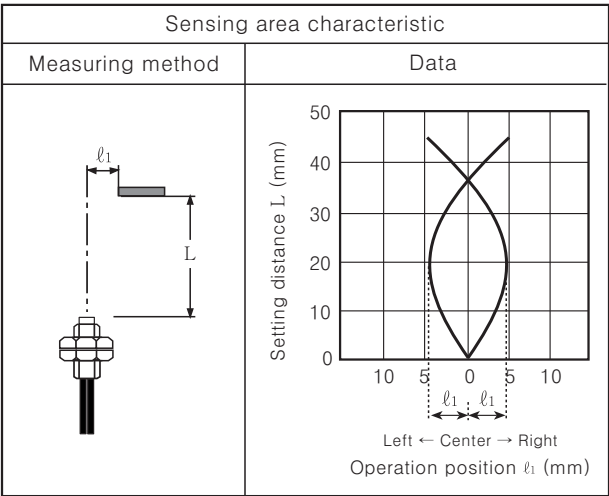
Through-beam

Measurement : BF3RX + FT-420-10



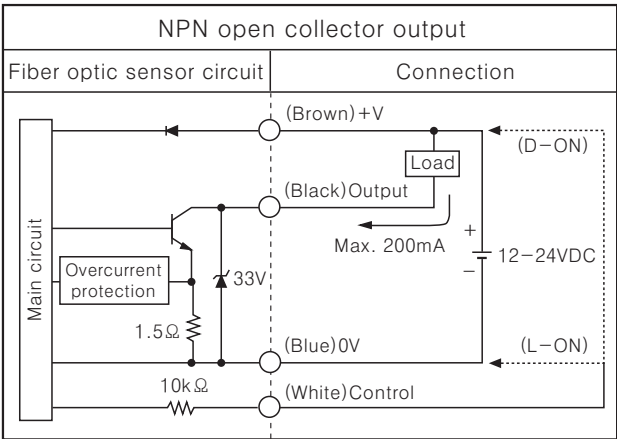
Diffuse reflective

Measurement : BF3RX + FD-620-10

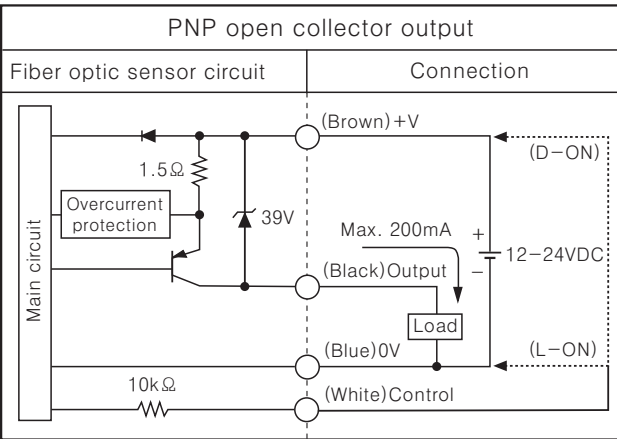


Control output diagram

BF3RX



BF3RX-P

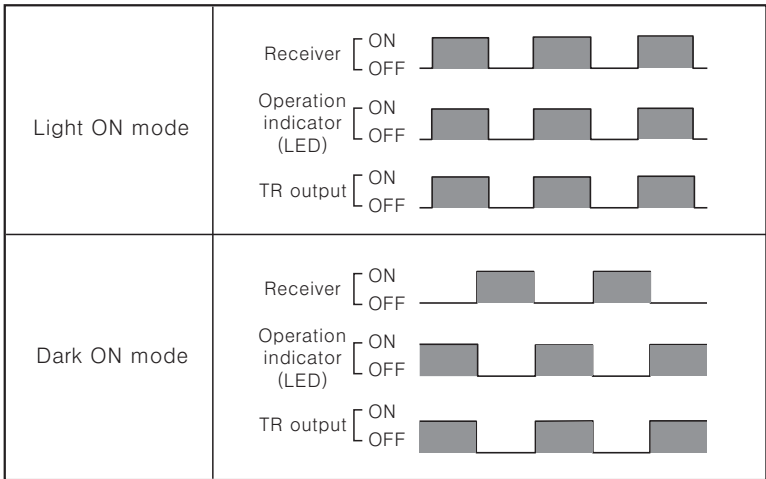


*When select Dark ON or Light ON, please use control wire (White)

Light ON : Connect control wire to 0V

 Dark ON : Connect control wire to +V

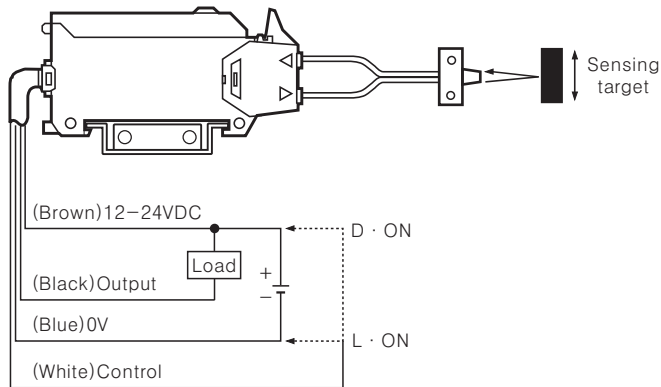
Operation mode



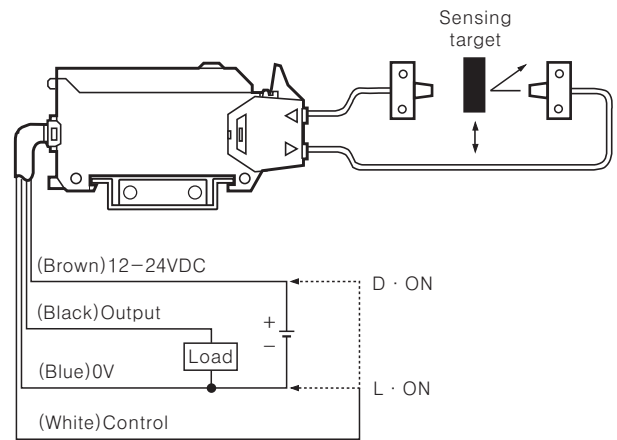
Fiber Optic Amplifier


■ Connections

©BF3RX



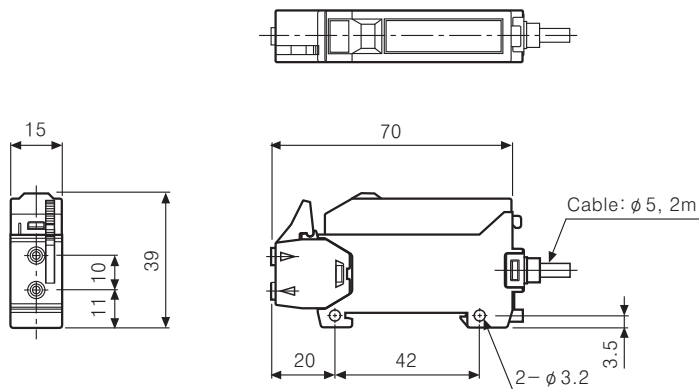
◎BF3RX-P



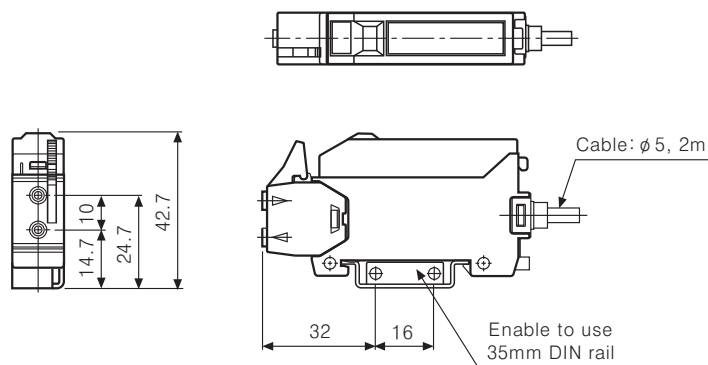
- ※ Enable to use as diffuse reflective type or through-beam type according to the fiber optic cable.
- ※ **Adapter** marked fiber optic cable should be used with adapter ().
- ※ GT-420-13H2 cannot be used because the length inserted into amp is too short.

▣ Dimensions

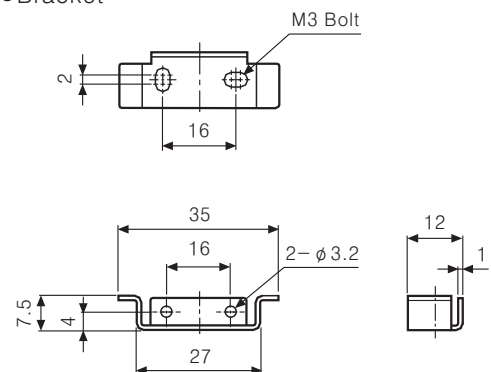
(Unit:mm)



- Connect the bracket



- Bracket



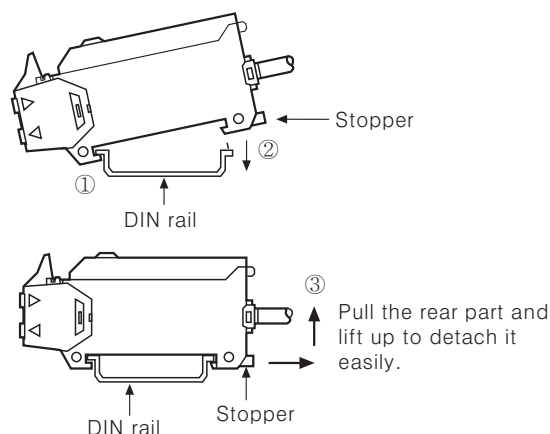
- | |
|--|
| (A) Photo electric sensor |
| (B) Fiber optic sensor |
| (C) Door/Area sensor |
| (D) Proximity sensor |
| (E) Pressure sensor |
| (F) Rotary encoder |
| (G) Connector/Socket |
| (H) Temp. controller |
| (I) SSR/Power controller |
| (J) Counter |
| (K) Timer |
| (L) Panel meter |
| (M) Tacho/Speed/Pulse meter |
| (N) Display unit |
| (O) Sensor controller |
| (P) Switching power supply |
| (Q) Stepping motor & Driver & Controller |
| (R) Graphic/Logic panel |
| (S) Field network device |
| (T) Production stoppage models & replacement |

BF3R Series

■ Installations

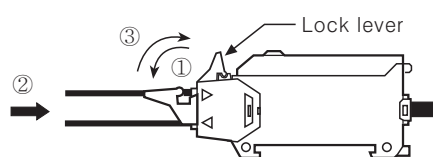
◎ Amplifier unit mounting

- ① Hook the amplifier on the front of DIN rail (or bracket).
- ② Press the rear part of the amplifier on DIN rail (or bracket).
- ③ Use screwdriver to move the stopper on rear of the amplifier backward.



◎ Fiber cable connection

- ① Open the Lock lever to "↙" direction. (Unlock)
- ② Insert the fiber optic cable in the amplifier slowly. (Depth : 10mm)
- ③ Close the Lock lever to "↗" direction. (Lock)




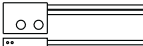
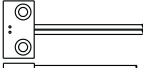








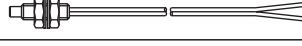
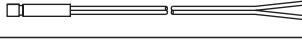
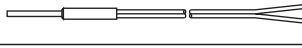







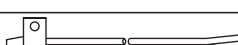
■ Sensitivity adjustment

- Adjust as the optimum sensitivity according to the order as shown below.
- Please observe below chart because operation lamp will be changed by sensing method.

Order	Sensing type		Adjustment	Adjuster	
	Reflective	Through-beam		COARSE	FINE
1	Initial setting		Adjuster(Coarse) should be fixed at min. and fixed at center (▼) for Fine adjustment.		
2	Light ON 	Light ON 	Fix adjuster(Coarse) to ON position by turning clockwise slowly when light is being received.		
3	Light ON 	Light ON 	Turn adjuster(Fine) until it is OFF toward(-), and turn until it is ON toward(+) again, then confirm that this will be A position.	Adjuster(Coarse) is not required to set afterwards.	
4	Dark ON 	Dark ON 	And then turn adjuster(Fine) until it is ON toward(+), and turning until it is OFF toward(-) again when light is not received. Then confirm that this position will be B position. (When it will not be ON, max. position will be B.)		
5	—	—	Fix it at middle of A and B position. This will be the best position to set.		
6	Light ON 	Light ON 	If you cannot adjust as above method, set adjuster(Fine) at max. position toward(+), then execute again.		

Fiber Optic Cable

■ Specifications(Diffuse reflective)

Type	Dimension	Feature	Model	(Note1) Sensing distance (mm)	(Note2) Min. sensing target	Allowable bend radius	(Note3) Cable length(L)	Temperature		
Flexible type	<div>LINE-UP</div> 	Flat type/ Top view(Up)	FDFU-210-05R	30	φ 0.0125	1R	1m <div>Free cut</div>	-40 to 60℃ (Humidity: 35 to 85% RH)		
	<div>LINE-UP</div> 	Flat type/ Side view	FDFN-210-05R							
	<div>LINE-UP</div> 	Flat type/ Flat view	FDF-210-05R	15	φ 0.04					
	<div>LINE-UP</div> 	M3 Bolt	FD-320-05R	25	φ 0.0125					
	<div>LINE-UP</div> 	M4 Bolt	FD-420-05R							
	<div>LINE-UP</div> 	M6 Bolt	FD-620-10R	80	φ 0.04					
	Break – resistant type	<div>LINE-UP</div> 	M3 Bolt	FD-320-06B	35		φ 0.0125		5R	
<div>LINE-UP</div> 		φ 3 Cylinder type	FDC-320-06B							
<div>LINE-UP</div> 		M4 Bolt	FD-420-06B	100						
<div>LINE-UP</div> 		M6 Bolt	FD-620-13B							
Standard type		M3 Bolt	FD-320-05	40	φ 0.03	15R	2m <div>Free cut</div>	-40 to 70℃ (Humidity: 35 to 85% RH)		
		M4 Bolt	FD-420-05			15R (SUS part 10R)				
		φ 3 Cylinder type	FDC-320-05							
		φ 3 Cylinder type SUS type (90mm)	FDCS-320-05							
		M3 Bolt SUS type (90mm)	FDS-320-05							
		M3 Bolt SUS type (45mm)	FDS2-320-05							
		M4 Bolt SUS type (90mm)	FDS-420-05							
		M4 Bolt SUS type (45mm)	FDS2-420-05							
		M6 Bolt	FD-620-10	120		30R				
		M6 Bolt SUS type (90mm)	FDS-620-10			30R (SUS part 10R)				
		M6 Bolt SUS type (45mm)	FDS2-620-10			30R				
		Plastic type	FDP-320-10							

※ (Note1) The sensing distance is a standard for Red LED of BF4 Series and 10% of Red LED is applied when it is Green LED.
It is applied to 40% of sensing distance for BF3RX.

※ (Note2) Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance(Note1).

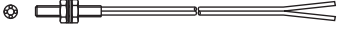

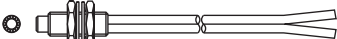

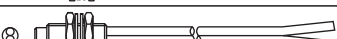
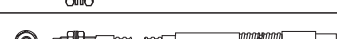

※ (Note3) Fiber optic cable out of the rated length can be customizable.

※ **Free cut** The sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-2) should be used for cutting fiber cable.]


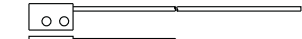

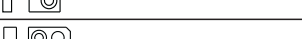
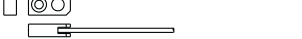
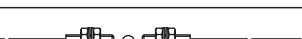
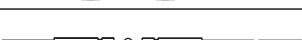

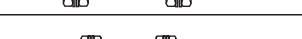

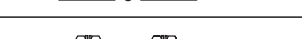
(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

Fiber Optic Cable

■ Specifications(Diffuse reflective)

Type	Dimension	Feature	Model	(Note1) Sensing distance (mm)	(Note2) Min. sensing target	Allowable bend radius	(Note3) Cable length(L)	Temperature
Coaxial type		M3 Bolt	FD-320-F	40	ø 0.03	15R	2m Free cut	-40 to 70℃ (Humidity: 35 to 85% RH)
		M3 Bolt	FD-320-F1	60				
		M6 Bolt	FD-620-F2	120		30R		
Heat-resistant type		M6 Bolt	FD-620-10H			30R		-40 to 105℃
		M6 Bolt	FD-620-15H1	160			-40 to 150℃	
		M4 Bolt Glass type	GD-420-20H2	100		50R	2m	-40 to 250℃
		M6 Bolt Glass type	GD-620-20H2					

■ Specifications(Through-beam)

Type	Dimension	Feature	Model	(Note1) Sensing distance (mm)	(Note2) Min. sensing target	Allowable bend radius	(Note3) Cable length(L)	Temperature
Flexible type	LINE-UP 	Flat type/ Top view(Up)	FTFU-210-05R	80	ø 0.04	1R	1m Free cut	-40 to 60℃ (Humidity: 35 to 85% RH)
	LINE-UP 	Flat type/ Side view	FTFN-210-05R	75				
	LINE-UP 	Flat type/ Flat view	FTF-210-05R	30				
	LINE-UP 	Flat type/ Side view+ top view	FTFB-210-05R	90				
	LINE-UP 	Integrated bracket (L type)/ Top view(Up)	FTLU-310-10R	250	ø 0.06			
			FTLU1-310-10R					
			FTLU2-310-10R					
	LINE-UP 	M3 Bolt	FT-320-05R	85	ø 0.3			
	LINE-UP 	ø 2 Cylinder type	FTC-220-05R					
	LINE-UP 	M4 Bolt	FT-420-10R	380	ø 0.5			
Break – resistant type	LINE-UP 	M3 Bolt	FT-320-06B	110	ø 0.3	5R	2m Free cut	
	LINE-UP 	ø 1.5 Cylinder type	FTC-1520-06B					
	LINE-UP 	M4 Bolt	FT-420-13B	400	ø 0.6			

※ (Note1) The sensing distance is a standard for Red LED of BF4 Series and 10% of Red LED is applied when it is Green LED.
It is applied to 40% of sensing distance for BF3RX.





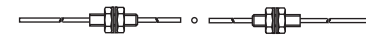





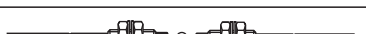

※ (Note2) Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance(Note1).

※ (Note3) Fiber optic cable out of the rated length can be customizable.

※ **Free cut** The sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-2) should be used for cutting fiber cable.]

※ **Glass type** is for BF5R, BF4R Series.

■ Specifications(Through-beam)

Type	Dimension	Feature	Model	(Note1) Sensing distance (mm)	(Note2) Min. sensing target	Allowable bend radius	(Note3) Cable length(L)	Temperature
Standard type		M3 Bolt	FT-320-05	150	ø 0.5	15R	2m Free cut	-40 to 70℃ (Humidity: 35 to 85% RH)
	LINE-UP 	ø 1.5 Cylinder type	FTC-1520-05					
		ø 2 Cylinder type	FTC-220-05					
		ø 2 Cylinder type (90mm)	FTCS-220-05					
		M3 Bolt SUS type (90mm)	FTS-320-05	500	ø 1	15R (SUS part 10R)		
		M3 Bolt SUS type (35mm)	FTS1-320-05					
		M3 Bolt SUS type (45mm)	FTS2-320-05					
		M4 Bolt	FT-420-10					
		ø 3 Cylinder type	FTC-320-10					
		Plastic type	FTP-320-10					
		M4 Bolt SUS type (90mm)	FTS-420-10					
		M4 Bolt SUS type (45mm)	FTS2-420-10					
Heat-resistant type		M4 Bolt	FT-420-10H	300		30R	-40 to 105℃	
		M4 Bolt	FT-420-15H1	500		50R	-40 to 150℃	
		M4 Bolt Glass type	GT-420-13H2	400		25R	2m	-40 to 250℃

※ (Note1) The sensing distance is a standard for Red LED of BF4 Series and 10% of Red LED is applied when it is Green LED.

It is applied to 40% of sensing distance for BF3RX.

※ (Note2) Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance(Note1).

※ (Note3) Fiber optic cable out of the rated length can be customizable.

※ **Free cut** The sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-2) should be used for cutting fiber cable.]

※ **Glass type** is for BF5R, BF4R Series.

※ FT-420-13 was discontinued. FT-420-13B is replacement.

(A)
Photo
electric
sensor

(B)
Fiber
optic
sensor

(C)
Door/Area
sensor

(D)
Proximity
sensor

(E)
Pressure
sensor

(F)
Rotary
encoder

(G)
Connector/
Socket

(H)
Temp.
controller

(I)
SSR/
Power
controller

(J)
Counter

(K)
Timer

(L)
Panel
meter

(M)
Tacho/
Speed/
Pulse
meter

(N)
Display
unit

(O)
Sensor
controller

(P)
Switching
power
supply

(Q)
Stepping
motor &
Driver &
Controller

(R)
Graphic/
Logic
panel

(S)
Field
network
device

(T)
Production
stoppage
models &
replacement

Fiber Optic Cable

■ Dimensions

(Unit:mm)

Model	Diffuse reflective	Model	Through-beam												
FDUF-210-05R M2-D0.5 ※Hood material :SUS304 Free cut		FTUF-210-05R M2-D0.5 ※Hood material :SUS304 Free cut													
FDNF-210-05R M2-D0.5 ※Hood material :SUS304 Free cut		FTNF-210-05R M2-D0.5 ※Hood material :SUS304 Free cut													
FDF-210-05R M2-D0.5 ※Hood material :SUS304 Free cut		FTF-210-05R M2-D0.5 ※Hood material :SUS304 Free cut													
FD-320-05(R) M3-D0.5 Free cut Adapter		FTFB-210-05R M2-D0.5 ※Hood material :SUS304 Free cut													
FD-320-06B M3-D0.6 Free cut Adapter															
FD-420-05(R) M4-D0.5 Free cut Adapter		FTLU-310-10R FTLU1-310-10R FTLU2-310-10R M3-D0.5 ※Hood material :SUS304 Free cut	<table border="1"><thead><tr><th>Model</th><th>L1</th><th>L2</th></tr></thead><tbody><tr><td>FTLU-310-10R</td><td>12.2</td><td>10</td></tr><tr><td>FTLU1-310-10R</td><td>17.2</td><td>15</td></tr><tr><td>FTLU2-310-10R</td><td>22.2</td><td>20</td></tr></tbody></table>	Model	L1	L2	FTLU-310-10R	12.2	10	FTLU1-310-10R	17.2	15	FTLU2-310-10R	22.2	20
Model	L1	L2													
FTLU-310-10R	12.2	10													
FTLU1-310-10R	17.2	15													
FTLU2-310-10R	22.2	20													
FD-420-06B M4-D0.6 Free cut Adapter															
FD-620-10(R) M6-D1.0 Free cut		FT-320-05(R) M3-D0.5 Free cut Adapter													
FD-620-13B M6-D1.3 Free cut		FT-320-06B M3-D0.6 Free cut Adapter													
FDC-320-05 M3-D0.5 Free cut Adapter		FT-420-10 M4-D1.0 Free cut													
FDC-320-06B M3-D0.6 Free cut Adapter		FT-420-10R M4-D1.0 Free cut													
FDCS-320-05 φ3-D0.5 SUS φ1.5×15mm Free cut Adapter		FT-420-13B M4-D1.3 Free cut													
FDS-320-05 M3-D0.5 SUS φ1.5×90mm Free cut Adapter		FTC-1520-05 φ2-D0.5 Free cut Adapter													

■ Dimensions

(Unit:mm)

Model	Diffuse reflective	Model	Through-beam
FDS2-320-05 M3-D0.5 SUS $\phi 1.5 \times 45\text{mm}$ Free cut Adapter		FTC-1520-06B $\phi 2-D0.6$ Free cut Adapter	
FDP-320-10 D1.0x2 Plastic Free cut		FTC-220-05(R) $\phi 2-D0.5$ Free cut Adapter	
FDS-420-05 M4-D0.5 SUS $\phi 1.5 \times 90\text{mm}$ Free cut Adapter		FTCS-220-05 $\phi 1.0-D0.5$ SUS $\phi 1 \times 15\text{mm}$ Free cut Adapter	
FDS2-420-05 M4-D0.5 SUS $\phi 1.5 \times 45\text{mm}$ Free cut Adapter		FTC-320-10 $\phi 3-D1.0$ Free cut	
FDS-620-10 M6-D1.0 SUS $\phi 2.5 \times 90\text{mm}$ Free cut		FTS-320-05 M3-D0.5 SUS $\phi 1.0 \times 90\text{mm}$ Free cut Adapter	
FDS2-620-10 M6-D1.0 SUS $\phi 2.5 \times 45\text{mm}$ Free cut		FTS1-320-05 M3-D0.5 SUS $\phi 1.0 \times 35\text{mm}$ Free cut Adapter	
FD-320-F Co-axial M3 $\phi 0.5, \phi 0.25 \times 4$ Free cut Adapter		FTS2-320-05 M3-D0.5 SUS $\phi 1.0 \times 45\text{mm}$ Free cut Adapter	
FD-320-F1 Co-axial M3 $\phi 0.5, \phi 0.25 \times 9$ Free cut Adapter		FTP-320-10 D1.0 Plastic Free cut	
FD-620-F2 Co-axial M6 $\phi 1.0 \phi 0.265 \times 16$ Free cut		FTS-420-10 M4-D1.0 SUS $\phi 1.5 \times 90\text{mm}$ Free cut	
FD-620-10H M6-D1.0 Heat Resistant 105°C Free cut		FTS2-420-10 M4-D1.0 SUS $\phi 1.5 \times 45\text{mm}$ Free cut	
FD-620-15H1 M6-D1.5 Heat Resistant 150°C Free cut		FT-420-10H M4-D1.0 Heat Resistant 105°C Free cut	
GD-420-20H2 M4-D0.05x1000 Heat Resistant 250°C		FT-420-15H1 M4-D1.0 Heat Resistant 150°C Free cut	
GD-620-20H2 M6-D0.05x1000 Heat Resistant 250°C		GT-420-13H2 M4-D1.3 Heat Resistant Max.250°C Glass Free cut	

- (A) Photo electric sensor
- (B) Fiber optic sensor
- (C) Door/Area sensor
- (D) Proximity sensor
- (E) Pressure sensor
- (F) Rotary encoder
- (G) Connector/Socket
- (H) Temp. controller
- (I) SSR/Power controller
- (J) Counter
- (K) Timer
- (L) Panel meter
- (M) Tacho/Speed/Pulse meter
- (N) Display unit
- (O) Sensor controller
- (P) Switching power supply
- (Q) Stepping motor & Driver & Controller
- (R) Graphic/Logic panel
- (S) Field network device
- (T) Production stoppage models & replacement

Fiber Optic Cable

■ Lens unit for long distance detection(Sold separately)

◎Model : **FTL-M26**



<Lens unit>

<Mounting at cable>

◎Mounting of lens

Mount the lens unit on the 3mm projecting point of the front hood

◎Ambient temperature range of lens unit

Able to use within -40 to 100°C .

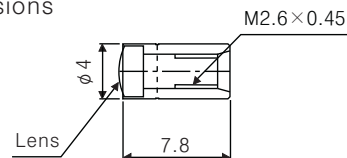
(Disable to use over 100°C .)

◎Applicable fiber optic cable and max. mounting distance

FT-420-10 : 2500mm

FT-420-10H : 1500mm

◎Dimensions



(Unit:mm)

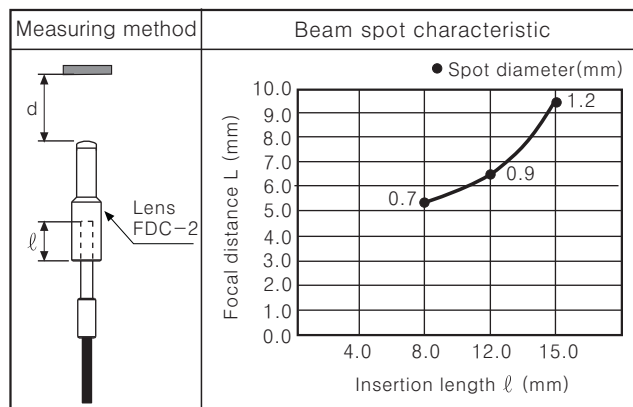
■ Micro spot fiber optic cable and lens unit(Sold separately)

◎Model

Fiber optic cable : **FDC-320-F**

Micro spot lens : **FDC-2**

◎Feature data

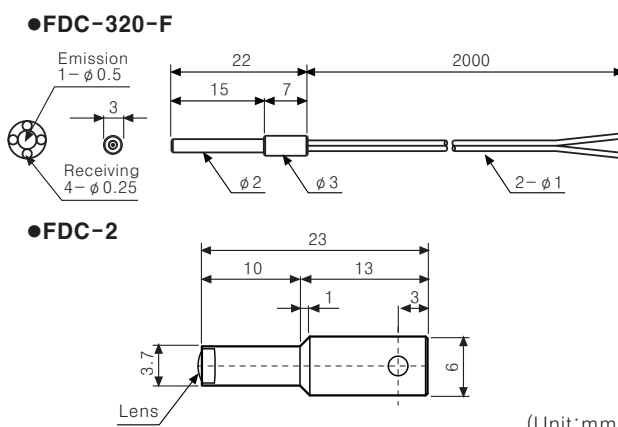


◎Ambient temperature range of lens unit

It should be used within -40 to 100°C .

(It cannot be used over 100°C .)

◎Dimensions



(Unit:mm)

■ Protection tube for fiber optic cable (Sold separately)

◎Usage : Protect cable from impact or cutting

(Unit:mm)

Model	Dimension
FTH-310	
FTH-410	
FDH-610	

※500mm tube can be customized.

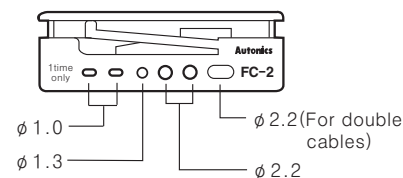
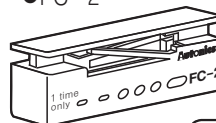
※Additional 8mm is for tube coupling.

■ Accessory

◎Fiber cutter

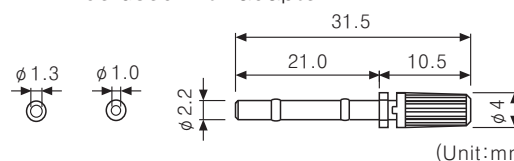
Usage : Cutting fiber optic cable, free cut type

●FC-2



◎Adapter

Adapter : Adapter marked fiber optic cable should be used with adapter .

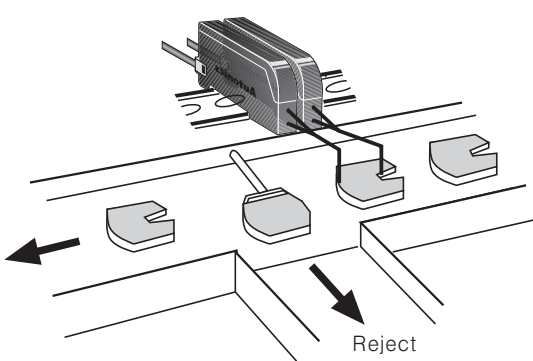
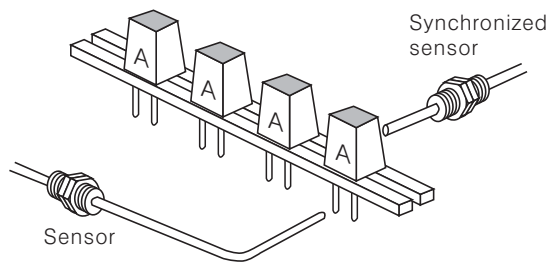
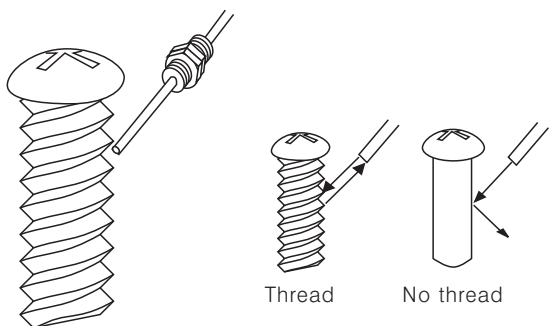
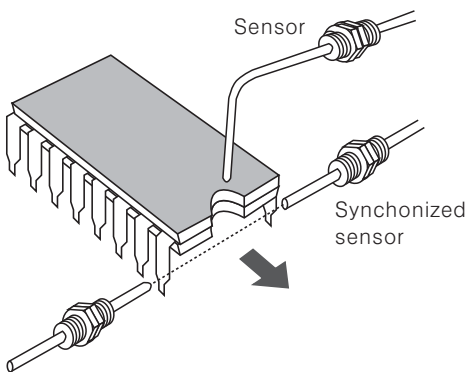



(Unit:mm)

※The inside diameter $\phi 1.0$ (Standard and black)

The inside diameter $\phi 1.3$ (Only applied to the receiver of FD-320-F1 and dark gray.)

■ Applications

<p>Sensing of the form of targets</p> 	<p>Sensing of components leads</p> 
<p>Sensing of presence / absence of tap</p> 	<p>Sensing of IC direction</p> 
<p>Available under water or in gas (Except amplifier)</p> 	

- (A) Photo electric sensor
- (B) Fiber optic sensor
- (C) Door/Area sensor
- (D) Proximity sensor
- (E) Pressure sensor
- (F) Rotary encoder
- (G) Connector/Socket
- (H) Temp. controller
- (I) SSR/ Power controller
- (J) Counter
- (K) Timer
- (L) Panel meter
- (M) Tacho/ Speed/ Pulse meter
- (N) Display unit
- (O) Sensor controller
- (P) Switching power supply
- (Q) Stepping motor & Driver & Controller
- (R) Graphic/ Logic panel
- (S) Field network device
- (T) Production stoppage models & replacement

Technical Description

■Fiber optic sensors overview

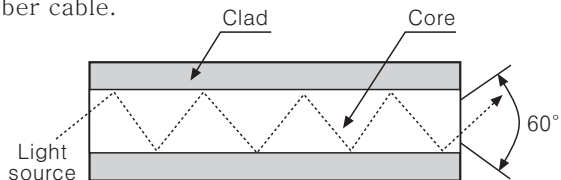
Fiber optic sensor applies for mark, and small object detection with fiber optic cable instead of photo sensor lens. With flexible characteristics of fiber optic cable, fiber optic sensor is able to install a limited space. Because of this, demand of fiber optic sensor is increasing these days.

■Fiber optic cable detection principle and configuration

◎Fiber optic cable configuration

As shown below picture, one optical fiber is composed of core which is high refractive index and clad. The incident light the one side of the fiber will be projected and go ahead to other side section during repeating total reflection at the boundary of core and clad. And in this case, the angel of reflection is 60° and is spared like a cone.

This optical fiber bundle with exterior coating such as silicon rubber or vinyl chloride is called optical fiber cable.



■Classification of optical fiber cable

◎The material list of optical fiber cable

Plastic type and glass type are used for optical fiber sensor.

	Plastic optical fiber	Glass optical fiber
Material	ϕ 0.5 to 1mm single or dual wire made by synthetic resins of polyacrylics	Make a stainless cable by several number of 30 to 50 μ glass fiber
Exterior coating	Polyethylene or vinyl chloride	Silicon rubber tube, stainless spiral tube, heat stress tube
Advantage	Lightweight and economical	High light penetration ratio, strong heat
Disadvantage	Low light penetration ratio and weak heat	Heavy, expansive, easy to be cut

◎The shape list of optical fiber cable

Type	Shape	Characteristic
Parallel (Normal)		Use for only plastic optical fiber cable. Floodlight and light interception are structured in parallel. It is the type of transferring
Coaxial		The center area and the surrounding area are separated. This type has the same detecting ability which is the operating position even though the object passes from any direction.
Split		Floodlight and light interception are separate, suitable to detect mark, usually used for glass optical fiber.

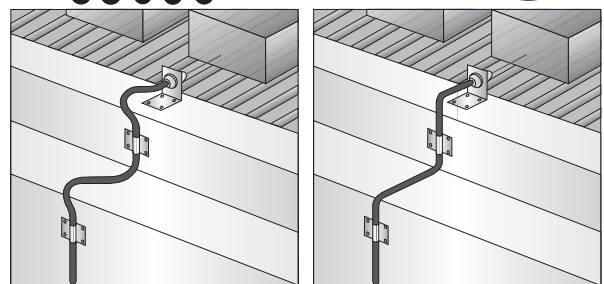
◎The characteristic list of optical fiber cable

- Standard optical fiber (Single core)
High efficiency of light transmission (long sensing distance)



- Flexible optical fiber (Multi core)

A large number of ultrafine cores are all surrounded by cladding. Easy to install the many places where are bending areas because the change of the intensity of radiation by bending is small.

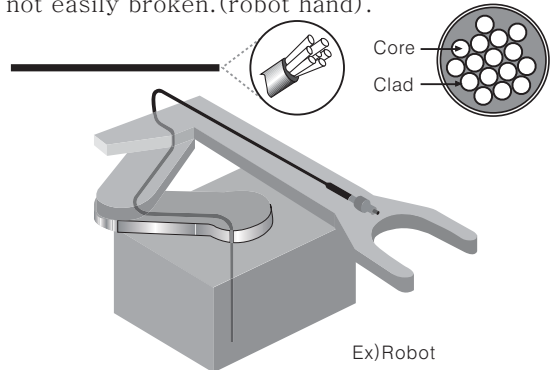


Standard type(R15 / R30)

Flexible type(R1)

- Break-resistant optical fiber

The fiber units contain a large number of independent fine fibers, ensuring a high degree of flexibility. It can be used for moving parts and it is not easily broken. (robot hand).

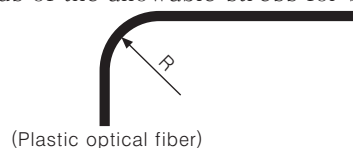


Ex)Robot

■The feature of optical fiber cable

◎The radius of allowable stress for bending

The optical fiber cable is able to be used in bend condition as much as user wants, but as the rate bend is increasing, the optical transmission rate is also decreased. And if the radius of bending is less than the radius of allowable stress for bending, the optical transmission rate is decreased rapidly. Please caution that the cable is not bent less than the radius of the allowable stress for bending.

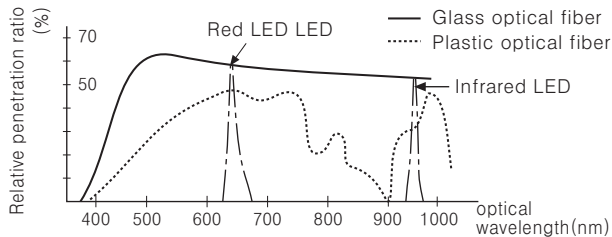


(Plastic optical fiber)

- Flexible type : R1
- Break-resistant type : R5
- Standard, Coaxial type : R30 or R15
- Heat-resistant type : R30 or R50

◎The optical transmission rate

The optical transmission rate is decided by the wavelength, the material, length of the optical fiber, and the using source of light for the optical fiber cable. The optical transmission rate of the optical wavelength decided by the wavelength and the material of the optical fiber is same as below picture. Especially the difference of the optical transmission rate of plastic optical fiber cable is bigger than glass optical fiber cable, and the efficiency of the red light source is higher than the efficiency of the infrared light source.

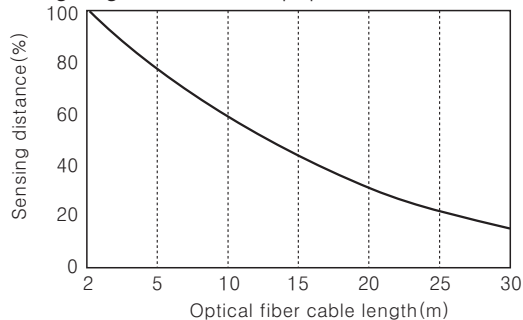


For the length of optical fiber cable and the optical transmission rate by the optical penetration ratio, when the length of optical fiber cable is long, the penetration rate is decreased, and the rate of diminution is changed by the light source.

◎The Characteristic of sensing distance by the length of the optical fiber cable

The sensing distance is changed by the length of the optical fiber cable. And by the cutting condition of the end of the optical fiber cable, more than 20% of the sensing distance can be declined, and it can be changed by the types of the optical fiber cable.

- Optical fiber cable: FD-620-10,
Sensing target : White mat paper



■Optical fiber sensor

The optical fiber sensor uses the optical fiber cable instead of lens which is the absolute item for the traditional photo sensor. It is able to be attached on any places by flexibility of the optical fiber.

◎The Characteristic of optical fiber sensor

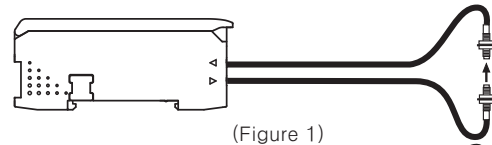
- Flexibility
 - Easy to install at the narrow or difficult place.
 - It does not need to install the fiber amplifier toward the sensing targets.
- Subminiature sensing front end
 - It is able to detect a small object (ϕ is small and the microscopic objects)
 - It is able to attach close to the detected object.
 - No space constraints because of small size

- The property of cable (heat-resisting property, exterior)
 - It is able to detect in high temperature. (use heat-resisting optical fiber cable)
 - It is able to use as explosion proof type because current does not flow on the fiber cable include front end sensing part
 - It is able to get stable detecting operating because it is not affected by noise.

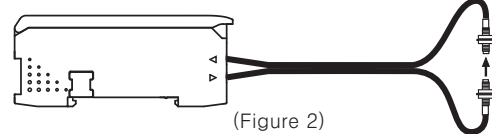
◎The sensing method of the optical fiber sensor

The optical fiber sensor is classified as the through-beam type and the diffuse reflective type by the sensing method, and can be selected by purpose.

- There are two kinds of optical fiber sensors for through-beam type. One is using two separate fiber cables as shown (Figure 1). Another is using a parallel optical fiber cable as shown (Figure 2).

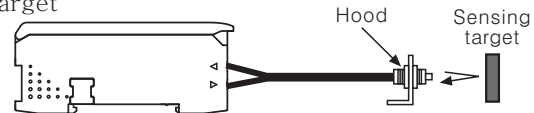


(Figure 1)



(Figure 2)

- For the diffuse reflective type, two parallel fiber cables are connected at one hood. Please caution that the sensing distance is changed by the surrounding color of the sensing target because this way detects the reflected light of the sensing target



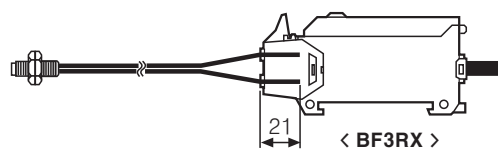
■Proper usage

◎The insertion depth of optical fiber cable

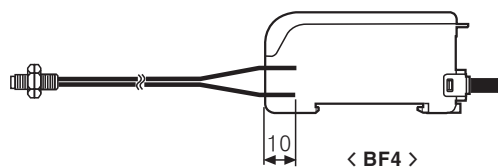
Please insert the optical fiber cable as following way.

The sensing distance is decreased if the insertion depth is not enough.

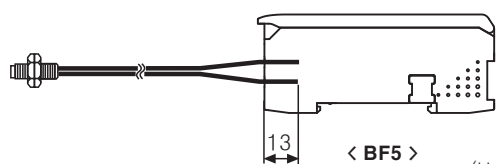
- The external diameter $\phi 2.2\text{mm}$ optical fiber cable



< BF3RX >



< BF4 >



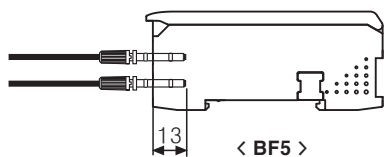
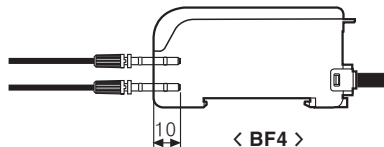
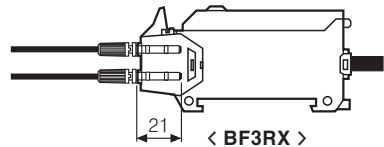
< BF5 >

(Unit:mm)

(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

Technical Description

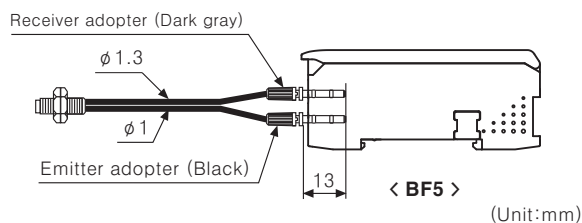
- The external diameter $\phi 1.0\text{mm}$ optical fiber cable
Please use the attached adapter when insert the external diameter $\phi 1\text{mm}$ optical fiber cable.



(Unit:mm)

●Coaxial type optical fiber cable

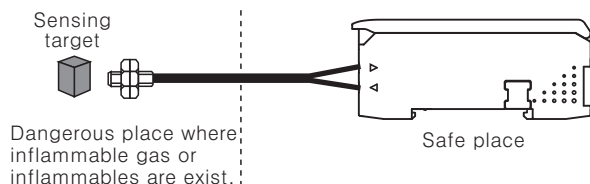
For the model FD-320-F1 of coaxial type fiber cable, the external diameters are $\phi 1\text{mm}$ for emitter and $\phi 1.3\text{mm}$ for receiver. Caution that the insertion position of the emitter cable ($\phi 1$) and the receiver cable ($\phi 1.3$) should not be changed each other. (also BR3RX and BF4R Series)



(Unit:mm)

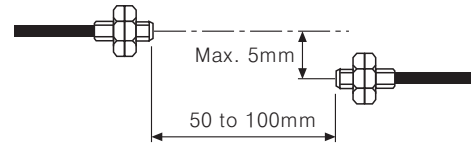
◎Install optical fiber sensor

- If the wire of the optical fiber sensor is set a pipe with high-tension wire or power line, it may cause malfunction or trouble. Please use separate wiring or single pipe to escape them.
- Please locate the optical fiber hood of the optical fiber sensor at the dangerous place, and locate fiber amplifier at the safe place.



- The optical fiber sensor needs to be installed close to the sensing target as you can, because the receiver level can be low when the sensing distance is long. The light transmitted from the optical fiber wires spreads of about 60° columnar.
- Please block strong light sources (sunlight, spotlight) with the shading plate. The strong light sources should not be at the angel of directivity of the receiver face of the optical fiber cable.

- When the optical fiber sensor is installed by through-beam type, it should be within 5mm from the center of the optical axis.

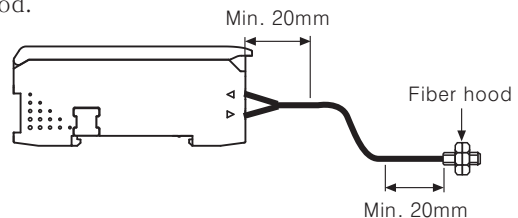


- When the side of the optical fiber cable is dirty, clean it with dry cloth. Do not use the organic solvent based thinner.
- Do not potentiate excessively such as compress or pulling at the hood part of the optical fiber cable.

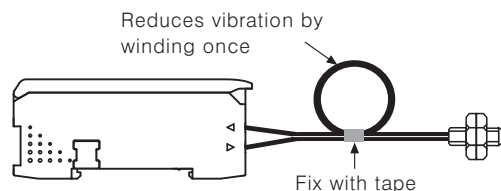
Tension of the optical fiber cable	
Diameter of the optical cable	Tensile strength
$\phi 0.5\text{mm}$	Max. 1kgf
$\phi 1.0\text{mm}$	Max. 3kgf

※Caution : When more than allowable force is potentiated at the optical fiber cable, the cable can get damage.

- Do not bend within 20mm from amplifier and fiber hood.

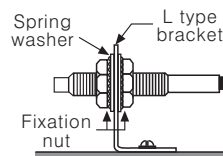


- After install the optical fiber sensor, please keep the remained cable as following way. (When cable is folded by vibration, the rate of light is reduced.)



- Do not potentiate excessively at the nut to close when fix the hood of the optical fiber cable. (Refer tightening torque of the type of the optical fiber cable)

< Bolt type >

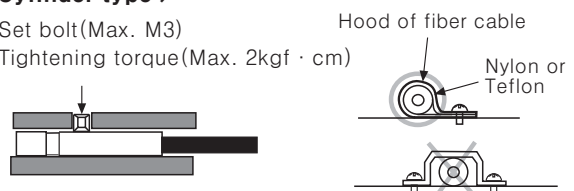


Tightening torque of fiber hood bolt	
Diameter	Tightening torque
M3	Max. 3kgf · cm
M4	Max. 8kgf · cm
M6	Max. 10kgf · cm

※Caution : When more than allowable torque is applied at the bolt of the fiber hood, the fiber hood can get damage.

< Cylinder type >

- Set bolt(Max. M3)
- Tightening torque(Max. 2kgf · cm)



◎Optical fiber cable cutting

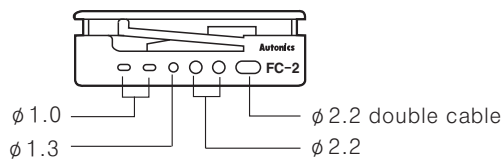
- Use the optical fiber cable after setting the cable. Insert the cable into the prescribed hole of cutter then cut it as user wants. If the cut cable is too long, the sensing distance will be shorter than the rated distance.
- Please cut the cable at once. If the surface of the cut is broken, or gets grooves, the sensing distance will be short.
- Do not use the hole which had used at once. The cutting surface will not be good. The sensing distance will be short. Please use another hole.
- Please use our given cutter (FC-2). Do not cut the cable with cutting nipper or stationeries (cutter, scissors)



- The external diameter $\phi 1\text{mm}$ ($\phi 1.3\text{mm}$) optical fiber cable should be cut the follow order.

①	Shipment in the pre-tightening condition as shown on the right.	
②	Unscrew to the arrow direction and move it.	
③	Insert the cable into the cutter (FC-2).	
④	After locate the adppter like picture on the right, screw it.	

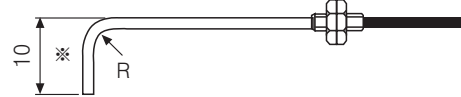
- Fiber cable cutter (FC-2)



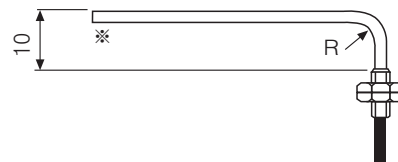
◎The bending radius of SUS type fiber cable

The bending radius (R) of the stainless pipe (SUS) should be as big as possible. If the bending radius is small, the sensing distance is also short.

< Bend the end of the SUS >



< Bend SUS in front of the hood >



Caution 1) When bend SUS, do not bend it less than 10mm.

Caution 2) The length of SUS for FTS-230-05 type is 35mm. Please do not bend SUS as user can.

◎Service temperature of fiber cable

- The service temperature of standard type of fiber cable is -40 to 70°C . If the surrounding temperature is high, the penetration ratio of the light becomes low. If user wants to use in the high temperature, please use the heat-resisting type optical fiber cable.
- Heat-resisting optical fiber cable

Detection method	Fiber material	Model	Ambient temperature
Diffuse reflective type	Plastic	FD-620-10H	-40 to 105°C
		FD-620-15H1	-40 to 150°C
	Glass	GD-420-20H2	-40 to 250°C
		GD-620-20H2	-40 to 250°C
Through-beam type	Plastic	FT-420-10H	-40 to 105°C
		FT-420-10H1	-40 to 150°C
	Glass	GT-420-14H2	-40 to 250°C

(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement