Autonics

LCD Display Fiber Optic Amplifier
BFX SERIES

INSTRUCTION MANUAL

CE

Thank you for choosing our Autonics products.
Please read the following safety considerations before use.

■ Safety Considerations

※Please observe all safety considerations for safe and proper product operation to avoid hazards.
※⚠ symbol represents caution due to special circumstances in which hazards may occur.

⚠ **Warning** Failure to follow these instructions may result in serious injury or death.
⚠ **Caution** Failure to follow these instructions may result in personal injury or product damage.

⚠ Warning

1. **Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)**
Failure to follow this instruction may result in fire, personal injury, or economic loss.
2. **Install the unit on DIN rail to use.**
Failure to follow this instruction may result in fire.
3. **Do not connect, repair, or inspect the unit while connected to a power source.**
Failure to follow this instruction may result in fire.
4. **Check 'Connections' before wiring.**
Failure to follow this instruction may result in fire.
5. **Do not disassemble or modify the unit.**
Failure to follow this instruction may result in fire.

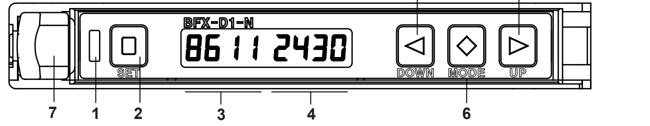
⚠ Caution

1. **Use the unit within the rated specifications.**
Failure to follow this instruction may result in fire or product damage.
2. **Use dry cloth to clean the unit, and do not use water or organic solvent.**
Failure to follow this instruction may result in fire.
3. **Do not use the unit in the place where flammable/explosive/corrosive gas, humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present.**
Failure to follow this instruction may result in fire or explosion.

■ Model

Model	Light source	Display part	Control output
BFX-D1-N	Red LED	Dual display	NPN open collector output
BFX-D1-P			PNP open collector output

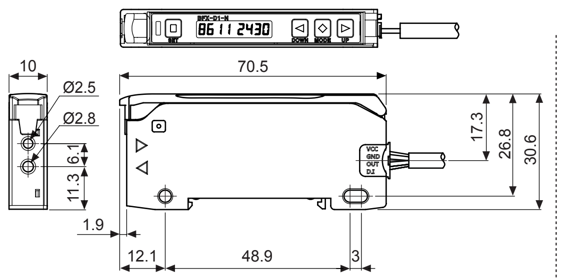
■ Unit Description



1. **Control output indicator:** Used to indicate control output provided by comparing SV and actual incident light level.
2. ■ **(SET) key:** Used to execute each operation and to set sensing sensitivity.
3. **Measured value (PV) display part:**
   - RUN mode: It displays present value (PV) of input incident light.
   - Setting mode: It displays the parameter.
4. **Set value (SV) display part:**
   - RUN mode: It displays the setting value (SV).
   - Setting mode: It displays the setting value of the parameter.
5. ◄, ► **key:** Used to enter SV setting mode, move up/down digit, set sensitivity manually.
6. ◆ **(MODE) key:** Used to enter program mode, RUN mode, move parameters, or save the setting value.
7. **Lock lever:** Used to connect fiber optic cable.

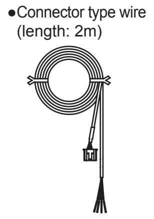
■ Dimensions

(unit: mm)



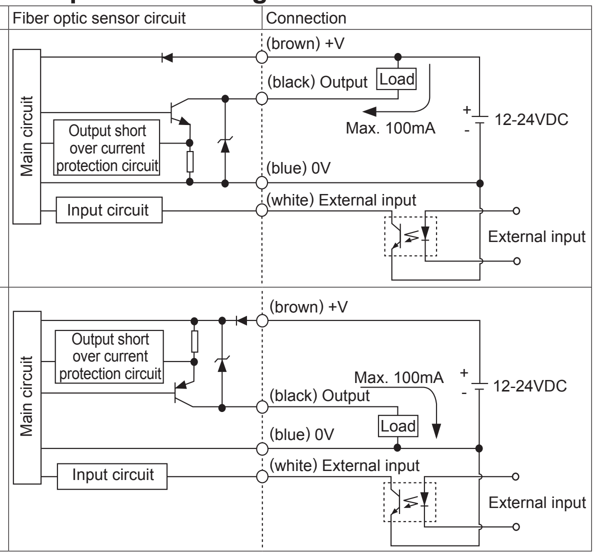
◎ Accessories

- Connector type wire (length: 2m)



■ Control Output Circuit Diagram and Connections

Control output	Fiber optic sensor circuit	Connection
NPN open collector output		
PNP open collector output		



※When using external input function, use photocoupler, external controller, etc. Otherwise, it may result in product damage.
※**The above specifications are subject to change and some models may be discontinued without notice.**
※**Be sure to follow cautions written in the instruction manual and the technical descriptions (catalog, homepage).**

■ Specifications

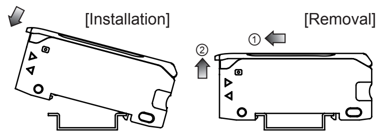
Model		NPN open collector output	PNP open collector output
		BFX-D1-N	**BFX-D1-P**
Light source		Red LED (660nm, modulated)	
Power supply		12-24VDC⎓ ±10%	
Current consumption		Max. 50mA	
Operation mode		Light ON/Dark ON selectable	
Control output		NPN or PNP open collector output • Load voltage: max. 24VDC⎓ • Load current: max. 100mA • Residual voltage - NPN: max. 1VDC⎓, PNP: max. 3VDC	
Protection circuit		Reverse power polarity protection, output short over current protection circuit, surge protection	
Response time		Ultra Fast: 50µs, fast: 150µs, standard: 500µs, long: 4ms, ultra Long: 10ms	
Display method		7 Segment (PV: red, SV: green) LCD Display, control output indicator (red) LED method	
Display function		Incident light level/SV display [4,000/10,000 resolution], standard / percentage display, high/low peak value display, normal/reversed display	
Sensitivity setting		· Manual sensitivity setting · Teaching sensitivity setting (sensitivity setting by button or external input) : Auto-tuning, 1-point, 2-point, positioning	
Timer function		OFF, OFF Delay, ON Delay, One-shot (time setting: 1 to 5000ms)	
External input function		Remote sensitivity setting, peak value reset, emitter OFF, control output setting (Keep/ON/OFF), energy saving OFF (operates applying over 2ms of external input signal)	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Dielectric strength		1,000VAC 50/60Hz for 1min	
Vibration		1.5 mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (received illumination)	
	Ambient temp.	-10 to 50℃, storage: -20 to 70℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 85% RH	
Protection		IP40 (IEC standard)	
Material		Case: polyketon, cover: polycarbonates	
Fiber optic cable tightening torque		Min. 2kgf	
Accessories		Connector type wire (Ø4mm, 4-wire, 2m / AWG22, core diameter: 0.08mm, number of cores: 60, insulator diameter: Ø1.25mm)	
Approval		CE	
Weight※1		Approx. 115g (approx. 16g)	

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Installations

◎ Amplifier unit mounting

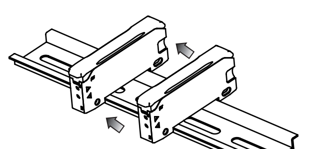
- Installation: Hang up the backside holder on the DIN rail and press the unit toward the DIN rail.
- Removal: Slide the back part of the unit as the ① figure and lift up the unit as the ② figure.



◎ Installing with several units

- After mounting the amplifier unit on DIN rail, attach additional amplifier units adjacently as shown in the arrow.
- This unit does not have mutual interference prevention function. Be sure not to have mutual interference.

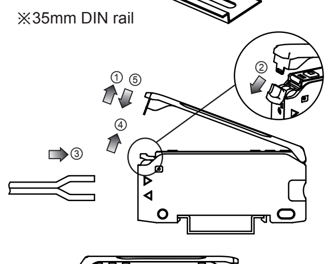
※Do not supply the power while connecting / disconnecting amplifier units.



※35mm DIN rail

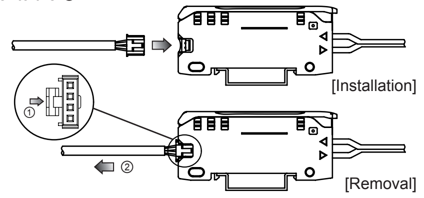
◎ Fiber optic cable connection

- Lift up the protective cover to the ① direction and completely lower the lock lever to the direction of to the ② direction to release the lock setting.
- Insert the cable to the ③ direction and adhere between the cable and the inside of the amplifier unit. (Insert depth: receiver part approx. 8mm / emitter part approx. 7mm)
- Place up the lock lever to lock the lock setting to the ④ direction and close the protective cover to the ⑤ direction.

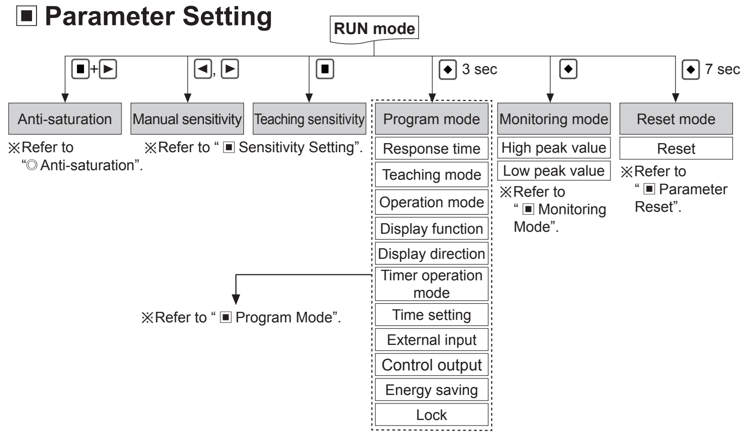


◎ Insert/Remove connector

- Insert the connector into the amplifier unit until it clicks into the right position.
- Remove the connector by pressing the end part at ① direction and pull it to ② direction.

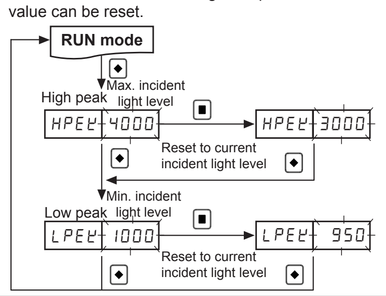


■ Parameter Setting



■ Monitoring Mode

This function is to monitor high/low peak value of incident light level. The monitored high/low peak value can be reset.

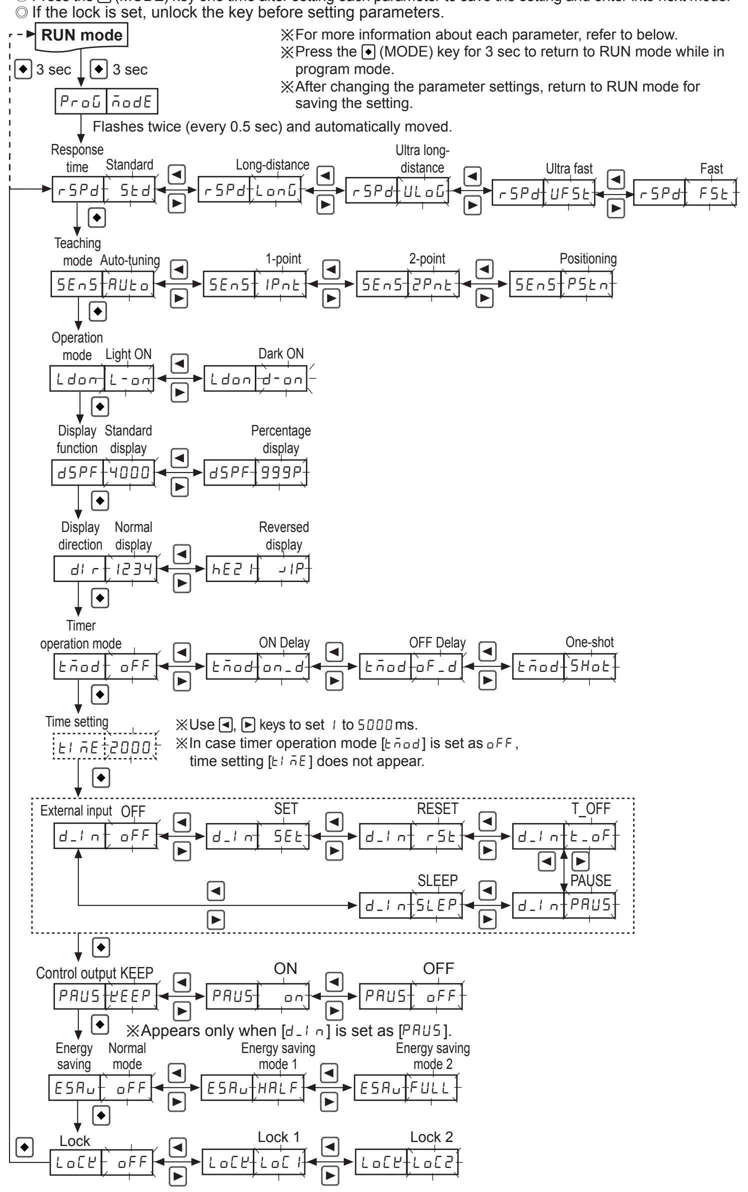


① Press the ◆ (MODE) key for a sec to monitor max./min. incident light level.
② Press the ■ (SET) key to initialize max./min. value to current incident light level during monitoring.
③ Press the ◆ (MODE) key to return to RUN mode.
※ When lock is set as LoC2 and max./min. value is checked, it is not reset.

■ Program Mode

◎ When entering into program mode, the parameter turns ON at the Measured value (PV) display part and the setting value flashes every 0.5 sec at the setting value (SV) display part. Use the ◄, ► keys to set each setting value.
◎ Press the ◆ (MODE) key one time after setting each parameter to save the setting and enter into next mode.
◎ If the lock is set, unlock the key before setting parameters.

※For more information about each parameter, refer to below.
※Press the ◆ (MODE) key for 3 sec to return to RUN mode while in program mode.
※After changing the parameter settings, return to RUN mode for saving the setting.



◎ Response time [rSPd]

This function is to set the response time of control output.

- Ultra fast [UFSt]: 50µs
- Fast [FSt]: 150µs
- Standard [Std]: 500µs
- Long distance [LonG]: 4ms
- Ultra long distance [ULoG]: 10ms

◎ Display [dSPF]

This function is to select display mode for incident light level on the PV display part.
: Standard display (4000) / Percentage display (999P)

- Display range of standard display: 0 to 4000 (0 to 9999, in case of long distance mode)
- Display range of percentage display: 0P to 999P (decimal point is not displayed)

◎ Display direction [dir]

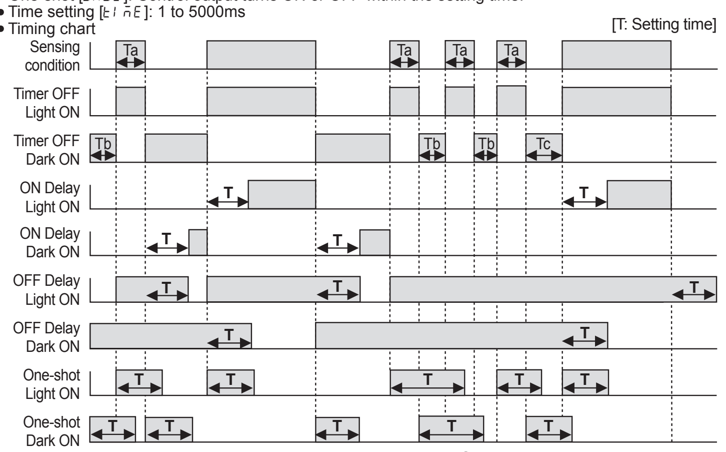
This function is to reverse the display direction to suit the unit installation location.
: Normal display / Reversed display selectable.
※Reversed display is upside-down (180˚) display of normal display.

◎ Timer [Timer operation mode: tmod, Time setting: tImE]

This function is for when the response speed of external device is too slow or control output time is short by small target sensing.

- Timer OFF [oFF]: Do not use timer function.
- ON Delay [on_d]: Control output time from OFF to ON is delayed during the setting time.
- OFF Delay [oF_d]: Control output time from ON to OFF is delayed during the setting time.
- One-shot [SHot]: Control output turns ON or OFF within the setting time.
- Time setting [tImE]: 1 to 5000ms
- Timing chart

[T: Setting time]



※Setting time: T>Ta , T>Tb , T>Tc>Tb

◎ External input [d_In]

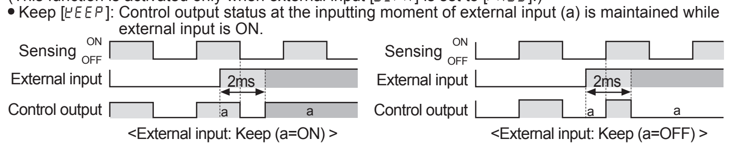
If button operation is difficult, external input is available to execute the dedicated operation.

- OFF [oFF]: Do not use external input function.
- SET [SEt]: External input is used for sensitivity setting, depending on the teaching mode [SEnS].
- RESET [rSt]: External input is used for initializing high peak/low peak.
- T_OFF [t_oF]: During external input, emitter turns OFF.
- PAUSE [PAUS]: External input is used for setting control output mode between Keep/ON/OFF.
- SLEEP [SLEP]: External input is used for turning OFF the energy saving [ESAu] mode.

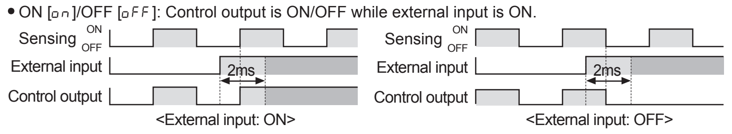
◎ Control output setting [PAUS]

External input is used for setting control output mode between Keep [KEEP]/ON [on]/OFF [oFF].
Only when inputting over the response time (2ms), it is regarded as external input and control output is changed as setting.
(This function is activated only when external input [d_In] is set to [PAUS].)

- Keep [KEEP]: Control output status at the inputting moment of external input (a) is maintained while external input is ON.



- ON [on]/OFF [oFF]: Control output is ON/OFF while external input is ON.



■ Sensitivity Setting

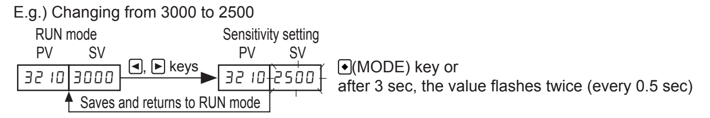
※**You can set sensitivity by manual or teaching (sensitivity setting by button or external input). Execute the proper sensitivity settings for your application.**

◎ Manual sensitivity setting (fine-adjusting sensitivity)

- This setting is to set the sensitivity manually.
- Used to fine-adjust sensitivity after the teaching sensitivity setting.
- Incident light level is still displayed on the Measured value (PV) display part during setting.

① Press the ◄, ► keys to set the value in RUN mode.
② Press the ◆ (MODE) key to save the setting. If there is no key input for 3 sec after completing setting, last set value flashes twice (every 0.5 sec) and automatically saved it and returned to RUN mode.

E.g.) Changing from 3000 to 2500



◎ Teaching sensitivity setting (sensitivity setting by button or external input)

- Sensitivity setting by button (■ (SET) key): Press the ■ (SET) key once in RUN mode and teaching automatically starts. When teaching completes, it returns to RUN mode automatically.
- Sensitivity setting by external input: Set the sensitivity by external input signal wire not by using the ■ (SET). This is available only when external input [d_In] is set as SEt.
(Refer to "■ Control output circuit diagram and Connections".)
- During teaching, the Measured value (PV) display part displays the set teaching mode parameter and the setting value (SV) display part displays progressing status.
- Before sensitivity setting, set the proper teaching mode (auto-tuning, one-point , two-point, positioning teaching mode).

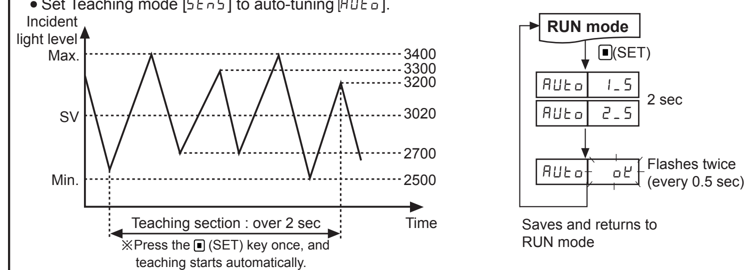
※Refer to the below for the each teaching sensitivity setting.

1. Auto-tuning 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 max./min. incident light level within a certain time period.

$$\text{Set value} = \frac{P(\text{Max.}) + P(\text{Min.})}{2}$$

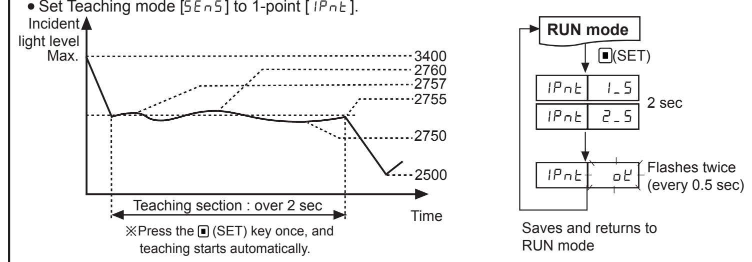
- Set Teaching mode [SEnS] to auto-tuning [AUto].



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 required little effect of dust or background.

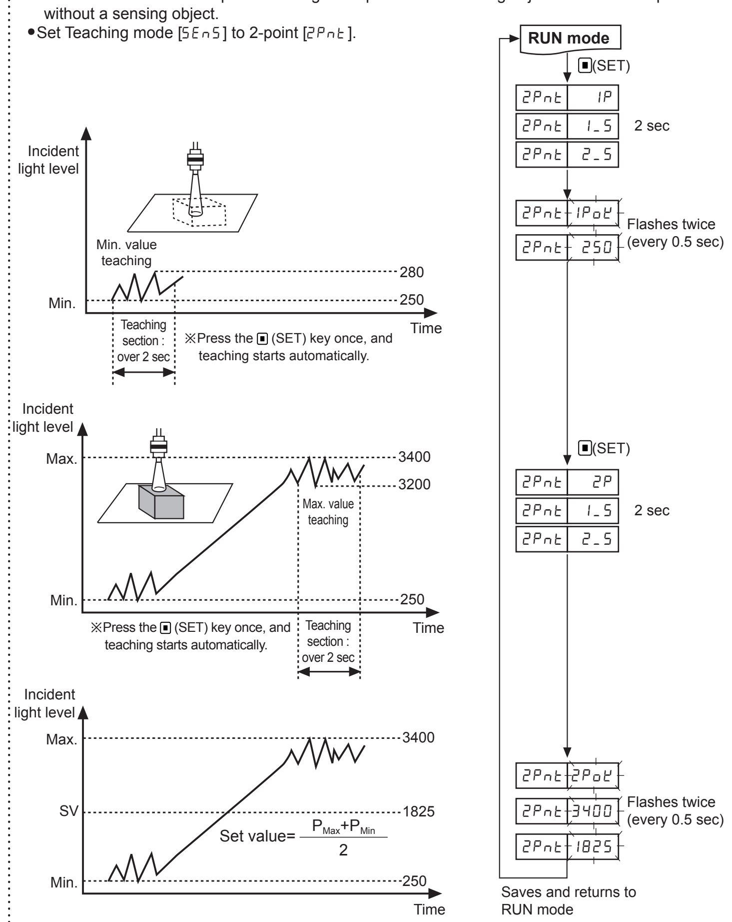
- Set Teaching mode [SEnS] to 1-point [1Pnt].



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 the 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.

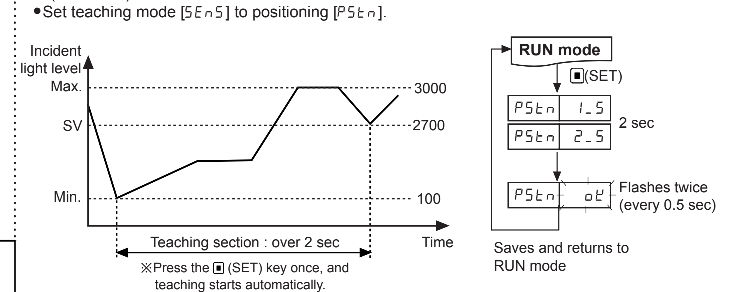
- Set Teaching mode [SEnS] to 2-point [2Pnt].



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 teaching mode [SEnS] to positioning [PStn].



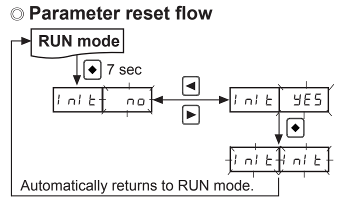
※Set value (SV) range for sensing distance.

Response Time	Teaching when incident light level is 0	Teaching when incident light level is saturated
UFSt / FSt / Std	Set to 10 digit.	Set to 3980 digit.
LoG / ULoG	Set to 5 digit.	Set to 9980 digit.

■ Parameter Reset

- This function is to initialize all parameters in memory to default value in case the possibility of mis-setting or mis-operation.
- Set lock function [LoCK] to oFF to execute parameter initialization.
- High peak value [HPEK] and low peak value [LPEK] is not initialized.

◎ Parameter reset flow



① Press the ◆ (MODE) key for 7 sec in RUN mode. [Init] turns ON on the Measured value (PV) display part and no flashes every 0.5 sec on the setting value (SV) display part.
② Press the ◆ (MODE) key once again to return to RUN mode not to execute the initialization.
③ Select YES using ◄, ► keys and press the ◆ (MODE) key. Init flashes twice on both the Measured value (PV) and Set value (SV) display parts.
④ When parameter initialization is completed, it is automatically returned to RUN mode.

◎ Factory default

Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
rSPd	Std	SEnS	AUto	Ldon	L-on	dSPF	4000	dir	1234
tmod	oFF	d_In	oFF	ESAu	oFF	LoCK	oFF	—	—
SV: 2000									

◎ Energy saving [ESAu]

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

Type	Control output indicator	Measured value (PV) display part	Set value (SV) display part
Normal mode [oFF]	☼	☼	☼
Energy saving mode 1 [HALF]	☼	☼	●
Energy saving mode 2 [FULL]	☼	●	●

☼: ON
●: OFF

◎ Lock [LoCK]

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

Parameter	oFF	LoC1	LoC2
Sensitivity setting	●	◐	◐
Program mode	●	◐	○
Parameter reset	●	○	○
Anti-saturation	●	○	○
External input	●	○	○

●: Available to check/set
◐: Available to check/ Unavailable to set
○: Unavailable to check/set

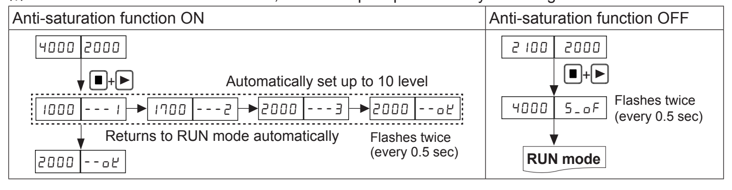
- In case of LoC2, it is required to set to lock first to enter into parameter mode.

◎ Anti-saturation

- When the sensing target comes too close and it is saturation status, this function corrects the optimize status.
- Press the ■ (SET) + ► keys one time and anti-saturation function operates automatically. There are max. 10 levels.
- Press the ■ (SET) + ► keys one time again and anti-saturation function is cleared.
- During anti-saturation, the setting value (SV) display part displays current level.
- When response time mode is ultra fast[UFSt], fast[FSt], standard[Std], and incident light is over than 2000, the setting is complete. When the mode is long distance[LonG], ultra long distance[ULoG], and incident light is over than 5000, the setting is complete. After completing the setting, it returns to RUN mode automatically.

※This function does not execute when present incident is lower than the determined value. (UFSt, FSt, Std: 2000, LonG, ULoG: 5000)
※When anti-saturation function is set, control output operation may be changed.

Anti-saturation function ON	Anti-saturation function OFF



■ Error Display

Error code	Cause	Troubleshooting
Err	In case overcurrent inflow occurs into the output circuit.	Remove the overcurrent due to the overload.

■ Caution during Use

1. Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
2. 12-24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. If power out of 12-24VDC is supplied, it may result in product malfunction because power inside of the product is unstable. Please use the product within the rated specification range.
4. When connecting DC relay or other inductive load to the output, remove surge by using diode or varistor.
5. Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
6. Use the product, after 3 sec of supplying power.
7. When using switching mode power supply to supply power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
8. Since external disturbance light (sunlight, fluorescent lighting, etc.) can cause product malfunction, use the product with a light shield or slit.
9. When sensing an object with the maximum sensitivity, sensing distance error can occur due to deviation of each feature.
10. When installing the fiber optic cable, refer to the radius of allowable stress for bending written in the catalogue.
If installing the fiber optic cable under the rated radius of allowable stress for bending, light extinction occurs and sensing distance is shortened.
11. Be cautious that a cross section of the fiber optic cable not be scratched.
12. Do not pull the cable, when the fiber optic cable is connected to an amplifier unit.
13. This unit may be used in the following environments.
①Indoors (in the environment condition rated in 'Specifications')
②Altitude max. 2,000m
③Pollution degree 2
④Installation category III

■ Major Products

- Photoelectric Sensors
- Fiber Optic Sensors
- Door Sensors
- Door Side Sensors
- Area Sensors
- Proximity Sensors
- Pressure Sensors
- Rotary Encoders
- Connectors/Sockets
- Switching Mode Power Supplies
- Control Switches/Lamps/Buzzers
- I/O Terminal Blocks & Cables
- Stepper Motors/Drivers/Motion Controllers
- Graphic/Logic Panels
- Field Network Devices
- Laser Marking System (Fiber, CO_2, Nd:YAG)
- Laser Welding/Cutting System
- Temperature Controllers
- Temperature/Humidity Transducers
- SSRs/Power Controllers
- Counters
- Timers
- Panel Meters
- Tachometers/Pulse (Rate) Meters
- Display Units
- Sensor Controllers

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