

# OMRON

## Smart Laser Amplifier

### E3NC-LA Series

### INSTRUCTION SHEET

Thank you for selecting an OMRON product. This sheet primarily describes precautions required in installing and operating the product.

- A specialist who has the knowledge of electricity must treat the product.
- Please read this manual carefully, and use it correctly after thoroughly understanding the product.
- Please keep this manual properly for future reference whenever it is necessary.



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#### PRECAUTIONS ON SAFETY

##### ● Meanings of Signal Words

**CAUTION** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

##### ● Warning Indications

#### PRECAUTIONS

Do not use the product with voltage in excess of the rated voltage. Excess voltage may result in malfunction or fire.

Never use the product with an AC power supply. Otherwise, explosion may result.



#### PRECAUTIONS FOR SAFE USE

The following precautions must be observed to ensure safe operation of the product. Doing so may cause damage or fire.

- Installation Environment**
  - Do not use the product in environments subject to flammable or explosive gases.
  - To secure the safety of operation and maintenance, do not install the product close to high-voltage devices and power devices.
  - Do not use the product in any atmosphere or environment that exceeds the ratings.
  - Do not use the product in environments subject to exposure to water, oil, chemicals, etc.
  - Burn injury may occur. The product surface temperature rises depending on application conditions, such as the ambient temperature and the power supply voltage. Use caution when operating or cleaning the product.
- Power Supply and Wiring**
  - Do not impose voltage exceeding the rated voltage: 10 to 30 VDC, including 10% ripple (p-p).
  - Do not apply voltages or currents that exceed the rated ranges.
  - When supplying power to the product, make sure that the polarity of the power is correct, and do not connect to an AC power supply.
  - Do not miswire such as the polarity of the power supply.
  - Do not apply any load exceeding the ratings.
  - Connect the load correctly.
  - Do not short both ends of the load.
  - Do not short-circuit the open collector output load.
  - High-Voltage lines and power lines must be wired separately from this product. Wiring them together or placing them in the same duct may cause induction, resulting in malfunction or damage.
- Installation**
  - Do not install the product in locations subjected to strong magnetic field or electric field.
- Others**
  - Do not attempt to disassemble, repair, or modify the product in any way.
  - Do not use the product if the case is damaged.
  - When disposing of the product, treat it as industrial waste.
  - When setting the sensor, be sure to check safety such as by stopping the equipment.

#### PRECAUTIONS FOR CORRECT USE

- Installation Location**
  - Do not install the product in the following locations.
    - (1) Locations subject to direct sunlight
    - (2) Locations subject to condensation due to high humidity
    - (3) Locations subject to corrosive gas
    - (4) Locations subject to vibration or mechanical shocks exceeding the rated values
- Power Supply and Wiring**
  - The product may require some time after it is turned ON to ensure a stable light reception intensity, depending on the operational environment.
  - Output pulses may occur when the power supply is turned OFF. Turn OFF the power supply to the load or load line first.
  - The product is ready to operate 200 ms after the power supply is turned ON. If the Sensor and load are connected to power supplies separately, turn ON the power supply to the product first.
  - Make sure that the power supply is turned OFF before connecting, separating or adding Amplifier Units.
  - Use an extension cable with a minimum thickness of 0.3 mm<sup>2</sup> and less than 100 m long.
- Installation**
  - Do not apply the forces on the cord exceeding the following limits:
    - Pull: 40N; torque: 0.1N·m; pressure: 20N; bending: 3 kg
  - Do not pull or twist the connector at an excessive force when it is fixed to the Amplifier Unit. (within 9.8N)
- Connection**
  - The Mobile Console E3X-MC11, E3X-MC11-SV2 and E3X-MC11-S cannot be connected.
  - The E3C, E2C, E3X-NA and E3X-SD cannot be connected.
  - The E3X-DA-N, E3X-HD and E3X-DA-S/MDA cannot be connected.
  - The Communication Unit E3X-DRT21-S, E3X-CRT, E3X-ECT and E3NW-DS cannot be connected.
  - When using a connector type product, place a protective label (provided with the E3X-CN22, E3X-CN21) on the power supply connecting terminals that are not used, to prevent electric shock or short circuit.

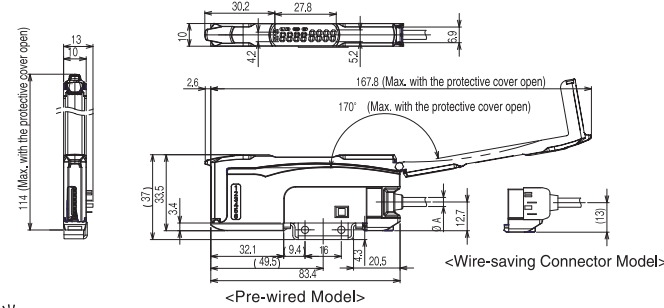
- Others**
  - Always keep the protective cover in place when using the product. Not doing so may cause malfunction.
  - Do not use thinner, benzene, acetone, and lamp oil for cleaning.

#### Checking the Package Content

- Amplifier Unit: 1
- Instruction Sheet (this sheet): 1 (Japanese, English and Chinese)

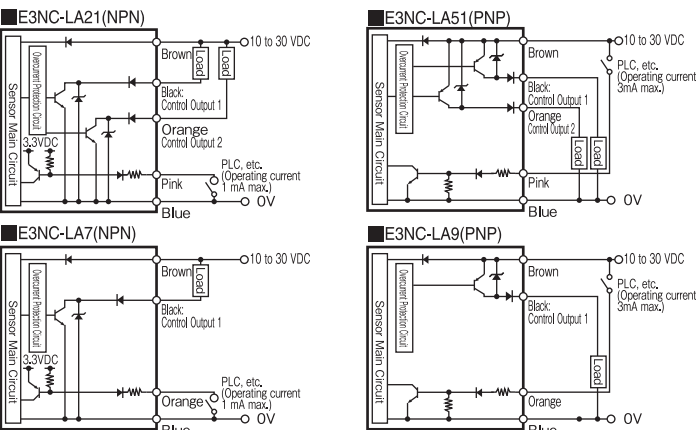
## 1 Installation

### 1-1 Dimensions

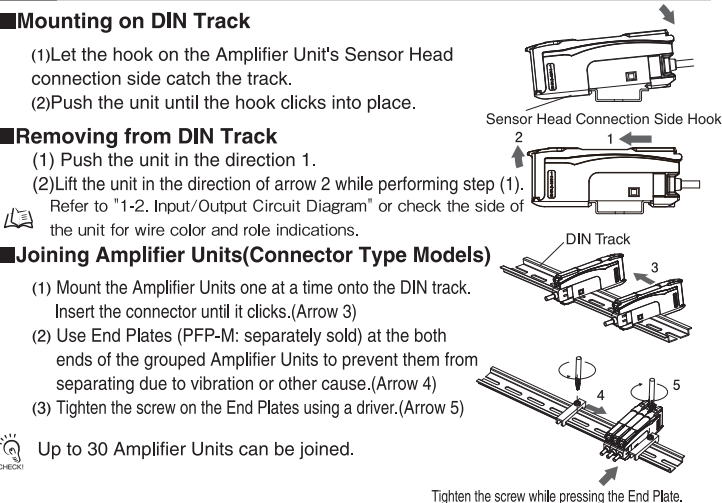


Dimensions in parentheses ( ) indicates the ones with related components. Unit: mm  
The cover could come off if it is tilted by 170 degrees or more.

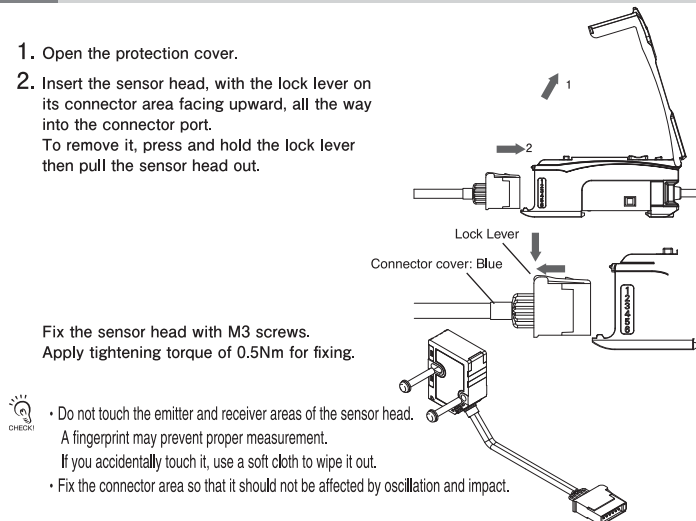
### 1-2 Input/Output Circuit Diagram



### 1-3 Mounting the Amplifier Unit

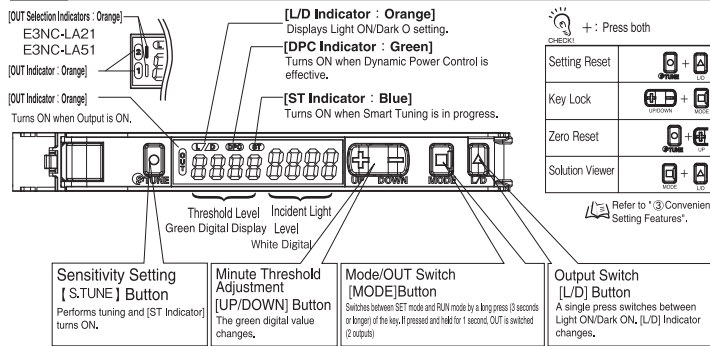


### 1-4 Mounting the sensor head



## 2 Settings

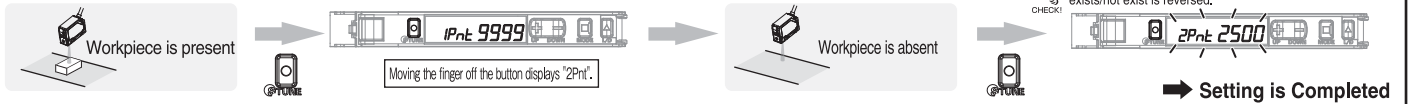
### 2-1 Setting and Display Overview



### 2-4 Smart Tuning [Easy Sensitivity Setting]

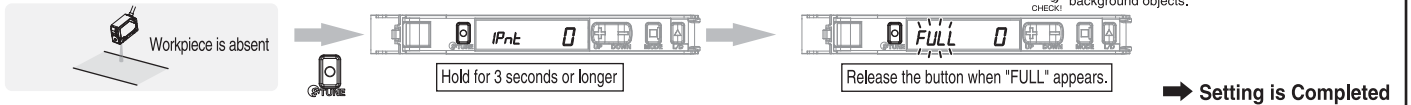
#### Basic Setting

##### ● 2-point Tuning



#### Enhancing Durability of the Head against Dust and Stain

##### ● Maximum Sensitivity Tuning



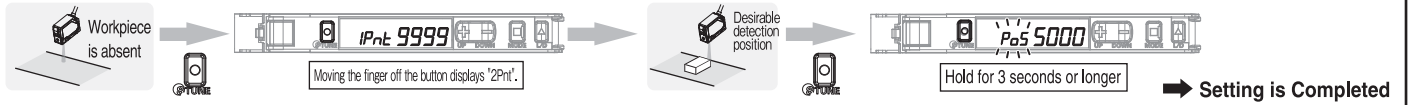
#### Setting for a Moving Workpiece

##### ● Full Auto Tuning



#### Setting to Detect by Workpiece Position

##### ● Position Tuning



#### Detecting a Transparent or Microscopic Object

##### ● Percentage Tuning



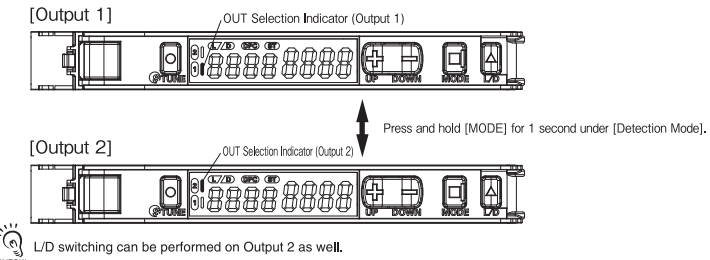
#### Initializing Light Intensity Changed Due to Dust or Dirt

##### ● Power Tuning

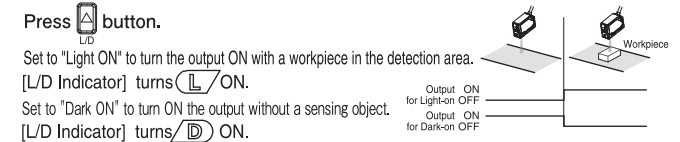


### 2-5 Output switching (2-output type: E3NC-LA21, E3NC-LA51)

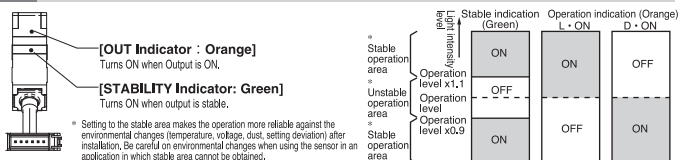
- OUT Selection Indicator switches to switch the settings.
- 1. Hold the [MODE] button for 1 second in [Measurement Mode].
- 2. OUT Selection Indicators (Output 1/Output 2) switch.



### 2-2 Switching Control Output

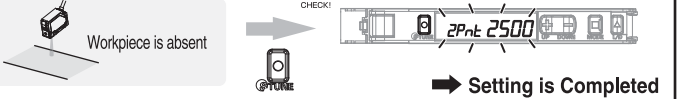


### 2-3 Sensor Head Display



### 2-6 Minute Adjustment of Threshold Level

Press UP/DOWN button to adjust the threshold level. The threshold level becomes higher. The threshold level becomes lower.



### 2-6 Smart Tuning Error

Error / Display / Cause	Error Origin Tuning Type	Remedy
Near Error <b>NEr Err</b> The light level difference between Points 1 and 2 are extremely small.	2-point Tuning Full Auto Tuning Positioning Tuning	Change the detection function to the mode of slower response time. Move the Sensor Head closer to the sensing object.
Over Error <b>ouEr Err</b> Incident light level is too high.	All	Move the Sensor Head away from the sensing object.
Low Error <b>Lo Err</b> Incident light level is too low.	Other than maximum sensitivity tuning	Move the Sensor Head closer to the sensing object.

### 2-6 Minute Adjustment of Threshold Level





### 3 Convenient Setting Features

For Stable Detection Regardless of Received Light Intensity Changed due to Dust or Dirt

**DPC Function**  
Use of DPC with through-beam model or regressive reflection model is recommended.  
The DPC indicator turns ON when the DPC function is effective.

Smart Tuning → Run → SET mode → Select → DPC Function ON

Refer to "② Settings". Disabled in area detection mode.

### Initializing Settings

**Setting Reset** Initialize all settings to the factory-set defaults.

Hold both for 3 sec. or longer.

### Saving/Reading Settings

**User Save Function/User Reset Function** While pressing [S.TUNE], press and hold the [L/D] button for 3 or more seconds.

**User Save Function**  
[S.TUNE] → [SAvE] → [SAvE YES]

**User Reset Function**  
[S.TUNE] → [rSt] → [rSt USER]

### Preventing Malfunction

**Key Lock Function** Disables all the button operations.  
Enable/Cancel (This procedure)  
[LoC] → [LoC ON]

Hold both for 3 sec. or longer.

\* Press either of UP/DOWN.

### 4 Maintenance

#### 4-1 Troubleshooting

Problem	Cause	Remedy
Nothing is shown on the indication.	No power supplied or the cable broken	Check the wiring, connector connection, power supply voltage and power supply capacity again. Refer to "1-2 Input/Output Circuit Diagram"
Nothing is shown on the digital indication.	Eco mode is ON.	Turn OFF Eco mode. Refer to "5. Detailed Settings". Refer to "5. Detailed Settings".
Sensing/Detection not possible despite the minimum threshold level	Detection set to a small light level mode Dust or dirt influences	Setting GIGA Mode increases emission power and light intensity. Refer to "5. Detailed Settings".
The operation indicator blinking	Mutual interference or other reason	Check the Amplifier Units mounted in a group and turn ON the power again. Refer to "1-3 Mounting Amplifier Unit"
Incident light level displayed in a negative value	The zero reset function is enabled.	Cancel the zero reset function. Refer to "3. Convenient Setting Features"
Lost tracking of the settings made	-	Reset the settings. Refer to "3. Convenient Setting Features"

Error Name / Display	Cause	Remedy
DPC Error 2000 4000	The incident light level has deteriorated due to dust or dirt.	Wipe the dust off the Fiber Unit detection surface or other relevant areas and recover the original incident light level. Then, perform Smart Tuning. Refer to "2-3 Smart Tuning"
Amp EEPROM time-out error E-rE 01	An error is found in amp setting memory.	Turn ON the power again. Reset the settings if the error is not corrected. Refer to "3. Convenient Setting Features"
Amp EEPROM checksum error E-rE 02	An error is found in amp setting memory.	Turn ON the power again. Reset the settings if the error is not corrected. Refer to "3. Convenient Setting Features"
Lock ON LoC ON	The key lock function enabled	Cancel the key lock function. Refer to "3. Convenient Setting Features"
Load short circuit detection error E-St 4000	The judgment output line is short circuited.	Turn off the power supply, check whether the output line is short circuited or not, and then turn on the power supply again.
Overcurrent protection error E-Hd CUr	Overcurrent is carried to the control output.	Turn OFF the power once and turn ON the power again.

\* The DPC indicator blinks.

### Returning Received Light Intensity Display to "0"

**Zero Reset Function**  
Enable  
The threshold also changes accordingly. The lower threshold limit is -1999.

Cancel  
The zero reset is cancelled when DPC function/smart tuning is executed.

### For Output When Received Light Intensity is Within the Area

**Area Detection Mode**

- Select (Setting Mode) - [OUT1 Mode] - [Area Detection Mode]. Pressing the [MODE] button for 3 seconds or longer exits the SET mode.
- Press the [MODE] button in [Measurement Mode] to display "OUT1 HIGH" and "OUT1 LOW". Green digital indicator shows HIGH and LOW.
- Provide Smart Tuning to each of HIGH/LOW thresholds by pressing the [S.TUNE] button.

In tuning by percent, the thresholds are set as follows:  
HIGH: Received light intensity in 3. + Received light intensity in 3. x Percent tuning level  
LOW: Received light intensity in 3. - Received light intensity in 3. x Percent tuning level

### Checking Received Light Intensity When Workpiece Passes at High Speed

**Change finder**

- Select (Setting Mode) -> [Digital Display] to set [diSP CFdr].
- Press the [MODE] button to exit SET mode.
- Let the workpiece pass.
- Displays the light intensity (maximum/minimum value) for 0.5 seconds when the workpiece passes.

### Determining If Workpiece is Detectable

**Solution Viewer**

- Press both the [MODE] and [L/D] buttons for at least 3 seconds to set to [SoLU on]. To release the setting, press the [MODE] and [L/D] buttons for at least 3 seconds to set to [SoLU off].
- Let the workpiece pass.
- Passing time and light amount difference are displayed.

#### 4-2 Ratings and Specifications

Model	NPN output PNP output	E3NC-LA21 E3NC-LA51	E3NC-LA7 E3NC-LA9
Control output	2	1	1
External input *1	1	1	1
Connection method	Pre-wired type	Wire-saving connector type	
Power supply voltage	10 to 30 VDC, including ripple (p-p) 10%		
Power consumption*2	Power supply voltage 24V: Normal mode: 1560mW max.(Power consumption 65mA max.) Power saving ECO: 1200mW max.(Power consumption 50mA max.) Load voltage: 30 VDC max., open collector output type Load voltage: 100 mA max, using single unit, 20 mA max, when four or more units connected (Residual voltage and load current less than 10 mA: 1 V max.) Off state current		
Control output	Off state current		
Protection circuit	Power supply reverse polarity protection, output short-circuit protection and output incorrect connection protection		
Maximum connectable Units	30 units		
Number of units for mutual interference prevention*3	0 Note: The communication and mutual interference prevention functions are disabled if the SHS mode is selected for detection function. High-speed mode SHS: 2 Standard mode SHS: 2 Sig mode (GB): 4		
Number of banks	4		
Ambient temperature range	Operating: 1 to 2 amplifiers connected: -25° C to 55° C, 3 to 10 amplifiers connected: -25° C to 50° C, 11 to 16 amplifiers connected: -25° C to 45° C, 17 to 30 amplifiers connected: -25° C to 40° C Storage: -30° C to 70° C (with no icing or condensation)		
Ambient humidity range	Operating and storage: 35% to 85% RH (with no condensation)		
Insulation resistance	20 MΩ min. (at 500 VDC)		
Dielectric strength	1,000 VAC, 50/60 Hz, 1 minute		
Vibration resistance	10 to 55 Hz with a 1.5-mm double amplitude for 2 hrs each in X and Y directions		
Shock resistance	500 m/s <sup>2</sup> , for 3 times each in X, Y and Z directions		
Weight (packed state/sensor)	Approx. 115 g / Approx. 75 g		Approx. 60 g / Approx. 20 g
Materials	Case and cover: Polycarbonate (PC), Cable: PVC		
*1. Details on inputs are as follows: NPN output: ON: Short circuit to 0V (Outflow current: 1 mA max.) OFF: Open or short circuit to Vcc PNP output: ON: Short circuit to Vcc (Sink current: 3mA max.) OFF: Open or short circuit to 0V Non-contact input (Transistor): ON: 1.5 V max. (Outflow current: 1 mA max.) OFF: Vcc-1.5 V to Vcc (Leakage current: 0.1 mA max.) ON: 2 ms min. OFF: 20 ms min.			
*2. Power consumption E3NC-LA21 E3NC-LA51 E3NC-LA7 E3NC-LA9 Normal mode: 1650mW max.(Power supply voltage 30V: Power consumption 55mA max./ Power supply voltage 10V: Power consumption 115mA max.) Power saving ECO: 1350mW max.(Power supply voltage 30V: Power consumption 45mA max./ Power supply voltage 10V: Power consumption 80mA max.)			
*3. The minimum number of units in the specifications is applied to the mutual interference between different amplifiers such as between fiber and laser.			

### 5 Detailed Settings

Hold [MODE] button for 3 seconds or longer to enter SET mode. The OUT Selection Indicators show items for Output1/Output 2 individually for each output.  
SET mode provides the function settings described hereafter. The initial display shown after transition from one function to another represents the factory default.

**1. Function Selection** Enabling 6 to 16  
Basic setting: FUnC dFLt → Detailed setting: FUnC oPt

**2. Detection Function** Changing Light Level and Response Time  
Detection function: HS 500 → STND 500 → GIGA 6000 → SHS 125  
Response time: 250 μs, 1ms, 16ms, 80 μs  
Light quantity: 1 reference, x1, x7, x1.1  
HS High-speed Mode, STND Standard Mode, GIGA Giga Mode, SHS Super High-speed Mode

**3. DPC Function** Stable Detection Regardless of Incident Light Level Change  
DPC OFF → DPC ON

**4. Timer Function** Setting Output Timer (Two outputs are displayed for the two-output type)  
Time Off: tOFF --- → After pressing the [MODE] button, use [UP/DOWN] button to set the power tuning level. [1 to 9999ms in 1ms steps; the initial value: 10]

Off-delay Timer: aOFFd, On-delay Timer: on-d, One shot: Shaot, On Off-delay Timer: onof

**5. Power Tuning Level** Changing the Target Incident Light Level (Power Tuning Level)  
P-Lv 9999 → Use [MODE] button to set the power tuning level. [1 to 9999 in 1 steps; the initial value: 9999]

**6. BANK Switching** Set values are saved for each configured bank.  
bAnk 1 → bAnk 2 → bAnk 3 → bAnk 4

**7. Power Tuning ON/OFF Setting** To Turn ON/OFF the Light Amount Adjustment at Tuning  
PtUn on → PtUn off

**8. Percentage Tuning** Detecting Transparent or Small Workpiece (Two outputs are displayed for the two-output type)  
PEr off → PEr on  
Press [MODE] button in [PEr on] menu, then use [UP/DOWN] button to set the percentage tuning level. (-99% to 99% in 1% steps; the initial value: -6%)

**9. Output 1 Mode** Output mode for the output 1 is changed.  
oUt Std → oUt ArER

**10. Output 2 Mode** Output mode for the output 2 is changed.  
oUt 1 Std → oUt 1 ALrn → oUt 1 Err  
Alarm output mode, Error output mode

Alarm Output Mode: After pressing the [MODE] button, press the [MODE] button to set alarm output level. [0 to 100 in 10 steps; the initial value: 50]  
On-delay of 300ms is applied.  
Error output mode: Output when an error of DPC, system or laser deterioration detection occurs.

**11. External Input** A type of external input is changed.  
In OFF → In TunE → In PtUn → In LoFF → In bAnk → In Or-St  
Short-circuit time when tuning is selected Input time is the same as the key input time.  
BANK switching OFF: 1, ON: 2 Zero reset

**12. Digital Display** Changing Digital Display in RUN Mode for Specific Purpose  
diSP Std → diSP PEr → diSP P-b → diSP bAr → diSP CFdr → diSP ch → diSP PEAR  
Threshold/Receiving light amount: (a) 2000 150P, (b) 8000 2000, (c) 3500 3000, (d) 1ch 3000, (e) 2000 9999  
(a) Margin of receiving light amount against threshold, (b) Minimum value of incident light peak and maximum value of incident light bottom, (c) Bar display, (d) Peak receiving light amount, (e) CH number and amount

**13. Inverted Display** Mounting Amplifier in Inverted Direction  
rEv OFF → rEv ON  
The display reverses. Threshold and light intensity are displayed on green digital and white digital respectively.

**14. Eco Function** Saving Power Consumption  
ECo OFF → ECo ON  
The indicators (green digital and white digital) turn OFF. They turn ON for approx. 10 seconds and then turn OFF by button operation.

**15. Hysteresis width**  
HStd 37 → HUSr 26 → HUSr 37  
Set the hysteresis width by initial value. Hysteresis width is provided for threshold to prevent the judgment output from becoming unstable near the boundaries. Be sure to check the stability of outputs as there is a possibility of chattering. Hysteresis width can be set by pressing the [MODE] button in the menu of "HUS-" and then pressing the [MODE] button. (Displayed on the two-output type)

**16. Writing to EEPROM of External Input**  
InSu ON → InSu OFF  
The settings that have been changed by an external input with "OFF" will not be overwritten to prevent EEPROM from reaching its lifespan (100,000 writings).

### Suitability for Use

THE PRODUCTS CONTAINED IN THIS SHEET ARE NOT SAFETY RATED. THEY ARE NOT DESIGNED OR RATED FOR ENSURING SAFETY OF PERSONS, AND SHOULD NOT BE RELIED UPON AS A SAFETY COMPONENT OR PROTECTIVE DEVICE FOR SUCH PURPOSES. Please refer to separate catalogs for OMRON's safety rated products.

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in the customer's application or use of the product.

Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used. Know and observe all prohibitions of use applicable to this product.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM. See also Product catalog for Warranty and Limitation of Liability.

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