OMRON

CMOS Laser Amplifier

E3NC-SA□□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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9908894-4C

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

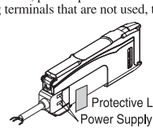
■ Installation Location
- Do not install the product in the following locations.

(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 mm² 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-CN21, E3X-CN22) on the power supply connecting terminals that are not used, to prevent electric shock or short circuit.



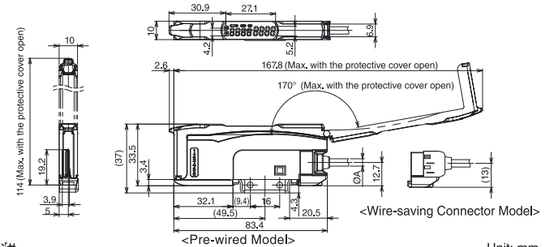
■ Others
- Always keep the protective cover in place when using the product. Not doing so may cause malfunction.
- Do not use thinner, benzine, acetone, and lamp oil for cleaning.

Checking the Package Content

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

1 Installation

1-1 Dimensions

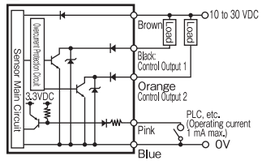


Unit: mm

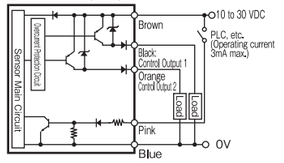
CHECK! Dimensions in parentheses ( ) indicates the ones with related components. The cover could come off if it is tilted by 170 degrees or more.

1-2 Input/Output Circuit Diagram

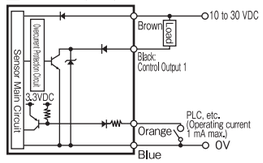
■E3NC-SA21(NPN)



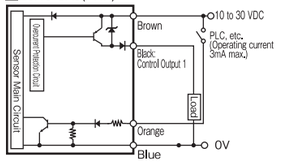
■E3NC-SA51(PNP)



■E3NC-SA7(NPN)



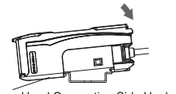
■E3NC-SA9(PNP)



1-3 Mounting the Amplifier Unit

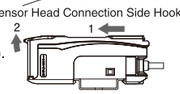
■**Mounting on DIN Track**

(1) Let the hook on the Amplifier Unit's Sensor Head connection side catch the track.
(2) Push the unit until the hook clicks into place.



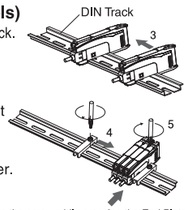
■**Removing from DIN Track**

(1) Push the unit in the direction 1.
(2) Lift the unit in the direction of arrow 2 while performing step (1).



■**Joining Amplifier Units(Connector Type Models)**

(1) Mount the Amplifier Units one at a time onto the DIN track. Insert the connector until it clicks. Slide the amplifier unit.(Arrow 3)
(2) Use End Plates (PFP-M: separately sold) at the both ends of the grouped Amplifier Units to prevent them from separating due to vibration or other cause.(Arrow 4)
(3) Tighten the screw on the End Plates using a driver. (Arrow 5)

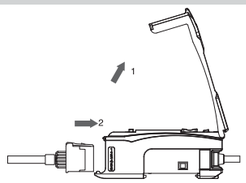


CHECK! Up to 30 Amplifier Units can be joined.

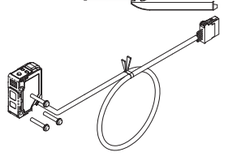
Tighten the screw while pressing the End Plate.

1-4 Mounting the sensor head

1. Open the protection cover.
2. Insert the sensor head, with the lock lever on its connector area facing upward, all the way into the connector port.
   The color of the connector cover for SH is white. Make sure to avoid misconnection by confirming the cover color in advance.
   To remove it, press and hold the lock lever then pull the sensor head out.



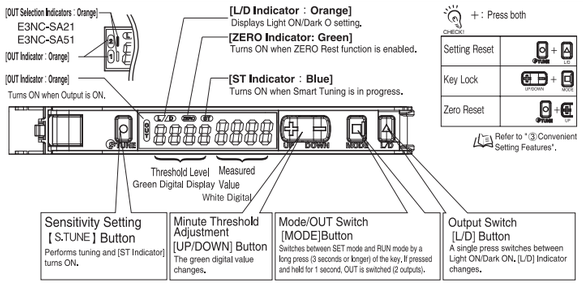
Fix the sensor head with M3 screws.
Apply tightening torque of 0.5N·m for fixing.



CHECK!
- Do not touch the emitter and receiver areas of the sensor head. A fingerprint may prevent proper measurement. If you accidentally touch it, use a soft cloth to wipe it out.
- Fix the connector area so that it should not be affected by oscillation and impact.

2 Settings

2-1 Setting and Display Overview



CHECK! + : Press both

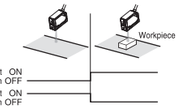
Setting Reset	S-TUNE + L/D
Key Lock	MODE + UP/DOWN
Zero Reset	S-TUNE + UP/DOWN

Refer to "③Convenient Setting Features".

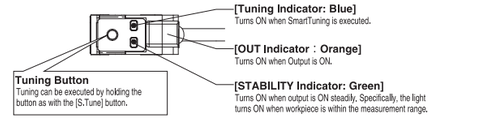
2-2 Switching Control Output

Press L/D button.

Set to "Light ON" to turn the output ON with a workpiece in the detection area.
[L/D Indicator] turns (L) ON.
Set to "Dark ON" to turn ON the output without a sensing object.
[L/D Indicator] turns (D) ON.



2-3 Sensor Head Display

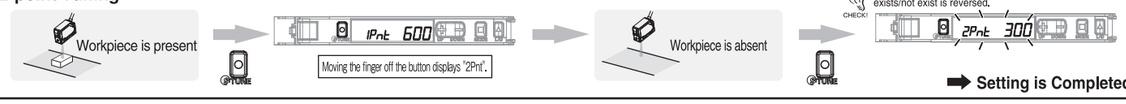


2-4 Smart Tuning [Easy Sensitivity Setting]

Basic Setting

● **2-point Tuning**

Threshold value setting: Set the value in the middle between the measured values for the 1st and 2nd points.



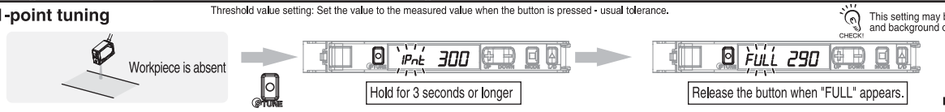
CHECK! Execution can be done even if the order of workpiece exists/not exist is reversed.

➡ Setting is Completed

Setting for a workpiece nearer than the background

● **1-point tuning**

Threshold value setting: Set the value to the measured value when the button is pressed - usual tolerance.



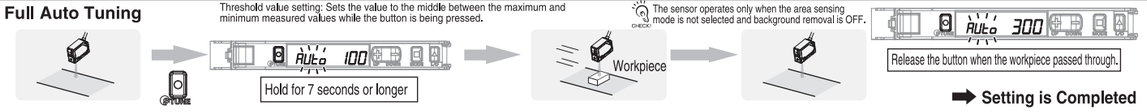
CHECK! This setting may be easily influenced by ambient environment and background objects.

➡ Setting is Completed

Setting for a Moving Workpiece

● **Full Auto Tuning**

Threshold value setting: Sets the value to the middle between the maximum and minimum measured values while the button is being pressed.



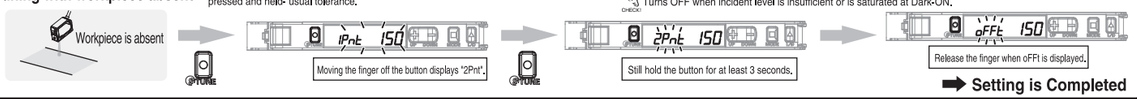
CHECK! The sensor operates only when the area sensing mode is not selected and background removal is OFF.

➡ Setting is Completed

Setting for judging presence/absence of workpiece according to the background

● **Tuning with workpiece absent**

Threshold value setting: Sets the value to the measured value when the button is pressed and held- usual tolerance.



CHECK! Turns ON when incident level is insufficient or is saturated at Light-ON.
Turns OFF when incident level is insufficient or is saturated at Dark-ON.

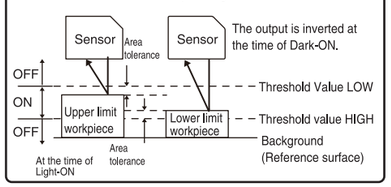
➡ Setting is Completed

Setting for sensing within the range of the upper and lower limits

● **2-point area tuning**

1. Select [Setting Mode] → [Output1 Mode] → [Area Sensing Mode].
2. Press and hold the [MODE] button for 3 seconds or longer to exit the Setting Mode.
3. Carry out the same operation as for the 2-point tuning.

Threshold value HIGH: Upper workpiece height + area tolerance
Threshold value LOW: Lower limit workpiece height - area tolerance

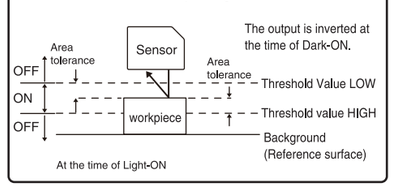


Setting for sensing with ± tolerance for workpiece

● **1-point area tuning**

1. Select [Setting Mode] → [Output1 Mode] → [Area Sensing Mode].
2. Press and hold the [MODE] button for 3 seconds or longer to exit the Setting Mode.
3. Carry out the same operation as for the 1-point tuning.

Threshold value HIGH: Upper workpiece height + area tolerance
Threshold value LOW: Lower limit workpiece height - area tolerance

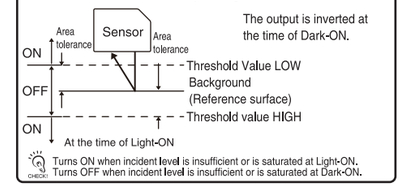


Setting for sensing with ± tolerance for the background

● **Area tuning with workpiece absent**

1. Select [Setting Mode] → [Output1 Mode] → [Area Sensing Mode].
2. Press and hold the [MODE] button for 3 seconds or longer to exit the Setting Mode.
3. Carry out the same operation as for the tuning with workpiece absent.

Threshold value HIGH: Upper workpiece height + area tolerance
Threshold value LOW: Lower limit workpiece height - area tolerance

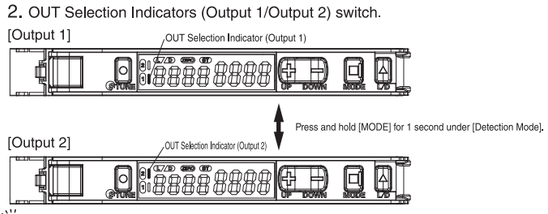


CHECK! Turns ON when incident level is insufficient or is saturated at Light-ON.
Turns OFF when incident level is insufficient or is saturated at Dark-ON.

2-5 Output switching (2-output type:E3NC-SA21, E3NC-SA51)

■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.



CHECK! Light-ON/Dark-ON can be switched with output 2.

● **Margin of the threshold**

Margins for threshold are shown below:
2-4 Smart Tuning

Normal margin	E3NC-SH100: 8 E3NC-SH250: 80
Area margin	E3NC-SH100: 4 E3NC-SH250: 40

● **Smart Tuning Error**

Error / Display / Cause	Error Origin Tuning Type	Remedy
Tuning Error EtUn Err Failed to perform tuning.	All	• Change the response time slower and then perform tuning again. • Before tuning, make sure that the distance between the Sensor and workpiece is within the measurement range.
Near Error nEAr Err Difference in the measured values for the 1st and 2nd points is too small.	2-point Tuning Full Auto Tuning	• Expand difference in the measured values for the 1st and 2nd points.

2-6 Minute Adjustment of Threshold Level

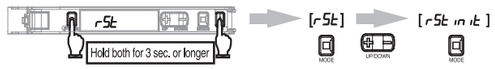
1. Press UP/DOWN button to adjust the threshold level.

CHECK! Hold the key for high-speed level adjustment.

3 Convenient Setting Features

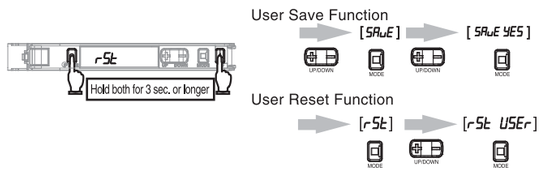
Initializing Settings

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



Saving/Reading Settings

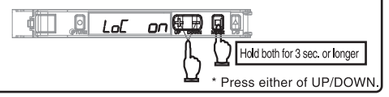
● User Save Function/User Reset Function



Preventing Malfunction

● Key Lock Function Disables all the button operations.

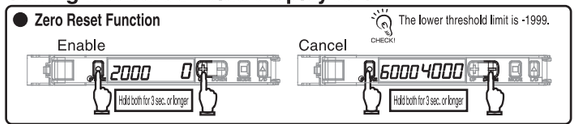
Enable/Cancel
(This procedure)



Setting measured value display to 0

● Zero Reset Function

CHECK! The lower threshold limit is -1999.



4 Maintenance

4-1 Troubleshooting

● Troubleshooting

Phenomena	Cause	Remedy
No digital display.	Is the Eco function not turned ON?	Turn OFF the Eco function. Refer to " ⑤Detailed Settings".
Display is blank.	Is the power supply ON? Are the cables not broken?	Check the wiring and sensor head, the power supply voltage and capacity. Refer to " Input/Output Circuit Diagram 1-2".
The Sensor restarts during operation.		
Laser is not emitted.	Is LD OFF input not short-circuited?	Check the wiring and external input settings. Refer to " Input/Output Circuit Diagram 1-2". Refer to "⑤Detailed Settings".
[LdoFF] appears in the display.		
Input signal is not received.	Are the external input settings ON?	Check the wiring and external input settings. Refer to " Input/Output Circuit Diagram 1-2".
Measured value is not stable, fluctuating depending on the day or time.	Temperature characteristic may be the cause.	Perform warming up at least for 10 minutes. Periodically zero-reset the value using a standard target object for compensation.

● Error Display

Error Name / Display	Cause	Remedy
Load short circuit detection error: E-St	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	A connection error is found in the sensor head.	Check if the sensor head is correctly mounted and turn ON the power supply again.
Amp EEPROM time-out error: E-nE 01	An error is found in amp setting memory.	Turn ON the power again. Reset the settings if the error is not corrected.
Amp EEPROM checksum error: E-nE 02	An error is found in amp setting memory.	
Sensor head single failure detection error: E-Hd Ld	A measurement value count could not be acquired from sensor head.	Turn OFF the power supply and check if the sensor head and amplifier unit are correctly connected and then turn ON the power supply again. If the error persists, the sensor head or amplifier unit are broken. Replace the sensor head or amplifier unit.
Sensor head communications time-out error: E-HdCon1	A communications error is found between the sensor head and amp.	
Sensor head command response error: E-HdCon2	A communications error is found between the sensor head and amp.	
Sensor head command response error: E-HdCon3	A communications error is found between the sensor head and amp.	
Amp connection detection error: E-HdCon4	The sensor head is not connected to the amp.	
Sensor head EEPROM time-out error: E-HdnEn1	An error is found in sensor head setting memory.	Turn off the power, check the connection of the sensor head, and turn on the power again. If the error persists, the sensor head is out of order. Replace the sensor head.
Sensor head EEPROM checksum error: E-HdnEn2	An error is found in sensor head setting memory.	

● Status Display

Error Name / Display	Cause	Remedy
Lock ON: LoC on	The key lock function enabled	Cancel the key lock function. Refer to " ③Convenient Setting Features"
Insufficient light amount error: dArK	A measurement error is found due to insufficient receiving light amount.	Adjust the distance between the sensor head and a workpiece within the measurable range.
Light amount saturation error: brGt	A measurement error is found due to receiving light amount saturation.	Adjust the distance between the sensor head and a workpiece within the measurable range.
Moving average count unreached error: ----	Moving average count could not be acquired from sensor head. BGS setting	Wait until the calculation of the moving average result is completed.
Before-checking-hold error: ----	A hold result is not calculated yet. Hold setting	Please wait until a hold result is calculated.

4-2 Ratings and Specifications

Model	NPN output	E3NC-SA21	E3NC-SA7
	PNP output	E3NC-SA51	E3NC-SA9
Control output		2	1
External input *3		1	1
Operating range		E3NC-SH100: 35 to 100 mm (Display value: 350 to1000) E3NC-SH250: 35 to 250 mm (Display value: 350 to 2500)	
Display resolution		Unit: Approx. 1 mm * Note 1. A guideline of a displayed value for sensing distance. When performing a zero-reset of the set value, the value will be shifted.	
Connection method		Pre-wired type	Wire-saving connector type
Power supply voltage		10 to 30 VDC, including ripple (p-p) 10%	
Power consumption*1		Power supply voltage 24V: Normal mode: 1920mW max.(Power consumption 80mA max.) Power saving ECO: 1680mW max.(Power consumption 70mA max.)	
Control output*2		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. Load current 10 to 100 MA: 2 V max.) 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	Super-high-speed mode (SHS)	0	
	High-speed mode (HS)	2	
	Standard mode (Std)	2	
	Giga mode (GIGA)	2	
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/s², 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 covering: PVC	

*1. Power supply voltage 10V to 30V:
Normal mode: 2250mW max.(Power supply voltage 30V: Power consumption 75mA max./Power supply voltage 10V: Power consumption 145mA max.)
Power saving ECO: 1950mW max.(Power supply voltage 30V: Power consumption 65mA max./Power supply voltage 10V: Power consumption 125mA max.)
*2. For two-output type, the total of the two outputs must be 100 mA max. (Residual voltage load current less than 10 mA : 1 V max, load current 10 to 100 mA: 2 Vmax.)
*3. Details on inputs are as follows:

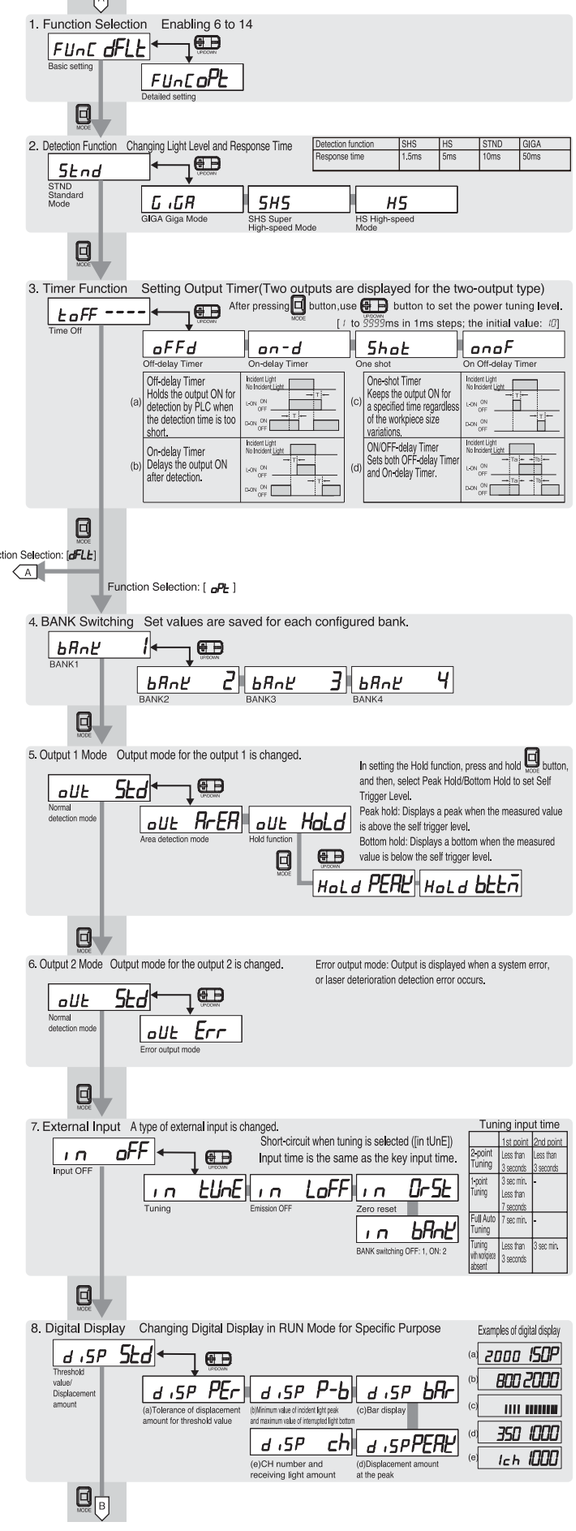
	Contact input (Relay or switch)	Non-contact input (Transistor)	Input time
NPN output	ON: Short circuit to 0V (Outflow current: 1 mA max.) OFF: Open or short circuit to Vcc	ON: 1.5 V max. (Outflow current: 1 mA max.) OFF: Vcc-1.5 V to Vcc (Leakage current: 0.1 mA max.)	ON: 2 ms min. OFF: 30 ms min.
PNP output	ON: Short circuit to Vcc (Sink current: 3mA max.) OFF: Open or short circuit to 0V	ON: Vcc-1.5 V to Vcc (Sink current: 3 mA max.) OFF: 1.5 V max. (Leakage current: 0.1 mA max.)	

5 Detailed Settings

Hold MODE button for 3 seconds or longer to enter SET mode.

CHECK! 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.



9. Keep Function
KEEP oFF
KEEP OFF
KEEP on
KEEP ON
Sets [dArk] and [brGt] in case of measurement error or output contents before fixing measurement.
OFF: Control output is OFF (In the case of 2 outputs: Both outputs are OFF.)
ON: Outputs the result for measured value just before deciding incapability of sensing.

10. Inverted Display Mounting Amplifier in Inverted Direction
rEv oFF
Normal
vo rnJ
Reverse
The display reverses.
Threshold and light intensity are displayed on white digital and green digital respectively.

11. Background Removal
bGS oFF
Background Removal OFF
bGS on
Background Removal ON
Sets to respond only for workpiece in tuning
OFF: No limit on sensitivity
ON: Conforming to sensitivity at tuning, limits are set on later measured values and sensitivity.
CHECK! Setting is enabled by conducting tuning after changing the setting to ON.

12. Eco Function Saving Power Consumption
ECo oFF
Eco function OFF
ECo on
Eco function ON
The indicators (green digital and white digital) turn OFF. They turn ON for approx. 10 seconds and then turn OFF by button operation.

13. Hysteresis width
HStd 37
Standard setting
*Reference value
HUSr 26
User setting
HUSr 37
User setting (Displayed on the two-output type)
Set the hysteresis width . Hysteresis width is provided for threshold to prevent the judgment output from becoming unstable near the boundaries.
CHECK! Be sure to check the stability of outputs as there is a possibility of chattering.
The hysteresis width can be set by pressing the SHIFT button in the menu of "HS-" and then pressing the MODE button.

14. Writing to EEPROM of External Input
inSu on
ON
inSu oFF
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).

A
Move to Detection Mode by holding the button for 3 seconds or longer.

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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