

# Smart Fiber Sensor E3X-HD 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.



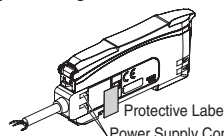
### PRECAUTIONS FOR SAFE USE

The following precautions must be observed to ensure safe operation of the Sensor.

- Do not use the Sensor in environments subject to flammable or explosive gases.
- Do not use the Sensor in environments subject to exposure to water, oil, chemicals, etc.
- Do not install the Sensor in environments subject to intense electric field or ferromagnetic field.
- Do not attempt to disassemble, repair, or modify the Sensor Unit in any way.
- Do not apply voltages or currents that exceed the rated ranges.
- Do not use the Sensor in any atmosphere or environment that exceeds the ratings.
- Do not miswire such as the polarity of the power supply.
- Connect the load correctly.
- Do not short both ends of the load.
- Do not use the Sensor if the case is damaged.
- When disposing of the Sensor, treat it as industrial waste.
- Burn injury may occur. The Sensor surface temperature rises depending on application conditions, such as the ambient temperature and the power supply voltage. Use caution when operating or cleaning the Sensor.
- 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.
- When setting the Sensor, be sure to check safety such as by stopping the equipment.

### PRECAUTIONS FOR CORRECT USE

- Do not install the Sensor in the following locations.
  - Locations subject to direct sunlight
  - Locations subject to condensation due to high humidity
  - Locations subject to corrosive gas
  - Locations subject to vibration or mechanical shocks exceeding the rated values
- Use an extension cable with a minimum thickness of 0.3 mm<sup>2</sup> and less than 100 m long.
- Do not apply the forces on the cord exceeding the following limits: Pull: 40N; torque: 0.1N·m; pressure: 20N; bending: 3 kg
- The Sensor 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 Sensor first.
- When using a connector type product, place a protective label (provided with the E3X-CN series connectors) on the power supply connecting terminals that are not used, to prevent electric shock or short circuit.



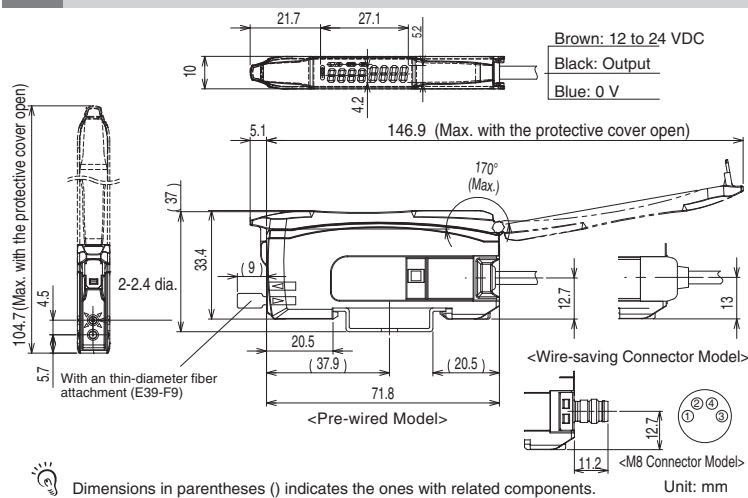
- Output pulses may occur when the power supply is turned OFF. Turn OFF the power supply to the load or load line first.
- Excessive incident light cannot be sufficiently handled by the mutual interference prevention function and may cause malfunction. To prevent this, set a higher threshold level.
- Make sure that the power supply is turned OFF before connecting, separating or adding Amplifier Units.
- Do not pull or apply excessive pressure or force (exceeding 9.8N) on the Fiber Unit when it is mounted on the Amplifier Unit.
- The E3X-MC11-SV2 and E3X-MC11-S Mobile Consoles cannot be used.
- Mutual interference prevention does not function among the E3X-DA-N/SD/NA amplifiers. It functions among E3X-DA-S/MDA models.
- The E3X-DRT21-S, E3X-CRT and E3X-ECT Communication Units cannot be used.
- Always keep the protective cover in place when using the Amplifier Unit.
- 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

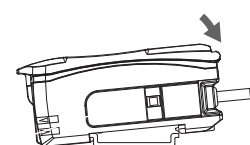
### 1-1 Dimensions



### 1-2 Mounting the Amplifier Unit

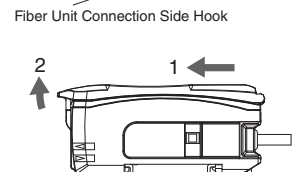
#### ■ Mounting on DIN Track

- Let the hook on the Amplifier Unit's Fiber Unit connection side catch the track and push the unit until it clicks.



#### ■ Removing from DIN Track

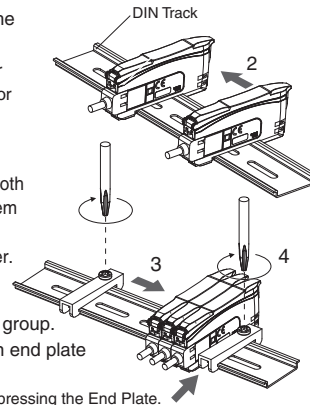
- Push the unit in the direction 1.
- Lift it up in the direction 2.



Refer to "1-1. Dimensions" or check the side of the unit for wire color and role indications.

#### ■ Mounting Amplifier Units in Group (Connector Type Models)

- Mount the Amplifier Units one at a time onto the DIN track and push them until they click. Use E3X-CN11 (Master connector) for the master Amplifier Unit and E3X-CN12 (Slave connector) for the slave Amplifier Units.
- Slide the Amplifier Units in the direction 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.
- Tighten the screw on the End Plates using a driver.



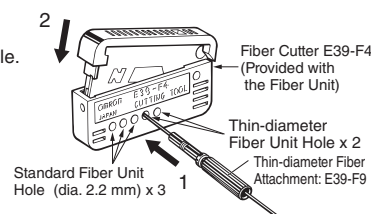
Up to 16 Amplifier Units can be mounted in a group. Under environments such as vibration, use an end plate even with a single amplifier unit.

Tighten the screw while pressing the End Plate.

### 1-3 Mounting Fiber Unit

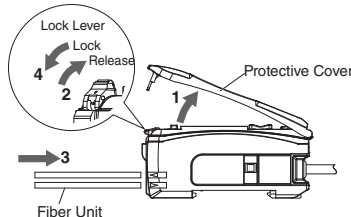
#### ■ Use Fiber Cutter

- Insert a Fiber Unit into a fiber cutter hole. Insert a standard Fiber Unit up to the position in which it is cut; and a thin-diameter Fiber Unit to the bottom of the hole.
- Press down the blade at a single stroke to cut the Fiber Unit.

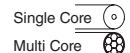


#### ■ Mount Fiber Unit

- Open the protective cover.
- Raise the lock lever.
- Insert the Fiber Unit in the fiber unit hole to the bottom.
- Return the lock lever to the original position and fix the Fiber Unit.

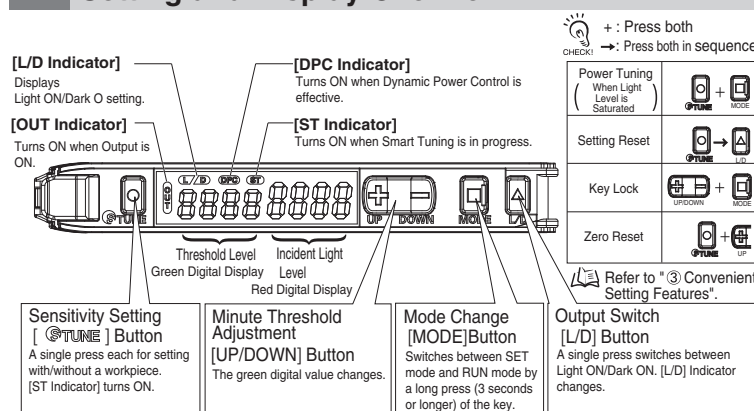


When mounting a coaxial reflective Fiber Unit, insert the single-core Fiber Unit to the upper hole (Emitter side) and the multi-core Fiber Unit to the lower hole (Receiver side).



## 2 Settings

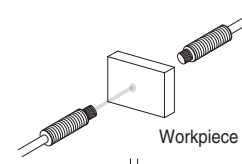
### 2-1 Setting and Display Overview



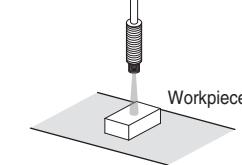
### 2-2 Switching Control Output

#### 1. Press [L/D] button.

Through-beam: Set to "Dark ON" to turn the output ON with a workpiece in the detection area. [L/D Indicator] turns  $\overline{D}$  ON.



Reflective: Set to "Light ON" to turn the output ON with a workpiece in the detection area. [L/D Indicator] turns  $\overline{L}$  ON.

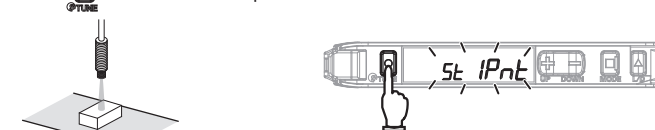


### 2-3 Smart Tuning [Easy Sensitivity Setting]

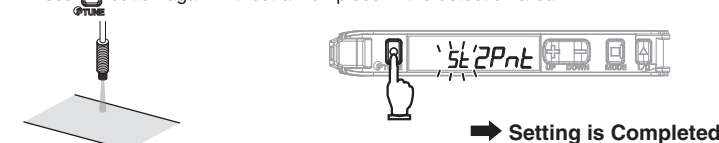
#### ① Detect for Workpiece Presence/Absence

##### ● 2-point Tuning

- Press [OPTUNE] button with a workpiece in the detection area.



- Press [OPTUNE] button again without a workpiece in the detection area.



Incident light level setting: The larger incident level of the Step 1 and 2 values is adjusted to the power tuning level.

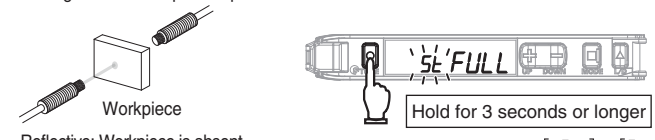
Threshold setting: Set to the middle between the Step 1 and 2 incident light levels.

Step 1 and Step 2 can be reversed.

#### ② Detect for Workpiece Presence/Absence

##### ● Maximum Sensitivity Tuning

- Hold [OPTUNE] button for 3 seconds or longer with/without workpiece as shown below. Release the button when [St FULL] is displayed. Through-beam: Workpiece is present



Reflective: Workpiece is absent The red digital display changes [IPnt] -> [FULL]



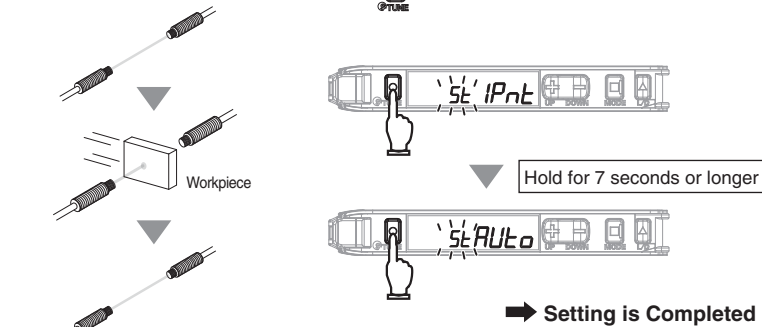
Incident light level setting: The incident level in Step 1 is adjusted to "0".

Threshold setting: The value is set to approx. 7% of the incident light level of 1. If the incident light level of 1 is smaller during long distance detection, the minimum value by which an output is correctly turned ON will be set.

### ③ Adjust for Moving Workpiece without Stopping Line

#### ● Full Auto Tuning

- Hold the [OPTUNE] button without the presence of a workpiece, and pass the workpiece through while [IPnt] -> [FULL] is displayed in red digital. (Keep holding the [OPTUNE] button while the workpiece passes through, and hold 7 seconds or longer until [FULL] is displayed in red digital. After the workpiece passes through, release your finger from the [OPTUNE] button.)



Incident light level setting: Adjust the max. incident light level on Step 1 as the power tuning level. Threshold setting: Set to the middle between max. and min. incident light levels on Step 1.

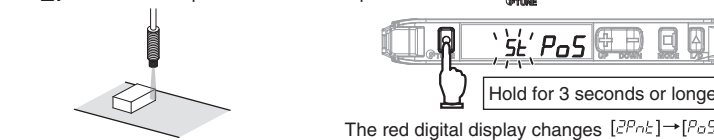
#### ④ Determine Workpiece Position

##### ● Position Tuning

- Press [OPTUNE] button without a workpiece in the area.



- Place the workpiece at the desired position and hold [OPTUNE] button.



Incident light level setting: The Step 2 incident level is adjusted to half the power tuning level. Threshold setting: Set to the same value as the Step 2 incident level.

#### ⑤ Detect Transparent or Small Workpiece (Set Threshold by incident light level percentage)

##### ● Percentage Tuning

- Turn ON Percentage Tuning in SET mode. Refer to "⑤ Detailed Settings".
- Press [OPTUNE] button without a workpiece in the area.



Incident light level setting: The Step 2 incident light level is adjusted to the power tuning level. Threshold setting: Set to the value obtained by [Incident Level at Step 2 x Percentage Tuning Level + Incident Level at Step 2].

No Smart Tuning other than Power Tuning can be used if Percentage Tuning is set.

##### ● Smart Tuning Error

Error / Display / Cause	Error Origin Tuning Type	Remedy
Near Error $nEr$ $Err$ The light level difference between Points 1 and 2 are extremely small.	2-point Tuning Full Auto Tuning Positioning Tuning	• Change the detection function mode to a slower response time mode. • Narrow the emitter and receiver distance (Through-beam) • Mount the sensor closer to the workpiece (Reflective)
Over Error $ouEr$ $Err$ Incident light level is too high.	All	• Enhance the power tuning level. • Use a thin-diameter fiber. • Widen the emitter and receiver distance (Through-beam) • Distance the sensor from the workpiece (Reflective)
Low Error $Lo$ $Err$ Incident light level is too low.	Tuning other than Maximum Sensitivity Tuning	• Decrease the power tuning level. • Narrow the emitter and receiver distance (Through-beam) • Locate the sensor closer to the workpiece (Reflective)

The adjustment range of smart tuning is approx. 20 to 1/100 times. When selecting Giga Mode as detection function, the range will be approx. 2 to 1/100 times due to the large initial value. Refer to "⑤ Detailed Settings" to change the powr tuning level.

### 2-4 Minute Adjustment of Threshold Level

- Press [UP/DOWN] button to adjust the threshold level.

The threshold level becomes higher. The threshold level becomes lower.



Hold the key for high-speed level adjustment.

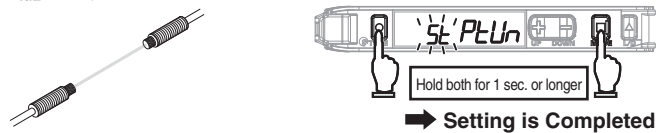


## 3 Convenient Setting Features

### 1 Restore from the Incident Level Changed due to Dust and Dirt

#### Power Tuning

- Hold and buttons for 1 second or longer without a workpiece in the area.



Incident light level setting: The Step 1 incident level is adjusted to the power tuning level. Threshold setting: Not changed. If the value is low, it will be set to the minimum value in which an output is turned ON/OFF correctly.

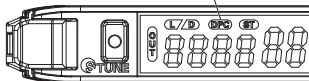
Perform the procedure with a workpiece in the area for reflective model setting. If the setting is made after position tuning, set both the through-beam model and reflective model with a workpiece.

### 2 Stable Detection Regardless of Incident Level Change due to Dust and Dirt

#### DPC Function

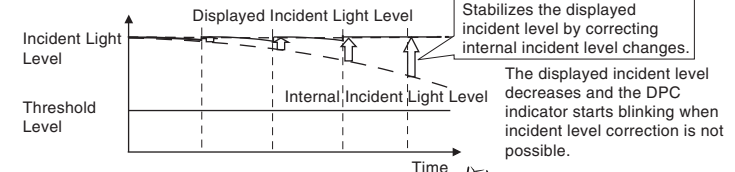
- Perform Smart Tuning. Refer to "2-3 Smart Tuning".
- Set the DPC function ON in SET mode.

The DPC indicator turns ON when the DPC function is effective.



- Refer to "5 Detailed Settings".

- Steps 1 and 2 can be reversed.
- The DPC function will be disabled when a smart tuning error occurs, differential function with maximum sensitivity tuning is performed, or the first incident light level of the positioning tuning is low.
- The incident light level is corrected to the power tuning level to maintain stable threshold and incident light levels. This provides stable detection regardless of the incident level changes caused by dirty sensor head, position error, or temperature changes.



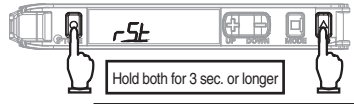
Refer to "4-1 Troubleshooting"

### 3 Reset Settings

#### Setting Reset

Initializes all the settings by returning them to the factory defaults.

- Hold button and then hold button for 3 seconds or longer.



- Select [**5**LT] in and press .

- Select [**5**LT] in and press .

Item	Initial Value
Threshold Value	55
Control Output	L-on

\* Settings for other functions are returned to the detailed setting initial values. User-saved settings are retained. Smart Tuning is canceled.

Caution is required; the output is inverted if button is pressed first.

### 4 Save or Read Settings

- Hold button and then hold button for 3 seconds or longer.

#### User Save Function

Saves the current settings.

- Select [**5**LT] in and press .

- Select [**5**LT] in and press .

#### User Reset Function

Reads out the saved settings.

- Select [**5**LT] in and press .

- Select [**5**LT] in and press .

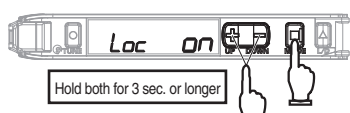
Caution is required; the output is inverted if button is pressed first.

### 5 Prevent Mis-operation

#### Key Lock Function

Disables all button operations. [**Loc ON**] is displayed when the button is pressed.

- Enable/Cancel (This procedure)



### 6 Reset Incident Light Level to "0"

\* Press either of UP/DOWN.

#### Zero Reset Function

Changes the incident light level to "0". The threshold level is also shifted accordingly.

- Enable

- Cancel



The zero reset function is canceled when either of the DPC function/differential function/Smart Tuning is performed.

## 4 Maintenance

### 4-1 Troubleshooting

#### Troubleshooting

Problem	Cause	Remedy
Blank display	No power supplied or the cable broken	Check the wiring, power supply voltage and capacity. Refer to "4-2 Input/Output Circuit Diagram"
No digital display	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	The GIGA mode setting enhances the light level and a larger incident level is displayed. Refer to "5 Detailed Settings".
Incident light level display fluctuation	Dust or dirt, temperature changes or vibration	Use the DPC function to stabilize the incident light level display. Refer to "3 Convenient Setting Features"
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 "1-2 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"
	The differential function is enabled.	Turn OFF the differential function. Refer to "5 Detailed Settings".
Lost tracking of the settings made	-	Reset the settings. Refer to "3 Convenient Setting Features"

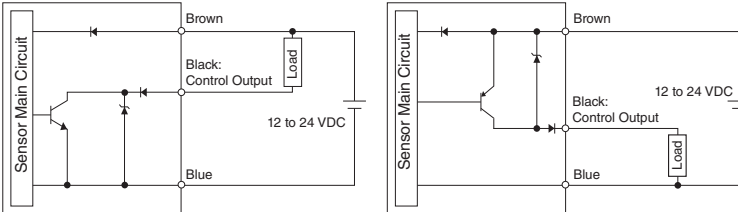
#### Error Display

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"
EEPROM Error EEP Err	Failed internal data read/out	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"
Current Over cUr OvEr	Over current flowing to the control output	Check the control output load and adjust it within the rated value. Check for a load short-circuit. Refer to "4-2 Input/Output Circuit Diagram" and "4-3 Ratings and Specifications"

\* The DPC indicator blinks.

### 4-2 Input/Output Circuit Diagram

- E3X-HD11, E3X-HD6, E3X-HD14 (NPN Type)
- E3X-HD41, E3X-HD8, E3X-HD44 (PNP Type)



### 4-3 Ratings and Specifications

Model	NPN Output	E3X-HD11	E3X-HD6	E3X-HD14
	PNP Output	E3X-HD41	E3X-HD8	E3X-HD44
Number of Control Outputs	1			
Connection Method	Pre-wired Type	Wire-saving Connector Type*1	M8 connector type	
Light Source (Wavelength)	Red 4-element LED (625 nm)			
Power Supply Voltage	12 to 24 VDC ±10%, ripple (p-p) 10% max.			
Power Consumption	Normal: 720 mW max. (current consumption: 30 mA max. at power supply voltage of 24 VDC; 60 mA max. at power supply voltage of 12 VDC) Power-saving ECO: 530 mW max. (current consumption: 22 mA max. at power supply voltage of 24 VDC; 44 mA max. at power supply voltage of 12 VDC)			
Control Output	Load power supply voltage: 26.4 VDC; NPN/PNP open collector; load current: 50 mA max.; residual voltage: 2 V max.			
Protection Circuits	Power supply reverse polarity protection, output short-circuit protection and output reverse polarity protection			
Maximum connectable units	16 units			
Mutual Interference Prevention	Possible for up to 10 units *2			
APC (Auto Power Control)	Always ON			
Ambient Illumination	Receiver side: Incandescent lamp: 20,000 lux max. / Sunlight: 30,000 lux max.			
Ambient Temperature Range	Operating: Groups of 1 to 2 Amplifiers: -25°C to 55°C Groups of 3 to 10 Amplifiers: -25°C to 50°C Groups of 11 to 16 Amplifiers: -25°C to 45°C Storage: -30°C to 70°C (with no icing or condensation)			
Ambient Humidity Range	Operating and storage: 35% to 85% (with no condensation)			
Insulation Resistance	20 MΩ min. (at 500 VDC megger)			
Dielectric Strength	1,000 VAC at 50/60 Hz for 1 minute			
Vibration Resistance	10 to 55 Hz with a 1.5-mm double amplitude for 2 hours each in X, Y and Z directions			
Shock Resistance	500 m/s <sup>2</sup> , for 3 times each in X, Y and Z directions			
Weight (Main Unit Only)	Approx. 65 g	Approx. 20 g	Approx. 22 g	
Material	Case: Heat resistant ABS (ABS) / Cover: Polycarbonate (PC)			

\*1: Either of E3X-CN11 (Master connector: three core) and E3X-CN12 (Slave connector: single core) can be used.

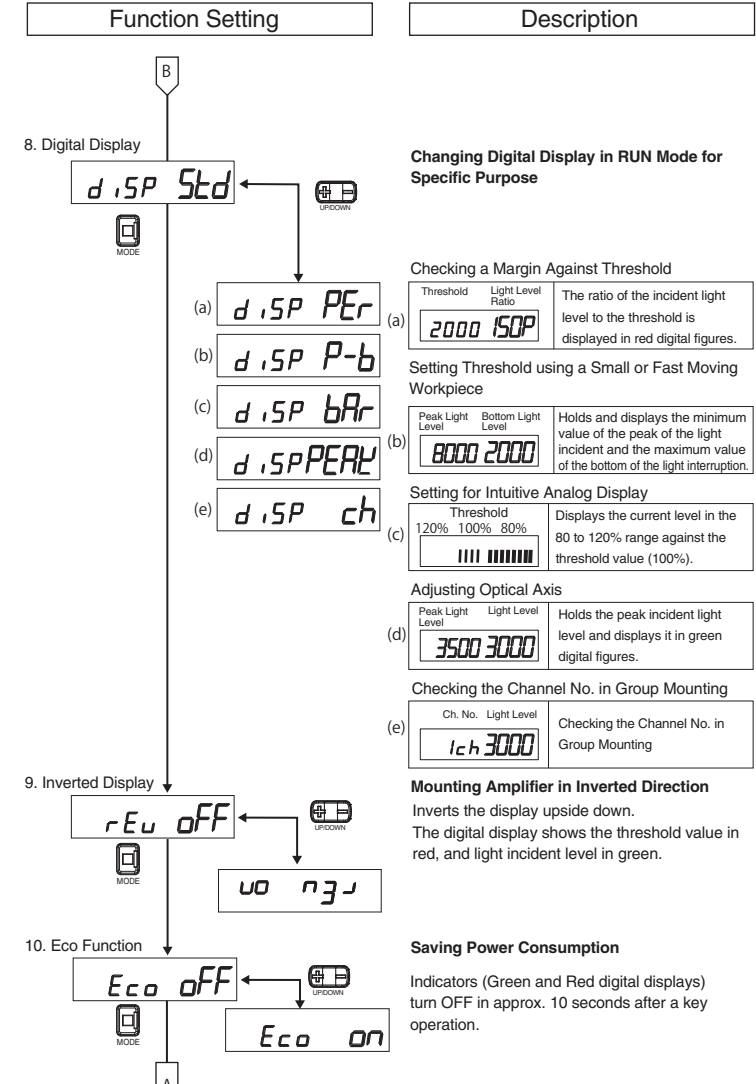
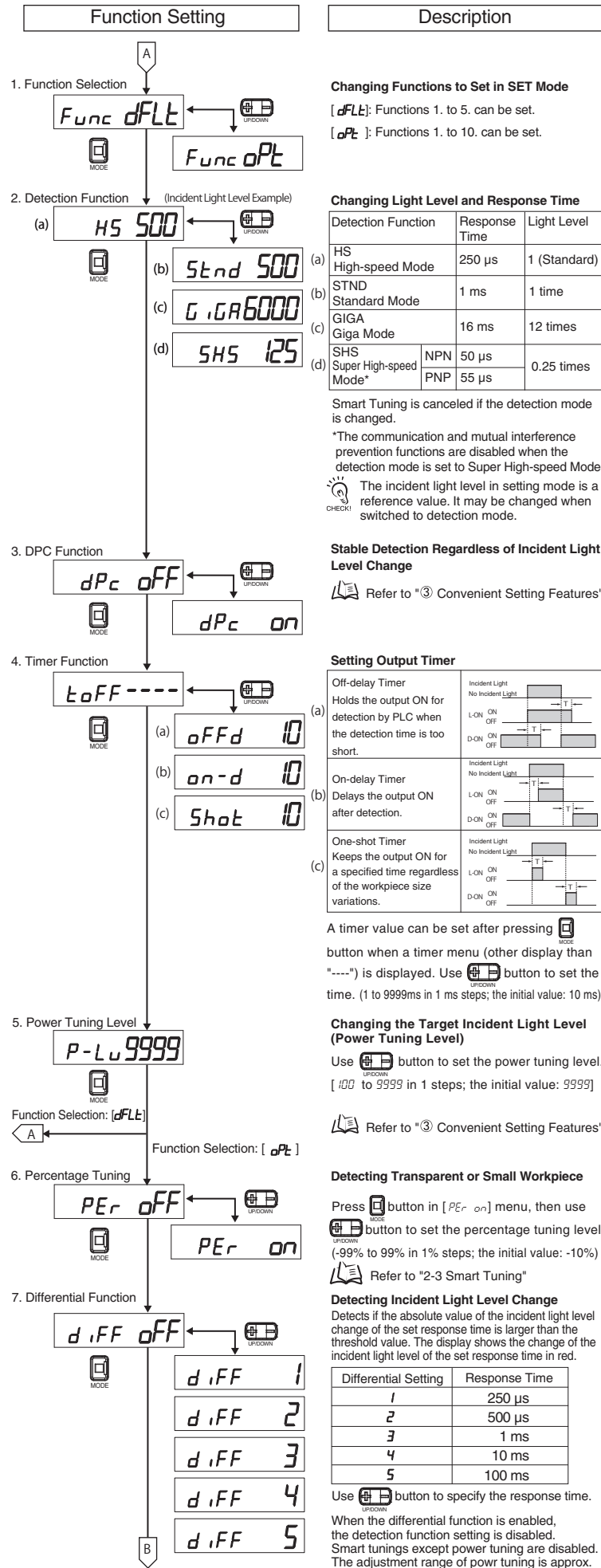
\*2: Mutual interference prevention is only possible for up to 6 units, if the E3X-DA-S/MDA sensors applied with power tuning are grouped with this sensor.

\*3: The communication and mutual interference prevention functions are disabled when the detection mode is set to Super High-speed Mode

## 5 Detailed Settings

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

SET mode provides the function settings described hereafter. The initial display shown after transition from one function to another represents the factory default.



## 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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