

E3T-ST□/FT□ series  
Photoelectric sensor

# Information for ISO13849-1 Compliance

Thank you for selecting OMRON product.

When the product is treated as ISO 13849-1 (Cat 1, PL c), please confirm the following:

Before operating the product, please read both this document and the 'Instruction Manual' included with the product together to acquire sufficient product knowledge. It is convenient to keep these documents on hand. When handling, please entrust it to a professional with specialized knowledge.

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Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

## Errors and Omissions.

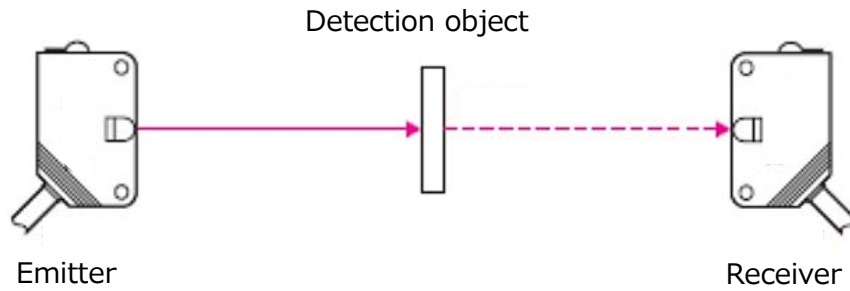
Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

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# 1. Product function

E3T-ST□/FT□ series is “Through-beam photoelectric sensor which detects objects that either reflect or interrupt visible or invisible light. The control output is a semiconductor switching element.



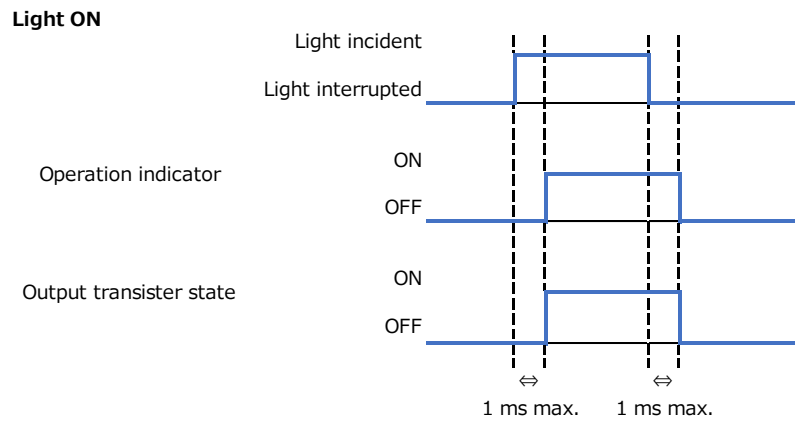
Sensing method		Through-beam									
Appearance		Rectangular type(Side-view)					Rectangular type(Flat)				
Item											
NPN output	Light-ON	E3T-ST31	E3T-ST31F	E3T-ST11(M)	E3T-ST11(M)F	E3T-ST21(M)	E3T-ST21(M)F	E3T-FT11	E3T-FT11F	E3T-FT21	E3T-FT21F
	Dark-ON	E3T-ST32	E3T-ST32F	E3T-ST12(M)	E3T-ST12(M)F	E3T-ST22(M)	E3T-ST22(M)F	E3T-FT12	E3T-FT12F	E3T-FT22	E3T-FT22F
PNP output	Light-ON	E3T-ST33	E3T-ST33F	E3T-ST13(M)	E3T-ST13(M)F	E3T-ST23(M)	E3T-ST23(M)F	E3T-FT13	E3T-FT13F	E3T-FT23	E3T-FT23F
	Dark-ON	E3T-ST34	E3T-ST34F	E3T-ST14(M)	E3T-ST14(M)F	E3T-ST24(M)	E3T-ST24(M)F	E3T-FT14	E3T-FT14F	E3T-FT24	E3T-FT24F
Sensing distance		2m		1m		300mm		500 mm		300 mm	
Standard sensing object		Opaque, 3-mm dia. min.		Opaque, 2-mm dia. min.				Opaque, 1.3-mm dia. min.			
Light source (wavelength)		Red LED (650 nm)	Infrared LED (860 nm)	Red LED (650 nm)	Infrared LED (860 nm)	Red LED (650 nm)	Infrared LED (860 nm)	Red LED (650 nm)	Infrared LED (860 nm)	Red LED (650 nm)	Infrared LED (860 nm)
Response time		Operate or reset: 1 ms max.									
Power supply voltage		12VDC -10% to 24VDC +10%, ripple (p-p) 10% max.									
Control output		Load power supply voltage: 26.4 VDC max. Load current: 50 mA max. (residual voltage: 2 V max. for load current of 10 to 50 mA, 1 V max. for load current of less than 10 mA) Open-collector output									
Dielectric strength		AC1,000V 50/60Hz 1min									
impulse withstand voltage		±1kV									
Current consumption		30 mA max. (Emitter 10 mA max., Receiver 20 mA max.)									
Degree of protection * 1		ISO13849-1 IP54					ISO13849-1 IP67				
Indicators		Operation indicator (orange), Stability indicator (green)									

\* 1 When compliant with IEC60529, the E3T-ST□/FT□ series is rated as IP67.

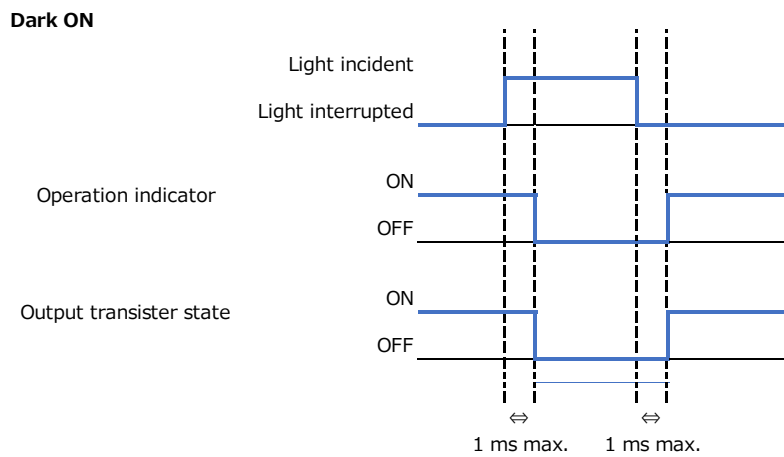
For ratings and specifications other than those described in this document, please refer to the catalog or Instruction Manual.

## 1.1 Timing chart

The light-operated and dark-operated timing charts are shown in Figure.



### Light-operated



### Dark-operated

## 1.2 Control output/ Operation mode

Control output is 2 type which is NPN output and PNP output. The operating mode, time chart, and output circuit are shown in the figure below.

### NPN Output

Model	Operation mode	Timing charts	Output circuit
E3T-□□□1(F) E3T-□□□1M(F)	Light-ON	<p>Light incident Light interrupted</p> <p>Operation indicator (orange) ON OFF</p> <p>Output transistor ON OFF</p> <p>Load (e.g., relay) Operate Reset</p> <p>(Between brown (1) and black (4) leads)</p>	<p>Through-beam Receivers and Reflective Sensors</p> <p>Through-beam Emitters</p> <p>*1. There is no diode for Small Cylindrical Sensors (E3T-C□□□(S)). *2. This is 80 mA max. for Small Cylindrical Sensors (E3T-C□□□(S)).</p>
E3T-□□□2(F) E3T-□□□2M(F) E3T-□□□2S	Dark-ON	<p>Light incident Light interrupted</p> <p>Operation indicator (orange) ON OFF</p> <p>Output transistor ON OFF</p> <p>Load (e.g., relay) Operate Reset</p> <p>(Between brown (1) and black (4) leads)</p>	<p>Through-beam Receivers and Reflective Sensors</p> <p>Through-beam Emitters</p> <p>*1. There is no diode for Small Cylindrical Sensors (E3T-C□□□(S)). *2. This is 80 mA max. for Small Cylindrical Sensors (E3T-C□□□(S)).</p>

### PNP Output

Model	Operation mode	Timing charts	Output circuit
E3T-□□□3(F) E3T-□□□3M(F)	Light-ON	<p>Light incident Light interrupted</p> <p>Operation indicator (orange) ON OFF</p> <p>Output transistor ON OFF</p> <p>Load (e.g., relay) Operate Reset</p> <p>(Between blue (3) and black (4) leads)</p>	<p>Through-beam Receivers and Reflective Sensors</p> <p>Through-beam Emitters</p> <p>*1. There is no diode for Small Cylindrical Sensors (E3T-C□□□(S)). *2. This is 80 mA max. for Small Cylindrical Sensors (E3T-C□□□(S)).</p>
E3T-□□□4(F) E3T-□□□4M(F) E3T-□□□4S	Dark-ON	<p>Light incident Light interrupted</p> <p>Operation indicator (orange) ON OFF</p> <p>Output transistor ON OFF</p> <p>Load (e.g., relay) Operate Reset</p> <p>(Between blue (3) and black (4) leads)</p>	<p>Through-beam Receivers and Reflective Sensors</p> <p>Through-beam Emitters</p> <p>*1. There is no diode for Small Cylindrical Sensors (E3T-C□□□(S)). *2. This is 80 mA max. for Small Cylindrical Sensors (E3T-C□□□(S)).</p>

The conditions under which the control output is turned on are different.

Operation mode	Output of Light-ON	Output of Dark-ON
Detection Object (Light interrupted)	OFF	ON
No detected object (Light incident)	ON	OFF

### 1.3 Dimensions

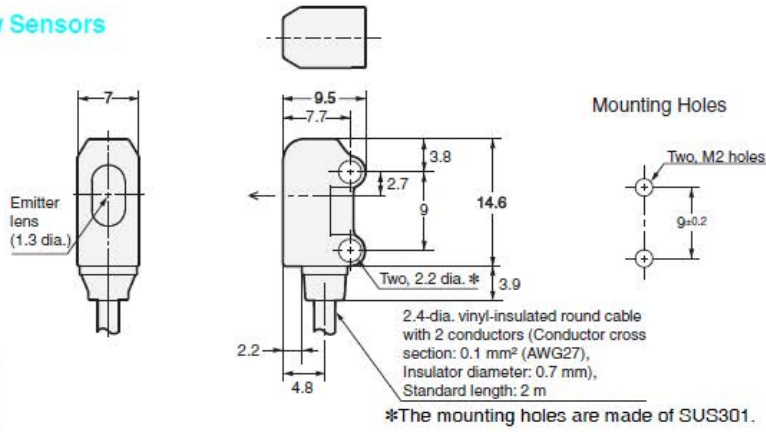
#### M2-mounting Sensors

##### Through-beam Side-view Sensors

E3T-ST1□(F) (Emitter)  
E3T-ST2□(F) (Emitter)  
E3T-ST3□(F) (Emitter)



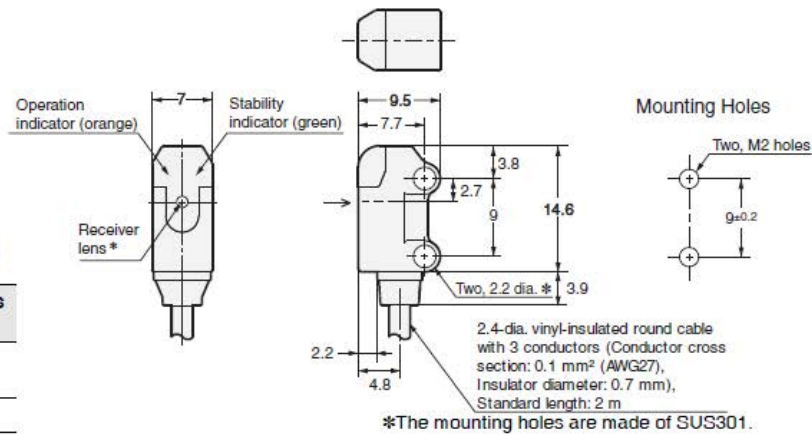
Emitter: E3T-ST□(F)-L  
Receiver: E3T-ST□(F)-D



E3T-ST1□(F) (Receiver)  
E3T-ST2□(F) (Receiver)  
E3T-ST3□(F) (Receiver)

\*The receiver lens diameters are given below.

Model	Receiver lens diameter
E3T-ST1□-D E3T-ST2□-D	(1.3 dia.)
E3T-ST3□-D	(2.4 dia.)

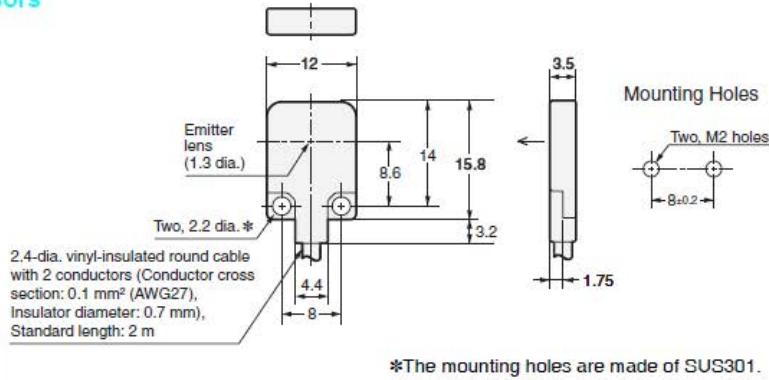


##### Through-beam Flat Sensors

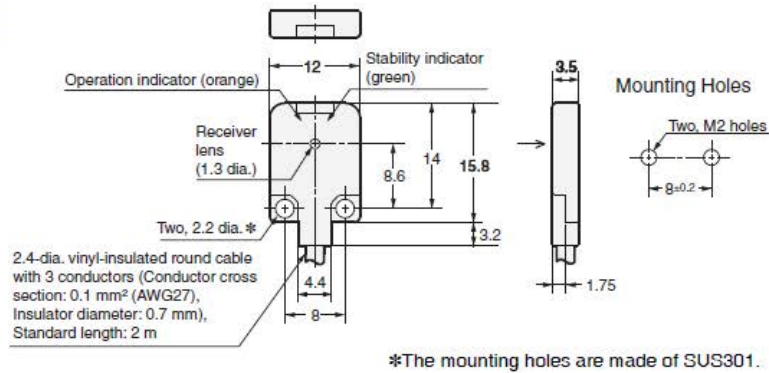
E3T-FT1□(F) (Emitter)  
E3T-FT2□(F) (Emitter)



Emitter: E3T-FT□(F)-L  
Receiver: E3T-FT□(F)-D



E3T-FT1□(F) (Receiver)  
E3T-FT2□(F) (Receiver)





## 1.4 Mounting distance

# ⚠ WARNING

Do not use the sensor system with mirrors in a retro-reflective configuration.



When using more than 1 set of E3T-ST□/FT□ in adjacent areas, the emitter of one E3T-ST□/FT□ may interfere with the receiver of the other, causing the safety functions to stop working properly.

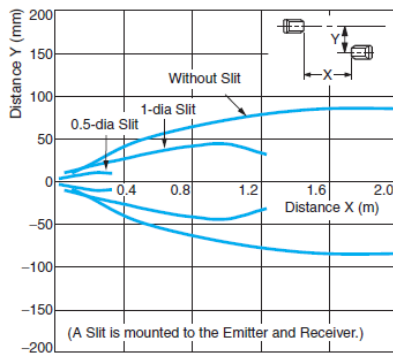


Install and configure them so that mutual interference does not occur.

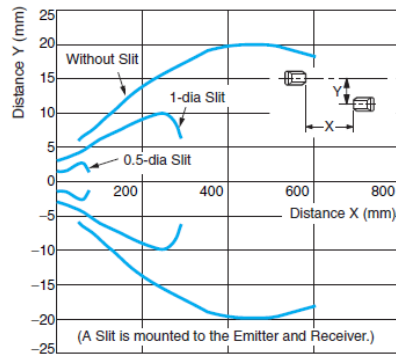
If using more than one sensor, which need to leave space given 1.5x in the following figure. When installing reflective objects around it as well, which need to leave space given 1.5x.

Using with mounted slit E39-S63/S64 is not scope of ISO13849-1(PL c,Cat1).

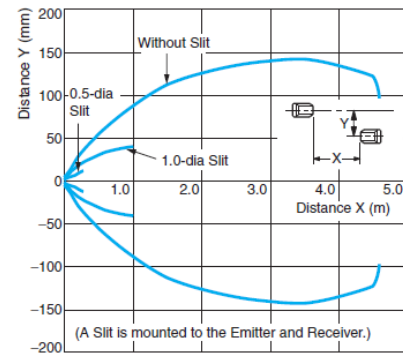
### Red LED



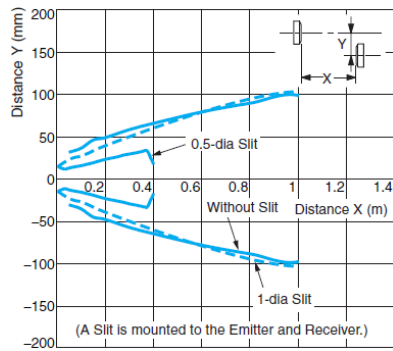
**E3T-ST1□(M)+E39-S63**



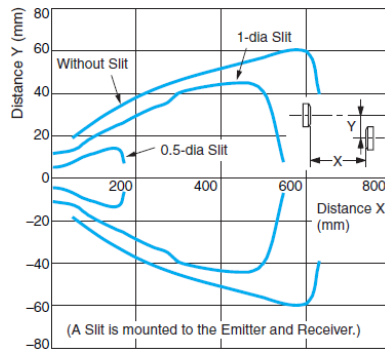
**E3T-ST2□(M)+E39-S63**



**E3T-ST3□+E39-S63**

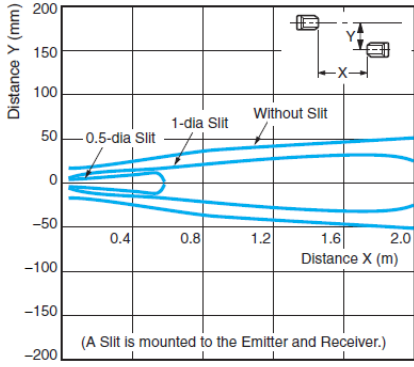


**E3T-FT1□+E39-S64**

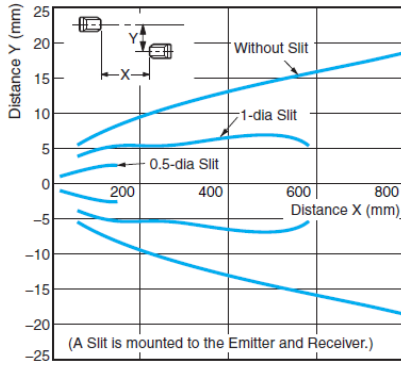


**E3T-FT2□+E39-S64**

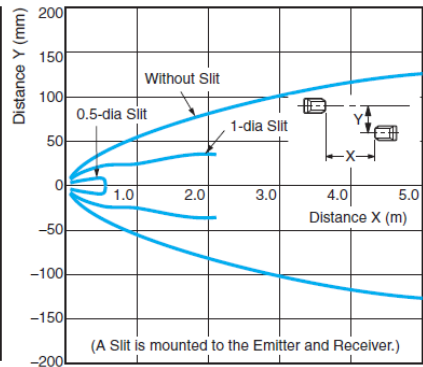
# Infrared LED



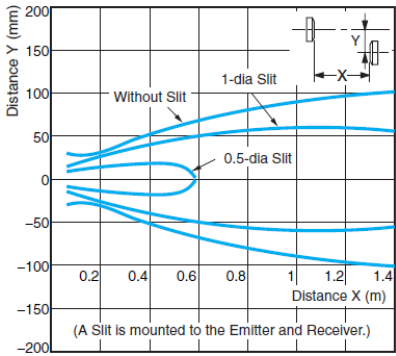
**E3T-ST1 □ (M)F+E39-S63**



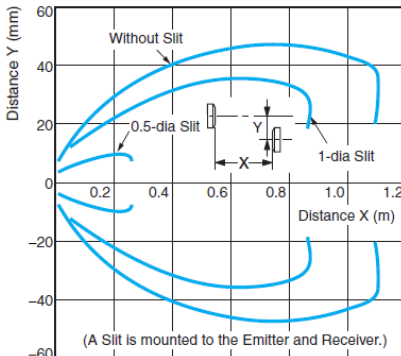
**E3TT-ST2 □ (M)F+E39-S63**



**E3T-ST3 □ (M)F+E39-S63**



**E3T-FT1 □ F+E39-S64**




**E3T-FT2 □ F+E39-S64**





## 2. Safety Precautions

The E3T-ST□ and E3T-FT□ series conforms to the international standard ISO 13849-1 (Cat 1, PL c). Before operating the product, please read both this document and the 'Instruction Manual' included with the product together to acquire sufficient product knowledge.






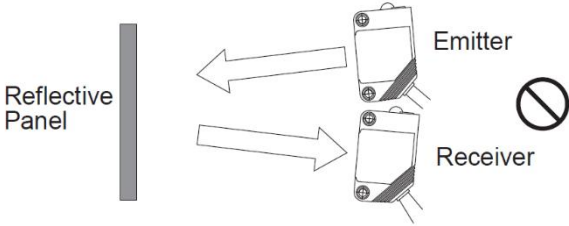




The following notation is used in this manual to provide precautions required to ensure safe usage of a E3T-ST□ and E3T-FT□ series.

 <b>WARNING</b>	<p>Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.</p>
<b>Precautions for Safe Use</b>	<p>Indicates precautions on what to do and what not to do to ensure using the product safely.</p>
<b>Precautions for Correct Use</b>	<p>Indicates precautions on what to do and what not to do to ensure proper operation and performance.</p>

The symbols have the following meanings:

	<p>Indicates prohibited actions.</p>
	<p>Indicates mandatory actions.</p>
	<p>Indicates the risk of electric shock</p>
	<p>Indicates the risk of rupture.</p>

## 2.1 Warning

 <b>WARNING</b>	
<p>Do not connect the E3T to an AC or DC power supply with higher voltage than nominal DC24V. Otherwise the sensor may explode, burn, or cause electric shock.</p>	 
<p>Do not use this product for an application where it directly detects the human body.</p>	
<p>Use an opaque test rod with 3mm in diameter. The E3T cannot detect transparent materials.</p>	
<p>Do not use the E3T in a reflective configuration, otherwise detection may fail.</p> <div style="text-align: center; margin-top: 20px;">  </div>	
<p>Do not install the E3T in a location where it can be affected by wall reflections to avoid detection failure, which may result in serious injury.</p>	
<p>When using multiple sets of E3T, arrange them to prevent mutual interference. Failure to do so may cause the sensor not to detect, resulting in serious injury.</p>	
<p>Wiring must be done while the power is turned OFF. Doing it with the power ON may cause an electric shock.</p>	

## 2.2 Precautions for Safe Use

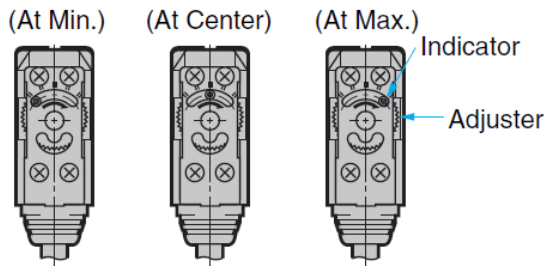
Precautions for Safe Use
<p>Be sure to follow the safety precautions below for added safety.</p> <ol style="list-style-type: none"> <li>(1) Do not use the sensor under the environment with explosive or ignition gas.</li> <li>(2) Never disassemble, repair nor tamper with the product.</li> <li>(3) Do not apply voltage more than the rated voltage.</li> <li>(4) Do not use the sensor over the rated values.</li> <li>(5) When you discard the product, please process industrial waste.</li> </ol>

## 2.3 Precautions for Correct Use

Precautions for Correct Use																			
Do not use the product in atmospheres or environments that exceed product ratings.																			
Wiring	<p>The maximum power supply voltage is 26.4 VDC. Before turning the power ON, make sure that the power supply voltage is not more than maximum voltage.</p> <p><b>Load short-circuit protection</b></p> <p>The E3T incorporates a load short-circuit protection function. If the load short-circuits, the output of the E3T will be turned OFF. Then, recheck the wiring and turn on the E3T again to reset the load short-circuit protection function. The load short-circuit protection function will work if there is a current flow that is 1.5 times larger than the rated load current. When using a capacitance load, be sure that the inrush current will not exceed 1.5 times larger than the rated current.</p>																		
Mounting	<p>When mounting the Sensor, never strike it with a heavy object, such as a hammer. Doing so may reduce its watertight properties. Use screws with spring, flat, or toothed washers to secure the Sensor. Tightening Torque</p> <p>M2-mounting Sensors: 0.15 N·m max M3-mounting Sensors: 0.5 N·m max Small Cylindrical Sensors: 1 N·m max</p> <p><b>【Attachment to Moving Parts】</b></p> <p>To mount the Photoelectric Sensor to a moving part, such as a robot hand, consider using a Sensor that uses a bending-resistant cable (robot cable).</p>																		
Adjusting	<p><b>Indicators</b></p> <ul style="list-style-type: none"> <li>The following graphs indicate the status of each operating level.</li> <li>Be sure to use the E3T within the stable operating range.</li> </ul> <table border="1"> <thead> <tr> <th rowspan="2">Operating Level</th> <th rowspan="2">Stability indicator (green)</th> <th colspan="2">Operation indicator (orange)</th> </tr> <tr> <th>E3T-□□□1 E3T-□□□3</th> <th>E3T-□□□2 E3T-□□□4</th> </tr> </thead> <tbody> <tr> <td>Operating level x 1.2</td> <td>ON</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>Operating level</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>Operating level x 0.8</td> <td>ON</td> <td>OFF</td> <td>ON</td> </tr> </tbody> </table> <p>* If the E3T's operating level is set to the stable operation range, the E3T will be in most reliable operation without being influenced by temperature change, voltage fluctuation, dust, or setting change. If the operating level cannot be set to the stable operation range, pay attention to environmental changes while operating the E3T.</p>	Operating Level	Stability indicator (green)	Operation indicator (orange)		E3T-□□□1 E3T-□□□3	E3T-□□□2 E3T-□□□4	Operating level x 1.2	ON	ON	OFF	Operating level	OFF	OFF	OFF	Operating level x 0.8	ON	OFF	ON
Operating Level	Stability indicator (green)			Operation indicator (orange)															
		E3T-□□□1 E3T-□□□3	E3T-□□□2 E3T-□□□4																
Operating level x 1.2	ON	ON	OFF																
Operating level	OFF	OFF	OFF																
Operating level x 0.8	ON	OFF	ON																

### Use of E39-E10 Sensitivity Adjustment Unit

(Dark-ON: E3T-ST12)



1. Mount the Unit on the Receiver.
2. Set the adjuster of the Sensitivity Adjustment Unit to Max. (Before shipping: Max.)
3. After mounting on the Sensor, adjust the optical axis and secure the Sensor.
4. Place a workpiece between the Emitter and Receiver and gradually turn the adjuster counterclockwise toward the Min. side. Stop turning the adjuster when the operation indicator and stability indicator (green) turn ON.
5. Remove the workpiece and confirm that the operation indicator is OFF and the stability indicator (green) is ON. This completes the adjustment.

#### ●Others

Do not use the product under the following conditions.

- In the place exposed to the direct sunlight.
- In the place where humidity is high and condensation may occur.
- In the place where corrosive gas exists.
- In the place where vibration or shock is directly transmitted to the product.

### 3. Information of standards

E3T-ST□/FT□ series applies with the following standards.

#### 3.1 Compliant Standards

- EMC: IEC60947-5-2:2019
- Low Voltage: IEC60947-5-2:2019

#### 3.2 Certification Standards

TUV: ISO13849-1:2023(Cat 1, PL c),IEC60947-5-2:2019

#### 3.3 Safety states

In case of E3T-ST/FT failure, safety state is Output transistor OFF.

#### 3.4 Safety-related parameters

Parameter	E3T-ST□/FT□
Output short-circuit protection	Yes
MTTF <sub>d</sub>	100years
PFH <sub>d</sub> [1/h]	$2.91 \times 10^{-7}$
DC <sub>avg</sub>	0
T <sub>M</sub>	20years
Response time	1ms max.

#### 3.5 Environment conditions

Parameter	E3T-ST□/FT□
Ambient temperature	Operation: -25 to +55 °C, Storage: -40 to +70 °C (with no condensing environment)
Ambient humidity	Operation: 35 to 85 % RH, Storage: 35 to 95 % RH (with no condensing environment)
Ambient illuminance	Incandescent light: 5,000 lx or less at the light-receiving face Sun light: 10,000 lx or less at the light-receiving face
Altitude	2000m max.
Pollution degree	3

## 4. Maintenance Checklist

### **WARNING**

Please perform daily and periodic inspections for all E3T-ST□/FT□ units. Operating this device without performing the inspection or without removing the abnormal condition may cause death or serious injury.

#### 4.1 Daily Inspection Checklist

Control output shall operate as follows:

- (Light-On Type) Output is ON when light is interrupted or OFF when light is incident.
- (Dark-On Type) Output is OFF when light is interrupted and ON when light is incident.

The operation indicator light shall exhibit the following behavior:

- (Light-On Type): The indicator light turns ON when light is incident (control output ON) and turns off when light is interrupted (control output OFF).
- (Dark-On Type): The indicator light turns OFF when light is incident (control output OFF) and turns off when light is interrupted (control output ON).
- Do not install equipment that generates external light disturbance, reflected light in the surroundings.
- Safety equipment, such as safety covers, is not damaged.

#### 4.2 Regular Inspection Checklist

- Wiring from this product is correct.
- There is no looseness in the screws related to this product, and connectors are not disconnected.
- The detection surface (lens) of the product is not dirty.

#### 4.3 Checklist for Product Replacement

Control output shall operate as follows:

- (Light-On Type) Output is ON when light is interrupted or OFF when light is incident.
- (Dark-On Type) Output is OFF when light is interrupted and ON when light is incident.

The operation indicator light shall exhibit the following behavior:

- (Light-On Type): The indicator light turns ON when light is incident (control output ON) and turns off when light is interrupted (control output OFF).
- (Dark-On Type): The indicator light turns OFF when light is incident (control output OFF) and turns off when light is interrupted (control output ON).
- Wiring from this product is correct.
- There is no looseness in the screws related to this product, and connectors are not disconnected.
- For installation, please refer to "1.2 Dimensions" and "1.3 Mounting distance".

\*Please confirm the inspection frequency for the entire application based on your own risk assessment.

\* If any abnormalities are found during the inspection, please refer to "5.Troubleshooting".



## 5. Troubleshooting

If the product is not operating or if there are abnormalities such as the output not switching ON/OFF, please take the following measures.

Unit	Trouble Contents	Cause and measures
Emitter	Emitter is not emitting red light. (Red LED )	There may be no power supply voltage. Please supply DC12~24V to the power supply voltage.
		There may be a wiring error. Please refer to the output circuit diagram for '1.1 Control output/Operating mode' and ensure correct wiring.
	The power indicator light (red) is not lighting up. (Infrared LED)	If the above measures do not restore operation, there may be a product malfunction. We recommend replacing the product.
Receiver	Both the orange and green indicator lights are not illuminated.	There may be no power supply voltage. Please supply DC12~24V to the power supply voltage.
		There may be a wiring error. Please refer to the output circuit diagram for '1.1 Control output/Operating mode' and ensure correct wiring.
		If the above measures do not restore operation, there may be a product malfunction. We recommend replacing the product.
	The control output is not switching ON/OFF.	There may be a short circuit with other signal lines to the control output. Please ensure the control output is correctly wired.
		There is a possibility that the lens surfaces of the projector and receiver are dirty. Please check the lens surfaces and keep them clean.
		There is a possibility that the optical axes of the projector and receiver are misaligned. Please check the mounting condition and ensure correct installation.
		The load may be short-circuited, and the load short-circuit protection function may be activated. Please check the condition of the load and ensure correct wiring.
		The load current may exceed the rated value, and it is possible that the load short-circuit protection function is working properly. Please check the load you are using.
		If the above measures do not restore operation, there may be a product malfunction. We recommend replacing the product.

## 6 . Revision History

Revision symbol	Revision date	Revisions
A	April, 2024	First release

**Note: Do not use this document to operate the Unit.**

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