Color Mark Photoelectric Sensor

E3S-DC

Color Mark Detection on Any Type of Packaging.

- Narrow Beam and large lens for stable detection of workpieces tilted at various angles.
- Detects subtle color differences.
- High luminance, three-element (RGB) LED light source for greater light intensity.
- Highly efficient optics technology provides high power and enables stable detection even of subtle color differences.
- Handles glossy workpieces.
- Thorough noise reduction.
- High dynamic range covers everything from black to mirror surfaces.
- IoT compatible.
- Models that support IO-Link also available.
- Sends RGB information to host with high-speed IO-Link communications.
- Optimum threshold set to reduce false detection.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Refer to *Safety Precautions* on page 17.

Ordering Information

Sensors (Refer to *Dimensions* on page 18.)

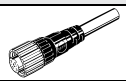
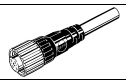
Red light, Green light, Blue light

Sensing method	Appearance	Connection method	Sensing distance	Output	Model	Baud rate *
Diffuse-reflective (mark detection)		M12 connector	10±3 mm	Push-pull	**E3S-DCP21-IL2**	COM2
					E3S-DCP21-IL3	COM3
				NPN	**E3S-DCN21**	---

Note: Download the IO-Link setup file (IODD file) from your OMRON website.
* Refer to *Ratings and Specifications* on page 13 for the baud rate.

Accessories (Sold Separately)

Sensor I/O Connectors (Required for a Sensor with a connector.)
Connectors are not provided with the Sensors. Be sure to order a Connector separately.

Size	Type	Appearance	Cable length	Model
M12	Socket on one cable end	Straight 	2 m	**XS2F-D421-D80-F**
			5 m	**XS2F-D421-G80-F**
		L-shape *2	2 m	**XS2F-D422-D80-F**
			5 m	**XS2F-D422-G80-F**
	Socket and plug on cable ends *1	Smartclick connector Straight/straight 	2 m	**XS5W-D421-D81-F**
			5 m	**XS5W-D421-G81-F**
		Smartclick connector L-shape/L-shape *2	2 m	**XS5W-D422-D81-F**
			5 m	**XS5W-D422-G81-F**

Note: 1. Refer to *Sensor I/O Connectors/Sensor Controllers* on your OMRON website for details.
The XS2W (Socket and Plug on Cable Ends) and XS5F (Socket on One Cable End) are also available.
There are also straight type/L-shape type combinations available.
2. The connectors will not rotate after they are connected.

Ratings and Specifications

Item	Model			
Sensing method		Diffuse-reflective (mark detection)		
Output		Push-pull		NPN
		E3S-DCP21-IL2	E3S-DCP21-IL3	E3S-DCN21
Sensing distance		10 ±3 mm (White paper 10 ×10 mm)		
Spot size (reference value)		1 × 4 mm		
Light source (wavelength)		Red LED (635 nm), Green LED (525 nm), Blue LED (465 nm)		
Power supply voltage		10 to 30 VDC±10% (Ripple (p-p) 10% max.)		
Power consumption		960 mW max. (Reference: Power supply voltage 24 V, Current consumption 40 mA max.)		
Control output		Load current: 100 mA max. (30 VDC max.)		
Indications		Operation indicator (orange), RUN indicator (green), 7-segment indicator (white), Key lock indicator (white), Timer indicator (white), 1-point teaching mode indicator (white)		
Operation mode		High when mark is detected.		ON when mark is detected.
Protection circuits		Power supply reverse polarity protection, output short-circuit protection and output incorrect connection protection		
Response time		Operate or reset: 50 μs max. for each (2-point teaching mode) Operate or reset: 150 μs max. for each (1-point teaching mode)		
Sensitivity adjustment		Teaching method		
Ambient illumination		Incandescent lamp: 3,000 lx max.		
Ambient temperature range		Operating: −10 to 55°C; Storage: −25 to 70°C (with no icing or condensation)		
Ambient humidity range		Operation: 35% to 85%, Storage: 35% to 95% (with no condensation)		
Insulation resistance		20 MΩ min. (at 500 VDC)		
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min		
Vibration resistance		Destruction: 10 to 55 Hz with double amplitude of 1.5 mm for 2 hours each in X, Y, and Z directions		
Shock resistance		Destruction: 500 m/s² 3 times each in X, Y, and Z directions		
Degree of protection		IEC 60529 IP67		
Connection method		M12, 4-pin connector		
Weight (packed state/Sensor only)	Model with connector	Approx. 370 g/approx. 320 g		
Materials	Case	Diecast zinc (nickel-plated brass)		
	Lens	Methacrylic resin (PMMA)		
	Indicators	ABS		
	Buttons	Elastomers		
	Connector	Diecast zinc (nickel-plated brass)		
Main IO-Link functions		• Operation mode switching between NO and NC • Timer function of the control output and timer time selecting function (Select a function from disabled, ON delay, OFF delay, one-shot or ON/OFF delay.) (Select a timer time of 1-5000 ms.) • Selecting function of ON delay timer time for instability (0 (disabled)-1000 ms) • Monitor output function (PD output indicating a relative detection quantity) • Energizing time read-out function (unit: h) • Initialize the settings function “Restore the factory settings”		---
Communication specifications	IO-Link specification	Version 1.1		---
	Baud rate	E3S-DCP21-IL3: COM3 (230.4 kbps), E3S-DCP21-IL2: COM2 (38.4 kbps)		---
	Data length	PD size: 8 bytes, OD size: 1 byte (M-sequence type: TYPE_2_2)		---
	Minimum cycle time	E3S-DCP21-IL3 (COM3): 1.5 ms, E3S-DCP21-IL2 (COM2): 4.8 ms		---
Accessories		Instruction manual		---

* Standard Sensing Object for the Mark Sensor

Color	Munsell code
White	N9.5
Red	4R 4.5/12.0
Yellow-red	4YR 6.0/11.5
Yellow	5Y 8.5/11.0
Yellow-green	3GY 6.5/10.0
Green	3G 6.5/9.0
Blue-green	5BG 4.5/10.0
Blue	3PB 5.0/10.0
Blue-purple	9PB 5.0/10.0
Purple	7P 5.0/10.0
Red-purple	6RP 4.5/12.5
(Black)	(N2.0)

Engineering Data (Reference Value)

Color vs. Detection Capability

E3S-DC

Teaching Capabilities

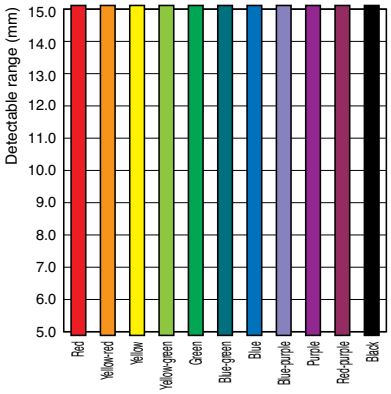
	White	Red	Yellow -red	Yellow	Yellow -green	Green	Blue -green	Blue	Blue -purple	Purple	Red -purple	Black
White		○	○	○	○	○	○	○	○	○	○	○
Red	○		○	○	○	○	○	○	○	○	○	○
Yellow -red	○	○		○	○	○	○	○	○	○	○	○
Yellow	○	○	○		○	○	○	○	○	○	○	○
Yellow -green	○	○	○	○		○	○	○	○	○	○	○
Green	○	○	○	○	○		○	○	○	○	○	○
Blue -green	○	○	○	○	○	○		○	○	○	○	○
Blue	○	○	○	○	○	○	○		○	○	○	○
Blue -purple	○	○	○	○	○	○	○	○		○	○	○
Purple	○	○	○	○	○	○	○	○	○		○	○
Red -purple	○	○	○	○	○	○	○	○	○	○		○
Black	○	○	○	○	○	○	○	○	○	○	○	

Note: The above chart shows the combinations of colors for which teaching is possible at a sensing distance of 10 mm.

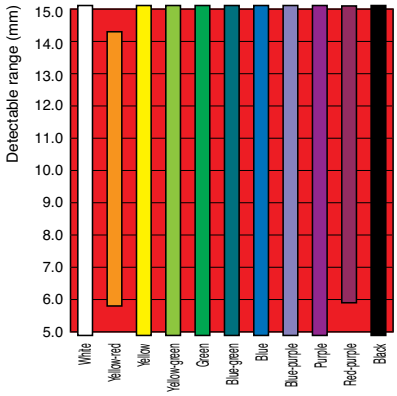
Detectable Ranges

E3S-DC

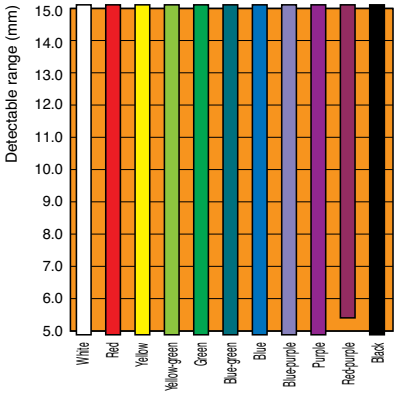
Background color: White
Teaching distance: 10 mm



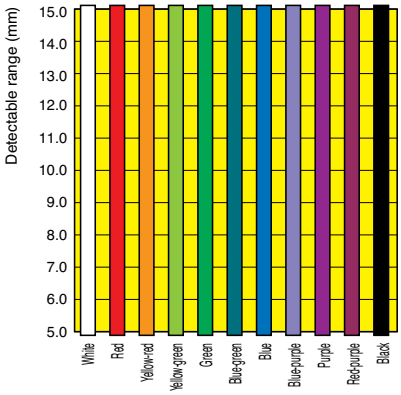
Background color: Red
Teaching distance: 10 mm



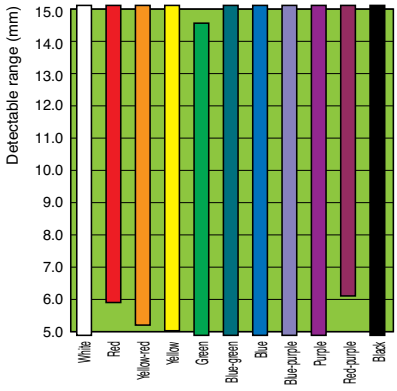
Background color: Yellow-red
Teaching distance: 10 mm



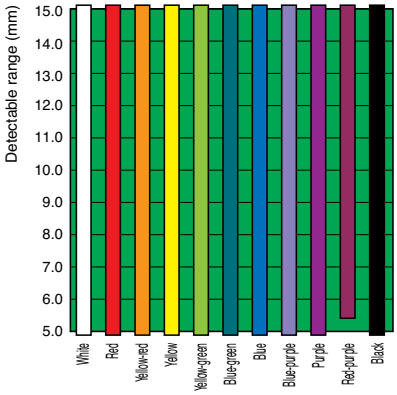
Background color: Yellow
Teaching distance: 10 mm



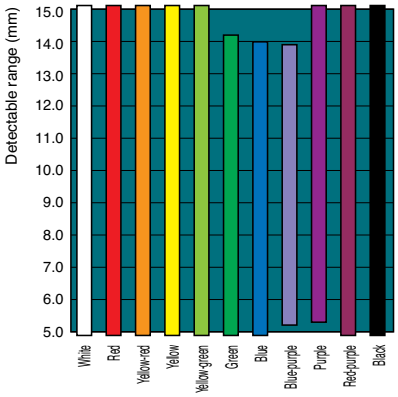
Background color: Yellow-green
Teaching distance: 10 mm



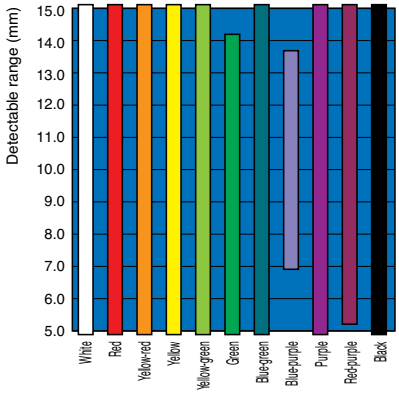
Background color: Green
Teaching distance: 10 mm



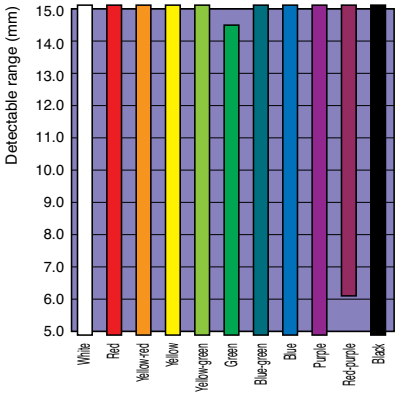
Background color: Blue-green
Teaching distance: 10 mm

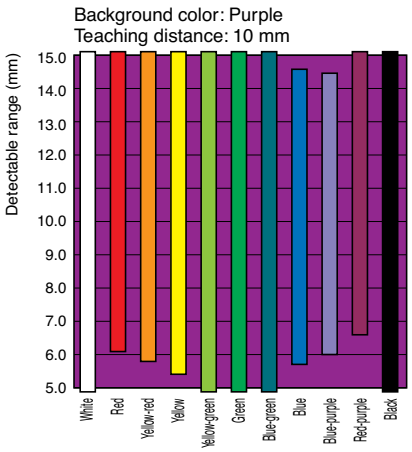


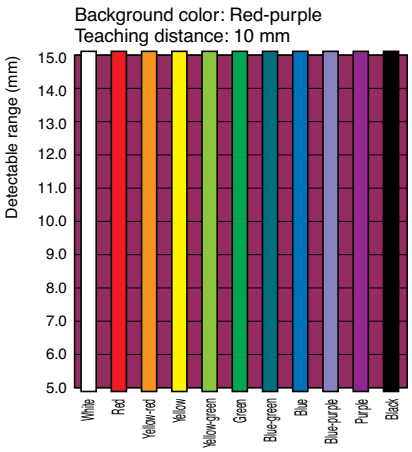
Background color: Blue
Teaching distance: 10 mm

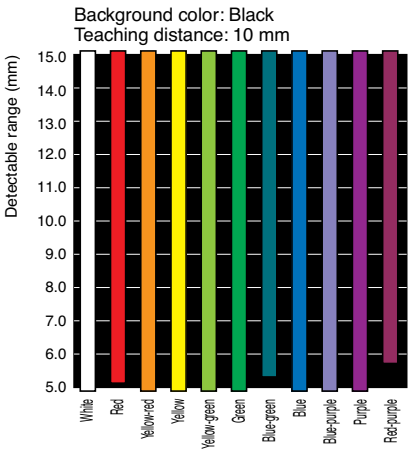


Background color: Blue-purple
Teaching distance: 10 mm



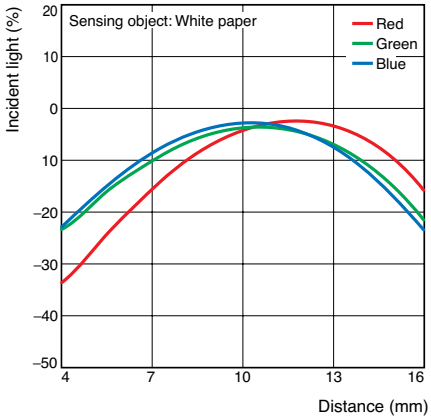


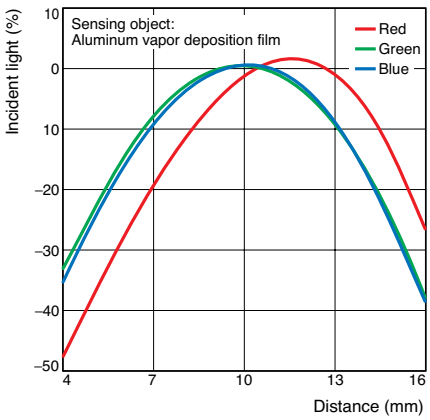




Excess Gain vs. Distance

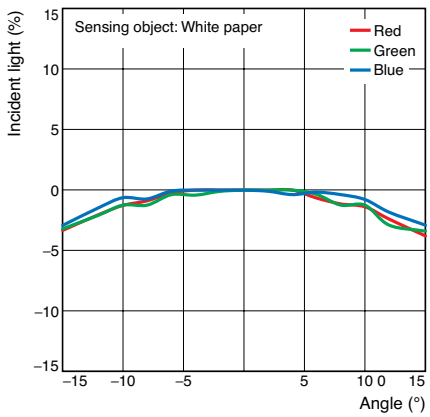
E3S-DC

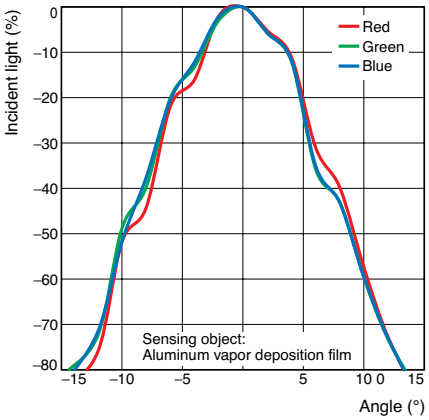




Angle vs. Incident Characteristics

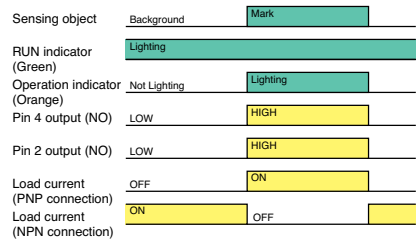
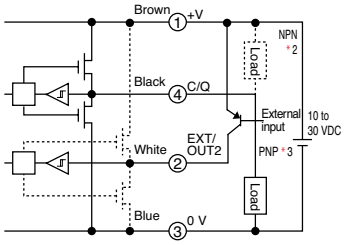
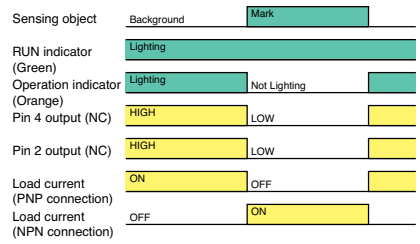
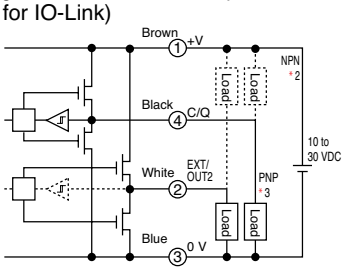
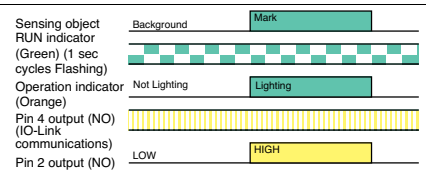
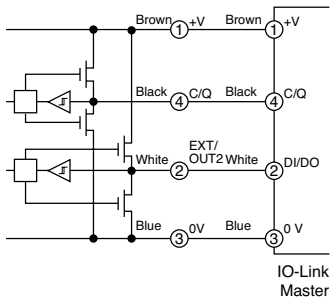
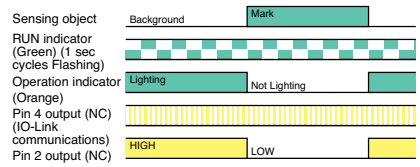
E3S-DC





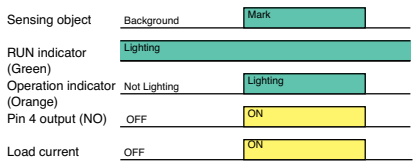
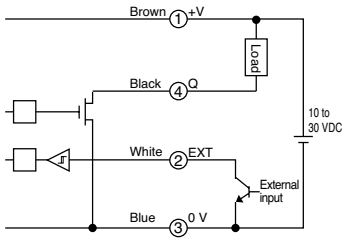
I/O Circuit Diagrams

Push-Pull Output

Model	Output mode	NO/NC setting * 4	Timing chart	Output circuit
E3S-DCP21-IL2 E3S-DCP21-IL3	Standard I/O mode (SIO mode) (Pin 2 Output Settings)	NO * 5		Using Pin 2 as an external input * 1 (enabled by default) 
		NC		Using Pin 2 with a control output * 1 (set for IO-Link) 
	IO-Link mode (Pin 2 Output Settings)	NO * 5		
		NC		

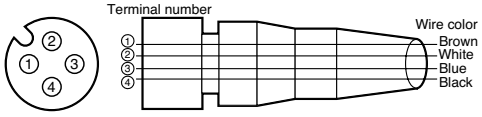
*1. Pin 2 input/output can be switched with the IO-Link communication command “Switchpoint Pin 2”.
*2. In case of NPN connection, please connect the load between Pin 1 and Pin 4.
*3. In case of PNP connection, please connect the load between Pin 3 and Pin 4.
*4. It can be switched in IO-Link.
*5. Factory default
Note: You can use IO-Link communications to reverse the operation logic, set an output delay, and change between an input and output.

NPN Output

Model	Timing chart	Output circuit
E3S-DCN21		

Plugs (Sensor I/O Connectors)

M12, 4-pin Connector



Classification	Wire color	Connector pin No.	Application	
			E3S-DCP21-IL2 E3S-DCP21-IL3	E3S-DCN21
DC	Brown		Power supply (+V)	Power supply (+V)
	White		External input *	External input
	Blue		Power supply (0 V)	Power supply (0 V)
	Black		Output C/Q	Control output

* It can be set as the control output with IO-Link.

Nomenclature

Operation indicator (Orange)
Turns ON when the mark is detected.
(when Pin 4 is set as NO)

7-segment indicator (White)
Displays the BANK No. being selected.

Key lock indicator (White)
Turns ON when key locksetting is activated.

Timer indicator (White)
Turns ON when timer setting is activated.

1-point teaching mode indicator (White)
Turns ON when 1-point teaching mode is active.

RUN indicator (Green)
Turns ON when power is supplied.
Blinks during IO-Link communication.

Setup change
[BANK] button
Changes the BANK setting.
(BANK NO.)

Sensitivity setting (Background)
[BKGD] button
Executes the background teaching.

Sensitivity setting (Mark)
[MARK] button
Executes the mark teaching.

Safety Precautions

Be sure to read the precautions for all models in the website at: http://www.ia.omron.com/.

Warning Indications

⚠WARNING	**Warning level** 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.
Precautions for Safe Use	Supplementary comments on what to do or avoid doing, to use the product safely.
Precautions for Correct Use	Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction or undesirable effect on product performance.

Meaning of Product Safety Symbols

	General prohibition Indicates the instructions of unspecified prohibited action.
	Caution, explosion Indicates the possibility of explosion under specific conditions.
	Caution, fire Indicates the possibility of fire under specific conditions.
	General caution Indicates unspecified general alert.

⚠ WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purpose.

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

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

Be sure to tighten the external lens until it reaches the chassis.

Precautions for Safe Use

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

1. Do not install the product in the following locations.
   - Locations subject to direct sunlight
   - Locations subject to condensation due to high humidity
   - Locations subject to corrosive gas
   - In the place where vibration or shock is directly transmitted to the product.
2. Do not use the product in environments subject to flammable or explosive gases.
3. Do not use the product in any atmosphere or environment that exceeds the ratings.
4. Do not pull on the cable with excessive strength.
5. Do not attempt to disassemble, repair, or modify the product in any way.
6. Do not use the product with the main unit damaged.
7. Be sure that before making supply the supply voltage is less than the maximum rated supply voltage (30 VDC).
8. Do not apply any load exceeding the ratings.
9. Do not short the load. Otherwise damage or fire may result.
10. Connect the load correctly.
11. Do not use the product under a chemical or an oil environment without prior evaluation.
12. Though this is type IP67, do not use in the water, rain or outdoors.
13. Do not use thinner, alcohol, or other organic solvents. Otherwise, the optical properties and degree of protection may be degraded.
14. When disposing of the product, treat it as industrial waste.
15. These Sensors are certificated for the UL standard on the assumption of usage in a Class 2 circuit. Use them with Class 2 power supplies in the United States or Canada. Use the OMRON XS2F-D4-series or XS5F-D4-series Cables. Cables that have wires less than AWG24 (0.2 mm^2) are for connection to terminal blocks and are not for field splicing. External overcurrent protection of 1 A for AWG26, 2 A for AWG24, or 3 A for AWG22 wire must be provided for cable protection.

Precautions for Correct Use

1. Note that the water-resistant function is impaired if installing the Photoelectric Sensor by hitting it with a hammer and so on.
2. Be sure to tighten the external lens until it reaches the chassis.
3. If the Sensor wiring is placed in the same conduits or ducts as high-voltage or high-power lines, inductive noise may cause malfunction or damage. Wire the cables separately or use a shielded cable.
4. To extend a cable in the standard I/O mode, use a cable of 0.3 mm^2 or more and keep the length 100 m or less. Keep the length 20 m or less if using the Sensor in the IO-Link mode.
5. Apply a screw tightening torque of 2.0 N·m or less.
6. If a commercial switching regulator is used, ground the FG (frame ground) terminal.
7. The Sensor will be able to detect objects 100 ms after the power supply is tuned ON. Start using the Sensor 100 ms or more after turning ON the power supply. If the load and the Sensor are connected to separate power supplies, be sure to turn ON the Sensor first.
8. Do not press the button with anything sharp such as a screwdriver because it might be damaged.
9. Output pulses may occur when the power supply is turned OFF. We recommend that you turn OFF the power supply to the load or load line first.

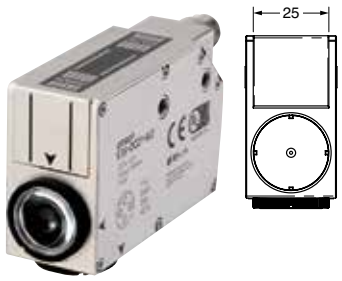
Dimensions

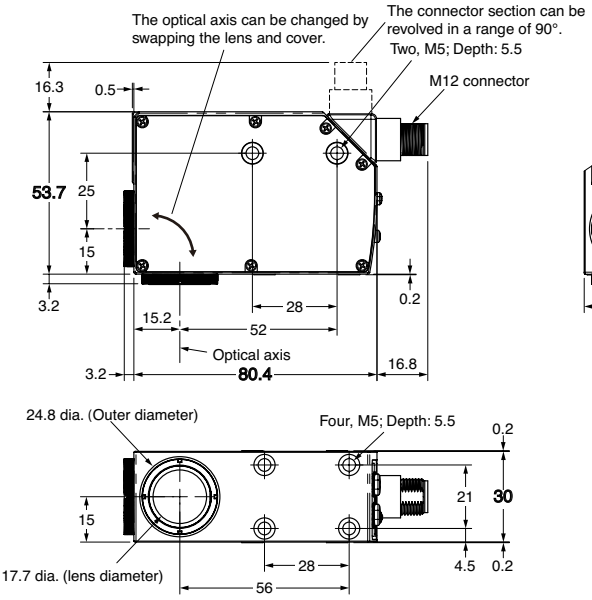
(Unit: mm)
Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

Sensors

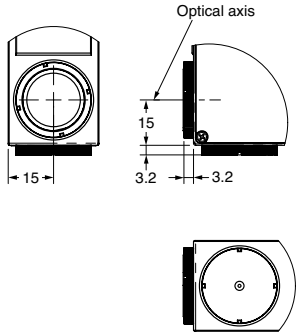
Diffuse-reflective Models

E3S-DCP21-IL2
E3S-DCP21-IL3
E3S-DCN21





When Lens or Cover Is Replaced



Note: 1. Apply a screw tightening torque of 2.0 N·m or less.
2. Be sure to tighten the external lens or cover until it reaches the chassis.

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