

Special family with inverted output logic

- Fully compatible with previous E3F2 family
- Simple installation due to compact format
- Wide variety of models



CE

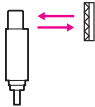
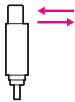
Ordering Information**E3FA/B straight types (PNP output)** [Refer to *Dimensions on page 8.*]
 Red light
 Infrared light

Sensor type	Sensing distance	Connection method	Model	
			Plastic housing	Metal housing
Through-beam ^{*1} 	 20 m	pre-wired	E3FA-TP11-F2 2M	E3FB-TP11-F2 2M
		M12 connector	E3FA-TP21-F2	E3FB-TP21-F2
Retro-reflective with MSR function ^{*2} 	 0.1 to 4 m with E39-R1S	pre-wired	E3FA-RP11-F2 2M	E3FB-RP11-F2 2M
		M12 connector	E3FA-RP21-F2	E3FB-RP21-F2
Diffuse-reflective 	 100 mm	pre-wired	E3FA-DP11-F2 2M	E3FB-DP11-F2 2M
		M12 connector	E3FA-DP21-F2	E3FB-DP21-F2
	 300 mm	pre-wired	E3FA-DP12-F2 2M	E3FB-DP12-F2 2M
		M12 connector	E3FA-DP22-F2	E3FB-DP22-F2
	 1 m	pre-wired	E3FA-DP13-F2 2M	E3FB-DP13-F2 2M
		M12 connector	E3FA-DP23-F2	E3FB-DP23-F2
	 100 mm	pre-wired	E3FA-DP14-F2 2M	E3FB-DP14-F2 2M
		M12 connector	E3FA-DP24-F2	E3FB-DP24-F2
	 300 mm	pre-wired	E3FA-DP15-F2 2M	E3FB-DP15-F2 2M
		M12 connector	E3FA-DP25-F2	E3FB-DP25-F2
BGS (background suppression) 	 100 mm	pre-wired	E3FA-LP11-F2 2M	E3FB-LP11-F2 2M
		M12 connector	E3FA-LP21-F2	E3FB-LP21-F2
	 200 mm	pre-wired	E3FA-LP12-F2 2M	E3FB-LP12-F2 2M
		M12 connector	E3FA-LP22-F2	E3FB-LP22-F2

^{*1} The set type includes the emitter and receiver.^{*2} The Reflector is sold separately. Select the Reflector model most suited to the application.

E3FA/B_-F2

E3RA/B radial types (PNP output) [Refer to Dimensions on page 8.] Red light

Sensor type	Sensing distance	Connection method	Model	
			Plastic housing	Metal housing
Retro-reflective with MSR function^{*1} 	 0.1 to 3 m with E39-R1S	pre-wired	E3RA-RP11-F2 2M	E3RB-RP11-F2 2M
		M12 connector	E3RA-RP21-F2	E3RB-RP21-F2
Diffuse-reflective 	 100 mm	pre-wired	E3RA-DP11-F2 2M	E3RB-DP11-F2 2M
		M12 connector	E3RA-DP21-F2	E3RB-DP21-F2
	 300 mm	pre-wired	E3RA-DP12-F2 2M	E3RB-DP12-F2 2M
		M12 connector	E3RA-DP22-F2	E3RB-DP22-F2

^{*1} The Reflector is sold separately. Select the Reflector model most suited to the application.

Ratings and Specifications

Straight type (E3FA/E3FB)

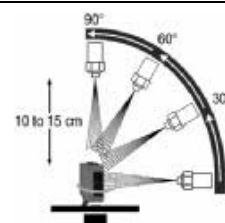
Model Item	Sensing method		Through-beam	Retro-reflective with MSR function
	PNP output	Pre-wired M12 Connector	E3F□-TP11-F2 2M E3F□-TP21-F2	E3F□-RP11-F2 2M E3F□-RP21-F2
Sensing distance			20 m	0.1 to 4 m (with E39-R1S)
Spot diameter (reference value)			—	
Standard sensing object			Opaque: 7 mm dia.min.	Opaque: 75 mm dia.min.
Differential travel			—	
Directional angle			2° min.	
Light source (wavelength)			Red LED (624 nm)	Red LED (624 nm)
Power supply voltage			10 to 30 VDC (include voltage ripple of 10%(p-p) max.)	
Current consumption			40 mA max. (Emitter 25 mA max. Receiver 15 mA max.)	25 mA max.
Control output			PNP (open collector) Load current: 100 mA max. (Residual voltage: 3 V max.), Load power supply voltage: 30 VDC max.	
Operation mode			Light-ON/Dark-ON selectable by wiring	
Indicator			Operation indicator (orange) Stability indicator (green) Power indicator (green): only Emitter of Through-beam	
Protection circuits			Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection	
Response time			0.5 ms	
Sensitivity adjustment			One-turn adjuster	
Ambient illumination (Receiver side)			Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max.	
Ambient temperature range			Operating: -25 to 55°C/ Storage: -30 to 70°C (with no icing or condensation)	
Ambient humidity range			Operating: 35 to 85%/ Storage: 35 to 95% (with no condensation)	
Insulation resistance			20 MΩ min. at 500 VDC	
Dielectric strength			1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case	
Vibration resistance			Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions	
Shock resistance			Destruction: 500 m/s ² 3 times each in X, Y and Z directions	
Degree of protection			IEC: IP67, DIN 40050-9: IP69K ¹⁾	
Weight (packed state/only sensor)	Pre-wired cable (2M)		E3FA: Approx. 110 g/ Approx. 50 g, respectively, E3FB: Approx. 175 g/ Approx. 65 g, respectively	E3FA: Approx. 60 g/ Approx. 50 g, E3FB: Approx. 95 g/ Approx. 65 g
	Connector		E3FA: Approx. 30 g/ Approx. 10 g, respectively, E3FB: Approx. 85 g/ Approx. 20 g, respectively	E3FA: Approx. 20 g/ Approx. 10 g, E3FB: Approx. 50 g/ Approx. 20 g
Material	Case		E3FA: ABS, E3FB: Nickel-brass	
	Lens and Display		PMMA	
	Adjuster		POM	
	Nut		E3FA: POM, E3FB: Nickel-brass	
Accessories			Instruction sheet M18 nuts (4 pcs)	Instruction sheet M18 nuts (2 pcs)

¹⁾ IP69K Degree of Protection Specifications

IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.

The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute.

The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.



Straight type (E3FA/E3FB)

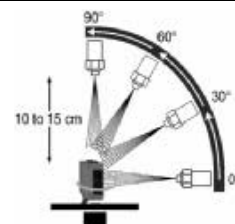
Model Item	Sensing method		Diffuse-reflective					
	PNP output	Pre-wired	E3F□-DP11-F2 2M	E3F□-DP12-F2 2M	E3F□-DP13-F2 2M	E3F□-DP14-F2 2M	E3F□-DP15-F2 2M	E3F□-DP16-F2 2M
		M12 Connector	E3F□-DP21-F2	E3F□-DP22-F2	E3F□-DP23-F2	E3F□-DP24-F2	E3F□-DP25-F2	E3F□-DP26-F2
Sensing distance			100 mm (white paper: 300 × 300 mm)	300 mm (white paper: 300 × 300 mm)	1 m (white paper: 300 × 300 mm)	100 mm (white paper: 300 × 300 mm)	300 mm (white paper: 300 × 300 mm)	1 m (white paper: 300 × 300 mm)
Spot diameter (reference value)			40 × 45 mm Sensing distance of 100 mm	40 × 50 mm Sensing distance of 300 mm	120 × 150 mm Sensing distance of 1 m	40 × 45 mm Sensing distance of 100 mm	40 × 50 mm Sensing distance of 300 mm	120 × 150 mm Sensing distance of 1 m
Standard sensing object			—					
Differential travel			20% max.					
Directional angle			—					
Light source (wavelength)			Red LED (624 nm)			Infrared LED (850 nm)		
Power supply voltage			10 to 30 VDC (include voltage ripple of 10%(p-p) max.)					
Current consumption			25 mA max.					
Control output			PNP (open collector) Load current: 100 mA max. (Residual voltage: 3 V max.), Load power supply voltage: 30 VDC max.					
Operation mode			Light-ON/Dark-ON selectable by wiring					
Indicator			Operation indicator (orange) Stability indicator (green)					
Protection circuits			Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection					
Response time			0.5 ms					
Sensitivity adjustment			One-turn adjuster					
Ambient illumination (Receiver side)			Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max.					
Ambient temperature range			Operating: -25 to 55°C/ Storage: -30 to 70°C (with no icing or condensation)					
Ambient humidity range			Operating: 35 to 85%/ Storage: 35 to 95% (with no condensation)					
Insulation resistance			20 MΩ min. at 500 VDC					
Dielectric strength			1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case					
Vibration resistance			Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions					
Shock resistance			Destruction: 500 m/s ² 3 times each in X, Y and Z directions					
Degree of protection			IEC: IP67, DIN 40050-9: IP69K ^{†1}					
Weight (packed state/only sensor)	Pre-wired cable (2M)		E3FA: Approx. 60 g/ Approx. 50 g, E3FB: Approx. 95 g/ Approx. 65 g					
	Connector		E3FA: Approx. 20 g/ Approx. 10 g, E3FB: Approx. 50 g/ Approx. 20 g					
Material	Case		E3FA: ABS, E3FB: Nickel-brass					
	Lens and Display		PMMA					
	Adjuster		POM					
	Nut		E3FA: POM, E3FB: Nickel-brass					
Accessories			Instruction sheet M18 nuts (2 pcs)					

^{†1} IP69K Degree of Protection Specifications

IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.

The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute.

The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.



Straight type (E3FA/E3FB)

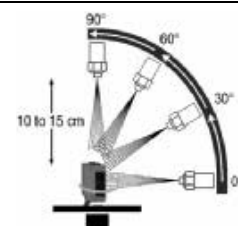
Model Item	Sensing method		BGS (Background suppression)	
	PNP output	Pre-wired	E3F□-LP11-F2 2M	E3F□-LP12-F2 2M
		M12 Connector	E3F□-LP21-F2	E3F□-LP22-F2
Sensing distance			100 mm (white paper: 300 × 300 mm)	200 mm (white paper: 300 × 300 mm)
Spot diameter (reference value)			10 × 10 mm Sensing distance of 100 mm	10 × 15 mm Sensing distance of 200 mm
Standard sensing object			—	
Differential travel			20% max.	
Directional angle			—	
Light source (wavelength)			Red LED (624 nm)	
Power supply voltage			10 to 30 VDC (include voltage ripple of 10%(p-p) max.)	
Current consumption			25 mA max.	
Control output			PNP (open collector) Load current: 100 mA max. (Residual voltage: 3 V max.), Load power supply voltage: 30 VDC max.	
Operation mode			Light-ON/Dark-ON selectable by wiring	
Indicator			Operation indicator (orange) Stability indicator (green)	
Protection circuits			Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection	
Response time			0.5 ms	
Sensitivity adjustment			Fixed	
Ambient illumination (Receiver side)			Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max.	
Ambient temperature range			Operating: -25 to 55°C/ Storage: -30 to 70°C (with no icing or condensation)	
Ambient humidity range			Operating: 35 to 85%/ Storage: 35 to 95% (with no condensation)	
Insulation resistance			20 MΩ min. at 500 VDC	
Dielectric strength			1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case	
Vibration resistance			Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions	
Shock resistance			Destruction: 500 m/s ² 3 times each in X, Y and Z directions	
Degree of protection			IEC: IP67, DIN 40050-9: IP69K ¹ *	
Weight (packed state/only sensor)	Pre-wired cable (2M)		E3FA: Approx. 60 g/ Approx. 50 g, E3FB: Approx. 95 g/ Approx. 65 g	
	Connector		E3FA: Approx. 20 g/ Approx. 10 g, E3FB: Approx. 50 g/ Approx. 20 g	
Material	Case		E3FA: ABS, E3FB: Nickel-brass	
	Lens and Display		PMMA	
	Adjuster		POM	
	Nut		E3FA: POM, E3FB: Nickel-brass	
Accessories			Instruction sheet M18 nuts (2 pcs)	

^{*1} IP69K Degree of Protection Specifications

IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.

The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute.

The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.



Radial type (E3RA/E3RB)

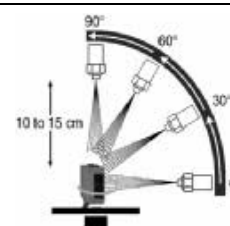
	Sensing method		Retro-reflective with MSR function	Diffuse-reflective	
Model Item	PNP output	Pre-wired M12 Connector	E3R□-RP11-F2 2M E3R□-RP21-F2	E3R□-DP11-F2 2M E3R□-DP21-F2	E3R□-DP12-F2 2M E3R□-DP22-F2
Sensing distance			0.1 to 3 m (with E39-R1S)	100 mm (white paper: 300 × 300 mm)	300 mm (white paper: 300 × 300 mm)
Spot diameter (reference value)			—	35 × 40 mm Sensing distance of 100 mm	40 × 45 mm Sensing distance of 300 mm
Standard sensing object			Opaque: 75 mm dia.min.	—	
Differential travel			—	20% max.	
Directional angle			2° min.	—	
Light source (wavelength)			Red LED (624 nm)		
Power supply voltage			10 to 30 VDC (include voltage ripple of 10%(p-p) max.)		
Current consumption			25 mA max.		
Control output			PNP (open collector) Load current: 100 mA max. (Residual voltage: 2 V max.), Load power supply voltage: 30 VDC max.		
Operation mode			Light-ON/Dark-ON selectable by wiring		
Indicator			Operation indicator (orange) Stability indicator (green) Power indicator (green): only Emitter of Through-beam		
Protection circuits			Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection		
Response time			0.5 ms		
Sensitivity adjustment			One-turn adjuster		
Ambient illumination (Receiver side)			Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max.		
Ambient temperature range			Operating: -25 to 55°C/ Storage: -30 to 70°C (with no icing or condensation)		
Ambient humidity range			Operating: 35 to 85%/ Storage: 35 to 95% (with no condensation)		
Insulation resistance			20 MΩ min. at 500 VDC		
Dielectric strength			1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case		
Vibration resistance			Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions		
Shock resistance			Destruction: 500 m/s ² 3 times each in X, Y and Z directions		
Degree of protection			IEC: IP67, DIN 40050-9: IP69K ^{*1} *		
Weight (packed state/only sensor)	Pre-wired cable (2M)		E3RA: Approx. 60 g/ Approx. 50 g, E3RB: Approx. 95 g/ Approx. 65 g		
	Connector		E3RA: Approx. 20 g/ Approx. 10 g, E3RB: Approx. 50 g/ Approx. 20 g		
Material	Case		E3RA: ABS, E3RB: Nickel-brass		
	Lens and Display		PMMA		
	Adjuster		POM		
	Nut		E3RA: POM, E3RB: Nickel-brass		
Accessories			Instruction sheet M18 nuts (2 pcs)		

^{*1} IP69K Degree of Protection Specifications

IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.

The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute.

The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.



Output circuit diagram

PNP Output

Model	Operation mode	Timing charts	Operation selector	Output circuit
E3F□-TP□ E3F□-RP□ E3F□-DP□ E3R□-RP□ E3R□-DP□	Light-ON	Light incident Light interrupted Operation indicator (orange) Output transistor Load (e.g., relay) Operate Reset (Between blue and black leads)	Connect the pink wire (Pin(2)) to the brown (Pin(1)) or open the pink wire (Pin(2))	Through-beam Receivers, Retro-reflective Models, Diffuse-reflective Models.
	Dark-ON	Light incident Light interrupted Operation indicator (orange) Output transistor Load (e.g., relay) Operate Reset (Between blue and black leads)	Connect the pink wire (Pin(2)) to the blue (Pin(3))	
Through-beam Emitter				
E3F□-LP□	Light-ON	NEAR FAR Operation indicator (orange) Output transistor Load (e.g., relay) Operate Reset (Between blue and black leads)	Connect the pink wire (Pin(2)) to the brown (Pin(1)) or open the pink wire (Pin(2))	Background suppression.
	Dark-ON	NEAR FAR Operation indicator (orange) Output transistor Load (e.g., relay) Operate Reset (Between blue and black leads)	Connect the pink wire (Pin(2)) to the blue (Pin(3))	

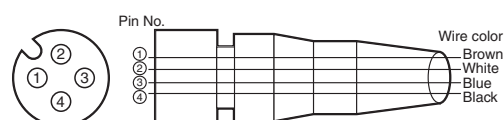
Connector Pin Arrangement

M12 Connector Pin Arrangement



Connectors (Sensor I/O connectors)

M12 4-wire Connectors



Classification	Wire color	Connector pin No.	Application
DC	Brown	①	Power supply (+V)
	White	②	L/on · D/on selectable
	Blue	③	Power supply (0 V)
	Black	④	Output

E3FA/B_-F2

Dimensions

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

Sensors (E3FA/E3RA Plastic housing)

E3FA series

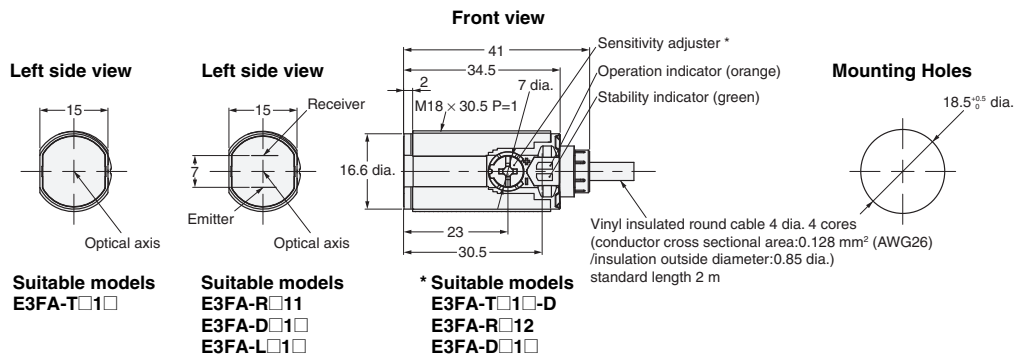
Pre-wired Models

E3FA-T□1□

E3FA-R□1□

E3FA-D□1□

E3FA-L□1□



E3FA series

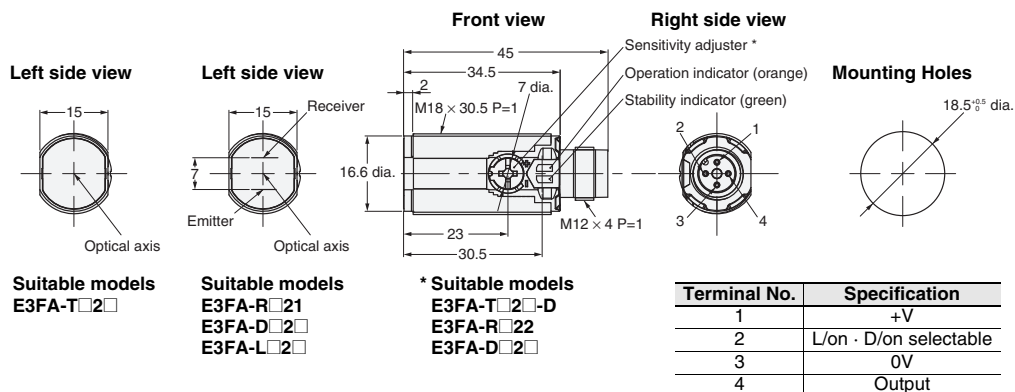
M12 Connector Models

E3FA-T□2□

E3FA-R□2□

E3FA-D□2□

E3FA-L□2□

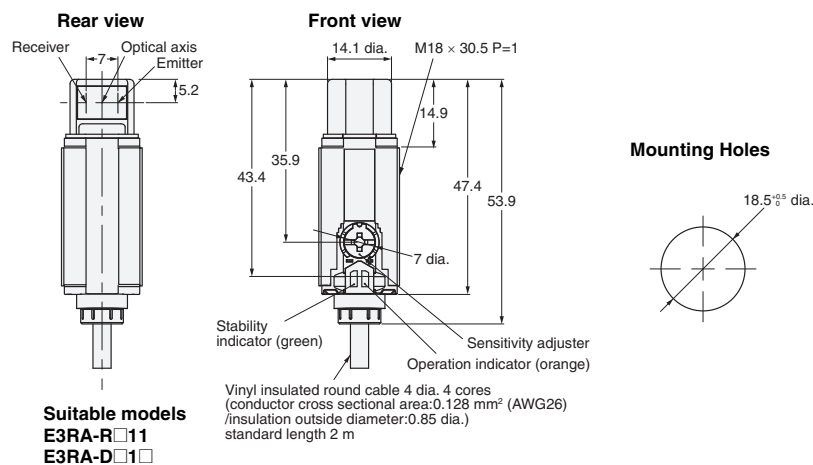


E3RA series

Pre-wired Models

E3RA-R□11

E3RA-D□1□

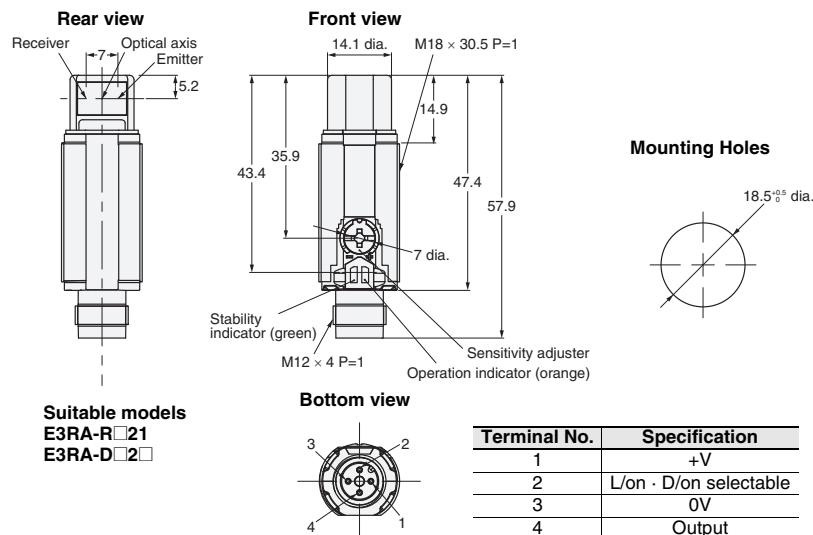


E3RA series

M12 Connector Models

E3RA-R□21

E3RA-D□2□



Sensors (E3FB/E3RB Metal housing)

E3FB series

Pre-wired Models

E3FB-T□11

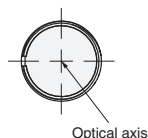
E3FB-R□1□

E3FB-D□1□

E3FB-L□1□

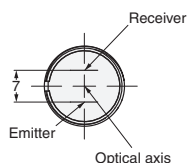


Left side view



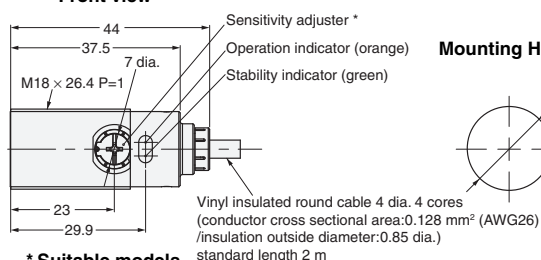
Suitable models
E3FB-T□11

Left side view



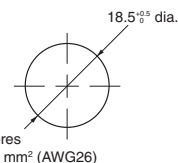
Suitable models
E3FB-R□11
E3FB-D□1□
E3FB-L□1□

Front view



* Suitable models
E3FB-T□11-D
E3FB-R□12
E3FB-D□1□

Mounting Holes



E3FB series

M12 Connector Models

E3FB-T□21

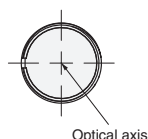
E3FB-R□2□

E3FB-D□2□

E3FB-L□2□

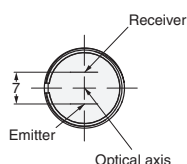


Left side view



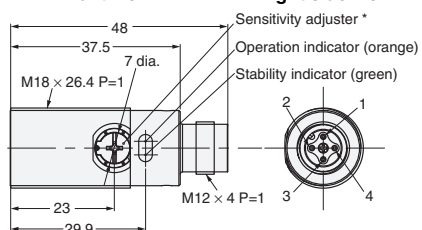
Suitable models
E3FB-T□21

Left side view



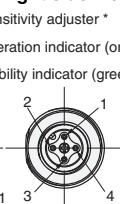
Suitable models
E3FB-R□21
E3FB-D□2□
E3FB-L□2□

Front view

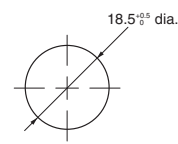


* Suitable models
E3FB-T□21-D
E3FB-R□22
E3FB-D□2□

Right side view



Mounting Holes



Terminal No.	Specification
1	+V
2	L/on · D/on selectable
3	0V
4	Output

E3RB series

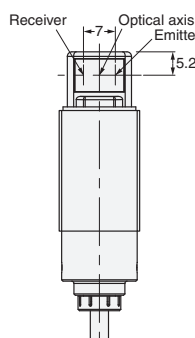
Pre-wired Models

E3RB-R□11

E3RB-D□1□

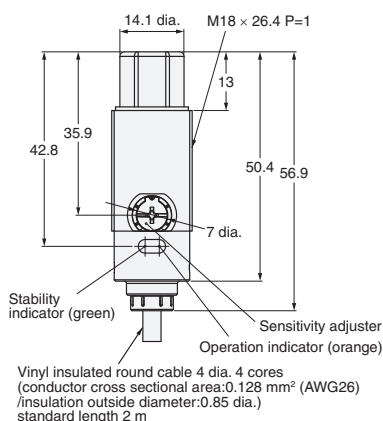


Rear view



Suitable models
E3RB-R□11
E3RB-D□1□

Front view



Mounting Holes



E3RB series

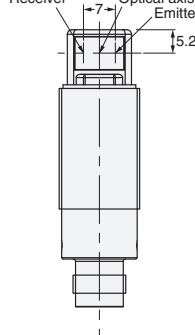
M12 Connector Models

E3RB-R□21

E3RB-D□2□

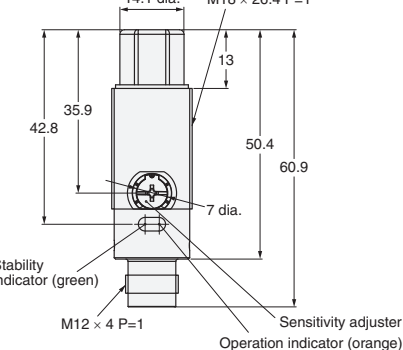


Rear view

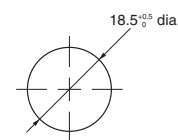


Suitable models
E3RB-R□21
E3RB-D□2□

Front view



Mounting Holes



Bottom view



Terminal No.	Specification
1	+V
2	L/on · D/on selectable
3	0V
4	Output

E3FA/B_-F2

Safety Precautions

Refer to *Warranty and Limitations of Liability*.

WARNING

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



CAUTION

Never use the product with an AC power supply.

Do not use the product with voltage in excess of the rated voltage.



Do not use the product with incorrect wiring.

Otherwise, explosion, fire, malfunction may result.



Precautions for Safe Use

Be sure to follow the safety precautions below for added safety.

1. Do not use the sensor under the environment with explosive, flammable or corrosive gas.
2. Do not use the sensor under the oil or chemical environment.
3. Do not use the sensor in the water, rain or outdoors.
4. Do not use the sensor in the environment where humidity is high and condensation may occur.

5. Do not use the sensor under the environment under the other conditions in excess of rated.
6. Do not use the sensor in place that is exposed by direct sunlight.
7. Do not use the sensor in place where the sensor may receive direct vibration or shock.
8. Do not use the thinner, alcohol, or other organic solvents.
9. Never disassemble, repair nor tamper with the sensor.
10. Please process it as industrial waste.

Precautions for Correct Use

1. Laying Sensor wiring in the same conduit or duct as high-voltage wires or power lines may result in malfunction or damage due to conduit or use shielded cable.
2. Do not pull on the cable with excessive force.
3. If a commercial switching regulator is used, ground the FG (frame ground) terminal.
4. The sensor will be available 100 ms after the power supply is tuned ON. Start to use 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.
5. Output pulses may be generated even when the power supply is OFF. Therefore, it is recommended to first turn OFF the power supply for the load or the load line.
6. The sensor must be mounted using the provided nuts. The proper tightening torque range of E3FA/E3RA plastic housing series is between 0.4 and 0.5 N·m. The proper tightening torque of E3FB/E3RB metal housing series is 20 N·m max..

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

OMRON Corporation Industrial Automation Company
Tokyo, JAPAN

Contact: www.ia.omron.com

Regional Headquarters

OMRON EUROPE B.V.
Sensor Business Unit
Carl-Benz-Str. 4, D-71154 Nufringen, Germany
Tel: (49) 7032-811-0/Fax: (49) 7032-811-199

OMRON ASIA PACIFIC PTE. LTD.
No. 438A Alexandra Road # 05-05/08 (Lobby 2),
Alexandra Technopark,
Singapore 119967
Tel: (65) 6835-3011/Fax: (65) 6835-2711

OMRON ELECTRONICS LLC
One Commerce Drive Schaumburg,
IL 60173-5302 U.S.A.
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

OMRON (CHINA) CO., LTD.
Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

Authorized Distributor:

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