Single-beam Safety Sensor

E3ZS/E3FS

CSM_E3ZS_E3FS_DS_E_10_4

Detects Intrusions into Hazardous Areas with a Single Beam and Complies with International Safety Standards.

⚠ Be sure to read the *"Safety Precautions"* on page 13.

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

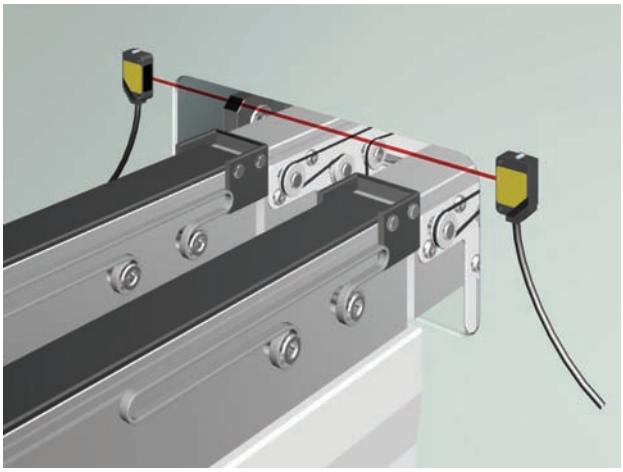
Note: Manufacturing of the E3FS listed in this datasheet was discontinued at the end of August 2016.

Features

Connect to a G9SP to Create a Type 2 Safety Sensor

Application Examples

For gaps in small-sized equipment



Protect personnel from the hazards of gaps in small-sized equipment or of semi-automated machinery.

The E3ZS is a Human Body Detection Sensor (Type 2) for production equipment. Make sure to use it in combination with an G9SP Safety Controller.

When used by itself, the E3ZS conforms to PLc/Safety Category 1 (EN ISO13849-1). No particular safety restrictions apply to the G9SP when used by itself, except the inability to use in human detection safety applications. We recommend using it in Light ON mode and using it with error detection via test input.

Note: Test Input
Use this function to enable the emitter of E3ZS to be turned ON/OFF from outside. It is possible to detect a number of E3ZS errors by monitoring the status of the test input and the E3ZS output signal.

For gaps in small to medium-sized equipment

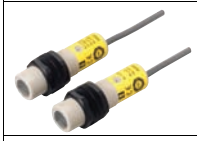
Use as a safety measure for protection from hazardous gaps or as guards for medium-sized equipment.

The E3FS is a Human Body Detection Sensor (Type 2) for production equipment. Make sure to use it in combination with a G9SP Safety Controller.

Ordering Information

Sensors

Red light Infrared light

Sensor method	Appearance	Case material	Sheath material	Connection method	Sensing distance	Output	Model
Through-beam		Polybutylene terephthalate	PVC	Pre-wired cable (2 m)	0.2 to 3 m	PNP	**E3ZS-T81A**
		ABS			10 m		**E3FS-10B4 2M ✻**
		Brass	---	M12 connector	10 m		**E3FS-10B4-M1-M ✻**

✻ Manufacturing has been discontinued.

Controller

Safety Controller G9SP Series

Name	No. of I/O points				Unit version	Model
	Safety inputs	Test outputs	Safety outputs	Standard outputs		
Safety Controller	10	4	Semiconductor outputs: 4	4	Ver.2.0	**G9SP-N10S**
	10	6	Semiconductor outputs: 16	---		**G9SP-N10D**
	20	6	Semiconductor outputs: 8	---		**G9SP-N20S**

Note: For details, refer to the G9SP Catalog (F090).

Accessories

Branch Connector

Appearance	Model
	**F39-CN3**

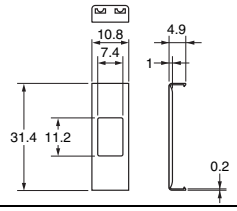
Sensor Mounting Bracket (for E3FS)

Appearance	Model
	**Y92E-B18**

Sensor Mounting Bracket (for E3ZS)

Appearance	Model
	**E39-L104**

Mutual Interference Prevention Filter (for E3ZS)

Dimensions	Model	Quantity	Remarks
	**E39-E11**	2 per Emitter and Receiver (4 total)	For use with E3ZS-T81A. This filter prevents mutual interference by changing the direction of polarized light of the 2 adjacent Emitter/Receivers. However, when the filter is attached, the maximum sensing distance of the E3ZS is reduced to 1.5 m.

Cables with Connectors (Socket and Plug) on Both Ends (for extension)

Type	Cable connection direction	Cable length L (m)	DC Model	UL standard
Fire-retardant, robot cable	Straight/straight	1	**XS2W-D421-C81-F**	●
		2	**XS2W-D421-D81-F**	
		5	**XS2W-D421-G81-F**	
		10	**XS2W-D421-J81-F**	
	Right angle/right angle	2	**XS2W-D422-D81-F**	
		5	**XS2W-D422-G81-F**	
	Straight/right angle	2	**XS2W-D423-D81-F**	
		5	**XS2W-D423-G81-F**	
	Right angle/straight	2	**XS2W-D424-D81-F**	
		5	**XS2W-D424-G81-F**	

Note: Extend the cable under the following conditions.
- Overall cable length for both an E3FS Receiver connected to an G9SP and the Emitter connected to the G9SP must be within 50 m.
- Overall cable length for both an E3ZS Receiver connected to an G9SP and the Emitter connected to the G9SP must be within 100 m.

Cables with Connector (Socket) on One End (connecting to G9SP)

Type	Cable connection direction	Cable length L (m)	DC Model	UL standard
Fire-retardant, robot cable	Straight	1	**XS2F-D421-C80-F**	●
		2	**XS2F-D421-D80-F**	
		5	**XS2F-D421-G80-F**	
		10	**XS2F-D421-J80-F**	
	Right angle	1	**XS2F-D422-C80-F**	
		2	**XS2F-D422-D80-F**	
		5	**XS2F-D422-G80-F**	
		10	**XS2F-D422-J80-F**	

Note: Extend the cable under the following conditions.
- Overall cable length for both an E3FS Receiver connected to an G9SP and the Emitter connected to the G9SP must be within 50 m.
- Overall cable length for both an E3ZS Receiver connected to an G9SP and the Emitter connected to the G9SP must be within 100 m.

Connector Plug Assemblies, Solder Type ✻

Applicable cable diameter (mm)	Cable connection direction	Connection method	Model
3 dia. (3 to 4 dia.)	Straight	Solder	**XS2G-D425**
	Right angle		**XS2G-D426**

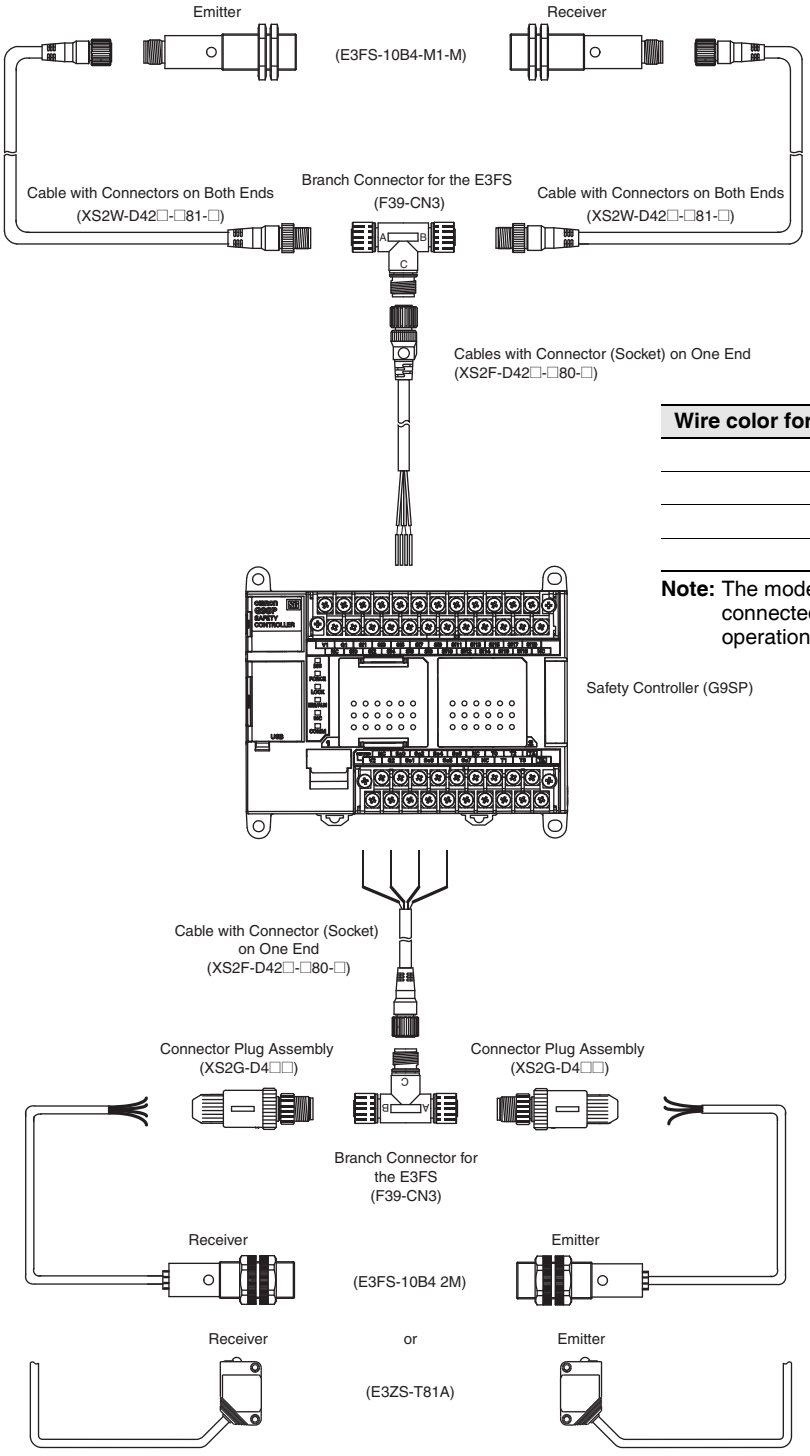
✻ Use when connecting an E3ZS-T81A or E3FS-10B4 2M to an F39-CN3 Branch Connector.

Connector Plug Assemblies, Screw-on Type ✻

Applicable cable diameter (mm)	Cable connection direction	Connection method	Model
3 dia. (3 to 4 dia.)	Straight	Screw-on	**XS2G-D4S5**
	Right angle		**XS2G-D4S6**

✻ Use when connecting an E3ZS-T81A or E3FS-10B4 2M to an F39-CN3 Branch Connector.

System Configuration



Wire color for XS2F-D42□-□80-□	Function
White	Test input
Black	Control input
Blue	0V
Brown	24V

Note: The mode selection input wire of the E3FS is connected to 24 V inside the F39-CN3. Light-ON operation is performed.

Specifications

E3ZS/E3FS

Item / Model		E3ZS-T81A	E3FS-10B4 2M	E3FS-10B4-M1-M
Sensor type		Through-beam models		
Safety category		See Applicable standards.		
Standard sensing object		Opaque object: 18 mm in diameter or greater	Opaque object: 11 mm in diameter or greater	
Lens diameter		Diameter 6.7 mm / diameter 9 mm		
Sensing distance		0.2 to 3 m	0 to 10 m	
Response time (under stable light incident condition)		1.0 ms (E3ZS only)	2.0 ms (E3FS only)	
Startup waiting time		100 ms		
Power supply voltage (Vs)		12 to 24 VDC±10% (ripple p-p 10% max.) ✻1	24 VDC±10% (ripple p-p 10% max.) ✻1	
Current consumption (no load)		Emitter: 15 mA max. Receiver: 20 mA max.	Emitter: 50 mA max. Receiver: 25 mA max.	
Light source (emitted wavelength)		Red LED (660 nm)	Infrared LED (870 nm)	
Effective aperture angle (EAA)		±5° (at 3 m)		
Control output (OSSD)		PNP transistor output, load current: 100 mA max., Residual voltage: 1 V max., (when load current is less than 10 mA), Residual voltage: 2 V max. (when load current is between 10 mA and 100 mA) (except for voltage drop due to cable extension) ✻1	PNP transistor output, load current: 100 mA max., Residual voltage: 2 V max. (except for voltage drop due to cable extension) ✻1	
Output operation mode		Light-ON ✻2		
Input voltage		22.5 to 24 VDC: Emitter OFF (source current: 3 mA max.) Open or 0 to 2.5 V: Emitter ON (leakage current: 0.1 mA max.) ✻1	21.5 to 24 VDC: Emitter OFF (source current: 3 mA max.) Open or 0 to 2.5 V: Emitter ON (leakage current: 0.1 mA max.) ✻1	
Indicators		Emitter: Emitting (orange); Receiver: Operation (orange), Stable (green)	Emitter: Emitting (orange); Receiver: Output OFF (red), Output ON (green)	
Test functions		External test (light emission stop function by test input)		
Connection method		Pre-wired cable (2 m)		M12 connector
Protective circuits		Power supply/output reverse connection protection, load short-circuit protection	Output reverse connection protection, load short-circuited protection	
Ambient temperature		Operating: –10 to 55°C Storage: –10 to 70°C (with no icing or condensation)	Operating: –20 to 55°C Storage: –30 to 70°C (with no icing or condensation)	
Ambient humidity		Operating: 35% to 85%, storage: 35% to 95% (with no icing or condensation)		
Ambient operating light intensity		Incandescent lamp: 3000 lx max (light intensity on the receiver surface). Sunlight: 10,000 lx max (light intensity on the receiver surface).		
Insulation resistance		20 MΩ min. (at 500 VDC)		
Dielectric strength		1000 VAC 50/60 Hz 1 min		
Degree of protection		IP67 (IEC standard)		
Vibration resistance	Operating limit	10 to 55 Hz, double amplitude: 0.7 mm, 50 min each in the X, Y, and Z directions		
	Malfunction	10 to 55 Hz, double amplitude: 1.5 mm, 2 h each in the X, Y, and Z directions		
Shock resistance	Operating limit	100 m/s^2, 1000 times in the X, Y, and Z directions		
	Malfunction	500 m/s^2, 3 times each in the X, Y, and Z directions		
Material		Case: Polybutylene terephthalate	Case: ABS	Case: Brass
Weight (packed state)		Approx. 120 g (for one set including 2-m cable)	Approx. 150 g (for one set including 2-m cable)	Approx. 125 g (for one set including only Sensor)
Accessories		Operation manual	Operation manual, nuts for mounting Emitter/Receiver (2 each)	
Applicable standards	Sensor only	IEC 60947-5-3 (PDDB) EN ISO13849-1 (PLc/Safety Category 1)	---	
	Sensor connected to G9SP	IEC(EN)61496-1 Type2 ESPE ✻3 IEC (EN)61496-2 Type2 AOPD ✻4 EN ISO13849-1 (PLc/Safety Category 2)		
Switching element category (from IEC60947-5-3)		DC13 (control of electromagnetic load)	---	

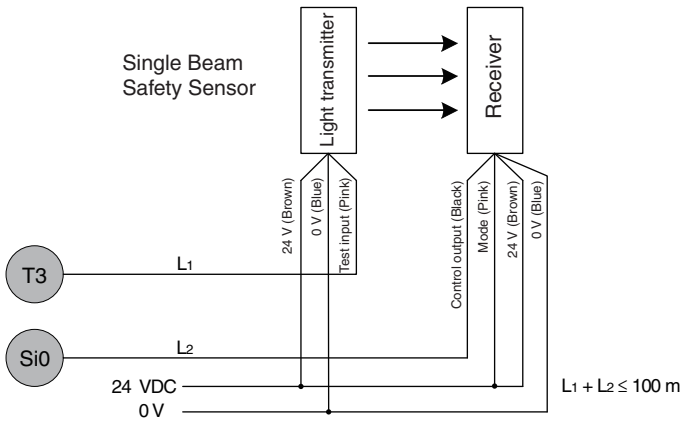
✻1. Connect the Sensor to an G9SP to use it as a safety device or as part of a safety system.
✻2. Depending on the wiring, this may turn ON when light is interrupted.
For your safety, be sure to connect the pink receiver wire (mode selection input) to 24 VDC to turn ON when light is incident.
✻3. Electro-Sensitive Protective Equipment
✻4. Active Opto-electronic Protective Device

Connections

Circuit Diagram Example

This section describes connecting an OMRON Safty Controller G9SP.

The OSSD 24-VDC semiconductor output from the Single Beam Safety Sensor is input.



G9SP Configurator Setting Example

Ter...	Name of settings	I/O Comment	Test Source
Si0	Single Beam Safety ...	Single Beam	T3

Note: 1. Only one E3ZS/E3FS Single Beam Safety Sensor can be connected to a G9SP-series Safety Controller with unit version 1.0 or unit version 1.1.
The maximum number of E3ZS/E3FS Single Beam Safety Sensors that can be connected to a G9SP-series Safety Controller with unit version 2.0 or later is as follows:
G9SP-N10S: 4 (1 Sensor · 4 systems)
G9SP-N10D/20S: 6 (1 Sensor · 6 systems)

2. The total wiring length ($L_1 + L_2$ in the above figure) for the E3ZS Single Beam Safety Sensor must be 100 m or less and for the E3FS Single Beam Safety Sensor must be 50 m or less.

3. The E3ZS/E3FS Single Beam Safety Sensor can be used in a Safety Category 2 or lower, or PLc or lower application. It cannot be used in a Safety Category 3 or higher, or PLd or higher application.

4. If you use more than one Single Beam Safety Sensor, it may not be possible to detect short circuits between wires. To satisfy safety category 2, you must protect the cables to the Single Beam Safety Sensors from external damage. Use ducts, separate the cables for each system, or implement other measures to protect the cables from external damage when you connect the Single Beam Safety Sensors. You can also provide protection against short circuits by using special cables (XS2F).

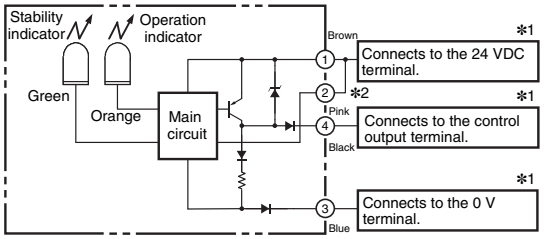
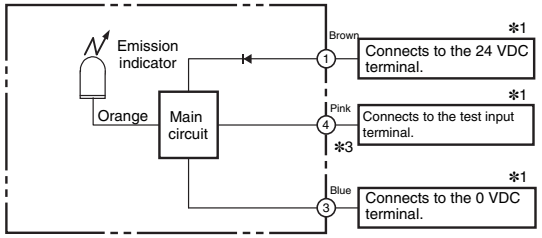
5. The test period for a Single Beam Safety Sensor test is as given below. Use the value as reference to determine conformance with standards for your system.
G9SP-N10S: 112 × Cycle time (ms)
G9SP-N10D/20S: 168 × Cycle time (ms)

I/O Circuit Diagrams

E3ZS

Circuit Diagrams (E3ZS-T81A with PNP Output)

Output mode: ON when light is incident (Light ON)

	I/O circuit
Receiver	
Emitter	

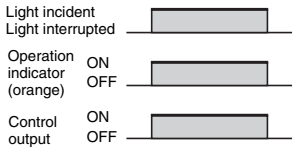
***1.** When using in Safety Category 2 or Type 2 ESPE configurations, make sure all terminals on a safety controller are properly connected.
See the safety controller operation manual for details.

***2.** Make sure to connect the pink wire (mode selection input 2) to 24 VDC.

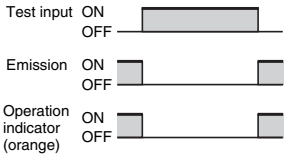
***3.** Make sure to connect to the 0V terminal when the E3ZS is not connected to a safety controller and the test input is not used.

Timing Charts

Output Modes and Timing Char



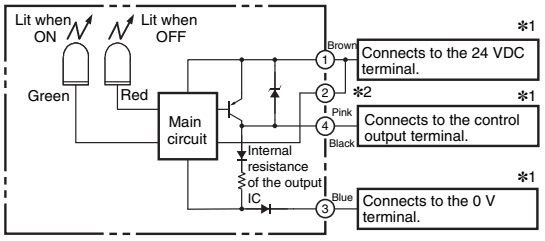
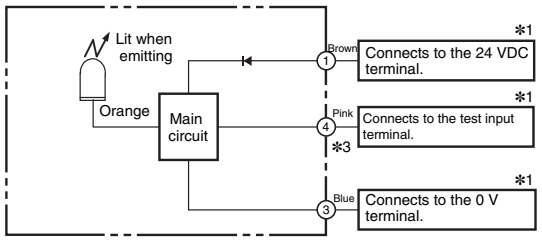
Emitter Timing Chart



E3FS

Circuit Diagrams (E3FS-10B4□□□ with PNP Output)

Output mode: ON when light is incident (Light ON).

	I/O circuit
Receiver	
Emitter	

***1.** Make sure all terminals on the G9SP are properly connected. Do not connect the terminals to another Module. See the G9SP operation manual for details.

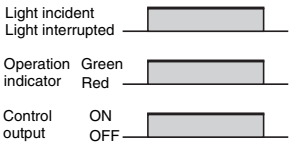
***2.** Make sure to connect the pink wire (mode selection input 2) to 24 VDC.

***3.** Make sure to connect to the 0V terminal when the E3FS is not connected to an G9SP and the test input is not used.

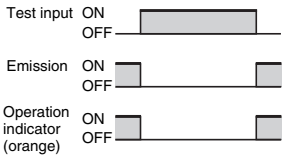
Note: The E3FS-10B4□□□ functions as a standalone Sensor when it is connected as shown in the wiring diagram above. However, it is certified a Type 2 Safety Sensor when it is properly connected to the B1 Module of the G9SP. This also means it must be properly connected to an G9SP to use it as part of a safety system.

Timing Charts

Output Modes and Timing Chart



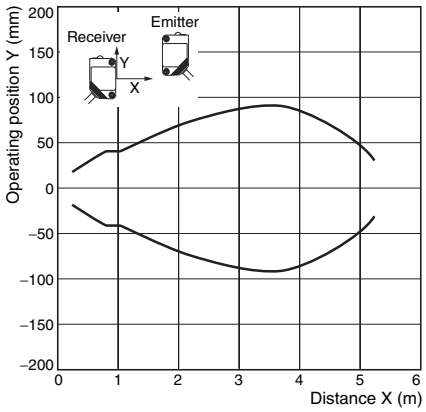
Emitter Timing Chart



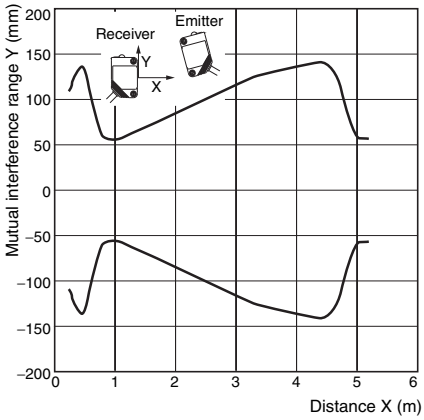
Engineering Data

E3ZS

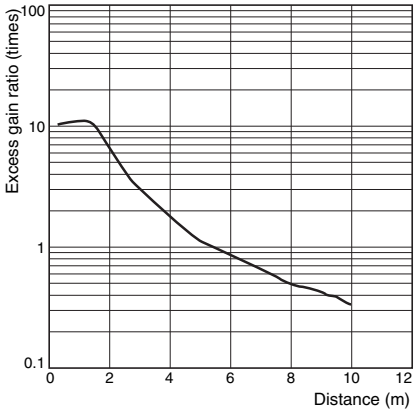
Parallel Operating Range



Mutual Interference Range

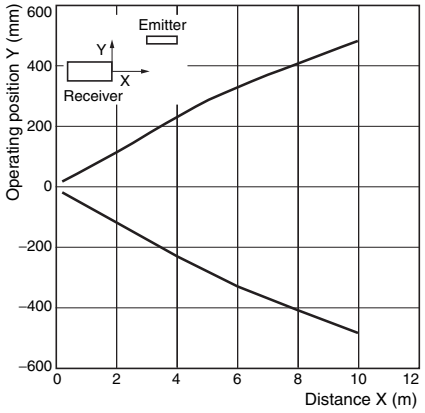


Excess Gain Ratio

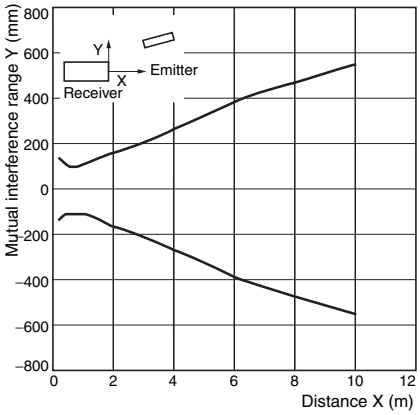


E3FS

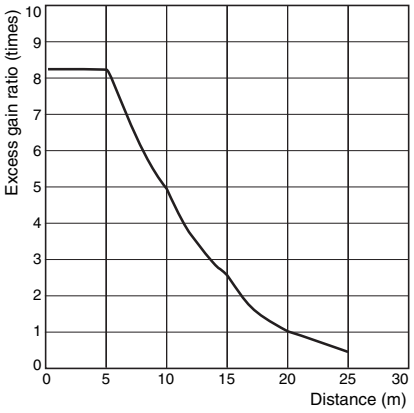
Parallel Operating Range



Mutual Interference Range



Excess Gain Ratio

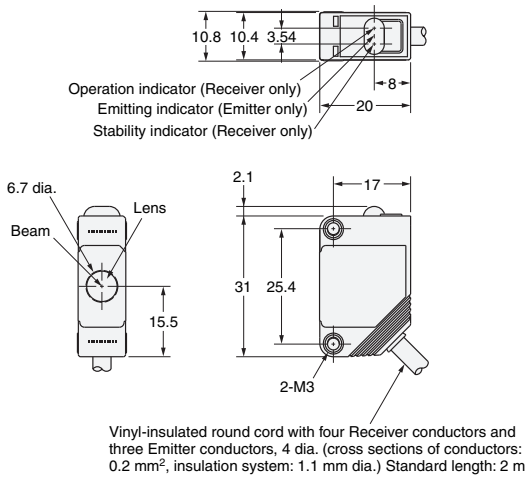


Dimensions

(Unit: mm)

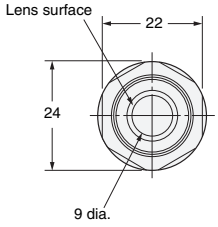
Sensors

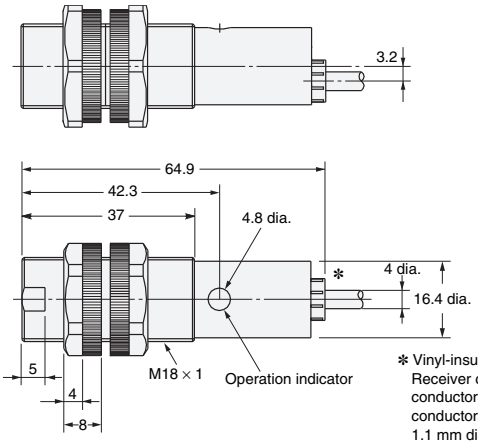
Pre-wired Cable with ABS Resin Case
E3ZS-T81A



Vinyl-insulated round cord with four Receiver conductors and three Emitter conductors, 4 dia. (cross sections of conductors: 0.2 mm^2, insulation system: 1.1 mm dia.) Standard length: 2 m

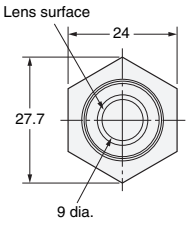
Pre-wired Cable with ABS Resin Case
E3FS-10B4 2M

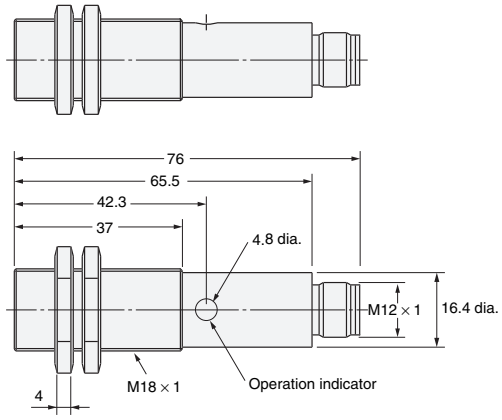




✻ Vinyl-insulated round cord with four Receiver conductors and three Emitter conductors, 4 dia. (cross sections of conductors: 0.2 mm^2, insulation system: 1.1 mm dia.)

Connector with Metal Case
E3FS-10B4-M1-M

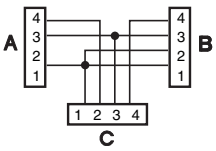


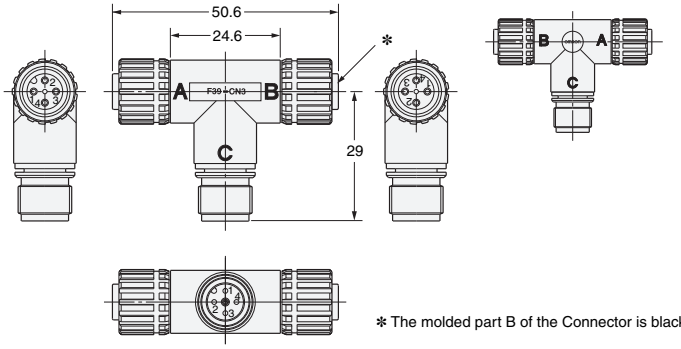


Accessories (Order Separately)

Branch Connector
F39-CN3

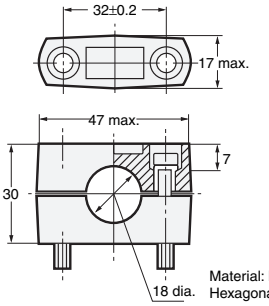
Wiring Diagram





✻ The molded part B of the Connector is black.

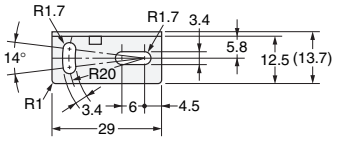
Sensor Mounting Bracket (for E3FS)
Y92E-B18

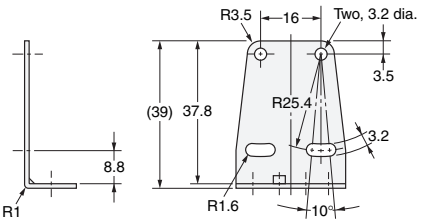


Material: Plastic
Hexagonal bolt: M5 x 32

Sensor Mounting Bracket (for E3ZS)
E39-L104

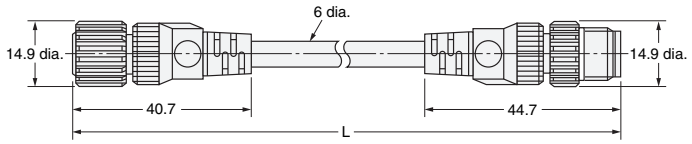
Material: Stainless steel (SUS304)



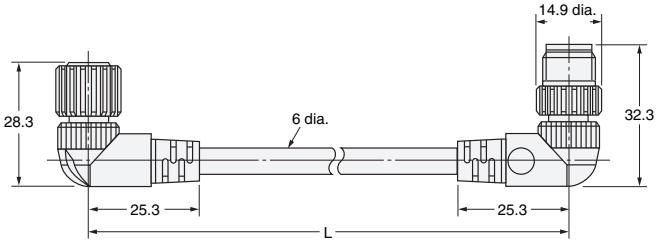


Cables with Connectors (Socket and Plug) on Both Ends (for extension)

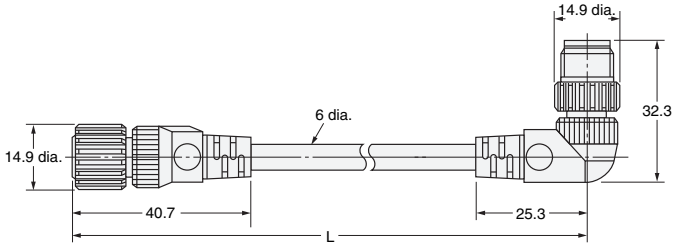
XS2W-D421-C81-F (L=1m)
XS2W-D421-D81-F (L=2m)
XS2W-D421-G81-F (L=5m)
XS2W-D421-J81-F (L=10m)



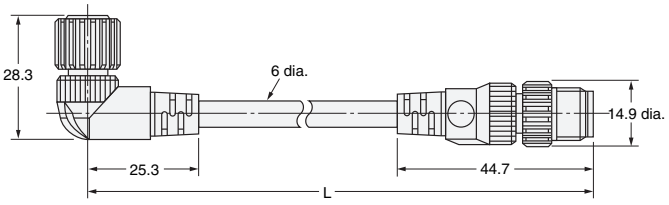
XS2W-D422-D81-F (L=2m)
XS2W-D422-G81-F (L=5m)



XS2W-D423-D81-F (L=2m)
XS2W-D423-G81-F (L=5m)



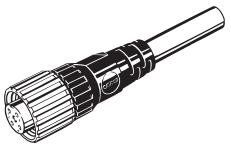
XS2W-D424-D81-F (L=2m)
XS2W-D424-G81-F (L=5m)

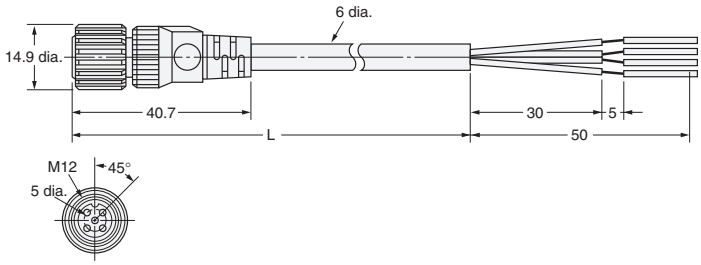


Sheath material: PVC

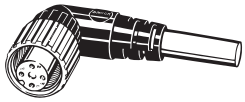
Cables with Connector (Socket) on One End (connecting to G9SP)

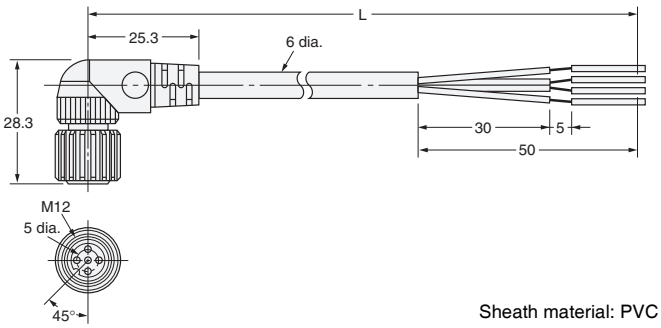
XS2F-D421-C80-F (L=1m)
XS2F-D421-D80-F (L=2m)
XS2F-D421-G80-F (L=5m)
XS2F-D421-J80-F (L=10m)





XS2F-D422-C80-F (L=1m)
XS2F-D422-D80-F (L=2m)
XS2F-D422-G80-F (L=5m)
XS2F-D422-J80-F (L=10m)

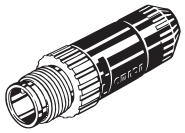


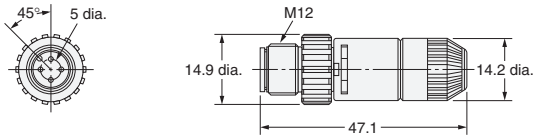


Sheath material: PVC

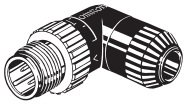
Connector Plug Assemblies, Solder Type

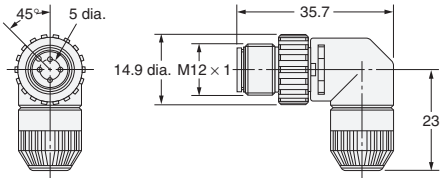
XS2G-D425





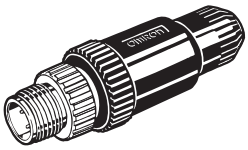
XS2G-D426

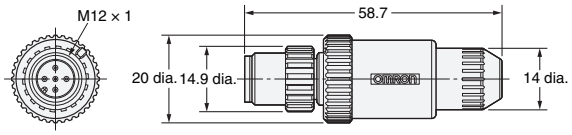




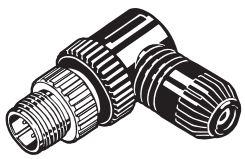
Connector Plug Assemblies, Screw-on Type

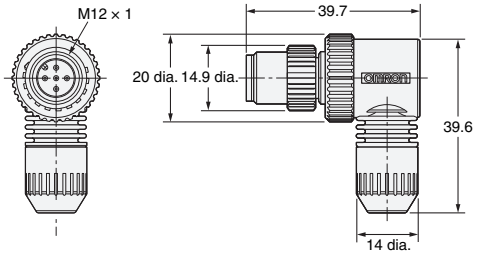
XS2G-D4S5





XS2G-D4S6





Safety Precautions

<Single-beam Safety Sensor E3ZS/E3FS>

⚠ WARNING

G9SP is the only Controller that can be used for the E3ZS-T81A/E3FS-10B4□□□ (type 2). Normal operation may not be possible if another Single-beam Sensor Controller is used.

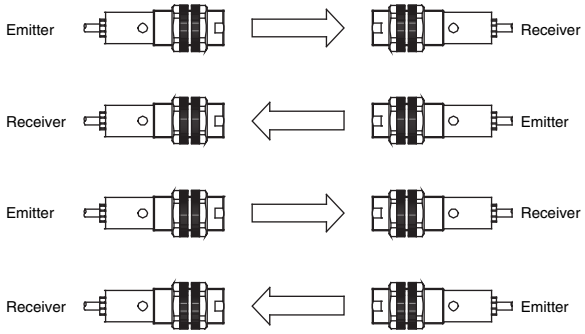
The Sensor cannot be used as part of a safety system when the mode selection input of the Single-beam Safety Sensor Receiver is connected to 0 V because the Sensor will turn ON when light is interrupted (Dark ON). Be sure to connect the mode selection input to 24 VDC if you want the Sensor to turn ON when light is incident (Light ON).

Refer to the website at: http://www.ia.omron.com/ for calculating the Safety distance.

Preventing Mutual Interference

Observe the following items during installation to prevent Single-beam Safety Sensors from interfering with each other or with Safety Light Curtains.

- Leave adequate space between the Sensors during installation. (Refer to the instruction manuals for the E3ZS/E3FS.)
- Use baffle plates to separate Sensors.
- Alternate Emitters and Receivers during installation. (See the figure below.)



Check for mutual interference between Single-beam Safety Sensors or Safety Light Curtains connected to the same or different Control Units before finalizing placement and starting normal operation.

⚠ WARNING

When installing multiple Safety Light Curtains, Multi-beam Safety Sensors, and Single-beam Safety Sensors, take necessary steps to prevent mutual interference. Otherwise detection may fail and serious injury may result.

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2016.8

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