

Single-beam Safety Sensor E3ZS/E3FS

CSM_E3ZS_E3FS_DS_E_3_1

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

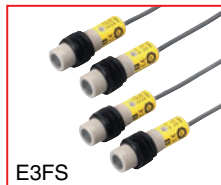


Be sure to read the "Safety Precautions" on page 15 and the "Precautions for All Safety Sensors".

Features

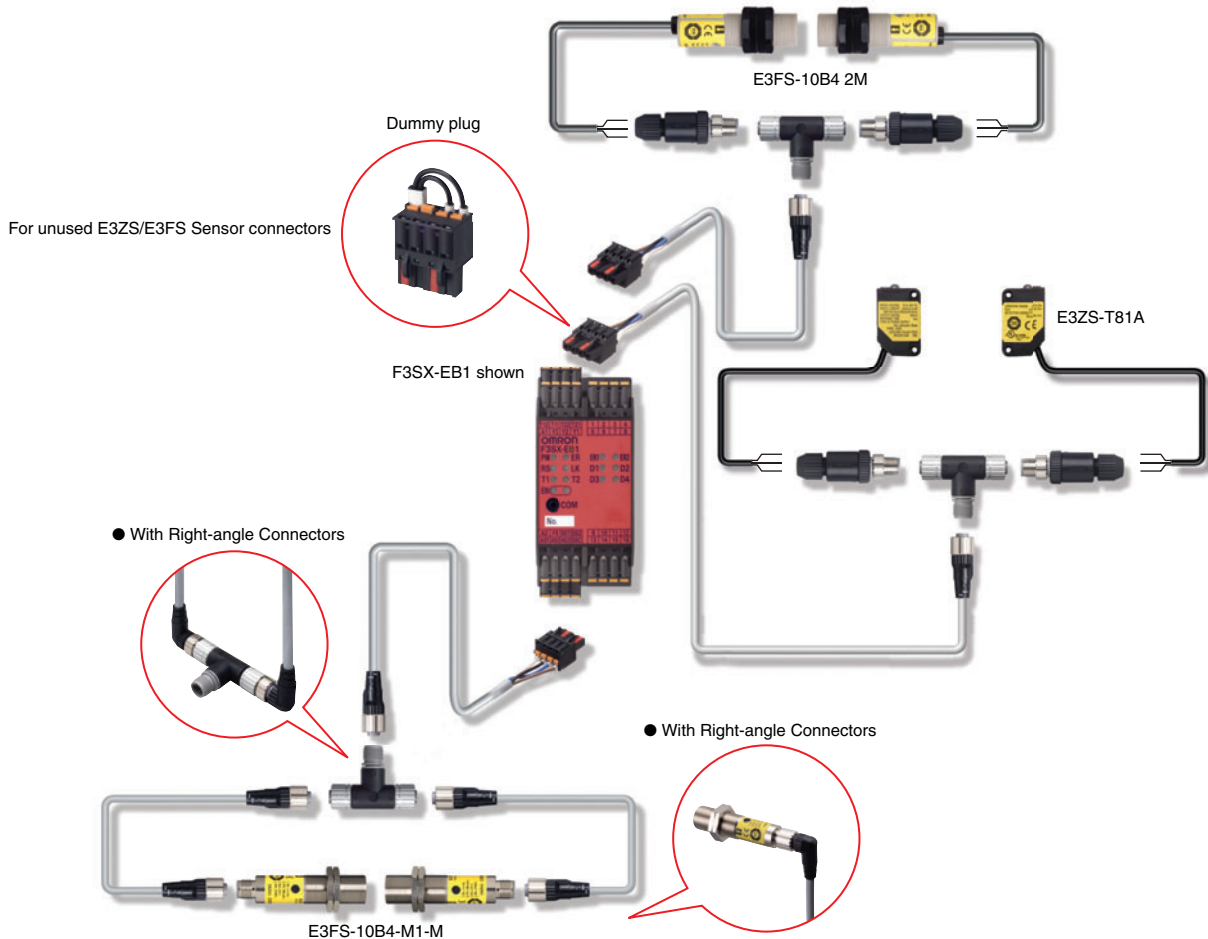
Connect up to 4 sets of E3ZS/E3FS per B1 Module for F3SX Safety Controller
Connect to a B1 Module for F3SX to Create a Type 2 Safety Sensor

Note: The B1 Module is designed specifically for E3ZS/E3FS input of the F3SX. The safety output turns OFF when light is interrupted or when an error occurs with one or more of the E3ZS/E3FS Sensors connected to the B1 Module.



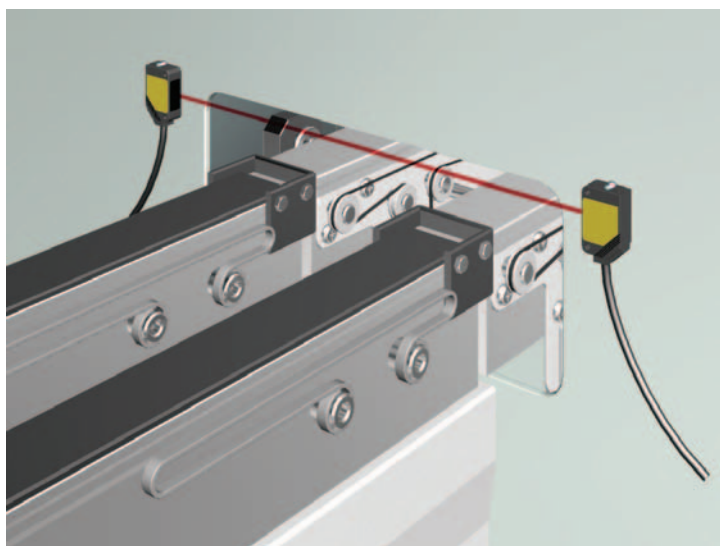
B1 Module for the F3SX
(F3SX-EB1 shown here)

Connects simply and easily using a wide range of accessories.



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 F3SX Safety Controller.

When used by itself, the E3ZS conforms to EN954-1 (Category 1). No particular safety restrictions apply to the E3ZS 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.




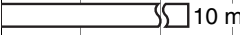

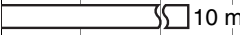
The E3FS is a Human Body Detection Sensor (Type 2) for production equipment. Make sure to use it in combination with a F3SX Safety Controller. A combination of E3FS and E3ZS Sensors can be connected to the B1 Module of the F3SX.

Note: Since the E3FS has not received any safety certification for use by itself, make sure to connect it with an F3SX for use in safety applications.

Ordering Information

Sensors

■ Red light □ Infrared light

Sensor method	Appearance	Case material	Connection method	Sensing distance	Output	Model
Through-beam		Polybutylene terephthalate	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

Controller

Instant Breaking Models

F3SX-N-□□□R (with Relay Safety Output)

Input types				Model	Width (W)	Weight
E3ZS/E3FS Safety Sensors	F3SJ/F3SN/F3SH Safety Light Curtains	Emergency Stop Switches	Door Switches			
4 sets	---	1 set	---	F3SX-N-B1R	90.0 mm	Approx. 0.5 kg
4 sets	---	1 set	2 sets	F3SX-N-B1D1R	112.5 mm	Approx. 0.6 kg
4 sets	---	1 set	4 sets	F3SX-N-B1D1D1R	135.0 mm	Approx. 0.7 kg
4 sets	2 sets	1 set	---	F3SX-N-L2B1R	112.5 mm	Approx. 0.6 kg

Instant Breaking Models

F3SX-E-□□□ (with DC Solid-state Safety Output)

Input types				Model	Width (W)	Weight
E3ZS/E3FS Safety Sensors	F3SJ/F3SN/F3SH Safety Light Curtains	Emergency Stop Switches	Door Switches			
4 sets	---	1 set	---	F3SX-EB1	45.0 mm	Approx. 0.3 kg
8 sets	---	1 set	---	F3SX-E-B1B1	67.5 mm	Approx. 0.4 kg
4 sets	---	1 set	2 sets	F3SX-E-B1D1	67.5 mm	Approx. 0.4 kg
4 sets	2 sets	1 set	---	F3SX-E-L2B1	67.5 mm	Approx. 0.4 kg

Instant Breaking Models

F3SX-E-□□□R (with Relay Safety Output and DC Solid-state Safety Output)

Input types				Model	Width (W)	Weight
E3ZS/E3FS Safety Sensors	F3SJ/F3SN/F3SH Safety Light Curtains	Emergency Stop Switches	Door Switches			
4 sets	---	1 set	---	F3SX-E-B1R	90.0 mm	Approx. 0.5 kg

OFF-delay Time Setting Models (Using Function Setup Software for the F3SX)

F3SX-N-□□□RR2 (with Relay Safety Output and DC Solid-state Safety Output)

Input types				Model	Width (W)	Weight
E3ZS/E3FS Safety Sensors	F3SJ/F3SN/F3SH Safety Light Curtains	Emergency Stop Switches	Door Switches			
4 sets	---	1 set	2 sets	F3SX-N-B1D1RR2	157.5 mm	Approx. 0.7 kg
4 sets	2 sets	1 set	---	F3SX-N-L2B1RR2	157.5 mm	Approx. 0.7 kg

OFF-delay Time Setting Models (Using Function Setup Software for the F3SX)


F3SX-E-□□□R2 (with Relay Safety Output and DC Solid-state Safety Output)

Input types				Model	Width (W)	Weight
E3ZS/E3FS Safety Sensors	F3SJ/F3SN/F3SH Safety Light Curtains	Emergency Stop Switches	Door Switches			
4 sets	---	1 set	---	F3SX-E-B1R2	90.0 mm	Approx. 0.5 kg
4 sets	---	1 set	2 sets	F3SX-E-B1D1R2	112.5 mm	Approx. 0.6 kg
4 sets	2 sets	1 set	---	F3SX-E-L2B1R2	112.5 mm	Approx. 0.6 kg

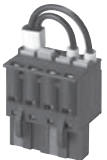
The F3SX-series Safety Controller is a multiple input, single output Controller. This is useful for individual control over the safety output when using multiple safety input devices. Custom models are also available. Refer to the F3SX, and consult with your OMRON representative.

Accessories


Branch Connector

Appearance	Model
	F39-CN3


Dummy Plug

Appearance	Model
	F39-CN4


Cables with Connectors on Both Ends for Branch Connector

Appearance	Model	Cable length
	F39-JF1S	1 m
	F39-JF2S	2 m
	F39-JF5S	5 m
	F39-JF10S	10 m

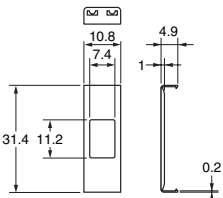
Sensor Mounting Bracket (for E3FS)

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

Type	Cable connection direction	Cable length L (m)	DC	UL standard
			Model	
Standard cable	Straight/straight	1	XS2W-D421-C81-A	●
		2	XS2W-D421-D81-A	
		5	XS2W-D421-G81-A	
		10	XS2W-D421-J81-A	
	Right angle/right angle	2	XS2W-D422-D81-A	
		5	XS2W-D422-G81-A	
	Straight/right angle	2	XS2W-D423-D81-A	
		5	XS2W-D423-G81-A	
	Right angle/straight	2	XS2W-D424-D81-A	
		5	XS2W-D424-G81-A	
Robot cable (vibration resistant)	Straight/straight	1	XS2W-D421-C81-R	---
		2	XS2W-D421-D81-R	
		5	XS2W-D421-G81-R	
		10	XS2W-D421-J81-R	

Note: Extend the cable under the following conditions.

- Overall cable length for both an E3FS Receiver connected to an F3SX and the Emitter connected to the F3SX must be within 50 m.
- Overall cable length for both an E3ZS Receiver connected to an F3SX and the Emitter connected to the F3SX must be within 100 m.

Cables with Connector (Socket) on One End

Type	Cable connection direction	Cable length L (m)	DC	UL standard
			Model	
Standard cable	Straight	1	XS2F-D421-C80-A	●
		2	XS2F-D421-D80-A	
		5	XS2F-D421-G80-A	
		10	XS2F-D421-J80-A	
	Right angle	1	XS2F-D422-C80-A	
		2	XS2F-D422-D80-A	
		5	XS2F-D422-G80-A	
		10	XS2F-D422-J80-A	
Robot cable (vibration resistant)	Straight	1	XS2F-D421-C80-R	---
		2	XS2F-D421-D80-R	
		5	XS2F-D421-G80-R	
		10	XS2F-D421-J80-R	
	Right angle	1	XS2F-D422-C80-R	
		2	XS2F-D422-D80-R	
		5	XS2F-D422-G80-R	
		10	XS2F-D422-J80-R	

Note: Extend the cable under the following conditions.

- Overall cable length for both an E3FS Receiver connected to an F3SX and the Emitter connected to the F3SX must be within 50 m.
- Overall cable length for both an E3ZS Receiver connected to an F3SX and the Emitter connected to the F3SX 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

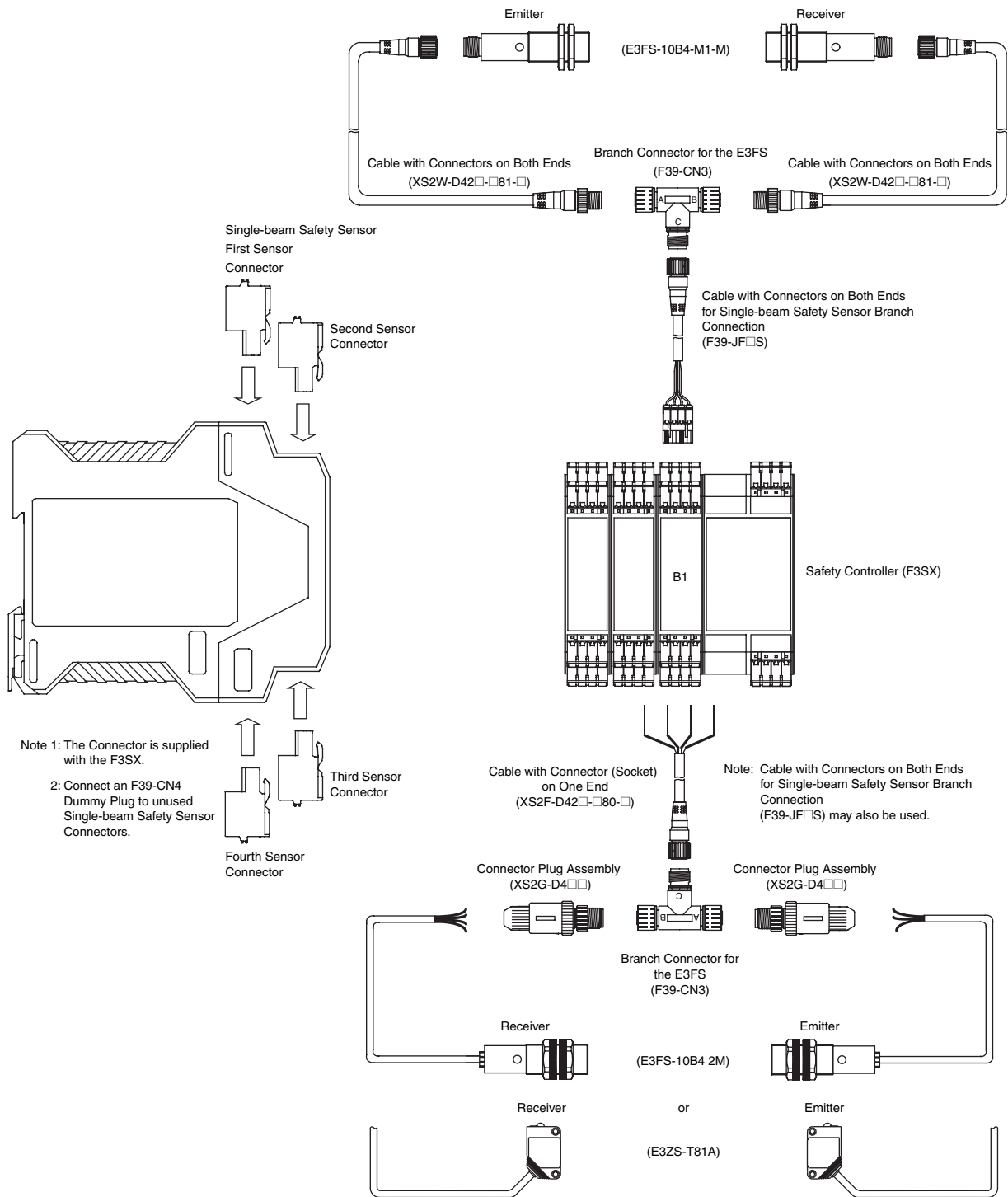
* Use when connecting an E3ZS-T81A or E3FS-10B4 2M to an F39-CN3 Branch Connector.

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.

Accessory Connection Example



Specifications

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) *1	2.0 ms (E3FS only) *1	
Startup waiting time		100 ms		
Power supply voltage (Vs)		12 to 24 VDC±10% (ripple p-p 10% max.) *2	24 VDC±10% (ripple p-p 10% max.) *2	
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) *2	PNP transistor output, load current: 100 mA max., Residual voltage: 2 V max. (except for voltage drop due to cable extension) *2	
Output operation mode		Light-ON *3		
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.) *2	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.) *2	
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 *4	Operation manual *4, nuts for mounting Emitter/Receiver (2 each)	
Applicable standards	Sensor only	IEC 60947-5-3 (PDF-D) EN954-1 (Category 1)		
	Sensor connected to F3SX	IEC (EN) 61496-1 Type 2 ESPE *5, IEC (prEN) 61496-2 Type 2 AOPD *6, EN 954-1 (Category 2)	IEC(EN)61496-1 Type2 ESPE *5 IEC(prEN)61496-2 Type2 AOPD *6	
Switching element category (from IEC60947-5-3)		DC13 (control of electromagnetic load)		---
Controller		F3SX Series		

*1. This may vary according to the F3SX model connected to the Sensor. For details, refer to the F3SX operation manual.

*2. Connect the Sensor to an F3SX to use it as a safety device or as part of a safety system.

*3. 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.

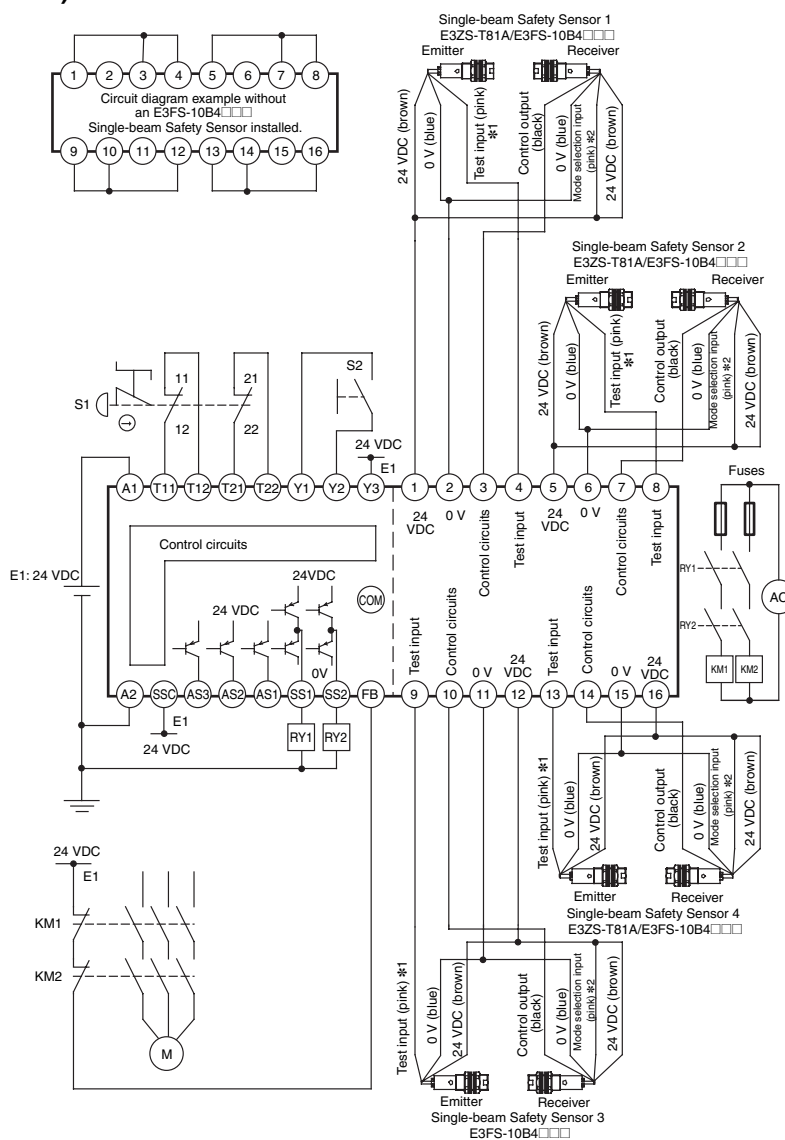
*4. F3SX operation manual is not included.

*5. Electro-Sensitive Protective Equipment

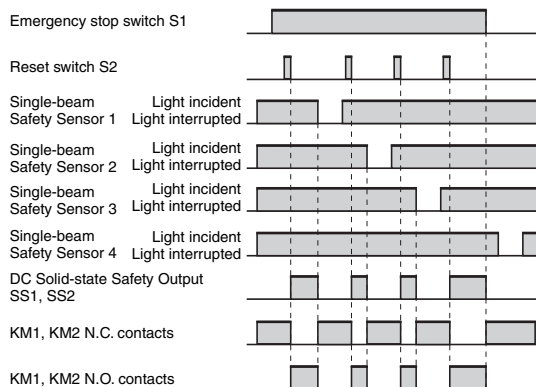
*6. Active Opto-electronic Protective Device

Connections

Circuit Diagram Example F3SX-EB1 (Manual Reset)



Timing Chart



- S1: Emergency stop switch with positive opening mechanism (A165E or A22E) ⊕
- S2: Reset switch
- KM1, KM2: Magnetic contactor
- RY1, RY2: Relay
- M: Three-phase motor
- E1: 24-VDC power supply (S82K)

- Note:**
- The above circuit diagram example conforms to Category 2.
 - The EN60204-1 stop function category is 0 (zero) for the example in the above circuit diagram.
 - When the FB (feedback input) function of the F3SX is not used, make setting changes with the F3SX function setup software (F3SX-CD100-E1).

- *1. The black wire is used when the Cable with Connector (Socket) on One End (XS2F-D42□-□80-□) is connected to an E3FS-10B4-M1-M Connector.
- *2. The white wire is used when the Cable with Connector (Socket) on One End (XS2F-D42□-□80-□) is connected to an E3FS-10B4-M1-M Connector.

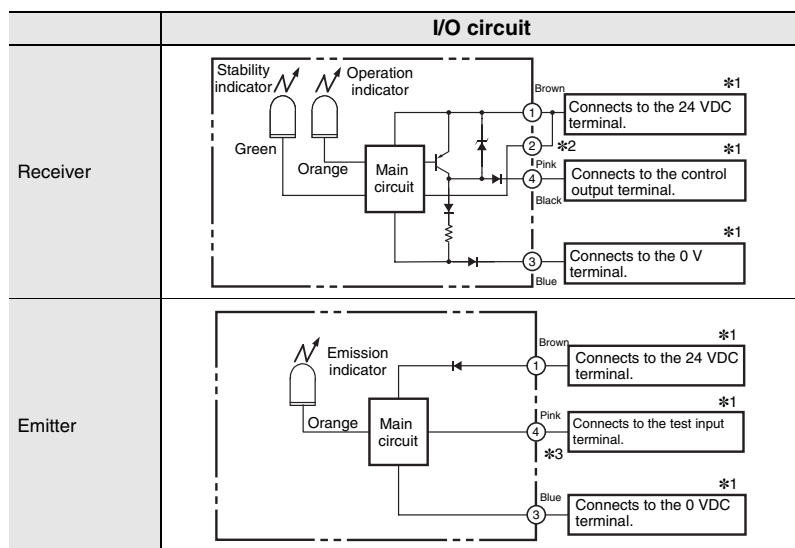
For connections, refer to the F3SX operation manual.

I/O Circuit Diagrams

E3ZS

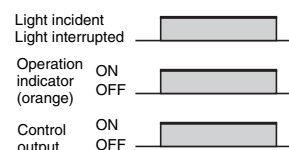
Circuit Diagrams (E3ZS-T81A with PNP Output)

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

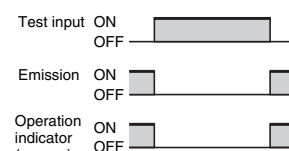


Timing Charts

Output Modes and Timing Chart



Emitter Timing Chart



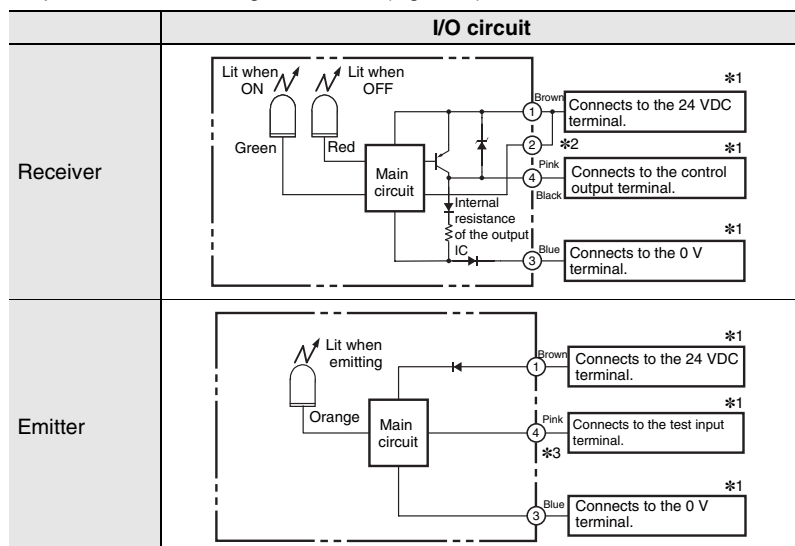
Note: The F3SX performs self-diagnosis every 20 ms.

- *1. When using in Safety Category 2 configurations, make sure all terminals on the B1 Module of the F3SX are properly connected. Do not connect the terminals to another module. See the F3SX 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 an F3SX and the test input is not used.

E3FS

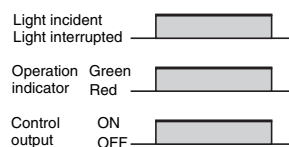
Circuit Diagrams (E3FS-10B4 with PNP Output)

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

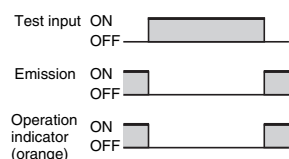


Timing Charts

Output Modes and Timing Chart



Emitter Timing Chart



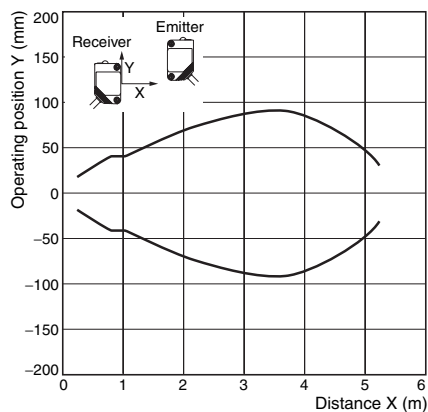
- *1. Make sure all terminals on the B1 Module of the F3SX are properly connected. Do not connect the terminals to another Module. See the F3SX operation manual for details.
- *2. Make sure to connect the pink wire (mode selection input 2) to 24 VDC.
- *3. Make sure to connect to the 0V terminal when the E3FS is not connected to an F3SX 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 F3SX. This also means it must be properly connected to an F3SX to use it as part of a safety system.

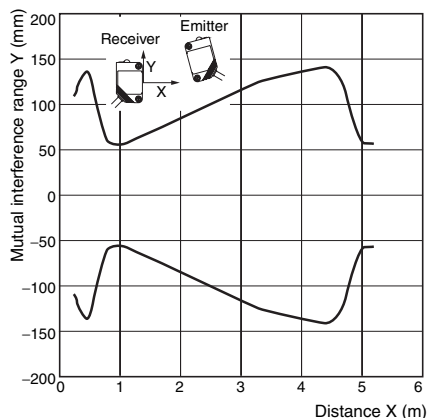
Engineering Data

E3ZS

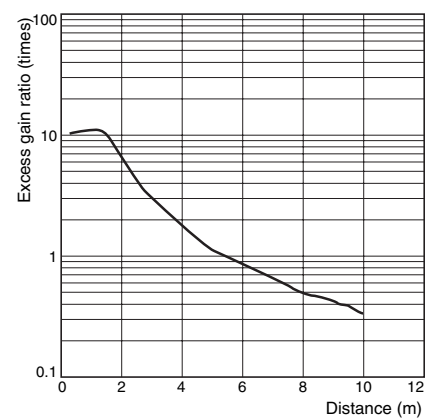
Parallel Operating Range



Mutual Interference Range

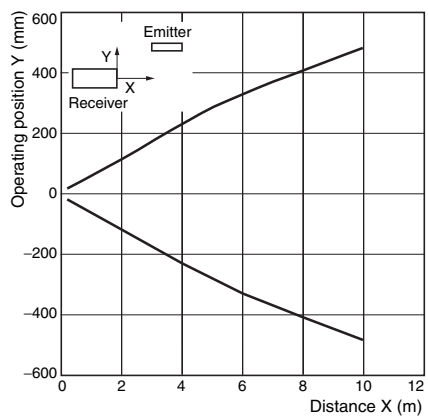


Excess Gain Ratio

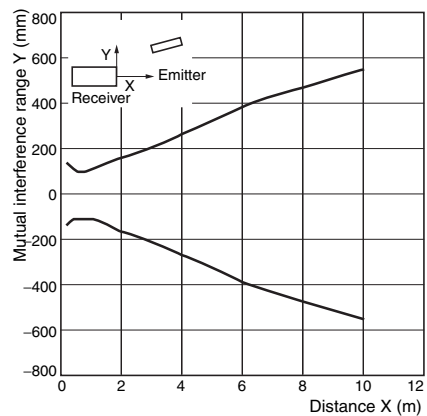


E3FS

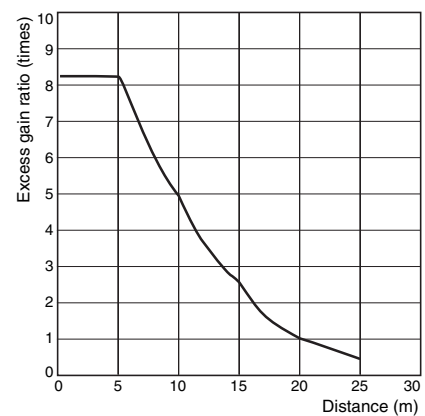
Parallel Operating Range



Mutual Interference Range

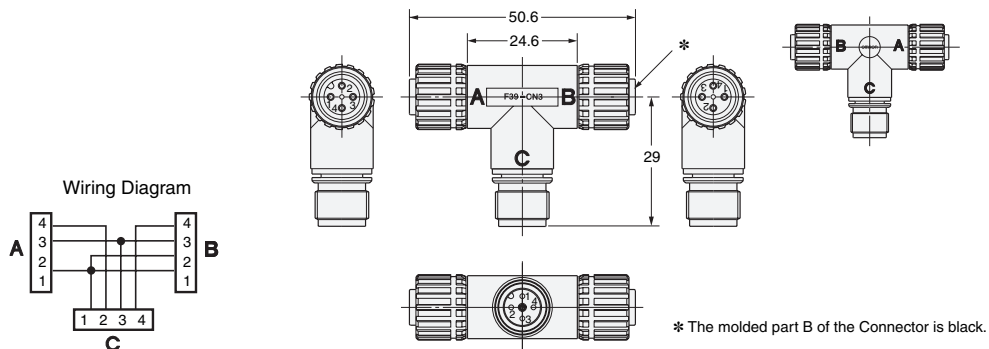


Excess Gain Ratio

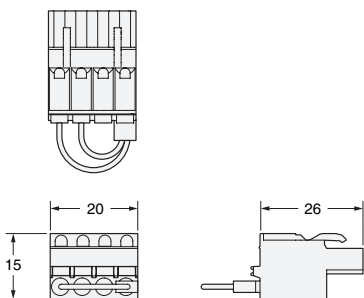


Accessories (Order Separately)

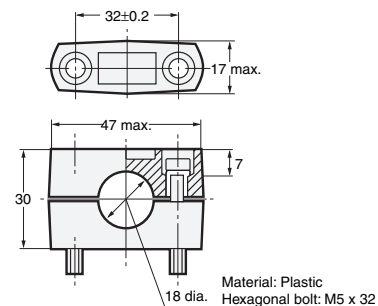
Branch Connector
F39-CN3



Dummy Plug
F39-CN4



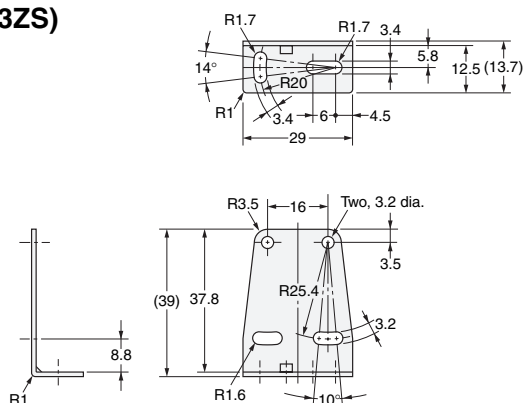
Sensor Mounting Bracket (for E3FS)
Y92E-B18



Sensor Mounting Bracket (for E3ZS)
E39-L104



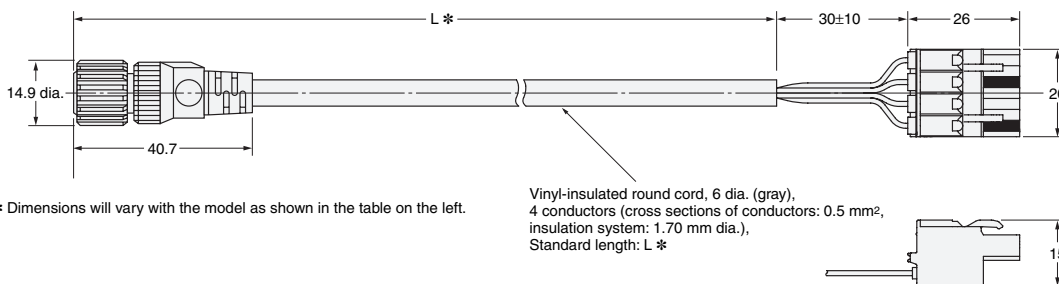
Material: Stainless steel (SUS304)



Cables with Connectors on Both Ends for Branch Connection

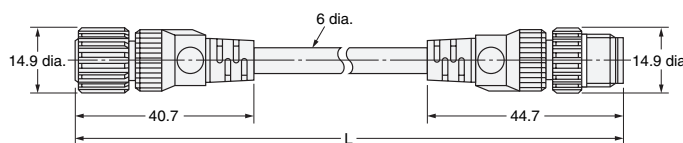
- F39-JF1S
- F39-JF2S
- F39-JF5S
- F39-JF10S

Model	L (mm)
F39-JF1S	1,000 ⁺¹⁵⁰ ₀
F39-JF2S	2,000 ⁺¹⁵⁰ ₀
F39-JF5S	5,000 ⁺³⁰⁰ ₀
F39-JF10S	10,000 ⁺³⁰⁰ ₀

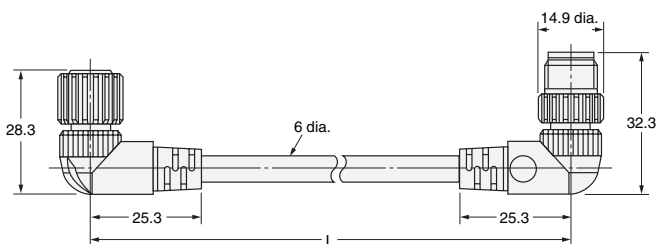


Cables with Connectors (Socket and Plug) on Both Ends

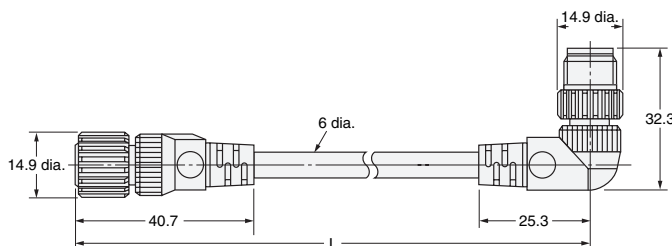
- XS2W-D421-C81-A (L=1m)
- XS2W-D421-D81-A (L=2m)
- XS2W-D421-G81-A (L=5m)
- XS2W-D421-J81-A (L=10m)
- XS2W-D421-C81-R (L=1m)
- XS2W-D421-D81-R (L=2m)
- XS2W-D421-G81-R (L=5m)
- XS2W-D421-J81-R (L=10m)



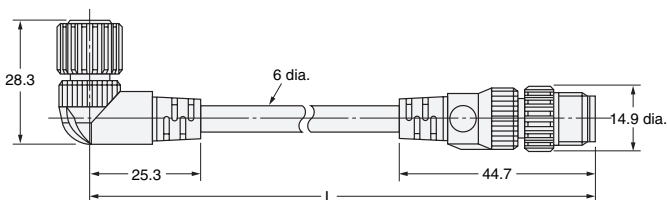
- XS2W-D422-D81-A (L=2m)
- XS2W-D422-G81-A (L=5m)



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

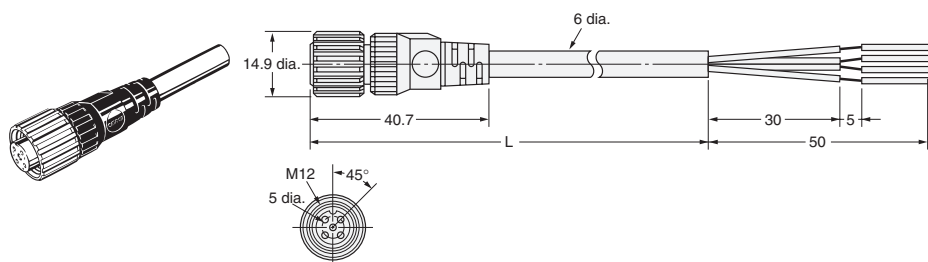


- XS2W-D424-D81-A (L=2m)
- XS2W-D424-G81-A (L=5m)

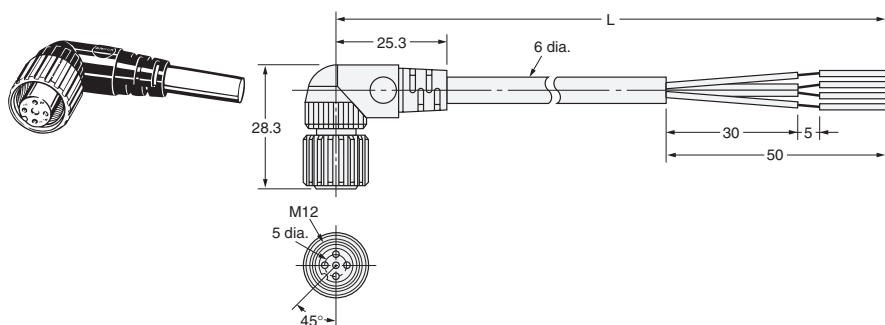


Cables with Connector (Socket) on One End

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

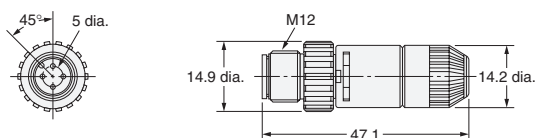
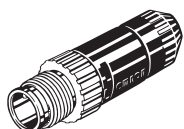


- XS2F-D422-C80-A (L=1m)
- XS2F-D422-D80-A (L=2m)
- XS2F-D422-G80-A (L=5m)
- XS2F-D422-J80-A (L=10m)
- XS2F-D422-C80-R (L=1m)
- XS2F-D422-D80-R (L=2m)
- XS2F-D422-G80-R (L=5m)
- XS2F-D422-J80-R (L=10m)

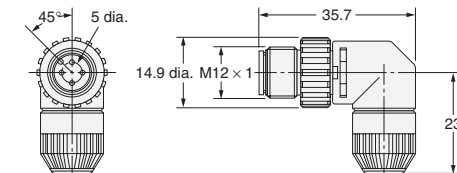
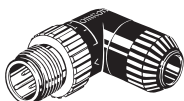


Connector Plug Assemblies, Solder Type

XS2G-D425

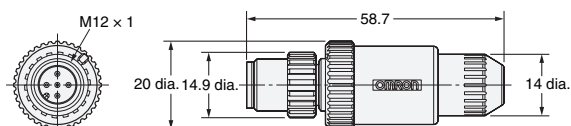
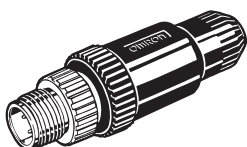


XS2G-D426

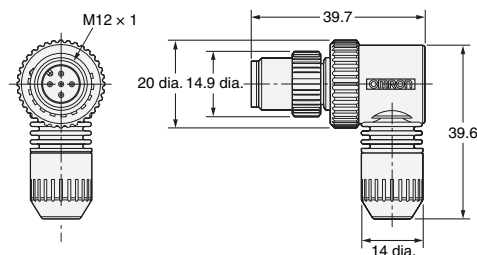
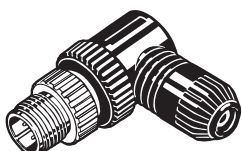


Connector Plug Assemblies, Screw-on Type

XS2G-D4S5



XS2G-D4S6



Safety Precautions

WARNING

OMRON's Single-beam Safety Sensor Input Module (B1 Module) from the F3SX Series 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).

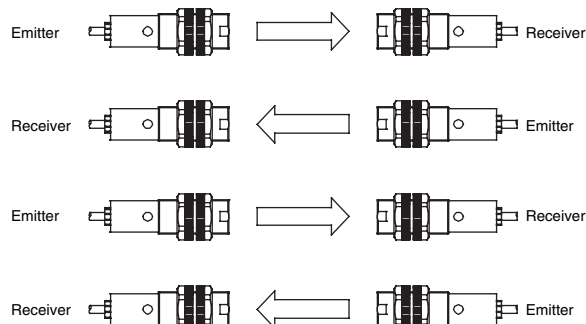


Refer to the "Precautions for All Safety Sensors" for calculating the Safety distance.

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 and the F3SN/F3SH.)
- 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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- Systems, machines, and equipment that could present a risk to life or property.

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2010.10

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