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Safety Single Beam Sensor & Controller

**E3FS series with  
F3SP-U3P-TGR and F3SP-U5P-TGR**



**Features**

The E3FS is a type 2 Safety Single beam sensor intended to be used with the control units F3SP-U3P -TGR and F3SP-U5P-TGR.

- Safety Single Beam (E3FS)
  - 1) Up to Category 2 (EN954-1)  
Type2 ESPE and Type2 AOPD.  
Approved by TÜV Product Service
- Muting Controller for Safety single beam sensor (F3SP-U3P-TGR and F3SP-U5P-TGR)
  - 1) Muting functions are integrated  
Muting inputs  
Override function  
Muting Lamp output  
Interlock function and Test Reset input
  - 2) 2 different model available  
2 beam unit (F3SP-U3P-TGR)  
4 beam unit (F3SP-U5P-TGR)
  - 3) Small Controller  
2 beam unit W=22.5 mm  
4 beam unit W=45.0 mm





- 2) High protection against water  
IP67 (IEC60529)
- 3) Small Sensor  
M18 x 65 mm
- 4) 4 different model available  
Plastic case (with cable type and connector type)  
Brass case (with cable type and connector type)

## Ordering Information



### Safety Single beam Sensors (Type 2)

#### E3FS-10B4 series

Appearance	Case material	Operation distance	Model	
	Plastic	 0 to 10 m	Cable Type	E3FS-10B4
			Plug Type	E3FS-10B4-P1
	Nickel Brass		Cable Type	E3FS-10B4-M
			Plug Type	E3FS-10B4-M1-M


### Controller for Safety Single beam Sensors

#### F3SP-UxP series


Appearance	Sensors	Output contacts	Width	Model
	1 to 2 Safety Single beam sensors	2 NO 2.5 A	22.5 mm	F3SP-U3P-TGR
	1 to 4 Safety Single beam sensors		45 mm	F3SP-U5P-TGR

### Accessories

#### Muting Lamp

Appearance	Model
	F39-A11

#### Bulb for Maintenance

Appearance	Specification	Model
	24 V DC 3 W E14	F39-A11MB

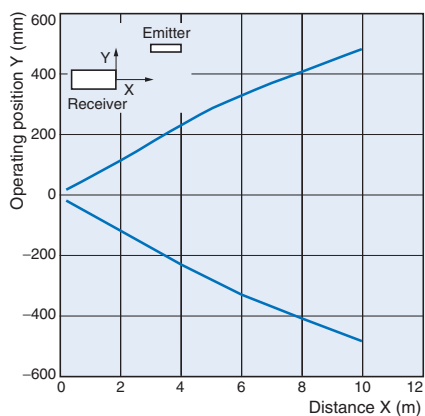
## Rating and Performance

### Sensors

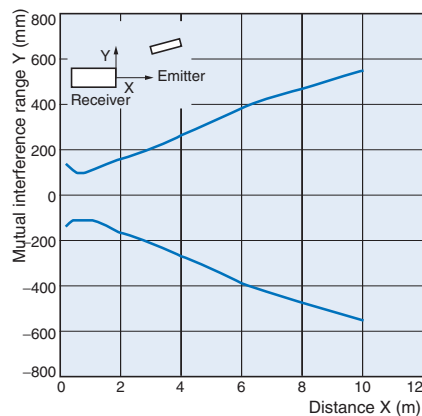
#### E3FS-10B4 series

Sensing method	Through-beam	
Controller	F3SP-U3P-TGR, F3SP-U5P-TGR	
Supply voltage	24 VDC ± 10% (ripple p-p 10% max.)	
Effective aperture angle (EAA)	±5° (at 3 m)	
Current consumption	Emitter:50 mA max. Receiver:25 mA max.	
Sensing distance	10 m	
Standard sensing object	Opaque object: 11 mm min. in diameter	
Response time	2.0 ms (E3FS only) Response time of controller = Response time of the system	
Control output	PNP transistor output, load current: 100 mA max., residual voltage: 2 V max. (Except for voltage drop due to cable extension)	
Test input (Emitter)	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.)	
Power supply reset time	100 ms	
Ambient light intensity	Incandescent lamp: 3,000 lx max. (light intensity on the receiver surface) Sunlight: 10,000 lx max. (light intensity on the receiver surface)	
Ambient temperature	Operating: -10 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)	
Insulation resistance	20 MΩ min. (at 500 VDC)	
Dielectric strength	1,000 VAC 50/60 Hz 1 min	
Vibration resistance	Malfunction	10 to 55 Hz, double amplitude: 1.5 mm, 2 h each in the X, Y, and Z directions
	Operating limit	10 to 55 Hz, double amplitude: 0.7 mm, 50 min each in the X, Y, and Z directions
Shock resistance	Malfunction	500 m/s <sup>2</sup> (approx. 50 G), 3 times each in the X, Y, and Z directions
	Operating limit	100 m/s <sup>2</sup> (approx. 10 G), 1,000 times in the X, Y, and Z directions
Degree of protection	IP67 (IEC standard)	
Light source	Infrared LED	
Operation indicators	Emitter: Emitting (orange) Receiver: Output ON (green), Output OFF (red)	
Protection	Output short-circuit protection, reverse polarity protection	
Weight (in packaging)	E3FS-10B4 2M (ABS resin case): approx. 150 g for 1 set (weight without cable: approx. 55 g) E3FS-10B4-M1-M (metal case): approx. 125 g for 1 set	
Applicable standard	IEC61496-1, EN61496-1 Type 2 ESPE (Electro-Sensitive Protective Equipment) IEC61496-2, prEN61496-2 Type 2 AOPD (Active Opto-electronic Protective Devices)	
Accessories	Emitter, Receiver, four nuts for mounting, and an instruction manual	

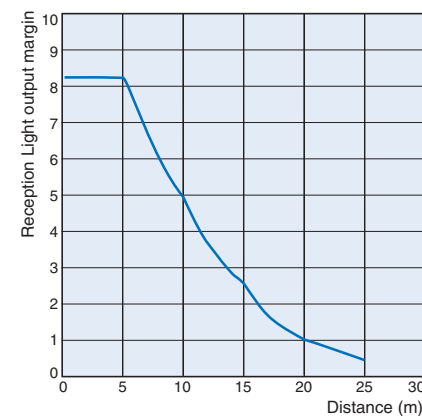
Parallel Operating Range



Mutual interference Range



Excess Gain Ratio



Controllers

F3SP-U series

	F3SP-U3P	F3SP-U5P
Number of sensors	1 to 2 Safety Single beam sensor	1 to 4 Safety Single beam Sensor
Width	22.5 mm	45 mm
Muting Input	2 Inputs	4 Inputs
Safety related function	Override function Muting Lamp Connection Interlock System (Automatic and manual reset)	
Power supply voltage	24 VDC $\pm 10\%$	
Power consumption	420 mA max.	
Output contacts	2 NO 2.5 A (protected by fuse), 115 V AC max.	2 NO 2.5 A (protected by fuse), 250 V AC max.
Indicators	6 LED for status and diagnostics	
Enclosure rating	IP20	
Terminal	16 screw terminals, Detachable blocks with '4pin'	32 screw terminals, Detachable blocks with '4pin'
Response time	$\leq 30$ ms	
Ambient temperature	Operation: $-10^{\circ}\text{C}$ $+55^{\circ}\text{C}$	
Housing material	Plastic; DIN rail mounting	
Weight	0.3 kg	

Operating Instructions

Output Circuit

Model	Connection method	Output transistor	Output circuit
E3FS-10DB4 2M E3FS-10DB4-P1 E3FS-10DB4-M 2M E3FS-10DB4-M1-M	Connect the pink and brown wire	ON when light is incident (Light-ON)	
Receiver circuit	Connect the pink and blue wire	ON when light is interrupted (Dark-ON)	
E3FS-10LB 2M E3FS-10LB-P1 E3FS-10LB-M 2M E3FS-10LB-M1-M		Emitter circuit	

## Timing Chart

### Output mode and timing chart

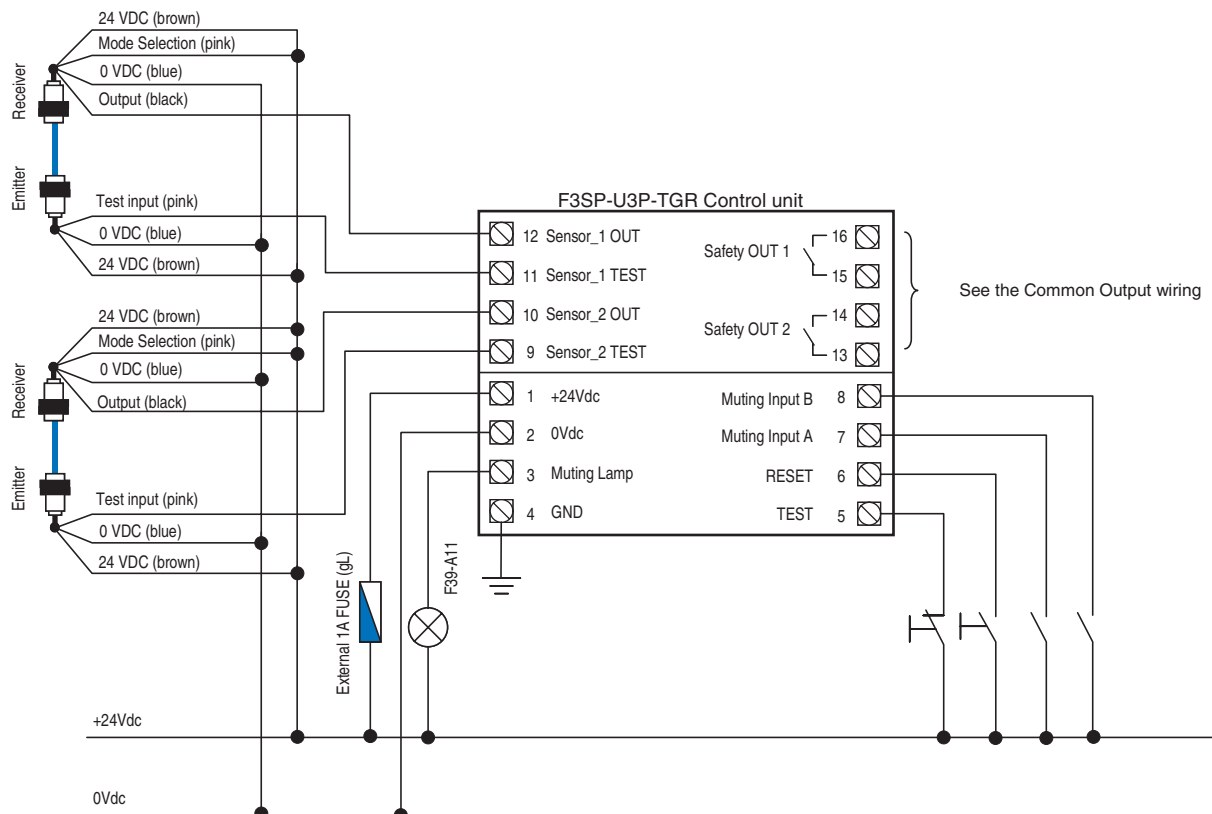
Receiver connection		Connect Pink (2) to Brown(1)	Connect Pink (2) to Blue (3)
Mode of output		ON when Incident (Light ON)	ON when interrupted (Dark ON)
Light Incident			
Light interrupted			
Indicator	Green		
	Red		
Control output	ON		
	OFF		
Load (Relay)	ON		
	OFF		

### Emitting timing chart

		Timing chart
Test input	ON	
	OFF	
Light emission	ON	
	OFF	
Indicator	ON	
	OFF	

## Connection

### F3SP-U3P Manual Reset (Cat2)

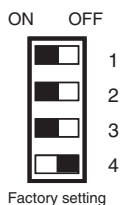


**WARNING:** Both safety contacts OUT1 and OUT2 must be connected. If the machine has a single locking circuit, the two normally opened contacts must be connected in series.

**WARNING:** The power supply of Safety sensors must be taken from the same supply of F3S-U3P-TGR unit.

#### Dip Switch setting

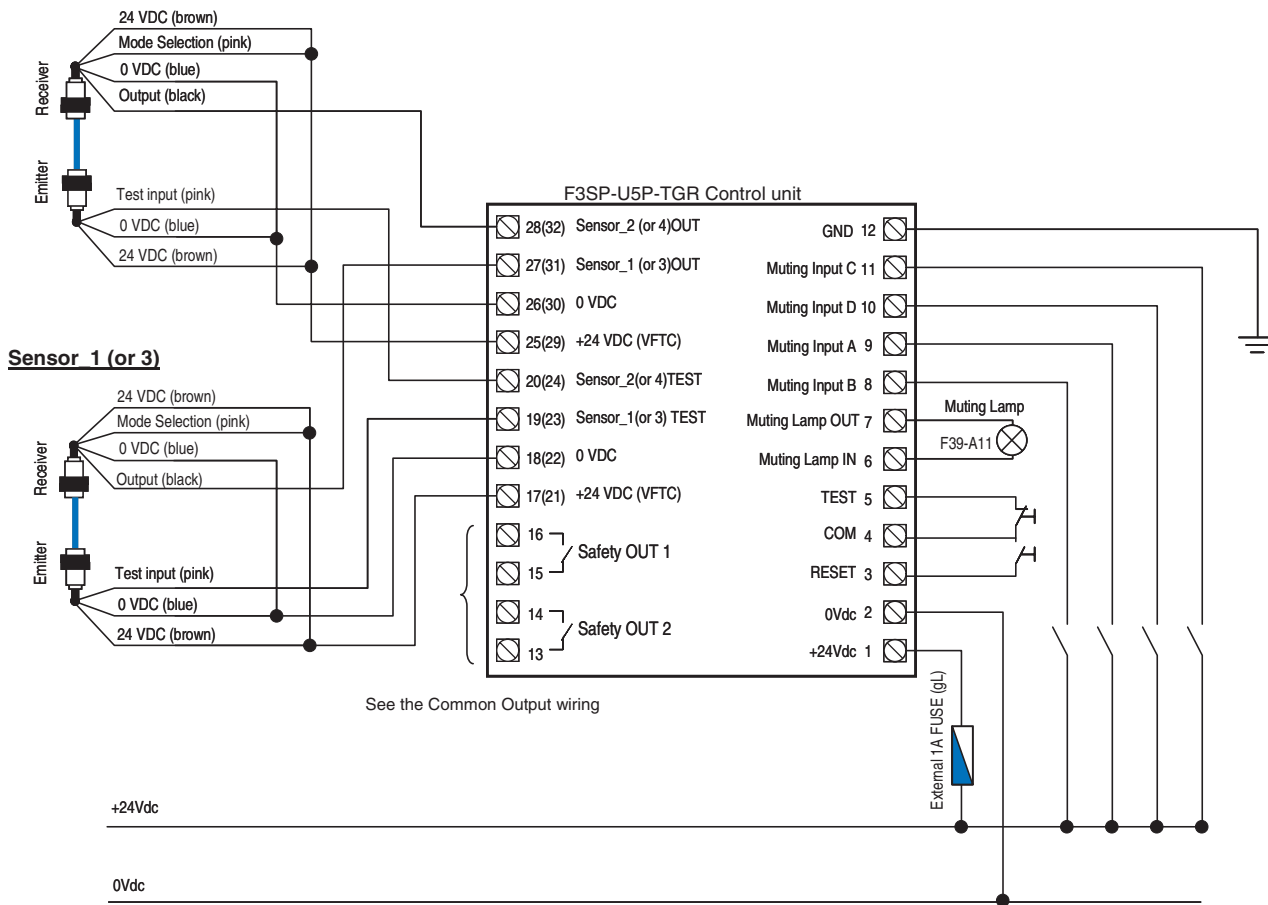
	Function	ON	OFF
4	Not used	-----	-----
3	Muting Activate	It will be muting Sensor_1 only	<u>It will be muting both Sensor</u>
2	Muting Duration	Infinite	<u>60 Second</u>
1	Reset mode	<u>Auto Reset</u>	Manual Reset



The underlines are initial setting (Factory setting)

### F3SP-U5P Manual Reset (Cat 2)

#### Sensor 2 (or 4)

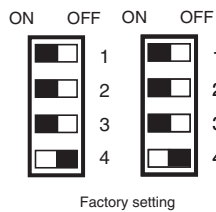


**WARNING:** Both safety contacts OUT1 and OUT2 must be connected. If the machine has a single locking circuit, the two normally opened contacts must be connected in series.

#### Dip Switch setting

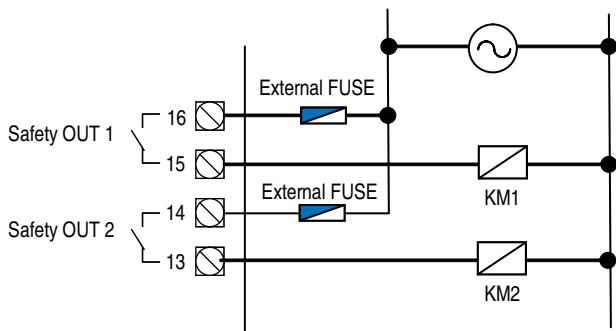
	Function	ON	OFF
4	Not used	-----	-----
3	Muting Activate	Muting inputs A-B act on the sensor_1. Muting inputs C-D act on the sensor_2. Other sensor 3-4 continue to work	<u>Muting inputs A-B act on the sensor 1 and 2.</u> <u>Muting inputs C-D act on the sensor 3 and 4.</u>
2	Muting Duration	Infinite	<u>60 Second</u>
1	Reset mode	<u>Auto Reset</u>	Manual Reset

The underlines mean initial setting (Factory setting)

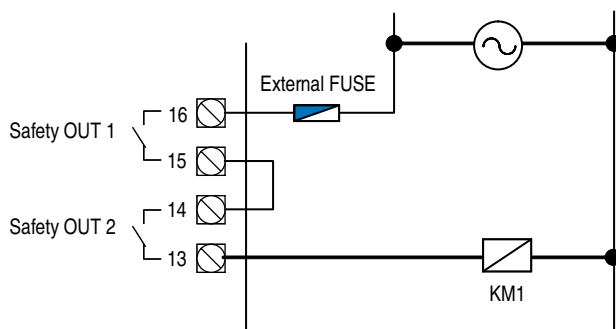


#### Common Output wiring

In case of 2 load



In case of 1 load





Precautions for Correct Use

**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 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).



**Safety Distance**

The safety distance is the minimum distance that must be maintained between the Sensor and a hazardous part of the machine in order to stop the machine before someone or something reaches it. The safety distance is calculated based on the following equation when a person moves perpendicular to the detection zone of the Sensor.

$$\text{Safety distance (S)} = \text{Intrusion speed into the detection zone (K)} \times \text{Total response time for the machine and Sensor} + \text{Additional distance calculated based on the detection capability of the Sensor (C)}$$

The safety distance varies with the national standards and individual machine standards. The equation is also different if the direction of intrusion is not perpendicular to the detection zone of the Sensor. Be sure to refer to the related standards.

Here  $T = T1 + T2 + T3$ , where

$T1 =$  Maximum machine stop time (s)

$T2 =$  Sensor response time (s)  
(From ON to OFF: 2.0 ms for the E3FS)

$T3 =$  F3SP response time (s)  
(From ON to OFF: Refer to Response Time.)

The maximum stop time for a machine is the time it takes to actually stop dangerous parts after the machine receives a stop signal from the F3SP.

**Warning**

Measure the actual maximum stop time for the machine and the periodical check it to see if the time changes.



Reference: Method for Calculating Safety Distance as Defined in the European Standard EN999 (with Intrusion Perpendicular to the Detection Zone)

K and C are as follows for the Single-beam Safety Sensors.

- 1) When a Single-beam Safety Sensor is used alone (when the risk assessment indicates that a single beam is sufficient)
  - K = 1600 mm/s
  - C = 1200 mm
  - Height of the beam from the ground or from a reference surface: 750 mm (EN999 recommendation)
- 2) When multiple Single-beam Safety Sensors are installed at different heights.
  - K = 1600 mm/s
  - C = 850 mm

The beam heights in the following table are the EN999 recommendations.

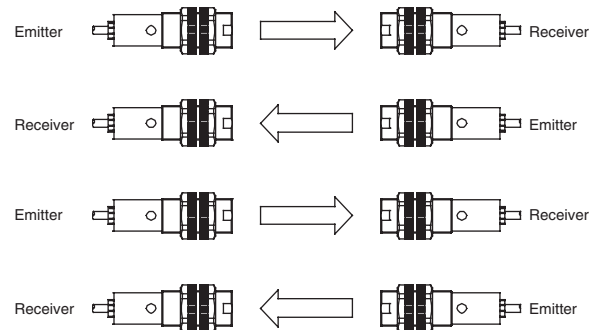
No. of beams	Height from the reference surface (example: the floor)
2	400 mm, 900 mm
3	300 mm, 700 mm, 1,100 mm
4	300 mm, 600 mm, 900 mm, 1,200 mm

Note: Refer to the F3SN/F3SH instruction manuals for details on Safety Light curtains and Multi-beam Safety Sensor.

**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 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.



## Dimensions

Note: All units are in millimeters unless otherwise indicated

### Plastic housing

Cable type:

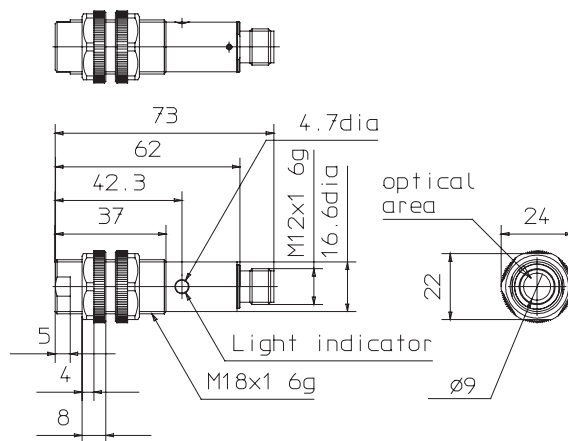
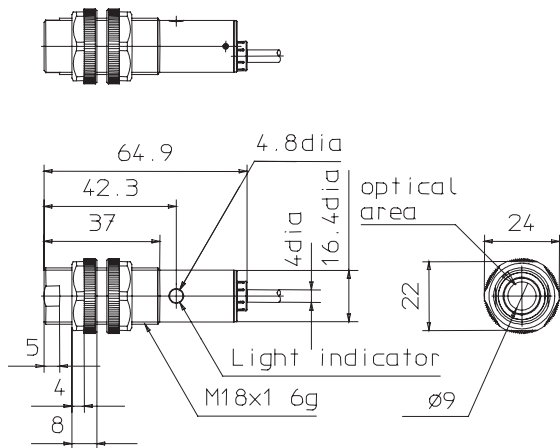
E3FS-10LB

E3FS-10DB4

Connector type:

E3FS-10LB-P1

E3FS-10DB4-P1



### Metallic housing

Cable type:

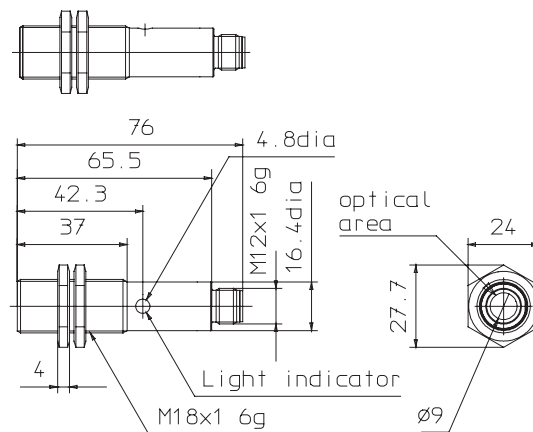
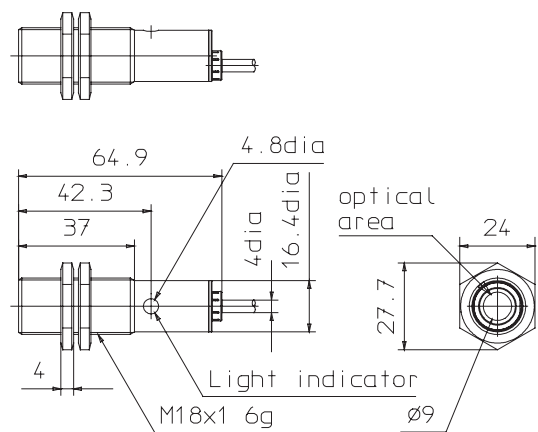
E3FS-10LB-M

E3FS-10DB4-M

Connector type:

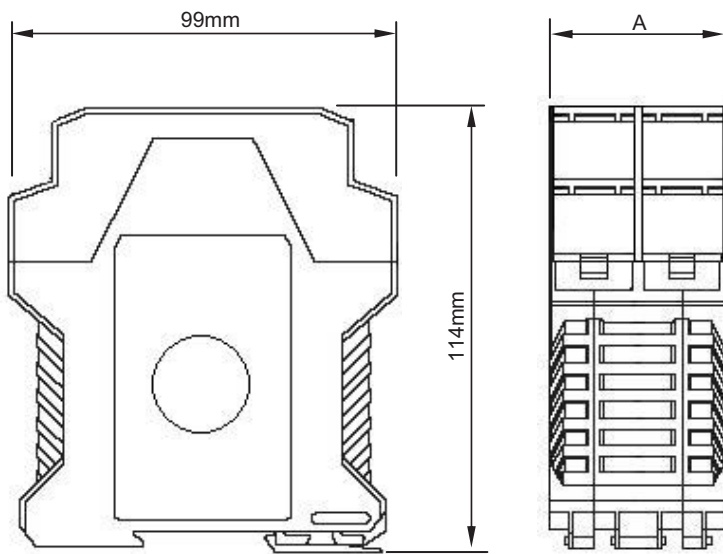
E3FS-10LB-M1-M

E3FS-10DB4-M1-M



Controller

F3SP-U3P and F3SP-U5P



Model	A
F3SP-U3P-TGR	22.5 mm
F3SP-U5P-TGR	45 mm

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

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



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