

### 13 New Fibers Offer High-Flexibility for Robotic, Reciprocating, and Moving Machinery

- All cables withstand constant flexing for robotic arms in automated assembly and material handling equipment
- Select from 11 models with 1 mm bending radius that allow 90° bends with little or no reduction in light transmission
- Fibers with 1 mm bending radius conform to contours or profiles of machinery, ensuring a perfect fit in tight applications
- Even the chemical-resistant and heat-resistant fibers have a minimum bending radius of only 10 mm



### Ordering Information

#### ■ Features

Application	Features	Sensing method	Part number
Robotic applications with constant flexing and little installation space at the sensing site	1 mm minimum bending radius, 3 mm dia. sensing head, nickel-plated brass sensing head (E32-T12R, E32-D22R), stainless steel sensing head (E32-D12R), and 2 m cable length	Through-beam	<b>E32-T12R</b>
		Diffuse	<b>E32-D22R</b>
			<b>E32-D12R</b>
Space-constrained robotic applications that require side-view sensing	1 mm minimum bending radius, 1 mm dia. sensing head (E32-T24R), 2 mm dia. sensing head (E32-D24R), 3 mm dia. sensing head (E32-T14LR), 6 mm dia. sensing head (E32-D14LR)	Through-beam	<b>E32-T14LR</b>
			<b>E32-T24R</b>
		Diffuse	<b>E32-D14LR</b>
			<b>E32-D24R</b>
Harsh environment applications requiring flexible, chemical and high-temperature resistant fibers	10 mm minimum bending radius, Teflon® sheath (E32-T81F), or Fluorocarbon resin (E32-T81R), protects cable and sensing head from chemicals, solvents and oil, withstands -40°C to 200°C; 6 mm diameter sensing head (E32-T81F), M4 threaded head (E32-T81R), glass core	Through-beam	<b>E32-T81F</b>
			<b>E32-T81R</b>
Applications that involve constant flexing and require wide sensing area, where objects are sensed when coming in random positions anywhere within the sensor's wide beam	1 mm minimum bending radius, wide beam head 30 mm sensing area (E32-T16WR), 11 mm side-view sensing area (E32-T16JR), 11 mm sensing area (E32-T16PR)	Through-beam	<b>E32-T16WR</b>
			<b>E32-T16JR</b>
			<b>E32-T16PR</b>
Robotic applications with constant flexing that require thin fiber for minute object detection	1 mm minimum bending radius, 2 mm dia. sensing head, stainless steel sensing head, 2 m cable length	Through-beam	<b>E32-T22R</b>

**Note:** Teflon® is a registered trademark of the Dupont company and the Mitsui Dupont Chemical for their fluorine resin.

# Sensing Distance with Fiber-Optic Cables

## ■ Through-Beam Fibers

- *Standard object* measurements were made with the E3X-DA-N and the E3X-NA set to Standard mode. The size of the standard object is the same as the fiber core diameter or the lens diameter for models with a lens.
- *Minimum sensing object* is shown in parentheses below the standard object (using the same column in the following table). For the E3X-DAN, minimum sensing object size was determined when it received light that exceeded a light incident value of 1000 (set to digital incident level display).
- The ✂ indicates models that customers can cut to length for their application. Models without this mark are pre-cut by the factory to maintain their respective specifications.

The table specifies the sensing characteristics of each fiber when used with the following amplifiers:

Legend:

DA-HS: E3X-DA-N (Digital amplifier - high speed mode)

DA-LD: E3X-DA-N (Digital amplifier - long distance mode)

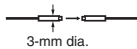
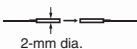
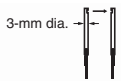
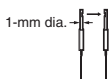
DA-SM: E3X-DA-N (Digital amplifier - standard distance mode)

NA□(V): E3X-NA□(V)

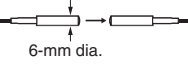
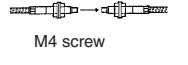

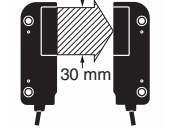

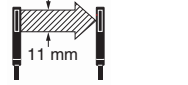

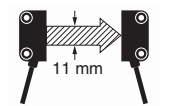
NAG□: E3X-NAG□

NA□F: E3X-NA□F

## Through-Beam, General Purpose Type

Application	Features	Appearance	Type	Detection distance <b>Note:</b> Values in ( ) are when using the E39-F1 Lens Unit.	Standard object <b>Note:</b> Values in ( ) are minimum detectable object: opaque.	Part number
Constant flexing	1 mm minimum bending radius, 2 m cable length ✂		DA-LD	670 mm (4,000 mm)	1.0 mm dia. (0.01 mm dia.)	E32-T12R
			DA-SM	530 mm (3,700 mm)		
			DA-HS	200 mm (1,400 mm)		
			NA□(V)	280 mm (2,100 mm)	1.0 mm dia. (0.03 mm dia.)	
			NAG□	50 mm (375 mm)	1.0 mm dia. (0.2 mm dia.)	
			NA□F	80 mm (600 mm)		
Thin fiber, minute object detection, constant flexing	1 mm minimum bending radius, 2 m cable length ✂		DA-LD	150 mm	0.5 mm dia. (0.01 mm dia.)	E32-T22R
			DA-SM	130 mm		
			DA-HS	50 mm		
			NA□(V)	60 mm	0.5 mm dia. (0.03 mm dia.)	
			NA□F	18 mm	0.5 mm dia. (0.1 mm dia.)	
Space-constrained, constant flexing, side-view sensing	Side-view sensing, 1 mm minimum bending radius ✂		DA-LD	270 mm	1.0 mm dia. (0.01 mm dia.)	E32-T14LR
			DA-SM	210 mm		
			DA-HS	90 mm		
			NA□(V)	110 mm	1.0 mm dia. (0.03 mm dia.)	
			NA□F	33 mm	1.0 mm dia. (0.2 mm dia.)	
Minute object detection, side-view sensing, constant flexing	Side-view sensing, 1 mm minimum bending radius ✂		DA-LD	60 mm	0.5 mm dia. (0.01 mm dia.)	E32-T24R
			DA-SM	50 mm		
			DA-HS	25 mm		
			NA□(V)	30 mm	0.5 mm dia. (0.03 mm dia.)	
			NA□F	9 mm		

## Through-Beam, Special-Purpose Fibers

Application	Features	Appearance	Type	Detection distance	Standard object Note: Values in ( ) are minimum detectable object: opaque.	Part number
Chemical-/ heat-resistant	10 mm minimum bending radius, Teflon® sheath protects cable and sensing head from chemicals, solvents and oil, withstands -40°C to 200°C		DA-LD	880 mm	1.0 mm dia. (0.2 mm dia.)	<b>E32-T81F</b>
			DA-SM	700 mm		
			DA-HS	260 mm	1.0 mm dia. (0.2 mm dia.)	
			NA□(V)	350 mm		
			NA□F	100 mm	1.0 mm dia. (0.5 mm dia.)	
	10 mm minimum bending radius, fluorine resin sheath protects cable from chemicals, withstands -40°C to 200°C		DA-LD	350 mm	1.0 mm dia. (0.01 mm dia.)	<b>E32-T81R</b>
			DA-SM	280 mm		
			DA-HS	100 mm	1.0 mm dia. (0.2 mm dia.)	
			NA□(V)	180 mm		
			NA□F	50 mm	1.5 mm dia. (0.5 mm dia.)	
Area Sensing	1 mm minimum bending radius, 30 mm sensing area 		DA-LD	2,300 mm	0.3 mm dia. (*1)	<b>E32-T16WR</b>
			DA-SM	1,800 mm		
			DA-HS	660 mm	0.5 mm dia. (*2)	
			NA□(V)	690 mm		
			NA□F	200 mm	4.0 mm dia. (*2)	
	1 mm minimum bending radius, 11 mm sensing area, side-view sensing 		DA-LD	980 mm	0.2 mm dia. (*1)	<b>E32-T16JR</b>
			DA-SM	750 mm		
			DA-HS	210 mm	0.3 mm dia. (*2)	
			NA□(V)	390 mm		
			NA□F	110 mm	2.0 mm dia. (*2)	
	1 mm minimum bending radius, 11 mm sensing area 		DA-LD	1,050 mm	0.2 mm dia. (*1)	<b>E32-T16PR</b>
			DA-SM	840 mm		
			DA-HS	320 mm	0.3 mm dia. (*2)	
			NA□(V)	450 mm		
			NA□F	130 mm	2.0 mm dia. (*2)	

\*1 These values were obtained when the sensing distance was set at 300 mm. Values for the diameter of the sensing object were obtained when the object was in a stationary state.

\*2 These values were obtained when the sensing distance was set at 100 mm. Values for the diameter of the sensing object were obtained when the object was in a stationary state.

# Sensing Distance with Fiber-Optic Cables

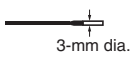
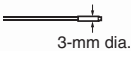
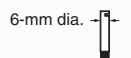
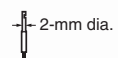
## ■ Diffuse Fibers

- *Standard object* measurements were made with the E3X-DA-N and the E3X-NA set to Standard mode. The size of standard object is the same as the fiber core diameter or the lens diameter for models with a lens.
- *Minimum sensing object* is shown in parentheses below the standard object (using the same column in the table below). The values of the minimum sensing object size were obtained at a distance where the smallest object (gold wire) can be sensed with the Diffuse Fiber unit.
- The  $\sphericalangle$  indicates models that customers can cut to length for their application. Models without this mark are pre-cut by the factory to maintain their respective specifications.

The table specifies the sensing characteristics of each fiber when used with the following amplifiers:

Legend:

DA-HS:	E3X-DA-N (Digital amplifier - high speed mode)
DA-LD:	E3X-DA-N (Digital amplifier - long distance mode)
DA-SM:	E3X-DA-N (Digital amplifier - standard distance mode)
NA□(V):	E3X-NA□(V)
NAG□:	E3X-NAG□
NA□F:	E3X-NA□F

Application	Features	Appearance	Type	Detection distance	Standard object <b>Note:</b> Values in ( ) are when min. detectable object is opaque.	Part number
Constant flexing and little installation space	1 mm minimum bending radius, 3 mm dia. sensing head, 2 m cable length $\sphericalangle$		DA-LD	220 mm	300 x 300 mm (0.01 mm dia.)	<b>E32-D12R</b>
			DA-SM	170 mm		
			DA-HS	80 mm	150 x 150 mm (0.01 mm dia.)	
			NA□(V)	90 mm		
			NAG□	15 mm	25 x 25 mm (0.1 mm dia.)	
			NA□F	30 mm		
Constant flexing and little installation space	1 mm minimum bending radius, 3 mm dia. sensing head, thin fibers $\sphericalangle$		DA-LD	40 mm	50 x 50 mm (0.01 mm dia.)	<b>E32-D22R</b>
			DA-SM	30 mm		
			DA-HS	10 mm	25 x 25 mm (0.01 mm dia.)	
			NA□(V)	15 mm		
			NA□F	5 mm	25 x 25 mm (0.03 mm dia.)	
Constant flexing and side-view sensing	1 mm minimum bending radius, 6 mm dia. sensing head $\sphericalangle$		DA-LD	60 mm	100 x 100 mm (0.01 mm dia.)	<b>E32-D14LR</b>
			DA-SM	45 mm		
			DA-HS	25 mm	25 x 25 mm (0.03 mm dia.)	
			NA□(V)	16 mm		
	1 mm minimum bending radius, 2 mm diameter sensing head $\sphericalangle$		DA-LD	25 mm	50 x 50 mm (0.01 mm dia.)	<b>E32-D24R</b>
			DA-SM	15 mm		
			DA-HS	6 mm	25 x 25 mm (0.03 mm dia.)	
			NA□(V)	7 mm		
NA□F	2.3 mm					

# Specifications

## Through-Beam Fiber-Optic Cables

Part number	Ambient operating temperature	Relative operating humidity	Permissible bending radius	Core material	Sheath material	Enclosure rating
E32-T12R	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Vinyl chloride copolymer	IP67
E32-T14LR	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Vinyl chloride copolymer	IP67
E32-T16JR	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Vinyl chloride copolymer	IP50
E32-T16PR	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Vinyl chloride copolymer	IP50
E32-T16WR	-25°C to 55°C (-13°F to 131°F)	35% to 85% RH	1 mm	PMMA	Vinyl chloride copolymer	IP50
E32-T22R	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Polyethylene	IP67
E32-T24R	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Polyethylene	IP67
E32-T81F	-40°C to 200°C (-40°F to 392°F)	35% to 85% RH	10 mm	Glass	Teflon®	IP67
E32-T81R	-40°C to 200°C (-40°F to 392°F)	35% to 85% RH	10 mm	Glass	Fluorine resin	IP67

## Diffuse Fiber-Optic Cables

Part number	Ambient operating temperature	Relative operating humidity	Permissible bending radius	Core material	Sheath material	Enclosure rating
E32-D12R	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Vinyl chloride copolymer	IP67
E32-D14LR	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Vinyl chloride copolymer	IP67
E32-D22R	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Polyethylene	IP67
E32-D24R	-40°C to 70°C (-40°F to 158°F)	35% to 85% RH	1 mm	PMMA	Polyethylene	IP67

# Dimensions

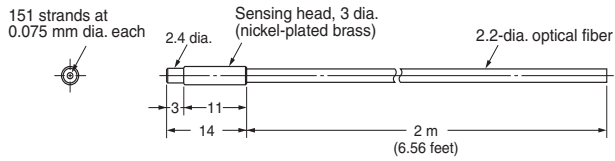
Unit: mm (unless noted)

**Note:** The ✂ indicates models that customers can cut to length for their application.

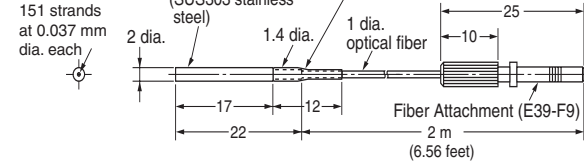
## Through-Beam Fibers

### Through-Beam, General Purpose Type

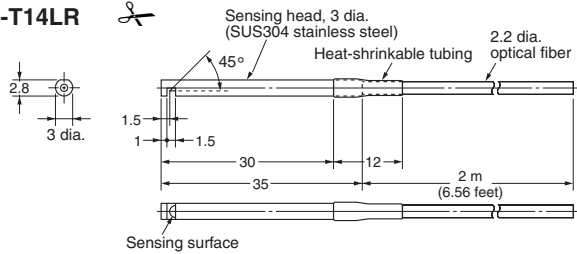
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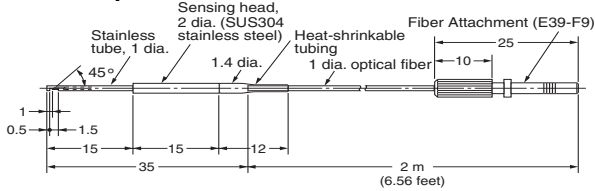
**E32-T22R** ✂



**E32-T14LR** ✂

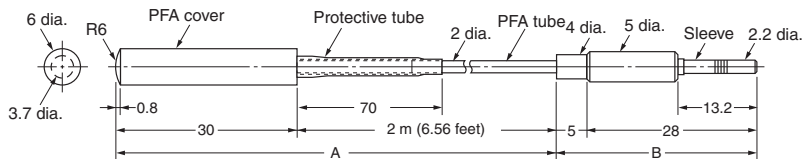


**E32-T24R** ✂



### Through-Beam, Special Purpose Fibers

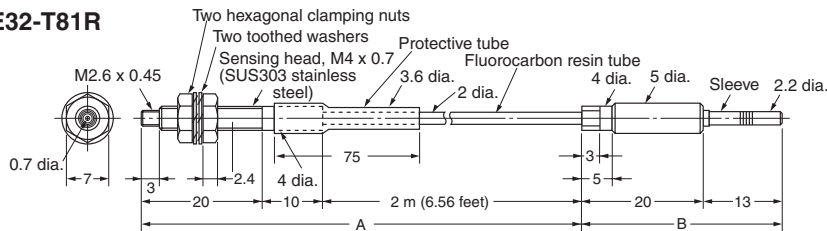
**E32-T81F**



**Note:** Section A resists 200°C and section B resists 110°C.

\*This model is pre-cut at the factory.

**E32-T81R**

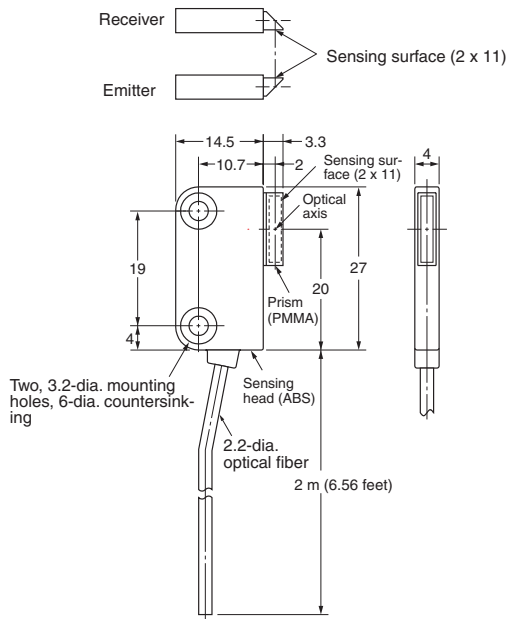


**Note:** Section A resists 200°C and section B resists 110°C.

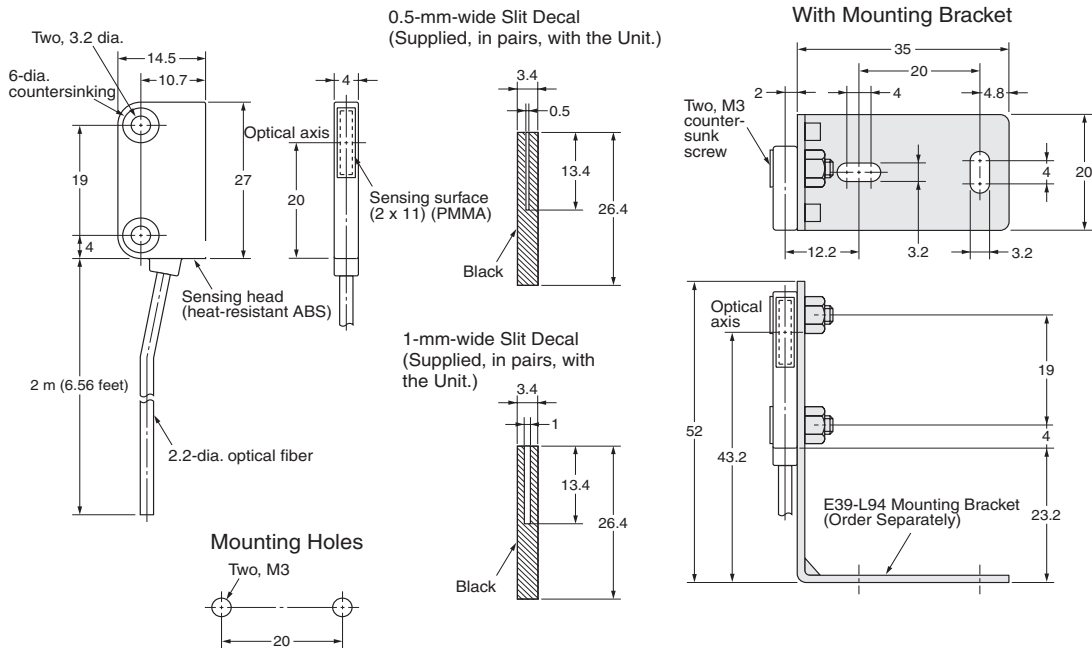
\*This model is pre-cut at the factory.

Through-Beam, Special-Purpose Fibers (continued)

E32-T16JR ✂



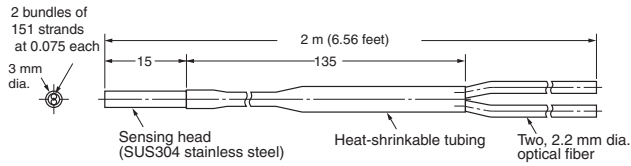
E32-T16PR ✂



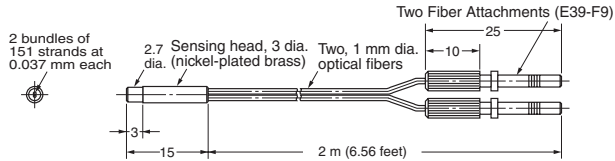
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## ■ Diffuse Fibers

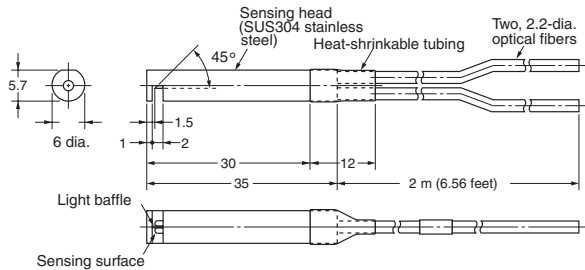
### E32-D12R ✂



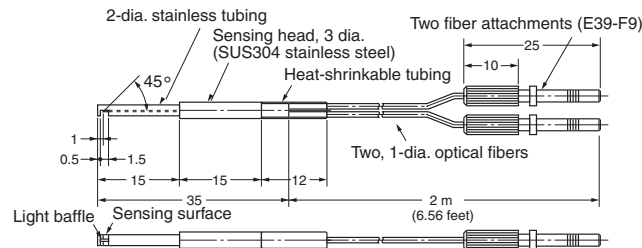
### E32-D22R ✂



### E32-D14LR ✂



### E32-D24R ✂



**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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