Fiberoptic Light Guides

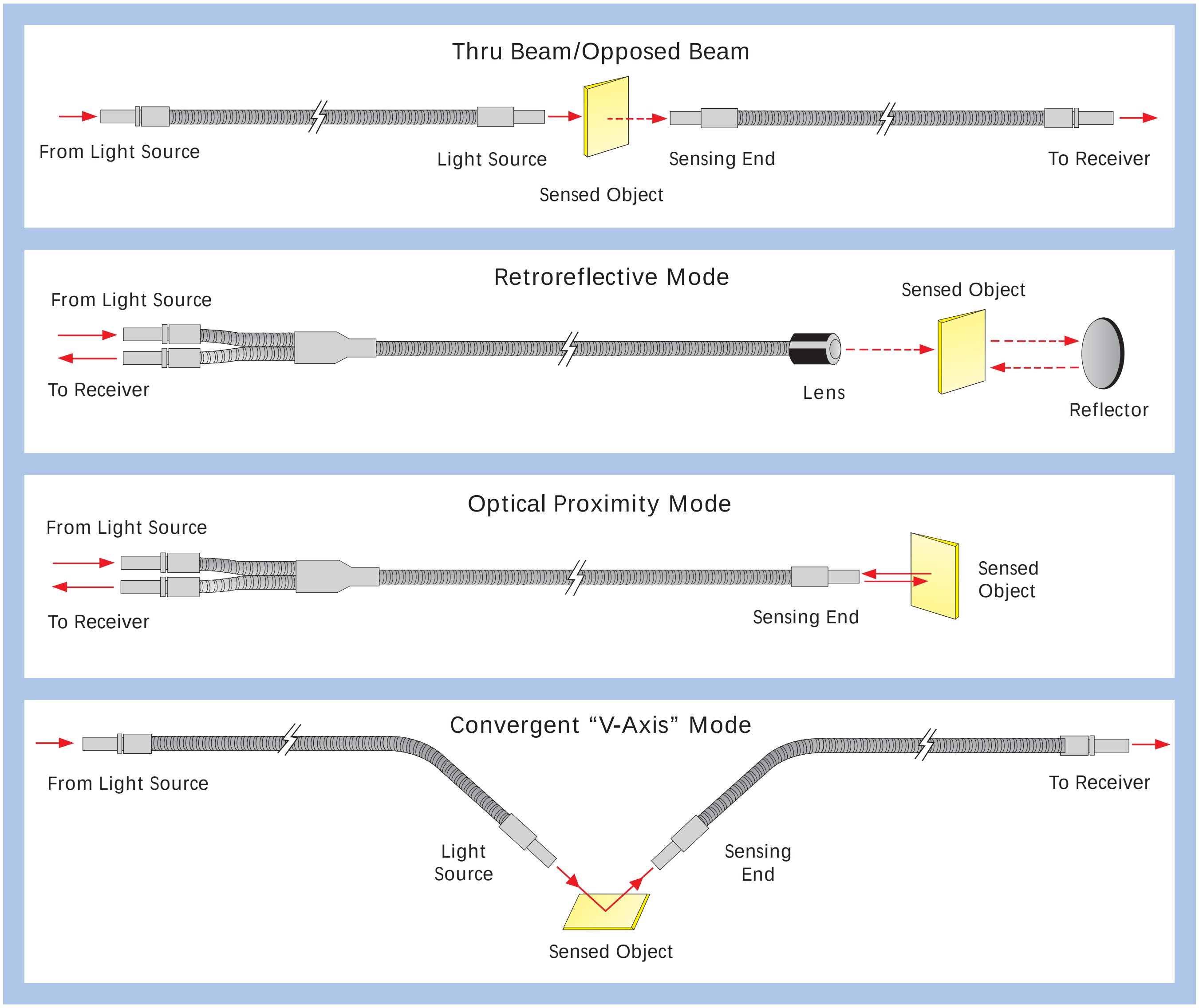
Shine a flashlight into one end of either a flexible plastic or glass fiberoptic light guide and you will see light coming out of the other end. This ability to guide light from one place to another provides many advantages when applied to industrial photoelectric sensing.

Fiberoptic Light Guides are flexible and small enough to fit into difficult sensing sites. This allows the sensor to be located in a more convenient, remote location — out of harm's way. Fibers are resistant to high temperatures, vibration, condensation, and corrosion.

One of the main advantages of glass fiberoptic light guides is that they can be sized and shaped to provide optical advantages. When fiberoptic light guides are utilized, they become the optics of the sensing system.

At the sensing site, the size and shape of the fiberoptic bundle carrying the light controls the size and shape of the transmitted light beam. The size and shape of the fiberoptic bundle receiving the light beam controls the effective viewing area of the sensing system.

Lenses are available to provide additional control of the transmitted and received light beams. Both Beam Break and Beam Make sensing modes are adaptable to fiberoptic sensing.



Fiberoptic Application *Hints & Tips*

1. USING STRAIGHT LIGHT GUIDES

Straight light guides are a bundle of glass fibers, with the same number of glass fibers on both ends.

• Thru-Beam/Opposed Mode Sensing

Straight light guides are used in pairs. One light guide is used to transmit the light from the sensor's light source to the sensing site. Here the light beam is focused, or directed across the area the target is to be passing. The receiving light guide is located on the opposite side, aligned in position to receive the light beam. Then this light guide transmits the received light back to the sensor's photo detector. When a target or object passes through the light beam, the sensor responds to the absence of light and switches its output accordingly. This is called Beam Break, or thru-beam sensing. (Refer to illustrations)

• Convergent “V” Axis Mode

At times thru-beam and proximity sensing won’t work for a particular application. By using a pair of straight fibers directed at an object in a “V” configuration, a certain part of the object can be detected. (Refer to illustrations)

2. USING BIFURCATED LIGHT GUIDES

Bifurcated light guides start out as one bundle of glass fibers. This single bundle is then split into two separate bundles of fibers at the sensor end, and left as one randomly mixed bundle at the sensing end.

• Beam Break Sensing or Retroreflective Mode

The sensing tip of the fiber is placed on one side of the detection path with a reflector on the other. The object passes between the fiber and the reflector, breaking the beam and switching the output of the sensor. (Refer to illustrations)

• Beam Make Sensing or Proximity Mode

One half of the fiber transmits the light to the sensing site. The other half transmits the reflecting or diffusing light off the surface of the target back to the sensor's photodetector. This “proximity mode” sensing is used to sense nearby objects.

3. EXPLOSIVE ENVIRONMENTS **WARNING**

While fiberoptics are considered to be intrinsically safe, the sheathing is a hollow tube that could conceivably provide a flame path. Additionally, the photoelectric sensor must be placed into an approved enclosure.

4. LONG FIBERS

Glass fibers absorb 10% of the remaining light for each foot of glass the light travels; 15-foot fibers have brighter beams than 20-foot fibers, etc. Fibers can be ordered in longer lengths in 12-inch increments up to 30 feet.

5. ROUTING

Avoid sharp bends when routing light guides around machines. A good minimum bend radius is approximately 10 times the jacket diameter.

6. WATERPROOF

Liquid inside the fiber’s protective jacket will lower transmission. Use PVC mono coil jackets in wet locations.

7. REPAIRS

Fiberoptics must *never be cut or broken.* Never pull on a fiberoptic’s protective jacket. They cannot be repaired or spliced. The tips cannot be bent unless specifically noted. They are filled with epoxy, and will break. Abrasion can scratch the face of the fiberoptic bundle and lower its performance.

8. CLEANING

Avoid dirt build-up on the bundle face. Clean with filtered air, soap and water, glass cleaners, toothbrushes, etc. Avoid abrasives.

9. FIBEROPTIC LIGHT GUIDES TEMPERATURE RATINGS

GLASS FIBERS (Type 304 stainless steel)

Standard Fibers

Excess heat above the rated temperature damages the epoxy in the tips, or melts the PVC monocoil jacket.

- **Flexible Stainless Steel Jacketing**
  Operating temperatures from -50°F to +525°F (-45°C to +275°C)
- **PVC Monocoil Jacketing**
  Operating temperatures from -40°F to +220°F (-40°C to +105°C)

High Temperature Fibers

On various tests our high temperature fiberoptics were subjected to temperatures above 500°C for ten hours, and they held their bonding elements without failure.

- **Stainless Steel Jacketing (Type 304)**
  Operating temperatures from -50°F to +900°F (-45°C to +480°C)

PLASTIC FIBERS

PLASTIC FIBER OPTIC SPECIFICATIONS	
Operating Temperature	-40º to 80º C (-40º to 176º F)
Sensing Range	Dependent on Fiber & Sensor Combination
Construction	Optical Fiber: Acrylic Monofilament
	Protective Jacket: Black Polyethylene
	Threaded End Tips & Hardware: Nickel Plated Brass
	Probe End Tips: SUS Stainless Steel
Minimum Bend Radius	.47” (12 mm) for .020” (0.5 mm) Fibers
	.98” (25 mm) for .040” (1.0 mm) Fibers
Chemical Resistance	Core is made of acrylic. Avoid exposing core to acids and aggressive bases as well as solvents. Jacket of fiber will provide a degree of protection from most chemical environments.

Fiberoptic Light Guides

1. Select mode of sensing best suited to your application, e.g., “straight light guide” for Beam Break/opposed mode sensing, or “bifurcated light guide” for Beam Make/proximity sensing.
2. Determine whether the standard size or the miniature fibers will work best.
3. Select “stainless steel armored cable” for most applications, including high temperatures, or “PVC jacketed monocoil” for wet applications.
4. Select fiberoptic bundle size and shape that optimize the viewing area and provide the greatest amount of contrast deviation as displayed on the CONTRAST INDICATOR.
5. Select the tip configuration that best fits the sensing needs, such as, right angle, straight, stainless or brass threaded (both 1.5” and .625” lengths), or side view.
6. Use the Glass Fiberoptic Model Number Matrix below to create the model number that matches your selected sensing mode, jacketing, fiberoptic bundle, size, and tip configuration.

Plastic Fiberoptic Light Guides
Model numbers for plastic fibers do not fit this matrix. If you have a need for a plastic fiber, look through this section and determine the tip configuration and fiber you require. See drawings for plastic fiber bundle sizes.

TEMPERATURE DESIGNATOR
Blank – Standard Fiber
H – High Temp Fiber

BUNDLE DESIGNATOR
Glass
A – .125"
B – .062"
C – .032" x .382" Rectangle
E – .046"
H – .015"
J – .027"
K – .020" x .150" Rectangle, A Tip
L – .057" 3" Bendable
P – .010" x 1.50" Rectangle

Miniature Glass
The following suffixes are different for Miniature Fibers
A – 0.090"
C – 0.250" X 0.025"

Plastic
G, H, S, W, Y, Z, Q, CZ
Diplex fibers have 2 plastic fibers fused together.

TIP CONFIGURATION DESIGNATOR
Standard Glass
T – 5/16" 24 THD x 1.5" Brass Threaded
TL – 5/16" 24 THD x .625" Brass Threaded
TR – 5/16" 24 THD x 1.5" Threaded Right Angle
TLR – 5/16" 24 THD x .625" Threaded Right Angle
TRS – 5/16" 24 THD x 1.5" 55 Threaded Right Angle
TLRS – 5/16" 24 THD x .625" SS Threaded Right Angle
RT – 5/16" 24 THD x 1.5" Right Angle Threaded
RTL – 5/16" 24 THD x .625" Right Angle Threaded
RTS – 5/16" 24 THD x 1.5" 55 Right Angle Threaded
RTLS – 5/16" 24 THD x .625" 55 Right Angle Threaded
RS – Side View Right Angle Tip
A – .187" Tip with B or E Bundle Size
AR – .187" Tip with B or E Bundle Size with Right Angle

Miniature Glass Fibers
The following suffixes are different for Miniature Fibers
T – I0 x 32 THD Brass
TM4 – M4 x 0.75 THD Stainless Steel Threaded Tip
TM6 – M6 x THD Stainless Steel Threaded Tip

Plastic Fibers
TL – M2.6 x 0.45 THD, M4 x 0.70 THD
TRL – M2.6 x 0.45 THD, M4 x 0.70 THD, Right Angle
T70 – 70 mm needle tip, M3 x 0.50 THD
T – 3 mm straight tip, M3 x 0.50 THD
T35 – 35 mm needle tip, M3 x 0.50 THD

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STYLE DESIGNATOR
F – Standard Fiber
BF – Bifurcated Fiber
MF – Miniature Straight
MBF – Miniature Bifurcated
PF – Plastic Fiber
PFD – Plastic Fiber Diplex

LENGTH DESIGNATOR
36 – 36" Glass Standard Length
Other lengths available in 12" increments
Plastic (See Drawing)

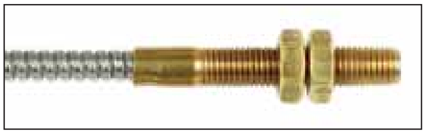
JACKET DESIGNATOR
Blank – Stainless Steel
P – PVC Monocoil

Consult the factory for custom fibers and tips.

This section lists only the most popular fiberoptic light guides. Many more configurations are also available directly from stock. Consult your local sales representative or the factory with your requirements.

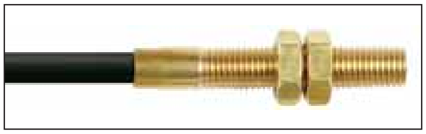
Fiberoptic Light Guides

JACKETING FOR FIBEROPTIC LIGHT GUIDES



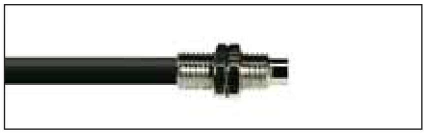
Glass Fiber – Flexible Stainless Steel Armored Cables

Stainless steel armored cables (Type 304 Stainless) provide maximum protection against shock and abrasion. The interlocked metal hose is both flexible and strong. However, it is not waterproof, oil tight, or vapor proof. Standard operating temperatures from -50°F to 525°F (-45°C to 275°C) High temperature from -50°F to +900°F (-45°C to +480°C)



Glass Fiber – PVC Jacketed Monocoil

PVC jacketed monocoil provides ample protection for most industrial applications. It is a flat-wound steel spring, forming a crush-proof flexible tube around the glass. PVC monocoil fibers are waterproof, oil tight, crush resistant, and very flexible. Operating temperatures from -40°F to 220°F (-40°C to 105°C) Not available in High Temperature. PVC Jacketed Monocoil (Add Suffix "P" to Model Numbers)



Plastic Fiber – Fluorinated Polymer Jacket

Core – Polymethyl Methacrylate (ultra grade) with an allowable bending radius of >17mm. Plastic Fibers should be used only with visible light. Operating temperatures from -40°F to +185°F (-40°C to +85°C)

Note: Due to their light transmission properties, plastic fiberoptic light guides are recommended for use only with visible light sensors.

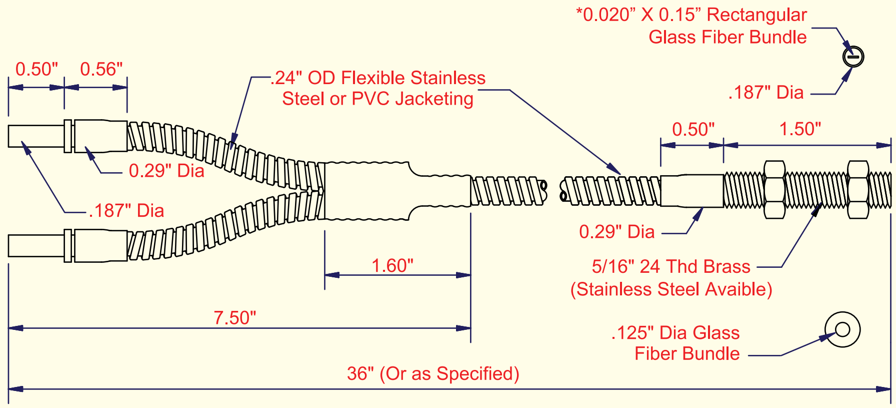
CUSTOM FIBERS

Custom Fiberoptics are a TRI-TRONICS® specialty! In most cases, we can meet your "special requirements" for customized tip configurations, fiber bundle sizes, and cable lengths, all with quick delivery. All requests for custom fiberoptic light guides must include a detailed drawing showing the critical tolerances before a quotation can be provided, to ensure construction requirements and tolerances are within TRI-TRONICS capabilities. Important: Custom fiberoptic light guides are non-refundable and non-returnable. Suitability for purpose is not guaranteed.

FIBEROPTIC ACCESSORIES

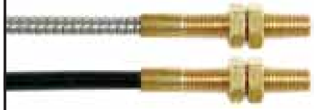
TRI-TRONICS carries a full line of Fiberoptic Accessories to complement your selection of fiberoptic light guides. See Accessories Section for details.

Glass Bifurcated Light Guides



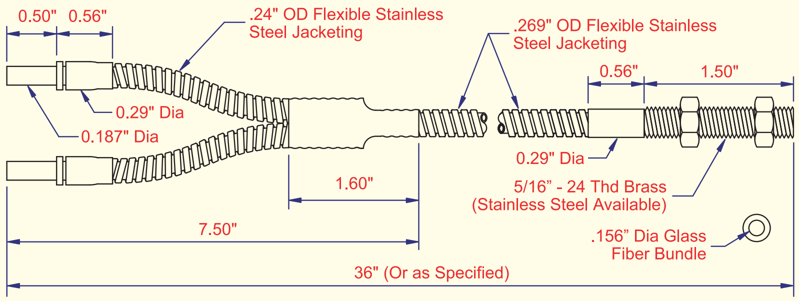
Straight Threaded Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-A-36T	.125"
BF-B-36T	.062"
BF-E-36T	.046"
BF-J-36T	.027"
* BF-K-36T	.020" x .15"



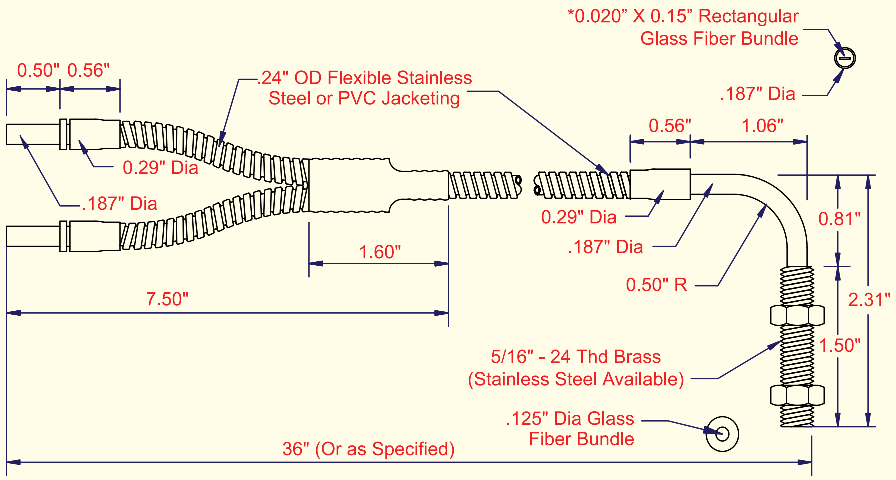
PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-A-36TP	.125"
BF-B-36TP	.062"
BF-E-36TP	.046"
BF-J-36TP	.027"
* BF-K-36TP	.020" x .15"



Straight Threaded Tip
Stainless Steel Jacket
Micro Polished for Superior Performance and Range

MODEL	BUNDLE SIZE
BF-U-36TUV	.156"



Threaded Tip, then Right Angle
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-A-36TR	.125"
BF-B-36TR	.062"
BF-E-36TR	.046"
* BF-K-36TR	.020" x .15"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-A-36TRP	.125"
BF-B-36TRP	.062"
BF-E-36TRP	.046"
* BF-K-36TRP	.020" x .15"