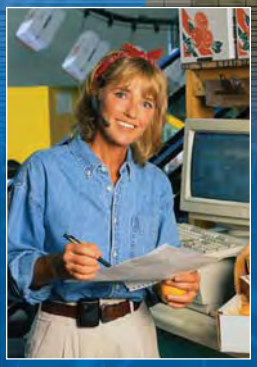
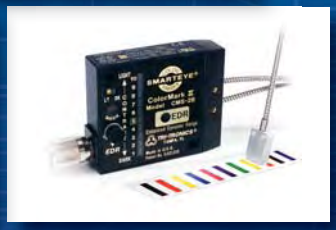
TRI-TRONICS®

Smart Photoelectric Solutions Since 1954





Photoelectric Sensor User Guide

2007 - 2008

800-237-0946 ttco.com 813-886-4000

TRI-TRONICS®

Smart Photoelectric Solutions Since 1954

Photoelectric Sensors, Fiber Optic Light Guides and Controls

The Company

TRI-TRONICS COMPANY, INC. was formed in 1954 as an engineering oriented firm specifically devoted to the design and manufacture of high quality Photoelectric Sensors and Controls. We have earned a reputation as a leading innovator in photoelectric technology and developed a number of revolutionary products. Our sensors are sold through a worldwide network of technical sales Representatives and stocking Distributors.

The Products

The Company designs and manufactures Photoelectric Sensors, Fiberoptic Light Guides and Controls for a wide variety of industrial applications. Included are sensors for use in the opposed, retroreflective, proximity and convergent modes. The product line includes registration mark/color perception sensors, miniature models, DC and AC sensors, fiberoptic light guides, controls and complete systems.

Recent Developments

Many new and innovative products have been introduced recently, including the **MINI-EYE™** miniature sensor, the all-purpose **EZ-EYE™** sensor, and the **RETROSMART™**, a high performance, clear object sensor. The **RETROSMART™** performs flawless detection of anything...from clear filled PET bottles to shiny cans. We have also increased our selection of **Plastic Fiberoptic Light Guides.**

The Facilities

TRI-TRONICS owns and operates a 28,000 sq. ft. facility in Tampa, Florida, close to Tampa International Airport.

Services

TRI-TRONICS offers a wide variety of innovative Photoelectric Sensors and Controls to fit nearly all industrial applications. Marketing, Sales and Engineering personnel welcome inquiries and will offer solutions to even the most difficult sensing problems.

ttco.com

GENERAL APPLICATION SENSORS

PAGE

SMARTEYE® EZ-PRO™ 2-1

- Automatic adjusting, local or remote
- One-Touch Autoset™

SMARTEYE® PRO & PRO REMOTE 2-9

- Automatic, self-adjusting
- Optional remote AUTOSET™ or action alert output

SMARTEYE® MARK II 2-17

- Enhanced performance with respect to the Classic SMARTEYE®
- Very high speed and resolution
- 50 microsecond response

SMARTEYE® MARK III 2-25

- Miniature, high performance
- DIN Rail mountable

SMARTEYE® CLASSIC 2-34

- High speed
- High resolution

OPTI-EYE® 2-42

- Economical DIN rail mount sensor
- Miniature general purpose sensor
- Changeable optical blocks

GENERAL APPLICATION SENSORS

PAGE

NEW!

EZ-EYE™ 2-49

- Affordable, all-purpose sensor
- EZ to use Push-button adjustment

NEW!

MINI-EYE™ 2-55

- Standard & 18 mm Mounting Models
- Thru-Beam models
- Laser Thru-Beam models
- M8 4-PIN connector or 6 ft. potted cable

MITY-EYE® 2-62

- AC & DC Miniature Sensors
- General purpose sensor
- Changeable optical blocks

TINY-EYE® 2-73

- Miniature, tamperproof sensor
- Proximity or Thru-Beam models

U.S. EYE® 2-79

- AC/DC Sensor with Timer, Relay or Triac Output Options
- Conventional sensor with unique features

SPECIALTY APPLICATION SENSORS

NEW!

PAGE

SMARTEYE® RETROSMART 2-83

- Flawless detection of clear FULL bottles and shiny cans
- No proxing on shiny objects
- Detection of irregular shaped clear objects

SMARTEYE® STEALTH-*UV* 2-89

NEW!

- Digital Models
- Analog Models
- Designed to detect the presence of invisible fluorescent materials
- Fiberoptic options
- Up to 24" range

SMARTEYE® DCS 2-94

- Remote, digitally controlled sensor
- Highest resolution of any model
- Parameters can be changed dynamically

LABEL•EYE® 2-101

- Optimized for label detection
- AUTOSET™ set up
- Low cost

SMARTEYE® EXTREME HIGH-INTENSITY 2-104

- Thru-Beam
- Fiber Optic
- Penetrates many packaging materials for content verification

REGISTRATION MARK SENSORS

PAGE

SMARTEYE® COLORMARK II 2-109

- High Resolution Registration Mark Sensor
- 5 LED color options
- 50 microsecond response time

MARK•EYE® PRO 2-115

- High Resolution Registration Mark Sensor
- White LED
- AUTOSET™
- Remote Set-Up option

MARK•EYE® 2-121

- Opacity Mode Gap Sensor
- Low cost
- AUTOSET™

DANGER WARNING DANGER

TRI-TRONICS industrial control products are designed for machine control in factory automation applications only.

They were not designed to meet OSHA and ANSI safety standards. Therefore, they should never be used in personal safety applications.

The output devices incorporated into the TRI-TRONICS controls and industrial sensors can fail in either the energized or de-energized state. Therefore, if inappropriately used in "people" protection systems, an unsafe operating condition may result which could lead to serious injury.

FIBEROPTIC LIGHT GUIDES AND ACCESSORIES

NEW! @ TTCO

RETRO SMART™

High-Performance Clear Object Sensor

Flawless detection of anything...from FULL clear bottles to shiny cans.

- Designed specifically to detect transparent/translucent plastic or glass containers, as well as shiny metal cans.
- Operates in the retroreflective (beam break) sensing mode, using a high performance reflector (AR6151 reflector included with sensor).
- Optimum range (distance to reflector) 6 in. to 8 ft. (15.24 cm to 2.4 m).
- AUTOSET™ setup routine requires a single push of a button with the reflector in view.

See Page 2-83

NEW!@ TTCO

MINI-EYE™

Our Lowest Cost Sensor That Outperforms Anything in its Price Range!

Miniature Photoelectric Sensor

TRI-TRONICS®

- Sensors are available with either infrared (IR) or red LED light source, and either NPN or PNP output transistor
- Standard and 18 mm mounting models
- Fixed Optics - Proximity, Retroreflective, Polarized Retroreflective, and Thru-Beam
- Laser Thru-Beam models
- Immune to indirect ambient light and strobes

See Page 2-55

18 mm mount

EZ EYE™

Affordable All-Purpose Sensor...

That's EZ To Use!

- EZ to adjust...AUTOSET™ routine requires a single push of a button.
- EZ to select sensing mode...Choose from ten completely interchangeable optical blocks.
- EZ to align...Flash Rate Indicator monitors received light intensity.
- EZ EYE™ sensors are equipped with both NPN and PNP output transistors.
- Responds to sensor's pulsed modulated light source...immune to most ambient light.

Premium Features at an economical price!

See Page 2-49

NEW!@ TTCO

Wider Selection of Plastic Fiberoptic Light Guides

- Economical
- Coaxial bundle

See Page 3-24

Fundamentals of Photoelectric Sensing

Fundamentals of Photoelectric Sensing

Today's photoelectric sensor is one of the most versatile non-contact sensing devices known to man. The reliability of photoelectric "eyes" or "sensors" took a giant leap forward in the early 1970s when the light emitting diode (LED) replaced the fragile incandescent light source.

This solid-state light source also enables the designer to eliminate most problems previously caused by ambient room light. Modern pulse modulated photoelectric sensors respond only to the light emitted by their own light source.

This capability allows the sensor to be very sensitive and responsive to small light changes that occur to the light beam path between the light source lens and the receiving lens.

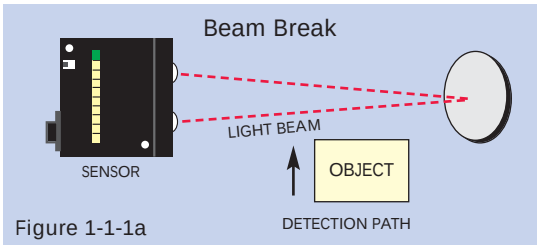


Figure 1-1-1a

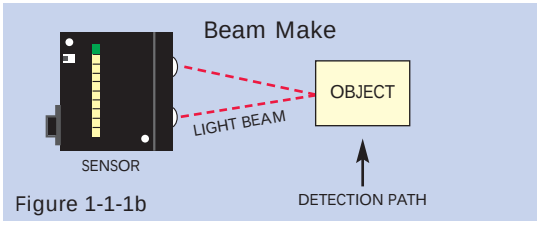


Figure 1-1-1b

For an object to be detected, it must affect the intensity of the light beam reaching the sensor's light detector in one of two ways:

- The object must break or diminish an existing light beam path between the light source lens and receiver lens—Beam Break mode. (See Figure 1-1-1a)
- The object itself must diffuse or reflect the light beam to the receiving lens—Beam Make mode. (See Figure 1-1-1b)

One sure way to simplify the selection of a photoelectric sensor to fit your application is to remember that you only have two choices—Beam Make or Beam Break.

Contrasting Light Levels

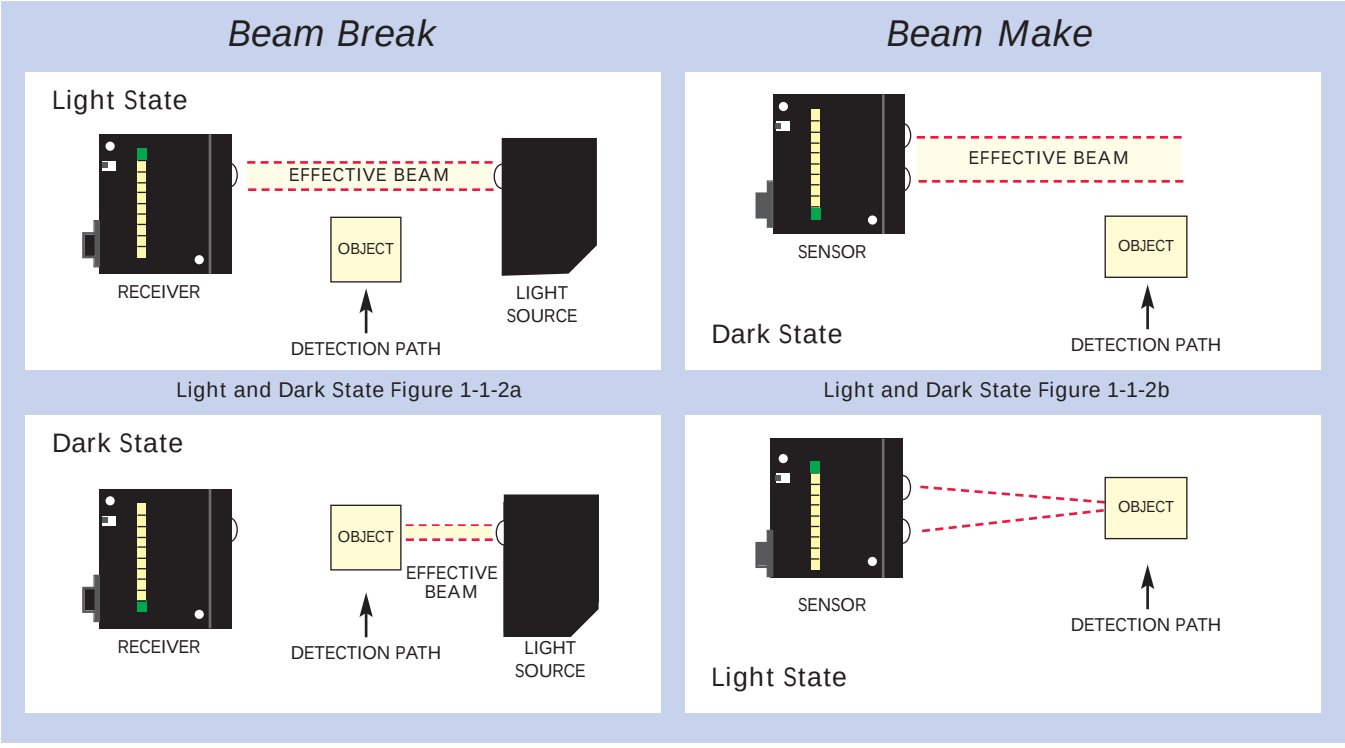
The sensing task of any digital switching photoelectric sensor is to respond to and resolve the difference between the contrasting light levels and switch its output accordingly.

When operating in the Beam Break mode, the intensity of the light beam reaching the receiving lens is in its brightest or lightest state condition before an object is introduced into the light beam path. Introducing an object into the light beam path will block out, or diminish, the intensity of the received light beam, resulting in the darkest state condition. (See Figure 1-1-2a)

In the Beam Make mode, the darkest state condition is before an object is placed in the light beam path. The lightest state condition is when an object is introduced into the light beam path so as to bounce, or reflect, the light beam to the receiving lens. (See Figure 1-1-2b)

The amount of difference or deviation of the intensity of the light beam in its lightest state condition vs. the intensity of the received light beam in the darkest state is called "contrast."

These contrasting light levels define the degree of difficulty of the sensing task. In real estate, it is well known that the three most important considerations are location, location, location. In photoelectric sensing, the three most important considerations are contrast, contrast, contrast.



Light and Dark State Figure 1-1-2a

Light and Dark State Figure 1-1-2b

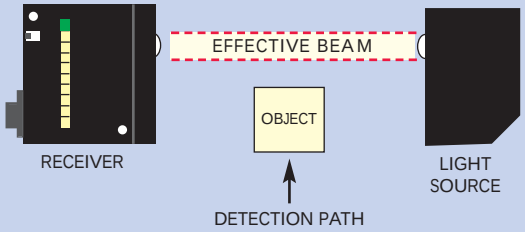
Beam Break Sensing

Opposed Mode

In the Opposed Mode of sensing, two separate devices utilizing either lensed or fiberoptic light guides are used to make or break a beam.

- One unit is the light source.
- The other is the receiver.

In this mode, the light source transmits a beam of light across the detection path to the receiver. Detection occurs when an object interrupts, or sufficiently diminishes, the intensity of the received light beam. (See Figure 1-2-1)



Opposed Mode, Figure 1-2-1

Unfortunately, Beam Break sensing is often overlooked as a result of the initial cost of purchasing and installing two separate devices and the sometimes tedious task of alignment. However, the opposed mode of sensing has distinct advantages when detecting opaque products. It provides the most reliable sensing method under very adverse conditions, such as dusty, dirty, and moisture-laden environments.

Remember…when opaque, go Beam Break.

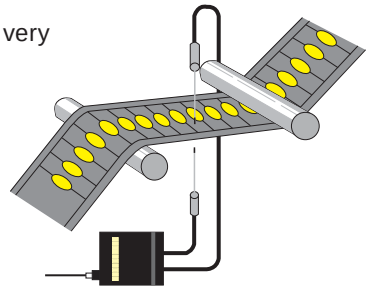
Retroreflective Mode

The Retroreflective sensor contains both the light source and receiving device in one housing. A unique dual lens system or bifurcated fiber optic light guide establishes the transmitted light beam path and the returned light beam path on the same axis. When a retroreflective sensor or fiber is pointed or aimed at a reflector, the light beam is reflected back to the receiving lens or fiber. (See Figure 1-3-1) Sensor alignment with a prismatic reflector can be skewed by 10 to 15 degrees and, still a strong light beam will return to the receiving lens on exactly the same axis as the original transmitted light beam.

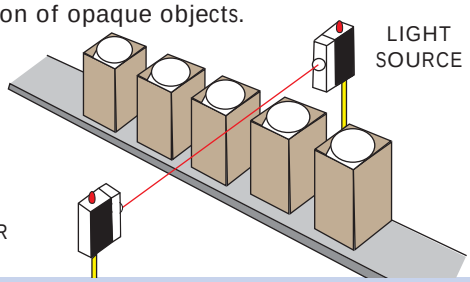
To detect presence or absence of objects, the light beam path is directed across the detection path so that

Opposed Mode

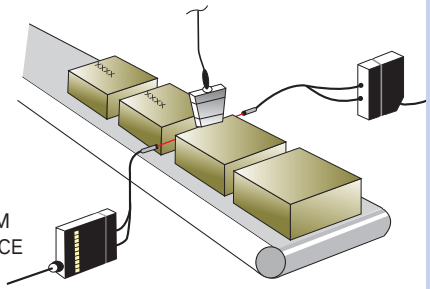
1. Detection of very small objects.



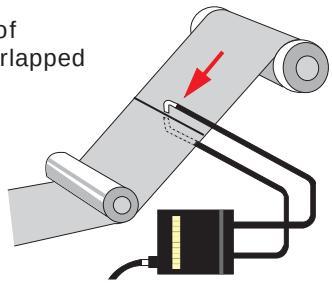
4. Detection of opaque objects.



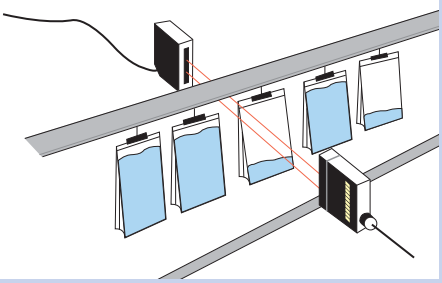
2. Detection of an object's precise location.



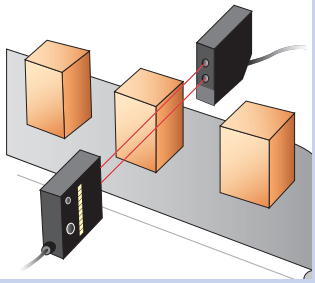
5. Detection of splices or overlapped materials.



3. Detection of fill levels in containers.



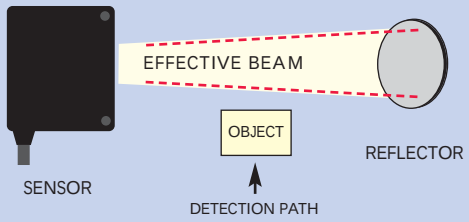
6. Detection of container contents.



Beam Break Sensing

passing opaque objects interrupt the light beam. When the light beam is broken or when the intensity of the received light beam is reduced below a threshold level, the sensor responds by switching its output.

When sensing small parts, the recommended choice is opposed mode sensing using fiberoptic light guides. The retroreflective sensor is generally low in cost and easy to install. However, care must be taken to ensure that shiny objects passing near the sensor do not reflect a light beam off the surface of the object strong enough to accidentally switch the sensor's output. This undesirable characteristic of the retroreflective sensor is referred to as proxing. To prevent proxing, the sensor's light beam can be aligned on an angle of incidence that reflects the light beam away from the receiving lens. Another way to reduce proxing is to polarize the light beam. Polarized light helps to ensure that only the light beam reflected off the prismatic reflector reaches the sensor's receiver. While reducing the response to light reflected off the surface of the sensed object, polarizing reduces sensing range.



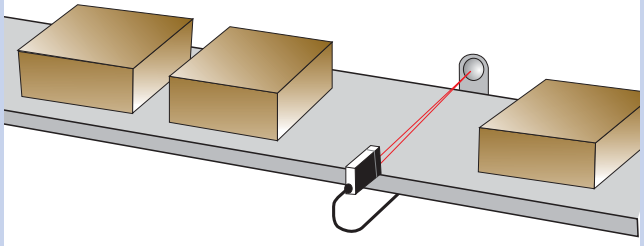
Retroreflective Mode, Figure 1-3-1

Transparent/Shiny Object Detection

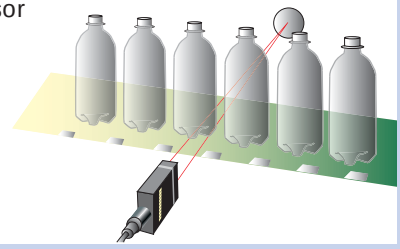
In the past, the retroreflective sensor has been the most effective choice when detecting opaque objects. However, recently things have changed! Thanks to advances in technology, the new RETROSMART™ retroreflective sensor can – absolutely, without fail, detect ANY transparent/translucent or shiny object. The RETROSMART sensor provides a single, non-chattering output for each transparent PET bottle or shiny metal can that passes through the sensor's narrow, red light beam.

Retroreflective Mode

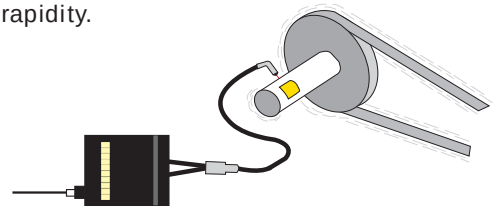
1. Detection of large objects.



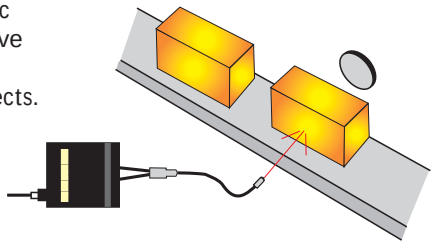
4. High performance retroreflective sensor for sensing a transparent glass or plastic product.



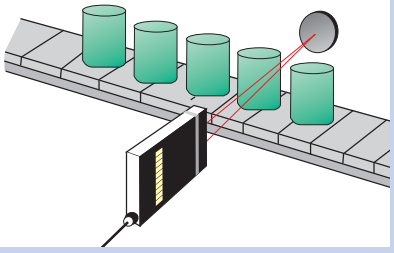
2. Detection of reflective tape moving at high rapidity.



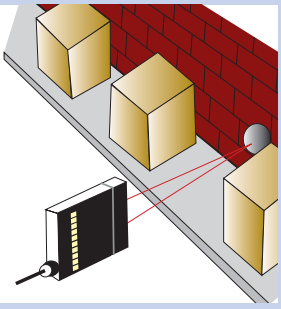
5. Fiber optic retroreflective detection of moving objects.



3. Detection of objects moving at high velocity.



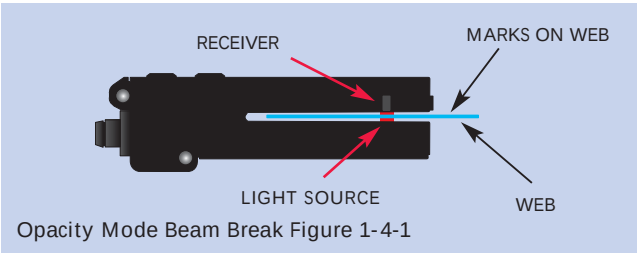
6. Beam Break detection of objects at sensing sites where mounting space is limited.



Beam Break Sensing

Gap Sensors

Gap sensors are an excellent choice to sense a distinguishing change or object on a continuous web or roll of materials. By using opacity mode sensing techniques that utilize a light source capable of penetrating through the web of materials, gap sensors can register slight contrasting light level changes and produce an output signal for a specific machine operation.



Opacity Mode Beam Break Figure 1-4-1

A significant advantage of opacity mode sensing with TRI-TRONICS gap sensors is that end users do not need to be concerned with web flutter or ambient light, including strobe flashes.

Depending on what you are trying to sense, opacity mode sensors can give you the desired output signal to perform machine functions. Typical applications include sensing labels on a roll, sensing registration marks on printed packaging material, and splice detection on continuous webs of material. Since opacity mode sensing distinguishes the light level change as light passes through a web of material, the web must be translucent or transparent. Most webs of packaging material such as film, metallized films, and paper do allow light to pass through. Opaque materials such as aluminum foil do not allow light to pass through and, therefore, cannot be used in opacity mode sensing.

MARK•EYE®

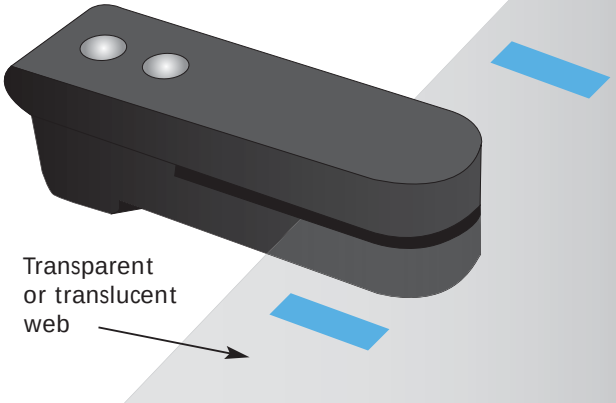
The MARK•EYE® sensor is designed to see printed registration marks on most packaging materials on a continuous web. By detecting the contrasting light level difference between the background material and the registration mark on the web, the sensor's output signals to perform a machine function.

LABEL•EYE®

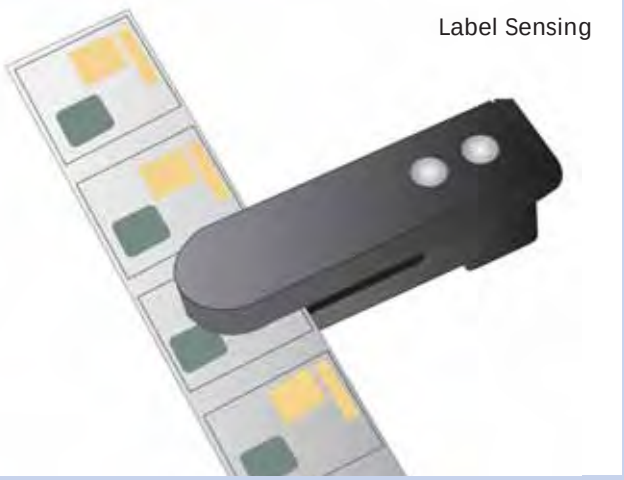
The LABEL•EYE® sensor is designed specifically to sense a variety of adhesive labels on a continuous roll. It works by detecting the contrasting light level change that penetrates through the backing material of a web and a self-adhesive label. The function of the LABEL•EYE® is to look through the backing paper to detect the "gap" between the labels and signal the labeling machine to stop the dispensing mechanism before the label is completely dislodged from the backing material. With the next "up" label protruding off the end of the peeler plate, it is now perfectly positioned to be applied to the next product as it passes by on a conveyor.

Opacity Mode

Registration Mark Sensing



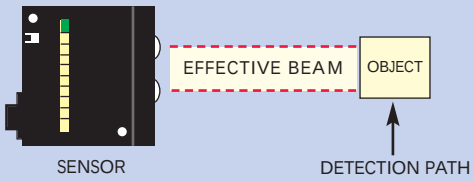
Label Sensing



Beam Make Sensing

Optical Proximity Mode

Optical Proximity sensors contain both the light source and the receiver in one common housing. The light source lens shapes the light beam into a diverging column of light that, with distance, increases in width and decreases in intensity. A wide angle receiving lens is used to collect the reflected light beam off the surface of the object to be detected. (See Figure 1-5-1)



Optical Proximity Mode Figure 1-5-1

A bifurcated fiber optic light guide can also be utilized as the light passes through the fiber optic light guide. The light is reflected off the object and passes back through the fiber to the sensor's receiver.

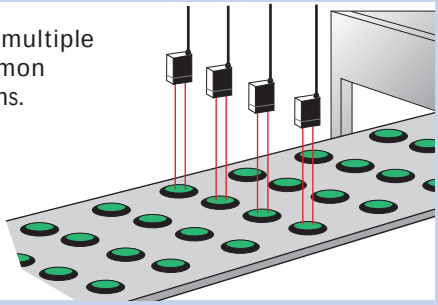
It is often difficult, if not impossible, to access both sides of the detection path of objects moving past the sensing site. When this circumstance occurs, the Beam Make mode of sensing is the only choice. For example, when attempting to detect each item in a row of objects resting on a common conveyor belt, the proximity sensor is recommended. In this situation, the proximity sensor must resolve the difference between the contrasting light levels reflecting off the object vs. light reflecting off the conveyor belt.

The suppression of light reflecting off shiny objects in the background can be enhanced by proper positioning of the sensor. If the angle of incidence to the reflected light beam is adjusted so that the light beam path does not return to the receiving lens, the proximity sensor will only respond to the light diffusing, or reflecting off the object itself.

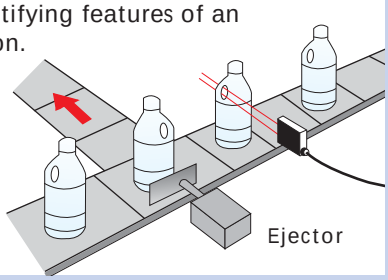
Unfortunately, there are many situations when the intensity of the light reflected off the object is not much

Optical Proximity Mode

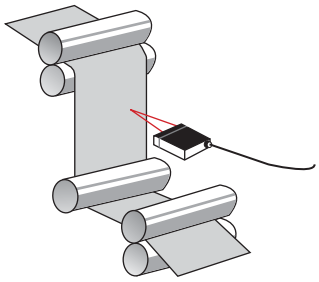
1. Detection of multiple objects on common conveyor systems.



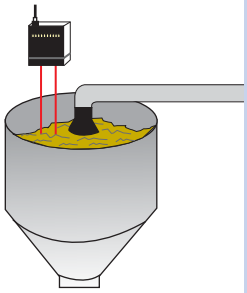
4. Detection of identifying features of an object for orientation.



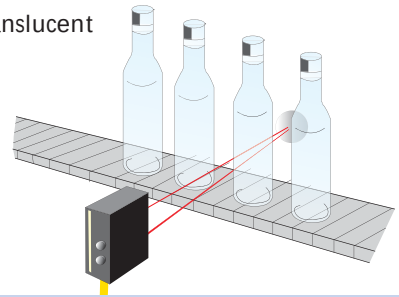
2. Detection of web material.



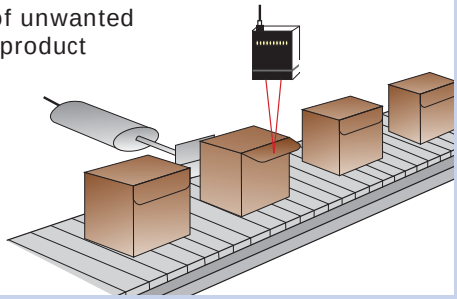
5. Detection of the fill level of the contents of a container.



3. Detection of translucent objects.

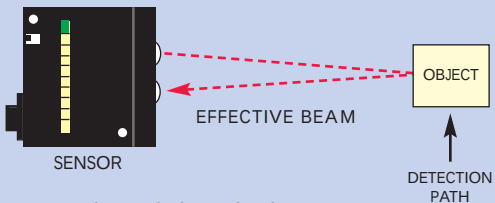


6. Detection of unwanted condition for product inspection task.



Beam Make Sensing

different than the intensity of light reflected off background objects. In applications when the differential between these contrasting light levels is minimal, a high performance sensor equipped with high gain amplifiers and the contrast indicator are recommended. As a result of the diverging light beam, it is sometimes necessary for small objects to be as near as 1/8 inch to the receiving lens or fiber tip to be detected. Larger objects can be detected at a distance of up to 6 feet or more in this mode.



Convergent ("V-Axis") Mode Figure 1-6-1

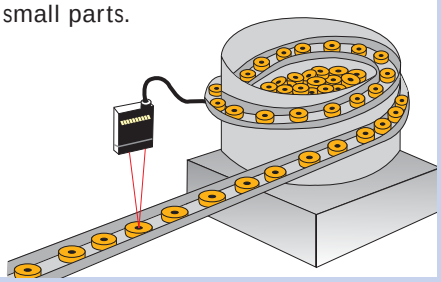
Convergent ("V-Axis") Mode

The convergent mode of Beam Make sensing is very similar to the proximity mode. The convergent beam sensor, like the proximity sensor, responds to a light beam path that reflects off the surface of the object. However, the lensing system of a convergent (also referred to as "V-Axis") sensor converges the light beam into a small spot of light at a distance of a few inches, precisely at the receiving lens focal point. Using this technique provides an effective method of enhancing background suppression, while directing, by reflection, a very strong light beam on a direct path to the receiving lens. In addition to improving background suppression, convergent sensing is very useful for small parts detection and for detection of printed identification data.

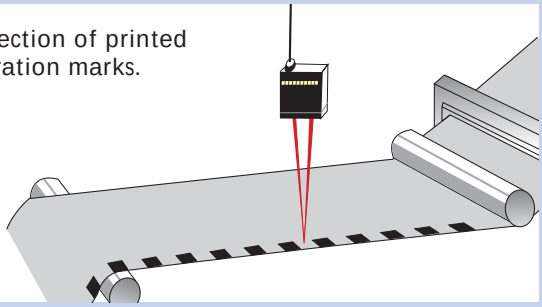
Fiberoptic light guides can also be used in a convergent mode for "V-Axis" sensing. Simply direct two fibers at the target in a "V" configuration and small parts or the contrasts of an object can be detected.

Convergent Mode

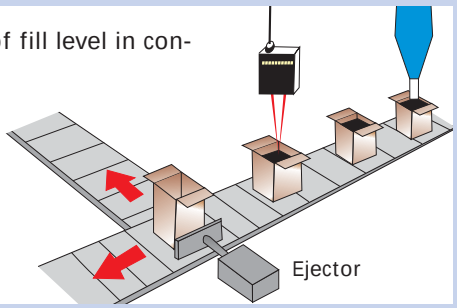
1. Detection of small parts.



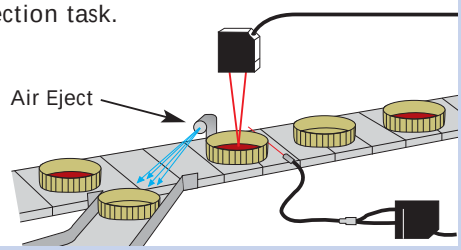
4. Detection of printed registration marks.



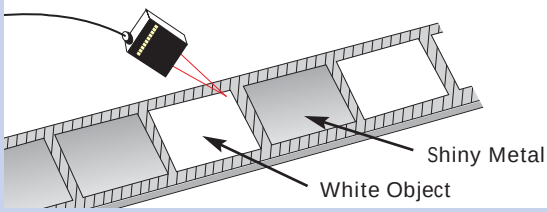
2. Detection of fill level in container.



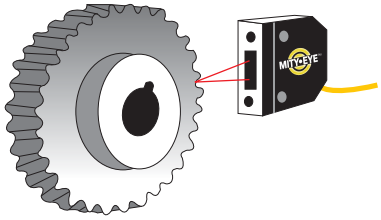
5. Detection of condition for product inspection task.



3. Detection of object when background light suppression is required.



6. Detection of object moving at high speed.



Color Perception for Detecting Registration Marks

White LED Light Source

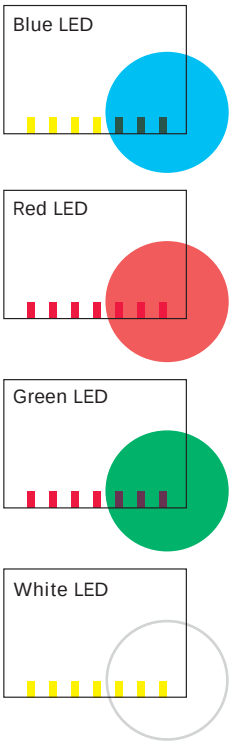
The White LED Light Source in our sensors is the best choice for detecting the widest variety of colored registration marks on today's packing material. White Light enhances performance when detecting dark-colored registration marks on dark-colored webs of materials. In addition, the COLORMARK II sensor is equipped with Red, Blue, White and Green LED light sources. These colors are useful in applications when the preferred White Light Source does not optimally perform; i.e., a White or Blue LED light source is recommended to detect pale yellow marks on a white background.

Color Registration Mark Sensing

When detecting registration marks printed in a wide variety of colors on packaging materials, we recommend white LED color light source for broad band color detection.

Imagine yourself viewing a printed red mark on white paper stock. The red mark looks dark in contrast to the white paper. Now, imagine placing a red transparent filter in front of your eye while trying to view that same red mark. The red mark now becomes difficult, if not impossible, to see. If the sensor is equipped with a red LED, the sensor would have the same problem. Now, imagine yourself viewing that same red mark through a green filter. The white background now appears bright green, but the red mark appears black or very dark. That's the contrast we are looking for!

Equipping the sensor with a green LED provides the sensor with the same advantage as the green filter did for your eye. Now, the red mark provides more



Color Perception

than adequate response to the contrasting light reflecting off the white background.

Opacity Mode Sensing

The MARK•EYE® offers an excellent solution for opacity mode sensing. It is a slot sensor optimized to see printed registration marks on transparent, some translucent, and metallized film on a continuous web of materials. Since the MARK•EYE® operates in the opacity sensing mode, the color of the registration mark simply doesn't matter.

Optical Proximity Mode

The MARK•EYE® has been designed to detect the widest variety of color marks on the widest variety of web colors. It is optimized for high-speed detection of registration marks on opaque materials.

When another color of LED is desired, the COLOR-MARK II is an excellent choice. With the Red, Blue, Green, and White LEDs, seeing the registration mark has never been easier.

Other Color Perception Tasks

The SMARTEYE® MARK II Series or EZ-PRO sensors are extremely useful in object sensing tasks when a difference in color is the only distinguishable feature. An example of an application where color perception is extremely useful in object sensing is identifying the contents of a container by the mere color of its cap. Please note that not all similar shades of the same color can be resolved; however, many can.

TRI-TRONICS sensors, designed for color perception, are all equipped with high gain amplifiers and the Contrast Indicator. They are capable of sensing differences in the color of objects introduced into the light beam path. The resulting signal level deviation is then amplified to a useful level and displayed on the 10 LED

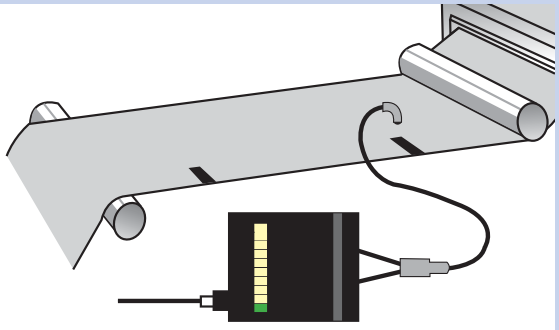
Contrast Indicator. Whenever a color perception task is presented to a SMARTEYE® MARK II or EZ-PRO sensor, the Contrast Indicator eliminates all the guesswork.

Choosing the Correct LED Color

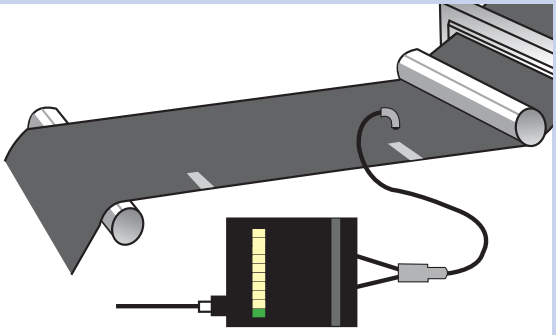
Preferred color perception of the sensor is controlled by the color of the LED light source.

Solid-state light emitting diodes are available in several different colors, such as white, red, green, blue, and infrared. Variable "shades" of colored visible light emitting diodes (LEDs) provide an extended choice for the light source of a pulsed photoelectric sensor. Selecting a color for the LED light source provides the same advantage as choosing a very selective colored filter for narrowing the response of the photoelectric sensor to a specific color. Narrowing the response of a photoelectric sensor to a specific color provides obvious advantages when color perception is required.

Please note that when operating in the Beam Make, proximity mode of sensing, a WHITE LED light source is the best choice for detecting dark colored objects.



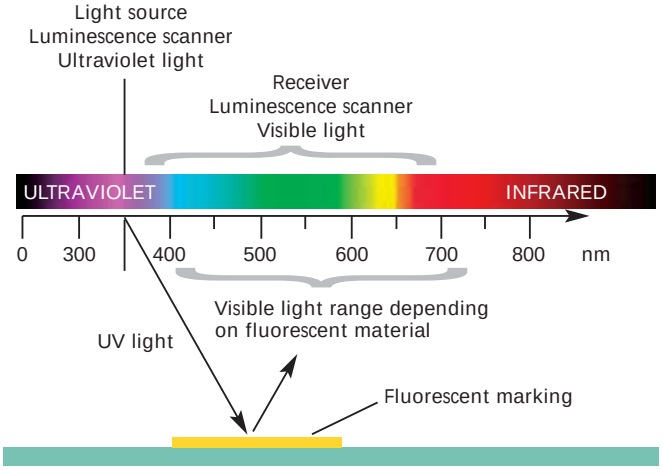
Dark Mark/Light Background



Light Mark/Dark Background

Luminescence Sensor

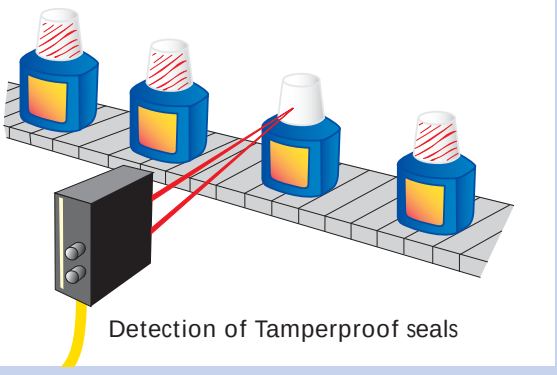
The SMARTEYE® *STEALTH-UV* sensor is a special purpose sensor designed to detect the presence of invisible fluorescent materials contained in special chalks, inks, paint, greases, glue, and optical brighteners found in labels, paper, tape, string, etc. The sensor contains an ultraviolet (UV) solid-state light source that is used to excite the luminescent materials to fluoresce in the visible range. The sensor's detector then responds to the visible fluorescing light. When the received fluorescing light level, as displayed on the Contrast Indicator, reaches a level of "4" or above, the NPN and PNP output transistors will switch to the opposite state.



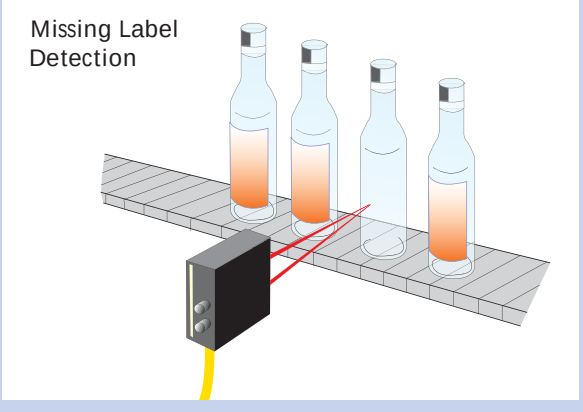
Typical Luminescence Sensor Applications:

- Detection of tamperproof seals
- Clear label detection
- Detection of invisible registration marks
- Product orientation
- Verification of presence of adhesives
- Verification of pull tabs on packages
- Tape or splice detection of web
- Verification of glue on paper, plastic, or transparent materials
- Flaw detection using chalk or invisible marks on lumber/wood products
- Detection of presence of a critical component in a complex assembly
- Thread break detection

Verification of seals



Detection of Tamperproof seals



Range

The sensing range specification provided by sensor manufacturers is typically the maximum absolute sensing range under ideal circumstances.

In the opposed mode of sensing, maximum range is defined as the absolute maximum distance allowable between the light source and the receiver.

In the retroreflective mode of sensing, it is the absolute maximum distance between the sensor and the prismatic reflector.

In the proximity mode of sensing, the maximum range is the absolute maximum distance between the sensor and the sensed object.

However, these maximum sensing range specifications are for reference only. That is because these range specifications are taken under ideal conditions, with clean lenses and in very clean environments. These conditions are not found in the vast majority of industrial applications.

Many manufacturers supply "excess gain" charts that plot range vs. signal strength obtained above the necessary level to trip the output of the sensor. These charts are plotted with the gain adjustments at maximum.

In the Beam Break mode, the target/object, is larger than the effective light beam and is always opaque.

When operating in the retroreflective mode, there is no way to obtain the effect of light reflecting off the sensed object.

In the Beam Make mode, the object is larger than the effective light beam, is perfectly flat, and has a 90% reflective white surface. In addition, in the Beam Make mode, there is no way to obtain the effect of light reflecting off background objects from excess gain charts.

In summary, excess gain charts totally ignore signal strength generated by the Dark State condition.

TRI-TRONICS unique Contrast Indicator™ provides actual signal strength indications that provide for perfect alignment by ascertaining actual response to the intensity of the received light. TRI-TRONICS sensors equipped with Contrast Indicators provide an instantaneous real time indication of the received light intensity at any range.

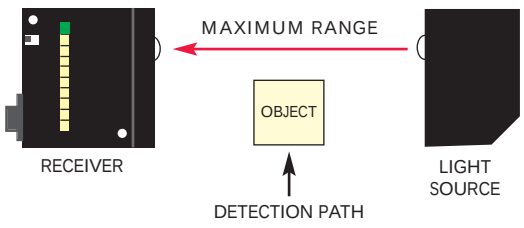
Contrast signal deviation charts are available on all sensors equipped with the Contrast Indicator™. These charts are extremely helpful in determining if the sensor you have selected will adequately perform your particular

Guidelines for Determining Useful Range

% of Range Decrease

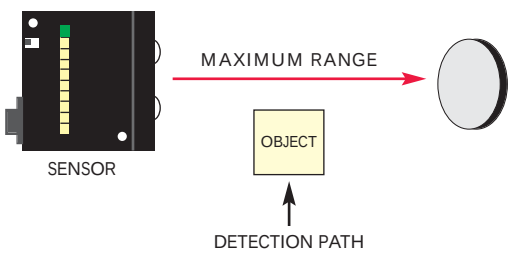
Sensing Environment	Opposed	Retroreflective	Proximity
Clean	-5%	-10%	-10%
Slightly Dirty	-10%	-15%	-25%
Dirty	-20%	-30%	-50%
Very Dirty	-40%	-60%	-75%

Maximum Range Opposed Mode

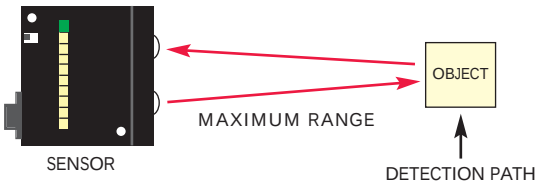


Maximum Range Proximity Mode

Maximum Range Retroreflective Mode



Maximum Range Convergent (V-Axis) Mode



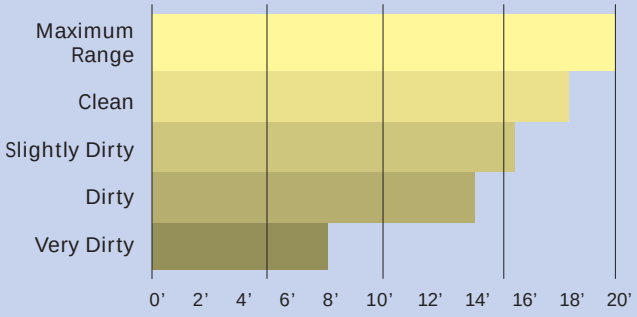
sensing task at the desired range. Simply reference the amount of contrast deviation required to perform the sensing task in your environment, and compare it to the performance chart of the sensor you have selected to determine if the sensing range is adequate.

For TRI-TRONICS sensors not equipped with Contrast Indicators, range guidelines charts are available that indicate recommended maximum sensing ranges. To estimate useful range in your environment, simply decrease the specified maximum range by the percentage indicated in the following table.

Guideline for Determining Useful Range

Sensing Environment	Percentage of Decrease		
	Opposed	Retroreflective	Proximity
Clean	-5%	-10%	-10%
Slightly Dirty	-10%	-15%	-25%
Dirty	-20%	-30%	-50%
Very Dirty	-40%	-60%	-75%

From clean to dirty lens



Example: Model MDIR4 *(Retroreflective)*

Environmental Useful Range

If the maximum range of a retroreflective sensor is rated at 20 feet and your sensing site environment is dirty, the specified maximum range would decrease by 30% to a useful range of 14 feet.

Environmental Considerations

When selecting the appropriate TRI-TRONICS sensor to fit your application, sensing site environmental conditions should always be considered. All TRI-TRONICS products are designed into enclosures or housings that provide varying degrees of protection against special environmental conditions. The accompanying table lists the NEMA and IEC/IP Standards that apply to individual TRI-TRONICS sensors and control enclosures.

Consult factory for RoHS compliance.

TRI-TRONICS Product Enclosure Ratings for Non-Hazardous Locations

PRODUCT FAMILY	NEMA	IEC/IP
CLASSIC SMARTEYE	4X, 6P	IP67
COLORMARK II	4X, 6P	IP67
EZ-PRO	4X, 6P	IP67
EZ-EYE	4	IP67
LABEL•EYE	4	IP67
MARK•EYE	4	IP67
MARKEYE PRO	4X, 6P	IP67
MINI-EYE	4X	IP66
MITY•EYE	4X	IP67
MULTI-MATE Controls	1	IP30
PIC Series Controls	1	IP30
RETROSMART	4	IP66
SEPS Power Supplies	1	IP30
SMARTEYE DCS	4X, 6P	IP67
SMARTEYE MARK II	4X, 6P	IP67
SMARTEYE MARK III	4X, 6P	IP67
SMARTEYE PRO	4X, 6P	IP67
SMARTEYE STEALTH-UV	4	IP66
TINY-EYE	4X, 6P	IP67
U.S. EYE	1	IP20

See Environmental Ratings, Data Section

Contrast Indicator™ *Guaranteed Performance*

Contrast Indicator™ Guarantees Performance

By viewing the Contrast Indicator readings during installation, the position that generates the largest amount of contrast deviation can be determined. Maximizing contrast deviation in any sensing application results in the guarantee of maximum performance and reliability.

Contrast Indicator™ Verifies Performance

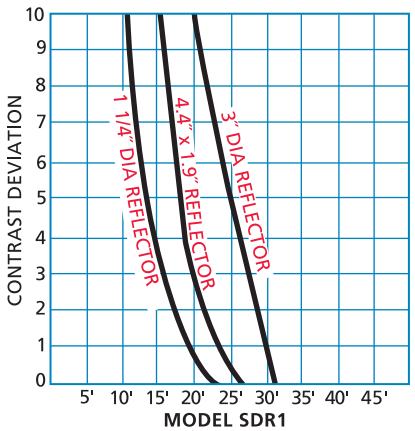
Performance of any SMARTEYE® can be diagnosed at the sensing site by observing contrast deviation as displayed on the Contrast Indicator. To ascertain deviation, simply subtract the lowest (Dark State) reading from the highest (Light State) reading and compare the resulting number to the contrast rating system below.

CONTRAST RATINGS

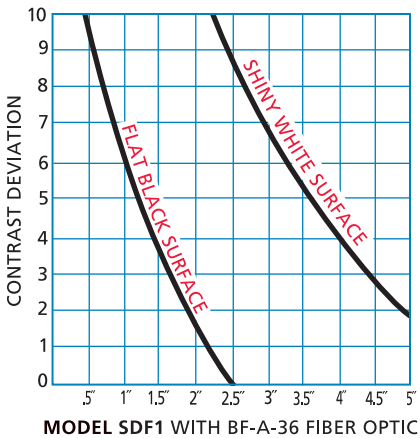
CONTRAST DEVIATION 5 Bar	8 Bar	10 Bar	RATING	PERFORMANCE COMMENTS
1	1 – 2	1 – 2	Poor	Insufficient contrast to adequately perform sensing task.
2	3	3 – 4	Fair	Adequate contrast when conditions can be repeated and when periodic adjustments are acceptable.
3	4	5 – 6	Good	Generally enough contrast to adequately perform most sensing tasks.
4	5 – 6	7 – 8	Very Good	Sufficient contrast to easily perform most sensing tasks.
5	7 – 8	9 – 10	Excellent	More than acceptable contrast which provides a very large operating margin.

Contrast Performance Charts Verify Sensing Range

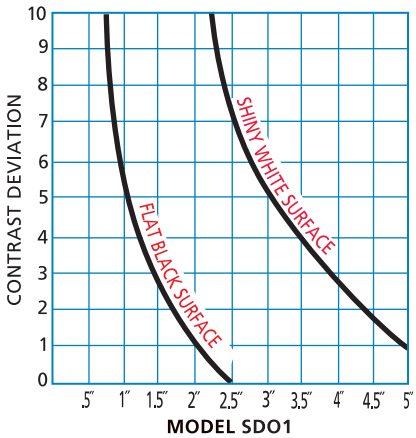
These charts are extremely helpful in determining if the SMARTEYE® you selected will adequately perform the sensing task at the desired range. Simply reference the amount of contrast deviation required to perform the sensing task in your environment and compare to the performance chart of the SMARTEYE® you have selected to determine if the sensing range is adequate. Shown below are typical performance charts on (3) Model SD SMARTEYE® Sensors.



MODEL SDR1



MODEL SDF1 WITH BF-A-36 FIBER OPTIC LIGHT GUIDE - PROXIMITY MODE



MODEL SDO1

Optical Block Selection

Interchangeable optical blocks provide universal application to sensors in any sensing application. Select the sensor first, then choose the optical block that matches the spot size and target.

	CLASSIC SMARTEYE® SMARTEYE® MARK II COLORMARK™ II SMARTEYE® DCS™	SMARTEYE® PRO™ SMARTEYE® EZ-PRO™ OPTI•EYE™ MITY•EYE™ TINY•EYE™ EZ-EYE™ MARKEYE®-PRO
Proximity Mode Sensing		
Wide beam optics useful for short-range sensing of transparent, translucent, or irregular shaped shiny objects.	O2	O4
Narrow beam optics useful in long-range sensing of medium to large size objects.	O1, O1G	O5
Adapts sensors to glass fiberoptic light guides.	F1	F4
Adapts sensors to plastic fiberoptic light guides.	–	F5, F6
Retroreflective Mode Sensing		
Very narrow beam optics designed to sense reflectors or reflective materials at long range. Designed for Beam Break sensing.	R1	R4
Polarized to reduce response to “hot spot” glare from shiny surface of detected object. Use with red or blue light source.	–	R5
Adapts sensors to glass fiberoptic light guides.	F1	F4
Adapts sensors to plastic fiberoptic light guides.	–	F5, F6
Convergent Mode Sensing		
Narrow beam optics that focus at a sensing range of 1". Useful for sensing small parts or registration marks. Also useful for proximity sensing (range of 1" to 5") to minimize response to reflected light from background objects.	V1, V1G	V4, V4A
Narrow beam optics that focus at a sensing range of 1.5". Useful for sensing small parts. Also useful for proximity sensing (range of 1.5" to 8") to minimize response to reflected light from background objects.	–	V6
Narrow beam optics that focus at a sensing range of .5". Useful for sensing small parts or registration marks. Also useful for proximity sensing (range of .25" to 5") to minimize response to reflected light from background objects.	–	V8

Fiberoptic Light Guides

When you shine a flashlight into one end of either a flexible plastic or glass fiberoptic light guide, you will see light shining out the other end. The ability to guide light from the sensor to the target provides many advantages in photoelectric sensing.

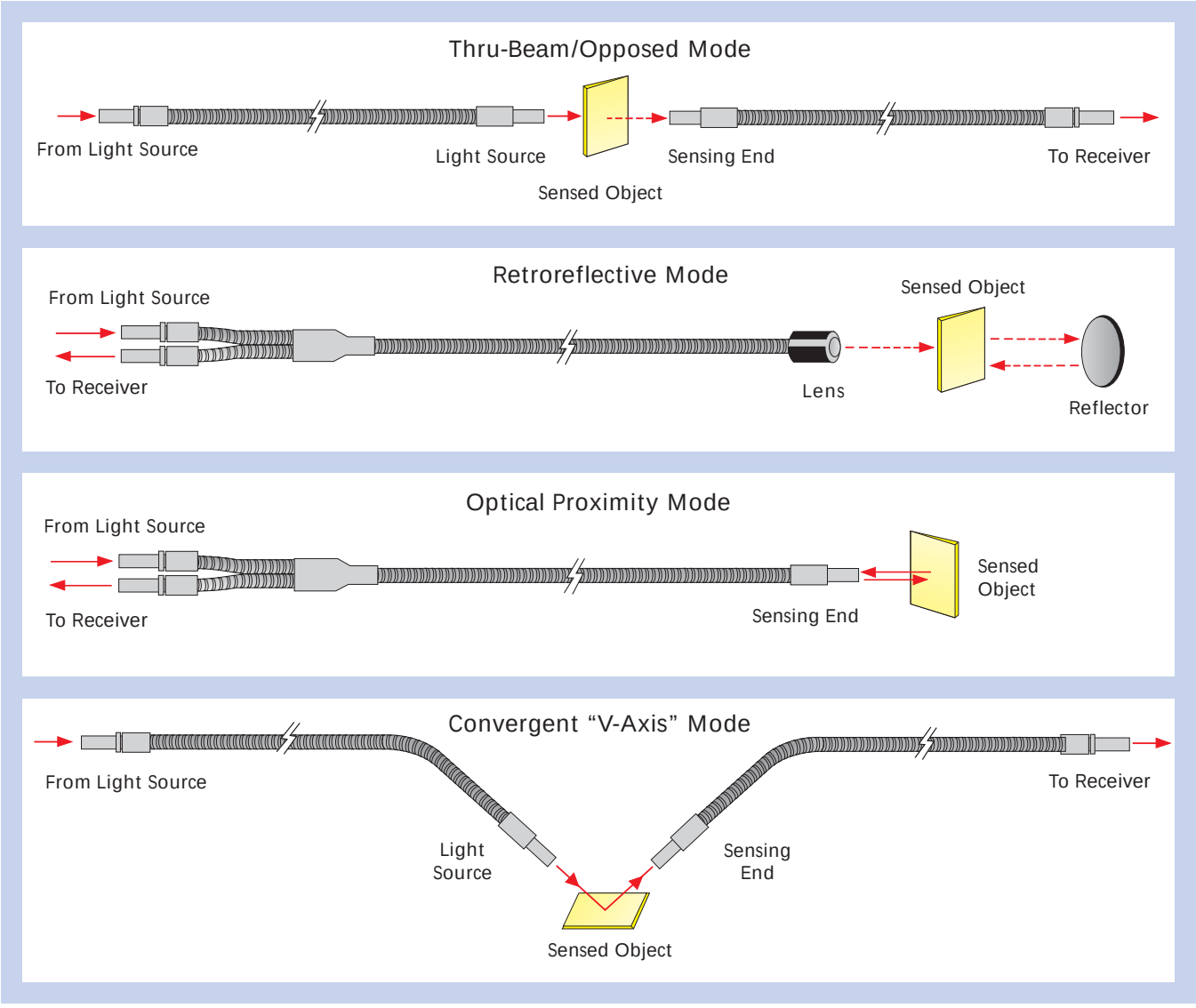
Fiberoptic Light Guides are flexible and small enough to fit into difficult sensing areas. This allows the sensor to be located in a more convenient location—out of harm's way. Fibers are resistant to high temperatures, vibration, condensation, and corrosion.

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

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

Lenses are available to gain optical advantage to the sensing tasks.

Our Miniature Glass Fiber Optic Light Guides combine superior high-color resolution of glass fibers with the size and flexibility of plastic fibers. The tighter bend radius allows you to reach more areas with ease.



Response Time/Operating Speed

Another very important factor in the selection of a photoelectric sensor is the sensor's ability to resolve input events occurring at rapid rates. Unfortunately, response time specifications provided by some photoelectric sensor manufacturers are sometimes vague or, at best, difficult to interpret. It should be noted that there is a difference between response time and operating speed.

Response Time is the length of time it takes for the output of the sensor to switch when a change from the lightest state to the darkest state (or vice versa) occurs. This can be important when attempting to locate the exact position of an object moving at a high velocity.

Operating Speed is the maximum output switching rate the sensor can achieve. This rating is usually expressed by the maximum rate of input events that can be resolved under set conditions.

These conditions generally involve input events that are equally spaced apart, i.e., the length of time the sensor will be in the Dark State condition is equal to the length of time in the Light State condition. This is referred to as a 50-50 duty cycle. If the duty cycle of the input event is other than 50-50, attention should focus on the minimum duration of time the input event will spend in either the Light State or the Dark State condition.

The shortest duration of time spent in either state should then be compared with the minimum Light State/Dark State response times as stipulated in the sensor's specifications.

A word to the wise: Beware, you cannot expect the sensor to achieve the specified minimum response time or maximum operating speeds under all sensing conditions without making some adjustments to either the gain or offset settings.

Speed Conversion Table

Ft/Min	In/Min	In/Sec	Sec/In	Ft/Min	In/Min	In/Sec	Sec/In
1	12	.2	5.000	60	720	12	.0833
2	24	.4	2.500	70	840	14	.0714
3	36	.6	1.667	80	960	16	.0625
4	48	.8	1.250	90	1,080	18	.0556
5	60	1.0	1.000	100	1,200	20	.0500
6	72	1.2	.833	125	1,500	25	.0400
7	84	1.4	.714	150	1,800	30	.0333
8	96	1.6	.625	175	2,100	35	.0286
9	108	1.8	.556	200	2,400	40	.0250
10	120	2.0	.500	225	2,700	45	.0222
11	132	2.2	.455	250	3,000	50	.0200
12	144	2.4	.417	275	3,300	55	.0182
13	156	2.6	.385	300	3,600	60	.0167
14	168	2.8	.357	350	4,200	70	.0143
15	180	3.0	.333	400	4,800	80	.0125
16	192	3.2	.313	450	5,400	90	.0111
17	204	3.4	.294	500	6,000	100	.0100
18	216	3.6	.278	600	7,200	120	.0083
19	228	3.8	.263	700	8,400	140	.0071
20	240	4.0	.250	800	9,600	160	.0063
25	300	5.0	.200	900	10,800	180	.0056
30	360	6.0	.167	1,000	12,000	200	.0050
35	420	7.0	.143	1,500	18,000	300	.0033
40	480	8.0	.125	2,000	24,000	400	.0025
45	540	9.0	.111	3,000	36,000	600	.0017
50	600	10.0	.100	5,000	60,000	1,000	.0010

Example: Determine the time a .25-inch registration mark remains totally in view of a sensor when traveling at 300 feet/min. and the sensor's effective beam width is .062 inch.

Answer: .25-inch mark width – .062-inch beam width = .188-inch travel distance. Using the table, a 1-inch travel distance at 300 feet/min. = .0167 sec/in. .188 inch x .0167 sec/in. = 3 milliseconds.

Local or Remote One-Touch AUTOSET™ Automatic Adjusting Options

SMARTEYE® EZ-PRO™

One-Touch AUTOSET™

The SMARTEYE® EZ-PRO™ is a high performance, automatic photoelectric sensor that can be adjusted by a *single push of a button.* As a result, there is no guess work on the part of the operator. Now you can throw away the screwdriver and the manual!

The EZ-PRO™ AUTOSET™ Adjustment Procedure is as simple as it gets.

1. Establish one of the following conditions:
   - Proximity — Reflect light off object.
   - Beam Break — Remove object from light beam path.
2. Depress either yellow or blue button for three seconds.

That's all there is to it! From that point on, the sensor will automatically maintain a perfect setting, thanks to the dynamic Automatic Contrast Tracking System (ACT™). The EZ-PRO™ AUTOSET™ routine can also be implemented from a momentary remote switch. (i.e. push-button or touch screen). The EZ-PRO™ is equipped with a Contrast Indicator™ as well as an Action Alert diagnostic indicator that allows the operator to visually substantiate performance. When the lock feature is enabled (see advanced features), the EZ-PRO™ sensor is tamperproof. Now, the sensor will provide you with the automatic, hassle-free performance that you expect from a SMARTEYE®.

Features

ACT™ AUTOMATIC CONTRAST TRACKING
ACT™ automatically adjusts the sensor as conditions change. This can include dirty or damaged lenses, reflectors, fiberoptics or LED light source, as well as thermal drift, and target variations such as position, orientation, or color. It can also compensate for signal shift or deterioration caused by high-speed input events. The EZ-PRO™ continues to operate requiring far less maintenance than other sensors, making it *the choice* in tough sensing applications.

AGS™ AUTOMATIC GAIN SELECT
This unique feature provides automatic digital selection of the amplifier gain based upon your application requirements.

AUTOSET™ ADJUSTMENT
The AUTOSET™ adjustment routine only requires one finger to push one button one time! Even in a dynamic operating condition, with ongoing input events, all you have to do is push a button for a perfect setting.

EDR®
Another unique feature, the EDR (Enhanced Dynamic Range) circuit is digitally controlled. It prevents dark state saturation and expands the operating range without reducing amplifier gain.

ACTION ALERT™ INDICATOR LED
This indicator provides an early warning to prevent marginal performance when the sensor can no longer provide full contrast deviation as displayed on the Contrast Indicator.

REMOTE AUTOSET™
Remotely adjust the sensor from a push button momentary switch or a touch screen to PLC instantaneously. The AUTOSET™ routine can occur during static or dynamic operating conditions.

5-LED DUAL FUNCTION INDICATOR AND CONTRAST INDICATOR™
Provides "at-a-glance" performance data during both setup and operation.

STATUS INDICATOR
Displays status of 3 selectable functions: Lock, Auto Track, and Timer; 10ms, 25ms, and 50ms.

VERSATILITY
Choice of ten "quick change" optical blocks allows one sensor to be used in the proximity, convergent, retroreflective, polarized retroreflective, fiberoptic applications.

LED LIGHT SOURCES
Choice of four LED light sources —infrared, red, blue, and white light.

CONNECTIONS
Built-in connector for use with quick disconnect cable or shielded 6' (1.80 m) cable.

MOUNTING OPTIONS
Built-in DIN Rail "snap-on" design, thru-hole, or bracket mount.

DUAL-FUNCTION BAR GRAPH
Primary Function: *Contrast Indicator*
Secondary Function: *Status Indicator* of Five Selectable Options

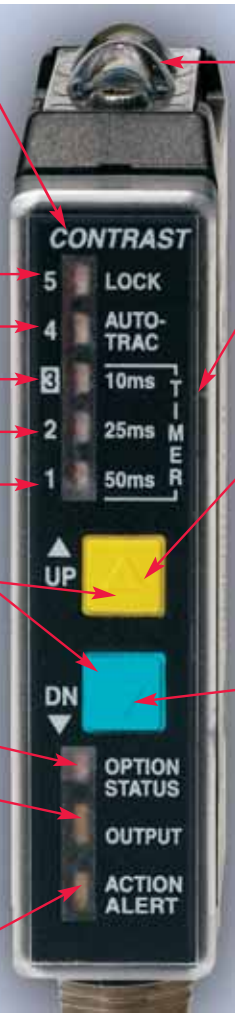
FIVE SELECTABLE OPTIONS
#5 LOCK – for tamperproof operation.
#4 AUTO TRAC™ – Automatic Contrast Tracking for perfect setting.
#3 10 millisecond pulse stretcher/off delay.
#2 25 millisecond pulse stretcher/off delay.
#1 50 millisecond pulse stretcher/off delay.

OPTION STATUS / MODE SELECT
Push both buttons for 3 seconds to switch bar graph display to status indicator of selectable options

OPTION STATUS MODE INDICATOR

OUTPUT STATUS INDICATOR
When illuminated, Option Status Indicator is enabled

MARGINAL PERFORMANCE INDICATOR



INTERCHANGEABLE OPTICAL BLOCKS
Choice of 10 Optical Blocks - O4, O5, R4, R5, F4, F6, V4, V4A, V6, V8

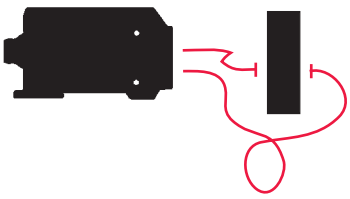
OPTIONAL TIMER
10, 25, or 50 millisecond pulse stretcher / "OFF" delay

YELLOW PUSH BUTTON - 3 Functions
1. Manual "UP" adjustment
2. Light state AUTOSET™ with light "ON" output
3. Toggle selected option to opposite state and return to normal operation

BLUE PUSH BUTTON - 3 Functions
1. Manual "DOWN" adjustment
2. Light state AUTOSET™ with dark "ON" output
3. Step to desired function to be altered when in option status mode

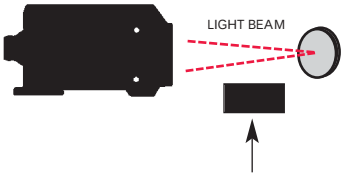
Preferred Mode: Beam Break

Option 1



Fiberoptic opposed mode is best choice for detecting any opaque object.
Sensor: Model EZPI/EZPIC with F4 Optical Block (IR lightsource)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Fiberoptic Light Guides: Model F-A-36T (2 Required)
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)
Sensing Range: Up to 16 in.
Accessories: Two Model UAC-15 lenses, extends sensing range to over 20 ft.
Mounting bracket, Model SEB-3, FMB-1

Option 2



Retroreflective mode. Use with reflector to detect medium to large size opaque objects.
NOTE: Not recommended for detecting highly reflective objects.
Sensor: Model EZPI/EZPIC with R4 Optical Block (IR light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft) or GSEC-15 (15 ft.)
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted. (See Accessories Section for complete listing of reflectors.)
Sensing Range: Up to 20 ft.
Accessories: Mounting bracket, Model SEB-3

Alternate Mode: Beam Make (Proximity)

NOTE: Consider proximity mode when installation sensing site conditions preclude using the preferred Beam Break mode.

Option 1

Fiberoptic proximity is used to detect medium to large flat-sided opaque objects.
Sensor: Model EZPI/EZPIC with F4 Optical Block (IR light source)
Cable: Shielded cable w/connector Model GSEC-6 (6ft.) or GSEC-15 (15ft.)
Fiberoptic Light Guides: Model BF-A-36T
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)
Sensing Range: Up to 6 in.
Accessories: Model UAC-15 lens. Use to extend sensing range up to 1 ft. Mounting bracket, Model SEB-3, FMB-1

Option 2

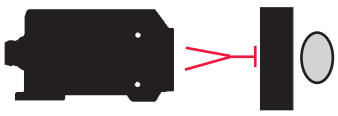
Convergent/proximity mode is useful to detect opaque objects when there is little (if any) gap between objects.
Sensor: Model EZPI/EZPIC with V6 Optical Block (IR light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Sensing Range: From 1.5 to 8 in.
Accessories: Mounting bracket, Model SEB-3

Option 3

Proximity (divergent beam) mode sensing is useful in detecting large size opaque objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model EZPI/EZPIC with O5 Optical Block (IR light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Sensing Range: From 1 to 5 ft.
Accessories: Mounting bracket, Model SEB-3

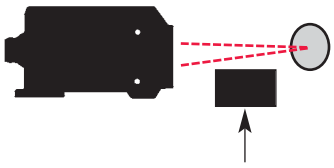
Preferred Mode: Retroreflective Beam Break

Option 1



Fiberoptic retroreflective is the best choice for detecting empty transparent or translucent objects. The SMARTEYE® EZ-PRO featuring a unique blue LED light source is recommended for detecting transparent or translucent plastic or glass objects. A red light source is recommended when detecting translucent (non-transparent) objects only.
Sensor: Model EZPB/EZPBC with F4 Block (Blue light source) or Model EZPR/EZPRC with F4 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6ft.) or GSEC-15 (15ft.)
Fiberoptic Light Guides: Model BF-A-36T
Reflector: Model 78P, plastic 4.4 in. X 1.9 in, screw mounted
Sensing Range: Up to 1 ft.
Accessories: Model UAC-15 lens. Use to extend sensing range from 1 ft. maximum without lens to over 3 ft. with lens. Mounting bracket, Model SEB-3, FMB-1

Option 2



Retroreflective (R4 optical block) is a good choice for detecting medium to large size empty transparent or translucent objects. The SMARTEYE® EZ-PRO featuring a unique blue LED light source is recommended for detecting transparent or translucent plastic or glass objects. A red light source is recommended when detecting translucent (non-transparent) objects only.
Sensor: Model EZPB/EZPBC with R4 Block (Blue light source) or Model EZPR/EZPRC with R4 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6ft.) or GSEC-15 (15ft)
Reflector: Model 78P, plastic 4.4 in. X 1.9 in., screw mounted.
Sensing Range: Up to 5 ft.
Accessories: Mounting bracket, Model SEB-3

Alternate Mode: Beam Make (Proximity)

NOTE: Consider proximity mode when translucent/transparent objects are containers filled with clear liquid or when site conditions preclude using the preferred retroreflective Beam Break mode.

Option 1

Fiberoptic proximity mode is useful to detect transparent/translucent objects.
Sensor: Model EZPR/EZPRC with F4 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Fiberoptic Light Guides: Model BF-A-36T
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)
Sensing Range: Up to 4 in.
Accessories: Model UAC-15 lens. Use to extend sensing range up to 1 ft.
Mounting bracket, Model SEB-3, FMB-1

Option 2

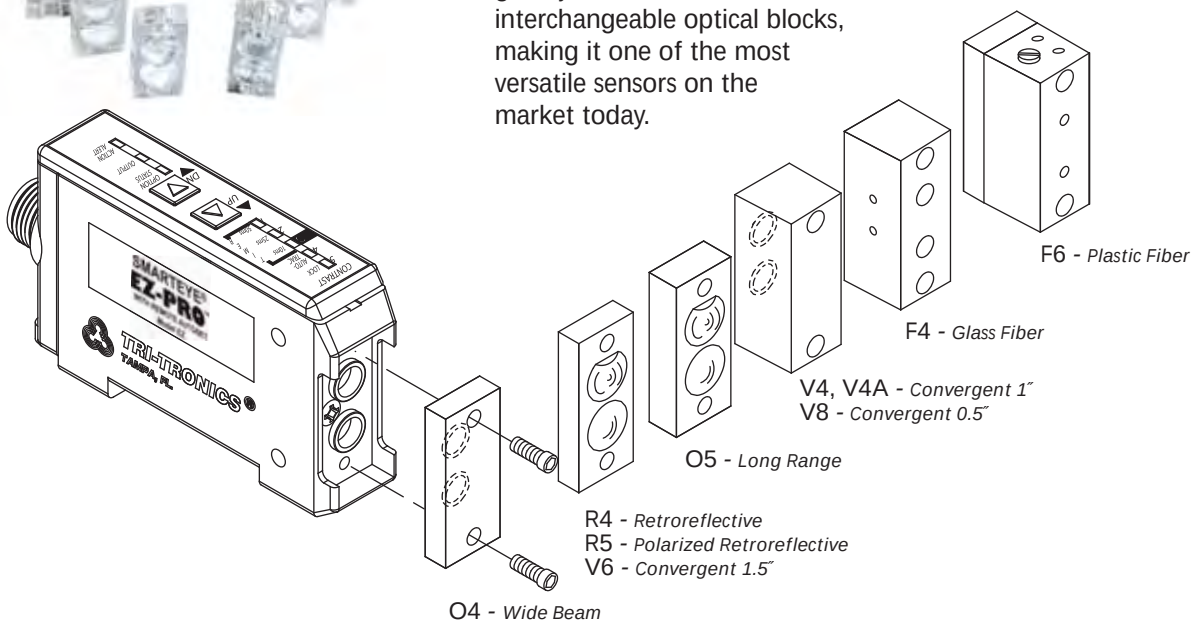
Convergent/proximity mode is useful to detect most transparent/translucent objects when there is little (if any) gap between objects.
Sensor: Model EZPR/EZPRC with V6 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Sensing Range: From 1 to 4 in
Accessories: Mounting bracket, Model SEB-3

Option 3

Proximity (divergent beam) mode sensing is useful in detecting some large size translucent/transparent objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model EZPR/EZPRC with O5 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Sensing Range: From 1 to 4 ft.
Accessories: Mounting bracket, Model SEB-3

Optical Block Selection

The SMARTEYE® EZ-PRO™ gives you a choice of 10 interchangeable optical blocks, making it one of the most versatile sensors on the market today.



O4 and O5
Proximity Sensing

V4, V4A, V6, and V8
Convergent Sensing

R4 and R5
Retroreflective Sensing

F4 and F6
Fiberoptic Sensing

How To Specify:

1. Select Sensor light source required:
   I = Infrared
   R = Red
   B = Blue
   WL = White
2. Select Connector required:
   Blank = Cable
   C = Connector
3. Select Optical Block based on mode of operation required.

Example: EZPRC F4

EZ-PRO	Red	Connector Model	Fiberoptic optical block

Sensing Range Guidelines

Convergent / Proximity / Retroreflective				
OPTICAL BLOCKS	IR	RED	BLUE	WHITE
V4, V4A	1 in.	1 in.	1 in.	1 in.
V6	1.5 in.	1.5 in.	1.5 in.	1.5 in.
V8	0.5 in.	0.5 in.	0.5 in.	0.5 in.
O4	18 in.	11 in.	4 in.	3 in.
O5	4 ft.	3 ft.	1.5 ft.	12 in.
R4	20+ ft.	18+ ft.	6 ft.	5 ft.
R5	N/A	7 ft.	4 ft.	3 ft.

NOTE: Proximity test utilized a 90% reflective white target. Retroreflective tests utilized a 3˝ diam. round reflector, Model AR-3

Glass Fiberoptics				
OPTICAL BLOCKS	IR	RED	BLUE	WHITE
Opposed Mode				
F4	3 ft.	1 ft.	8 in.	5 in.
F4 w/lens	20+ ft.	20+ ft.	12 ft.	9 ft.
Proximity Mode				
F4	7 in.	5 in.	1 in.	1 in.
F4 w/lens	1 ft.	1 ft.	N/A	6 in.

NOTE: Range tests utilized a .125˝ diam. fiber bundle

Plastic Fiberoptics		
OPTICAL BLOCKS	RED	WHITE
Opposed Mode		
F6	9 in.	2 in.
F6 w/lens	6 ft.	2 ft.
F6 w/right angle lens	3 ft.	1 ft.
Proximity Mode		
F6	7 in.	5 in.
F6 w/lens	1 ft.	1 ft.

NOTE: Range tests utilized a .040˝ diam. fiber

Light Source Guidelines

INVISIBLE INFRARED LIGHT SOURCE (880 nm)

A. Best choice in most opaque object sensing tasks
B. Provides longest possible sensing range in either Beam Make or Beam Break sensing modes
C. Best choice in hostile environments; useful in penetrating lens contamination
D. Preferred for use with small glass fiberoptic light guides Note: Do not use IR light with plastic fiberoptic light guides
E. Preferred when sensing dark colored objects in the proximity (Beam Make) mode, i.e., black, blue, green, etc.
F. Useful in penetrating containers for verification of contents; also useful in detecting overlapped splices in dense materials
G. Color perception; tends to favor blue colored objects

BLUE LIGHT SOURCE (480 nm)

A. Useful for detecting translucent, transparent, plastic, or glass objects in the retroreflective mode when using the R4 optical block
B. Used as blue filter for color perception advantages, i.e. resolving yellow vs. white colored objects or printed registration marks

RED LIGHT SOURCE (660 nm)

A. Best choice for use with plastic fiberoptic light guides
B. Useful when sensing translucent objects in proximity (Beam Make) mode
C. Useful when sensing transparent objects in fiberoptic retroreflective (Beam Break) mode
D. Can be polarized for retroreflective (Beam Break) sensing to reduce proxing on shiny objects
E. Opposed fiberoptic light guides can be polarized for sensing some translucent plastic containers; consult factory for details
F. Used as red filter for color perception advantages

WHITE LIGHT SOURCE

(Broadband Color Spectrum)

A. Best choice for detecting all printed registration marks on packaging material
B. Recommended for detecting dark colored objects in the proximity (Beam Make) mode
C. Best choice for sorting colored objects

Accessories

Micro Cable Selection Guide, 5-wire M12

GSEC-6
6' (1.8 m) Shielded cable

GSEC-15
15' (4.6 m) Shielded cable

GSEC-25
25' (7.62 m) Shielded cable

GSEC-2MU
6.5' (2.0 m) Low-cost, unshielded

GSEC-5MU
16.4' (5.0 m) Low-cost, unshielded

GRSEC-6
6' (1.8 m) Right angle shielded cable

GRSEC-15
15' (4.6 m) Right angle shielded cable

GRSEC-25
25' (7.62 m) Right angle shielded cable

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

SEB-3
Stainless “L” Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

LK-4
Lens Kit
(See Optical Blocks
Accessories for contents)

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45 mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP sensor output transistor
- Sensor outputs can sink or source up to 150 mA (current limited)
- All outputs are continuously short circuit protected

REMOTE AUTOSET™ INPUT
- Opto isolated sinking input (10 mA)

RESPONSE TIME
- Light/Dark state response = 300 microseconds

LED LIGHT SOURCE
- Infrared = 880 nm, Red = 660 nm, Blue = 480 nm, White = Broadband Color Spectrum
- Pulse modulated

PUSH BUTTON CONTROL
- Yellow/Blue – AUTOSET™
- Manual Adjustments
- Set status of 3 options: 5) Lock, 4) Auto-Trac, 3) Timers: 10 ms, 25 ms, 50 ms

HYSTERESIS
- "Factory-set" for high resolution – less than one bar on the Contrast Indicator

LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source, resulting in high immunity to most ambient light, including indirect sunlight or strobes

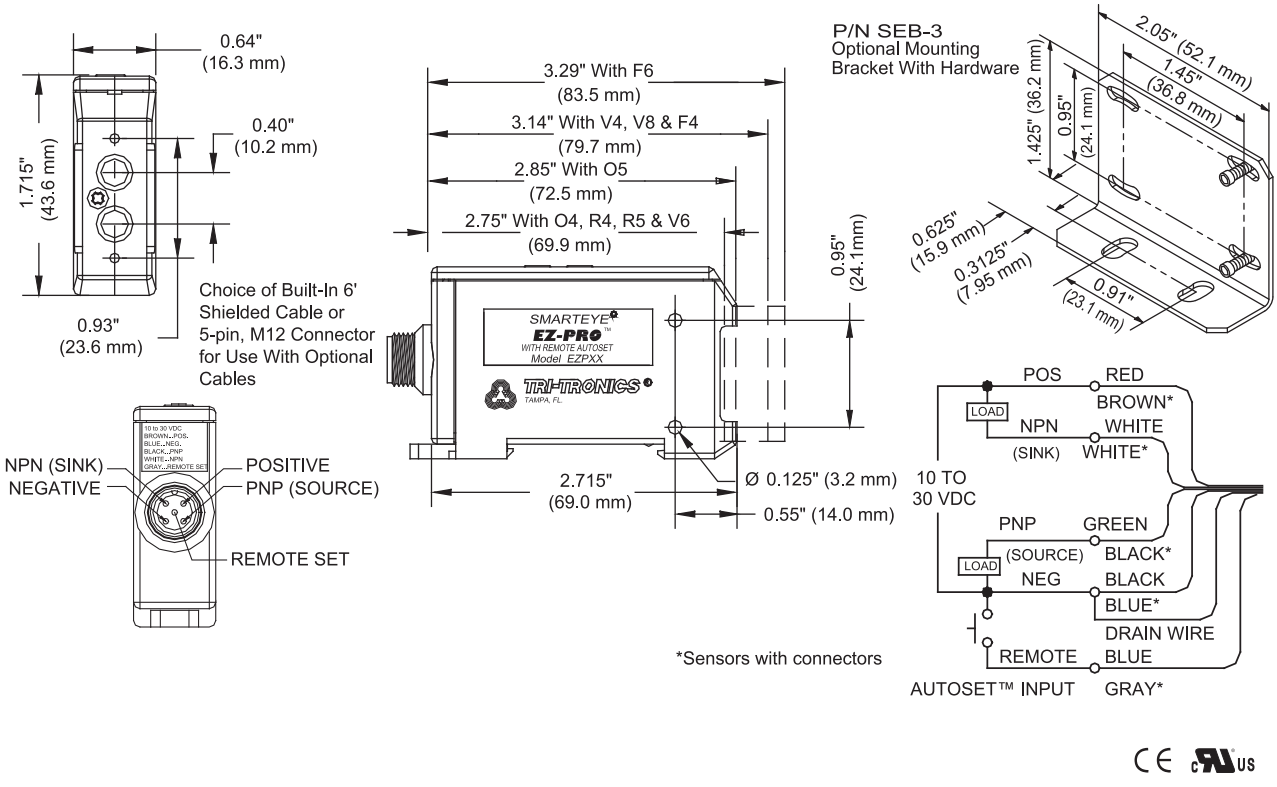
DIAGNOSTIC INDICATORS
- 5-LED bar graph functions in one of two modes:
  1. Contrast Indicator – displays scaled reading of sensor's response to contrasting light levels (light to dark)
  2. Status Indicator – Displays status of 5 selectable options
- Red LED output indicator = Illuminates when the sensor's output transistors are "on." NOTE: If Output LED flashes, a short circuit condition exists
- Amber LED = Illuminates when in the options select mode
- Yellow LED = Illuminates when action alert is activated. Also indicates when ACT™ adjusts sensor

AMBIENT TEMPERATURE
- - 40°C to 70°C (- 40°F to 158°F)

RUGGED CONSTRUCTION
- Chemical resistant, high impact polycarbonate housing
- Waterproof ratings: NEMA 4X, 6P and IP67
- Conforms to heavy industry grade CE requirements

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions SMARTEYE® EZ-PRO® PHOTOELECTRIC SENSOR



One-Touch Setup
Automatic, Self-Adjusting
Light State or Dark State Setup

SMARTEYE® PRO

Action Alert

SMARTEYE® PRO REMOTE

Remote AUTOSET™

Automatic, Self-Adjusting *From Clean to Dirty...It Keeps On Working!*

SMARTEYE® PRO

SMARTEYE® PRO REMOTE

From Clean To Dirty Lens

The SMARTEYE® PRO is not a teach mode sensor; it is an automatic sensor. It is a high performance photoelectric sensor that, after the initial set-up, can be adjusted by a single push of a button, (either on the sensor or at a remote location). As a result, there is no guesswork on the part of the operator. Now you can throw away the screwdriver!

After selecting the features of your application requirements, the SMARTEYE® PRO sensor is ready to be adjusted. Simply put the target in front of the sensor (proximity mode) and push the AUTOSET™ button. From that point on, the sensor will automatically maintain a perfect setting, thanks to the dynamic ACT™ (Automatic Contrast Tracking) system. The SPB Series Sensors are also equipped with a 5-LED Contrast Indicator™ as well as an Action Alert™ diagnostic tool that allows the operator to visually substantiate performance. The RSP Series Sensors feature a remote autoset input. When the lock feature is enabled, the SMARTEYE® PRO sensor is tamperproof. Now the sensor will provide you with the hassle-free performance that you expect from a SMARTEYE®.

Space-saving Multiple Sensor Mounting Design

Five Selectable Options:

5 LOCK
– for tamperproof operation

4 AUTOSET™
– set up in Light or Dark state

3 OUTPUT STATE
– indicates Light or Dark State output

2 ACT™
– automatic Contrast Tracking for perfect setting

1 TIMER
– 10 ms pulse stretcher timer function

Features

ACT™ AUTOMATIC CONTRAST TRACKING
ACT™ automatically adjusts the sensor as conditions change. This can include dirty or damaged lenses or reflectors, damaged fiberoptics, LED light source or thermal drift, and target variations such as position, orientation, or color. It can also compensate for signal shift or deterioration caused by high-speed input events. The SMARTEYE®-PRO continues to operate requiring far less maintenance than other sensors, making it the choice in tough sensing applications.

AGS™ AUTOMATIC GAIN SELECT
This unique feature provides automatic digital selection of the amplifier gain based upon your application requirements.

QUICKSET™ ADJUSTMENT
This two-step procedure is easy to perform and requires no expertise whatsoever.
1. Establish one of the following conditions:
Proximity Mode – Reflect light off object.
Beam Break – Remove object from light beam path.
2. Depress the red and green button simultaneously for three seconds.

AUTOSET™ ADJUSTMENT
The AUTOSET™ adjustment routine only requires one finger to push one button one time! Even in a dynamic operating condition, with ongoing input events, all you have to do is push a button for a perfect setting.

EDR (Pat. No. 5,621,205)
Another unique feature, the EDR (Enhanced Dynamic Range) circuit is digitally controlled. It prevents dark state saturation and expands the operating range without reducing amplifier gain.

ACTION ALERT™ INDICATOR LED
This indicator provides an early warning to prevent marginal performance, when the sensor can no longer provide full contrast deviation as displayed on the Contrast Indicator.

REMOTE AUTOSET™ (RSP Series)
Remotely adjust the sensor from a push button, momentary switch or a touch screen to PLC instantaneously. The AUTOSET™ routine can occur during static or dynamic operating conditions.

5-LED DUAL FUNCTION INDICATOR CONTRAST INDICATOR™
Provides "at-a-glance" performance data during both setup and operation.

STATUS INDICATOR
Displays status of 5 selectable functions: Lock, AUTOSET™, and Light/Dark, AUTOTRACK and Timer.

VERSATILITY
Choice of nine "quick change" optical blocks allows use in the proximity, convergent, retroreflective, polarized retroreflective, fiberoptic, or gap sensing modes.

LED LIGHT SOURCES
Choice of four LED light sources – invisible infrared, red, blue, and white light.

CONNECTIONS
Built-in connector for use with quick disconnect cable or shielded 6' (1.80 m) cable.

TIMER
10 ms pulse stretcher/off delay.

DUAL-FUNCTION BAR GRAPH
Primary Function: *Contrast Indicator*
Secondary Function: *Status Indicator* of Five Selectable Options

QUICKSET
1. Establish one of the following conditions
   Proximity - Reflect light off an object
   Beam Break - Remove object from light beam path
2. AUTOSET™ to preset level with LOCK FUNCTION OFF (Hold for three seconds)
3. Depress both green and red buttons simultaneously for three seconds.

OPTION STATUS / MODE SELECT

OUTPUT STATUS INDICATOR
When illuminated, Option Status Indicator is enabled

MARGINAL PERFORMANCE INDICATOR

INTERCHANGEABLE OPTICAL BLOCKS
Choice of 10 Optical Blocks - O4, O5, R4, R5, F4, F6, V4, V4A, V6, V8

OPTIONAL 10 ms TIMER

THREE FUNCTION SWITCH
1. "UP" adjust in Normal Operating Mode with LOCK FUNCTION OFF
2. AUTOSET™ to preset level with LOCK FUNCTION OFF (hold for three seconds)
3. Toggle selected option to OPPOSITE STATE and return to normal operation

THREE FUNCTION SWITCH
1. "DOWN" adjust in normal operating mode with LOCK FUNCTION OFF
2. OPTION STATUS MODE (Hold for three seconds)
3. Step to desired function to be altered

NOTE: If required, use Green (UP) and Red (DOWN) buttons to tweak adjustment

NOTE: Model SPB includes visual LED and PNP output. Model RSP includes visual LED only.

Light Source Guidelines

SMARTEYE® PRO SMARTEYE® PRO REMOTE

INVISIBLE INFRARED LIGHT SOURCE (880 nm)

A. Best choice in most opaque object sensing tasks
B. Provides longest possible sensing range in either Beam Make or Beam Break sensing modes
C. Best choice in hostile environments; useful in penetrating lens contamination
D. Preferred for use with small glass fiberoptic light guides Note: Do not use IR light with plastic fiberoptic light guides
E. Preferred when sensing dark colored objects in the proximity (Beam Make) mode, i.e., black, blue, green, etc.
F. Useful in penetrating containers for verification of contents; also useful in detecting overlapped splices in dense materials
G. Color perception; tends to favor blue colored objects

BLUE LIGHT SOURCE (480 nm)

A. Useful for detecting translucent, transparent, plastic, or glass objects in the retroreflective mode when using the R4 optical block
B. Used as blue filter for color perception advantages, i.e., resolving yellow vs. white colored objects or printed registration marks

RED LIGHT SOURCE (660 nm)

A. Best choice for use with plastic fiberoptic light guides
B. Useful when sensing translucent objects in proximity (Beam Make) mode
C. Useful when sensing transparent objects in fiberoptic retroreflective (Beam Break) mode
D. Can be polarized for retroreflective (Beam Break) sensing to reduce proxing on shiny objects
E. Opposed fiberoptic light guides can be polarized for sensing some translucent plastic containers (consult factory for details)
F. Used as red filter for color perception advantages

WHITE LIGHT SOURCE

(Broadband Color Spectrum)

A. Best choice for detecting all printed registration marks on packaging material
B. Recommended for detecting dark colored objects in the proximity (Beam Make) mode
C. Best choice for sorting colored objects

Optical Block Selection

Interchangeable optical blocks provide for universal application of the SMARTEYE® PRO to any sensing application from large object sensing to finite sensing of small parts, registration mark detection, and product inspection tasks.

Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent, or irregular shaped shiny objects.

Type O5
Proximity
Narrow beam optics useful in long-range sensing of medium to large size objects.

Type R4
Retroreflective
Very narrow beam optics designed to sense reflectors or reflective materials at long range. Designed for Beam Break sensing.

Type R5
Polarized Anti-Glare Retroreflective
Polarized to reduce response to "hot spot" glare from shiny surface of detected object. Use with red or blue light source.

Type F4
Glass Fiberoptics
Adapter for use with a wide variety of glass fiberoptic light guides for both the proximity and opposed sensing modes.

Type V4, V4A
Convergent 1" "V" Axis
Narrow beam optics that focus at a sensing range of 1". Useful for sensing small parts. Also useful for proximity sensing (range of 1" to 5") to minimize response to reflected light from background objects.

Type V6
Convergent 1.5" "V" Axis
Narrow beam optics that focus at a sensing range of 1.5". Useful for sensing small parts. Also useful for proximity sensing (range of 1.5" to 8") to minimize response to reflected light from background objects.

Type V8
Convergent .5" "V" Axis
Narrow beam optics that focus at a sensing range of .5". Useful for sensing small parts or registration color marks. Also useful for proximity sensing (range of .25" to 5") to minimize response to reflected light from background objects.

Type F6
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes.

Sensing Range Guidelines

Convergent / Proximity / Retroreflective

OPTICAL BLOCKS	IR	RED	BLUE	WHITE
V4, V4A	1 in.	1 in.	1 in.	1 in.
V6	1.5 in.	1.5 in.	1.5 in.	1.5 in.
V8	0.5 in.	0.5 in.	0.5 in.	0.5 in.
O4	18 in.	11 in.	4 in.	3 in.
O5	4 ft.	3 ft.	1.5 ft.	12 in.
R4	20+ ft.	18+ ft.	6 ft.	5 ft.
R5	N/A	7 ft.	4 ft.	3 ft.

NOTE: Proximity test utilized a 90% reflective white target. Retroreflective tests utilized a 3˝ diam. round reflector, Model AR-3

Glass Fiber Optics

OPTICAL BLOCKS	IR	RED	BLUE	WHITE
Opposed Mode				
F4	3 ft.	1 ft.	8 in.	5 in.
F4 w/lens	20+ ft.	20+ ft.	12 ft.	9 ft.
Proximity Mode				
F4	7 in.	5 in.	1 in.	1 in.
F4 w/lens	1 ft.	1 ft.	N/A	6 in.

NOTE: Range tests utilized a .125˝ diam. fiber bundle

Plastic Fiber Optics

OPTICAL BLOCKS	RED	WHITE
Opposed Mode		
F6	9 in.	2 in.
F6 w/lens	6 ft.	2 ft.
F6w/right angle lens	3 ft.	1 ft.
Proximity Mode		
F6	7 in.	5 in.
F6 w/lens	1 ft.	1 ft.

NOTE: Range tests utilized a .040˝ diam. fiber

How to Specify

1. Select Sensor Type (SPB or RSP)
   SPB – Includes Action Alert RSP – Includes Remote AUTOSET™
2. Select Sensor Light Source required: I = Infrared; R = Red; B = Blue; WL = White.
3. Select Connection required: Blank = Cable; C = Connector (RSP available with connector only)
4. Select Optical Block.

Example: SPBRCR4

- SPB — SMARTEYE® PRO
- R — Red
- C — Connector Model
- R4 — Retroreflective Optical Block

Accessories

Micro Cable Selection Guide, 5-wire M12

GSEC-6
6' (1.8 m) Shielded cable

GSEC-15
15' (4.6 m) Shielded cable

GSEC-25
25' (7.62 m) Shielded cable

GSEC-2MU
6.5' (2.0 m) Low-cost, unshielded

GSEC-5MU
16.4' (5.0 m) Low-cost, unshielded

GRSEC-6
6' (1.8 m) Right angle shielded cable

GRSEC-15
15' (4.6 m) Right angle shielded cable

GRSEC-25
25' (7.62 m) Right angle shielded cable

GX-25
25' (7.62 m) extension cable

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

SEB-3
Stainless “L” Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

LK-4
Lens Kit
(See Optical Blocks Accessories for contents)

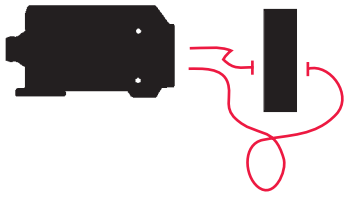
Selection Guidelines *Opaque Object Sensing*

SMARTEYE PRO

Preferred Mode: Beam Break

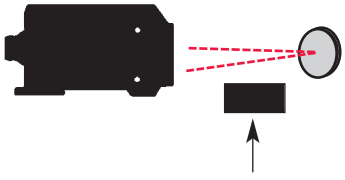
SMARTEYE PRO REMOTE

Option 1



Fiberoptic opposed mode is best choice for detecting any opaque object.
Sensor: Model SPBI/SPBIC/RSPIC with F4 Optical Block (IR lightsource)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Fiberoptic Light Guides: Model F-A-36T (Two Required)
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)
Sensing Range: Up to 16 in.
Accessories: Two Model UAC-15 lenses, extends sensing range to over 20 ft.
Mounting bracket: Model SEB-3, FMB-1

Option 2



Retroreflective mode. Use with reflector to detect medium to large size opaque objects
NOTE: Not recommended for detecting highly reflective objects.
Sensor: Model SPBI/SPBIC/RSPIC with R4 Optical Block (IR light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft) or GSEC-15 (15 ft.)
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted. (See Accessories Section for complete listing of reflectors)
Sensing Range: Up to 20 ft.
Accessories: Mounting bracket, Model SEB-3

Alternate Mode: Beam Make (Proximity)

Option 1

Fiberoptic proximity is used to detect medium to large flat-sided opaque objects
Sensor: Model SPBI/SPBIC/RSPIC with F4 Optical Block (IR Light Source)
Cable: Shielded cable w/connector Model GSEC-6 (6ft.) or GSEC-15 (15ft.)
Fiberoptic Light Guides: Model BF-A-36T
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)
Sensing Range: Up to 6 in.
Accessories: Model UAC-15 lens. Use to extend sensing range up to 1 ft.
Mounting bracket: Model SEB-3, FMB-1
NOTE: Consider proximity mode when installation sensing site conditions preclude using the preferred Beam Break mode.

Option 2

Convergent/proximity mode is useful to detect opaque objects when there is little (if any) gap between objects.
Sensor: Model SPBI/SPBIC/RSPIC with V6 Optical Block (IR light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Sensing Range: From 1.5 to 8 in.
Accessories: Mounting bracket, Model SEB-3

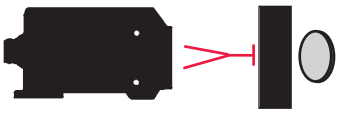
Option 3

Proximity (divergent beam) mode sensing is useful in detecting some large size opaque objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model SPBI/SPBIC/RSPIC with O5 Optical Block (IR light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Sensing Range: From 1 to 5 ft.
Accessories: Mounting bracket, Model SEB-3

Selection Guidelines *Translucent/Transparent Object Sensing*

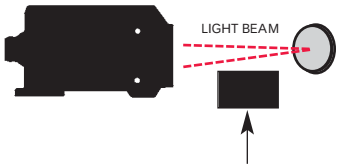
Preferred Mode: Retroreflective Beam Break

Option 1



Fiberoptic retroreflective is the best choice for detecting empty transparent or translucent objects. The SMARTEYE® PRO featuring a unique blue LED light source is recommended for detecting transparent or translucent plastic or glass objects. A red light source is recommended when detecting translucent (non-transparent) objects only.
Sensor: Model SPBB/SPBBC/RSPBC with F4 Block (Blue light source) or Model SPBR/SPBRC/RSPRC with F4 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6ft.) or GSEC-15 (15ft.)
Fiberoptic Light Guides: Model BF-A-36T
Reflector: Model 78P, plastic 4.4 in. x 1.9 in, screw mounted
Sensing Range: Up to 1 ft.
Accessories: Model UAC-15 lens. Use to extend sensing range from 1 ft. maximum without lens to over 3 ft. with lens. Mounting bracket, Model SEB-3, FMB-1

Option 2



Retroreflective (R4 optical block) is a good choice for detecting medium to large size empty, transparent, or translucent objects. The SMARTEYE® PRO, featuring a unique blue LED light source, is recommended for detecting transparent or translucent plastic or glass objects. A red light source is recommended when detecting translucent (non-transparent) objects only.
Sensor: Model SPBB/SPBBC/RSPBC with R4 Block (Blue light source) or ModelSPBR/SPBRC/RSPRC with R4 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6ft.) or GSEC-15 (15ft)
Reflector: Model 78P, plastic 4.4 in. X 1.9 in., screw mounted.
Sensing Range: Up to 5 ft.
Accessories: Mounting bracket, Model SEB-3

Alternate Mode: Beam Make (Proximity)

Option 1

Fiberoptic proximity mode is useful to detect transparent/translucent objects.
Sensor: Model SPBR/SPBRC/RSPRC with F4 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Fiberoptic Light Guides: Model BF-A-36T
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)
Sensing Range: Up to 4 in.
Accessories: Model UAC-15 lens. Use to extend sensing range up to 1 ft.
Mounting bracket, Model SEB-3, FMB-1
NOTE: Consider proximity mode when translucent/transparent objects are containers filled with clear liquid or when site conditions preclude using the preferred retroreflective Beam Break mode.

Option 2

Convergent/proximity mode is useful to detect most transparent/translucent objects when there is little (if any) gap between objects.
Sensor: Model SPBR/SPBRC/RSPRC with V6 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Sensing Range: From 1 to 4 in
Accessories: Mounting bracket, Model SEB-3

Option 3

Proximity (divergent beam) mode sensing is useful in detecting some large size translucent/transparent objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model SPBB/SPBBC/RSPBC with O5 Block (Red light source)
Cable: Shielded cable w/connector Model GSEC-6 (6 ft.) or GSEC-15 (15 ft.)
Sensing Range: From 1 to 4 ft.
Accessories: Mounting bracket, Model SEB-3

Specifications

SMARTEYE® PRO SMARTEYE® PRO REMOTE

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45 mA (exclusive of load)

OUTPUT TRANSISTORS (Current Limited)
- (1) NPN and (1) PNP sensor output transistor
  (1) PNP Action Alert output transistor (SPB Series)
- Sensor outputs can sink or source up to 150 mA
- All outputs are continuously short circuit protected
- Action Alert PNP transistor source up to 75 mA
  (Action Alert available on SPB models only)

REMOTE AUTOSET™ INPUT
- Opto isolated sinking input (10 mA) (RSP Series)

RESPONSE TIME
- Light/Dark state response = 300 microseconds

HYSTERESIS
- Set for high resolution – less than one bar on the Contrast Indicator

LED LIGHT SOURCE
- Options:
  A. Infrared = 880 nm,
  B. Red = 660 nm,
  C. Blue = 480 nm,
  D. White = Broadband spectrum
- Pulse modulated

PUSH BUTTON CONTROL
- Automatic set-up routines, i.e., QuickSet™/AUTOSET™
- Manual Adjustments
- Set status of five options: LOCK, AUTOSET, LT/DK ON, AUTOTRAC, and 10 ms TIMER

LIGHT IMMUNITY
- Responds to sensor's pulse modulated light source, resulting in high immunity to most ambient light, including indirect sunlight

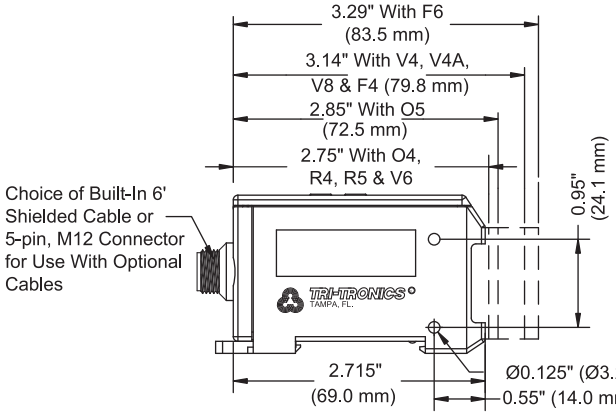
AMBIENT TEMPERATURE
- - 40°C to 70°C (- 40°F to158°F)

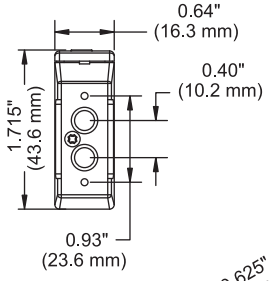
RUGGED CONSTRUCTION
- Chemical resistant, high-impact polycarbonate housing
- Waterproof ratings: NEMA 6 and IP67
- Conforms to heavy industry grade CE requirements

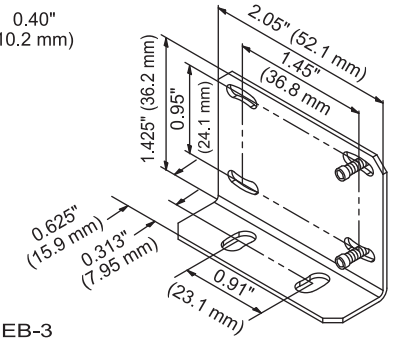
INDICATORS
- 5-LED Bar graph functions in one of two modes:
  1. Contrast Indicator – Displays scaled reading of sensor's response to contrasting light levels (light to dark)
  2. Status Indicator – Displays status of 5 selectable options
- Red LED output indicator – Illuminates when the sensor's output transistors are "on." NOTE: If Output LED flashes, a short circuit condition exists
- Amber LED – Illuminates when in the options select mode
- Yellow LED – Illuminates when action alert is activated. Also indicates when ACT™ adjusts sensor

Product subject to change without notice.
Consult Factory for RoHS Compliance.

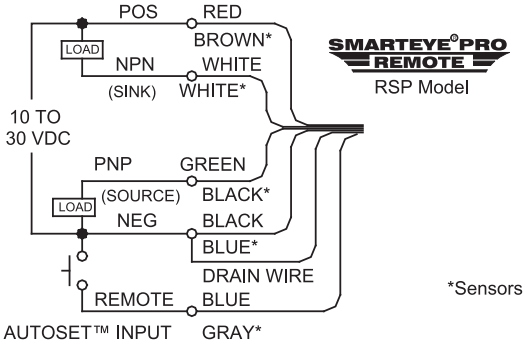
Connections and Dimensions SMARTEYE® PRO PHOTOELECTRIC SENSOR



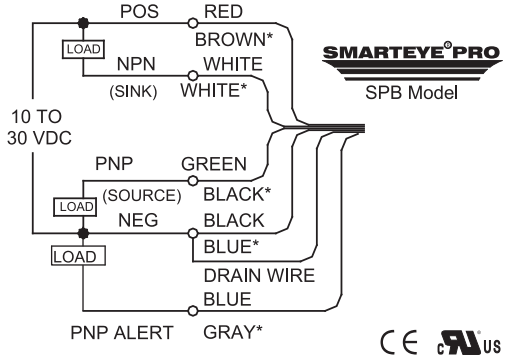




SEB-3
Optional Mounting Bracket with Hardware



*Sensors with connectors



Enhanced Dynamic Range
Very High Speed, High Resolution

MARK SMARTEYE® II

The Performance Standard *High Speed, High Resolution*

Featuring the patented EDR® — Enhanced Dynamic Range

The SMARTEYE® MARK II sensor is TRI-TRONICS' most popular photoelectric sensor. The SMARTEYE MARK II features extremely high gain combined with very high speed. These high performance sensors were designed to resolve the most difficult sensing tasks...the hallmark of all TRI-TRONICS SMARTEYE sensors. In addition to superior high gain/high speed, the SMARTEYE MARK II is equipped with many new improvements.

Among the many features included in the design of the SMARTEYE MARK II, none is more important than the addition of the EDR® circuit. Now, thanks to the addition of EDR® (Enhanced Dynamic Range), the dynamic operating range has been extended and background suppression has been enhanced.

Also included in the design of the new SMARTEYE MARK II are all of the proven features included in all SMARTEYE sensors, including our famous Contrast Indicator. Without question, the SMARTEYE MARK II sets a "new standard of performance" in photoelectric sensing. When the sensing task involves resolving critical identifying features such as size, texture, distance, opacity, depth, or color, the SMARTEYE MARK II will give you that extra measure of performance that is often required to ensure proper operation. Marginal performance cannot be tolerated when the entire operation of an automated machine process relies on the ability of a photoelectric sensor to perform its sensing task.

SMARTEYE® MARK II Patent No. 5,621,205
Features:

- Very fast response time (50 microseconds) and operating speed while maintaining extremely high gain on all models
- Unique Enhanced Dynamic Range indicator
- Seven Interchangeable optical blocks
- Clutched offset adjustment
- Operational from 12 to 24 VDC...(polarity protected)
- Choice of models with infrared, red, white, or blue LED light source provides unique color perception, i.e., yellow vs. white
- 10-LED CONTRAST INDICATOR provides "at a glance" performance data during state set up as well as during dynamic conditions when input events are ongoing
- Built-in connector
- Waterproof housing complies with NEMA 4X, 6P, and IP67
- Both NPN and PNP Output transistors
- Short circuit protection for output transistors
- Light On/Dark on selector switch
- Anti-pulsing protection on power up

CONTRAST INDICATOR™

The Contrast Indicator displays a scale reading of the level of light received by the sensor's photo detector. The more light received, the higher the reading. The less light received, the lower the reading.

Contrast is a comparison of the lightest state reading versus the darkest state reading. The sensing task of any digital (switching) photoelectric sensor is to resolve the difference between these two light levels and switch the output accordingly. The SMARTEYE® switches its output when the light level passes the midscale reading of "5".

FIBEROPTIC LIGHT GUIDES

Flexible fiberoptic light guides are available in sizes small enough to fit into your tightest job sensing sites. There are models for inaccessible places, detection of extremely small parts, and high-vibration locations, plus straight light guides for thru-beam and bifurcated light guides for proximity sensing. Refer to Section 3 for details.

EDR® *Enhanced Dynamic Range*

(Patent No. 5,621,205)

The EDR® circuit extends the dynamic operating range to provide unequaled performance at very bright light levels.

Eliminates Saturation

Every photoelectric sensor has a saturation point – a point at which any further increase in received light level to its detector (from its own pulsing LED light source) will not result in any further internal signal level increase. This is apparent on the SMARTEYE's Contrast Indicator. For example, in an object sensing task, if the background (i.e., white conveyor belt) is reflecting enough light back to the sensor's detector to reach the sensor's saturation level, the arrival of an object (such as a cookie) will not result in any signal level increase as displayed on the Contrast Indicator. This undesirable condition is referred to as saturation. To avoid saturation and enhance background suppression, the EDR circuit monitors the offset adjustment during setup to determine when the sensor's operating level is approaching the sensor's light level saturation point. Before saturation occurs, the EDR circuit adjusts the sensor in such a unique manner so as to prevent saturation and extends the overall dynamic range of the SMARTEYE® MARK II sensor.

Proximity Sensing Mode Advantages

Another performance benefit provided by the EDR circuit when operating in the proximity mode is that the SMARTEYE® MARK II does not typically require the use of convergent or triangulating optics to resolve objects resting on shiny or highly reflective backgrounds. Instead, the optics can be divergent, allowing a wider field of view. The larger the area in view of the sensor's optics, the greater the contrast deviation. Convergent or triangulating optics results in pinpoint spots of light. These optical sensing methods can result in falsely switching the sensor's output by responding to minute surface variations or imperfections. A wider field of view offered by divergent optics (i.e., wide angle proximity lens or large bundle fiberoptic guides) allows the SMARTEYE® MARK II to overlook most minor surface irregularities.

Beam Break Sensing Mode Advantages

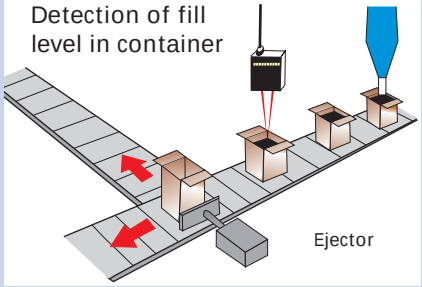
When operating in the Beam Break (opposed) mode of sensing, the EDR circuit once again prevents saturation. This is particularly advantageous when attempting to detect the presence of splices, overlapping materials, container contents, or adhesive labels on backing materials. Saturation can easily occur particularly when the materials involved are translucent or transparent. *Example:* In label detection, if the intensity of light penetrating through the label has reached the saturation level of the sensor, the arrival of the gap between labels will not increase the signal level as displayed on the Contrast Indicator. If this is allowed to occur, detection of the label is impossible. The new EDR circuit built into the SMARTEYE® MARK II prevents this from occurring by compensating during the setup procedure to prevent saturation.

EDR® Benefits:

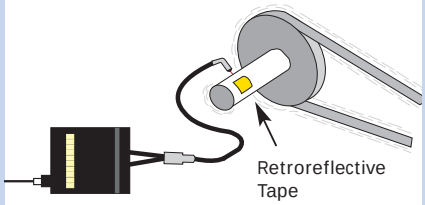
- Extends dynamic operating range to include high light level operation without reducing amplifier gain
- Eliminates saturation, important for both Beam Make or Beam Break sensing modes
- Enhances background suppression
- When operating in the proximity mode, allows use of divergent, wide beam optics to increase contrast deviation and reduce the possibility of false response to minute surface irregularities or variations in position

Typical Applications

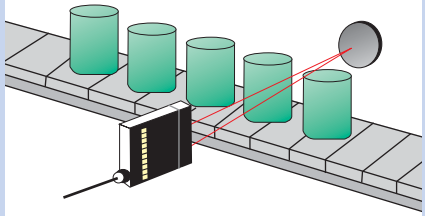
Detection of fill level in container



Detection of reflective tape moving at high rapidity



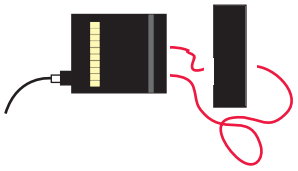
Detection of objects moving at high velocity



Selection Guidelines *Opaque Object Sensing*

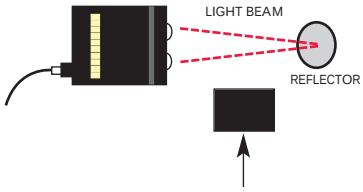
Preferred Mode: Beam Break

Option 1



Fiberoptic opposed mode is best choice for detecting any opaque object
Sensor: Model SEIF1 (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6 (6 ft.), SEC-15 (15 ft.), or SEC-25 (25 ft.)
Fiberoptic Light Guides: (2) Model F-A-36T
Sensing Range: Up to 3 ft
Accessories: (2) Model UAC-15 lenses, extends sensing range to over 20 ft., Mounting bracket, Model SEB-1, FMB-1
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)

Option 2



Retroreflective mode. Use with reflector to detect medium to large size opaque objects
Sensor: Model SERR1 (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6 (6 ft) or SEC-15 (15 ft.)
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted. (See Accessories Section for complete listing of reflectors)
Sensing Range: Up to 25 ft.
Accessories: Mounting bracket, Model SEB-1
NOTE: Not recommended for detecting highly reflective objects

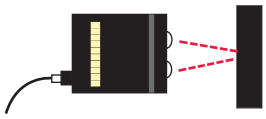
Alternate Mode: Beam Make (Proximity)

NOTE: Consider proximity mode when installation sensing site conditions preclude using the preferred Beam Break mode.

Option 1

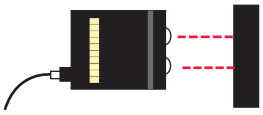
Fiberoptic proximity is used to detect medium to large flat sided opaque objects
Sensor: Model SEIF1 (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6 6ft.) or SEC-15 (15ft.)
Fiberoptic Light Guides: Model BF-A-36T
Sensing Range: Up to 4 in.
Accessories: (1) Model UAC-15 lens. Use to extend sensing range up to 1 ft.
Mounting bracket, Model SEB-1, FMB-1
NOTE: Select smaller fiber bundle for small part detection. (See Fiber Optic Section)

Option 2



Convergent/proximity mode is useful to detect opaque objects when there is little (if any) gap between objects.
Sensor: Model SEIV1 (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6 (6 ft.) or SEC-15 (15 ft.)
Sensing Range: From 1 to 4 in.
Accessories: Mounting bracket, Model SEB-1

Option 3



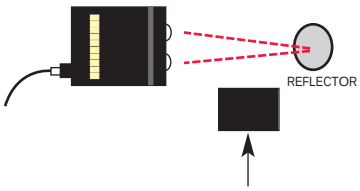
Proximity (divergent beam) mode sensing is useful in detecting some large size opaque objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model SEIO1 (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6 (6 ft.) or SEC-15 (15 ft.)
Sensing Range: From 6 in. to 5 ft.
Accessories: Mounting bracket, Model SEB-1

Preferred Mode: Retroreflective Beam Break

Option 1

Fiberoptic retroreflective is the best choice for detecting empty transparent or translucent objects. The SMARTEYE® MARK II featuring a unique blue LED light source is recommended for detecting transparent or translucent plastic or glass objects. A red light source is recommended when detecting translucent (non-transparent) objects only.
Sensor: Model SEBF1 (Blue Light Source) or Model SERF1 (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6 (6ft.) or SEC-15 (15ft.)
Fiberoptic Light Guides: Model BF-A-36T
Reflector: Model 78P, plastic 4-4 in. X 1.9 in, screw mounted
Sensing Range: Up to 1 ft.
Accessories: (1) Model UAC-15 lens. Use to extend sensing range from 1 ft. maximum without lens to over 3 ft. with lens. Mounting bracket, Model SEB-1, FMB-1

Option 2

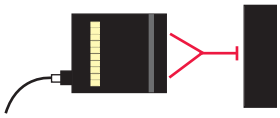


Retroreflective (R1 optical block) is a good choice for detecting medium to large size empty transparent or translucent objects. The SMARTEYE® MARK II featuring a unique blue LED light source is recommended for detecting transparent or translucent plastic or glass objects. A red light source is recommended when detecting *translucent* (non-transparent) objects only.
Sensor: Model SEBR1 (Blue Light Source) or Model SERR1 (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6 (6ft.) or SEC-15 (15ft)
Reflector: Model 78P, plastic 4.4 in. X 1.9 in., screw mounted
Sensing Range: Up to 5ft.
Accessories: Mounting bracket, Model SEB-1

Alternate Mode: Beam Make (Proximity)

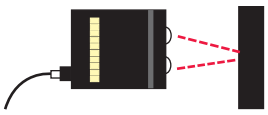
NOTE: Consider proximity mode when translucent/transparent objects are containers filled with clear liquid or when site conditions preclude using the preferred retroreflective Beam Break mode.

Option 1



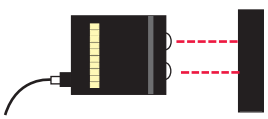
Fiberoptic proximity mode is useful to detect transparent/translucent objects.
Sensor: Model SERF1 (Red light source)
Cable: Shielded cable w/connector Model SEC-6 (6 ft.) or SEC-15 (15 ft.)
Fiberoptic Light Guides: Model BF-A-36T
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)
Sensing Range: Up to 4 in.
Accessories: (1) Model UAC-15 lens. Use to extend sensing range up to 1 ft., Mounting bracket, Model SEB-1, FMB-1

Option 2



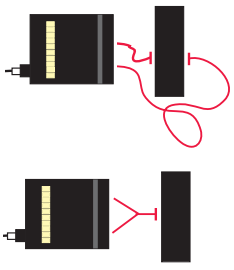
Convergent/proximity mode is useful to detect most transparent/translucent objects when there is little (if any) gap between objects.
Sensor: Model SERV1 (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6 (6 ft.) or SEC-15 (15 ft.)
Sensing Range: From 1 to 4 in
Accessories: Mounting bracket, Model SEB-1

Option 3

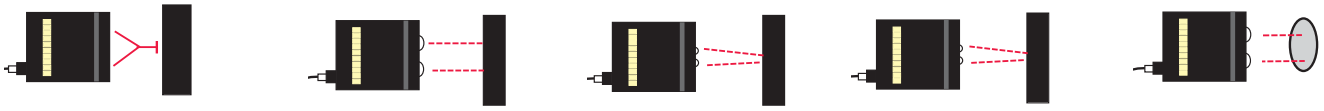


Proximity (divergent beam) mode sensing is useful in detecting some large size translucent/transparent objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model SER01 (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6 (6 ft.) or SEC-15 (15 ft.)
Sensing Range: From 6 in. to 4 ft.
Accessories: Mounting bracket, Model SEB-1

Optical Block Selection



Interchangeable optical blocks provide for universal application of the SMARTEYE® MARK II to any sensing task from large object sensing to finite sensing of small parts. Plastic lenses standard. Glass lenses available. Consult factory.



Type F1 Fiberoptic Adapter

Type F1 adapts MARK II to any standard fiber optic light guide with .187" O.D. tips. The light guide is inserted and held in place with set screws. See Section 3 for selection.

Type O1, O1G (Glass) Medium to Long Range Proximity

Type O1, O1G (glass) adapts the MARK II to the optical proximity mode of sensing. Range is dependent on size, shape, surface reflectivity of the object to be detected.

Type O2 Short Range Proximity

Type O2 also adapts the MARK II to the optical proximity mode of sensing, but on a sharp "V" axis to control depth of view. Range is dependent on model of the MARK II selected.

Type V1, V1G (Glass) Focused Lens "V" Axis

Type V1, V1G (Glass) is for direct lens "V" axis sensing at close ranges. Used for small part or precise leading edge sensing. Range is dependent on model of the MARK II selected.

Type R1 Retroreflective

Type R1 turns the MARK II into a retroreflective sensor. Range is dependent on model of the MARK II selected and size of reflectors.

Sensing Range Guidelines

Optical Blocks	IR	RED	BLUE	WHITE
O1, O1G	6 ft.	5.5 ft.	N/A	N/A
O2	3.5 in.	3.5 in.	2 in.	1.5 in.
V1, V1G	4 in.	4 in.	2.25 in.	2 in.
R1	35 ft.	30 ft.	10 ft.	N/A
F1 (Prox)	5.5 in	4.5 in	1 in.	0.5 in.
F1 (Prox w/lens)	1.5 ft.	14 in.	5 in.	2 in.
F1 Opposed	3.5 ft.	1.5 ft.	6 in.	1.75 in.
F1 Opposed w/lens	20+ ft.	20+ ft.	6.5 ft.	6.5 ft.

NOTES:
- For more Information on useful range, see Fundamentals, Section 1.
- PROXIMITY tests utilized a 90% reflective target.
- RETROREFLECTIVE tests utilized a 3 in. diam. reflector Model AR3
- FIBER OPTIC tests utilized .125 in. diam. fiber bundles. Model UAC-15 Lens was used as indicated.

How to Specify

1. Select Sensor Model based on light source required
   SEI = Infrared
   SER = Red
   SEB = Blue
   SEWL = White
2. Select adjustment type
   Blank = Potentiometer adjust
   K = Knob
3. Select Optical Block based on mode of sensing required

Example: SER K F1

- SER — Red MARK II
- K — Adjustment Type – Knob
- F1 — Fiberoptic Optical Block

Accessories

Micro Cable Selection Guide, 4-wire M12

Yellow Shielded Cable Assemblies

SEC-6
6' (1.8 m) cable with connector

SEC-15
15' (4.6 m) cable with connector

SEC-25
25' (7.62 m) cable with connector

RSEC-6
6' (1.8 m) cable / right angle conn.

RSEC-15
15' (4.6 m) cable / right angle conn.

RSEC-25
25' (7.62 m) cable / right angle conn.

Black Shielded Cable Assemblies (Lightweight)

BSEC-6
6' (1.8 m) cable with connector

BSEC-15
15' (4.6 m) cable with connector

BSEC-25
25' (7.62 m) cable with connector

BRSEC-6
6' (1.8 m) cable / right angle conn.

BRSEC-15
15' (4.6 m) cable / right angle conn.

BRSEC-25
25' (7.62 m) cable / right angle conn.

BX-10
10' (3.1 m) Extension cable

BX-25
25' (7.62 m) Extension cable

Grey Unshielded Cable Assemblies

GSEC-2MU
6.5' (2.0 m) Low-cost

GSEC-5MU
16.4' (5.0 m) Low-cost

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

SEB-1
Stainless “L” Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

Specifications

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 85 mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP Output transistor:
- NPN: Sink up to 150 mA
- PNP: Source up to 150 mA
- Momentary short circuit protected
- Outputs protected from pulsing during power up
- Light/dark switch determines Output Status:
  Light = Light "ON" operate
  Dark = Dark "ON" operate

RESPONSE TIME
- Minimum duration of input event
- Light state response = 50 microseconds
- Dark state response = 140 microseconds
- Leading edge Variation less than 20 microseconds

HYSTERESIS
- Less than 400 millivolts for maximum sensitivity and resolution

LED LIGHT SOURCE
- Pulse modulation rate 45 KHZ
- Choice of color:
  A. Infrared = 880nm
  B. Red = 660nm
  C. White = Broadband Color Spectrum
  D. Blue = 480nm

LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source
- Immune to most ambient light

OFFSET/EDR® ADJUSTMENT
- Sets initial level on CONTRAST INDICATOR in relation to mid-scale switch point of 5 – functions as sensitivity adjustment
- Controls Enhanced Dynamic Range circuit (EDR™) which functions to avoid saturation

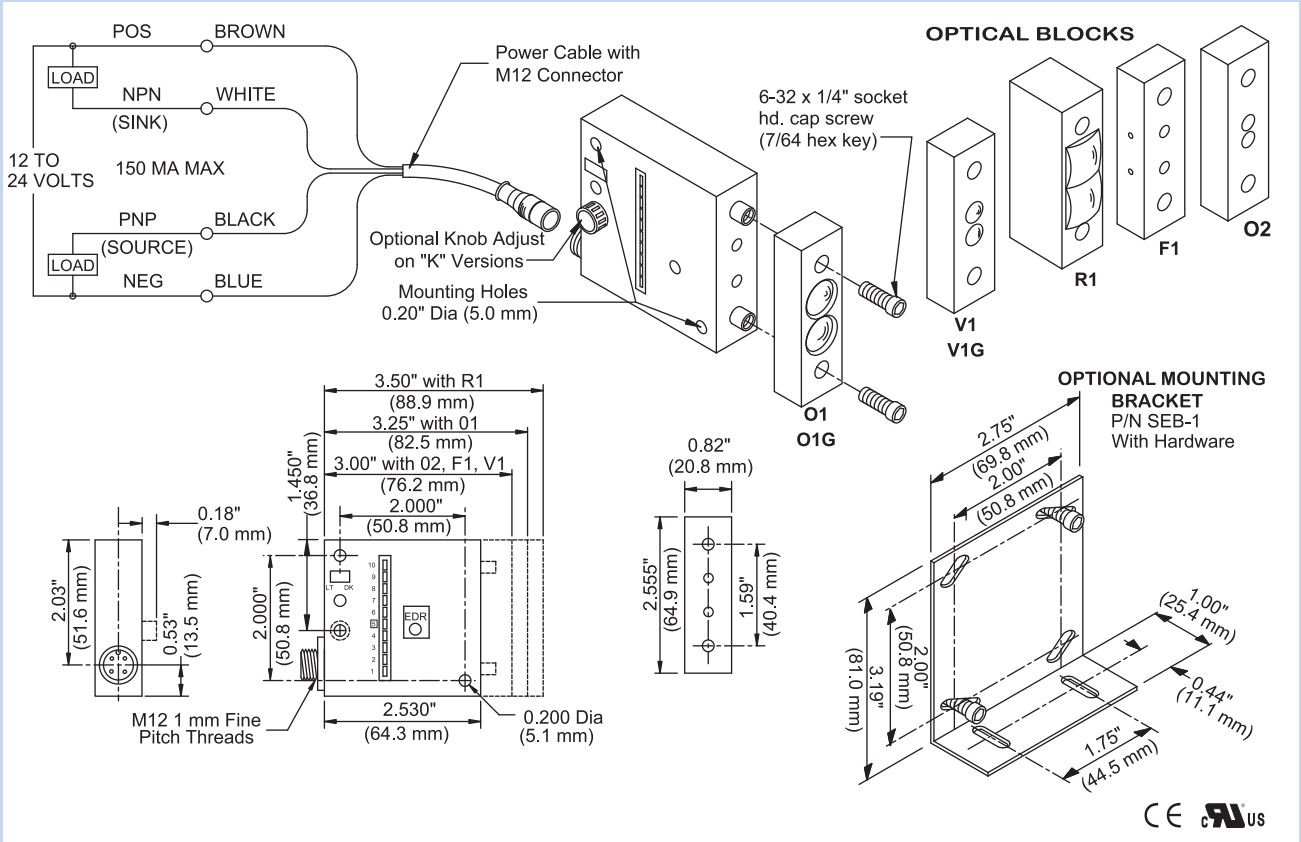
INDICATORS
- OUTPUT INDICATOR - RED LED illuminates and the NPN or PNP outputs switch to the opposite state when returned light level exceeds "5" on the CONTRAST INDICATOR
- EDR™ INDICATOR - Intensity of GREEN LED provides indication of where in the dynamic operating range the offset, EDR™ adjustment has been set
- FULLY LIT: Operating near saturation
- OFF: Operating near maximum sensing range
- CONTRAST INDICATOR – Displays scaled reading of sensor's response to contrasting light levels (light vs. dark) on a 10 bar LED display

AMBIENT TEMPERATURE
- - 40°C to 70°C (- 40°F to 158°F)

RUGGED CONSTRUCTION
- Chemical resistant, high impact polycarbonate housing
- Waterproof, NEMA 4X, 6P and IP67 enclosure ratings
- Epoxy encapsulated for mechanical strength

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions SMARTEYE® MARK II PHOTOELECTRIC SENSOR



Miniature, High Performance
DIN Rail Mountable

SMARTEYE® MARK III

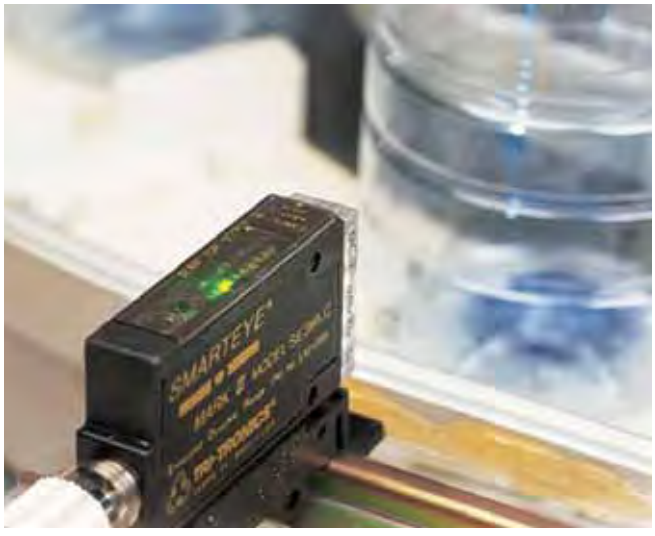
World-Class Versatility *Miniature High Performance Sensor*

The SMARTEYE® MARK III is the "first" high performance photoelectric sensor in a miniature size that you can use anywhere...for any task...including your toughest industrial sensing applications. The SMARTEYE MARK III is loaded with features and benefits, never before offered in a miniature sensor, including extremely high gain and high speed of response (50 microseconds). High gain enables the sensor to resolve the most difficult low contrast sensing tasks. High speed response provides resolution of the exact position of objects traveling at high speeds.

You can easily optimize the SMARTEYE MARK III to conform to your particular sensing task because of its unique modular construction.

QUICK-CHANGE OPTICAL BLOCK LENSES

You can choose from a wide variety of blocks to operate in the proximity, convergent, retroreflective, or fiberoptic sensing mode. A newly designed sensing model F5 fiberoptic block enhances performance when using plastic fiberoptic light guides. These inexpensive, interchangeable optical blocks reduce the inventory burden of replacement parts and eliminate the need for discarding a complete sensor in the event of damage to the optical block.



LED LIGHT SOURCES

When color perception is a requirement to perform your sensing task, you can select the correct LED light source from one of our available colors...Infrared, Red, Blue, or White. For example, select the invisible IR light source for long-range sensing or hostile environments. Select the RED light source for use with plastic fibers. Select the BLUE light source for use in the retroreflective mode to detect translucent or transparent plastic or glass objects. Select the WHITE light source for detecting registration marks or for providing color perception advantages.

Always remember that selecting the proper color of LED Light Source is important in even the simplest object sensing tasks...particularly in the proximity mode.

10-LED CONTRAST INDICATOR™

The Contrast Indicator provides "at-a-glance" analysis of the sensor's response to light state vs. dark sensing conditions. This device is not only useful in static conditions for alignment purposes, but is also functional during dynamic conditions when input events are ongoing.

EDR® *Enhanced Dynamic Range*

(Patent No. 5,621,205)

OFFSET/EDR® ADJUSTMENT (Patent No. 5,621,205)

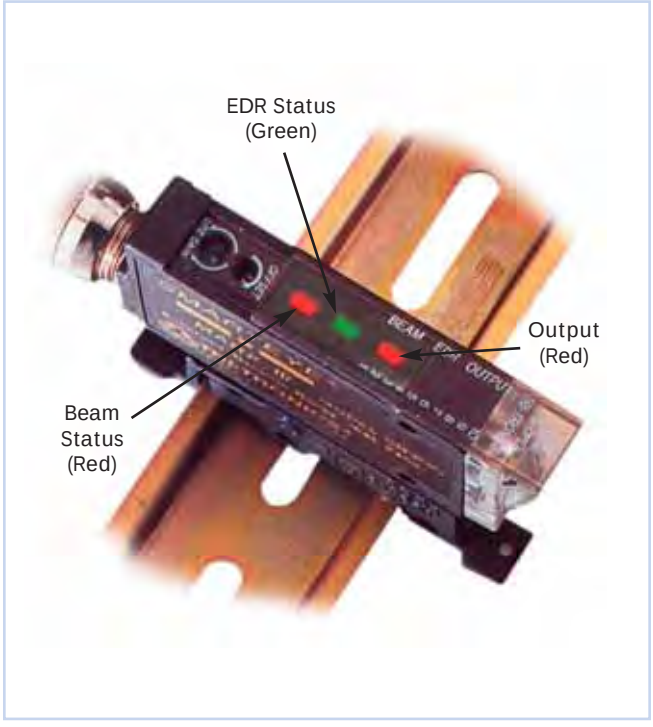
With the Offset/EDR® adjustment feature, the SMARTEYE MARK III sensor can resolve very low contrast sensing tasks over a wider range of light intensities, including proper operation at high light levels. In addition, EDR improves background suppression.

Please note that as the OFFSET/ EDR® adjustment is rotated in the counterclockwise direction, the green EDR indicator LED will begin to turn on and glow dimly. As the counter clockwise rotation proceeds, the intensity of the EDR® indicator will continue to increase. This indicator provides the installer an idea of just where in the overall dynamic operating range of the sensor the OFFSET/EDR® adjustment has been set. For example, if after adjustment to obtain maximum contrast deviation the OFFSET/ EDR® is "off," the sensor is operating under very low received light conditions. If the EDR® indicator is fully lit, the sensor is operating under very high received light conditions. The concept of how to interpret the green EDR® indicator is simple – after adjustment this indicator should not be fully lit or completely off. Anywhere in between indicates that the sensor is operating within its dynamic operating range.

EDR Indicator Status	Sensing Condition	Performance Enhancement
OFF	Operating near maximum sensing range	A. Move closer to target (proximity mode) B. Use larger diameter fiber optic light guides C. Use accessory lens D. Decrease sensing range
FULLY LIT	Operating near saturation	A. Move away from target (proximity mode) B. Increase sensing range (Beam Break mode) C. Downsize diameter of fiber optic

The suggested performance enhancements as listed above will ensure that contrast deviation response has been maximized.

Optimizing the SMARTEYE® MARK III



Light Source Guidelines

INVISIBLE INFRARED LIGHT SOURCE (880 nm)

A. Best choice in most opaque object sensing tasks
B. Provides longest possible sensing range in either Beam Make or Beam Break sensing modes
C. Best choice in hostile environments; useful in penetrating lens contamination
D. Preferred for use with small glass fiberoptic light guides Note: Do not use IR light with plastic fiberoptic light guides
E. Preferred when sensing dark colored objects in the proximity (Beam Make) mode, i.e., black, blue, green, etc.
F. Useful in penetrating containers for verification of contents; also useful in detecting overlapped splices in dense materials
G. Color perception; tends to favor blue colored objects

BLUE LIGHT SOURCE (480 nm)

A. Useful for detecting translucent, transparent, plastic, or glass objects in the retroreflective mode when using the R4 optical block
B. Used as blue filter for color perception advantages, i.e., resolving yellow vs. white colored objects or printed registration marks

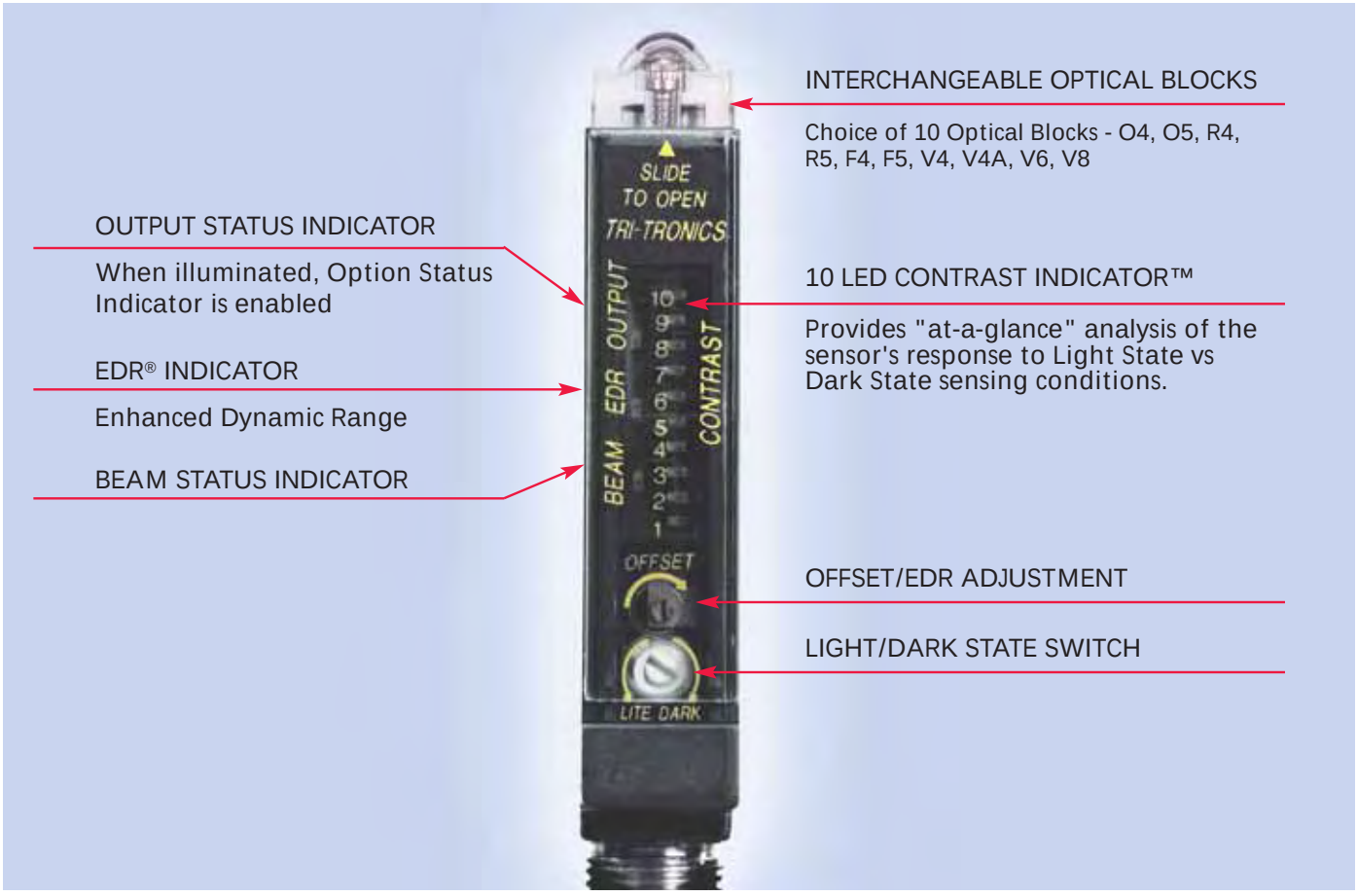
RED LIGHT SOURCE (660 nm)

A. Best choice for use with plastic fiberoptic light guides
B. Useful when sensing translucent objects in proximity (Beam Make) mode
C. Useful when sensing transparent objects in fiber optic retroreflective (Beam Break) mode
D. Can be polarized for retroreflective (Beam Break) sensing to reduce proxing on shiny objects
E. Opposed fiberoptic light guides can be polarized for sensing some translucent plastic containers; consult factory for details
F. Used as red filter for color perception advantages

WHITE LIGHT SOURCE

(Broadband Color Spectrum)

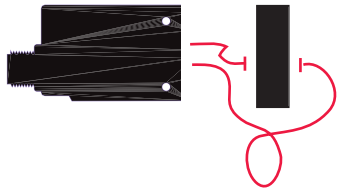
A. Best choice for detecting all printed registration marks on packaging material
B. Recommended for detecting dark colored objects in the proximity (Beam Make) mode
C. Best choice for sorting colored objects



Preferred Mode: Beam Break

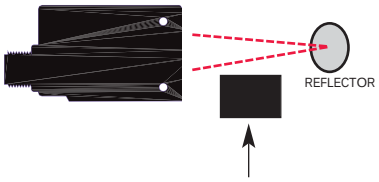
Fiberoptic opposed mode is best choice for detecting any opaque object.
Sensor: Model SE3I/SE3IC with F4 Optical Block (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6 ft.) or SEC-15/BSEC-15 (15 ft.)
Fiberoptic Light Guides: Model F-A-36T (two required)
Sensing Range: Up to 16 in.
Accessories: (2) Model UAC-15 lenses, extends sensing range to over 20 ft.
Mounting bracket: Model SEB-3, FMB-1
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)

Option 1



Retroreflective mode. Use with reflector to detect medium to large size opaque objects.
Sensor: Model SE3I/SE3IC with R4 Optical Block (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6 ft) or SEC-15/BSEC-15 (15 ft.)
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted. (See Accessories Section for complete listing of reflectors.)
Sensing Range: Up to 20 ft.
Accessories: Mounting bracket, Model SEB-3
NOTE: Not recommended for detecting highly reflective objects.

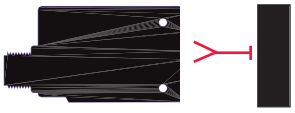
Option 2



Alternate Mode: Beam Make (Proximity)

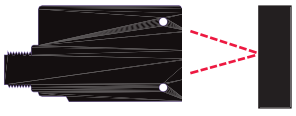
NOTE: Consider proximity mode when installation sensing site conditions preclude using the preferred Beam Break mode.

Option 1



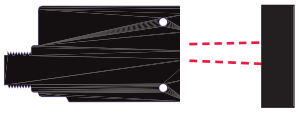
Fiberoptic proximity is used to detect medium to large flat sided opaque objects.
Sensor: Model SE3I/SE3IC with F4 Optical Block (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6 ft.) or SEC-15/BSEC-15 (15 ft.)
Fiberoptic Light Guides: Model BF-A-36T
Sensing Range: Up to 6 in.
Accessories: Model UAC-15 lens. Use to extend sensing range up to 1 ft.
Mounting bracket: Model SEB-3, FMB-1
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)

Option 2



Convergent/proximity mode is useful to detect opaque objects when there is little (if any) gap between objects.
Sensor: Model SE3I/SE3IC with V6 Optical Block (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6 ft.) or SEC-15/BSEC-15 (15 ft.)
Sensing Range: From 1.5 to 8 in.
Accessories: Mounting bracket, Model SEB-3

Option 3

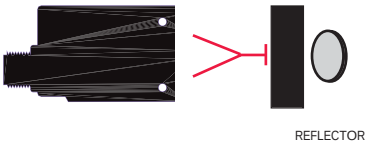


Proximity (divergent beam) mode sensing is useful in detecting some large size opaque objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model SE3I/SE3IC with O5 Optical Block (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6 ft.) or SEC-15/BSEC-15 (15 ft.)
Sensing Range: From 1 to 5 ft.
Accessories: Mounting bracket, Model SEB-3

Selection Guidelines *Translucent/Transparent Object Sensing*

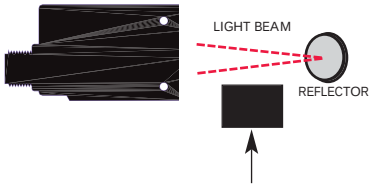
Preferred Mode: Retroreflective Beam Break

Option 1



Fiberoptic retroreflective is the best choice for detecting empty transparent or translucent objects. The SMARTEYE® MARK III featuring a unique Blue LED Light Source is recommended for detecting transparent or translucent plastic or glass objects. A Red Light Source is recommended when detecting translucent (non-transparent) objects only.
Sensor: Model SE3B/SE3BC with F4 Block (Blue Light Source) or Model SE3R/SE3RC with F4 Block (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6ft.) or SEC-15/BSEC-15 (15ft.)
Fiberoptic Light Guides: Model BF-A-36T
Reflector: Model 78P, plastic 4.4 in. X 1.9 in, screw mounted
Sensing Range: Up to 1 ft.
Accessories: Model UAC-15 lens. Use to extend sensing range from 1 ft. maximum without lens to over 3 ft. with lens. Mounting bracket, Model SEB-3, FMB-1

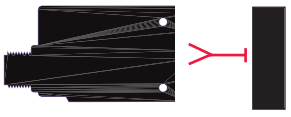
Option 2



Retroreflective (R4 optical block) is a good choice for detecting medium to large size empty transparent or translucent objects. The SMARTEYE® MARK III featuring a unique Blue LED Light Source is recommended for detecting transparent or translucent plastic or glass objects. A Red Light Source is recommended when detecting translucent (non-transparent) objects only.
Sensor: Model SE3B/SE3BC with R4 Block (Blue Light Source) or Model SE3R/SE3RC with R4 Block (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6ft.) or SEC-15/BSEC-15 (15ft)
Reflector: Model 78P, plastic 4.4 in. X 1.9 in., screw mounted.
Sensing Range: Up to 5 ft.
Accessories: Mounting bracket, Model SEB-3

Alternate Mode: Beam Make (Proximity)

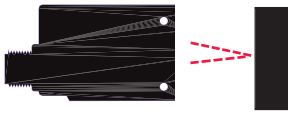
Option 1



NOTE: Consider proximity mode when translucent/transparent objects filled with clear liquid or when site conditions preclude using the preferred retroreflective Beam Break mode.

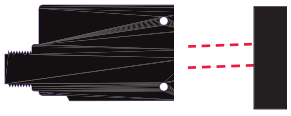
Fiberoptic proximity mode is useful to detect transparent/translucent objects.
Sensor: Model SE3R/SE3RC with F4 Block (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6ft.) or SEC-15/BSEC-15 (15 ft.)
Fiberoptic Light Guides: Model BF-A-36T
Sensing Range: Up to 4 in.
Accessories: Model UAC-15 lens. Use to extend sensing range up to 1 ft.
Mounting bracket, Model SEB-3, FMB-1
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)

Option 2



Convergent/proximity mode is useful to detect most transparent/translucent objects when there is little (if any) gap between objects.
Sensor: Model SE3R/SE3RC with V6 Block (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6ft.) or SEC-15/BSEC-15 (15 ft.)
Sensing Range: From 1 to 4 in
Accessories: Mounting bracket, Model SEB-3

Option 3



Proximity (divergent beam) mode sensing is useful in detecting some large size translucent/transparent objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model SE3R/SE3RC with O5 Block (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6ft.) or SEC-15/BSEC-15 (15 ft.)
Sensing Range: From 1 to 4 ft.
Accessories: Mounting bracket, Model SEB-3

Optical Block Selection

Interchangeable optical blocks provide for universal application of the SMARTEYE® MARK III to any sensing applications from large object sensing to finite sensing of small parts, registration mark detection and product inspection tasks.

Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent, or irregular shaped shiny objects.

Type O5
Proximity
Narrow beam optics useful in long-range sensing of medium to large size objects.

Type R4
Retroreflective
Very narrow beam optics designed to sense reflectors or reflective materials at long range. Designed for Beam Break sensing.

Type R5
Polarized Anti-Glare Retroreflective
Polarized to reduce response to "hot spot" glare from shiny surface of detected object. Use with red or blue light source.

Type V4, V4A
Convergent 1" "V" Axis
Narrow beam optics that focus at a sensing range of 1". Useful for sensing small parts. Also useful for proximity sensing (range of 1" to 5") to minimize response to reflected light from background objects.

Type V6
Convergent 1.5" "V" Axis
Narrow beam optics that focus at a sensing range of 1.5". Useful for sensing small parts. Also useful for proximity sensing (range of 1.5" to 8") to minimize response to reflected light from background objects.

Type V8
Convergent .5" "V" Axis
Narrow beam optics that focus at a sensing range of .5". Useful for sensing small parts or registration color marks. Also useful for proximity sensing (range of .25" to 5") to minimize response to reflected light from background objects.

Type F4
Glass Fiberoptics
Adapts MARK III for use with a wide variety of glass fiberoptic light guides for both the proximity and opposed sensing modes.

Type F5
Plastic Fiberoptics
Adapts MARK III for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes.

Sensing Range Guidelines

Convergent / Proximity / Retroreflective					Glass Fiber Optics					Plastic Fiber Optics		
OPTICAL BLOCKS	IR	RED	BLUE	WHITE	OPTICAL BLOCKS	IR	RED	BLUE	WHITE	OPTICAL BLOCKS	RED	WHITE
V4, V4A	1 in.	1 in.	1 in.	1 in.	Opposed Mode					Opposed Mode		
V6	1.5 in.	1.5 in.	1.5 in.	1.5 in.	F4	3 ft.	1 ft.	8 in.	5 in.	F5	9 in.	2 in.
V8	0.5 in.	0.5 in.	0.5 in.	0.5 in.	F4 w/lens	20+ ft.	20+ ft.	12 ft.	9 ft.	F5 w/lens	6 ft.	2 ft.
O4	18 in.	11 in.	4 in.	3 in.						F5 w/right angle lens	3 ft.	1 ft.
O5	4 ft.	3 ft.	1.5 ft.	12 in.	Proximity Mode					Proximity Mode		
R4	20+ ft.	18+ ft.	6 ft.	5 ft.	F4	7 in.	5 in.	1 in.	1 in.	F5	7 in.	5 in.
R5	N/A	7 ft.	4 ft.	3 ft.	F4 w/lens	1 ft.	1 ft.	N/A	6 in.	F5 w/lens	1 ft.	1 ft.

NOTE: *Proximity test utilized a 90% reflective white target. Retroreflective tests utilized a 3˝ diam. round reflector, Model AR-3*

NOTE: *Range tests utilized a .125˝ diam. fiber bundle*

NOTE: *Range tests utilized a .040˝ diam. fiber*

How to Specify

1. Select Sensor Model based on light source required
   SE3I = Infrared
   SE3R = Red
   SE3B = Blue
   SE3WL = White

2. Select Optical Block based on mode of operation

NOTE: DRB-1 Bracket included

Example: SE3RF4

- SE3 — SMARTEYE® MARK III
- R — Red, Blue, White, Infrared
- F4 — Fiberoptic Optical Block

Accessories

Micro Cable Selection Guide, 4-wire, M12

Yellow Shielded Cable Assemblies

SEC-6
6' (1.8 m) cable with connector

SEC-15
15' (4.6 m) cable with connector

SEC-25
25' (7.62 m) cable with connector

RSEC-6
6' (1.8 m) cable / right angle conn.

RSEC-15
15' (4.6 m) cable / right angle conn.

RSEC-25
25' (7.62 m) cable / right angle conn.

Black Shielded Cable Assemblies (Lightweight)

BSEC-6
6' (1.8 m) cable with connector

BSEC-15
15' (4.6 m) cable with connector

BSEC-25
25' (7.62 m) cable with connector

BRSEC-6
6' (1.8 m) cable / right angle conn.

BRSEC-15
15' (4.6 m) cable / right angle conn.

BRSEC-25
25' (7.62 m) cable / right angle conn.

BX-10
10' (3.1 m) Extension cable

BX-25
25' (7.62 m) Extension cable

Grey Unshielded Cable Assemblies

GSEC-2MU
6.5' (2.0 m) Low-cost

GSEC-5MU
16.4' (5.0 m) Low-cost

SEB-3
Stainless “L” Bracket

TA-18
18mm Adapter

DRB-1
Bracket

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

MB-18
18mm Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

Specifications

SUPPLY VOLTAGE
- 12 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 85 mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP output transistor:
  NPN: Sink up to 150 mA
  PNP: Source up to 150 mA
- Momentary short circuit protected
- Outputs protected from pulsing during power up
- Light/Dark switch determines output status:
  Light = Light "ON" operate
  Dark = Dark "ON" operate

RESPONSE TIME
- Minimum duration of input event:
  Light state response = 50 microseconds
  Dark state response = 140 microseconds
- Leading edge variation less than 20 microseconds

LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source – resulting in high immunity to most ambient light, including sunlight

HYSTERESIS
- Less than 400 millivolts for maximum sensitivity and resolution

LED LIGHT SOURCE
- Pulse modulation rate 36 KHZ.
- Choice of color: A. Infrared = 880 nm
  B. Red = 660 nm C. Blue = 480 nm
  D. White = Broadband Spectrum

INDICATORS
- OUTPUT INDICATOR – RED LED illuminates when the output transistors are in the "ON" state as determined by the position of the Light/Dark switch
- BEAM STATUS INDICATOR – RED LED illuminates when returned light level exceeds "5" on the CONTRAST INDICATOR
- EDR® INDICATOR – Intensity of GREEN LED provides indication of where in the dynamic operating range the offset/EDR® adjustment has been set
- CONTRAST INDICATOR™ – Displays scaled reading of sensor's response to contrasting light levels (light vs. dark) on a 10 bar LED display

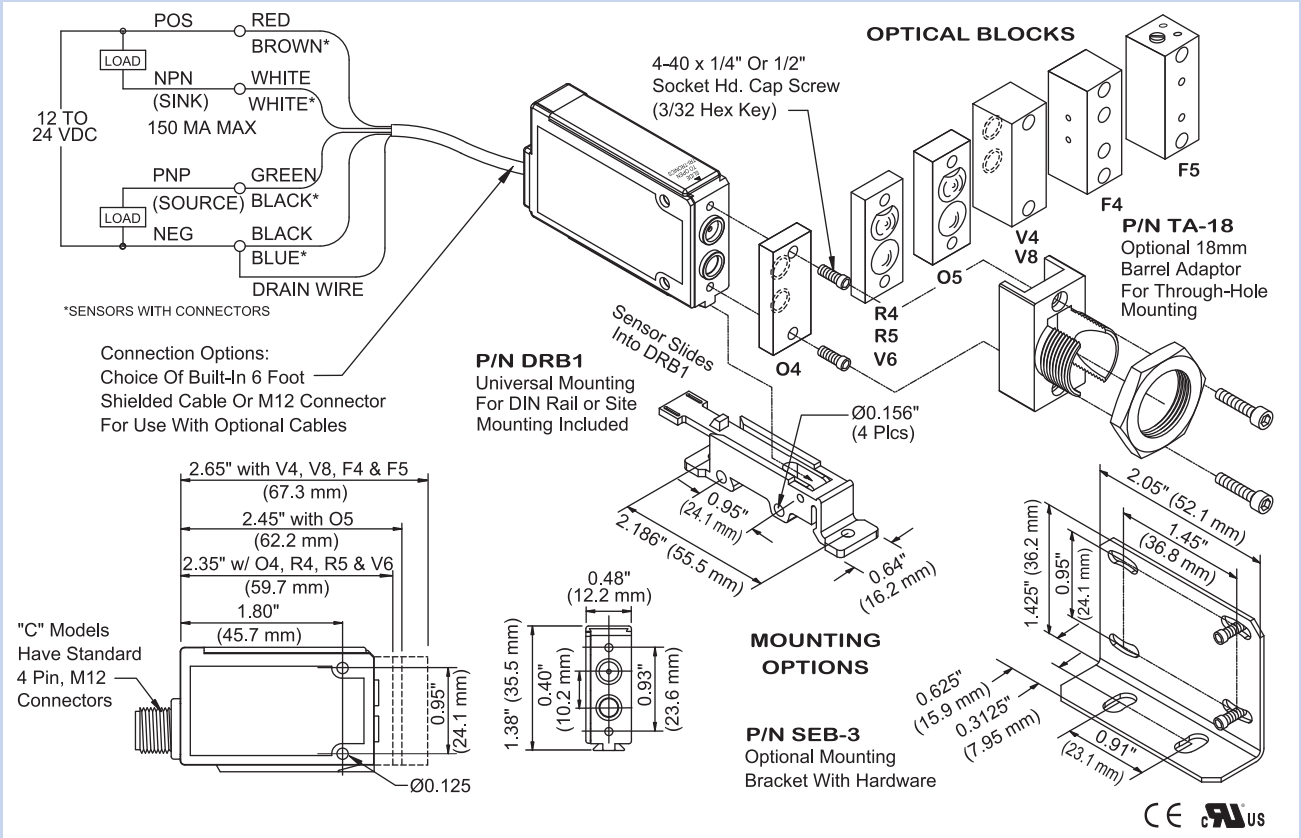
OFFSET/EDR® ADJUSTMENT*
- Sets initial level on the CONTRAST INDICATOR™ in relation to mid-scale switch point of 5 – functions as sensitivity adjustment
- Controls Enhanced Dynamic Range circuit (EDR®) which functions to avoid saturation

AMBIENT TEMPERATURE
- –40°C to +70°C (–40°F to 158°F)

RUGGED CONSTRUCTION
- Chemical resistant housing
- Rated NEMA 4X, 6P and IP67
- Epoxy encapsulated for mechanical strength.

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions SMARTEYE® MARK III PHOTOELECTRIC SENSOR



High Resolution
High Speed

SMARTEYE®

CLASSIC

SMARTEYE® CLASSIC *High Resolution, High Speed*

Since introducing the SMARTEYE® line, these unique pulse modulated Photoelectric Sensors have successfully performed hundreds of intricate "low contrast" sensing tasks in critical material handling and automation applications— including product inspection tasks where even $5,000 and $10,000 vision systems couldn't do the job!

In fact, the versatile SMARTEYE® has set a new "standard of performance" in the photoelectric sensing of size, texture, distance, opacity, depth and even color. With SMARTEYE®, there is no question whether it will perform the task, because SMARTEYE® will do the job with "performance to spare."

High-speed response, high sensitivity, and long-range capabilities, combined with the unique CONTRAST INDICATOR™ give you a sensor that you can depend on—a sensor that eliminates marginal performance—and all at an affordable price!

Contrast Indicator

The CONTRAST INDICATOR displays a scaled reading of the level of light received by the sensor's photo detector. The more light received, the higher the reading. The less light received, the lower the reading.

Contrast is a comparison of the lightest state reading vs. the darkest state reading. The sensing task of any digital (switching) photoelectric sensor is to resolve the difference between these two light levels and switch the output accordingly. The SMARTEYE® switches its output when the light level passes the midscale reading of "5".

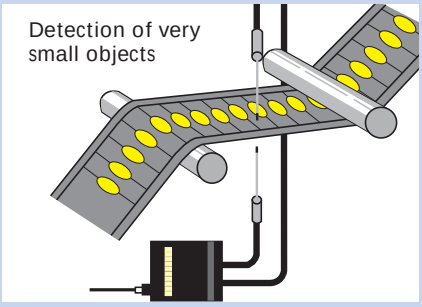
Fiberoptic Light Guides

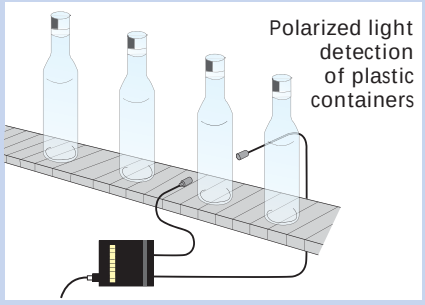
Flexible fiberoptic light guides are available in sizes small enough to fit into your toughest job sensing sites, in models for inaccessible places and detection of extremely small parts, for high temperature applications, corrosive environments, or high-vibration locations, as well as straight light guides for Beam Break and bifurcated light guides for proximity sensing.

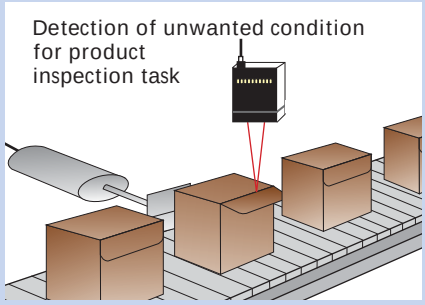
Features

- Unique CONTRAST INDICATOR™ allows easy setup for optimum performance and displays actual performance during operation
- High-speed models: 500 microseconds Beam Make or Beam Break. Excellent resolution and high-speed response. Recommended for most sensing tasks
- High-gain models: 1.5 milliseconds Beam Make or Beam Break. Highest resolution. Recommended for "very low"contrast tasks
- Very high-speed models. 100 microseconds Beam Make or Beam Break. Good resolution with very high-speed response. Recommended for use when speed of response is critical
- Pulse-modulated for high immunity to ambient light
- Unique interchangeable optical block design
- Digital (switching) NPN or PNP output transistor models available
- Analog (DC proportional) output models available
- Light source selection: infrared, high intensity, red, (vis-

Typical Applications







SMARTEYE® CLASSIC *High Resolution, High Speed*

Switching Models NPN (Digital)	Switching Models PNP	DC Proportional Models (Analog)	Performance	Light Source
SD	PSD	SA	High Speed, 500 µs	Infrared
SDL	PSDL	SAL	High Gain, 1.5 ms	Infrared
VSD	PVSD	-	Very High Speed, 100 µs	Infrared
SDR	PSDR	SAR	High Speed, 500 µs	Red
SDLR	PSDLR	SALR	High Gain, 1.5 ms	Red
SDLG	PSDLG	-	High Gain, 1.5 ms	Green
HSD	PHSD	-	High Speed, 500 µs	High Intensity IR
HSDL	PHSDL	-	High Gain, 1.5 ms	High Intensity IR
-	-	SAQ	Near Linear Output/Opposed Mode	Infrared
-	-	HSAQ	Near Linear Output/Proximity Mode	High Intensity IR

NOTE: NPN models shown. To order PNP Current Sourcing outputs, add prefix "P" to model number.

PERFORMANCE

High Speed Models: SD, PSD

(recommended for most sensing tasks)

Excellent resolution and high-speed response. 500 µs Beam Make or Beam Break. Maximum input events per second =1000. Optimized to provide a balance between high speed of response and performance to match moderate to low-contrast applications typically found in high-speed automation.

High Gain Models: HSD, PHSD

(recommended for very low contrast applications)

Highest resolution. 1.5 ms Beam Make or Beam Break. Maximum input events per second = 333. High amplification enables sensor to respond to very low contrast applications found in the more difficult sensing tasks. High gain is often necessary in SMARTEYE®s used to perform product inspection or orientation sensing tasks.

Very High Speed Models: VSD, PVSD

(recommended only when high-speed sensing is critical)

Good resolution and very high-speed response. 100 µs Beam Make or Beam Break. Maximum input events per second = 5000. Optimized to provide very high speed response while maintaining the necessary performance levels required in high velocity/high speed sensing.

LIGHT SOURCE SELECTION

Infrared Light Source

Invisible light – recommended in opaque object sensing applications. Infrared LED light source provides long-range sensing in either Beam Make or Beam Break modes. Infrared light maximizes the sensor's ability to penetrate contamination found in harsh environments.

High Intensity Infrared Light Source

Invisible light for maximum possible range in either Beam Make or Beam Break sensing modes. Provides maximum penetration for use in harsh environments. Also works well with the small diameter fiberoptic light guides. NOTE: Not recommended for use in close-up sensing or for use in most low contrast applications.

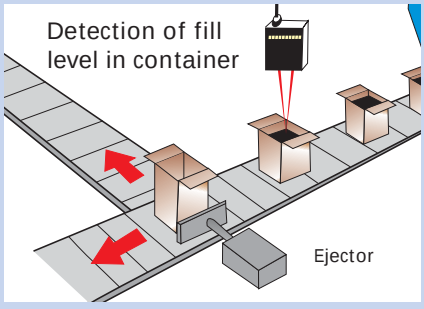
Red (Visible) Light Source

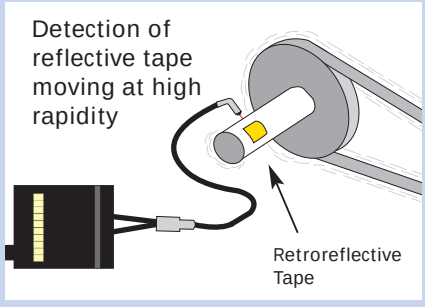
Visible red LED light source recommended for sensing transparent/translucent objects. Outperforms infrared light in many moderate to low contrast applications. Also recommended for use with plastic fiberoptic light guides.

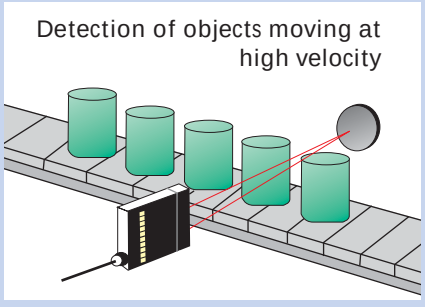
Green (Visible) Light Source

Recommended for use only in applications where the color green provides an obvious advantage. An example would be sensing a light colored red/pink object on a white background. Also has been used in film processing applications when red or infrared light can cause damage to sensitive film.

Typical Applications





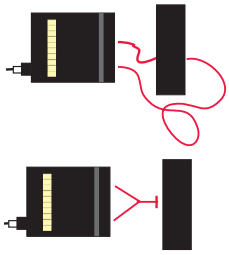


Optical Block Selection

Interchangeable optical blocks provide for universal application of the SMARTEYE® CLASSIC to any sensing task from large object sensing to finite sensing of small parts. Plastic lenses standard. Glass lenses available. Consult factory.

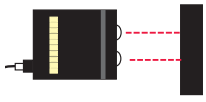
Type F1
Fiberoptic Adapter

Type F1 adapts SMARTEYE® CLASSIC to any standard fiberoptic light guide with .187" O.D. tips. The light guide is inserted and held in place with set screws. See Fiberoptic Light Guides Section for selection.



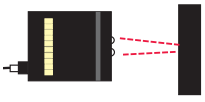
Type O1, O1G
(Glass) Medium to Long Range Proximity

Type O1, O1G (Glass) adapts the SMARTEYE® CLASSIC to the optical proximity mode of sensing. Range is dependent on size, shape, surface reflectivity of the object to be detected.



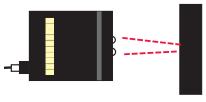
Type O2
Short Range Proximity

Type O2 also adapts the SMARTEYE® CLASSIC to the optical proximity mode of sensing, but on a sharp "V" axis to control depth of view. Range is dependent on model of The SMARTEYE® CLASSIC selected.



Type V1, V1G
(Glass) Focused Lens "V" Axis

Type V1, V1G (Glass) is for direct lens "V" axis sensing at close ranges. Used for small part or precise leading edge sensing. Range is dependent on model of the SMARTEYE® CLASSIC selected.



Type R1
Retroreflective

Type R1 turns the SMARTEYE® CLASSIC into a retroreflective sensor. Range is dependent on model the SMARTEYE® CLASSIC selected and size of reflectors.

Sensing Range Guidelines

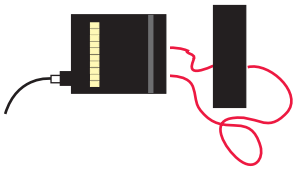
SMARTEYE® CLASSIC DIGITAL (SWITCHING) MODELS

Optical Blocks	SD	SDL	VSD	SDR	SDLR	SDLG	HSD	HSDL
O1, O1G	3 ft.	4 ft.	2 ft.	1 1/2 ft.	2 1/2 ft.	N/A	5 ft.	6 ft.
O2	4 1/2 in.	5 1/2 in.	3 in.	1 3/4 in.	2 1/4 in.	N/A	5 1/2 in.	7 in.
V1, V1G	3 in.	4 1/2 in.	2 1/2 in.	2 1/4 in.	3 in.	3/4 in.	4 3/4 in.	7 in.
R1	20 ft.	30 ft.	16 ft.	12 ft.	30 ft.	N/A	32 ft.	35 ft.
F1 (Prox)	3 1/2 in.	5 in.	2 in.	3 in.	4 1/2 in.	1/4 in.	5 1/2 in.	6 1/2 in.
F1 (Prox w/lens)	7 in.	10 in.	6 in.	10 in.	9 in.	N/A	10 in.	NOT RECOMMENDED
F1 Opposed	32 in.	48 in.	28 in.	6 in.	12 in.	2 3/4 in.	54 in.	66 in.
F1 Opposed w/lens	16 ft.	20 ft. +	14 ft.	11 ft.	13 1/2 ft.	3 ft.	20 ft. +	20 ft. +

NOTES:
- For more Information on useful range, see Fundamentals, Section 1.
- PROXIMITY tests utilized a 90% reflective target.
- RETROREFLECTIVE tests utilized a 3 In. diam. reflector Model AR3
- FIBEROPTIC tests utilized .125 in. diam. fiber bundles. Model UAC-15 Lens was used as indicated.

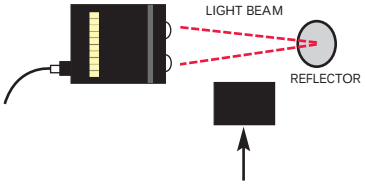
Preferred Mode: Beam Break

Option 1



Fiberoptic opposed mode is best choice for detecting any opaque object.
Sensor: Model SDF1(IR Light Source)
Fiberoptic Light Guides: (2) Model F-A-36T
Sensing Range: Up to 3.2 in.
Accessories: (2) Model UAC-15 lenses, extends sensing range up to 15 ft.
Mounting bracket, Model SEB-1, FMB-1
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)

Option 2

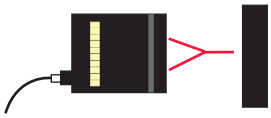


Retroreflective mode. Use with reflector to detect medium to large size opaque objects.
Sensor: Model SDRR1 (Red Light Source)
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted. (See Accessories Section for complete listing of reflectors)
Sensing Range: Up to 20 ft.
Accessories: Mounting bracket, Model SEB-1
NOTE: Not recommended for detecting highly reflective objects.

Alternate Mode: Beam Make (Proximity)

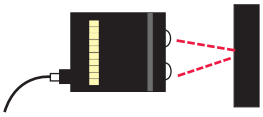
NOTE: Consider proximity mode when installation sensing site conditions preclude using the preferred Beam Break mode.

Option 1



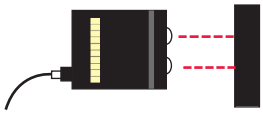
Fiberoptic proximity is used to detect medium to large flat sided opaque objects.
Sensor: Model SDF1 (IR Light Source)
Fiberoptic Light Guides: Model BF-A-36T
Sensing Range: Up to 3.5 in.
Accessories: (1) Model UAC-15 lens. Use to extend sensing range up to 7 in.
Mounting bracket, Model SEB-1, FMB-1
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)

Option 2



Convergent/proximity mode is useful to detect opaque objects when there is little (if any) gap between objects.
Sensor: Model SDV1 (IR Light Source)
Sensing Range: From 1/2 to 3 in.
Accessories: Mounting bracket, Model SEB-1

Option 3



Proximity (divergent beam) mode sensing is useful in detecting some large size opaque objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model SD01 (IR Light Source)
Sensing Range: From 1/2 to 3 ft.
Accessories: Mounting bracket, Model SEB-1

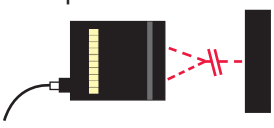
Preferred Mode: Retroreflective Beam Break

NOTE: The *Preferred Sensor* is the SMARTEYE® EZ-PRO Model EZPRF1, EZPBF1 or EZPRCF4 with a BF-A-36T fiber and a 78P reflector. (Refer to SMARTEYE® EZ-PRO Selection Guidelines, for details)

Alternate Mode: Beam Make (Proximity)

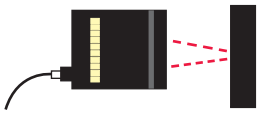
NOTE: Consider proximity mode when translucent/transparent objects/containers are filled with clear liquid or when site conditions preclude using the preferred retroreflective Beam Break mode.

Option 1.



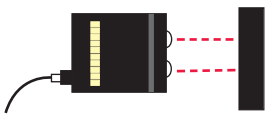
Fiberoptic proximity mode is useful to detect transparent/translucent objects.
Sensor: Model SDLRF1 (Red Light Source)
Fiberoptic Light Guides: Model BF-A-36T
Sensing Range: Up to 4.5 in.
Accessories: (1) Model UAC-15 lens. Use to extend sensing range up to 9 in.
Mounting bracket, Model SEB-1, FMB-1
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)

Option 2.



Convergent/proximity mode is useful to detect most transparent/translucent objects when there is little (if any) gap between objects.
Sensor: Model SDLV1 (Red Light Source)
Sensing Range: From 1/2 in. to 3 in.
Accessories: Mounting bracket, Model SEB-1

Option 3.

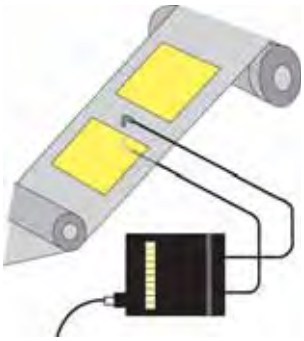


Proximity (divergent beam) mode sensing is useful in detecting some large size translucent/transparent objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model SDLR01 (Red Light Source)
Sensing Range: From 1/2 in. to 2.5 ft.
Accessories: Mounting bracket, Model SEB-1

LABEL SENSING:

Alternate Mode: Fiberoptic Opacity (Thru-Beam)

Alternate Mode:



Best method to detect self-adhesive labels on backing material.
Sensor: Model SDF1 (IR Light Source)
Fiberoptic Light Guides: (2) Model F-A-36T
Sensing Range: From 1/2 in. to 2 in.
Accessories: Mounting bracket, Model SEB-1, FMB-1
NOTE: It is not necessary to use smaller fibers for this application. However, many optional sensing tip configurations are available that may provide an improved mechanical fit for your sensing site conditions.

See LABEL•EYE® for preferred method of sensing.

How to Specify

1. Select Sensor Model based on LED light source and output required

Example: SD FI

SMARTEYE® CLASSIC — Fiberoptic Optical Block

NPN Output

HSDL	High Gain, High Intensity IR
HSD	High Speed, High Intensity IR
SDL	High Gain IR
SD	High Speed IR
VSD	Very High Speed IR
SDLR	High Gain Red
SDR	High Speed Red

PNP Output

PHSDL	High Gain, High Intensiity IR
PHSD	High Speed, High Intensity IR
PSDL	High Gain IR
PSD	High Speed IR
PVSD	Very High Speed IR
PSDLR	High Gain Red
PSDR	High Speed Red

Analog Output

SAL	High Gain IR
SA	High Speed IR
SALR	High Gain Red
SAR	High Speed Red
HSAQ	Near Linear High Intensity IR
SAQ	Near Linear High Intensity IR

2. Select Optical Block based on mode of operation required

   F 1 = Fiberoptic

   O1, O1G = Medium to Long Range Proximity

   O2 = Short Range proximity

   V1, V1G = Focused V-Axis Lens (not available on Analog Sensors)

   R1 = Retroreflective (not available on Analog Sensors)

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

SEB-1
Stainless “L” Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

Specifications

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity protected

CURRENT REQUIREMENTS
- 75 mA (exclusive of load)

OUTPUTS
Digital (Switching)
- Models with complementary NPN output transistors sink up to 100 mA @ 40 VDC max
- Models with complementary PNP output transistors source up to 100 mA @ 40 VDC max
- Zener protected against voltage spikes

Analog (DC Proportional)
- Output swings from 0 up to 3 volts less than supply voltage with RL greater than 10K ohms

Models SAQ and HSAQ
- Approximates near linear output

HYSTERESIS
- 400 millivolts for maximum sensitivity and resolution

LED LIGHT SOURCE WAVELENGTH
A. Infrared = 880 nm
B. Red = 660 nm
C. Green = 550 nm

RESPONSE TIME
- Minimum duration of input event– Beam Make or Beam Break

High Speed Models = 500 microseconds, 1000 input events per second

High Gain Models = 1.5 milliseconds, 333 input events per second

Very High Speed Models = 100 microseconds, 5000 input events per second

Analog Models = Speed of response represents rise time output from 10% to 90% of voltage swing

LIGHT IMMUNITY
- Pulse modulated to provide extremely high immunity to ambient light—including sunlight

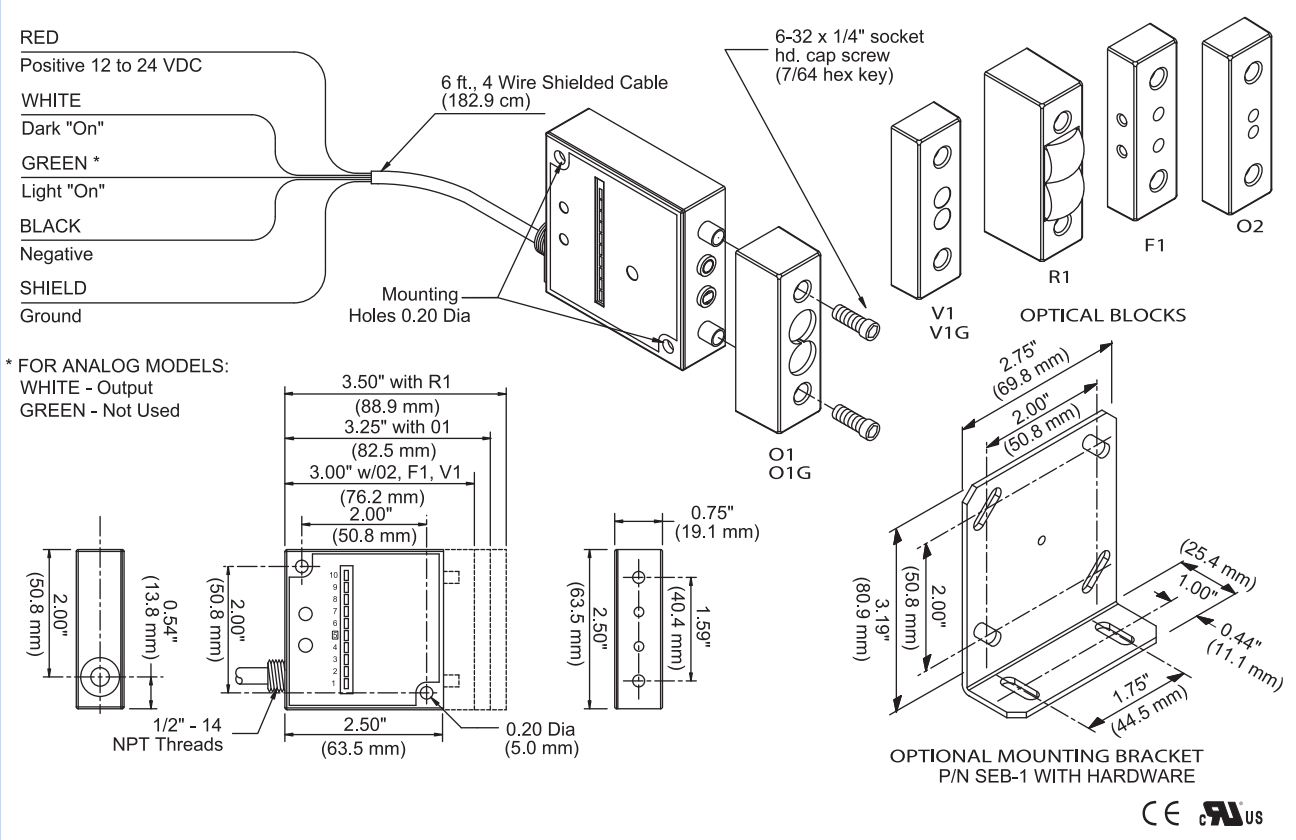
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

RUGGED CONSTRUCTION
- Chemical resistant, high impact poly carbonate housing
- Epoxy encapsulated for mechanical stability
- Waterproof, ratings: NEMA 4X, 6P and IP67

ADJUSTMENTS AND INDICATORS
- OFFSET – Sets initial level in relation to switch point of "5" on CONTRAST INDICATOR– also functions as a sensitivity adjustment
- OUTPUT INDICATOR – LED illuminates and output switches when returned light level exceeds "5" on CONTRAST INDICATOR
- CONTRAST INDICATOR – Displays scaled reading of contrasting light levels (light vs. dark) on a 10-bar LED display
- ANALOG MODELS – Gain sets amplification level to light /dark differential

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions SMARTEYE® CLASSIC



Economical DIN Rail Mount Sensor
Changeable Optical Blocks

OPTI-EYE®

OPTI-EYE®

OPTI-EYE® Photoelectric Sensors are high performance and versatile when applied to tough industrial sensing tasks. This sensor provides a combination of high gain and high speed of response (500 microseconds). High gain enables the sensor to resolve low contrast sensing tasks. High speed response provides resolution of the exact position of objects traveling at high speed.

OPERATING MODE OPTIONS:

Choice of nine"quick change" optical blocks allows use in the proximity, convergent, retroreflective, polarized retroreflective or fiberoptic sensing modes.

LED LIGHT SOURCE OPTIONS:

Choice of two LED light sources. Use the invisible IR light source for long range sensing or hostile environments. Use the visible RED light source for use with plastic fibers or for polarized retroreflective sensing.

CONNECTION OPTIONS:

Choice of built-in 6 foot shielded cable or connector for use with optional cables.

MOUNTING OPTIONS:

Choice of five mounting methods including DIN rail, through-hole and bracket mount.

OPTICAL BLOCK OPTIONS:

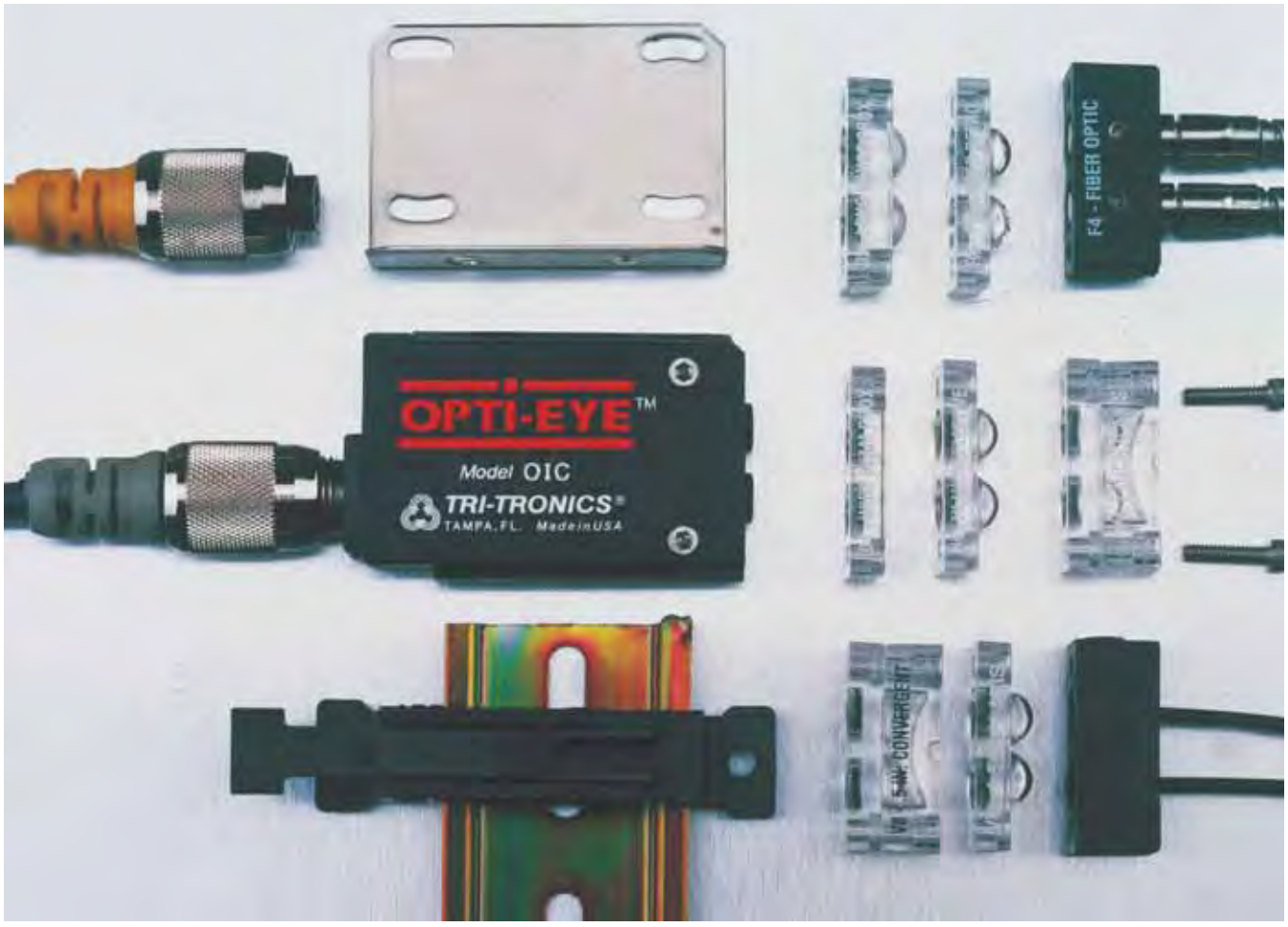
OPTI-EYE®'s unique lensed optical blocks are molded of solid optical grade, high-impact plastic. This innovative concept helps to prevent condensation or fog build-up on the inside of the lens. Multiple varieties of optical blocks are available for operating the OPTI-EYE®

in either the retroreflective, polarized (non-glare), proximity, opposed, fiberoptic, or convergent sensing modes. A simple change of the optical block can be very useful in determining the best sensing mode for use in your specific sensing task. These inexpensive, interchangeable optical blocks reduce the inventory burden of replacement parts and eliminate the need for discarding a complete sensor in the case of damage to the optical block.

OPTI-EYE® offers many unique features including a range adjustment (light source intensity) and three LED setup indicators. The range adjustment allows operation over a wide dynamic range. The green LED indicator illuminates when the received light level exceeds the sensor's light state switch point.

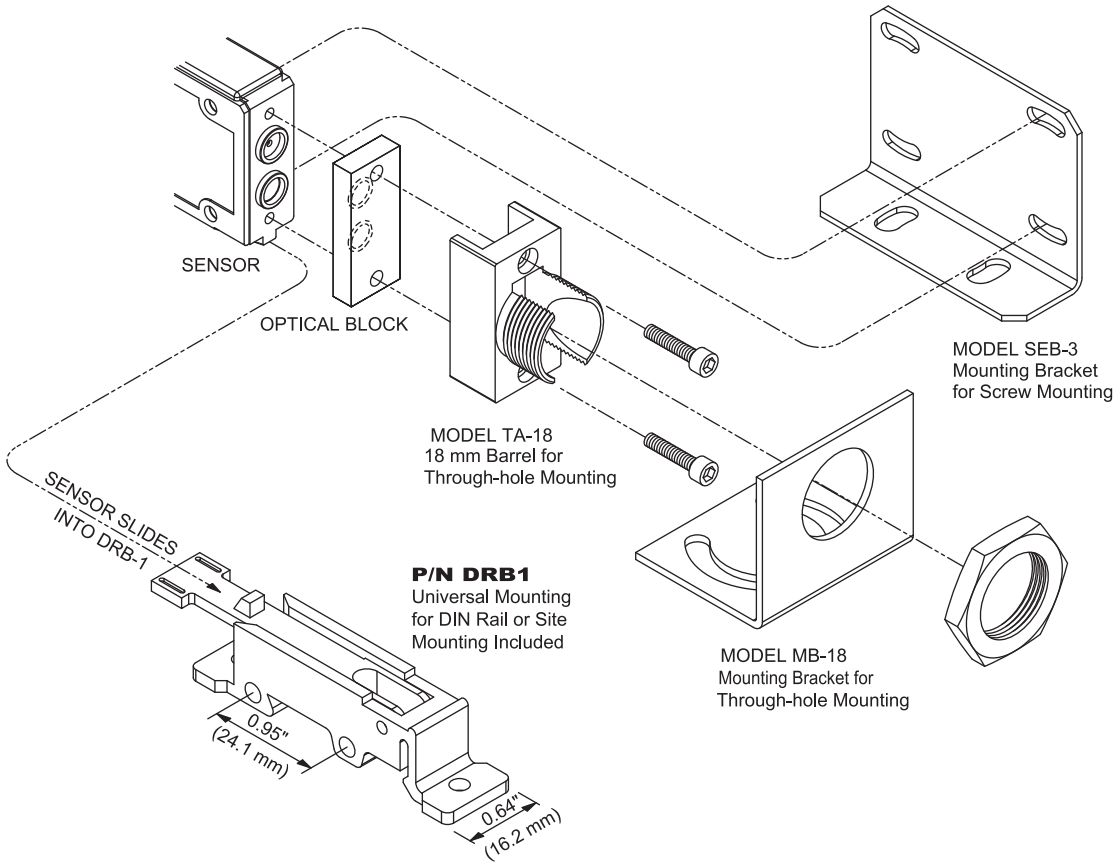
The yellow LED indicator displays the intensity of the sensor's light source. This indicator provides the installer an idea of where in the overall dynamic operating range the adjustment has been set. This is particularly important when using the invisible IR light source. The red LED illuminates when the output transistors are in the "on" status. Now you can set up and adjust the sensor as easily as monitoring the status of three LED indicators.

OPTI•EYE® is a complete modular system



Five Unique Mounting Options:

1. Snap Mount onto a DIN rail with Universal Bracket Model DRB-1
2. Screw mount at sensing site with Universal Bracket Model DRB-1
3. Through-hole mount with optional 18mm Threaded Barrel Adapter Model TA-18
4. Screw mount with optional "L" Shaped Stainless Steel Bracket Model SEB-3
5. Screw mount directly to the machine



Light Source Guidelines

INVISIBLE INFRARED LIGHT SOURCE (880 nm)

A. Best choice in most opaque object sensing tasks.

B. Provides longest possible sensing range in either Beam Make or Beam Break sensing modes.

C. Best choice in hostile environments. Useful in penetrating lens contamlnation.

D. Preferred for use with small glass fiberoptic light guides. Note: Do not use IR light with plastic fiberoptic light guides.

E. Preferred when sensing dark colored objects in the proximity (Beam Make) mode. i.e. black, blue, green, etc.

F. Useful in penetrating containers for verification of contents. Also useful in detecting overlapped splices in dense materials.

G. Color perception; tends to favor blue colored objects.

RED LIGHT SOURCE (660 nm)

A. Best choice for use with plastic fiberoptic light guides.

B. Useful when sensing translucent objects in proximity (Beam Make) mode.

C. Useful when sensing transparent objects in fiberoptic retroreflective (Beam Break) mode.

D. Can be polarized for retroreflective (Beam Break) sensing to reduce proxing on shiny objects.

E. Opposed fiberoptic light guides can be polarized for sensing some translucent plastic containers. Consult factory for details.

F. Used as red filter for color perception advantages.

Optical Block Selection

Interchangeable optical blocks provide for universal application of the OPTI-EYE® to any sensing applications from large object sensing to finite sensing of small parts, registration mark detection, and product inspection tasks.

Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent or irregular shaped shiny objects.

Type O5
Proximity
Narrow beam optics useful in long-range sensing of medium to large size objects.

Type R4
Retroreflective
Very narrow beam optics designed to sense reflectors or reflective materials at long range. Designed for Beam Break sensing.

Type R5
Polarized Anti-Glare Retroreflective
Polarized to reduce response to "hot spot" glare from shiny surface of detected object. Use with red light source.

Type V4, V4A
Convergent 1" "V" Axis
Narrow beam optics that focus at a sensing range of 1". Useful for sensing small parts. Also useful for proximity sensing (range of 1" to 5") to minimize response to reflected light from background objects.

Type V6
Convergent 1.5" "V" Axis
Narrow beam optics that focus at a sensing range of 1.5". Useful for sensing small parts. Also useful for proximity sensing (range of 1.5" to 8") to minimize response to reflected light from background objects.

Type V8
Convergent .5" "V" Axis
Narrow beam optics that focus at a sensing range of .5". Useful for sensing small parts or registration color marks. Also useful for proximity sensing (range of .25" to 5") to minimize response to reflected light from background objects.

Type F4
Glass Fiber Optics
Adapts OPTI•EYE® for use with a wide variety of glass fiberoptic light guides for both the proximity and opposed sensing modes.

Type F5
Plastic Fiber Optics
Adapts OPTI•EYE® for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes.

Sensing Range Guidelines

Convergent / Proximity / Retroreflective

OPTICAL BLOCKS	IR	RED
V4, V4A	1 in.	1 in.
V6	1.5 in.	1.5 in.
V8	0.5 in.	0.5 in.
O4	5 in.	2.5 in.
O5	3 ft.	1.5 ft.
R4	20+ ft.	18 ft.
R5	N/A	10 ft.

NOTE: Proximity test utilized a 90% reflective white target. Retroreflective tests utilized a 3˝ diam. round reflector, Model AR-3

Glass fiberoptics

OPTICAL BLOCKS	IR	RED
Opposed Mode		
F4	8 in.	4 in.
F4 w/lens	20 ft.	18 ft.
Proximity Mode		
F4	3 in.	1.25 in.
F4 w/lens	6 in.	3 in.

NOTE: Range tests utilized a .125˝ diam. fiber bundle

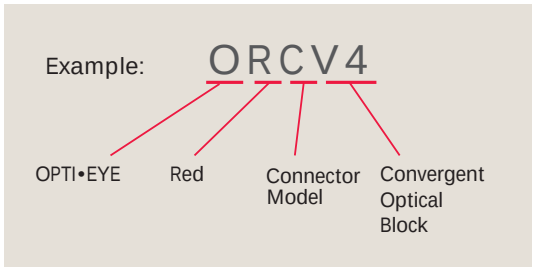
Plastic fiberoptics

OPTICAL BLOCKS	IR	RED
Opposed Mode		
F5	N/A	2 in.
F5 w/lens	N/A	2 ft.
F5 w/right angle lens	N/A	1 ft.
Proximity Mode		
F5	N/A	5 in.
F5 w/lens	N/A	1 ft.

NOTE: Range tests utilized a .040˝ diam. fiber

How To Specify

1. Select Sensor Model.
2. Select Sensor light source required:
   I = Infrared; R = Red
3. Select Connector required:
   Blank = Cable; C = Connector
4. Select Optical Block based on mode of operation required.



Accessories

Micro Cable Selection Guide, 4-wire, M12

Yellow Shielded Cable Assemblies

SEC-6
6' (1.8 m) cable with connector

SEC-15
15' (4.6 m) cable with connector

SEC-25
25' (7.62 m) cable with connector

RSEC-6
6' (1.8 m) cable / right angle conn.

RSEC-15
15' (4.6 m) cable / right angle conn.

RSEC-25
25' (7.62 m) cable / right angle conn.

Black Shielded Cable Assemblies (Lightweight)

BSEC-6
6' (1.8 m) cable with connector

BSEC-15
15' (4.6 m) cable with connector

BSEC-25
25' (7.62 m) cable with connector

BRSEC-6
6' (1.8 m) cable / right angle conn.

BRSEC-15
15' (4.6 m) cable / right angle conn.

BRSEC-25
25' (7.62 m) cable / right angle conn.

BX-10
10' (3.1 m) Extension cable

BX-25
25' (7.62 m) Extension cable

Grey Unshielded Cable Assemblies

GSEC-2MU
6.5' (2.0 m) Low-cost

GSEC-5MU
16.4' (5.0 m) Low-cost

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

LK-4
Lens Kit
(See Optical Blocks
Accessories for contents)

SEB-3
Stainless “L” Bracket

TA-18
18mm Adapter

MB-18
Mounting Bracket

DRB-1
Bracket

IMPORTANT:
To reduce the possibility of electrical interference, use TRI-TRONICS molded plug/shielded cable assembly

Specifications

OPTI-EYE®

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 60 mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP output transistors:
  NPN: Sink up to 150 mA
  PNP: Source up to 150 mA
- Momentary short circuit protected
- Outputs protected from pulsing during power up
- Light/Dark switch determines output status:
  LT = Light "ON" operate
  DK = Dark "ON" operate

RESPONSE TIME
- Minimum duration of input event:
  500 microseconds

HYSTERESIS
- Set for Medium-to-Low contrast application

LED LIGHT SOURCE
- Choice of color: Infrared = 880 nm
  or Visible Red = 660 nm

LIGHT IMMUNITY
- Responds to sensor's pulse modulated
  light source – immune to most ambient light

RANGE ADJUSTMENT
- 15 turn Light Source Intensity control

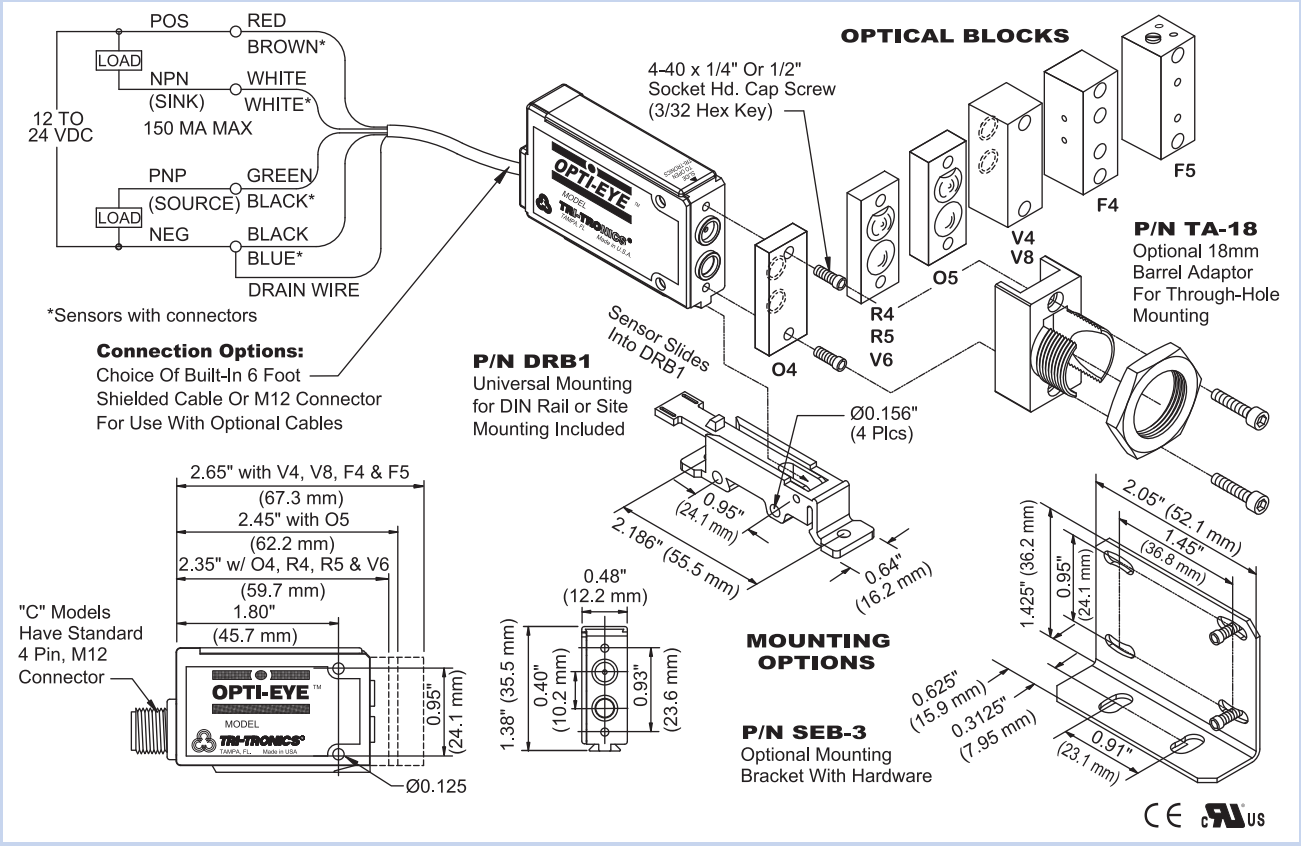
AMBIENT TEMPERATURE
- –40°C to 70°C (–40°F to 158°F)

INDICATORS
- OUTPUT INDICATOR
  RED LED illuminates when the output transistors are in the "ON" state as determined by the Light/Dark switch
- BEAM STATUS INDICATOR
  GREEN LED illuminates when received light level exceeds the sensor's light state switch point
- LIGHT SOURCE INTENSITY INDICATOR
  YELLOW LED illuminates proportionally to the Light Source intensity as determined by the Range adjustment

RUGGED CONSTRUCTION
- Chemical resistant housing
- Waterproof, ratings, NEMA 4X, 6P and IP67
- Epoxy encapsulated for mechanical strength

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions OPTI-EYE® PHOTOELECTRIC SENSOR



NEW!

Affordable
All-Purpose
EZ To Use

EZ™ EYE

Miniature Push-Button Photoelectric Sensor

- Object Detection
- Web Break Detection
- Counting
- Inspection
- Orientation and much more...

EZ-EYE™ miniature photoelectric sensors fulfill the need for an affordable, push-button sensor that is EZ to align and EZ to adjust. Optimized for machine control automation, the setup is easy with the unique one-touch AUTOSET™ routine. Simply place the sensor in the Light State condition and push the button once for a perfect setting. That's all there is to it!

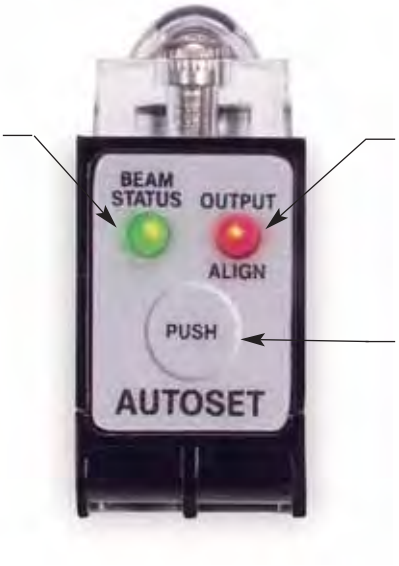
Push-Button Adjustment: EZ to select higher excess gain... just tap the button twice to increase the excess gain (sensitivity). Note: Initiating the AUTOSET™ routine followed by tapping the button emulates a screwdriver adjustment.

Optical Block Options: Unique lensed optical blocks are molded of solid, optical-grade, high-impact plastic. This innovative concept helps to prevent condensation on the inside of the lens. Ten varieties of optical blocks are available for operating the EZ-EYE, such as retroreflective, polarized retroreflective, proximity, fiberoptic or convergent sensing modes. A simple change of the optical block can be very useful in determining the best sensing mode for your specific sensing task. These inexpensive, interchangeable optical blocks eliminate the need for discarding a complete sensor in the case of damage to the optical block.

The EZ-EYE™ photoelectric sensor by TRI-TRONICS® fulfills the need for an affordable, push-button sensor that is EZ to align and EZ to adjust.

FEATURES & BENEFITS

- EZ to adjust...AUTOSET™ routine requires a single push of a button.
- EZ to align...Flash Rate Indicator monitors received light intensity.
- EZ to select higher excess gain...tap the button twice to increase excess gain (sensitivity). Note: Initiating the AUTOSET™ routine followed by tapping the button emulates a screwdriver adjustment.
- EZ to select sensing mode...choose from ten completely interchangeable optical blocks.
- EZ-EYE™ sensors are available with either infrared (IR) or red LED light sources.
- EZ EYE™ sensors are equipped with both NPN and PNP output transistors.
- Power supply requirements: 10 to 24 VDC.
- Responds to sensor's pulsed modulated light source... resulting in high immunity to most ambient light, including strobes.



Dual Function LED Indicator

- GREEN indicates "ON" after AUTOSET™ routine
- Flashes twice, then turns AMBER after Excess Gain Adjustment

Triple Function LED Indicator

- RED indicates output status. Illuminates when transistors are in the "ON" state condition
- GREEN indicates flash rate alignment
- AMBER flashes when AUTOSET™ routine is complete

Push-Button Control

- AUTOSET™ — Place sensor in Light State condition, then press and hold until the Alignment Indicator flashes, then release
- Press and hold to use Flash Rate Alignment Indicator
- Tap 2 times to advance excess gain
- Tap 5 times to toggle output status

LIGHT SOURCE GUIDELINES

INVISIBLE INFRARED LIGHT SOURCE (880 nm)

A. Best choice in most opaque object sensing tasks.

B. Provides longest possible sensing range in either Beam Make or Beam Break sensing modes.

C. Best choice in hostile environments. Useful in penetrating lens contamination.

D. Preferred for use with small glass fiberoptic light guides. Note: Do not use IR light with plastic fiberoptic light guides.

E. Preferred when sensing dark colored objects in the proximity (Beam Make) mode, i.e., black, blue, green, etc.

F. Useful in penetrating containers for verification of contents. Also useful in detecting overlapped splices in dense materials.

RED LIGHT SOURCE (660 nm)

A. Best choice for use with plastic fiberoptic light guides.

B. Useful when sensing translucent or transparent objects in proximity (Beam Make) mode.

C. Can be polarized for retroreflective (Beam Break) sensing to reduce proxing on shiny objects.

D. Opposed fiberoptic light guides can be polarized for sensing some translucent plastic containers. Consult factory for details.

OPTICAL BLOCK SELECTION

Interchangeable optical blocks provide for universal application of the EZ-EYE™ to any sensing application from large object sensing to finite sensing of small parts and product inspection tasks.

Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent or irregular shaped shiny objects.

Type O5
Proximity
Narrow beam optics useful in long-range sensing of medium to large size objects.

Type R4
Retroreflective
Very narrow beam optics designed to sense reflectors or reflective materials at long range. Designed for Beam Break sensing.

Type R5
Polarized Anti-Glare Retroreflective
Polarized to reduce response to "hot spot" glare from shiny surface of detected object. Use with red light source.

Type V4
Convergent 1" "V" Axis
Narrow beam optics that focus at a sensing range of 1". Useful for sensing small parts. Also useful for proximity sensing (range of 1" to 5") to minimize response to reflected light from background objects.

Type V4A
Convergent Aperture 1" "V" Axis
Aperture provides spot focus light beam at a sensing range of 1". Useful for sensing small parts or narrow gaps. Also useful for proximity sensing (range of 1" to 5") to minimize response to reflected light from background objects.

Type V6
Convergent 1.5" "V" Axis
Narrow beam optics that focus at a sensing range of 1.5". Useful for sensing small parts. Also useful for proximity sensing (range of 1.5" to 8") to minimize response to reflected light from background objects.

Type V8
Convergent .5" "V" Axis
Narrow beam optics that focus at a sensing range of .5". Useful for sensing small parts. Also useful for proximity sensing (range of .25" to 5") to minimize response to reflected light from background objects.

Type F4
Glass Fiberoptics
Adapts for use with a wide variety of glass fiberoptic light guides (.187 O.D.) for both the proximity and opposed sensing modes.

Type F5
Plastic Fiberoptics
Adapts for use with a wide variety of plastic fiberoptic light guides (.090 O.D.) for both the proximity and opposed sensing modes.

RANGE GUIDELINES

OPTICAL BLOCKS	PZI Infrared LED	PZR Red LED
O4 Proximity	5" (127 mm)	2.0" (51 mm)
O5 Proximity	3' (914 mm)	16" (406 mm)
R4 Retroreflective	40' (12.0 m)	20' (6.09 m)
R5 Polarized Retro.	N/A	12' (3.6 m)
V4, V4A Convergent	1" (25.4 mm)	1" (25.4 mm)
V6 Convergent	1.5" (38 mm)	1.5" (38 mm)
V8 Convergent	.5" (12.7 mm)	.5" (12.7 mm)

GLASS FIBEROPTICS	PZI Infrared LED	PZR Red LED
Type F4, .125" diam. (3.175 mm)		
Proximity	2.5" (63.5 mm)	1.25" (31.75 mm)
Proximity w/ UAC-15	5" (127 mm)	6" (152.4 mm)
Opposed	7" (178 mm)	3.5" (88.9 mm)
Opposed w/ UAC-15	10' (3.048 m)	5' (1.524 m)

PLASTIC FIBEROPTICS	Type F5, .040" diam. (1.016 mm)	
Proximity	N/A	1" (25.4 mm)
Opposed	N/A	4.5" (114.3 mm)
Opposed w/ GLA-2 Lens	N/A	10' (3.048 m)

NOTE: All proximity tests utilized a 90% reflective, white target.
All retroreflective tests utilized model AR6151 high-performance reflector.

HOW TO SPECIFY

Example: PZ R C F5

- PZ — EZ-EYE™
- R — Red LED = R; Infrared LED= I
- C — C = Connector; Blank = Cable
- F5 — Optical Blocks F4, F5, O4, O5, R4, R5, V4, V4A, V6, V8 (See Range Guidelines)

ACCESSORIES

4-Wire Nano Cable, M8

GEC-6
6' (1.8 m) cable with connector

GEC-15
15' (4.6 m) cable with connector

GEC-25
25' (7.6 m) cable with connector

RGEC-6
6' (1.8 m) cable / right angle conn.

RGEC-15
15' (4.6 m) cable / right angle conn.

GEX-9
9' (2.7 m) extension cable

Screw Mount Reflectors

78P
4.4" x 1.9"
(111.7 mm x 48.3 mm)

AR3
3" diam.
(76.2 mm diam.)

Optional Prismatic High-Performance Reflectors NEMA 4, IP67

AR6151
AR6151G
(Chemical Resistant Glass Cover)
2.4" x 2.0"
(61 x 51 mm)

AR4060
1.6" x 2.36"
(40.5 x 60 mm)

AR46
1.8" diam.
(46 mm diam.)
Glue Mount

EEB-1
Vertical Stainless
Bracket Assembly

EEB-2
Horizontal
Bracket Assembly

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

LK-4
Lens Kit
(See Optical Blocks Accessories for contents)

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or
Plastic Fiberoptic
Mounting Brackets

Go to ttco.com for fiberoptic light guide selections

Specifications

SUPPLY VOLTAGE
- 10 to 24 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 50 mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP sensor output transistor
- Sensor's output can sink or source up to 150 mA (current limited)
- Outputs are continuously short-circuit protected

RESPONSE TIME
- Light State response = 500 microseconds
- Dark State response = 500 microseconds

LED LIGHT SOURCE
- Red = 660 nm
- Infrared = 880 nm
- Pulse Modulated

PUSH BUTTON CONTROL
- AUTOSET™ Routine: Push and release with sensor in "light" state
- Excess Gain Adjustment: Tap twice to step to higher excess gain
- Push and hold to activate Flash Rate Alignment Indicator
- Light /Dark "ON" selection: Tap 5 times to toggle

RANGE
- Dependent on optical block (see range guidelines)

HYSTERESIS
- Approximately 15% of signal

LIGHT IMMUNITY
- Responds to sensor's pulse-modulated light source, resulting in high immunity to most ambient light, including high intensity strobes.

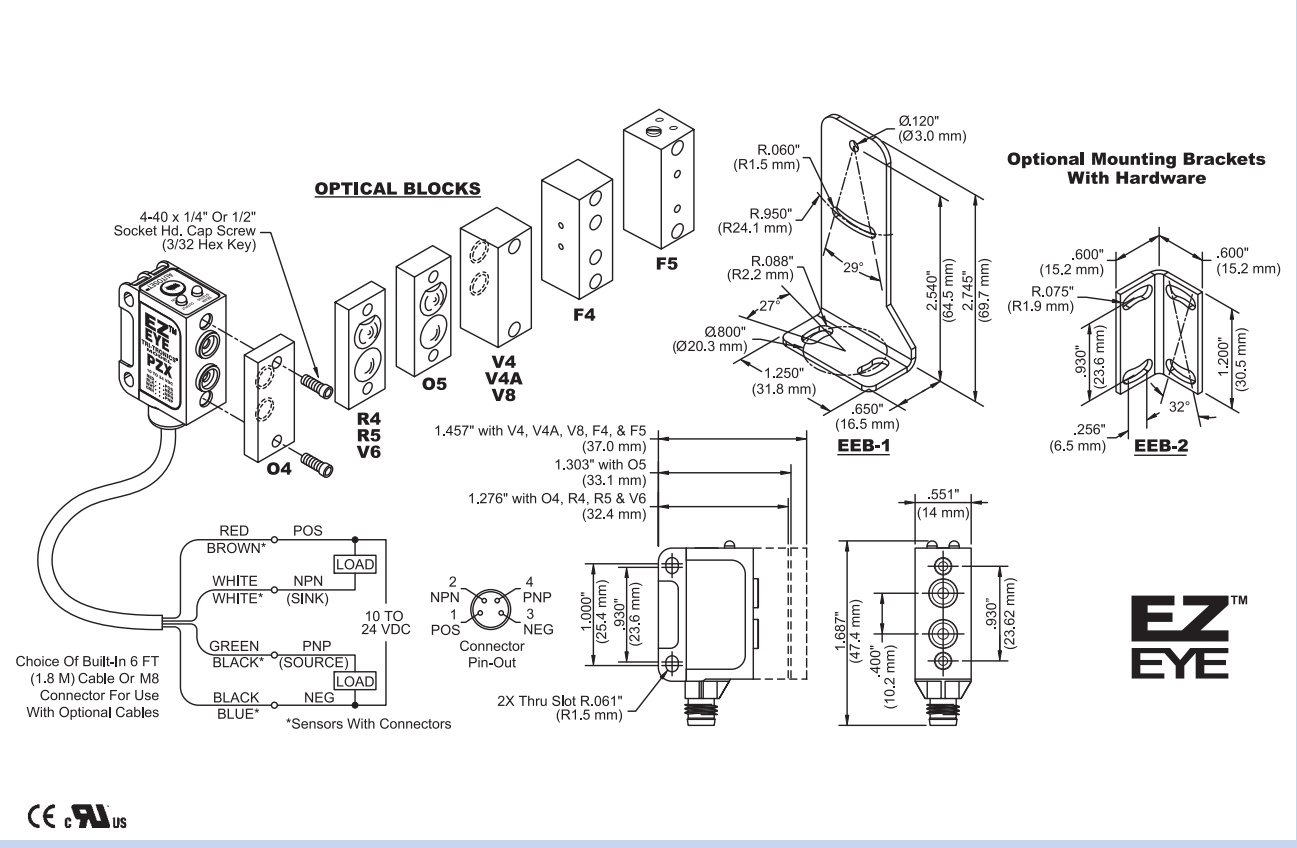
DIAGNOSTIC INDICATORS
- Dual Red/Green LED
  Red = Output Status NOTE: If Output LED flashes, a short circuit condition exists.
  Green = Flash Rate Alignment Indicator
- Dual Green/Amber LED
  Green = "ON" After AUTOSET™ Routine
  Amber = "ON" After Excess Gain Adjustment

AMBIENT TEMPERATURE
- -40° to 70°C (-40° to 158° F)

RUGGED CONSTRUCTION
- Chemical resistant, high impact polycarbonate housing
- Waterproof ratings: NEMA 4, IP67
- Conforms to heavy industry grade CE requirements

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions — EZ-EYE™ PHOTOELECTRIC SENSOR



"Small, Rugged and Powerful...
yet Low in Price"

MINI-EYE™

MINI-EYE™

"Small, Rugged and Powerful... yet Low in Price"

The TRI-TRONICS MINI-EYE™ photoelectric sensors are designed to be low in cost and high in value. The sensors are waterproof and are enclosed in a high-impact plastic housing.

Thru-Beam Models utilize a separate light source and receiver for "Beam Make" or "Beam Break" sensing. Recommended for long-range sensing or for use in environments where dust or dirt buildup may cover the lens.

The sensors provide a very narrow beam path from the light source to the receiver and are perfect for sensing small gaps or precise sensing tasks, which is critical when attempting to resolve the exact location of passing objects. The light source requires a simple 2-wire connection and functions independently of other receivers.

Retroreflective Models operate in either the "Beam Make" or "Beam Break" sensing mode and are designed to be used with a prismatic reflector. Detection occurs when the light beam is broken by a passing target or object. The visible, red, polarized model helps to prevent "proxing" or responding to undesirable light reflecting from shiny objects, such as cans, glass and clear plastic. The invisible, infrared light source model is recommended for long-range sensing.

Proximity Models are designed for close range sensing tasks and operate by detecting the reflected light from targeted objects. The red LED light source is recommended for detecting transparent objects, such as clear glass or plastic bottles. The invisible infrared LED light source is recommended for general purpose sensing tasks.

All MINI-EYE™ sensors are available with a quick disconnect M8 4-PIN connector or a potted 6' (1.8 m) 4-wire cable, and with a red or infrared LED light source. They are easy to set up and can operate in either the light "ON" or dark "ON" mode. For light "ON" operation, connect the white wire to negative and for dark "ON" operation, simply connect the white wire to positive.

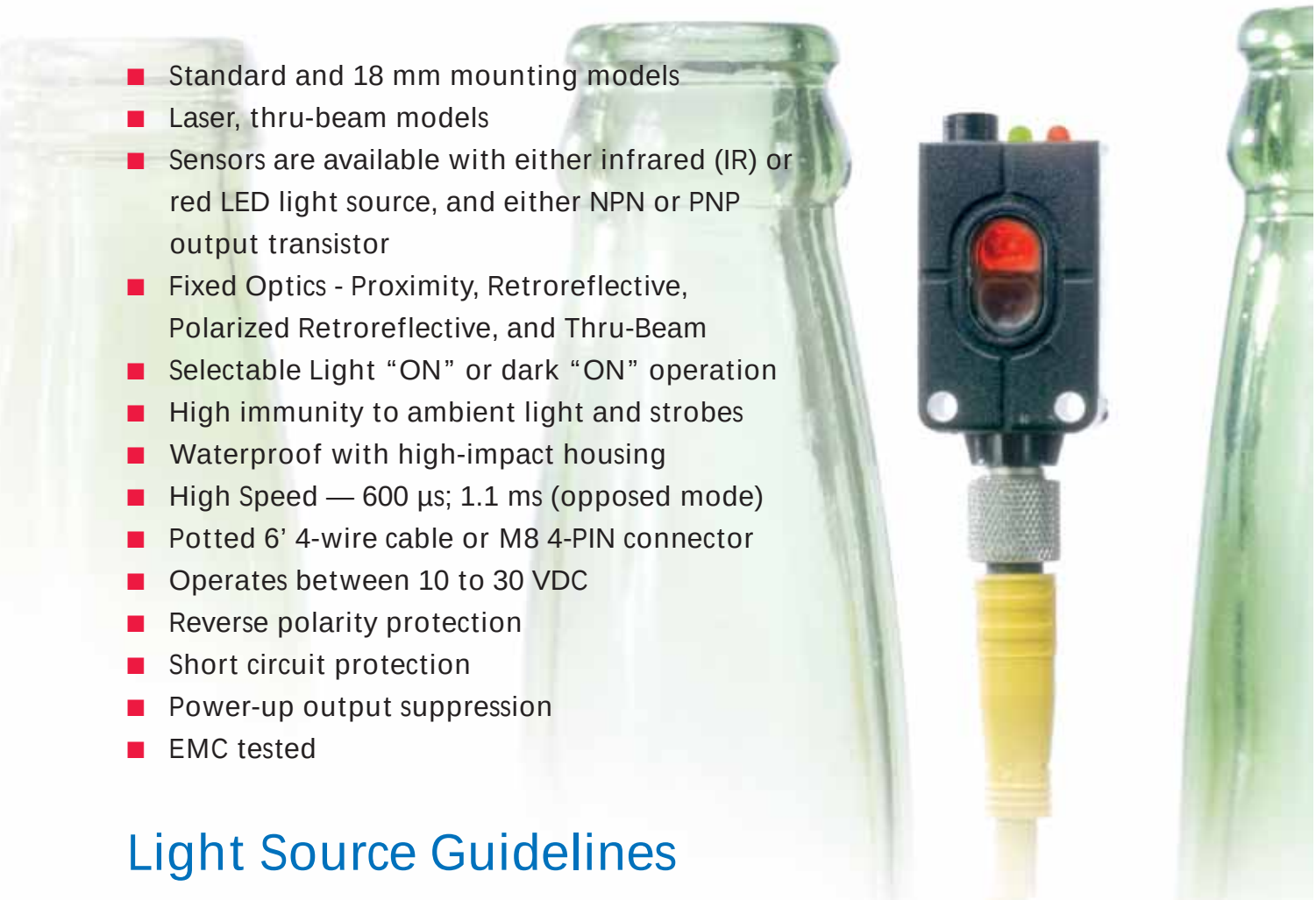
Hands down, the MINI-EYE is a tough little sensor that outperforms anything in its price range!

Our Lowest Cost Sensor that outperforms anything in its price range!

Applications:

- Presence/Absence Detection
- Material Handling
- Counting
- Sorting
- Orientation
- Web Break Detection

Features



- Standard and 18 mm mounting models
- Laser, thru-beam models
- Sensors are available with either infrared (IR) or red LED light source, and either NPN or PNP output transistor
- Fixed Optics - Proximity, Retroreflective, Polarized Retroreflective, and Thru-Beam
- Selectable Light “ON” or dark “ON” operation
- High immunity to ambient light and strobes
- Waterproof with high-impact housing
- High Speed — 600 µs; 1.1 ms (opposed mode)
- Potted 6’ 4-wire cable or M8 4-PIN connector
- Operates between 10 to 30 VDC
- Reverse polarity protection
- Short circuit protection
- Power-up output suppression
- EMC tested

Light Source Guidelines

INVISIBLE INFRARED LIGHT SOURCE (850 nm)

A. Best choice in most opaque object sensing tasks

B. Provides longest possible sensing range in either Beam Make or Beam Break sensing modes

C. Best choice in hostile environments; useful in penetrating lens contamination

D. Preferred when sensing dark colored objects in the proximity (Beam Make) mode, i.e., black, blue, green, etc.

RED LED LIGHT SOURCE (633 nm)

A. Useful when sensing translucent objects in proximity (Beam Make) mode

B. Can be polarized for retroreflective (Beam Break) sensing to reduce proxing on shiny objects

C. Visible red LED allows for easy alignment

NOTE: Red, laser light source, 650 nm, Class 1

Fine Tuning Adjustment

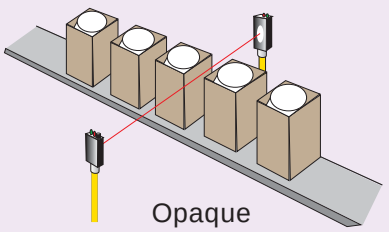
18 mm Mounting

Gain (Sensitivity)
Screwdriver Adjustment
(Adjustment N/A on Receiver models)

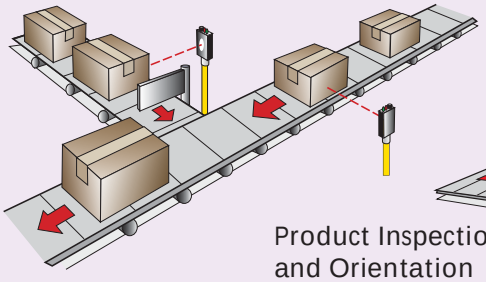
Power “ON” Indicator
GREEN LED

Output Status Indicator
RED LED
(N/A on Light Source models)

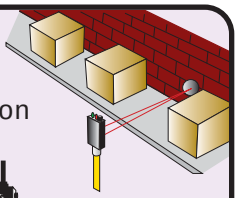
Typical Applications



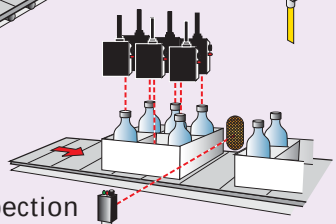
Opaque
Object Detection



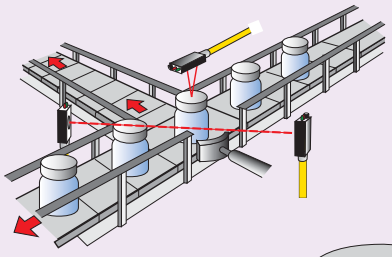
Gating
and Sorting



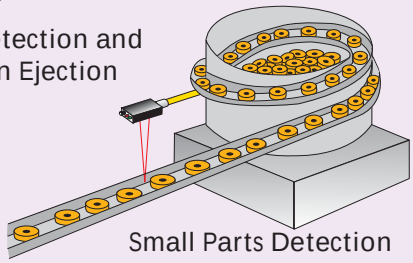
Beam
Break
Detection



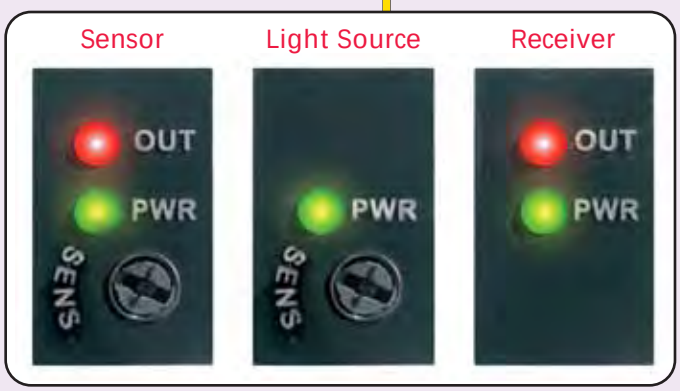
Product Inspection
and Orientation



Cap Detection and
Position Ejection



Small Parts Detection



Selection Guidelines

18 mm Available Spring '07

HOW TO SPECIFY

MODELS		DESCRIPTION	RANGE
STANDARD	18 mm	SHORT RANGE PROXIMITY	
MIVC	MIVC-18	IR, NPN, Connector	6" (152.4 mm)
MIV	MIV-18	IR, NPN, Cabled	6" (152.4 mm)
MRVC	MRVC-18	Red, NPN, Connector	4" (101.6 mm)
MRV	MRV-18	Red, NPN, Cabled	4" (101.6 mm)
PMIVC	PMIVC-18	IR, PNP, Connector	6" (152.4 mm)
PMIV	PMIV-18	IR, PNP, Cabled	6" (152.4 mm)
PMRVC	PMRVC-18	Red, PNP, Connector	4" (101.6 mm)
PMRV	PMRV-18	Red, PNP, Cabled	4" (101.6 mm)
		LONG RANGE PROXIMITY	
MIPC	MIPC-18	IR, NPN, Connector	24" (609.6 mm)
MIP	MIP-18	IR, NPN, Cabled	24" (609.6 mm)
MRPC	MRPC-18	Red, NPN, Connector	16" (406.4 mm)
MRP	MRP-18	Red, NPN, Cabled	16" (406.4 mm)
PMIPC	PMIPC-18	IR, PNP, Connector	24" (609.6 mm)
PMIP	PMIP-18	IR, PNP, Cabled	24" (609.6 mm)
PMRPC	PMRPC-18	Red, PNP, Connector	16" (406.4 mm)
PMRP	PMRP-18	Red, PNP, Cabled	16" (406.4 mm)
		RETROREFLECTIVE	
MIRC	MIRC-18	IR, NPN, Connector	7' (2.1 m)
MIR	MIR-18	IR, NPN, Cabled	7' (2.1 m)
MRRC	MRRC-18	Red, Polarized, NPN, Connector	8' (2.4 m)
MRR	MRR-18	Red, Polarized, NPN, Cabled	8' (2.4 m)
PMIRC	PMIRC-18	IR, PNP, Connector	7' (2.1 m)
PMIR	PMIR-18	IR, PNP, Cabled	7' (2.1 m)
PMRRC	PMRRC-18	Red, Polarized, PNP, Connector	8' (2.4 m)
PMRR	PMRR-18	Red, Polarized, PNP, Cabled	8' (2.4 m)
		THRU-BEAM	
LIGHT SOURCE			
MLSIC	MLSIC-18	Infrared, Connector	65' (20 m)
MLSI	MLSI-18	Infrared, Cabled	65' (20 m)
MLSRC	MLSRC-18	Red, Connector	15' (4.6 m)
MLSR	MLSR-18	Red, Cabled	15' (4.6 m)
RECEIVERS			
MRC	MRC-18	NPN, Connector	DEPENDENT ON LIGHT SOURCE
MR	MR-18	NPN, Cabled	
PMRC	PMRC-18	PNP, Connector	
PMR	PMR-18	PNP, Cabled	
		LASER THRU-BEAM	
LIGHT SOURCE			
MLZRC	MLZRC-18	Red, Connector	200' (61 m)
MLZR	MLZR-18	Red, Cabled	200' (61 m)
RECEIVERS			
MLRC	MLRC-18	NPN, Connector	
MLR	MLR-18	NPN, Cabled	
PMLRC	PMLRC-18	PNP, Connector	
PMLR	PMLR-18	PNP, Cabled	

NOTE: Retroreflective sensors equipped with a red light source are polarized to prevent proxing off shiny objects. Proximity test utilized a 90% reflective white target.

Retroreflective tests utilized a 3" diam., round reflector, Model AR3.

NOTE: Receivers can be used with either IR or Red Light Sources.

Laser Available Summer '07

Accessories

4-Wire Nano Cable, M8

GEC-6
6' (1.8 m) cable with connector

GEC-15
15' (4.6 m) cable with connector

GEC-25
25' (7.6 m) cable with connector

RGEC-6
6' (1.8 m) cable / right angle conn.

RGEC-15
15' (4.6 m) cable / right angle conn.

GEX-9
9' (2.7 m) extension cable

Standard Mounting

18 mm Mounting

Screw Mount Reflectors

78P
4.4 in. x 1.9 in.

AR3
3 in. Diameter

Optional Mounting Brackets

MB-18
Mounting Bracket
(for 18 mm
mounting models)

MIB-1
Stainless Bracket
Assembly

Prismatic High-Performance Reflectors

AR4060
1.6" x 2.36"
40.5 x 60 mm

AR6151
AR6151G
(Chemical Resistant
Glass Cover)
2.4" x 2.0"
(61 x 51 mm)

AR-46
1.8"diameter
46 mm diameter
Glue Mount

MIB-2
Stainless Bracket
Assembly

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity protected

CURRENT REQUIREMENTS
- 30mA (exclusive of load)
  OUTPUT TRANSISTORS (CURRENT LIMITED)
- NPN: Sink up to 100mA
- PNP: Source up to 100mA
- All outputs are continuously short circuit protected

RESPONSE TIME
- Light State response = 600µs (1,100µs, Thru-Beam)
- Dark State response = 600µs (1,100µs, Thru-Beam)

LIGHT SOURCE
- LED, Red = 660 nm
- LED, Infrared = 880 nm
- Pulse Modulated
- Laser, Red = 650 nm, Class 1

LIGHT/DARK "ON" OPERATION
- Light "ON" achieved by connecting white wire to negative lead
- Dark "ON" achieved by connecting white wire to positive lead

RANGE
- Dependent on model, see Selection Guidelines

HYSTERESIS
- Approximately 20% of signal

LIGHT IMMUNITY
- Responds to sensor's pulse-modulated light source, resulting in high immunity to most ambient light, including high intensity strobes

DIAGNOSTIC INDICATORS
- Red LED = Output Status
- Green LED = Power "ON"

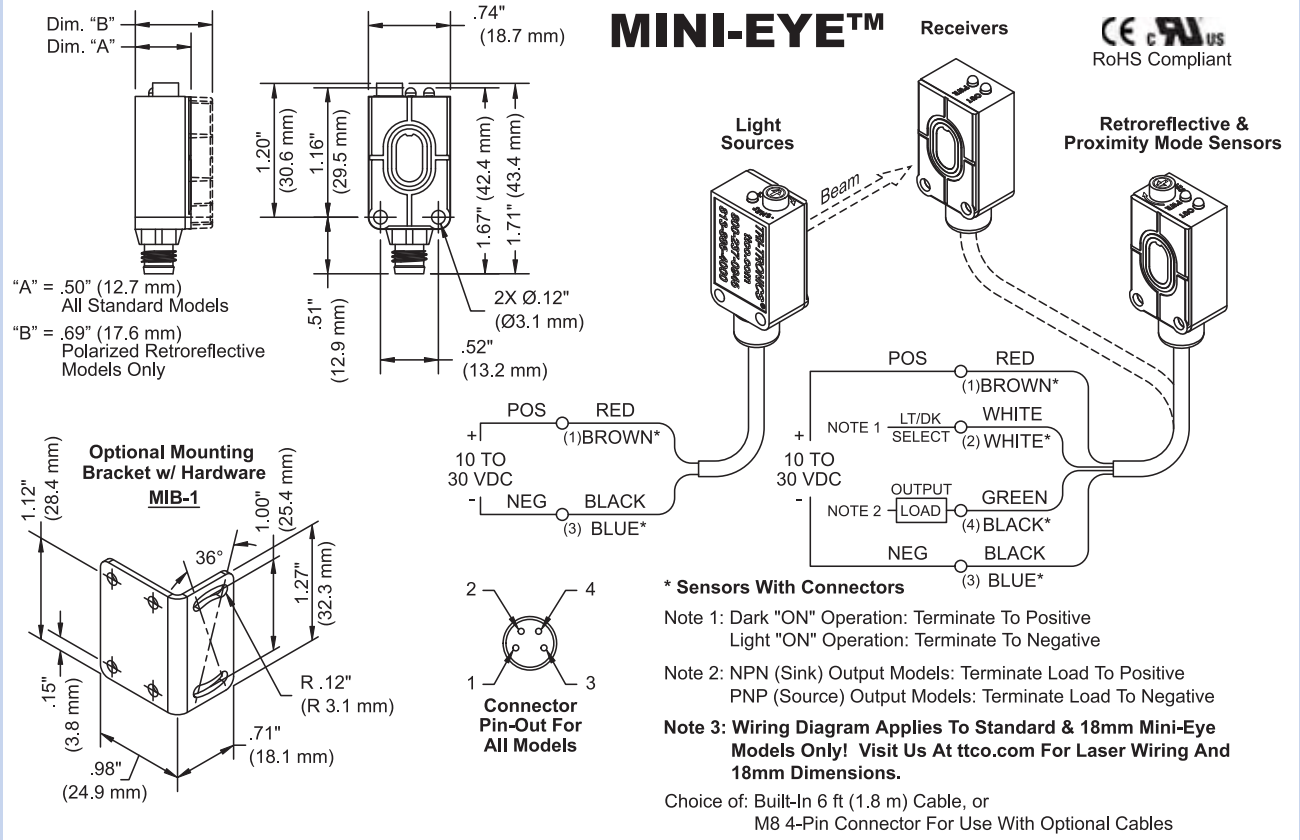
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

MINI-EYE™

RUGGED CONSTRUCTION
- Chemical resistant, high-impact polycarbonate housing
- Waterproof ratings: NEMA 4X, IP66

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions MINI-EYE™



AC & DC Miniature Sensors
Changeable Optical Blocks

MITY•EYE®

Designed for Trouble-Free Operation

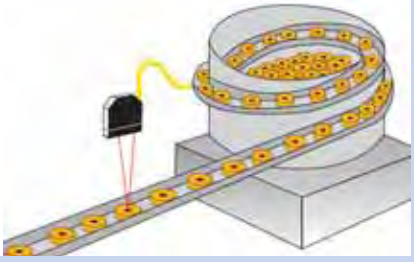
Many design features have been incorporated into the MITY•EYE® to prevent mechanical or electrical damage and to provide trouble-free operation. The sensitivity pot is protected with a clutch to prevent damage from over-travel. The entire sensor is epoxy-encapsulated to ensure mechanical strength. The case itself is rugged and watertight.

To prevent electrical mishaps, the optically isolated AC solid state switch is protected by an MOV (Metal Oxide Varistor). In addition, the AC switch turns on synchronously at near zero volts which helps to prevent electrical line noise generated by hard relay contacts or inductive loads.

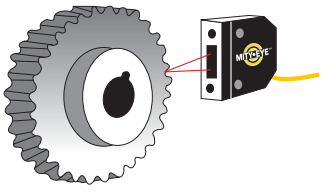
MITY•EYE's unique lensed optical blocks are molded of solid optical grade, high-impact plastic. This innovative concept helps to prevent condensation or fog buildup on the inside of the lens. Multiple varieties of optical blocks are available for operating the MITY•EYE® in either the retroreflective, polarized (non-glare), proximity, fiberoptic, or convergent sensing modes. A simple change of the optical block can be very useful in determining the best sensing mode for use in your specific sensing task. These inexpensive, interchangeable optical blocks reduce the inventory burden of replacement parts and eliminate the need for discarding a complete sensor in the case of damage to the optical block.

Typical Applications

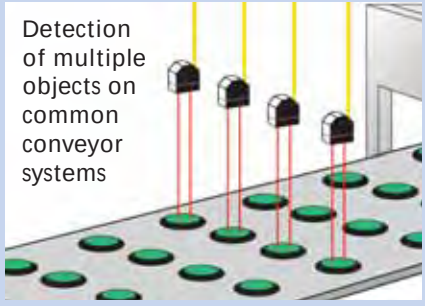
Detection of small parts



Detection of object moving at high speed



Detection of multiple objects on common conveyor systems



Features

- 500 µs Speed of Response
- Totally interchangeable high-impact optical blocks
- Rugged, watertight case
- Selection of red, infrared, or high-intensity red light sources
- Designed to meet or exceed testing laboratory standards
- Convenient "pop-open" hinged control access panel reveals:
  – 4-turn clutched sensitivity adjustment
  – 2-position light/dark switch
- "Extra bright" LED output indicator
- Protected from output chatter/pulsing on power-up
- Operational from:
  DC models: 10 to 30 VDC
  AC models: 24 to 240 VAC
- Reverse polarity protection
- One NPN sinking output and one PNP sourcing output (status determined by light/dark switch)
- Output transistor short circuit protection
- Selector switch to determine output status
- Optional micro quick-change connector

Both the light/dark switch and sensitivity adjustment are located behind a clear plastic cover. The panel is made watertight by the use of an "O" ring seal, and its cover is permanently captured by a hinge – no lost screw or cover to worry about! The light/dark switch is a 2-position slide switch that is easily viewable through the clear cover.

The 4-turn sensitivity adjustment was selected over conventional 10 or 15-turn types because it is faster and easier to operate.

The "extra bright" red LED Output indicator is located to the side on a slanted panel so that the indicator can be easily viewed from a wide angle.

MITY•EYE® Photoelectric Sensors are designed to provide you with features and benefits of large, expensive sensors ... in a truly miniature package at an affordable price. With features like high speed of response, totally interchangeable optical blocks (including nonglare, polarized retroreflective), and selection of AC or DC-powered models, you can use MITY•EYE® in nearly all of your automation sensing tasks. Best of all, you'll get high quality and unequaled performance in a miniature photoelectric sensor.

Optical Block Selection

MITY•EYE® ALL MODELS

Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent or irregular shaped shiny objects.

Type O5
Proximity
Narrow beam optics useful in long-range sensing of medium to large size objects.

Type R4
Retroreflective
Very narrow beam optics designed to sense reflectors or reflective materials at long range. Designed for Beam Break sensing.

Type R5
Polarized Anti-Glare Retroreflective
Polarized to reduce response to "hot spot" glare from shiny surface of detected object. Use with red or blue light source.

Type F4
Glass Fiber Optics
Adapts MITY•EYE® for use with a wide variety of glass fiberoptic light guides for both the proximity and opposed sensing modes.

Type V4, V4A
Convergent 1" "V" Axis
Narrow beam optics that focus at a sensing range of 1". Useful for sensing small parts. Also useful for proximity sensing (range of 1" to 5") to minimize response to reflected light from background objects.

Type V6
Convergent 1.5" "V" Axis
Narrow beam optics that focus at a sensing range of 1.5". Useful for sensing small parts. Also useful for proximity sensing (range of 1.5" to 8") to minimize response to reflected light from background objects.

Type V8
Convergent.5" "V" Axis
Narrow beam optics that focus at a sensing range of .5". Useful for sensing small parts or registration color marks. Also useful for proximity sensing (range of .25" to 5") to minimize response to reflected light from background objects.

Type F5
Plastic Fiber Optics
Adapts MITY•EYE® for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes.

Sensing Range Guidelines

Optical Blocks	MITY•EYE® Models IR	RED	HI INT RED
04 Proximity	2 in.	1 in.	2 in.
05 Proximity	18 in.	9 in.	18 in.
R4 Retroreflective	20 ft.	16 ft.	N/A
R5 Polarized Retro	N/A	17 ft.	12 ft.
V4, V4A Convergent	1 in.	1 in.	1 in.
V6 Convergent	1.5 in.	1.5 in.	1.5 in.
V8 Convergent	.5 in.	.5 in.	.5 in.
Glass Fiberoptics			
F4 Proximity	1.5 in.	.5 in.	1 in.
F4 Proximity w UAC-15 lens	8 in.	N/A	6 in.
F4 Opposed	3.5 in.	2.5 in.	3 in.
F4 Opposed w UAC-15 lens	15 ft.	8 ft.	15 ft.
Plastic Fiberoptics			
F5 Proximity	N/A	N/A	1/2 in.
F5 Opposed		1 in.	2 in.
F5 Opposed w HLA-1 lens	N/A	3.5 ft.	4.5 ft.

MITY•EYE® Sensors offer a selection of either Infrared (invisible), Red (visible), or High Intensity Red (visible) light sources.

Infrared – invisible light source recommended for opaque object sensing. The IR LED provides long-range sensing capabilities and maximizes the ability to penetrate contaminated lenses.

Red – visible red light source recommended for sensing transparent/translucent objects and for use with the polarized retroreflective lens.

High Intensity Red – recommended for long-range proximity sensing and for use with plastic fiberoptic light guides.

NOTES: Proximity test utilized a 90% reflective white target. Retroreflective tests utilized a 3˝ diam. round reflector, Model AR-3. Range tests utilized a .125˝ diam. glass fiber bundle or .040˝ diam. plastic fiber.

How To Specify

Example: MDHR C F4

- MDHR: MITY•EYE DC High Intensity RED
- C: Connector Model
- F4: Fiberoptic Optical Block

1. Select sensor model based on light source required
   DC POWERED
   MDI = Infrared
   MDHR = High Intensity RED
   MDR = Red
   AC POWERED
   MAI = Infrared
   MAHR = High Intensity RED
   MAR = Red
2. Select Connection
   Blank = Cable
   C = Connector

NOTE:
CAC15 power cable for AC MITY•EYE® ONLY

3. Select Optical Block based on mode of operation required.
   04 = Short Range Proximity
   05 = Long Range Proximity
   R4 = Retroreflective
   R5 = Polarized Retroreflective
   V4 , V4A = 1.0" V-Axis
   V6 = 1.5" V-Axis
   V8 = 0.5" V Axis
   F4 = Fiberoptic
   F5 = Plastic fiberoptic

MITY•EYE®

AC & DC
Miniature Sensors

Accessories

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic Fiberoptic Mounting Brackets

TA-18
18mm Adapter

CAC15
Special AC MITY•EYE® Cable, 15' (4.6 m)

LK-4
Lens Kit
(See Optical Blocks Accessories for contents)

MEB-1
Mounting Bracket

MB-18
Mounting Bracket

DC MITY•EYE® Cable
4-wire, M12

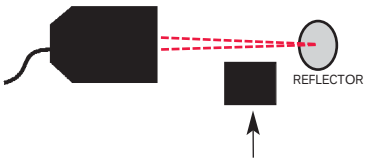
SEC-2MU
6.5' (2.0 m) Low-cost

SEC-5MU
16.4' (5.0 m) Low-cost

Opaque Object Sensing

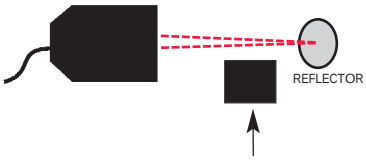
Preferred Mode: Beam Break

Option 1



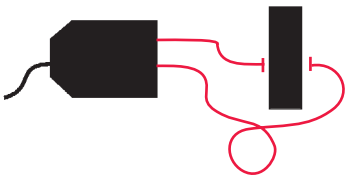
Polarized retroreflective mode is a cost effective mode to detect medium to large size shiny or non-shiny opaque objects. Use with reflector.
Sensor: Model MDRR5 (with red light source and 6 ft. cable) or MDRCR5 (with inline connector...requires mating cable Model SEC-5MU).
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted. (See Accessories Section for complete listing of reflectors.)
Sensing range: Up to 6 ft. (Dependent on size of reflector)
Accessories: Mounting bracket, Model MEB-1

Option 2



Retroreflective is a cost effective mode to detect medium to large size non-shiny opaque objects. Longer sensing range than polarized mode. Use with reflector.
Sensor: Model MDIR4 (with infrared light source and 6 ft. cable) or MDICR4 (with inline connector requires mating cable Model SEC-5MU).
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted. (See Accessories Section for complete listing of reflectors.)
Sensing range: Up to18 ft. (Dependent on size of reflector)
Accessories: Mounting bracket, Model MEB-1

Option 3



Fiberoptic opposed mode is excellent choice for detecting any opaque object, particularly in a hostile sensing environment.
Sensor: Model MDIF4 (with infrared light source and 6 ft. cable) or MDICF4 (with inline connector...requires mating cable Model SEC-5MU).
Fiberoptic light guides: (2) Model F-A-36T
NOTE: Select smaller fiber bundle for small part detection (See Fiberoptic Section)
Sensing range: Up to 3 in. without lens. Up to 15ft. with (2) UAC-15 lenses
Accessories: (2) Model UAC-15 or (2) UAC-5 Lenses Mounting bracket, Model MEB-1, FMB-1

Alternate Mode: Beam Make (Proximity)

Option 1

NOTE: Consider proximity mode when installation sensing site conditions preclude using the preferred Beam Break mode.

Convergent/proximity mode is useful to detect a wide variety of opaque objects when there is little (if any) space between objects.
Sensor: Model MDIV6 (infrared light source and 6 ft. cable) or MDICV6 (with inline connector requires mating cable Model SEC-5MU).
Sensing range: From .75 in. to 4 in.
Accessories: Mounting bracket, Model MEB-1

Option 2

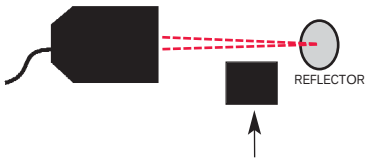
Divergent/proximity mode sensing is useful in detecting medium to large size objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model MD105 (infrared light source and 6 ft. cable) or MDIC05 (with inline connector…requires mating cable Model SEC-5MU).
Sensing range: Up to 1.5 ft.
Accessories: Mounting bracket, Model MEB-1

Option 3

Fiberoptic proximity is useful to detect any opaque object in hostile environments.
Sensor: Model MDIF4 (with infrared light source and 6 ft. cable) or MDICF4 (with inline connector…requires mating cable Model SEC-5MU).
Fiberoptic light guide: Model BF-A-36T
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section)
Sensing range: Up to 1.5 in. without lens. Up to 8 in. with UAC-15 lens
Accessories: Mounting bracket Model MEB-1, FMB-1. Model UAC-15 lens

Translucent Object Sensing

Option 1



Preferred Mode: Beam Break

Polarized retroreflective mode
Sensor: Model MDRF4 (with red light source and 6 ft. cable) or MDRCR5 (with inline connector... requires mating cable Model SEC-5MU)
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted
Sensing range: Up to 6 ft. (dependent on size of reflector)
Accessories: Mounting bracket, Model MEB-1

Option 2

Fiberoptic retroreflective mode
Sensor: Modes MDRF4 (with red light source and 6 ft. cable) or MDRCF4 (with inline connector...requires mating cable Model SEC-5MU)
Fiberoptic light guide: Model BF-A-36T
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted.
Sensing range: Up to 4 ft. without lens. Up to 8 ft. with UAC-15 lens
Accessories: Mounting bracket, Model MEB-1, FMB-1. UAC-15 lens

Option 3

Alternate Mode: Beam Make (Convergent/proximity)

Sensor: Model MDRV6 (with red light source and 6 ft. cable) or, MDRCV6 (with inline connector...requires mating cable Model SEC-5MU)
Sensing range: Up to 3 in. dependent on size, shape and color
Accessories: Mounting bracket, Model MEB-1

Transparent Object Sensing

NOTE: Totally transparent objects can be very difficult to detect. A high performance sensor may be required. See RETROSMART® section for details.

Option 1

Preferred Mode: Beam Make (Convergent/proximity)

Sensor: Model MDRV6 (with red light source and 6 ft. cable) or MDRCV6 (with in-line connector...requires mating cable Model SEC-5MU)
Sensing range: Up to 2 in. dependent on size, shape and color
Accessories: Mounting bracket, Model MEB-1

Specifications

POWER REQUIREMENTS
- 10 T0 30 VDC @ 35mA (reverse polarity protected)

OUTPUT DEVICES
- Provide both NPN and PNP open collector output transistors capable of sinking or sourcing up to150 mA continuous
- Short circuit protected
- Zener Diode protected to 36 volts
- Protected against false chattering/ pulsing during power up

RESPONSE TIME
- 500 microseconds (light or dark)

LIGHT IMMUNITY
- Pulse modulated to provide extremely high immunity to ambient light

SENSING RANGE
- Range determined by model type, mode of sensing, and optical block type as selected. See Range Chart for details

ADJUSTMENTS/INDICATORS
- 4-turn clutched sensitivity adjustment
- 2-position light “on” / dark “on” selection switch
- Red LED indicator energizes when light beam is established

AMBIENT TEMPERATURE
- -20°C to 70°C (-20°F to 158°F)

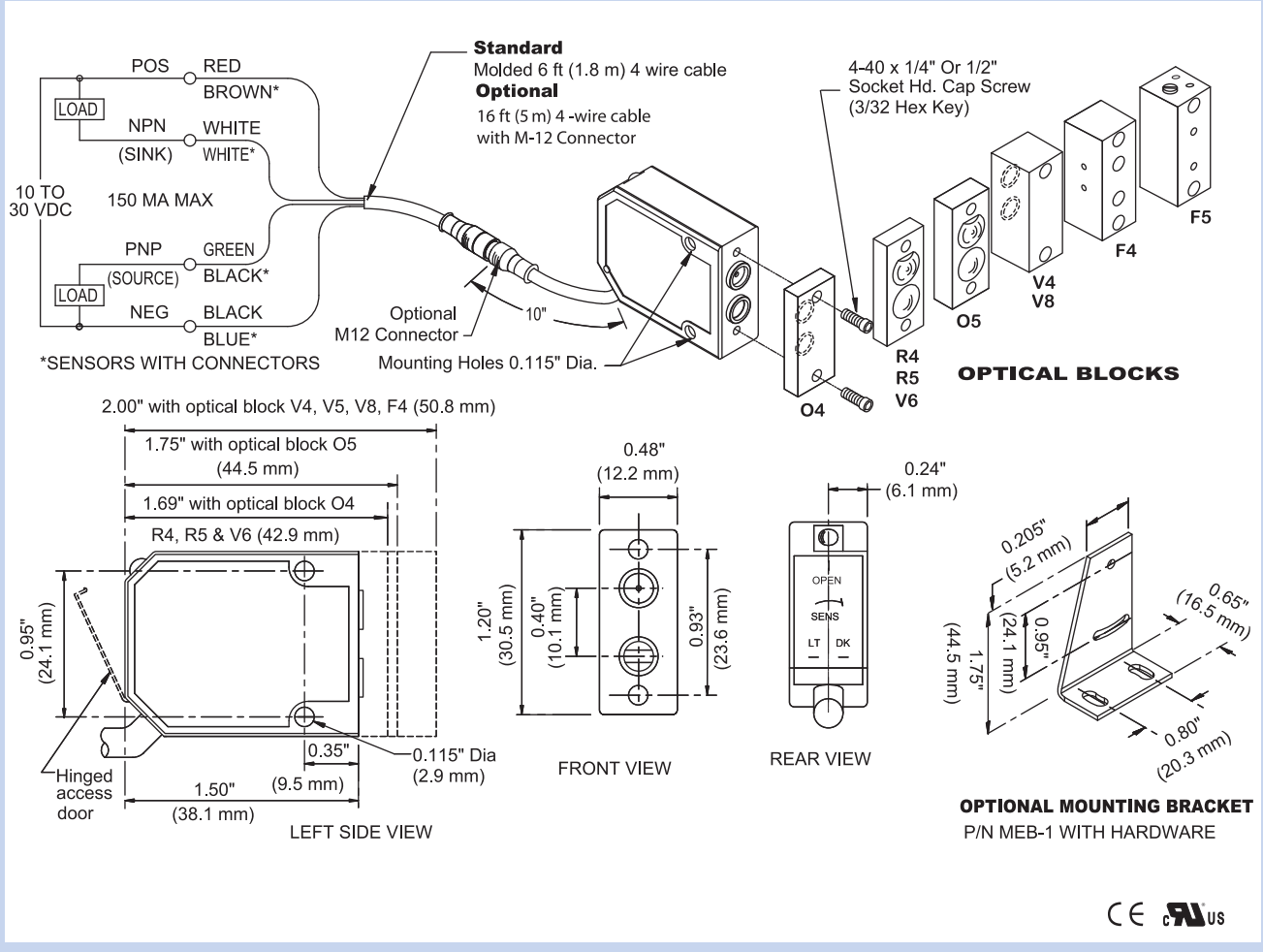
RUGGED CONSTRUCTION
- Chemical resistant case, “O” ring sealed to provide moisture protection
- Epoxy encapsulated for mechanical stability
- NEMA 4X, 6P and IP67

LED LIGHT SOURCE WAVELENGTH
- Infrared = 880 nm
- Red = 660 nm
- High Intensity Red = 650 nm

NOTE: DC Mity•Eye with 10” Pigtail is designed to be used with the SEC-5MU Power Cable.

Product subject to change without notice.
Consult Factory for RoHS Compliance.

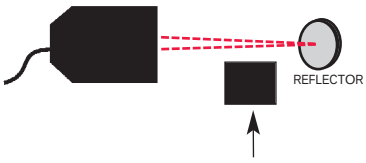
Connections and Dimensions DC MITY•EYE®



Opaque Object Sensing

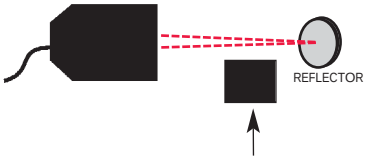
Preferred Mode: Beam Break

Option 1



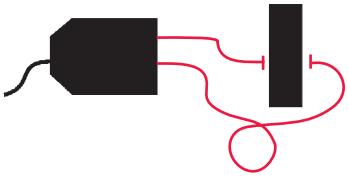
Polarized retroreflective mode is a cost effective mode to detect medium to large size shiny or non-shiny opaque objects. Use with reflector.
Sensor: Model MARR5 (with red light source and 6 ft. cable) or MARCR5 (with inline connector...requires mating cable Model CAC15)
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted. (See Accessories Section for complete listing of reflectors.)
Sensing range: Up to 6 ft. (Dependent on size of reflector)
Accessories: Mounting bracket, Model MEB-1

Option 2



Retroreflective is a cost effective mode to detect medium to large size non-shiny opaque objects. Longer sensing range than polarized mode. Use with reflector.
Sensor: Model MAIR4 (with infrared light source and 6 ft. cable) or MARCR4 (with inline connector requires mating cable Model CAC15).
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted. (See Accessories Section for complete listing of reflectors.
Sensing range: Up to 18 ft. (Range is dependent on size of reflector)
Accessories: Mounting bracket, Model MEB-1

Option 3



Fiberoptic opposed mode is excellent choice for detecting any opaque object... particularly in a hostile sensing environment.
Sensor: Model MAIF4 (with infrared light source and 6 ft. cable) or MAICF4 (with inline connector...requires mating cable Model CAC15)
Fiberoptic light guides: (2) Model F-A-36T
NOTE: Select smaller fiber bundle for small part detection (See Fiberoptic Section)
Sensing range: Up to 3 in. without lens. Up to 15ft. with (2) UAC-15 lenses
Accessories: (2) Model UAC-15 or (2) UAC-5 Lenses, Mounting bracket, Model MEB-1, FMB-1

Alternate Mode: Beam Make (Proximity)

NOTE: Consider proximity mode when installation sensing site conditions preclude using the preferred Beam Break mode.

Option 1

Convergent/proximity mode is useful to detect a wide variety of opaque objects when there is little (if any) space between objects.
Sensor: Model MAIV6 (infrared light source and 6 ft. cable) or MAICV6 (with inline connector requires mating cable Model CAC15)
Sensing range: From .75 in. to 4 in. (Dependent upon size, shape, color and surface reflectivity.)
Accessories: Mounting bracket, Model MEB-1

Option 2

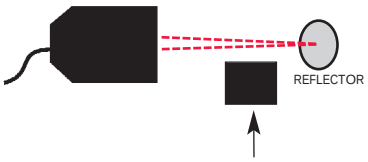
Divergent/proximity mode sensing is useful in detecting medium to large size objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model MAI05 (infrared light source and 6 ft. cable) or MAICO5 (with inline connector..requires mating cable Model CAC15)
Sensing range: Up to 1.5 ft.
Accessories: Mounting bracket, Model MEB-1

Option 3

Fiberoptic proximity is useful to detect any opaque object in hostile environments.
Sensor: Model MAIF4 (with infrared light source and 6 ft. cable) or MAICF4 (with inline connector...requires mating cable Model CAC15)
Fiberoptic light guide: Model BF-A-36T
NOTE: Select smaller fiber bundle for small part detection. (See Fiberoptic Section.)
Sensing range: Up to 1.5 in. without lens. Up to 8 in. with UAC-15 lens (dependent upon size, shape, color, and surface reflectivity.)
Accessories: Mounting bracket Model MEB-1, FMB-1. Model UAC-15 lens

Translucent Object Sensing

Option 1



Preferred Mode: Beam Break

Polarized retroreflective mode
Sensor: Model MARR5 (with red light source and 6 ft. cable) or, MARCR5 (with inline connector requires mating cable Model CAC15)
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted
Sensing range: Up to 6 ft. (dependent on size of reflector)
Accessories: Mounting bracket, Model MEB-1

Option 2

Fiberoptic retroreflective mode
Sensor: Model MARF4 (with red light source and 6 ft. cable) or, MARCF4 (with in-line connector...requires mating cable Model CAC15)
Fiberoptic light guide: Model BF-A-36T
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted.
Sensing range: Up to 4ft. without lens. Up to 8 ft. with UAC-15 lens
Accessories: Mounting bracket, Model MEB-1, FMB-1. Model UAC-15 lens

Option 3

Alternate Mode: Beam Make (Convergent/proximity)

Sensor: Model MARV6 (with red light source and 6 ft. cable) or, MARCV6 (with in-line connector...requires mating cable Model CAC15)
Sensing range: Up to 3 in. dependent on size, shape and color
Accessories: Mounting bracket, Model MEB-1

Transparent Object Sensing

NOTE: Totally transparent objects can be very difficult to detect. A high performance sensor may be required. See RETROSMART® section for details.

Option 1

Preferred Mode: Beam Make (Convergent/proximity)

Sensor: Model MARV6 (with red light source and 6 ft. cable) or, MARCV6 (with in-line connector...requires mating cable Model CAC15)
Sensing range: Up to 2 in. dependent on size, shape and color
Accessories: Mounting bracket, Model MEB-1

Specifications

MITY•EYE® AC MODELS

POWER REQUIREMENTS
- 24 T0 240 VAC

OUTPUT DEVICES, AC MODELS
- 2-wire isolated solid state triac rated at 500 mA rms continuous
- MOV protected
- Switches “On” and “Off” synchronously at near zero volts
- “Off” state leakage less than 1 mA

RESPONSE TIME
- 4 milliseconds

LIGHT IMMUNITY
- Pulse modulated to provide extremely high immunity to ambient light

SENSING RANGE
- Range determined by model type, mode of sensing, and optical block type as selected. See Range Chart for details

ADJUSTMENTS/INDICATORS
- 4-turn clutched sensitivity adjustment
- 2-position light “on”/dark “on” selection switch
- Red LED indicator energizes when light beam is established

AMBIENT TEMPERATURE
- -20°C to 70°C (-20°F to 158°F)

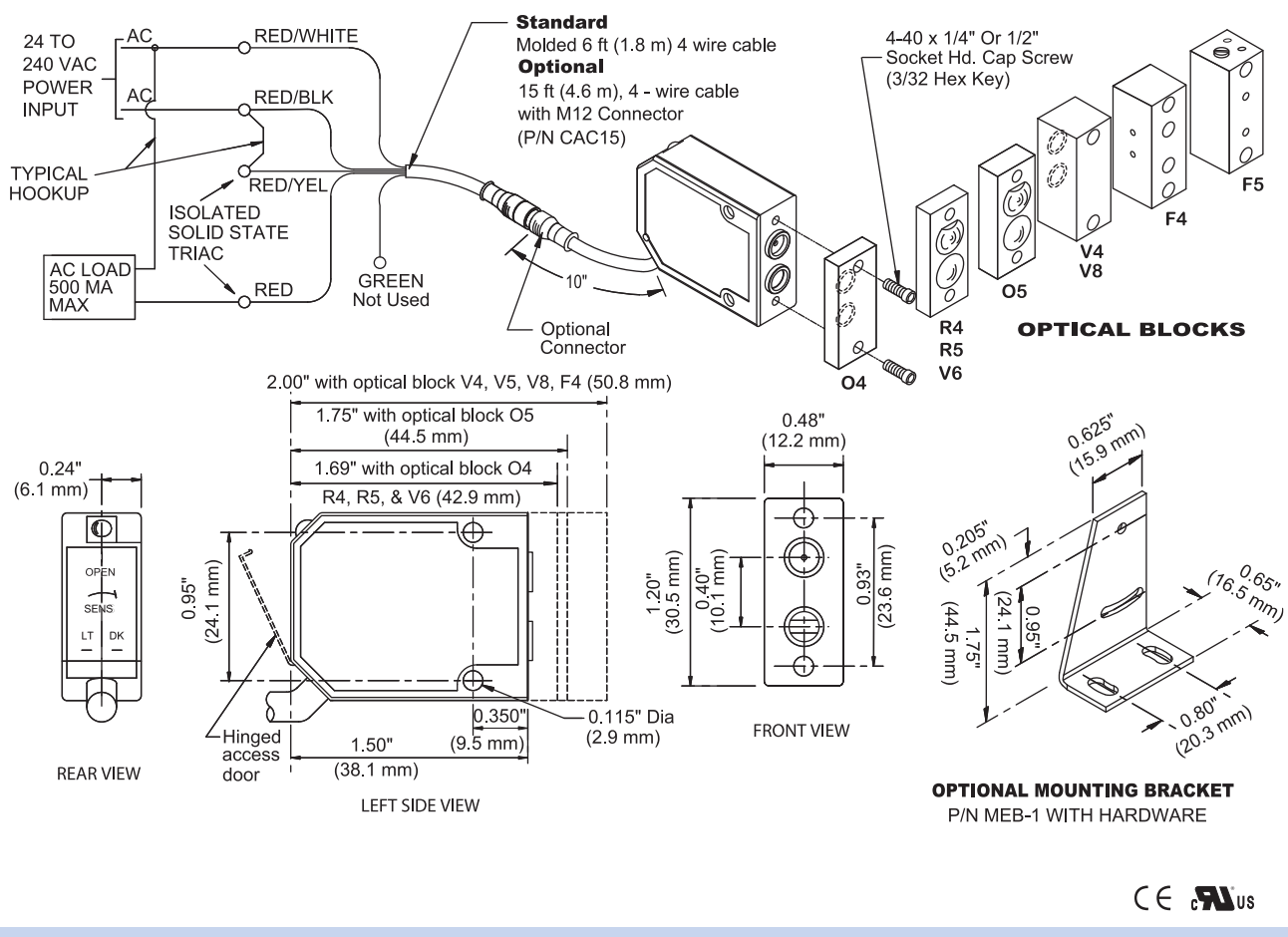
RUGGED CONSTRUCTION
- Chemical resistant case, “O” ring sealed to provide moisture protection
- Epoxy encapsulated for mechanical stability
- NEMA 4X, 6P and IP67

LED LIGHT SOURCE WAVELENGTH
- Infrared = 880 nm
- Red = 660 nm
- High Intensity Red = 650 nm

NOTE: AC Mity•Eye with 10" Pigtail is designed to be used with the CAC15 Power Cable.

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions AC MITY•EYE®



Our Miniature, Tamperproof Sensor

TINY•EYE®

Miniature DC-Powered Sensors *Small and Economical*

TINY•EYE®

The TINY-EYE® Miniature Photoelectric Sensor "unlocks the door" to big cost savings with its ability to perform many industrial sensing tasks. Changing the lens changes the sensing mode. TINY-EYE® utilizes our "quick-change" optical blocks, allowing the TINY-EYE® to be used in multiple sensing modes.

BIG PERFORMANCE

- 500 µsec Speed of Response
- 10 to 30 VDC Operating Voltage
  (5 VDC Operating Voltage available
  Consult Factory)
- Pulse Modulated
- Reverse Polarity Protected
- Both NPN and PNP Outputs
- Red or Infrared Light Sources
- Step-Function Remote Sensitivity Adjustment
- Rugged and Waterproof

BIG CAPABILITY

- Wide Beam Proximity
- Long Range Proximity
- One or Two Inch Convergent
- Retroreflective
- Polarized Retroreflective
- Opposed (Separate Light Source/Receiver)
- Fiber Optics

Interchangeable Optical Blocks

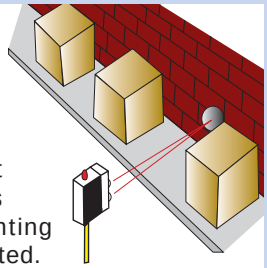
TINY-EYE®'s unique lensed optical blocks are molded of solid optical grade, high-impact plastic. This innovation concept helps to prevent condensation or fog buildup on the inside of the lens. Multiple varieties of optical blocks are available for operating the TINY-EYE® in either the retroreflective, polarized (non-glare), proximity, opposed, fiberoptic, or convergent sensing modes. A simple change of the optical block can be very useful in determining the best sensing mode for use in your specific sensing task. These inexpensive, interchangeable optical blocks reduce the inventory burden of replacement parts and eliminate the need for discarding a complete sensor in the case of damage to the optical block.

Tamperproof, Trouble-Free Operation

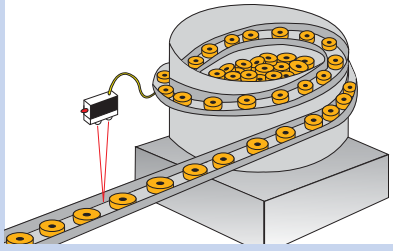
Many design features have been incorporated into the TINY-EYE® to prevent mechanical or electrical damage, and to provide trouble-free operation. The rugged case is molded of high-impact polycarbonate. To prevent electrical mishaps, the sensors are protected from reverse polarity.

Typical Applications

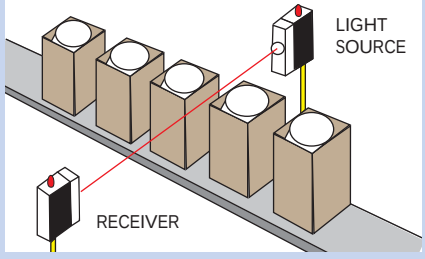
Beam break detection of objects at sensing sites where mounting space is limited.



Detection of small parts.



Detection of opaque objects.



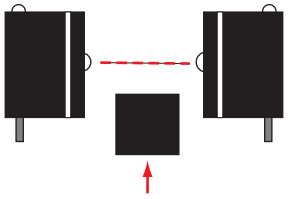
Selection Guidelines *Opaque/Translucent Sensing*

TINY•EYE®

OPAQUE OBJECT SENSING

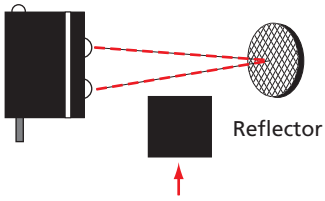
Preferred Mode: Beam Break

Option 1:



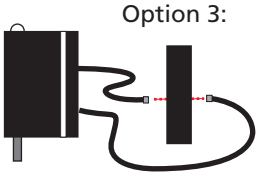
Opposed mode, uses separate light source/receiver. Provides long range sensing.
Best choice for use in hostile environments.
Sensor: Model STIT4 Light source (infrared)
Model RTLT4 Light "on" receiver or RTDT4 Dark "on" receiver.
Range: In excess of 20 ft.
Accessories: Model TEB-1 (vertical mount) or TEB-2 (horizontal mount) bracket.

Option 2:



Polarized retroreflective mode is a cost effective mode to detect medium to large size shiny or non-shiny opaque objects. Use with reflector.
Sensor: Model TRLR5, Light "on" output. (red light source) or TRDR5 Dark "on" output.
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted.
Sensing range: Up to 10 ft. (Dependent on size of reflector).
Accessories: Model TEB-1 (vertical mount) or TEB-2 (horizontal mount) bracket.

Option 3:

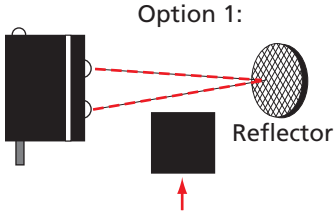


Fiberoptic opposed mode is useful to detect any opaque object in hostile environment.
Sensor: Model TILF4, Light "on" operate (red light source) or TIDF4, Dark "on" operate.
Fiberoptic light guides: Model F-A-36T (use smaller fiber for smaller parts).
Sensing range: Up to 6 in. without lens. Up to 15 ft. with (2) UAC-15 lenses
Accessories: Model TEB-1 (vertical mount) or TEB-2 (horizontal mount) bracket.

TRANSLUCENT OBJECT SENSING

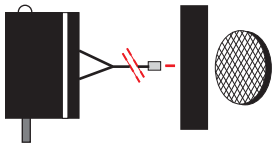
Preferred Mode: Beam Break

Option 1:

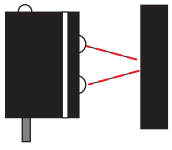


Polarized retroreflective mode.
Sensor: Model TRLR5, Light "on" operate (red light source) or TRDR5, Dark "on"
Reflector: Model 78P, Plastic, 4.4 in. x 1.9 in. screw mounted.
Sensing range: Up to 10 ft. (dependent on size of reflector)
Accessories: Model TEB-1 (vertical mount) or TEB-2 (horizontal mount) bracket.

Option 2:



Fiberoptic retroreflective mode.
Sensor: Model TRLF4, Light "on" operate (red light source) or TRDF4, Dark "on"
Fiberoptic light guide: Model BF-A-36T
Reflector: Model 78P, Plastic, 4.4 in. x 1.9 in. screw mounted
Sensing range: Up to 4 ft. without lens. Up to 8 ft. with UAC-15 lens.
Accessories: Model TEB-1 (vertical mount) or TEB-2 (horizontal mount) bracket.



Alternate Mode: Beam Make

Sensor: Model TRLV6, Light "on" operate (red light source) or TRDV6, Dark "on".
Sensing range: Up to 3 in. (dependent on size, shape and color).
Accessories: Model TEB-1 (vertical mount) or TEB-2 (horizontal mount) bracket.

Optical Block Selection

Interchangeable optical blocks provide for universal application of the TINY•EYE® to any sensing applications from large object sensing to finite sensing of small parts, registration mark detection and product inspection tasks.

Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent, or irregular shaped shiny objects.

Type O5
Proximity
Narrow beam optics useful in long-range sensing of medium to large size objects.

Type R4
Retroreflective
Very narrow beam optics designed to sense reflectors or reflective materials at long range. Designed for Beam Break sensing.

Type R5
Polarized Anti-Glare Retroreflective
Polarized to reduce response to "hot spot" glare from shiny surface of detected object. Use with red or blue light source.

Type V4, V4A
Convergent 1" "V" Axis
Narrow beam optics that focus at a sensing range of 1". Useful for sensing small parts. Also useful for proximity sensing (range of 1" to 5") to minimize response to reflected light from background objects.

Type V6
Convergent 1.5" "V" Axis
Narrow beam optics that focus at a sensing range of 1.5". Useful for sensing small parts. Also useful for proximity sensing (range of 1.5" to 8") to minimize response to reflected light from background objects.

Type V8
Convergent .5" "V" Axis
Narrow beam optics that focus at a sensing range of .5". Useful for sensing small parts or registration color marks. Also useful for proximity sensing (range of .25" to 5") to minimize response to reflected light from background objects.

Type F4
Glass Fiber Optics
Adapter for use with a wide variety of glass fiberoptic light guides for both the proximity and opposed sensing modes.

Type F5
Plastic Fiber Optics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes.

Type T-4 Opposed Optical Blocks
Uses separate Light Source/Receiver. Designed for extra long-range sensing.

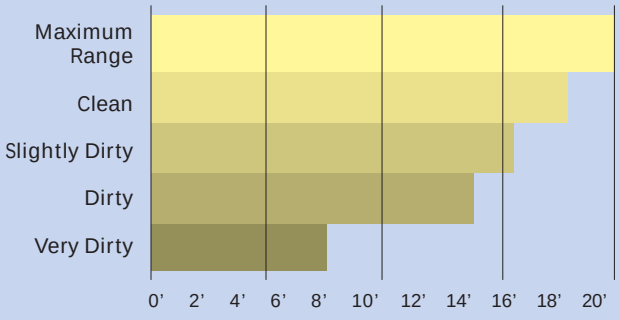
Light Source Selection

TINY•EYE® Sensors offer a selection of either Infrared (invisible), or High Intensity Red (visible) light sources.

Infrared – Invisible light source recommended for opaque object sensing. The IR LED provides long-range sensing capabilities and maximizes the ability to penetrate contaminated lenses.

High Intensity Red – recommended for long-range proximity sensing and for use with plastic fiberoptic light guides.

Example: Model TILR4 *(Retroreflective)*



Environmental Useful Range
If the maximum range of a retroreflective sensor is rated at 20 feet and your sensing site environment is dirty, the specified maximum range would decrease by 30%, to a useful range of 14 feet.

How to Specify

Example: TR D 5 O4

- TR — TINY•EYE Red Light Source
- D — Dark-On Output
- 5 — 5 VDC
- O4 — Proximity Optical Block

Thru-Beam Light Source Receiver Models

1. Select Light Source Model based on light source required:
   STIT4 = Infrared Light Source; STRT4 = Red Light Source
2. Select Receiver Model based on light source required:
   RTLT4 = Light-On Receiver; RTDT4 = Dark-On Receiver

Example: Light Source STIT4; Receiver RTLT4

Sensor Models

1. Select Sensor Model based on light source required:
   TI = Infrared Light Source; TR = Red Light Source
2. Select Dark/Light Output
   D = Dark-On Output; L = Light-On Output
3. Select Operational Voltage: Blank = 10 – 30 VDC, 5 = 5 VDC
4. Select Optical Block based on mode of operation required.

TINY•EYE®

Range Guidelines

OPTICAL BLOCK TYPES	TINY-EYE® MODELS TIL/TID (Infrared)	TRL/TRD (Red)
O4 Proximity	2 in.	1.5 in.
O5 Proximity	18 in.	16 in.
R4 Retroreflective	20 ft.	20 ft.
R5 Polarized Retroreflective	N/A	7 ft.
V4, V4A Convergent	1 in.	1 in.
V6 Convergent	1-1/2 in.	1-1/2 in.
V8 Convergent	.5 in.	.5 in.
Type F4 with .125 in. diam. Glass Fiberoptic Bundle		
Proximity	1-1/2 in.	1 in.
Proximity w/ UAC-15 Lens	8 in.	6 in.
Opposed	6 in.	3 in.
Opposed w/ UAC-15 Lens	15 ft.	15 ft.
Type F5 with .040 in. diam. Plastic Fiberoptics		
Proximity	N/A	1/2 in.
Opposed	N/A	2 in.
Opposed w/ HLA-1 Lens	N/A	4 ft.

Type T4 Opposed Mode – Light Source/Receiver

Light Source	Receiver	Max. Range
STIT4	RTLT4	25 ft.
STIT4	RTDT4	25 ft.
STRT4	RTLT4	20 ft.
STRT4	RTDT4	20 ft.

NOTES:
- PROXIMITY tests utilizes a 90% reflective white target.
- RETROREFLECTIVE tests utilizes a 3˝ diam. round reflector Model AR-3.

*Maximum ranges at 24 VDC. (Varies with supply voltage)

POWER REQUIREMENTS
- Sensors 10 - 30 VDC @ 35 mA Max
- Receivers 10 - 30 VDC @ 15 mA Max
- Light Source 10- 30 VDC @ 20 mA Max

NOTE: All devices equipped with reverse polarity protection

OUTPUT TRANSISTORS (SENSORS/ RECEIVERS)
- NPN (1) and PNP (1) Output Transistors provided

NPN: Sink up to 100 mA
PNP: Source up to 100 mA

RESPONSE TIME: (SENSORS/RECEIVERS)
500 microseconds (light or dark)

LIGHT IMMUNITY: (SENSORS/RECEIVERS)
Pulse modulated to provide extremely high immunity to ambient light

SENSING RANGE:
Sensing range determined by model type, mode of sensing, optical block selected, and supply voltage

SENSITIVITY/RANGE ADJUSTMENT:
Adjusting light source intensity by termination of designated wire lead (Blue for Sensors/Green for Light Sources) determines sensitivity/range setting
Maximum Range - connect wire lead to POSITIVE. (24 VDC Supply)
Mid-Range - no connection required. (12 - 24 VDC Supply)
Low Range - connect wire lead to NEGATIVE. (12 - 24 VDC Supply)
NOTE: Continuous adjustment can be accomplished by connecting the wire lead to a remote potentiometer. Consult factory

AMBIENT TEMPERATURE:
- -30°C to 70°C (-22°F to 158°F)

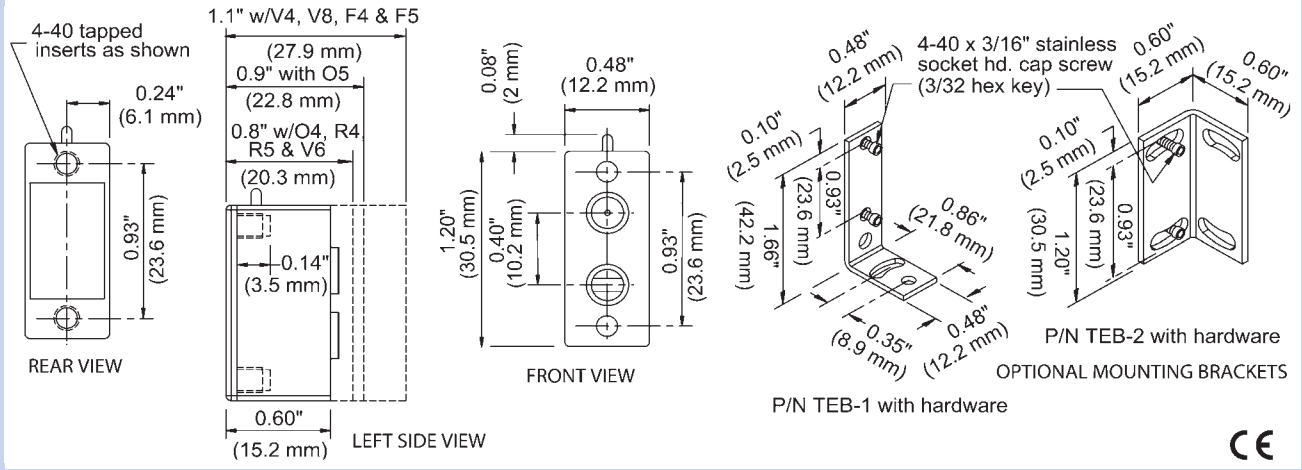
RUGGED CONSTRUCTION:
- High impact polycarbonate housing
- Waterproof, NEMA 4X, 6P and IP67
- Encapsulated for mechanical strength

LED LIGHT SOURCE WAVELENGTH:
- Infrared = 880 nm
- High intensity red = 660 nm

Accessories See Dimensions drawing

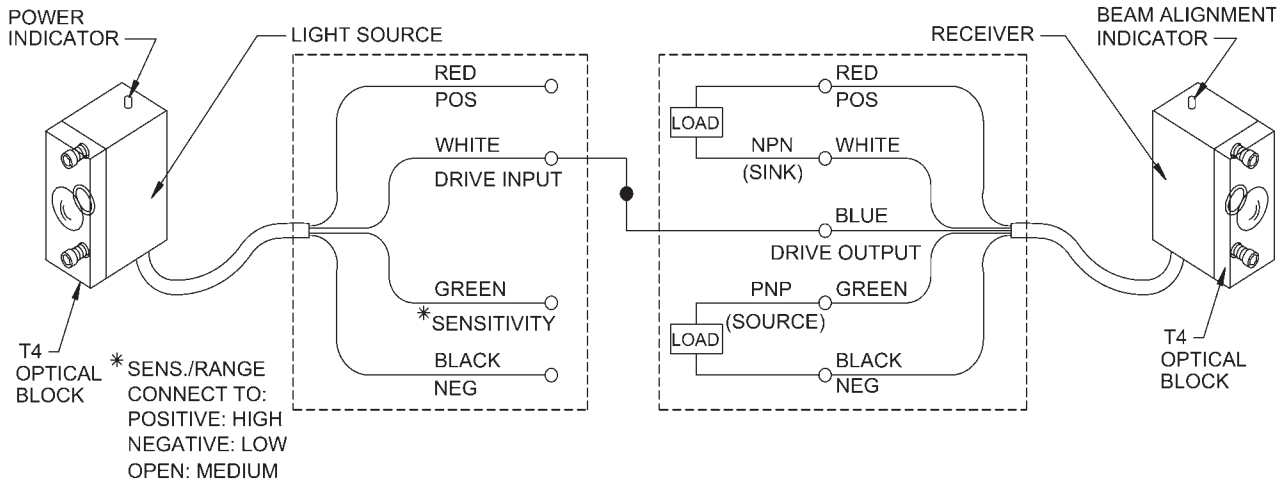
Model	Description
TEB-1	Vertical mount Tiny-Eye Mounting Bracket
TEB-2	Horizontal Mount Tiny-Eye Mounting Bracket

Dimensions TINY•EYE® SENSOR MODELS

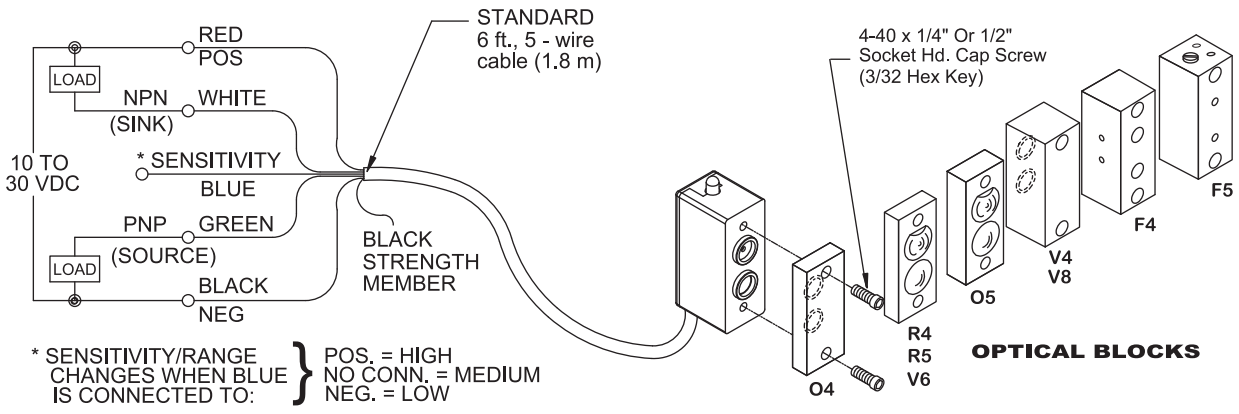


CE

Connections TINY•EYE® LIGHT SOURCE / RECEIVER MODELS - OPPOSED MODE



Connections ALL TINY•EYE® SENSOR MODELS



AC/DC Sensor with Timer,
Relay or Triac Output Options

U.S. EYE®

U.S. EYE®

U.S. EYE® Photoelectric Sensors were designed and built by TRI-TRONICS to answer the demand for economical, high-performance sensors with U.S. quality—backed by U.S. service! They are available with a unique Contrast Indicator for difficult sensing tasks and without the Contrast Indicator for simple tasks at an even lower cost.

Function modes available:

- ON/OFF – output relay switches for duration of input.
- Type T1, delay timer – offers two options using light/dark switch:
  a) "ON" delay for product jam or backup detection.
  b) "OFF" delay for product void detection.
- Type T2, "one-shot" timer – may be used for short, momentary output pulse or in the "triggerable" mode for "stop motion" detection. (See Timing Sequence Data Charts.)

Contrast Indicator™ Models

The Contrast Indicator displays a scaled reading of the level of light received by the sensor's photo detector. The more light received, the higher the reading. The less light received, the lower the reading. Contrast is a comparison of the lightest state reading vs. the darkest state reading. The sensing task of any photoelectric sensor is to resolve the difference between these two light levels and switch the output accordingly. The U.S. EYE® switches its output when the light level passes the mid-scale reading of "5." Refer to section 1 for details.

Fiberoptic Models

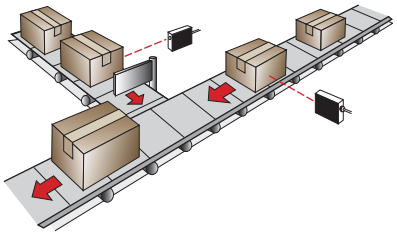
Flexible fiberoptic light guides are available in sizes small enough to fit into your toughest job sensing sites, with models designed for inaccessible places, detection of extremely small parts, high temperature applications, corrosive environments, or high vibration locations, as well as straight light guides for Beam Break and bifurcated light guides for proximity sensing.

Features

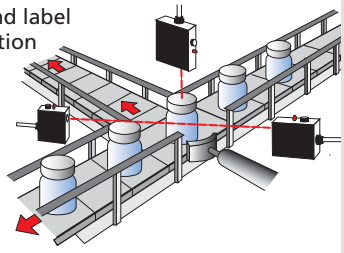
- Easy installation – includes all accessories, mounting bracket, reflector, and hardware
- Thru-beam models include both light source and receiver
- All models operate on AC or DC from 24 to 130 volts; relay or triac outputs
- Output relay contacts are rated at 5 amps
- High-speed response – limited by the output relay itself. 7 ms Beam Make or Beam Break
- Fiberoptic models available with infrared or red LED light sources
- All models equipped with sensitivity adjustments
- All models have red LED indicator showing status of output relay
- All models have green LED beam status indicator for easy alignment
- High-impact plastic case is dirt and moisture sealed
- Switching power supply eliminates failures often caused by power line transients

Typical Applications

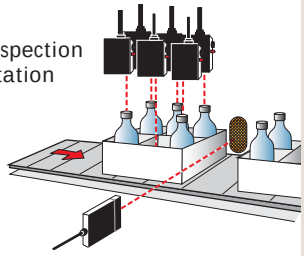
Gating, sorting, and seal inspection



Cap and label inspection



Product inspection and orientation



On or Off Delay Switch

With Contrast Indicator	Without Contrast Indicator	Light Source	Max Range	Speed of Response	Output Information
Beam Break Mode Retroreflective (Models Include 78P Reflector)					
UCR-A	UR-A	Infrared	15 ft.	7 ms	On/Off Relay
TUCR-A	TUR-A	Infrared	15 ft.	8 ms	On/Off Triac
UCR-AT1	UR-AT1	Infrared	15 ft.	7 ms	On or Off Delay
UCR-AT2	UR-AT2	Infrared	15 ft.	7 ms	One-Shot Motion
Beam Break Opposed Mode (Models Include Both Light Source and Receiver)					
UCT-A	UT-A	Infrared	75 ft.	7 ms	On/Off Relay
UCT-AT1	UT-AT1	Infrared	75 ft.	7 ms	On or Off Delay
UCT-AT2	UT-AT2	Infrared	75 ft.	7 ms	One-Shot Motion
Receiver Replacements W Contrast Indicator	Receiver Replacements W/O Contrast Indicator	Light Source Replacements			
UCT-A	UT-AR	UT	order replacements separately		
UCT-AT1	UT-AT1R	UT	order replacements separately		
UCT-AT2	UT-AT2R	UT	order replacements separately		
Beam Make Mode Proximity Diffused Beam					
UCD-A	UD-A	Infrared	3 ft.	7 ms	On/Off Relay
TUCD-A	TUD-A	Infrared	3 ft.	8 ms	On/Off Triac
UCD-AT1	UD-AT1	Infrared	3 ft.	7 ms	On or Off Delay
UCD-AT2	UD-AT2	Infrared	3 ft.	7 ms	One-Shot Motion

Fiberoptic Mode

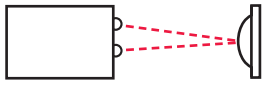
With Contrast Indicator	Without Contrast Indicator	Light Source	Opposed Range*		Proximity Range*		Speed of Response	Output Information
			With Lens	W/O Lens	With Lens	W/O Lens		
UCF-A	UF-A	Infrared	12 ft.	2 ft.	4 in.	2.5 in.	7 ms	On/Off Relay
TUCF-A	TUF-A	Infrared	12 ft.	2 ft.	4 in.	2.5 in.	8 ms	On/Off Triac
UCF-AT1	UF-AT1	Infrared	12 ft.	2 ft.	4 in.	2.5 in.	7 ms	On or Off Delay
UCF-AT2	UF-AT2	Infrared	12 ft.	2 ft.	4 in.	2.5 in.	7 ms	One-Shot Motion
UCFR-A	UFR-A	Red	6 ft.	8 in.	4 in.	1 in.	7 ms	On/Off Relay
UCFR-AT1	UFR-AT1	Red	6 ft.	8 in.	4 in.	1 in.	7 ms	On or Off Delay
UCFR-AT2	UFR-AT2	Red	6 ft.	8 in.	4 in.	1 in.	7 ms	One-Shot Motion

NOTES:
- FIBER OPTIC range tests utilized .125 in. diameter fiber bundles and UAC-15 lenses as indicated.
- PROXIMITY tests utilized a 90% Reflective target. RETROREFLECTIVE tests utilized a 78P reflector.

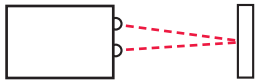
Specifications

U.S. EYE®

RETROREFLECTIVE



PROXIMITY



THRU-BEAM
dual beam for long range

FIBER OPTIC
(Refer to Fiberoptic
Light Guide Section)

Operating Range: 24 to 130 VAC or VDC
Power Consumption: 2 VA
Temperature Range: -10°C to + 50°C (14°F to 122°F)
Output:
- SPDT Relay Models: 5 amps @ 120 VAC
  Normally de-energized before input occurs.
- Isolated Solid State TRIAC Models: 1 amp at 50°C

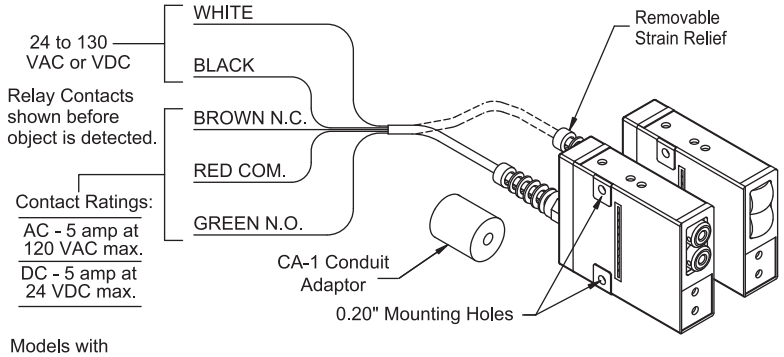
Response Time: Relax: 7 ms light or dark TRIAC: 8 ms
Timer Range: 0.1 to 15 seconds
Contrast Indicator Models: Displays a 10 bar LED scaled reading of contrasting light level
LED Light Source Wavelength: Infrared (880 nm), Red (660 nm)
Sensitivity Adjustment: Provided on all models
Beam Status Indicator: (Green LED) "ON" when beam is established
Output Indicator: (Red LED) Follows status of output relay
Cabling: 6' standard, 5-conductor

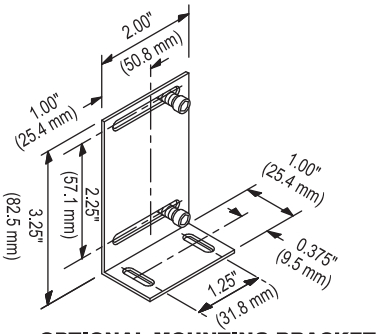
Accessories

Model #	Miscellaneous
CA-1	1/2 in. Conduit Adaptor
FSR-1	Flexible Strain Relief
UMB-1	U.S. Eye Bracket
USB-1	U.S. Eye Sub-Bracket

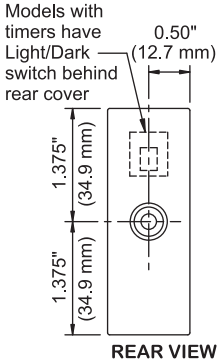
Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions U.S. EYE

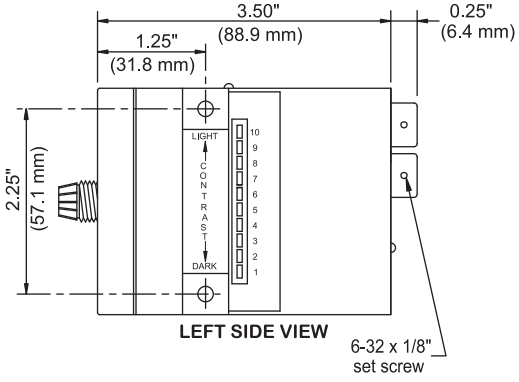




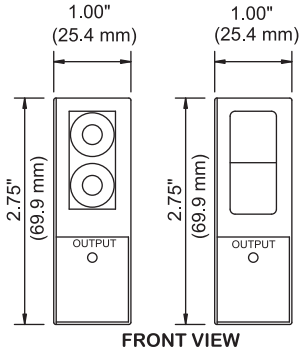
OPTIONAL MOUNTING BRACKET
MODEL UMB-1 WITH HARDWARE



REAR VIEW



LEFT SIDE VIEW



FRONT VIEW

U. S. EYE™ PHOTOELECTRIC SENSOR
(WITH MECHANICAL RELAY or TRIAC OUTPUT)
ALL DIMENSIONS IN BRACKETS ARE METRIC

NEW!

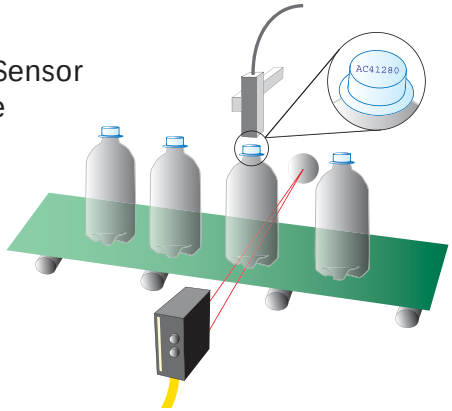
High Performance Clear Object Sensor

RETRO SMART®

Dependable Detection of Clear and Shiny Objects

RETROSMART®

- No Proxing On Shiny Objects
- Detection of transparent PET and glass containers...full or empty
- Detection of Shiny Objects at High Velocity
- Leading Edge Detection of Irregular objects



Trigger Sensor for Code Marking

The *TRI-TRONICS*® *RETROSMART*® retroreflective sensor is optimized to detect translucent/transparent containers and shiny objects. You can depend on the *RETROSMART*® sensor's ability to reliably sense any object, regardless of the size or shape, from the leading edge to the trailing edge without false signals, a requirement when the sensing task involves monitoring a conveyor line for jam detection. The sensor's red, narrow light beam assures accuracy in detecting the leading edge of any product to trigger the response, such as filling, capping, labeling, and coding.

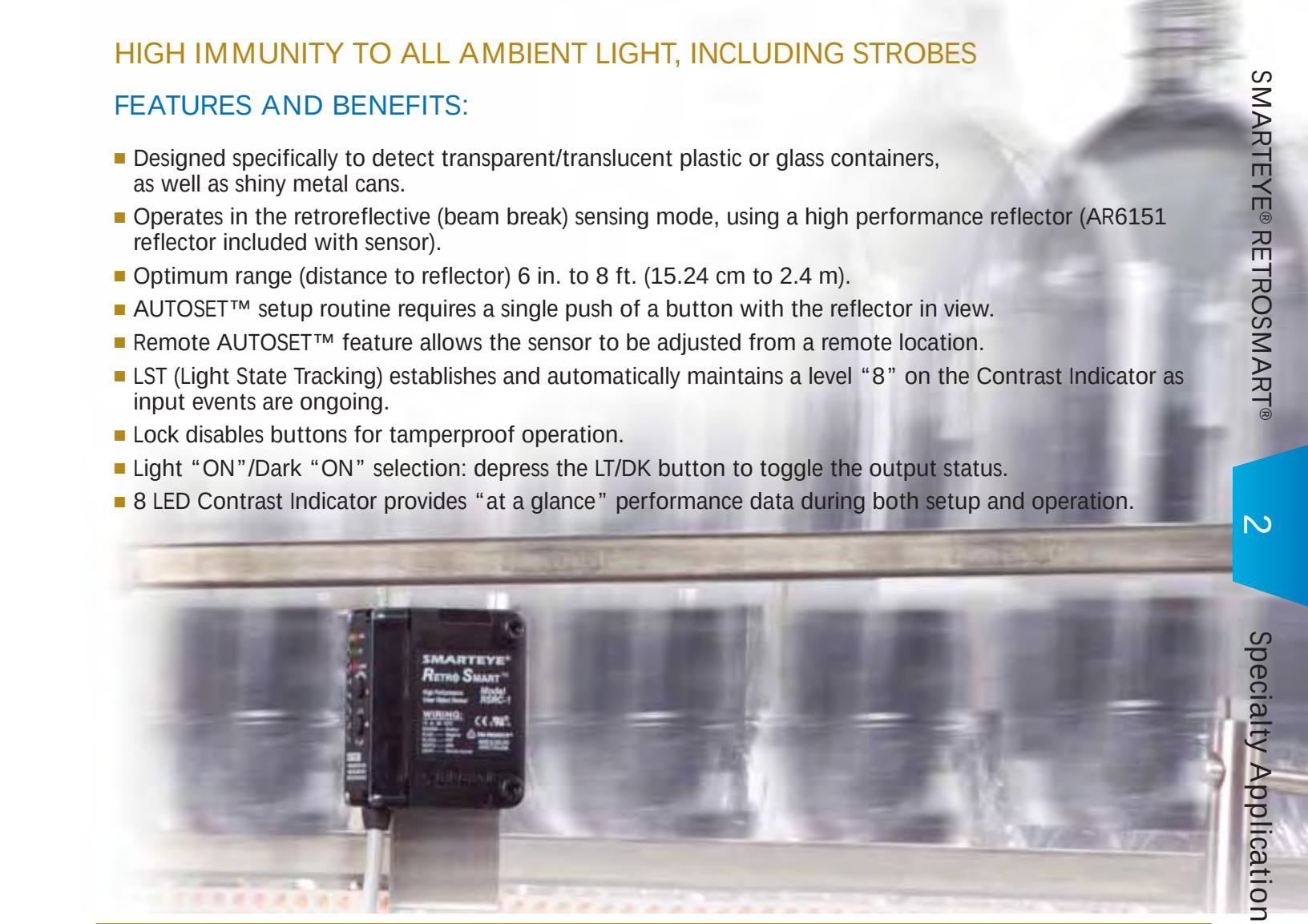
Many of today's industrial control functions require a sensor that can provide dependable detection of position or presence of transparent containers. The *RETROSMART*® will provide a single, non-chattering output for each transparent container that passes by, independent of size, shape, empty, or full.

Imagine…just point the *RETROSMART*® sensor's red, narrow light beam at the reflector and push the AUTOSET™ button one time. Now sit back and watch the sensor flawlessly detect any size PET bottle filled with water, with no need to worry about burnthrough or double signals. When the efficiency of an entire production line depends on the performance of a photoelectric sensor, the *RETROSMART*® is the smart choice.

HIGH IMMUNITY TO ALL AMBIENT LIGHT, INCLUDING STROBES

FEATURES AND BENEFITS:

- Designed specifically to detect transparent/translucent plastic or glass containers, as well as shiny metal cans.
- Operates in the retroreflective (beam break) sensing mode, using a high performance reflector (AR6151 reflector included with sensor).
- Optimum range (distance to reflector) 6 in. to 8 ft. (15.24 cm to 2.4 m).
- AUTOSET™ setup routine requires a single push of a button with the reflector in view.
- Remote AUTOSET™ feature allows the sensor to be adjusted from a remote location.
- LST (Light State Tracking) establishes and automatically maintains a level "8" on the Contrast Indicator as input events are ongoing.
- Lock disables buttons for tamperproof operation.
- Light "ON"/Dark "ON" selection: depress the LT/DK button to toggle the output status.
- 8 LED Contrast Indicator provides "at a glance" performance data during both setup and operation.



CONTRAST INDICATOR

CONTRAST INDICATOR BAR 8
Remains illuminated when Light State signal strength is 8 or above

SWITCH POINT BAR 4
Sensor outputs toggle or switch to opposite state when the signal level passes above or below 4

CONTRAST INDICATOR BAR 1
Extinguishes when Light State signal strength is below 1

PUSH BUTTON – 3 FUNCTIONS
1. LST (Light State Tracking)
   Depress and hold for 6 seconds to toggle
2. Light/Dark Output Status
   Depress and release after 2 seconds to toggle
3. Manual Down Adjust
   Tap and release for less than 1/4 second

LOCK INDICATOR
Illuminates when buttons are disabled
Depress both buttons for 2 seconds to toggle

LST INDICATOR
(Light State Tracking)
Illuminates when LST is enabled

OUTPUT STATUS INDICATOR
When illuminated, Option Status Indicator is enabled

PUSH BUTTON – 2 FUNCTIONS
1. AUTOSET™
   Depress for 1 second to initiate Light State AUTOSET™ routine
2. Manual UP Adjust
   Tap and release for less than 1/4 second LOCK INDICATOR

RETROSMART®

HOW IT WORKS!

The RETROSMART® sensor is equipped with a pinpoint source of red, visible light that transmits a concentrated, narrow beam. When the beam is directed toward our high quality corner cube reflector (AR6151, included with each sensor), a thru-beam is established. Any object that comes between the sensor and the reflector will break the beam, signaling an output.

SENSING ADVANTAGE

With the RETROSMART® there is no need to be concerned with air currents, convection heat, humidity, or irregular shaped objects. It has high performance with a sensing range of 8' and a 500 microsecond response time.

UNIQUE FEATURES:

- AUTOSET™ ADJUSTMENT
  The AUTOSET™ adjustment routine only requires the push of one button, one time! All you have to do is aim the sensor at the reflector and push the button for a perfect setting.
- REMOTE AUTOSET™
  To remotely AUTOSET™ the sensor, apply a momentary contact closure from the AUTOSET™ input wire to negative, as shown in the wiring diagram. A remote AUTOSET™ command will duplicate the last manual AUTOSET™.
- AGS™ AUTOMATIC GAIN SELECT
  This unique feature provides automatic digital selection of amplifier gain based upon your sensing requirements.
- LST™ (LIGHT STATE TRACKING)
  When enabled, the sensor will continually adjust to the perfect setting of "8" on the Contrast Indicator. Just set it and forget it.

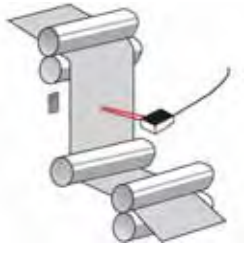
Detection of transparent PET and glass containers...full or empty.

Detection of shiny objects at high velocity.

Leading edge detection of irregularly shaped objects without false signals.

Clear Detection Applications

- *Shrink-wrap*
- *Double Sheet*
- *Splice*



Recommended for wraparound machinery and material handling; does not prox when looking through site glass up to 8' (5.5m) range.

HOW TO SPECIFY

RETROSMART® SENSORS

RSR-1	Includes 6' cable (1.8 m) & AR6151 reflector
RSR-1G	Includes chemical resistant glass window, 6' cable (1.8 m) & AR6151G reflector
RSRC-1	Includes 5-PIN 6" pigtail connector & AR6151 reflector (Accessory Cable required)
RSRC-1G	Includes chemical resistant glass window, 5-PIN 6" pigtail connector & AR6151G reflector (Accessory Cable required)

NEW!

HIGH PERFORMANCE REFLECTOR INCLUDED WITH EACH SENSOR

AR6151

AR6151G
(Chemical Resistant Glass Cover)

ACCESSORIES

CABLE CONNECTION

5-Wire Shielded MicroCable, M-12

GSEC-6
6' (1.8 m) cable with connector

GSEC-15
15' (4.6 m) cable with connector

GSEC-25
25' (7.62 m) cable with connector

GRSEC-6
6' (1.8 m) cable/right angle connector

GRSEC-15
15' (4.6 m) cable/right angle connector

GRSEC-25
25' (7.6 m) cable/right angle connector

GPSEC-15
15' (4.6 m) non-metallic shell

5-Wire Unshielded Cable, M-12, Low Cost

GSEC-2MU
5.5' (2.0 m)
cable with connector

GSEC-5MU
16.4' (5.0 m)
cable with connector

5-Wire Extension Cable, M-12

GX-25
25' (7.6 m) extension cable

OPTIONAL STAINLESS MOUNTING BRACKET ASSEMBLY

SEB-4

Note: Rigid mounting of sensor and reflector required.

Optional Prismatic High-Performance Reflectors NEMA 4, IP67

Screw Mount

AR4060
1.6" x 2.36"
(40.5 x 60 mm)

Glue Mount

AR46
1.8" diam.
(46 mm diam.)

AR6151
2.4" x 2.0" (61 x 51 mm)

AR6151G (Chemical Resistant Glass Cover)
2.4" x 2.0" (61 x 51 mm)

Economical Reflective Discs with Adhesive Backing

PRD1
1" x .03" (25 mm x .75 mm)
PRD2
2" x .03" (50 mm x .75 mm)

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 50 mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP output transistor:
  NPN: Sink up to 150 mA
  PNP: Source up to 150 mA
- Continuous short-circuit protection
- Outputs protected from pulsing during power up

REMOTE AUTOSET™ INPUT
- Opto-isolated momentary sinking input (10 mA)

RESPONSE TIME
- Light State response = 500 microseconds
- Dark State response = 500 microseconds

LED LIGHT SOURCE
- Red 660 nm
- Pulse Modulated

PUSH BUTTON CONTROL
- "One-Touch" AUTOSET™ push-button setup
- Tweak adjustments with "up" or "down" buttons
- LST™ (Light State Tracking) Enable/Disable
- Light "ON"/Dark "ON" selection

RANGE
- Optimum from 6 in. to 8 ft.
(15.24 cm to 2.4 m) distance to the AR6151 reflector

HYSTERESIS
- Two bars as displayed on
  Contrast Indicator
  Light State Switch = 5
  Dark State Switch = 3

LIGHT IMMUNITY
- Responds to sensor's pulse-modulated light source, resulting in high immunity to most ambient light, including high intensity strobes

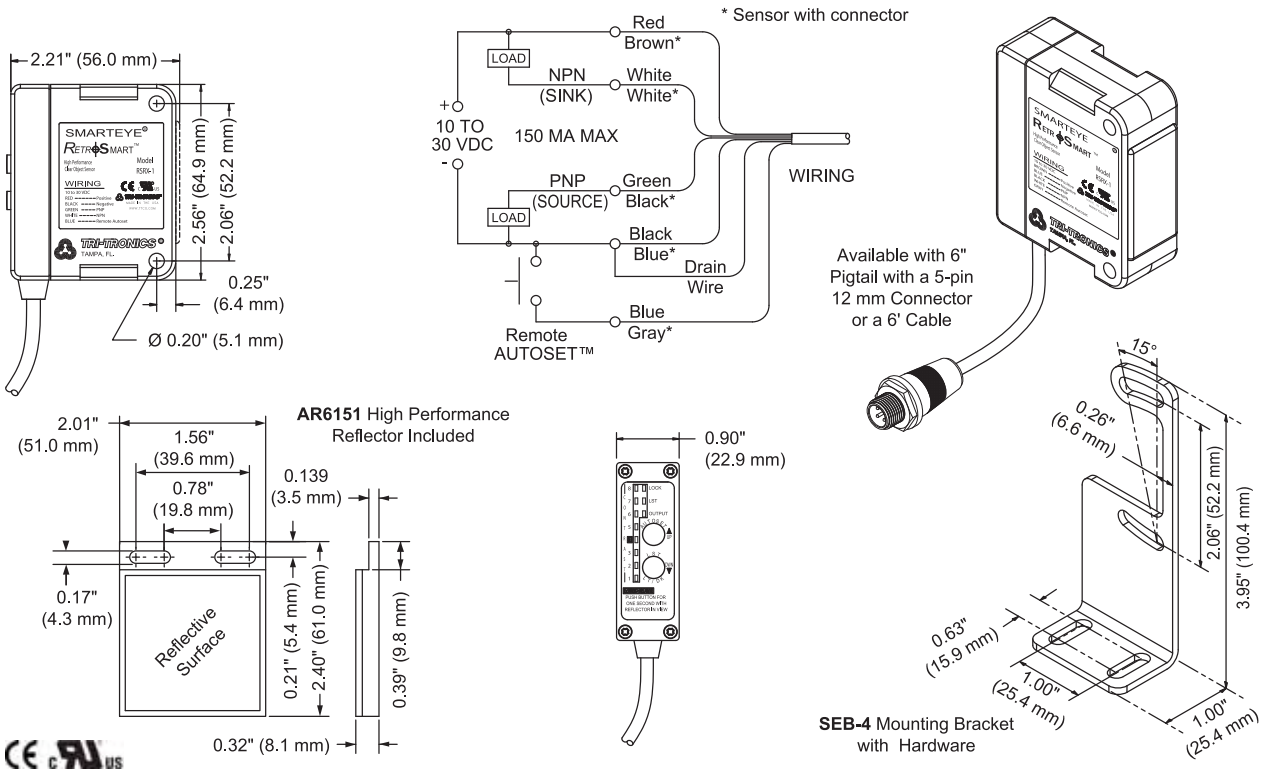
DIAGNOSTIC INDICATORS
- Contrast Indicator-Display scaled reading of sensor's response to contrasting light levels (light vs. dark) on an 8-bar LED display
- Red LED "LOCK" Indicator
- Green LED LST (Light State Tracking)
- Red Output Status Indicator NOTE: If Output LED flashes, a short circuit condition exists.

AMBIENT TEMPERATURE
- -40° to 70° C (-40° to 158° F)

RUGGED CONSTRUCTION
- Chemical resistant, high-impact polycarbonate housing
- Waterproof ratings: NEMA 4, IP66

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions SMARTEYE® *RETROSMART®*



Detects the Presence of Invisible Fluorescent Materials

NEW!

Digital Models
Analog Models
Fiberoptic Options
Up to 24" Range
AUTOSET™ Adjustment

SMARTEYE®

STEALTH-UV™

The SMARTEYE® *STEALTH-UV*™ Luminescence Sensor

The SMARTEYE® STEALTH-UV sensor is a special purpose sensor designed to detect the presence of invisible fluorescent materials contained in or added to chalks, inks, paint, greases, glue, or optical brighteners found in labels, paper, tape, string, etc. The sensor contains an ultraviolet (UV) solid state light source that is used to excite the luminescent materials to fluoresce in the visible range. The sensor's detector then responds to the visible fluorescing light. When the received fluorescing light level (displayed on the Contrast Indicator) reaches a level of "4" or above, the NPN and PNP output transistors will switch to the opposite state.

Typical Applications

- Detection of clear tamperproof seals
- Label verification on containers
- Detection of invisible registration marks for printing, cutting, positioning
- Registering UV adhesives on clear labels
- Triggering on inkjet printed marks for product identification or insertion
- Thread break detection
- Continuous web splice detection
- Detecting marks (chalk) for grading or sorting, such as lumber, hardwood, and tile products

- Orientation of products
- Detecting the presence of a critical component in a complex assembly
- Seeing UV threads in carpets for cutting or positioning
- Detection of cellophane tape or adhesives on cardboard cartons or boxes
- Verification of pull tabs on packages
- Verifying the presence of lubricants, such as oil or grease, or identifying oil leaks

- Product Inspection/ Verification:
  - Amount of glue/adhesives on paper, plastics, envelopes, and transparent materials
  - Detecting LOCTITE P/N 24221 on machine threads or bolts

  - Verifying that products are inserted into packages, such as coupons into cake mixes, or pamphlets into pharmaceutical products
  - Label verification on bottles (white label on a white plastic bottle)

The SMARTEYE® *STEALTH-UV*™ Advantage

The *STEALTH-UV* operates in the ultraviolet region where there is little interference from other light sources. The *STEALTH-UV* responds to the ultraviolet (UV) fluorescent regions found in many man-made and natural materials. Another advantage is that, unlike most UV light, the *STEALTH-UV* can use our standard glass fiberoptic light guides.

Glass Fiberoptic Light Guides

SMARTEYE® *STEALTH-UV*™ — High immunity to all ambient light, including strobes

Features

CONTRAST INDICATOR™
Provides "at-a-glance" performance data, both statically and dynamically.

OPTIMIZED GAIN ADJUSTMENT
This unique feature provides automatic digital selection of amplifier gain based upon your sensing requirements.

AUTOSET™ ADJUSTMENT
The AUTOSET™ adjustment routine only requires the push of one button, one time! Simply place the UV target in view and press the AUTOSET™ button for 1/2 second.

TIMER
When the "OFF" delay pulse stretcher is enabled, the output duration is extended by 15 milliseconds. Enabling the Timer allows ample time for the controller to respond to short duration input events.

HIGH SPEED
Detection varies with model selection. See *Specifications* for details.

CONNECTIONS
Built-in 4-pin 12 mm 6" (152.4 mm) male micro connector (M-12)

MOUNTING OPTIONS
Through-hole or bracket mount.

CONTRAST INDICATOR

CONTRAST INDICATOR BAR 8
Remains illuminated when light-state signal strength is 8 or above.

SWITCH POINT BAR 4
Sensor outputs toggle or switches to the opposite state when the signal level passes above and below bar 4.

CONTRAST INDICATOR BAR 1
Extinguishes when dark state signal strength is below bar 1.

TIMER INDICATOR
Color green illuminates when the 15 millisecond pulse stretching timer is enabled. Push both buttons simultaneously to enable/disable the timer.

OUTPUT INDICATOR
Color red illuminates when the output transistors are in the "on" state.

MANUAL UP ADJUST BUTTON
Tap to "tweak" setting if needed.

LIGHT/DARK TOGGLE
Push button for 2 seconds to select "light on" or "dark on" operation.

MANUAL DOWN ADJUST BUTTON
Tap to "tweak" setting if needed.

AUTOSET™
Push button for 1/2 second with fluorescent target in view.

Responds to invisible fluorescent UV materials

How To Specify:

NEW! *Analog Output Available Spring '07*

Coaxial

UVS-1 / UVS-1A (Analog Output)
Focal Distance 0.50" (12.7 mm)
Spot Size 0.067" (1.7 mm)
Usable Range 0 to 5.0" (0 to 127 mm)
Response Time 200 microseconds

UVS-2 / UVS-2A (Analog Output)
Focal Distance 1.0" (25.4 mm)
Spot Size 0.086" (2.2 mm)
Usable Range 0 to 7.5" (0 to 190.5 mm)
Response Time 200 microseconds

UVS-3 / UVS-3A (Analog Output)
Focal Distance 2.0" (50.8 mm)
Spot Size 0.128" (3.25 mm)
Usable Range 0 to 10.0" (0 to 254 mm)
Response Time 200 microseconds

UVS-4 / UVS-4A (Analog Output)
Focal Distance 4.0" (101.6 mm)
Spot Size 0.16" (4.1 mm)
Usable Range 0 to 13.0" (0 to 330 mm)
Response Time 200 microseconds

Convergent

UVS-5 / UVS-5A (Analog Output)
Focal Distance 8.0" (203 mm)
Spot Size 1.0" (25.4 mm)
Usable Range 2.0 to 24.0" (50.8 to 609.6 mm)
Response Time 750 microseconds

Fiberoptic

UVS-6 / UVS-6A (Analog Output)
Micro Polished Fiberoptic Light Guide
BF-U-36TUV 0.156" Bundle Size (4.0 mm)
Usable Range Up to 2.5" (63.5 mm)
Response Time 350 microseconds

Model/Range Guidelines

Optimal range is dependent upon fluorescent concentration, size, and surface reflectivity.

NOTE: Sensor selection should not be determined solely by range. It may be advisable to test multiple sensors or fiber optic light guide tip configurations to ensure optimum performance.

Note: For chemical resistant glass window, add "G" to model numbers. Examples: UVS-1G, UV-1AG

Accessories

Micro Cable Selection Guide
4-wire, M12

Yellow Shielded Cable Assemblies

SEC-6
6' (1.8 m) cable with connector

SEC-15
15' (4.6 m) cable with connector

SEC-25
25' (7.62 m) cable with connector

Black Shielded Cable Assemblies (Lightweight)

BSEC-6
6' (1.8 m) cable with connector

BSEC-15
15' (4.6 m) cable with connector

BSEC-25
25' (7.62 m) cable with connector

BX-10
10' (3.1 m) Extension cable

BX-25
25' (7.62 m) Extension cable

Unshielded Cable Assemblies

SEC-2MU
6.5' (2.0 m) Low-cost

SEC-5MU
16.4' (5.0 m) Low-cost

Suggested Fiberoptic Light Guides for Stealth UV:

BF-U-36TUV
BF-A-36T
BF-C-36

SEB-4
Stainless Stealth Mounting Bracket

FMB-1 (8.4 mm diam.)
Standard Fiberoptic Mounting Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic Fiberoptic Mounting Brackets

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- UVS-1, UVS-2, UVS-3 & UVS-4: 50 mA
- UVS-5 & UVS-6: 65 mA (exclusive of load)

TRANSISTOR OUTPUT
- (1) NPN and (1) PNP output transistor:
  NPN: Sink up to 150 mA
  PNP: Source up to 150 mA
- Continuous short circuit protected
- Outputs protected from pulsing during power up

NEW!

ANALOG OUTPUT
- 4 – 20 mA (Consult factory for specifications)

RESPONSE TIME
- Varies by sensor model

AMBIENT TEMPERATURE
- - 40°C to +70°C (- 40°F to 158°F)

Verification of Tamperproof Seals or Labels

LIGHT IMMUNITY
- Responds to sensor's pulse modulated light source, resulting in high immunity to most ambient light and strobes, including indirect sunlight

RUGGED CONSTRUCTION
- Chemical resistant high impact polycarbonate housing, acrylic lens cover
- Industry Ratings: NEMA 4, IP67

PUSH BUTTON CONTROL
- "One-Touch" AUTOSET™ push-button setup
- Tweak adjustments with "up" or "down" buttons
- Selection of Light/Dark operation
- Enable/Disable pulse stretcher

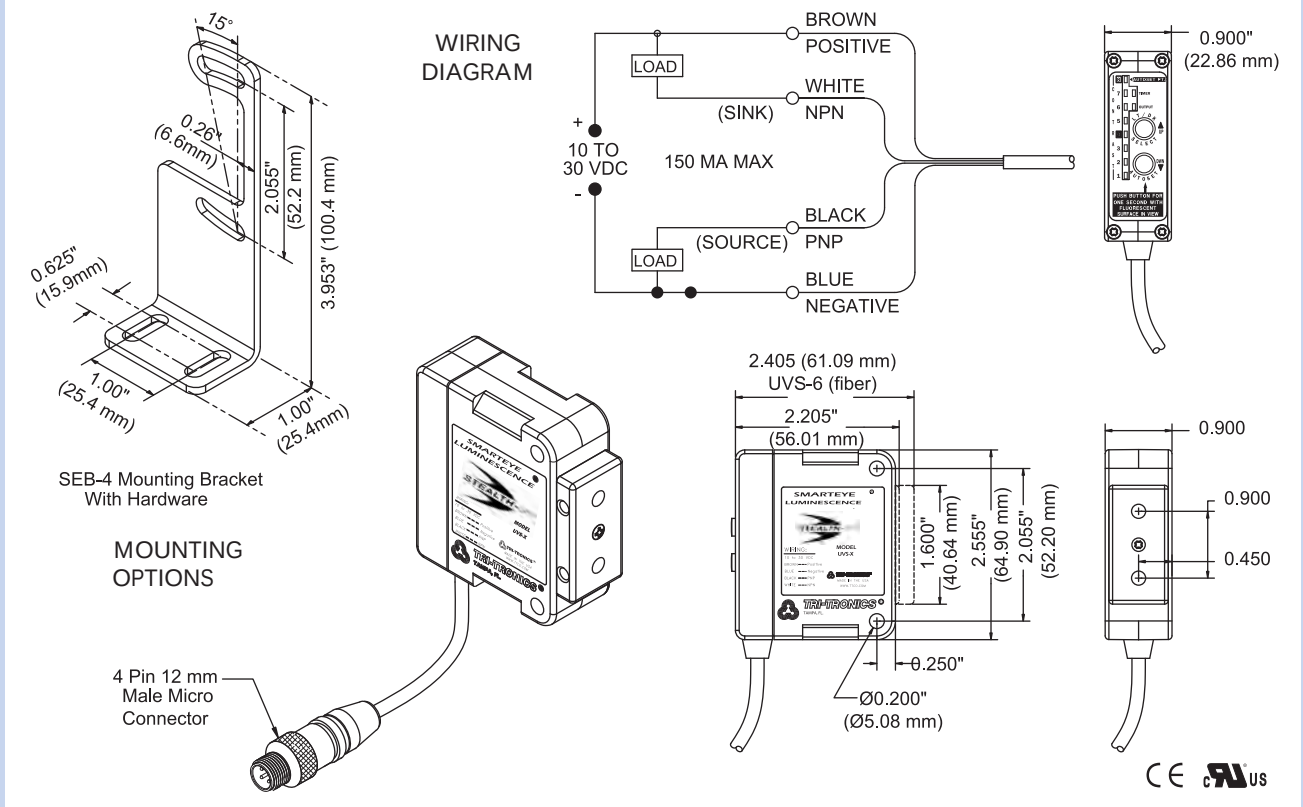
HYSTERESIS
- 2 bars as displayed on Contrast Indicator:
  Light State switch = 5
  Dark State Switch = 3

DIAGNOSTIC INDICATORS
- Contrast Indicator – Display scaled reading of sensor's response to contrasting light levels (light vs. dark) on an 8 bar LED display
- RED LED OUTPUT INDICATOR Illuminates when the sensor's output transistors are "on" NOTE: If Output LED flashes, a short circuit condition exists
- GREEN LED TIMER INDICATOR Illuminates when the 15 millisecond pulse stretcher timer is enabled

LIGHT SOURCE
- UV LED, 375 nm Wavelength

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions — SMARTEYE® STEALTH-UV™



Remote Digitally Controlled Sensor
Highest Resolution of Any Model

SMARTEYE®

DCS®

SMARTEYE® DCS®

DIGITALLY CONTROLLED SMARTEYE® SENSOR

(Patent No. 6,950,778)

Solve Your Sensing Problems

- Icons Simplify Setup
- Unlimited Product Memory Settings
- Graphical Performance Monitor
- Configurable Performance Options
- Multiple Timer Options
- Tamperproof

Many of today's photoelectric sensors are equipped with limited features that are both confusing and difficult to control. The operator can find it difficult to implement even a simple setup procedure or monitor the diagnostic indicators. By combining the power of the computer with the SMARTEYE® DCS® sensor, setup procedures are simplified, performance options are easily configured, and the operator is provided a unique, graphic display.

Without a doubt, the SMARTEYE® DCS® (Digitally Controlled Sensor) is equipped with the greatest variety of performance enhancing options ever offered in a single photoelectric sensor. Because this sensor offers so many features and benefits, it would be easy to assume that it would be difficult for a machine operator to adjust. Frankly, the opposite is true. While viewing a simple, easy-to-use graphic display, all that's required is for the operator to point and click on the specific icon depicting the sensing mode in use, i.e., Beam Make (proximity) or Beam Break (retroreflective or opposed). Another setup option is to go to the product memory screen to store or recall previous settings, based upon specific product descriptions.

After initiating the AUTOSET™ routine, the operator has the option of monitoring the response of the sensor to contrasting light levels on either a bargraph contrast indicator or a unique oscilloscope-style Contrast Deviation Analyzer (Patent Pending). The analyzer charts the signal level deviation against the background of the dynamic range of the sensor while monitoring on-going events. Now the operator, while viewing the contrast analyzer on the screen, can

SMARTEYE® DCS®

From your Control Display Screen, you can…

ADJUST THE SENSOR

A. Click on the icon depicting the sensing mode in use to initiate the automatic setup routine. (AUTOSET™)

B. Recall prior settings from product memory. *NOTE:* Both the stored settings and the configured options will be instantly recalled.

C. While viewing the oscilloscope-style Contrast Deviation Analyzer, the adjustments can be tweaked to obtain the setting that absolutely guarantees the most reliable performance.

CONFIGURE THE SENSOR

The following options are automatically configured by using selectable icons or can be manually configured.

A. ACT™ (Automatic Contrast Tracking)
B. Response Time
C. Hysteresis
D. AUTOSET™ Mode
E. AUTOSET™ Point
F. Output Mode
G. Adjustable Signal Conditioning Timer Options
    1. Signal Conditioning
        a. Leading Edge Debounce
        b. Trailing Edge Debounce
        c. Blind/Inhibit Timer
    2. Motion Control Function (traditional On/Off delays)

MONITOR THE SENSOR *(Unique to the Industry)*

A. Indicators
    1. Contrast Indicator
    2. Output Status
    3. Dynamic Range
    4. RS-232 Communications Error
    5. Product Serial Number
    6. Sensor Change Indicator (sensor in use is not original sensor)

B. Oscilloscope-Style Contrast Deviation Monitor
(charts actual signal level response to input events)
    1. Screen number *one* displays signal level response while monitoring actual output switching
    2. Screen number *two* charts signal level deviation against the background of the dynamic range of the sensor

While viewing the display, the operator can "tweak" the adjustment to obtain the most ideal setting that guarantees reliable sensing. In addition, the signal conditioning timers can be properly adjusted.

The following options are automatically configured by using selectable icons, or they can be manually configured.

ACT™ AUTOMATIC CONTRAST TRACKING

ACT™ automatically adjusts the sensor as conditions change. This can include dirty lenses or reflectors, damaged fiberoptics or lenses, LED light source or thermal drift, and target variations such as position, orientation, or color. It can also compensate for signal shift or deterioration caused by high-speed input events. The DCS® continues to operate requiring far less maintenance than other sensors, making it *the choice* in tough sensing applications.

In applications where conventional photoelectric sensors require constant adjustments, the digitally controlled sensor is the answer. The ACT™ system is event driven, *i.e., the sensor monitors each input and makes appropriate adjustments.* This results in the truly unique ability of the sensor to track with gradual deterioration of contrasting light levels in dynamic conditions, while input events are ongoing.

Without question, the ACT™ system has proven to be extremely useful and should be activated as the default setting. It may be advantageous to turn the ACT™ off when performing product inspection or extremely low contrast sensing tasks.

RESPONSE TIME

In general, it is advantageous to have a high speed of response from the sensor that triggers an electro-mechanical response required to perform a machine operation or function *i.e., drill it, cap it, fill it, label it, print it, etc.* As a result, the location of the performed operation remains consistent, independent of variations in the velocity of the moving target. Therefore, for the vast majority of applications, the 125-microsecond response time is your best choice and should be considered the default setting. However, in some situations it may be advisable to slow down the response time of the sensor to 500 microseconds. For example, when attempting to respond to printed registration marks on paper or "web" materials, you may elect to desensitize the sensor to avoid responding to minor surface blemishes that pass rapidly through the sensor's light beam. Selecting a slower speed of response is also useful to prevent the sensor's output from chattering due to extreme electrical noise.

HYSTERESIS

The DCS® sensor has *two* switch point signal levels as displayed on the Contrast Indicator that determine when the output of the sensor will switch. When the signal level passes through the upper, or light state switch point, the sensor will switch to the light state condition. When the signal level drops below the dark state switch point, the output will switch to the dark state condition. The difference between the light state and dark state switch points defines the hysteresis of the sensor.

It is common for all photoelectric sensors to have a level of hysteresis to prevent the output of the sensor from inadvertently switching or "chattering" due to, for example, electrical interference or minute changes in the level of light received caused by vibrating objects partially in view of the sensor's light beam. The DCS® sensor is unique in that two levels of hysteresis are available. The low *hysteresis* setting is from 4 to 6 (3 bars as displayed on the Contrast Indicator). This is generally more than enough to provide for clean output switch transitions and prevents an output response on both the leading edge and trailing edge of the passing object. The low setting should be considered the default setting.

The high hysteresis setting of 2 to 8 (7 bars as displayed on the Contrast Indicator) can be used in applications when there is severe vibration of the objects stopped in front of the sensor.

The Operator can tweak the adjustments from the monitor for any sensing purpose.

AUTOSET™ MODE

The Light State AUTOSET™ Routine

On command, it automatically adjusts the sensor to a light state set point slightly above 10 on the Contrast Indicator. Best choice when operating in the Proximity (reflected light) mode. Provides a near perfect adjustment that prevents the sensor from responding to objects in the background at the sensing site. NOTE: The light state AUTOSET™ routine is the best choice for both Beam Make (Proximity) or Beam Break (Retroreflective) sensing modes and should be considered the default setting.

The Dark State AUTOSET™ Routine

On command, it automatically adjusts sensor to a dark state set point slightly below 1 (zero) on the Contrast Indicator. It can be useful to obtain the longest possible sensing range when operating in the Proximity (Beam Make) mode and can only be useful when there are no objects in the immediate background. Use with care.

AUTOSET™ POINT

The level to which the sensor sets itself when an AUTOSET™ command is implemented. The automatic set point (Excess Gain) can be optimized to a high or low contrast sensing task. Therefore, we have built into the sensor two possible AUTOSET™ points, one for high contrast applications and one for low contrast applications. For general purpose sensing tasks, the high contrast AUTOSET™ switch point is the default setting.

OUTPUT MODE

In the *Light "ON"* mode the output transistor will turn "ON" when the signal level is above the mid-scale switch point on the Contrast Indicator. When operating in the Proximity (Beam Make mode), the *Light "ON"* mode will result in the output transistor turning "ON" when the leading edge of the object moves into the sensor's light beam.

In the *Dark "ON"* mode the output transistor will turn "ON" when the signal level is below the mid-scale switch point on the Contrast Indicator. When operating in the Beam Break Mode (Opposed mode), the *Dark "ON"* mode will result in the output transistor turning "ON" when the leading edge of the object breaks the light beam.

ADJUSTABLE SIGNAL CONDITIONING TIMER OPTIONS

Timer #1

Leading edge "Debounce" timer can be selected to prevent the output from chattering as the leading edge of an object enters the sensor's effective light beam. NOTE: When in use, this timer will delay an output response for the adjustable timed period.

Timer #2

"Blind" or "Inhibit" timer can be selected to prevent the output from returning to the non-detection state *during* an input event. This timer function can be used to ignore short duration response to undesired target or object conditions that can return the output to the non-detection state prior to the trailing edge clearing the sensor's light beam, *i.e. can be used to ignore a hole in the middle of an object as it passes through the sensor's light beam.*

Timer #3

Trailing edge "Debounce" timer can be selected to prevent the output from chattering as the trailing edge of an object exits the sensor's effective light beam. NOTE: When in use, the output will be delayed from returning to the non-detection state for the adjustable time period after the trailing edge of the object has cleared the sensor's effective light beam.

IMPORTANT:

When both of the Debounce timers are set to the same time duration, the sensor's response will be delayed and will be representative of the actual input duration.

How to Specify

1. SELECT SENSOR

DCSIC	Infrared
DCSRC	Red
DCSWLC	White

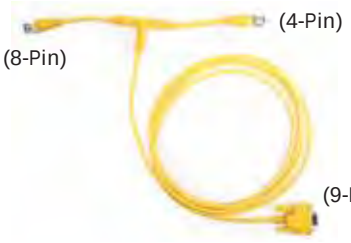
2. SELECT OPTICAL BLOCK

F1	Fiber Optic
V1, V1G	Convergent 2 – 4"
R1	Retroreflective
O1, O1G	Long Range Proximity
O2	Wide Beam Proximity

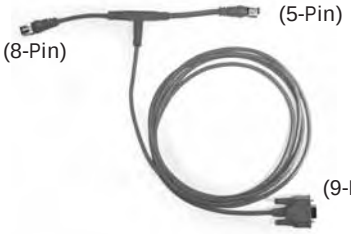
Example: DCSRCF1

DCS — LED Color — Connector Model — Optical Block

Accessories



TJC-2
"T" Junction Splitter Cable,
4-Pin Output



TJC-3
"T" Junction Splitter Cable,
5-Pin Output

DCS8-2M
Cable, 8-wire, M12

004-0097
EYEWARE CD
(Free)

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

SMARTEYE® DCS®

4-Wire, M12 (for TJC-2)

BSEC-6
6' (1.8 m) cable with connector

BSEC-15
15' (4.6 m) cable with connector

BSEC-25
25' (7.6 m) cable with connector

5-Wire, M12 (for TJC-3)

GSEC-6
6' (1.8 m) cable with connector

GSEC-15
15' (4.6 m) cable with connector

GSEC-25
25' (7.62 m) cable with connector

Range Guidelines

Convergent/Proximity/Retroreflective

OPTICAL BLOCKS	IR	RED	WHITE
O1, O1G	6 ft.	5.5 in.	N/A
O2	3.5 in.	3.5 in.	1.5 in.
V1, V1G	4 in.	4 in.	2 in.
R1	35 ft.	30 ft.	N/A

NOTE: Proximity test utilized a 90% reflective white target. Retroreflective tests utilized a 3˝ diam. round reflector, Model AR-3

Glass Fiberoptics Opposed Mode

F1	6 ft.	5.5 in.	N/A
F1 w/lens	20+ ft.	20+ ft.	9 ft.

Glass Fiberoptics Proximity Mode

F1	6 in.	4.5 in.	1.75 in.
F1 w/lens	1 ft.	1 ft.	1 ft.

NOTE: Range tests utilized a .125˝ diam. fiberoptic bundle

Specifications

SUPPLY VOLTAGE:
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS:
- 65 mA (exclusive of load)

OUTPUTS:
- (1) NPN and (1) PNP open collector output transistors
- Sensor outputs can sink or source up to 150 miliamps (current limited)
- All outputs are continuously short circuit protected

COMMUNICATIONS PORT:
- RS-232 I/O
- Baud Rate 19.2k

LED LIGHT SOURCE:
- Options: Infrared = 880nm, Red = 660nm, or White = Broadband Spectrum

LIGHT IMMUNITY:
- Responds to sensor's pulsed modulated light source resulting in high immunity

INDICATORS:
- Red LED output indicator illuminates when the sensor's output transistor is "ON", NOTE: If Output LED flashes, a short circuit condition exists.
- Yellow ACT™ indicator – illuminates when contrast deviation fails to rise above "8" in the light state condition or fails to go below "2" in the dark state condition. Indicates performance approaching marginal level.
- 10 LED Contrast Indicator – displays scaled readings of sensor's response to contrasting light levels (light vs. dark)

AMBIENT TEMPERATURES:
- -40° C to +70° C (-40° F to +158° F)

RUGGED CONSTRUCTION:
- Chemical resistant high impact polycarbonate plastic housing
- Waterproof rating: NEMA 4X, 6, IP-67
- Conforms to heavy industrial grade CE requirements

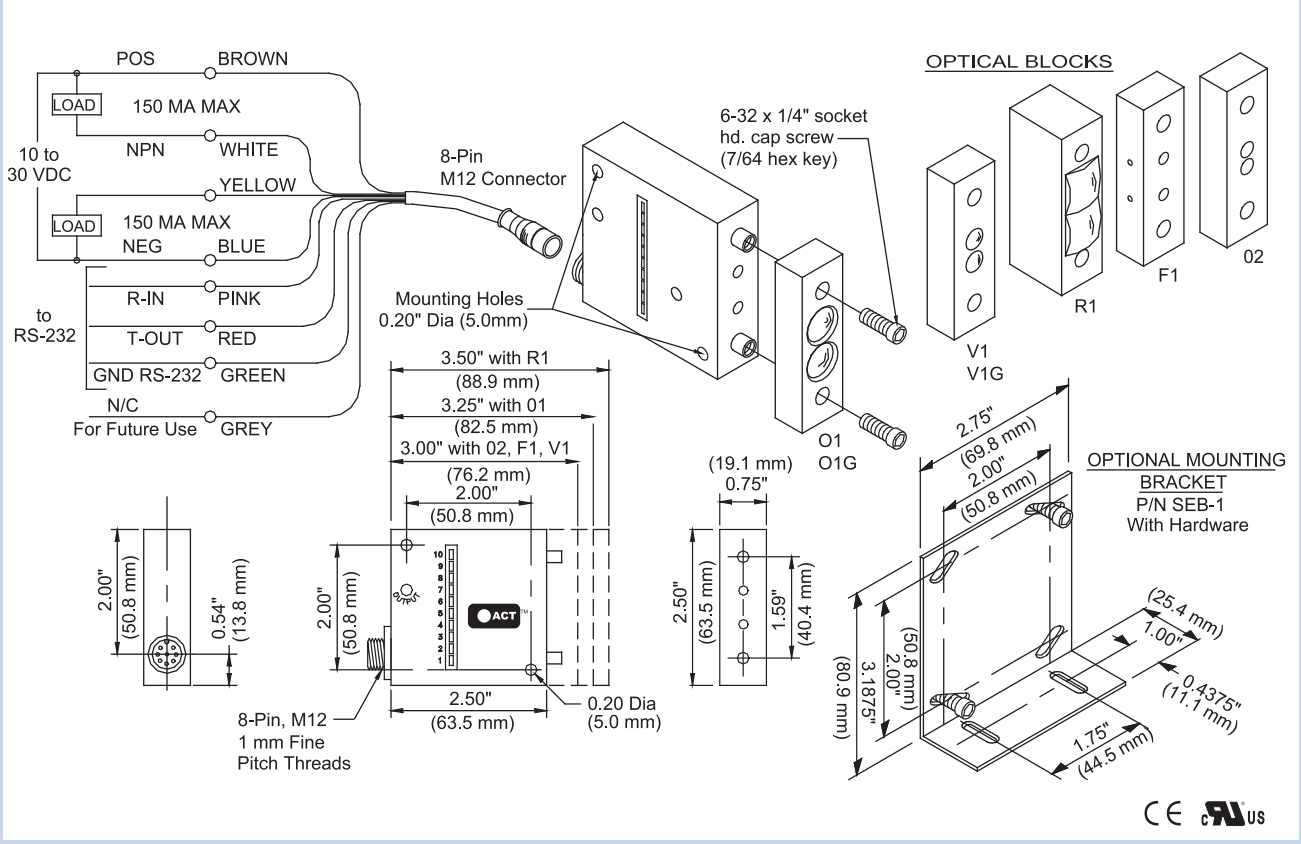
The DCS® Sensors are compatible with computers, PLC's, imbedded controllers, or any controlling device equipped with an RS-232 serial port.

EYEWARE software and ASCII command set available online (free).

(Patent No. 6,950,778)

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions SMARTEYE® DCS®



Optimized for Label Detection
AUTOSET™ Setup
Low Cost

LABEL•EYE®

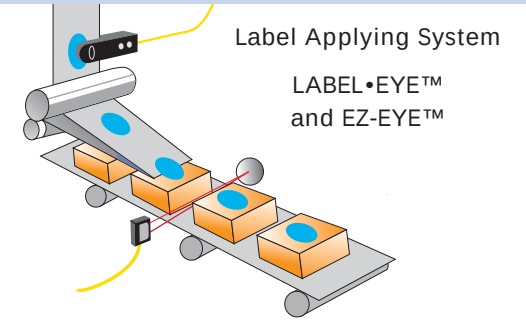
Opacity Mode Special Purpose Sensor

Designed specifically for the detection of labels

The LABEL•EYE® is a photoelectric sensor designed specifically to sense labels on a roll. Since the LABEL•EYE is an automatic one-touch sensor and not the conventional "teach mode" sensor, set-up is simple. Position the gap between the labels directly under the sensor's sight guide and push the AUTOSET™ button. The sensor does the rest, adjusting itself to the perfect setting. Sensing labels has never been easier.

Other Possible Uses:

- Double sheet detection
- Envelope contents sensing
- Edge guiding
- Splice detection
- Label counting
- Unwinder, Rewinder
- Die cutter
- Label hot-printing
- Rotary die cutting and converting
- High speed dispensing



The Label Applicator Process

The LABEL•EYE is a special purpose gap or slot sensor optimized to sense adhesive labels adhering to a roll of backing paper. The web of labels is directed from a “roll” across a peeler plate or around a sharp edge. As the web passes around the sharp edge of the peeler plate, the adhesive label dislodges from the backing material. The function of the LABEL•EYE is to look through the backing paper to detect the "gap" between the labels and signal the labeling machine to stop the dispensing mechanism before the label is completely dislodged from the backing material. With the next "up" label protruding off the end of the peeler plate, it is now perfectly positioned to be applied to the next product as it passes by on a conveyor.

The LABEL•EYE operates on 10 to 30 VDC and is pulse-modulated to prevent any problems from ambient light. Although designed for label detection, the LABEL•EYE can be useful in a variety of applications.

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45 mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP output transistors
- Sensor outputs can sink or source up to 150 mA (current limit)
- All outputs are continuously short circuit protected

RESPONSE TIME
- Light state response = 100 microseconds
- Dark state response = 100 microseconds

LED LIGHT SOURCE
- High intensity red LED
- Pulse modulated

PUSH BUTTON CONTROL
- Automatic setup routines based on web opacity
- One push button setup
- Pushing both buttons simultaneously inverts output

HYSTERESIS
- Minimal hysteresis promotes the detection between the backing material and the label depending on the settings

LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source, resulting in high immunity to most ambient light

INDICATORS
- Green LED flashes when AUTOSET™ routine is activated and stays illuminated when AUTOSET™ is completed
- Red LED illuminates when sensor's output transistors are "ON". NOTE: The status of the output transistors can be inverted by pushing both buttons simultaneously. If Output LED flashes, a short circuit condition exists.

AMBIENT TEMPERATURE
- –40°C to 70°C (-40°F to 158°F)

RUGGED CONSTRUCTION
- Chemical resistant high thermoplastic PPS housing
- Waterproof, ratings: NEMA 4 and IP66
- Conforms to heavy industry grade CE and UL requirements

How To Specify:

Example:

LER – Red LED, 4 conductor cable

LERC – Red LED, 4 pin Nano connector, M8

4-Wire Nano Cable, M8

GEC-6
6' (1.8 m) cable with connector

GEC-15
15' (4.6 m) cable with connector

GEC-25
25' (7.6 m) cable with connector

RGEC-6
6' (1.8 m) cable / right angle conn.

RGEC-15
15' (4.6 m) cable / right angle conn.

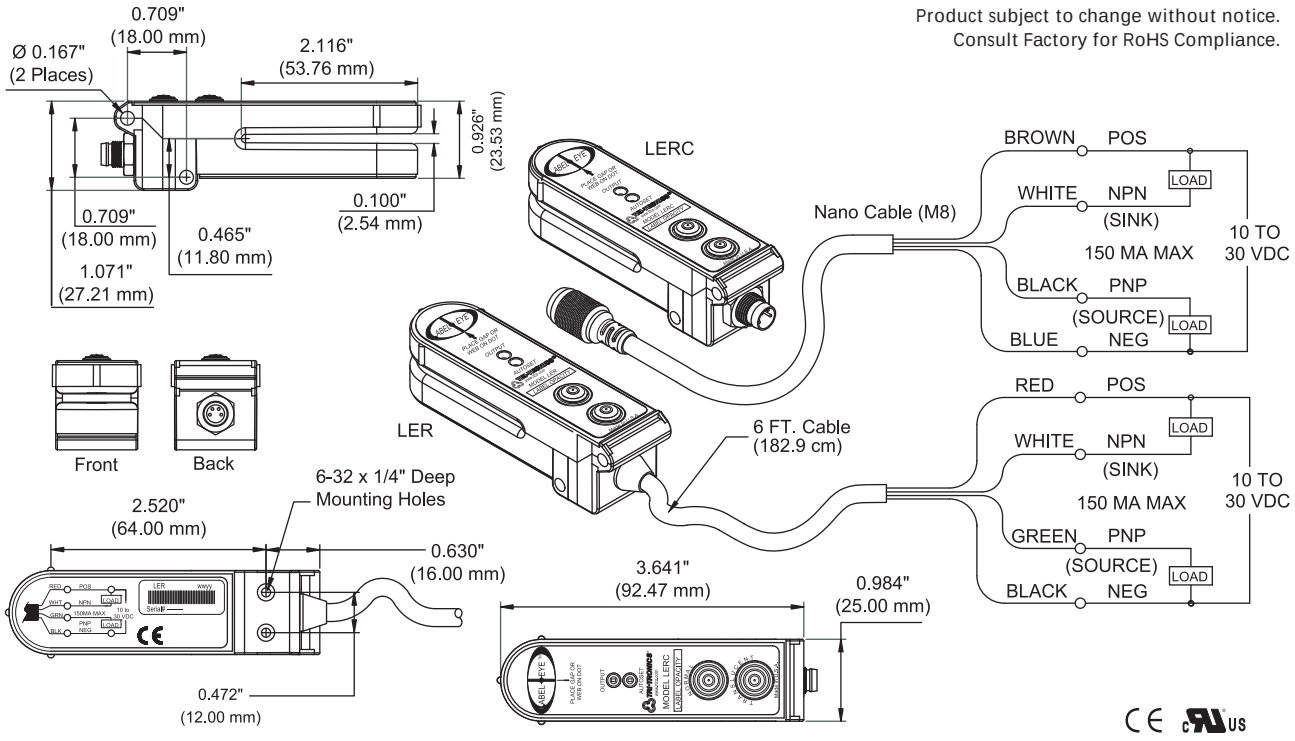
GEX-9
9' (2.7 m) extension cable

NOTE: Red flashing LED — Short circuit condition exists
Green flashing LED — No contrast through web

Connections and Dimensions

LABEL•EYE®

Product subject to change without notice.
Consult Factory for RoHS Compliance.



Extreme High-Intensity Sensors Thru-Beam and Fiberoptic Penetrates Many Packaging Materials for Content Verification

SMARTEYE®

High-Intensity Sensors

The Model HSLS-12 Super High Intensity Light Source has been added to the SLS Series product line. The Light Source emits 10 times the optical power, enabling it to easily penetrate cardboard or plastic containers. Applications include verification of container contents, proper fill levels or overlap splice detection of dense materials.

SMARTEYE® Light Sources and Receivers have been designed to perform Beam Break or thru-beam sensing tasks where the material or container is dense, the lens is subject to contamination buildup, or for long range sensing in harsh environments. A complete system includes a Dual LED High-Intensity Light Source and a Complementary Receiver.

SMARTEYE®

HIGH INTENSITY

Super High Intensity Light Source provides 10X the Optical Power!

Features

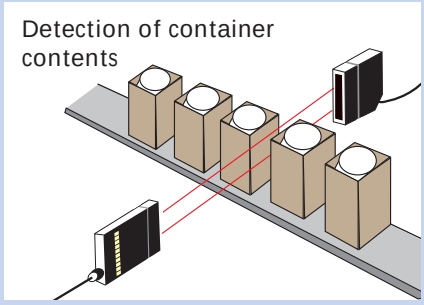
- Unique CONTRAST INDICATOR™ allows easy set-up for optimum performance and displays actual performance during operation
- Dual LED high-intensity design
- Pulse modulated for high immunity to ambient light
- Complementary NPN or PNP output transistors
- 800 microseconds – Beam Make or Beam Break

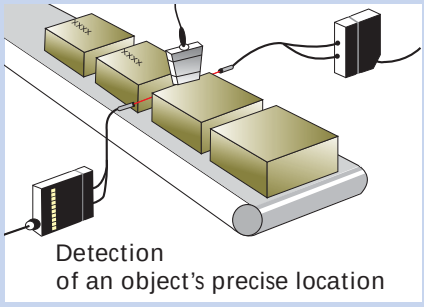
Sees through many packages

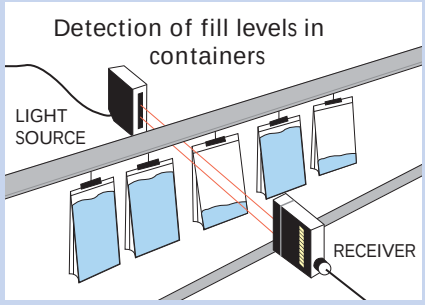
Fiberoptic Light Guides

Flexible Fiberoptic Light Guides are available in sizes small enough to fit into your toughest job sensing sites, with models for inaccessible places, detection of extremely small parts, high temperature applications, corrosive environments, or high vibration locations, as well as straight light guides for opposed mode (Beam Make) and bifurcated light guides for proximity sensing.

Typical Applications







Model Selection & Specifications

SMARTEYE®

HIGH INTENSITY

Receiver Specifications

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity protected

CURRENT REQUIREMENTS
- 50 mA (exclusive of load)

OUTPUTS
- Complementary NPN or PNP output transistors sink/source up to 100 mA

RESPONSE TIME
- 800 microseconds – Beam Make or Beam Break

HYSTERESIS
- 400 millivolts – maximum sensitivity and resolution

LIGHT IMMUNITY
- Extremely high immunity to ambient light – sensor responds to pulse modulated light only

LED INDICATOR
- When the light level reaching the photodetector exceeds “5” on the Contrast Indicator, the output switch, and the output LED indicator illuminates

CONTRAST INDICATOR
- Displays the receiver’s full and complete response to contrasting light levels (lightest state vs. darkest state) on the LED bar graph

AMBIENT TEMPERATURE/RH
- -40°C to 70°C (-40°F to 158°F)
- 95% relative humidity

RUGGED CONSTRUCTION
- High-impact plastic case is dirt and moisture sealed
- Epoxy encapsulated for mechanical stability

High Power Light Source Specifications

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity protected

CURRENT REQUIREMENTS
- Dual LED light source 65 mA
- HSLS-12 light source 70 mA

LED LIGHT SOURCE
- Infrared = 880 nm wavelength
- Model SLS, 2 LED’s; Model HSLS-12, 10 LED’s

AMBIENT TEMPERATURE/RH
- -40°C to 70°C (-40°F to 158°F)
- 95% relative humidity

RUGGED CONSTRUCTION
- High-impact plastic case is dirt and moisture sealed
- Epoxy encapsulated for mechanical stability

CONTAINER CONTENTS DETECTION
Dual LED Light Source Model SLS-1 and Dual Detector Receiver Model SR-1.
This basic system is used without optical blocks. It was designed for closeup thru-beam sensing through dense containers and materials. Applications include detecting the presence or absence of contents in plastic containers or cardboard boxes, detecting overlap splices in dense materials, etc.

LONG RANGE HARSH
ENVIRONMENT PENETRATION
Dual LED Light Source Model SLS-2R1 and Dual Detector Receiver Model SR-2R1.
Type R1 Optical Block which allows the light source and receiver to be placed as far apart as 100'. This system is capable of penetrating severe contamination buildup on the lenses. Applications include detecting opaque objects under the most adverse conditions found in the lumber, paper, and steel industries.

Model Selection, Specifications & Accessories

FIBEROPTIC BEAM BREAK DETECTION
Dual LED Light Source Model SLS-2F1 and Dual Detector Receiver Model SR-2F1.
Type F1 allows the use of our fiberoptic light guides. Utilizing a bifurcated light guide, the light energy available from the two LED light sources is used to create a very high intensity light beam. The Dual Detector receiver can be used with one bifurcated light guide and one or two straight light guides.

SMARTEYE®

HIGH INTENSITY

Accessories

Model #	Description
F1	Fiberoptic Optical Block
R1	Thru-Beam Optical Block
DCB-1	Light Source Mounting Bracket
SEB-1	Receiver Mounting Bracket; S.S.
CA-1	Conduit Adapter
FSR-1	Flexible Strain Relief
UAC-15	Threaded Long Range Lens

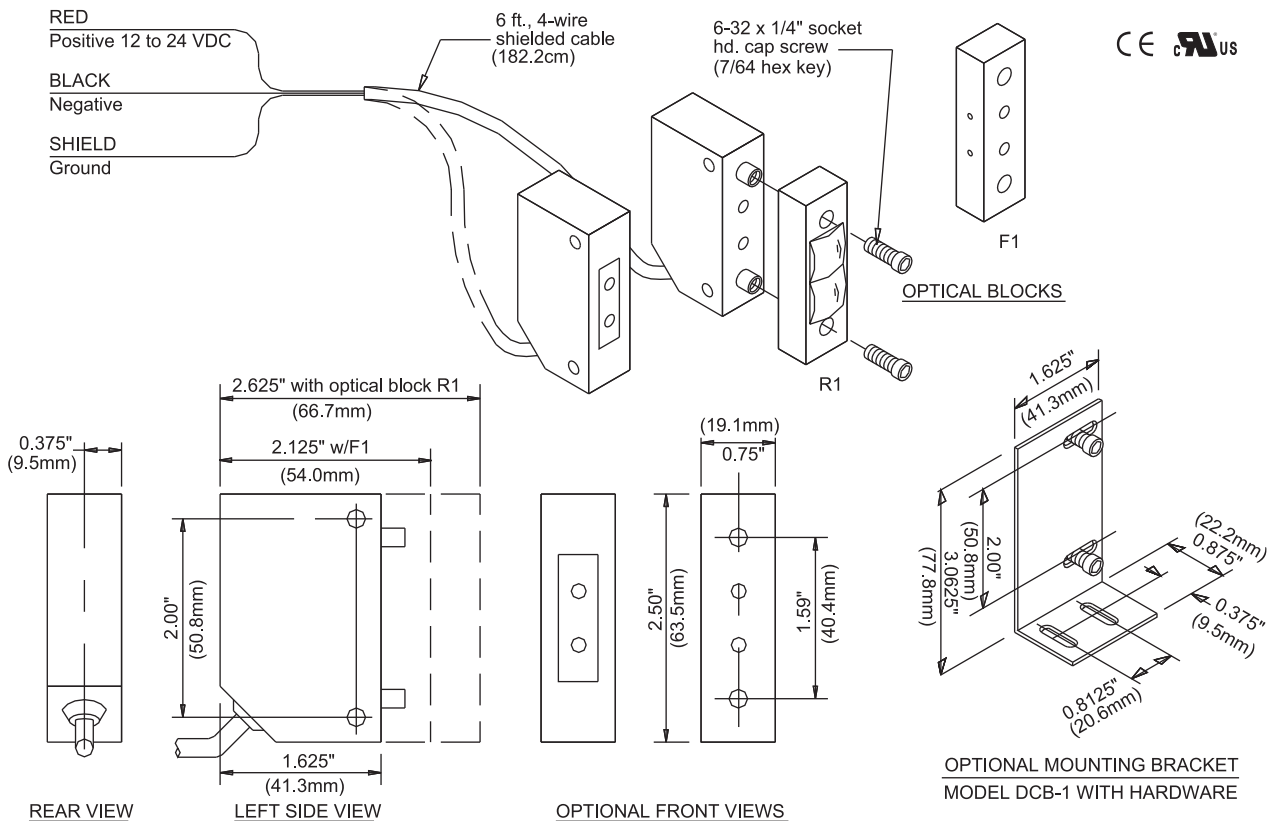
How to Specify

Light sources and receivers are not furnished in pairs and they must be ordered separately.

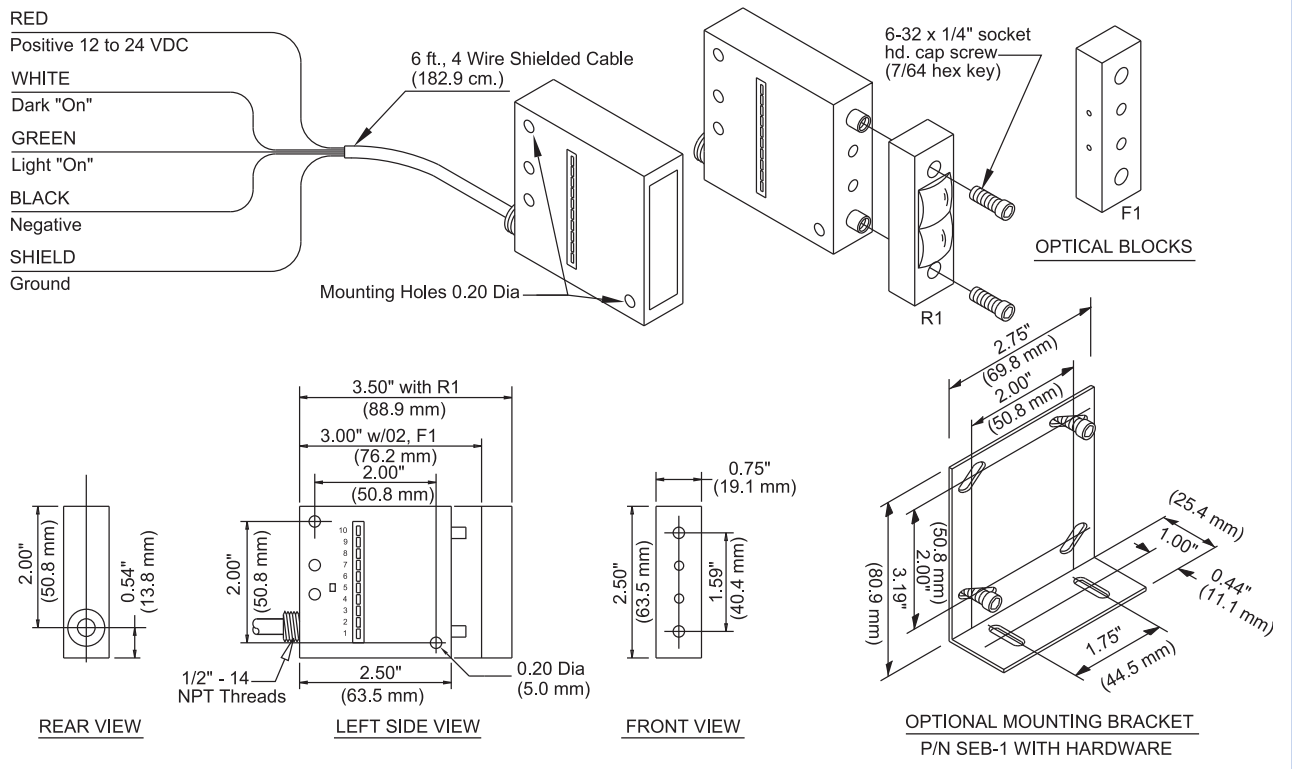
Light Source Model #	Receiver NPN Model #	Receiver PNP Model #	Range Guidelines	Applications
High Intensity Light Sources				
SLS-1	SR-1	PSR-1	Up to 12 in.	Short range, high power opacity sensing. Use in shortest range possible for maximum penetration.
SLS-2R1	SR-2R1	PSR-2R1	Up to 100 ft.	Long range, Beam Break object sensing.
SLS-2F1	SR-2F1	PSR-2F1	Up to 3 ft.	Short range fiberoptic Beam Break sensing.
(with fiberoptic light guide)			without lens	
			Up to18 ft. with lenses	Long range fiberoptic Beam Break sensing. Using 2 UAC-15 lenses.
Super High Intensity Light Sources				
HSLS-12	SR-1	PSR-1	35 ft.	10X Optical power. Verification of container contents, proper fill levels, or overlap splice detection of dense materials.

High Intensity

High Intensity Light Source/Receiver Models



Dual Detector Receivers



High Resolution Registration Mark Sensor
4 LED Color Option
50 Microsecond Response Time

COLOR SMARTEYE® MARK II

High Resolution Registration Mark Sensors

SMARTEYE® COLORMARK™ II Features:

- Built-in Connectors
- Waterproof Housings
- Clutch Knob Adjustment (Offset/EDR)
- Unique 10 LED Contrast Indicator
- Addition of EDR® "Enhanced Dynamic Range"– eliminates hot spot glare effects. Works on the shiniest materials, including foils.
- Optional Pulse Stretcher guarantees a minimum of 10 milliseconds output – ample time for visual LED verification and for the control to respond.
- Choice of light source – green, red, blue, or white.

TRI-TRONICS SMARTEYE® COLORMARK™ II Registration Mark Sensors now combine unique color perception ability with very high speed response. Many important features have been incorporated into the design to meet the increasing demand for precision registration control on today's higher speed packaging machinery.

The specific task of a photoelectric registration mark detector is to respond to printed registration marks on packaging material as they pass through the sensor's light beam. The output of the sensor must switch when the mark arrives precisely in position for the control function to occur. The resolution of the exact location of each passing registration mark is keynote to ensure that the initiation of the electromechanical response triggered by the sensor is in synchronization with the arrival of the mark.

The high speed (50 microseconds) response time of the SMARTEYE® COLORMARK™ II helps to ensure that the point of detection of the sensed mark will not shift as the velocity of the moving web varies from slow startup to maximum velocity.

COLOR REGISTRATION MARK SENSING

Color perception is a must for detecting registration marks printed in a wide variety of colors. Imagine viewing a printed red mark on white paper stock. Now, imagine placing a red transparent filter in front of your eye while trying to view that same red mark. The red mark now becomes difficult, if not impossible, to see. If the sensor was equipped with a red LED, it would have the same problem. Now, imagine viewing that same red mark through a green filter. The white background now appears bright green, but the red mark appears black or very dark. That's the contrast we are looking for. Equipping the sensor with a green LED light source provides the same advantages as the green filter did for your eye. Now, the red mark provides more than adequate response to the contrasting light reflecting off the white background. The SMARTEYE® COLORMARK™ II recommended for detecting the greatest variety of color of marks is equipped with a unique combination of white LED light source and photodetector. In addition, there are SMARTEYE® COLORMARK™ II sensors equipped with red, green or blue LED light sources that are useful in other applications when the preferred white light source fails to perform; i.e., a blue LED light source is recommended to detect pale yellow marks on a white background. Consult selection guidelines to help in specifying the correct SMARTEYE® COLORMARK™ II to fit your sensing requirements.

Setup Guide *Registration Mark Sensing Using Fiberoptic Light Guides*

TRI-TRONICS CMS Series Sensors are easier to set up than conventional color sensors because of their unique built-in Contrast Indicator™. Examples of setup instructions for various materials are shown below.

Opaque Material (Non-Foil)

1. Position fiberoptic light guide to view material looking straight down. (See Fig.1)
2. Place background in view of fiberoptic light guide.
3. Adjust "offset" as follows...

   A – For dark mark on light background, adjust for a reading of "10" on the Contrast Indicator with the background in view.

   B – For light mark on dark background, adjust for a reading of "1" on the Contrast Indicator with the background in view.
4. Set light/dark switch in the position that turns the "mark" indicator off.
5. Move mark into view. Note the new contrast reading. If this reading has deviated from the initial reading by 4 to 5 bars or more, enough contrast exists for proper detection.

Foil Material

1. Position fiberoptic light guide as follows:

   A – For a black or dark mark on shiny foil, position light guide to view material looking straight down.(See Fig. 1)

   B – For white or light mark on shiny foil, position light guide to view material looking on a 45° angle. (See Fig. 2)
2. Place mark in view of fiberoptic light guide.
3. Adjust "offset" as follows:

   A – For black or dark mark on shiny foil, adjust for a reading of "1" when the black mark in view.

   B – For white or light mark on shiny foil, adjust for a reading of "10" when the white mark is in view.
4. Set light/dark switch in the position that turns the mark indicator "ON" when the mark is in view.
5. Move mark out of view. With the background in view, note the new contrast reading. If this reading has deviated from the initial reading by 4 to 5 bars or more, enough contrast exists for proper detection.

Transparent Material

1. Position fiberoptic light guide to view material looking straight down.
2. Place background (transparent area) in view of fiberoptic light guide.
3. Adjust "offset" for a reading of 9 or 10 on the Contrast Indicator.
4. Set light/dark switch in the position that turns the mark indicator off.
5. Move the mark into view. Note the new contrast reading. If this reading has decreased or deviated from the initial reading by 6 to 8 bars or more, enough contrast exists for proper detection.

Hints and Tips:

1. False tripping or erratic operation is usually caused by excessive web flutter, wrinkles or variations in material back ground color or marks. Minor adjustments of the "offset" can help to eliminate erratic operation.
2. If the surface of opaque (non-foil) material is extremely shiny, consider placing fiberoptic light guide into the 45° angle position. (See Fig. 2). The position that results in the maximum contrast deviation as displayed on the Contrast Indicator will give the most reliable performance.
3. A metal guide plate for the material to flow across provides several necessary advantages:
   A – Helps to iron out wrinkles.
   B – Helps to eliminate web flutter.
   C – Provides shiny background when sensing marks on transparent material.

Fig. 1 Straight Position

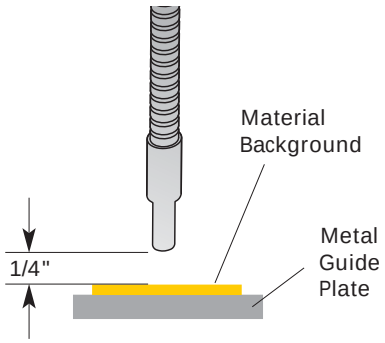
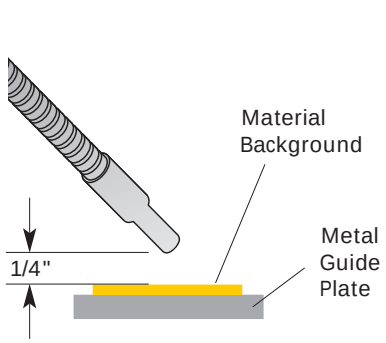


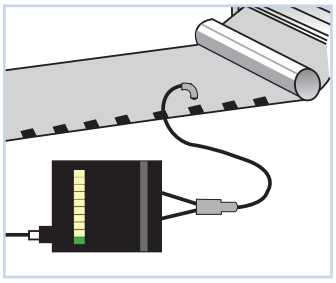
Fig. 2 45º Angle Position



Selection Guidelines

Fiberoptic Models

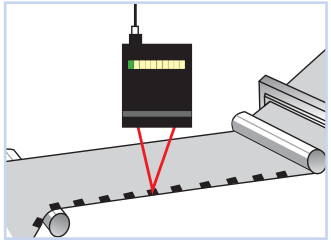
Lensed “V” Axis Models



Preferred Mode: Fiberoptic Reflective (Proximity)

Based upon the characteristics of the web material, the printed mark and the sensing site conditions, the following guidelines will help to select the proper SMARTEYE® COLORMARK™ II to fit your sensing needs.

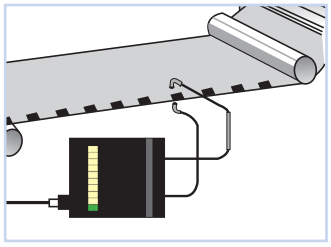
Sensor: Model CMSWL-1BF1 (with Pulse Stretcher) or Model CMSWL-2BF1 (w/o Pulse Stretcher). White Light Source.
Cable: Shielded cable w/connector. Right angle or straight mating connectors available.
Fiberoptic Light Guide: Model BF-A-36T (straight) or Model BF-A-36RT (right angle) as shown above. See Fiberoptic Light Guides section for availability in a wide variety of bundle sizes and shapes.
Sensing Range: From 1/4 to 3/8 in. Optional lenses can be used to extend sensing ranges.
Accessories: Mounting Bracket: Model SEB-1



Alternate Mode (A): Convergent Beam “V” Axis

Optional choice to detect printed registration marks on opaque or translucent packaging materials.

Sensor: Model CMSWL-1BV1G (with Pulse Stretcher) or Model CMSWL-2BV1G (w/o Pulse Stretcher). White light source.
Cable: Shielded cable w/connector. Right angle or straight mating connector available.
Sensing Range: 1 in.
Accessories: Mounting Bracket: Model SEB-1



Alternate Mode (B): Fiberoptic Thru-Beam

Good choice to detect printed registration marks on transparent packaging material.

Sensor: Model CMSWL-1BF1 (with Pulse Stretcher) or Model CMSWL-2BF1 (w/o Pulse Stretcher). White light source.
Cable: Shielded cable w/connector. Right angle or straight mating connectors available.
Fiberoptic Light Guide: Model (2) F-A-36T (straight) or Model (2) F-A-36RT (right angle).
See Fiberoptic Light Guides section for availability in a wide variety of bundle sizes and shapes.
Sensing Range: Recommended 2 to 3 in.
Accessories: Mounting Bracket: Model SEB-1

How to Specify

1. Select Sensor Model based on light source required
   CMS = Green
   CMSR = Red
   CMSB = Blue
   CMSWL = White
2. Select Pulse Stretcher
   -1B = 10ms Pulse Stretcher
   -2B = No Pulse Stretcher
3. Select Optical Block based on mode of operation required
   F1= Fiberoptic
   Range – 1/4" to 3/8" in Proximity Mode
   1/2" to 3" in Opposed Mode
   VIG = 1" V-Axis Glass Lens
   Range – 1"

Example: CMS-1BF1

- CMS: COLORMARK II Green
- 1B: 10ms Pulse Stretcher
- F1: Optical Block

Clutch Knob Adjustment

Accessories

Micro Cable Selection Guide, 4-wire, M12

Yellow Shielded Cable Assemblies

SEC-6
6' (1.8 m) cable with connector

SEC-15
15' (4.6 m) cable with connector

SEC-25
25' (7.62 m) cable with connector

RSEC-6
6' (1.8 m) cable / right angle conn.

RSEC-15
15' (4.6 m) cable / right angle conn.

RSEC-25
25' (7.62 m) cable / right angle conn.

Black Shielded Cable Assemblies (Lightweight)

BSEC-6
6' (1.8 m) cable with connector

BSEC-15
15' (4.6 m) cable with connector

BSEC-25
25' (7.62 m) cable with connector

BRSEC-6
6' (1.8 m) cable / right angle conn.

BRSEC-15
15' (4.6 m) cable / right angle conn.

BRSEC-25
25' (7.62 m) cable / right angle conn.

BX-10
10' (3.1 m) Extension cable

BX-25
25' (7.62 m) Extension cable

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

SEB-1
Stainless "L" Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

(Mark Samples)

Specifications

SUPPLY VOLTAGE
- 12 T0 24 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 85 mA (exclusive of load)

OUTPUT TRANSISTOR
- (1) NPN and (1) PNP output transistor
- NPN: Sink up to 150 mA
- PNP: Source up to 150 mA
- Momentary short circuit protected
- Output transistors turn "ON" when mark is in view
- Anti-pulsing on power-up

RESPONSE TIME
- Minimum duration of input event:
- Light state response: 50 microseconds
- Dark state response: 140 microseconds
- Leading edge variation: less than 20 microseconds

HYSTERESIS
- Less than 400 millivolts for maximum sensitivity and resolution

LED LIGHT SOURCE
- Choice of color:
  A. White - Broadband Spectrum (CMSWL)
  B. Green - 550 nm (CMS)
  C. Blue - 480 nm (CMSB)
  D. Red - 660 nm (CMSR)

LIGHT IMMUNITY
- Pulse modulated to provide extremely high immunity to ambient light

PULSE STRETCHER TIMER (Optional)
- Provides minimum of 10 milliseconds output duration

OFFSET/EDR® CLUTCH KNOB ADJUSTMENT
- Sets initial level on Contrast Indicator in relation to mid-scale switch point of 5 – functions as sensitivity adjustment
- Controls Enhanced Dynamic Range circuit (EDR®) which functions to avoid glare effect

LIGHT/DARK SWITCH
- Dark position for dark mark; Light position for light mark

INDICATORS
- OUTPUT INDICATOR - Red LED illuminates when output transistors are "ON"
- EDR INDICATOR – Intensity of Green LED provides indication of where in the dynamic operating range the offset / EDR adjustment has been set
  FULLY LIT: Operating near saturation
  OFF: Operating near maximum sensing range

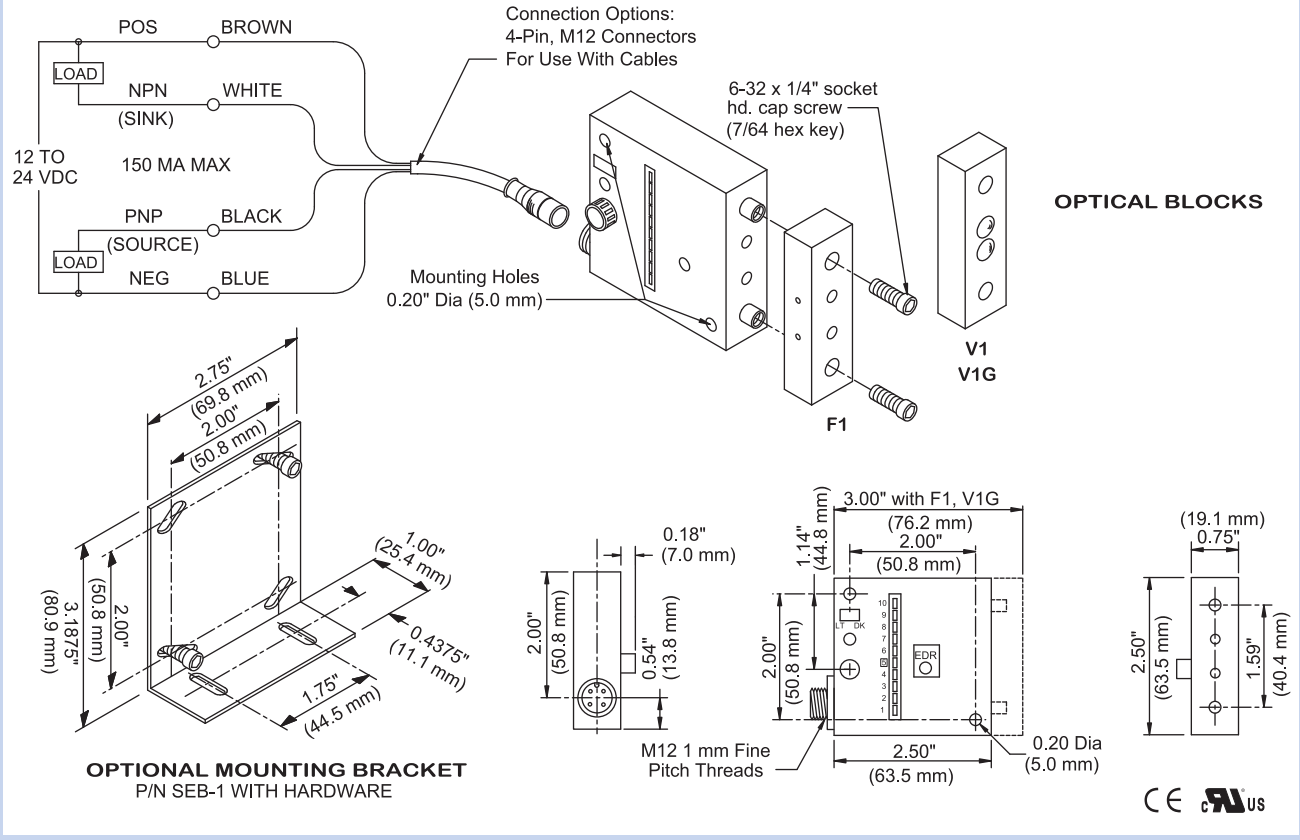
- CONTRAST INDICATOR – Displays returned contrasting light levels (background vs. mark)

AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

RUGGED CONSTRUCTION
- Chemical resistant, high impact polycarbonate housing
- Waterproof, ratings: NEMA 4X, 6P and IP67
- Epoxy encapsulated for mechanical strength

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions SMARTEYE® COLORMARK™ II



Miniature High-Resolution Registration Mark Sensor
White LED
AUTOSET™
Remote Setup Option

MARK·EYE® PRO

High-Resolution Registration Mark Sensor

MARK·EYE® PRO

- See any color mark on any background
- High immunity to all ambient light, including strobes
- 5 LED Contrast Indicator
- "One-touch" AUTOSET™ push-button setup
- Remote AUTOSET™ option
- Lens and fiberoptic light guide options

The MARK•EYE® PRO registration mark sensor was designed to detect printed registration marks on a continuous web. Optimized for high-speed color detection, seeing registration marks on form-fill-seal machinery has never been easier.

The MARK•EYE® PRO sensor was designed to deliver high-resolution performance by utilizing the broadband characteristics of a white light LED for detecting the greatest variety of color combinations on any color background. The "one-touch" AUTOSET™ routine can be accomplished by pushing the appropriate button on the sensor or from a remote push-button switch.

The MARK•EYE® PRO sensor was designed for both the apertured V-axis (V4A) lens or fiberoptic light guides. We recommend using glass fiberoptic light guides for detecting low contrast registration marks. Our *NEW* miniature glass fiberoptic light guides are excellent when you need a tight bend radius or for those hard-to-get-to locations.

Plastic light guides can also be used with this new sensor. A variety of fiberoptic accessory lenses can be used to enhance sensing performance.

Setup could not be easier with the "One-Touch AUTOSET™. Simply put the background in view and press the black button if the background is darker than the registration mark or press the white button if the background is lighter than the registration mark.

MARK•EYE® PRO

High immunity to all ambient light, including strobes

AGS™ AUTOMATIC GAIN SELECT
This unique feature provides automatic digital selection of amplifier gain based upon your sensing requirements.

AUTOSET™ ADJUSTMENT
The AUTOSET™ adjustment routine only requires the push of one button, one time! Even in a dynamic operating condition, with ongoing input events, all you have to do is push the button for a perfect setting.

EDR®
Another unique feature is the digitally-controlled EDR (Enhanced Dynamic Range) circuit. It prevents dark state saturation and expands the operating range without reducing amplifier gain.

REMOTE AUTOSET™
To remotely AUTOSET™ the sensor, apply a momentary contact closure from the AUTOSET™ input wire to negative as shown in the wiring diagram. A remote AUTOSET™ command will duplicate the last manual AUTOSET™.

5 LED DUAL FUNCTION INDICATOR
Contrast Indicator™ – Provides "at-a-glance" performance data.
Status Indicator – Displays status of selectable features:

Lock – When this feature is enabled the sensor becomes tamperproof. Note: The remote AUTOSET™ is not affected by the lock.

Output Invert – Allows the sensor to be programmed for the output transistors to be "ON" or "OFF" when the registration mark comes into view.

Timer – When the "OFF" delay pulse stretcher is enabled, the output duration is extended by 10, 25, or 50 milliseconds (not additive). Enabling the Timer allows ample time for the controller to respond. The time durations of the gap between marks must be less than the selected delay.

HIGH SPEED
175 microsecond response when detecting light or dark marks.

CONNECTIONS
Built-in 12 mm connector or 6' cable.

MOUNTING OPTIONS
Built-in DIN rail "Snap-On" design, through hole, or bracket mount.

Dual Function Bar Graph
Primary function: Contrast Indicator
Secondary function: Status Indicator of 5 selectable options

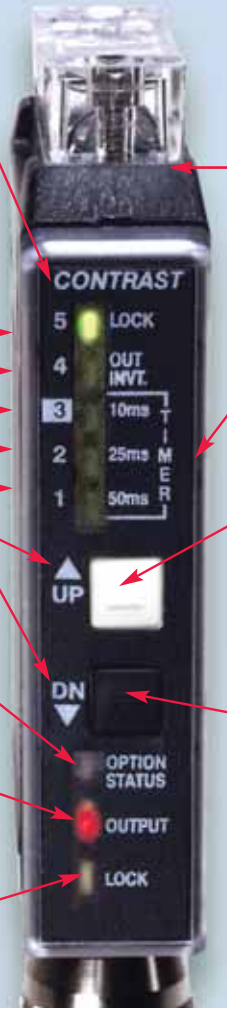
5 Selectable Options
#5 LOCK – for tamperproof operation
#4 Output Invert
#3 10 ms pulse stretcher/"OFF" delay
#2 25 ms pulse stretcher/"OFF" delay
#1 50 ms pulse stretcher/"OFF" delay

Option Status Mode Select
Push both buttons for 3 seconds to switch bargraph display to status indicator of selectable options

Option Status Mode Indicator
Illuminates when in program mode

Output Status Indicator
When illuminated, Option Status Indicator is enabled

Lock Status Indicator
Illuminates when sensor controls are locked



Interchangeable Optical Blocks
Choice of 3 interchangeable optical blocks
1. F4 (Glass fiberoptic light guides)
2. F6 (Plastic fiberoptic light guides)
3. V4A (Apertured V-Axis Convergent lens)

Optional Timer
10, 25, or 50 millisecond pulse stretcher/"OFF" delay

White Push-button - 3 functions
1. Manual "UP" adjustment
2. AUTOSET™ on "light" background
3. Toggle selected option to opposite state and return to normal operation

Black Push-button - 3 functions
1. Manual "DOWN" adjustment
2. AUTOSET™ on "dark" background
3. When in Option Status Mode, tap to desired function to be altered.

Setup Guide *Registration Mark Sensing Using Fiberoptic Light Guides*

TRI-TRONICS MARK•EYE® PRO Series Sensors are easier to set up than conventional color mark sensors because of their unique built-in Contrast Indicator™. Examples of setup instructions for various materials are shown below.

Opaque Material (Non-Foil)

1. Position the fiberoptic light guide to view material looking straight down. (See Fig.1)
2. Place background in view of fiberoptic light guide.
3. Adjust "offset" as follows...
   A. For dark mark on light background, adjust for a reading of "5" on the Contrast Indicator with the background in view.
   B. For light mark on dark background, adjust for a reading of "1" on the Contrast Indicator with the background in view.
4. Set light/dark switch in the position that turns the "mark" indicator off.
5. Move mark into view. Note the new contrast reading. If this reading has deviated from the initial reading by 2 to 3 bars or more, enough contrast exists for proper detection.

Foil Material

1. Position fiberoptic light guide as follows:
   A. For a black or dark mark on shiny foil, position light guide to view material looking straight down. (See Fig. 1)
   B. For white or light mark on shiny foil, position light guide to view material looking on a 20º – 30° angle. (See Fig. 2)
2. Place mark in view of fiberoptic light guide.
3. Adjust "offset" as follows:
   A. For black or dark mark on shiny foil, adjust for a reading of "1" when the black mark in view.
   B. For white or light mark on shiny foil, adjust for a reading of "5" when the white mark is in view.
4. Set light/dark switch in the desired output state.
5. Move mark out of view. With the background in view, note the new contrast reading. If this reading has deviated from the initial reading by 4 to 5 bars or more, enough contrast exists for proper detection.

Transparent Material

1. Position fiberoptic light guide to view material looking straight down without the mark in view.
3. Adjust "offset" for a reading of 5 on the Contrast Indicator.
4. Set light/dark switch in the desired position.
5. Move the mark into view. Note the new contrast reading. If this reading has decreased or deviated from the initial reading by 4 to 5 bars or more, enough contrast exists for proper detection.

Hints and Tips:

1. False tripping or erratic operation is usually caused by excessive web flutter, wrinkles, or variations in material background color or marks. Minor adjustments of the manual Up/Down adjustment can help to eliminate erratic operation.
2. If the surface of opaque (non-foil) material is extremely shiny, consider placing fiberoptic light guide in a slightly angled position. The position that results in the maximum contrast deviation as displayed on the Contrast Indicator will give the most reliable performance.
3. A metal guide plate for the material to flow across provides several necessary advantages:
   A. Helps to iron out wrinkles.
   B. Helps to eliminate web flutter.
   C. Provides shiny background when sensing marks on transparent material.

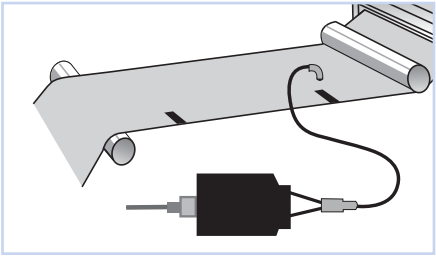


Fig. 1 Straight Position

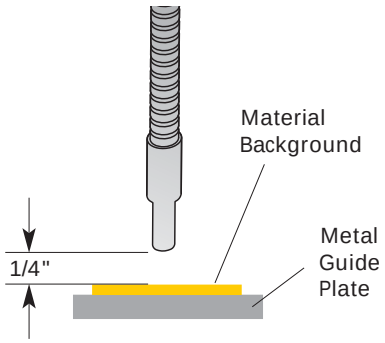
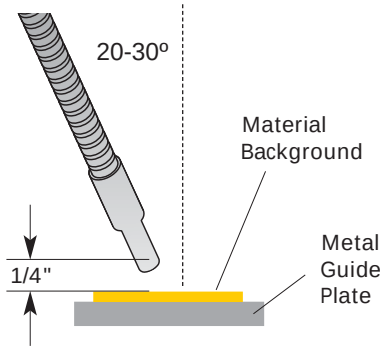


Fig. 2 20-30º Angle Position



White Light Source

(Broadband Color Spectrum)
The "White Light" LED light source built into the MARK•EYE® PRO promotes easy detection of the largest variety of color marks printed on the largest variety of colored web materials. By combining a White LED light source, our Contrast Indicator and the "One-Push" AUTOSET™ setup, you have a winning combination of high performance with an easy to use sensor:

- The best choice for detecting printed registration marks on packaging materials
- The best choice for detecting pale yellow marks on white backgrounds

How to Specify

Model	Description
MEPWL	White LED, 5-conductor, 6' (1.8 m) cable attached
MEPWLC	White LED, 5-pin micro connector (M12)

1. Sensor model: MEP
2. White light source: WL
3. Select Connector
   Blank = 6' Cable, C = Connector
4. Select Optical Block based on sensing mode:
   F4 – Glass Fibers 0.25" (6.4 mm) to 0.50" (12.7 mm) range
   V4A – Apertured V-Axis 0.75" (19.1 mm) to 1.0" (25.4 mm) range
   F6 – Plastic Fibers 0.25" (6.4 mm) range

MARK•EYE® PRO

Example:

M E P W L C F 4

- MEP: MARK•EYE® PRO
- W: White LED
- L: Connector Option
- C: Fiberoptic Optical Block

Hardware & Accessories

- Micro Cable Selection Guide, 5-wire, M12

GSEC-6
6' (1.8 m) Shielded cable

GSEC-15
15' (4.6 m) Shielded cable

GSEC-25
25' (7.62 m) Shielded cable

GSEC-2MU
6.5' (2.0 m) Low-cost, unshielded

GSEC-5MU
16.4' (5.0 m) Low-cost, unshielded

GRSEC-6
6' (1.8 m) Right angle shielded cable

GRSEC-15
15' (4.6 m) Right angle shielded cable

GRSEC-25
25' (7.62 m) Right angle shielded cable

GX-25
25' (7.62 m) extension cable

FMB-1 (8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket

SEB-3
Stainless "L" Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

LK-4
Lens Kit
(See Optical Blocks Accessories for contents)

(Mark Samples)

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45 mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP output transistor
- Outputs sink or source up to 150 mA (current limit)
- All outputs are continuously short circuit protected

REMOTE AUTOSET™ INPUT
- Opto-isolated momentary sinking input (10 mA)

RESPONSE TIME
- Light state response: 175 microseconds
- Dark state response: 175 microseconds

LED LIGHT SOURCE
- White LED provides detection of registration marks of the widest variations of contrasting colors

PUSH BUTTON CONTROL
- AUTOSET™
- Manual Adjustments
- Set status of 5 options: 5) Lock, 4) Output Invert, and Pulse Stretchers 3) 10ms, 2) 25ms, and 1) 50ms

HYSTERESIS
- Set for high resolution; less than one bar on the contrast indicator

LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source, resulting in high immunity to most ambient light and strobes, including indirect sunlight

DIAGNOSTIC INDICATORS
- 5-LED Bar graph functions in one of two modes:
  1. Contrast Indicator displays scaled reading of sensor's response to contrasting light levels (light to dark)
  2. Status Indicator displays status of 5 selectable options
- Red LED output indicator Illuminates when the sensor's output transistors are "ON" NOTE: If Output LED flashes, a short circuit condition exists
- Amber LED Illuminates when in the options select mode
- Yellow LED Illuminates when Lock feature is activated

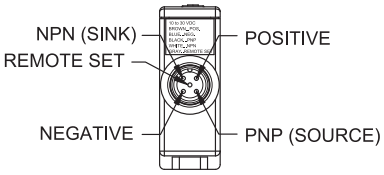
AMBIENT TEMPERATURE
- –40°C to 70°C (-40°F to 158°F)

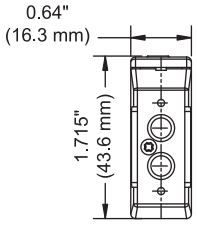
MARK•EYE® PRO

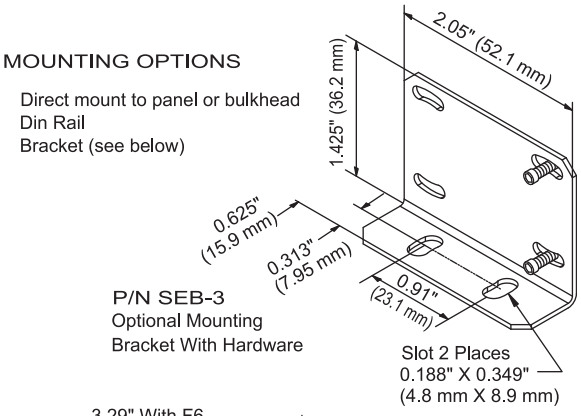
RUGGED CONSTRUCTION
- Chemical resistant high impact poly carbonate housing
- Industry Ratings: NEMA 4X, 6P, IP67

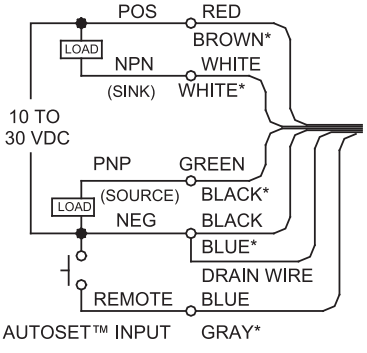
Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions MARK•EYE® PRO

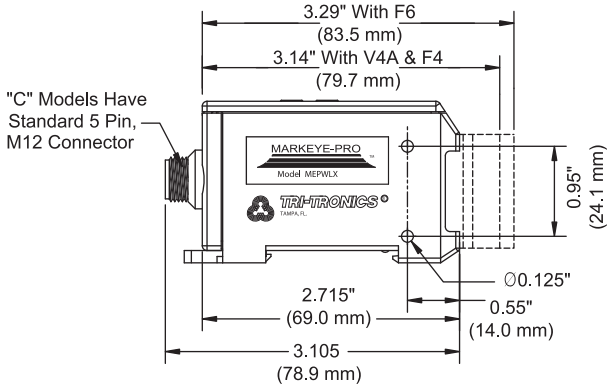








*SENSORS WITH CONNECTORS



Opacity Mode Registration Mark Gap Sensor

One-Touch AUTOSET™
Remote Setup Option
Low Cost

Opacity Mode Registration Mark Gap Sensor

White LED Light Source

- Color mark registration detection on transparent and translucent material, including many metallized films and paper
- Single, one push-button setup
- Includes remote AUTOSET™
- Selectable 15 ms Pulse Stretcher

The Mark•Eye® is a registration mark sensor designed to see printed registration marks on most packaging materials on a continuous web. The "one-touch" setup enables the sensor to be adjusted with a single push of a button. There is no more guess work, making the operator's adjustment procedure easy!

The Mark•Eye® utilizes a white LED light source that is optimized to detect printed registration marks on translucent, transparent, and many metallized films and paper. This sensor is particularly useful on form, fill, and seal machines. Note that most packaging materials (except foil) are translucent! Many of the translucent packaging materials that we have tested allow light to penetrate either the backing material or the registration mark. Because this sensor operates in the opacity sensing mode, the color of the registration mark simply doesn't matter!
Note: Marks as small as 1/16" wide by 1/4" long can be detected, dependent upon web opacity (contrast) and velocity.

The Mark•Eye® operates on 10 to 30 VDC and is pulse modulated to prevent any problems with ambient light. Its design incorporates a white LED light source directing a beam of light across the gap to the receiving lens of a photoelectric detector. In operation, the moving web of packaging material passes through the gap/slot. This sensor can detect registration marks in a wide variety of applications, as long as the size of the mark and velocity meets the capability of the sensor. When the intensity of the light beam transmitted through the web of material is altered by the presence of printed registration mark, the Mark•Eye® will switch its output accordingly.
Note: For metallized film that does not produce the desired response, we recommend sensing with a reflective mode sensor, such as the CMS Series or the Mark•Eye® Pro.

Setup: The Mark•Eye® is an automatic sensor...it is not a conventional "teach mode" sensor. As a result, all that is required to adjust the sensor is to place the web between the marks and push the appropriate AUTOSET™ button one time. The sensor will automatically adjust itself to a perfect setting. The Mark•Eye® will now sense the difference or contrast between the light level penetrating through the web, giving an output when the mark is in view. Provision for a remote AUTOSET™ switch is also provided.

White Light Source

(Broadband Color Spectrum)

The "White Light" LED light source built into the Mark•Eye® promotes easy detection of the largest variety of color marks printed on the largest variety of colored web materials. By combining a White LED light source, our Contrast Indicator, and the one-push AUTOSET™ setup, you have a winning combination of high performance with an easy to use sensor:

- The best choice for detecting printed registration marks on packaging materials
- The best choice for detecting pale yellow marks on white backgrounds

How to Specify

Example:
MEWL
White LED, 5-conductor, 6' (1.8 m) cable attached
MEWLC
White LED, 5-pin micro connector on a 6" pigtail (M12)

Hardware & Accessories

Micro Cable Selection Guide, 5-wire, M12

GSEC-6
6' (1.8 m) Shielded cable

GSEC-15
15' (4.6 m) Shielded cable

GSEC-25
25' (7.62 m) Shielded cable

GSEC-2MU
6.5' (2.0 m) Low-cost, unshielded

GSEC-5MU
16.4' (5.0 m) Low-cost, unshielded

GRSEC-6
6' (1.8 m) Right angle shielded cable

GRSEC-15
15' (4.6 m) Right angle shielded cable

GRSEC-25
25' (7.62 m) Right angle shielded cable

GX-25
25' (7.62 m) extension cable

(Mark Samples)

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45 mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP output transistor
- Sensor outputs can sink or source up to 150 mA (current limit)
- All outputs are continuously short circuit protected

REMOTE AUTOSET™ INPUT
- Opto isolated momentary sinking input (10 mA)

RESPONSE TIME
- Light/Dark state response = 100 microseconds

LED LIGHT SOURCE
- High intensity white LED
- Pulse modulated

PULSE STRETCHER TIMER (Selectabe)
- Provides minimum of 15 millisecond output duration

PUSH-BUTTON CONTROL
- Automatic setup routines based on web opacity
- One push-button setup
- Pushing both buttons simultaneously inverts output

HYSTERESIS
- Minimal hysteresis promotes detection of low contrast registration marks

LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source resulting in high immunity to most ambient light

INDICATORS
- Green LED flashes when AUTOSET™ routine is activated and stays illuminated when AUTOSET™ is completed
- Red LED illuminates when sensor's output transistors are "ON". NOTE: The status of the output transistors can be inverted by pushing both buttons simultaneously.

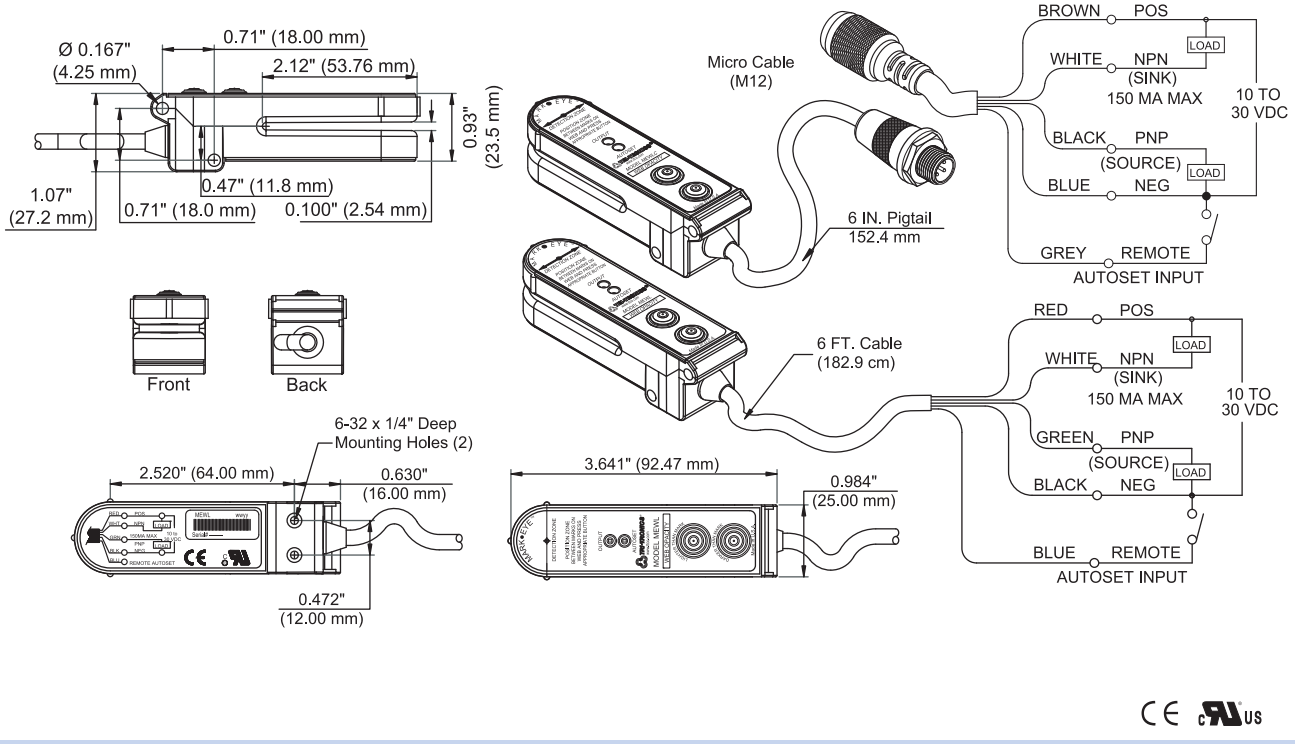
AMBIENT TEMPERATURE
- –40°C to 70°C (-40°F to 158°F)

RUGGED CONSTRUCTION
- Chemical resistant high thermoplastic PPS housing
- Waterproof, ratings: NEMA 4 and IP66
- Conforms to heavy industry grade CE and UL requirements

NOTE: Red flashing LED — Short circuit condition exists
Green flashing LED — No contrast through web

Product subject to change without notice.
Consult Factory for RoHS Compliance.

Connections and Dimensions MARK•EYE®



Fiberoptic Sensing Solutions

Standard Glass Fiberoptic Light Guides

Miniature Glass Fiberoptic Light Guides

NEW! Wider Selection of Plastic Fiberoptic Light Guides

Custom Tips and Lengths

Fiberoptic Light Guides

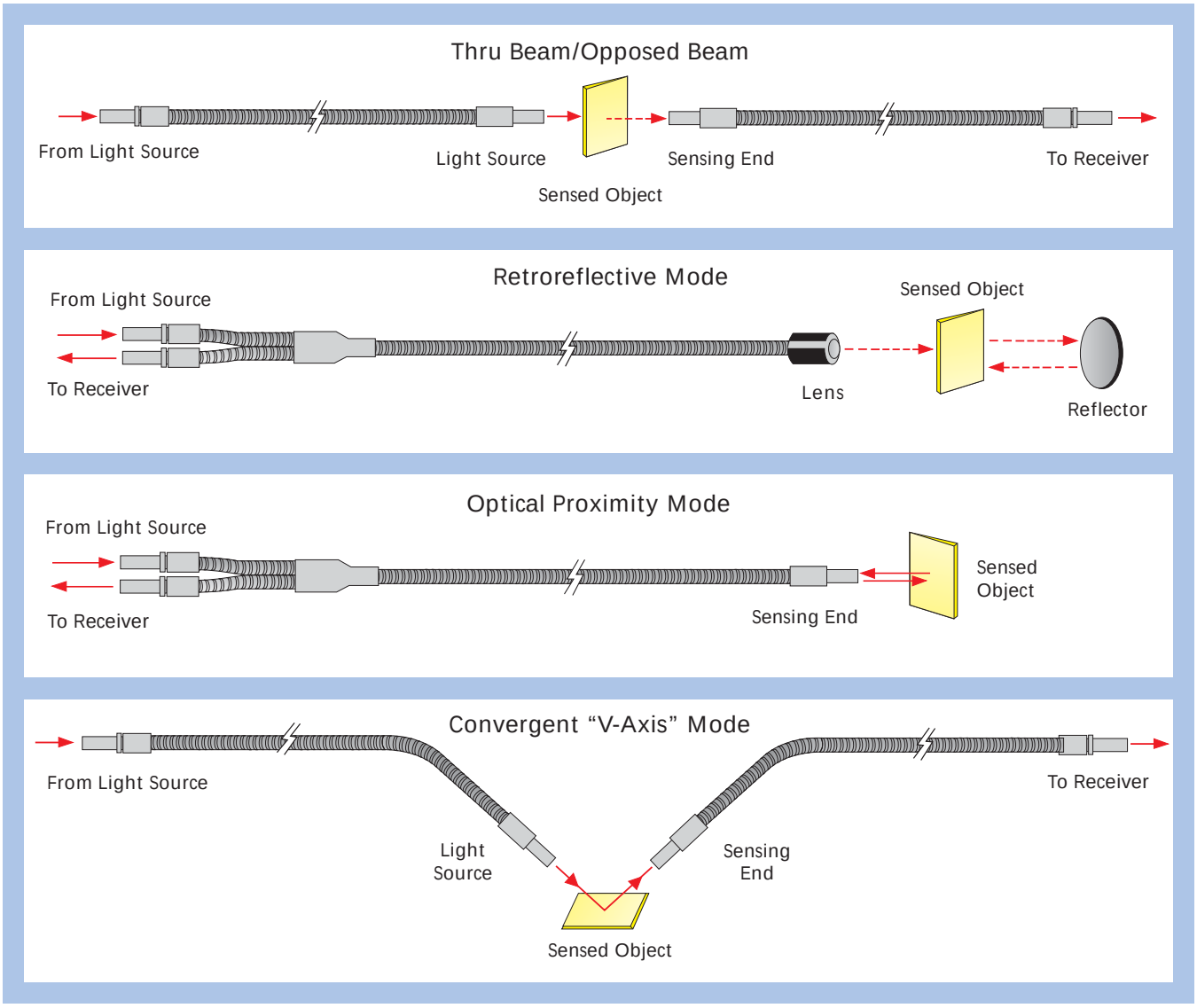
Shine a flashlight into one end of either a flexible plastic or glass fiberoptic light guide and you will see light coming out of the other end. This ability to guide light from one place to another provides many advantages when applied to industrial photoelectric sensing.

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.

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	–	l0 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

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.

TEMPERATURE DESIGNATOR

Blank – Standard Fiber

H – High Temp Fiber

XXXX - X - XXXXXXX

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.

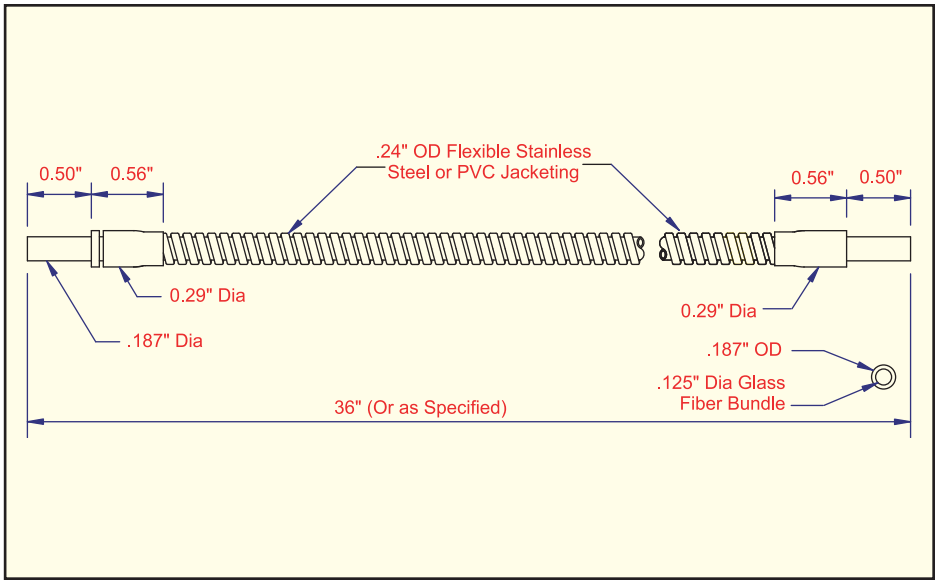
Glass Single Light Guides

Straight Barrel Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-A-36	.125"
F-B-36A	.062"
F-E-36A	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-A-36P	.125"
F-B-36AP	.062"
F-E-36AP	.046"

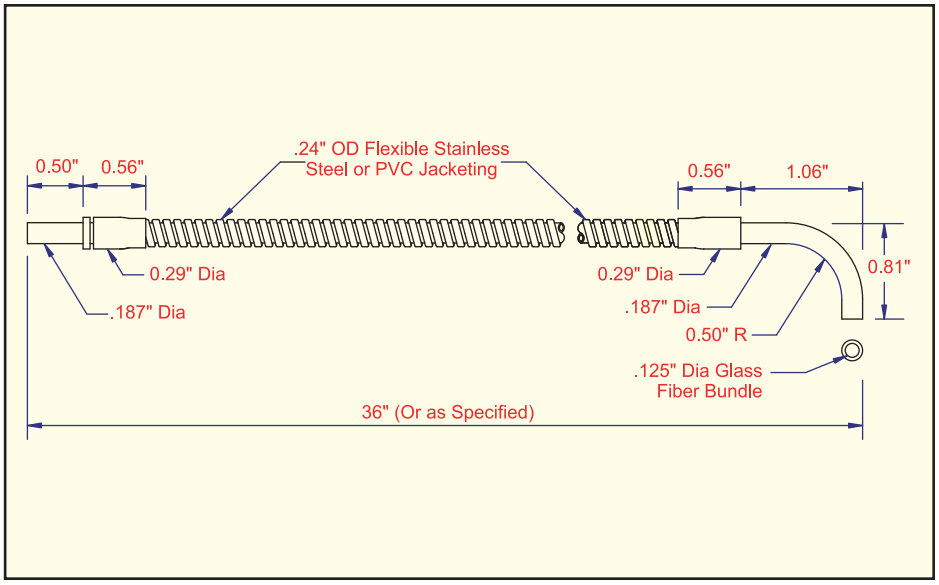


Right AngleTip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-A-36R	.125"
F-B-36AR	.062"
F-E-36AR	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-A-36RP	.125"
F-B-36ARP	.062"
F-E-36ARP	.046"

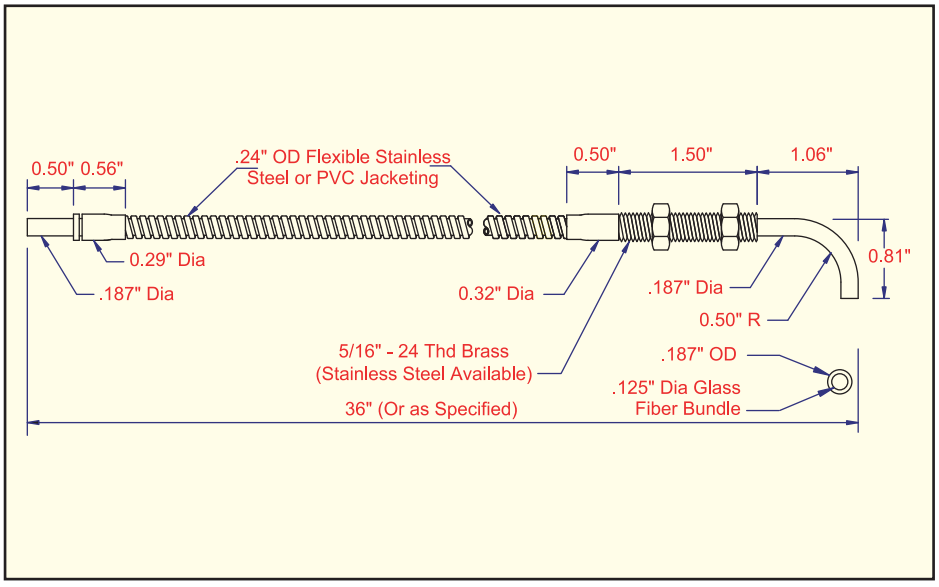


Right Angle Tip, then Threaded
Stainless Steel Jacket

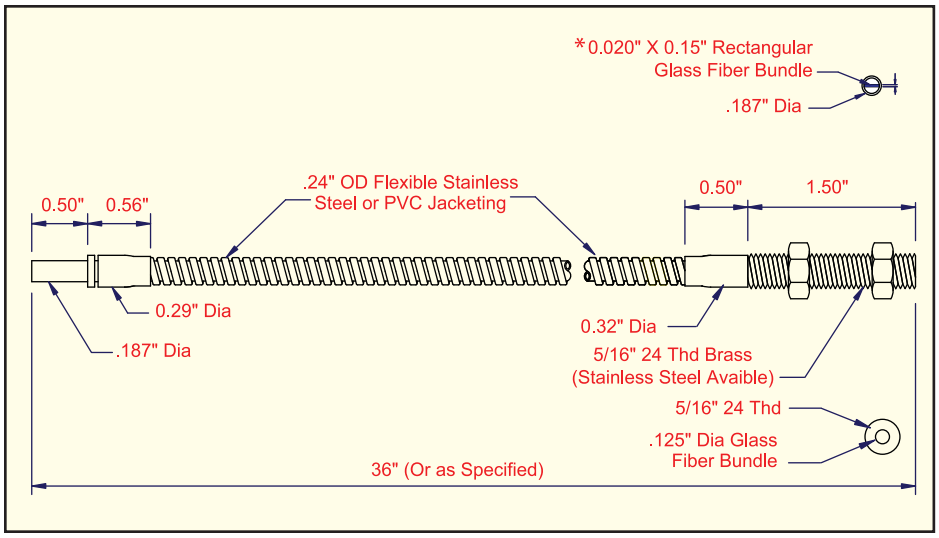
MODEL	BUNDLE SIZE
F-A-36RT	.125"
F-B-36RT	.062"
F-E-36RT	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-A-36RTP	.125"
F-B-36RTP	.062"
F-E-36RTP	.046"



Glass Single Light Guides

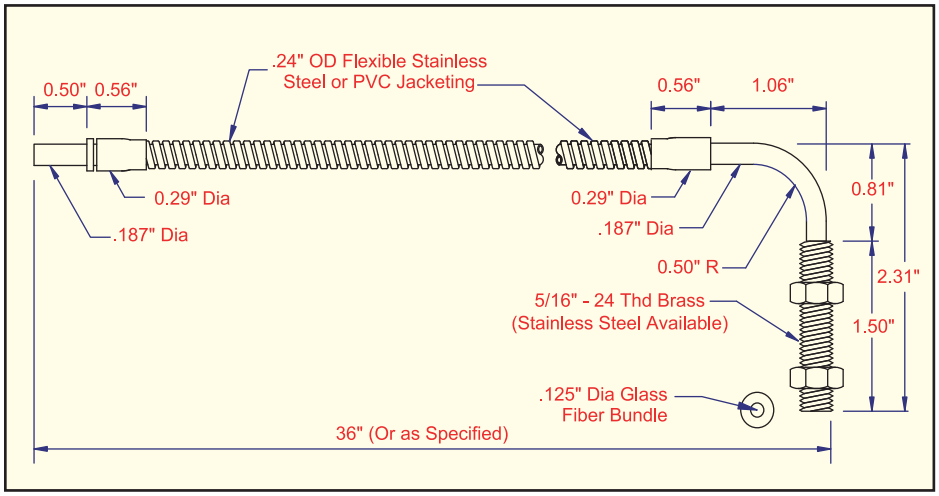


Straight Threaded Tip Stainless Steel Jacket

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

PVC Monocoil Jacket

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

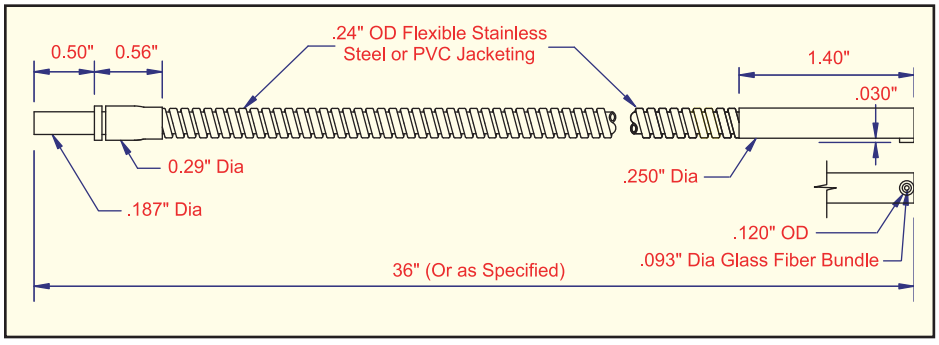


Threaded Tip, then Right Angle Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-A-36TR	.125"
F-B-36TR	.062"
F-E-36TR	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-A-36TRP	.125"
F-B-36TRP	.062"
F-E-36TRP	.046"

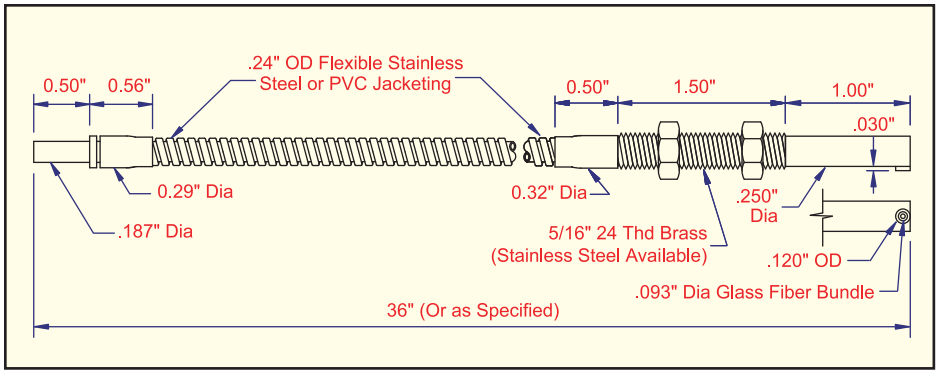


Side View, Right AngleTip Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-A-36RS	.093"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-A-36RSP	.093"



Side View, Right Angle Threaded Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-A-36RST	.093"

NEW!

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-A-36RSTP	.093"

Drawings available at ttco.com

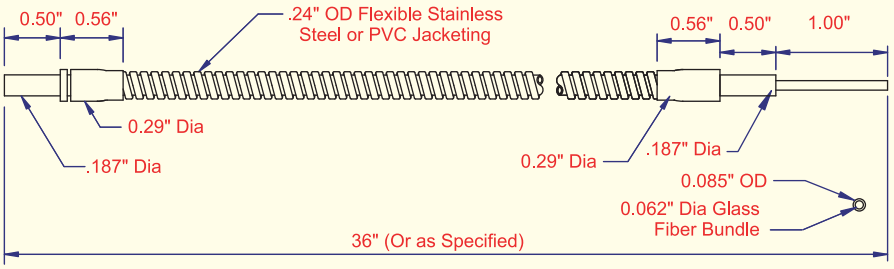
Glass Single Light Guides

Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-B-36	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-B-36P	.062"

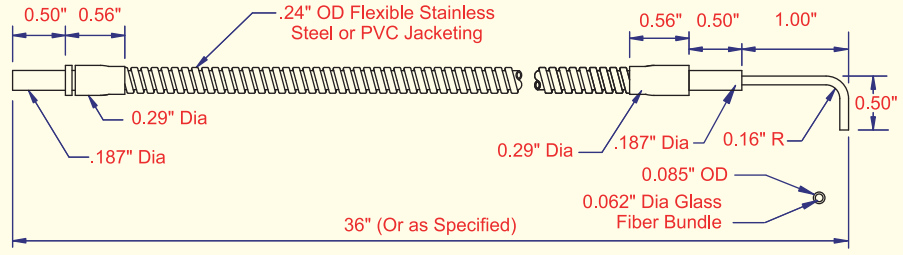


Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-B-36R	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-B-36RP	.062"

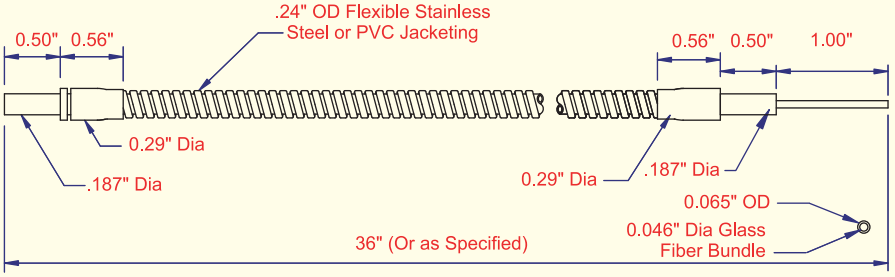


Straight Needle Tip
Stainless Steel Jacket

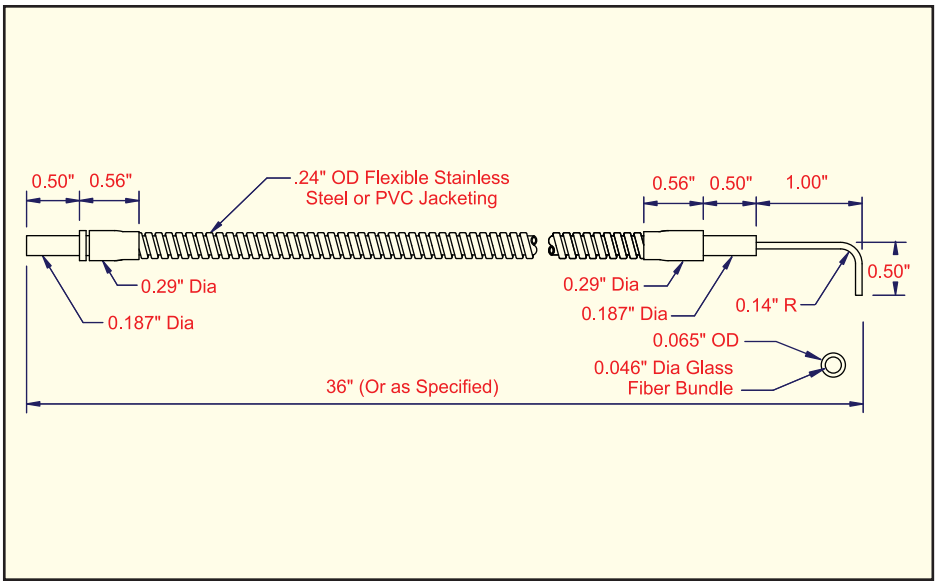
MODEL	BUNDLE SIZE
F-E-36	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-E-36P	.046"



Glass Single Light Guides

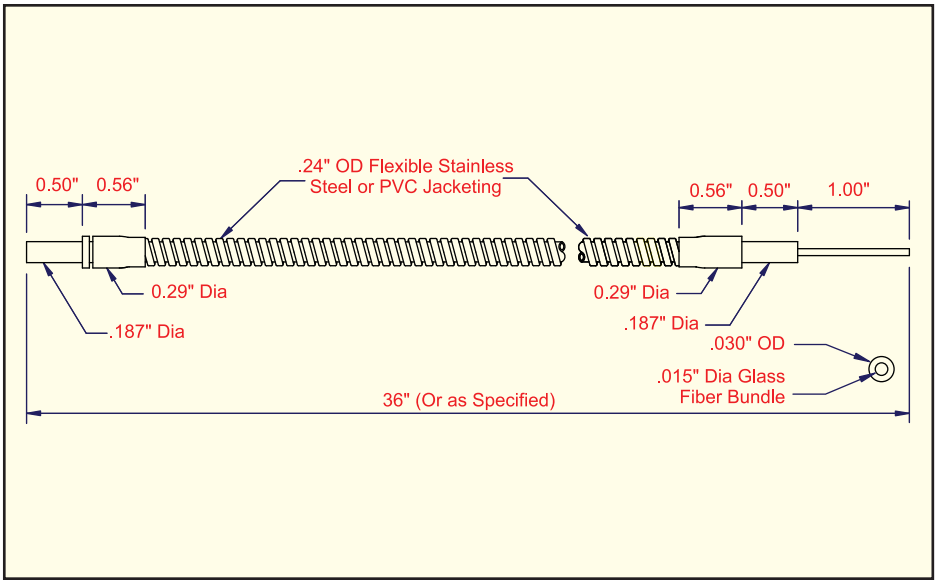


Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-E-36R	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-E-36RP	.046"

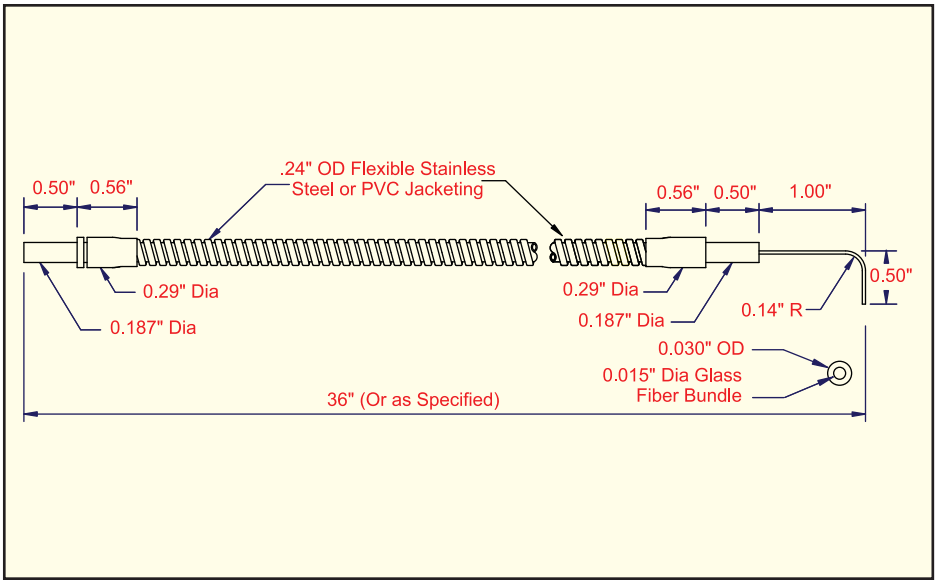


Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-H-36	.015"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-H-36P	.015"



Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-H-36R	.015"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-H-36RP	.015"

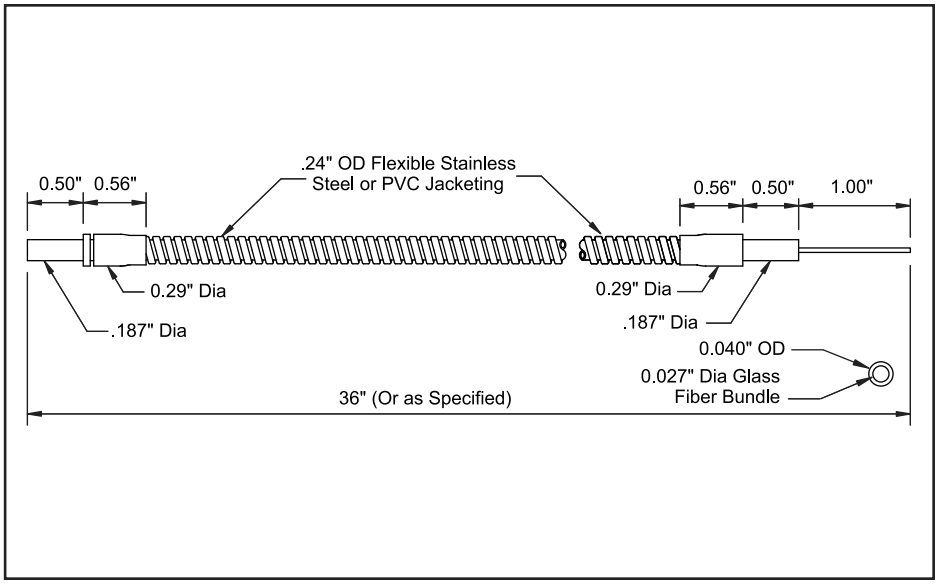
Drawings available at ttco.com

Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-J-36	.027"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-J-36P	.027"

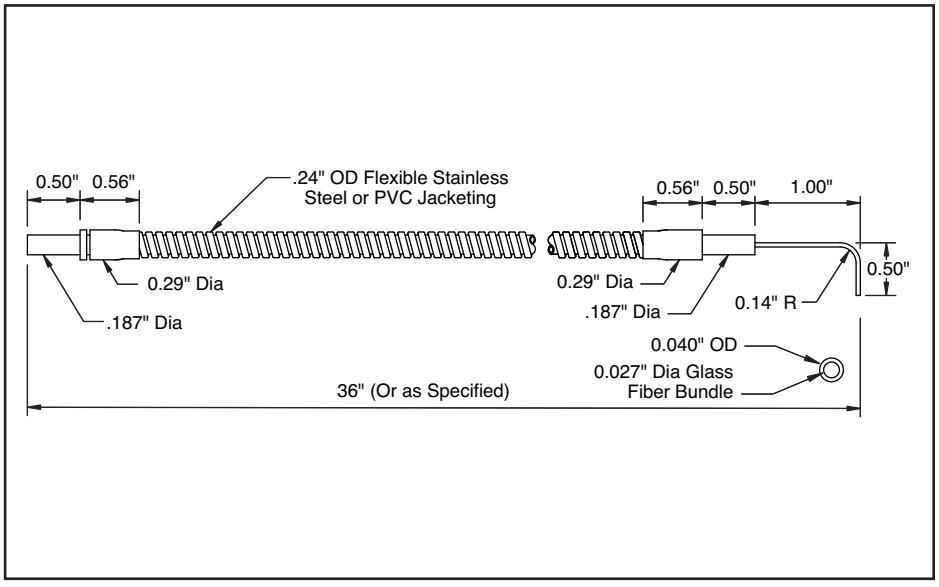


Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-J-36R	.027"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-J-36RP	.027"

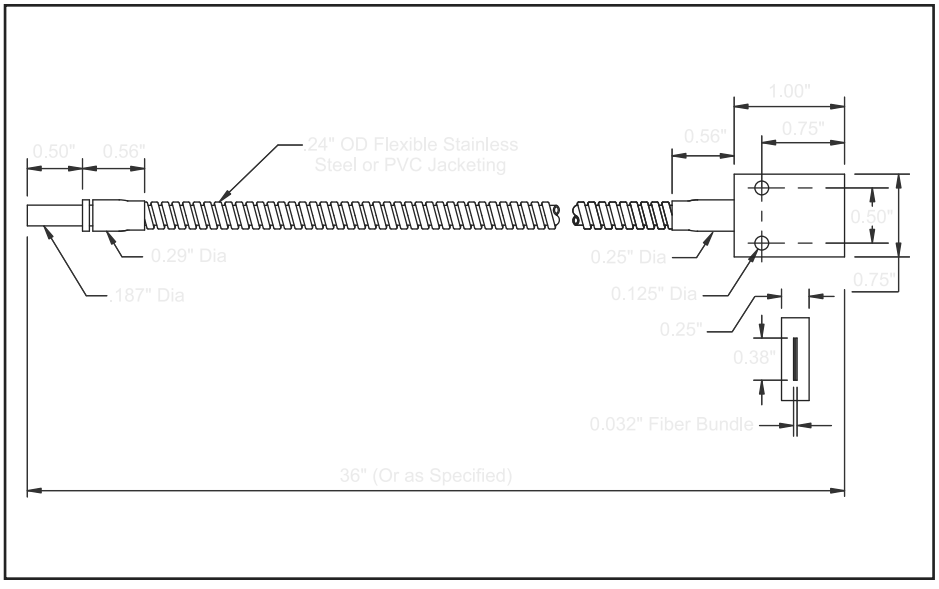


Rectangular Flat Housing
Stainless Steel Jacket

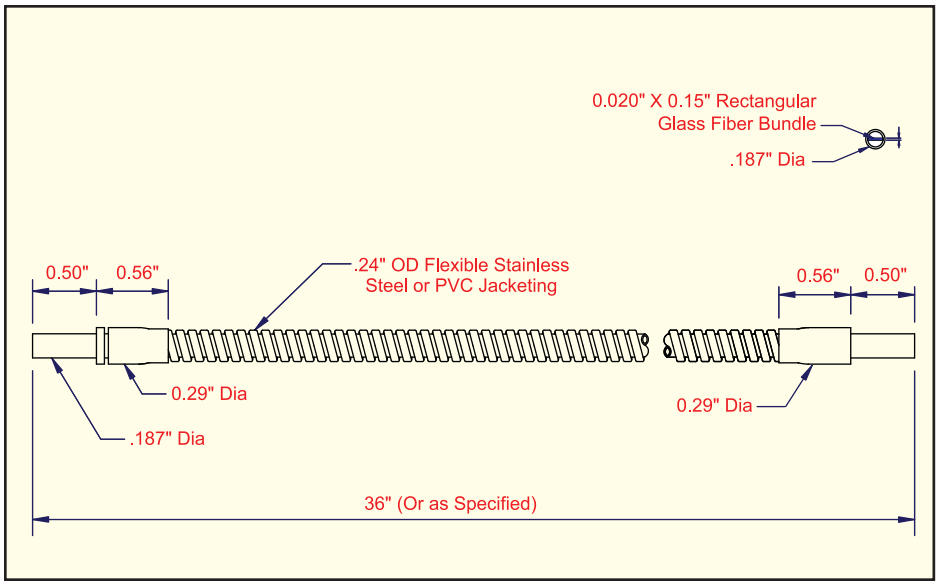
MODEL	BUNDLE SIZE
F-C-36	.032" x .38"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-C-36P	.032" x .38"



Glass Single Light Guides

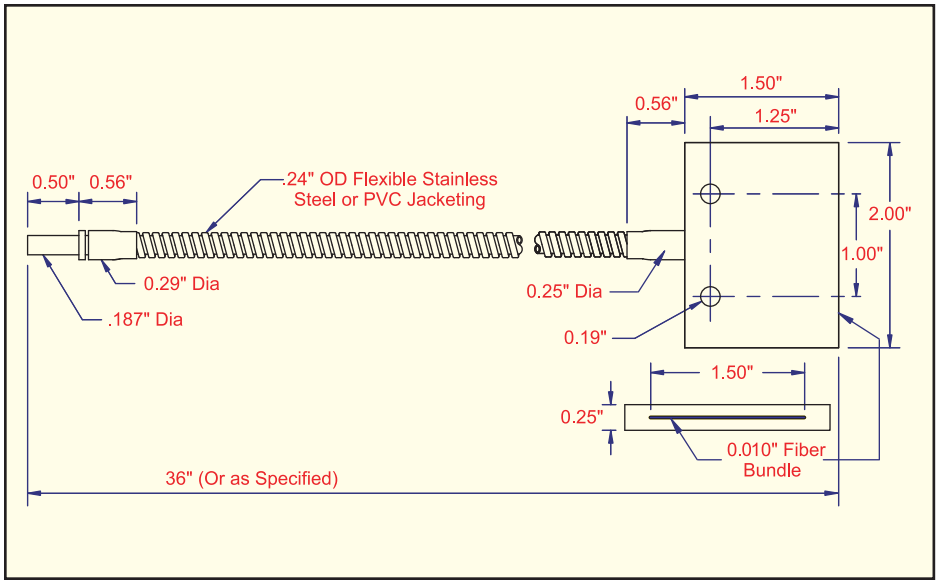


Rectangular Bundle Barrel Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-K-36	.020" x .15"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-K-36P	.020" x .15"

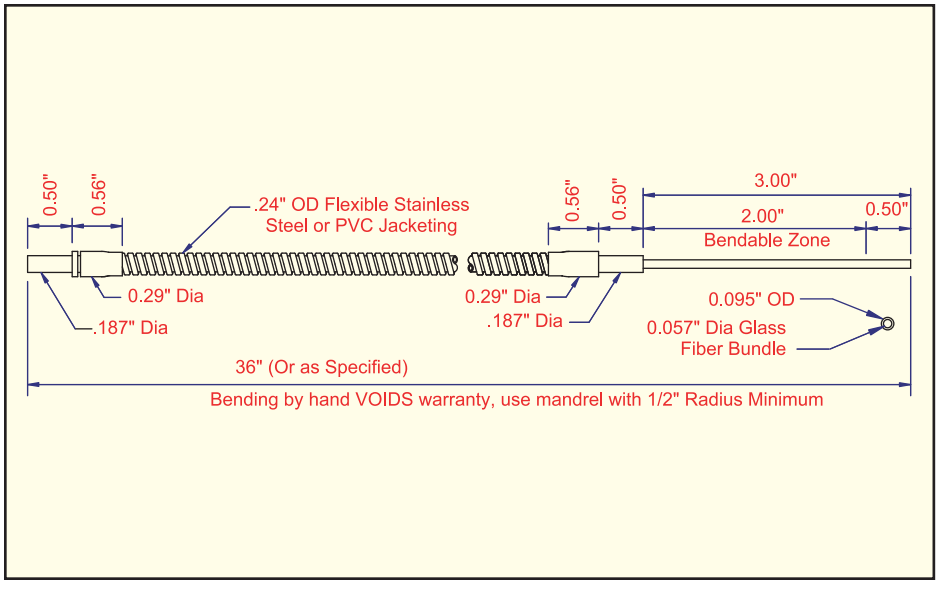


Rectangular 2" Flat Housing
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-P-36	.010" x 1.50"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-P-36P	.010" x 1.50"



3" Long Bendable Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-L-36B	.057"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-L-36BP	.057"

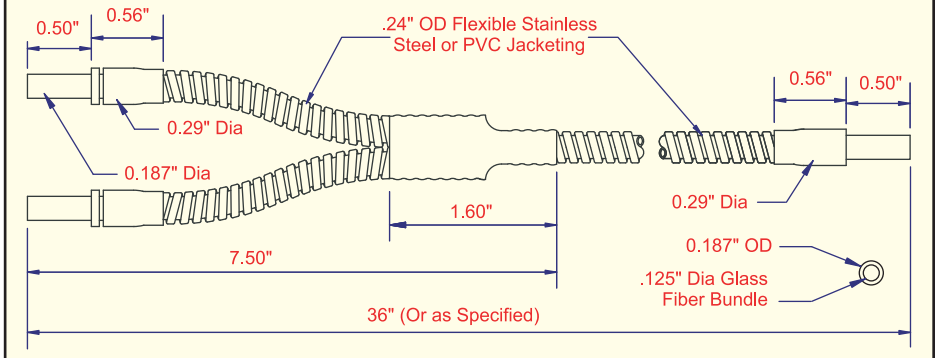
Glass Bifurcated Light Guides

Straight Barrel Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-A-36	.125"
BF-B-36A	.062"
BF-E-36A	.046"
BF-J-36A	.027"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-A-36P	.125"
BF-B-36AP	.062"
BF-E-36AP	.046"
BF-J-36AP	.027"

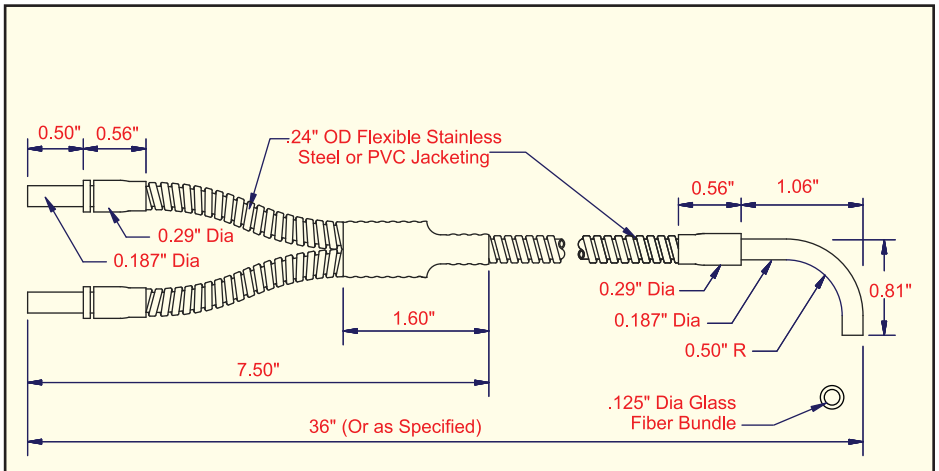


Right Angle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-A-36R	.125"
BF-B-36AR	.062"
BF-E-36AR	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-A-36RP	.125"
BF-B-36ARP	.062"
BF-E-36ARP	.046"

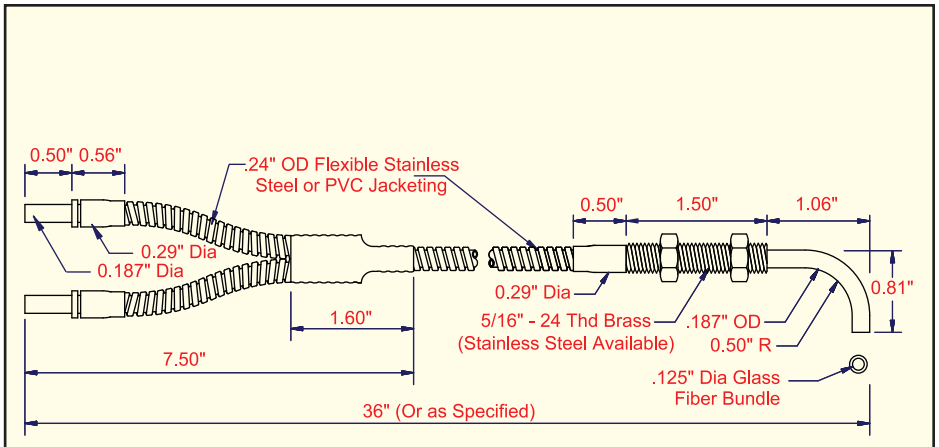


Right Angle Tip,
then Threaded
Stainless Steel Jacket

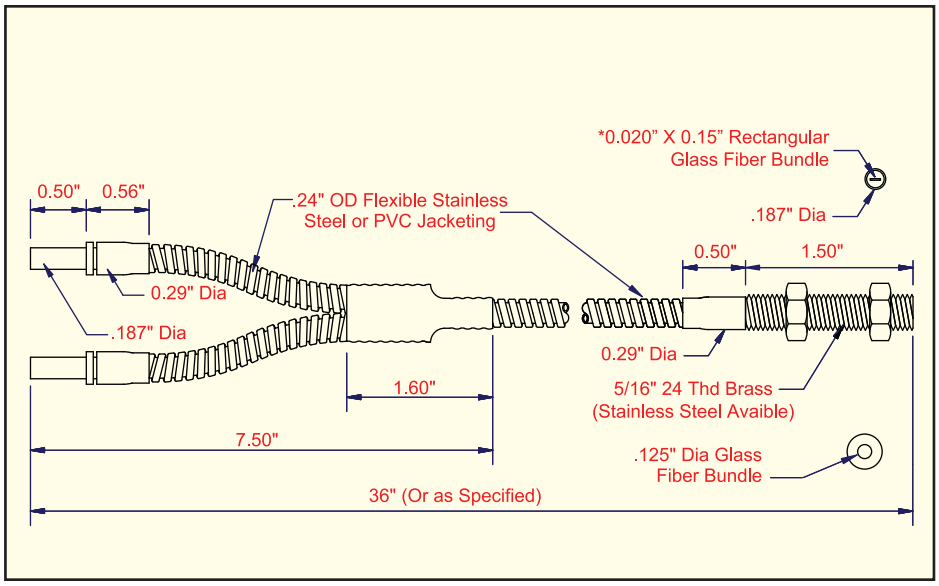
MODEL	BUNDLE SIZE
BF-A-36RT	.125"
BF-B-36RT	.062"
BF-E-36RT	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-A-36RTP	.125"
BF-B-36RTP	.062"
BF-E-36RTP	.046"



Glass Bifurcated Light Guides

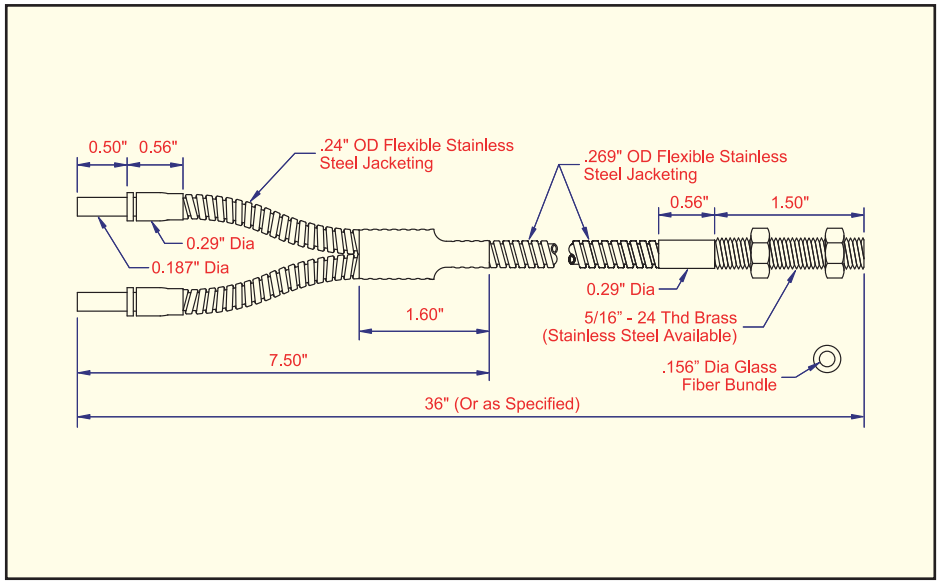


Straight Threaded Tip
Stainless Steel Jacket

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"

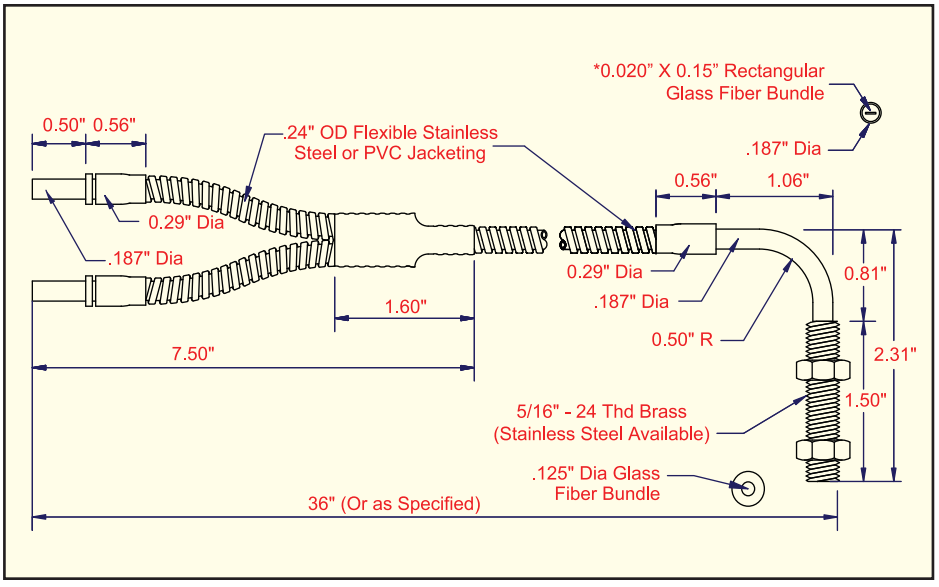
PVC Monocoil Jacket

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"

Drawings available at ttco.com

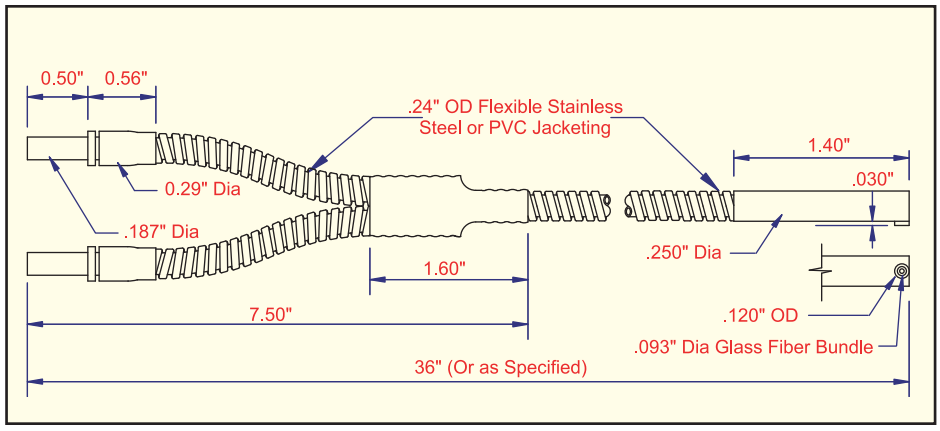
Glass Bifurcated Light Guides

Side View, Right Angle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-A-36RS	.093"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-A-36RSP	.093"



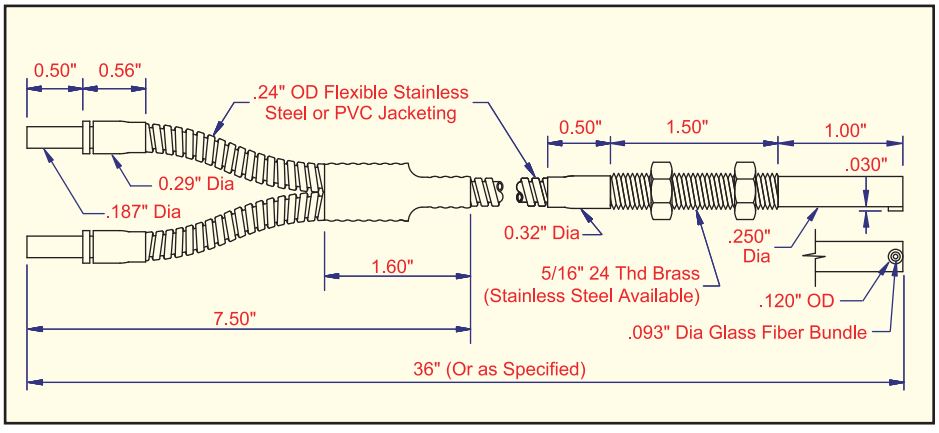
NEW!

Side View, Right Angle Threaded, Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-A-36RST	.093"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-A-36RSTP	.093"

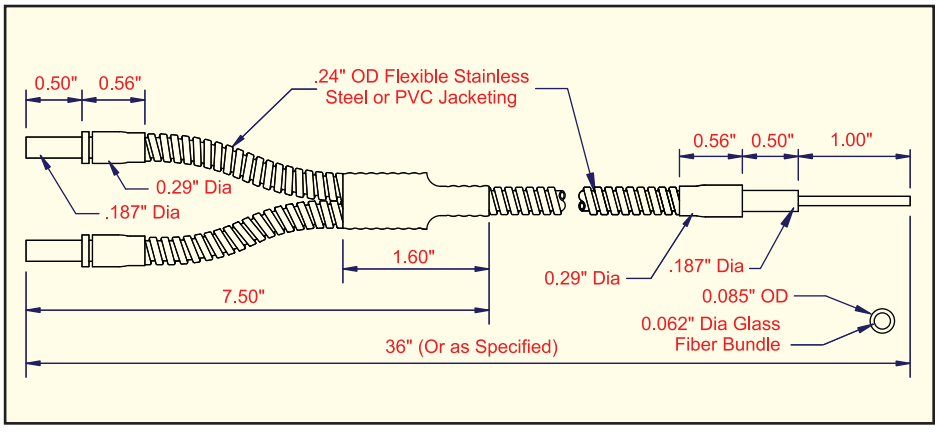


Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-B-36	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-B-36P	.062"

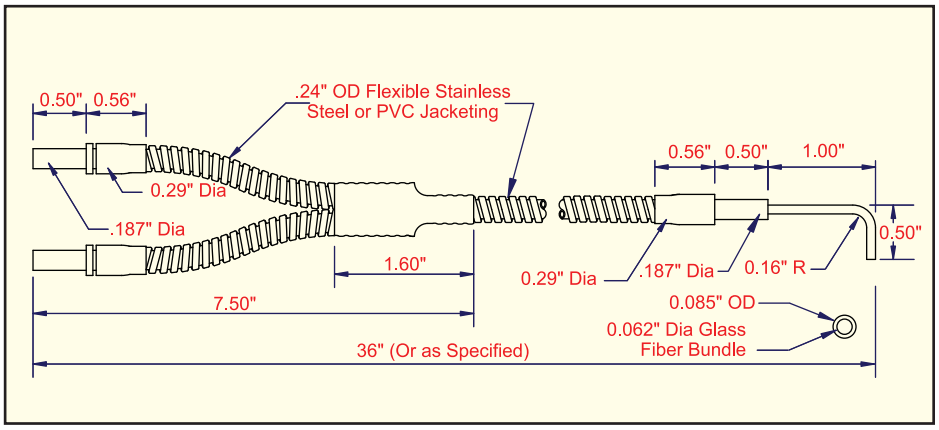


Right Angle Needle Tip
Stainless Steel Jacket

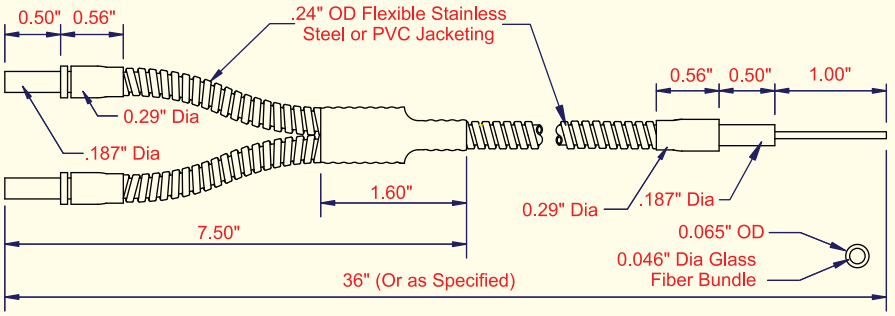
MODEL	BUNDLE SIZE
BF-B-36R	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-B-36RP	.062"



Glass Bifurcated Light Guides

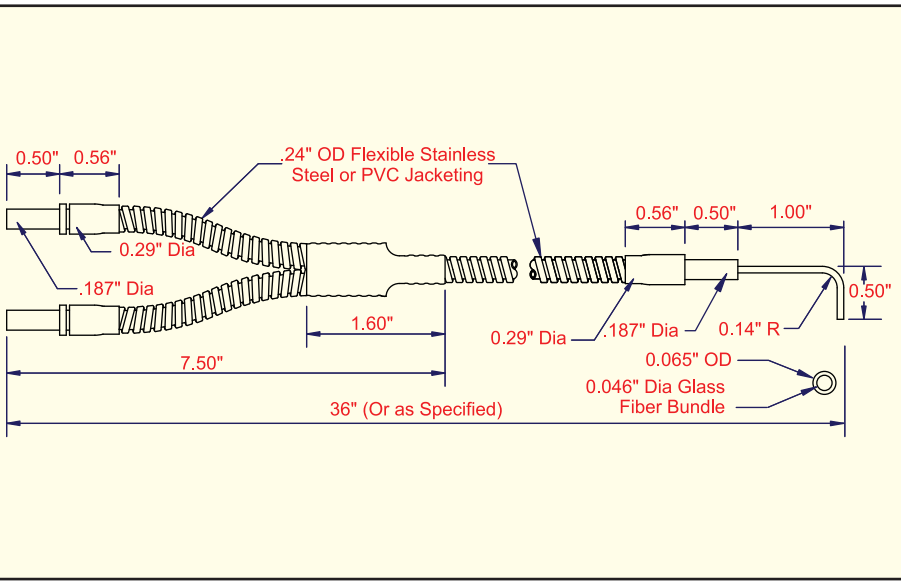


Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-E-36	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-E-36P	.046"

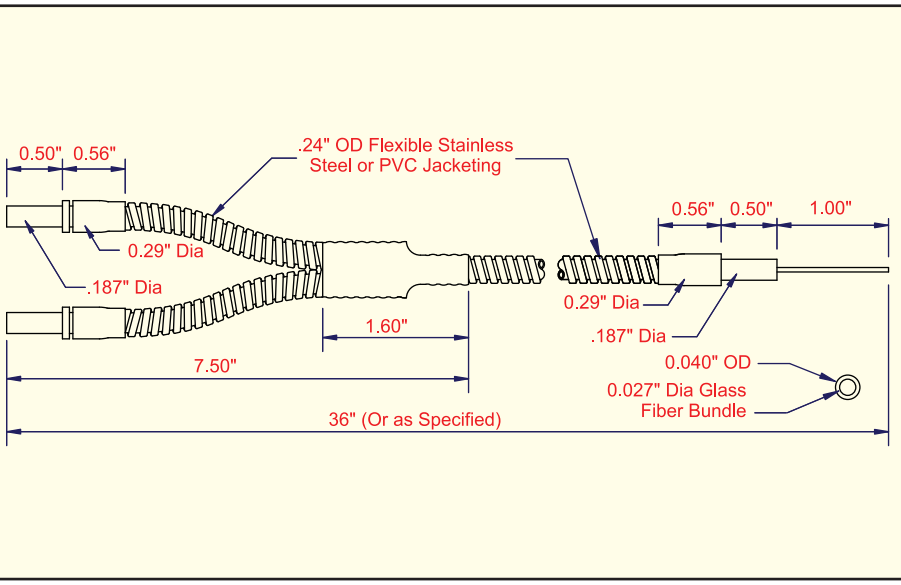


Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-E-36R	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-E-36RP	.046"



Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-J-36	.027"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-J-36P	.027"

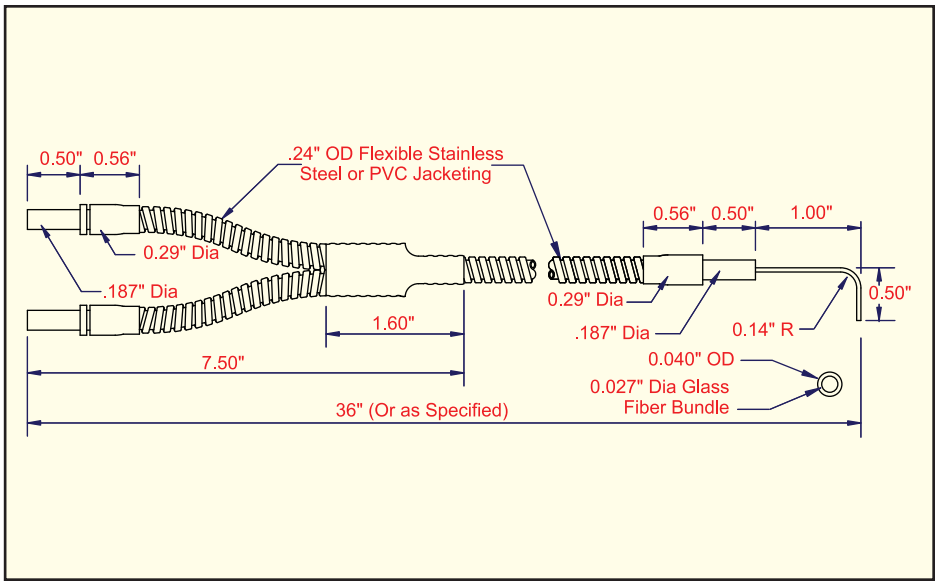
Drawings available at ttco.com

Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-J-36R	.027"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-J-36RP	.027"

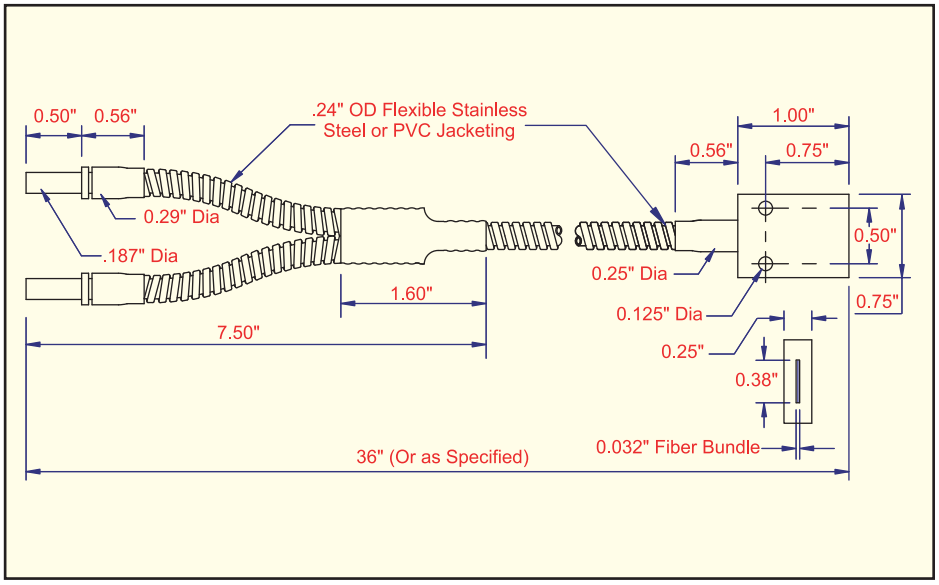


Rectangular Flat Housing
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-C-36	.032" x .38"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-C-36P	.032" x .38"

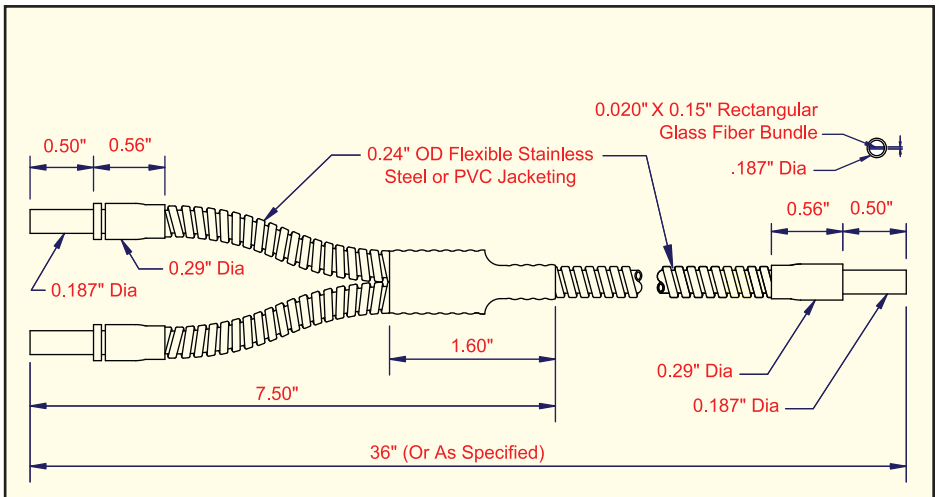


Rectangular Bundle Barrel Tip
Stainless Steel Jacket

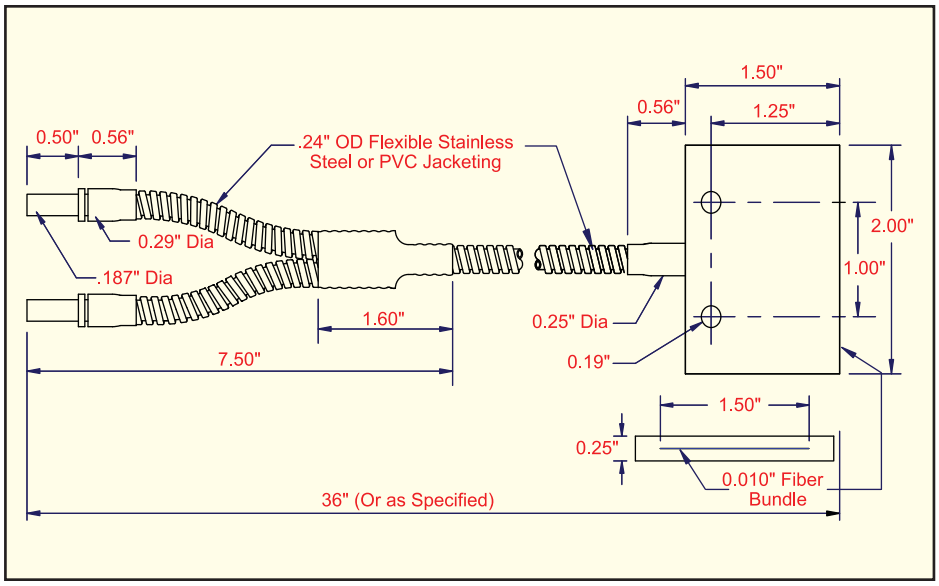
MODEL	BUNDLE SIZE
BF-K-36	.020" x .15"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-K-36P	.020" x .15"



Glass Bifurcated Light Guides

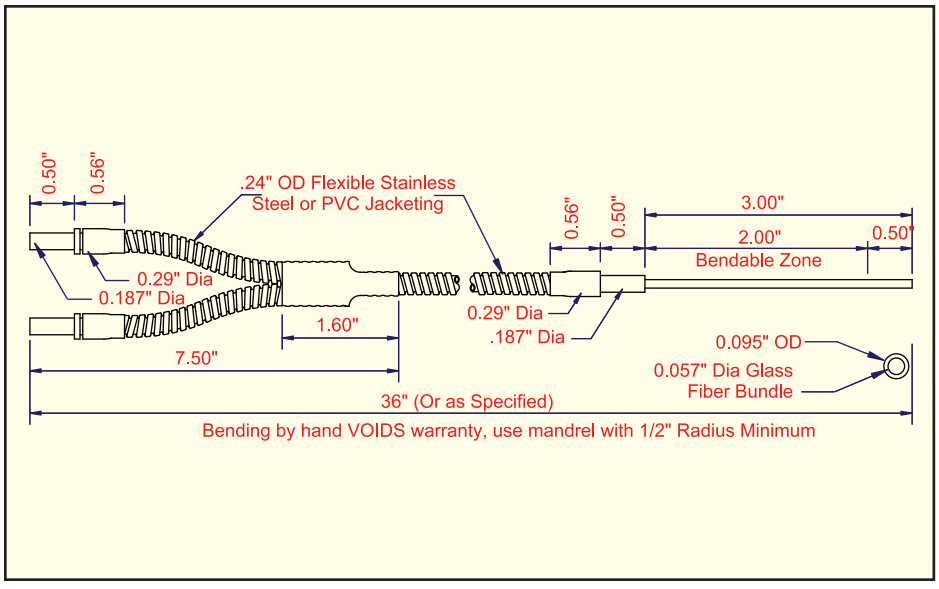


Rectangular, 2" Flat Housing
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-P-36	.010" x 1.50"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-P-36P	.010" x 1.50"



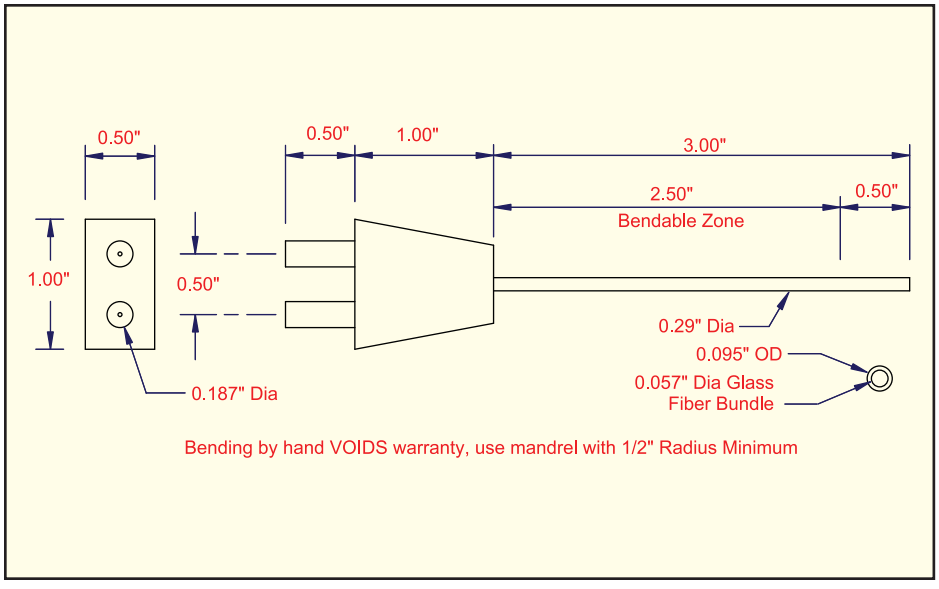
Bending by hand VOIDS warranty, use mandrel with 1/2" Radius Minimum

3" Long Bendable Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-L-36B	.057"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-L-36BP	.057"



Bending by hand VOIDS warranty, use mandrel with 1/2" Radius Minimum

Sensor Adaptor
Bendable 3" Tip
For use with
F1 Optical Block

MODEL	BUNDLE SIZE
BF-L-3B	.057"

Miniature Glass Single Light Guides

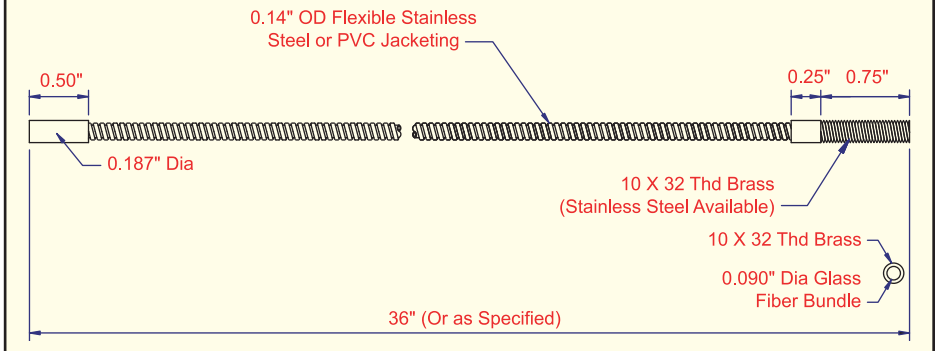
Our MINIATURE GLASS FIBEROPTIC LIGHT GUIDES utilize the high performance and protection of glass fibers with the space saving flexibility of plastic fibers, plus a tighter bend radius. *Now there is nowhere we can't take you.*

Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-A-36T	.090"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36TP	.062"

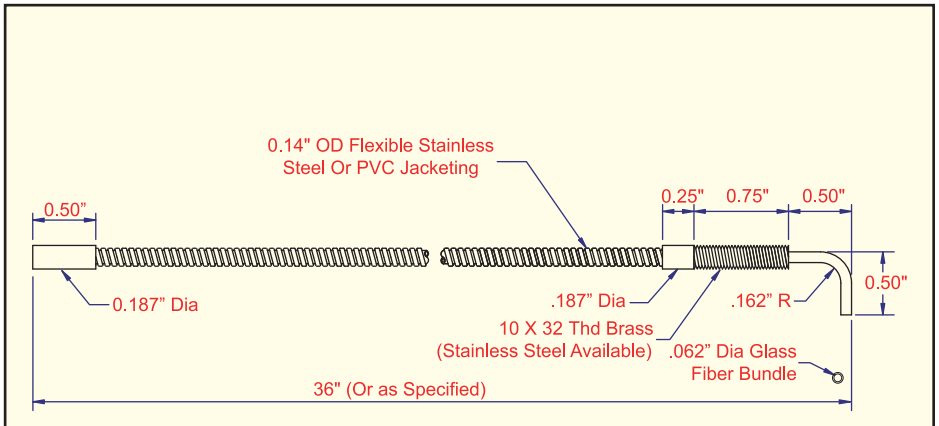


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-B-36RT	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36RTP	.062"

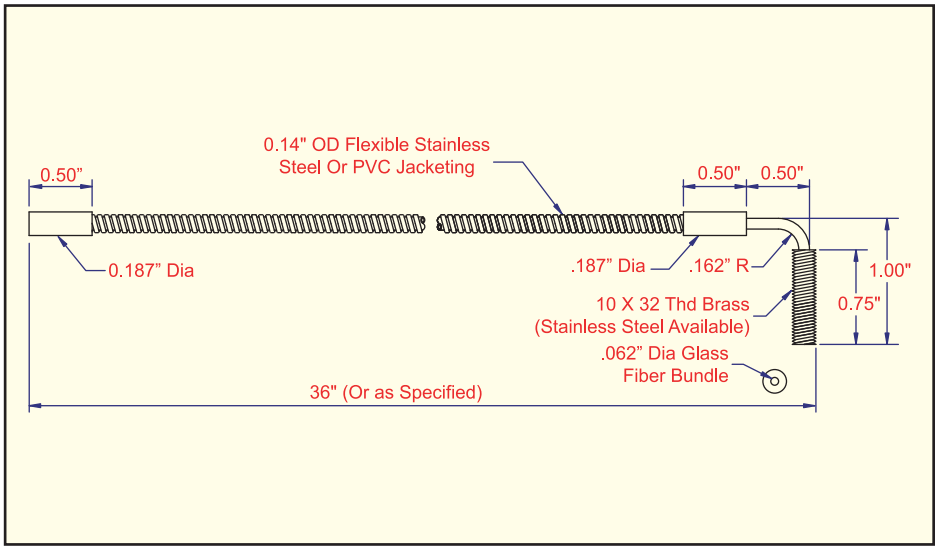


Stainless Steel Jacket

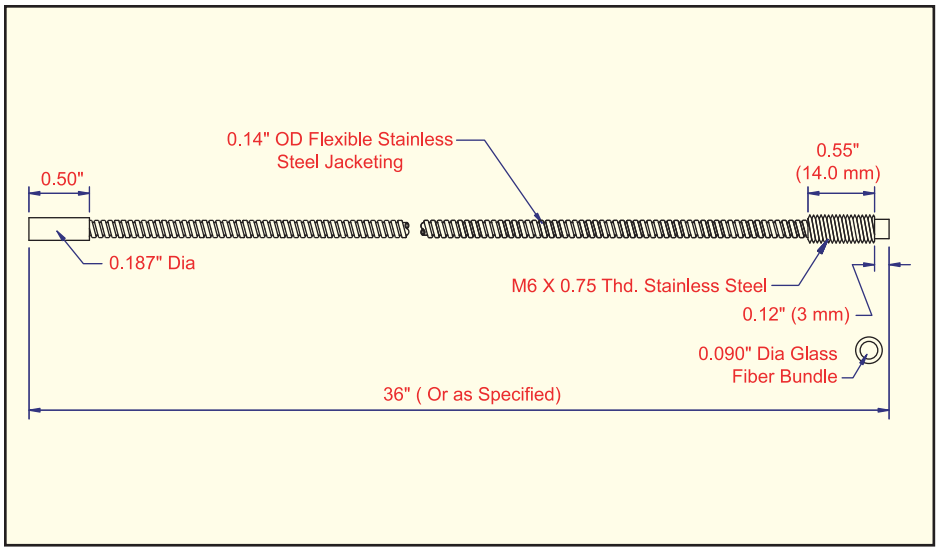
MODEL	BUNDLE SIZE
MF-B-36TR	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36TRP	.062"



Miniature Glass Single Light Guides

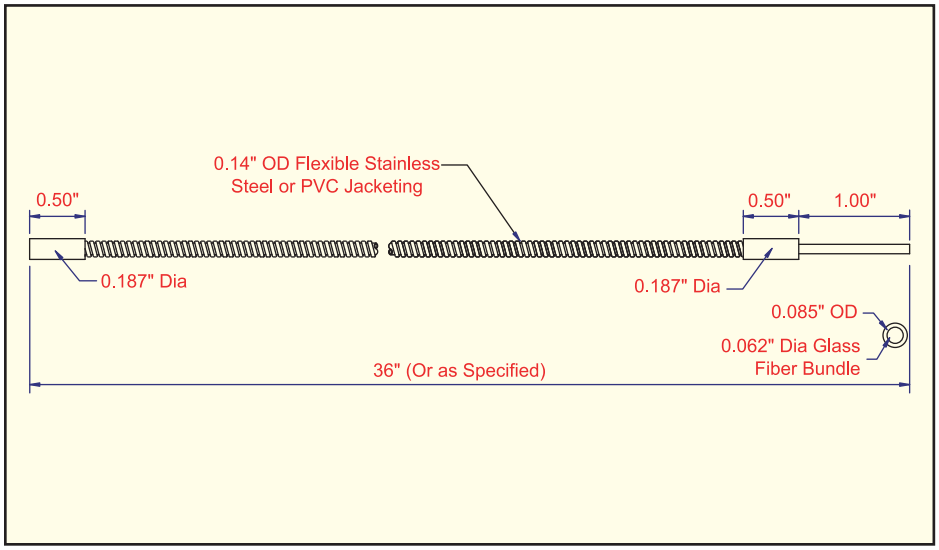


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-A-36TM6	.090"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36TM6P	.062"

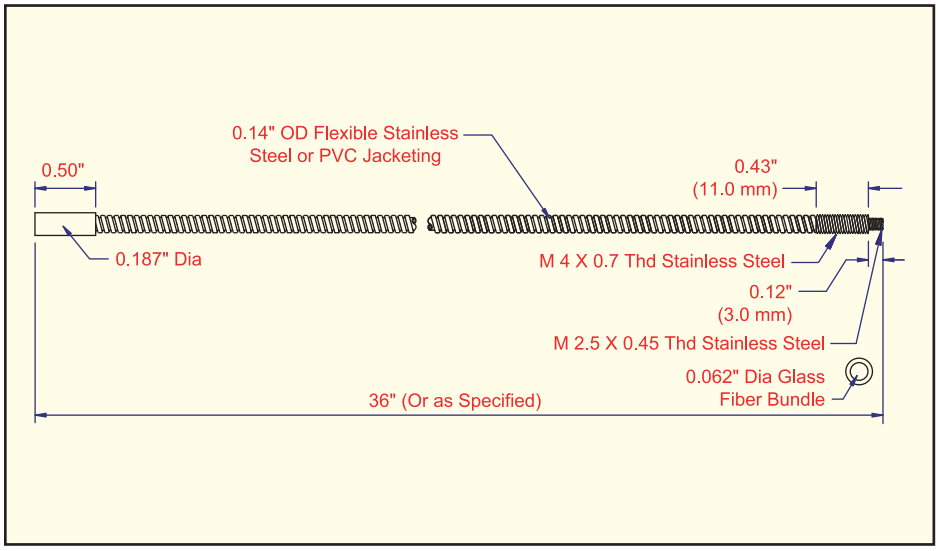


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-B-36	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36P	.062"



Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-B-36TM4	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36TM4P	.062"

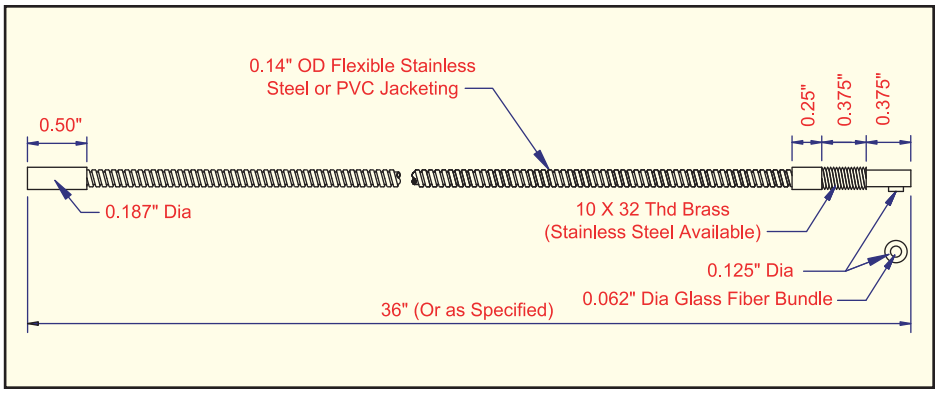
Miniature Glass Single Light Guides

Side View, Right Angle, Threaded, Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-B-36RS	.062"

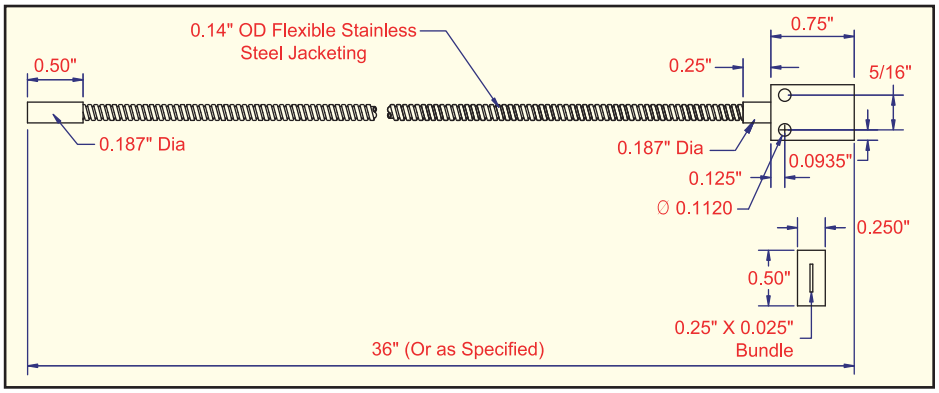
PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36RSP	.062"



Rectangular Flat Housing Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-C-36	0.250" X 0.025"

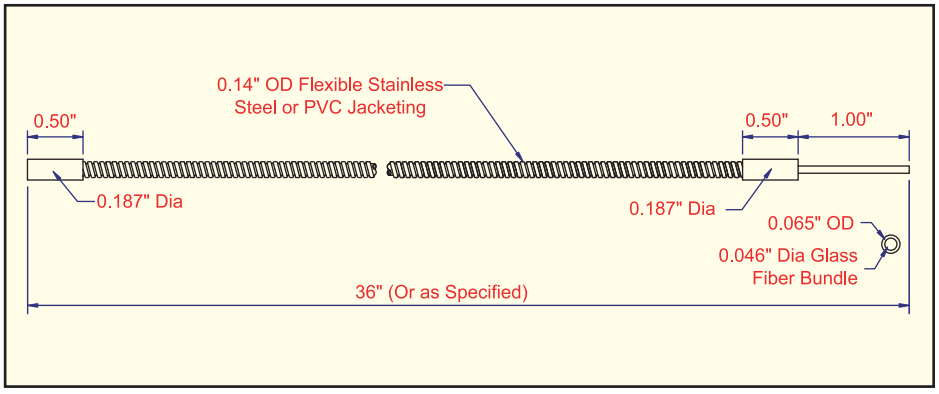


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-E-36	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-E-36P	.046"

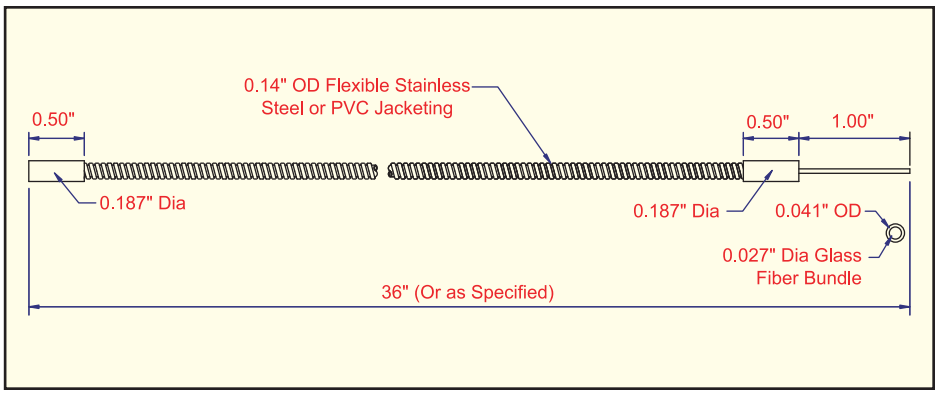


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-J-36	.027"

PVC Monocoil Jacket

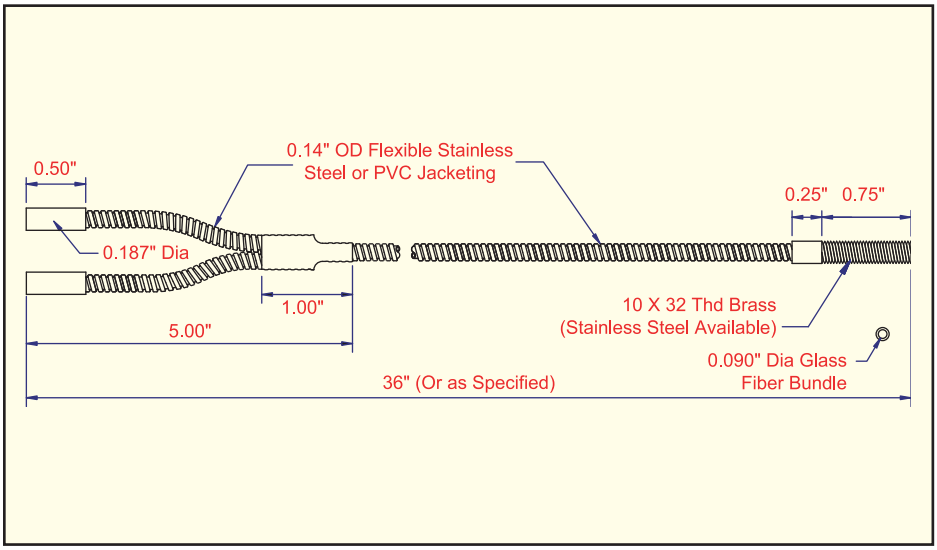
MODEL	BUNDLE SIZE
MF-J-36P	.027"



Miniature Glass Bifurcated Light Guides

FINALLY… BIFURCATED FIBEROPTIC LIGHT GUIDES

in a small package with the performance of glass

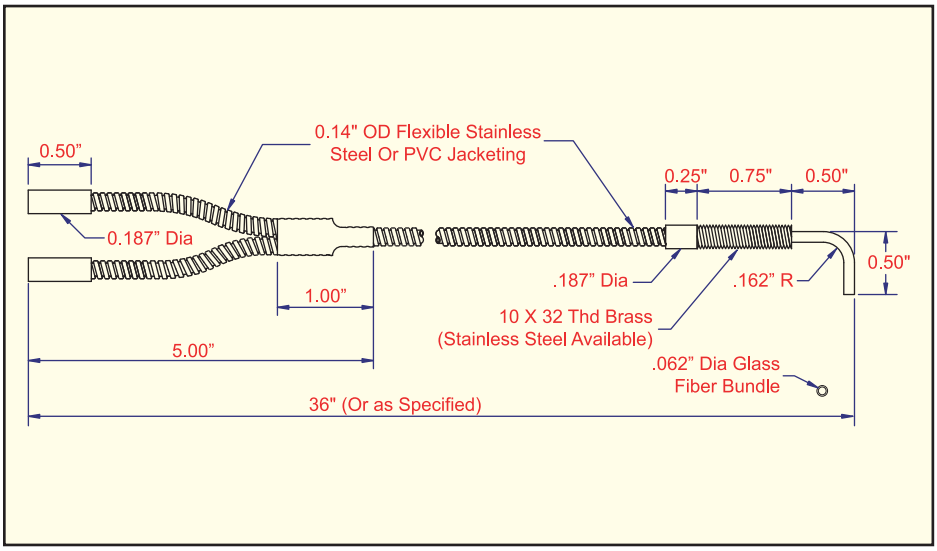


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-A-36T	.090"
MBF-B-36T	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-A-36TP	.090"
MBF-B-36TP	.062"

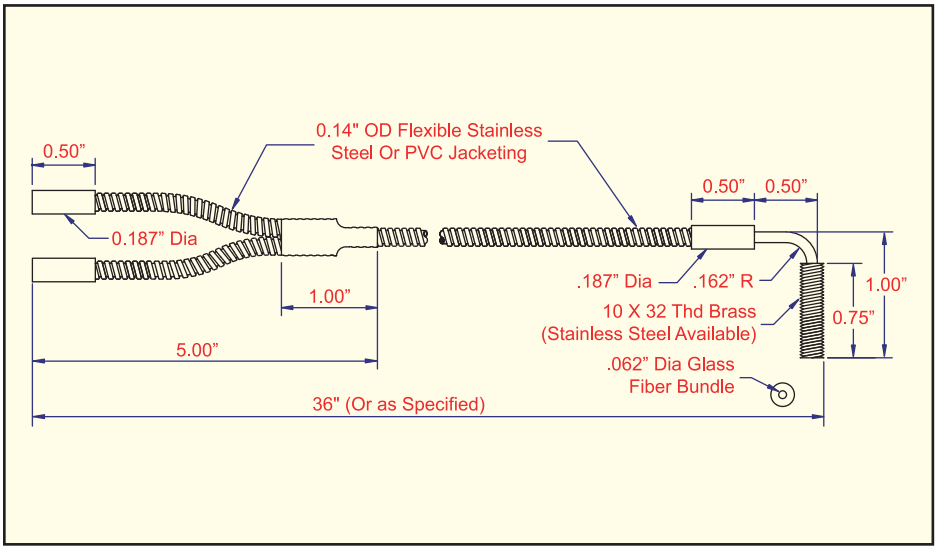


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-B-36RT	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36RTP	.062"



Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-B-36TR	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36TRP	.062"

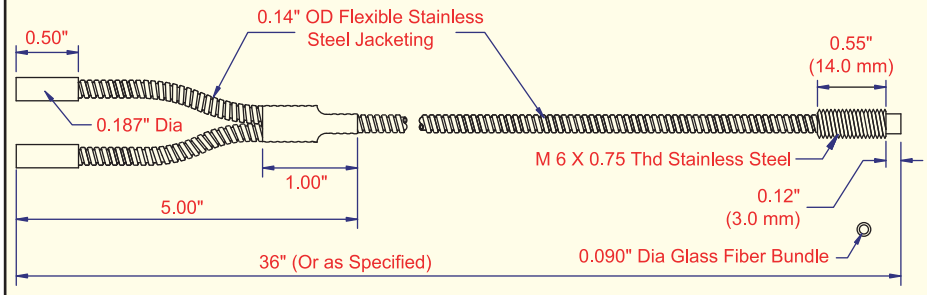
Drawings available at ttco.com

Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-A-36TM6	.090"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36TM6P	.062"

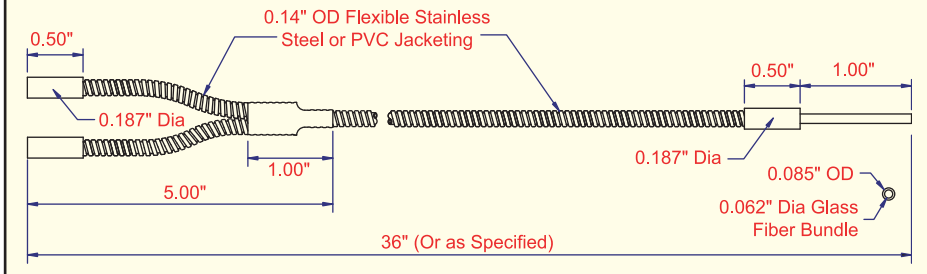


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-B-36	062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36P	062"

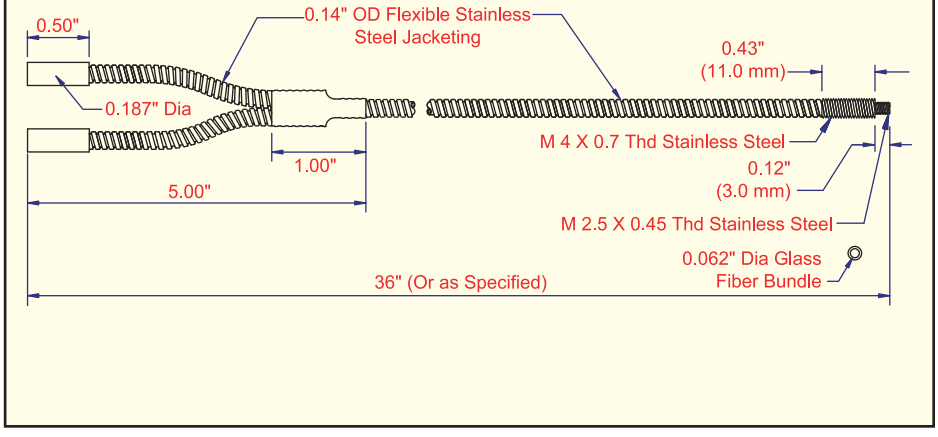


Stainless Steel Jacket

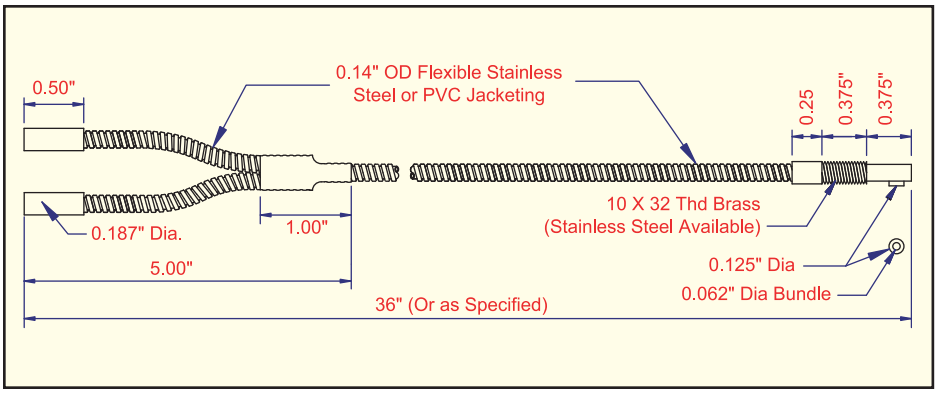
MODEL	BUNDLE SIZE
MBF-B-36TM4	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36TM4P	062"



Miniature Glass Bifurcated Light Guides

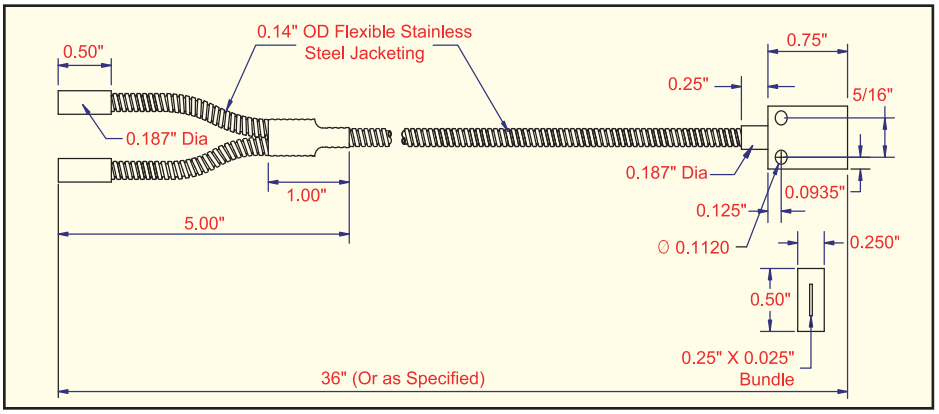


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-B-36RS	.062"

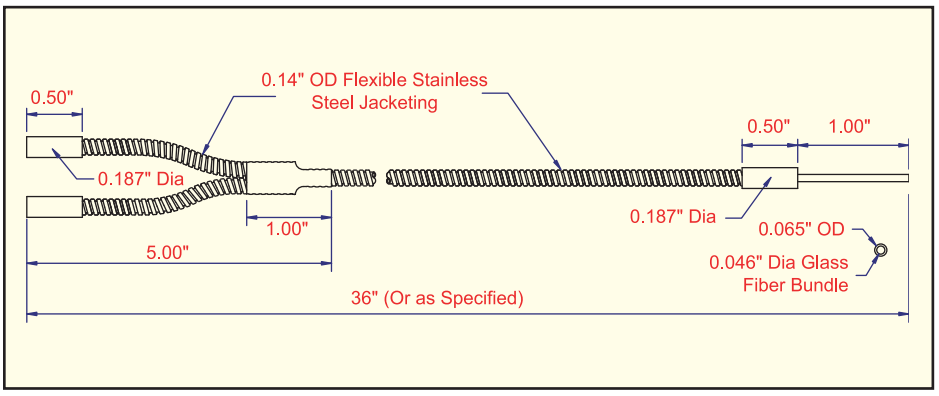
PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36RSP	.062"



Rectangular Flat Housing Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-C-36	0.250" X 0.025"

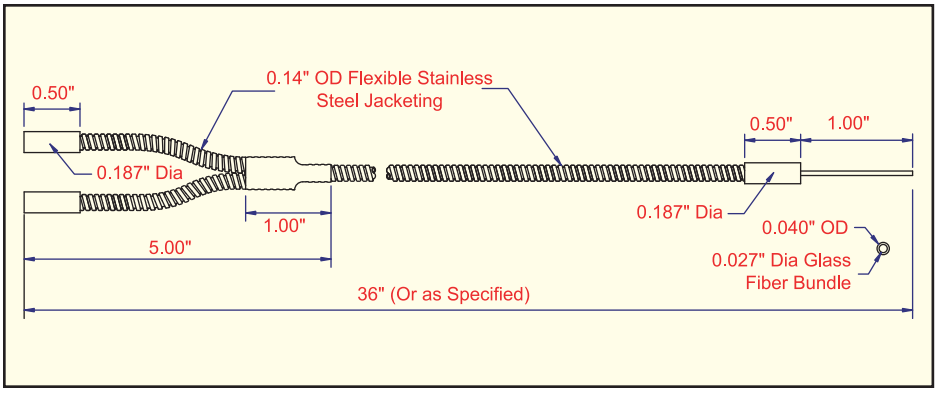


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-E-36	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-E-36P	.046"



Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-J-36	.027"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-J-36P	.027"

Drawings available at ttco.com

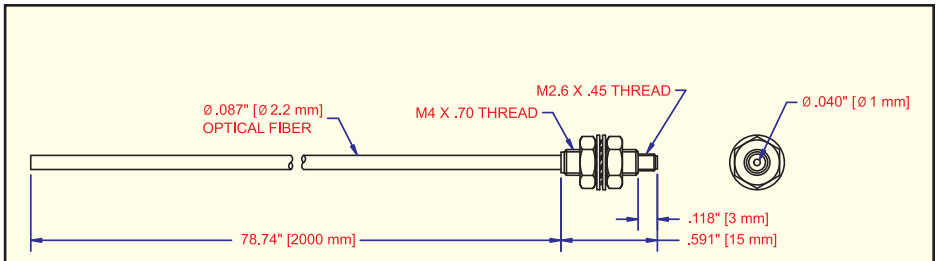
Plastic Single Light Guides

NEW!

Two per package*

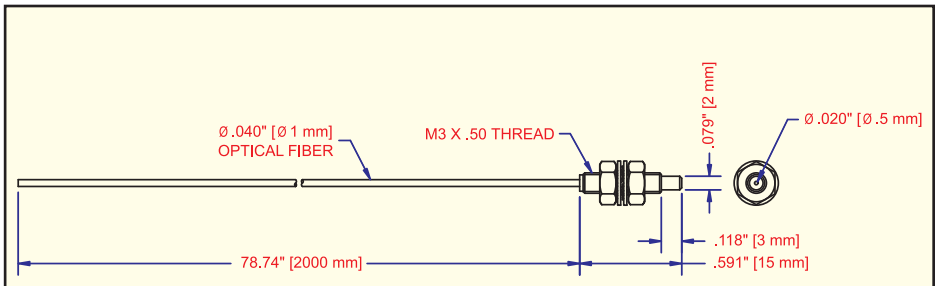
Straight Threaded Tip

MODEL	BUNDLE SIZE
PF-Z-78TL	.040"



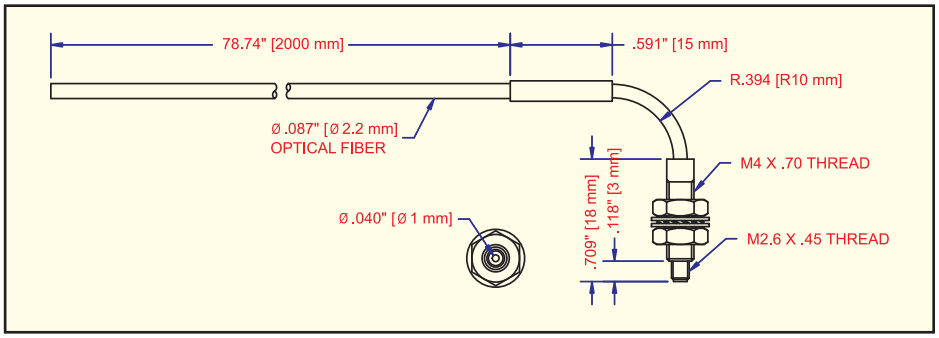
Straight Threaded Tip

MODEL	BUNDLE SIZE
PF-Q-78T	.020"



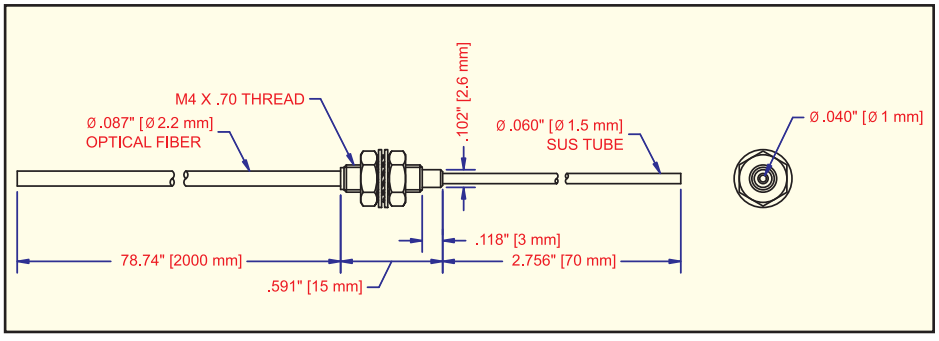
Threaded Tip then Right Angle

MODEL	BUNDLE SIZE
PF-Z-78TRL	.040"



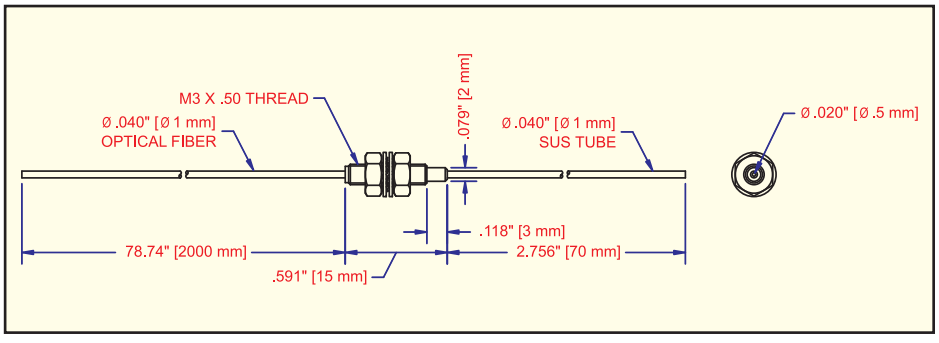
Straight Threaded Needle Tip

MODEL	BUNDLE SIZE
PF-Z-78T70	.040"



Straight Needle Tip with Threaded Mounting

MODEL	BUNDLE SIZE
PF-Q-78T70	.020"

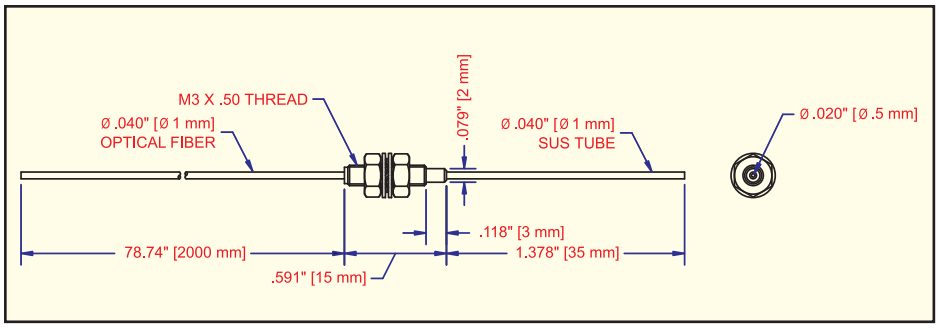


*All Plastic Fibers are priced per package

Plastic Single Light Guides

Two per package

NEW!

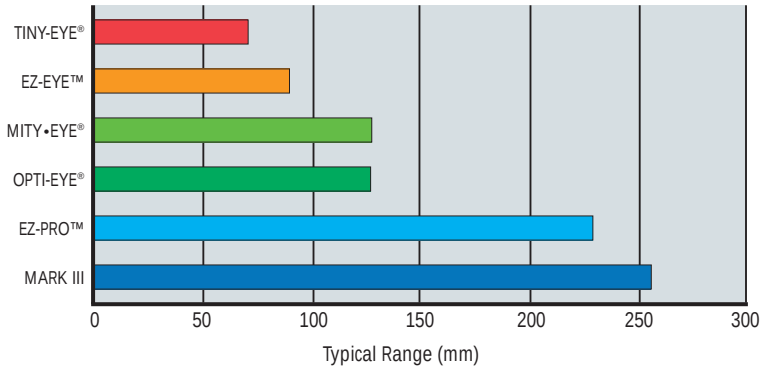


Straight Needle Tip with Threaded Mounting

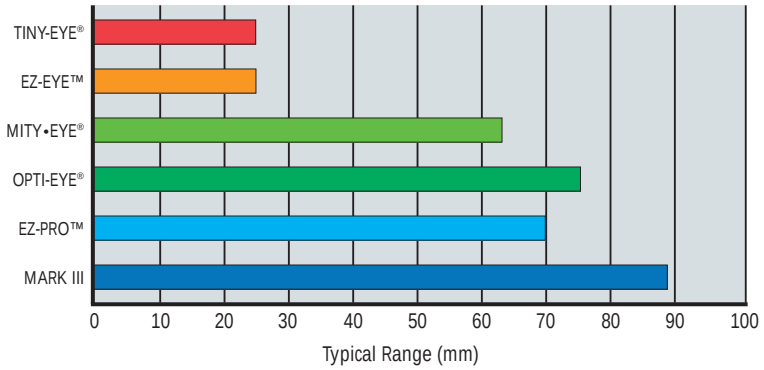
MODEL	BUNDLE SIZE
PF-Q-78T35	.020"

Range Guidelines with Red LED

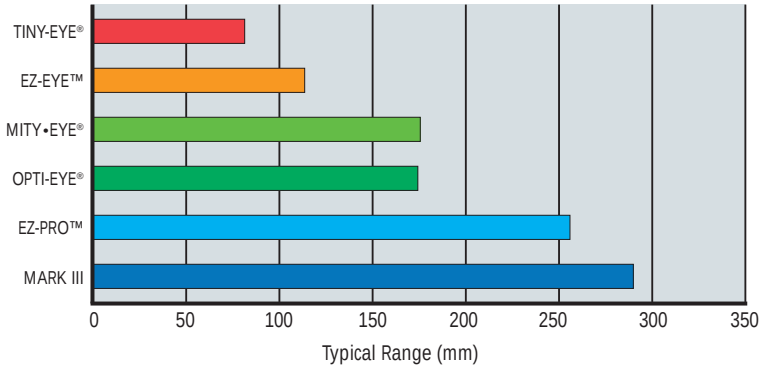
PF-Z-78TL, PF-Z-78T70



PF-Q-78T, PF-Q-78T35, PF-Q-78T70



PF-Z-78TRL



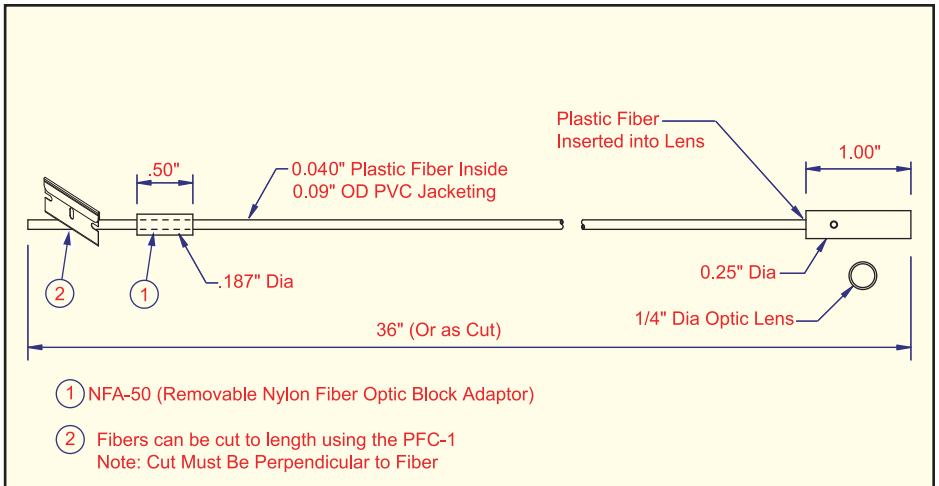
Drawings available at ttco.com

Plastic Single Light Guides

One per package

Slip-on Barrel
Lens 1/4" x 1"

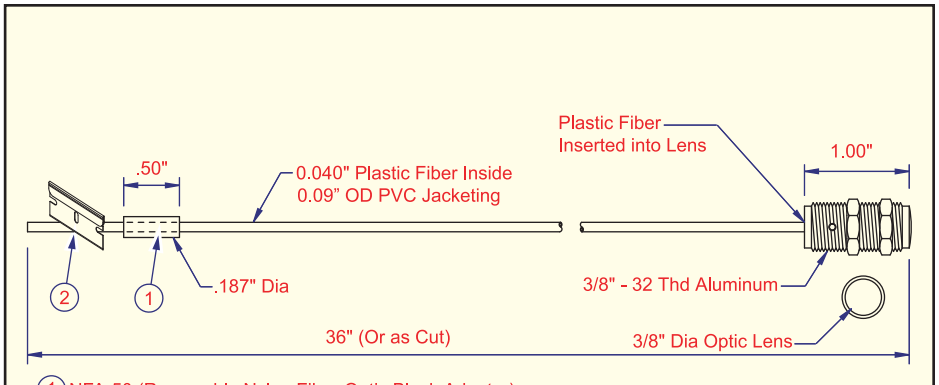
MODEL	BUNDLE SIZE
LF-G-36	.040" 36" Cable Length
LF-G-72	.040" 72" Cable Length



1. NFA-50 (Removable Nylon Fiber Optic Block Adaptor)
2. Fibers can be cut to length using the PFC-1
   Note: Cut Must Be Perpendicular to Fiber

Slip-on Threaded Barrel
Lens 3/8" x 1"

MODEL	BUNDLE SIZE
LF-H-36	.040" 36" Cable Length
LF-H-72	.040" 72" Cable Length

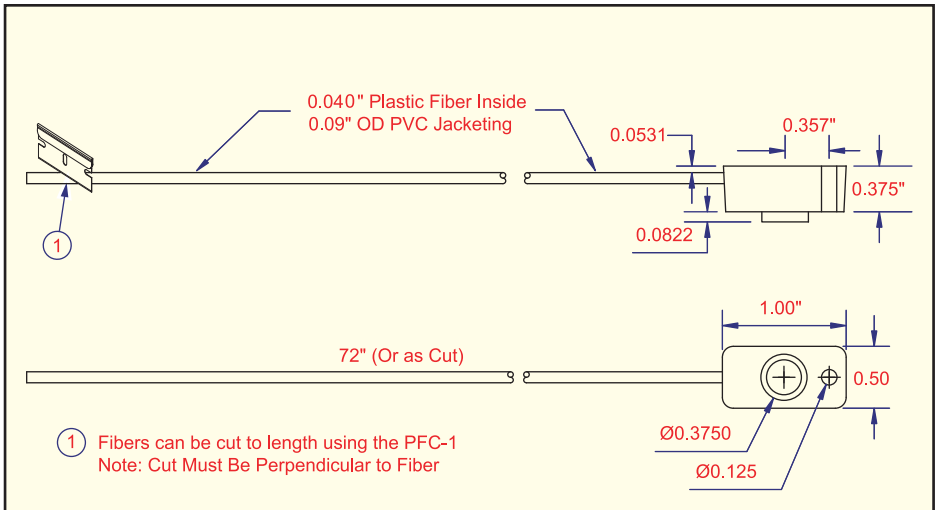


1. NFA-50 (Removable Nylon Fiber Optic Block Adaptor)
2. Fibers can be cut to length using the PFC-1
   Note: Cut Must Be Perpendicular to Fiber

Plastic Fibers
Right Angle

MODEL	BUNDLE SIZE
F-S-72R	.040"
F-S-120R	

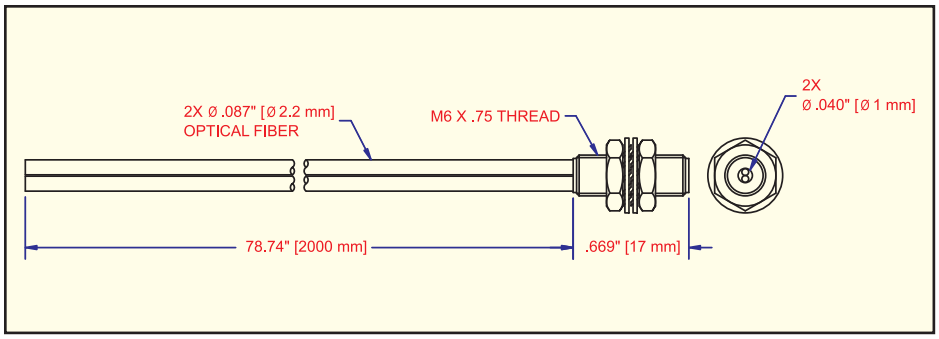
Low Cost, right angle plastic fiberoptic light guides offer the most reliable sensing mode for opaque objects. Wide beam simplifies alignment. 72" or 120" long cut-to-length fibers.



1. Fibers can be cut to length using the PFC-1
   Note: Cut Must Be Perpendicular to Fiber

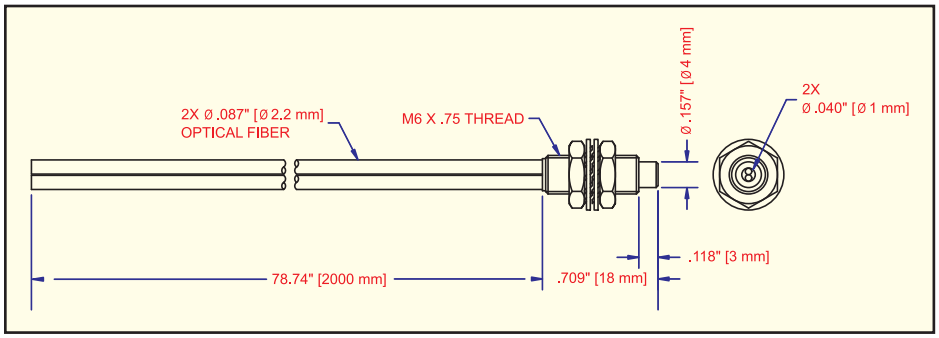
Plastic Diplex Light Guides

NEW!



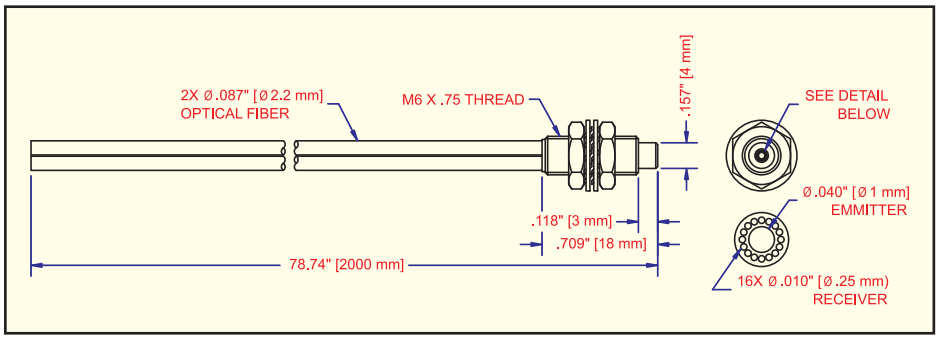
Threaded Tip

MODEL	BUNDLE SIZE
PFD-Z-78M6	.040"



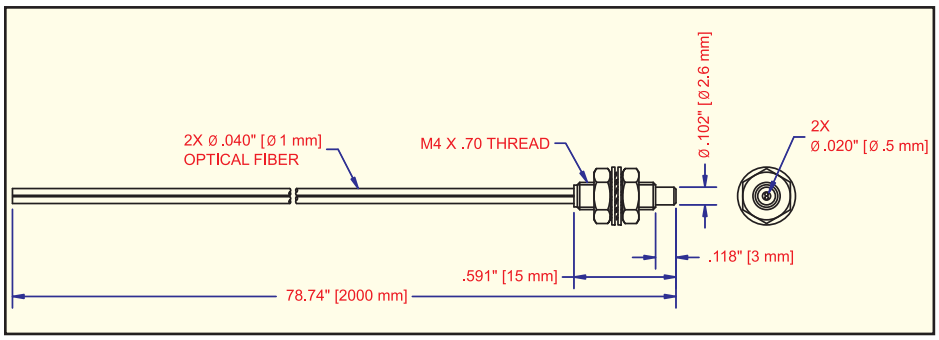
Threaded Tip

MODEL	BUNDLE SIZE
PFD-Z-78M64	.040"



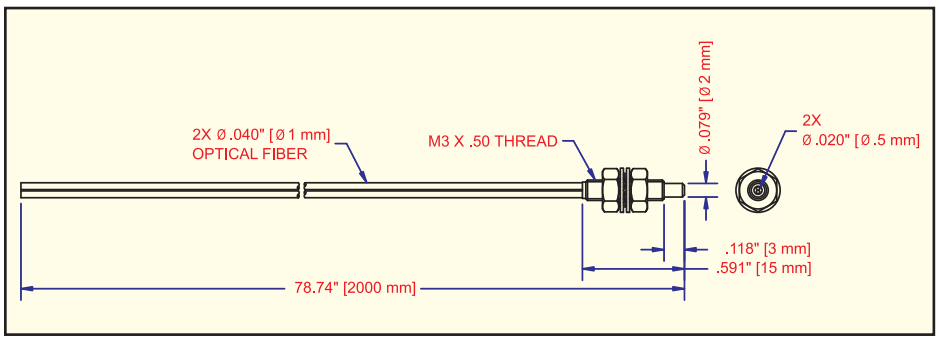
Coaxial Threaded Tip

MODEL	BUNDLE SIZE
PFD-CZ-78T	Emitter: .040" Receiver: .010"



Threaded Tip

MODEL	BUNDLE SIZE
PFD-Q-78M4	.020"



Threaded Tip

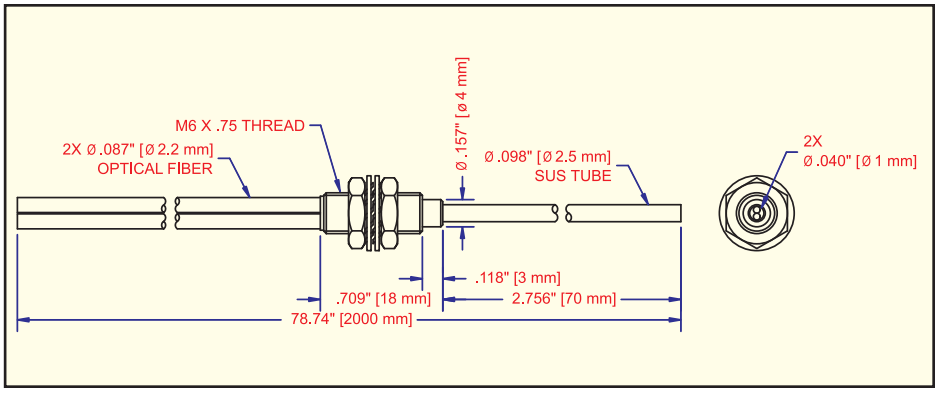
MODEL	BUNDLE SIZE
PFD-Q-78M3	.020"

Drawings available at ttco.com

NEW!

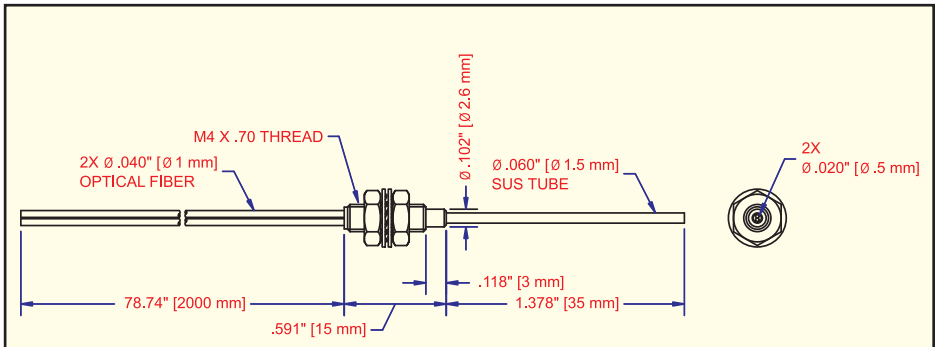
Straight Needle Tip, Threaded

MODEL	BUNDLE SIZE
PFD-Z-78T70	.040"



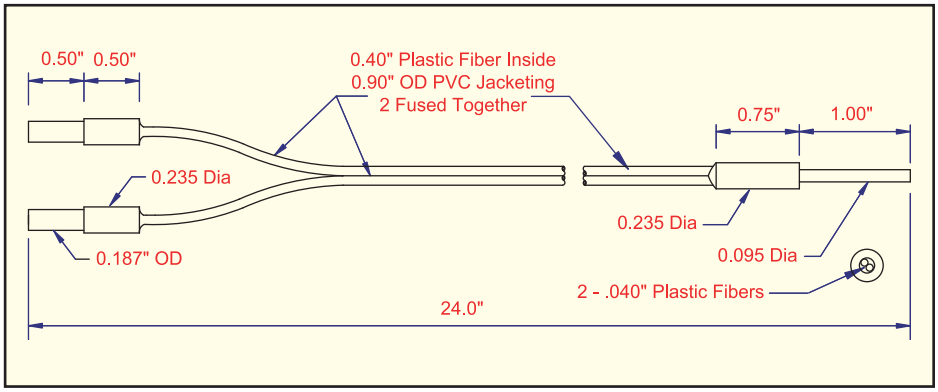
Needle Tip with Threaded Mounting Diplex

MODEL	BUNDLE SIZE
PFD-Q-78T35	.020"



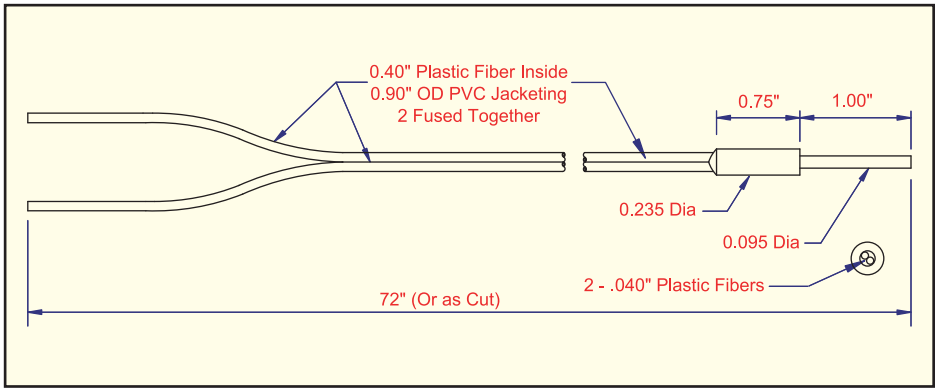
Straight Needle Tip

MODEL	BUNDLE SIZE
BF-W-24PP	.040"



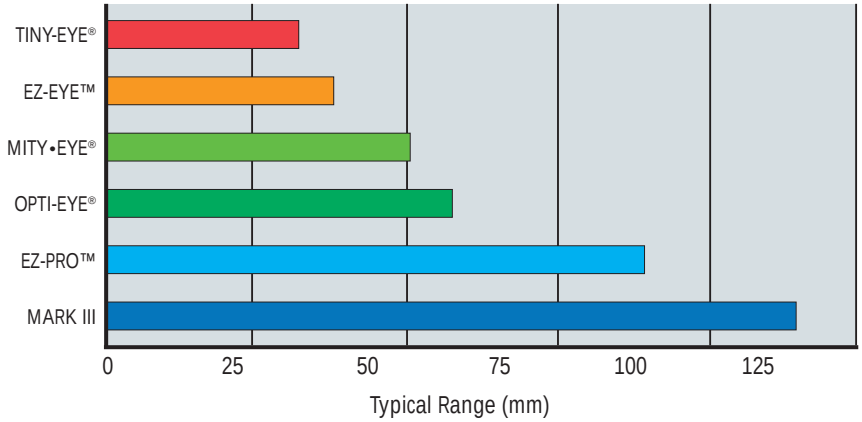
Straight Needle Tip

MODEL	BUNDLE SIZE
BF-Y-72PPC	.040"

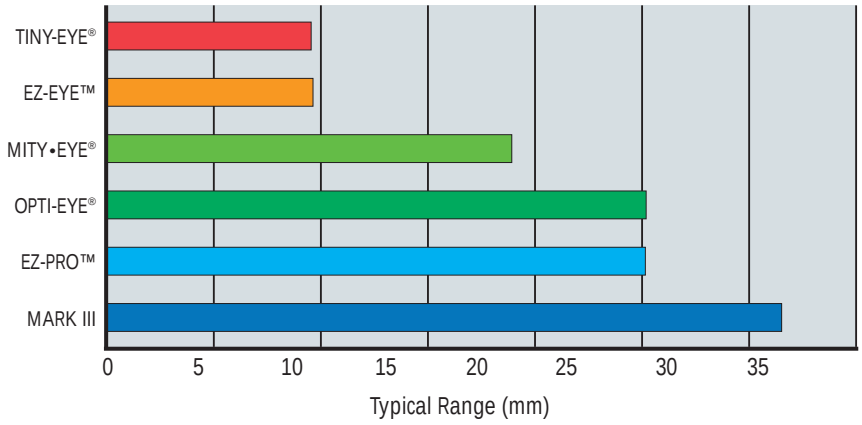


Plastic Diplex Light Guides

PFD-Z-78M6, PFD-Z-78M64, PFD-Z-78T70, PFD-CZ-78T



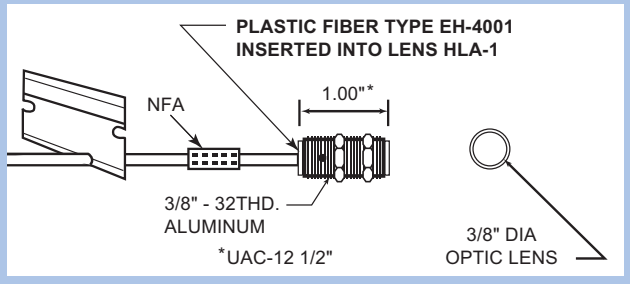
PFD-Q-78M3, PFD-Q-78M4, PFD-Q-78T35,

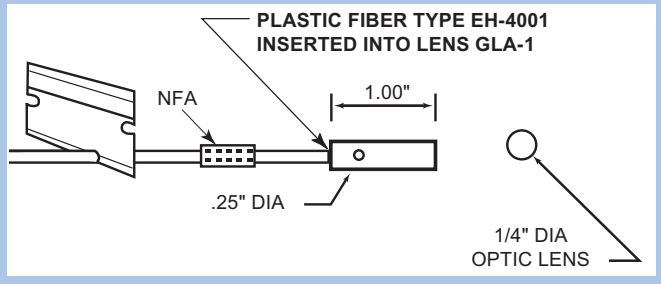


INDIVIDUAL CUT-TO-LENGTH COMPONENTS

Plastic Fiber Cutter, model # PFC-1

Model No.	Description
EH-4001-25	25' of .040 Single Plastic Fiberoptic Cable
EH-4001-50	50' of .040 Single Plastic Fiberoptic Cable
EH-4001-100	100' of .040 Single Plastic Fiberoptic Cable
EH-4002-25	25' of 2-.040" Diplex Plastic Fiberoptic Cable
EH-4002-50	50' of 2-.040" Diplex Plastic Fiberoptic Cable
EH4002-100	100' of 2-.040" Diplex Plastic Fiberoptic Cable
PFC-1	Plastic Fiber Cutter
NFA-50	.5" Nylon Fiberoptic Adaptor, 50 pieces
NFA12-50	.25" Nylon Fiberoptic Adaptor, 50 pieces





Drawings available at ttco.com

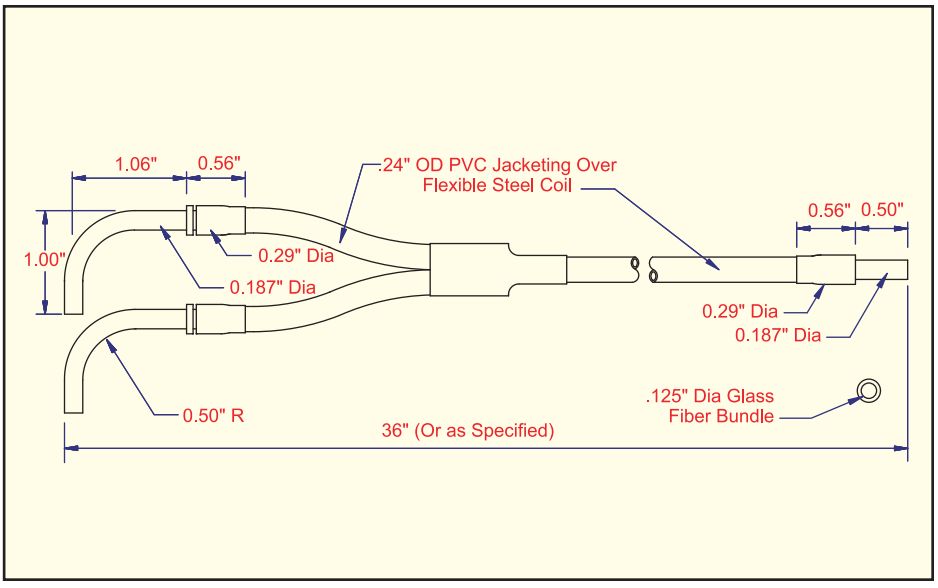
Examples of Custom Light Guides

Custom Fiberoptic tips and lengths BTO (built to order). Please consult factory.

Straight Barrel Tip
PVC Monocoil Jacket
Low Profile

MODEL
BF-A-36X31

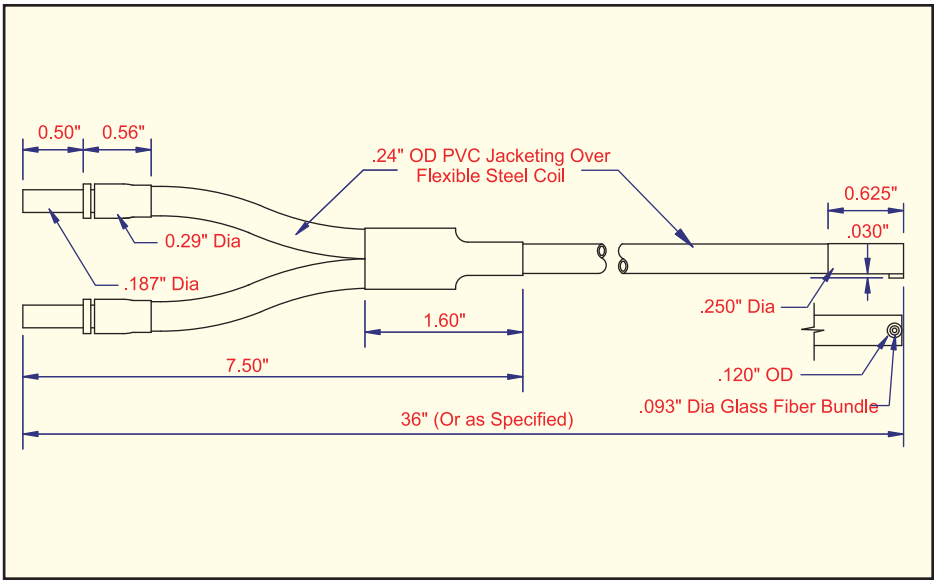
BUNDLE SIZE
.125"



Side View Right
Angle Short Tip
PVC Monocoil Jacket

MODEL
BF-A-36X408

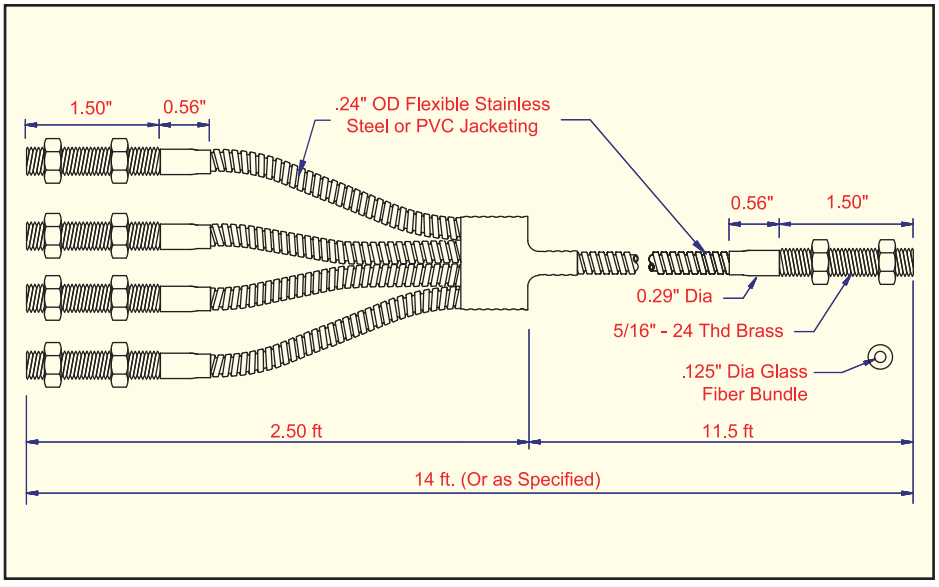
BUNDLE SIZE
.093"



Straight Threaded Tip
Stainless Steel Jacket
Light Pipe

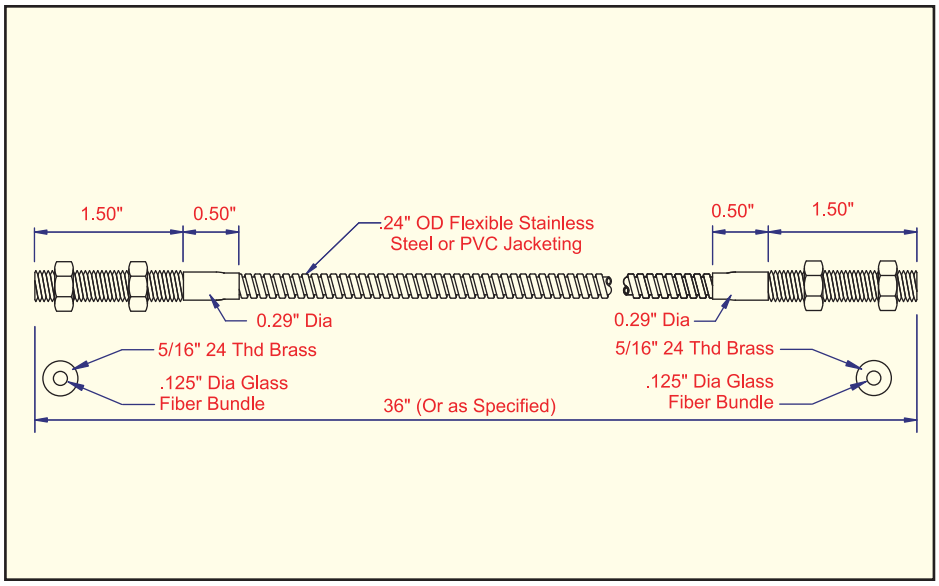
MODEL
F-A-168X448

BUNDLE SIZE
.125"



Examples of Custom Light Guides

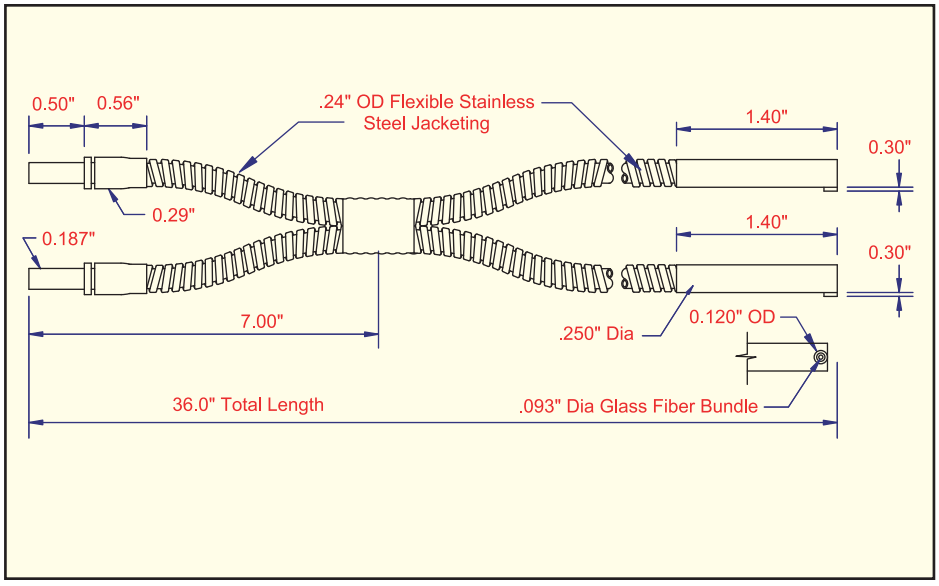
Custom Fiberoptic tips and lengths BTO (built to order). Please consult factory.



Straight Threaded Tip
Light Pipe
Stainless Steel Jacket

MODEL
F-A-36X70

BUNDLE SIZE
.125"

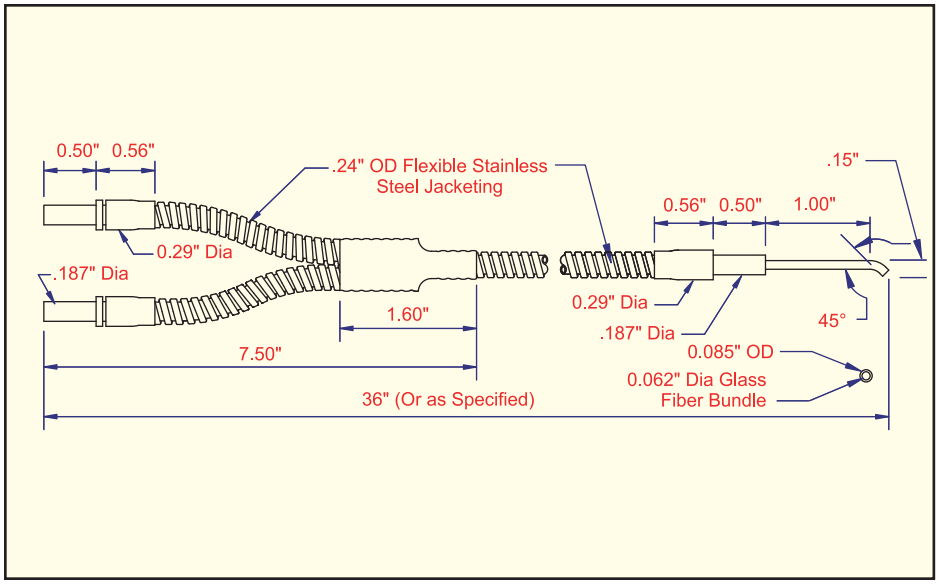


Side View Right Angle
Dual Head Tip
Stainless Steel Jacket

MODEL
BF-A-36X107

BUNDLE SIZE
.093"

Dual Head Tip



45° Short Curved Tip
Stainless Steel Jacket

MODEL
BF-B-36X397

BUNDLE SIZE
.062"

Short Curved Tip

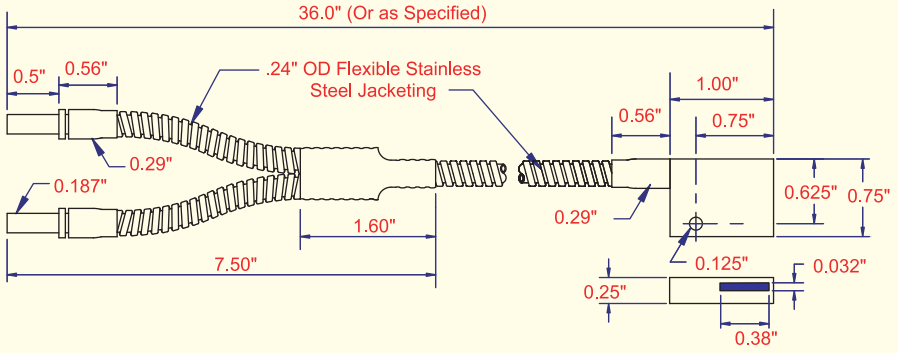
Examples of Custom Light Guides

Custom Fiberoptic tips and lengths BTO (built to order). Please consult factory.

Right Angle “C” Fiber
Stainless Steel Jacket

MODEL
BF-C-36X374

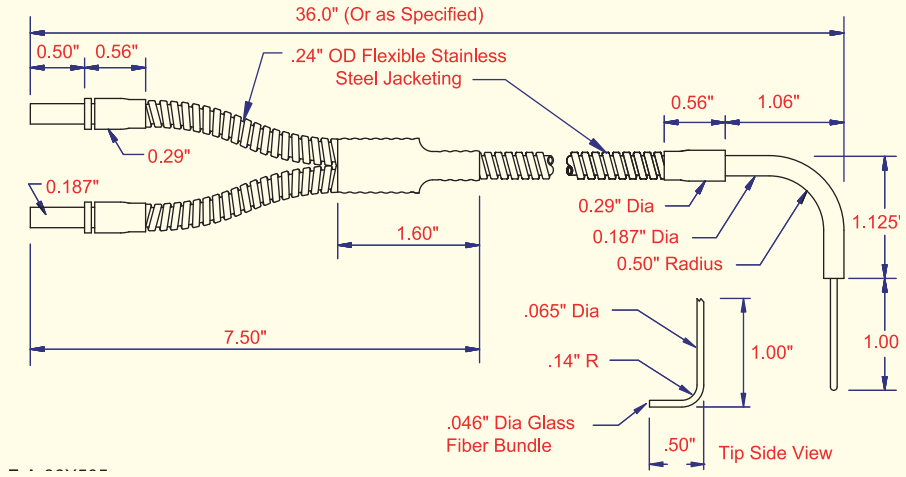
BUNDLE SIZE
0.38" X 0.032"



Jig Fit Fiber
Stainless Steel Jacket

MODEL
BF-E-36X92

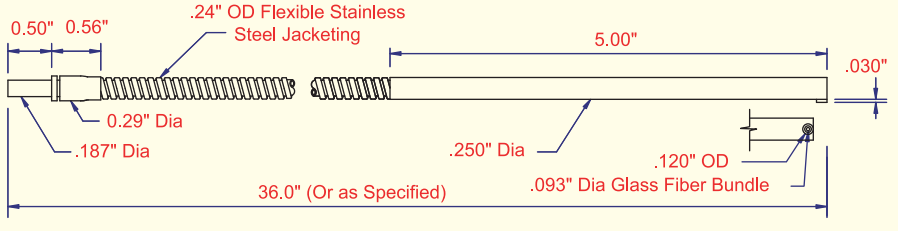
BUNDLE SIZE
.046"



Jig Fit Fiber
Stainless Steel Jacket

MODEL
F-A-36X505

BUNDLE SIZE
.093"



Fiberoptic Lenses and Mounting Brackets

FMB-1
(8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket
Use with Threaded Glass
Fiberoptic

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

FPA-1
Slip-on Polarizing Adaptor
Lens (2 Required)
Slips over end of
Model F-A-36 Straight
Light Guides only

FPA-2
Friction Mount Polarizing
Adaptor Lens (2 Required)
Friction mounts onto
F-A-36P Straight Light
Guides only

GLA-1
1/4" X 1"
Slip-on Lens Assembly
Slips on Model
EH-4001 plastic fibers

GLA-2
Long Range Lens
for Through-Beam
Use with M4 Tips

HLA-1
3/8" X 1" Threaded
Slip-on Lens Assembly
Slips on Model EH-4001
plastic fibers

HLA-2
Spot Focus Lens for
Diffused Beam
Use with M6 Tips
Focal Point .50" (12.7 mm)

UAC-12
Slip-on Long Range Plastic
Lens, Use on .187" O.D.
straight or right angle
fiber tip or .040" fiber

UAC-15
Threaded Long Range Glass
Lens, 2" Focal Point
Fits any standard threaded
tip Glass Fiberoptic
Lg. 1 3/8" (35 mm)

UAC-5
Threaded Spot Focus Plastic
Lens, 1" Focal Point
Fits any standard threaded
tip Glass Fiberoptic
Lg. 2" (51 mm)

UAC-5G
Threaded Spot Focus Glass
Lens, 1" Focal Point
Fits any standard threaded
tip Fiberoptic
Lg. 2" (51 mm)

NFA-50
.5" Nylon Fiberoptic Adaptor,
50 pieces, Insert adapts F1 and F4
optical blocks to all .040" diam.
cut-to-length plastic fiberoptic
light guides.

NFA12-50
.25" Nylon Fiberoptic
Adaptor, 50 pieces,
Use to adapt UAC-12
Lens to .040" diam.
plastic fibers.

PFC-1
Plastic Fiber Cutter

Reflectors and Mounting Brackets

NEW!

Standard Reflectivity

Screw Mount

78P
4.4" x 1.9"

AR3
3" diam.

Glue Mount

AR114
1 1/4" diam.

AR158
1 5/8" diam.

AR58
5/8" diam.

AR78
7/8" diam.

Self-Adhesive Mount

98S
3.2" x 1.45"

Reflector Mounting Brackets

RB-1
Mounting kit includes
98S Reflector and
RB-2 Bracket

RB-2
98S Reflector
Mounting Bracket

Prismatic High Performance Reflectors NEMA 4, IP67

These reflectors work with all retroreflective sensors, including the RetroSmart® (RSR) series.

Acrylic

AR4060
40.5 x 60 mm

AR6151
AR6151G
(Chemical Resistant Glass Cover)
2.4" x 2.0", (61 x 51 mm)

AR82
82.1 mm diam.

AR46
46 mm diam.

Flexible Acrylic, Self-Adhesive Mount

PRD1 Round Reflector
1" (25 mm) diam.

PRD2 Round Reflector
2" (50 mm) diam.

SPR1 Square Reflector
1 1/16" (27 mm)

SPR2 Square Reflector
2" (50.8 mm)

Acrylic, Self-Adhesive Reflector Tape

Very thin – .03" (.76 mm)

2000X	Square Relector Tape 3" (76.2 mm)
2001X-1F	Relector Tape 1" x 12" (25.4 mm x 304.8 mm) 12" minimum
2001X-50F	Relector Tape 1" x 50' (25.4 mm x 15.2 m) 50' roll
2002X-1F	Reflector Tape 2" x 12" (50.8 mm x 304.8 mm) 12" minimum
2002X-75F	Reflector Tape 2" x 75' (50.8 mm x 22.8 m) 75' roll

Control Modules

SEPS™ Series
DC Power Supply Control Modules

- Relay or TRIAC output models accept inputs from remote sensors
- Convert 120 VAC or 240 VAC to 24 VDC power
- One or two SPDT relays or one or two opto-isolated TRIAC models are available

MULTI-MATE®
Multi-Function Programmable Control Modules

- Program up to 25 functions
- Single or dual event models
- Dual outputs; TRIAC or NPN transistors
- Provides 24 VDC for remote sensor

PIC™ Series
Product Inspection Control Modules

- Provides 24 VDC for remote sensor
- Used for on-line product sorting and inspection systems
- Programmable outputs and timing functions
- Requires interrogate and inspection sensors

SEPS™ Series Control Modules *DC Power Supply*

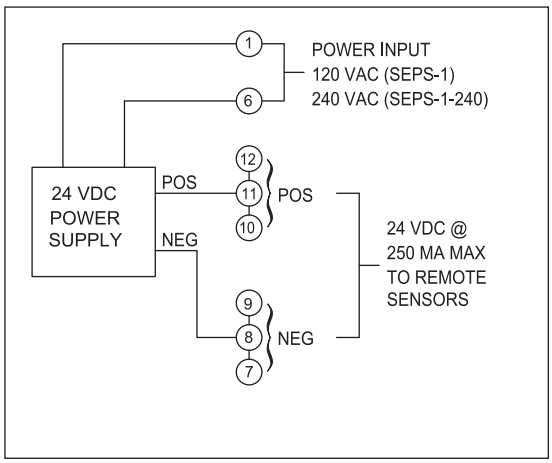
SEPS™ Series plug-in modules offer a convenient means of converting 120 VAC or 240 VAC power into 24 VDC unregulated power for use with TRI-TRONICS DC-powered sensors.

The original SEPS™ module was designed to supply only DC power to the sensors. New SEPS™ modules are available with the capability to convert NPN open collector transisitor outputs from the sensor into conventional hard relay contact outputs or into solid state AC TRIAC outputs. *All modules supply 24 VDC to remote sensors.* Models are also available with either one or two relays, or one or two TRIACs.

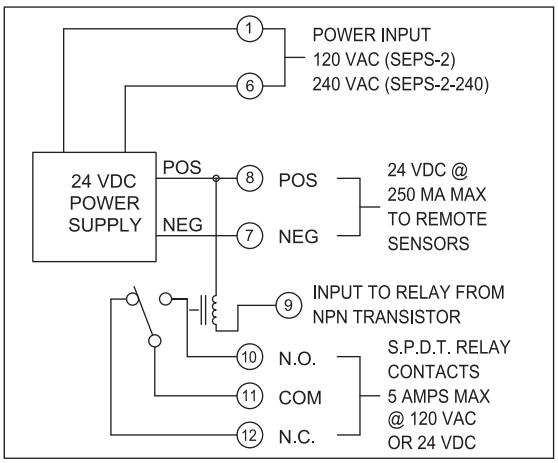
All inputs of the SEPS™ relay devices can be addressed by the outputs of independent sensors. These inputs can also be paralleled to accept the output of a single sensor to drive loads in unrelated circuits.

Feeding the complementary outputs of a remote sensor into the two separate inputs of the SEPS-5 dual output module emulates the action of a single-pole/double-throw solid state relay.

The number of sensors that can be simutaneously powered by a single SEPS power supply control module is dependent upon the total current draw of the sensor/sensors to be used. Example: Up to three SMARTEYE® sensors or up to eight MITY-EYE® sensors can be powered by a single SEPS™ module. Refer to the specifications of the specific sensor or sensors to be used in order to calculate total current requirements.

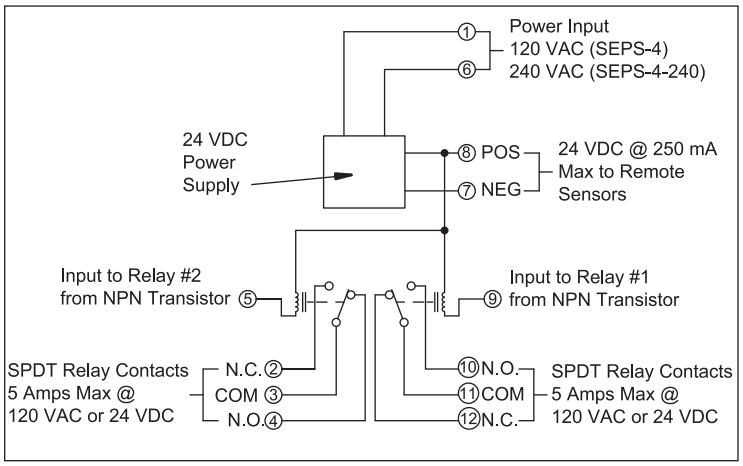


SEPS-1 & SEPS-1-240 Power Supply

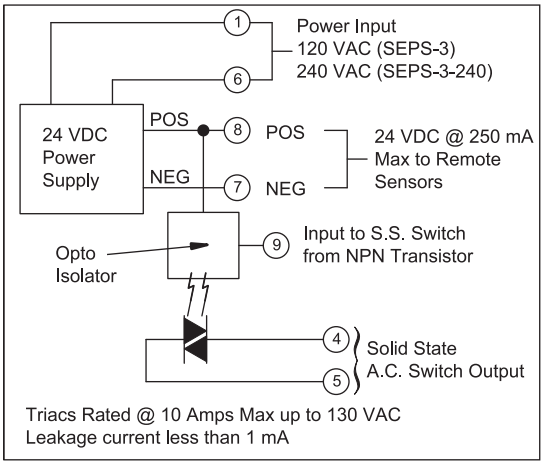


SEPS-2 & SEPS-2-240 Power Supply

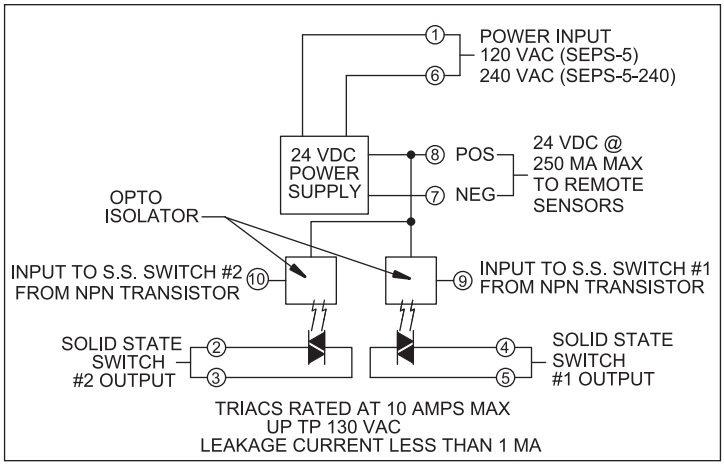
SEPS™ Series Control Modules



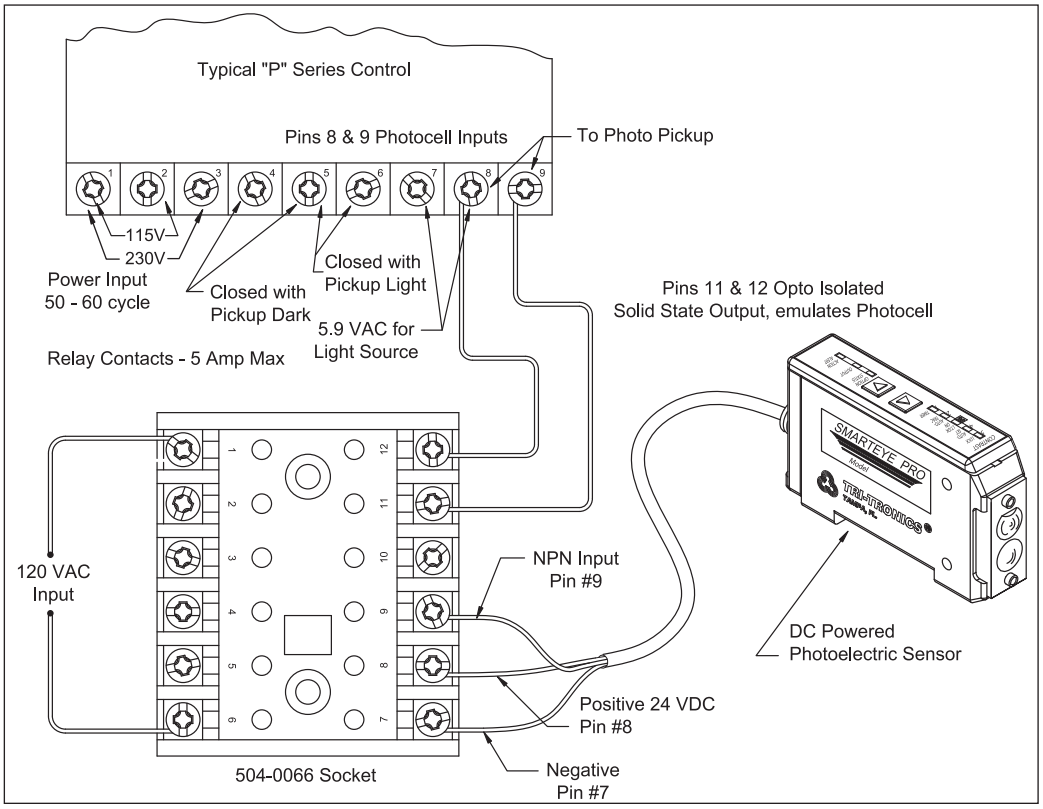
SEPS-3 & SEPS-3-240 Power Supply



SEPS-4 & SEPS-4-240 Power Supply



SEPS-5 & SEPS-5-240 Power Supply

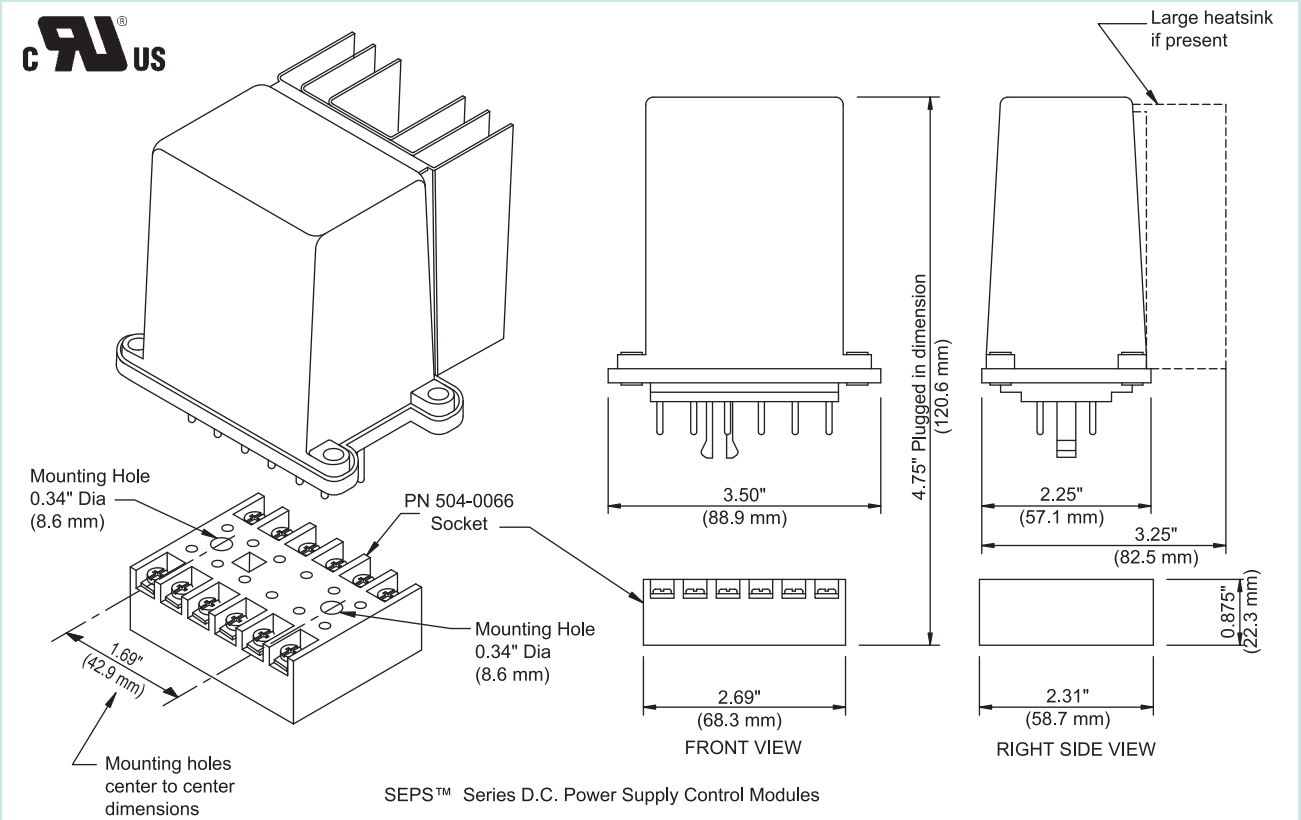


SEPS-6 & SEPS-6-240 Interface Module

Model #	Operating Voltage		Description
SEPS-1	120 VAC	50/60 HZ	Power Supply Only
SEPS-1-240	240 VAC	50/60 HZ	
SEPS-2	120 VAC	50/60 HZ	PS with (1) 5 amp AC or DC SPDT Relay
SEPS-2-240	240 VAC	50/60 HZ	
SEPS-3	120 VAC	50/60 HZ	PS with (2) 5 amp AC or DC SPDT Relay
SEPS-3-240	240 VAC	50/60 HZ	
SEPS-4	120 VAC	50/60 HZ	PS with (1) 10 amp Solid State AC Triac
SEPS-4-240	240 VAC	50/60 HZ	
SEPS-5	120 VAC	50/60 HZ	PS with (2) 10 amp Solid State AC Triac
SEPS-5-240	240 VAC	50/60 HZ	
SEPS-6	120 VAC	50/60 HZ	Provides DC Power to replacement sensor and interfaces output to photocell input of older Tri-Tronics Controls, such as P-Type chassis.
SEPS-6-240	240 VAC	50/60 HZ	

NOTE: Power Output Current Draw; 24 VDC / 250 mA - Consider total number of sensors being used and amount of current being drawn. Specify Socket Separately Model No. 504-0066

Dimensions



SEPS™ Series D.C. Power Supply Control Modules

MULTI-MATE® Control Modules *Multi-Function, Programmable*

MULTI-MATE Dual Function Models

MULTI-MATE Dual Function Models with high current output and heat sink

MULTI-MATE Single Function Models

Features

- The simplicity of a plug-in module with the versatility of programming up to 25 functions.
- Available in both Single Event (Model PM-8100/8125) and Dual Event (Model PM-8200/8225) versions, both providing dual outputs.
- Gives you the unique capability of programming for one function now, then changing the program as your needs change.

MULTI-MATE® Control Modules provide users with the flexibility to program up to 25 functions. These unique controls are the perfect match for use with TRI-TRONICS DC-powered sensors. They combine the simplicity of plug-in controls with the versatility of programming a wide variety of functions.

MULTI-MATE® Control Modules are available in either single or dual function models. All models provide a heavy-duty AC solid state output switch (TRIAC) as well as an output from a NPN open collector transistor. The controls also provide 24 VDC power for the remote sensor. The input to the control can be from an open collector transistor or a switch.

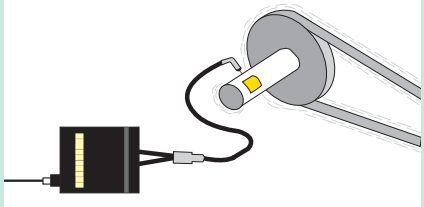
Event functions, timing ranges, and operating sequence are easily programmed using 8-position mini-dip switches, which are conveniently accessible through ports located on the front of the control. Switches 1 thru 5 program the function and 6 thru 8 set the timing range.

Many of the programmable timing/control functions are useful in monitoring product flow, i.e. "ON" delay, "OFF" delay, retriggerable one-shot/motion, etc. Additional programmable funtions are useful to control and manipulate products through the manufacturing process, such as "LATCH," one shot, etc.

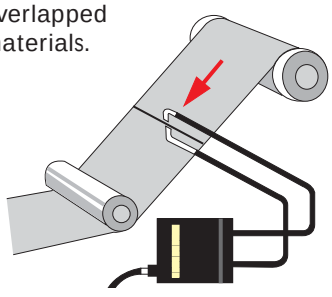
Some examples of applications where the timing and control functions provided by the MULTI-MATE® are extremely useful are:

- Jam detection
- Product void detection
- Motion detection
- Registration control
- Door control
- Over travel/limit/stop control
- Edge guide control
- Splice detection
- Product ejection monitor
- Batch counting
- Hopper level control
- Loop level control

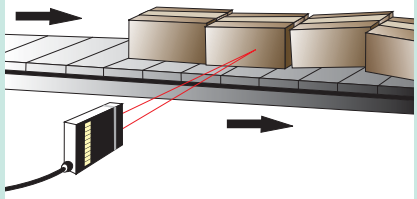
1. Detection of reflective tape moving at high rapidity.



2. Detection of splices or overlapped materials.



3. Jam detection



Single and Dual Event controls offer:

Dual Outputs:

1. TRIAC (AC switch) — selection of medium-duty rated at 1/6 HP or heavy-duty rated up to 1/4 HP.
2. NPN grounded emitter open collector output transistor rated to 100 mA maximum.

NOTE:
24 VDC power supply provides power to all DC sensors.

A variety of programmable functions:

Single Event Model PM-8100/8125:

- Motion (Retriggerable One-Shot)
- On-Delay
- Off-Delay
- One-Shot
- Latch

Dual Event Model PM-8200/8225:

25 programmable functions. These are the most common:

- On-Delay then Off-Delay
- One-Delay then One-Shot
- On-Delay then Latch
- Off-Delay then One-Shot
- Off-Delay then Latch
- One-Shot Input and One-Shot
- One-Shot (Delay) then One-Shot
- One-Shot (Delay) then Latch
- Motion then One-Shot
- Motion then Latch
- Latching Input then On-Delay
- Latching Input then One-Shot

Programming Simplicity

Event functions are programmed by an 8-position mini-dip switch, easily accessible through a port at the front of the control. Switches 1-5 program the function; switches 6-8 set the maximum time limits as follows:

Switch #1 - Motion (Retriggerable One-Shot)
Switch #2 - Delay
Switch #3 - Latch
Switch #4 - Light/Dark
Switch #5 - Output Invert (N/A on first function of Dual Event Model PM-8200)
Switch #6* - 1 second (Max. timing switch)
Switch #7* - 5 seconds (Max. timing switch)
Switch #8* - 15 seconds (Max. timing switch)

*With Switches #6, #7 and #8 "OFF," maximum time would be 1/2 second if the adjustments on top of the controls are turned to maximum. If Switches, #6, #7 and #8 are in the "ON" position, the maximum time would be 21 seconds. Timers are additive.

NOTE: Time adjustments are not applicable in "Latching" functions.

Programming

In the programming instructions below, it is assumed that:

1. Input from the sensor is normally "OFF" and the function is to occur on the leading edge of the input event. If this is not the case, simply reverse the position of Switch #4 (Light/Dark).

2. Output (TRIAC) is normally "OFF". If this is not the case, simply reverse the position of Switch #5 (Output Invert).

Single Event (Model PM-8100 and PM-8125)

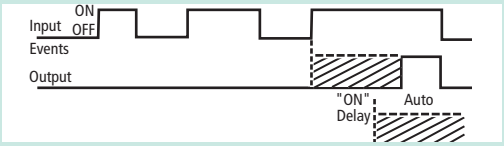
SEQUENCE*	PLACE LISTED SWITCHES TO >ON (ALL OTHERS OFF <)	CONTROL SEQUENCE*
"On" Delay	2,4	1
"Off" Delay	2,5	2
One-Shot	5	3
Motion Retriggerable One-Shot	1,5	4
Latch, Edge-Triggered	3,5	5

Dual Event (Model PM-8200 and PM-8225)

PLACE LISTED SWITCHES TO > ON (ALL OTHERS OFF <)	INPUT EVENT	OUTPUT EVENT	CONTROL SEQUENCE*
"On" Delay then "Off" Delay	2,4	2,5	6
"On" Delay then One-Shot	2,4	5	7
"On" Delay then Latch	2,4	3,5	8
"Off" Delay then One-Shot	2	5	9
"Off" Delay then Latch	2	3,5	10
One-Shot Triggers One-Shot	All "OFF"	4,5	11
One-Shot (Delay) than One-Shot	All "OFF"	5	12
One-Shot (Delay) then Latch	All "OFF"	3,5	13
Motion then One-Shot	1	5	14
Motion then Latch	1	3,5	15
Latch then "On" Delay	3	2	16
Latch then One-Shot	3	4,5	17

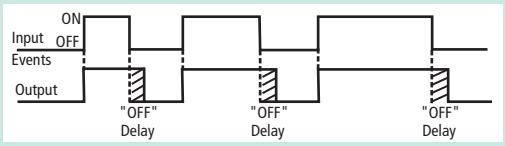
Functional Control and Timing Sequence Data

1



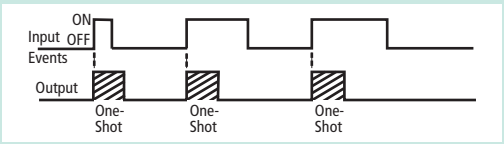
"ON" Delay

2



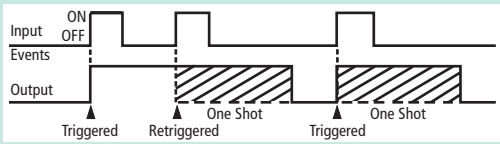
"OFF" Delay Pulse Stretcher

3



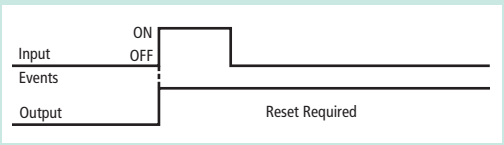
One-Shot

4



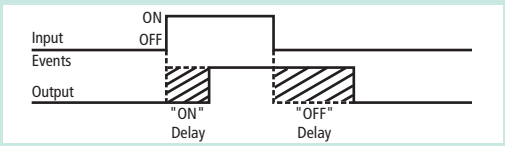
Motion Detection, Retriggerable One-Shot

5



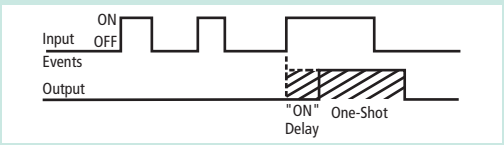
Latching, Edge Triggered

6



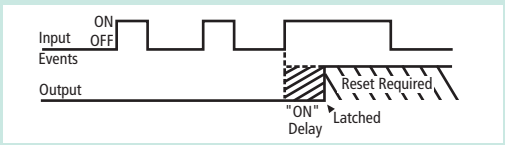
"ON" Delay then "OFF" Delay

7



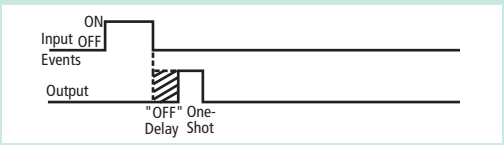
"ON" Delay, then One-Shot

8



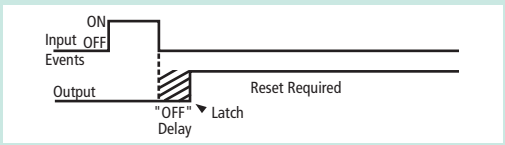
"ON" Delay then Latch

9



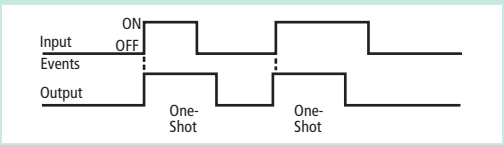
"OFF" Delay then One-Shot

10



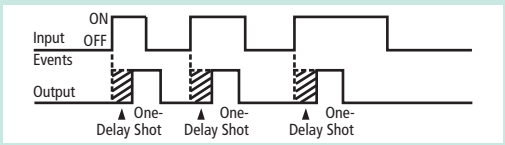
"OFF" Delay then Latch

11



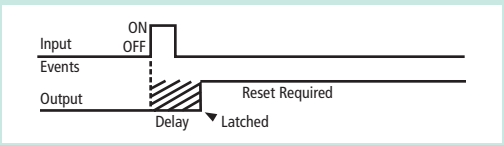
One-Shot Triggers One-Shot

12



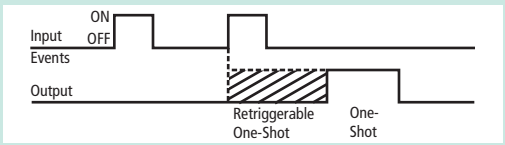
One-Shot Delay, then One-Shot

13



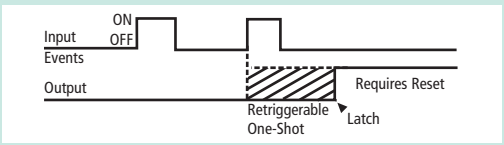
One-Shot Delay, then Latch

14



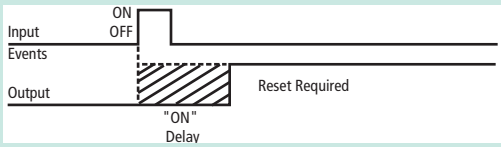
Stop Motion, then One-Shot

15



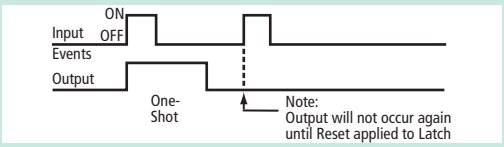
Stop Motion, then Latch

16



Latch then "ON" Delay

17



Latch, then One-Shot

Electrical Specifications

Input Power Requirements: Choice of 120 or 240 VAC ± 10%; 50-60 Hz models.

DC Power Output: 24 VDC Nominal @ 150 mA . (Unregulated) (Supplies power to DC sensor)

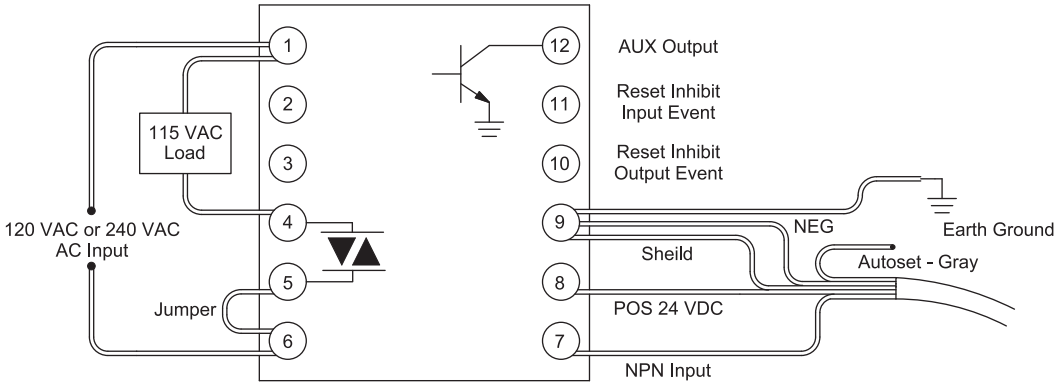
Output Relay: Models PM-8100/PM-8200 – Solid state AC relay. Triac rated at up to 1/6 HP motor load or 3.2 amp inductive load at 115 VAC.
Models PM-8125/PM-8225 – Equipped with larger heat sink Triac rated up to 1/4 HP motor load or 5.4 amp inductive load at 115 VAC.

Output Transistor (Pin 12): NPN grounded emitter open collector output transistor rated at 100 mA maximum. Maximum voltage = 40 VDC.

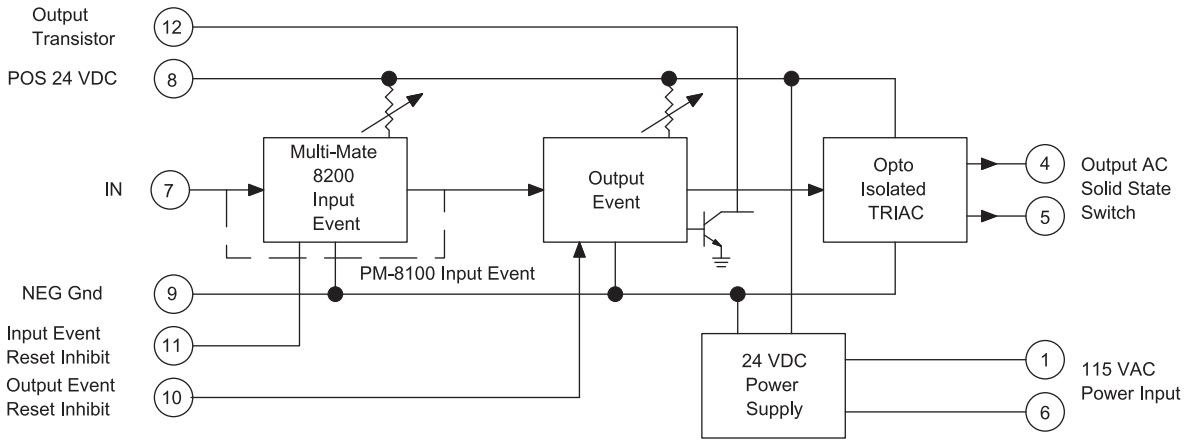
Input (Pin 7): Opto-isolated for high noise immunity. Accepts input from NPN open collector transistor or switch to ground. Responds to input durations as short as 100 microseconds.

Reset/Inhibit (Pin 10 or 11): Accepts input from NPN open collector transistor or switch to ground (Pin 9). Activated when Pin 9 is shorted to Pin 10 or 11.

Typical Wiring Diagram



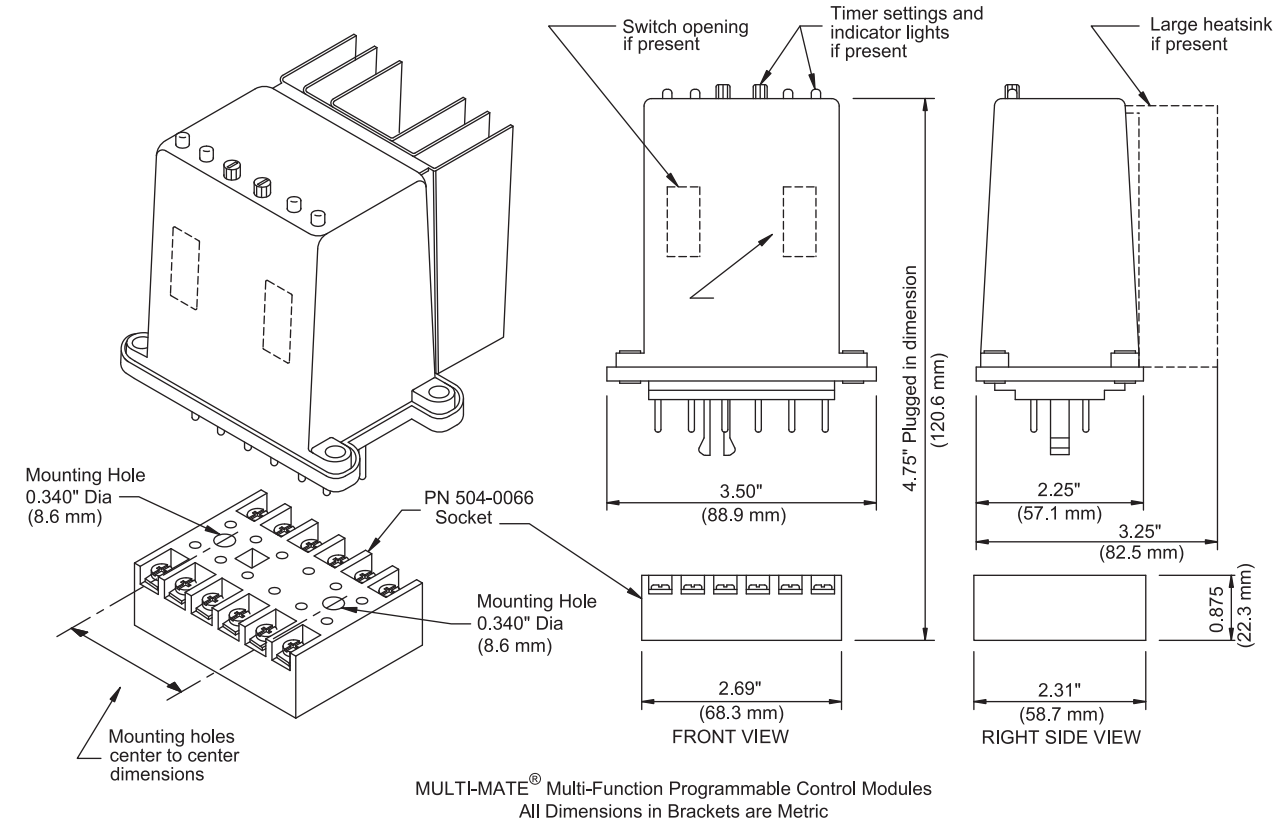
Functional Block Diagram



Model	Power Output Current Draw	Operating Voltage	Description
PM-8100 c UL us	24V DC 150 mA	120V AC 50/60HZ	Single Function Programmable with Solid State AC Switch, 1/6 HP rated
PM-8100-240 c UL us	24V DC 150 mA	240V AC 50/60HZ	Single Function Programmable with Solid State AC Switch, 1/6 HP rated
PM-8125	24V DC 150mA	120VAC 50/60HZ	Single Function Programmable with Solid State AC Switch, 1/4 HP rated
PM-8125-240	24V DC 150 mA	240V AC 50/60HZ	Single Function Programmable with Solid State AC Switch, 1/4 HP rated
PM-8200 c UL us	24V DC 150 mA	120V AC 50/60HZ	Dual Function Programmable with Solid State AC Switch, 1/6 HP rated
PM-8200-240	24V DC 150 mA	240V AC 50/60HZ	Dual Function Programmable with Solid State AC Switch, 1/6 HP rated
PM-8225	24V DC 150 mA	120V AC 50/60HZ	Dual Function Programmable with Solid State AC Switch, 1/4 HP rated
PM-8225-240	24V DC 150 mA	240V AC 50/60HZ	Dual Function Programmable with Solid State AC Switch, 1/4 HP rated
504-0066			Plug-In Socket Sold Separately

NOTE: 1/6 HP Rating = 3.2 amp inductive load at 115 VAC, 1/4 HP Rating = 5.4 amp inductive load at 115 VAC

Dimensions



MULTI-MATE® Multi-Function Programmable Control Modules
All Dimensions in Brackets are Metric

Description

The PIC™ Series Programmable Controls were designed to meet the demand for an easy-to-install and easy-to-use control for product sortation and inspection systems.

PIC™ Controls are used with a minimum of two DC-powered sensors. Any "product sensor" is used to detect the arrival of the product, and the "inspection sensor" (a SMARTEYE® or EZ-PRO®) is used to identify or inspect the product for the critical identifying features; e.g., variations in color, pattern, position, orientation, size, opacity, or surface reflectivity.

PIC™ controls supply 24 VDC power to both the product and inspection sensors. The control accepts inputs from NPN open collector transistor outputs of the remote sensors. Each input is opto-isolated to prevent problems with electrical noise and interference. The status of each input can be easily monitored via LED indicators located on the top of the control.

Programming

PIC™ Controls can be programmed to provide one of two outputs—either an adjustable one-shot (momentary) output or a latching output – whenever it responds to the recognition of the identifying feature. An optional program allows for an output response whenever the identifying feature has not been identified or detected.

An adjustable delay can be programmed to provide time for the product to move out of view of the sensors to a position where an electro-mechanical device can be located to eject the product from the conveyor line.

The optional latching output can be used to shut the machine off until a manual reset command from a remote switch is applied to the reset input of the control.

The output of the PIC™ Control is from a heavy-duty solid state TRIAC Switch that is capable of directly driving AC loads.

An additional open collector NPN transistor output provides the capability to drive logic controls such as counters or PLCs. This output is ideal when the application requires counting either "bad" or "good" products.

Operational Examples

The "product sensor" detects the arrival of the object or product to be inspected for the purpose of telling the control when to perform the inspection task. This sensor (also referred to as the "leading edge" sensor) generates an instantaneous "interrogate" or "look now" signal. It can be easily converted to a "trailing edge" sensor by simply switching to the sensor's complementary output, making it the interrogate input; e.g., switch from white to green wire or vice versa.

The "inspection sensor" performs the actual inspection task, such as detecting the presence or absence of a top or lid of a container, the correct color of a lid, the presence or absence of a label, foil liner or handle, etc. The list of inspection tasks this system will perform is virtually endless.

Utilizing a TRI-TRONICS high-performance sensor with the PIC™ Control makes this a unique system that is capable of responding to color, opacity, reflectivity, pattern, position, size or orientation.

In some applications, more than one "inspection sensor" can be used in the control system by combining multiple outputs into one common input for "and/or" gating functions. Examples of where this capability is useful are in the detection of labels on both sides of a bottle or for inspection of a complex pattern.

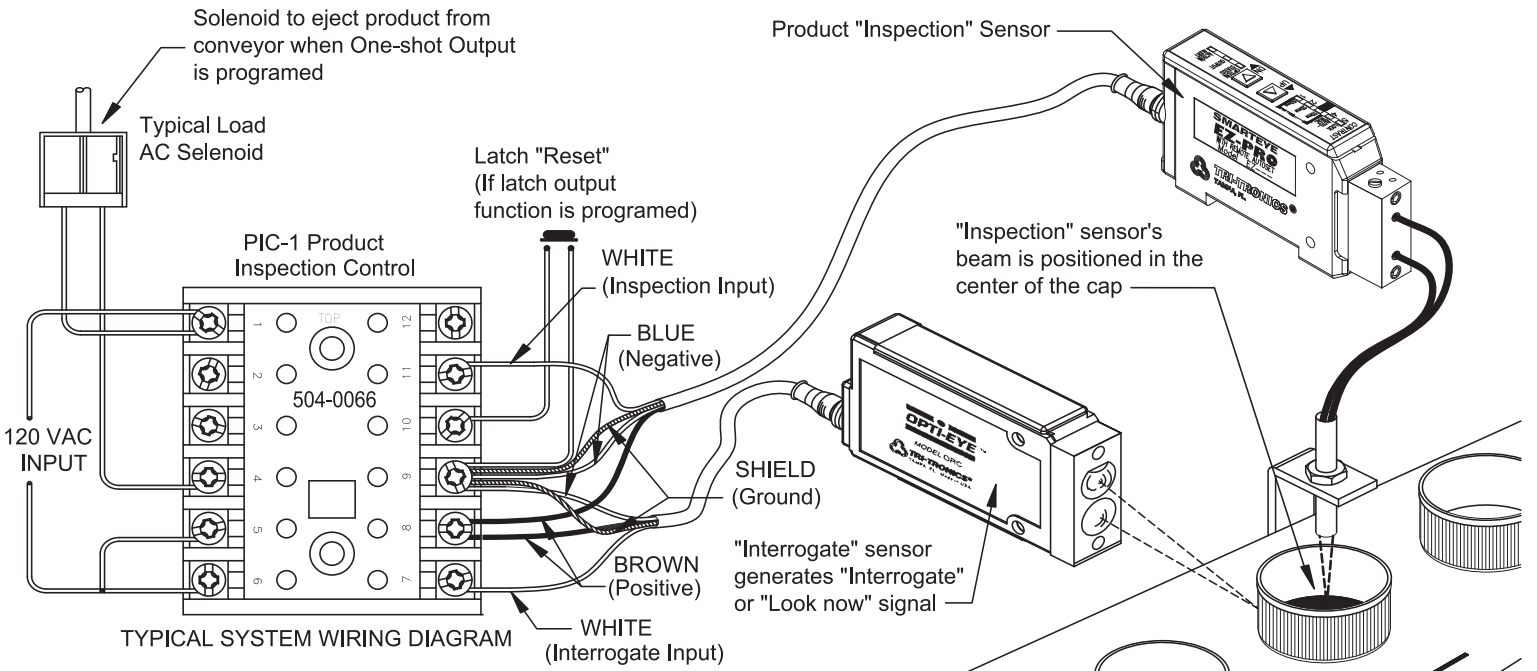
For inspecting the bottle labels, one PIC™ Control is used with one "product sensor" and two "inspection sensors".

For pattern recognition, one, two, or more SMARTEYE® sensors are used to view light/dark areas on complex patterns for specific identification purposes.

Contact your local Representative or the Factory for applications assistance.

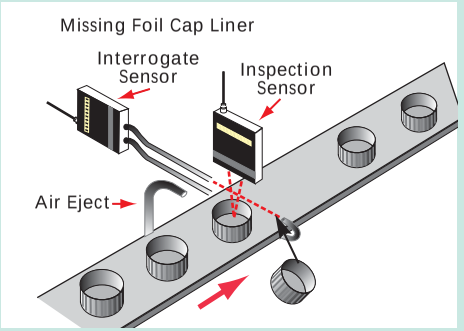
PIC-1™ PRODUCT INSPECTION CONTROL

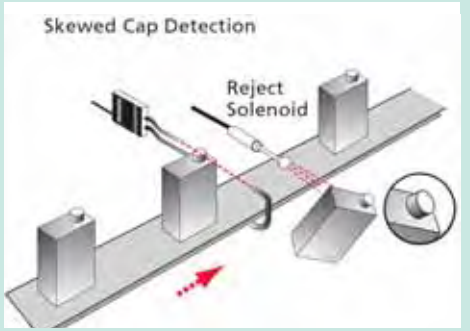
MISSING LINER DETECTOR, COLOR INSPECTION, CAP INSPECTION

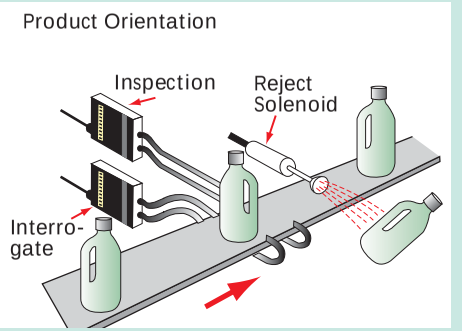


This product inspection system utilizes an EZ-Pro, Opti•Eye, and a PIC-1. The output event can be programmed to provide a one-shot output used to power the solenoid to eject product from the conveyor, or to be a latching output used to interrupt power to stop the machine (manual reset required). The "Interrogate" sensor sees the cap and tells the "Inspections" sensor to look for the liner. If no liner is present, the PIC-1 sends a signal to the selenoid to eject the cap from the conveyor.

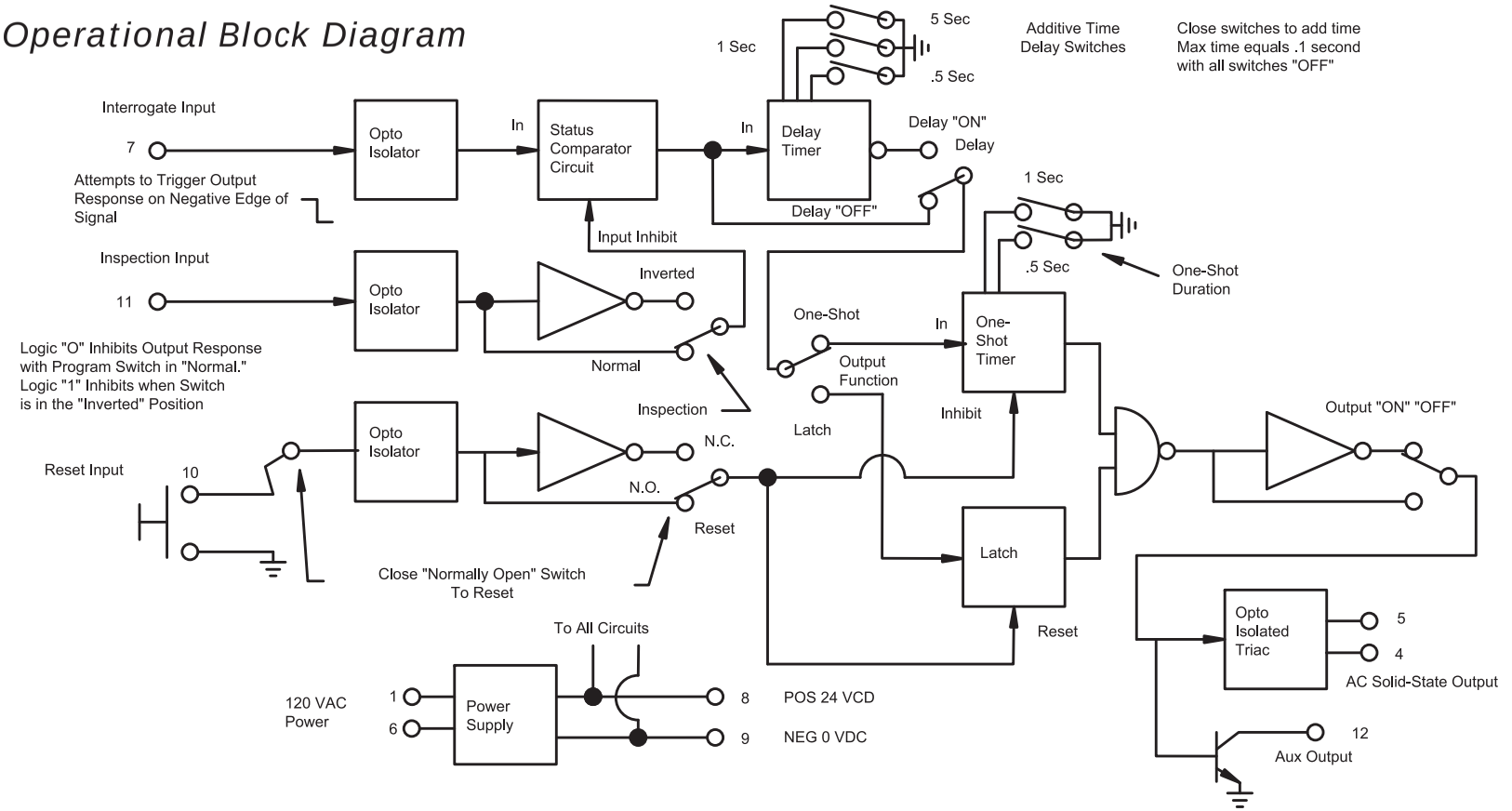
Typical Applications







Operational Block Diagram



Input Power requirements
(Pins 1 and 6)
Model PIC-1: 120 VAC ± 10%; 50-60 Hz
Model PIC-1-240: 240 VAC ± 10%; 50-60 Hz

D.C. Power Output
(POS Pin 8, NEG Pin 9) - All Models
24 VDC nominal @ 150 mA (unregulated)

Output Relay
(pins 4 and 5)
Solid state AC relay drives up to 1/6 HP load or 3.2 amp inductive load at 115 VAC MOV protection provided.

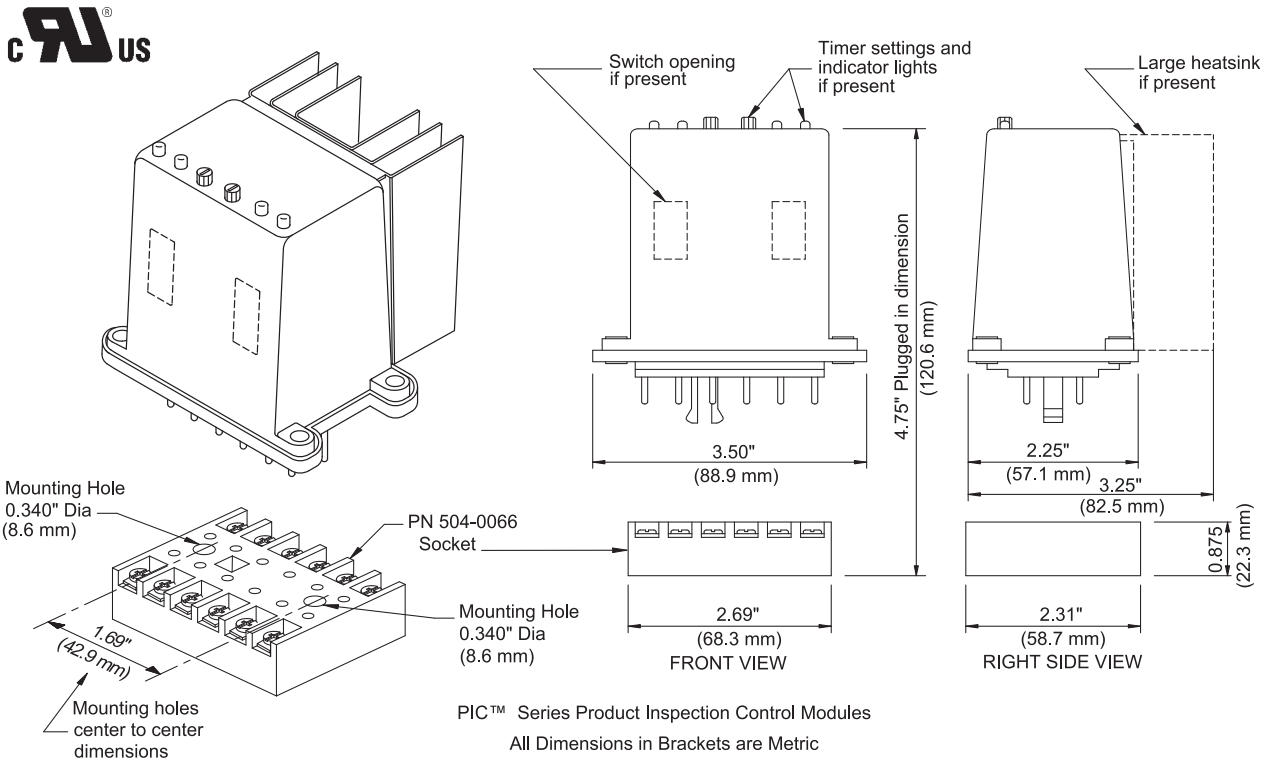
Output Transistor
(Pin 12) - All Models
NPN grounded emitter open collector output transistor rated at 100 mA maximum.

Maximum voltage = 40 VDC. Zener protected from voltage spikes.

Inputs
(Pins 7,10 and 11) -All Models All inputs are opto-isolated for high immunity to noise. All accept inputs from NPN transistors or switch to negative. Inputs respond to input durations as short as 100 microseconds. Interrogate Input: Pin 7. Inspection Input: Pin 11. Reset Input (for latched output): Pin10.

Model	Power Output Current Draw	Operating Voltage	Description
PIC-1	24V DC 150 mA	120V AC 50/60HZ	Solid State AC Relay, 10 Amp Triac
PIC-1-240	24V DC	240V AC 50/60HZ	Solid State AC Relay, 10 Amp Triac
504-0066			Plug-In socket sold separately

Dimensions



PIC™ Series Product Inspection Control Modules
All Dimensions in Brackets are Metric

Accessories

Cables
Reflectors
Lenses
Optical Blocks
Sensor Mounting Brackets

Cable Connection

4-Wire Shielded Micro Cables, M12 Black shielded cable assemblies that are lightweight and flexible

BSEC-6
6' (1.8 m) cable with connector

BSEC-15
15' (4.6 m) cable with connector

BSEC-25
25' (7.6 m) cable with connector

BRSEC-6
6' (1.8 m) cable / right angle conn.

BRSEC-15
15' (4.6 m) cable / right angle conn.

BRSEC-25
25' (7.6 m) cable / right angle conn.

4-Wire Yellow Shielded Cables, M12

SEC-6
6' (1.8 m) cable with connector

SEC-15
15' (4.6 m) cable with connector

SEC-25
25' (7.6 m) cable with connector

RSEC-6
6' (1.8 m) cable / right angle conn.

RSEC-15
15' (4.6 m) cable / right angle conn.

RSEC-25
25' (7.6 m) cable / right angle conn.

4-Wire Extension Cable, M12

BX-10
10' (3.1 m) Extension cable

BX-25
25' (7.6 m) Extension cable

4-Wire, Unshielded, M12

SEC-2MU
6.5' (2.0 m) Low-cost

SEC-5MU
16.4' (5.0 m) Low-cost

Cable Connection

4-Wire Nano Cable, M8

GEC-6
6' (1.8 m) cable with connector

GEC-15
15' (4.6 m) cable with connector

GEC-25
25' (7.6 m) cable with connector

RGEC-6
6' (1.8 m) cable / right angle conn.

RGEC-15
15' (4.6 m) cable / right angle conn.

GEX-9
9' (2.7 m) extension cable

Field Replacable 4-wire Connectors (waterproof)

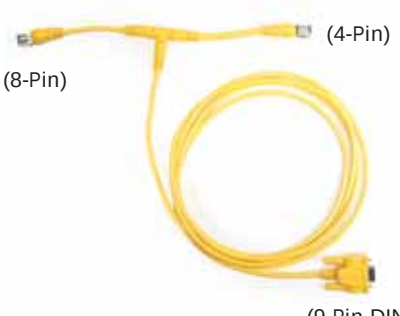
M12-4F
4-Wire, Female/Receptacle

M12-4M
4-Wire, Male/Plug

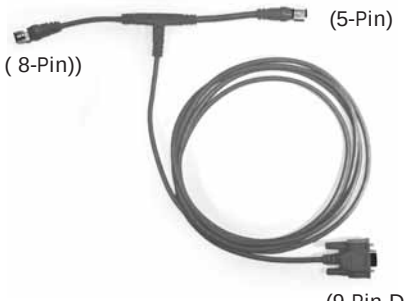
4-Wire, AC Only Mity•Eye Cable

CAC15
AC Mity•Eye
15' (4.6 m) cable,
AC only

DCS Specialty Cables



TJC-2
"T" Junction Splitter Cable,
4-Pin Output



TJC-3
"T" Junction Splitter Cable,
5-Pin Output

DCS8-2M
8-wire (2 m), M12
Non-metallic shell

Cable Connection

5-Wire Shielded Micro Cables, M12

GSEC-6
6' (1.8 m) cable with connector

GSEC-15
15' (4.6 m) cable with connector

GSEC-25
25' (7.6 m) cable with connector

GRSEC-6
6' (1.8 m) cable / right angle conn.

GRSEC-15
15' (4.6 m) cable / right angle conn.

GRSEC-25
25' (7.6 m) cable / right angle conn.

GPSEC-15
15' (4.6 m) Non-metallic shell

Field Replacable 5-wire Connectors (waterproof)

M12-5F
5-Wire, Female/Receptacle

M12-5M
5-Wire, Male/Plug

5-Wire Unshielded Cable, M12, low cost

GSEC-2MU
6.5' (2.0 m) Low-cost

GSEC-5MU
16.4' (5.0 m) Low-cost

5-Wire Extension Cable, M12

GX-25
25' (7.6 m) Extension cable

Reflectors and Mounting Brackets

Standard Reflectivity

Screw Mount

78P
4.4" x 1.9"

AR3
3" diam.

Glue Mount

AR114
1 1/4" diam.

AR158
1 5/8" diam.

AR58
5/8" diam.

AR78
7/8" diam.

Self-Adhesive Mount

98S
3.2" x 1.45"

Reflector Mounting Brackets

RB-1
Mounting kit includes
98S Reflector and
RB-2 Bracket

RB-2
98S Reflector
Mounting Bracket

Prismatic High Performance Reflectors NEMA 4, IP67

NEW!

These reflectors work with all retroreflective sensors, including the RetroSmart® (RSR) series.

Acrylic

AR4060
40.5 x 60 mm

AR6151
AR6151G
(Chemical Resistant Glass Cover)
2.4" x 2.0", (61 x 51 mm)

AR82
82.1 mm diam.

AR46
46 mm diam.

Flexible Acrylic, Self-Adhesive Mount

PRD1 Round Reflector
1" (25 mm) diam.

PRD2 Round Reflector
2" (50 mm) diam.

SPR1 Square Reflector
1 1/16" (27 mm)

SPR2 Square Reflector
2" (50.8 mm)

Acrylic, Self-Adhesive Reflector Tape

Very thin – .03" (.76 mm)

2000X	Square Relector Tape 3" (76.2 mm)
2001X-1F	Relector Tape 1" x 12" (25.4 mm x 304.8 mm) 12" minimum
2001X-50F	Relector Tape 1" x 50' (25.4 mm x 15.2 m) 50' roll
2002X-1F	Reflector Tape 2" x 12" (50.8 mm x 304.8 mm) 12" minimum
2002X-75F	Reflector Tape 2" x 75' (50.8 mm x 22.8 m) 75' roll

Fiberoptic Accessories Lenses and Mounting Brackets

FMB-1
(8.4 mm diam.)
Standard Fiberoptic
Mounting Bracket
Use with Threaded Glass
Fiberoptic

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic
Fiberoptic Mounting
Brackets

FPA-1
Slip-on Polarizing Adaptor
Lens (2 Required)
Slips over end of
Model F-A-36 Straight
Light Guides only

FPA-2
Friction Mount Polarizing
Adaptor Lens (2 Required)
Friction mounts onto
F-A-36P Straight Light
Guides only

GLA-1
1/4" X 1"
Slip-on Lens Assembly
Slips on Model
EH-4001 plastic fibers

GLA-2
Long Range Lens
for Through-Beam
Use with M4 Tips

HLA-1
3/8" X 1" Threaded
Slip-on Lens Assembly
Slips on Model EH-4001
plastic fibers

HLA-2
Spot Focus Lens for
Diffused Beam
Use with M6 Tips
Focal Point .50" (12.7 mm)

UAC-12
Slip-on Long Range Plastic
Lens, Use on .187" O.D.
straight or right angle
fiber tip or .040" fiber

UAC-15
Threaded Long Range Glass
Lens, 2" Focal Point
Fits any standard threaded
tip Glass Fiberoptic
Lg. 1 3/8" (35 mm)

UAC-5
Threaded Spot Focus Plastic
Lens, 1" Focal Point
Fits any standard threaded
tip Glass Fiberoptic
Lg. 2" (51 mm)

UAC-5G
Threaded Spot Focus Glass
Lens, 1" Focal Point
Fits any standard threaded
tip Fiberoptic
Lg. 2" (51 mm)

NFA-50
.5" Nylon Fiberoptic Adaptor,
50 pieces, Insert adapts F1 and F4
optical blocks to all .040" diam.
cut-to-length plastic fiberoptic
light guides.

NFA12-50
.25" Nylon Fiberoptic
Adaptor, 50 pieces,
Use to adapt UAC-12
Lens to .040" diam.
plastic fibers.

PFC-1
Plastic Fiber Cutter

Power Supply Accessories

PME-7 Enclosure

504-0066 Socket

Model No.	Description	Application/ Ordering Information
PME-7	Enclosure, 2 Piece black anodized, Clam Shell Style 5 in. H x 6 in. W x 4 in. D (NEMA-1)	Use with Controls Pages 4-1 to 4-12
504-0066	Socket, 12 Pin Pressure Term Universal Socket (SD-12)	Use with Controls Pages 4-1 to 4-12

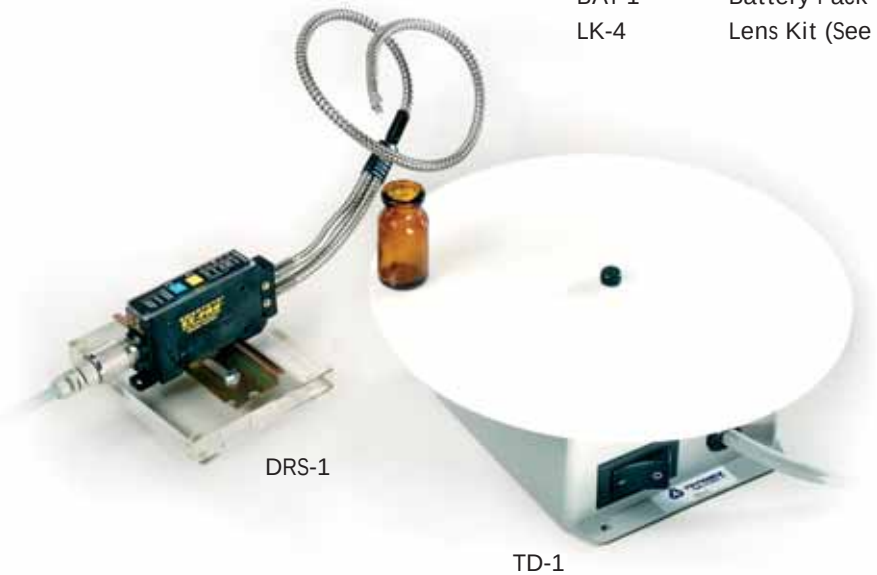
Accessories for Testing

Rigid Stainless Stay-put Fiberoptic Light Guides

Rigid but flexible stay-put fiberoptic light guides are excellent for many applications and demonstration purposes.

Custom lengths & tip configurations are built to order. (Add "S" to the beginning of fiber part number.)

Model No.	Description
SBF-A-18T	18" Threaded Tip
SBF-A-24	24" Standard Tip
TD-1	Demo Turntable
DRS-1	Din Rail Stand Assembly
BAT-1	Battery Pack with buzzer and charger
LK-4	Lens Kit (See Optical Blocks Accessories for contents)



DRS-1

TD-1

BAT-1 Battery Pack

Optical Blocks Accessories

Optical Blocks — SMARTEYE® Series for Standard Sensors

Type F1

Type O1, O1G

Type O2

Type R1

Type V1, V1G

Type GP2

Model No.	Description
F1	Fiberoptic Adaptor Block
01	Medium Range Proximity Block, Plastic
O1G	Medium Range Proximity Block, Glass
O2	Short Range Proximity Block
R1	Retroreflective Block
V1	"V" Axis Block, Plastic Lens
V1G	"V" Axis Block, Glass Lens

Model No.	For Standard Sensors
GP1	Gap Probe, provides a 1.5" probe
GP2	Gap Probe, provides a 2.5" probe
GP3	Gap Probe, provides a 3.5" probe

Optical Blocks for Miniature Sensors

Model No.	Description
F4	Fiberoptic Optical Block
F5	Plastic Fiberoptics
F6	Plastic Fiberoptics
O4	Proximity, Wide Beam Optical Block
O5	Proximity, Long Range Optical Block
R4	Retroreflective Optical Block
R5	Polarized Retroreflective Optical Block
V4	"V" Axis Optical Block, 1 in. Range
V4A	Apertured Optical Block, 1 in. Range
V6	"V" Axis Optical Block, 1.5 in. Range
V8	"V" Axis Optical Block, .5 in. Range

Model No.	For Miniature Sensors
GP6	Gap Probe, provides a 1.5" probe
GP7	Gap Probe, provides a 2.5" probe
GP8	Gap Probe, provides a 3.5" probe

LK-4
Lens Kit (one each F4, F5, F6, O4, O5, R4, R5, V4, V4A, V6, V8)

Sensor Mounting Brackets (Assembly Includes Mounting Screws)

NOTE: All black mounting brackets are aluminum.

DCB-1
HSLS-12 Mounting Stainless Bracket Assembly

DRB-1
Smarteye Mark III Din Rail Bracket

MB-18
18 mm Bracket, for use with TA-18

NUT-18
18 mm Mounting Nut for use with MINI•EYE™

SEB-1
Smarteye® Mark II
Smarteye® Classic
Smarteye® Colormark II
Stainless Mounting Bracket Assembly

SEB-3
Opti-Eye, Mark III, Smarteye Pro, Stainless Bracket Assembly

SEB-4
Stealth Stainless Mounting Bracket Assembly

MEB-1
Mity-Eye Mounting Bracket Assembly

TEB-1
Tiny-Eye Vertical Mount, Mounting Bracket Assembly

TEB-2
Tiny-Eye Horizontal Mount, Mounting Bracket Assembly

UMB-1
U.S. Eye Mounting Bracket Assembly

USB-1
U.S. Eye Adjustable Sub-Bracket Assembly

FMB-1 (8.4 mm diam.)
Standard Fiberoptic Mounting Bracket

FMB-2 (5.1 mm diam.)
FMB-3 (3.1 mm diam.)
Miniature Glass or Plastic Fiberoptic Mounting Brackets

MIB-1
Mini-Eye Stainless Bracket Assembly

MIB-2
Stainless Bracket Assembly

Data Reference Tables

NEMA RATINGS

2.1 GENERAL

The features of each enclosure Type are applicable only when the enclosure is completely and properly installed.

All mechanical and electrical parts mounted on or through an enclosure shall pass the applicable tests for the enclosure Type unless otherwise specified.

2.2 SPECIFIC TYPES

Table 2.1 and table 2.2 are guides for comparing specific applications of enclosures.

The specific enclosure Types, their applications, and the environmental conditions they are designed to protect against are as follows:

Type 1 — Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection against falling dirt.

Type 2 — Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment, to provide a degree of protection against falling dirt, and to provide a degree of protection against dripping and light splashing of liquids.

Type 3 — Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, and windblown dust; and that will be undamaged by the external formation of ice on the enclosure.

Type 3R — Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, and windblown dust; and in which the external mechanism(s) remain operable when ice laden.

Type 4 — Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, and windblown dust; splashing water, and hose-directed water; and that will be undamaged by the external formation of ice on the enclosure.

Type 4x — Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, and windblown dust; splashing water, and hose-directed water;and corrosion; and that will be undamaged by the external formation of ice on the enclosures.

Type 5 — Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment, to provide a degree of protection against falling dirt; against setting airborne dust, lint, fibers, and flyings; and to provide a degree of protection against dripping and light splashing of liquids.

Type 6 — Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against hose-directed water and the entry of water during occasional temporary submersion at a limited depth; and that will be undamaged by the external formation of ice on the enclosure.

NEMA RATINGS

Type 6P Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against hose-directed water and the entry of water during prolonged submersion at a limited depth; and that will be undamaged by the external formation of ice on the enclosure.

Type 12 Enclosures constructed (without knockouts) for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against circulating dust, lint, fibers, and flyings; and against dripping and light splashing of liquids.

Type 12K Enclosures constructed (with knockouts) for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against circulating dust, lint, fibers, and flyings; and against dripping and light splashing of liquids.

Type 13 Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment, to provide a degree of protection against falling dirt; against circulating dust, lint, fibers, and flyings; and against the spraying, splashing and seepage of water, oil, and non-corrosive coolants.

The rating established by IEC Publications 144 and 529 define the following "IP" ratings:

1st CHARACTERISTIC: Protection against contact and penetration of solid bodies

Numeral	Short Description
0	Non-protected
1	Protected against solid objects greater than 50 mm
2	Protected against solid objects greater than 12 mm
3	Protected against solid objects greater than 2.5 mm
4	Protected against solid objects greater than 1.0 mm
5	Dust protected
6	Dust-tight

2nd CHARACTERISTIC: Protection against the penetration of liquids

Numeral	Short Description
0	Non-protected
1	Protected against dripping water
2	Protected against dripping water when tilted up to 15 `
3	Protected against spraying water
4	Protected against splashing water
5	Protected against water jets
6	Protected against heavy seas
7	Protected against the effects of immersion
8	Protected against submersion

TABLE 2-1
Comparison of Specific Applications of Enclosures for Indoor Nonhazardous Locations

Provides a Degree of Protection Against the Following Environmental Conditions	Type of Enclosure									
	1*	2*	4	4X	5	6	6P	12	12K	13
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X
Falling dirt	X	X	X	X	X	X	X	X	X	X
Falling liquids and light splashing	–	X	X	X	X	X	X	X	X	X
Circulating dust, lint, fibers, and flyings**	–	–	X	X	–	X	X	X	X	X
Settling airborne dust, lint, fibers, and flyings**	–	–	X	X	X	X	X	X	X	X
Hosedown and splashing water	–	–	X	X	–	X	X	–	–	–
Oil and coolant seepage	–	–	–	–	–	–	–	X	X	X
Oil or coolant spraying and splashing	–	–	–	–	–	–	–	–	–	X
Corrosive agents	–	–	–	X	–	–	X	–	–	–
Occasional temporary submersion	–	–	–	–	–	X	X	–	–	–
Occasional prolonged submersion	–	–	–	–	–	–	X	–	–	–

* These enclosures maybe be ventilated

** These fibers and flyings are nonhazardous materials and are not considered Class III type ignitable fibers or combustible flyings. For Class III type ignitable fibers or combustible flyings see the National Electrical Code, Article 500.

TABLE 2-2
Comparison of Specific Applications of Enclosures for Outdoor Nonhazardous Locations

Provides a Degree of Protection Against the Following Environmental Conditions	Type of Enclosure						
	3	3R*	3S	4	4X	6	6P
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X
Rain, snow, and sleet **	X	X	X	X	X	X	X
Sleet ***	–	–	X	–	–	–	–
Windblown dust, lint, fibers, and flyings	X	–	X	X	X	X	X
Hosedown	–	–	–	X	X	X	X
Corrosive agents	–	–	–	–	X	–	X
Occasional temporary submersion	–	–	–	–	–	X	X
Occasional prolonged submersion	–	–	–	–	–	–	X

* These enclosures maybe be ventilated

** External operating mechanisms are not required to be operable when the enclosure is ice covered.

*** External operating mechanisms are operable when the enclosure is ice cvered. See 5.6

TABLE 1. Units of Measure

Unit	Symbol	Physical Quantity
ac volts	V ac	electrical potential - alternating current
ampere	A	electrical current
dc volts	V dc	electrical potential - direct current
degrees Celsius	ºC	temperature
degrees Fahrenheit	ºF	temperature
diameter	ø	circular width
Hertz	Hz	frequency
lumen*	lm	light energy
lux	lx	illumination (lm/m^2)
meter	m	length
microamp	μA	electrical current (10^{-6} A)
microsecond	μs	time (10^{-6} s)
milliamp	mA	electrical current (10^{-3} A)
millimeter	mm	length (10^{-3} m)
millisecond	ms	time (10^{-3} s)
nanometer	nm	length (light wavelength)
ohm	Ω	electrical resistance
second	s	time
volt	V	electrical potential
volt-amp	VA	power
watt	W	power

* 1 lumen = 0.001496 watt of monochromatic light at a wavelength of 546 nm

TABLE 2. Unit Prefixes

Decimal Equivalent	Prefix	Symbol	Exponential Expression
1 000 000 000 000	tera	T	10^{12}
1 000 000 000	giga	G	10^{9}
1 000 000	mega	M	10^{6}
1 000	kilo	k	10^{3}
100	hecto	h	10^{2}
10	deka	da	10
0.1	deci	d	10^{-1}
0.01	centi	c	10^{-2}
0.001	milli	m	10^{-3}
0.000 001	micro	μ	10^{-6}
0.000 000 001	nano	n	10^{-9}
0.000 000 000 001	pico	p	10^{-12}

English/Metric Conversion Chart

To convert millimeters to inches, multiply by 0.0394. • To convert inches to millimeters, multiply by 25.4.

Inches Fraction	Inches Decimal	Millimeter
----	.0039	0.1
----	.0079	0.2
----	.0118	0.3
1/64	.0156	0.397
----	.0157	0.4
----	.0197	0.5
----	.0236	0.6
----	.0276	0.7
1/32	.0312	0.794
----	.0315	0.8
----	.0354	0.9
----	.0394	1
3/64	.0469	1.191
1/16	.0625	1.588
5/64	.0781	1.984
----	.0787	2
3/32	.0938	2.381
7/64	.1094	2.778
----	.1181	3
1/8	.1250	3.175
9/64	.1406	3.572
5/32	.1562	3.969
----	.1575	4
11/64	.1719	4.366
3/16	.1875	4.762
----	.1968	5
13/64	.2031	5.159
7/32	.2188	5.556
15/64	.2344	5.953
----	.2362	6
1/4	.2500	6.350
17/64	.2656	6.747
----	.2756	7
9/32	.2812	7.144
19/64	.2969	7.541
5/16	.3125	7.938
----	.3150	8
21/64	.3281	8.334
11/32	.3438	8.731
----	.3543	9
23/64	.3594	9.128
3/8	.375	9.525
25/64	.3906	9.922
----	.3937	10
13/32	.4062	10.319
27/64	.4219	10.716
----	.4331	11
7/16	.4375	11.112
29/64	.4531	11.509
15/32	.4688	11.906
----	.4724	12
31/64	.4844	12.303
1/2	.500	12.700
----	.5118	13
33/64	.5156	13.097
17/32	.5312	13.494
35/64	.5469	13.891
----	.5512	14
9/16	.5625	14.288
37/64	.5781	14.684
----	.5905	15
19/32	.5938	15.081
39/64	.6094	15.478
5/8	.625	15.875
----	.6299	16
41/64	.6406	16.272
21/32	.6562	16.669
----	.6693	17
43/64	.6719	17.066
11/16	.6875	17.462
45/64	.7031	17.859
----	.7087	18
23/32	.7188	18.256
47/64	.7344	18.653
----	.7480	19
3/4	.750	19.050
49/64	.7656	19.447
25/32	.7812	19.844
----	.7874	20
51/64	.7969	20.241
13/16	.8125	20.638
----	.8268	21
53/64	.8281	21.034
27/32	.8438	21.431
55/64	.8594	21.828
----	.8661	22
7/8	.875	22.225
57/64	.8906	22.622
----	.9055	23
29/32	.9062	23.019
59/64	.9219	23.416
15/16	.9375	23.812
----	.9449	24
61/64	.9531	24.209
31/32	.9688	24.606
----	.9842	25
63/64	.9844	25.003
1	1.000	25.400

Glossary of Photoelectric Terms

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Alignment
Positioning the light beam in the best possible location to optimize the sensor's response to contrasting light levels.

Alternating Output
Successive input events alternately energize and de-energize the outputs. The output signal can switch on either the leading edge or the trailing edge of the input event.

Ambient Light
Environmental light in the sensing area.

Analog Output
An output event (voltage or current) that varies in proportion to the received light intensity.

Angle Of Incidence
The angle between a beam of light striking a surface and a line perpendicular to that surface.

Aperture
An opening in opaque material that is placed in-line with the light beam path, so as to restrict, or shape, the effective beam.

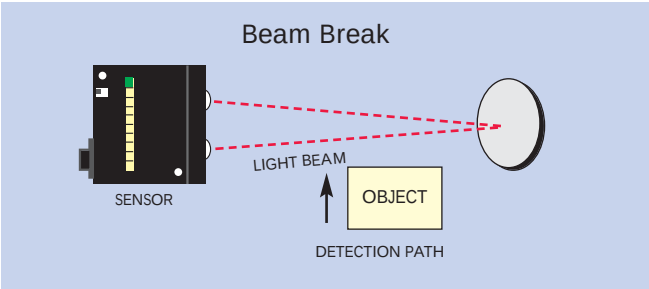
Attenuation
Lessening of sensing energy caused by environmental elements such as dirt, dust, moisture, or other contaminants in the sensing area.

AUTOSET™
Provides for a one-button, one-push setup routine.

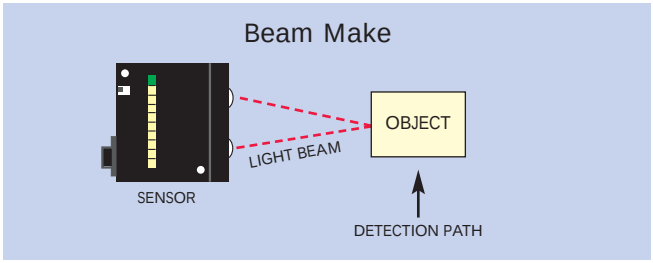
Automatic Contrast Tracking (ACT™)
Provides for self adjusting sensor to changes in contrasting light levels as input events are ongoing. Automatic Contrast Tracking (ACT™) automatically adjusts the sensor as conditions change, both light and dark states.

Automatic Gain Select (AGS™)
This unique feature provides automatic digital selection of amplifier gain based upon your sensing requirements.

Beam Break Mode (Thru-Beam)
A sensing mode in which the object to be sensed breaks, or diminishes, an existing light beam path between the light source and the receiver.



Beam Make Mode
A sensing mode in which the object itself reflects, or diffuses, the transmitted light beam on its path to the receiving lens.



Bifurcated Fiber Optic
A fiber optic bundle that branches into 2 parts.

Burn-Through
Describes the ability of high-powered modulated opposed mode sensors to "see" through paper, thin cardboard, opaque plastics, and materials of similar optical density. Burn-through may be used to advantage in some sensing situations, such as when looking through an opaque walled container (like a cereal box) to sense the presence or absence of product inside.

Color Perception Sensor
Differentiates between two different colors or between a colored mark and the background material. (See Registration Mark)

Continuous Motion
Constant machine motion without interruption. As opposed to cyclic motion.

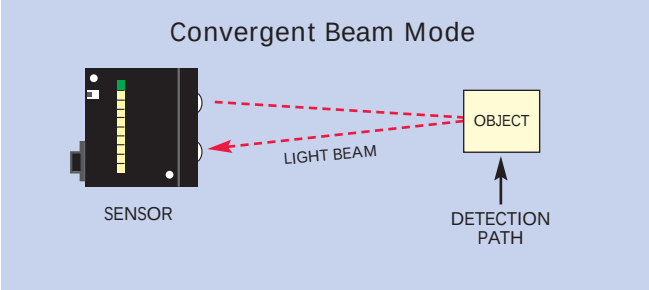
Complementary Outputs
Dual state outputs from a common source. When one output is normally open, the other is normally closed.

Contrast
The difference in the intensity of the received light beam in its lightest state vs. its darkest state.

Convergent Beam Mode
A type of proximity sensing in which the field of illumination from the light source and the field of vision seen by the receiver converge at a fixed point in front of the sensor. (See illustration on next page)

Corner-Cube Reflector
Also called a corner-cube prism. A prism having three mutually perpendicular surfaces and a hypotenuse face. Light entering through the hypotenuse face is reflected

Glossary of Photoelectric Terms



by each of the three surfaces and emerges back through the hypotenuse face parallel to the entering beam. The light beam is returned to its source. May also be constructed from three first-surface mirrors. Corner-cube geometry is used for retroreflective materials. See "retroreflector".

Crosstalk (Electrical)
Electrical crosstalk occurs in modulated photoelectric component systems when the modulated emitter signal (which is a high-current pulsed signal) couples directly onto the receiver lead wires. This results in a "lock-on" condition of the amplifier (i.e. the amplifier recognizes a light condition regardless of the sensor's status). Crosstalk is usually a result of improper splicing of additional remote sensor lead length. In component systems, remote sensors require separate shielded cables for emitter and receiver lead extension, even if the original cable length contained wires for both the emitter and the receiver.

Crosstalk (Optical)
Optical crosstalk occurs when a photoelectric receiver responds to light from an adjacent emitter. This is often an unwanted situation. If crosstalk cannot be resolved by repositioning of sensors, it can often be eliminated using sensor multiplexing, as with the MP-8 multiplexer module. Crosstalk can be resolved by repositioning the sensor.

Current Sinking Output (NPN)
A transistor output from a control circuit that, when in the "on" state, allows current flow from the load through the output transistor and then to negative. The output device is usually an NPN transistor with its emitter tied to negative of the supply. The load is connected from the output to positive.

Current Sourcing Output (PNP)
A transistor output from a control circuit that, when in the "on" state, allows current flow from the output transistor, through the load and then to negative. The output device is usually a PNP transistor with its emitter tied to positive of the supply. The load is connected from the output to negative.

Cyclic Motion
Intermittent motion of machinery occurring in repetitive cycles, i.e., start then stop then start. As opposed to continuous motion.

Dark State
A condition that produces an output when the intensity of the received light beam falls below a sensor's fixed threshold. (See Beam Break Mode)

Detection Path
Direction of travel of the object to be detected past the sensing site.

Detector (photoelectric)
Element that receives the light coming from the emitter.

Diffused Mode
See Proximity Mode

Digital Output
A switching output signal that has only 2 stable states..."On" or "Off".

DIN
An abbreviation for "Deutsches Institut fur Normung", West German industry standards.

DIN Rail Mount
Convenient method for mounting a sensor to a DIN Rail.

Disable
(See Inhibit)

Divergent Sensing Mode
A variation of the diffuse photoelectric sensing mode in which the emitted beam and the receiver's field of view are both very wide. Divergent mode sensors have very forgiving alignment requirements, but have shorter sensing range as compared to diffuse mode sensors of the same basic design. Divergent sensors are particularly useful for sensing transparent or translucent materials or for sensing objects with irregular surfaces (e.g. webs with "flutter"). They are also used to reflectively sense objects with very small profiles, like small diameter thread or wire, at close range.

DPDT Relay
Double-Pole, Double-Throw. A relay with two sets of Single-Pole, Double-Throw form C contacts that are operated simultaneously by a single action.

Glossary of Photoelectric Terms

Duty Cycle
The duration of time the sensor will be in the dark state or the light state. Equal times are referred to as a 50/50 duty cycle.

Enhanced Dynamic Range (EDR®)
A circuit that extends the dynamic operating range to provides unequaled performance at very bright light levels.

Effective Beam
That portion of the transmitted light beam collected by the receiving lens.

Electromagnetic Interference (EMI)
Electrical "noise" which may interfere with proper operation of sensors, programmable logic controllers, counters, data recorders, and other sensitive electronic equipment. Common sources of EMI include lighting fixtures and controls, motors, generators, and contactors. EMI emissions are distributed evenly across the radio frequency spectrum. Emissions are readily conducted along cables, so EMI sources can often be found by following along wireways with a portable radio.

Emitter (Photoelectric)
1. The sensor containing the light source in an opposed mode photoelectric sensing pair (see "opposed sensing mode").
2. The light emitting device within any photoelectric sensor (e.g. LED, incandescent bulb, laser diode, etc.).

Enable
To allow an output to occur in response to an input signal. Synonomous with "interrogate" when used to describe the gating function in an inspection scheme. See "inspection logic".

Excess Light
(Excess Gain) The amount of light received in excess of the amount necessary to switch the output.

Fiber Optics
Transparent fibers of glass or plastic used to "carry" light to and from a sensing site.

Field Of View
Refers to the area of response of a photoelectric sensor.

Fixed Focal Point
See Convergent Beam.

Fluorescence
The emission by a material of light radiation at a longer wavelength as a result of the absorption of some other radiation of shorter wavelengths. For example, the emission of visible light as a result of excitation by ultraviolet light.

Gain Adjustment
See Sensitivity Adjustment.

Gate
1. A combinational logic circuit having one or more input channels.
2. Used as shorthand for "interrogate".

Hysteresis
The differential between the operate point and the release point of the sensor's output.

Hertz (Hz)
The international unit of frequency, equal to one cycle per second.

IEC
International Electrotechnical Commission; a standard rating system for environmental conditions.

Individual Fiber(Optic)
A fiber optic assembly having one control end and one sensing end. Used for piping photoelectric light from an emitter to the sensing location or from the sensing location back to a receiver. Usually used in in pairs in the opposed sensing mode, but can also be used side-by-side in the diffuse proximity mode or angled for the specular reflection or mechanical convergent mode.

Infrared Led
IR, Invisible light emitting device, 880nm or above.

Inhibit
To prevent a control circuit's response to an input signal.

Input
1. The signal (voltage or current) applied to a circuit to

cause the output of that circuit to change state.
2. The terminals, jack, or receptacle provided for reception of the input signal.

Input Voltage
The power source required by an electric or electronic device (e.g. a self-contained sensor) in order for the device to operate properly.

Interrogate Signal
A command signal used to sample the status of the state of a variable signal or condition. Typically used to instantaneously sample the status of an inspection sensor. Product inspection systems often require an interrogate signal to determine if an output response is required.

IP Ratings
The rating system established by IEC Publications 144 and 529 define the following "IP" ratings:
1st CHARACTERISTIC: Protection against contact and penetration of solid bodies

Numeral	Short Description
0	Non-protected
1	Protected against solid objects greater than 50 mm
2	Protected against solid objects greater than 12 mm
3	Protected against solid objects greater than 2.5 mm
4	Protected against solid objects greater than 1.0 mm
5	Dust protected
6	Dust-tight

2nd CHARACTERISTIC: Protection against the penetration of liquids

Numeral	Short Description
0	Non-protected
1	Protected against dripping water
2	Protected against dripping water when tilted up to 15º
3	Protected against spraying water
4	Protected against splashing water
5	Protected against water jets
6	Protected against heavy seas
7	Protected against the effects of immersion
8	Protected against submersion

Latching Output
An output that switches, and permanently latches, its output to the opposite state until a reset signal is applied. The latching action can occur on either the leading edge or the trailing edge of an input signal.

LED (Light Emitting Diode)
A semiconductor device that emits visible or invisible light.

Leakage Current
Residual current flow when a solid state switching device is in the off state.

Light Beam Path
Direction of travel of the light beam from the light source lens to the receiving lens.

Light State
A condition that produces an output when the intensity of the received light beam is above a fixed threshold. (See Beam Make)

Light State Tracking (LST™)
When enabled, the sensor will continually adjust to the appropriate Light State setting on the Contrast Indicator.

Linear Output
An analog sensor's output voltage that is proportional to the light level.

Load
A device or circuit that is connected to and operated by the sensor's output.

Logic Module
A module that modifies input signals for use in control system processing.

Maximum Load
The maximum continuous current that an output switching device can provide without the possibility of damage.

Microsecond
One millionth of a second. 1 microsecond = 0.000001 second or 0.001 millisecond. Abbreviated: µs

Minimum Load
The minimum current required to insure proper operation of an output switching device.

Millisecond
One thousandth of a second. 1 millisecond = 0.001 second or 1000 microseconds. Abbreviated: ms

Glossary of Photoelectric Terms

Modulation
In photoelectrics, modulation of an LED simply means to turn it on and off at a high frequency (typically several kilohertz). The secret of a modulated photoelectric sensor's superior performance is that the sensor's phototransistor and amplifier are tuned to the frequency of modulation. Only the modulated light is amplified, and all other light which reaches the receiveris ignored. This is analogous to a radio receiver which tunes solidly to one station, while ignoring all of the other radio waves that are present in the room. In fact, a modulated sensor's LED is most often referred to as the transmitter or emitter and its phototransistor as the receiver.

MOTION DETECTOR
(See Retriggerable One-Shot)

MOV: (METAL-OXIDE VARISTOR)
A component that is used to protect against damage from voltage spikes.

NEMA
National Electrical Manufacturers Association. NEMA standards are used to specify suitability of sensor and sensing system enclosures for various sensing environments.

NEMA 1	Indoor use Protects against accidental contact by personnel & falling dirt
NEMA 2	Indoor use Protects against falling dirt & liquid & light splash
NEMA 3	Outdoor use Protects against rain, sleet, snow, dirt, & dust
NEMA 3S	Outdoor use Protects against rain, sleet, snow, dirt, dust & ice buildup
NEMA 4	In- or outdoor Protects against dirt, dust, hosedown (and heavy splash)
NEMA 4X	In- or outdoor Protects against dirt, dust, hosedown, & corrosion
NEMA 6	In- or outdoor Protects against dirt, dust, hosedown, & occasional submersion
NEMA 6P	In- or outdoor Protects against dirt, dust, hosedown, & prolonged submersion
NEMA 7	Indoor use For use in areas of explosive gases or vapors or combustible dust
NEMA 9	Indoor use For use in areas of atmospheres containing combustible dust
NEMA 12	Indoor use Protects against dirt, dust, light splash, & oil or coolant seepage
NEMA 13	Indoor use Protects against dirt, dust, light splash, & oil or coolant spray

Non-Contact Sensor
A sensing device that can detect the presence or absence of an object without the necessity of physical contact.

NPN
(See Current Sinking)

Off-Delay Timer
A control circuit that switches its output on the leading edge of an input signal. If, and when, the input signal returns to its original state over a preset timed interval, the output signal will return to its original state.

Offset Adjustment
Duplicates the function of a sensitivity adjustment by allowing the operator to preset the sensor's response to contrasting light levels as viewed on the Contrast Indicator.

Ohm's Law
E = I x R. Current (I) is directly proportional to voltage (E) and inversely proportional to total resistance (R) of a circuit.

On-Delay Timer
A control circuit that "times" the duration of the input signal. The output of this circuit switches only if, and when, the duration of the input signal exceeds a preset timed interval. When this occurs, the output stays switched for the remaining duration of the input signal.

One-Shot Timer (Non-Retriggerable)
Produces preset timed output signal on the occurrence of an input signal. The timed output response may begin on either the leading edge or the trailing edge of the input signal. The preset time is independent of the duration of the input signal.

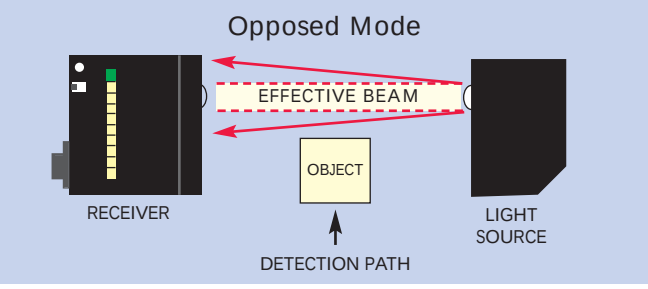
Opacity Mode
See Beam Break.

Opaque
A term used to describe a material that blocks the passage of light energy. "Opacity" is the relative ability of a material to obstruct the passage of light.

Open-Collector
An NPN or PNP transistor that is not connected to any other part of the output circuit.

Operating Speed
Maximum output switching rate usually expressed by maximum rate of input events that can be resolved under set conditions.

Opposed Mode
See Beam Break



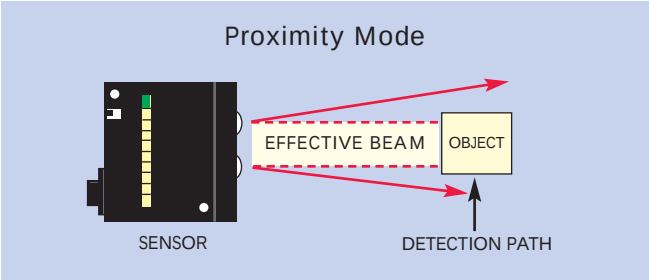
Glossary of Photoelectric Terms

Output
1. The section of a sensor or control circuit that energizes and/or de-energizes the attached load (or input).
2. The useful energy delivered by a circuit or device.

Output Mode
Light or Dark on.

Polarized Light
Light that vibrates in one plane only(in contrast to ordinary light, which vibrates in all directions).

Proximity Mode
A sensing mode in which the light beam bounces off an object in front of the sensor and is reflected back to the sensor. (See Beam Make)



Proxing
An undesirable characteristic of a retroreflective sensor to respond to light reflected off the surface of the sensed object. Shiny objects passing near a retroreflective sensor can reflect sufficient light to accidentally switch the output. Some retroreflective sensors include polarized filters to reduce proxing.

Pulse Stretcher
(See Off-DelayTimer) A signal conditioning circuit used to insure a minimum duration output signal response to a short duration input signal.

Pulse Modulated Sensor
Asensor with an LED light source that is pulsed or turned "on" and "off" at a high rate of speed. The output signal from the sensor's receiving device is processed by a tuned circuit that responds only to the frequency of the pulsed LED light source. This prevents unwanted response to ambient light.

PVC (polyvinyl chloride)
A member of the vinyl plastic resin family, with many applications, including jacketing of wire and fiberoptic cables. Characterized by its high degree of flexibility and good chemical resistance.

Radio Frequency Interference (RFI)
Interference caused by electromagnetic radiation at radio frequencies to sensors or to other sensitive electronic circuitry. RFI may originate from radio control equipment, stepper motor controls, CRTs, computers, walkie-talkies, public service communications, commercial broadcast stations, or a variety of other sources. RFI occurs most often at a specific frequency or within a specific range of frequencies. As a result, one electronic instrument may be radically affected by the presence of RF interference, while another similar instrument in the same area may appear completely immune.

Receiver (photoelectric)
Element that receives the light coming from the emitter.

Refraction
The "bending" of light rays as they pass through the boundary from a medium having one refractive index into a medium with a different refractive index. For example, as from air into water
or from air into glass or plastic.

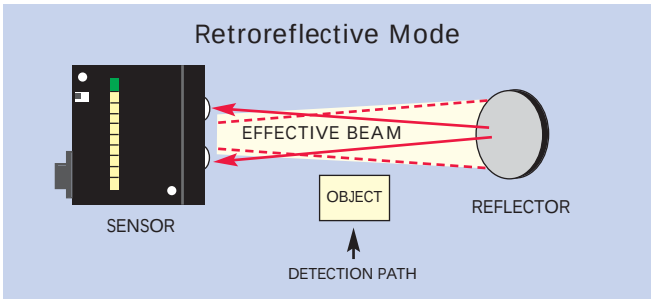
Registration Mark
A contrasting color mark printed on material that can be "seen" by a sensor. Used to control a variety of packaging and material
handling operations.

Repeatability
A measure of the repeat accuracy of a sensor and/or timer and/or control mechanism (e.g. motor, brake, solenoid, etc.). Usually expressed as a distance or time.

Response Time
The length of time it takes for the output to switch from light state to dark state and vice versa.

Retriggerable One-Shot Timer
Same as one-shot timer, except that, if input events occur before the preset time expires, the timer is automatically reset, the timed period begins again and the output signal remains switched. Used for Motion Detection.

Retroreflective Mode
The light source and receiver are contained in one housing, projecting a light beam to a reflector mounted on the opposite side of the product flow. When the product breaks the beam, an output signal is produced.



Glossary of Photoelectric Terms

RoHS (Reduction of Hazardous Substances)
European Union regulations enforceable on July 1, 2006 that set maximum concentration limits on hazardous materials used in electrical and electronic equipment.

Reverse Polarity Protector
Protects the sensor from damage if power leads are accidentally reversed.

Ripple
An ac voltage component on the output of a dc power supply. Usually expressed as a percentage of the supply voltage. Ripple may be suppressed ("smoothed") with capacitor filtering. Most dc only devices require less than about 10% ripple for reliable operation.

R/S Flip-Flop
A control circuit that has both "set" and "re-set" inputs. A momentary input signal to the "set" input circuit sets the output to one of the two states. A momentary input signal to the "re-set" input toggles the output back to the original state.

Saturation Voltage
The voltage drop appearing across a switching transistor or SCR that is fully turned "on". See "voltage drop".

Sensing Task
The specific purpose or application assigned to a sensing device.

Sensitivity Adjustment
A potentiometer device that is used to adjust the gain of an amplifier stage in photoelectric sensing.

Signal Conditioning
The addition of timing functions to achieve on-delay, off-delay, motion, latching and one shot.

Short Circuit Protection
Protects output transistors from damage if accidentally connected to power supply leads or if the load becomes shorted.

Skew Angle
An alignment technique used in diffuse, retroreflective and convergent mode sensing to increase the optical contrast ratio. In diffuse and convergent sensing, it is done to reduce background reflections. The sensor is angled so that its beam strikes the background at an angle other than 90 degrees (i.e. straight on). In reflective sensing, skewing the sensor is done to reduce the amount of light reflected directly back.

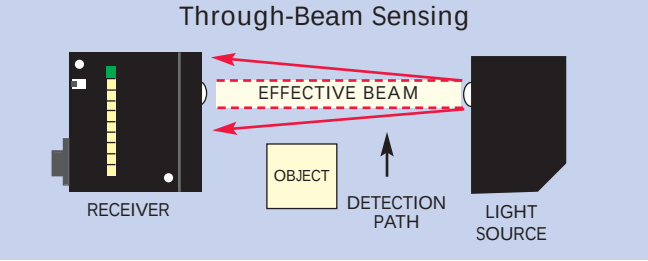
Snubber Network
A capacitor in series with a resistor placed across the output terminals of a solid state switching device or relay contacts to prevent damage caused by voltage transients.

SPDT Relay
Single-Pole, Double-Throw.A relay with one set of form C contacts. One contact is open when the other is closed. (Complementary switching)

Supply Voltage
The acceptable operating voltage range of the sensor's power input.

Straight Light Guides
For fiberoptic Thru-beam. Separate light source and receiver for Beam Break.

Through-Beam Sensing
See Beam Break.



Transient
A very short duration pulse of voltage (or current) that is many times larger in magnitude than the supply voltage. Transients are usually caused by the operation of a heavy load or of any size inductive load like motors, contactors, and solenoids. Voltage transients can cause false actuation of fast electronic circuits such as solid-state counters, one-shot timers, and latching outputs. The problems resulting from transients are dealt with by careful shielding and grounding of remote sensor lead wires, by physical separation of signal wires from power wires in wireways, and by installing transient suppressors directly across offending loads.

Translucent
Refers to material that allows some light to pass through, but not transparent. Clear images cannot be viewed through translucent objects.

Transparent
Refers to material that allows light to pass through with little, if any, loss. Clear images can be viewed through transparent objects..

TRIAC
Solid state AC switch

UL
Underwriters Laboratories; an independent testing laboratory that certifies products conforming to industry safety standards.

UV (Ultraviolet)
Invisible short wavelength light energy that lies immediately beyond the violet end of the color spectrum between approximately 100 and 380 nm. Some materials "fluoresce" and produce light of visible wavelengths when excited by UV energy. This re-radiation of visible light can be detected by a "UV sensor". See "LED".

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WARRANTY & LIMITATION OF LIABILITY

Tri-Tronics Company, Inc., warrants that the products delivered by it will be of the kind and quality described in the order or contract and will be free of defects in workmanship or material. Should any failure to conform to the express warranty appear within one (1) year of delivery, Tri-Tronics shall upon written notification correct such non-conformity, including non-conformance with Tri-Tronics' specifications, at its option, either by repairing any defective part or parts or by making available, F.O.B. the seller's plant, a repaired or replacement part. This warranty shall be for a period of one (1) year after the date of delivery of any product not meeting Tri-Tronics' specifications.

This warranty is in lieu of all warranties of merchantability, fitness for a particular purpose, or other warranties, expressed or implied, except of title and against patent infringement. Correction of non-conformities in the manner and for the period of time provided above shall constitute fulfillment of all liabilities of Tri-Tronics to anyone, whether based on contract, negligence, or otherwise with respect to or arising out of such products.

Tri-Tronics shall not be liable for special, indirect, or consequential damages. The remedies set forth herein are exclusive, and the liability of Tri-Tronics with respect to any contract or sale or anything done in connection therewith, whether in contract, in tort, under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the product or products on which such liability is based.

This warranty shall not apply to any product that has been subjected to misuse, negligence, accident, or misapplied or modified or repaired usage by unauthorized persons, or as the result of improper installation thereof. Furthermore, any improper use, operation beyond capacity, substitution of parts not approved by Tri-Tronics, or any alteration or repair by others in such manner as in Tri-Tronics' judgment affects the product materially and adversely shall void this warranty.

Tri-Tronics Company, Inc.
7705 Cheri Court
Tampa, FL 33634-2419
813.886.4000

Terms & Conditions of Sale

Orders placed with Tri-Tronics (written or verbal) are subject to the terms and conditions as stipulated in this document. No modifications or revisions to the terms and conditions as listed will be allowed without special written authorization by an officer of Tri-Tronics Co. Inc. No employee or representative of Tri-Tronics is authorized to change the warranty or terms and conditions in any way or to grant any other warranty. Purchaser's acceptance of an order shall be deemed as assenting to the terms and conditions set forth herein. The lack of an objection by Tri-Tronics to any and all revisions, alterations, or additions to the terms and conditions, as set forth herein, by the purchaser contained in any prior or subsequent purchase order or communication shall not be construed as a waiver or acceptance by Tri-Tronics.

CREDIT

Tri-Tronics reserves the right to decline any order if the purchaser fails to provide necessary credit information regarding the purchaser's ability and willingness to pay for the merchandise within the net 30-day terms. Tri-Tronics may, as an option to refusing the order, elect to require an advance payment, a credit card, or a C.O.D. shipment.

In the event of purchaser's default in payment for orders shipped on credit, the purchaser shall be responsible for all reasonable collection costs and expenses, and Tri-Tronics shall not be obligated to make any further shipments to the purchaser.

All sales shall be governed by the laws of the State of Florida. Tri-Tronics and the purchaser mutually agree that venue for any action at law or in equity in any way arising out of any order, sale, or this agreement shall lie exclusively in Hillsborough County, Florida, USA.

PAYMENT TERMS

Contingent upon prior credit approval, Tri-Tronics' terms are net 30 days from the invoice date, unless otherwise indicated. Payment is to be made to the address printed on the face of the invoice.

SHIPPING

Tri-Tronics will ship the merchandise to the purchaser as soon as possible after the receipt of an order. In the event that the ordered merchandise is not in stock, Tri-Tronics reserves the right to make partial shipments. These shipments will be individually invoiced and the purchaser agrees to submit payment within the net 30-day terms for each shipment. If, for any reason, Tri-Tronics fails to ship by a specified date, Tri-Tronics shall not be held responsible for any special or consequential damages.

PRICING

All quoted prices are FOB Tampa, Florida, and are subject to change without notice. All written quotations are valid for 30 days if not otherwise specified. Quoted prices do not include sales, use, or excise taxes or shipping costs. All applicable taxes must be paid by the purchaser. Customer will be responsible for payment of import duties, customs fees and permits, and licenses.

DAMAGE AND LOSS

All Tri-Tronics products are packed and labeled for shipment adhering to good commercial packaging techniques. Upon delivery to the carrier for shipment, responsibility for delivery intact to its destination rests with the carrier. Upon receipt of the shipment at its destination, the merchandise should be inspected for visible or concealed damage. Claims for damage or loss should be filed with the carrier immediately. Tri-Tronics will assist whenever possible in securing adjustment of claims; however, all claims for damage or loss must be initiated by the purchaser directly to the carrier.

RETURN OF MERCHANDISE

Any material returns must be marked with a Return Authorization Number that shall be obtained from Tri-Tronics. All material must be properly packed and shipped prepaid. No C.O.D. shipments will be accepted. Any materials being returned for credit will be subject to examination by Tri-Tronics for customer misuse or abuse before determining the amount of credit.

IMPORTANT

The products of Tri-Tronics Company, Inc., are not authorized for use as critical components in any life support devices or systems whatsoever without the express written approval of the President of Tri-Tronics:

a. Life support devices or systems are devices or systems which (1) are intended for surgical implant into the body or (2) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user;

b. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

In addition to the foregoing and without limiting or modifying the foregoing, Tri-Tronics hereby expressly prohibits the use of its products or any component parts thereof in or on personal safety devices including, but not limited to, punch presses or any other dangerous machinery in which the failure of such product could cause serious bodily injury, without the express written consent of Tri-Tronics. The definitions of "personal safety devices" and "other dangerous machinery" shall be those definitions formulated by Tri-Tronics in its sole discretion and will be provided to the purchaser upon written request.

TRI-TRONICS®

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Tampa, FL 33622-5135
800.237.0946

7705 Cheri Court
Tampa, FL 33634-2419
800.375.8861 fax

SENSOR SELECTION GUIDE

A. Brief description of sensing task: _____

_____

_____

_____

_____

B. Size and shape of object (or condition of object) to be sensed:

_____

C. Spacing or gap between sensed objects: _____

D. Motion of conveying device/machine: ❑ Continuous ❑ Cyclic

E. Length of time sensed object will remain in view of sensor: _____

Considerations

Velocity of sensed object: _____

Quantity of sensed objects per hour/minute: _____

Conveyor/web speed: _____

F. Sensing Environment: ❑ Clean ❑ Slightly Dirty

❑ Dirty ❑ Very Dirty ❑ Moist ❑ Washdown area

G. Ambient temperature: _____

H. Preferred Sensing Mode:

BEAM BREAK

Retroreflective Mode ❑

Considerations:

Distance between sensor and reflector _____

Distance between sensor and sensed object _____

Surface reflectivity of sensed object:

❑ Shiny ❑ Moderately Shiny ❑ Dull

Light transmission properties of sensed object:

❑ Transparent ❑ Translucent ❑ Opaque

Opposed Mode ❑

Considerations:

Distance between light source and receiver: _____

Light transmission properties of sensed object:

❑ Transparent ❑ Translucent ❑ Opaque

BEAM MAKE

Proximity Mode ❑ or Convergent ❑

Considerations:

Distance between sensed objects and objects in background: _____

Color of sensed objects: _____

Color of background objects: _____

Surface reflectivity of sensed object:

❑ Shiny ❑ Moderately Shiny ❑ Dull

Surface reflectivity of background:

❑ Shiny ❑ Moderately Shiny ❑ Dull

Light transmission properties of sensed object::

❑ Transparent ❑ Translucent ❑ Opaque

1. Power Source:
A.C. Voltage_____ D.C. Voltage _____

J. Output Requirements:

❑ **NPN** (sinking) Transistor ❑ Conventional Relay

❑ **PNP** (sourcing) Transistor ❑ Solid State AC Switch (TRIAC)

K. Load A.C. Load: Current _____ Voltage_____

D.C. Load: Current _____ Voltage_____

PLC Load: A.C. Voltage _____

Allowable Leakage Current_____

D.C.: ❑ **NPN** (sinking) Transistor

❑ **PNP** (sourcing) Transistor

Simplified Drawing of Application

TRI-TRONICS®

Custom Fiber Fax Form

Fax: 813-884-8818

Distributor _____

Distributor Phone _____ Fax _____

Customer Phone _____ Fax _____

Model # _____

TTCO Rep _____

TTCO Rep Phone _____ Fax _____

Delivery Date _____

Customer Approcval _____

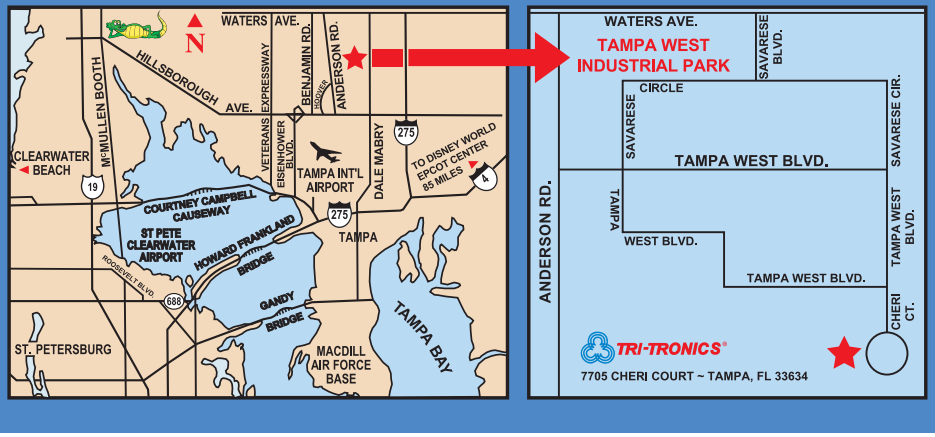
Made In The USA since 1954

and still under the same dependable ownership and management!

TRI-TRONICS designs, manufactures, and supplies high-quality photoelectric sensors, fiberoptic light guides, and controls for a wide variety of industrial applications.

This catalog provides documentation regarding the capabilities of ***TRI-TRONICS*** products and is specifically designed to simplify the process of selecting the proper sensing technique to fit a particular sensing requirement. Using this catalog combined with the expertise of a local ***TRI-TRONICS*** stocking distributor should provide quick answers to your questions regarding photoelectric sensors and controls.

For the name and location of the nearest ***TRI-TRONICS*** representative and stocking distributor, call (813) 886-4000 or e-mail us at: info@ttco.com. Factory application engineers are also available to provide technical assistance for solving your most difficult problems.



TRI-TRONICS' manufacturing facility is located in Tampa, Florida, in close proximity to Tampa International Airport. We cordially invite you to schedule a visit to our facility on your next business or vacation trip to Florida. We welcome the opportunity to meet our customers in person!

ttco.com

TRI-TRONICS®

Smart Photoelectric Solutions Since 1954

SMARTEYE®

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