TRI-TRONICS®

Smart Sensing Solutions Since 1954

Photoelectric Sensor Catalog

2013-2014

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TRI-TRONICS®

Smart Sensing 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, Controls and a new family of Rotary Optical Encoders 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

The last couple of years have proven our dedication to innovation and technological superiority. With the invention of the **ColorWise**™ True Color Sensor, the **CLS** - Ultrasonic Clear Label Sensor, the **LER10** - Ultra-High Speed Label Sensor, and the ***X-MARK*** registration mark sensor we have created some of the most prolific sensing devices available on the market.

The Facilities

TRI-TRONICS® owns and operates a 28,000 square-foot 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.

Product Selection Guide

1 Fundamentals of Photoelectric Sensing

2 Photoelectric Sensors

3 Fiberoptic Light Guides

4 Plug-in Control Modules

5 Accessories

6 Data Reference Tables

7 Glossary of Terms, Index, Request Forms

GENERAL APPLICATION SENSORS

***SMARTEYE*® EZ-PRO™** 2-1
General Purpose Photoelectric Sensor

***SMARTEYE*® *PRO*™** 2-7
General Purpose Photoelectric Sensor

***SMARTEYE*® MARK II** 2-13
General Purpose Photoelectric Sensor

***SMARTEYE*® MARK III** 2-19
General Purpose Photoelectric Sensor

***SMARTEYE*® CLASSIC** 2-25
General Purpose Photoelectric Sensor

OPTI-EYE™ 2-31
General Purpose Photoelectric Sensor

GENERAL APPLICATION SENSORS

EZ-EYE™ 2-37
General Purpose Photoelectric Sensor

MINI-EYE™ 2-43
General Purpose Photoelectric Sensor

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General Purpose Photoelectric Sensor

TINY•EYE® 2-55
General Purpose Photoelectric Sensor

U.S. EYE™ 2-61
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SPECIALTY APPLICATION SENSORS

***SMARTEYE*® COLORWISE™** 2-65
True Color Sensor

***SMARTEYE*® X-PRO XPC™** 2-73
Photoelectric Communication Sensor

***SMARTEYE*® RETROSMART™** 2-81
High Performance Clear Object Sensor

***SMARTEYE*®**
STEALTH-UV™ 2-87
Digital Luminescence Sensor

***SMARTEYE*®**
STEALTH-UV™ 2-93
Analog/Digital Luminescence Sensor

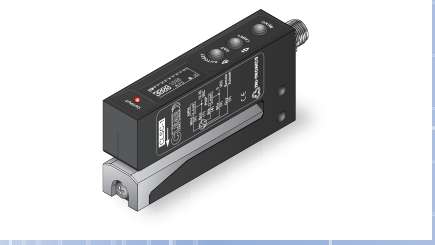
LABEL•EYE® 2-109
Label Gap Sensor

SPECIALTY APPLICATION SENSORS

SMARTEYE® 2-113
HIGH INTENSITY
High Intensity Through Beam Sensor

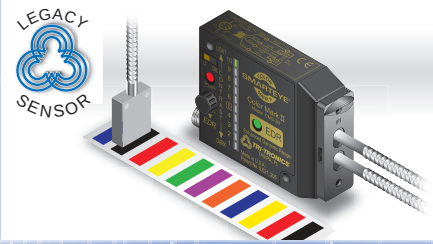
SMARTEYE® 2-119
X-PRO XP10™
Extremely High Speed Sensor

HIGH SPEED 2-105
LABEL EYE
Extremely High Speed Label Sensor



ULTRASONIC 2-99
CLEAR LABEL SENSOR
Uniquely Designed for Clear Label Sensing

REGISTRATION MARK SENSORS



SMARTEYE® 2-135

COLORMARK II

Registration Mark Sensor

***MARK•EYE®* PRO** 2-141

High Resolution/High Speed
Registration Mark Sensor

MARK•EYE® 2-147

Opacity Mode Registration Mark Gap Sensor

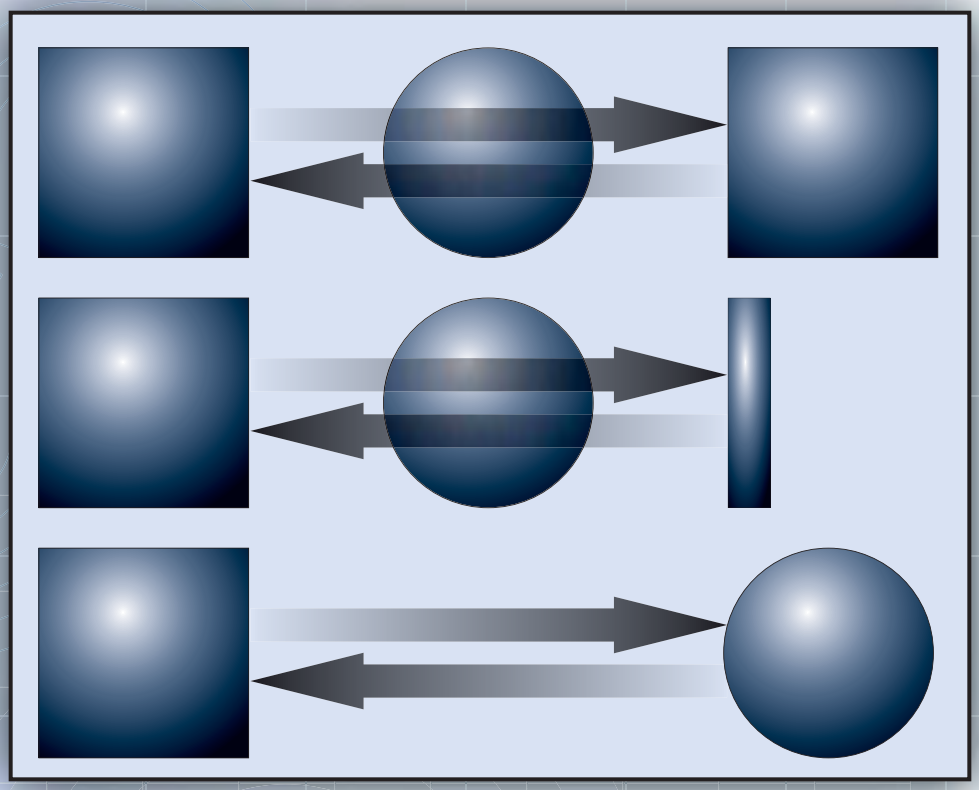
SMARTEYE® X-MARK™ 2-127

X-tremely High Speed
Photoelectric Registration Sensor
Now with Tri-Color LED and Horizontal and Vertical line optics

LEGACY SENSORS are mature products that have been replaced by new technology. These sensors are still available and in demand, although no longer advertised or offered in product demonstrations.

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.



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.

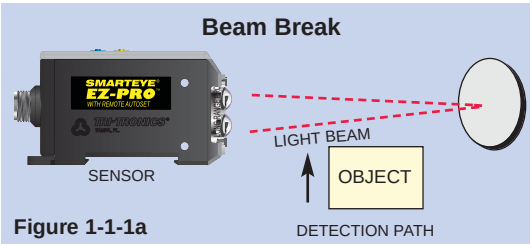


Figure 1-1-1a

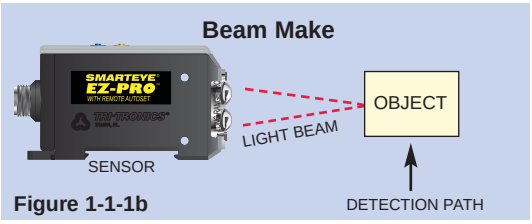


Figure 1-1-1b

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

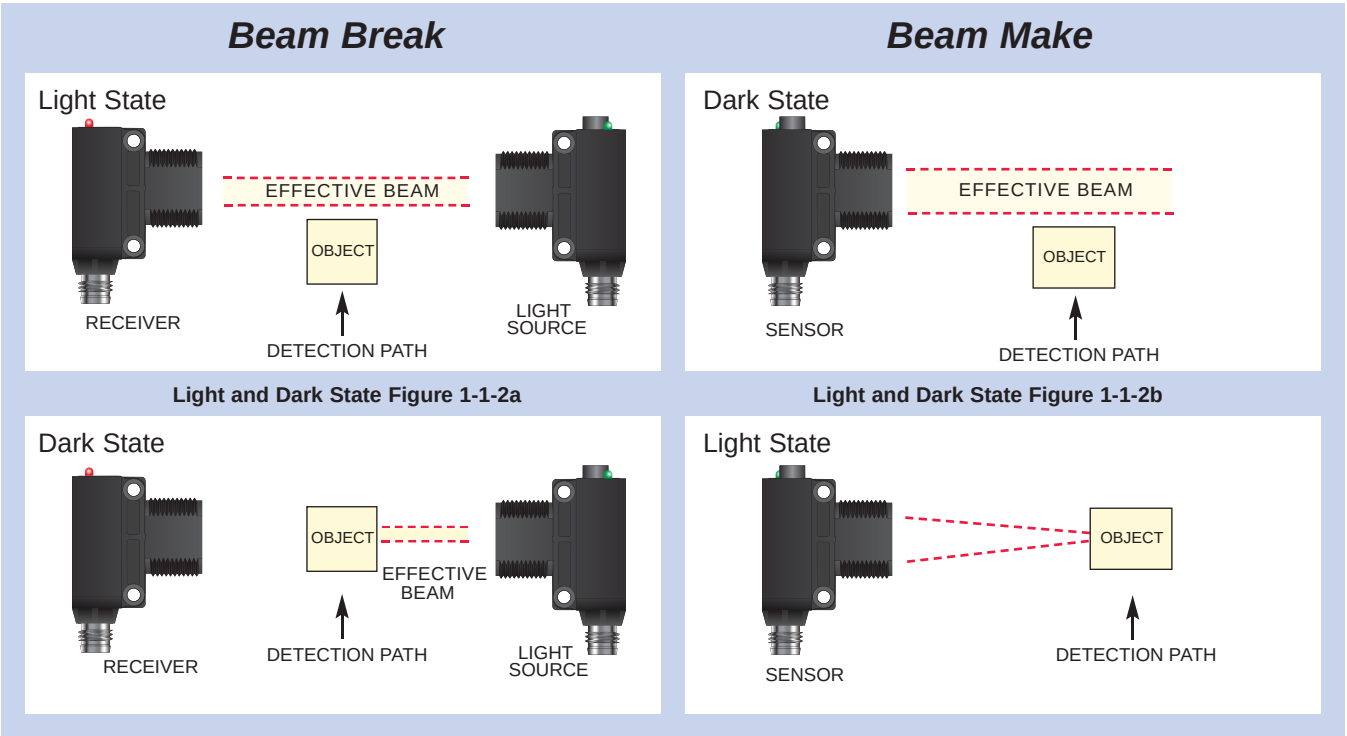
The sensing task of any digital switching photoelectric sensor is to respond to and resolve the difference between the contrasting light levels and switch its output accordingly.

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.



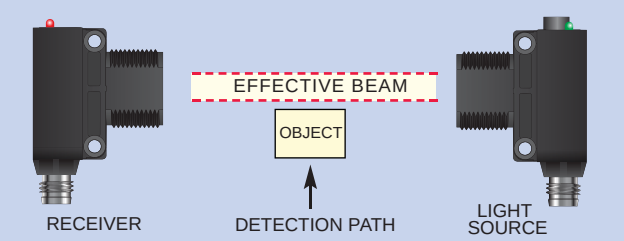
Beam Break Sensing

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).



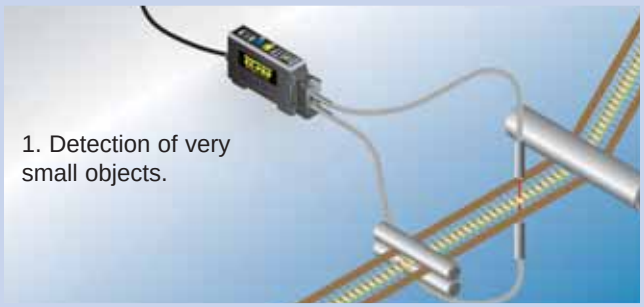
Opposed Mode, Figure 1-2-1

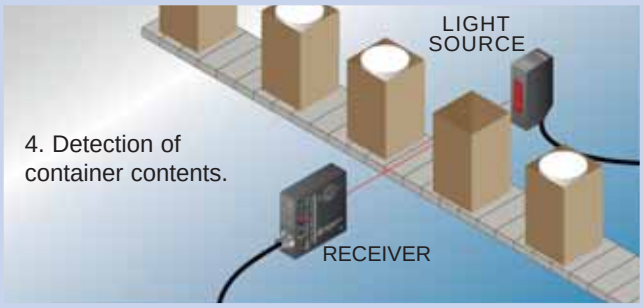
Unfortunately, Beam Break sensing is often overlooked as a result of the initial cost of purchasing and installing two separate devices and the sometimes tedious task of alignment. However, the opposed mode of sensing has distinct advantages when detecting opaque products. It provides the most reliable 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.

Opposed Mode

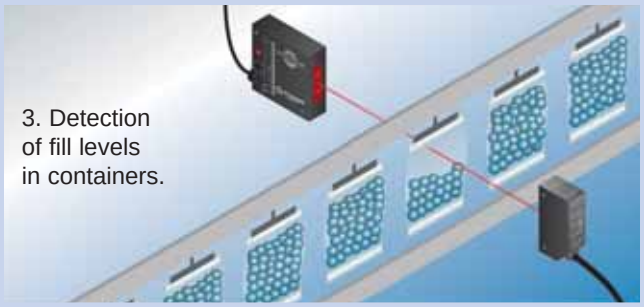

1. Detection of very small objects.

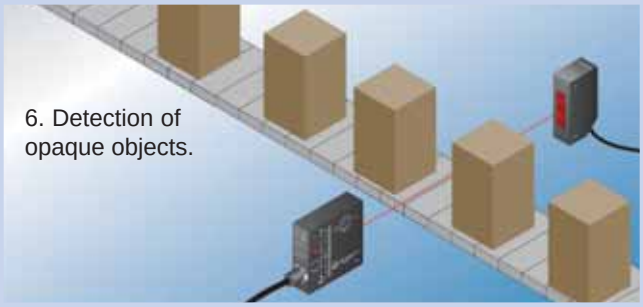


4. Detection of container contents.

2. Detection of an object's precise location.

5. Detection of splices or overlapped materials.

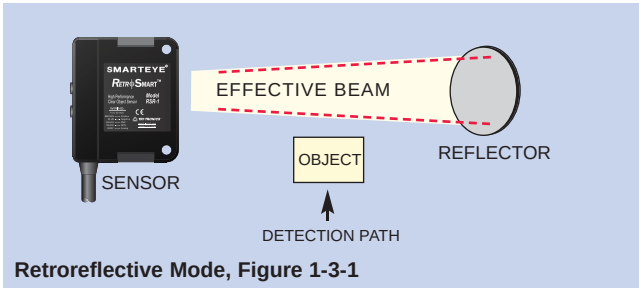

3. Detection of fill levels in containers.


6. Detection of opaque objects.

Beam Break Sensing

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

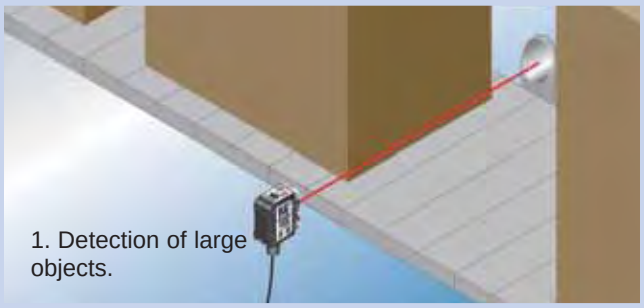


Retroreflective Mode, Figure 1-3-1

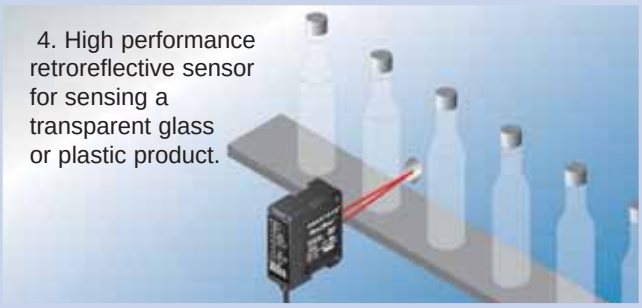
Transparent/Shiny Object Detection

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

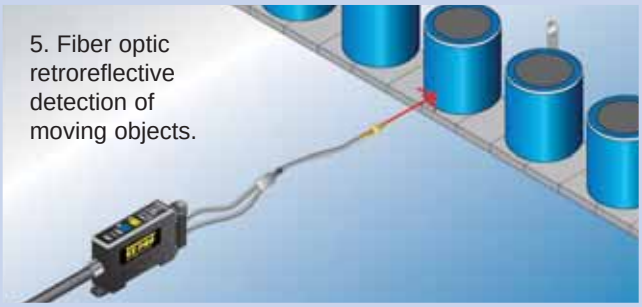


1. Detection of large objects.

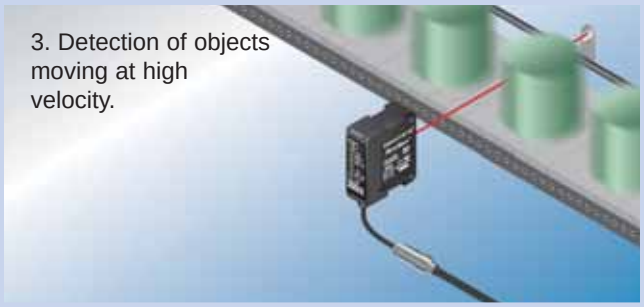


4. High performance retroreflective sensor for sensing a transparent glass or plastic product.

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.

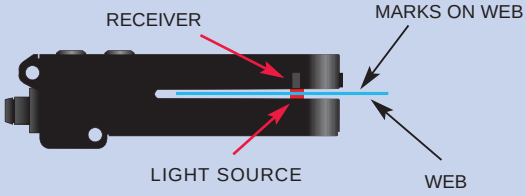
6. Beam Break detection of objects at sensing sites where mounting space is limited.

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.

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.



Opacity Mode Beam Break Figure 1-4-1

MARK•EYE®

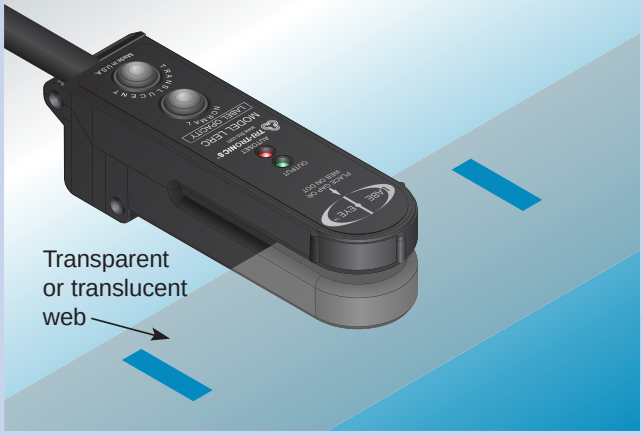
The MARK•EYE® sensor is designed to see printed registration marks on most packaging materials on a continuous web. By detecting the contrasting light level difference between the background material and the registration mark on the web, the sensor's output signals to perform a machine function.

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

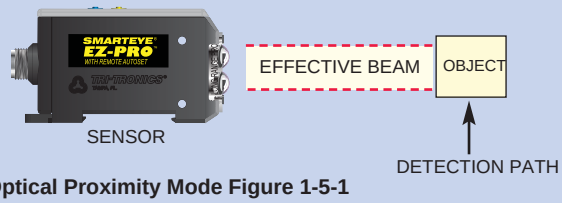


Label Sensing

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

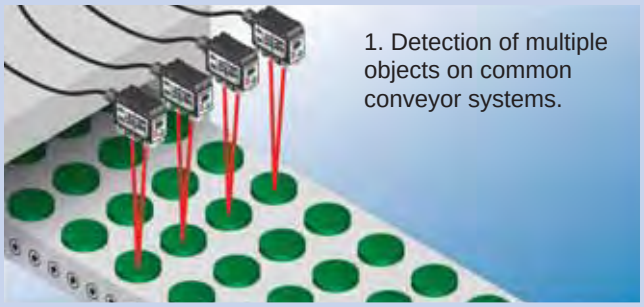
A bifurcated fiber optic light guide can also be utilized as the light passes through the fiber optic light guide. The light is reflected off the object and passes back through the fiber to the sensor's receiver.

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.

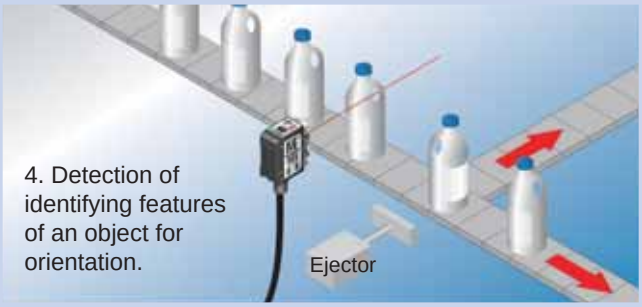
The suppression of light reflecting off shiny objects in the background can be enhanced by proper positioning of the sensor. If the angle of incidence to the reflected light beam is adjusted so that the light beam path does not return to the receiving lens, the proximity sensor will only respond to the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

Unfortunately, there are many situations when

Optical Proximity Mode



1. Detection of multiple objects on common conveyor systems.

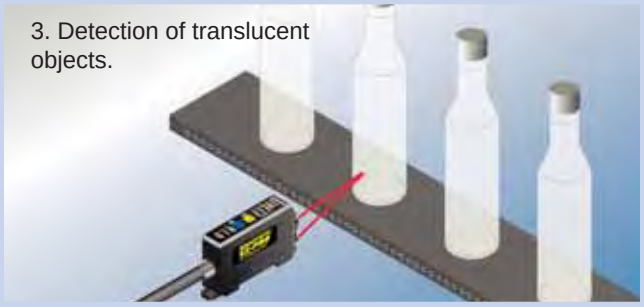


4. Detection of identifying features of an object for orientation.

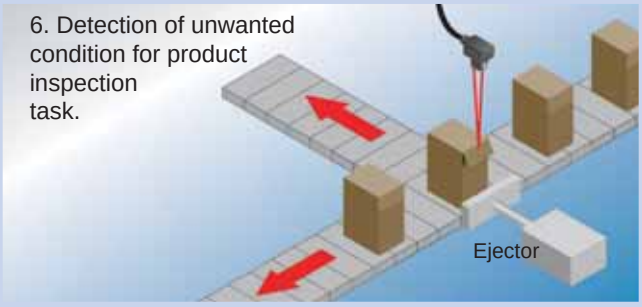
Ejector

2. Detection of web material.

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



3. Detection of translucent objects.

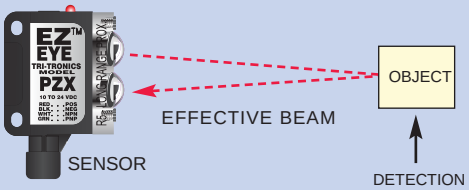


6. Detection of unwanted condition for product inspection task.

Ejector

Beam Make Sensing

the intensity of the light reflected off the object is not much 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 distanc of up to 6 feet or more in this mode.



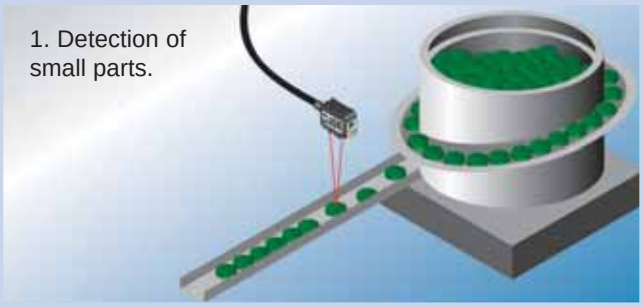
Convergent ("V-Axis") Mode Figure 1-6-1

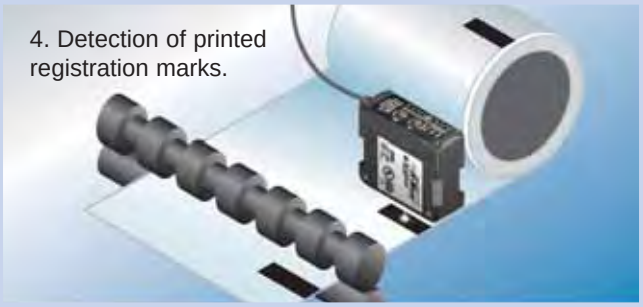
Convergent ("V-Axis") Mode

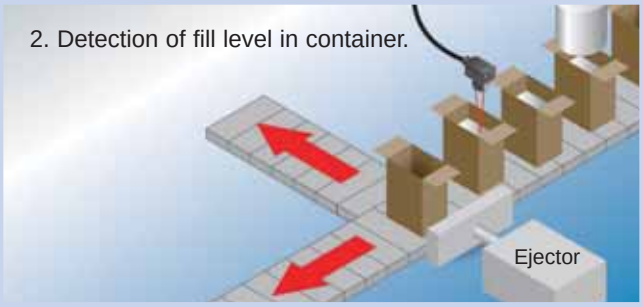
The convergent mode of Beam Make sensing is very similar to the proximity mode. The convergent beam sensor, like the proximity sensor, responds to a light beam path that reflects off the surface of the object. However, the lensing system of a convergent (also referred to as "V-Axis") sensor converges 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.

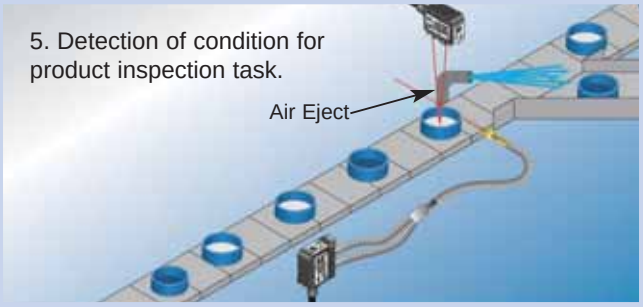
Fiberoptic light guides can also be used in a convergent mode for "V-Axis" sensing. Simply direct two fibers at the target in a "V" configuration and small parts or the contrasts of an object can be detected.

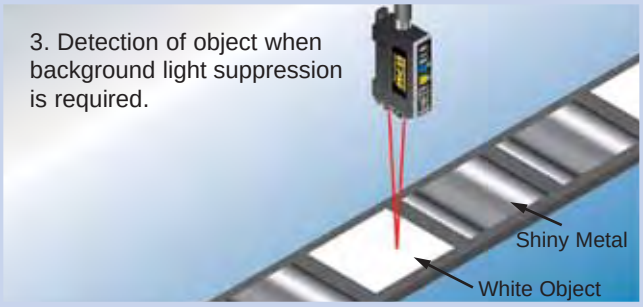
Convergent Mode











Color Perception for Detecting Registration Marks

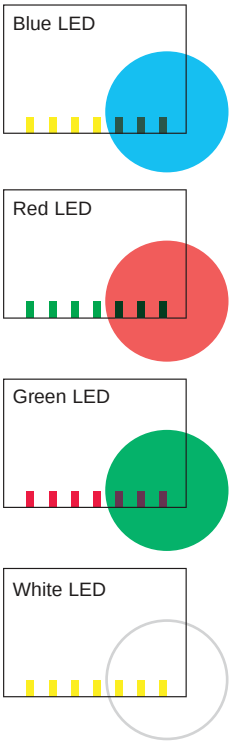
Registration Mark Sensing

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 *SMARTEYE*® 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.

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 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.



Color Perception

Optical Proximity Mode

The MARK•EYE® PRO 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 COLORMARK 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*® ColorWise™ sensor is 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.

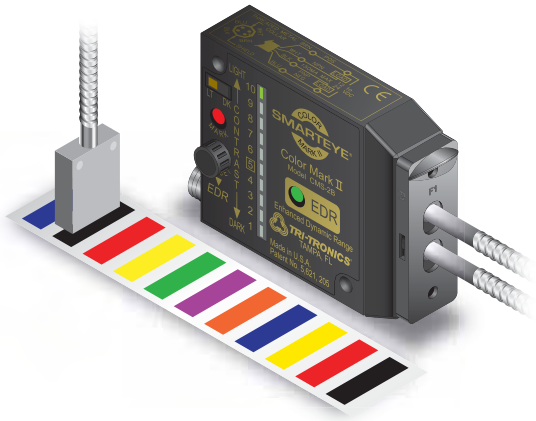
The *SMARTEYE*® ColorWise™ is designed for color perception and recognition. All models are equipped with high gain amplifiers that provide excellent resolution in applications that require color-to-color, or shade-to-shade capability. Individual Channel Monitors (X4) provide visual feedback for color matching, signal strength, increasing user confidence in application solution success.

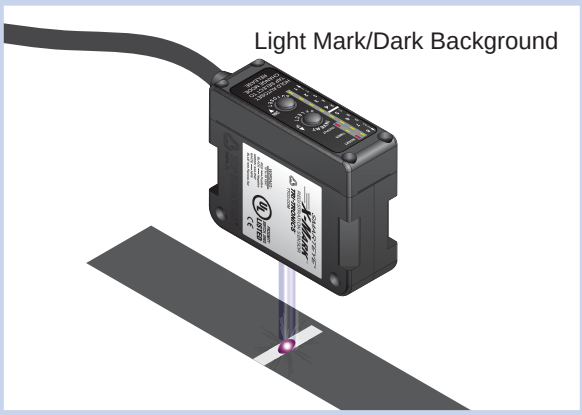
Choosing the Correct LED Color

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.

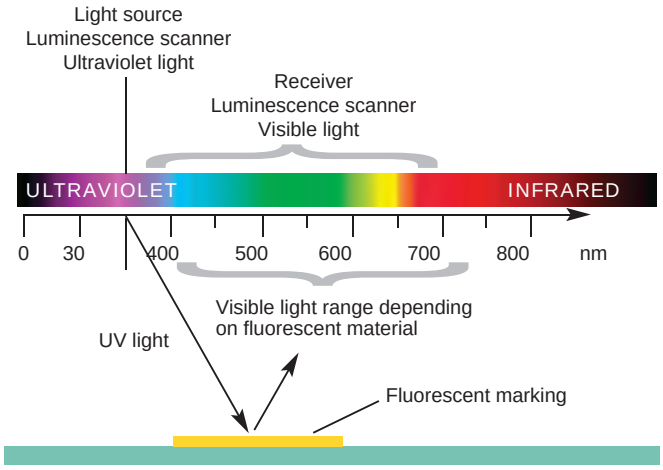




Luminescence Sensing

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.

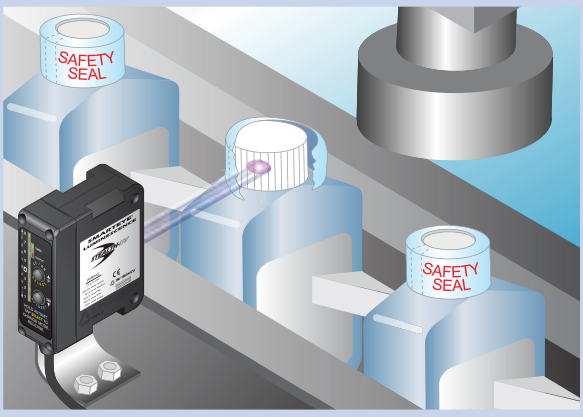


Typical Luminescence Sensor Applications:

- 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



Missing Label Detection

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.

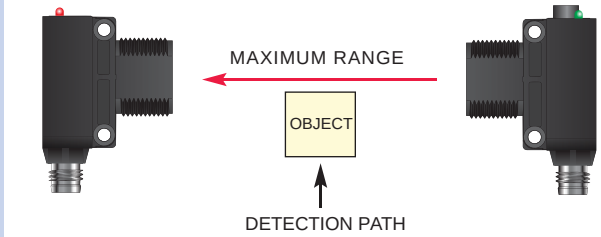
TRI-TRONICS® unique Contrast Indicator provides actual signal strength indications that provide for perfect alignment by ascertaining actual response to the intensity of the received light. TRI-TRONICS® sensors equipped with Contrast Indicators provide an instantaneous real time indication of the received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

Guidelines for Determining Useful Range

% of Range Decrease

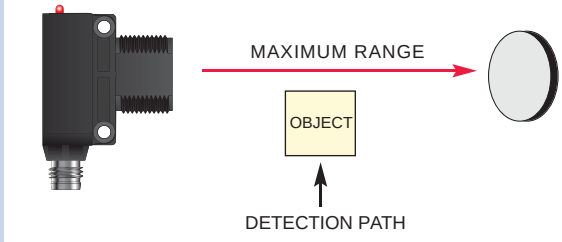
Sensing Environment	Opposed	Retroreflective	Proximity
Clean	-5%	-10%	-10%
Slightly Dirty	-10%	-15%	-25%
Dirty	-20%	-30%	-50%
Very Dirty	-40%	-60%	-75%

Maximum Range Opposed Mode



Maximum Range Proximity Mode

Maximum Range Retroreflective Mode



Maximum Range Convergent (V-Axis) Mode

Range

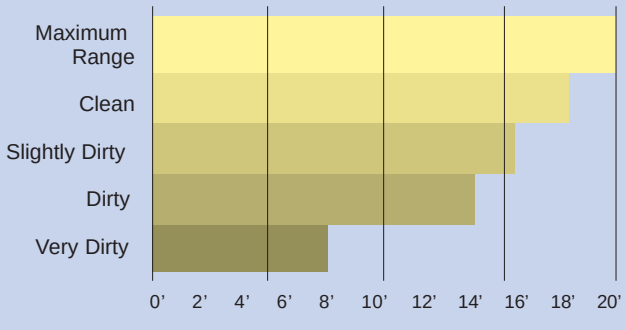
Contrast signal deviation charts are available on all sensors equipped with the Contrast Indicator. These charts are extremely helpful in determining if the sensor you have selected will adequately perform your particular sensing task at the desired range. Simply reference the amount of contrast deviation 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.

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 with 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.



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.

Guidelines 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%

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
MARK•EYE 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 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
COLORWISE	4	IP66
OPTI-EYE	4X, 6P	IP67
X-MARK	4X, 6P	IP67
X-PRO XP10	4X, 6P	IP67
X-PRO XPC	4X, 6P	IP67

See Environmental Ratings, Data Section

From clean to dirty lens

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

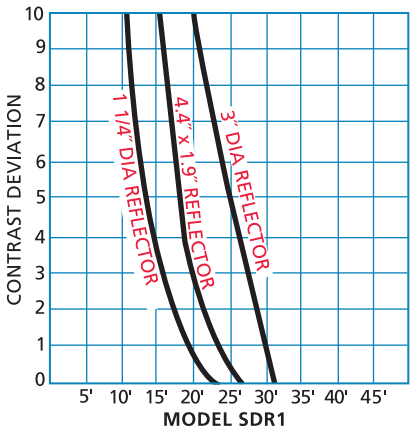
Performance of any *SMARTEYE*® can be diagnosed at the sensing site by observing contrast deviation as displayed on the Contrast Indicator. To ascertain deviation, simply subtract the lowest (Dark State) reading from the highest (Light State) reading and compare the resulting number to the contrast rating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

CONTRAST RATINGS

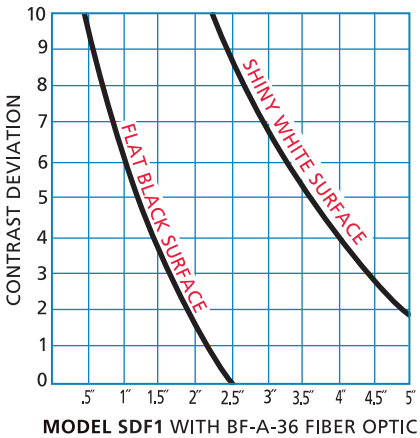
CONTRAST DEVIATION			RATING	PERFORMANCE COMMENTS
5 Bar	8 Bar	10 Bar		
1	1 – 2	1 – 2	Poor	Insufficient contrast to adequately perform sensing task.
2	3	3 – 4	Fair	Adequate contrast when conditions can be repeated and when periodic adjustments are acceptable.
3	4	5 – 6	Good	Generally enough contrast to 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

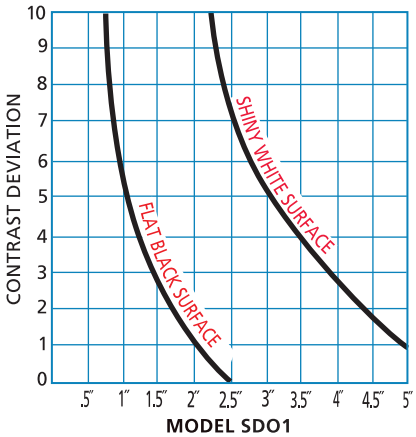
These charts are extremely helpful in determining if the *SMARTEYE*® you selected will adequately perform the sensing task at the desired range. Simply reference the amount of contrast deviation required to perform the sensing task in your environment and compare to the performance chart of the *SMARTEYE*® 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® 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**

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**

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.

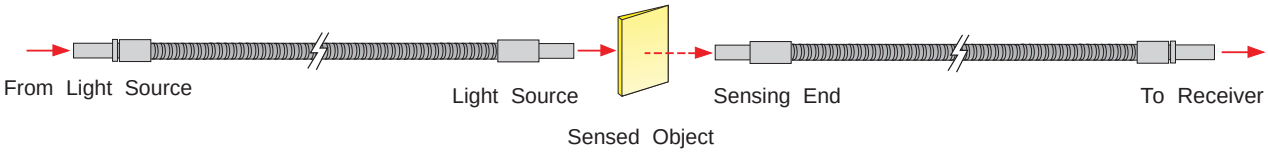
Fiberoptic Light Guides are flexible and small enough to fit into difficult sensing areas. This allows the sensor to be located in a more convenient location—out of harm's way. Fibers are resistant to high temperatures, vibration, condensation, and corrosion.

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.

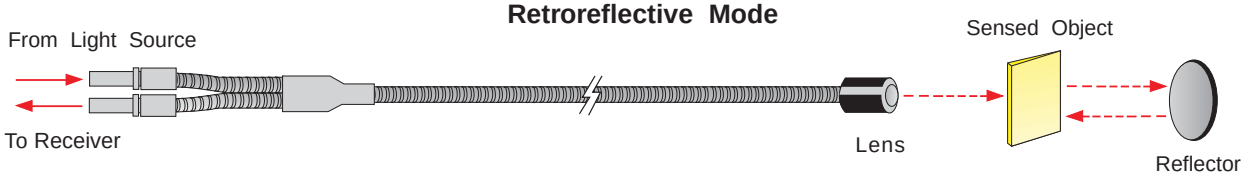
At the sensing site, the size and shape of the fiber optic bundle carrying the light controls the size and shape of the transmitted light beam. The size and shape of the fiberoptic tip controls the effective viewing area of the sensing system. Lenses are available to gain optical advantage to the sensing 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.

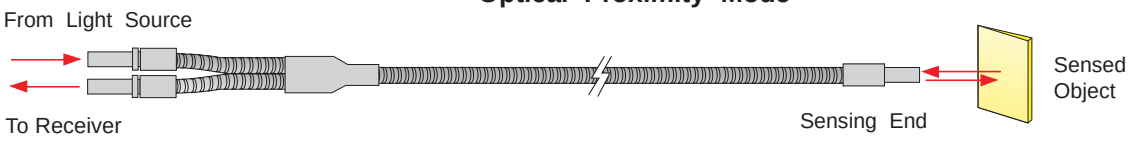
Thru-Beam/Opposed Mode



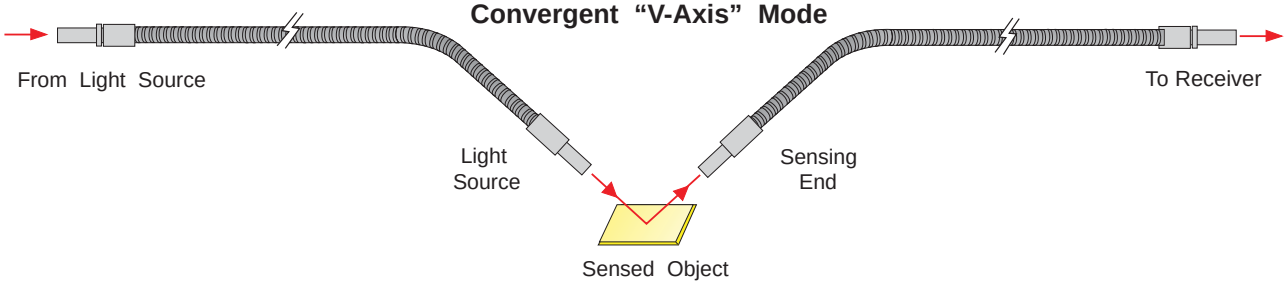
Retroreflective Mode



Optical Proximity Mode



Convergent "V-Axis" Mode



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.

General Purpose Photoelectric Sensor

SMARTEYE® EZ-PRO™

SMARTEYE® EZ-PRO™

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.

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. pushbutton 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

- AUTOSET, one button push setup
- Remote AUTOSET
- ACT, Automatic Contrast Tracking
- Action Alert indicator
- Three pulse stretchers; 10ms, 25ms, and 50ms (not accumulative)
- 5-LED Contrast Indicator
- Cable or quick disconnect
- Interchangeable optical blocks
- Button lock out
- Light On/Dark On automatic select
- NPN and PNP output

Benefits

- Easy to use
- Reduces downtime
- Robust design
- High reliability
- Lower inventory costs
- Tamperproof

Applications

- Printing/Marking/Coding
- Pharmaceutical
- Registration mark sensing
- Product detector
- Labeling line sensor
- Packaging machine trigger
- Inspection sensor

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 highspeed 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 three selectable functions: Lock, Auto Trac, and Timer; 10ms, 25ms, and 50ms.

VERSATILITY
Choice of ten “quick change” optical blocks allows one sensor to be used in proximity, convergent, retroreflective, polarized retroreflective, and 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, thruhole, or bracket mount.

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

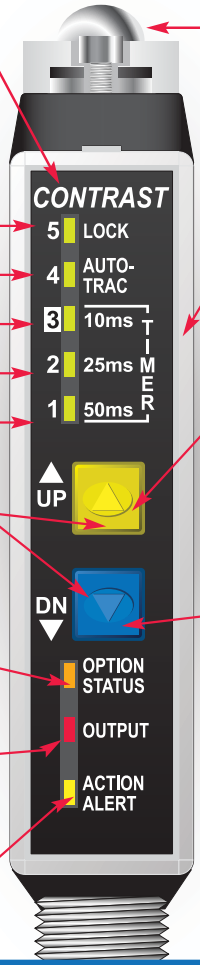
FIVE SELECTABLE OPTIONS
#5 LOCK – for tamperproof operation.
#4 AUTO TRAC – Automatic Contrast Tracking for perfect setting.
#3 10 millisecond pulse stretcher / off delay.
#2 25 millisecond pulse stretcher / off delay.
#1 50 millisecond pulse stretcher / off delay.

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

OPTION STATUS INDICATOR
Illuminates when in Option Status mode

OUTPUT STATUS INDICATOR
Illuminates when output transitors are “ON.”

MARGINAL PERFORMANCE INDICATOR
Illuminates when sensor's performance falls below optimum contrast levels



INTERCHANGEABLE OPTICAL BLOCKS
Choice of 10 Optical Blocks - O4, O5, R4, R5, F4, F5, V4, V4A, V6, V8

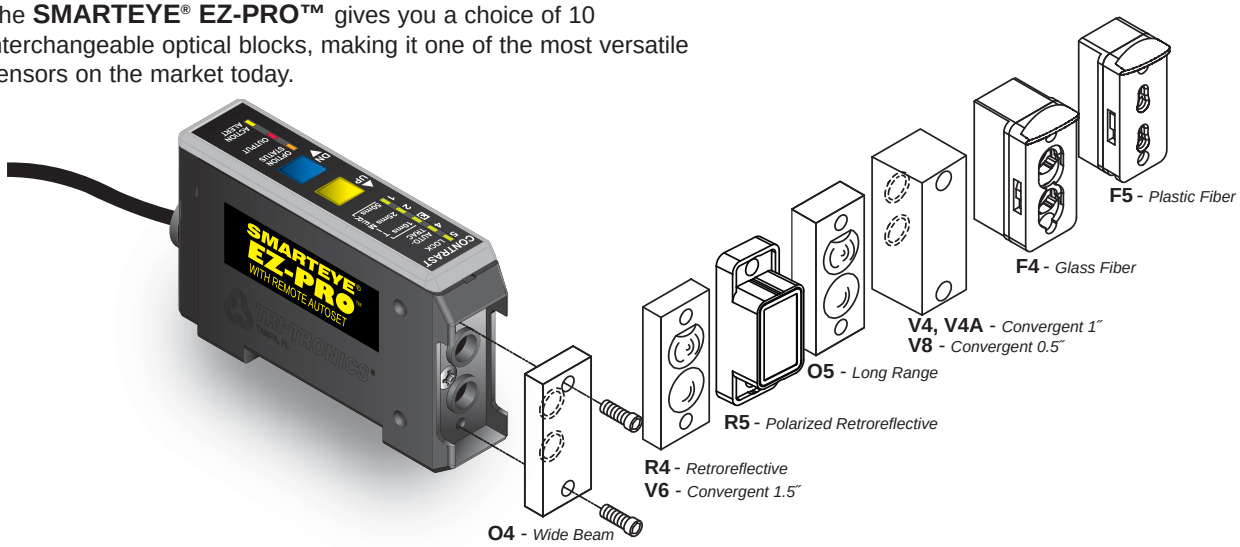
OPTIONAL TIMER
10, 25, or 50 millisecond pulse stretcher / “OFF” delay

YELLOW PUSHBUTTON - 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 PUSHBUTTON - 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

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.



Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent, opaque, 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 visible 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 F5
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes

Type V4, V4A
Convergent 1" “V” Axis
Useable range of 1" to 5".

Type V6
Convergent 1.5" “V” Axis
Useable range of 1.5" to 8".

Type V8
Convergent .5" “V” Axis
Useable range of .25" to 5"

Narrow beam optics useful for sensing small parts. Also useful for proximity sensing to minimize response to reflected light from background objects..

How To Specify:

1. Select Sensor light source required:
   I = Infrared
   R = Red
   B = Blue
   WL = White
2. Select Connector required:
   Blank = Cable 6 ft. (1.8m)
   C = Connector
3. Select Optical Block based on mode of operation required.

Example: EZP R C F4

- EZP — *EZ*-PRO
- R — Light Emitter
- C — Connector
- F4 — Optical Block

Sensing Range Guidelines

1 in. = 25.4mm / 1 ft. = 0.3048 meters

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.	1 ft.
R4	20+ ft.	18+ ft.	6 ft.	5 ft.
R5	N/A	7 ft.	4 ft.	3 ft.

Note: Proximity tests utilized a 90% reflective white target. Retroreflective tests utilized a 3” diameter round reflector, Model AR3.

Glass Fiberoptics

OPTICAL BLOCKS	IR	RED	BLUE	WHITE
Opposed Mode				
F4	16 in.	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: Proximity tests utilized a .125” diameter fiber bundle.

Plastic Fiberoptics

OPTICAL BLOCKS	RED	WHITE
Opposed Mode		
F5	9 in.	2 in.
F5 w/lens	6 ft.	2 ft.
F5 w/right angle lens	3 ft.	1 ft.
Proximity Mode		
F5	7 in.	5 in.
F5 w/lens	1 ft.	1 ft.

Note: Proximity tests utilized a .040” diameter fiber bundle.

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Light Source Guidelines

INVISIBLE INFRARED LIGHT SOURCE (880nm)

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 (480nm)

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 (660nm)

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' (1.8m) Shielded cable

GSEC-15
15' (4.6m) Shielded cable

GSEC-25
25' (7.62m) Shielded cable

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

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

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

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

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

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

SEB-3
Stainless “L” Bracket

FMB-2 (5.1mm diam.)
FMB-3 (3.1mm 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
- 45mA (exclusive of load)

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

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

RESPONSE TIME
- Light/Dark state response = 300 microseconds

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

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

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

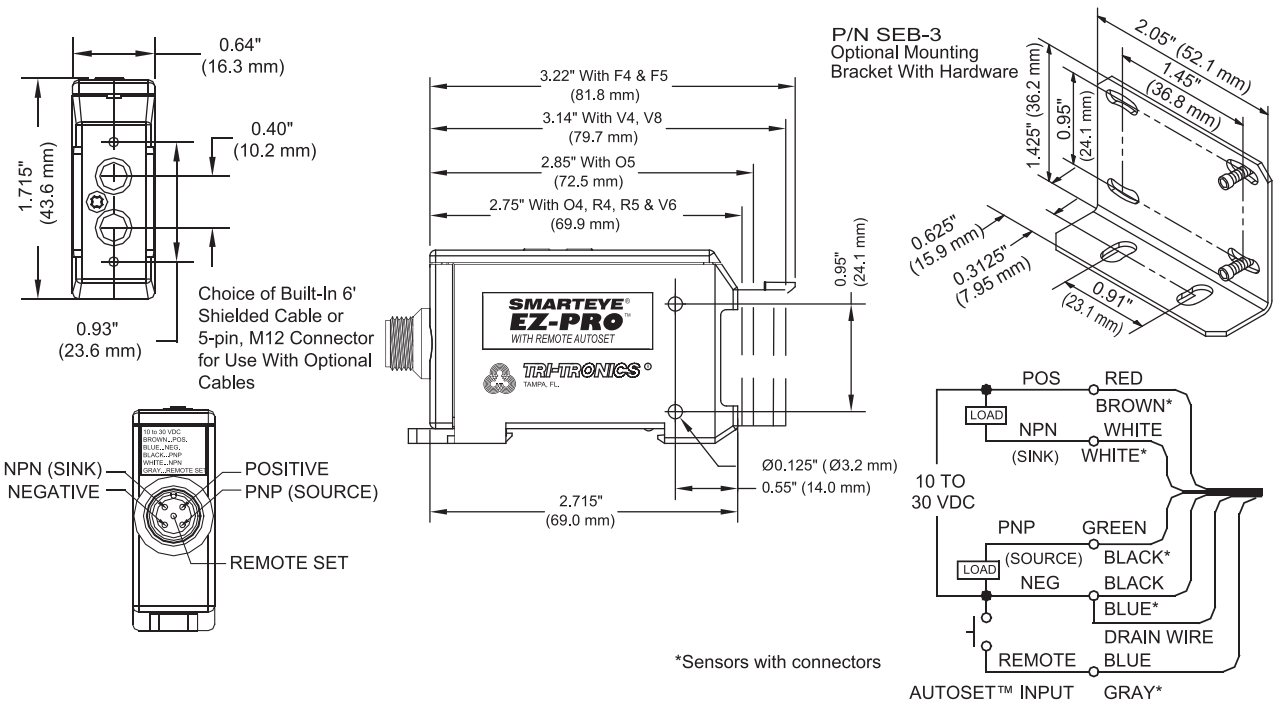
- Red LED output indicator = Illuminates when the sensor's output transistors are "on." *NOTE: If Output LED flashes, a short circuit condition exists*
- Amber LED = Illuminates when in the options select mode
- Yellow LED = Illuminates when action alert is activated. Also indicates when ACT adjusts 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

RoHS Compliant
Product subject to change without notice

Connections and Dimensions — *SMARTEYE®* EZ-PRO® PHOTOELECTRIC SENSOR



General Purpose Photoelectric Sensor

SMARTEYE®PRO

SMARTEYE® PRO

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 setup, can be adjusted by a single push of a button. 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 green AUTOSET button. From that point on, the sensor will automatically maintain a perfect setting, thanks to the dynamic ACT (Automatic Contrast Tracking) system. The *SMARTEYE® PRO* 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 Smarteye Pro sensors have the ability to perform a Light State AUTOSET as well as a Dark State AUTOSET (selectable in Option Status Mode). Dark State AUTOSET is useful for maximum range applications, or when the background is shiny or reflective.

The Lock feature ensures the *SMARTEYE® PRO* sensor is tamperproof. When the Lock feature is enabled in Options Status mode, the sensor's buttons will not allow an AUTOSET to be performed. This feature provides assurance of hassle-free operation operators have come to expect from a *SMARTEYE®*.

Features

- AUTOSET, one button push setup
- ACT, Automatic Contrast Tracking
- Action alert output
- Pulse stretcher timer - 10ms non-adjustable
- 5-LED Contrast Indicator
- Cable or quick disconnect
- Interchangeable optical blocks
- Button lock out
- NPN and PNP output
- Selectable Light State or Dark State AUTOSET

Benefits

- Easy to use
- Reduces downtime
- Robust design
- High reliability
- Lower inventory costs
- Tamper proof

Applications

- Printing/Marking/Coding
- Pharmaceutical
- Registration mark sensing
- Product detector
- Labeling line sensor
- Packaging machine trigger
- Inspection sensor

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 highspeed 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.

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

STATUS INDICATOR
Displays status of five selectable functions: Lock, AUTOSET, and Light/Dark, Auto Trac and Timer.

VERSATILITY
Choice of ten “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' (1.80m) cable.

TIMER
10ms pulse stretcher/off delay.

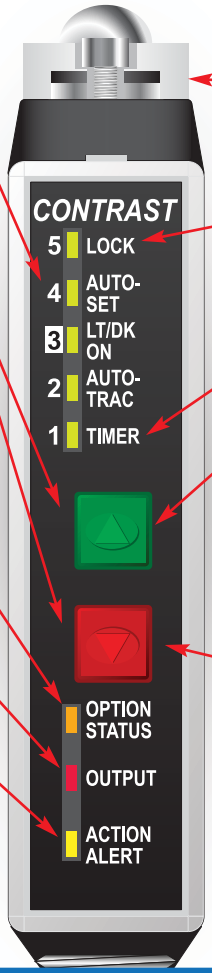
DUAL-FUNCTION BAR GRAPH
Primary Function: Contrast Indicator
Secondary Function: Status Indicator of Five Selectable Options

QUICKSET
1. Establish one of the following conditions:
   Proximity - Reflect light off an object
   Beam Break - Remove object from light beam path
2. Depress green and red buttons simultaneously for three seconds to perform AUTOSET/Quickset

OPTION STATUS INDICATOR
Illuminates when in Option Status mode

OUTPUT INDICATOR
Illuminates when Outputs are on

ACTION ALERT INDICATOR
Illuminates when sensor's performance falls below optimum contrast levels, and when automatic adjustments are made when Auto Trac feature is enabled



INTERCHANGEABLE OPTICAL BLOCKS
Choice of ten Optical Blocks - O4, O5, R4, R5, F4, F5, V4, V4A, V6, V8

LOCK
Lock out buttons for tamperproof operation

OPTIONAL 10ms TIMER

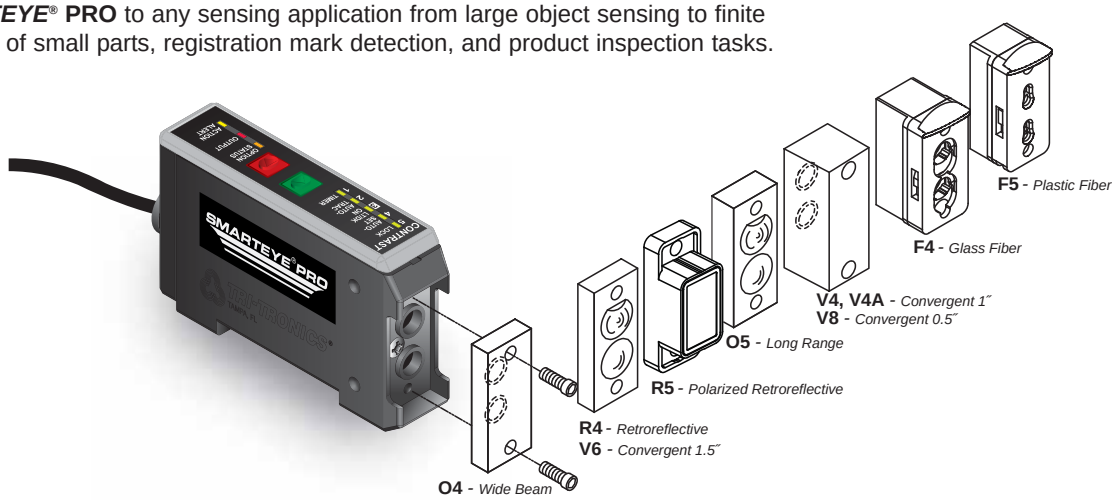
THREE FUNCTION SWITCH
1. UP adjustment in Normal Operation mode
2. AUTOSET to preset threshold level
3. Quickset when pushed with red button
4. Toggle selected option to opposite state when in Option Status mode

THREE FUNCTION SWITCH
1. DOWN adjustment in Normal Operation mode
2. Quickset when pushed with red button
3. Press and hold for three seconds for Option Status mode
4. Step down to desired function to be altered when in Option Status mode

Optical Block Selection

SMARTEYE® PRO

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, opaque, 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 visible 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 F5
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes

Type V4, V4A
Convergent 1" "V" Axis
Useable range of 1" to 5".

Type V6
Convergent 1.5" "V" Axis
Useable range of 1.5" to 8".

Type V8
Convergent .5" "V" Axis
Useable range of .25" to 5"

Narrow beam optics useful for sensing small parts. Also useful for proximity sensing to minimize response to reflected light from background objects..

How To Specify:

1. Select sensor type:
   SPB = Includes Action Alert
2. Select sensor LED light source required: I = Infrared; R = Red; B = Blue; WL = White.
3. Select connection required:
   Blank = Cable 6 ft. (1.8m)
   C = Connector
4. Select Optical Block.

Example: SPB R C R4

- SPB — ***SMARTEYE®* PRO**
- R — Light Emitter
- C — Connector
- R4 — Optical Block

Sensing Range Guidelines

1 in. = 25.4mm / 1 ft. = 0.3048 meters

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.	1 ft.
R4	20+ ft.	18+ ft.	6 ft.	5 ft.
R5	N/A	7 ft.	4 ft.	3 ft.

Note: Proximity tests utilized a 90% reflective white target. Retroreflective tests utilized a 3" diameter round reflector, Model AR3.

Glass Fiberoptics

OPTICAL BLOCKS	IR	RED	BLUE	WHITE
Opposed Mode				
F4	16 in.	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: Proximity tests utilized a .125" diameter fiber bundle.

Plastic Fiberoptics

OPTICAL BLOCKS	RED	WHITE
Opposed Mode		
F5	9 in.	2 in.
F5 w/lens	6 ft.	2 ft.
F5 w/right angle lens	3 ft.	1 ft.
Proximity Mode		
F5	7 in.	5 in.
F5 w/lens	1 ft.	1 ft.

Note: Proximity tests utilized a .040" diameter fiber bundle.

Light Source Guidelines

SMARTEYE® PRO

INVISIBLE INFRARED LIGHT SOURCE (880nm)

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 (480nm)

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 (660nm)

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' (1.8m) Shielded cable

GSEC-15
15' (4.6m) Shielded cable

GSEC-25
25' (7.62m) Shielded cable

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

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

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

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

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

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

SEB-3
Stainless “L” Bracket

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

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

Specifications

SMARTEYE®PRO

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45mA (exclusive of load)

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

RESPONSE TIME
- Light/Dark state response = 300 microseconds

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

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

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

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

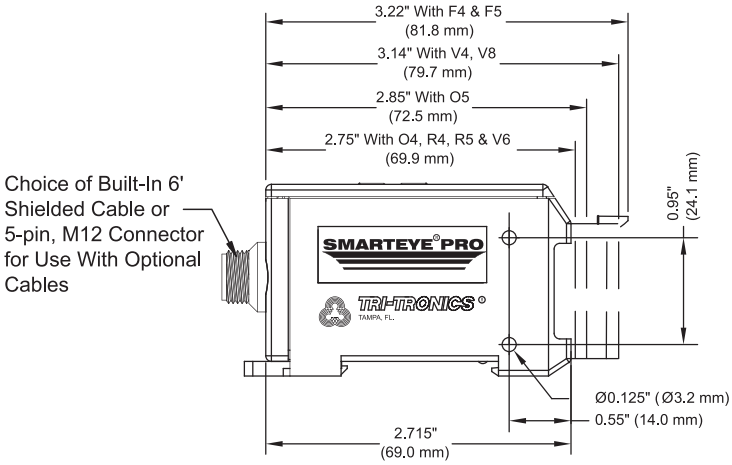
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to158°F)

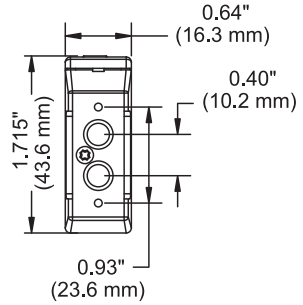
RUGGED CONSTRUCTION
- Chemical resistant, high-impact polycarbonate housing
- Waterproof ratings: NEMA 6 and IP67
- Conforms to heavy industry grade CE requirements

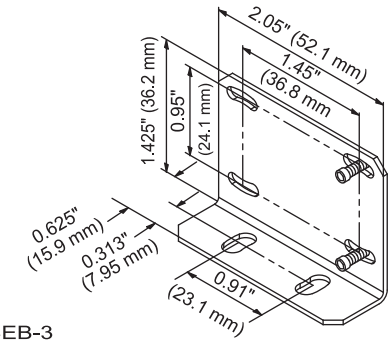
HYSTERESIS
- Set for high resolution – less than one bar on the Contrast Indicator

RoHS Compliant
Product subject to change without notice

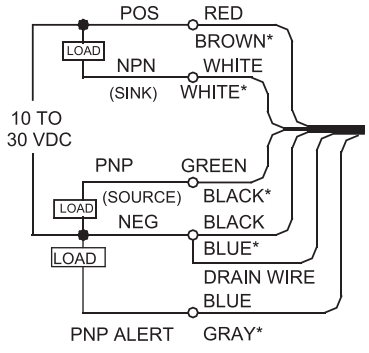
Connections and Dimensions — *SMARTEYE®PRO® PHOTOELECTRIC SENSOR*







SEB-3
Optional Mounting Bracket with Hardware



*Sensors with connectors

General Purpose Photoelectric Sensor

MARK SMARTEYE® II

High Performance Sensor

The ***SMARTEYE®* MARK II** sensor is one of TRI-TRONICS' most popular photoelectric sensors. 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 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 unique 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.

Features

- Response time (50 microseconds)
- Enhanced Dynamic Range
- Seven interchangeable optical blocks
- Clutched offset adjustment
- Operational from 12 to 24 VDC…(polarity protected)
- Choice with infrared, red, white, or blue LED
- 10-LED CONTRAST INDICATOR
- Built-in connector
- Waterproof housing
- NPN and PNP output transistors
- Short circuit protection
- Light On/Dark on selector switch
- Anti-pulsing protection on power up

Benefits

- Accurate and repeatable
- Easy to setup
- Easy to maintain
- Lower maintenance costs
- Lower inventory costs
- Adaptable and flexible for many applications

Applications

- Printing/Coding/Marking
- Registration mark sensing
- High speed counting
- Low contrast inspection sensing
- Label applicator product detector
- Small parts detection

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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.

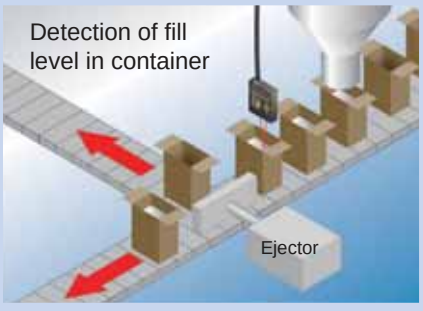
Beam Break Sensing Mode Advantages

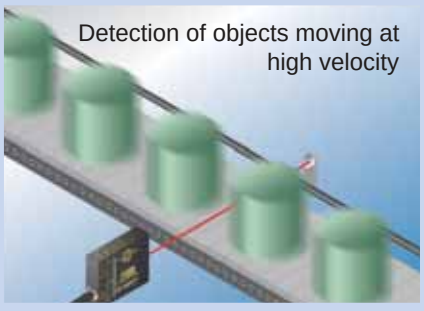
When operating in the Beam Break (opposed) mode of sensing, the EDR® circuit once again prevents saturation. This is particularly advantageous when attempting to detect the presence of splices, overlapping materials, container contents, or adhesive labels on backing materials. Saturation can easily occur 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

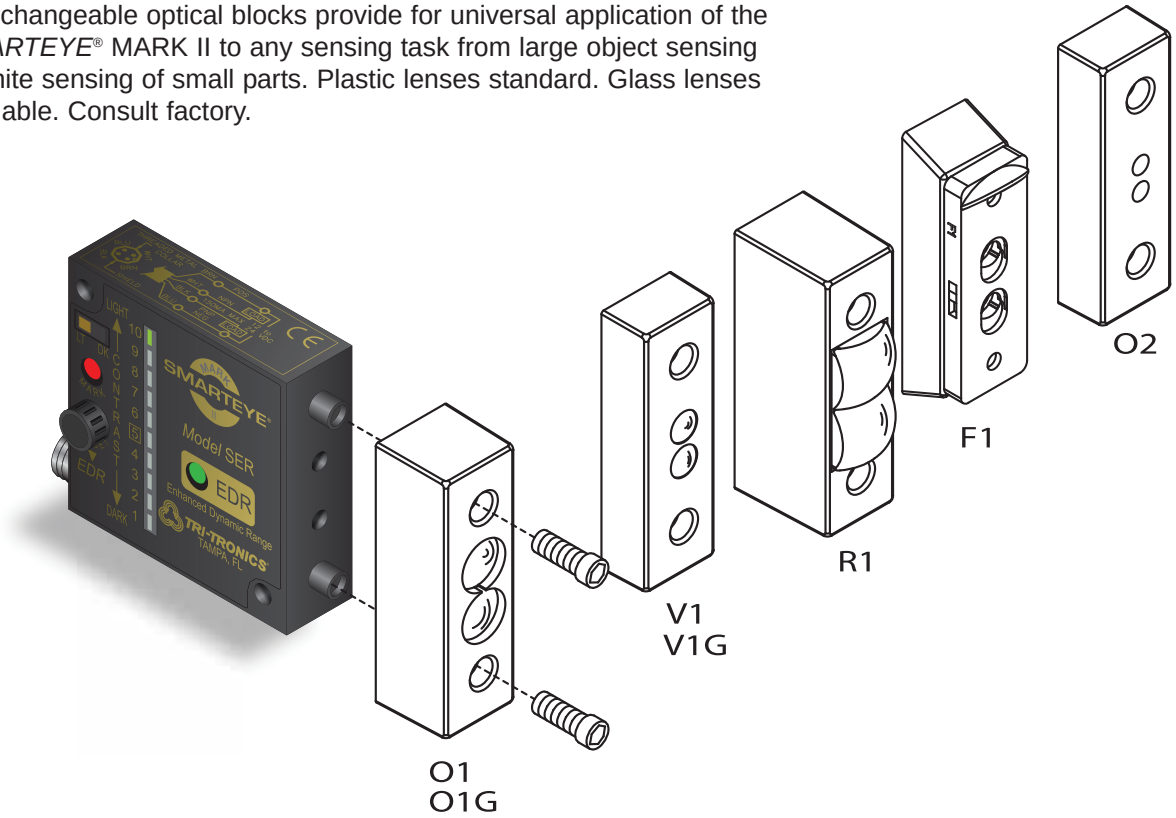
Typical Applications





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 a slide-action snap.
See Section 3 for fiberoptic 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.

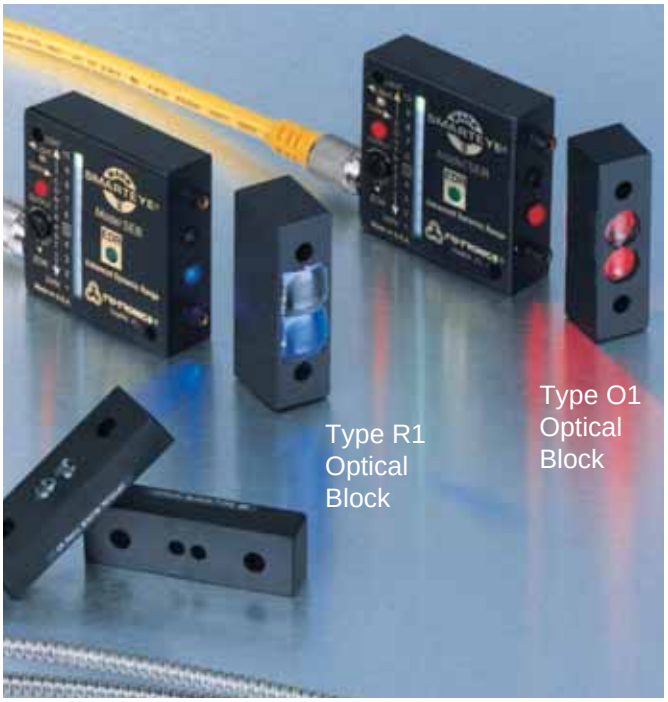
Type V1, V1G
(Glass)
Focused Lens "V" Axis
Type V1, V1G (Glass) is for direct lens "V" axis sensing at close ranges. Used for small part or precise leading edge sensing. Range is dependent on model of the MARK II selected.

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.



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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:
   (see Range Guidelines)

Example: SER K F1

- ***SMARTEYE*® MARK II**
- Adjustment Type
- Optical Block

Accessories

Micro Cable Selection Guide, 4-wire M12

Yellow Shielded Cable Assemblies

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

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

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

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

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

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

Black Shielded Cable Assemblies (Lightweight)

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

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

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

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

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

BRSEC-25

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

BX-10
10' (3.1m) Extension cable

BX-25
25' (7.62m) Extension cable

Grey Unshielded Cable Assemblies

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

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

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

SEB-1
Stainless “L” Bracket

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

Specifications

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 85mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP Output transistor:
- NPN: Sink up to 150mA
- PNP: Source up to 150mA
- 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

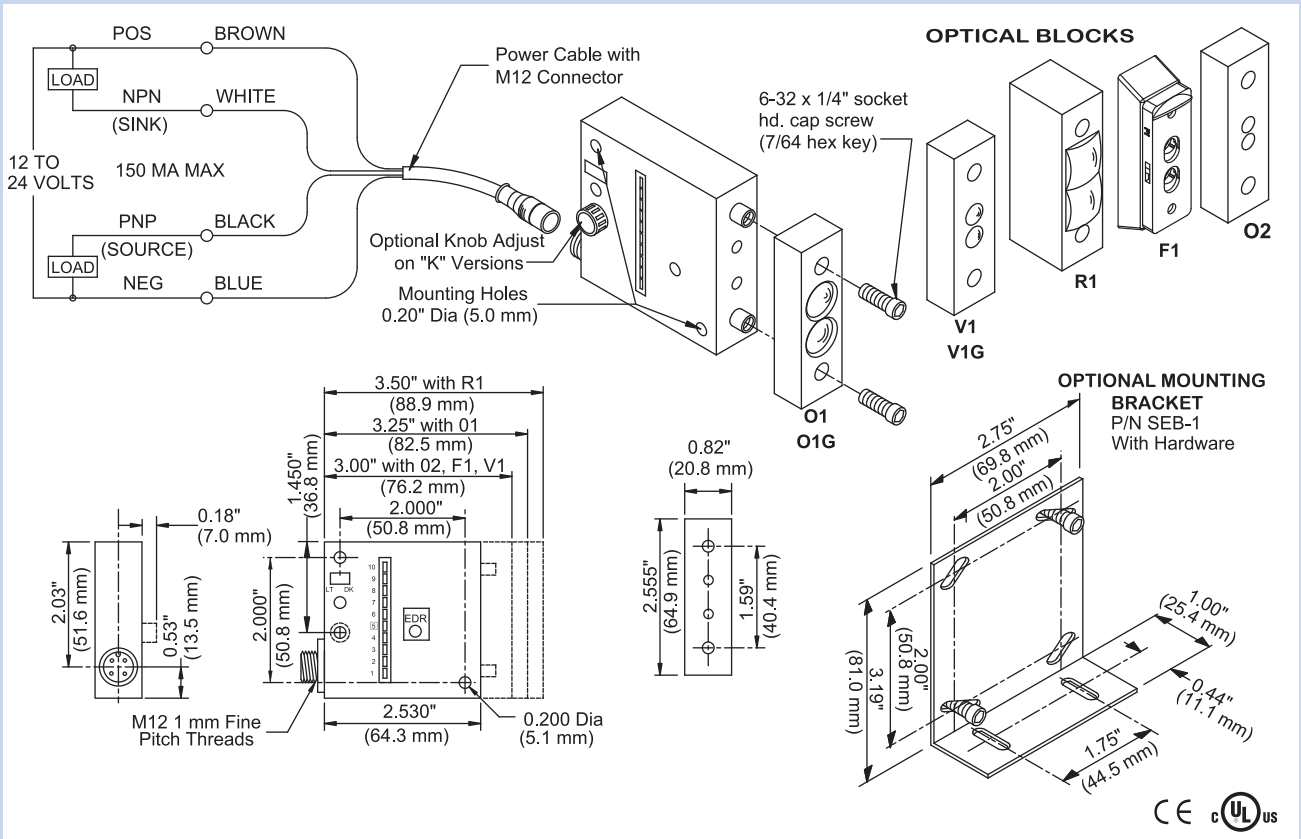
INDICATORS
- OUTPUT INDICATOR - Red LED illuminates and the NPN or PNP outputs switch to the opposite state when returned light level exceeds "5" on the CONTRAST INDICATOR
- EDR® INDICATOR - Intensity of GREEN LED provides indication of where in the dynamic operating range the offset, EDR® adjustment 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 ten 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

RoHS Compliant
Product subject to change without notice

Connections and Dimensions — *SMARTEYE®* MARK II PHOTOELECTRIC SENSOR



General Purpose Photoelectric Sensor

SMARTEYE®
MARK III

SMARTEYE® MARK III

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.

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 clock wise 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.

Features

- Response time (50 microseconds)
- Enhanced Dynamic Range
- Interchangeable optical blocks
- Clutched offset adjustment
- Operational from 12 to 24 VDC…(polarity protected)
- Choice with infrared, red, white, or blue LED
- 10-LED CONTRAST INDICATOR
- Built-in connector
- Waterproof housing
- NPN and PNP output transistors
- Short circuit protection
- Light On/Dark on selector switch
- Anti-pulsing protection on power up

Benefits

- Accurate and repeatable
- Easy to setup
- Easy to maintain
- Lower maintenance costs
- Lower inventory costs
- Adaptable and flexible for many applications

Applications

- Printing/Coding/Marking
- Registration mark sensing
- High speed counting
- Low contrast inspection sensing
- Label applicator product detector
- Small parts detection

Light Source Guidelines

SMARTEYE® MARK III

INVISIBLE INFRARED LIGHT SOURCE (880nm)

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 (480nm)

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 (660nm)

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

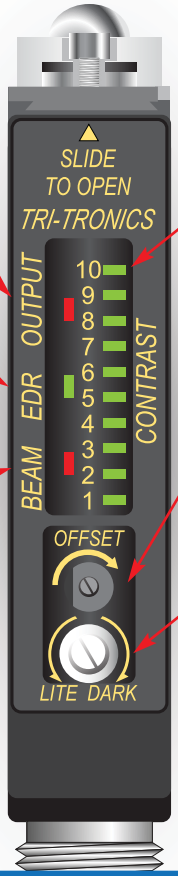
WHITE LIGHT SOURCE

(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



OUTPUT STATUS INDICATOR
Illuminates when outputs are “ON”

EDR® INDICATOR
Illuminates gradually in intensity when adjusting Offset

BEAM STATUS INDICATOR
Illuminates when received light level exceeds the number 5 on the Contrast Indicator

10 LED CONTRAST INDICATOR
Provides "at-a-glance" analysis of the sensor's response to Light State vs Dark State sensing conditions

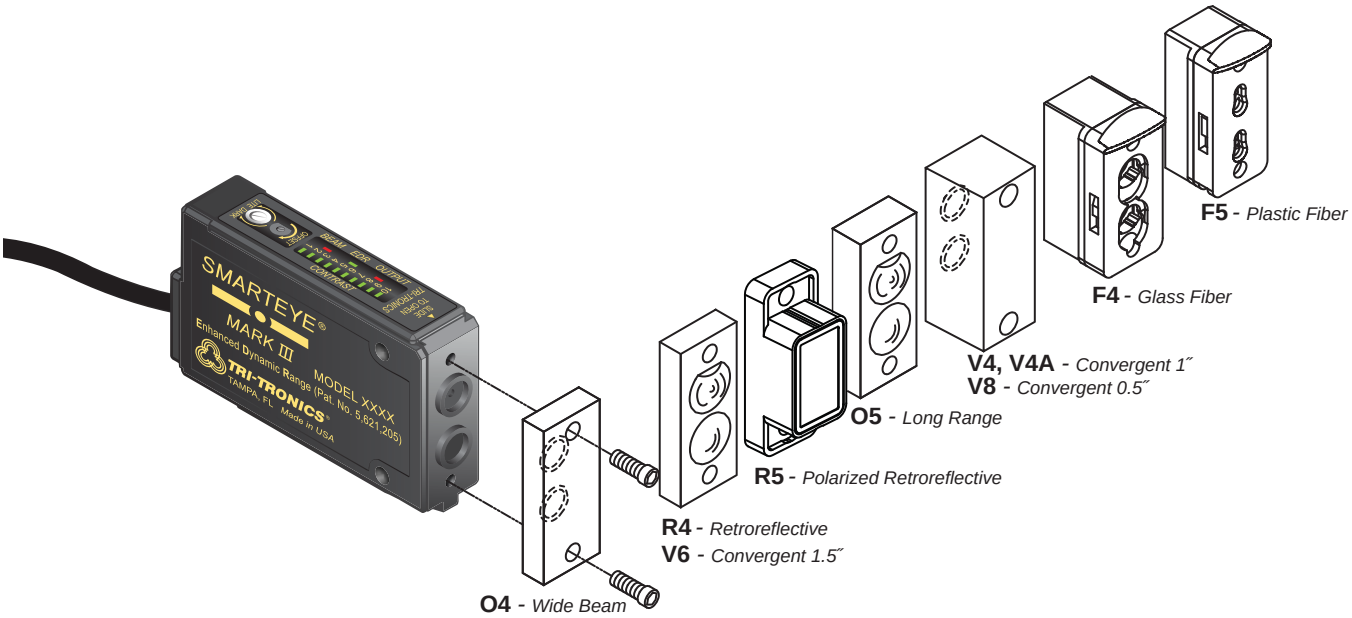
OFFSET/EDR® ADJUSTMENT
Manual adjustment above or below the switching point, i.e. the number 5 on the Contrast Indicator

LIGHT/DARK ON SWITCH
Turn all the way counter clockwise for Light On operation; output turns on when the received light level exceeds the number 5 on the Contrast Indicator.

Turn all the way clockwise for Dark On operation; output turns on when the received light level recedes below the number 5 on the Contrast Indicator.

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, opaque, 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 visible 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 F5
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes

Type V4, V4A
Convergent 1" “V” Axis
Useable range of 1" to 5".

Type V6
Convergent 1.5" “V” Axis
Useable range of 1.5" to 8".

Type V8
Convergent .5" “V” Axis
Useable range of .25" to 5"

Narrow beam optics useful for sensing small parts. Also useful for proximity sensing to minimize response to reflected light from background objects..

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	1.5 ft.	11 in.	4 in.	3 in.
O5	4 ft.	3 ft.	1.5 ft.	1 ft.
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		
F5	9 in.	2 in.
F5 w/lens	6 ft.	2 ft.
F5 w/right angle lens	3 ft.	1 ft.
Proximity Mode		
F5	7 in.	5 in.
F5 w/lens	1 ft.	1 ft.

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

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How To Specify

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

2. Select connection required:
Blank = Cable 6 ft. (1.8m)
C = Connector

3. Select Optical Block based on mode of sensing required (see Range Guidelines)

NOTE: DRB-1 Bracket included

Example: SE3 R C F4

- ***SMARTEYE® MARK III*** — SE3
- Light Emitter — R
- Connector — C
- Optical Block — F4

Accessories

Micro Cable Selection Guide, 4-wire M12

Yellow Shielded Cable Assemblies

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

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

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

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

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

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

Black Shielded Cable Assemblies (Lightweight)

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

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

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

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

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

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

BX-10
10' (3.1m) Extension cable

BX-25
25' (7.62m) Extension cable

Grey Unshielded Cable Assemblies

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

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

SEB-3
Stainless “L” Bracket

TA-18
18mm Adapter

DRB-1
Bracket

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

MB-18
18mm Bracket

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

Specifications

SMARTEYE® MARK III

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 85mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP Output transistor:
- NPN: Sink up to 150mA
- PNP: Source up to 150mA
- 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
- Immune to most ambient light

HYSTERESIS
- Less than 400 millivolts for maximum sensitivity and resolution

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

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

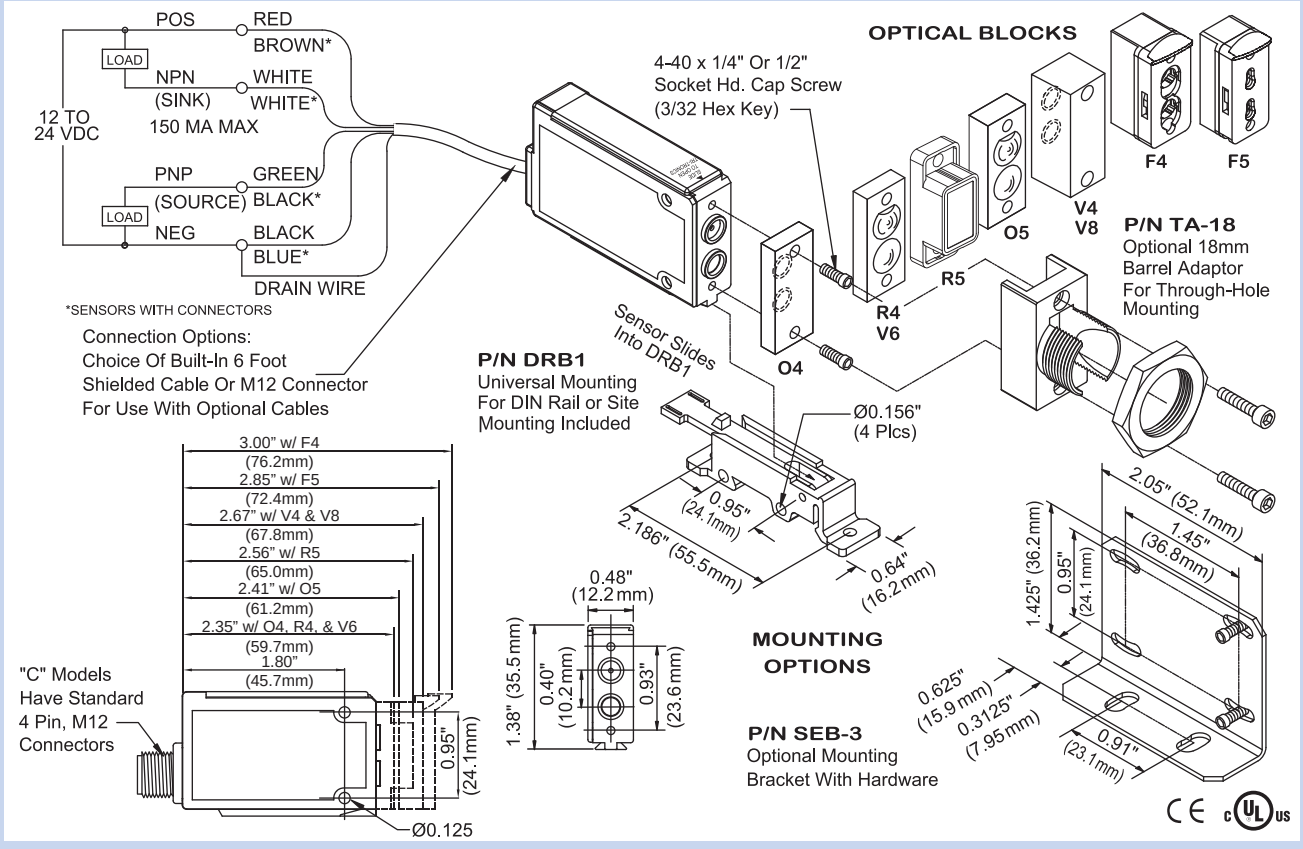
OFFSET/EDR® ADJUSTMENT
- Sets initial level on CONTRAST INDICATOR in relation to mid-scale switch point of 5 – functions as sensitivity adjustment
- Controls Enhanced Dynamic Range circuit (EDR®) which functions to avoid saturation

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

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

RoHS Compliant
Product subject to change without notice

Connections and Dimensions — *SMARTEYE*® MARK III PHOTOELECTRIC SENSOR



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General Purpose Photoelectric Sensor

SMARTEYE®

CLASSIC

SMARTEYE®

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 *the* "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 the toughest job sensing sites. There are many models available for inaccessible areas such as extremely tight mechanical pockets, high temperature applications, corrosive or caustic environments, or high vibration mounting considerations. There are many varieties of tip configurations available for either straight or bifurcated fiberoptic requirements.

Features

- 10-LED Contrast Indicator
- 100 microseconds response time
- High Gain
- Ambient light immunity
- Analog output (DC proportional)
- NPN or PNP output
- Infrared, Red, Green light source options

Benefits

- Easy to use
- High reliability
- Lower maintenance costs
- Reduce downtime
- Improve machine throughput

Applications

- High speed counting
- Contents inspection
- Parts presence/absence
- Printing/Marking/Coding

Features

PERFORMANCE

High Speed Models: SD, PSD
(recommended for most sensing tasks)
Excellent resolution and high-speed response. 500µs 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. 1.5ms 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. 100µs 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

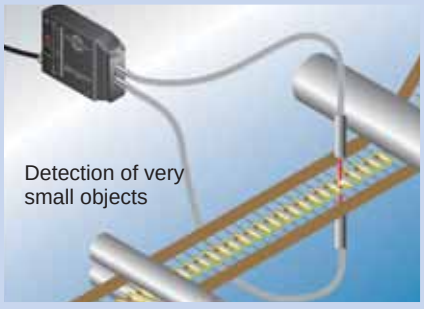
Infrared Light Source
Invisible light – recommended in opaque object sensing applications. Infrared LED light source provides long-range sensing in either Beam Make or Beam Break modes. Infrared light maximizes the sensor's ability to penetrate contamination found in harsh environments.

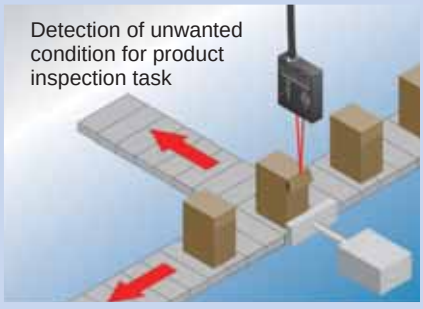
High Intensity Infrared Light Source
Invisible light for maximum possible range in either Beam Make or Beam Break sensing modes. Provides maximum penetration for use in harsh environments. Also works well with the small diameter fiberoptic light guides. *NOTE: Not recommended for use in close-up sensing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

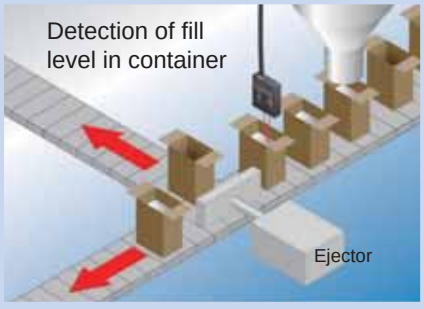
Red (Visible) Light Source
Visible red LED light source recommended for sensing transparent/translucent objects. Outperforms infrared light in many moderate to low contrast applications. Also recommended for use with plastic fiberoptic light guides.

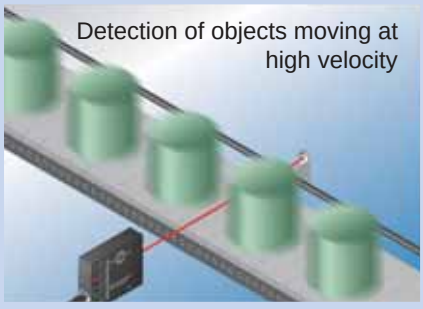
Green (Visible) Light Source
Recommended for use only in applications where the color green provides an obvious advantage. An example would be sensing a light colored red/pink object on a white background. Also has been used in film processing applications when red or infrared light can cause damage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

Typical Applications



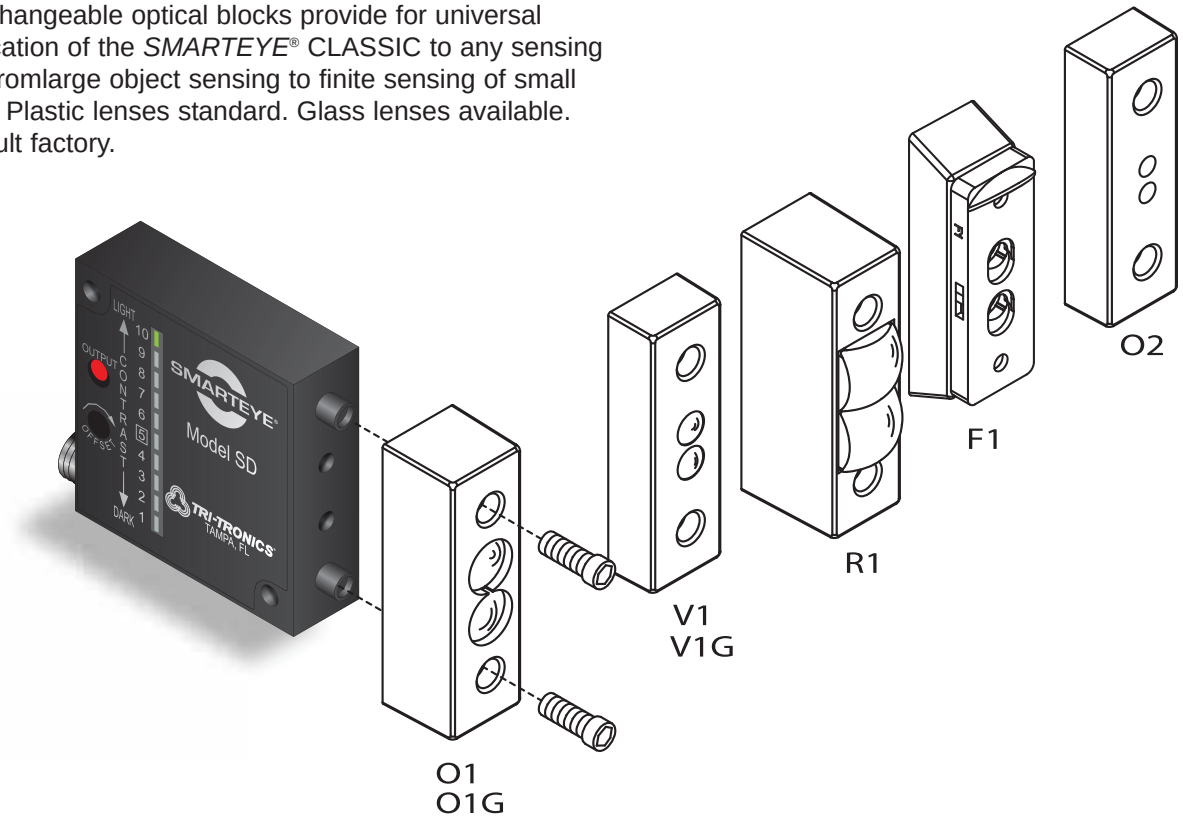






Optical Block Selection

Interchangeable optical blocks provide for universal application of the *SMARTEYE*® CLASSIC to any sensing task fromlarge 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 fiber optic light guide with .187" O.D. tips. The light guide is inserted and held in place with a slide-action snap.
See Section 3 for fiberoptic 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 of 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.

How to Specify

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

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
SDLG	High Gain Green

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
PSDLG	High Gain Green

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

F1 = 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)

Example: SD F1

SMARTEYE® CLASSIC — SD

Optical Block — F1

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

SEB-1
Stainless “L” Bracket

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

Specifications

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity protected

CURRENT REQUIREMENTS
- 75mA (exclusive of load)

OUTPUTS
Digital (Switching)
- Models with complementary NPN output transistors sink up to 100mA @ 40 VDC max
- Models with complementary PNP output transistors source up to 100mA @ 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 = 880nm
B. Red = 660nm
C. Green = 550nm

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

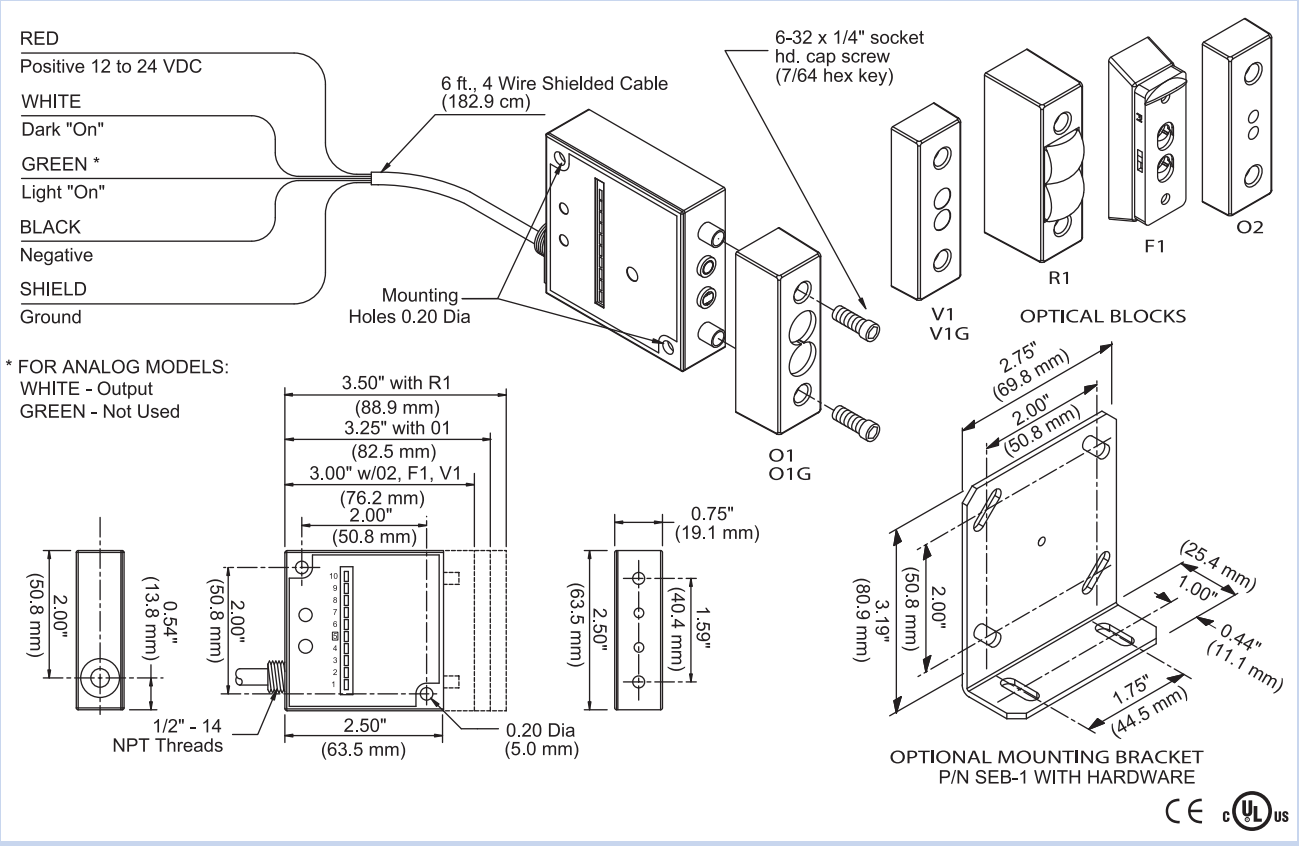
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

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

RoHS Compliant
Product subject to change without notice

Connections and Dimensions — *SMARTEYE®* CLASSIC PHOTOELECTRIC SENSOR



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General Purpose Photoelectric Sensor

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.

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 beam status LED indicator illuminates when the received light level exceeds the sensor's light state switch point. The yellow light intensity 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 output LED illuminates when the output transistors are in the "on" state. Now you can set up and adjust the sensor as easily as monitoring the status of three LED indicators.

With seven interchangeable optical blocks; DIN rail, side, and bracket mounting; as well as cable or connector version options, the Opti-Eye is one of the most versatile, low cost, general purpose sensors available in it's class... Opti-mal for most high contrast sensing applications.

Features

- 500 microseconds response time
- Potentiometer range adjustment
- Cable or quick disconnect
- NPN and PNP outputs
- DIN rail, bracket, or through-hole mounting
- Interchangeable Optical Blocks

Benefits

- Easy to use
- Lower maintenance costs
- Reduce downtime
- Improve machine throughput

Applications

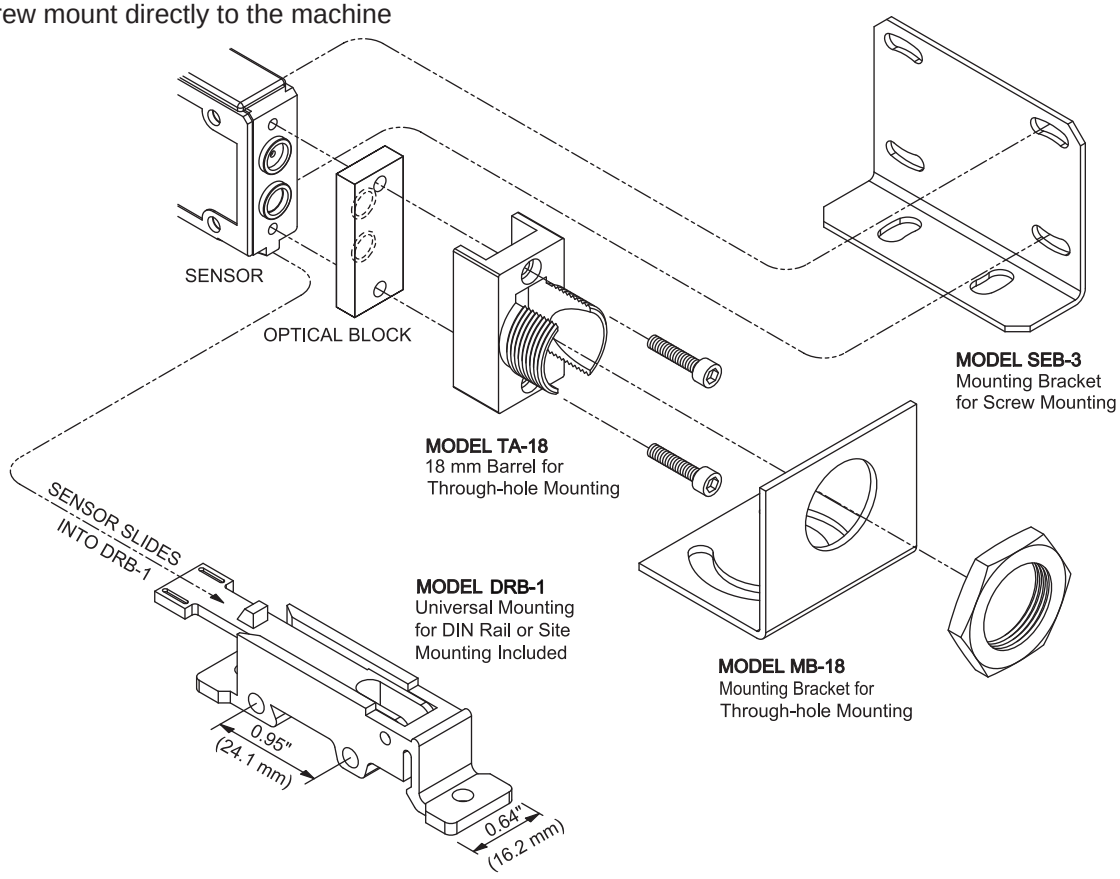
- High speed counting
- Product/object detector
- Inspection sensing
- Product Orientation
- Labeling
- Printing/Marking/Coding

Mounting and Light Source Guidelines

OPTI-EYE®

Five 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 (880nm)

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 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 (660nm)

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.

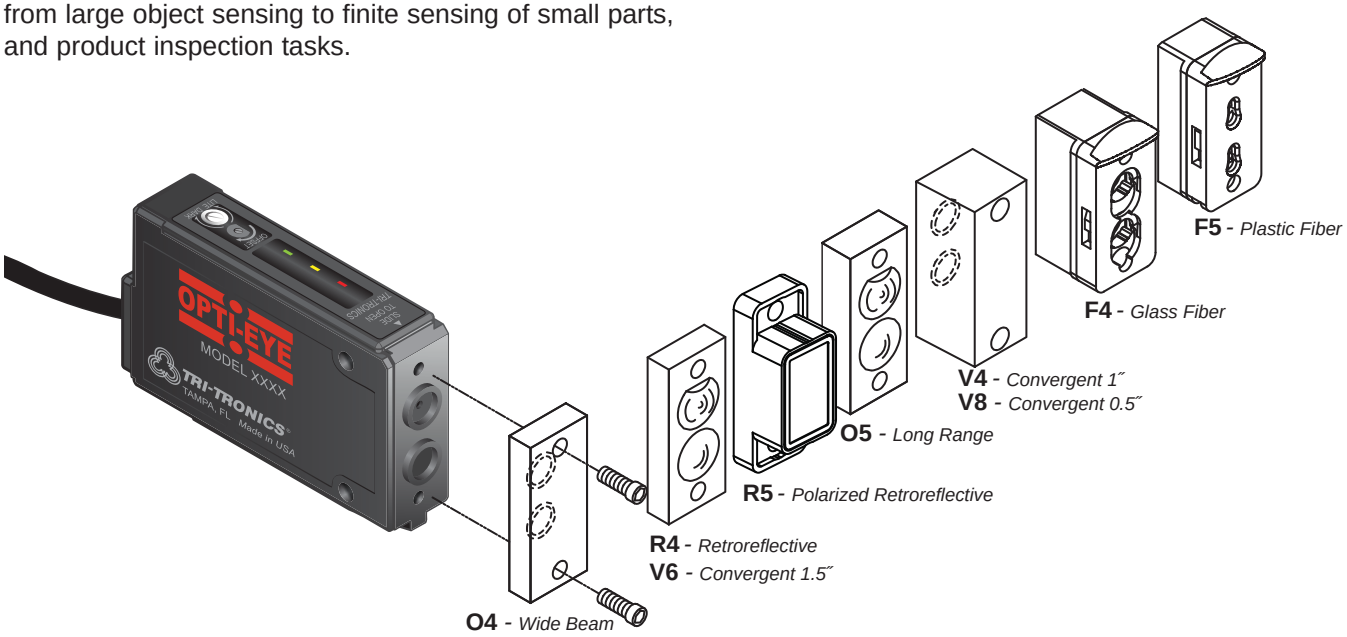
D. Can be polarized for retroreflective (Beam Break) sensing to reduce proxing on shiny objects.

E. Used as red filter for color perception advantages.

Optical Block Selection

OPTI-EYE®

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, and product inspection tasks.



Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent, opaque, 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 visible 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 F5
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes

Type V4
Convergent 1" “V” Axis
Useable range of 1" to 5".

Type V6
Convergent 1.5" “V” Axis
Useable range of 1.5" to 8".

Type V8
Convergent .5" “V” Axis
Useable range of .25" to 5"

Narrow beam optics useful for sensing small parts. Also useful for proximity sensing to minimize response to reflected light from background objects..

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 and UAC-15 lens

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 based on light source required
   OI = Infrared
   OR = Red
2. Select connection required:
   Blank = Cable
   C = Connector
3. Select Optical Block based on mode of sensing required (see Range Guidelines)

Example: O R C V4

- **OPTI-EYE®**
- Light Source
- Connector
- Optical Block

Accessories

Micro Cable Selection Guide, 4-wire M12

Yellow Shielded Cable Assemblies

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

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

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

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

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

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

Black Shielded Cable Assemblies (Lightweight)

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

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

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

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

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

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

BX-10
10' (3.1m) Extension cable

BX-25
25' (7.62m) Extension cable

Grey Unshielded Cable Assemblies

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

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

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

FMB-2 (5.1mm diam.)
FMB-3 (3.1mm 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
- 60mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP output transistors:
  NPN: Sink up to 150mA
  PNP: Source up to 150mA
- 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 = 880nm
  or Visible Red = 660nm

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

RANGE ADJUSTMENT
- 15 turn Light Source Intensity control

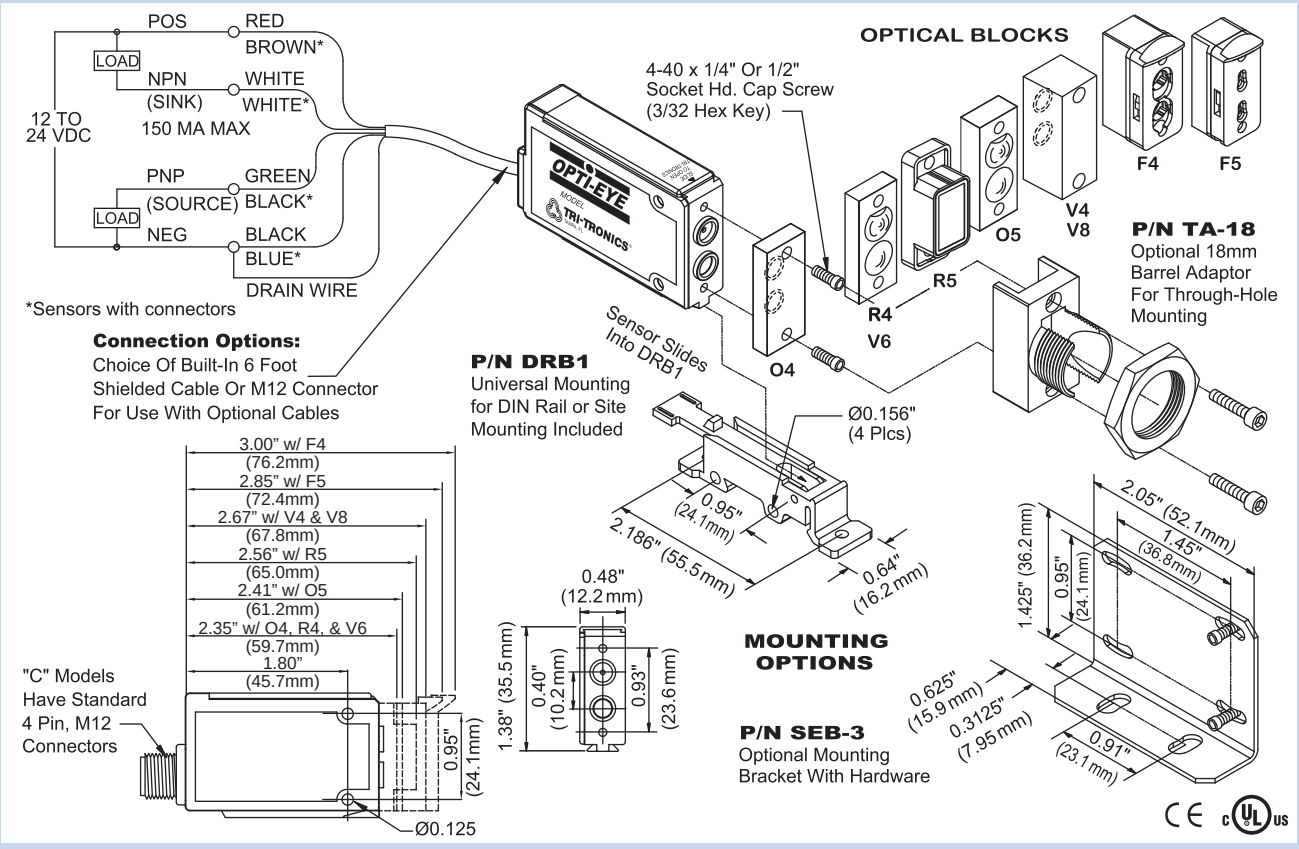
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

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

RoHS Compliant
Product subject to change without notice

Connections and Dimensions OPTI-EYE® PHOTOELECTRIC SENSOR



General Purpose Photoelectric Sensor

EZ EYE™

EZ-EYE™

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.

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.

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.

Features

- Single button push AUTOSET
- NPN and PNP outputs
- Cable or quick disconnect
- Interchangeable optical blocks
- 500 microsecond response time
- Immune to most ambient light

Benefits

- Easy to use
- Small and compact for mechanical space issues
- Lower maintenance costs
- Reduce downtime
- Increase machine throughput

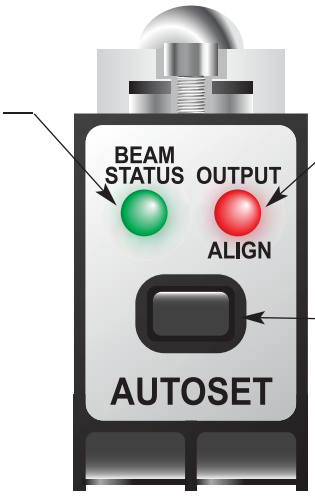
Applications

- Product presence/absence
- High speed counting
- Object detector
- Printing/Marking/Coding
- Inspection trigger

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 (880nm)

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 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. Also useful in detecting overlapped splices in dense materials.

RED LIGHT SOURCE (660nm)

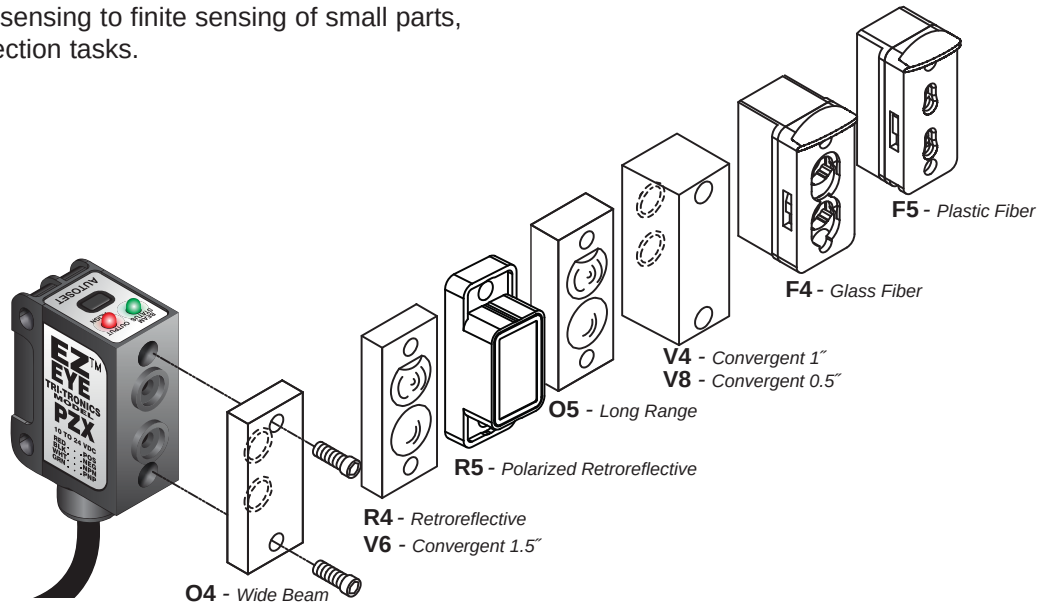
A. Best choice for use with plastic fiberoptic light guides.

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.

OPTICAL BLOCK SELECTION

Interchangeable optical blocks provide for universal application of the **EZ-EYE®** to any sensing applications 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, opaque, 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 visible 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 F5
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes

Type V4
Convergent 1" “V” Axis
Useable range of 1" to 5".

Type V6
Convergent 1.5" “V” Axis
Useable range of 1.5" to 8".

Type V8
Convergent .5" “V” Axis
Useable range of .25" to 5"

Narrow beam optics useful for sensing small parts. Also useful for proximity sensing to minimize response to reflected light from background objects..

Sensing Range Guidelines

1 in. = 25.4mm / 1 ft. = 0.3048 meters

Convergent / Proximity / Retroreflective

OPTICAL BLOCKS	IR	RED
V4	1 in.	1 in.
V6	1.5 in.	1.5 in.
V8	0.5 in.	0.5 in.
O4	5 in.	2 in.
O5	3 ft.	16 in.
R4	40 ft.	20 ft.
R5	N/A	12 ft.

Note: Proximity tests utilized a 90% reflective white target. Retroreflective tests utilized a 3” diameter round reflector, Model AR3.

Glass Fiberoptics

OPTICAL BLOCKS	IR	RED
Opposed Mode		
F4	7 in.	3.5 in.
F4 w/ UAC-15	10 ft.	5 ft.
Proximity Mode		
F4	2.5 in.	1.25 in.
F4 w/ UAC-15	5 in.	6 in.

Note: Proximity tests utilized a .125” diameter fiber bundle.

Plastic Fiberoptics

OPTICAL BLOCKS	IR	RED
Opposed Mode		
F5	N/A	4.5 in.
F5 w/lens	N/A	10 ft.
Proximity Mode		
F5	N/A	1 in.
F5 w/lens	N/A	N/A

Note: Proximity tests utilized a .040” diameter fiber bundle.

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HOW TO SPECIFY

1. Select sensor model based on light source required:
   PZI = Infrared
   PZR = Red
2. Select connection required:
   Blank = Cable
   C = Connector
3. Select Optical Block based on mode of sensing required:
   (see Range Guidelines)

Example: PZ R C F5

- **EZ-EYE®**
- Light Source
- Connector
- Optical Block

Accessories

4-Wire Nano Cable, M8

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

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

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

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

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

GEX-9
9' (2.7m) extension cable

Screw Mount Reflectors

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

AR3
3" diam.
(76.2mm diam.)

Optional Prismatic High-Performance Reflectors NEMA 4, IP67

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

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

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

EEB-1
Vertical Stainless
Bracket Assembly

EEB-2
Horizontal
Bracket Assembly

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

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

FMB-2 (5.1mm diam.)
FMB-3 (3.1mm 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
- 50mA (exclusive of load)

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

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

LED LIGHT SOURCE
- Red = 660nm
- Infrared = 880nm
- 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.

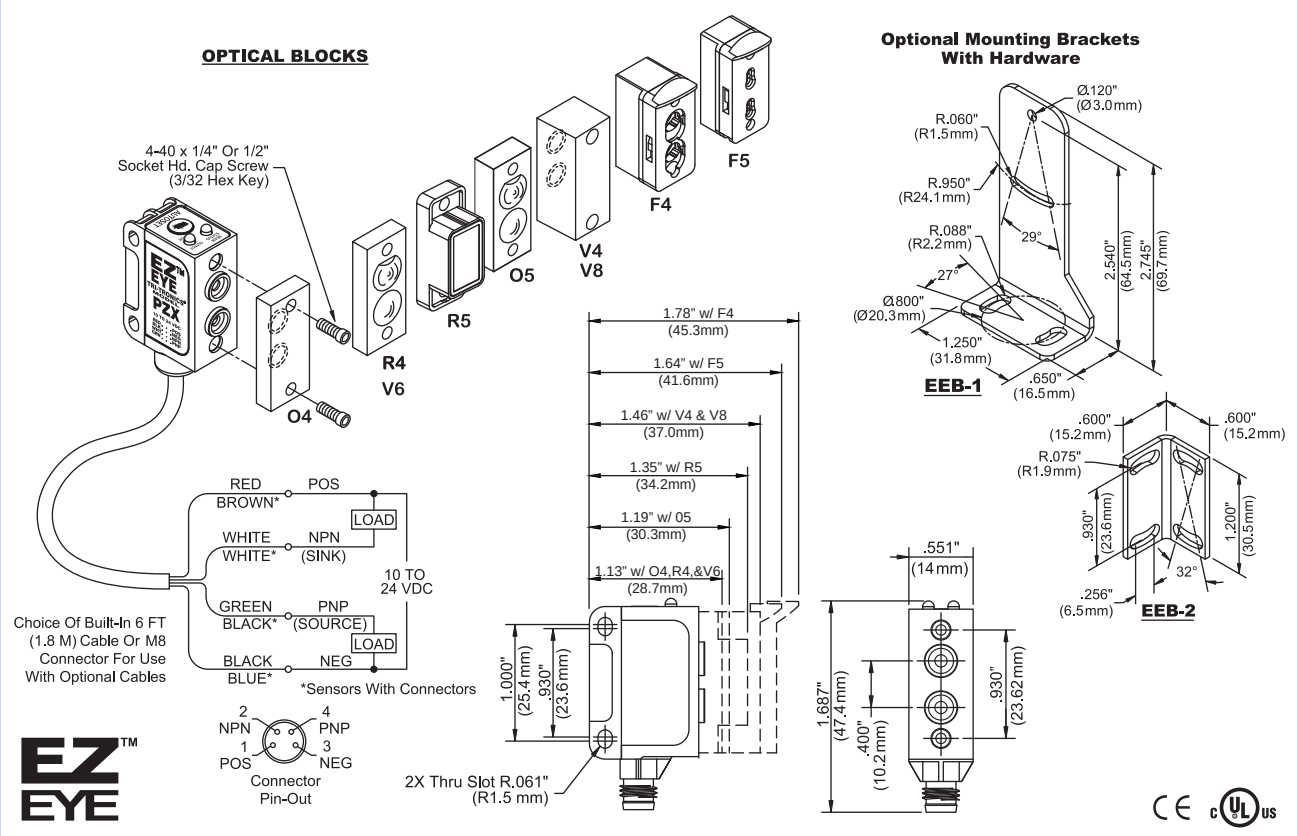
DIAGNOSTIC INDICATORS
- Dual Red/Green LED
  Red = Output Status NOTE: If Output LED flashes, a short circuit condition exists.
  Green = Flash Rate Alignment Indicator
- Dual Green/Amber LED
  Green = "ON" After AUTOSET™ Routine
  Amber = "ON" After Excess Gain Adjustment

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

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

RoHS Compliant
Product subject to change without notice

Connections and Dimensions EZ-EYE™ PHOTOELECTRIC SENSOR



General Purpose Photoelectric Sensor

MINI-EYE™

MINI-EYE™

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 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 or M12 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.

Features

- 18mm mounting
- Laser thru-beam
- 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
- Available in 6 foot 4-Wire cable, M8 4-Pin connector, or M12 4-Pin 6 inch pigtail
- Reverse polarity protection
- Short circuit protection
- Power-up output suppression
- 5VDC models available (please consult factory)

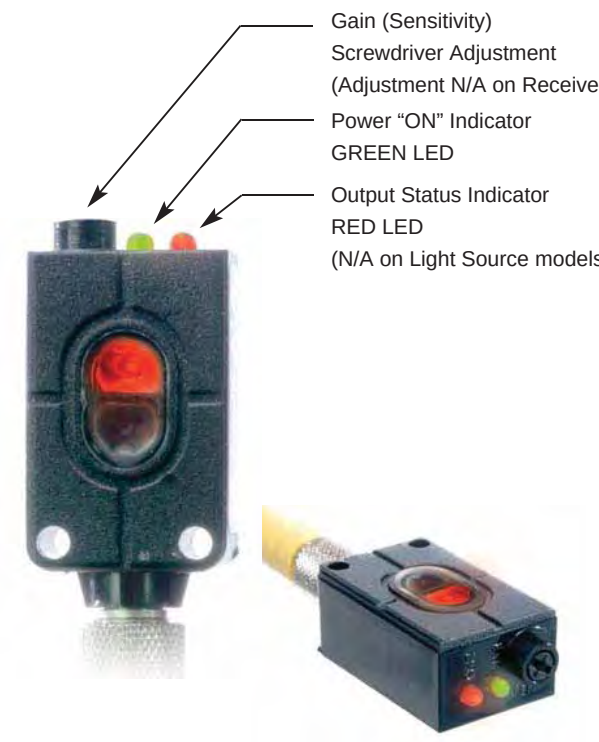
Benefits

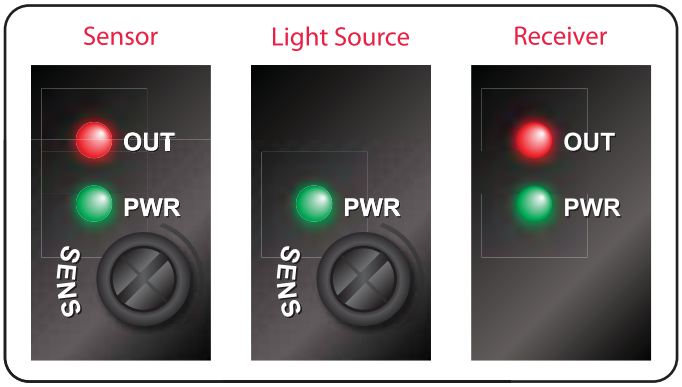
- Easy to use
- Lower inventory costs
- Lower maintenance costs
- Flexible

Applications

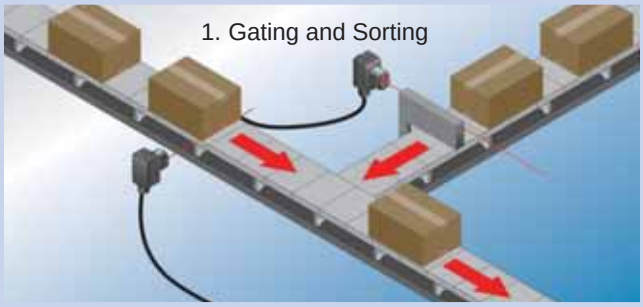
- Presence/Absence Detection
- Material Handling
- Counting
- Sorting
- Orientation
- Web Break Detection

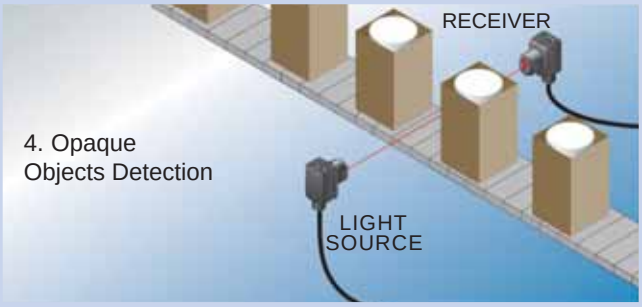
Fine Tuning Adjustment

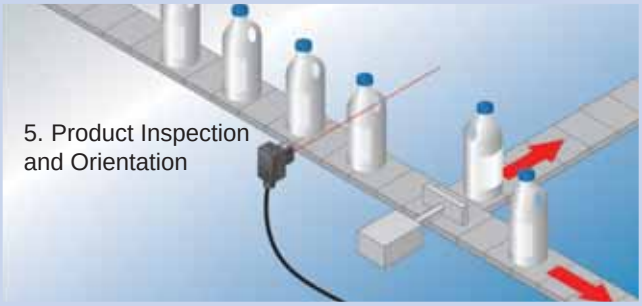


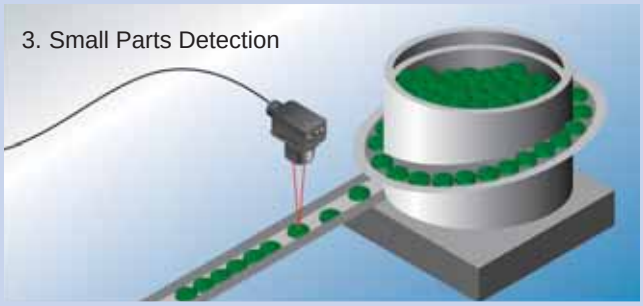


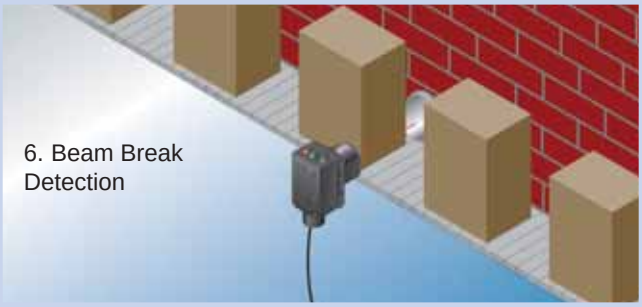
Typical Applications











HOW TO SPECIFY

MODELS		DESCRIPTION	RANGE	
STANDARD	18mm	SHORT RANGE PROXIMITY	STANDARD	18mm
MIVC	MIVC-18	IR, NPN, Connector	5" (127.0mm)	6" (152.4mm)
MIV	MIV-18	IR, NPN, Cabled	5" (127.0mm)	6" (152.4mm)
MRVC	MRVC-18	Red, NPN, Connector	4" (101.6mm)	5" (127.0mm)
MRV	MRV-18	Red, NPN, Cabled	4" (101.6mm)	5" (127.0mm)
PMIVC	PMIVC-18	IR, PNP, Connector	5" (127.0mm)	6" (152.4mm)
PMIV	PMIV-18	IR, PNP, Cabled	5" (127.0mm)	6" (152.4mm)
PMRVC	PMRVC-18	Red, PNP, Connector	4" (101.6mm)	5" (127.0mm)
PMRV	PMRV-18	Red, PNP, Cabled	4" (101.6mm)	5" (127.0mm)
		LONG RANGE PROXIMITY		
MIPC	MIPC-18	IR, NPN, Connector	20" (508.0mm)	20" (508.0mm)
MIP	MIP-18	IR, NPN, Cabled	20" (508.0mm)	20" (508.0mm)
MRPC	MRPC-18	Red, NPN, Connector	14" (355.6mm)	8" (203.2mm)
MRP	MRP-18	Red, NPN, Cabled	14" (355.6mm)	8" (203.2mm)
PMIPC	PMIPC-18	IR, PNP, Connector	20" (508.0mm)	20" (508.0mm)
PMIP	PMIP-18	IR, PNP, Cabled	20" (508.0mm)	20" (508.0mm)
PMRPC	PMRPC-18	Red, PNP, Connector	14" (355.6mm)	8" (203.2mm)
PMRP	PMRP-18	Red, PNP, Cabled	14" (355.6mm)	8" (203.2mm)
		RETROREFLECTIVE		
MIRC	MIRC-18	IR, NPN, Connector	12' (3.7m)	15' (3.8m), 35' (8.8m)*
MIR	MIR-18	IR, NPN, Cabled	12' (3.7m)	15' (3.8m), 35' (8.8m)*
MRRC	MRRC-18	Red, Polarized, NPN, Connector	3.5' (0.9m), 8.5' (2.2m)	6' (1.8m), 15' (4.6m)
MRR	MRR-18	Red, Polarized, NPN, Cabled	3.5' (0.9m), 8.5' (2.2m)	6' (1.8m), 15' (4.6m)
PMIRC	PMIRC-18	IR, PNP, Connector	12' (3.7m)	15' (3.8m), 35' (8.8m)*
PMIR	PMIR-18	IR, PNP, Cabled	12' (3.7m)	15' (3.8m), 35' (8.8m)*
PMRRC	PMRRC-18	Red, Polarized, PNP, Connector	3.5' (0.9m), 8.5' (2.2m)	6' (1.8m), 15' (4.6m)
PMRR	PMRR-18	Red, Polarized, PNP, Cabled	3.5' (0.9m), 8.5' (2.2m)	6' (1.8m), 15' (4.6m)
		THRU-BEAM		
LIGHT SOURCE (Range to receivers below)				
MLSIC	MLSIC-18	Infrared, Connector	65' (19.8m)	65' (19.8m)
MLSI	MLSI-18	Infrared, Cabled	65' (19.8m)	65' (19.8m)
MLSRC	MLSRC-18	Red, Connector	45' (13.7m)	15' (4.6m)
MLSR	MLSR-18	Red, Cabled	45' (13.7m)	15' (4.6m)
RECEIVERS (Range w/ recievers below)				
MRC	MRC-18	NPN, Connector		
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	60' (18.2m)	60' (18.2m)
MLZR	MLZR-18	Red, Cabled	60' (18.2m)	60' (18.2m)
RECEIVERS				
MLRC	MLRC-18	NPN, Connector		
MLR	MLR-18	NPN, Cabled		
PMLRC	PMLRC-18	PNP, Connector		
PMLR	PMLR-18	PNP, Cabled		

**AR82 High performance reflector.*

Note: Standard connector models utilize an M8 4-pin connector. M12 4-pin 6 inch pigtails are built to order. Ex. MIV-18M12

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.

4-Wire Nano Cable, M8

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

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

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

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

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

GEX-9
9' (2.7m) extension cable

Standard
Mounting

18mm
Mounting

Screw Mount Reflectors

78P
4.4 in. x 1.9 in.
111.8 x 48.3mm

AR3
3 in. Diameter
76.2mm Diameter

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 51mm

AR-46
1.8"diameter
46mm diameter
Glue Mount

Optional Mounting Brackets

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

MIB-1
Stainless Bracket
Assembly

MIB-2
Stainless Bracket
Assembly

MIB-3 (Standard)
MIB-4 (18mm)
Stainless Laser Light
Source Bracket

Specifications

MINI-EYE™

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected
  Note: 5 VDC +/- 10%

CURRENT REQUIREMENTS
- 30mA (exclusive of load)

OUTPUT TRANSISTORS
- NPN: Sink up to 100mA
- PNP: Source up to 100mA
- All outputs are continuously short circuit protected

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

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

LED LIGHT SOURCE
- LED, Red = 660nm
- LED, Infrared = 880nm
- Pulse Modulated
- Laser, Red = 650nm, 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
  Note: 5 VDC models, range reduced by 10%

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"

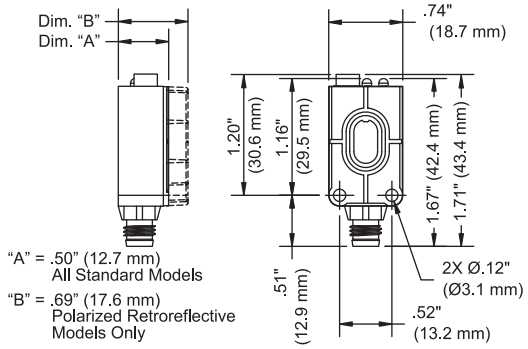
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

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

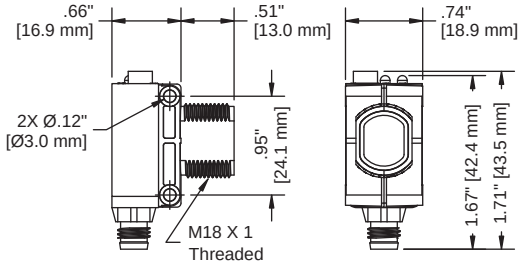
RoHS Compliant
Product subject to change without notice

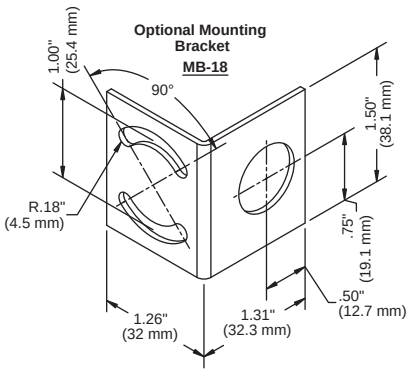
Connections and Dimensions MINI-EYE™

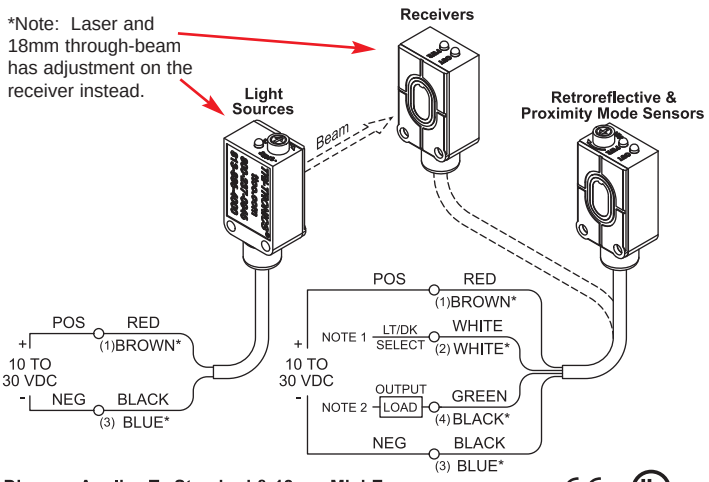
STANDARD MODELS

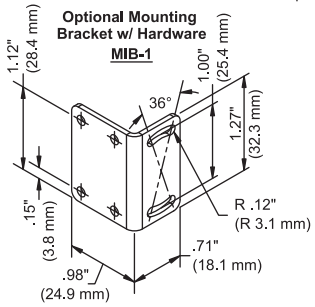


18MM MODELS



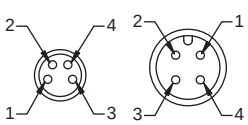






Note: Wiring Diagram Applies To Standard & 18mm Mini-Eye Models Only. Visit Us At ttco.com For Laser Wiring And 18mm Dimensions.

RoHS Compliant



Connector Pin-Out For M8 Models

Connector Pin-Out For M12 Models

Note 1: Dark "ON" Operation: Terminate To Positive
Light "ON" Operation: Terminate To Negative

Note 2: NPN (Sink) Output Models: Terminate Load To Positive
PNP (Source) Output Models: Terminate Load To Negative

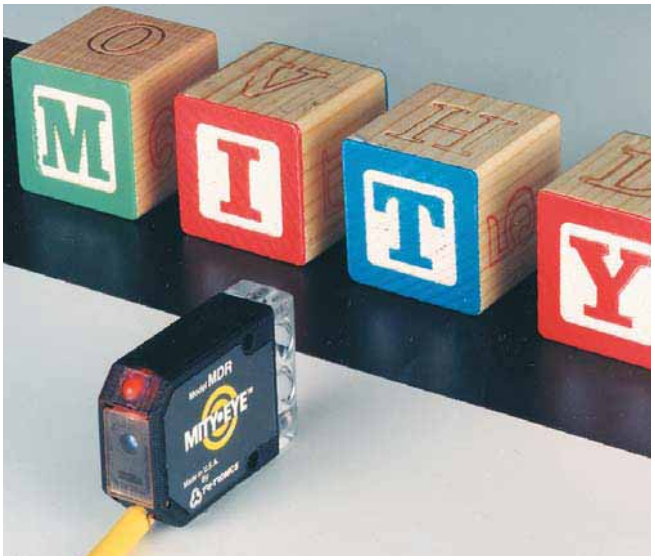
Note 3: No Contact On This Line For CJx Models
[Wired Internally For Either Light On (L) or Dark On (D)].

Choice of: Built-In 6 ft (1.8 m) Cable, or
M8 (or M12) 4-Pin Connector For Use With Optional Cables

General Purpose Photoelectric Sensor

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 (nonglare), 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.

Features

- Cable or pigtail quick disconnect
- AC or DC models available
- NPN and PNP outputs or triac output, depending on model
- Interchangeable optical blocks
- 500 microsecond response time on DC models
- Potentiometer adjustment
- Light On/Dark On switch
- Bracket or through-hole mounting

Benefits

- Lower inventory costs
- Reduce maintenance costs
- Improve machine throughput
- Easy to use
- Small and compact for mechanical constraints

Applications

- Feeder bowl sensor
- Small parts detector
- High speed counting
- Printing/Marking/Coding

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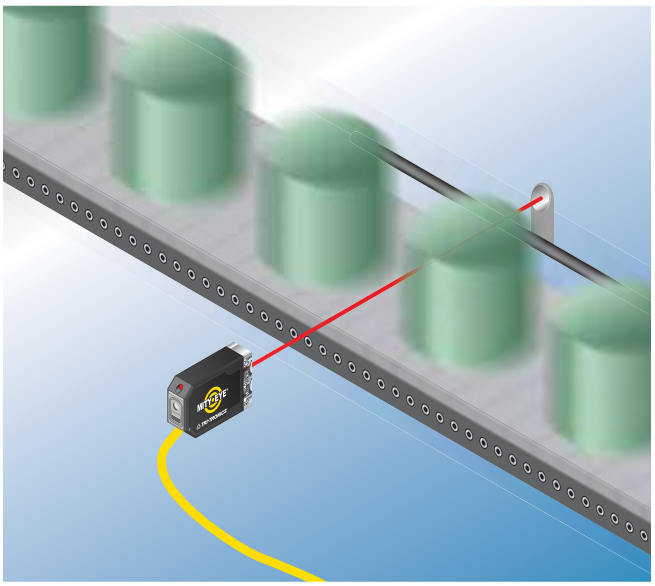
Typical Applications

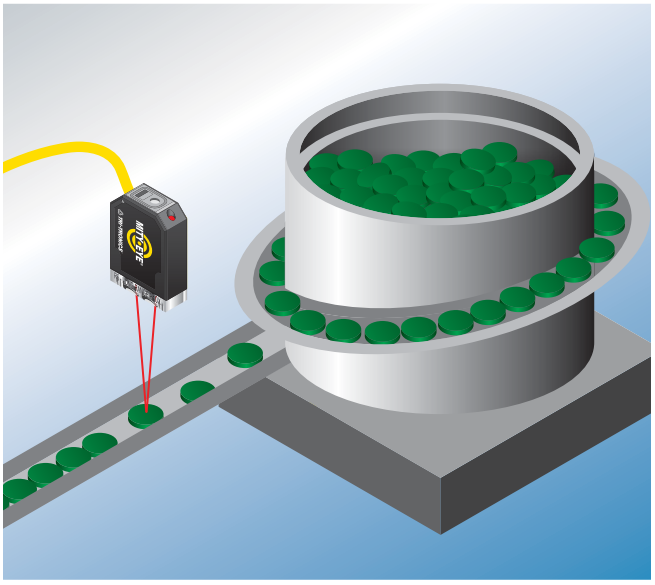
High Speed Applications:

The 500µs response time provides the **MITY•EYE®** with the ability to detect fast moving targets accurately for counting, labeling, printing, and filling applications. The interchangeable optical block feature allows for many different sensing options including fiber optic, retroreflective, and long range and short proximity, providing a flexible sensing option for a reasonable price.



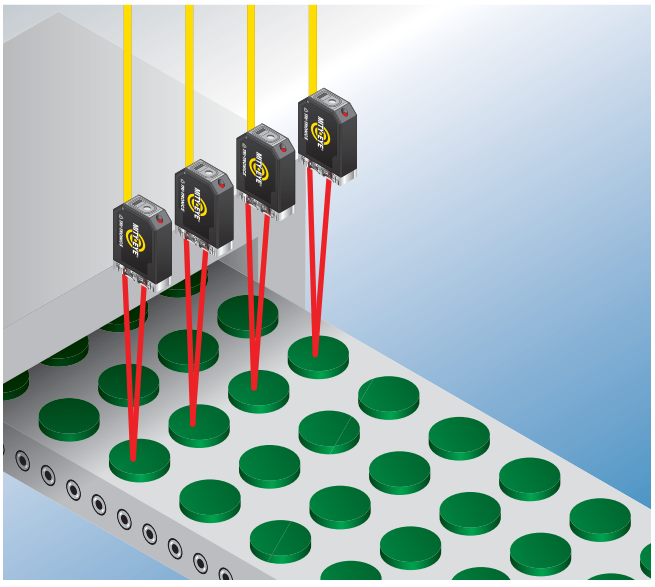
Small Target Detection:

The small, compact size of the **MITY•EYE®** is perfect for Small Target applications such as illustrated to the right. Having the ability to change to a pin point fiber optic light guide, or spot focus convergent lens provides a solution for small targets that is accurate, repeatable, and easy to change. The **MITY•EYE®** is available with 6 ft. cable, or 4-Pin, M12, 6 in. pigtail connector.



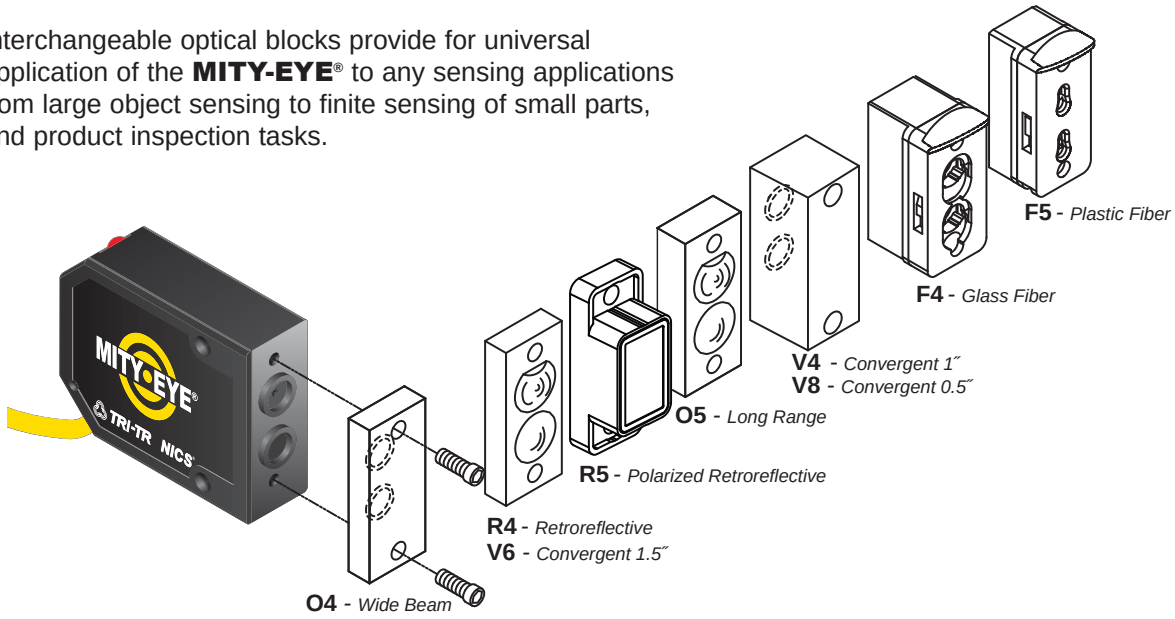
Multiple Target Sensing:

The small, compact size of the **MITY•EYE®** is desirable for applications that require multiple sensors in close mechanical spacing constraints. Being able to gang together the sensors in tight physical space is helpful as a solution in this environment.



Optical Block Selection

Interchangeable optical blocks provide for universal application of the **MITY-EYE®** to any sensing applications 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, opaque, 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 visible 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 F5
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes

Type V4
Convergent 1" "V" Axis
Useable range of 1" to 5".

Type V6
Convergent 1.5" "V" Axis
Useable range of 1.5" to 8".

Type V8
Convergent .5" "V" Axis
Useable range of .25" to 5"

Narrow beam optics useful for sensing small parts. Also useful for proximity sensing to minimize response to reflected light from background objects..

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 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

1. Select sensor model based on light source required:

DC POWERED	AC POWERED
MDI = Infrared	MAI = Infrared
MDHR = High Intensity RED	MAHR = High Intensity RED
MDR = Red	MAR = Red

2. Select connection required:
Blank = Cable
C = Connector

3. Select Optical Block based on mode of sensing required (see Range Guidelines)

Example: MDH R C V4

- MITY•EYE®
- Light Source
- Connector
- Optical Block

AC & DC Miniature Sensors

Accessories

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

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

TA-18
18mm Adapter

CAC15
Special AC MITY•EYE® Cable, 15' (4.6m)
NOTE: CAC15 power cable for AC MITY•EYE® ONLY

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' (2.0m) Low-cost

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

Specifications

DC MODELS SUPPLY VOLTAGE
- 10 to 30 VDC @ 35mA (reverse polarity protected)

DC MODELS OUTPUT DEVICES
- Provide both NPN and PNP open collector output transistors capable of sinking or sourcing up to150mA continuous
- Short circuit protected
- Zener Diode protected to 36 volts
- Protected against false chattering/ pulsing during power up

DC MODELS RESPONSE TIME
- 500 microseconds (light or dark)

AC MODELS SUPPLY VOLTAGE
- 24 to 240 VDC @ 35mA (reverse polarity protected)

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

AC MODELS RESPONSE TIME
- 4 microseconds

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

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)

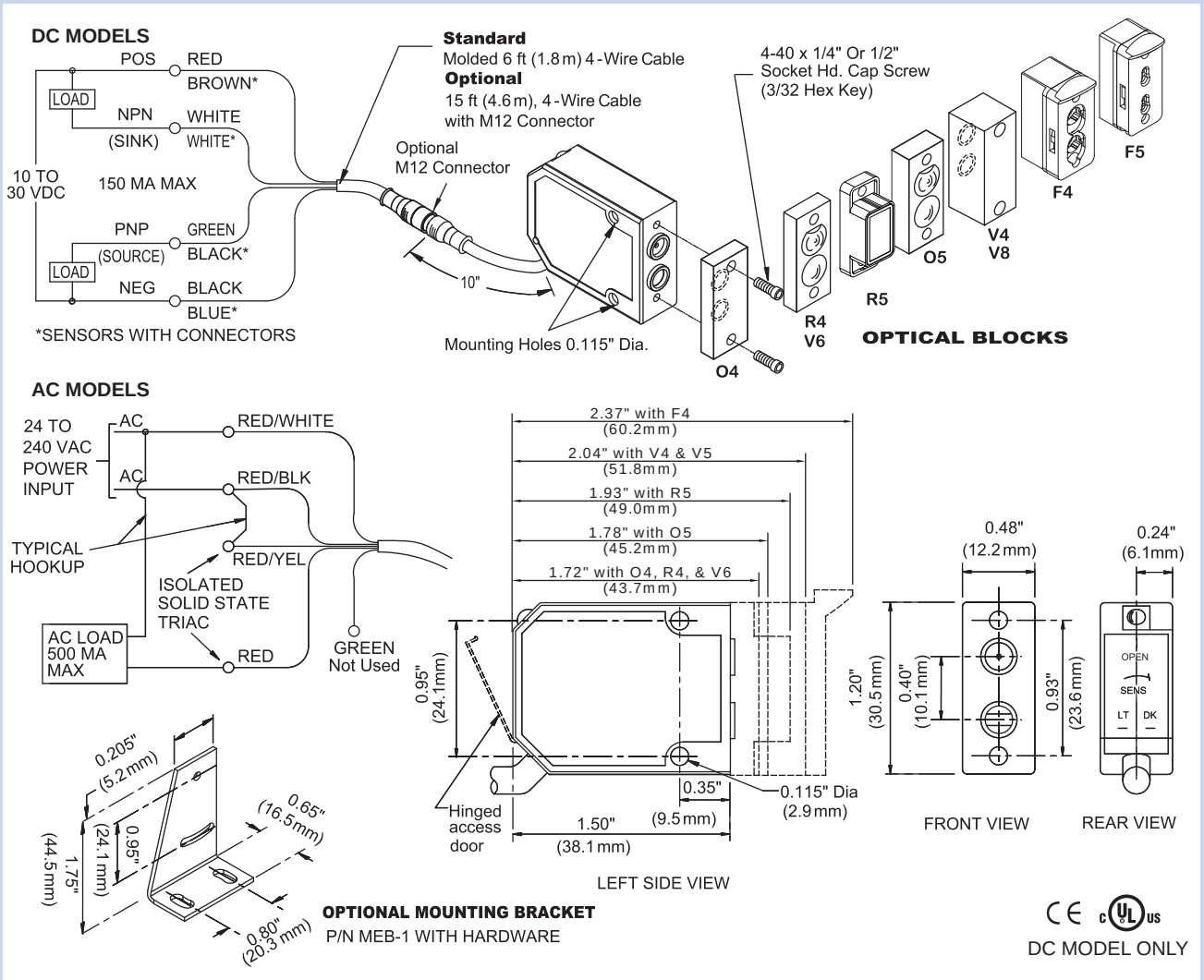
RUGGED CONSTRUCTION
- Chemical resistant case, “O” ring sealed to provide moisture protection
- Epoxy encapsulated for mechanical stability
- NEMA 4X, 6P and IP67

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

NOTE:DC Mity•Eye with 10” Pigtail is designed to be used with our 4-Wire M12 Power Cable.

RoHS Compliant
Product subject to change without notice

Connections and Dimensions — AC and DC MITY•EYE®



General Purpose Photoelectric Sensor

TINY•EYE®

TINY•EYE®

Big Performance
Big Capability

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.

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.

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.

Features

- 500 microsecond 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

Benefits

- Lower inventory costs
- Reduce maintenance costs
- Improve machine throughput
- Flexible and affordable

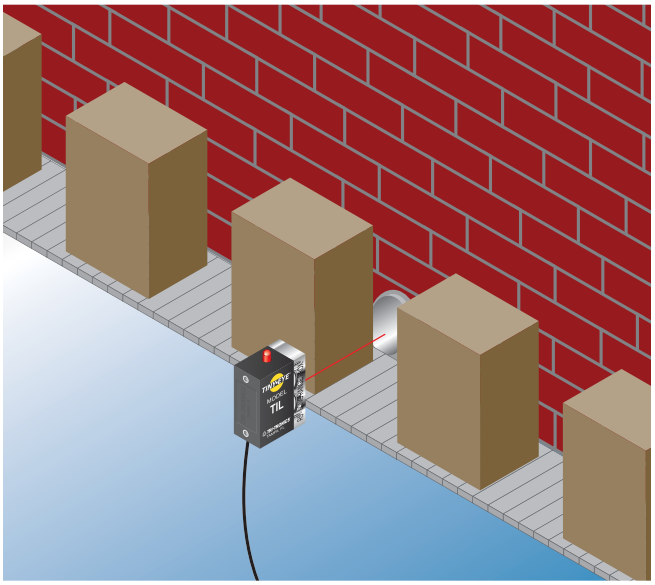
Applications

- Product detect
- Object absence/presence
- Inspection trigger
- Printing/Marking/Coding

Typical Applications

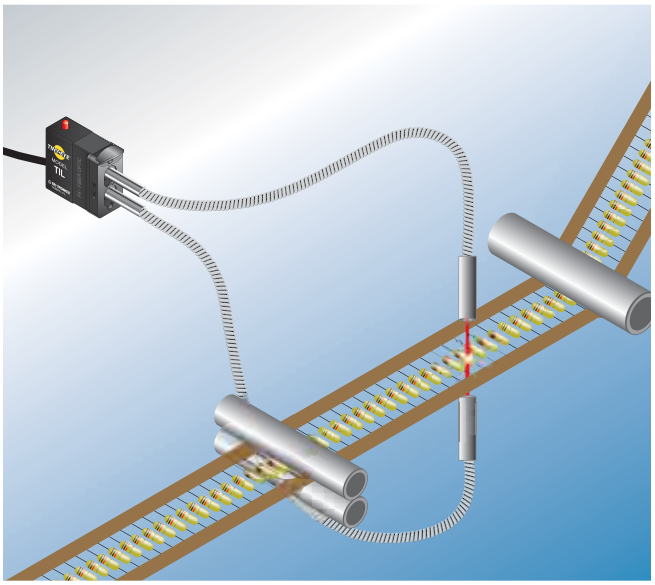
Limited Space

The ***TINY-EYE***®, as it's name implies, is small and compact...allowing for installation in the most mechanically demanding applications. Since there is no adjustment on the ***TINY-EYE***®, there is no need to access the sensor at the sensing sight. Providing a wire for making adjustments in three modes...High, Medium, and Low range...enables the sensor to be adjusted from a remote location.



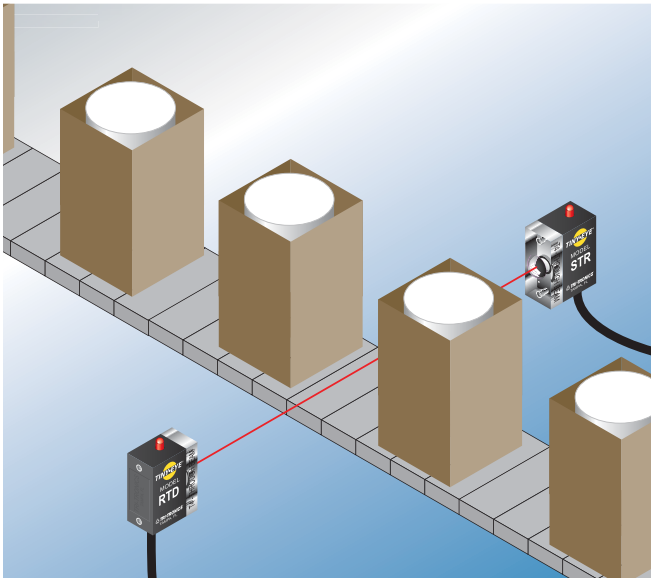
Small Parts Detection:

The ***TINY-EYE***® has the same features as most of our other miniature sensors; Interchangeable Optical Blocks. The sensor can be fitted with a fiber optic, retroreflective, short/long range proximity, or convergent optical blocks. This enables the ***TINY-EYE***® to be used in many different applications requiring an even smaller mechanical or physical profile.



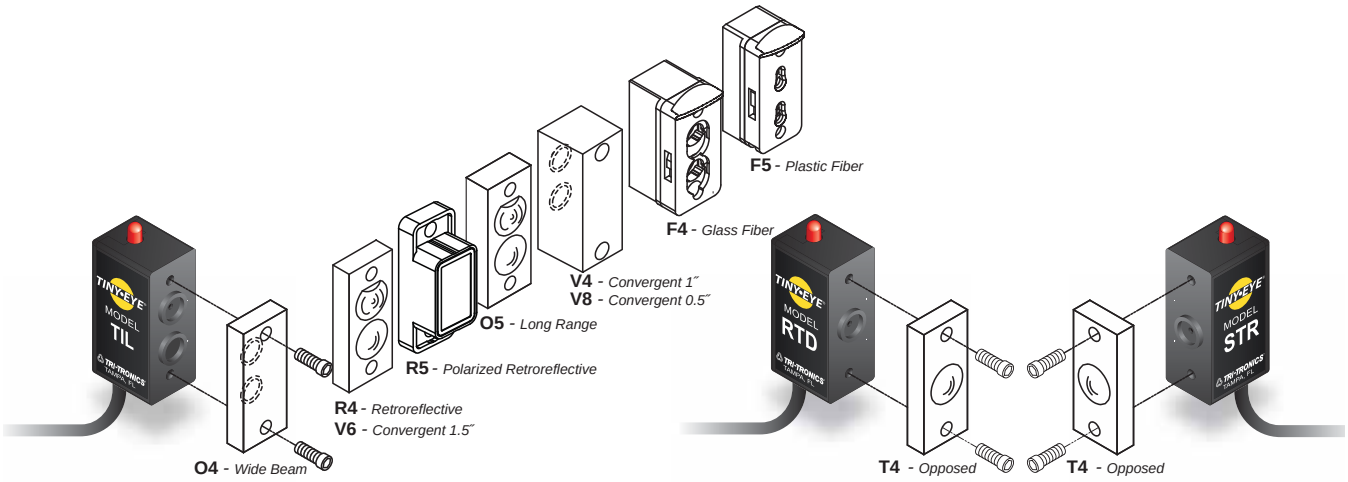
Opaque Objects:

One of the most powerful through-beam sensors available, the ***TINY-EYE***® can span a range of 25+ feet. In many applications where the requirement calls for a small package with big performance, the solution is an expensive laser sensor. This sensor meets the both requirements at a much more reasonable cost, removing the burden of higher inventory investments and higher maintenance fees.



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, and product inspection tasks.



Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent, opaque, 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 visible 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 F5
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes

Type V4
Convergent 1" "V" Axis
Useable range of 1" to 5".

Type V6
Convergent 1.5" "V" Axis
Useable range of 1.5" to 8".

Type V8
Convergent .5" "V" Axis
Useable range of .25" to 5"

Narrow beam optics useful for sensing small parts. Also useful for proximity sensing to minimize response to reflected light from background objects..

Type T4
Opposed Optical Blocks
Uses separate Light Source/Receiver. Designed for extra long-range sensing

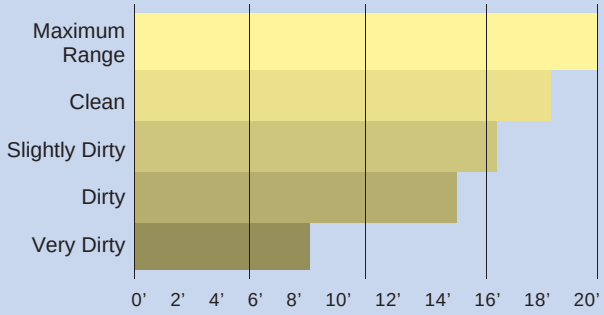
Light Source Selection

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.

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How to Specify

TINY•EYE®

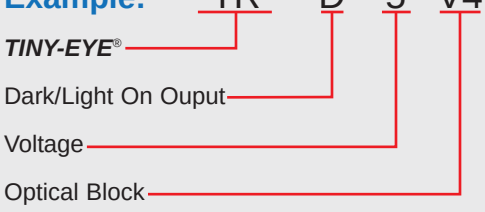
Thru-Beam Light Source Receiver Models

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

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 to 30 VDC, 5 = 5 VDC
4. Select Optical Block based on mode of operation required.

Example: TR D 5 V4



Range Guidelines

	TINY-EYE® MODELS	
OPTICAL BLOCK TYPES	**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 3½ diam. round reflector Model AR-3.

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

POWER REQUIREMENTS
- Sensors 10 to 30 VDC @ 35mA Max
- Receivers 10 to 30 VDC @ 15mA Max
- Light Source 10 to 30 VDC @ 20mA 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 100mA
- PNP: Source up to 100mA

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. (12 to 24 VDC Supply)
Mid-Range - no connection required. (12 to 24 VDC Supply)
Low Range - connect wire lead to NEGATIVE. (12 to 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)

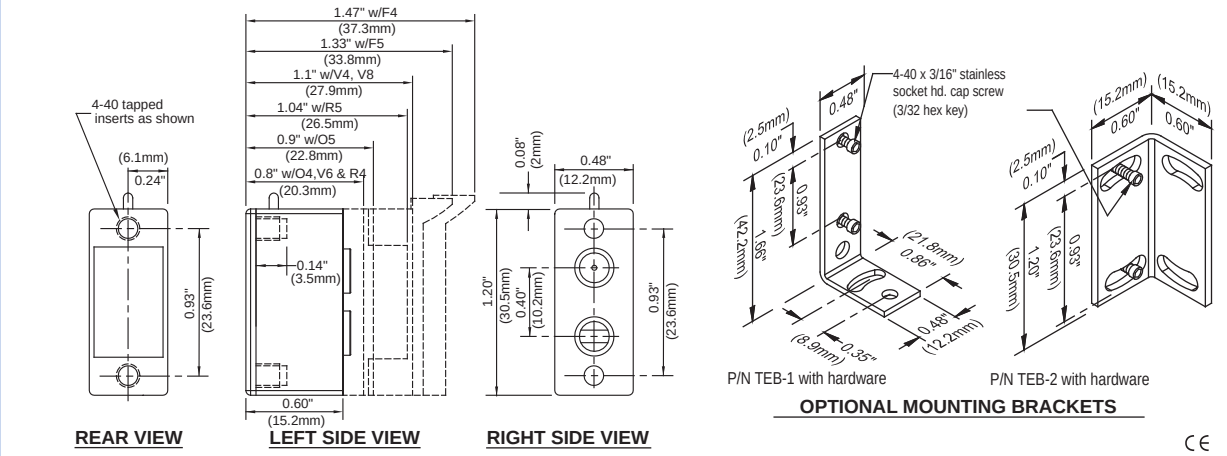
RUGGED CONSTRUCTION:
- High impact polycarbonate housing
- Waterproof, NEMA 4X, 6P and IP67
- Encapsulated for mechanical strength

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

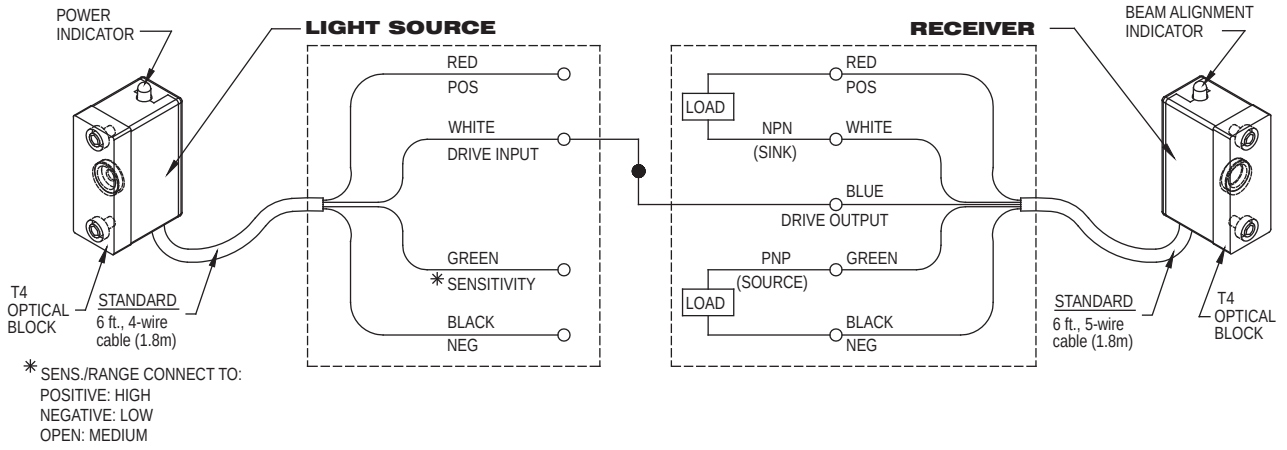
Accessories See Dimensions drawing

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

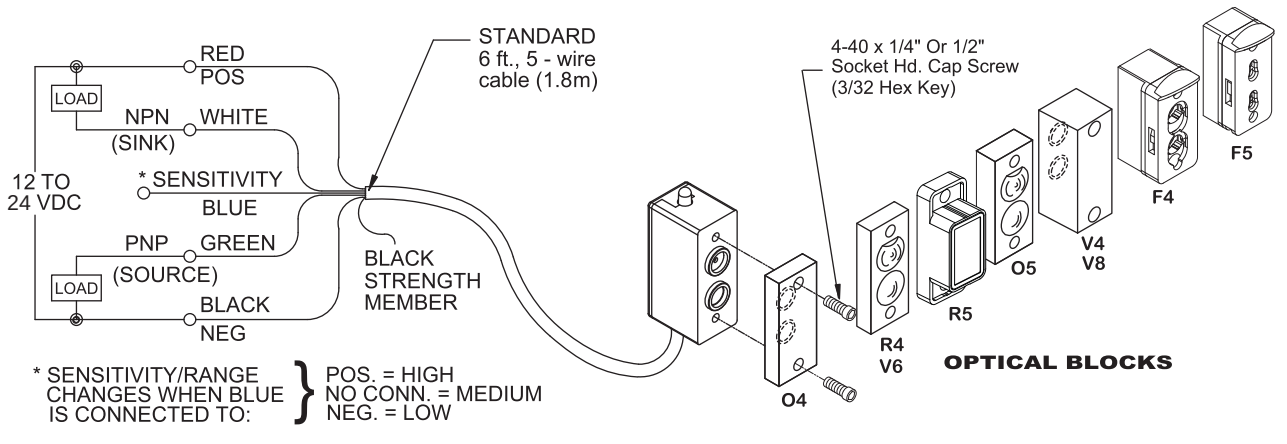
Dimensions — TINY-EYE® SENSOR MODELS



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



Connections — ALL TINY-EYE® SENSOR MODELS



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Product subject to change without notice

General Purpose AC/DC Photoelectric Sensor

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 AC sensors. 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 midscale 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. 7ms 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
- Switching power supply eliminates failures often caused by power line transients

On or Off Delay Switch

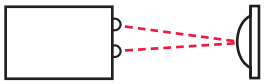
With Contrast Indicator	Without Contrast Indicator	Light Source	Max Range	Speed of Response	Output Information
Beam Break Mode Retroreflective (Models Include 78P Reflector)					
UCR-A	UR-A	Infrared	15 ft.	7ms	On/Off Relay
TUCR-A	TUR-A	Infrared	15 ft.	8ms	On/Off Triac
UCR-AT1	UR-AT1	Infrared	15 ft.	7ms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

Fiberoptic Mode

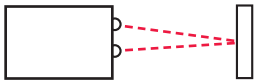
With Contrast Indicator	Without Contrast Indicator	Light Source	Opposed Range*		Proximity Range*		Speed of Response	Output Information
			With Lens	W/O Lens	With Lens	W/O Lens		
UCF-A	UF-A	Infrared	12 ft.	2 ft.	4 in.	2.5 in.	7ms	On/Off Relay
TUCF-A	TUF-A	Infrared	12 ft.	2 ft.	4 in.	2.5 in.	8ms	On/Off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

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: 2VA
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

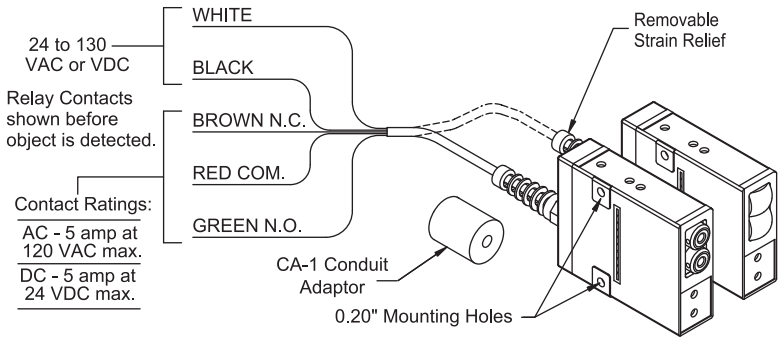
Response Time: Relax: 7ms light or dark TRIAC: 8ms
Timer Range: 0.1 to 15 seconds
Contrast Indicator Models: Displays a 10 bar LED scaled reading of contrasting light level
LED Light Source Wavelength: Infrared (880nm), Red (660nm)
Sensitivity Adjustment: Provided on all models
Beam Status Indicator: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

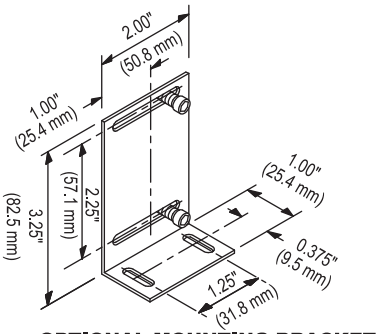
Accessories

Model #	Miscellaneous
CA-11/2 in.	Conduit Adaptor
FSR-1	Flexible Strain Relief
UMB-1	U.S. Eye Bracket
USB-1	U.S. Eye Sub-Bracket

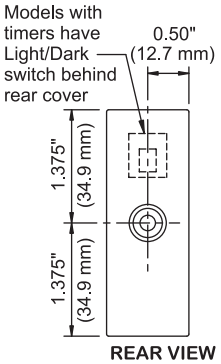
RoHS Compliant
Product subject to change without notice

Connections and Dimensions U.S. EYE

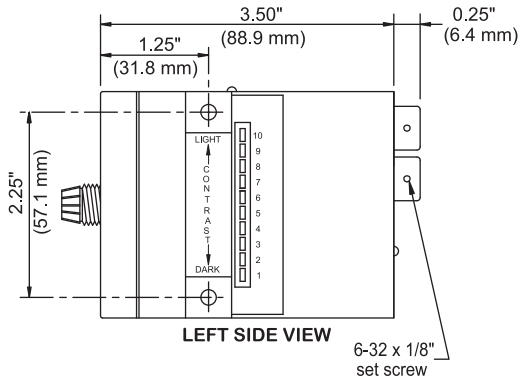




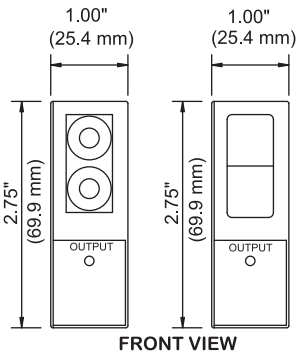
OPTIONAL MOUNTING BRACKET
MODEL UMB-1 WITH HARDWARE



REAR VIEW



LEFT SIDE VIEW



FRONT VIEW

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

True Color Sensor

SMARTEYE® COLORWISE™ TRUE COLOR SENSOR

SMARTEYE® COLORWISE™ TRUE COLOR SENSOR

The ***SMARTEYE*® COLORWISE™ *True Color Sensor*** is the most feature packed color sensor available. Designed to work as well as an instrument or spectrometer, this sensor can solve the most difficult color applications at higher speeds than color cameras or the closest priced competitive product. The 4 Channel Monitor provides a visual confirmation of performance without having to switch channel selections or touch the sensor in any way. Providing a choice in speed versus resolution, the ***SMARTEYE*® COLORWISE™** puts the controls of the performance of the sensor in the hands of the operator; allowing for more application solutions, and removing the limits that either speed or resolution alone can offer.

With control over Tolerance, Light Intensity, Output Configuration (NPN or PNP), Timers, Input Configuration (Edge or Gate), the ***SMARTEYE*® COLORWISE™** provides a tailored and customized solution for the most difficult color sorting, or inspection problems facing today's packaging and production lines. The ***SMARTEYE*® COLORWISE™** also comes equipped with 4 digital and 3 analog outputs that not only help to sort products by color, but can determine specific color signatures as well.

The ***SMARTEYE*® COLORWISE™ *True Color Sensor*** from Tri-Tronics®:

The Wisest choice you can make!

Features

- 4-Digital Outputs (NPN or PNP)
- 4-Channel Monitor for at-a-glance performance evaluation
- 3-Analog Outputs (XYZ or xyY); 0 to 5 VDC
- Adjustable Tolerance for each channel
- Adjustable Timers for each channel: One Shot; On Delay; Off Delay; Latch
- 14-Pin 6" pigtail 1/4-turn locking connector or cable version
- Adjustable LED light intensity
- Select high speed versus high resolution (CW-1 model only)
- Short range and long range models available
- Remote Color Capture
- Button Lockout

Benefits

- Flexible and convertible for many different color applications
- Useful for color sorting and color verification applications all in one sensor
- No-touch setup via remote color capture wire (selectable input; NPN/Negative or PNP/Positive)
- Reduce cost and speed constraints of color cameras or spectrometers
- Quick digital changeover
- Tamperproof with button lockout feature

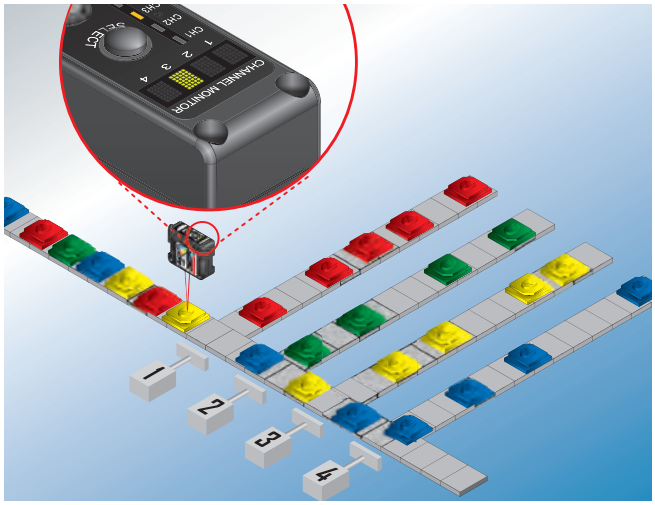
Applications

- Automotive - Trim Color Assembly, Carpet and Mat matching, Paint Verification
- Textile - Color Verification, Die Quality Control
- Bottle Industry - Color Sorting, Color Verification, Quality Inspection
- Food Industry - Cooking Time Control, Quality Inspection/Control
- Graphic Art - Color Verification, Quality Control, Missing Color Detection

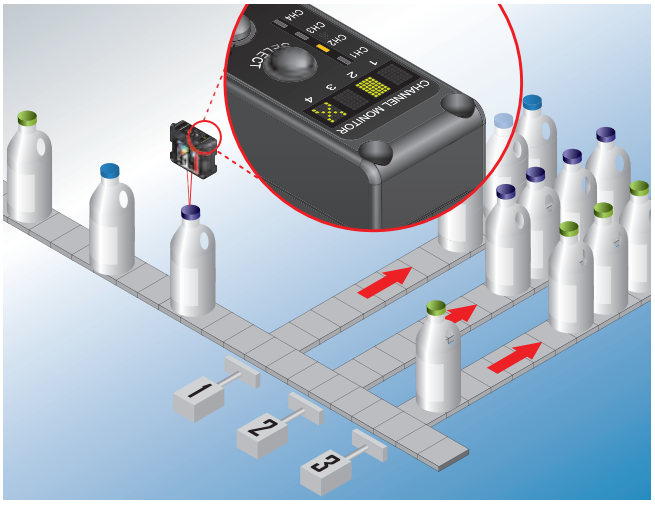
Applications

SMARTEYE® COLORWISE™ TRUE COLOR SENSOR

Color Sorting

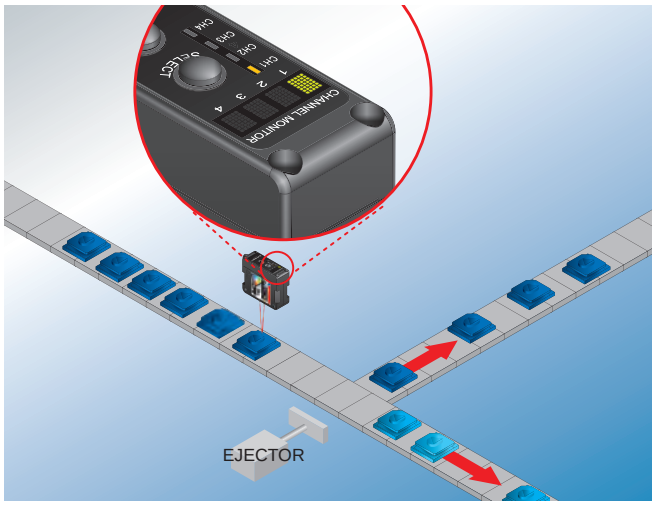


Sort items by color.

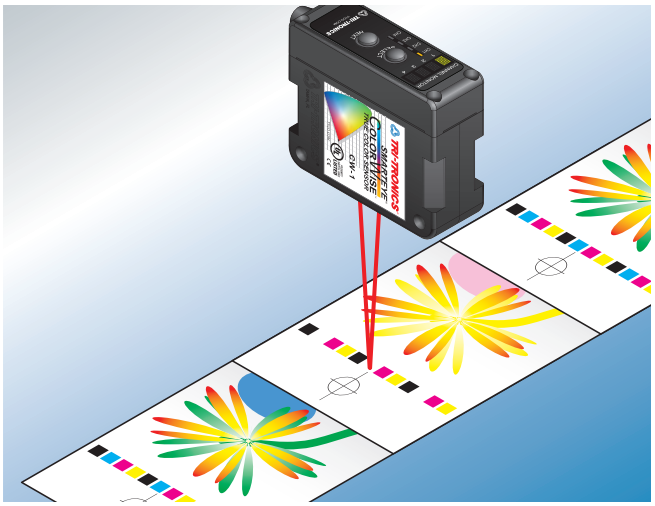


Separate grouped items by color.

Color Verification for Quality Inspection

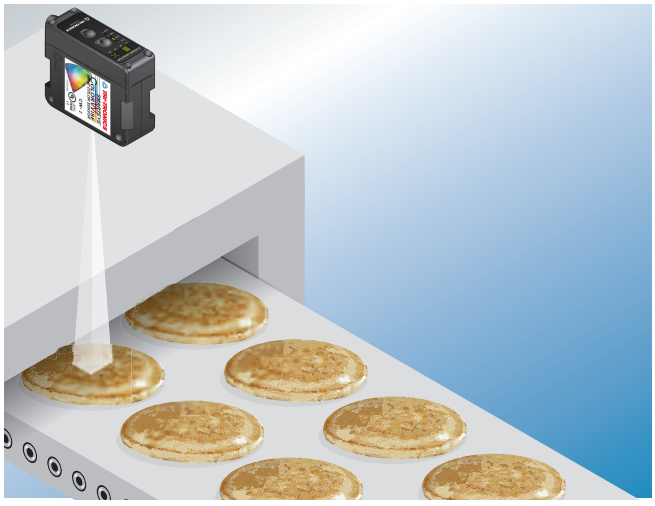


Verify proper shade of color.

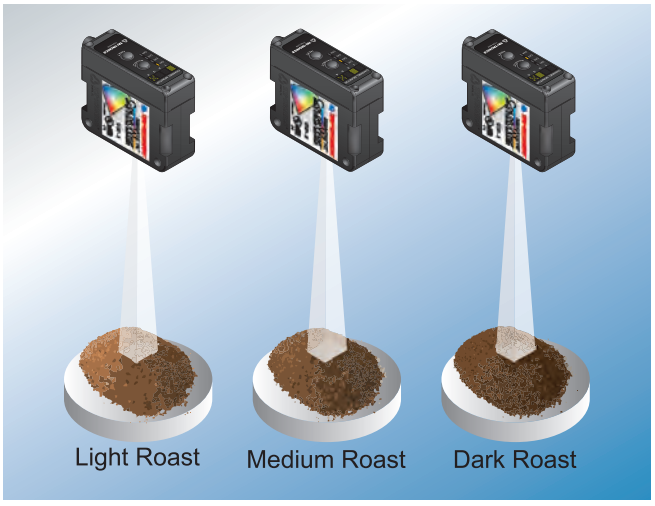


Inspect for missing colors.

Color Process Control



Guarantee uniform cooking for efficient process.



Control energy usage via color process control.

Features

SMARTEYE® COLORWISE™ TRUE COLOR SENSOR

Color Capture (CAPT)
Setup on target color with a simple push of a button. Four individual digital channels.

Four Channel Color Monitor (CH-X)
At-a-glance visual confirmation of real time performance for all four channels. Bargraph indicates quality of color match on each channel.

Tolerance Adjustment
Precise adjustment of tolerance levels for each of the four channels provides a wide range of resolution capabilities.

Color (C) or Color + Intensity (CI)
The ability to select between Color and Color + Intensity provides the ability to differentiate between slight color differences, or shade-to-shade changes.

Output Mode
Select LO for output ON for a color match; DO for output OFF for no color match; and MUTE to de-select channel monitor and disable output.

Speed versus Resolution
Select Uspd - Ultra High Speed (75µs); HSpd - High Speed (150µs); or HRes -High Resolution (300µs).
Note: This feature available on CW-1 models only.

Light Intensity
Adjust Light Intensity (L100) in System Parameter from L10, dimmest to L100, brightest. Useful when mechanical restrictions limit sensor position or distance.

Timer
Timer available for each of the four channels:
Toff = No Timer; OffD = Off Delay; OnD = On Delay; Shot = One Shot; Ltch = Latch. Adjustable from 1ms to 9999ms.

Remote Capture
Pulse the Remote Capture wire to Negative or Positive, dependent upon the IN> setting, NPN or PNP, respectively.
Note: Each pulse on for 40ms to 400ms. The time between pulses is 40ms to 400ms.

Signal Strength Monitor
Displays the total signal strength as a number from 0 (low) to 100 (high). This feature is useful in determining when too much or too little light is being received. Useful for setup in determining sensor position.

Input (Gate or Edge)
Provides a window of time to detect/capture the target color, allowing for inspection of color at the proper space and time during continuous product flow and normal production line speeds.

Connections
Available with standard 6', 14 wire cable; or optional 6" pigtail, 14 pin, 1/4-turn locking connector. Mating cable model #BCC-6.

Mounting Options
Through-hole or available bracket mounting.

ALPHANUMERIC DISPLAY
1. 4-Channel Color Monitor for "At-A-Glance" performance feedback
2. Alphanumeric display of available options

OUTPUT INDICATORS
LED's for CH1 through CH4 ON when outputs are ON

SELECT
1. Select sub menu
2. Initiate color capture
3. Alter system parameters
4. Alter numeric values
5. Change from Channel Monitor to Signal Strength display

NEXT
Advance through menu options

Note: If any output indicators (CH1 - CH4) blink, output is shorted or overloaded.

Special Features

SMARTEYE® COLORWISE™ TRUE COLOR SENSOR

Analog XYZ and xyY

The ColorWise has three analog output wires that operate together in one of two modes, XYZ or xyY as set in the System Parameters menu. In the XYZ mode, the sensor provides an RGB type output. The X, Y and Z output wires represent the intensity of the red, green and blue components of the target color as a 0- 5 VDC signal. In the xyY mode, the sensor provides an output that separates color from intensity. The x and y signals act as (x,y) coordinates to give an indication of color while the magnitude of the Y signal gives an indication of signal intensity or color brightness. Output signals in xyY mode are also given as 0-5 VDC on each wire.

The ColorWise analog outputs can easily be evaluated by a PLC for use in process control, inspection, sorting and other applications.

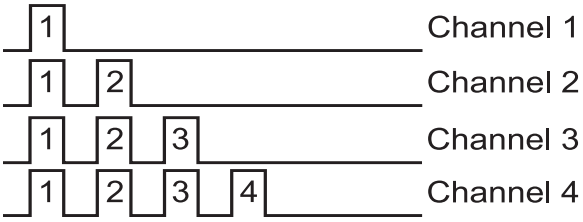
For more information on the XYZ and xyY Color Space and definitions, go to:

http://www.optics.arizona.edu/opti588/reading/CIE_color_space.pdf

Remote Capture

Pulse the Remote Capture wire to Negative or Positive, dependent upon IN> setting; NPN or PNP, respectively.

NOTE: Each pulse on for 40ms to 400ms. The idle time between pulses is 40ms to 400ms



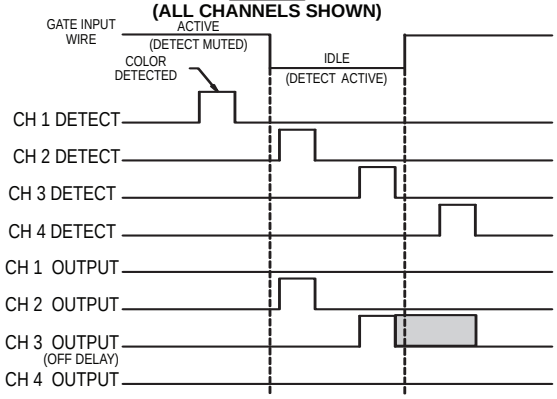
Gate Input

The Gate Input Wire can be used with or without the Latch Timer function. Useful for resetting the latch, gating or triggering the sensor at a specific time and location on the target, and for "windowing" the sensor to ignore other targets or objects that may come into view which should be ignored. The Input can be configured for either an NPN/Negative, or a PNP/Positive signal.

GATE INPUT FUNCTIONALITY - LATCH DISABLED

GATE MODE OR EDGE MODE SET IN SYSTEM MENU

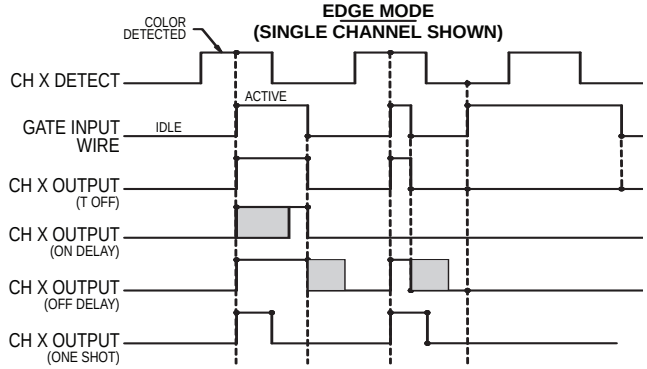
GATE MODE (ALL CHANNELS SHOWN)



NOTE: Output can extend beyond idle to active transition for off-delay & one shot.

OR

EDGE MODE (SINGLE CHANNEL SHOWN)

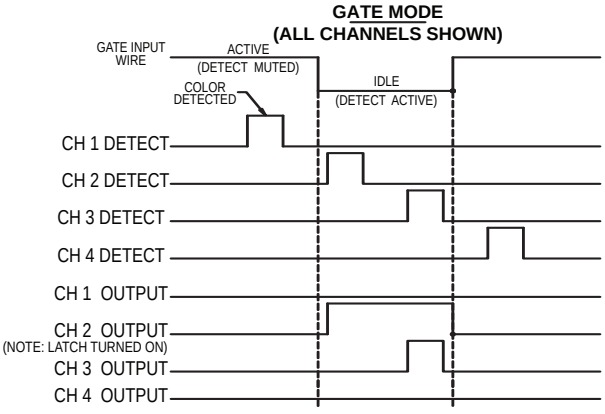


NOTE: DEFAULT STATE OF LINE IS RELEASE (OUTPUTS ARE ACTIVE)
NOTE: IN EDGE MODE: 1. SAMPLE ON GATE INPUT TRANSITION TO ACTIVE
2. RESET OUTPUT ON GATE INPUT TRANSITION TO IDLE

GATE INPUT FUNCTIONALITY - LATCH ENABLED

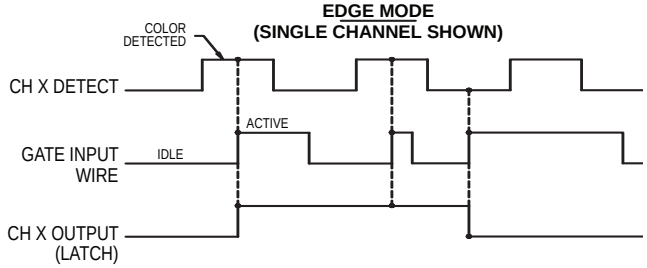
GATE MODE OR EDGE MODE SET IN SYSTEM MENU

GATE MODE (ALL CHANNELS SHOWN)



OR

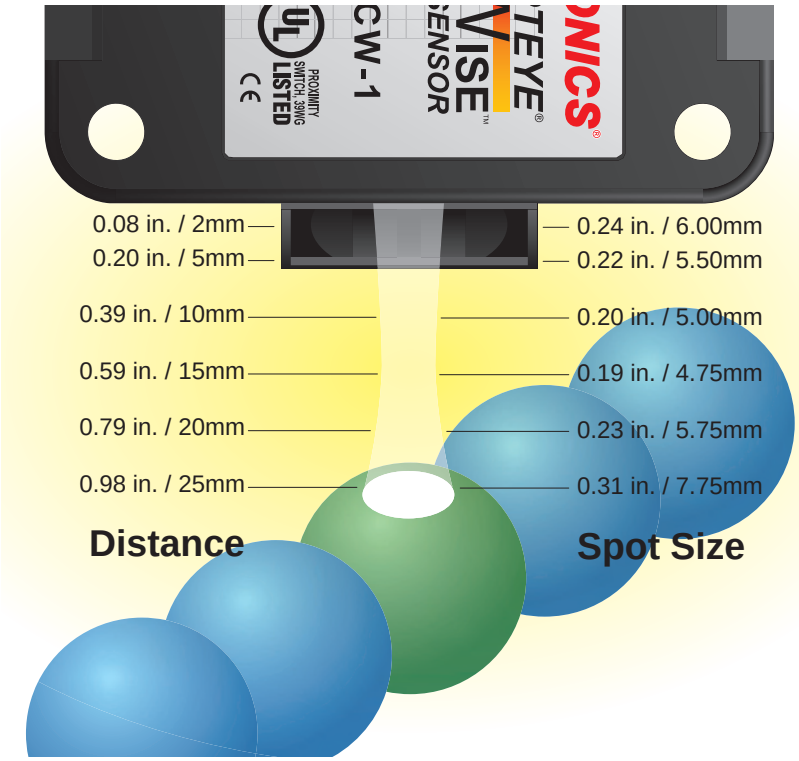
EDGE MODE (SINGLE CHANNEL SHOWN)



NOTE: DEFAULT STATE OF LINE IS RELEASE (OUTPUTS ARE ACTIVE)

ColorWise Range Guideline

SMARTEYE® COLORWISE™ TRUE COLOR SENSOR



Short Range Guideline (CW-1)

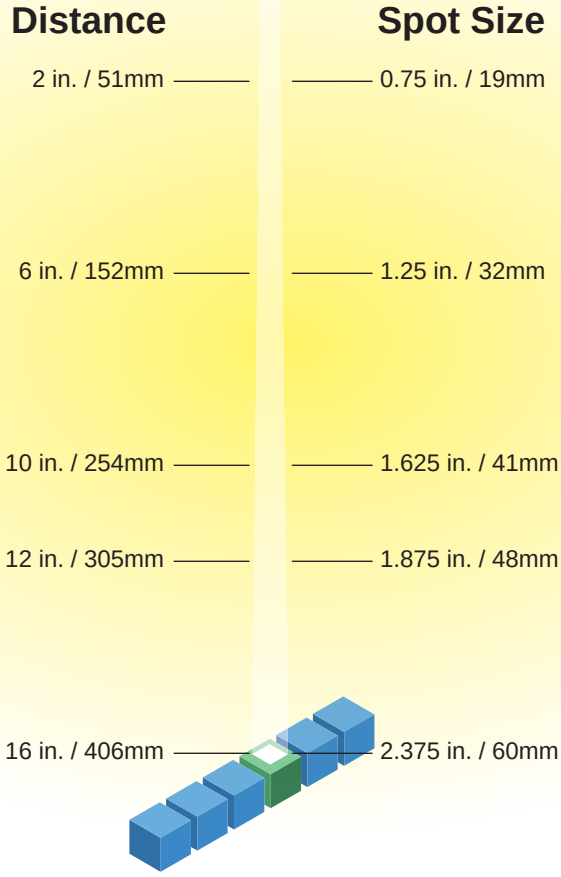
The short range version is useful when the color is consistent across the entire product: when product is small; when the target is a color registration mark; or when the target is a specific color on a label. Applications that may be solved with the short range models are cap color, registration marks, label orientation, pharmaceutical color coding, tote sorting, etc.

The short range version allows for a selection of speed versus resolution to resolve high speed color applications as well as low levels of color shade changes.

Long Range Guideline (CW-2)

The long range models should be used when distance to the target exceeds the range of the short range model, the physical or mechanical constraints require a longer range, or the product needs a larger spot of light for averaging, as in applications such as textile, food, or grainy products or surfaces.

The long range model provides a wide range of focal distances, with a large beam to view over surfaces that require more color averaging over many different substrate surface textures.



How to Specify

SMARTEYE® ColorWise™ True Color Sensor

1. Select Sensor:
SMARTEYE® ColorWise™ True Color Sensor

2. Select Cable:
Blank = 6 foot (1.8m), 14 conductor, 28AWG Cable
C = 6 inch (152mm) pigtail with 14-pin, 1/4-turn locking connector

3. Select Model:
-1 = Short Range
-2 = Long Range

4. Select Lens Material:
Blank = Acrylic
G = Glass

Example: CW C -1 G

SMARTEYE® ColorWise™ True Color Sensor

Blank = 6' Cable (1.8m)
C = 14-Pin Pigtail Connector 6" (152mm)

Model Type
-1 = Short Range
-2 = Long Range

Lens Material
Blank = Acrylic
G = Glass

Hardware & Accessories

Extension Cable and Bracket Selection Guide

XMB-1L
Left-hand Universal Mounting Bracket

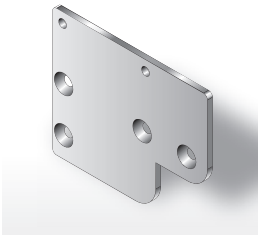
XMB-1R
Right-hand Universal Mounting Bracket

XMB-2
Front-mount Mounting Bracket

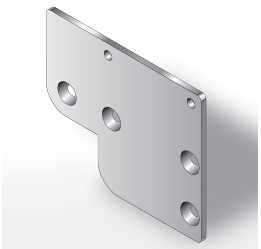
SEB-4
Stainless Steel Vertical Mounting Bracket

BCC-6
6-ft. (1.8m), 14-pin, twist-lock Connector Cable

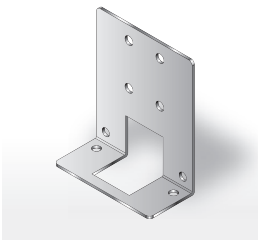
BCC-6
Sensor Cable, 6 foot. (1.8m)



XMB-1L
Left



XMB-1R
Right



XMB-2
Front Mount

SEB-4
Stainless Steel
Mounting Bracket

Specifications

SMARTEYE® COLORWISE™ TRUE COLOR SENSOR

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity Protected
- Intended for use in Class 2 circuits

CURRENT REQUIREMENTS
- CW-1: 110mA@12VDC, 80mA@24VDC
- CW-2: 140mA@12VDC, 85mA@24VDC

PERFORMANCE
- CW-1: Effective Resolution: Min. 12 bit, Max. 16 bit
- CW-2: Effective Resolution: 14 bit

OPTICAL CHARACTERISTICS
- Light emitter: White LED
- Optical axis: CW-1: Coaxial; CW-2: Convergent
- Receiving spectrum: 400nm to 700nm

DIGITAL OUTPUTS
- Four (4) selectable NPN or PNP open collector outputs
- 75mA capacity
- Short circuit & transient voltage protected
- Residual voltage: NPN, 1.35 max.; PNP, 2.05 max.

ANALOG OUTPUTS
- Three outputs: Selectable as XYZ for color differentiation (RGB equivalent) or xyY for color + intensity differentiation
- 0-5 VDC +/-1%
- 10 bit resolution
- Max load per channel: 2k OHMS
- Transient Suppression

OUTPUT SELECTION
- LO (Light On or Color Match)
- DO (Dark On or No-Match)
- Mute (Channel Off)

REMOTE CAPTURE INPUT
- Input time: 25ms (ON) / 25ms (OFF) minimum
- Selectable (sinking or sourcing)
- Contact or solid-state input 1mA
- Transient suppression

GATE INPUT
- Selectable NPN/Sinking or PNP/Sourcing
- Selectable EDGE or GATE trigger for latch reset or inhibit for windowing
- Contact or solid-state input 1mA
- Transient suppression

TIMER
- On delay, off delay, one shot, and latch
- Duration: 1mS to 10 seconds +/-1%

DETECTION MODE
- Color or color + intensity

ALPHANUMERIC DISPLAY
- 4-Channel Color Monitor for "At-A-Glance" Performance Feedback
- Alphanumeric Display for Available Options

RESPONSE TIME
- Color-to-color: CW-1: 75µs (Uspd), 150µs (Hspd), and 300µs (Hres); CW-2: 600µs
- Shade-to-shade: CW-1: 100µs (Uspd), 200µs (Hspd), and 800µs (Hres); CW-2: 800µs

DIAGNOSTIC INDICATORS
- Output Indicator – (Amber) CH 1 through CH 4
- Four Character Alphanumeric Display – (Green)

AMBIENT LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source – immune to most ambient light including indirect sunlight

HUMAN INTERFACE
- Pushbutton control: Select, Next

AMBIENT TEMPERATURE
- -5°C to 55°C (23°F to 131°F) No ice, frost, or fogging allowed

STORAGE TEMPERATURE
- 5°C to 90°C (41°F to 104°F)

RELATIVE HUMIDITY
- 35% to 85%

VIBRATION
- 10 to 55 Hz, 0.5mm, 30 minutes each axis

SHOCK
- Half-sine wave, 30g, 1µs 6 times 3 axis

CERTIFICATIONS
- CE - Complies with IEC 60947-5-2 edition 3.0 2007-10
- UL & CUL listed; CCN NRKH & NRKH7

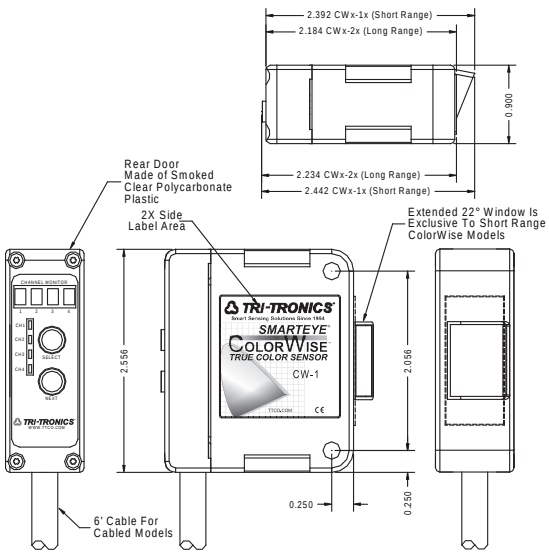
LENS MATERIAL
- Acrylic or glass

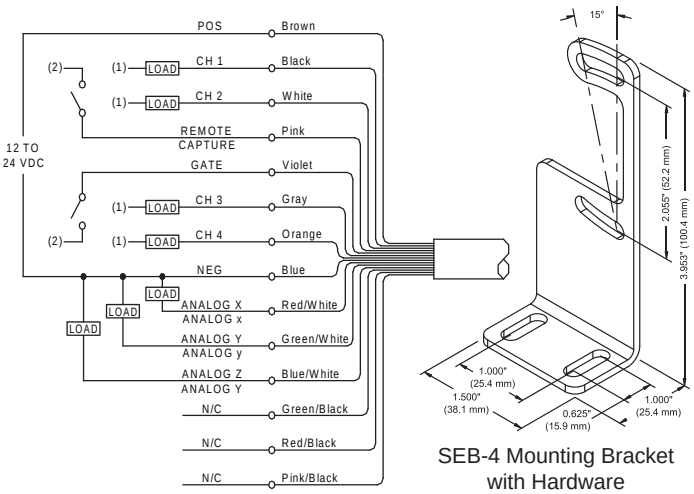
RUGGED CONSTRUCTION
- Chemical resistant, high impact polycarbonate housing
- Waterproof ratings: NEMA 4, IP65.

RoHS Compliant
Product subject to change without notice

Connections and Dimensions

SMARTEYE® ColorWise™





(1) - NPN (SINKING) OUTPUT LOAD TERMINATED TO POSITIVE
PNP (SOURCING) OUTPUT LOAD TERMINATED TO NEGATIVE

(2) - NPN (SINKING) INPUT ACTIVATED BY CONNECTING TO NEGATIVE
PNP (SOURCING) INPUT ACTIVATED BY CONNECTING TO POSITIVE

For connector models use:
BCC-6 - 6 ft. 14 Wire Cable with ¼ Turn Locking Connector

SEB-4 Mounting Bracket with Hardware

Photoelectric Communication Sensor

SMARTEYE® X-PRO

XPC – Extremely Versatile Photoelectric Communication Sensor

The *SMARTEYE*® X-PRO XPC is the most versatile Photoelectric Communication Sensor available on the market. Its patented communication technology allows for instant access, as well as feedback to and from the sensor. This unique photoelectric sensor is designed to be used in any application where physical contact of the sensor is either restricted, undesirable, or adds too much time to production line throughput. The *SMARTEYE*® X-PRO XPC sensor is just the kind of sensor innovation you would expect from Tri-Tronics. We've been pushing the envelope for half a century and continue to offer customers superior performance sensors for their unique application requirements.

The XPC is available in two communications options; RS-485 for multi-drop applications where sensors need to be addressed and bussed together, or RS-232 for single-drop applications where the sensor is behind safety interlocks, or in hard-to-reach areas that restrict easy access. These sensors can be easily interfaced to HMI's or PLC's using MODBUS ASCII or RTU communication protocol. Our unique and comprehensive EyewareXPC software is free of charge in either the development kit or upon request from the factory. We can also custom configure software requirements. ***Please consult the factory for details.***

No other communication sensor available on the market provides this kind of accessibility, control, and flexibility. *The SMARTEYE® X-PRO XPC Photoelectric Communication Sensor by Tri-Tronics, another breakthrough technology from a world class leader in innovation.*

Features

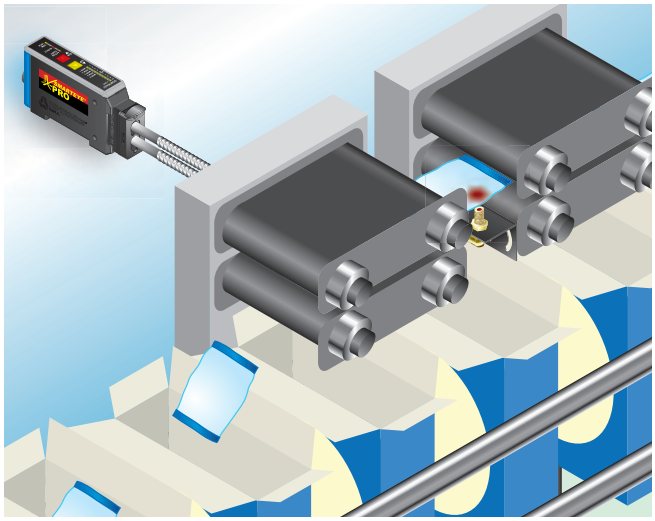
- Downloadable Recipes
- Half-Duplex Communication
  - RS-485 (multi-drop) or RS-232 (single drop)
  - MODBUS ASCII or RTU
- Five Onboard Memory Locations
- Button Lockout
- Configurable Response Time: 60µs, 125µs, or 450µs
- 8-Pin Male, M12 Connector
- Available in White, Red, or Infrared LED
- Patent No.'s 5,621,205 and 6,950,778
- 10-LED Dual-Function Bar Graph
- EyewareXPC Software Includes:
  - Two 4-Segment Digital Displays (Signal Level & Threshold)
  - Digital Sensor Scope
  - Full Featured Command Set

Note: EyewareXPC is free demonstration software. Command Set also available for custom interface software.

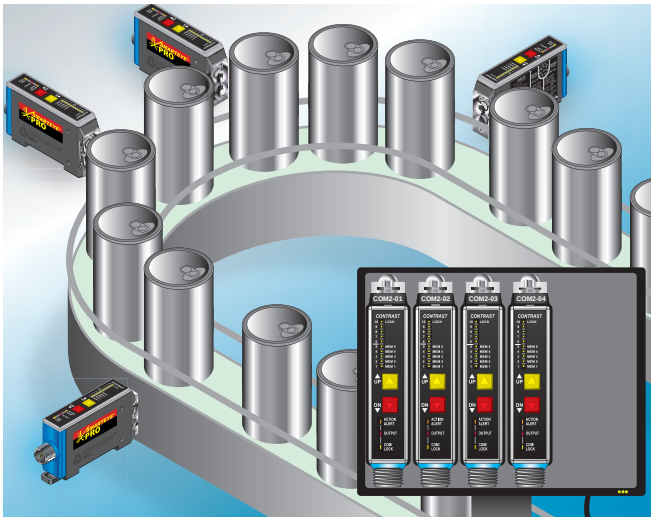
Benefits

- P.A.T. Compliant Process Analytical Technology
- No-Touch Setup
- Quick Digital Changeover
- Tamperproof
- Capture and Save Setups
- Log Sensor Performance
- Digital Process Validation
- Performance Calibration
- Universal Application Flexibility
- Quality Verification

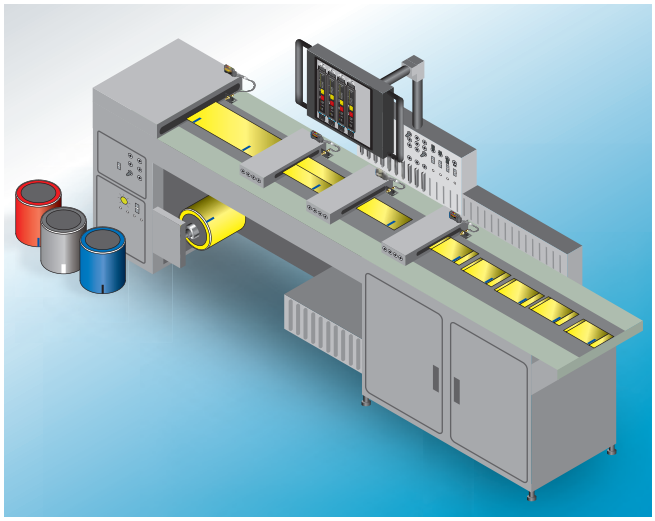
Applications



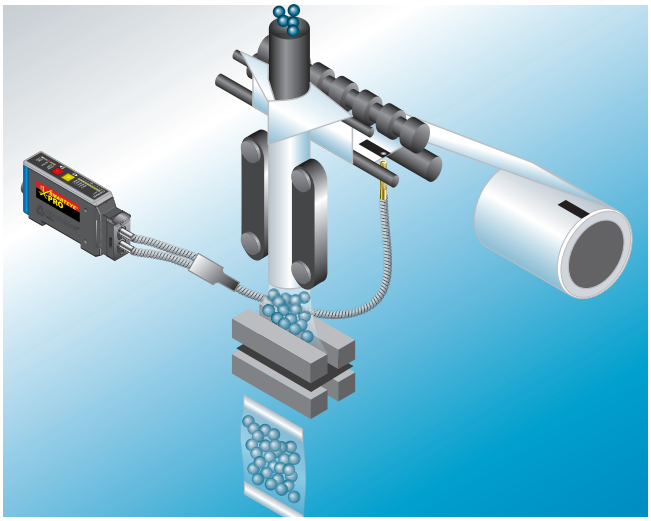
Coupon Dispensing - Use Downloadable Recipes for Quick Digital Changeover



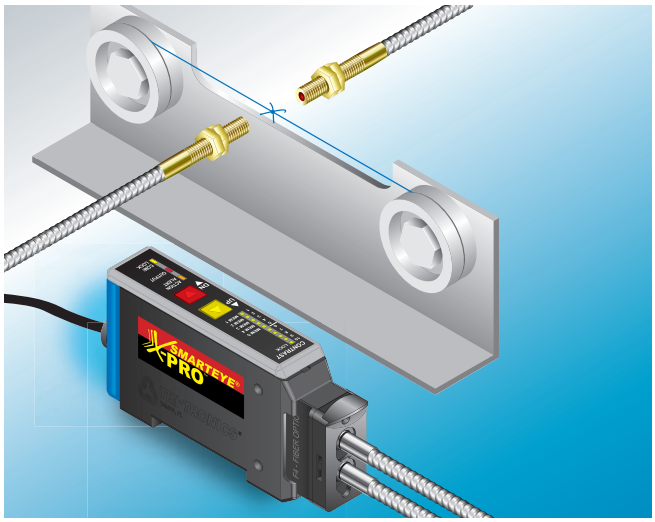
Access All Sensors from One Location for Process Validation and Monitoring



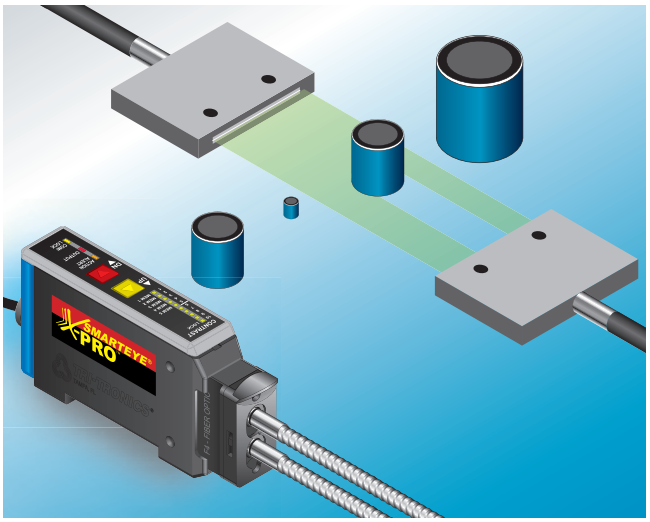
Conversion Machine with Multiple Sensors - Use Downloadable Recipes for Quick Digital Changeover



Form, Fill, & Seal - Registration Mark Sensing with Downloadable Recipes



Suture Knot Detection - Use Threshold Adjustment with Digital Sensor Scope to Optimize Performance



Sort Parts by Size - Use Digital Display of Sensor Signal Level for Part Profiling

Features

10 LED DUAL-FUNCTION BAR GRAPH

Contrast Indicator – Provides "at-a-glance" performance data.
Lock – When this option is enabled the sensor becomes tamperproof. Note: The remote AUTOSET and programming are not affected by the Lock option.
MEM 1 through MEM 5 - LED indicates MEM location selected.
NOTE: Any changes to the sensor will automatically be saved to current MEM # location.

EDR®
(Patent No. 5,621,205)

EDR® (Enhanced Dynamic Range) circuit prevents dark state saturation and expands the operating range without reducing amplifier gain.

ACT

ACT (Automatic Contrast Tracking) automatically adjusts the sensor for diminishing conditions. Ex. Dirty environment, scratched lenses, thermal drift, or LED light power.

AGS

AGS (Automatic Gain Select) is an unique feature that 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. Oftentimes, in dynamic operating conditions, all you have to do is push the button for a perfect setting. This is dependent upon at least a 4:1 duty cycle ratio.

(Note: The buttons on the sensor are inactive when in communication mode; if COM/LOCK LED is on or blinking)

COMMUNICATIONS

RS-485 or RS-232 in either MODBUS ASCII or MODBUS RTU protocol. Up to 128 sensors per node, more-or-less, depending on cable length. Baud rate and addresses are user selected and defined when utilizing the EyewareXPC software, or proper commands as defined by the Command Set. When using EyewareXPC software, simply tap the Communications button located on Screen 2 in order to access the Baud Rate or Address widows.

RESPONSE TIME SELECTION

60µs, 125µs, and 450µs available.

AUX IO

AUX IO line can be configured as:
• Remote AUTOSET
Remotely AUTOSET the sensor by applying a momentary contact closure from the Remote AUTOSET input wire to negative as shown in the wiring diagram. The Remote AUTOSET command will duplicate the last manual AUTOSET.
• Remote Input
• Action Alert Output
• Output Mode: On
• Output Mode: Off

Note: Configure AUX IO by using complimentary EyewareXPC software or Full Featured Command Set.

CONNECTIONS

Built-in 8-pin M12 Connector.

MOUNTING OPTIONS

Built-in DIN rail "Snap-On" design, through hole, or bracket mount.

DUAL FUNCTION BAR GRAPH
Primary function: Contrast Indicator
Secondary function: Option Status Indicator of 6 selectable options

#10 LOCK
Tamper proof Operation

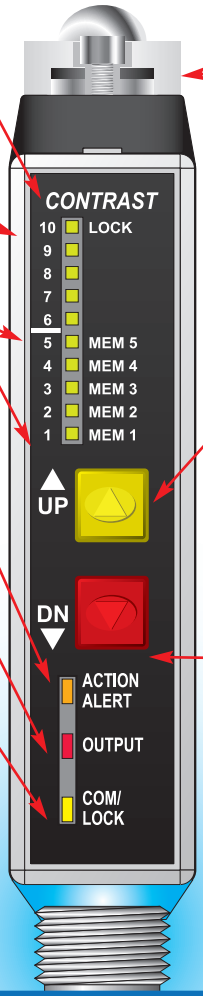
#5 – #1 MEMORY (MEM)
Illuminates to indicate active memory and/or selecting new memory

ACTION ALERT INDICATOR
Illuminates when action alert occurs

OUTPUT STATUS INDICATOR
Illuminates when Output is "ON"

COM/LOCK MODE INDICATOR
Illuminates during communication activity and/or when Lock feature is enabled

LARGE HIGH VISIBILITY OUTPUT INDICATOR
Illuminates when Output is "ON"
Flashes when LOCATE button activated on EyewareXPC Screen 2



10 INTERCHANGEABLE OPTICAL BLOCKS
1. O4 (Wide Beam Proximity)
2. O5 (Long Range Proximity)
3. R4 (Retroreflective)
4. R5 (Polarized Retroreflective)
5. V4 (Convergent, 1" Axis)
6. V4A (Convergent, 1" Axis, Apertured)
7. V6 (Convergent, 1.5" Axis)
8. V8 (Convergent, 0.5" Axis)
9. F4 (Glass Fiberoptic Light Guides)
10. F5 (Plastic Fiberoptic Light Guides)

YELLOW PUSHBUTTON – 4 Functions
1. Manual "UP" Adjustment
2. Options Select & AUTOSET Programming
3. Toggle selected option to opposite state and return to normal operation
4. When holding red AUTOSET button, tap to alter AUTOSET mode… Light State/Dark State

RED PUSHBUTTON – 4 Functions
1. Manual "DOWN" adjustment
2. Options Select & AUTOSET Programming
3. When in Option Status Mode, tap to desired function to be altered
4. When holding yellow AUTOSET button, tap to alter AUTOSET mode… Light State/Dark State

Note: Press and hold both red and yellow buttons simultaneously for 3 seconds to enter Options mode.

Special Features

EyewareXPC Software - Complimentary

EyewareXPC is a free diagnostic tool to aid the user in setting up, testing, and debugging applications.
Write your own custom controls using the available full featured Command Set.
Note: EyewareXPC Software works only with modbus ASCII versions of XPC.

Addressable

RS-485 Multidrop. Distinct, customer defined addresses. Up to 128 sensors on one Network.

On-Screen Adjustment

Buttons are active on screen...manually adjust the sensor UP or DOWN for precise sensor setup.

Output LED

The blue and red LED Output Indicators are active on the screen and turn on when the output is activated.

Contrast Indicator

These 10 LEDs are active on the screen and respond up and down to each sensor's received light level.

Screen One

"Load" - Recipe Load

"Save" - Save Recipes & Configurations

"Sensors..." - Locate, Add or Connect Sensors

"Help" - EyewareXPC Details

Detailed Features

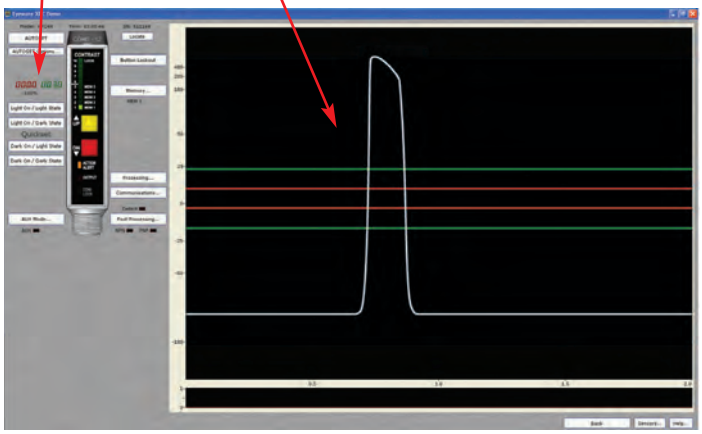
"Click" or "Touch" an area of the sensor on the screen, other than the red/yellow buttons, and you will advance to the screen below, Screen Two. To return to the multi-sensor screen view, or Screen One, click on the Back button in the lower right corner.

This area is feature rich with many buttons available to customize any sensing solution.

4-Segment Digital Displays

Sensor Scope

Screen Two



AUTOSET — Performs previous AUTOSET function

AUTOSET Options... — Change hysteresis multiplier, and set point percentage

• 4 AUTOSET Buttons -

Light On / Light State | Dark On / Light State

Light On / Dark State | Dark On / Dark State

AUX Mode... — Change auxiliary line to Remote AUTOSET, Remote Input, Action Alert, or Input/Output

Locate — Blinks the blue output LED on the back of the sensor

Button Lockout — Locks the buttons on the sensor to make it tamperproof

Memory... — Selection of MEM 1 through 5

Processing... — Change response time, Light On/Dark On, and activate Automatic Contrast Tracking (ACT™)

Communications... — Select Baud rate and device address

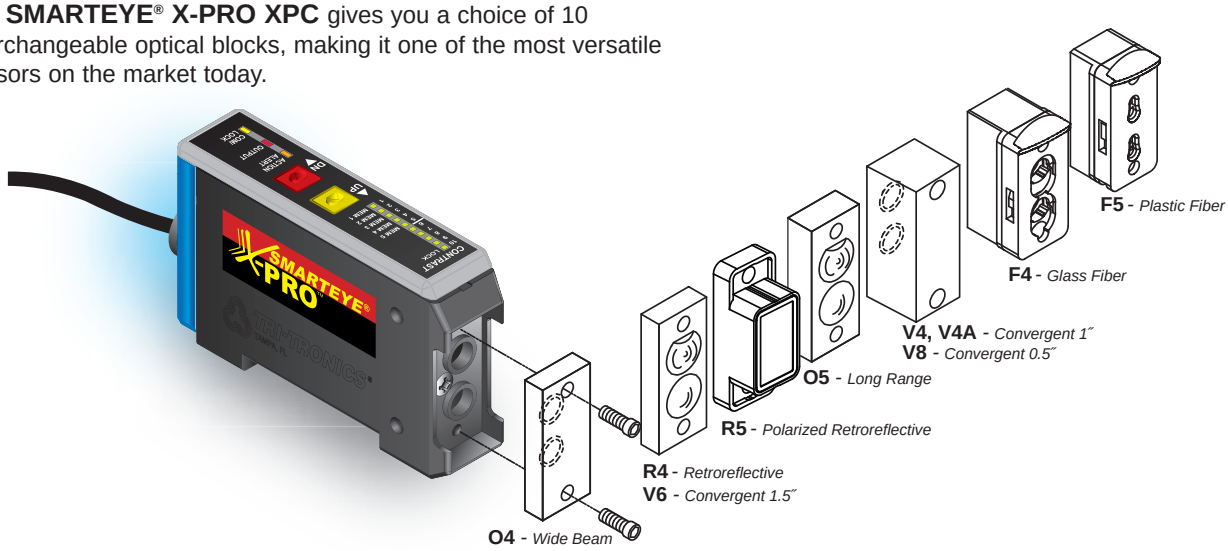
Post-Processing... — Select and alter time delays, and output invert

• Sensor Scope - Analyze received light levels, threshold settings, and hysteresis ON/OFF points

All of these features are detailed in the Help button in the lower right corner.

Optical Block Selection

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



Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent, opaque, 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 visible 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 F5
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes

Type V4, V4A
Convergent 1" "V" Axis
Useable range of 1" to 5".

Type V6
Convergent 1.5" "V" Axis
Useable range of 1.5" to 8".

Type V8
Convergent .5" "V" Axis
Useable range of .25" to 5"

Narrow beam optics useful for sensing small parts or registration color marks. Also useful for proximity sensing to minimize response to reflected light from background objects..

Sensing Range Guidelines

Convert to Inches
25.4mm = 1"

Speed Setting Sensing Mode		60µs Reflective			125µs Reflective			450µs Reflective		
Fiber	Block	IR	Red	White	IR	Red	White	IR	Red	White
Glass Fibers	F4	89mm	63mm	76mm	178mm	115mm	102mm	229mm	127mm	115mm
	F4 w/UAC-15	178mm	152mm	203mm	330mm	330mm	330mm	356mm	357mm	356mm
Plastic Fibers	F5	N/A	38mm	95mm	N/A	44mm	115mm	N/A	59mm	127mm
	F5 w/HLA-2	N/A	102mm	57mm	N/A	140mm	76mm	N/A	152mm	83mm
Speed Setting Sensing Mode		**60µs Opposed**			**125µs Opposed**			**450µs Opposed**		
Fiber	Block	IR	Red	White	IR	Red	White	IR	Red	White
Glass Fibers	F4	254mm	203mm	356mm	406mm	305mm	457mm	610mm	357mm	559mm
	F4 w/UAC-15	4.6M	3.7M	6+M	6+M	5.5M	6+M	6+M	6+M	6+M
Plastic Fibers	F5	N/A	127mm	115mm	N/A	203mm	152mm	N/A	241mm	165mm
	F5 w/GLA-2	N/A	1.2M	1.1M	N/A	2.1M	9.5M	N/A	2.5M	1.5M
	Lens Blocks	**60µs**			**125µs**			**450µs**		
		IR	Red	White	IR	Red	White	IR	Red	White
	O4 SR Proximity	178mm	127mm	203mm	279mm	203mm	254mm	406mm	229mm	305mm
	O5 LR Proximity	1.1M	813mm	610mm	254mm	1.3M	9.1M	2.4M	1.5M	965mm
	R4 Retro	4.6M	5.5M	3M	7.6M	8.2M	4.3M	9.1M	8.5M	4.6M
	R4 Retro wo/prox	1.5M	2.8M	1.1M	2.4M	2.7M	762mm	1.5M	2.7M	1.1M
	R5 Polarized Retro	N/A	2.1M	N/A	N/A	2.1M	N/A	N/A	2.1M	N/A

Note: Proximity tests utilized a 90% reflective white target. Retroreflective tests utilized a 3" (76.2mm) diameter round reflector, Model AR3.

Note: R4 retroreflective tests utilized a Kraft paper target, with no proxing.

Note: Glass fiber tests utilized a .125" (3.175mm) diameter fiber bundle. Plastic fiber tests utilized a diplex, .040" (1.016mm) diameter fiber bundle.

How to Specify

1. Select Sensor Communication Type required:

XPC**2** = RS-232 MODBUS ASCII
XPC**3** = RS-232 MODBUS RTU
XPC**4** = RS-485 MODBUS ASCII
XPC**5** = RS-485 MODBUS RTU

2. Select Sensor LED Light Source required:

I = Infrared
R = Red
W = White

3. Select Optical Block:

F4 Glass Fiber Optic
F5 Plastic Fiber Optic
V4 Convergent Lens, 1.0" Focal Point
V4A Convergent Lens, 1.0" Focal Point
V6 Convergent Lens, 1.5" Focal Point
V8 Convergent Lens, 0.5" Focal Point
R4 Retroreflective Lens
R5 Polarized Retroreflective Lens
O4 Wide Beam Proximity Lens
O5 Long Range Proximity Lens

Example: XPC 4 W F4

X-PRO, Photoelectric Communication Sensor

2 = RS-232 MODBUS ASCII
3 = RS-232 MODBUS RTU
4 = RS-485 MODBUS ASCII
5 = RS-485 MODBUS RTU

Light Emitter
I = Infrared
R = Red
W = White

Optical Block

Hardware & Accessories

Micro Cable Selection Guide, 8-wire, M12

TJC-3
T-Junction Cable, 8-pin F, 5-pin M, DB9 for RS-232

TJC-5
T-Junction Cable, 8-pin F, 5-pin M, DB9 for RS-485

DCS8-2M
2 meter 8-pin cable

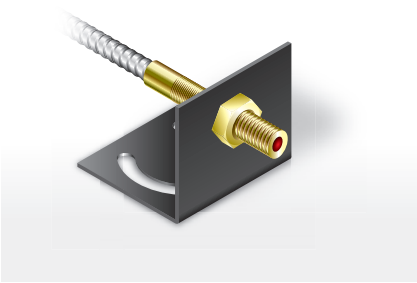
DCS8-5M
5 meter 8-pin cable

RDCS8-5M
5 meter 8-pin cable, right angle

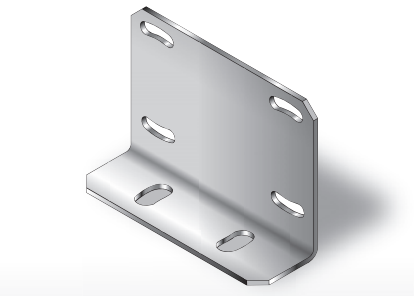
XPC4-DEV
Development Kit for RS-485 Models
Includes: Software, USB Adaptor, and TJC-5 Cable

XPC2-DEV
Development Kit for RS-232 Models
Includes: Software, USB Adaptor, and TJC-3 Cable

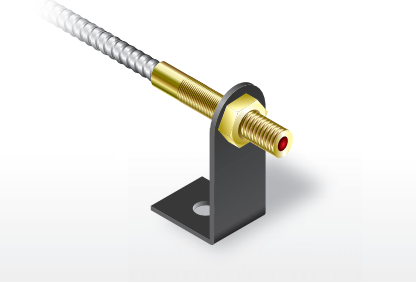
Mounting Brackets



FMB-1 (8.4 mm diam.)
Standard Fiberoptic



SEB-3
Stainless “L” Bracket



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

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected
- Intended for use in Class 2 circuits

CURRENT REQUIREMENTS
- 45mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP sensor output transistors
- Outputs sink or source up to 150mA (current limit)
- All outputs are continuously short circuit protected

REMOTE AUTOSET INPUT/AUX I/O
- Opto-isolated momentary sinking input (10mA)
- Can be configured as INPUT or OUTPUT (PNP Sourcing up to 150mA)

2-WIRE COMMUNICATION
- RS-485 or RS-232 models available

RESPONSE TIME
- 60µs (High Speed Mode)
- 125µs (Standard Mode)
- 450µs (Long Range/High Rez Mode)

REPEATABILITY
- 20µs (High Speed Mode)
- 25µs (Standard Mode)
- 50µs (Long Range/High Resolution Mode)

LED LIGHT SOURCE
- Infrared = 880 nm, Red = 660 nm, White = Broadband Color Spectrum

PUSHBUTTON CONTROL
- AUTOSET
- Manual Adjustments
- Set status of options: 10) Lock, 5–1) Five Memory Locations
  NOTE: Any changes to the sensor will automatically be saved to current MEM # location.

HYSTERESIS
- Software Configured by User; Factory Default Setting = 1.
  (See EyewareXPC Help for details)

LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source – immune to most ambient light including indirect sunlight

DIAGNOSTIC INDICATORS
- 10-LED dual-function bar graph operates 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 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 Action Alert occurs
- Yellow LED – Illuminates during Com Activity and/or when Lock feature is enabled

- Blue LED Output Indicator - Illuminates when output is "ON" Flashes when Locate button activated on EyewareXPC Screen 2

AMBIENT TEMPERATURE
- 0°C to 70°C (32°F to 158°F)

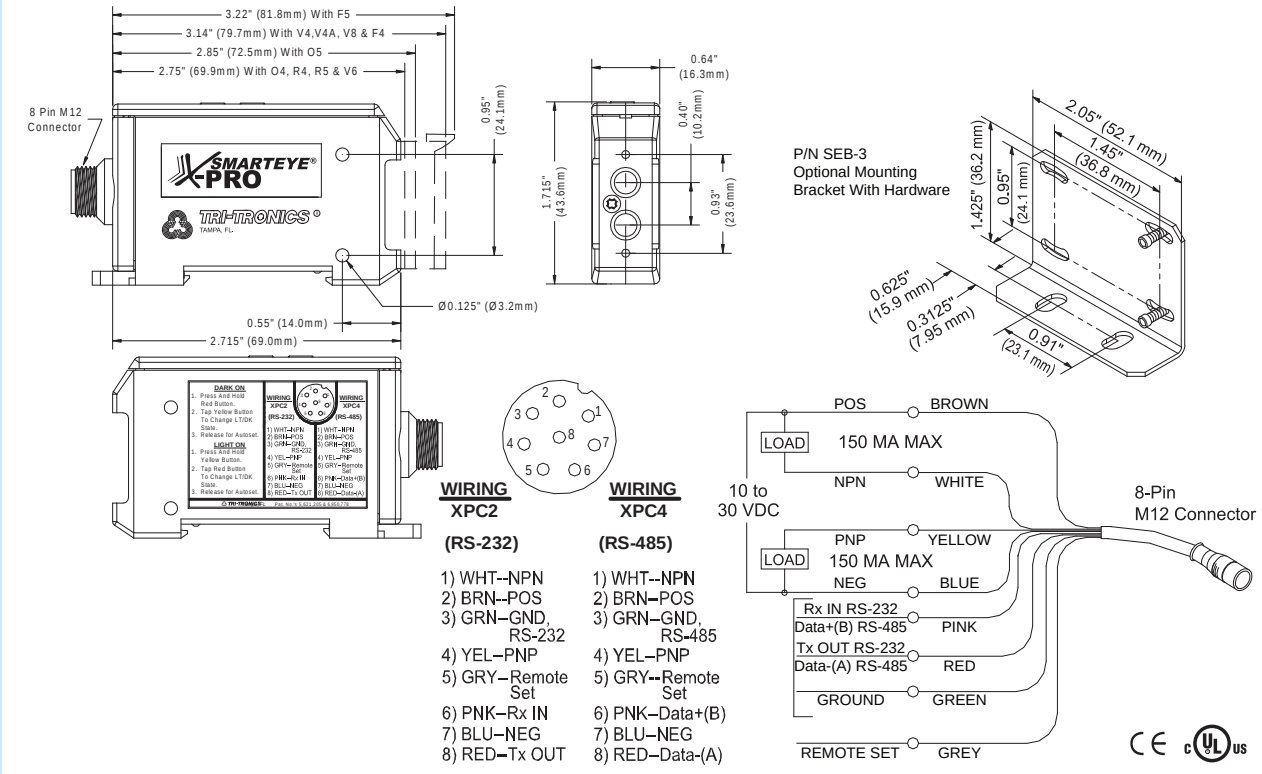
RUGGED CONSTRUCTION
- Chemical resistant, high impact polycarbonate housing
- Waterproof ratings: NEMA 4X, 6P and IP67
- Conforms to heavy industry grade CE requirements

Patents No. 5,621,205 and No. 6,250,778

RoHS Compliant
Product subject to change without notice

Connections and Dimensions

SMARTEYE® X-PRO XPC



800-237-0946 • ttco.com

High Performance Clear Object Sensor

RETRO SMART®

RETROSMART®

High Performance Clear Object Sensor

The ***SMARTEYE®*** ***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 burn-through 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.

Features

- 100µs response time
- Polarized Retroreflective - from a few inches up to 8 feet
- Remote AUTOSET
- Light State Tracking
- Button lockout
- Cable or quick disconnect versions
- Immune to most ambient light, including strobes

Benefits

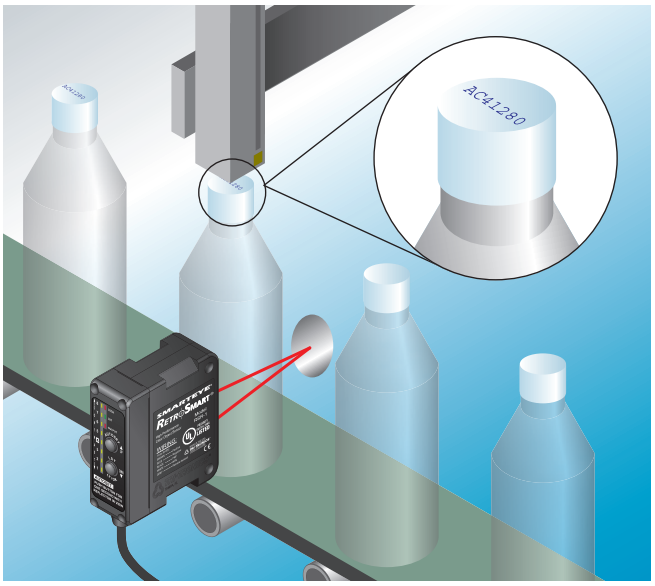
- Reliable and repeatable detection of the clearest and shiniest of materials from leading to trailing edge
- No false triggers
- Easy Remote AUTOSET for hard to reach areas
- Through-hole or bracket mounting for easy installation
- Robust design to improve up-time

Applications

RETROSMART®

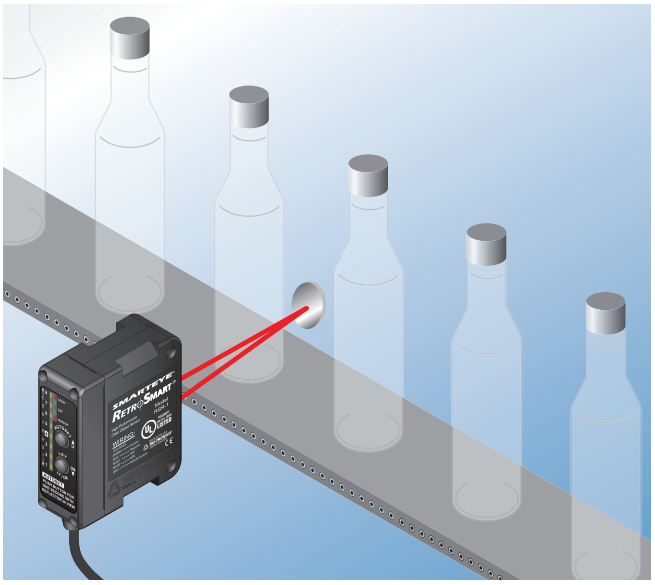
Trigger Sensor for Code Marking

- Accurate from leading edge to trailing edge.
- No false triggers
- Remove print distortion errors
- Easy setup
- Available with glass lens for ink-jet applications



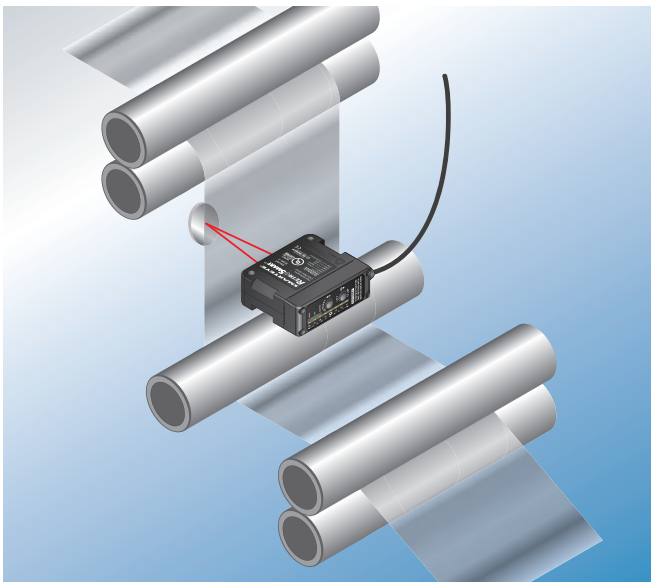
Detection of Transparent Containers

- Full or empty, no false triggers
- Solid, repeatable performance regardless of the shape, shininess, or transparency
- Works on glass, plastic, acrylic, or clear Mylar films



Clear Detection Applications

- Clear bottles, vials, food containers (clamshell boxes), syringes, liquids, etc.
- Clear web break/web splice
- Inspection systems for glass bottles, PET bottles, food products, etc.
- No false signals sensing shiny bags, foil webs, or cans



Features

RETROSMART®

AGS
AGS (Automatic Gain Select) is an unique feature that 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.

8 LED DUAL FUNCTION INDICATOR
Contrast Indicator – Provides “at-a-glance” performance data.

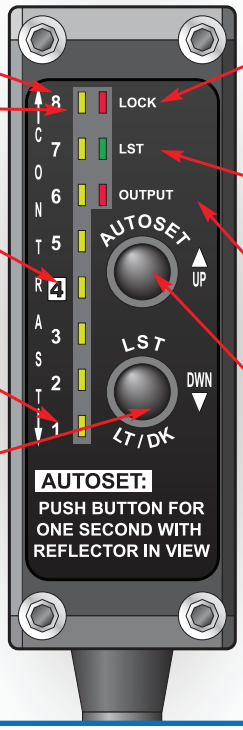
LOCK
When this feature is enabled the sensor becomes tamperproof.
Note: The remote AUTOSET is not affected by the lock.

LST
LST (Light State Tracking) automatically adjusts the sensor up in order to maintain a perfect setting. When diminishing conditions occur, as in a dusty environment, or slight misalignment issues, the sensor will "bump" up the gain to compensate for the reduced performance.

HIGH SPEED
100 microsecond response time f high-speed bottling, filling, or printing applications.

CONNECTIONS
Built-in 12mm connector or 6' cable.

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 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

PUSHBUTTON – 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

How to Specify

RETROSMART®

1. **Select Sensor:**
   SMARTEYE® RETROSMART®
2. **Select Cable or Connector:**
   Blank = 6 foot (1.8m)
   C = 6 inch (152mm) pigtail with 5-pin connector *(accessory cable required)*
3. 1 = Standard RetroSmart
4. **Select Lens Material:**
   Blank = Acrylic
   G = Chemical Resistant Glass Window

   NOTE: All models include AR6151 high perfomance prizmatic reflector.

Example: RSR C -1 G

- RSR — *SMARTEYE® RETROSMART®*
- C — Blank = 6' Cable (1.8m); C = 5-Pin Pigtail Connector 6" (152 mm)
- -1 — Standard RetroSmart
- G — Lens Material: Blank = Acrylic; G = Glass

Hardware & Accessories

Extension Cable and Bracket Selection Guide

Cables

5-Wire Shielded MicroCable, M-12

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

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

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

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

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

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

GPSEC-15
15' (4.6m) cable with connector, non-metallic shell

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

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

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

5-Wire Extension Cable, M-12

GX-25
25' (7.6m) extension cable

Reflectors

Screw Mount

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

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

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

Glue Mount

AR46
1.8" diam. (46mm diam.)

Economical Reflective Discs with Adhesive Backing

PRD1
1" x .03" (25mm x .75mm)

PRD2
2" x .03" (50mm x .75mm)

Note: See page 5-5 in the Accessories section for a full listing of reflectors.

Mounting Bracket

SEB-4
Stainless Steel
Mounting Bracket

Specifications

RETROSMART®

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 50mA (exclusive of load)

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

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

RESPONSE TIME
- Light State = ***100*** microseconds
- Dark State = ***100*** microseconds

LED LIGHT SOURCE
- Red 660 nm
- Pulse Modulated

PUSH BUTTON CONTROL
- "One-Touch" AUTOSET pushbutton 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 2.4m) 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 Indicator - LOCK
- Green LED Indicator - LST (Light State Tracking)
- Red LED Indicator - OUTPUT

NOTE: If Output LED flashes, a short circuit condition exists.

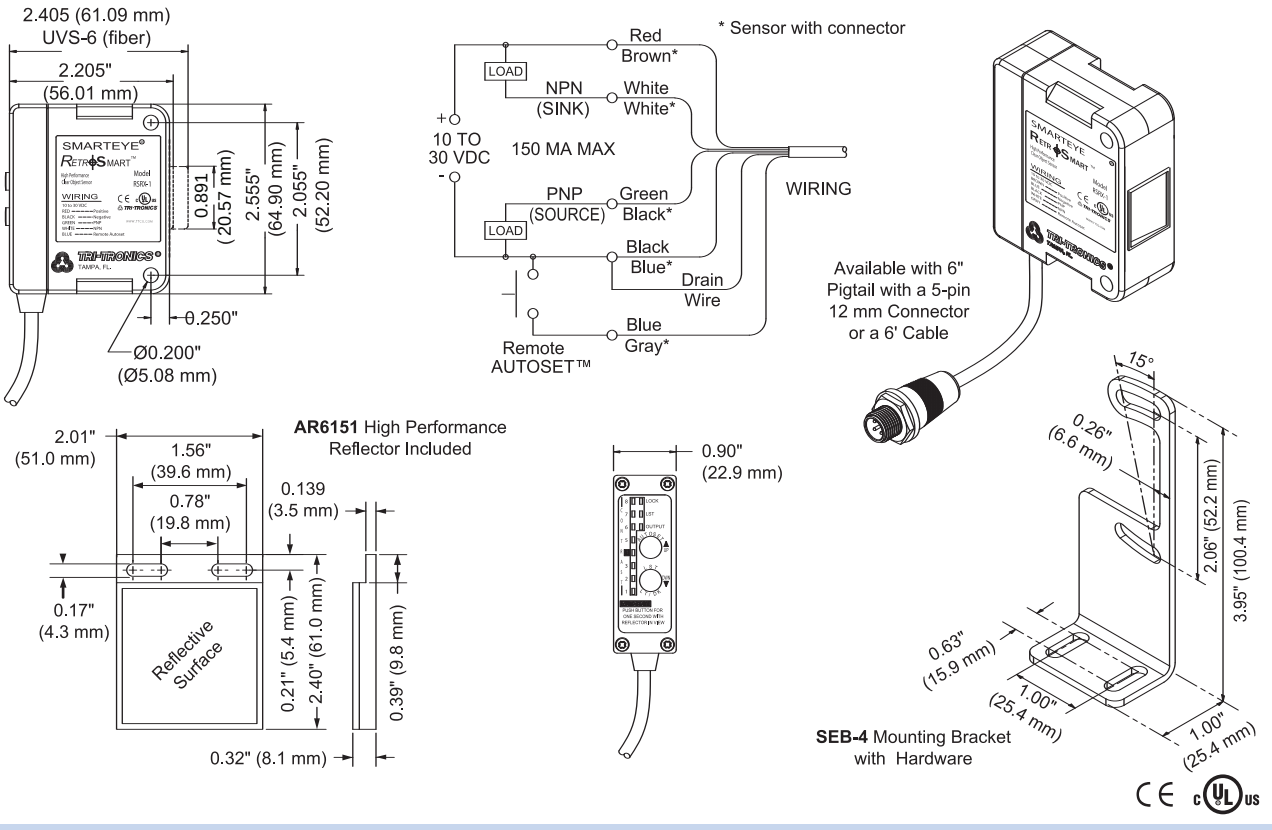
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

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

RoHS Compliant
Product subject to change without notice

Connections and Dimensions

SMARTEYE® RETROSMART®



Luminescence Sensor

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.

The ***SMARTEYE®*** **STEALTH-UV** sensor is useful for a number of applications including high speed, invisible, registration mark sensing. Many clear bags and labels are manufactured with the highest level of cosmetic sensitivity, making the use of a standard colored registration marks undesirable. Having the high speed, highly accurate sensor available for this application ensures customer satisfaction and the highest production line speeds.

The ability for the ***SMARTEYE®*** **STEALTH-UV** sensor to be used with standard glass fiber optic light guides is a very cost effective way of getting the sensor into tight mechanical positions, or caustic and harsh environments that would be harmful for standard lensed sensors. Not having to use extremely high cost "special" fiber optic light guides for UV detection offers a solution that is very reasonable compared to the competition.

Features

- High Speed
- Short Range, Long Range, Fiber Optic models available
- 6 inch pigtail with 4-pin M12 Connector
- Waterproof
- NPN and PNP outputs
- Easy push button AUTOSET
- 15ms Pulse Stretcher
- 8-LED Contrast Indicator
- LT On/DK On selectable
- Button adjust for fine tuning

Benefits

- Minimize downtime
- High speed and highly accurate for consistent performance to maximize productivity
- Low maintenance cost
- Flexible configurations for a multitude of application requirements
- Remove mechanical flexibility issues and physical constraints

Applications

When you need to see the . . .

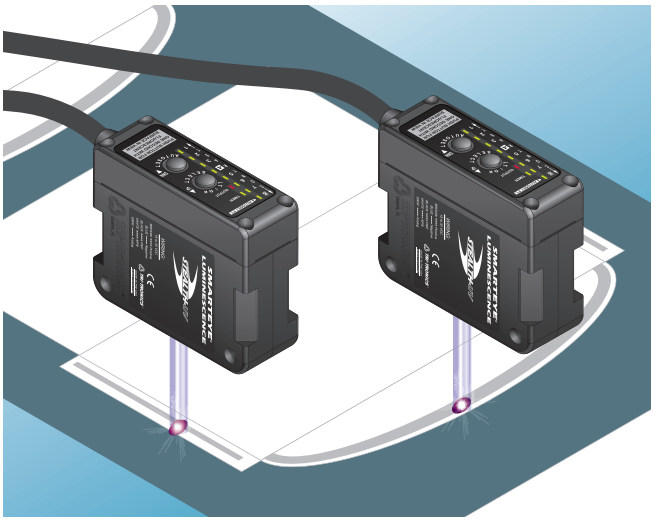
INVISIBLE

INVISIBLE

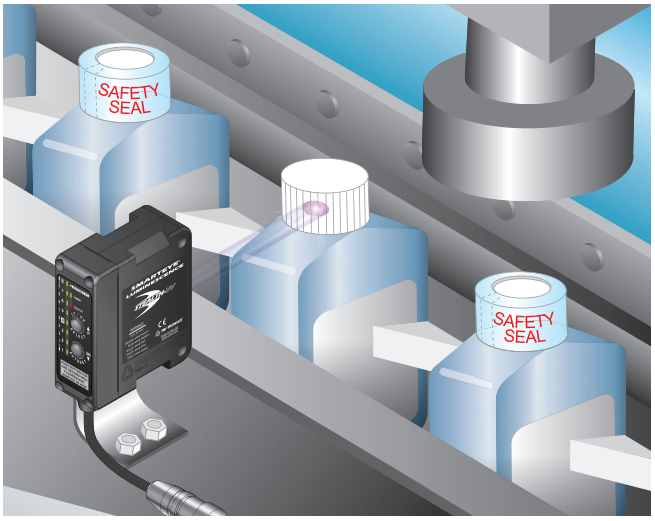
INVISIBLE

TYPICAL SMARTEYE® *Stealth-UV Digital* Sensor Applications

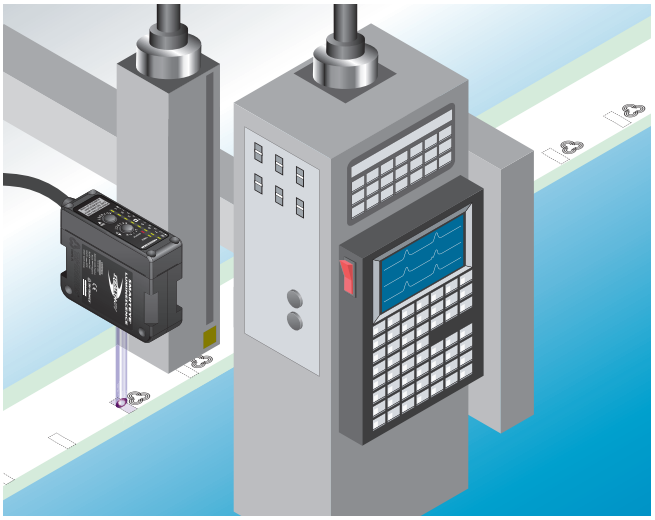
- Product inspection & verification
- Glue/adhesives on paper, plastics, envelopes and transparent materials
- Detection and verification of invisible registration marks for printing, cutting, positioning
- Continuous web splice detection
- Detecting marks (chalk) for grading or sorting such as lumber/wood, and tile products
- Verifying the presence of lubricants such as oil, grease or identifying oil leaks
- Detecting UV threads in carpets for cutting or positioning
- Triggering on inkjet printed marks for product identification or inserting
- Detection of liquid thread-lock
- Detection & verification of cap liners for quality assurance & control



Glue Detection and Bead Size



Safety Seal Inspection/Detection



UV Registration Mark Sensing

Features

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.

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

HIGH SPEED
- 200µs for UVS-1 thru 4
- 750µs for UVS-5
- 300µs for UVS-6

NOTE: Custom models available; consult factory for details

CONNECTIONS
6 inch pigtail with 4-pin M12 connector

MOUNTING OPTIONS
Through-hole or bracket mount.

Sensing Range Guidelines

*Catalog Listing	Digital Output	Supply Voltage	Focal Distance	Usable Range	Spot Size
UVS-1	NPN/PNP	10 to 30 VDC	0.5 Inches	5 Inches	.067 Inches
UVS-2	NPN/PNP	10 to 30 VDC	1.0 Inches	7.5 Inches	.086 Inches
UVS-3	NPN/PNP	10 to 30 VDC	2.0 Inches	10 Inches	.128 Inches
UVS-4	NPN/PNP	10 to 30 VDC	4.0 Inches	13 Inches	.160 Inches
UVS-5	NPN/PNP	10 to 30 VDC	8.0 Inches	2 Inches to 2 Feet	1.0 Inch
UVS-6	NPN/PNP	10 to 30 VDC	Dependent upon fiber optic selection	2 Inches to 2 Feet	Dependent upon fiber optic selection

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

CONTRAST INDICATOR BAR 4
Switching Threshold - sensor outputs toggle state when signal passes through Bar 4... above or below

CONTRAST INDICATOR LEDs (X8)
Green - provides visible, "at-a-glance" performance data

TIMER INDICATOR
Green - illuminates when 15ms pulse stretcher timer is enabled
Hold both buttons for two seconds to enable/disable timer

OUTPUT INDICATOR
Red - illuminates when output transistors are on
Flashes when output transistor is over current limit

LIGHT/DARK AND MANUAL UP ADJUST
1. Push for two seconds to select "Light On" or "Dark On" operation
2. Tap UP to "Tweak" setting if needed

AUTOSET/MANUAL DOWN ADJUST
1. Push and hold for AUTOSET
2. Tap DWN to "Tweak" setting if needed

Responds to invisible luminescent materials

How to Specify

1. Select sensor model number required:
   UVS-1 through 6 (see Sensing Range Guidelines)*
2. Select window required:
   BLANK = ACRYLIC
   G = GLASS (chemical resistant)

**Note: Sensor selection should not be determined solely by range. It may be advisable to test multiple sensors or fiberoptic light guide tip configurations to ensure optimum performance.*

Example: UVS - 3 G

- ***STEALTH-UV***®
- Model Selection
- Window

Hardware & Accessories

Micro Cable Selection Guide, 4-wire, M12

Yellow Shielded Cable Assemblies

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

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

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

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

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

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

Black Shielded Cable Assemblies (Lightweight)

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

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

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

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

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

BRSEC-25

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

BX-10
10' (3.1m) Extension cable

BX-25
25' (7.62m) Extension cable

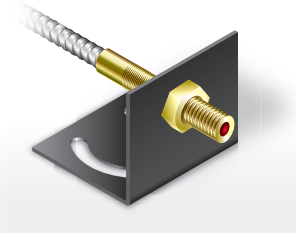
Grey Unshielded Cable Assemblies

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

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

Suggested fiber optic light guides for Stealth UV:

BF-U-36TUV
BF-A-36T
BF-C-36



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

SEB-4
Stainless Steel Mounting Bracket

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- UVS-1, UVS-2, UVS-3 & UVS-4: 50mA
- UVS-5 & UVS-6: 65mA (exclusive of load)

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

RESPONSE TIME
- 200µs for UVS-1A through 4A
- 750µs for UVS-5A
- 300µs for UVS-6A

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

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

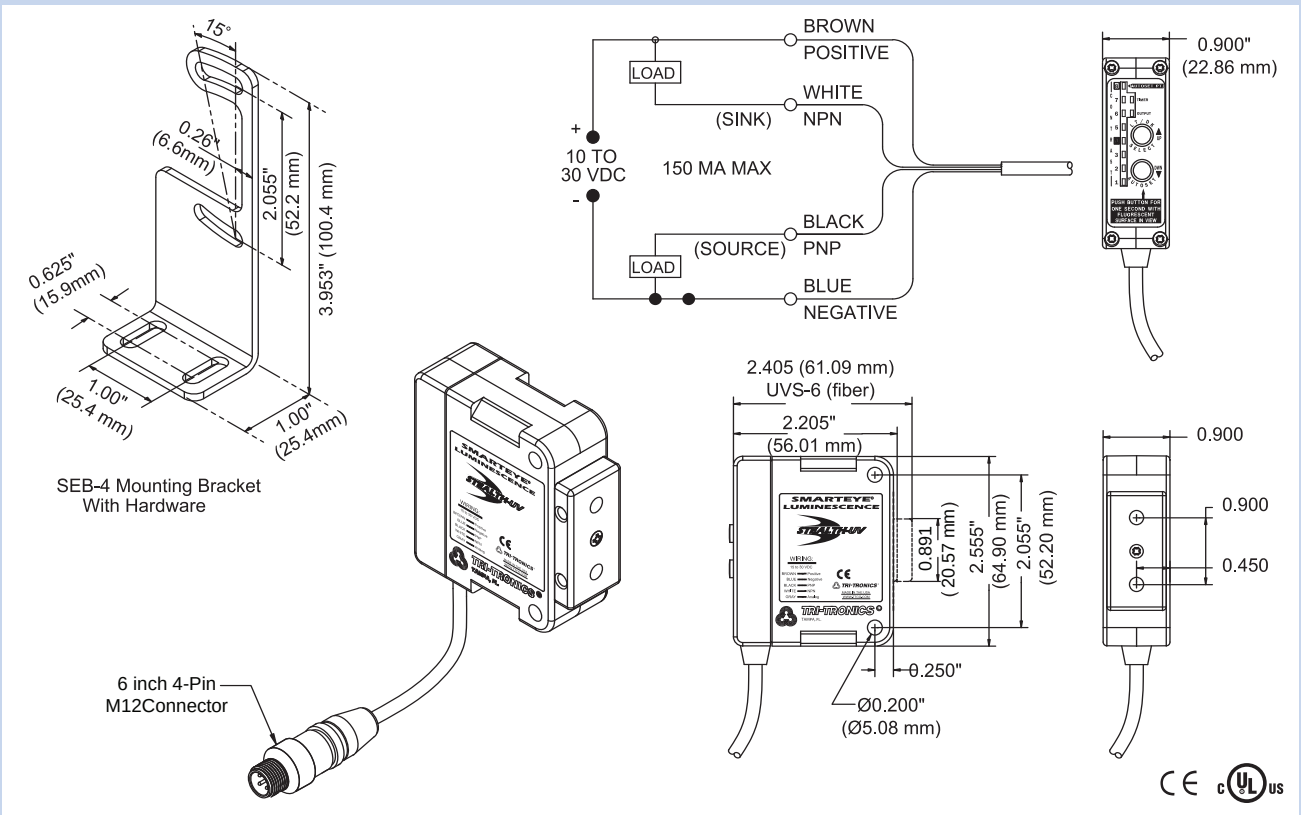
PUSH BUTTON CONTROL
- "One-Touch" AUTOSET push-button setup
- Tweak adjustments with "up" or "down" buttons
- Selection of Light/Dark operation
- Enable/Disable pulse stretcher

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, 375nm Wavelength

RoHS Compliant
Product subject to change without notice



UVS – Analog/Digital Luminescence Sensor

STEALTH-UV

UVS – Analog/Digital Luminescence Sensor

The SMARTEYE® *Stealth-UV* Analog/ Digital Sensor is a special-purpose sensor designed to detect the presence of invisible UV fluorescent materials contained in special chalk, ink, paint, grease, 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 **Analog Output** is 4-20mA as the standard factory default configuration. The sensor can also be ordered with a 0-5 or a 0-10 VDC output. This provides flexibility when interfacing to different machine input requirements.

Four AUTOSET Modes allow for custom control of the sensor's unique AUTOSET routines. **Light State** AUTOSET is the default setting and should be used when performing a setup with the luminescent material in view. **Dark State** AUTOSET should be used when setting up on the background, or non-luminescent material. This setting provides for maximum range and highest gain when the background is clear of all luminescent material. **Mid-Point** AUTOSET should be used when determining the exact amount of luminescent material that is optimal. Then the sensor will respond to any amount of luminescent material that is too much or too little compared to the optimal amount. **Two-Point** AUTOSET should be used when there are two luminescent materials that require contrast deviation. For instance, the background may be a white envelope with luminescent material and the target is the luminescent glue on the envelope.

These two features make the SMARTEYE® *Stealth-UV* Analog/Digital Sensor the most flexible and versatile luminescent sensor on the market.

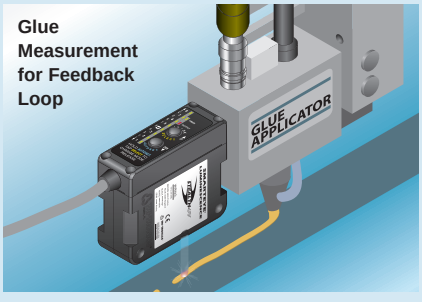
Features

- The widest selection of UV sensors in the world
- Analog and Digital outputs in one sensor:
  - Digital: NPN and PNP
  - Analog: 4-20mA, 0-5 VDC, or 0-10 VDC
- Four easy AUTOSET modes
  - Light State
  - Dark State
  - Mid-Point
  - Two-Point
- The only standard fiber optic Luminescence sensor available in the industry
- Longest range, up to 24 inches
- Immune to most ambient light, including direct sunlight
- Contrast Indicator for "at-a-glance" performance data

Benefits

- One sensor fits all – both analog and digital outputs
- Three analog output configurations for multiple machine interfaces (0-5 VDC, 0-10 VDC, or 4-20mA)
- Four AUTOSET modes for maximum sensing flexibility and sensitivity
- Minimize inventory requirements
- Easy to use

Typical Applications



Features

CONTRAST INDICATOR

Provides “at-a-glance” performance data, both statically and dynamically.

All 8 LEDs will flash three times if contrast insufficient or too low in Two-Point AUTOSET mode.

AUTOMATIC GAIN SELECT

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

AUTOSET ADJUSTMENT

Four AUTOSET Modes:

Light State, Dark State, Mid-Point, and Two-Point

The default AUTOSET mode is Light State as described in the Special Features Section.

MANUAL ADJUSTMENT

The AUTOSET (DWN) and SELECT (UP) button also provide tweaking capability for fine tuning. Simply tap the (DWN) button or (UP) button for small, incremental changes.

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.

RESPONSE TIME

- 200µs for UVS-1A thru 4A
- 750µs for UVS-5A
- 300µs for UVS-6A

Note: Custom models available; consult factory for details

CONNECTIONS

Built in 6" pigtail cable with 5-Pin Male, M12 connector

MOUNTING OPTIONS

Through-hole or bracket mount.

Note: Custom brackets available; consult factory for details

LT/DK OUTPUT SELECT

Push and hold this button for two seconds to toggle "Light On" or "Dark On" operation

CONTRAST INDICATOR BAR 8

Remains illuminated when Light State signal strength is 8 or above

CONTRAST INDICATOR BAR 4

Switching Threshold - sensor digital outputs toggle state when signal passes through Bar 4...above or below

CONTRAST INDICATOR LEDs (X8)

Green - provides visible, “at-a-glance” performance data

All 8 LEDs will flash three times if contrast insufficient or too low in Two-Point AUTOSET mode

Responds to invisible luminescent materials

TIMER INDICATOR

Green - illuminates when 15ms pulse stretcher timer is enabled
Hold both buttons for two seconds to enable/disable timer

OUTPUT INDICATOR

Red - illuminates when output transistors are on
Flashes when output transistor is over current limit

LIGHT/DARK AND MANUAL UP ADJUST

1. Push for two seconds to select “Light On” or “Dark On” operation
2. Tap UP to “Tweak” setting if needed
3. When holding AUTOSET button tap to select next AUTOSET mode

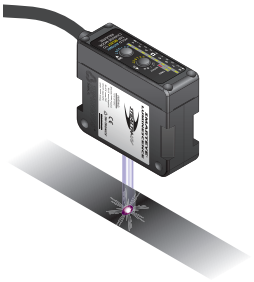
AUTOSET/MANUAL DOWN ADJUST

1. Push and hold to view current AUTOSET mode; release for AUTOSET
2. Tap DWN to “Tweak” setting if needed

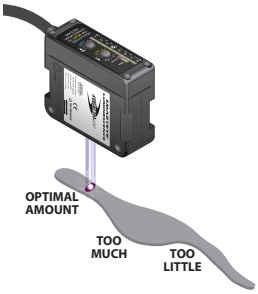
Special Features

A. Light State AUTOSET Mode – With luminescent target in view, the sensor samples the signal level from the target and sets the switching threshold just below that signal level. The sensor is sensitive to less luminescent materials in this mode. This is the default mode and is useful in solving most common applications. The analog output can be used to provide feedback of target brightness level for control applications.

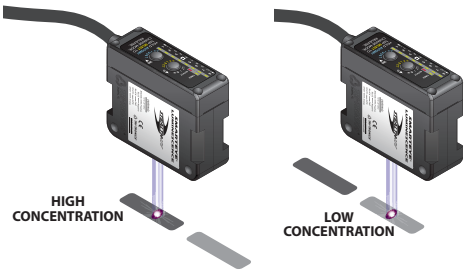
B. Dark State AUTOSET Mode – With background in view, the sensor samples the signal level from the background and sets the switching threshold just above that signal level. The sensor is sensitive to more luminescent materials in this mode. This mode is useful in solving many common applications. The analog output can be used to provide feedback of target brightness level for control applications in this mode as well.



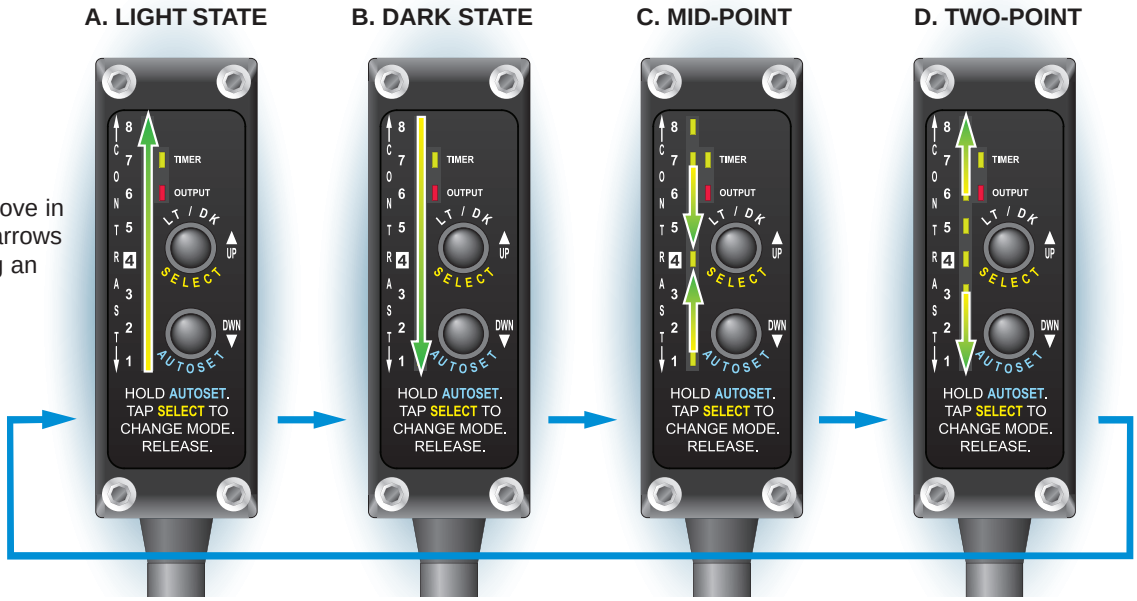
C. Mid-Point AUTOSET Mode – This mode is recommended for use in analog output applications only. With the luminescent material in view, the sensor samples the signal level from the target and sets the sensor at the switching threshold. The sensor's analog output then reflects the level of fluorescence as compared to the target…either higher or lower than the sampled signal level. This can be used as part of a feedback loop to maintain or control the flow of materials at an optimum level.



D. Two-Point AUTOSET Mode – Use this mode to establish upper and lower limits. When monitoring the target luminescence using the analog output, this mode will set your upper and lower control limits at specific points on the analog output scale. This is the most sensitive mode for detection of low contrast differences in two UV luminescent materials. An example would be glue on a white paper envelope, where both the glue and the paper have optical brighteners present.



NOTE: LEDs move in the direction of arrows when performing an AUTOSET



How to Specify

1. Select sensor model number required:
   UVS-1 through 6 (see Sensing Range Guidelines)*
2. Select Analog Output
   A = 4-20mA
   A5 = 0-5 VDC
   A10 = 0-10 VDC
3. Select window required:
   BLANK = ACRYLIC
   G = GLASS (chemical resistant)

**Note: Sensor selection should not be determined solely by range. It may be advisable to test multiple sensors or fiberoptic light guide tip configurations to ensure optimum performance.*

Example: UVS - 3 A10 G

- ***STEALTH-UV***®
- Model Selection
- Analog Output
- Window

Sensing Range Guidelines

*Catalog Listing	Digital Output	Analog Output	Supply Voltage	Min. Load Voltage Out	Max. Impedance Out	Focal Distance	Usable Range	Spot Size
UVS-1A	NPN/PNP	4-20mA	10 to 30 VDC	N/A	500 Ohms @ 12 VDC In	0.5 Inches	5 Inches	.067 Inches
UVS-1A5		0 to 5 VDC	10 to 30 VDC	1k Ohm	N/A			
UVS-1A10		0 to 10 VDC	15 to 30 VDC					
UVS-2A	NPN/PNP	4-20mA	10 to 30 VDC	N/A	500 Ohms @ 12 VDC In	1.0 Inches	7.5 Inches	.086 Inches
UVS-2A5		0 to 5 VDC	10 to 30 VDC	1k Ohm	N/A			
UVS-2A10		0 to 10 VDC	15 to 30 VDC					
UVS-3A	NPN/PNP	4-20mA	10 to 30 VDC	N/A	500 Ohms @ 12 VDC In	2.0 Inches	10 Inches	.128 Inches
UVS-3A5		0 to 5 VDC	10 to 30 VDC	1k Ohm	N/A			
UVS-3A10		0 to 10 VDC	15 to 30 VDC					
UVS-4A	NPN/PNP	4-20mA	10 to 30 VDC	N/A	500 Ohms @ 12 VDC In	4.0 Inches	13 Inches	.160 Inches
UVS-4A5		0 to 5 VDC	10 to 30 VDC	1k Ohm	N/A			
UVS-4A10		0 to 10 VDC	15 to 30 VDC					
UVS-5A	NPN/PNP	4-20mA	10 to 30 VDC	N/A	500 Ohms @ 12 VDC In	8.0 Inches	2 Inches To 2 Feet	1.0 Inch
UVS-5A5		0 to 5 VDC	10 to 30 VDC	1k Ohm	N/A			
UVS-5A10		0 to 10 VDC	15 to 30 VDC					
UVS-6A	NPN/PNP	4-2 mA	10 to 30 VDC	N/A	500 Ohms @ 12 VDC In	Dependent upon fiber optic selection	Up To 2.5 Inches	Dependent upon fiber optic selection
UVS-6A5		0 to 5 VDC	10 to 30 VDC	1k Ohm	N/A			
UVS-6A10		0 to 10 VDC	15 to 30 VDC					

Hardware & Accessories

Micro Cable Selection Guide, 5-wire, M12

GSEC-6
6' (1.8m) Shielded cable

GSEC-15
15' (4.6m) Shielded cable

GSEC-25
25' (7.62m) Shielded cable

GSEC-2MU
6.5' (2.0m) Unshielded

GSEC-5MU
16.4' (5.0m) Unshielded

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

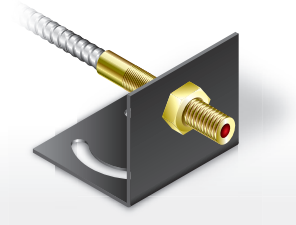
GRSEC-15
15' (4.6m) Right angle shielded cable

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

GX-25
25' (7.62m) Extension cable

Suggested fiber optic light guides for Stealth UV:

BF-U-36TUV
BF-A-36T
BF-C-36



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

SEB-4
Stainless Stealth Mounting Bracket

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC on A and A5 models
- 15 to 30 VDC for A10 models
- Polarity Protected

CURRENT REQUIREMENTS
- UVS-1A through 4A; 50mA max
- UVS-5A & 6A; 65mA max (exclusive of load)

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

ANALOG OUTPUT
- 4-20mA; 0-5 VDC; or 0-10 VDC

RESPONSE TIME
- 200µs for UVS-1A through 4A
- 750µs for UVS-5A
- 300µs for UVS-6A

AMBIENT TEMPERATURE
- -15°C to +70°C (5°F to 158°F)

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

CONNECTION TYPE
- 6" pigtail 5-Pin, M12 connector

PUSHBUTTON CONTROL
- AUTOSET pushbutton setup
- Tweak adjustments with "UP" or "DWN" buttons
- Selection of Light/Dark operation
- Enable/Disable pulse stretcher
- "Select" button scrolls thru four AUTOSET modes

DIAGNOSTIC INDICATORS
- Contrast Indicator – Display scaled reading of sensor's response to contrasting UV light levels (light vs. dark) on an 8 bar LED display
  Note: All 8 LEDs will flash three times if contrast insufficient or too low in Two-Point AUTOSET mode
- 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 15ms pulse stretcher timer is enabled

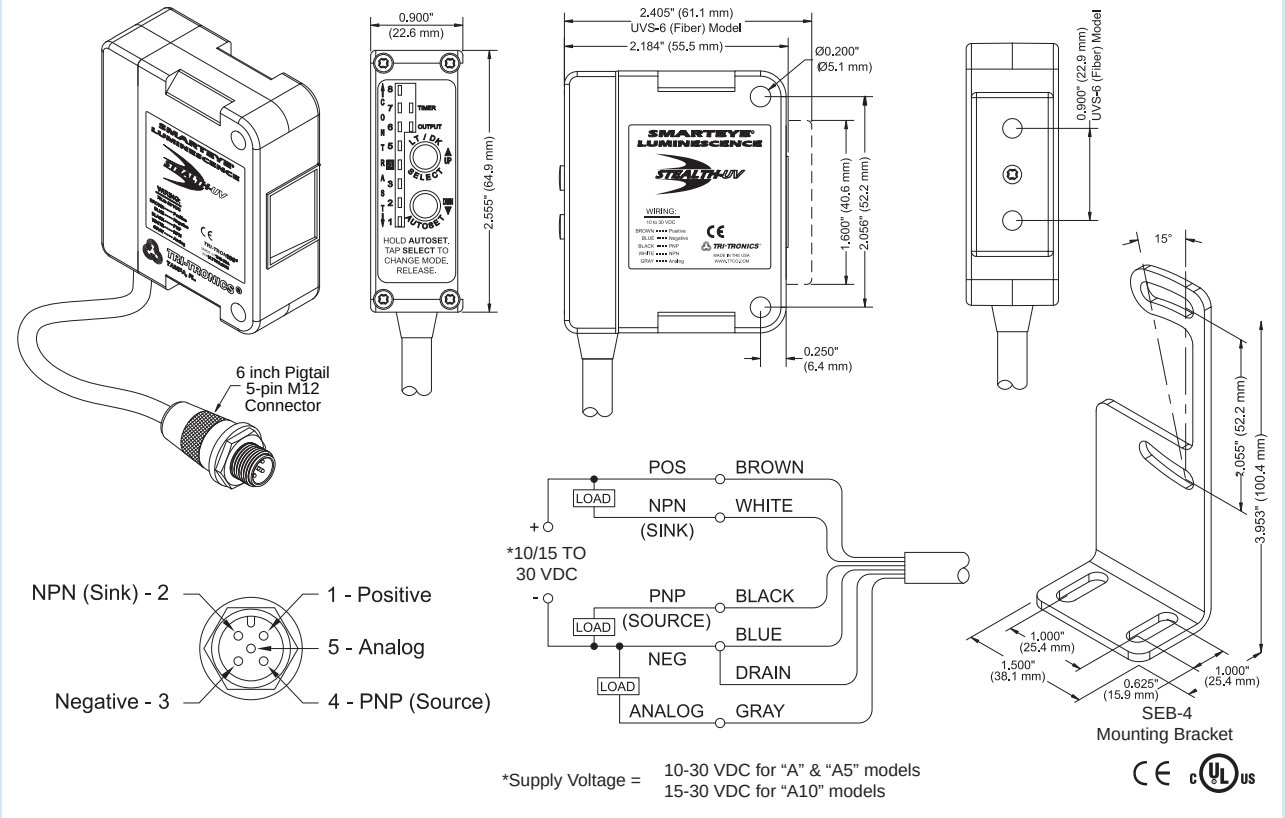
LIGHT SOURCE
- UV LED, 375nm Wavelength

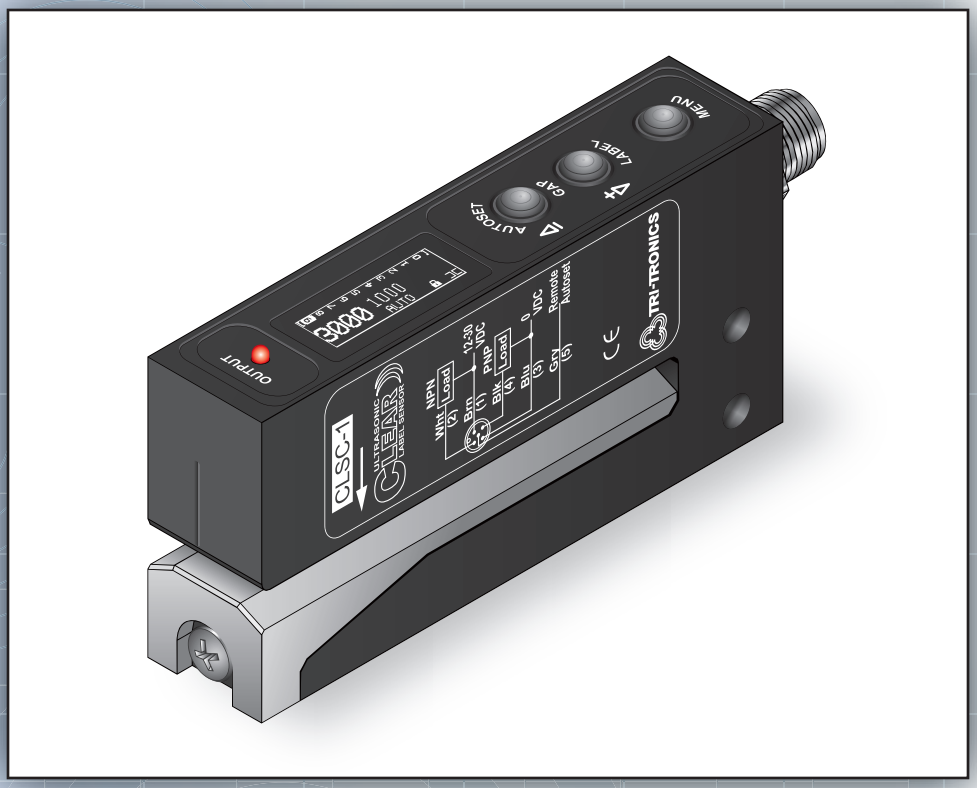
RUGGED CONSTRUCTION
- Chemical resistant high impact polycarbonate housing, acrylic or glass lens cover
- Industry Ratings: NEMA 4, IP67

CERTIFICATIONS
- UL, CE, RoHS

RoHS Compliant
Product subject to change without notice

Connections and Dimensions — SMARTEYE® *STEALTH-UV* Analog/Digital





Clear Label Sensor

ULTRASONIC CLEAR LABEL SENSOR

ULTRASONIC CLEAR LABEL SENSOR

Ultrasonic CLEAR LABEL Sensor

TRI-TRONICS® introduces the very first **Ultrasonic Clear Label Sensor** with a High Performance Graphic OLED display. The OLED display provides the user with an unprecedented view of the sensor's performance, options, program modes, and helpful simple instructions never before offered in a Clear Label Sensor. Designed into the sensor are all the Ease-of-Use characteristics that have made Tri-Tronics' sensors so well known in the industry.

The Ultrasonic Clear Label Sensor is the answer to what the industry has been asking for...

"a reliable, durable, high quality clear label sensor that provides visual confirmation of proper setup and function..." a simple solution, with the ability to accurately adjust for repeatable and reliable performance.

Now "CONFIDENTLY" walk away from the labeling line, "KNOWING" the throughput is at peak performance and trouble free.

Features

- OLED Alphanumeric Display
- 10 Bar Graphic Contrast Indicator
- Static and Dynamic Numerical Display
- One button AUTOSET (Gap Set)
- Tweak-able (Momentary Up/Down Adjustable)
- Available Timers and Delays
- Cable and Connector Version (M12 and M8)
- Removable Gap Plate
- High Speed (200µs) (1800'/548M per minute)
- Durable and Robust Housing
- Compatible with Existing Mounting Configurations

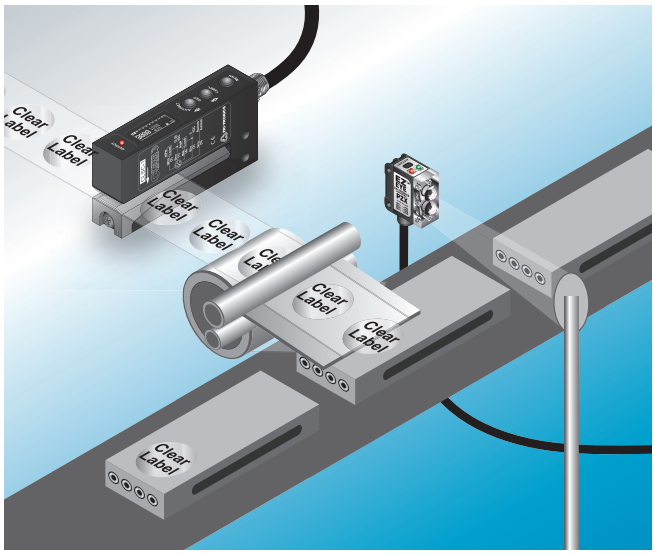
Benefits

- Easy to Set Up
- Highly Accurate and Precise
- Low Maintenance
- Affordable, Low-Cost Option
- Made in USA
- Durable and Reliable

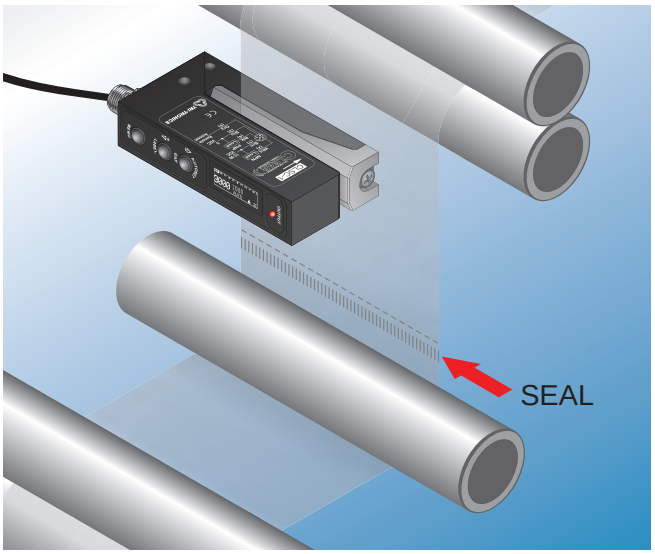
Applications

- Label Rewinding
- Label Applying
- Clear, Paper, Foil, or Mylar Labels
- Splice Detection
- Fold or Crease Detection

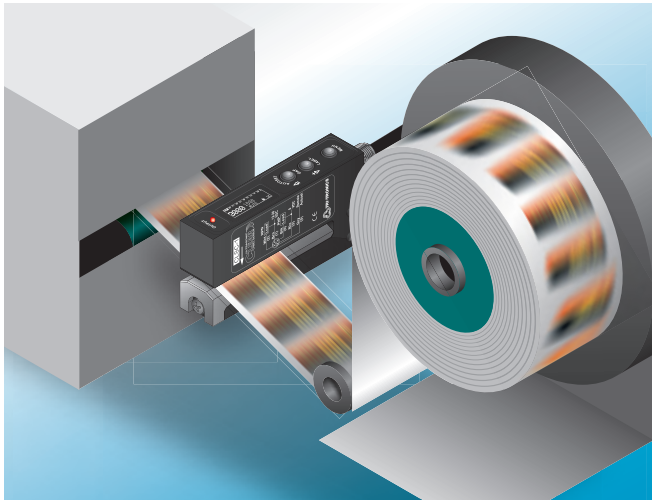
Applications



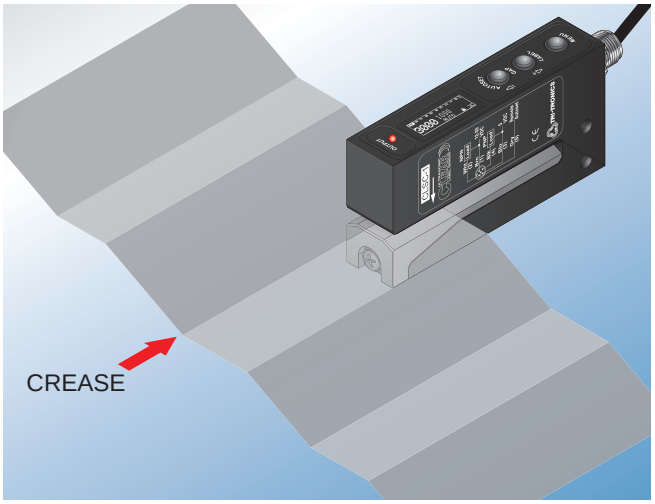
Clear Label Application



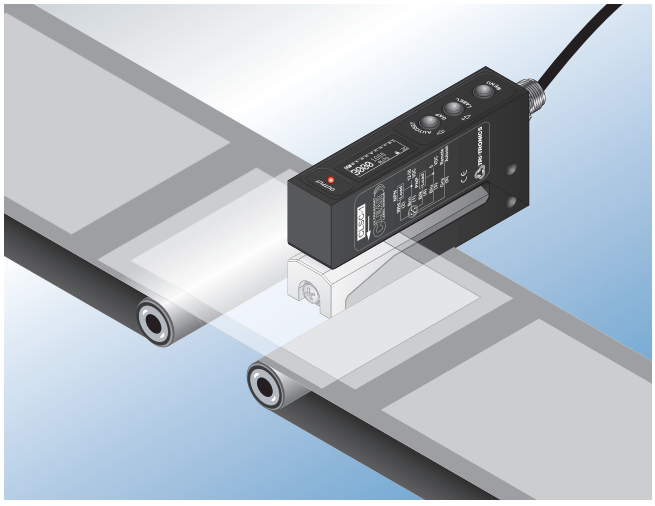
Heat Seal Detection



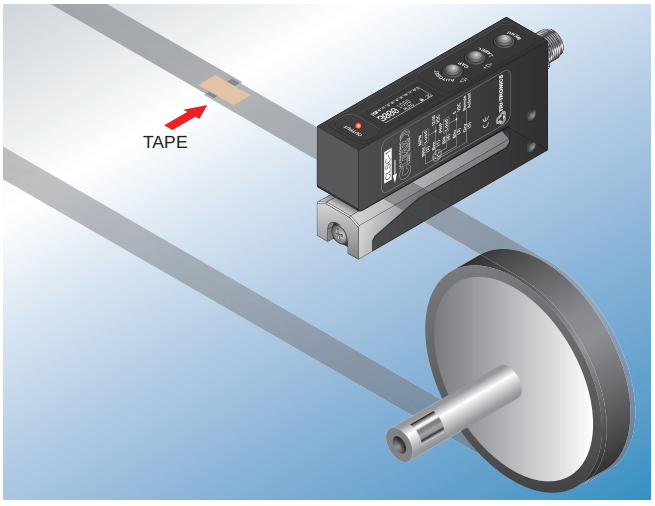
High Speed Rewinding...Clear, Metal Foil, or Paper Labels



Fold or Crease Detection



Double Sheet Detection

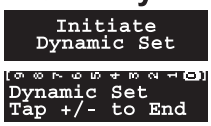


Splice Detection

Menu Options

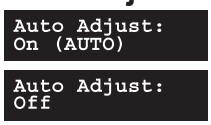
ULTRASONIC CLEAR LABEL SENSOR

Initiate Dynamic Set



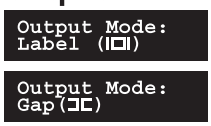
Dynamic Set is a convenient and easy way to set up the CLS sensor. Once initiated, simply pull labels and gaps through the sender receiver transducers and then push the Gap or Label button to complete. This feature is also available via the remote set wire. Dynamic Set is beneficial when holding the gap in place is not easily accomplished, or physical access to the sensor is not practical.

Auto Adjust



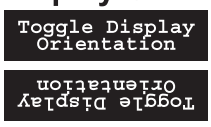
The Auto Adjust feature is helpful in applications with diminishing conditions...such as dirty or dusty environments, or with inconsistent label or web material thickness. This feature bumps up the gain automatically in order to maintain a functional and repeatable contrast between labels and gaps.

Output Mode



The Output Mode allows the user to decide which is more important to detect...the label or the gap. The leading or trailing edge of labels may be more desirable to receive an output in some applications than others. This option allows the user to make that determination and provides flexibility in real world conditions.

Display Orientation



For visual preference, the Display Orientation allows the user to flip the screen for a more user-friendly visibility.

Timer Mode *(**Advanced Option)*

The Timer Mode is offered as an Advanced Option. This feature provides users with the option to condition the output specifically for the application requirement.

Off Delay: Extends the Output Time.
On Delay: Extends the Input Time.
One Shot: Provides a defined Output "On" Time.
Debounce: Provides an Anti-Chatter timer.

Button Lockout

Button Lockout is useful for maintaining a set up without worry. This is tamper-proof, and reassures the continued performance of the sensor and up-time of the production line.

Quick Reference

Quick Reference was included as a way to visually instruct through the different set up options. This feature also includes contact information for the factory.

Sensor Scope *(**Advanced Option)*

The Sensor Scope is also an Advanced Option and allows the user to visually see how the sensor is detecting the target. Whether the labels or web materials are inconsistent, or noise issues occur occasionally, this feature clearly shows the user exactly where the problems are and how to resolve the issue quickly.

How to Specify

1. Select Sensor:
Ultrasonic Clear Label Sensor

2. Select Cable or Connector:
Blank = 6' (1.8m) Cable
C = Connector M12, 5-Pin (Standard)

3. Select Connector Type:
-1 = Standard M12 Connector (see #2). Includes both NPN and PNP
-1M8 = M8, 4-Pin Connector NPN/PNP Software Selectable
-1M8LE = Wired like LERC

NOTE: The M12 version is not wired the same as LERRC-M12.

Example: CLS C -1

Ultrasonic Clear Label Sensor

Blank = 6' Cable
C = Connector

-1
-1M8
-1M8LE

Features

OUTPUT INDICATORS
Red LED illuminates when when outputs are ON

Flashes when short circuit or overload detected

AUTOSET/GAP ⧋ BUTTON
1. Push and Hold with gap in view for 2 seconds for AUTOSET.
2. Tap for UP on Contrast Indicator, or reduce threshold.
3. Change settings in MENU options

AUTOSET/LABEL ± ▽ BUTTON
1. Push and Hold with label in view after GAP AUTOSET on rare occasions when labels have multiple layers.
2. Tap DOWN on Contrast Indicator, or increase threshold.
3. Change settings in MENU options

OLED NUMERICAL DISPLAY
1. 1 to 10 bar Contrast Indicator
2. Numerical display for threshold and feedback number
3. Options Status Display: Button Lock or Unlock (🔒); auto adjust on/off (AUTO); output in Gap(⊐⊏) or on Label (▭).
4. View Menu Options

MENU BUTTON
1. Push and Hold for 1 second to enter Menu Options.
2. Tap to scroll through Menu options.
3. Hold during power up for additional Menu Options; Timers and Factory Diagnostics (or sensor scope).

Hardware & Accessories

Micro Cable Selection Guide

Yellow Cable Assemblies 4-wire, M8

GEC-6
6' (1.8m) Cable with Connector

GEC-15
15' (4.6m) Cable with Connector

GEC-25
25' (7.62m) Cable with Connector

RGEC-6
6' (1.8m) Right Angle Cable with Connector

RGEC-15
15' (4.6m) Right Angle Cable with Connector

RGEC-25
25' (7.62m) Right Angle Cable with Connector

GEX-9
9' (2.7m) Extension Cable

Grey Cable Assemblies 5-wire, M12

GSEC-6
6' (1.8m) Shielded Cable

GSEC-15
15' (4.6m) Shielded Cable

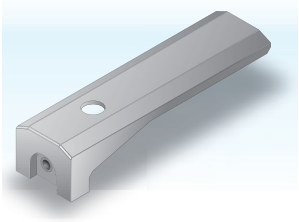
GSEC-25
25' (7.62m) Shielded Cable

GRSEC-6
6' (1.8m) Right Angle Shielded Cable

GRSEC-15
15' (4.6m) Right Angle Shielded Cable

GRSEC-25
25' (7.62m) Right Angle Shielded Cable

GX-25
25' (7.62m) Extension Cable



CLS-GP
Gap Plate

Specifications

ULTRASONIC CLEAR LABEL SENSOR

SUPPLY VOLTAGE
- 12 to 30 VDC
- Polarity Protected
  Note: For use in Class 2 Circuits

CURRENT REQUIREMENTS
- 95mA @ 12 VDC, 45mA @ 30 VDC

DIGITAL OUTPUTS
- (1) NPN and (1) PNP open collector output 150mA Max; <2V Residual Voltage
  (Note: On CLSC-1M8, NPN & PNP are software selectable).
- All outputs are continuously short circuit protected

REMOTE AUTOSET INPUT
- Momentary sinking or sourcing input; 1.2mA max; Software Selectable

DIAGNOSTIC INDICATORS
- OLED Graphic Display - Includes Contrast Indicator, Numerical Display, Set Point and Trigger Point, and all sensor options and modes.
- Red LED Output Indicator– Illuminates when the sensor's output transistors are "ON".
  Note: If output LED flashes on power up, a short circuit condition exists.

PUSHBUTTON CONTROL
- Three (3) push button controls
- Gap (for Gap AUTOSET)
- Label (for multi-layered labels)
- Menu (for accessing Options)

HYSTERESIS
- Dynamic – adjusted by AUTOSET

RESPONSE TIME
- 200µs

REPEATABILITY
- 125µs

AMBIENT TEMPERATURE
- 4°C to 50°C (39°F to 122°F)

RUGGED CONSTRUCTION
- Chemical resistant, high impact Aluminum housing
- Waterproof ratings: NEMA 4X, 6P and IP65
- Conforms to heavy industry grade CE requirements

THRESHOLD SET
- 1-Point, 2-Point, or Dynamic AUTOSET; manually or remotely.

THRESHOLD ADJUST
- Manual or AUTO Adjust

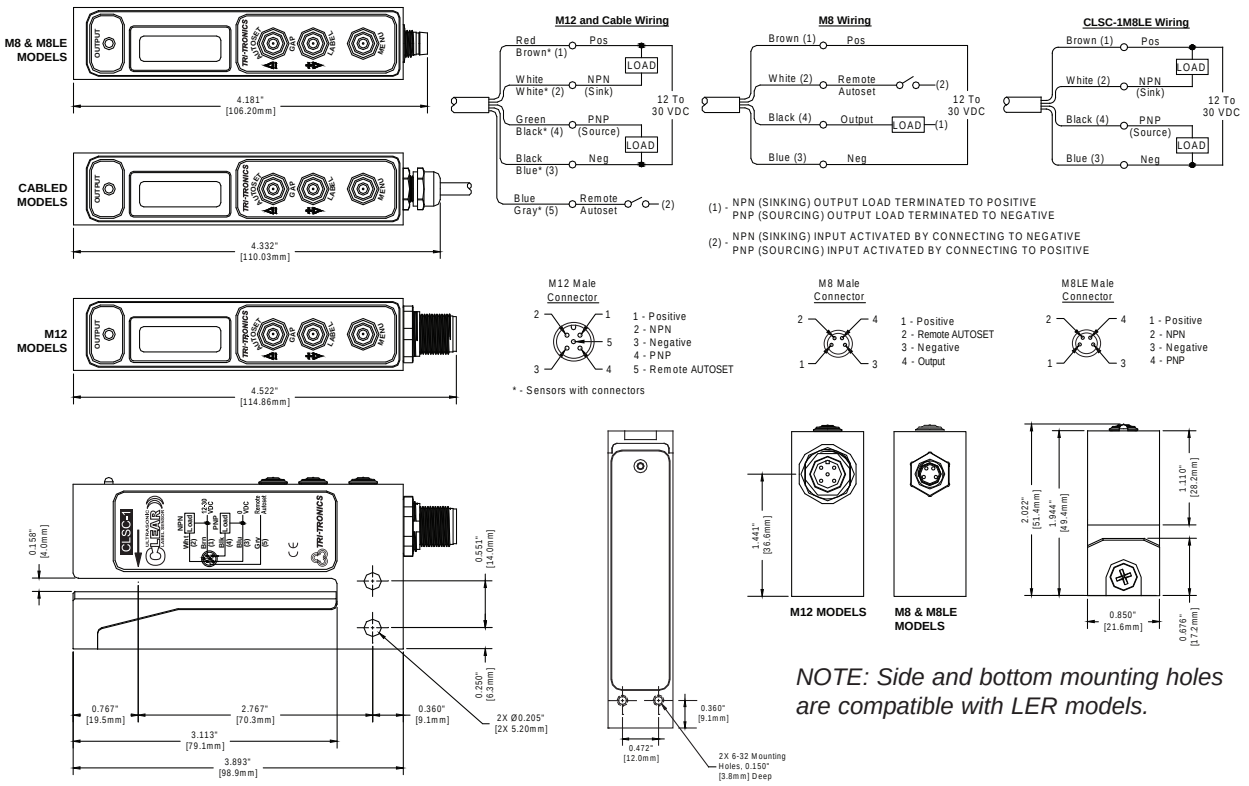
OUTPUT TIMERS
- On Delay, Off Delay, One Shot, or Debounce (Advanced Option, software selectable).

CONNECTOR
- M12 5-Pin, M8 4-Pin, or 6' (1.8m) Shielded Cable

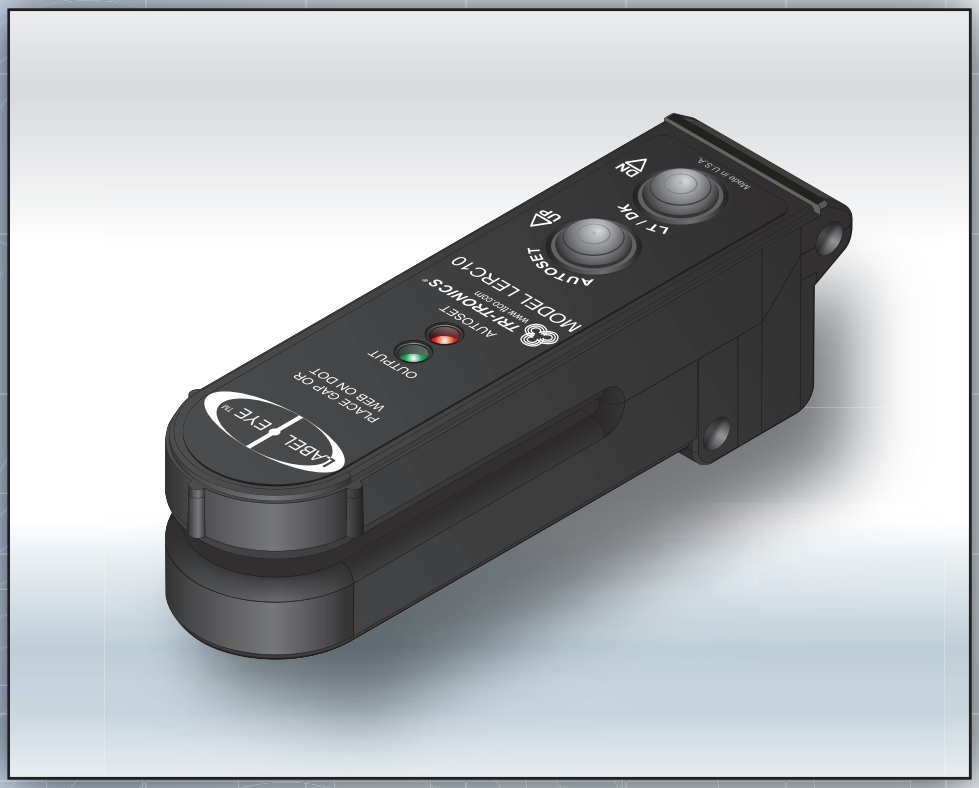
RoHS Compliant
Product subject to change without notice

Connections and Dimensions

Ultrasonic Clear Label Sensor



NOTE: Side and bottom mounting holes are compatible with LER models.



High Speed Label Sensor

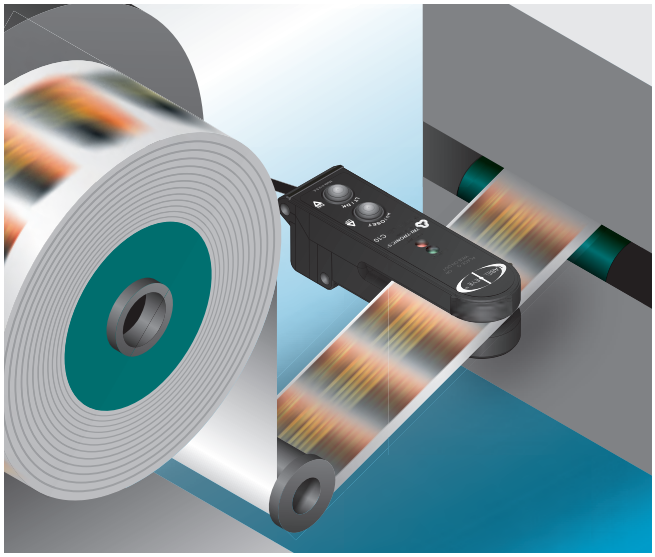
LABEL EYE®

Ultra-High Speed LABEL•EYE

The **Ultra-High Speed LABEL•EYE** was specifically designed to overcome issues of speed and accuracy that are common in label applying, counting, printing, and inspecting. Designing a sensor that is accurate within just .004" at 2000 feet per minute is no small feat. This American designed and manufactured sensor also is the most affordable product in its class... starting at just under $150. It is the most economical solution as well as the most robust.

If the application is to print a date code in a small white box on a label, or on a web, there is no simpler product available at this speed and price. From start up speed to top line speeds, the **Ultra-High Speed LABEL•EYE** doesn't miss a single label, nor will it have to be adjusted for print migration/drifting or label landing inconsistency... it is just that repeatable.

If the overall cost of your current solution is less than desirable and expensive high speed label sensors provide an unreliable result, then applying the **Ultra-High Speed LABEL•EYE** should provide the worry free, reliable, and high level production accuracy desired.



Label Rewinding

Features

- 10 microseconds Response Time
- 5 microseconds Repeatability
- One Button AUTOSET
- Tweak-able Up/Down Adjustment
- M12, M8, or Cable Models
- Robust Electrical and Mechanical Design
- Remote AUTOSET on M12 Models
- Waterproof

Benefits

- Easy to Set Up
- Highly Accurate and Precise
- Low Maintenance
- Affordable, Low-Cost Option
- Made in USA
- Durable and Reliable

Applications

- Label Rewinding
- Label Applying
- Splice Detection
- High Speed Counting
- Perforation Detection
- Weld Seam Detection
- Registration Mark Sensing

How to Specify

1. Select Sensor:
Ultra-High Speed LABEL•EYE
LERC10 = Red LED, 4-pin M8 Connector
LERR10 = Red LED, 5 Conductor, 6 ft. (1.8m) Cable
LERRC10-M12 = Red LED, 5-Pin, M12 Connector

2. Select Cable or Connector:
Blank = 6 foot (1.8m) Cable
C = 6 inch (152mm) pigtail with 5-pin connector
(accessory cable required)

Example: LER R C10 -M12

- LER — **LABEL•EYE®** with Red LED
- R — Remote AUTOSET
- C10 — Connector, Blank = 6 ft. Cable
- M12 - Connector Type

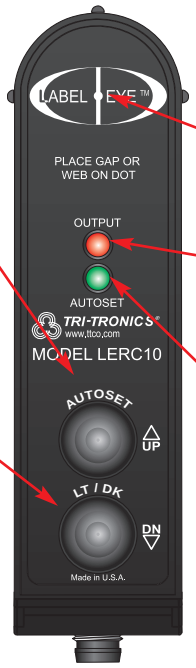
Features

LOCATOR TABS
Help to center gap for proper detection

AUTOSET BUTTON
1. Hold AUTOSET for 1 second when gap is in view.
2. Tap UP to increase time from threshold (less sensitive).

LT/DK BUTTON
1. Hold for 1 second to switch from Light on Output to Dark on Output.
2. Tap DN to decrease time to threshold (more sensitive).

NOTE: Optimized for opaque label sensing.



CENTER of DETECTION
This point marks the exact center of light source and receiver through-beam.

RED LED OUTPUT INDICATOR
Illuminates when output is on
Flashes when sensor is shorted or overloaded

GREEN LED AUTOSET
Flashes rapidly during AUTOSET, for about 1/2 a second, and remains illuminated when complete
Flashes rapidly during AUTOSET, for about 1 second, and then flashes slowly with red LED Output Indicator four times when AUTOSET incomplete

Hardware & Accessories

Micro Cable Selection Guide

Yellow Cable Assemblies 4-wire, M8

GEC-6
6' (1.8m) Cable with Connector

GEC-15
15' (4.6m) Cable with Connector

GEC-25
25' (7.62m) Cable with Connector

RGEC-6
6' (1.8m) Right Angle Cable with Connector

RGEC-15
15' (4.6m) Right Angle Cable with Connector

RGEC-25
25' (7.62m) Right Angle Cable with Connector

GEX-9
9' (2.7m) Extension Cable

Grey Cable Assemblies 5-wire, M12

GSEC-6
6' (1.8m) Shielded Cable

GSEC-15
15' (4.6m) Shielded Cable

GSEC-25
25' (7.62m) Shielded Cable

GRSEC-6
6' (1.8m) Right Angle Shielded Cable

GRSEC-15
15' (4.6m) Right Angle Shielded Cable

GRSEC-25
25' (7.62m) Right Angle Shielded Cable

GX-25
25' (7.62m) Extension Cable

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45mA (exclusive of load)

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

RESPONSE TIME
- 10 microseconds response time
- 5 microseconds repeatability

PUSH BUTTON CONTROL
- AUTOSET - One-push button setup
- LT/DK - Push and Hold to change output Light On/Dark On
- UP/DWN - Tweak-able Up/Down Adjustment

LED LIGHT SOURCE
- High intensity red LED
- Pulse modulated

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".

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

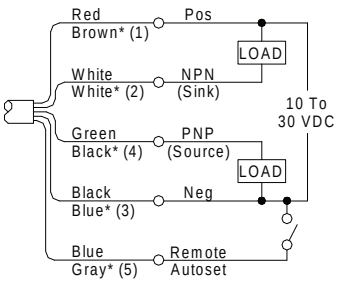
RUGGED CONSTRUCTION
- Chemical resistant high thermoplastic PPS housing
- Waterproof, ratings: NEMA 4 and IP66
- Conforms to heavy industry grade CE and UL requirements

RoHS Compliant
Product subject to change without notice

Connections and Dimensions

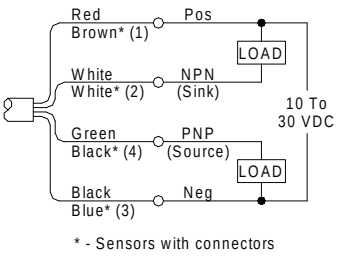
Ultra-High Speed LABEL•EYE

Label Eye Wiring (Remote Set)



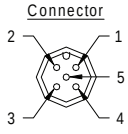
* - Sensors with connectors

Label Eye Wiring (Standard)



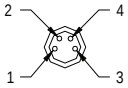
* - Sensors with connectors

M12 Male Connector

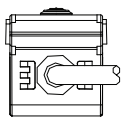


1 - Positive
2 - NPN
3 - Negative
4 - PNP
5 - Remote Autoset
(Pin 5 not present on non-Remote models)

M8 Male Connector

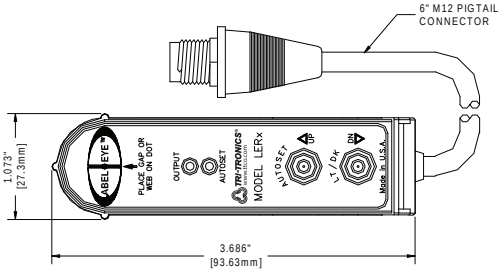


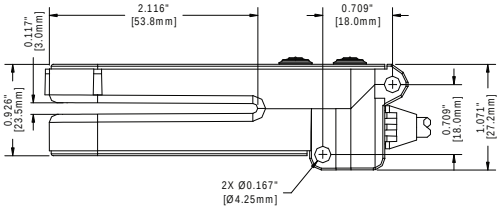
1 - Positive
2 - NPN
3 - Negative
4 - PNP

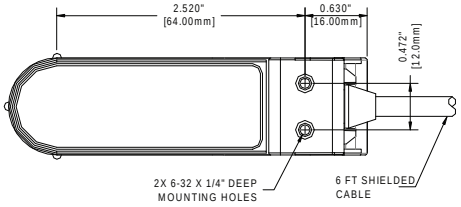


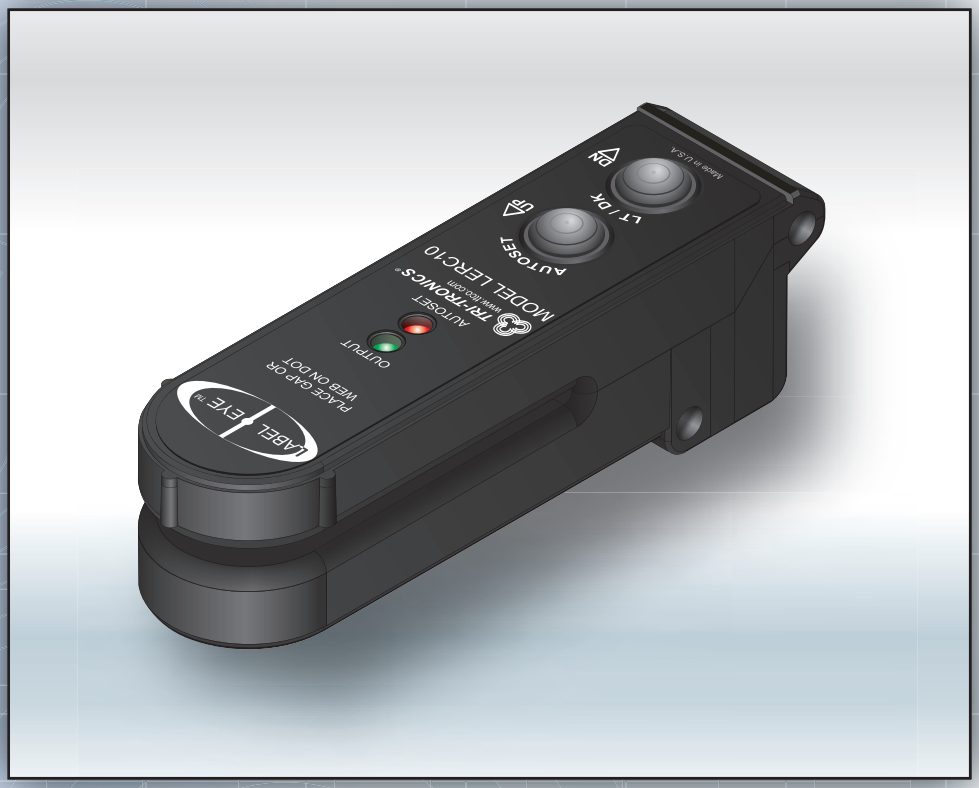
CABLE / M12
REAR VIEW

M8
REAR VIEW









Label Sensor

Label Sensor

The **LABEL•EYE®** is a photoelectric sensor designed specifically to sense labels on a roll. Since the LABEL•EYE® is a one-touch AUTOSET 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 "Normal" or "Translucent" button. The sensor does the rest, adjusting itself to the perfect setting. Sensing labels has never been easier.

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 peels 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 such as edge guiding, small parts counting, and splice detection.

Features

- 100µs response time
- Two AUTOSET Modes: Normal or Translucent
- Cable and quick disconnect models
- NPN and PNP outputs
- One button AUTOSET

Benefits

- Easy to Setup
- Accurate and repeatable
- Easy to mount
- Common style and configuration for compatibility

Applications

- Double sheet detection
- Envelope contents sensing
- Edge guiding
- Splice detection
- Label counting
- Winder, re-winder
- Die cutter
- Label hot-printing
- High speed dispensing

How to Specify

1. Select sensor model number required:

2.

Model Numbers	Description
LER	Red LED, 4 conductor, 6 ft (1.8m) cable
LERC	Red LED, 4-pin M8 connector
LERR	Red LED, 5 conductor, 6 ft (1.8m) cable
LERRC-M12	Red LED, 5-pin M12 pigtail connector
LERC-M12	Red LED, 4-pin M12 pigtail connector

Example: LER R C - M12

- **LABEL•EYE®** with Red LED
- Remote AUTOSET
- Connector, Blank = 6 ft. Cable
- M12 - Connector Type

Features

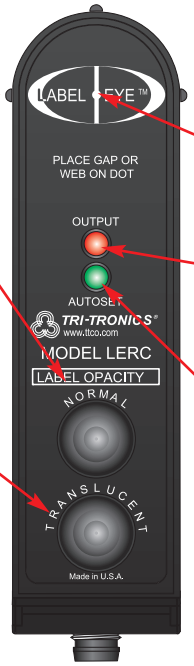
One button AUTOSET!

LOCATOR TABS
Help to center gap for proper detection

NORMAL BUTTON
1. AUTOSET: Press and hold for 1 second when backing is paper, mylar, plastic, or opaque material.
2. Hold down both buttons for 2 seconds to change output from Dark On to Light On.

TRANSLUCENT BUTTON
1. AUTOSET: Press and hold for 1 second when backing is translucent or transparent.
2. Hold down both buttons for 2 seconds to change output from Dark On to Light On.

NOTE: Optimized for opaque label sensing.



CENTER of DETECTION
This point marks the exact center of light source and receiver through-beam.

RED LED OUTPUT INDICATOR
Illuminates when output is on
Flashes when sensor is shorted or overloaded

GREEN LED AUTOSET
Flashes rapidly during AUTOSET, for about 1/2 a second, and remains illuminated when complete
Flashes rapidly during AUTOSET, for about 1 second, and then flashes slowly with red LED Output Indicator four times when AUTOSET incomplete

Hardware & Accessories

Micro Cable Selection Guide

Yellow Cable Assemblies 4-wire, M8

GEC-6
6' (1.8m) Cable with Connector

GEC-15
15' (4.6m) Cable with Connector

GEC-25
25' (7.62m) Cable with Connector

RGEC-6
6' (1.8m) Right Angle Cable with Connector

RGEC-15
15' (4.6m) Right Angle Cable with Connector

RGEC-25
25' (7.62m) Right Angle Cable with Connector

GEX-9
9' (2.7m) Extension Cable

Grey Cable Assemblies 5-wire, M12

GSEC-6
6' (1.8m) Shielded Cable

GSEC-15
15' (4.6m) Shielded Cable

GSEC-25
25' (7.62m) Shielded Cable

GRSEC-6
6' (1.8m) Right Angle Shielded Cable

GRSEC-15
15' (4.6m) Right Angle Shielded Cable

GRSEC-25
25' (7.62m) Right Angle Shielded Cable

GX-25
25' (7.62m) Extension Cable

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP output transistors
- Sensor outputs can sink or source up to 150mA (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.

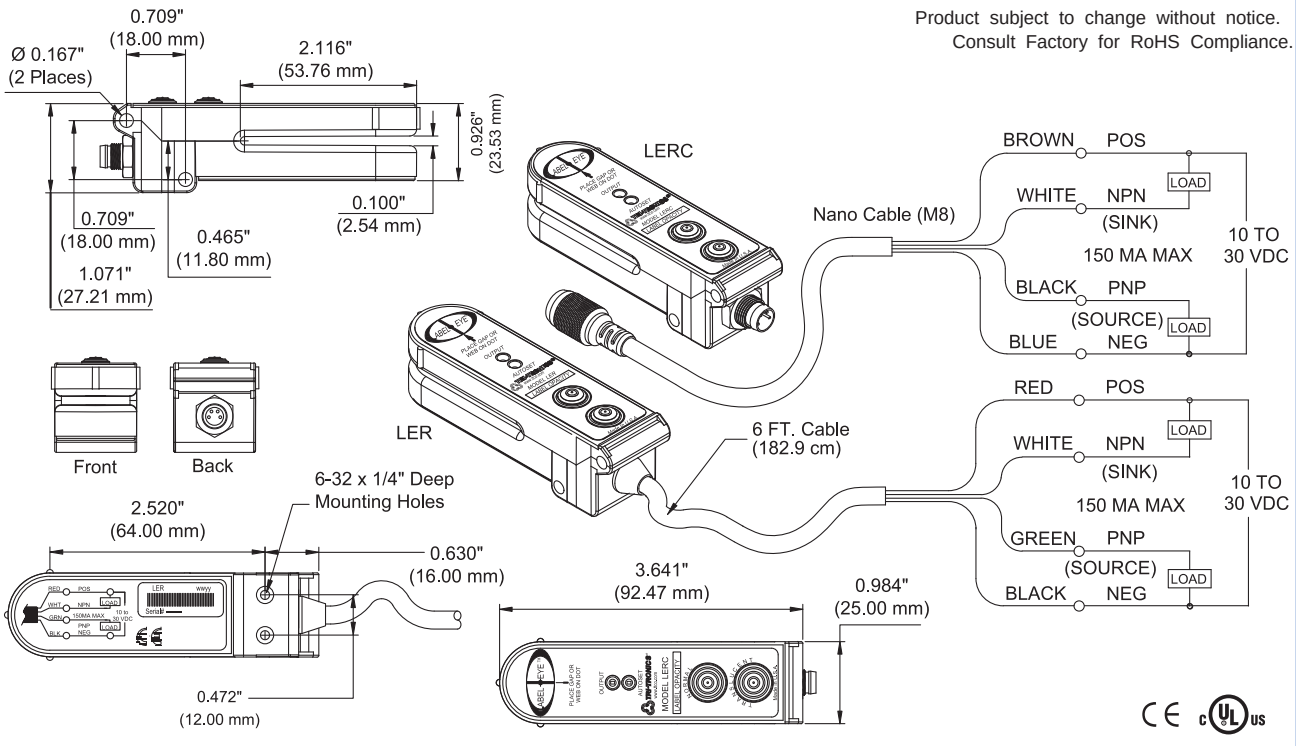
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

RUGGED CONSTRUCTION
- Chemical resistant high thermoplastic PPS housing
- Waterproof, ratings: NEMA 4 and IP66
- Conforms to heavy industry grade CE and UL requirements

RoHS Compliant
Product subject to change without notice

Connections and Dimensions LABEL•EYE®

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



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High Intensity Through Beam Sensor

SMARTEYE®

High Intensity Through Beam Sensor

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.

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.

The *SMARTEYE*®, High Intensity, Through Beam sensors can be used with or without optical blocks, or in combination with fiber optic light guides. The fiber optic light guides help narrow the focus of the detector or light source, providing for a more precise concentration of light in applications requiring more pinpoint targeting.

Features

- 2 or 10 LED infrared light source
- 10-LED contrast indicator
- Screwdriver adjustable Offset
- Fiber optic or lensed models
- Asynchronous light source

Benefits

- Penetrates through many opaque objects and cartons
- Easy to align and adjust
- Flexible available configurations
- Uses standard fiber optic mounting and tip configurations

Applications

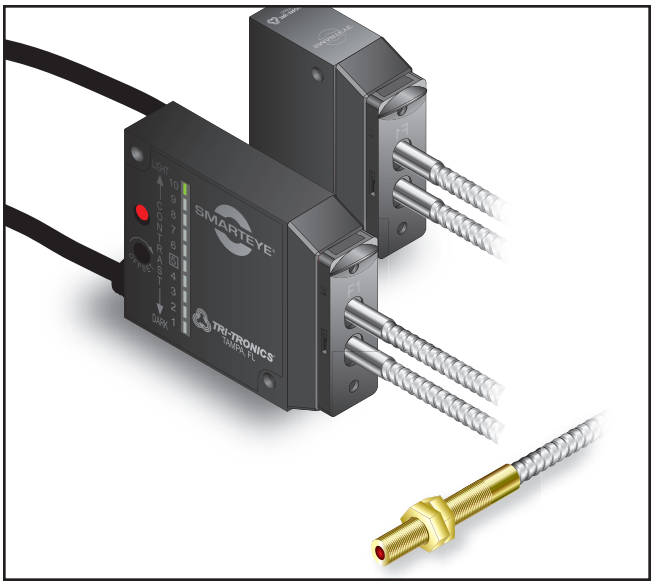
- Paper box contents verification/inspection
- Opaque liquid level detection
- Paper insert/instruction verification/inspection
- Paper box contents orientation
- Able to penetrate easily through dirty and dusty environments

Applications

FIBEROPTIC BEAM BREAK DETECTION

Dual LED Light Source Model SLS-2F1 and Dual Detector Receiver Model SR-2F1.

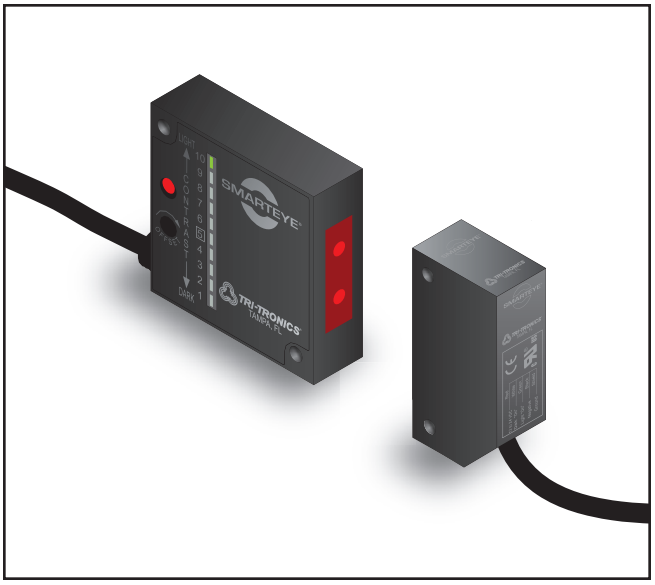
Type F1 allows the use of our fiberoptic light guides. Utilizing a bifurcated light guide, the light energy available from the two LED light sources is used to create a very high intensity light beam. The Dual Detector receiver can be used with one bifurcated light guide and one or two straight light guides.



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.

How to Specify

Light sources and receivers are not furnished in pairs, and they must be ordered separately.

Receiver

1. Select NPN or PNP Transistor Output:
   Blank = NPN
   P = PNP
2. Select sensor model number required:
   SR-1 = Use with no optical block
   SR-2 = Use with F1 or R1 optical block
3. Select Block:
   Blank = No block
   F1 = Fiber Optic
   R1 = Long Range Lens

Example: P SR-1 R1

- P — PNP / NPN
- SR-1 — ***SMARTEYE®*** Receiver
- R1 — Optical Block

Light Source

1. Select sensor model:
   SLS-1 = Use with no optical block
   SLS-2 = Use with F1 or R1 optical block
   HSLS-12 = Use with no optical block
2. Select Block:
   Blank = no block
   F1 = Fiber Optic block
   R1 = Long Range block

Example: SLS-1 R1

- SLS-1 — ***SMARTEYE® High Intensity*** Llight Source
- R1 — Optical Block

Sensing Range Guidelines

1 in. = 25.4mm / 1 ft. = 0.3048 meters

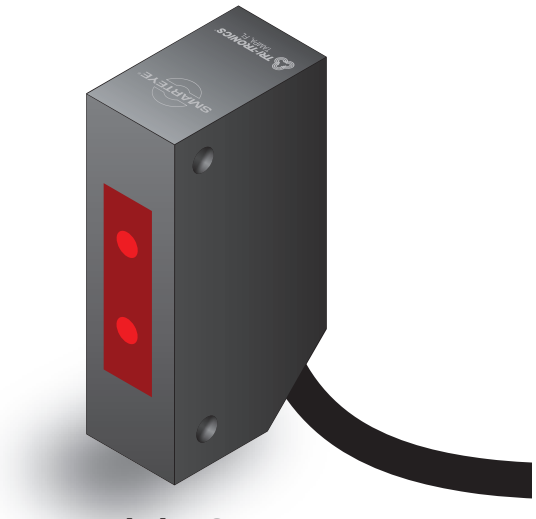
Light Source Model #	Receiver NPN Model #	Receiver PNP Model #	Range Guidelines	Applications
High Intensity				
SLS-1	SR-1	PSR-1	Up to 12 in.	Short range, high power opacity sensing. Use in shortest range possible for maximum penetration.
SLS-2R1	SR-2R1	PSR-2R1	Up to 100 ft.	Long range, Beam Break object sensing.
SLS-2F1	SR-2F1	PSR-2F1	Up to 3 ft.	Short range fiberoptic Beam Break sensing.
(with fiberoptic light guide)			without lens	
			Up to 18 ft.	Long range fiberoptic Beam Break sensing. Using 2 UAC-15 lenses.
			with lens	
Super High Intensity				
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.

Sees through many packages

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

Specifications



Receiver Specifications

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity protected

CURRENT REQUIREMENTS
- 50mA (exclusive of load)

OUTPUTS
- Complementary NPN or PNP output transistors sink/source up to 100mA

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 65mA
- HSLS-12 light source 70mA

LED LIGHT SOURCE
- Infrared = 880nm wavelength
- Model SLS, 2 LEs;D ’Model HSLS-12, 10 LED’s

AMBIENT TEMPERATURE/RH
- -40°C to 70°C (-40°F to 158°F)
- 95% relative humidity

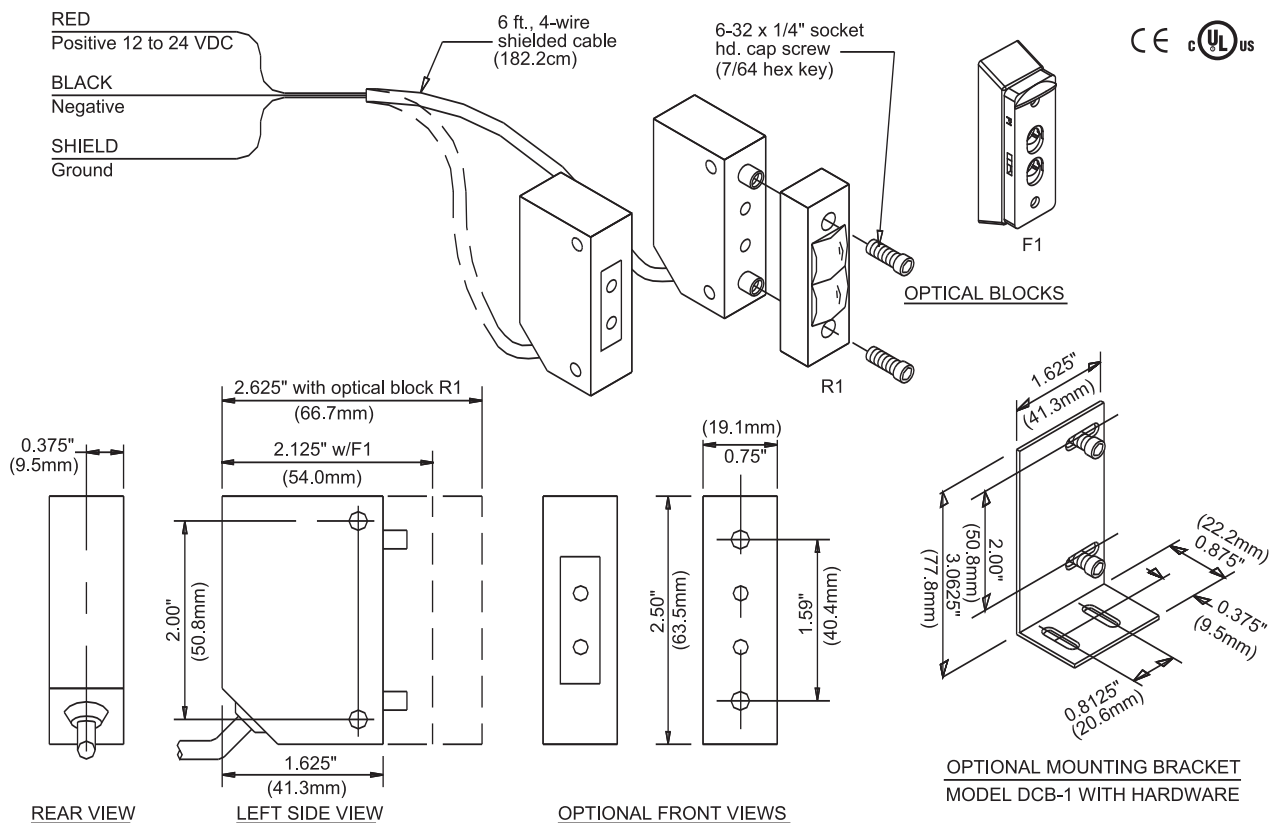
RUGGED CONSTRUCTION
- High-impact plastic case is dirt and moisture sealed
- Epoxy encapsulated for mechanical stability

See drawings on the next page.

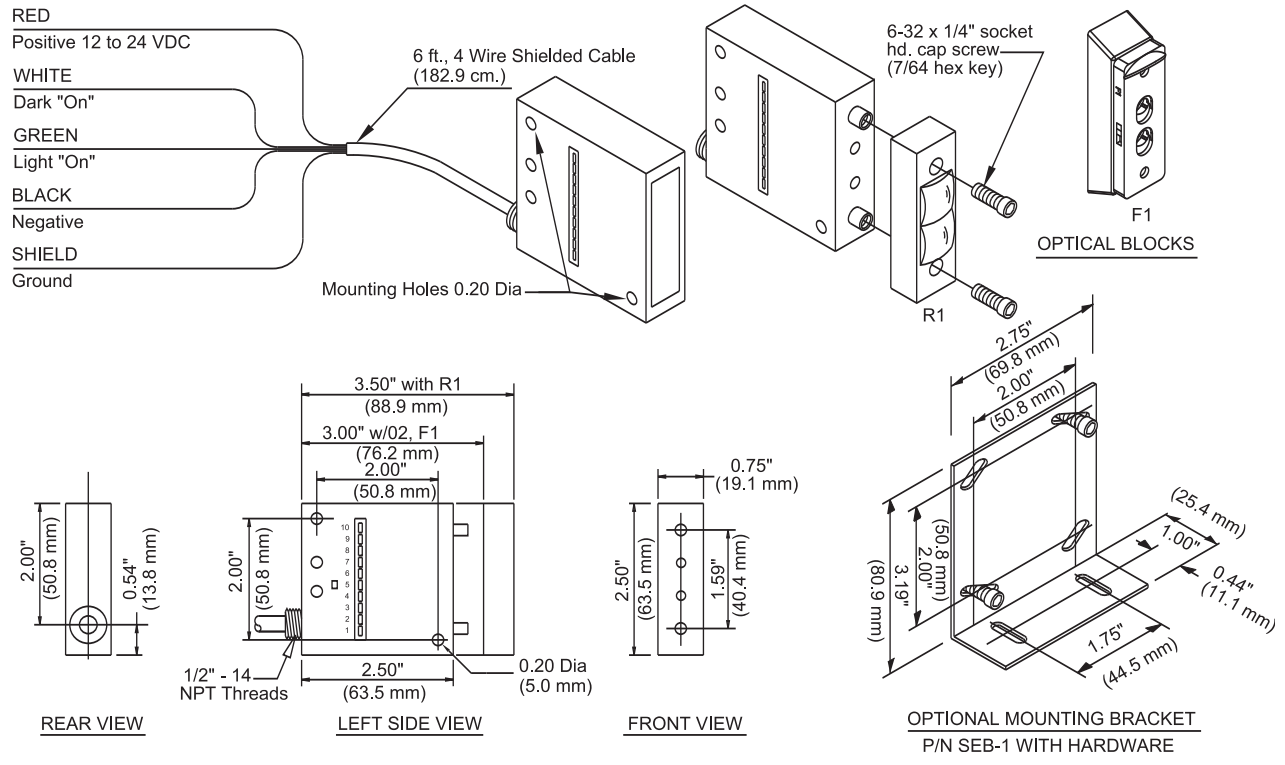
RoHS Compliant
Product subject to change without notice

High Intensity

High Intensity Light Source/Receiver Models



Dual Detector Receivers



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XP10 – Extremely High Speed Sensor

SMARTEYE® X-PRO

Extremely High Speed (10µs) Photoelectric Sensor

The *SMARTEYE*® X-PRO XP10 is the highest speed (10µs) dual-function sensor in the world. This dual-function sensor is designed to be a precision registration mark sensor with 5µs repeatability, and a standard photoelectric sensor for any high speed application, in one package.

Mark Mode allows the user quick and easy set-up for detection of registration marks by performing an AUTOSET with the background in view. When in Mark Mode, the sensor will automatically configure to give an output on the mark.

Standard Mode allows the user independent control of the AUTOSET mode, (Light State or Dark State), and output, (Light ON or Dark ON). Standard Mode provides the greatest flexibility for general purpose applications.

Five Memory Locations are available to be used in either Mark Mode or Standard Mode when the Enable option is selected. These Memory locations can store all options and AUTOSET settings for up to five different application requirements. This Memory feature allows fast changeover when running several different types of materials on the same machine. Additionally, when the Enable option is selected, the sensor has the ability to be programmed by a PLC or other device via the Remote AUTOSET input wire. You can access any option, Memory location, or AUTOSET routine through this uniquely designed input feature.

No other sensor in the world gives you these high performance features packaged together in one compact design. The *SMARTEYE*® X-PRO XP10 photoelectric sensor from Tri-Tronics is the most comprehensive sensor available in its class.

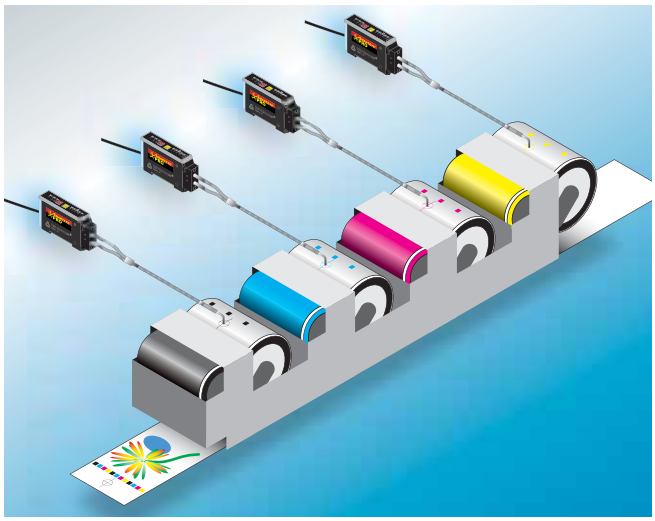
Features

- 10µs Response Time
- 5µs Repeatability
- Dual-Function Sensor
  - Mark Mode – For Registration
  - Standard Mode – Object Sensing
- 5 Memory Locations
- External Programming Through the Remote Input Line
- Connector or Cabled Version
- Available in White, Red and Infrared LED
- Patents No. 5,621,205 and No. 6,950,778
- AUTOSET - One-Touch Setup
- 10-LED Dual-Function Bar Graph

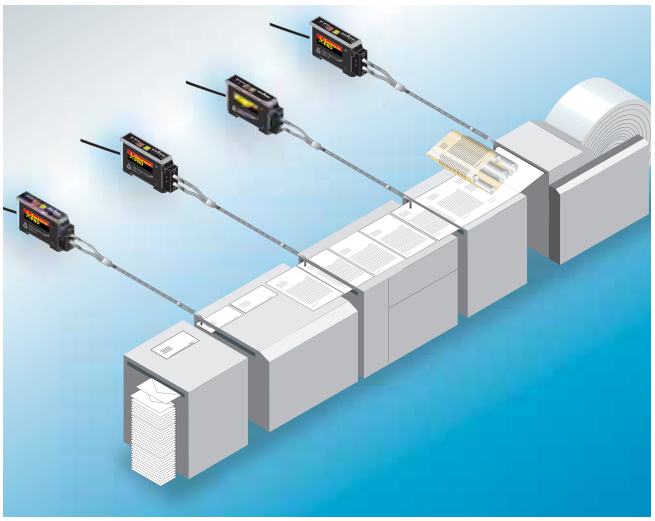
Benefits

- Increase Edge Accuracy at All Speeds
- Virtually Eliminate Setup Time
- Reduce Material Scrap
- Eliminate Compensation Software
- Repeatable Leading Edge or Trailing Edge Accuracy Consistently at 5µs
- Increase Throughput Capacity
- Eliminate Machine Speed Constraint

Applications

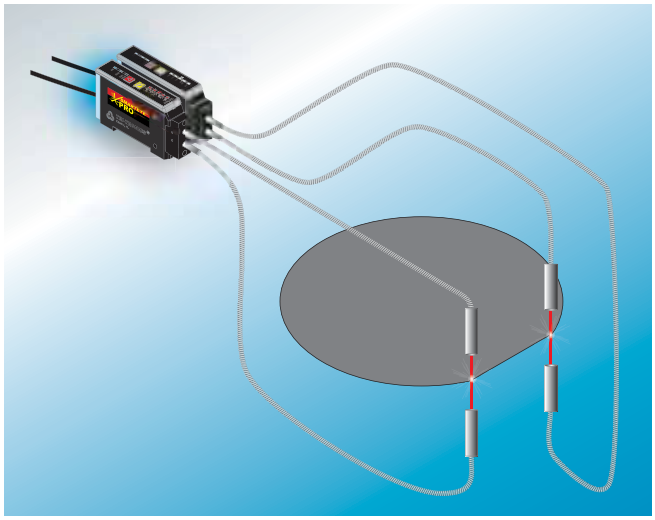


High Speed Offset Printing

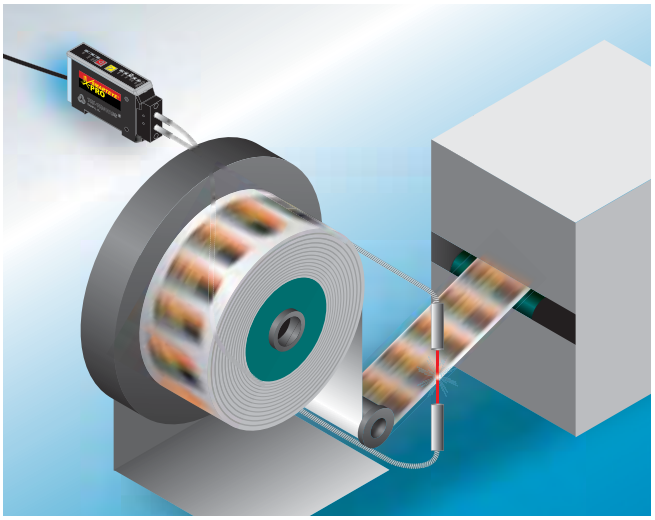


High Speed Paper Converting

When Timing is Everything!



High Speed Edge Detecting



High Speed Label Rewinding

Features

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. Oftentimes, in dynamic operating conditions, all you have to do is push the button for a perfect setting. This is dependent upon at least a 4:1 duty cycle ratio.

AUTOSET/ REMOTE PROGRAMMING (Patent No. 6,950,778)
Remotely AUTOSET or program the sensor's multiple options by applying a sequential momentary contact closure from the AUTOSET input wire to negative as shown in the wiring diagram. The remote AUTOSET command will duplicate the last manual AUTOSET.

EDR® (Patent No. 5,621,205)
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.

10 LED DUAL-FUNCTION BAR GRAPH
Contrast Indicator – Provides "at-a-glance" performance data.
Status Indicator – Displays status of selectable options:
Lock – When this option is enabled the sensor becomes tamperproof.
Note: The Remote AUTOSET and Remote Programming are not affected by the Lock option.
Mark - When this feature is enabled, the sensor buttons function like a MARK•EYE® PRO: Push and hold yellow button for light background and red button for dark background.
Pulse Stretcher (PS) – When the "OFF" delay pulse stretcher is enabled, the output duration is extended by 10 or 20 milliseconds (not additive). Enabling the Timer allows ample time for the controller to respond. The time durations of the gap between marks must be longer than the selected delay.
Enable – This option provides access to MEM-1 thru MEM-5 locations and enables remote programming.
NOTE: Any changes to the sensor will automatically be saved to current MEM # location.

HIGH SPEED
10µs response time when responding to light or dark state.
5µs repeatability.

CONNECTIONS
Built-in 5-pin M12 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: Option Status Indicator of ten selectable options

#10 LOCK
Tamperproof Operation

#9 MARK
When illuminated – "ON" = Mark Mode
When not illuminated – "OFF" = Standard Mode

#8, #7 PULSE STRETCHER (PS)
10 or 20 Millisecond Pulse Stretcher "OFF"Delay

#6 ENABLE
Illuminates when advanced features are enabled...MEM 1 - MEM 5 and Remote Programming

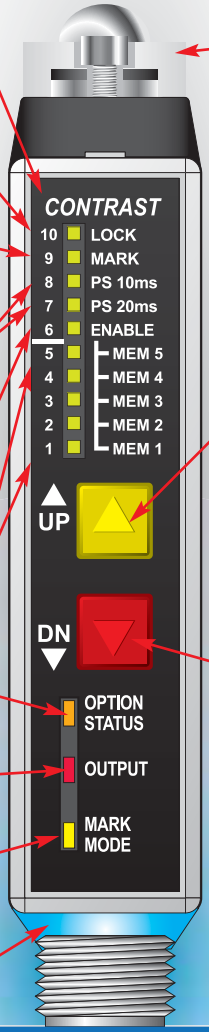
#5 – #1 MEMORY (MEM)
Illuminates to Indicate Active Memory

OPTION STATUS INDICATOR
Illuminates when in Option Status Mode

OUTPUT INDICATOR
Illuminates when Output is "ON"

MARK MODE INDICATOR
Illuminates when Mark Mode is enabled

LARGE HIGH VISIBILITY OUTPUT INDICATOR
Illuminates when Output is "ON"



10 INTERCHANGEABLE OPTICAL BLOCKS
1. O4 (Wide Beam Proximity)
2. O5 (Long Range Proximity)
3. R4 (Retroreflective)
4. R5 (Polarized Retroreflective)
5. V4 (Convergent, 1" Axis)
6. V4A (Convergent, 1" Axis, Apertured)
7. V6 (Convergent, 1.5" Axis)
8. V8 (Convergent, 0.5" Axis)
9. F4 (Glass Fiberoptic Light Guides)
10. F5 (Plastic Fiberoptic Light Guides)

YELLOW PUSHBUTTON – Four Functions
1. Manual "UP" Adjustment
2. Options Select & AUTOSET Programming
3. Toggle selected option to opposite state and return to normal operation
4. When holding red AUTOSET button, tap to alter AUTOSET mode… Light State/Dark State

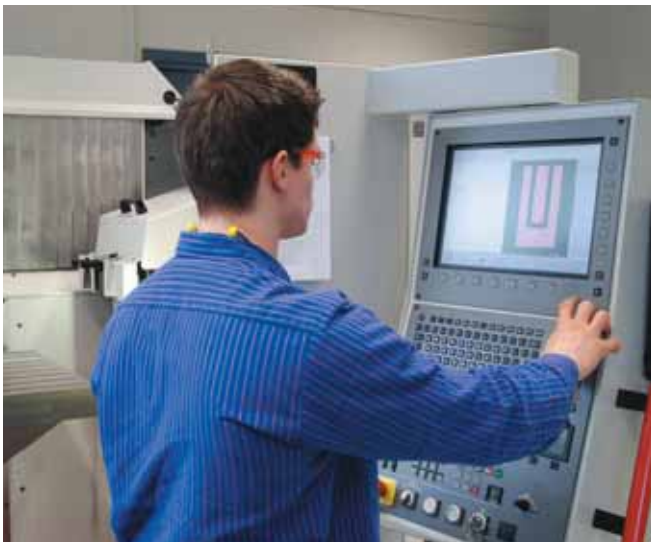
RED PUSHBUTTON – Four Functions
1. Manual "DOWN" adjustment
2. Options Select & AUTOSET Programming
3. When in Option Status Mode, tap to desired function to be altered
4. When holding yellow AUTOSET button, tap to alter AUTOSET mode… Light State/Dark State

Note: Press and hold both red and yellow buttons simultaneously for 3 seconds to enter Options mode.

Special Features

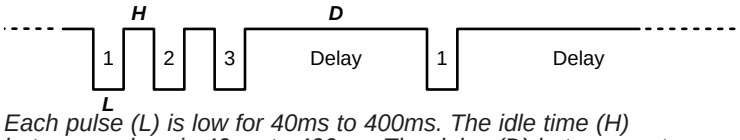
REMOTE PROGRAMMING

The Remote Programming feature of the SMARTEYE® X-PRO XP10 allows the customer to configure, AUTOSET, and tweak the sensor using a PLC pulse-train, HMI, NPN transistor output, or momentary pushbutton switch to 0 VDC/ground. This provides the customer with control over every aspect of the sensor configuration without having to physically touch the sensor. If you have several sensors on your machine; have sensors buried deep within the mechanical structure of the machine; or have your sensors in safe areas behind interlocks… you can easily access these sensors remotely to perform a "digital changeover" due to this unique, special feature.



HMI - Human Machine Interface

Ex. Selection of MEM 1



Each pulse (L) is low for 40ms to 400ms. The idle time (H) between pulses is 40ms to 400ms. The delay (D) between sets of pulses is .75 seconds to 5 seconds.

FIVE MEMORY LOCATIONS

There are Five Memory locations available to store various configurations of the sensor for particular applications. For instance, if you have 5 different web materials…the background colors are different, the mark colors are different, and the marks are different sizes…you would need to perform a different AUTOSET for each background, and you might need to add a Pulse Stretcher timer for the different sized marks. The SMARTEYE® X-PRO XP10 sensor allows you to store and recall that information so the setup time is eliminated completely, reducing down-time and change-over complications when running different materials. This feature is also a benefit for any other application with changing conditions; different sized bottles, different colored labels, varying background materials, varying product textures, etc.

Packaging Five Memory locations together with the unique Remote Programming feature above makes the SMARTEYE® X-PRO XP10 sensor the fastest sensor in the world for "rapid digital changeover", as well as for speed and accuracy.

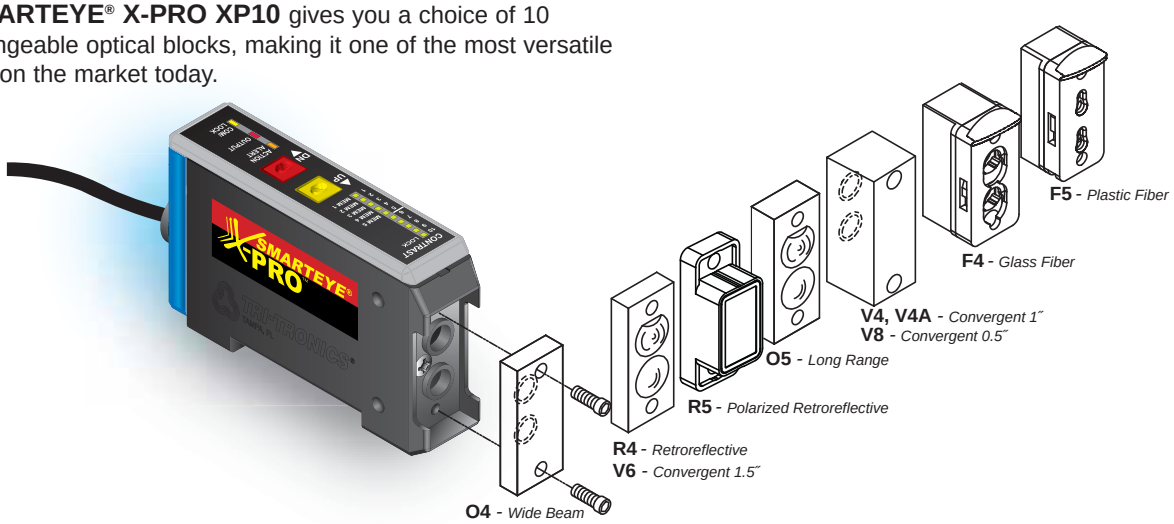
NOTE: Any changes to the sensor will automatically be saved to current MEM # location.

Ex. Five Registration Marks

(Mark Samples)

Optical Block Selection

The **SMARTEYE® X-PRO XP10** gives you a choice of 10 interchangeable optical blocks, making it one of the most versatile sensors on the market today.



Type O4
Proximity
Wide beam optics useful for short-range sensing of transparent, translucent, opaque, 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 visible 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 F5
Plastic Fiberoptics
Adapter for use with a wide variety of plastic fiberoptic light guides for both the proximity and opposed sensing modes

Type V4, V4A
Convergent 1" "V" Axis
Useable range of 1" to 5".

Type V6
Convergent 1.5" "V" Axis
Useable range of 1.5" to 8".

Type V8
Convergent .5" "V" Axis
Useable range of .25" to 5"

Narrow beam optics useful for sensing small parts. Also useful for proximity sensing to minimize response to reflected light from background objects..

Sensing Range Guidelines

Convergent / Proximity / Retroreflective

Optical Blocks	IR	RED	WHITE
V4, V4A	1 in. (25.4mm)	1 in. (25.4mm)	1 in. (25.4mm)
V6	1.5 in. (38.1mm)	1.5 in. (38.1mm)	1.5 in. (38.1mm)
V8	0.5 in. (12.7mm)	0.5 in. (12.7mm)	0.5 in. (12.7mm)
O4	4 in. (101.6mm)	3.75 in. (92.3mm)	5 in. (127mm)
O5	30 in. (762mm)	26 in. (660.4mm)	18 in. (457.2mm)
R4	15 ft. (4,572mm)	12 ft. (3,657mm)	8 ft. (2,438mm)
R5	N/A	3 ft. (914.4mm)	1 ft. (304.8mm)
No Prox on craft paper			
R4	4 ft. (1,219mm)	6 ft. (1,829mm)	4 ft. (1,219mm)

Glass Fiberoptics

Optical Blocks	IR	RED	WHITE
Opposed Mode			
F4	6 in. (152.4mm)	6 in. (152.4mm)	11 in. (279.4mm)
F4 w/lens	6 ft. (1,829mm)	6 ft. (1,829mm)	6 ft. (1,829mm)
Proximity Mode			
F4	2.0 in. (50.8mm)	2.0 in. (50.8mm)	1.75 in. (44.5mm)
F4 w/lens	6 in. (152.4mm)	6 in. (152.4mm)	6 in. (152.4mm)

Plastic Fiberoptics

Optical Blocks	.04" Diameter RED	.04" Diameter WHITE	.02" Diameter RED	.02" Diameter WHITE
Opposed Mode				
F5	4 in. (101.6mm)	4 in. (101.6mm)	1 in. (25.4mm)	1 in. (25.4mm)
F5 w/lens	4 ft. (1,219mm)	3 ft. (914.4mm)	N/A	N/A
F5 w/right angle lens	3 ft. (914.4mm)	1 ft. (304.8mm)	N/A	N/A
Proximity Mode				
F5	1 in. (25.4mm)	1 in. (25.4mm)	0.25 in. (6.35mm)	0.25 in. (6.35mm)
F5 w/lens	1.5 in. (38.1mm)	1.5 in. (38.1mm)	N/A	N/A

Note: Proximity tests utilized a 90% reflective white target. Retroreflective tests utilized a 3" diameter round reflector, Model AR3.

Note: Proximity tests utilized a .125" diameter fiber bundle.

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How to Specify

1. Select Sensor Model based on LED Light Source required:

XP10I = Infrared
XP10R = Red
XP10W = White

2. Select Connection required:

Blank = Cable
C = Connector

3. Select Optical Block:

F4 Glass Fiber Optic
F5 Plastic Fiber Optic
V4 Convergent Lens, 1.0" Focal Point
V4A Convergent Lens, 1.0" Focal Point
V6 Convergent Lens, 1.5" Focal Point
V8 Convergent Lens, 0.5" Focal Point
R4 Retroreflective Lens
R5 Polarized Retroreflective Lens
O4 Wide Beam Proximity Lens
O5 Long Range Proximity Lens

Example:

XP10 W C F4

X-PRO,10 µs Response Time

Light Emitter
I = Infrared
R = Red
W = White

C = Connector
Blank = 6 Ft Cable

Optical Block
F4, F5, V4, V4A, V6, V8, R4, R5, O4, O5

Hardware & Accessories

Micro Cable Selection Guide, 5-wire, M12

GSEC-6
6' (1.8m) Shielded cable

GSEC-15
15' (4.6m) Shielded cable

GSEC-25
25' (7.62m) Shielded cable

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

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

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

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

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

GX-25
25' (7.62m) extension cable

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

SEB-3
Stainless "L" Bracket

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

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

Specifications

SUPPLY VOLTAGE
- 12 to 24 VDC
- Polarity Protected
- Intended for use in Class 2 circuits

CURRENT REQUIREMENTS
- 45mA (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP sensor output transistors
- Outputs sink or source up to 150mA (current limit)
- All outputs are continuously short circuit protected

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

RESPONSE TIME
- Light/Dark = 10µs
- Repeatability = 5µs

LED LIGHT SOURCE
- Infrared = 880nm, Red = 660nm, White = Broadband Color Spectrum

PUSHBUTTON CONTROL
- AUTOSET
- Manual Adjustments
- Set status of 10 options: 10) Lock, 9) Mark, 8) PS 10ms, 7) PS 20ms, 6) Enable, 5–1) Five Memory Locations
  NOTE: Any changes to the sensor will automatically be saved to current MEM # location.

HYSTERESIS
- Set for high resolution – less than one bar on the contrast indicator

LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source – immune to most ambient light including indirect sunlight

DIAGNOSTIC INDICATORS
- 10-LED dual-function bar graph operates 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 ten 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 Option Status Mode
- Yellow LED – Illuminates when Mark Mode feature is activated
- Blue LED output indicator - Illuminates when output is "ON".

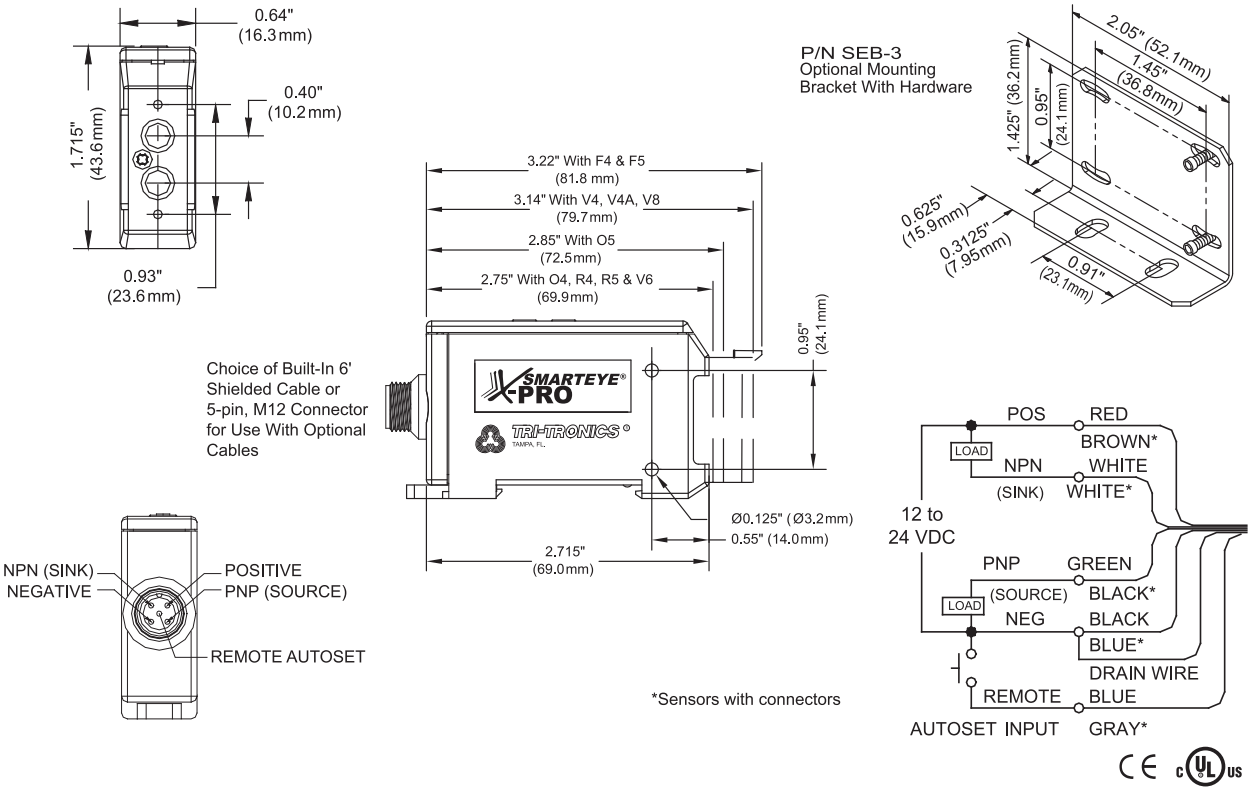
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

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

Patents No. 5,621,205 and No. 6,950,778

RoHS Compliant
Product subject to change without notice

Connections and Dimensions — *SMARTEYE*® X-PRO XP10



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X-tremely High Speed Photoelectric Registration Sensor

SMARTEYE® X-MARK™

SMARTEYE® X-MARK™

Photoelectric Registration Sensor

The *SMARTEYE® X-MARK™* is the fastest, most accurate registration mark sensor available on the market. The *X-MARK™* was designed to target the printing, packaging, and converting markets. By creating a specific sensor to exceed the current capability of the market leaders, and at a price that removes all barriers to change, the *X-MARK™* is sure to attract the attention of engineers and purchasing agents alike.

The *SMARTEYE® X-MARK™* uses a 2.2mm light spot that can detect a mark, edge, or product as it approaches the sensor in any direction. Some competitive models use a line to give the impression of accuracy, but through specific testing, we've discovered that these very expensive sensors are not as accurate as they appear. The *X-MARK™* sensors' 5µs repeatability provides reassurance of accuracy at the highest speeds in any direction. The only question is... "How fast can the machine run?"

The sensor was designed as a drop-in replacement to the existing market leaders. The bracket system provides the customer with a hole-for-hole configuration that aligns the focal point in the exact position of similar sensors currently on the market. Having this unique ability to be a drop-in replacement ensures the customer's requirements are met and exceeded without additional mechanical, electrical, or performance considerations.

Using the *X-MARK™*, High Speed Photoelectric Registration Sensor from Tri-Tronics® removes performance limitations and allows for full throughput capacity at the highest speeds in any direction.

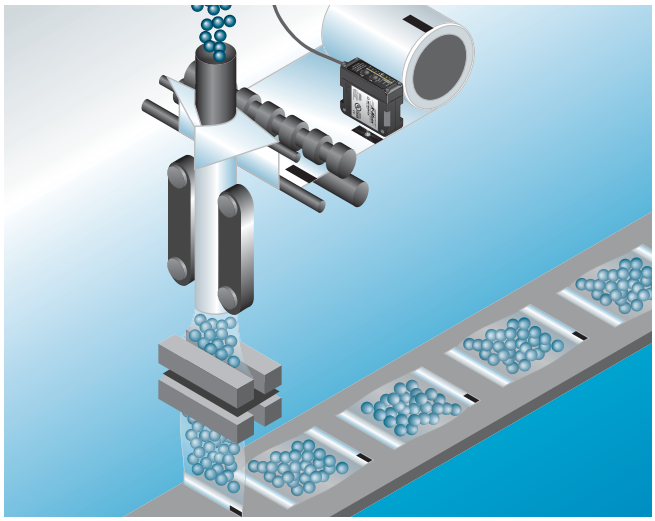
Features

- 10µs Response Time
- 5µs Repeatability
  H & V Models
  - *12µs Response Time*
  - *6µs Repeatability*
- Four AUTOSET Modes
  - Light State
  - Dark State
  - Two-Point
  - Dynamic
- Remote AUTOSET
- Connector or Cabled Version
- Full Spectrum, White LED
- AUTOSET – One-Touch Setup
- 8-LED Dual-Function Bar Graph
- Full Spectrum, White LED; or Tri-Color LED
- Vertical and Horizontal Line Optics

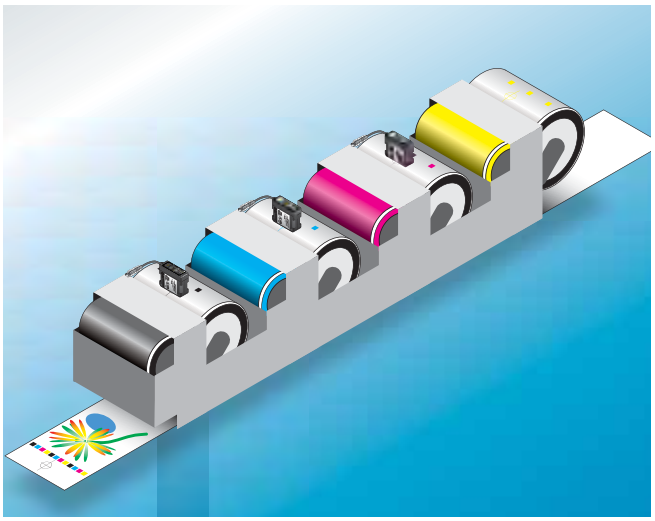
Benefits

- Increase Edge Accuracy at the Highest Speeds
- Virtually Eliminate Setup Time
- Reduce Material Waste
- Eliminate Compensation Software
- Increase Throughput Capacity
- Eliminate Machine Speed Constraint
- Quick Digital Changeover
- Drop-in Replacement of Existing Sensors

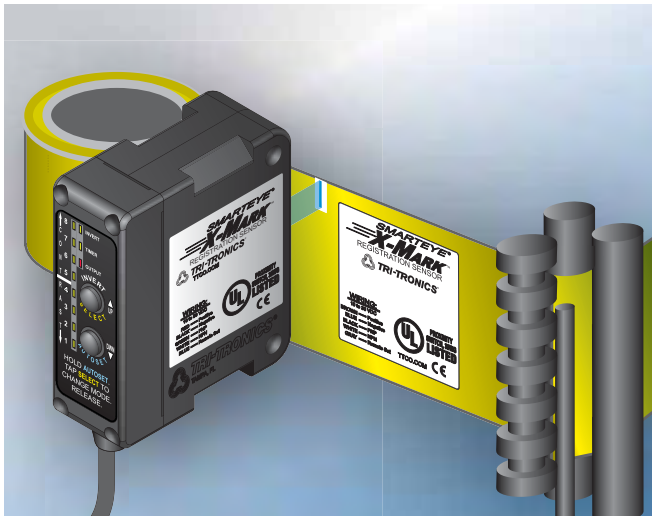
Applications



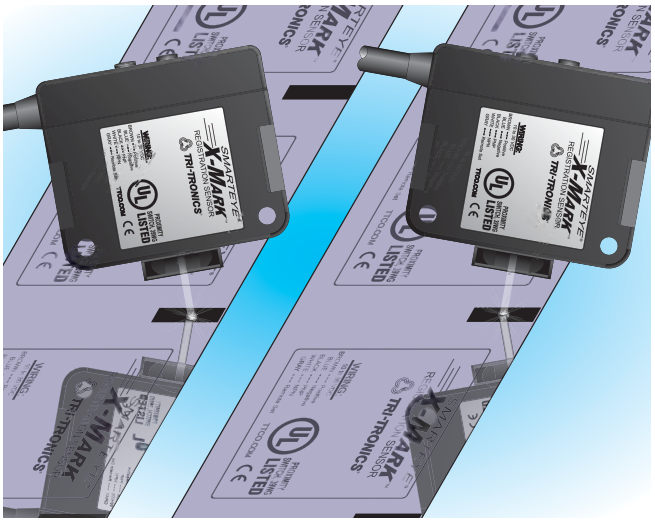
Form, Fill, & Seal



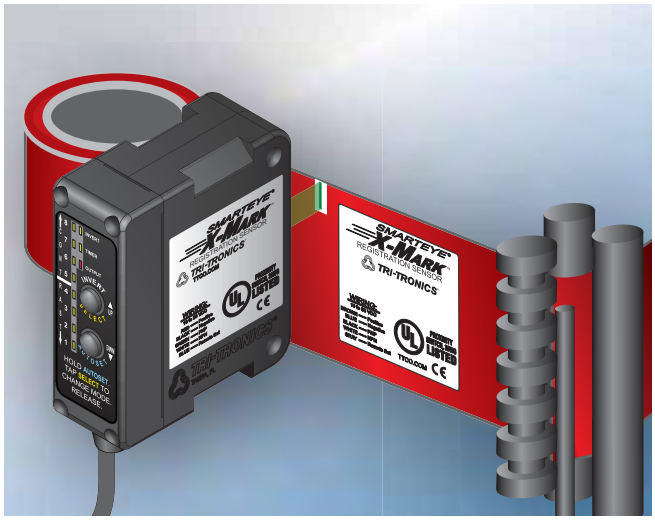
High Speed Offset Printing



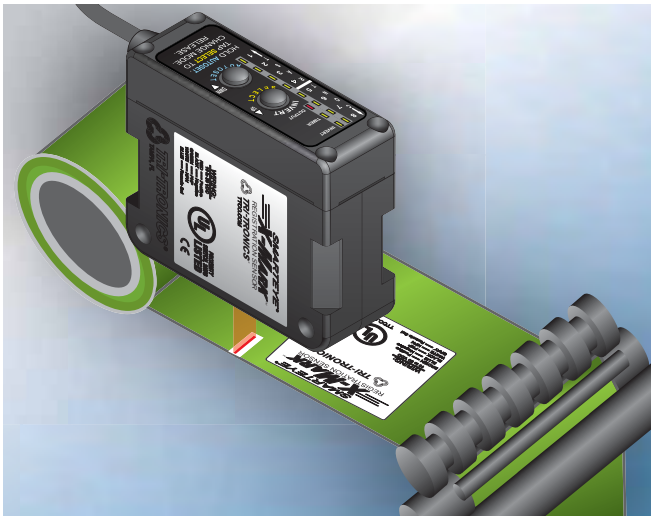
Registration Mark Sensing



Angle for Glare and Shiny Webs



Vertical Line Tri-Color Optics



Horizontal Line Tri-Color Optics

Features

SMARTEYE® X-MARK™

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. There are four AUTOSET Modes to choose from: Light State, Dark State, Two-Point, and Dynamic. Light State AUTOSET is used when there is a light background with a dark mark; Dark State AUTOSET is used when there is a dark background with a light mark; Two-Point AUTOSET is used when the background and mark are very similar in color or contrast; Dynamic AUTOSET is used when there is a requirement to jog the mark past the sensor on-the-fly, or when there isn't an opportunity to stop the system for setup.

CONTRAST INDICATOR™
Provides “at-a-glance” performance data.

REMOTE AUTOSET
Remotely AUTOSET the sensor by applying a contact closure from the Remote AUTOSET input wire to negative (0VDC) or positive (10-30VDC), depending on model, as shown in the wiring diagram. The Remote AUTOSET command will duplicate the last manual AUTOSET performed.

EDR® (Patent No. 5,621,205)
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.

TIMER
When the “OFF” delay pulse stretcher is enabled, the output duration is extended by 10 milliseconds. Enabling the Timer allows ample time for the controller to respond. The time durations of the gap between marks must be longer than the selected delay.

HIGH SPEED
10µs response time when responding to Light or Dark State.
5µs repeatability.
H & V Models:
12µs Response Time
6µs Repeatability

CONNECTIONS
Built-In 6 inch (152mm) pigtail with 5-pin connector *(accessory cable required) or 6 foot (1.8m) cable.*

MOUNTING OPTIONS
Through-hole or Bracket Mount.

REMOTE PROGRAMMING (XM/XMC-1 Models Only)
Remotely program the sensor's four AUTOSET Modes, Change the Timer, Invert the output, make minor adjustments, and repeat the last AUTOSET performed by applying a contact closure to negative (0VDC) in a simple sequence of pulses. This can be accomplished using a PLC pulse train, an HMI, or a momentary pushbutton switch.

NOTE: H & V models use tri-color LEDs, and are only available with Two-Point and Dynamic AUTOSET modes.

CONTRAST INDICATOR BAR 8
Remains on when signal strength is above Bar 8.

THRESHOLD POINT
Between Bars 4 & 5

CONTRAST INDICATOR BAR 1
Remains on when signal strength is below Bar 1.

CONTRAST INDICATORS (8X)
Green LED

Note: Insufficient contrast using Two-Point AUTOSET Mode is indicated by a triple-flash of all 8 contrast LEDs.

INVERT
Red LED
Illuminates when INVERT is enabled.

TIMER INDICATOR
Green LED
Illuminates when 10ms pulse stretch Timer is enabled.

OUTPUT INDICATOR
Red LED
Illuminates when output is On.
Flashes when output transistor is over current limit.

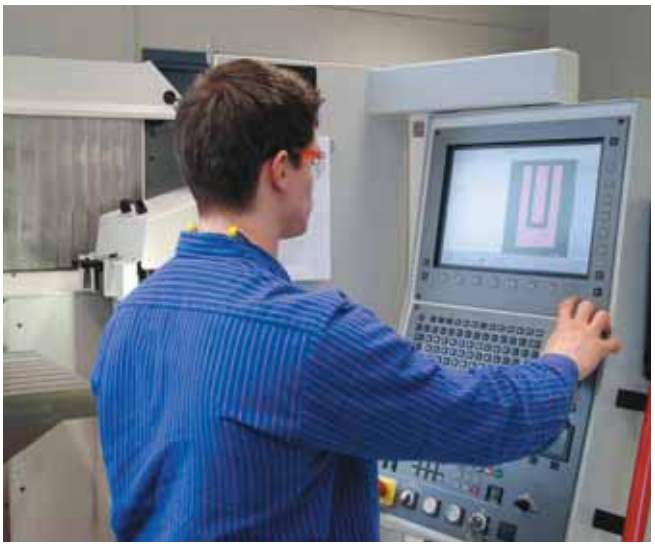
INVERT/SELECT
1. When holding the AUTOSET button, tap to select the AUTOSET mode.
2. Push for two seconds to INVERT output
3. Manual Up adjustment; tap UP to "Tweak" setting .

AUTOSET
1. Push and hold for AUTOSET, then release.
2. Manual Down adjust; tap DWN to "Tweak" setting.

Special Features

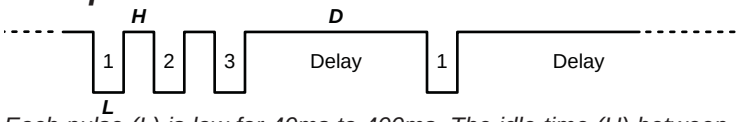
REMOTE PROGRAMMING (XM/XMC-1 Models Only)

The Remote Programming feature of the *SMARTEYE® X-MARK™* allows the customer to configure, AUTOSET, and tweak the sensor using a PLC pulse-train, HMI, NPN transistor output, or momentary pushbutton switch to 0VDC/ground. This provides the customer with control over every aspect of the sensor configuration without having to physically touch the sensor. If you have several sensors on your machine; have sensors buried deep within the mechanical structure of the machine; or have your sensors in safe areas behind interlocks… you can easily access these sensors remotely to perform a "digital changeover" due to this unique, special feature.



HMI - Human Machine Interface

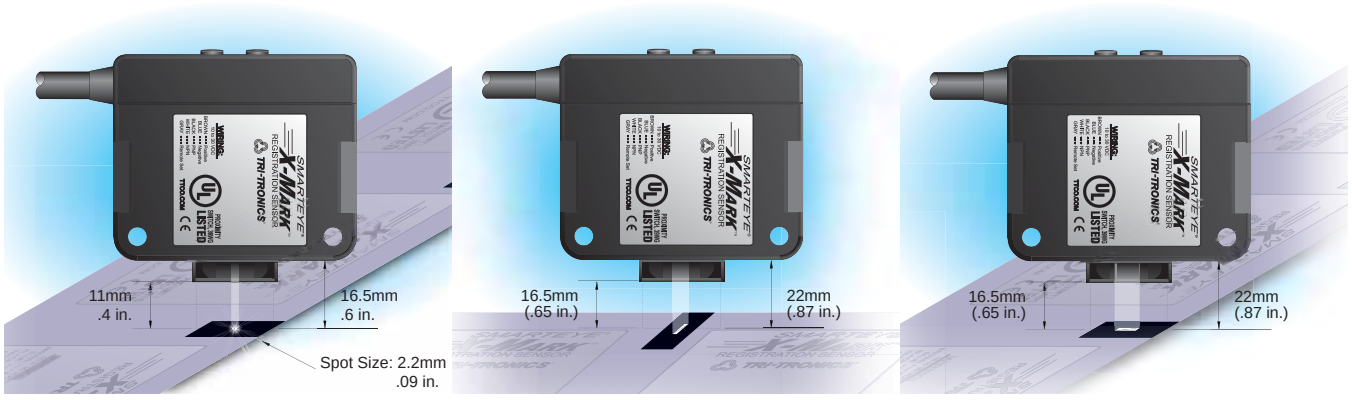
Example: Invert Mode - Normal



Each pulse (L) is low for 40ms to 400ms. The idle time (H) between pulses is 40ms to 400ms. The delay (D) between sets of pulses is .75 seconds to 5 seconds.

NOTE: H & V models use tri-color LEDs, and are only available with Two-Point and Dynamic AUTOSET modes.

Sensing Range



Standard Model | Horizontal Model | Vertical Model

***NOTE: H & V models use tri-color LEDs, and are only available with Two-Point and Dynamic AUTOSET modes.*

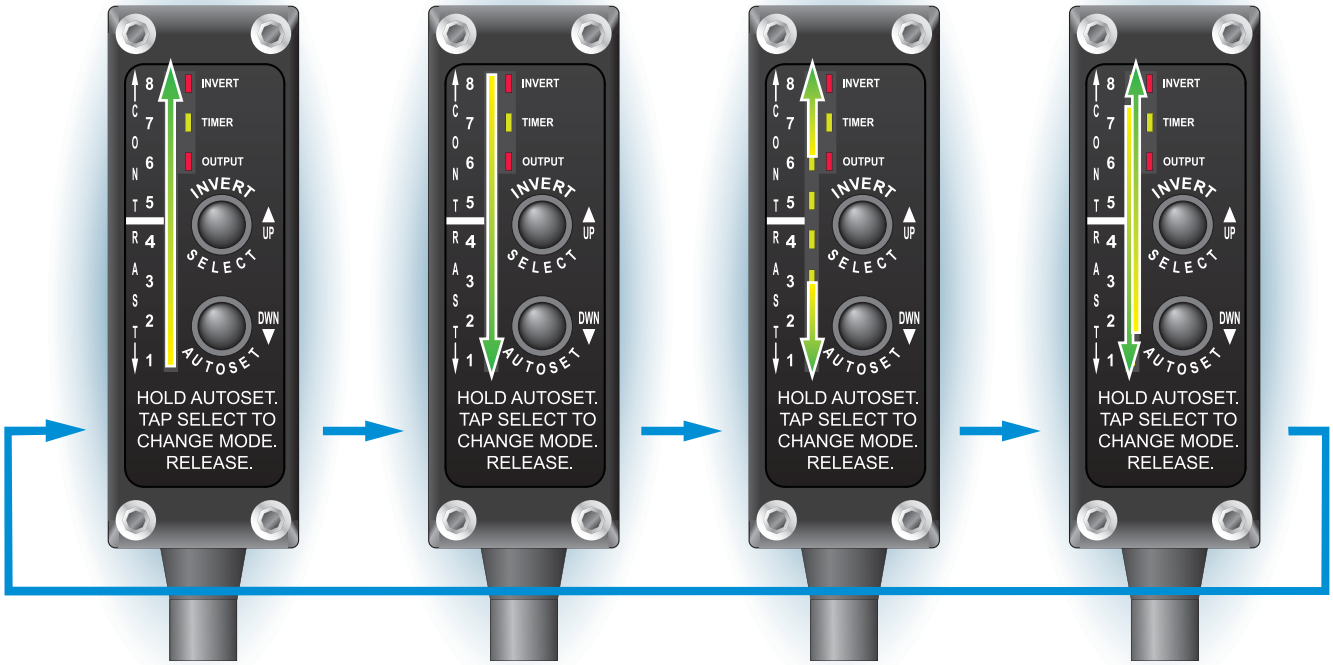
(Mark Samples)

SELECT AUTOSET MODE:

While holding down the AUTOSET button, tap the "SELECT" button to advance through the four AUTOSET Modes. The direction of the LED's indicates the current AUTOSET mode illustrated below. When desired AUTOSET mode is selected, release the AUTOSET button (see below for details).

A. LIGHT STATE **B. DARK STATE** **C. TWO-POINT** **D. DYNAMIC**

(Note: Light/Dark State is not available on H & V models)



INITIATE AUTOSET: First, select the appropriate AUTOSET Mode.

A. LIGHT STATE AUTOSET MODE - Place the light background in view, press and release the AUTOSET button *(Note: Not available on H & V models).*

B. DARK STATE AUTOSET MODE - Place the dark background in view, press and release the AUTOSET button *(Note: Not available on H & V models).*

C. TWO-POINT (Span Adjustment) - Place the background in view, press and release the AUTOSET button. Then place the mark in view, press and release the AUTOSET button.

D. DYNAMIC - With the background in view, press and hold the AUTOSET button, move the mark in view, or past the sensor, then release the AUTOSET button.

INVERT: To invert the output, press and hold the INVERT button for 2 seconds.

TIMER: To select the 10ms pulse stretcher, press and hold both buttons for 2 seconds.

REMOTE AUTOSET:

1. When using the Remote AUTOSET line, the AUTOSET mode must first be selected manually via the pushbuttons, see Select AUTOSET Mode.

2. To initiate a Remote AUTOSET, pulse the AUTOSET line using the same sequence as specified in the pushbutton instructions for that AUTOSET mode. The pulse must have a minimum duration of .75 seconds and is active low for XM/XMC-1 and -2 models and active high for XM/XMC-3 models. See Connections and Dimensions.

NOTE: AUTOSET automatically selects Output "ON" for mark. LT/DK line on XM/XMC-2 and -3 models will override automatic output selection.

How To Specify

1. Select Sensor:
SMARTEYE® X-MARK™ Registration Sensor

2. Select Cable:
Blank = 6 ft. (1.8m) cable
C = 6in. (152mm) Pigtail, M12 Connector

3. Select Output Configuration:
-1 = NPN/PNP
-2 = NPN w/ Remote LT/DK
-3 = PNP w/ Remote LT/DK

4. Select Light Projection:
Blank = Standard Round Spot
V = Vertical
H = Horizontal
NOTE: H & V models use tri-color LEDs, and are only available with Two-Point and Dynamic AUTOSET modes.

5. Select Lens Material:
Blank = Glass
P = Acrylic

NOTE: H & V models use tri-color LEDs, and are only available with Two-Point and Dynamic AUTOSET modes.

Example:

XM C -1 H P

SMARTEYE® X-MARK™ Registration Sensor

Blank = 6 ft. (1.8m) cable
C = 6in. (152mm) Pigtail, M12

Output Configuration
-1 = NPN/PNP
-2 = NPN w/ Remote LT/DK
-3 = PNP w/ Remote LT/DK

Light Projection
Blank = Standard
H = Horizontal
V = Vertical

Lens Material
Blank = Glass
P = Acrylic

Hardware & Accessories

Micro Cable Selection Guide, 5-wire, M12

Cables

GSEC-6
6' (1.8m) Shielded cable

GSEC-15
15' (4.6m) Shielded cable

GSEC-25
25' (7.62m) Shielded cable

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

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

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

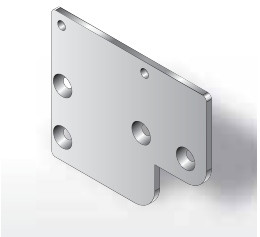
GX-25
25' (7.62m) Extension cable

GSEC-X

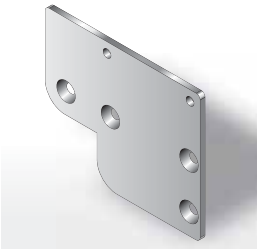
GRSEC-X

GX-X

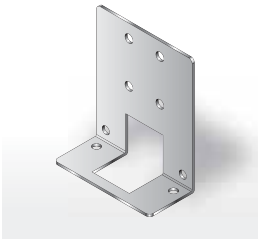
Universal Mounting Brackets



XMB-1L
Left



XMB-1R
Right



XMB-2
Front Mount

SEB-4
Stainless Stealth Mounting Bracket

Specifications

SMARTEYE® X-MARK™

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected
- Intended for use in Class 2 circuits

CURRENT REQUIREMENTS
- 30mA (exclusive of load; standard model)
- 50mA (exclusive of load; H & V models)

OUTPUT TRANSISTORS
- (1) NPN and/or (1) PNP output transistor. *Note: Dependent on Model; see "How to Specify, #3".*
- Outputs sink or source up to 150mA (current limit)
- All outputs are continuously short circuit protected

REMOTE AUTOSET INPUT
- XM/XMC-1 & 2 Models – Momentary sinking input (1mA)
- XM/XMC-3 Models – Momentary sourcing input (1mA)
  Note: Remote programming available in XM/XMC-1 Models only.

REMOTE LT/DK INPUT
- XM/XMC-2 Models - Connect to Negative/0VDC
- XM/XMC-3 Models - Connector to Positive/10-30VDC

RESPONSE TIME
- 10µs (standard model)
- 12µs (H & V models)

REPEATABILITY
- 5µs (standard model)
- 6µs (H & V models)

LED LIGHT SOURCE
- White = Broadband Color Spectrum (standard model)
- Tri-Color LED = Red (635nm), Green (520nm) Blue (470nm) - (H & V models)

DIAGNOSTIC INDICATORS
- Contrast Indicator – Display scaled reading of sensor's response to contrasting light levels (light vs. dark) on an 8 bar LED display
  Note: All 8 LEDs will flash three times if contrast insufficient or too low in Two-Point AUTOSET mode.
- 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 10ms pulse stretch timer is enabled
- Red LED INVERT Indicator – Illuminates when INVERT is enabled

PUSHBUTTON CONTROL
- AUTOSET
- INVERT outputs
- Manual Adjustments
- Timer – 10ms Pulse Stretcher

HYSTERESIS
- Dynamic – adjusted by AUTOSET

LIGHT IMMUNITY
- Responds to sensor's pulsed modulated light source – immune to most ambient light including indirect sunlight

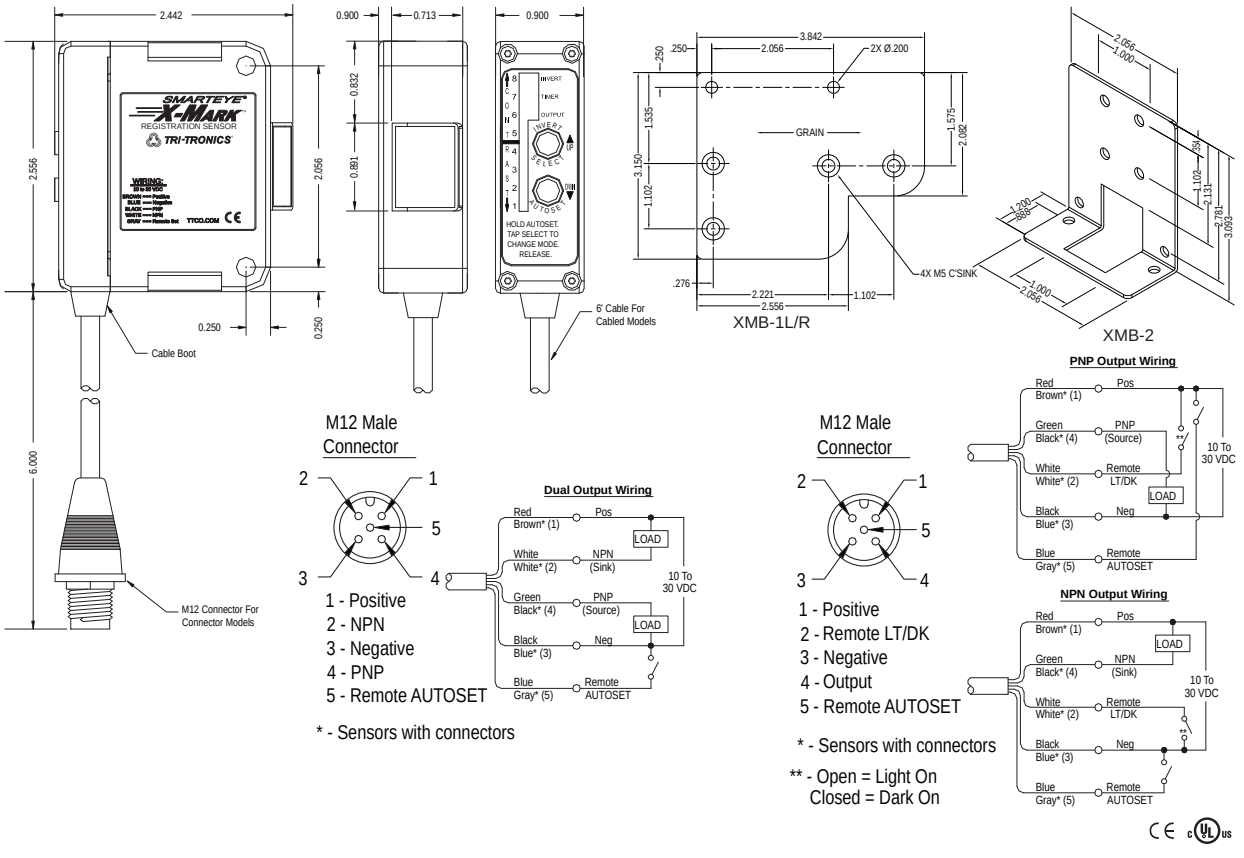
AMBIENT TEMPERATURE
- 10°C to 60°C (50°F to 140°F)

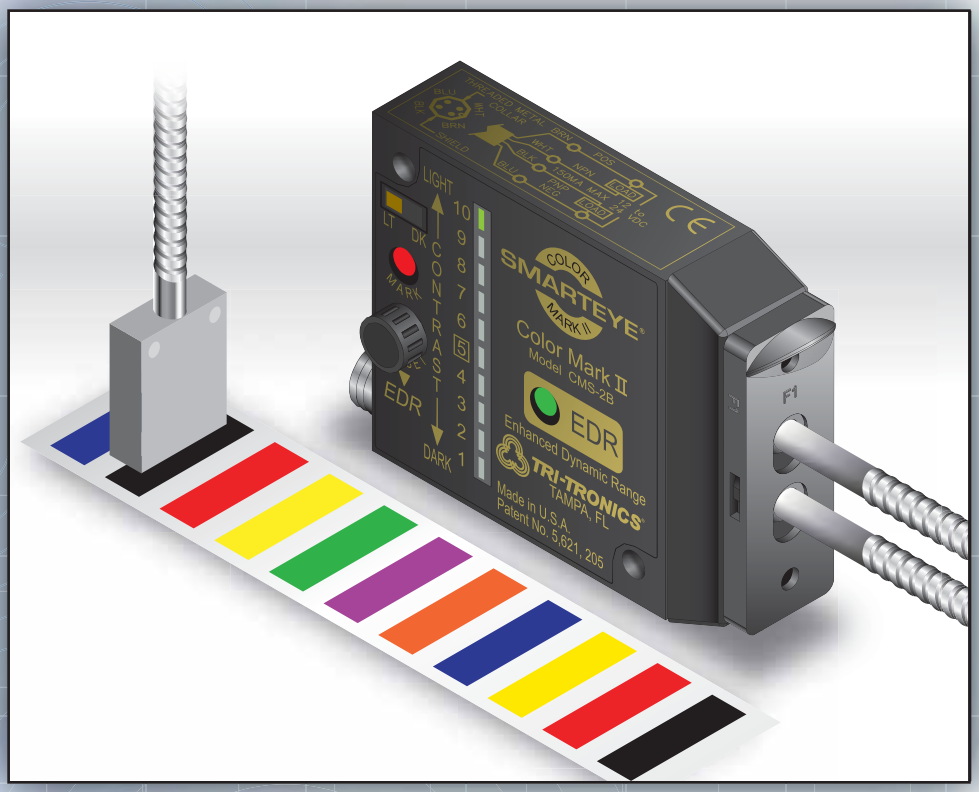
RUGGED CONSTRUCTION
- Chemical resistant, high impact polycarbonate housing
- Waterproof ratings: NEMA 4X, 6P and IP67
- Conforms to heavy industry grade CE requirements
- Standard Light Projection Models are UL Listed. Horizontal and Vertical Beam Models are UL Pending"

RoHS Compliant
Product subject to change without notice

Connections and Dimensions

SMARTEYE® X-MARK™





Registration Mark Sensor

COLOR SMARTEYE® MARK II

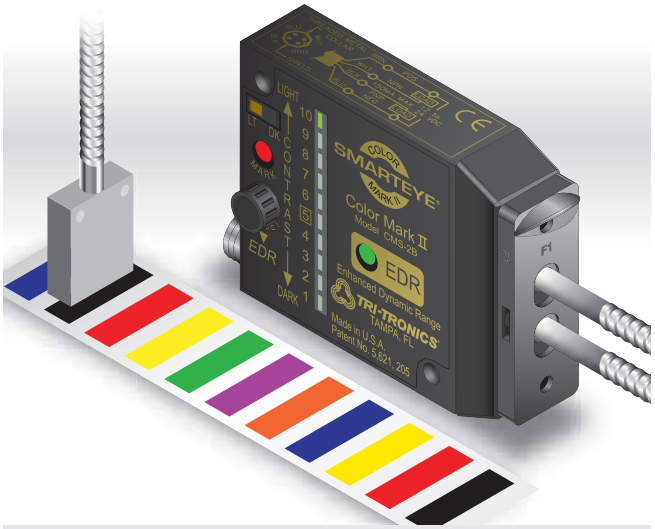
Registration Mark Sensor

The ***SMARTEYE*® COLORMARK™ II** Registration Mark Sensors 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 perception is a must for detecting registration marks printed in a wide variety of colors. The ***SMARTEYE*® COLORMARK™ II** is recommended for detecting the greatest variety of color of marks and 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.



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.

Benefits

- Minimizes downtime
- Flexible and accommodating for a variety of registration materials and marks
- Easily adjusted for optimum performance
- Very accurate and repeatable with unnoticeable migration from start up to full speed
- High Quality and High Reliability

Application Setup Guide

Registration Mark Sensing Using Fiberoptic Light Guides

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 “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 is 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

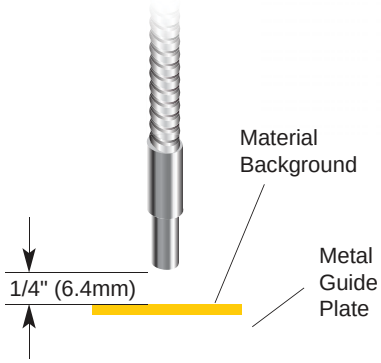
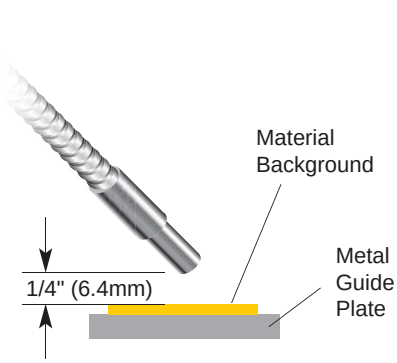
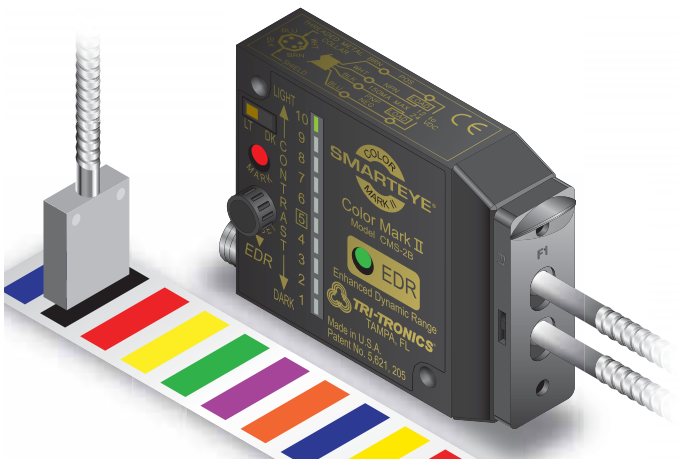


Fig. 2 45º Angle Position

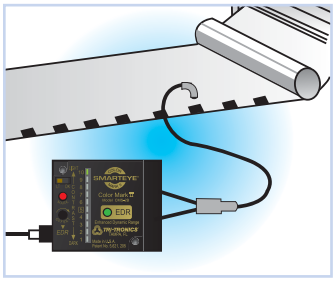


Selection Guidelines



Fiberoptic Models

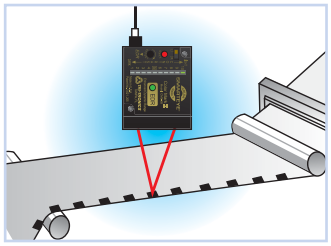
Lensed “V” Axis Models



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.

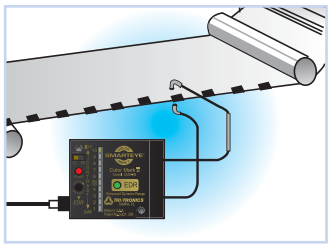
Sensor: Model CMSWL-1BF1 (with Pulse Stretcher) or Model CMSWL-2BF1 (w/o Pulse Stretcher).
White Light Source.
Cable: Shielded cable w/connector. Right angle or straight mating connectors available.
Fiberoptic Light Guide: Model BF-A-36T (straight) or Model BF-A-36RT (right angle) as shown above. See 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 required:
-1B = 10ms Pulse Stretcher
-2B = No Pulse Stretcher
-2BT = with toggle switch

3. Select Optical Block based on mode of sensing required
F1 = Fiberoptic
Range: 1/4" to 3/8" Proximity Mode
1/2" to 3" Opposed Mode
VIG= 1" V-Axis Glass Lens
Range: 1"

Example: CMS WL -1B F1

- **COLORMARK™ II** — CMS
- Light Emitter — WL
- Pulse Stretcher — -1B
- Optical Block — F1

Hardware & Accessories

Micro Cable Selection Guide, 4-wire, M12

Yellow Shielded Cable Assemblies

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

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

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

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

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

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

Black Shielded Cable Assemblies (Lightweight)

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

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

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

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

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

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

BX-10
10' (3.1m) Extension cable

BX-25
25' (7.62m) Extension cable

SEB-1
Stainless "L" Bracket

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

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

(Mark Samples)

Specifications

SUPPLY VOLTAGE
- 12 T0 24 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 85mA (exclusive of load)

OUTPUT TRANSISTOR
- (1) NPN and (1) PNP output transistor
- NPN: Sink up to 150mA
- PNP: Source up to 150mA
- 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 - 550nm (CMS)
  C. Blue - 480nm (CMSB)
  D. Red - 660nm (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

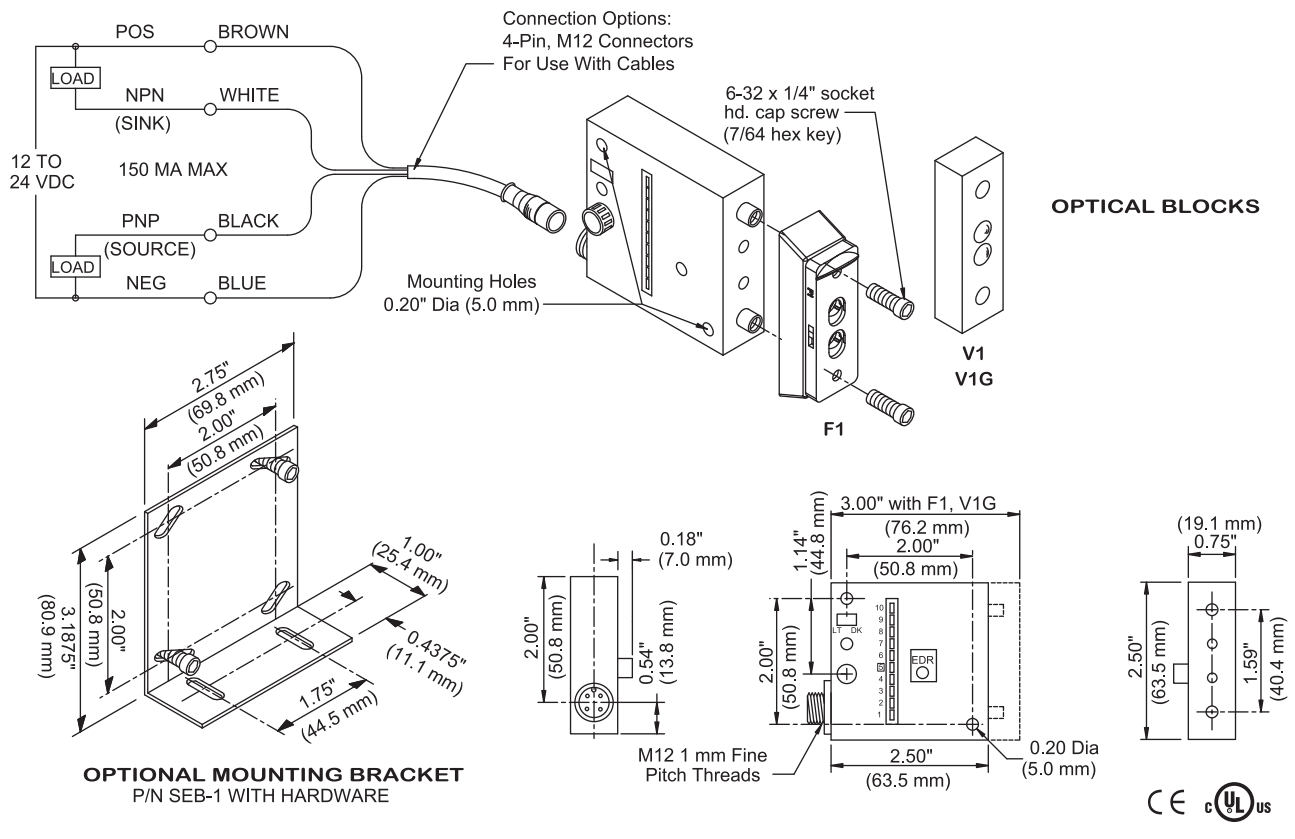
INDICATORS
- OUTPUT INDICATOR - Red LED illuminates when output transistors are “ON”
- EDR INDICATOR – Intensity of Green LED provides indication of where in the dynamic operating range the offset / EDR adjustment has been set
  FULLY LIT: Operating near saturation
  OFF: Operating near maximum sensing 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

RoHS Compliant
Product subject to change without notice

Connections and Dimensions — SMARTEYE® COLORMARK™II



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High Resolution/High Speed Registration Mark Sensor

MARK·EYE® PRO

MARK•EYE® PRO

High Resolution/High Speed Registration Mark Sensor

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.

Features

- White Light LED
- 175µs or 45µs models available
- Interchangeable optical blocks; Fiber Optic or V-axis lens.
- Pulse Stretch Timers; 10ms, 25ms, or 50ms selectable.
- One button push setup
- Outputs automatically configured for mark
- Remote AUTOSET wire
- Button lock
- Cable or connector version

Benefits

- Highly accurate for precise detection of marks at high speeds
- High resolutions for a variety of colored marks on various colored backgrounds
- Timers to assist in overcoming inconsistent web materials, or false triggers
- Remote setup for hard to reach areas
- Flexibility in sensing applications reduces inventory costs and setup time

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Setup Guide

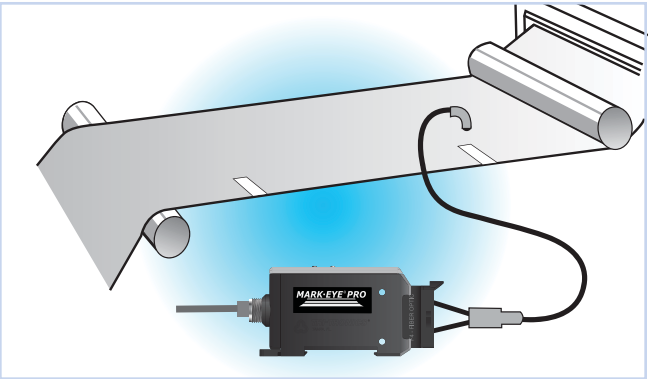
TRI-TRONICS *MARK•EYE® PRO* Series Sensors are easier to set up than conventional color mark sensors because of their unique built-in Contrast Indicator™. Examples of setup instructions for various materials are shown below.

Opaque or Transparent Web Material

1. Position the sensor or fiberoptic light guide to view material looking straight down (see Fig.1).
2. Place background in view of fiberoptic light guide.
3. Push button as follows...
   A. For dark mark on light background, push and hold the white AUTOSET button for about 1 second with background in view. The contrast indicator will illuminate from 1 to 5, flash, and then remain on 5.
   B. For a light mark on a dark background, push and hold the black AUTOSET button for about 1 second with background in view. The contrast indicator will illuminate from 5 to 1, flash, and then remain on 1.
4. Move mark into view to test the setup. The contrast indicator should move from 5 to 1 on a dark mark, and 1 to 5 on a light mark. If the contrast is less than a full swing, then you can use the buttons to manually adjust the sensor by tapping up or down to dial in the proper contrast. If the contrast is less than 5 bars of deviation, then move closer to the web.

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. 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.
3. For foil or shiny material with black mark, you may need to angle sensor or fiber optic light guide slightly, 10 degrees or more.
4. For foil or shiny material with white mark, you may need to angle the sensor or fiber optic light guide by 30 degrees or more.



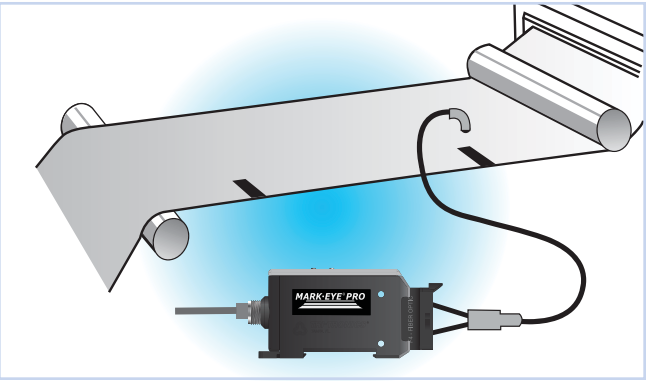


Fig. 1 Straight Position

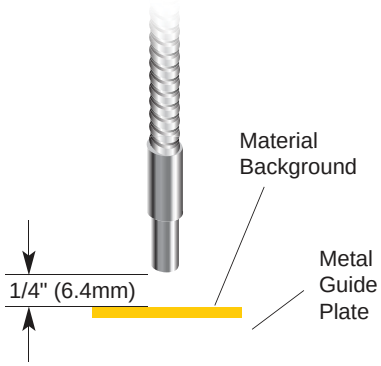
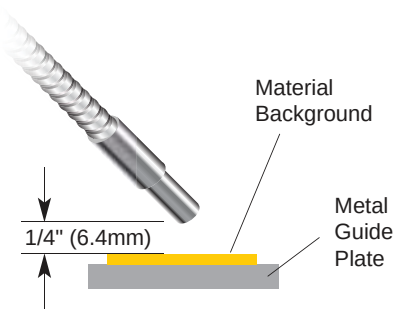


Fig. 2 45º Angle Position



Features

MARK•EYE® PRO

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 that is required is to 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-aglance" 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
45 or 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 five selectable options

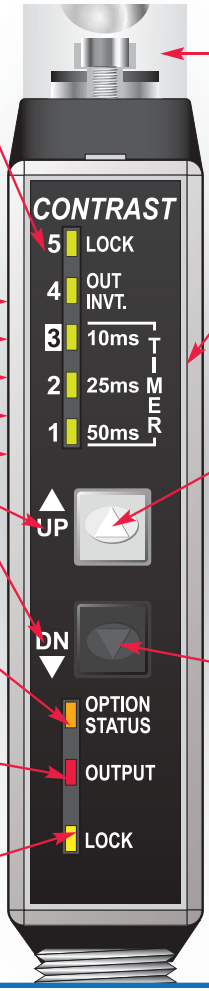
5 Selectable Options
#5 LOCK – for tamperproof operation
#4 Output Invert
#3 10 ms pulse stretcher/"OFF" delay
#2 25 ms pulse stretcher/"OFF" delay
#1 50 ms pulse stretcher/"OFF" delay

Option Status Mode Select
Push both buttons for three seconds to switch bargraph display to status indicator of selectable options

Option Status Indicator
Illuminates when in Option Status mode

Output Status Indicator
Illuminates when outputs are "ON"

Lock Status Indicator
Illuminates when sensor buttons are locked



Interchangeable Optical Blocks
Choice of three interchangeable optical blocks
1. F4 (Glass fiberoptic light guides)
2. F5 (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 - three 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 - three functions
1. Manual "DOWN" adjustment
2. AUTOSET on "dark" background
3. When in Option Status Mode, tap to desired function to be altered.

How to Specify

Model	Description
5-Conductor, Cable Attached:	
MEP45WL	45µs Response Time, White LED
MEPWL	175µs Response Time, White LED
5-Pin Micro Connector (M12):	
MEP45WLC	45µs Response Time, White LED
MEPWLC	175µs Response Time, White LED

1. Sensor model: MEP45, MEP
2. White light source: WL
3. Select Connector
Blank = 6' (1.8m) Cable, C = Connector
4. Select Optical Block based on sensing mode:
F4 – Glass Fibers 0.25" (6.4mm) to 0.50" (12.7mm) range
V4A – Apertured V-Axis 0.75" (19.1mm) to 1.0" (25.4mm) range
F5 – Plastic Fibers 0.25" (6.4mm) range

Example: MEP45 WL C V4

- **MARK•EYE® PRO**
- Light Emitter
- Connector
- Optical Block

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

Hardware & Accessories

Micro Cable Selection Guide, 5-wire, M12

GSEC-6
6' (1.8m) Shielded cable

GSEC-15
15' (4.6m) Shielded cable

GSEC-25
25' (7.62m) Shielded cable

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

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

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

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

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

GX-25
25' (7.62m) extension cable

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

SEB-3
Stainless "L" Bracket

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

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

(Mark Samples)

Specifications

MARK•EYE® PRO

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45 milliamps (exclusive of load)

OUTPUT TRANSISTORS
- (1) NPN and (1) PNP sensor output transistors
- Outputs sink or source up to 150 milliamps (current limit)
- All outputs are continuously short circuit protected

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

RESPONSE TIME
- MEP45WL – Light/Dark = 45µs Repeatability = 13µs
- MEP – Light/Dark = 175µs

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 … immune to most ambient light and strobes, including indirect sunlight

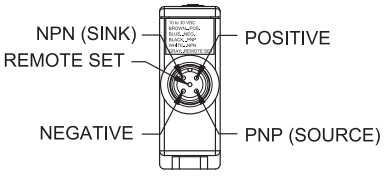
DIAGNOSTIC INDICATORS
- 5-LED Bargraph functions in one of two modes:
  1. Contrast Indicator… Displays scaled reading of sensor's response to contrasting light levels (light to dark)
  2. Status Indicator…Displays status of five selectable options
- Red LED output indicator … Illuminates when the sensor's 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

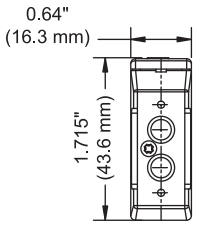
AMBIENT TEMPERATURE
- -40°C to 70°C (-40°F to 158°F)

RUGGED CONSTRUCTION
- Chemical resistant high impact polycarbonate housing
- Industry Ratings: NEMA 4X, 6P, IP67

RoHS Compliant
Product subject to change without notice

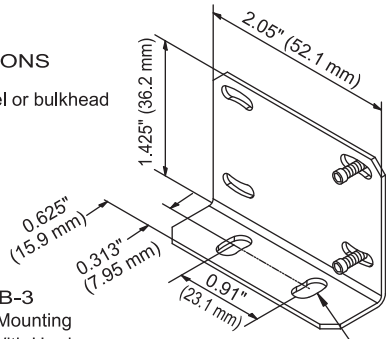
Connections and Dimensions MARK•EYE® PRO





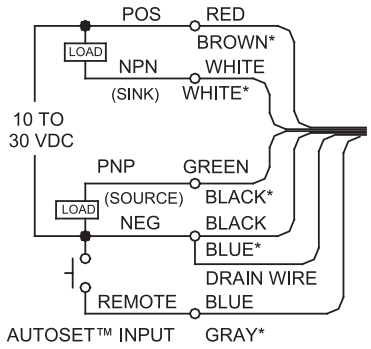
MOUNTING OPTIONS

Direct mount to panel or bulkhead
Din Rail
Bracket (see below)

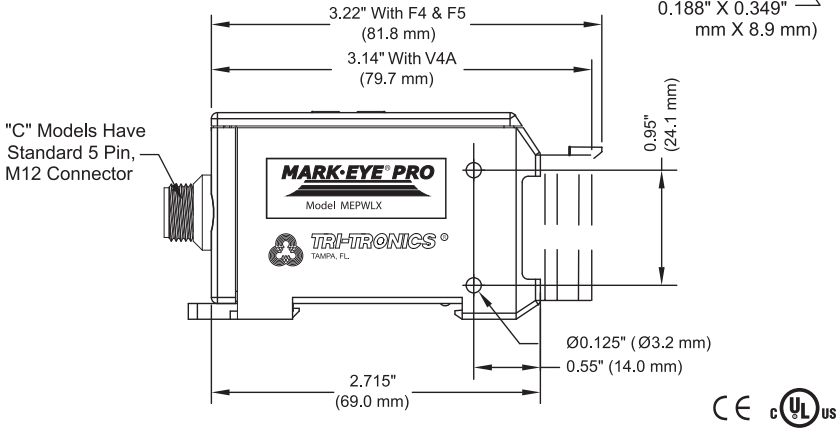


P/N SEB-3
Optional Mounting
Bracket With Hardware

Slot 2 Places
0.188" X 0.349"
mm X 8.9 mm)



*SENSORS WITH CONNECTORS



Opacity Mode Registration Mark Gap Sensor

Registration Mark Gap Sensor

The **Mark•Eye**® is a registration mark sensor designed to see printed registration marks on most packaging materials on a continuous web. The “onetouch” 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 Smarteye X-Mark, X-Pro, or the Mark•Eye® Pro sensor.

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.

Features

- One touch AUTOSET
- Two AUTOSET options; background lighter than mark or background darker than mark
- 100µs response time
- Remote AUTOSET; repeats last button pushed
- 15ms pulse stretcher
- Cable or M12 quick disconnect
- Accurate edge detection
- White light LED

Benefits

- Fast & Easy setup minimizes down time
- Accessible in hard to reach areas
- Reliable and repeatable performance
- Consistent detection of mark from startup to full speed, unnoticeable migration
- Simple mounting configurations - through-holes and threaded inserts

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How to Specify

Model	Description
MEWL	White LED, 5-conductor, 6' (1.8m) cable attached
MEWLC	White LED, 5-pin micro connector (M12)

Example: ME WL C

- **MARK•EYE®**
- Light Emitter
- Connector

1. Sensor model: ME
2. White LED Light Emitter; Full Spectrum
3. Select Connector
   Blank = 6' (1.8m) Cable, C = Connector, 6" (152mm) pigtail, M12 5-Pin

Features

One button AUTOSET!

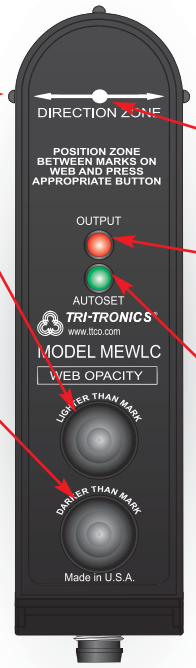
LOCATOR TABS
Help to center optics for proper detection of registration marks

LIGHTER THAN MARK
1. AUTOSET: Press and hold for 1 second with light background in view.
2. Hold down both buttons for 2 seconds to change output from Dark ON to Light ON.

DARKER THAN MARK
1. AUTOSET: Press and hold for 1 second with dark background in view.
2. Hold down both buttons for 2 seconds to change output from Dark ON to Light ON.

NOTE: Optimized for registration mark sensing.

PULSE STRETCHER: To enable Pulse Stretcher, please refer to Setup Instructions.



CENTER of DETECTION
This point marks the exact center of light source and receiver through-beam.

RED LED OUTPUT INDICATOR
Illuminates when output is on
Flashes when sensor is shorted or overloaded

GREEN LED AUTOSET
Flashes rapidly during AUTOSET, for about 1/2 a second, and remains illuminated when complete
Flashes rapidly during AUTOSET, for about 1 second, and then flashes slowly with red LED Output Indicator four times when AUTOSET incomplete

Accessories

GSEC-6
6' (1.8m) Shielded cable

GSEC-15
15' (4.6m) Shielded cable

GSEC-25
25' (7.62m) Shielded cable

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

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

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

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

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

GX-25
25' (7.62m) extension cable

(Mark Samples)

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

Specifications

SUPPLY VOLTAGE
- 10 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 45mA (exclusive of load)

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

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

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

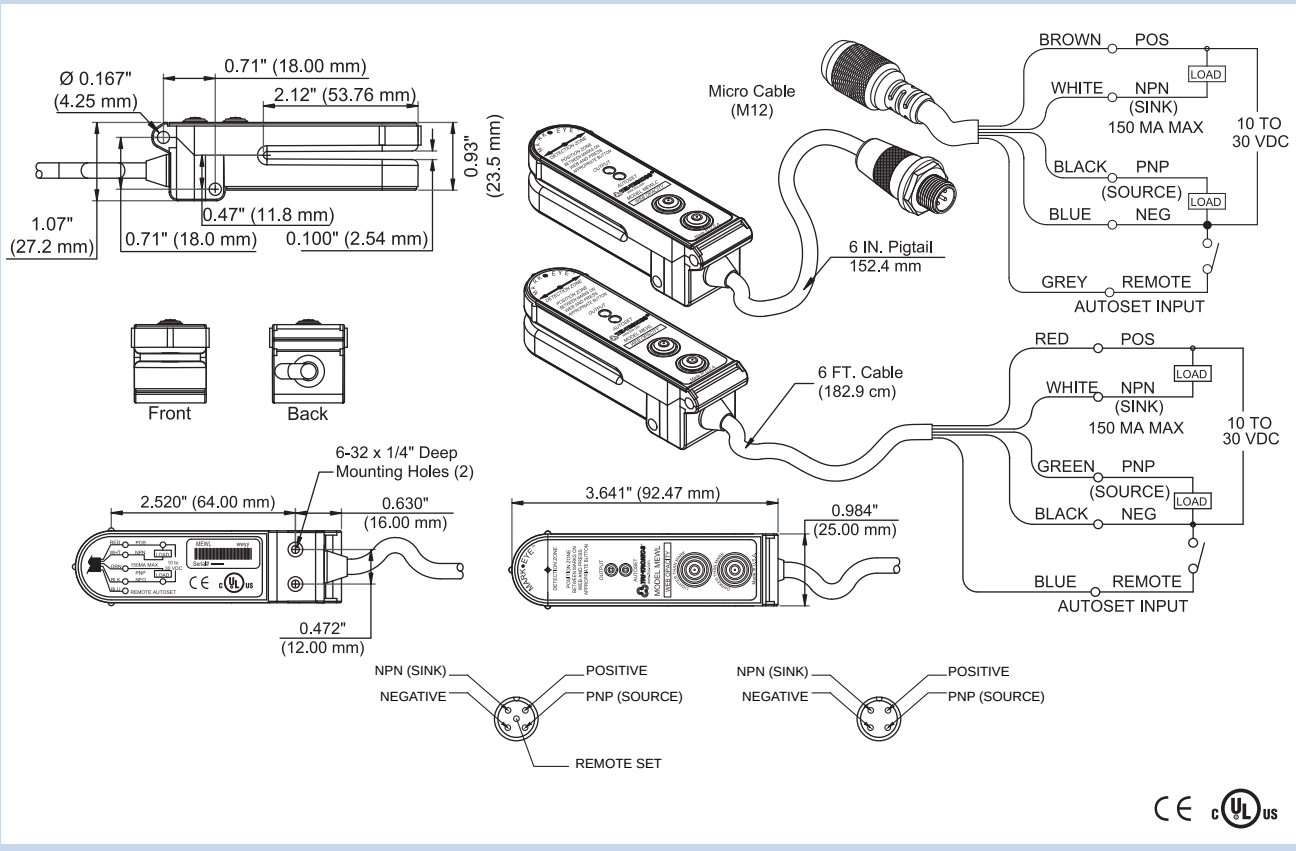
NOTE: Red flashing LED — Short circuit condition exists

Green flashing LED — No contrast through web

RoHS Compliant
Product subject to change without notice

Connections and Dimensions

MARK•EYE®



Fiberoptic Light Guides

Fiberoptic Light Guides

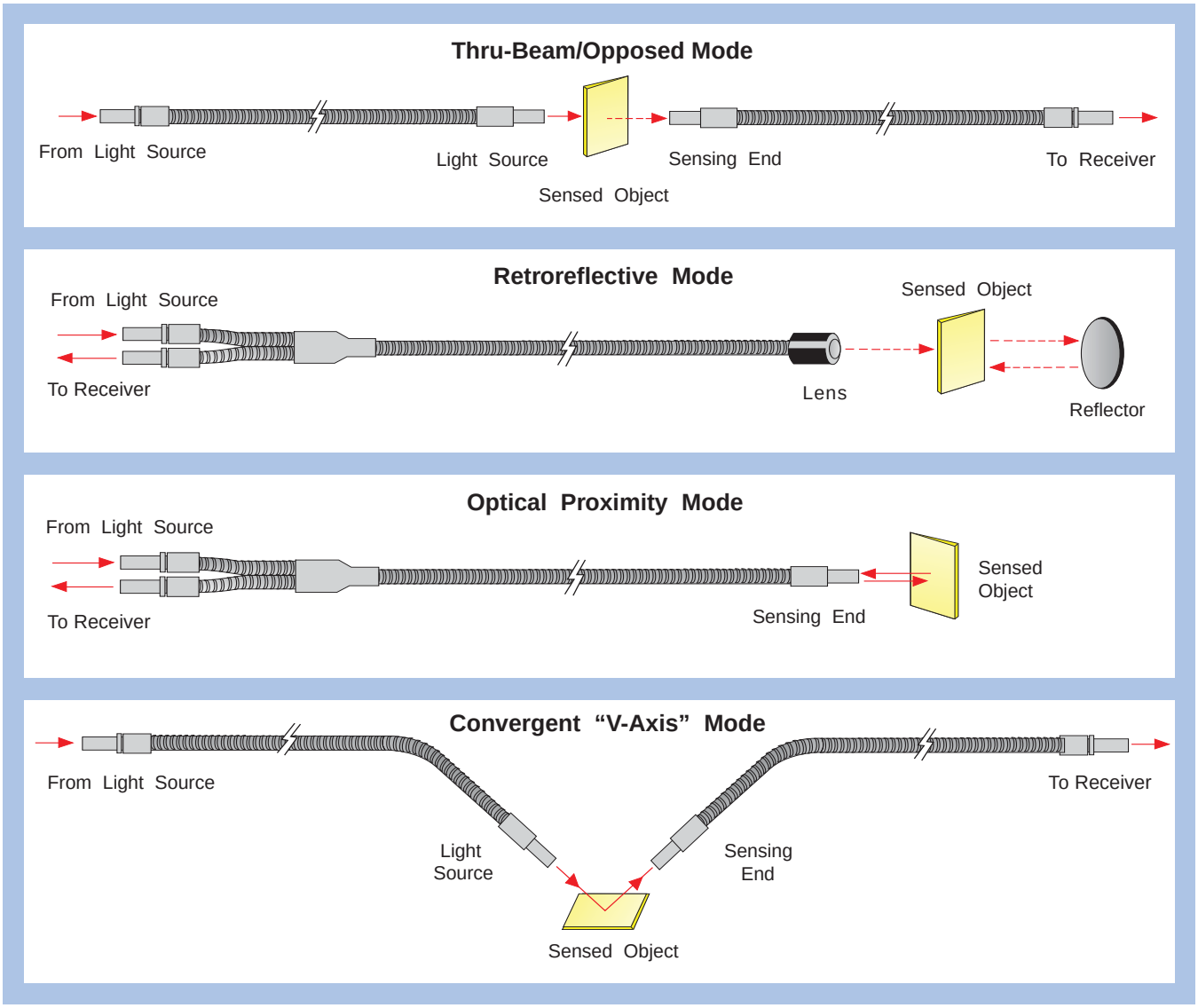
Shine a flashlight into one end of either a flexible plastic or glass fiberoptic light guide and you will see light coming out of the other end. This ability to guide light from one place to another provides many advantages when applied to industrial photoelectric sensing.

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.



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/BEND RADIOUS

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 monocoil 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.

Model Number Matrix

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
TS	–	5/16" 24 THD x 1.5" SS Threaded
TRS	–	5/16" 24 THD x 1.5" SS 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" SS Right Angle Threaded
RTLS	–	5/16" 24 THD x .625" SS 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
S	–	Stainless Steal Tip (add to end of model number)
		Note: For Brass Threading only.
L	–	Shorter Threaded Tip .625"

Miniature Glass Fibers

The following suffixes are different for Miniature Fibers

T	–	l0 x 32 THD Brass
TM4	–	M4 x 0.70 THD Stainless Steel Threaded Tip
TM6	–	M6 x 0.70 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.

NON-STANDARD DESIGNATOR

Blank – Standard Fiber
H – High Temp Fiber
S – Stiff

X X X X - X - X X X X X X X

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).

Miniature Glass Fiber – PVC and Stainless Steel Cables

Smaller O.D, smaller tip configurations, with the same flexibility and durability as our standard fiber optic light guides. Smaller tips and diameter allow these fiber optics to fit into smaller spaces for mechanic constraint issues, and still provide a robust and chemical resistant solution for difficult sensing tasks in harsh environments.

Plastic Fiber – Fluorinated Polymer Jacket

Core – Polymethyl Methacrylate (ultra grade) with an allowable bending radius of >17mm. Operating temperatures from -40°F to +185°F (-40°C to +85°C).

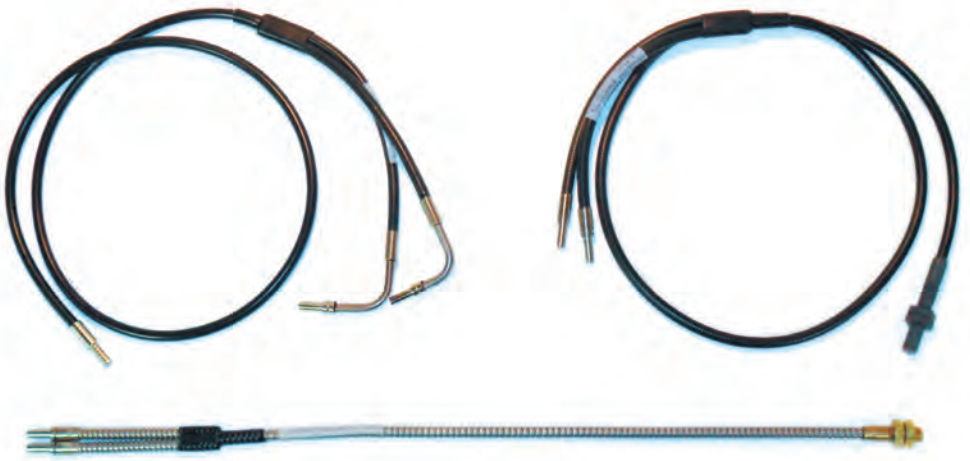
Note: Due to their light transmission properties, plastic fiberoptic light guides are recommended for use only with visible light sensors.

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. Custom length fibers are +/- .5 inches per foot.

EXAMPLES:



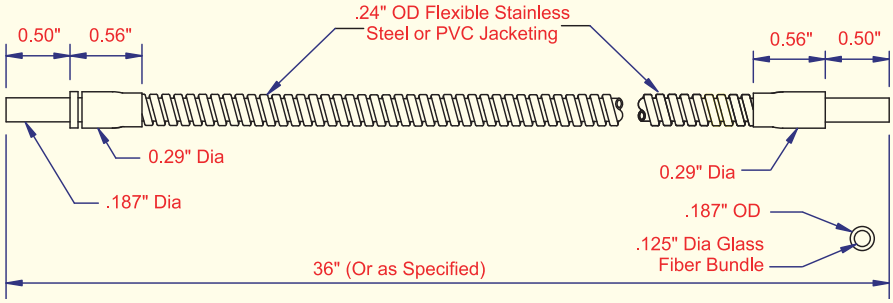
Glass Single Light Guides

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"

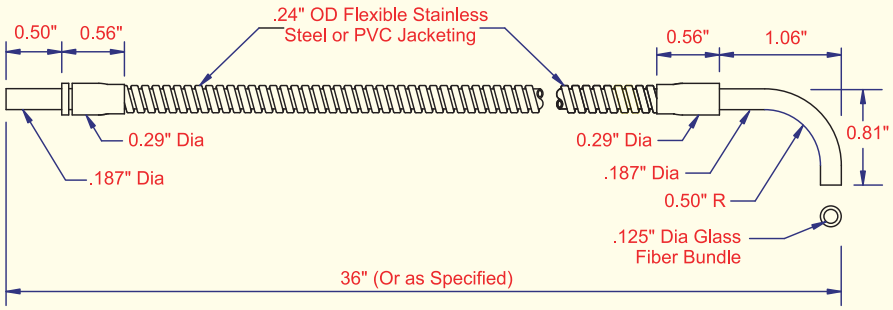


Right AngleTip
Stainless Steel Jacket

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"

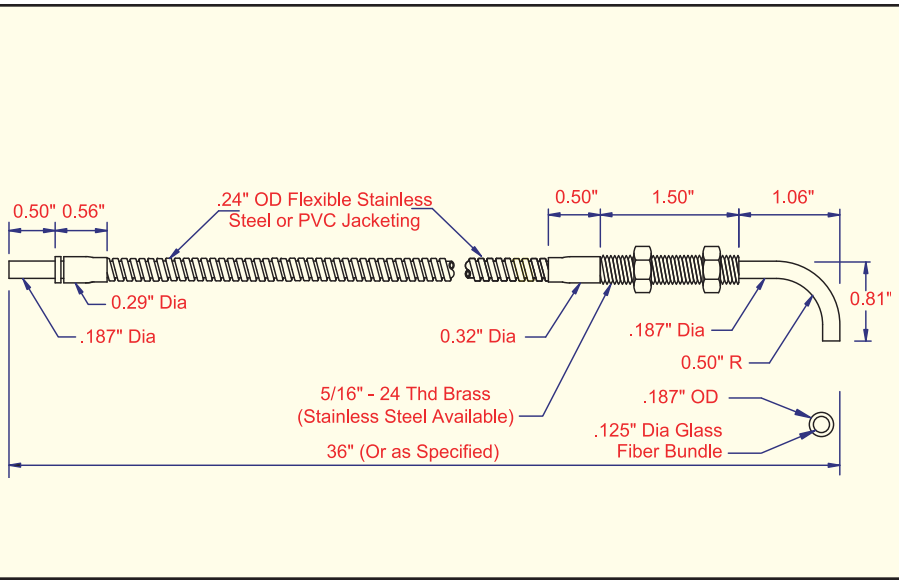


Right Angle Tip, then Threaded
Stainless Steel Jacket

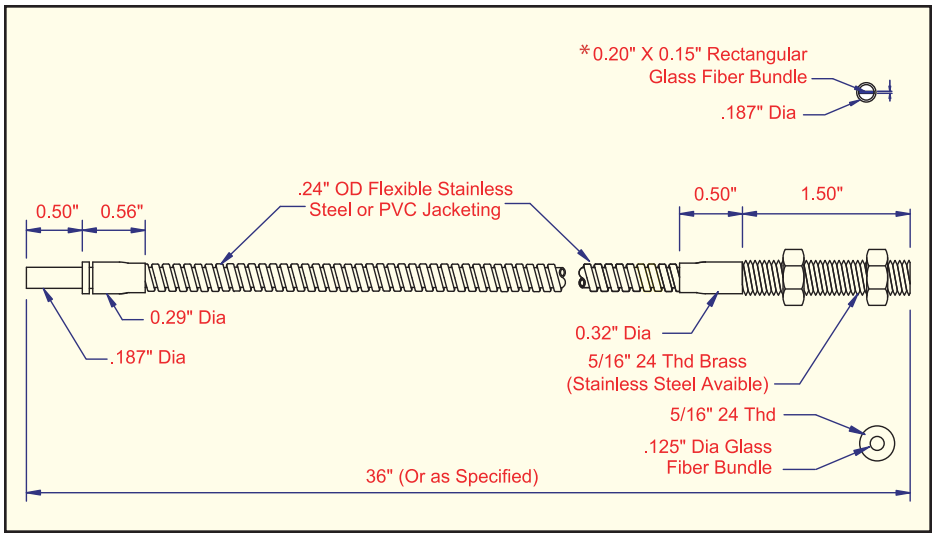
MODEL	BUNDLE SIZE
F-A-36RT	.125"
F-B-36RT	.062"
F-E-36RT	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-A-36RTP	.125"
F-B-36RTP	.062"
F-E-36RTP	.046"



Glass Single Light Guides

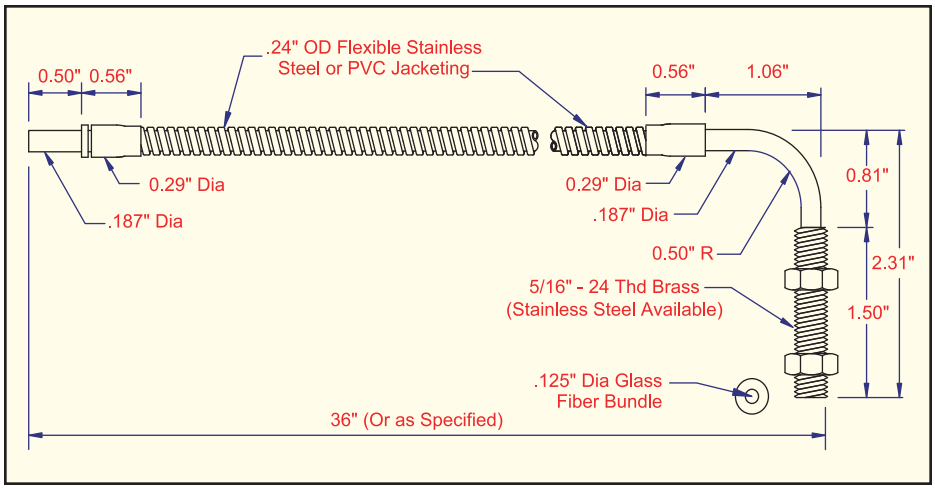


Straight Threaded Tip Stainless Steel Jacket

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"

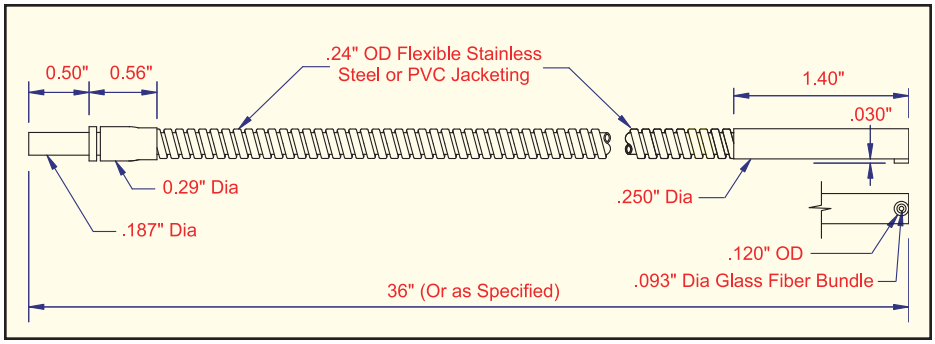


Threaded Tip, then Right Angle Stainless Steel Jacket

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"

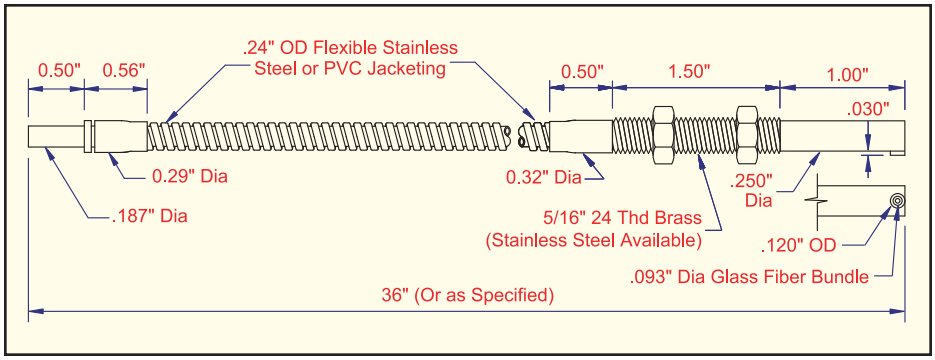


Side View, Right AngleTip Stainless Steel Jacket

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"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-A-36RSTP	.093"

Drawing available at ttco.com

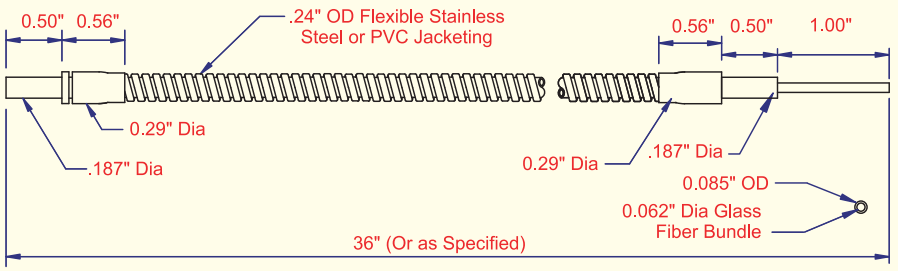
Glass Single Light Guides

Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-B-36	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-B-36P	.062"

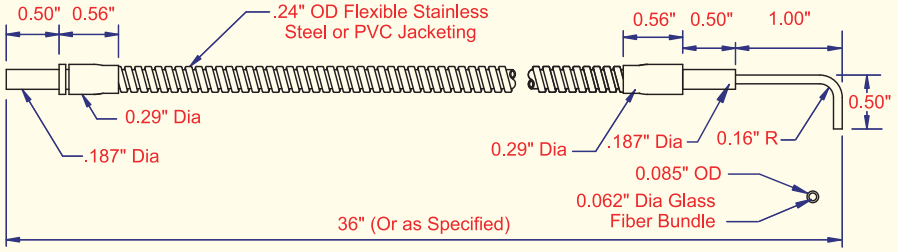


Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-B-36R	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-B-36RP	.062"

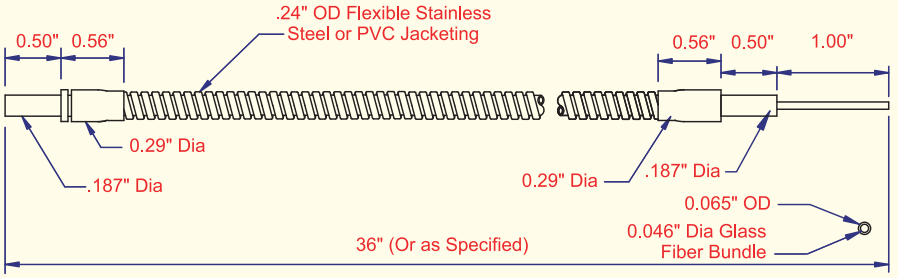


Straight Needle Tip
Stainless Steel Jacket

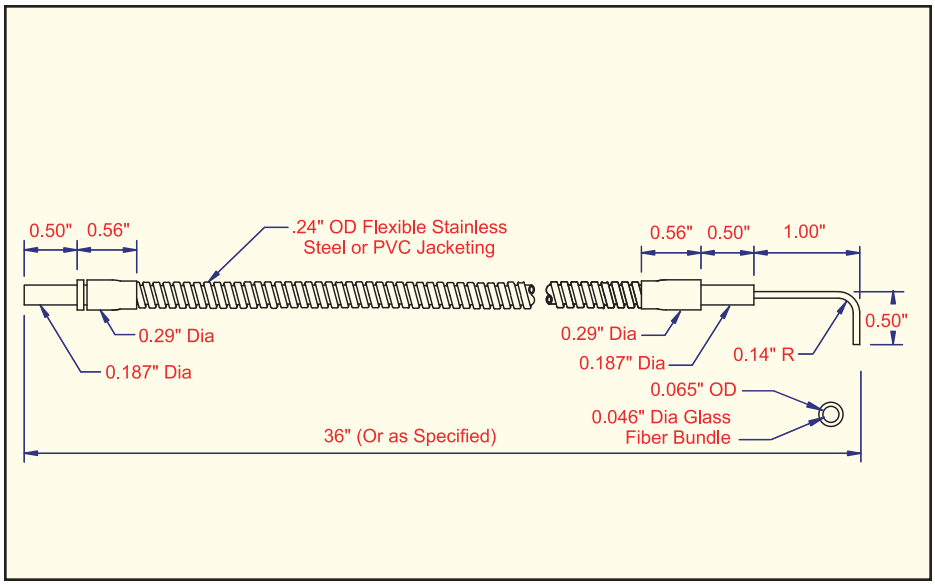
MODEL	BUNDLE SIZE
F-E-36	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-E-36P	.046"



Glass Single Light Guides

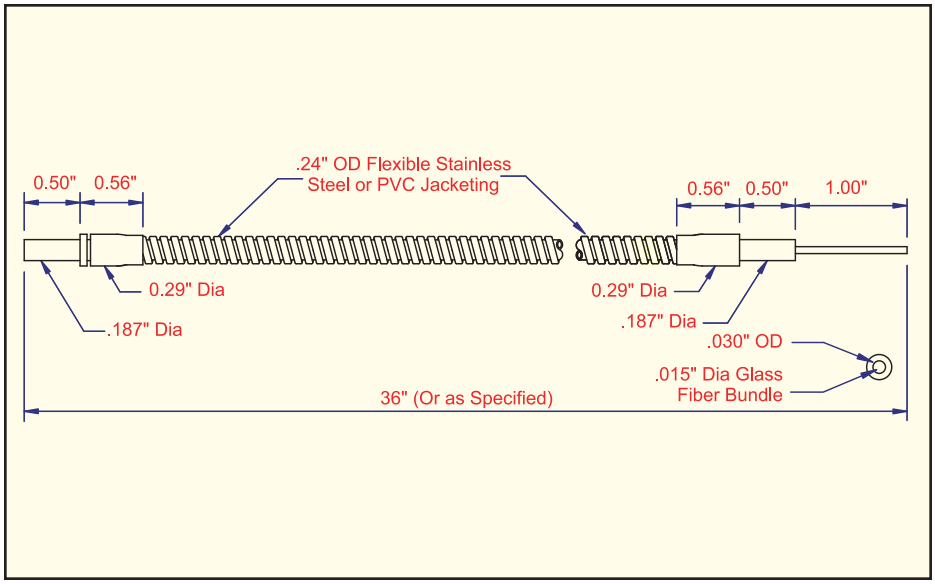


Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-E-36R	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-E-36RP	.046"

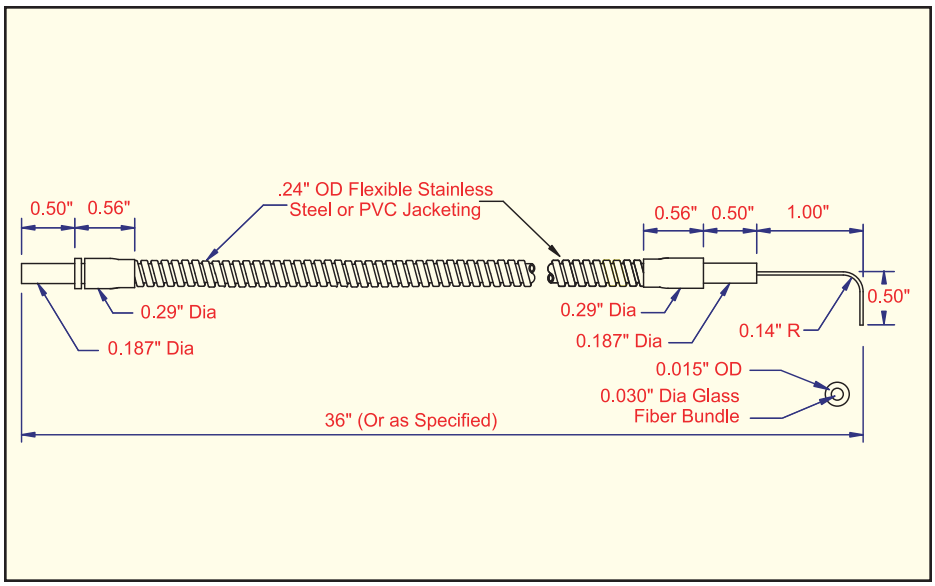


Straight Needle Tip
Stainless Steel Jacket

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"

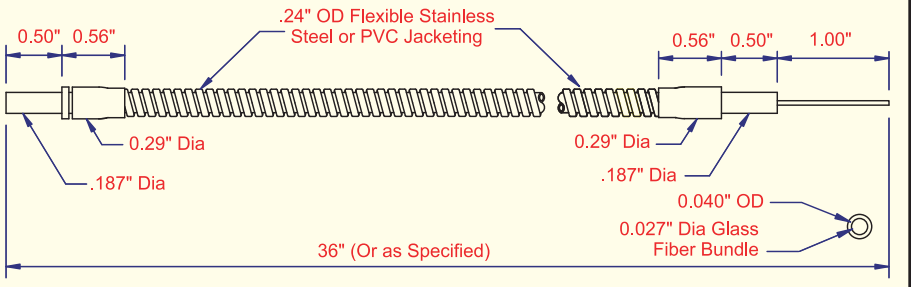
Glass Single Light Guides

Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-J-36	.027"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-J-36P	.027"

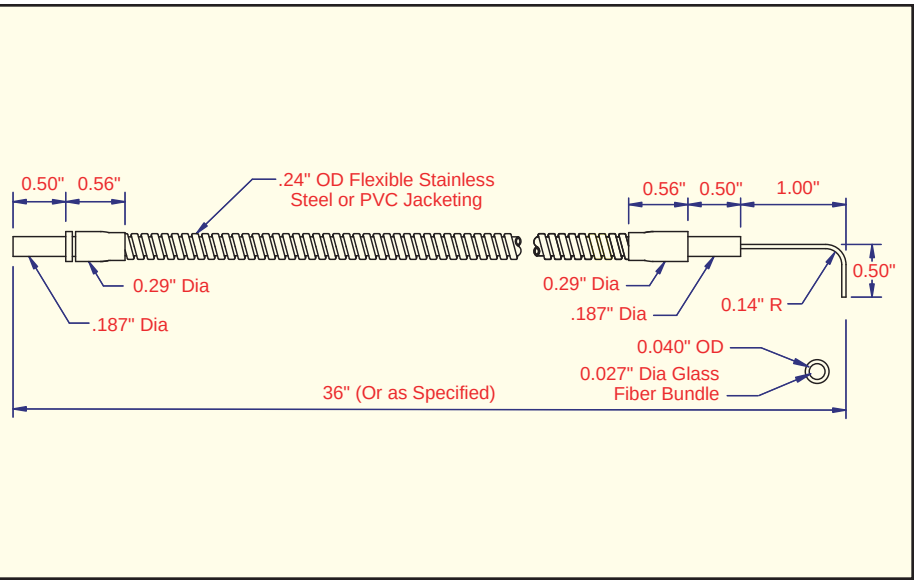


Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-J-36R	.027"

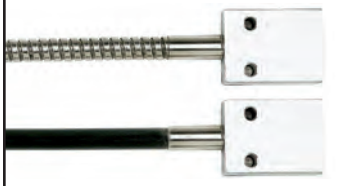
PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-J-36RP	.027"



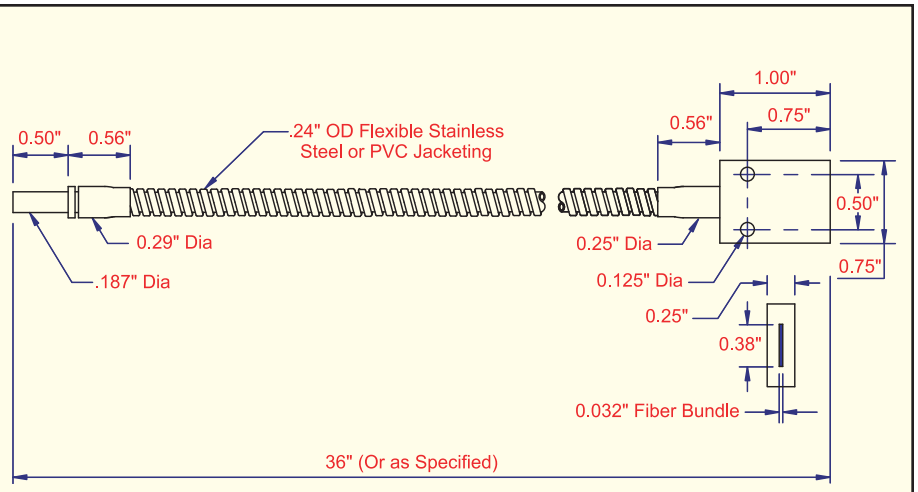
Rectangular Flat Housing
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-C-36	.032" x .38"

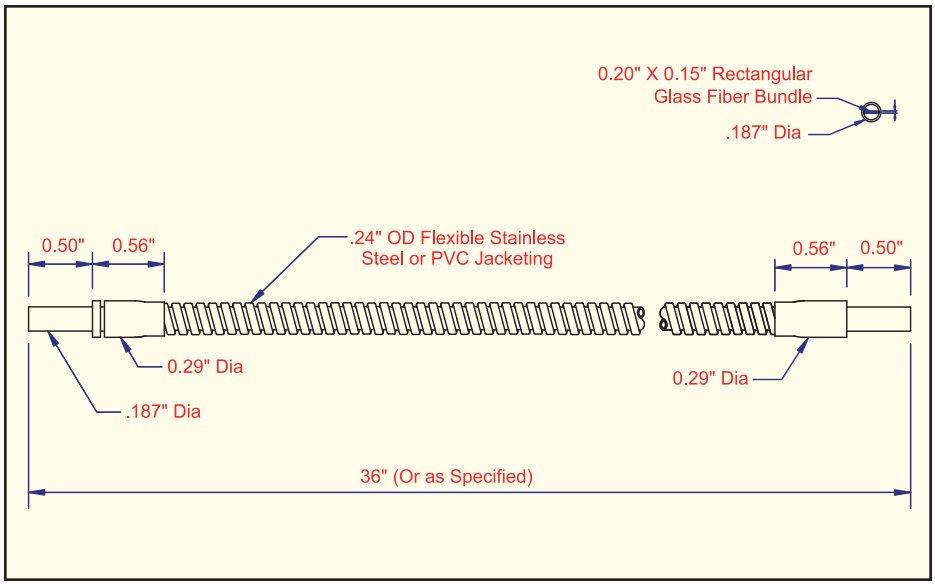


PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-C-36P	.032" x .38"



Glass Single Light Guides

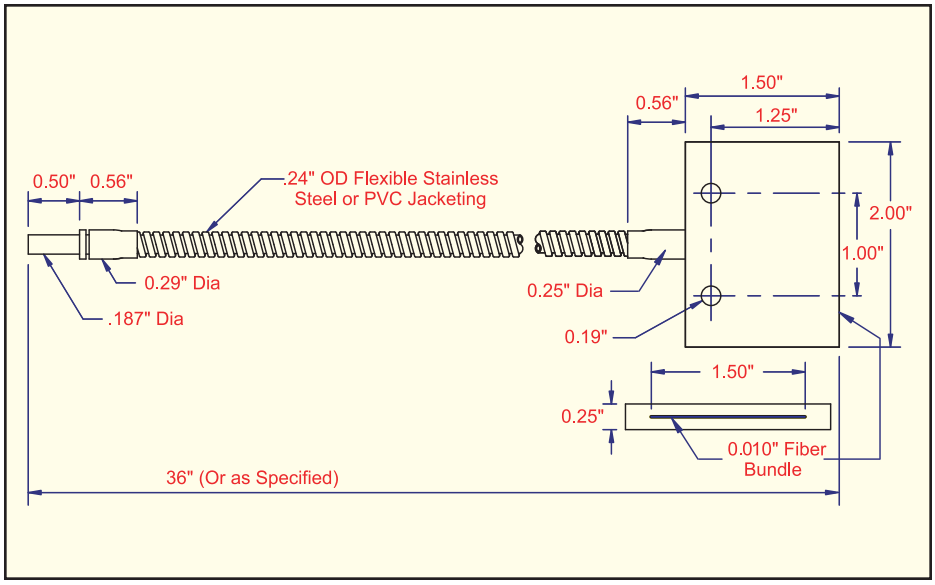


Rectangular Bundle Barrel Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
F-K-36	.020" x .15"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
F-K-36P	.020" x .15"

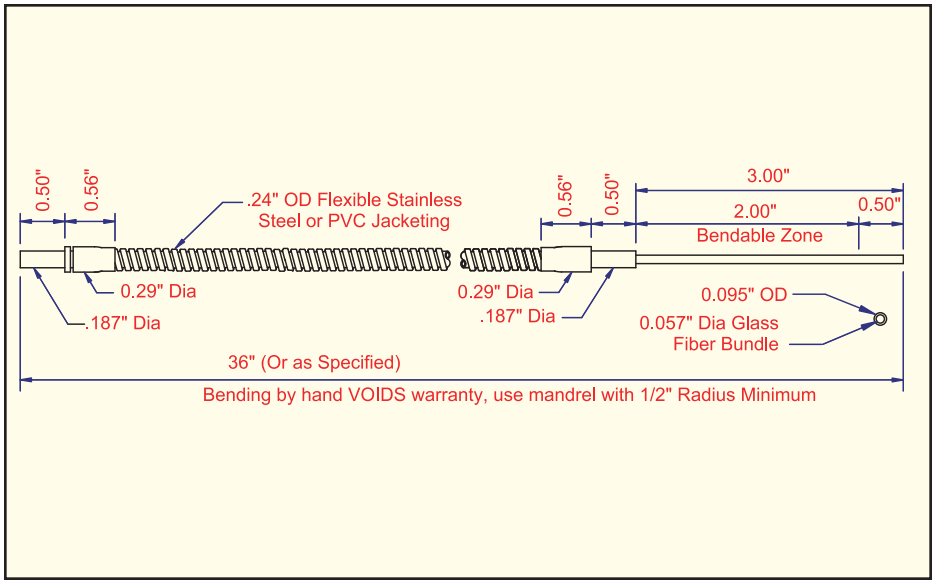


Rectangular 2" Flat Housing
Stainless Steel Jacket

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"

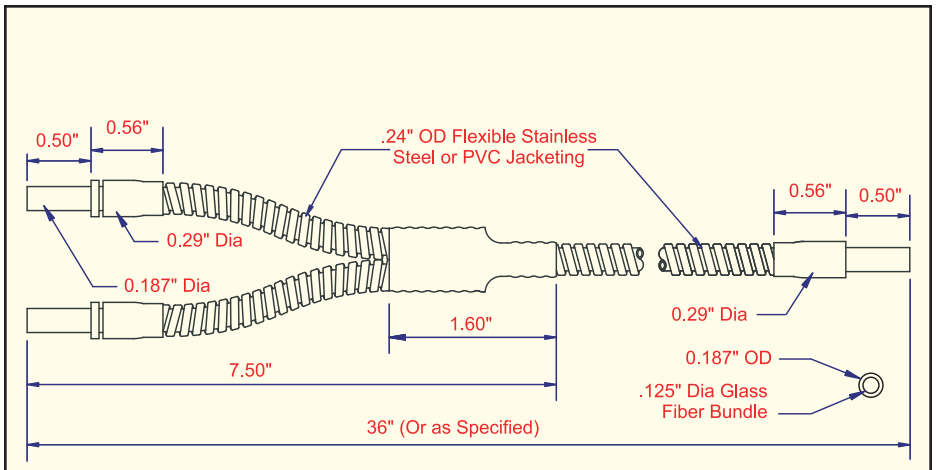
Glass Bifurcated Light Guides

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"

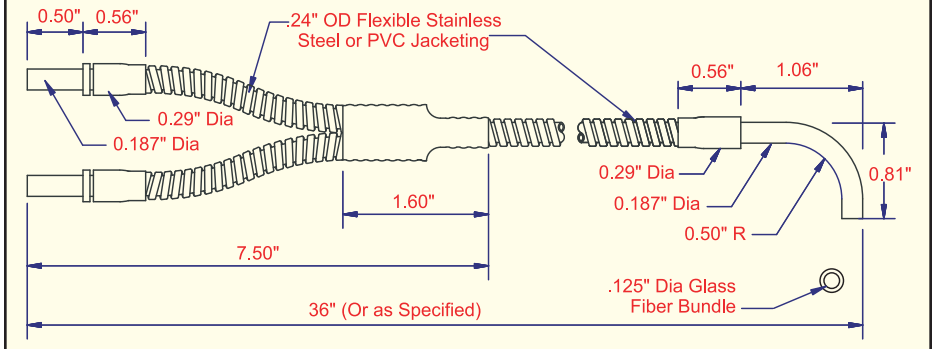


Right Angle Tip
Stainless Steel Jacket

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"

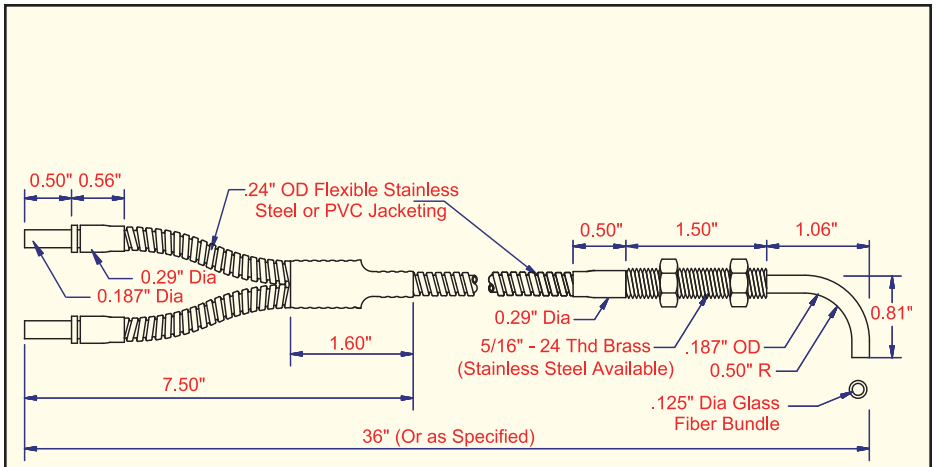


Right Angle Tip,
then Threaded
Stainless Steel Jacket

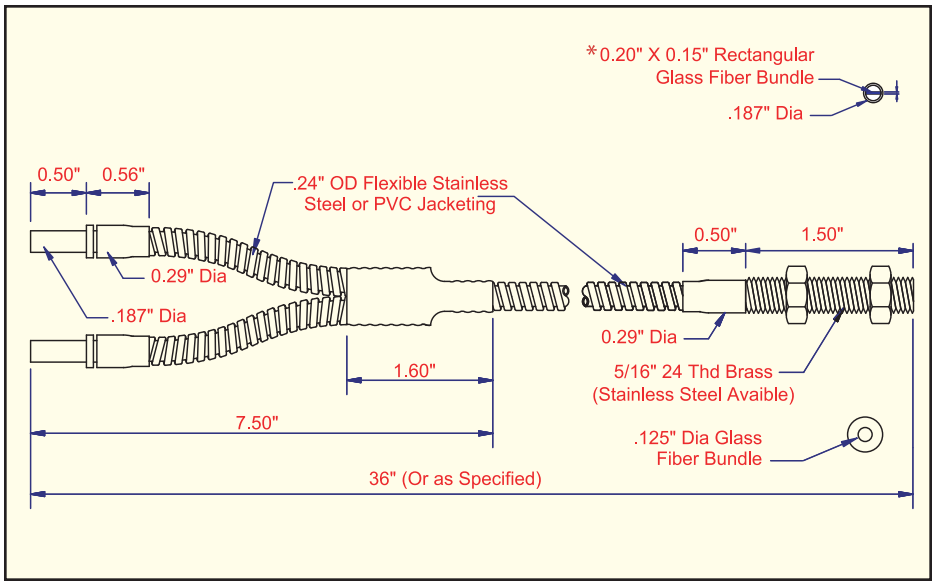
MODEL	BUNDLE SIZE
BF-A-36RT	.125"
BF-B-36RT	.062"
BF-E-36RT	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-A-36RTP	.125"
BF-B-36RTP	.062"
BF-E-36RTP	.046"



Glass Bifurcated Light Guides

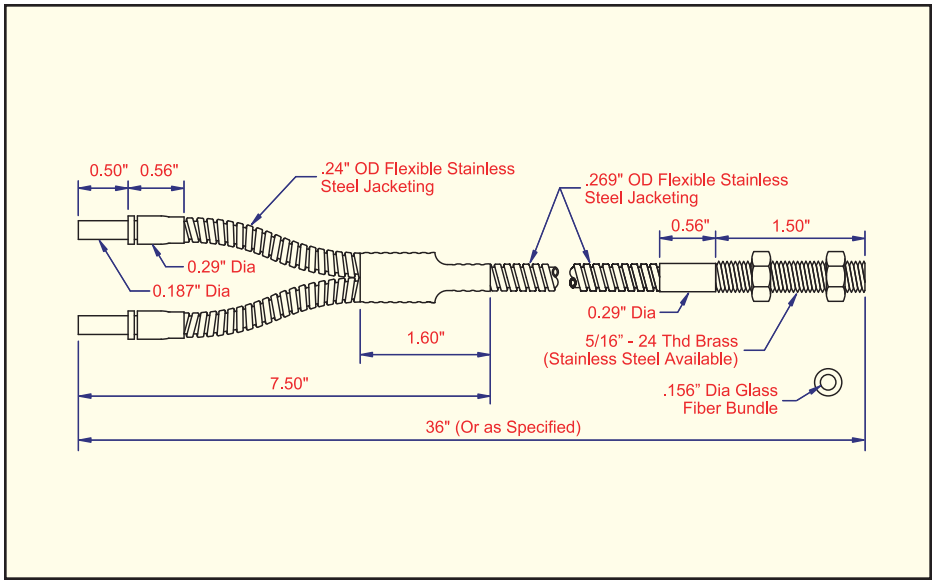


Straight Threaded Tip
Stainless Steel Jacket

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"

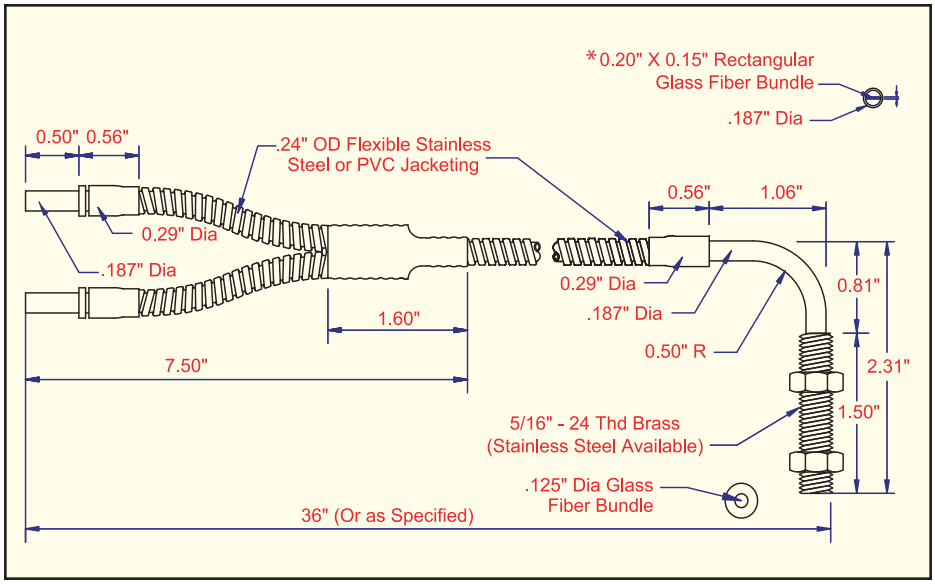
PVC Monocoil Jacket

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"

Drawing available at ttco.com

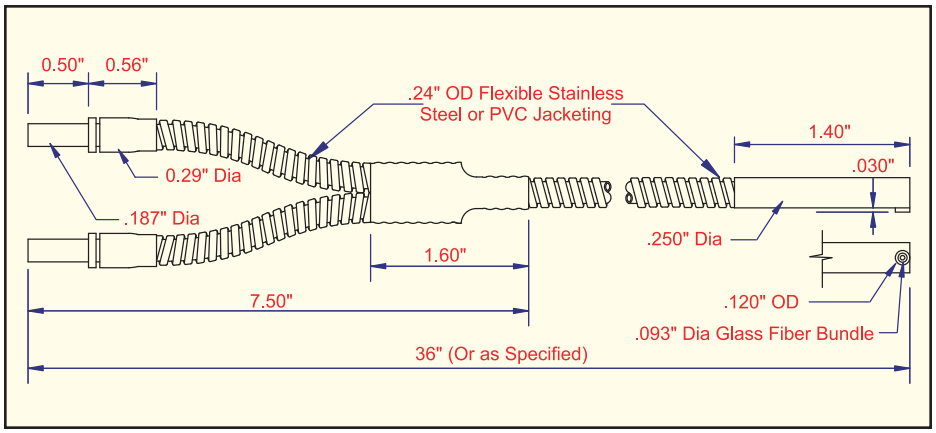
Glass Bifurcated Light Guides

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"

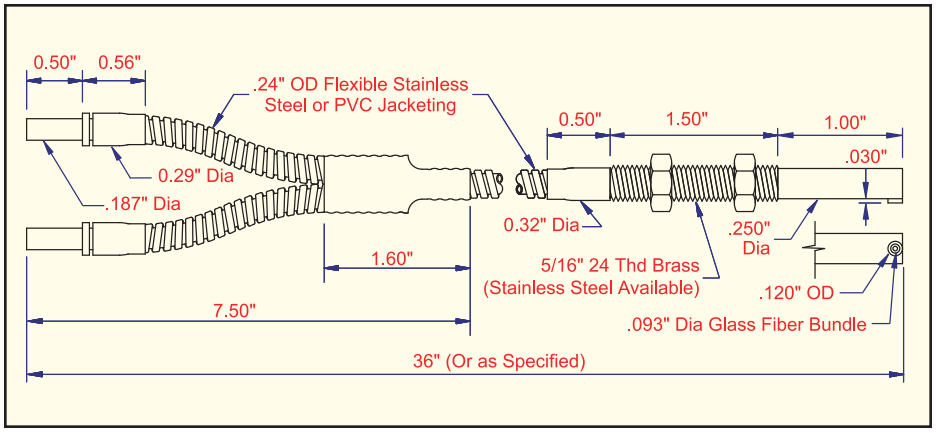


Side View, Right Angle Threaded, Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-A-36RST	.093"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-A-36RSTP	.093"

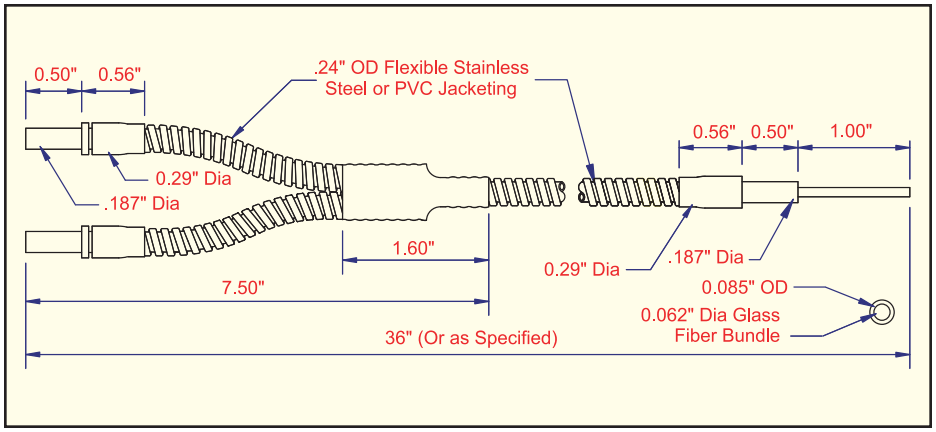


Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-B-36	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-B-36P	.062"

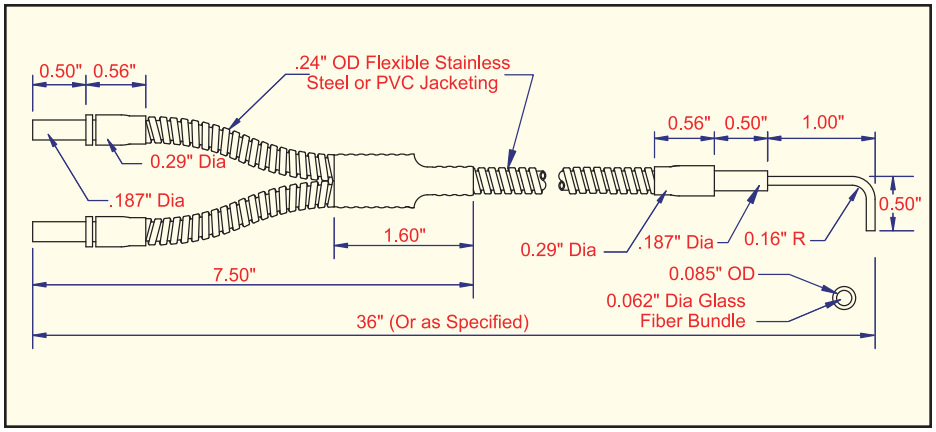


Right Angle Needle Tip
Stainless Steel Jacket

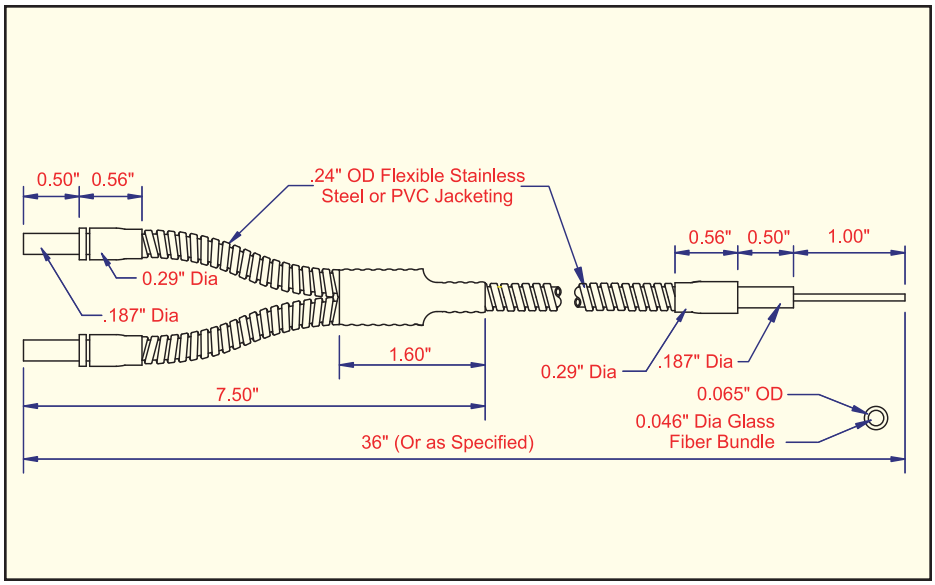
MODEL	BUNDLE SIZE
BF-B-36R	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-B-36RP	.062"



Glass Bifurcated Light Guides

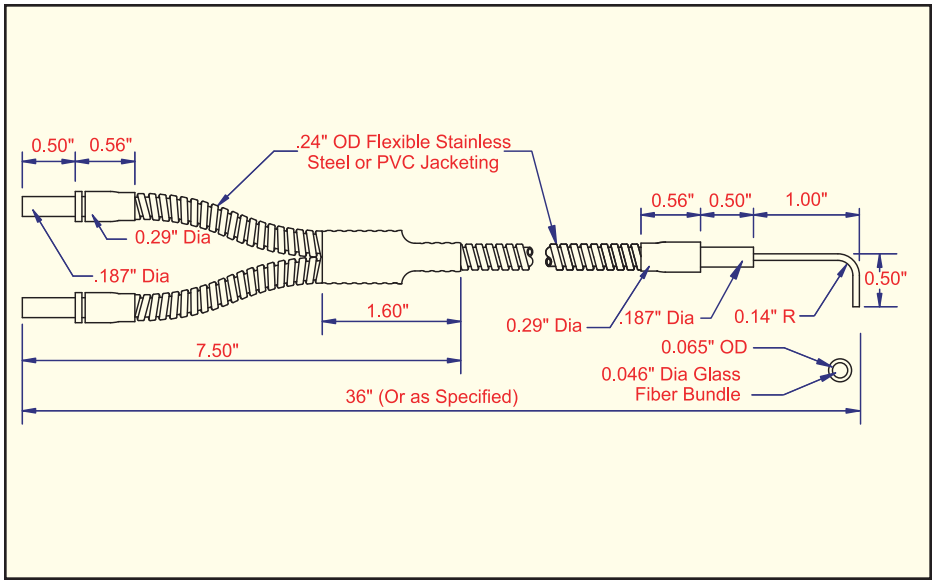


Straight Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-E-36	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-E-36P	.046"

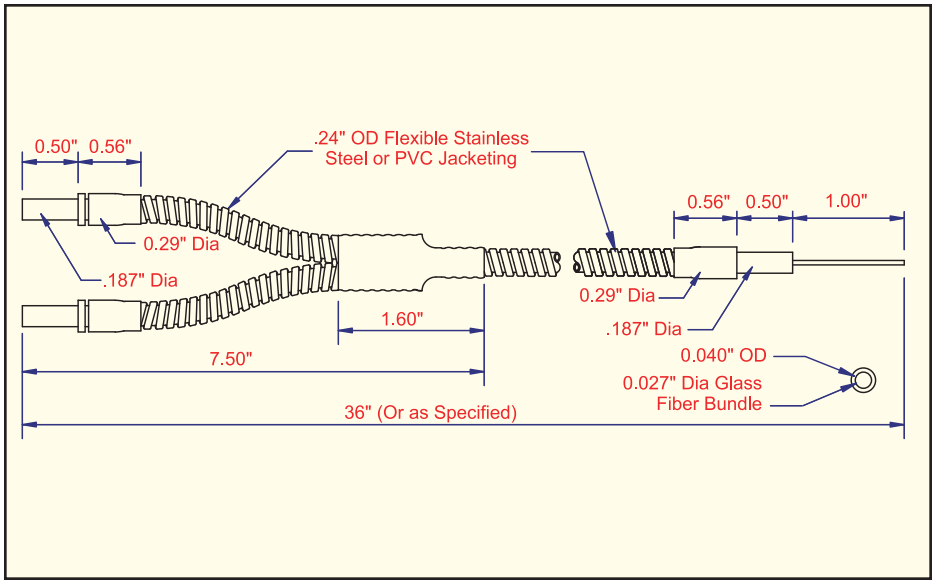


Right Angle Needle Tip
Stainless Steel Jacket

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"

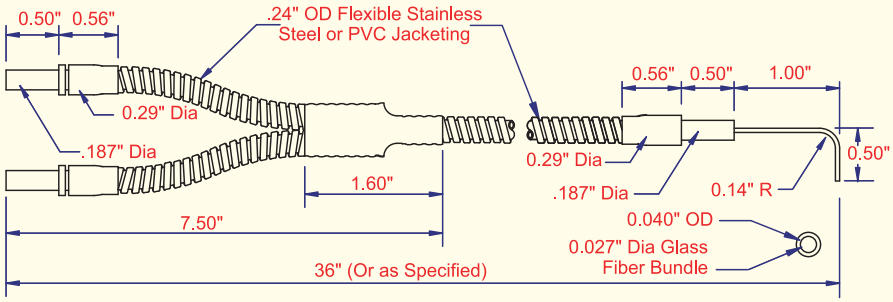
Glass Bifurcated Light Guides

Right Angle Needle Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-J-36R	.027"

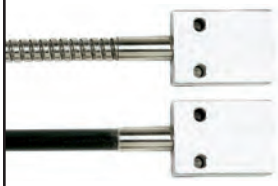
PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-J-36RP	.027"



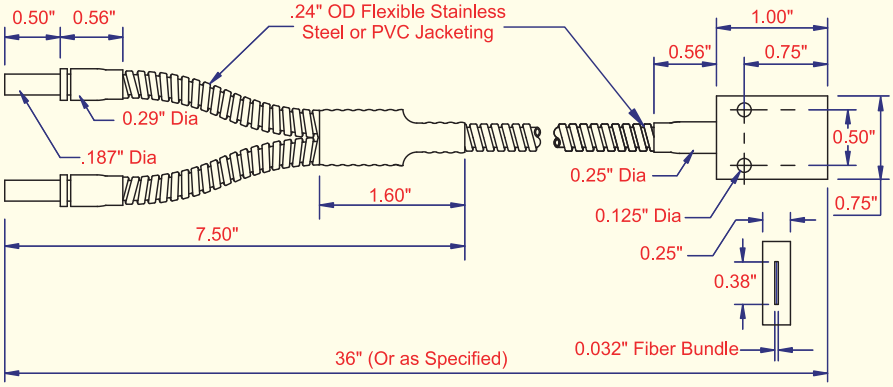
Rectangular Flat Housing
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-C-36	.032" x .38"



PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-C-36P	.032" x .38"

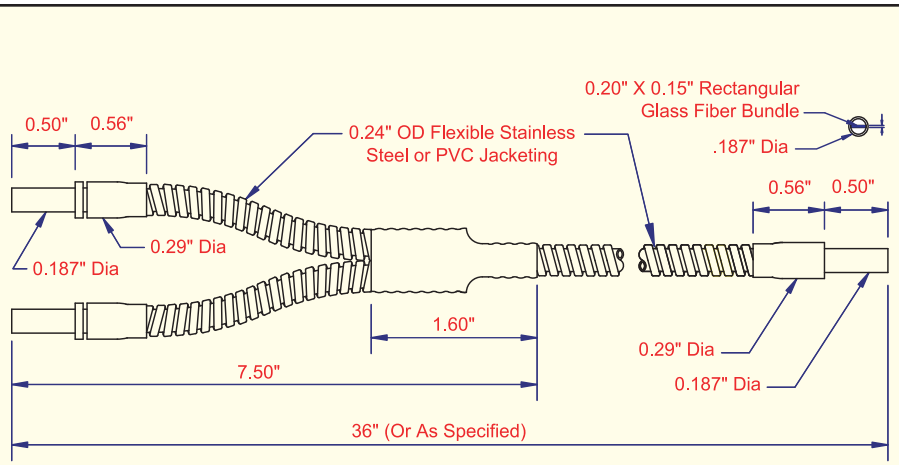


Rectangular Bundle Barrel Tip
Stainless Steel Jacket

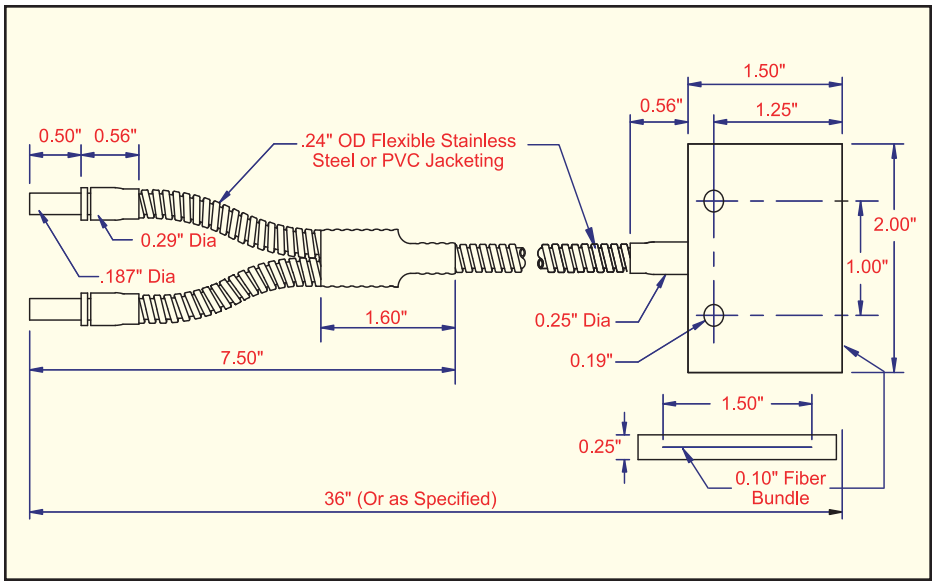
MODEL	BUNDLE SIZE
BF-K-36	.020" x .15"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-K-36P	.020" x .15"

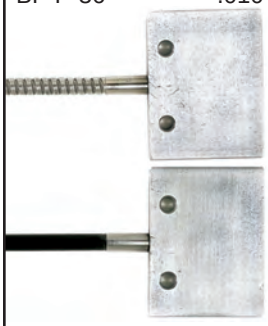


Glass Bifurcated Light Guides



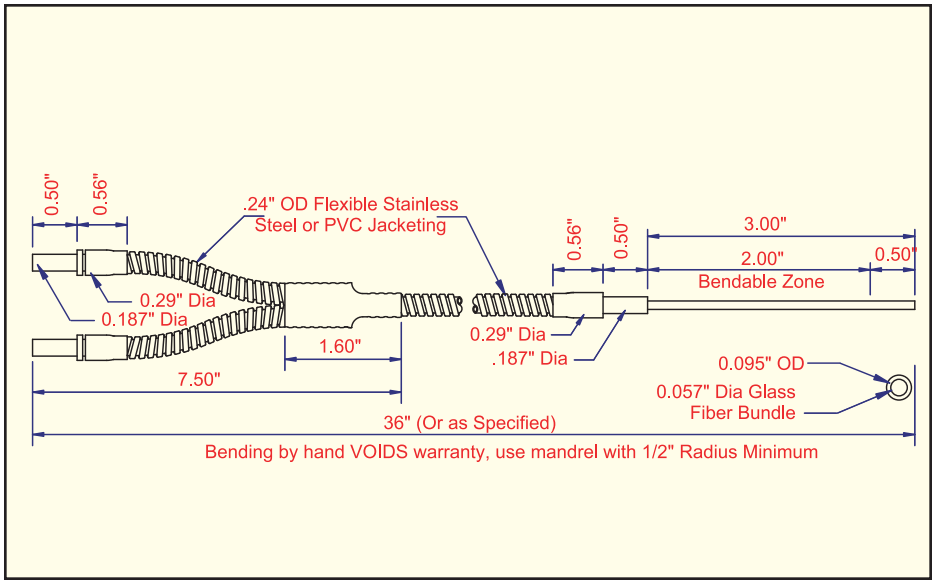
Rectangular, 2" Flat Housing
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-P-36	.010" x 1.50"



PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-P-36P	.010" x 1.50"

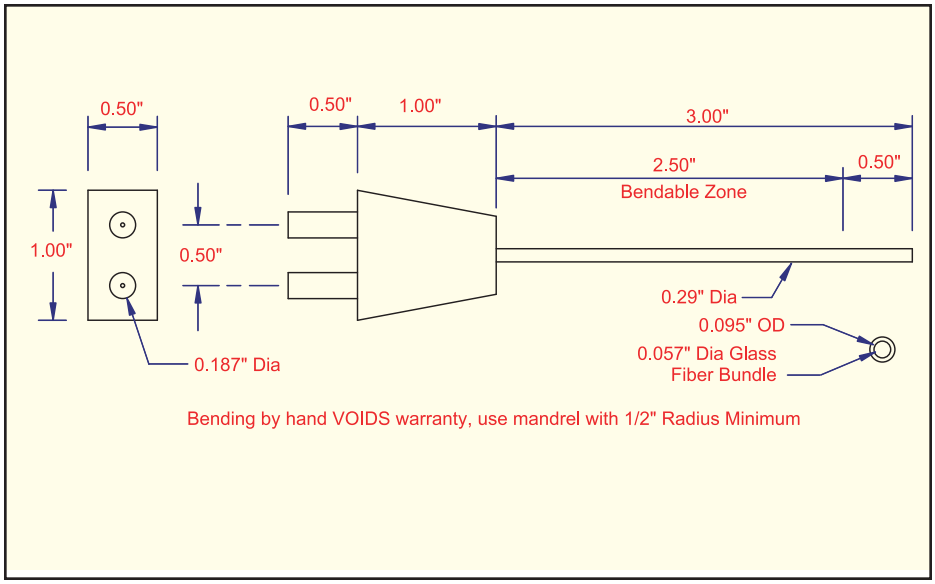


3" Long Bendable Tip
Stainless Steel Jacket

MODEL	BUNDLE SIZE
BF-L-36B	.057"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
BF-L-36BP	.057"



Sensor Adaptor
Bendable 3" Tip
For use with
F1 Optical Block

MODEL	BUNDLE SIZE
BF-L-3B	.057"

Drawing available at ttco.com

Miniature Glass Single Light Guides

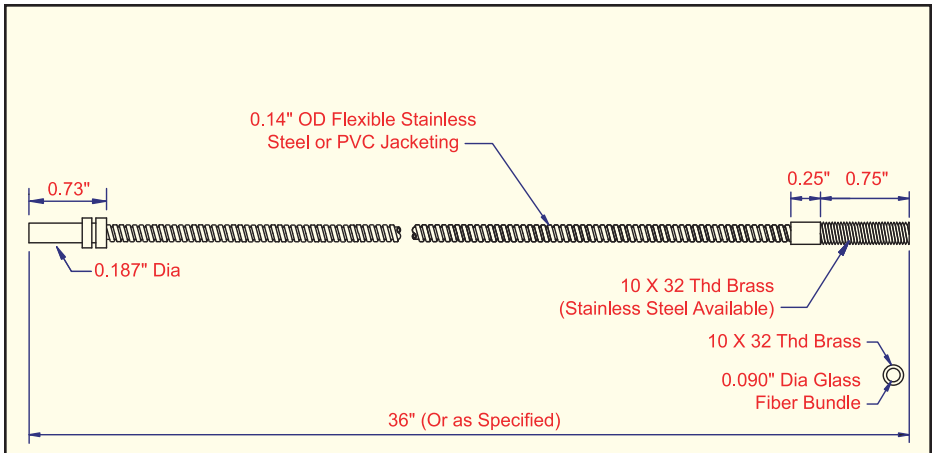
Our **MINIATURE GLASS FIBEROPTIC LIGHT GUIDES** utilize the high performance and protection of glass fibers with the space saving flexibility of plastic fibers, plus a tighter bend radius. ***Now there is nowhere we can't take you.***

Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-A-36T	.090"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36TP	.062"

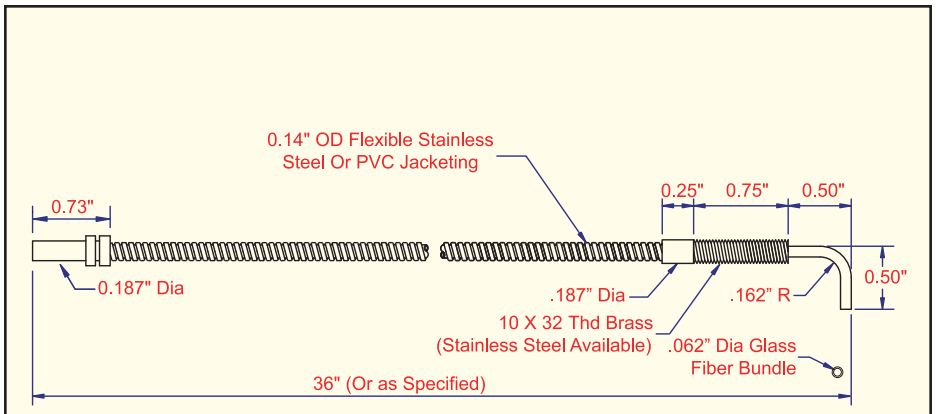


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-B-36RT	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36RTP	.062"

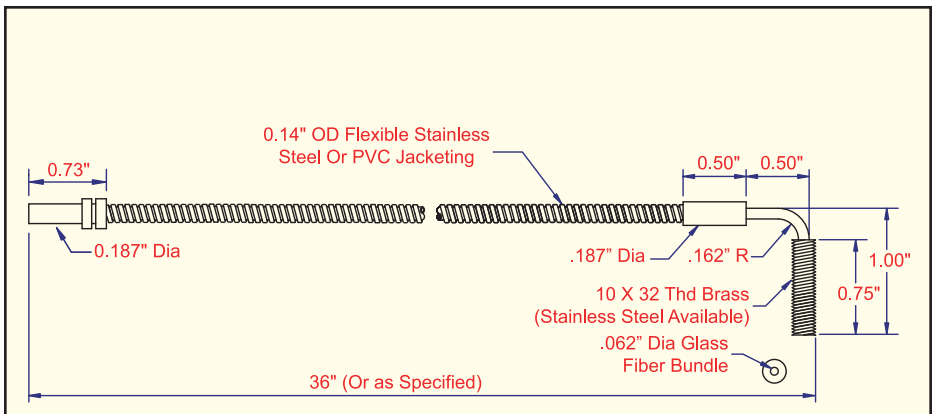


Stainless Steel Jacket

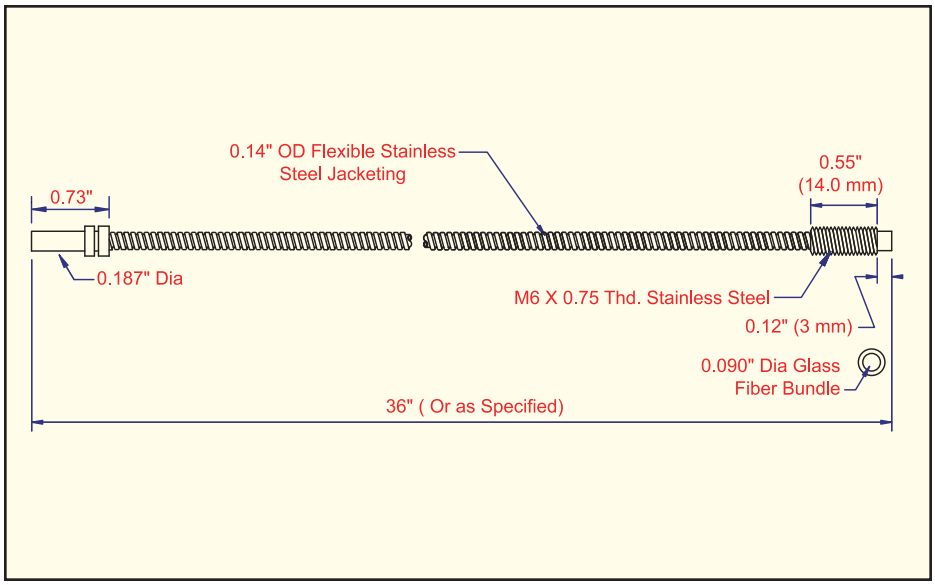
MODEL	BUNDLE SIZE
MF-B-36TR	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36TRP	.062"



Miniature Glass Single Light Guides

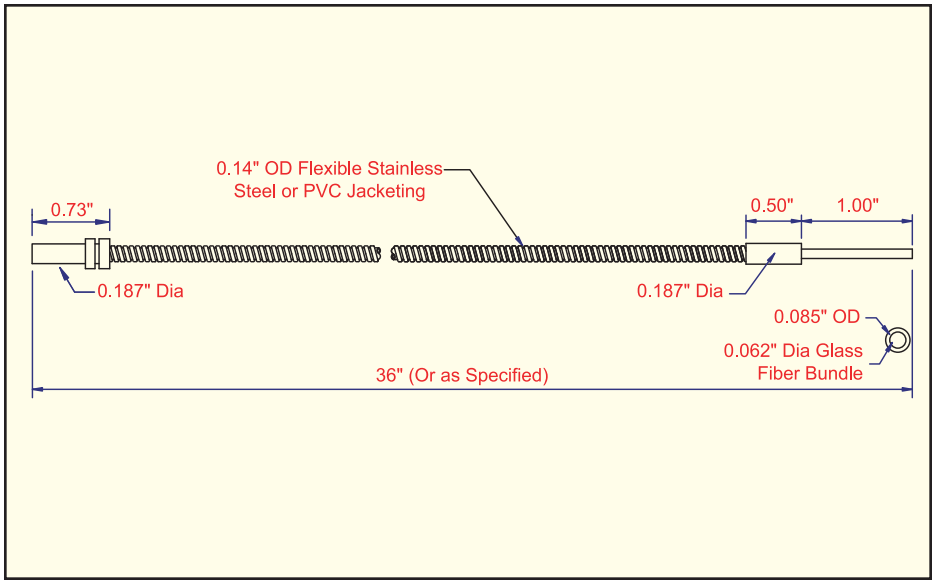


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-A-36TM6	.090"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36TM6P	.062"

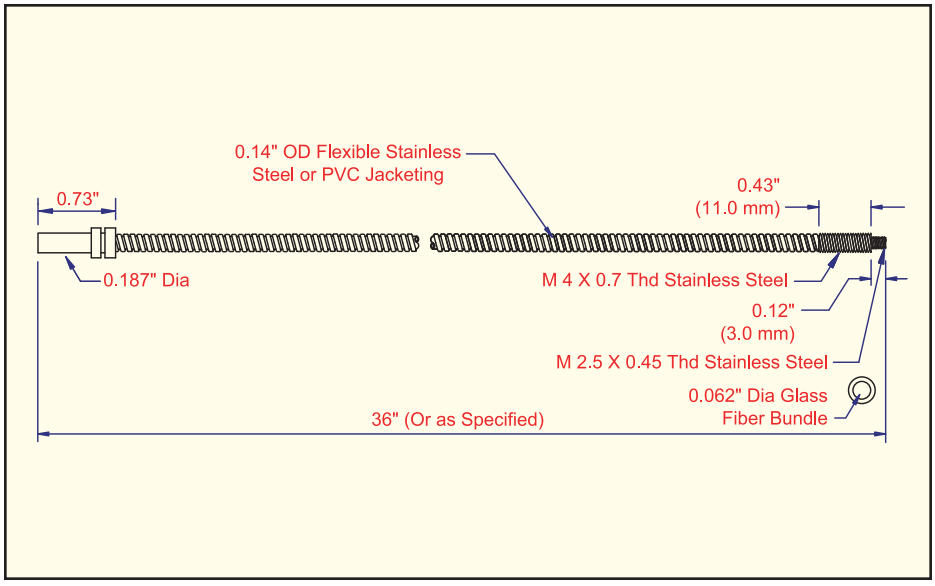


Stainless Steel Jacket

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"

Drawing available at ttco.com

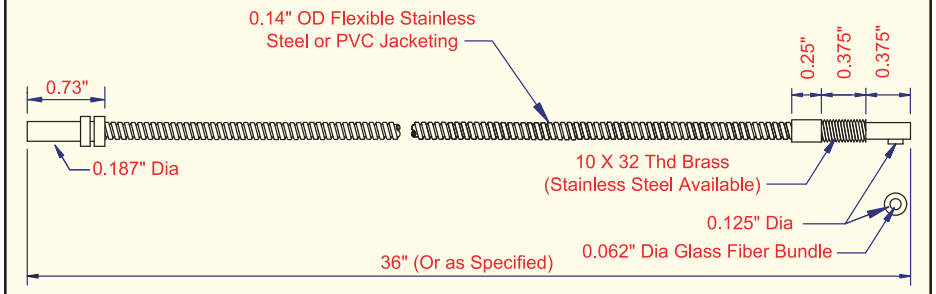
Miniature Glass Single Light Guides

Side View, Right Angle, Threaded, Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-B-36RS	.062"

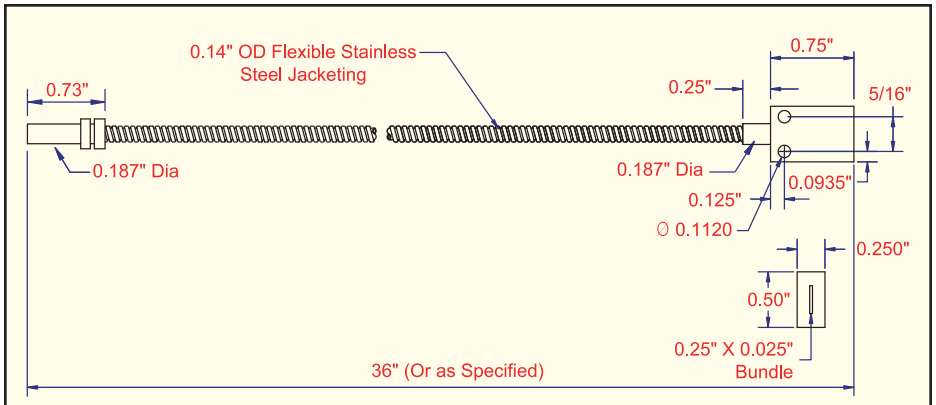
PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-B-36RSP	.062"



Rectangular Flat Housing Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-C-36	0.250" X 0.025"

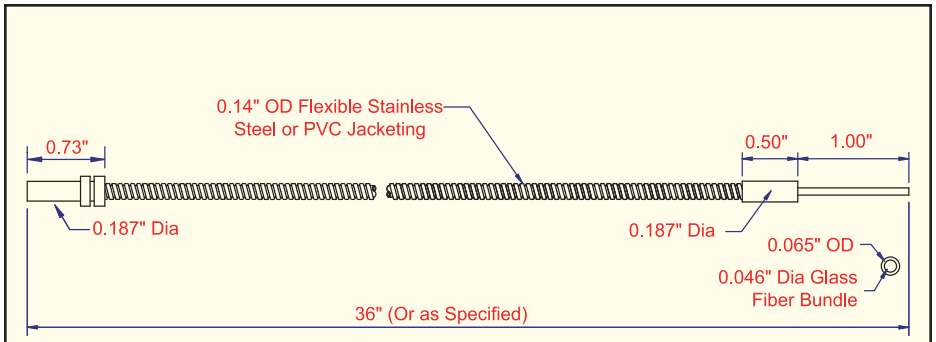


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-E-36	.046"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-E-36P	.046"

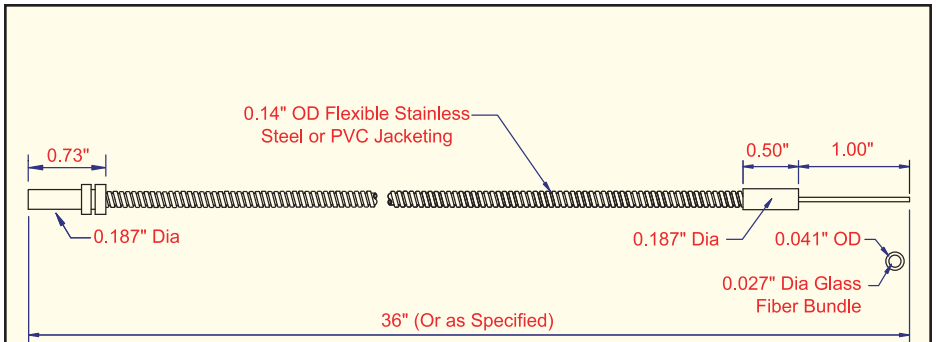


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MF-J-36	.027"

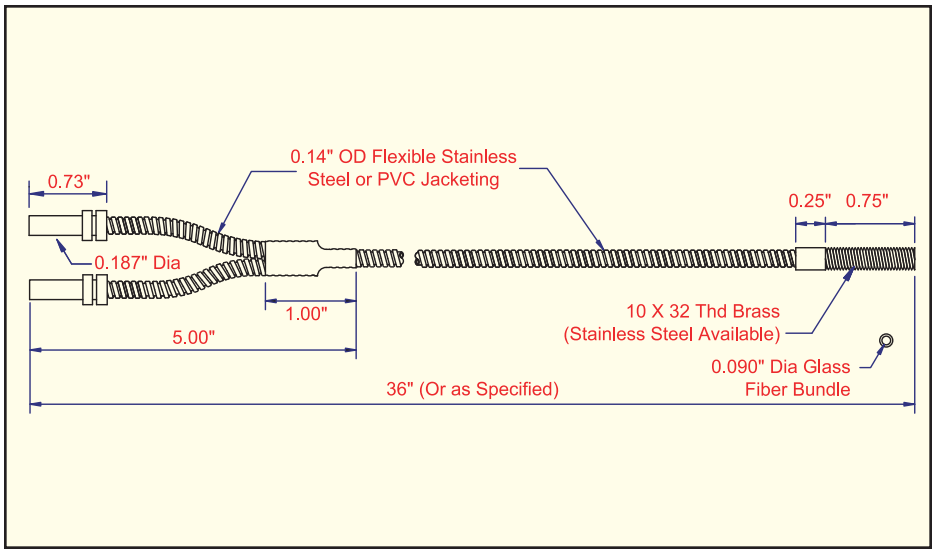
PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MF-J-36P	.027"



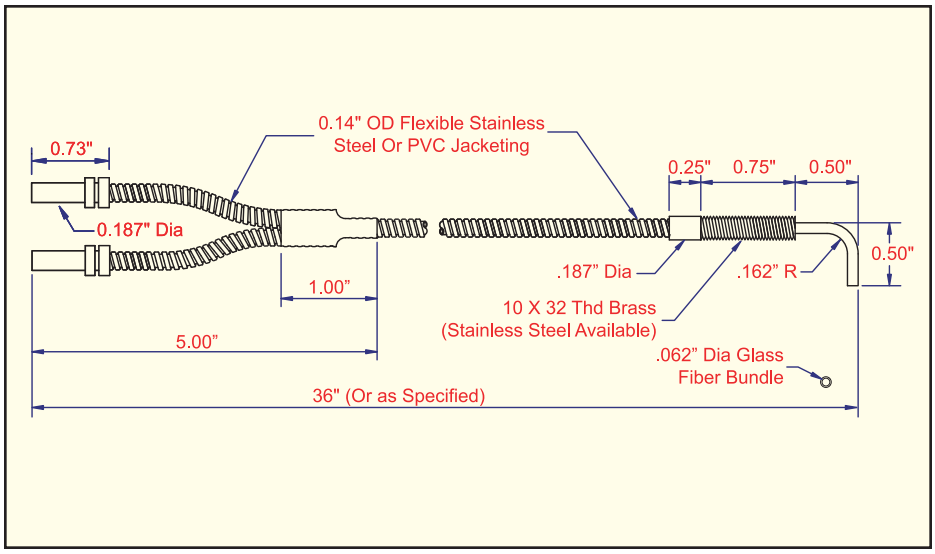
FINALLY… BIFURCATED FIBEROPTIC LIGHT GUIDES

in a small package with the performance of glass



Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-A-36T	.090"
MBF-B-36T	.062"

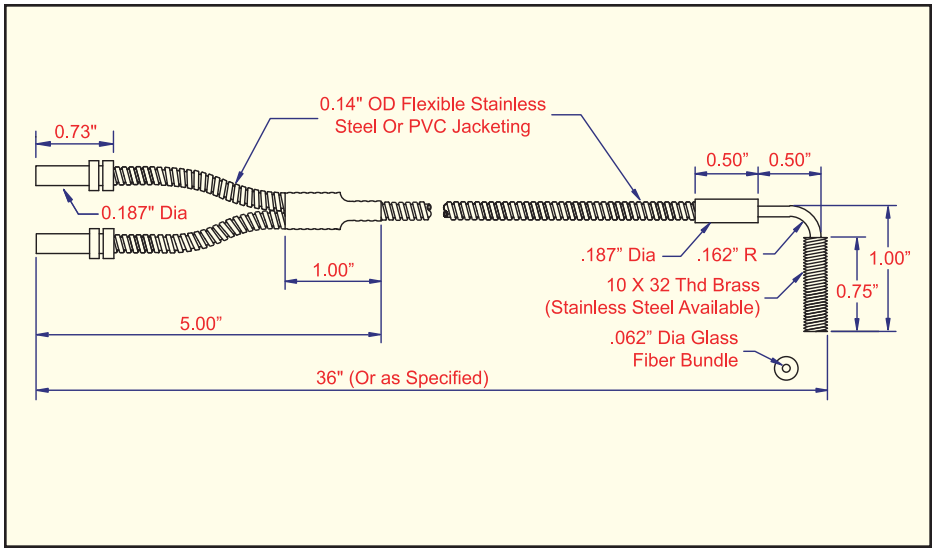


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-B-36RT	.062"

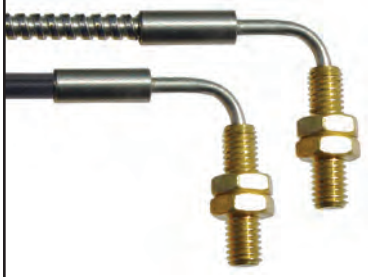
PVC Monocoil Jacket

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"

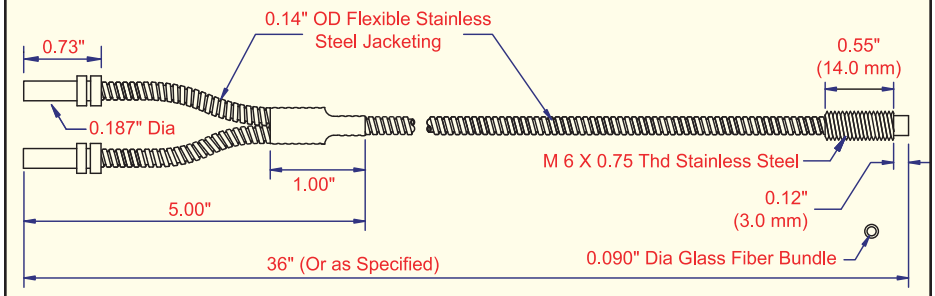
Miniature Glass Bifurcated Light Guides

Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-A-36TM6	.090"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36TM6P	.062"

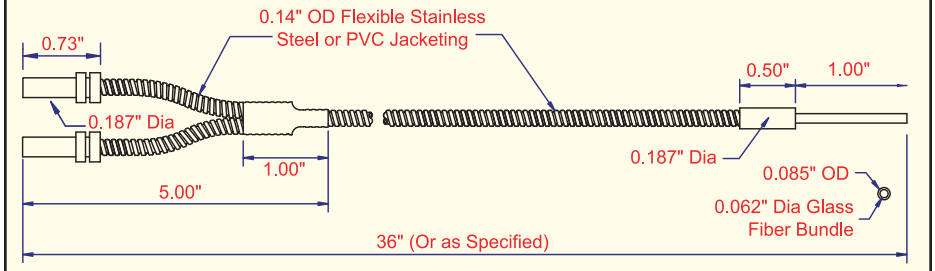


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-B-36	062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36P	062"

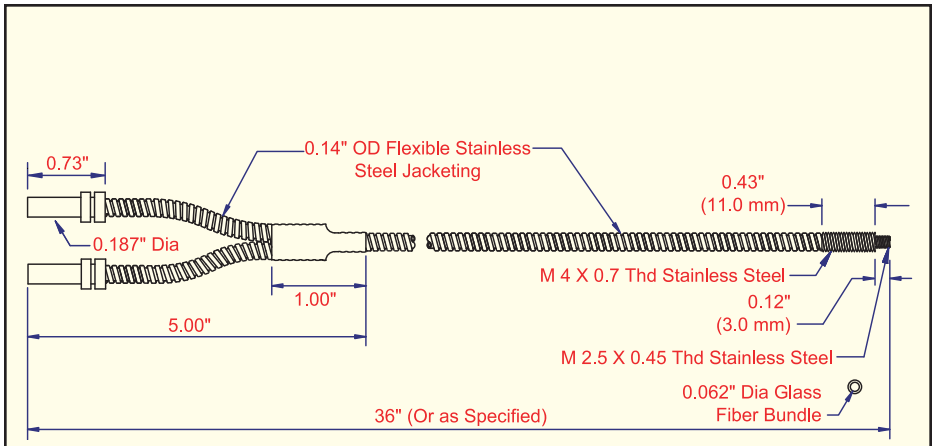


Stainless Steel Jacket

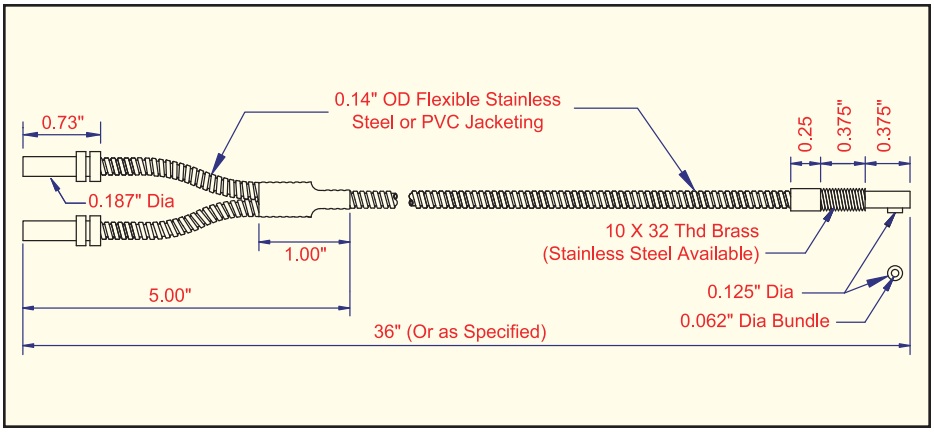
MODEL	BUNDLE SIZE
MBF-B-36TM4	.062"

PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36TM4P	062"



Miniature Glass Bifurcated Light Guides

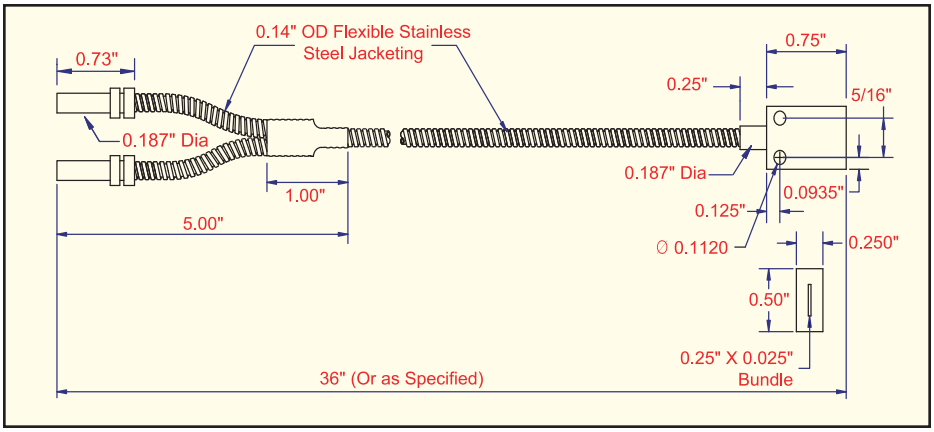


Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-B-36RS	.062"

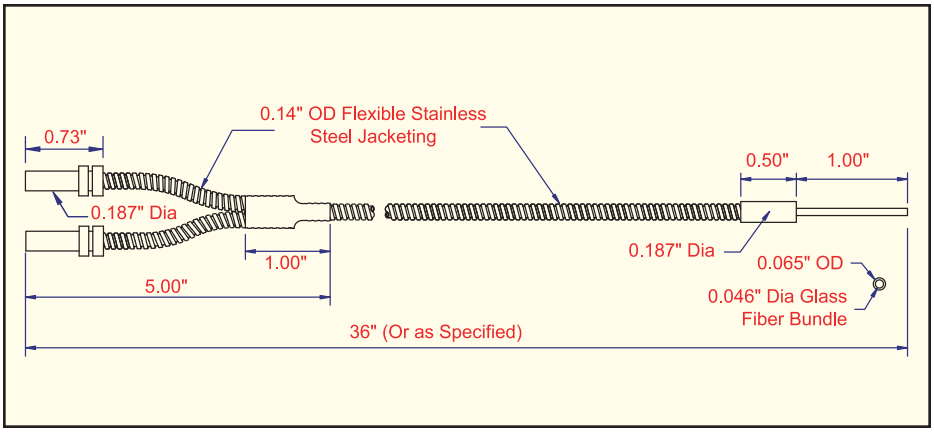
PVC Monocoil Jacket

MODEL	BUNDLE SIZE
MBF-B-36RSP	.062"



Rectangular Flat Housing Stainless Steel Jacket

MODEL	BUNDLE SIZE
MBF-C-36	0.250" X 0.025"

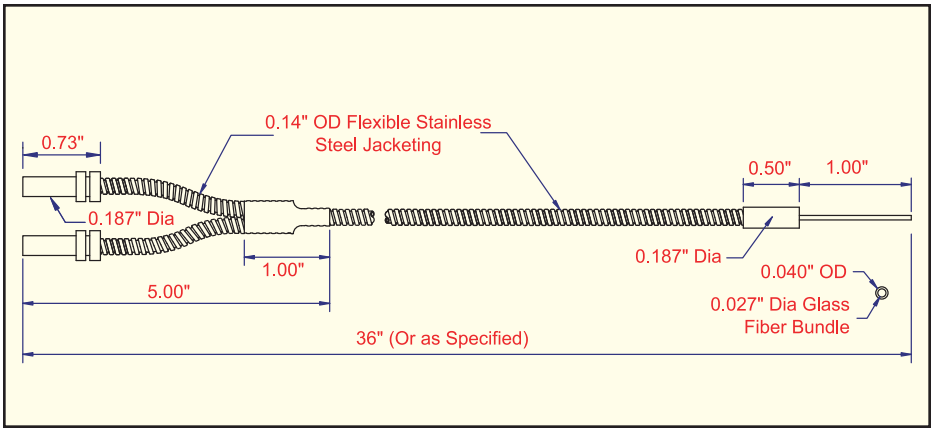


Stainless Steel Jacket

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

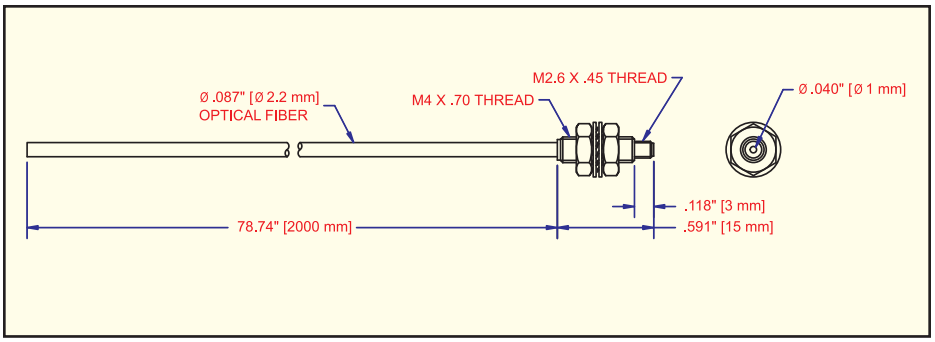
MODEL	BUNDLE SIZE
MBF-J-36P	.027"

Plastic Single Light Guides

All Plastic Fibers are priced per package.
Plastic Single Light Guides have two per package.

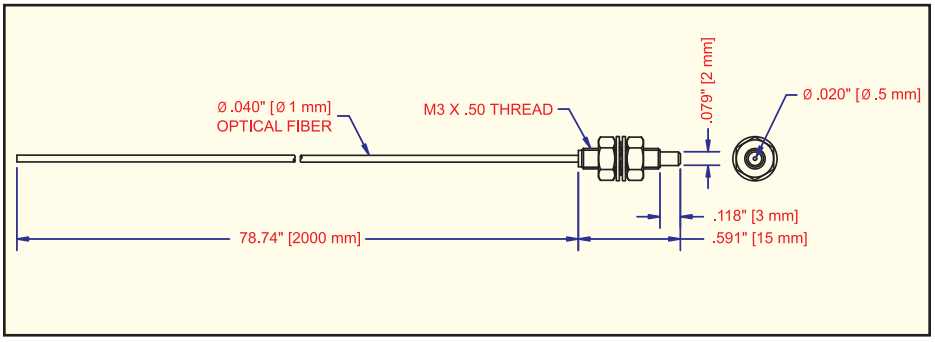
Straight Threaded Tip

MODEL	BUNDLE SIZE
PF-Z-78TL	.040"



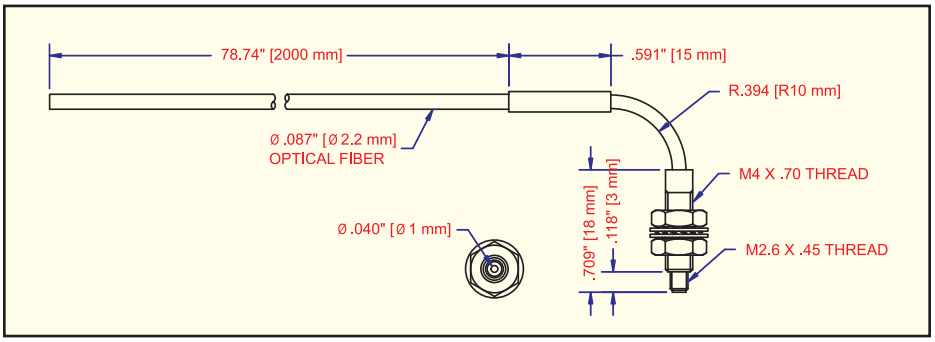
Straight Threaded Tip

MODEL	BUNDLE SIZE
PF-Q-78T	.020"



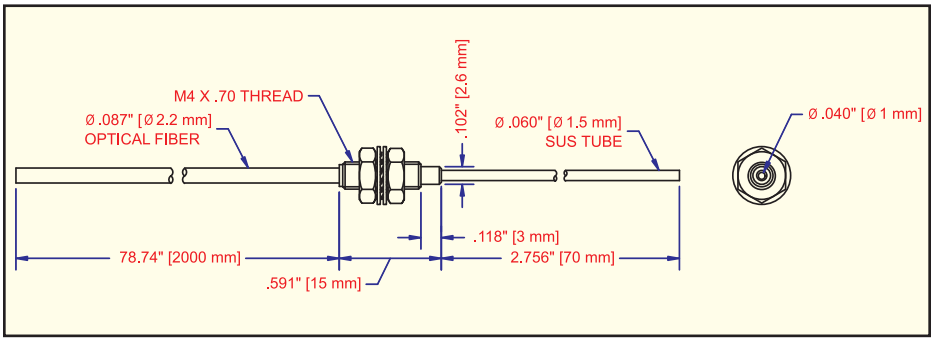
Threaded Tip then Right Angle

MODEL	BUNDLE SIZE
PF-Z-78TRL	.040"



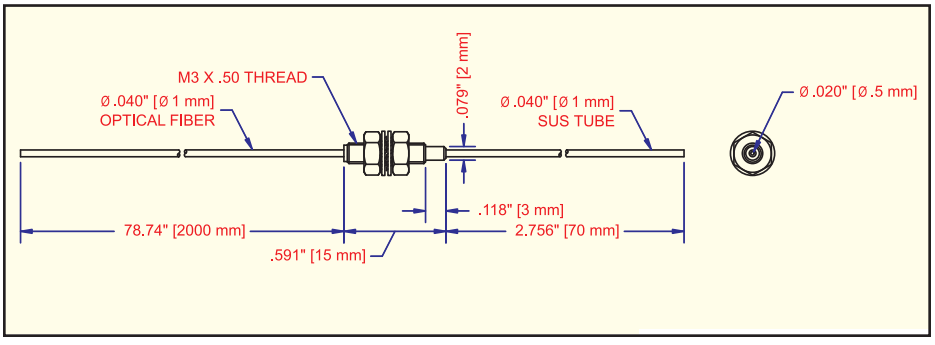
Straight Threaded Needle Tip

MODEL	BUNDLE SIZE
PF-Z-78T70	.040"



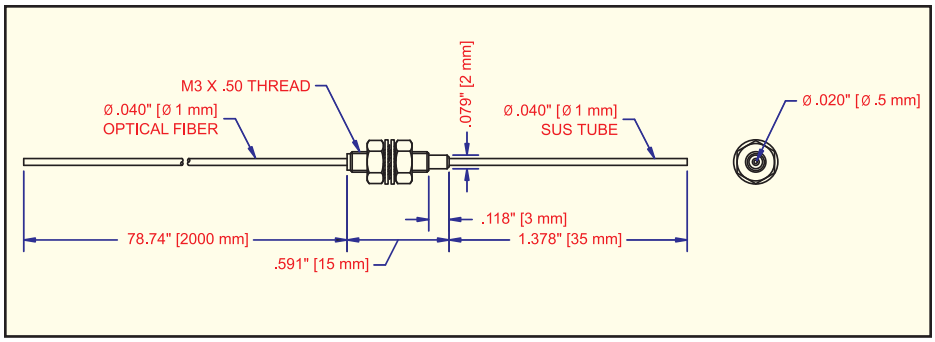
Straight Needle Tip with Threaded Mounting

MODEL	BUNDLE SIZE
PF-Q-78T70	.020"



Plastic Single Light Guides

All Plastic Fibers are priced per package.
Plastic Single Light Guides have two per package.

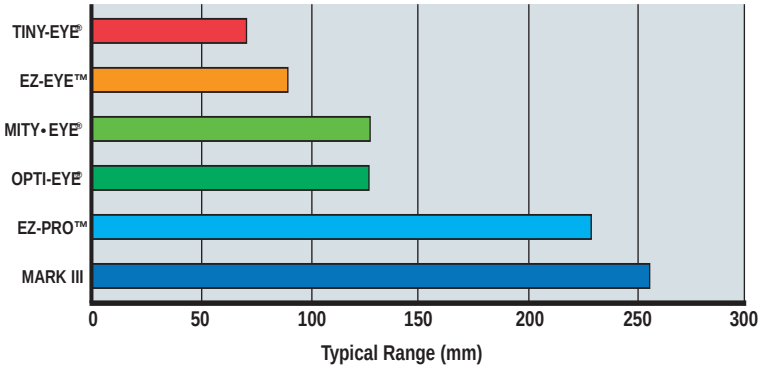


Straight Needle Tip with Threaded Mounting

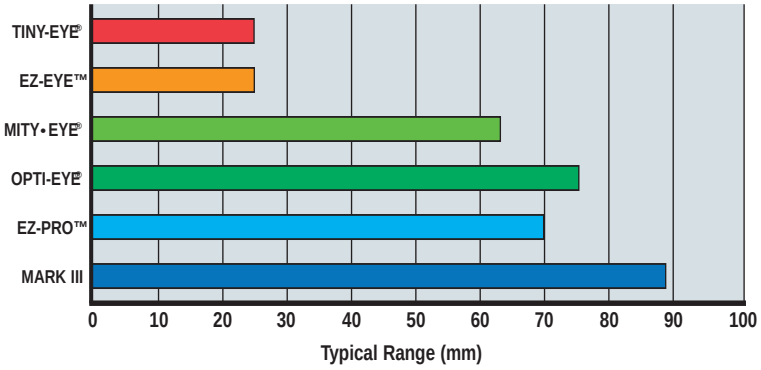
MODEL	BUNDLE SIZE
PF-Q-78T35	.020"

Range Guidelines with Red LED

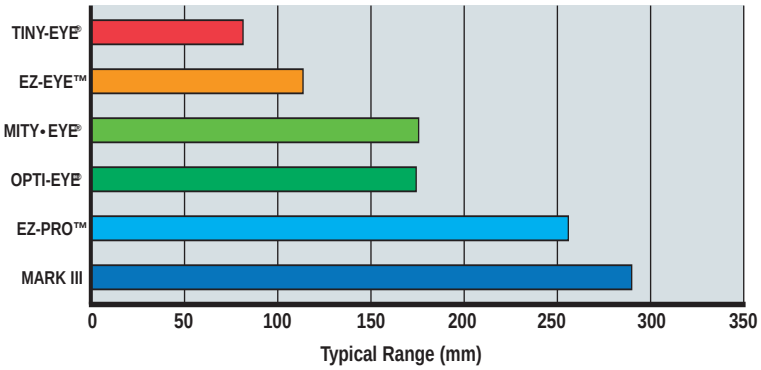
PF-Z-78TL, PF-Z-78T70



PF-Q-78T, PF-Q-78T35, PF-Q-78T70



PF-Z-78TRL



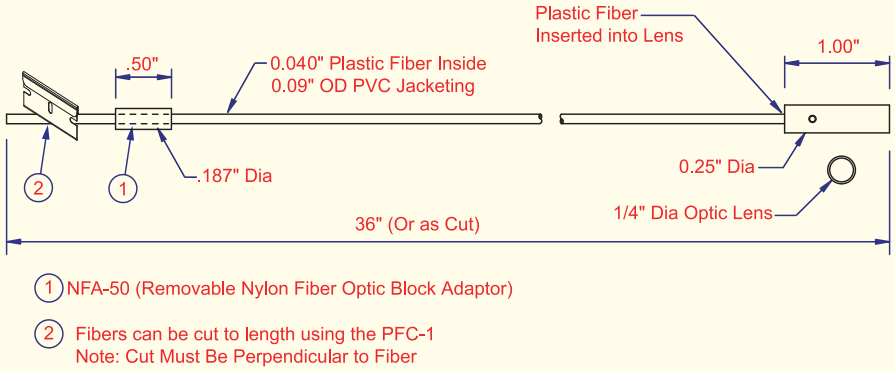
Drawing available at ttco.com

Plastic Single Light Guides

All Plastic Fibers are priced per package.
Plastic Single Light Guides have two 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

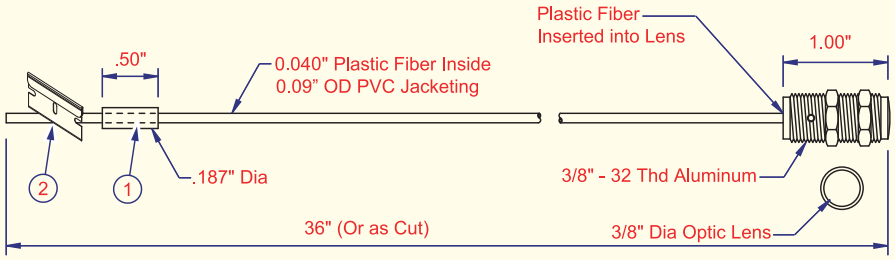


1 NFA-50 (Removable Nylon Fiber Optic Block Adaptor)

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



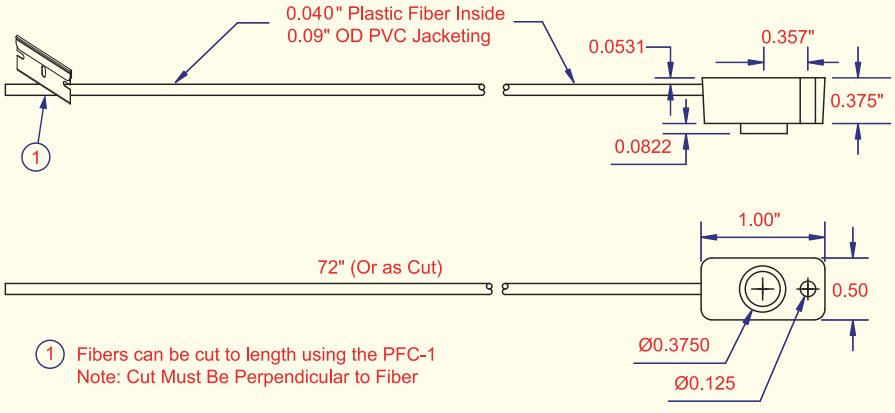
1 NFA-50 (Removable Nylon Fiber Optic Block Adaptor)

2 Fibers can be cut to length using the PFC-1
Note: Cut Must Be Perpendicular to Fiber

Plastic Fibers
Right Angle

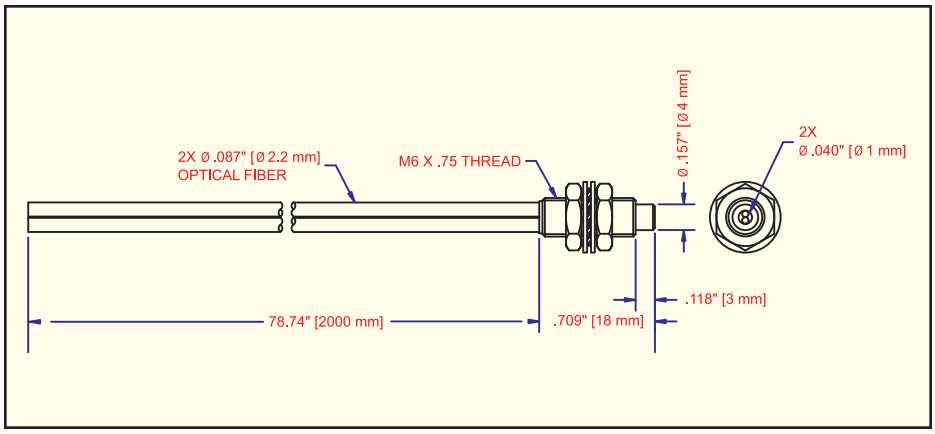
MODEL	BUNDLE SIZE
F-S-72R	.040"
F-S-120R	

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.**



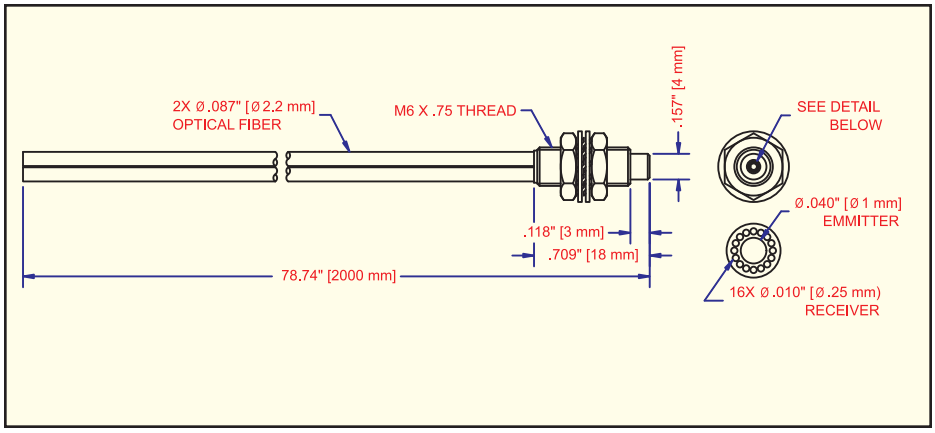
1 Fibers can be cut to length using the PFC-1
Note: Cut Must Be Perpendicular to Fiber

Plastic Diplex Light Guides



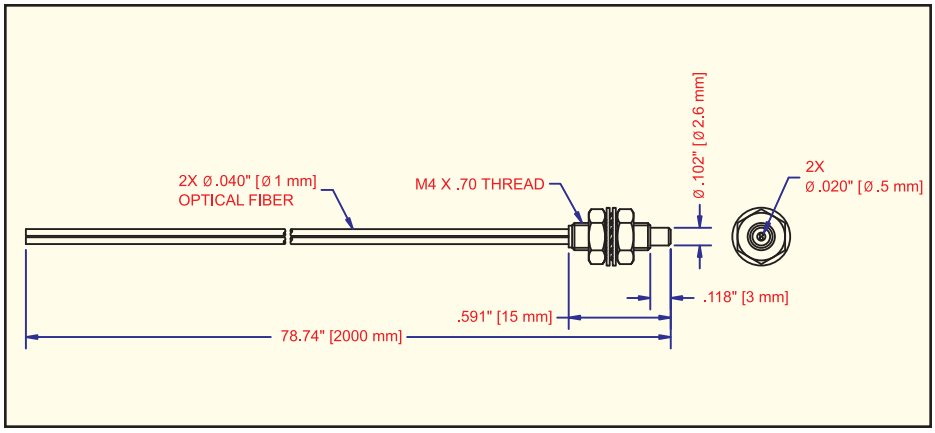
Threaded Tip

MODEL	BUNDLE SIZE
PFD-Z-78M6-4	.040"



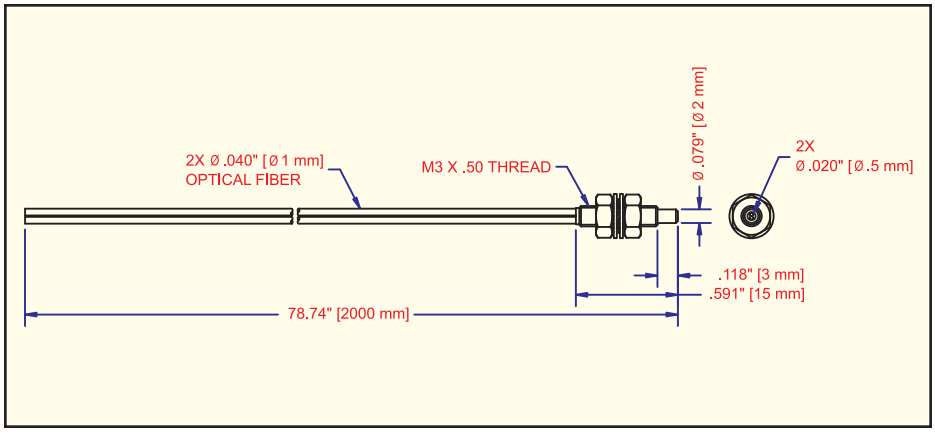
Coaxial Threaded Tip

MODEL	BUNDLE SIZE
PFD-CZ-78T	Emitter: .040" Receiver: .010"



Threaded Tip

MODEL	BUNDLE SIZE
PFD-Q-78M4	.020"



Threaded Tip

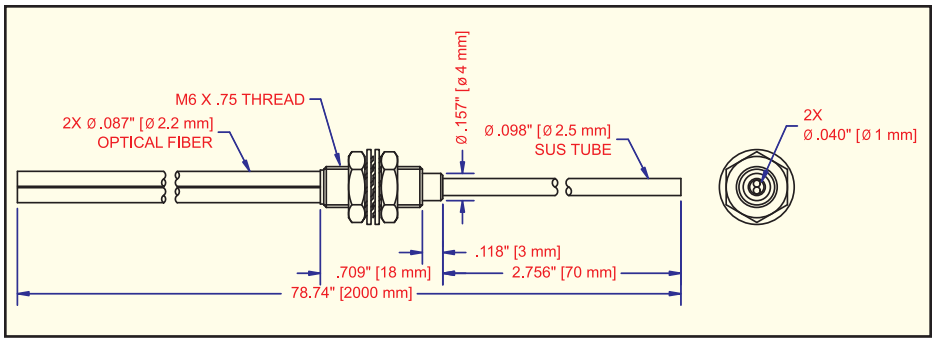
MODEL	BUNDLE SIZE
PFD-Q-78M3	.020"

Drawing available at ttco.com

Plastic Diplex Light Guides

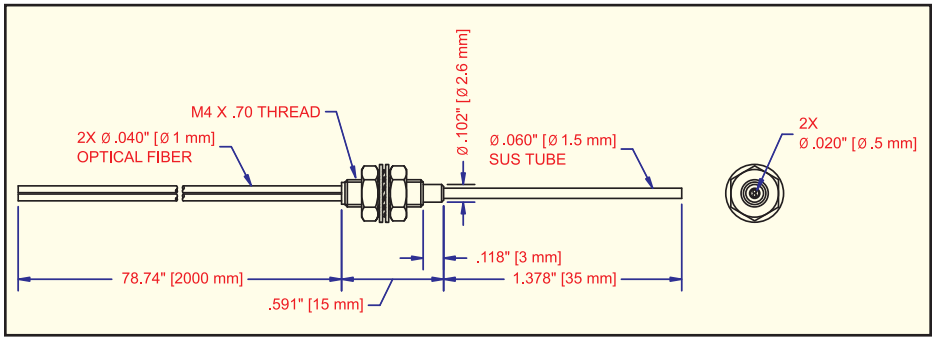
Straight Needle Tip, Threaded

MODEL	BUNDLE SIZE
PFD-Z-78T70	.040"



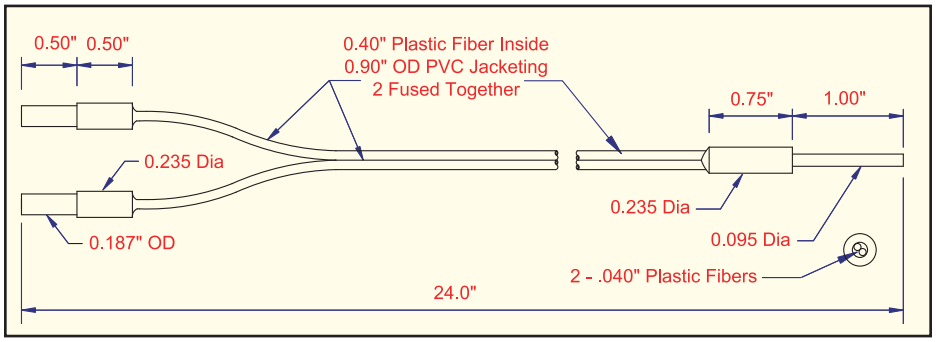
Needle Tip with Threaded Mounting Diplex

MODEL	BUNDLE SIZE
PFD-Q-78T35	.020"



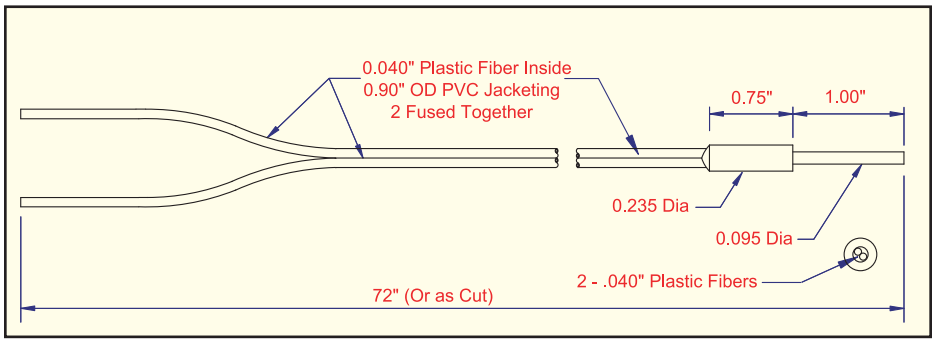
Straight Needle Tip

MODEL	BUNDLE SIZE
BF-W-24PP	.040"



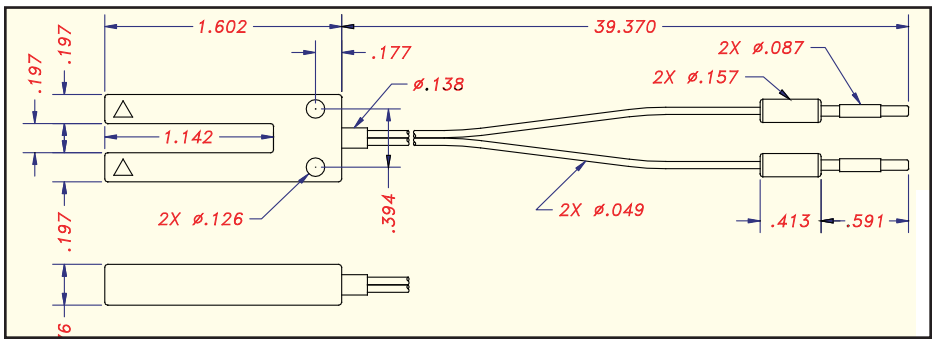
Straight Needle Tip

MODEL	BUNDLE SIZE
BF-Y-72PPC	.040"



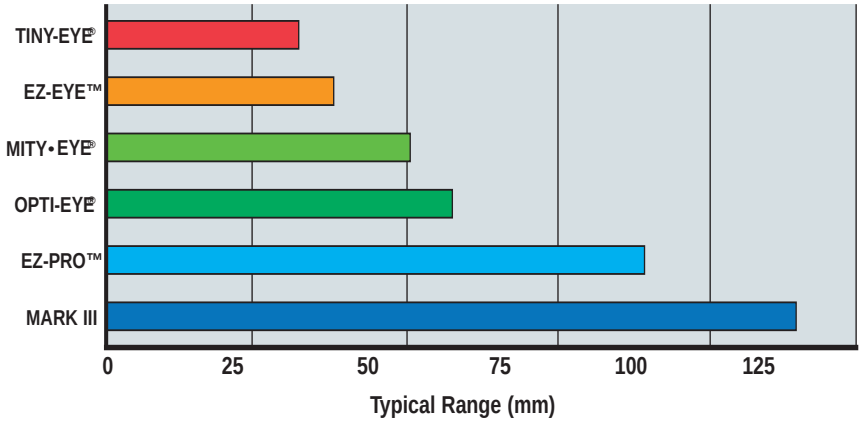
Gap Probe Tip

MODEL	BUNDLE SIZE
PF-G-41	.40"

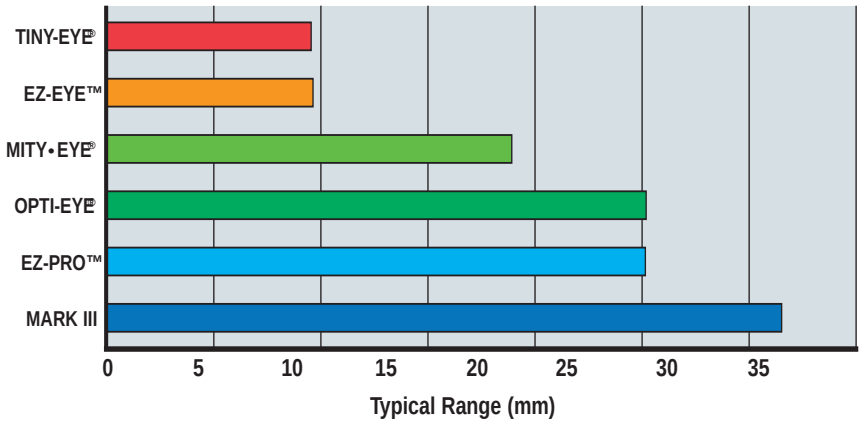


Plastic Diplex Light Guides

PFD-Z-78M6, PFD-Z-78M64, PFD-Z-78T70, PFD-CZ-78T



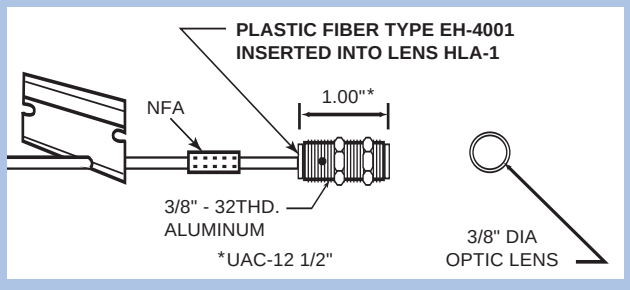
PFD-Q-78M3, PFD-Q-78M4, PFD-Q-78T35,

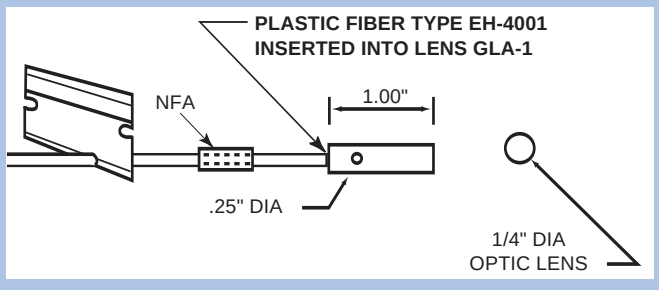


INDIVIDUAL CUT-TO-LENGTH COMPONENTS

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





Drawing available at ttco.com

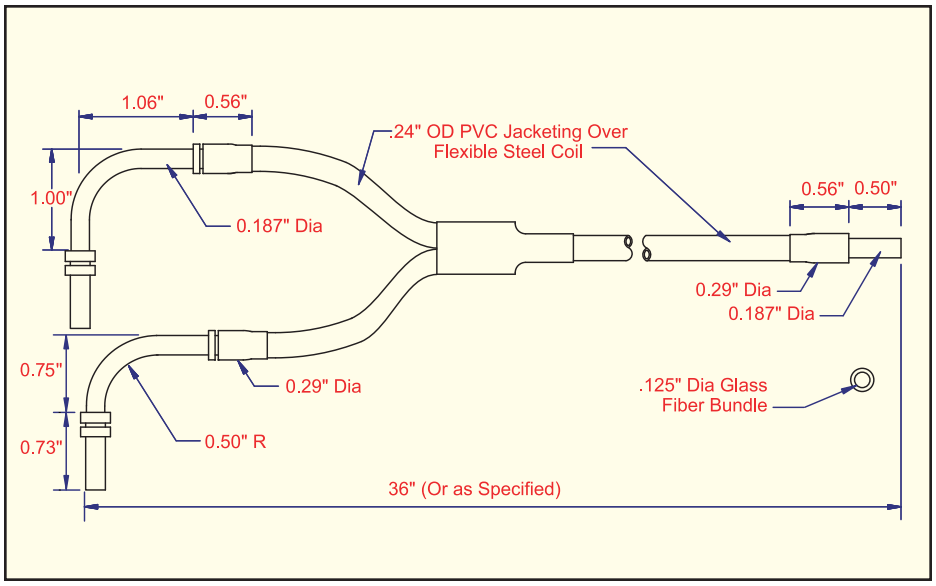
Examples of Custom Light Guides

Custom Fiberoptic tips and lengths BTO (built to order). Please consult factory.

Straight Barrel Tip
PVC Monocoil Jacket
Low Profile

MODEL
BF-A-36X31

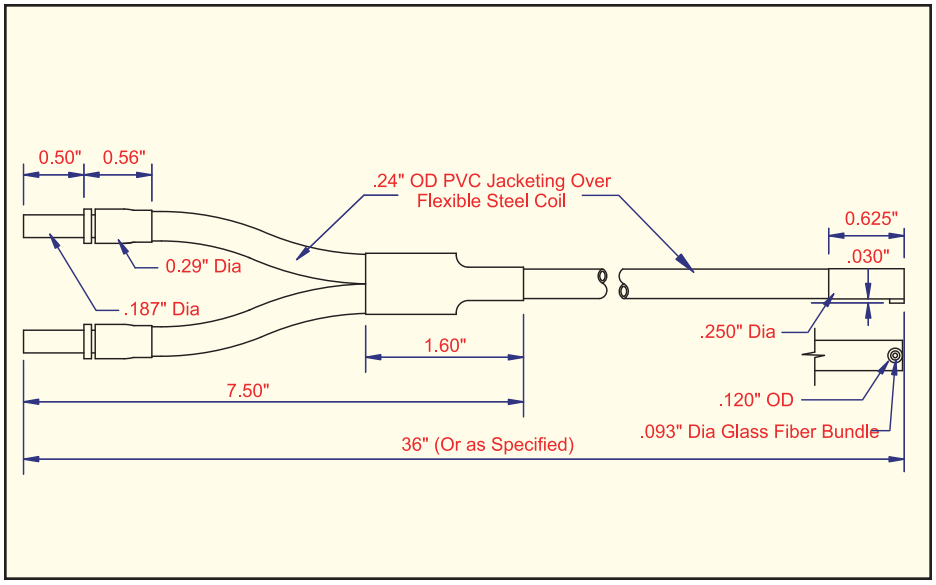
BUNDLE SIZE
.125"



Side View Right
Angle Short Tip
PVC Monocoil Jacket

MODEL
BF-A-36X408

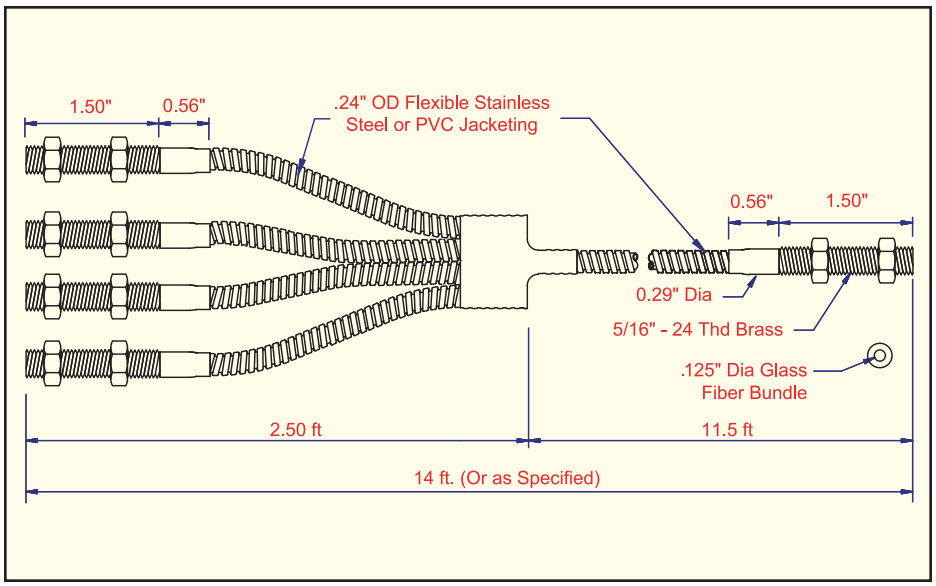
BUNDLE SIZE
.093"



Straight Threaded Tip
Stainless Steel Jacket
Light Pipe

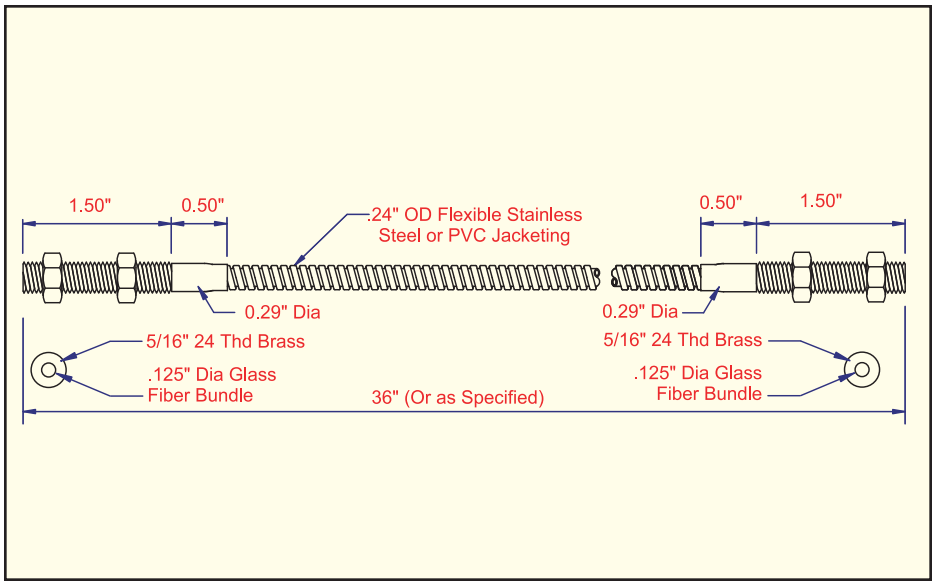
MODEL
F-A-168X448

BUNDLE SIZE
.125"



Examples of Custom Light Guides

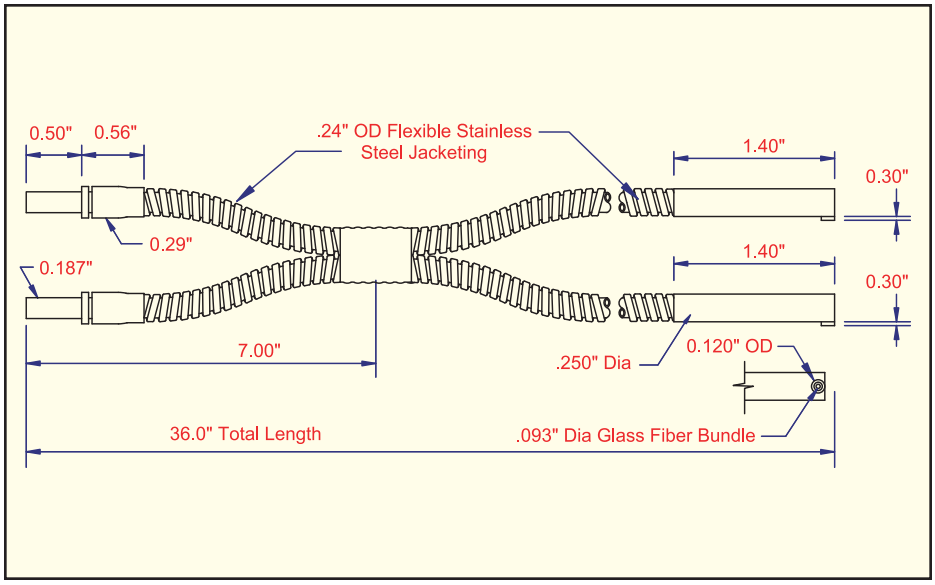
Custom Fiberoptic tips and lengths BTO (built to order). Please consult factory.



Straight Threaded Tip
Light Pipe
Stainless Steel Jacket

MODEL
F-A-36X70

BUNDLE SIZE
.125"

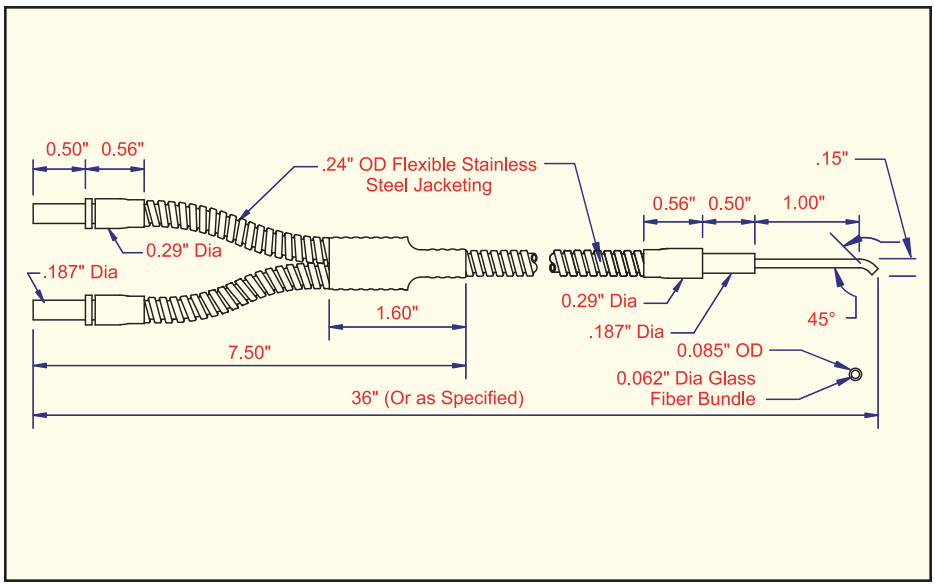


Side View Right Angle
Dual Head Tip
Stainless Steel Jacket

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

Drawing available at ttco.com

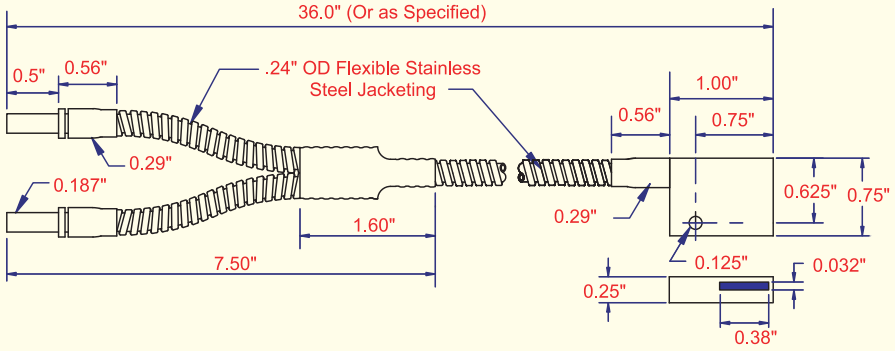
Examples of Custom Light Guides

Custom Fiberoptic tips and lengths BTO (built to order). Please consult factory.

Right Angle "C" Fiber
Stainless Steel Jacket

MODEL
BF-C-36X374

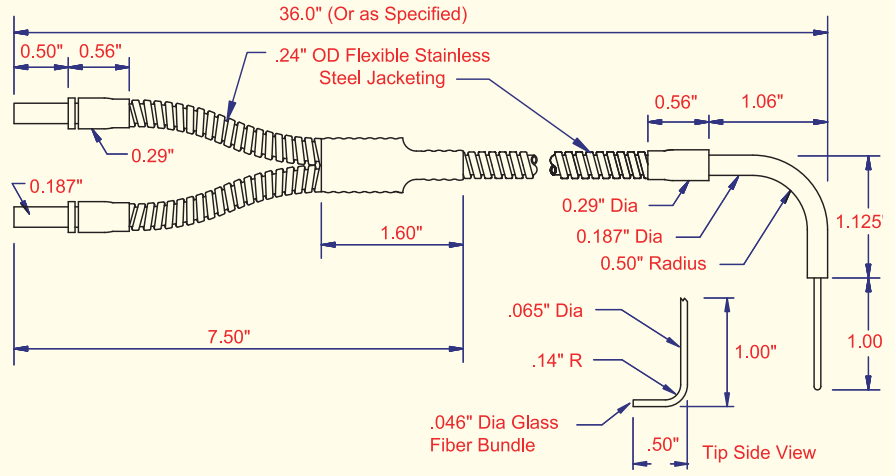
BUNDLE SIZE
0.38" X 0.032"



Jig Fit Fiber
Stainless Steel Jacket

MODEL
BF-E-36X92

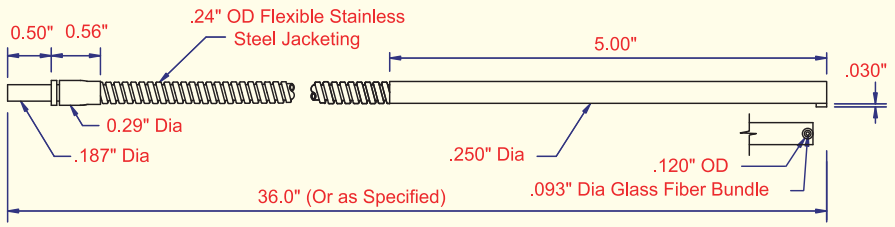
BUNDLE SIZE
.046"



Jig Fit Fiber
Stainless Steel Jacket

MODEL
F-A-36X505

BUNDLE SIZE
.093"



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

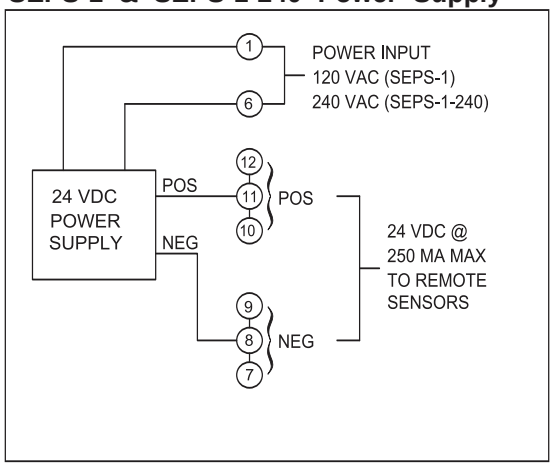
SEPS Series plug-in modules offer a convenient means of converting 120 VAC or 240 VAC power into 24 VDC unregulated power for use with TRI-TRONICS DC powered sensors.

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.

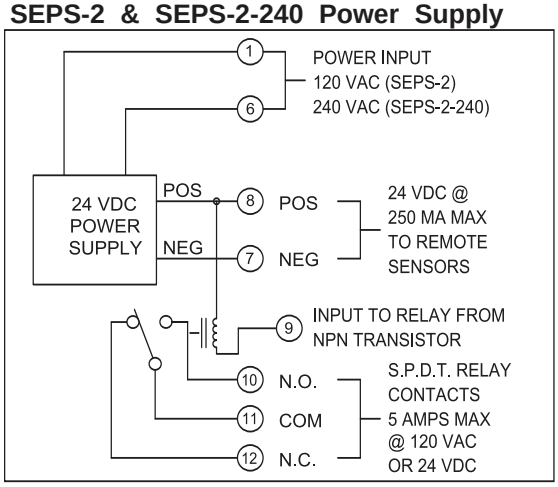
All inputs of the SEPS relay devices can be addressed by the outputs of independent sensors. These inputs can also be paralleled to accept the output of a single sensor to drive loads in unrelated circuits. Feeding the complementary outputs of a remote sensor into the two separate inputs of the SEPS-5 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(s) 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(s) to be used in order to calculate total current requirements.

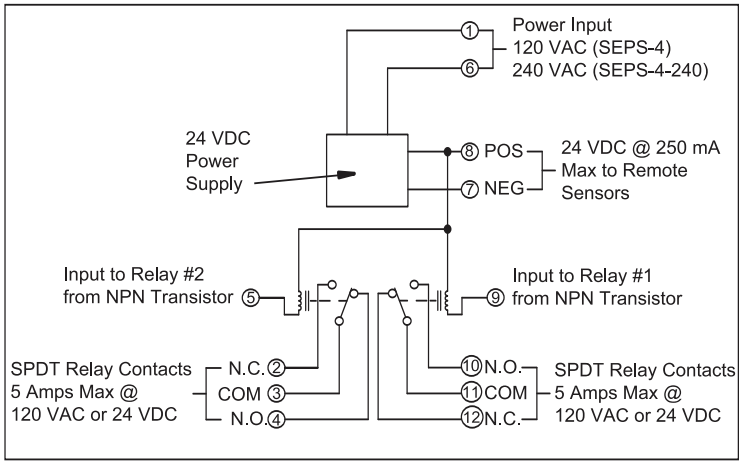
SEPS-1 & SEPS-1-240 Power Supply



SEPS-2 & SEPS-2-240 Power Supply

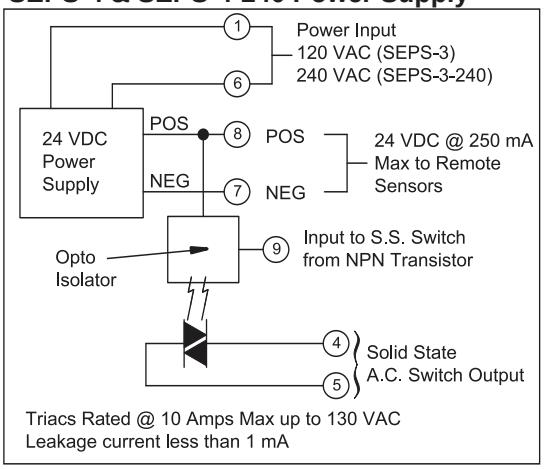


SEPS-3 & SEPS-3-240 Power Supply

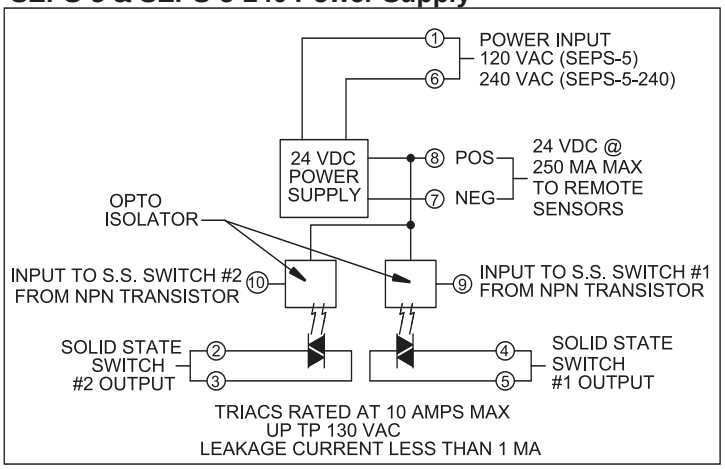


SEPS Series Control Modules

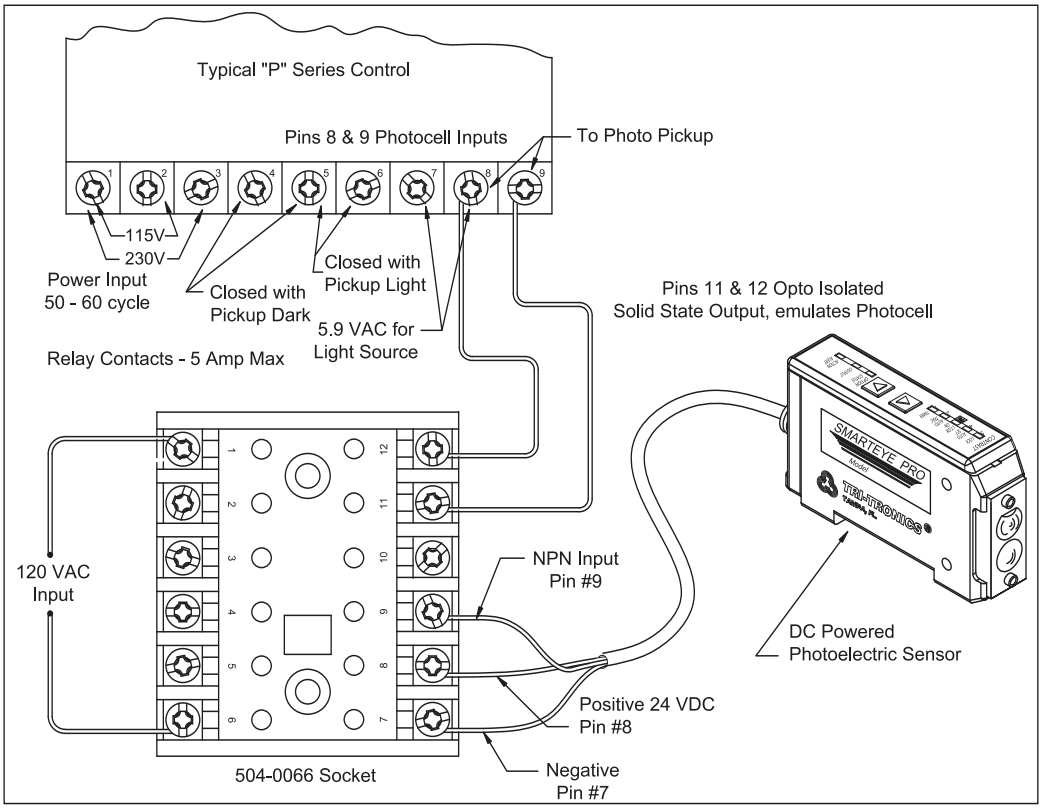
SEPS-4 & SEPS-4-240 Power Supply



SEPS-5 & SEPS-5-240 Power Supply



SEPS-6 & SEPS-6-240 Interface Module

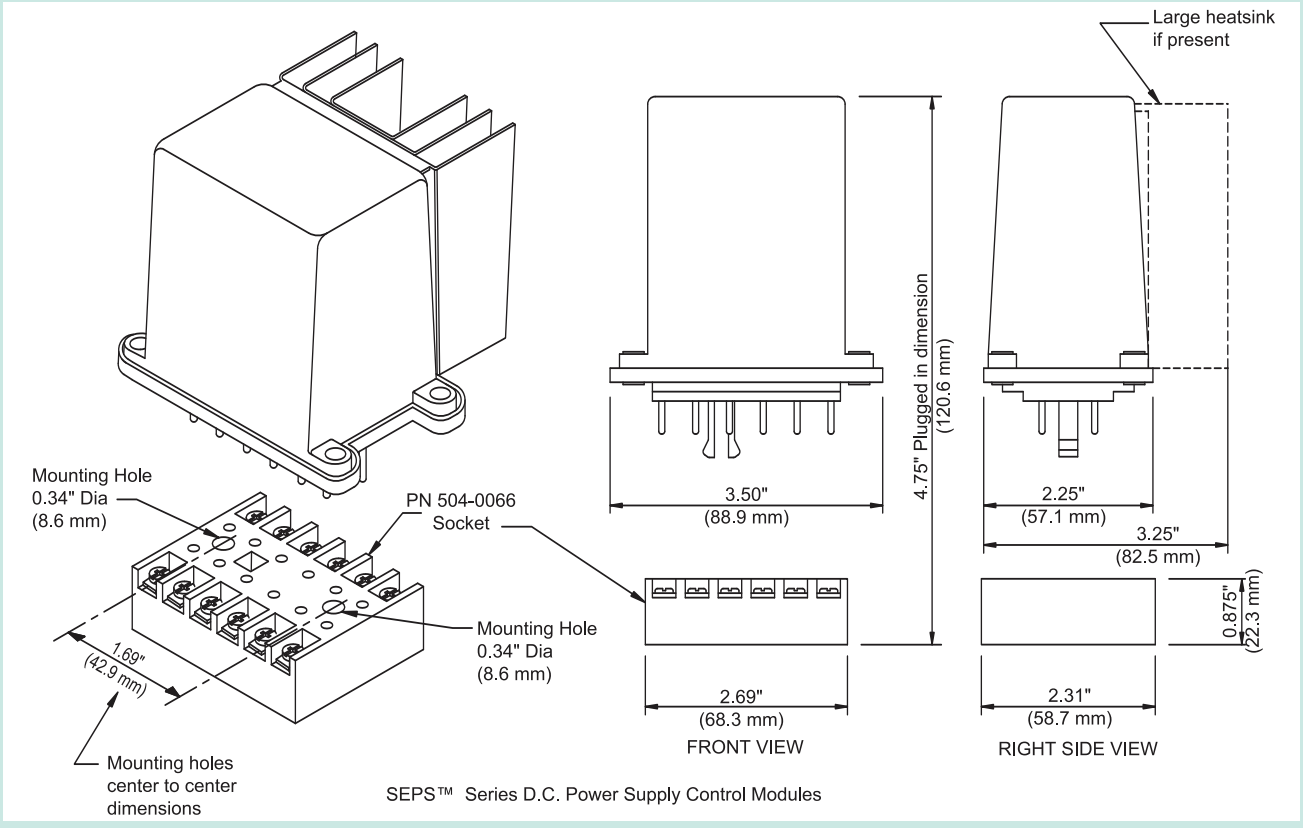


SEPS Series Control Modules

Model #	Operating Voltage	Description
SEPS-1 SEPS-1-240	120 VAC 50/60 HZ 240 VAC 50/60 HZ	Power Supply Only
SEPS-2 SEPS-2-240	120 VAC 50/60 HZ 240 VAC 50/60 HZ	PS with (1) 5 amp AC or DC SPDT Relay
SEPS-3 SEPS-3-240	120 VAC 50/60 HZ 240 VAC 50/60 HZ	PS with (2) 5 amp AC or DC SPDT Relay
SEPS-4 SEPS-4-240	120 VAC 50/60 HZ 240 VAC 50/60 HZ	PS with (1) 10 amp Solid State AC Triac
SEPS-5 SEPS-5-240	120 VAC 50/60 HZ 240 VAC 50/60 HZ	PS with (2) 10 amp Solid State AC Triac
SEPS-6 SEPS-6-240	120 VAC 50/60 HZ 240 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.

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-MATE® Dual Function Models

MULTI-MATE® Dual Function Models with high current output and heat sink

MULTI-MATE® Single Function Models

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 oneshot/ motion, etc. Additional programmable functions are useful to control and manipulate products through the manufacturing process, such as “LATCH,” one shot, etc.

Features

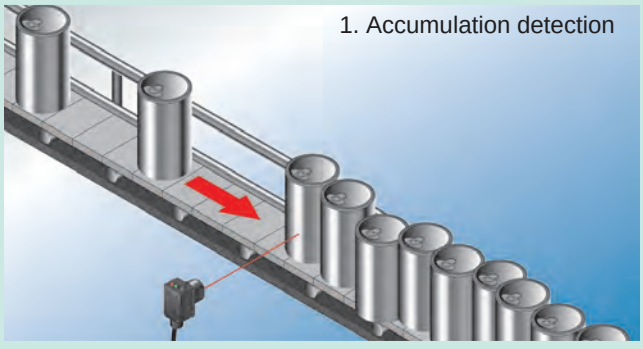
- The simplicity of a plug-in module with the versatility of programming up to 25 functions.
- Available in both Single Event (Model PM-8100/8125) and Dual Event (Model PM-8200/8225) versions, both providing dual outputs.
- Gives you the unique capability of programming for one function now, then changing the program as your needs change.

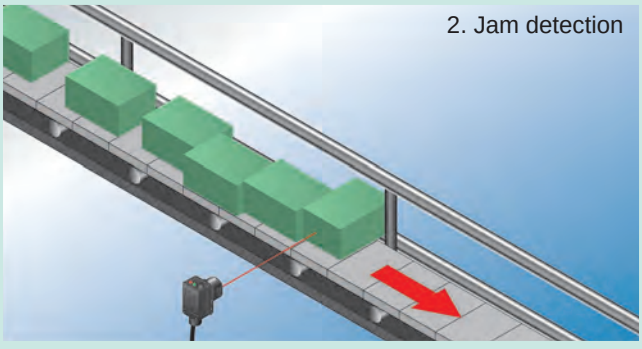
Some examples of applications where the timing and control functions provided by the MULTIMATE® are extremely useful are:

Applications:

- 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

Typical Applications





MULTI-MATE® Control Modules

Single and Dual Event controls offer:

Dual Outputs:

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

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)

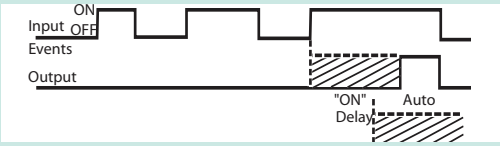
SEQUENCE*	PLACE LISTED SWITCHES TO >ON (ALL OTHERS OFF <)	CONTROL SEQUENCE*
“On” Delay	2,4	1
“Off” Delay	2,5	2
One-Shot	5	3
Motion Retriggerable One-Shot	1,5	4
Latch, Edge-Triggered	3,5	5

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

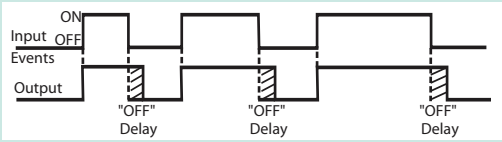
Functional Control and Timing Sequence Data

1



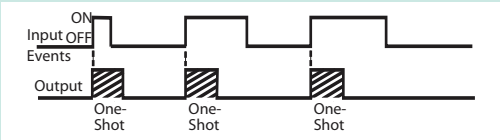
"ON" Delay

2



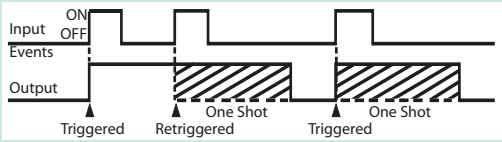
"OFF" Delay Pulse Stretcher

3



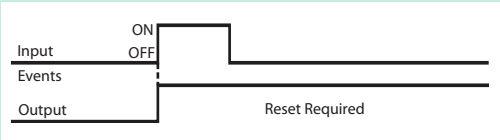
One-Shot

4



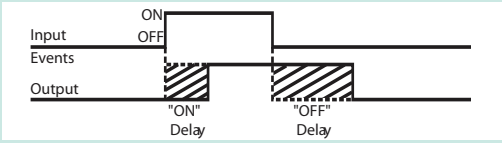
Motion Detection, Retriggerable One-Shot

5



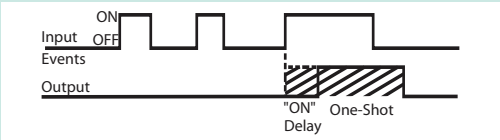
Latching, Edge Triggered

6



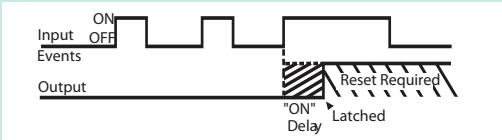
"ON" Delay then "OFF" Delay

7



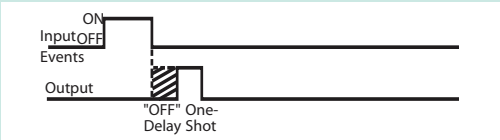
"ON" Delay, then One-Shot

8



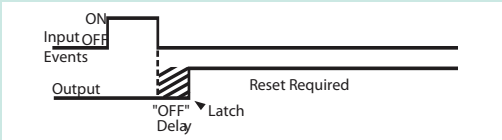
"ON" Delay then Latch

9



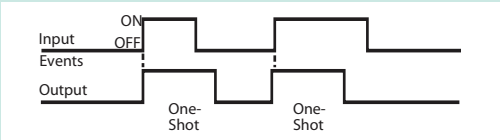
"OFF" Delay then One-Shot

10



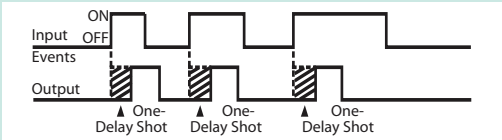
"OFF" Delay then Latch

11



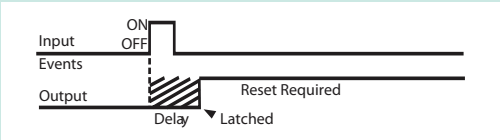
One-Shot Triggers One-Shot

12



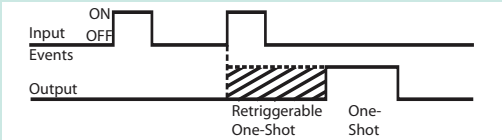
One-Shot Delay, then One-Shot

13



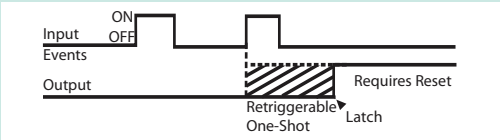
One-Shot Delay, then Latch

14



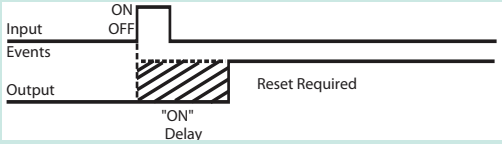
Stop Motion, then One-Shot

15



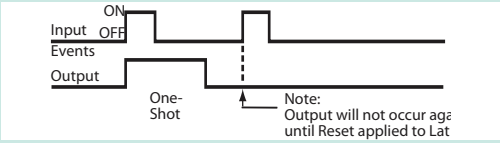
Stop Motion, then Latch

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.

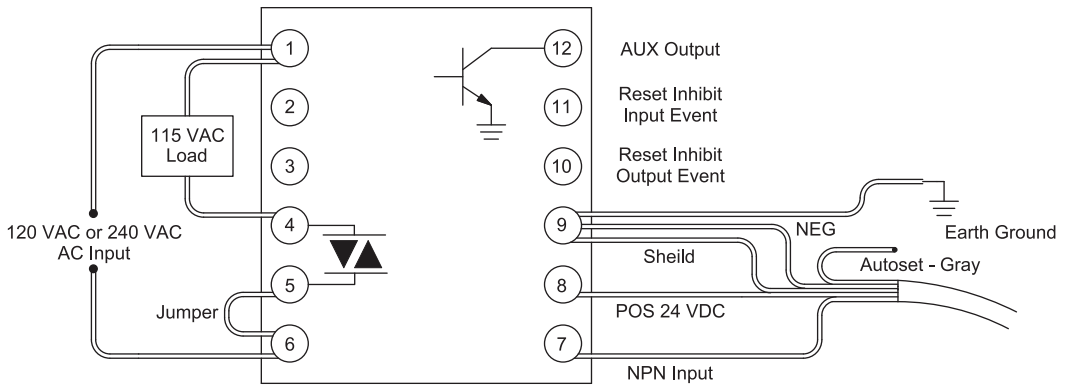
DC Power Output: 24 VDC Nominal @ 150mA . (Unregulated) (Supplies power to DC sensor)

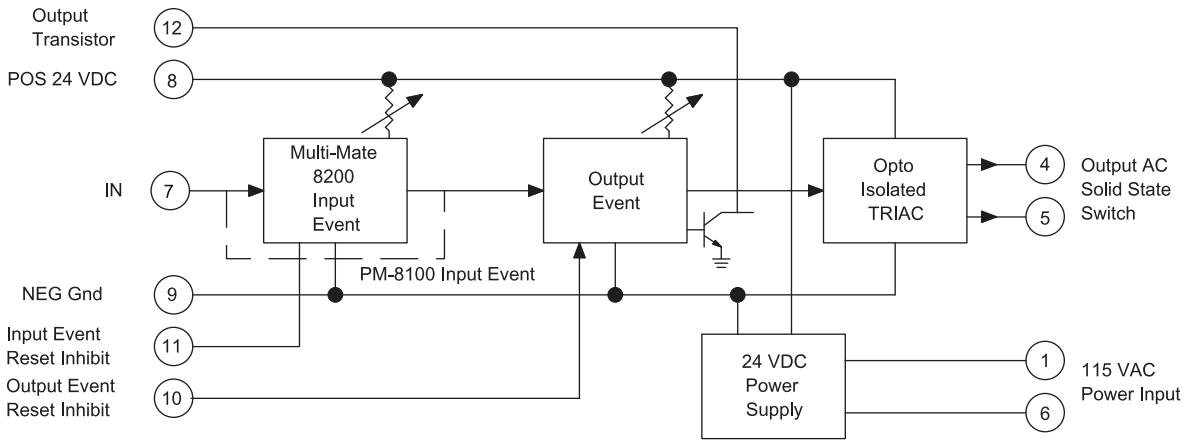
Output Relay: Models PM-8100/PM-8200 – Solid state AC relay. Triac rated at up to 1/6 HP motor load or 3.2 amp inductive load at 115 VAC.
Models PM-8125/PM-8225 – Equipped with larger heat sink Triac rated up to 1/4 HP motor load or 5.4 amp inductive load at 115 VAC.

Output Transistor (Pin 12): NPN grounded emitter open collector output transistor rated at 100mA 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.



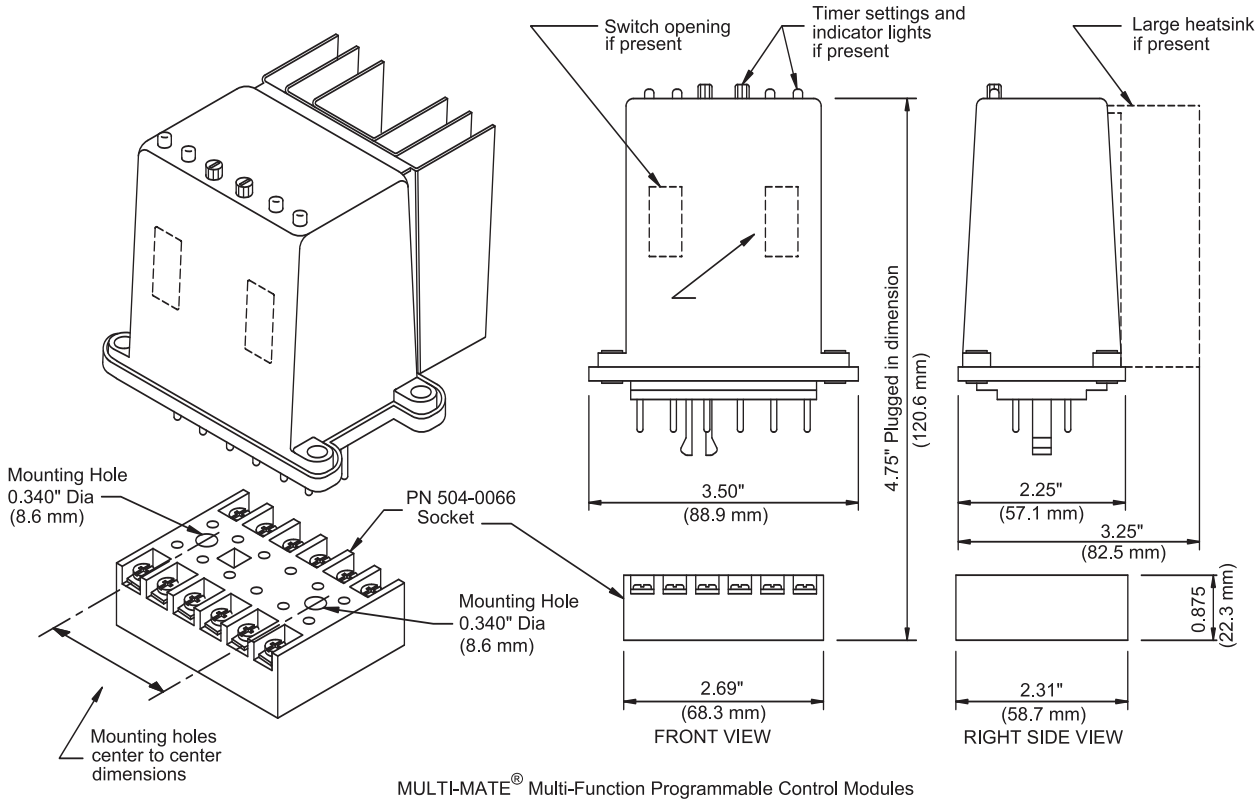


MULTI-MATE® Control Modules

Model Current	Power Output Operating Draw Voltage		Description
PM-8100	24 VDC 150mA	120 VAC 50/60 HZ	Single Function Programmable with Solid State AC Switch, 1/6 HP rated
PM-8100-240	24 VDC 150mA	240 VAC 50/60 HZ	Single Function Programmable with Solid State AC Switch, 1/6 HP rated
PM-8125	24 VDC 150mA	120 VAC 50/60 HZ	Single Function Programmable with Solid State AC Switch, 1/4 HP rated
PM-8125-240	24 VDC 150mA	240 VAC 50/60 HZ	Single Function Programmable with Solid State AC Switch, 1/4 HP rated
PM-8200	24 VDC 150mA	120 VAC 50/60 HZ	Dual Function Programmable with Solid State AC Switch, 1/6 HP rated
PM-8200-240	24 VDC 150mA	240 VAC 50/60 HZ	Dual Function Programmable with Solid State AC Switch, 1/6 HP rated
PM-8225	24 VDC 150mA	120 VAC 50/60 HZ	Dual Function Programmable with Solid State AC Switch, 1/4 HP rated
PM-8225-240	24 VDC 150mA	240 VAC 50/60 HZ	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

Control Modules

Product Inspection Control

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.

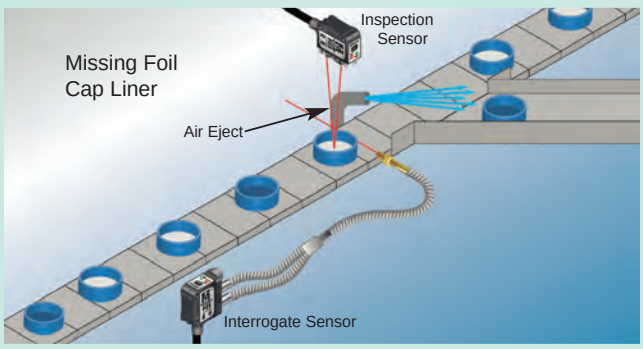
In some applications, more than one "inspection sensor" can be used in the control system by combining multiple outputs into one common input for "and/or" gating functions. Examples of where this capability is useful are in the detection of labels on both sides of a bottle or for inspection of a complex pattern.

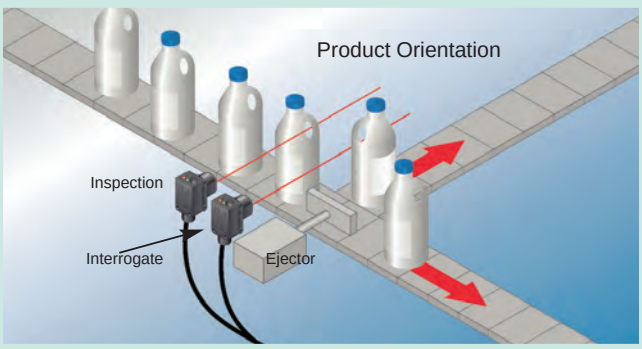
For inspecting the bottle labels, one PIC Control is used with one "product sensor" and two "inspection sensors".

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.

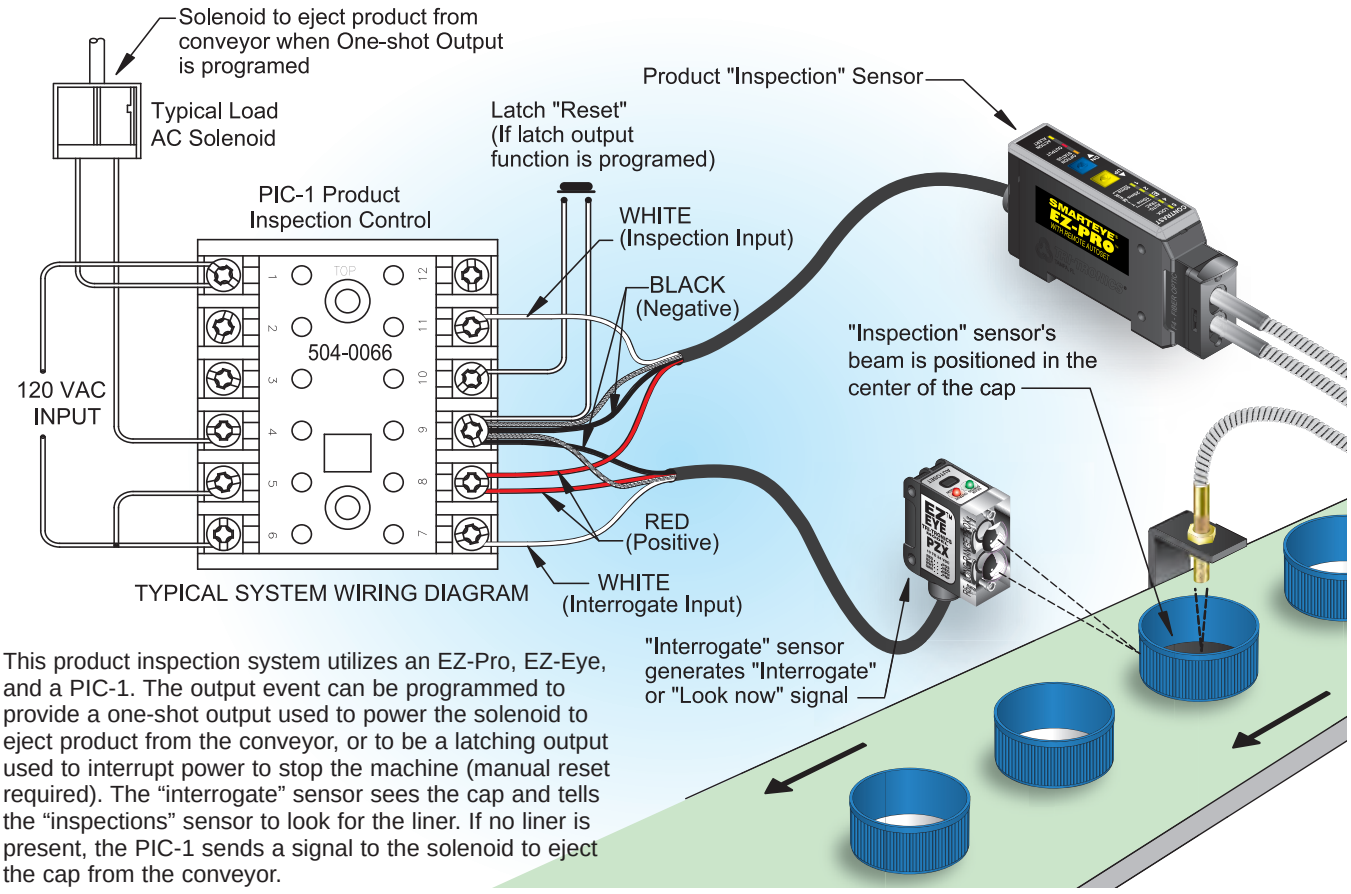
Typical Applications





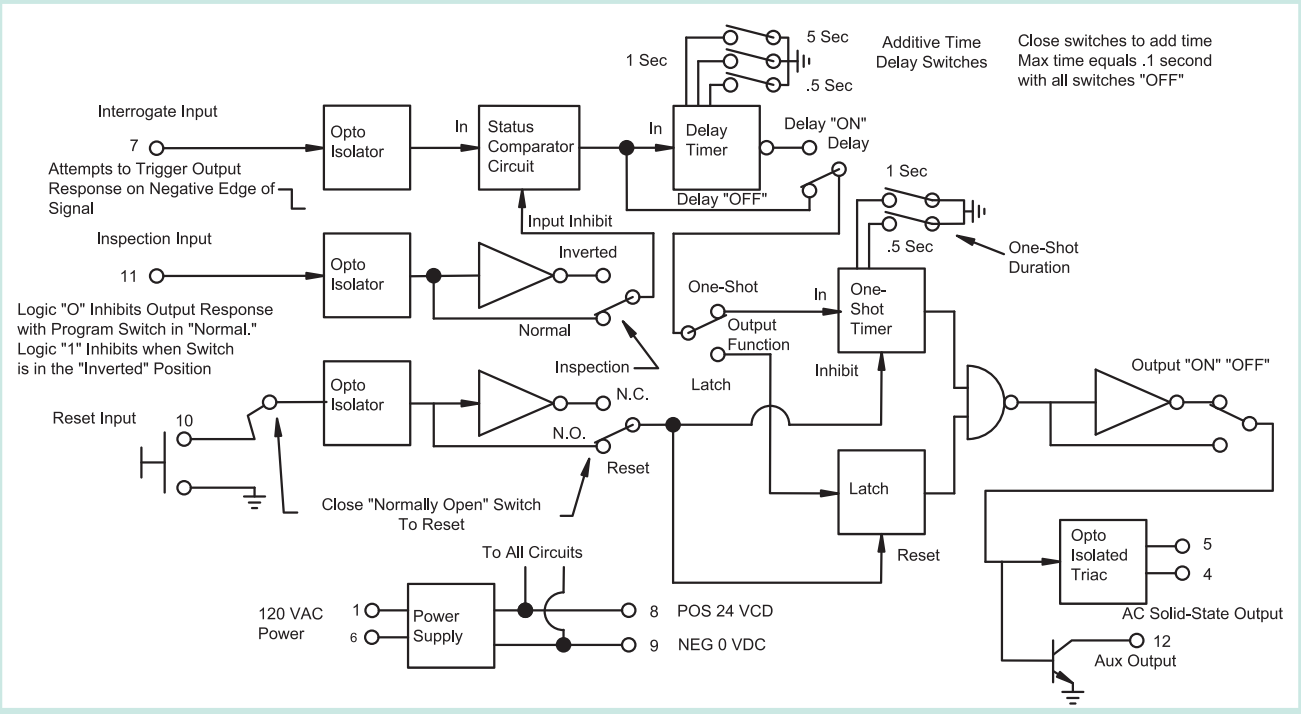
PIC-1 PRODUCT INSPECTION CONTROL

MISSING LINER DETECTOR, COLOR INSPECTION, CAP INSPECTION



This product inspection system utilizes an EZ-Pro, EZ-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 solenoid to eject the cap from the conveyor.

Operational Block Diagram



Control Modules *Product Inspection Control*

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 @ 150mA (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.

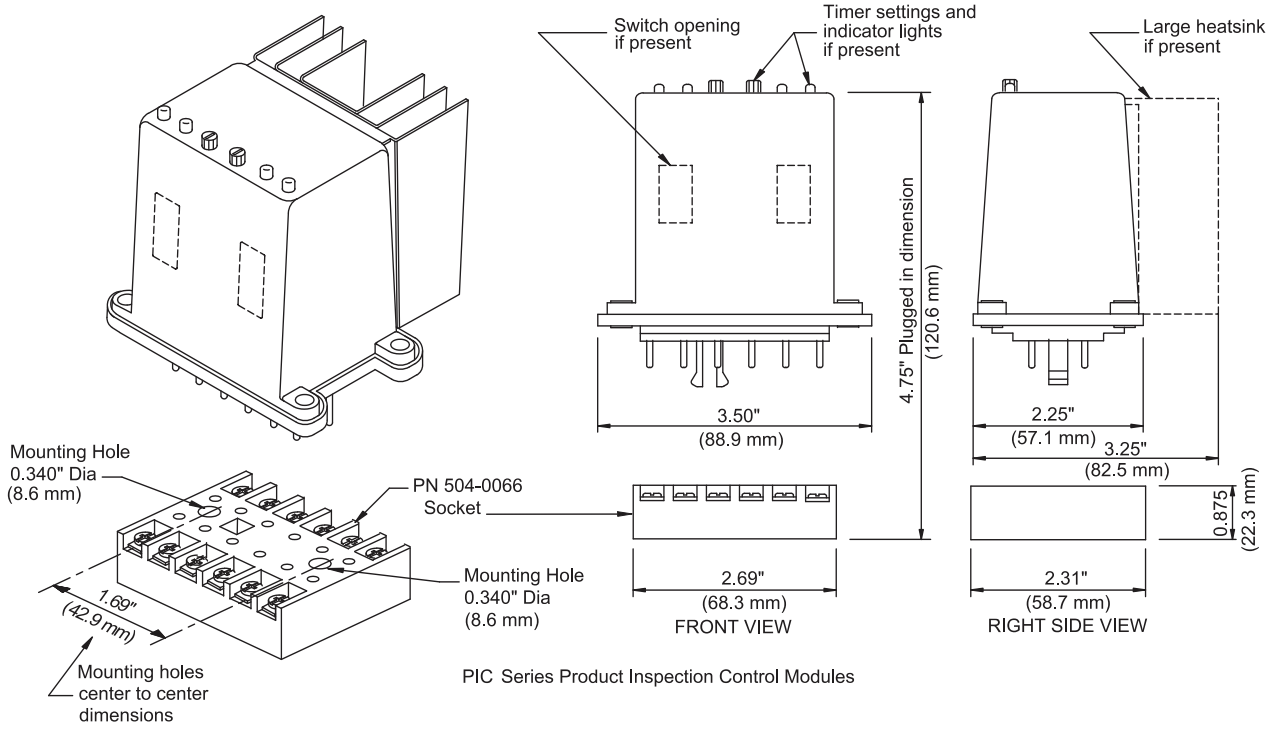
Output Transistor (Pin 12) - All Models
NPN grounded emitter open collector output transistor rated at 100mA maximum.

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 µs. Interrogate Input: Pin 7. Inspection Input: Pin 11. Reset Input (for latched output): Pin10.

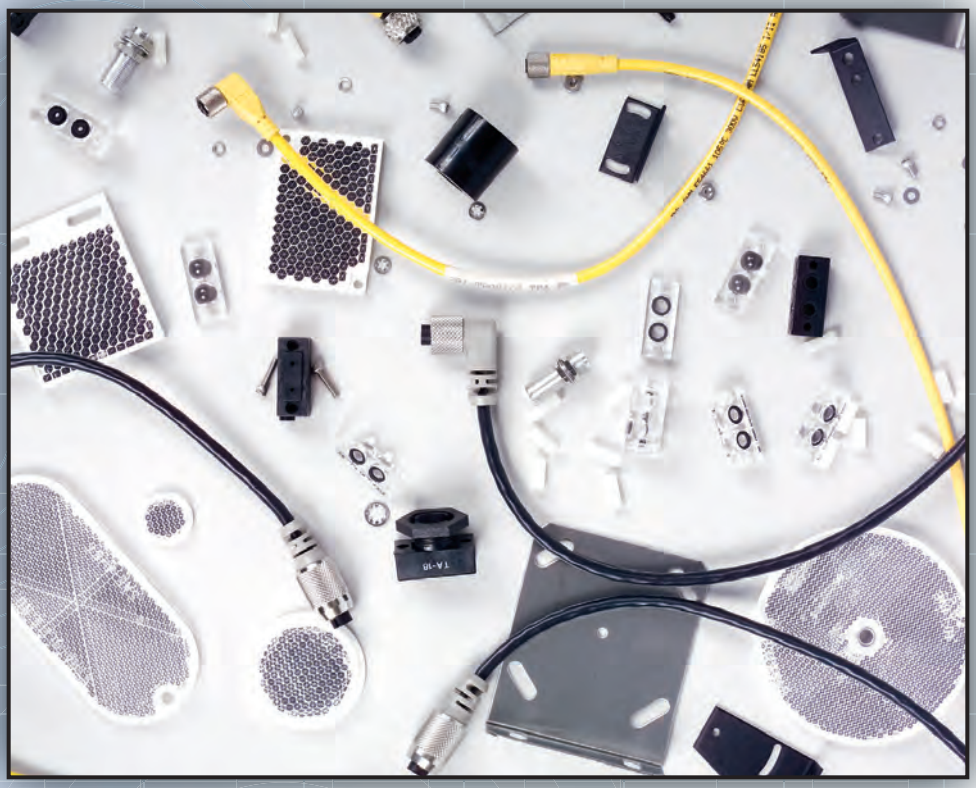
Model	Power Output Current Draw	Operating Voltage	Description
PIC-1	24 VDC 150mA	120 VAC 50/60 HZ	Solid State AC Relay, 10 Amp Triac
PIC-1-240	24 VDC	240 VAC 50/60 HZ	Solid State AC Relay, 10 Amp Triac
PIC-1AB	24 VDC 150mA	120 VAC 50/60 HZ	Solid State DC Relay, 10 Amp Triac
504-0066			Plug-In socket sold separately

Dimensions



PIC Series Product Inspection Control Modules

800-237-0946 • ttco.com



Accessories

4-Wire Shielded Micro Cables, M12

Black shielded cable assemblies that are lightweight and flexible

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

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

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

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

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

BRSEC-25
25' (7.6m) cable / right angle conn.

4-Wire Yellow Shielded Cables, M12

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

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

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

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

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

RSEC-25
25' (7.6m) cable / right angle conn.

4-Wire Extension Cable, M12

BX-10
10' (3.1m) Extension cable

BX-25
25' (7.6m) Extension cable

4-Wire, Unshielded, M12

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

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

M-12 Field Replaceable 4-wire Connectors

(waterproof)

M12-4F
4-Wire, Female Receptacle

M12-4M
4-Wire, Male Plug

4-Wire Nano Cable, M8

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

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

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

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

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

GEX-9
9' (2.7m) extension cable

M-8 Field Replaceable 3 & 4-wire Connectors
(Waterproof)

M8-4F
4-Wire, Female Receptacle

M8-4M
4-Wire, Male Plug

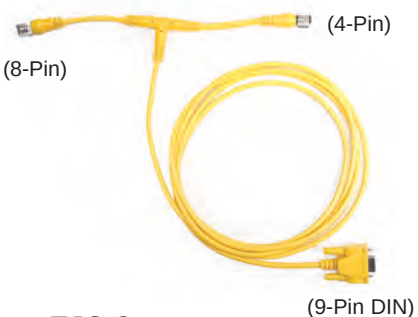
M8-3F
3-Wire, Male Plug

M8-3M
3-Wire, Male Plug

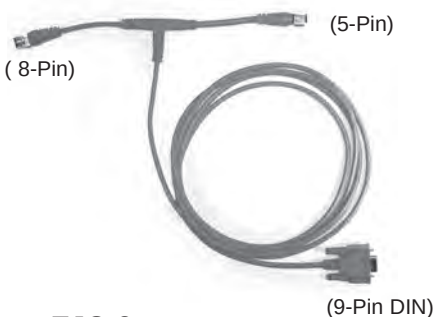
4-Wire, AC Only Mity•Eye Cable

CAC15
AC Mity•Eye
15' (4.6m) cable,
AC only

XPC Specialty Cables



TJC-2
"T" Junction Splitter Cable,
4-Pin Output



TJC-3
"T" Junction Splitter Cable,
5-Pin Output

DCS8-2M
8-wire (2m), M12
Non-metallic shell

5-Wire Shielded Micro Cables, M12

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

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

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

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

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

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

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

Field Replaceable 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' (2.0m) Low-cost

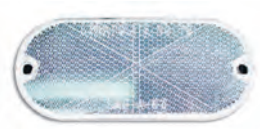
GSEC-5MU
16.4' (5.0m) Low-cost

5-Wire Extension Cable, M12

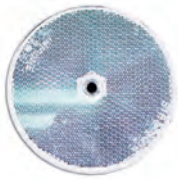
GX-25
25' (7.6m) Extension cable

Standard Reflectivity

Screw Mount

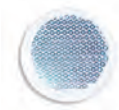


78P
4.4" x 1.9"
(111.8mm x 48.3mm)

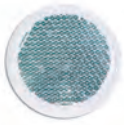


AR3
3" (76.2mm) diam.

Glue Mount



AR114
1 1/4" (31.8mm) diam.



AR158
1 5/8" (41.3mm) diam.

AR58
5/8" (15.9mm) diam.

AR78
7/8" (22.2mm) diam.

Self-Adhesive Mount

98S
3.2" x 1.45" (81.3 x 36.8mm)

Reflector Mounting Brackets

RB-1
Mounting kit includes
98S Reflector and
RB-2 Bracket

RB-2
98S Reflector
Mounting Bracket

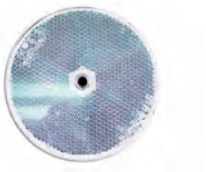
Prismatic High Performance Reflectors NEMA 4, IP67

These reflectors work with all retroreflective sensors, including the RetroSmart® (RSR) series.

Screw Mount

AR4060
(40.5 x 60mm)

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



AR82
(82.1mm) diam.

AR46
(46mm) diam.

Flexible Acrylic, Self-Adhesive Mount

PRD1 - Round Reflector
1" (25mm) diam.

PRD2 - Round Reflector
2" (50mm) diam.

SPR1 - Square Reflector
1 1/16" (27mm)

SPR2 - Square Reflector
2" (50.8mm)

Acrylic, Self-Adhesive Reflector Tape

Very thin – .03" (.76mm)

2000X	Square Relector Tape 3" x 3" (76mm x 76mm)
2001X-1F	Relector Tape 1" x 12" (25.4mm x 304.8mm) 12" minimum
2001X-50F	Relector Tape 1" x 50' (25.4mm x 15.2m) 50' roll
2002X-1F	Reflector Tape 2" x 12" (50.8mm x 304.8mm) 12" minimum
2002X-75F	Reflector Tape 2" x 75' (50.8mm x 22.8m) 75' roll
3000X	Retroreflective Tape 3" x 3" (76mm x 76mm) (Best Choice) +20% reflectivity
3001X-1F	Retroreflective Tape 1" x 12" (25.4mm x 304.8mm) (Best Choice) +20% reflectivity

FMB-1
(8.4mm diam.)
Standard Fiberoptic
Mounting Bracket
Use with Threaded Glass
Fiberoptic

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

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

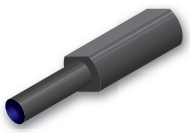
HLA-2
Spot Focus Lens for
Diffused Beam
Use with M6 Tips
Focal Point .50" (12.7mm)

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" (35mm)

UAC-5
Threaded Spot Focus Plastic
Lens, 1" Focal Point
Fits any standard threaded
tip Glass Fiberoptic
Lg. 2" (51mm)

UAC-5G
Threaded Spot Focus Glass
Lens, 1" Focal Point
Fits any standard threaded
tip Fiberoptic
Lg. 2" (51mm)



PLA-M4
Threaded, Spot Focus
plastic lens. 1" Focal Point.
Fits M4 threaded tips for
plastic or mini-glass fiber
optic light guides.

NFA-50
.5" Nylon Fiberoptic Adaptor
(50 pieces)
Use to adapt F1S and F4S
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

Optical Block Accessories

Optical Blocks — SMARTEYE® Series for Standard Sensors

Type F1

Type O1, O16

Type O2

Type R1

Type V1,V1G

Type GP2

Mode	Description
F1	Fiberoptic Adaptor Block
O1	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	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

Type F4

Type F5

Type O4

Type O5

Type R4

Type R5

Type V4

Type V4A

Type V6

Type V8

Type GP7

LK-4

Model	Description
F4	Fiberoptic Optical Block
F5	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

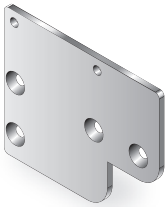
Model	For Miniature Sensors
GP6	Gap Probe, provides a 1.5” probe
GP7	Gap Probe, provides a 2.5” probe
GP8	Gap Probe, provides a 3.5” probe

LK-4
Lens Kit (includes F4, F5, O4, O5, R4, R5, V4, V4A, V6, V8)
Alan wrenches and screws

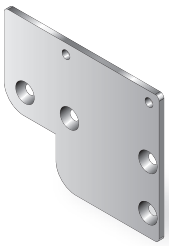
Sensor Accessories

Sensor Mounting Brackets (assembly includes mounting screws)

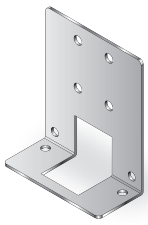
NOTE: All black mounting brackets are aluminum.



XMB-1L
SMARTEYE® X-MARK
Mounting Bracket



XMB-1R
SMARTEYE® X-MARK
Mounting Bracket



XMB-2
SMARTEYE® X-MARK
Mounting Bracket

MIB-1
MINI•EYE™
Stainless Bracket
Assembly

MIB-2
MINI•EYE™
Stainless Bracket
Assembly

MIB-3
MINI•EYE™
Standard
Mounting Bracket

MIB-4
MINI•EYE™
18mm
Mounting Bracket

SEB-4
Stealth-UV,
RetroSmart, *X-MARK*,
and COLORWISE
Stainless Mounting
Bracket Assembly

SEB-3
Opti-Eye, Mark lll,
SMARTEYE® Pro
Series, Stainless
Bracket
Assembly

DRB-1
SMARTEYE® Mark lll
Din Rail Bracket

SEB-1
SMARTEYE® Series
Stainless Mounting
Bracket Assembly

MB-18
18mm Bracket,
for use with TA-18

NUT-18
18mm Mounting Nut
for use with
MINI•EYE™

DCB-1
HSLS-12 Mounting
Stainless Bracket
Assembly

MEB-1
Mity-Eye
Mounting Bracket
Assembly

TEB-1
Tiny-Eye
Vertical Mount,
Mounting Bracket
Assembly

EEB-2 - EZ-Eye
TEB-2 - Tiny-Eye
Horizontal Mount,
Mounting Bracket
Assembly

EEB-1
EZ-Eye
Vertical Mount,
Mounting Bracket
Assembly

UMB-1
U.S. Eye
Mounting Bracket
Assembly

USB-1
U.S. Eye
Adjustable
Sub-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 filings; 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 filings; 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 filings; 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 filings; 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 filings**	–	–	X	X	–	X	X	X	X	X
Settling airborne dust, lint, fibers, and filings**	–	–	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 may be be ventilated

** These fibers and filings are nonhazardous materials and are not considered Class III type ignitable fibers or combustible filings. For Class III type ignitable fibers or combustible filings 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 filings	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 may be 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

Reference Tables

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/m2)
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 (10-3m)
millisecond	ms	time (10-3 s)
nanometer	nm	ength (light wavelength)
ohm	O	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 546nm

TABLE 2. Units of 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	ì	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.

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

To convert inches to millimeters, multiply by 25.4.

Inches Fraction	Inches Decimal	Millimeter
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

Glossary of Photoelectric Terms

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.

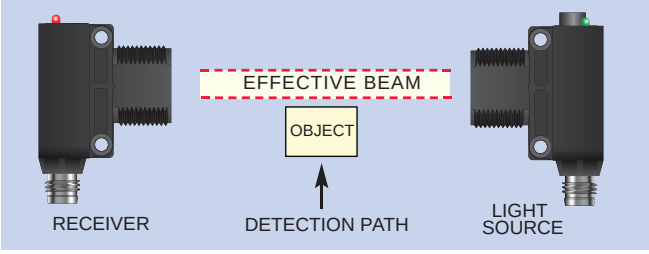
Attenuation
Lessening of sensing energy caused by environmental elements such as dirt, dust, moisture, or other contaminants in the sensing area.

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 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.

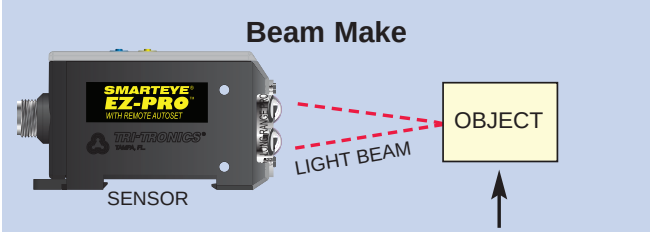


Figure 1-1-1b

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.

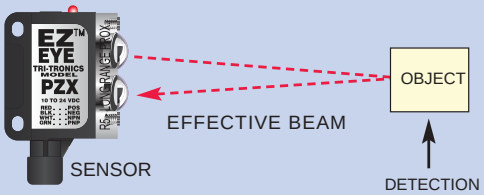
Complementary Outputs
Dual state outputs from a common source. When one output is normally open, the other is normally closed.

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 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

Glossary of Photoelectric Terms



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

source. May also be constructed from three first-surface mirrors. Cornercube 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. 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 two 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.

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.

Glossary of Photoelectric Terms

Enhanced Dynamic Range (EDR®)
A circuit that extends the dynamic operating range to provide 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. Synonymous 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.

Glossary of Photoelectric Terms

IP Ratings
The rating system established by IEC Publications 144 and 529 define the following "IP" ratings:

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Numeral	Short Description
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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

Millilamps (mA)
A unit of current that is equal to one thousandth (10^{-3}) of an ampere.

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 receiver is 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 from voltage spikes.

Glossary of Photoelectric Terms

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.

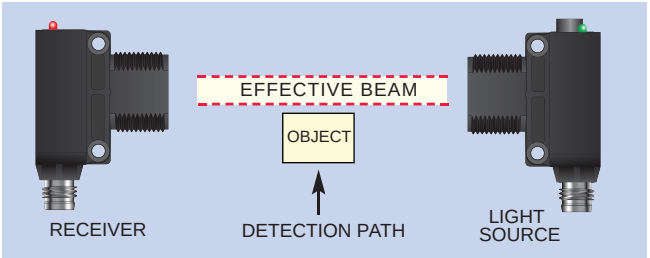
Opposed Mode
See Beam Break

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.

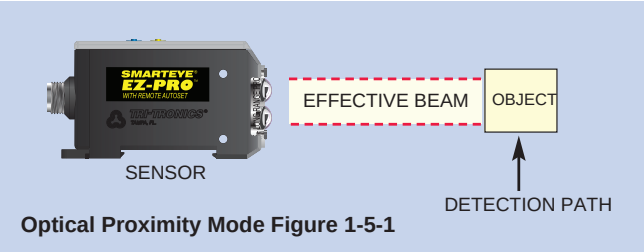
Polarized Light
Light that vibrates in one plane only(in contrast to ordinary light, which vibrates in all directions).



Opposed Mode, Figure 1-2-1

Glossary of Photoelectric Terms

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)



Optical Proximity Mode Figure 1-5-1

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
A sensor 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.

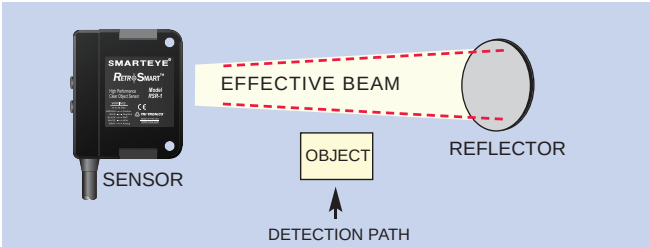
Registration Mark
A contrasting color mark printed on material that can be “seen” by a sensor. Used to control a variety of packaging and material handling operations.

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.



Retroreflective Mode, Figure 1-3-1

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

Glossary of Photoelectric Terms

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".

Voltage Drop
Voltage drop is the reduction in voltage in the passive elements (not containing sources) of an electrical circuit.

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XMC-1HP	21985	X-Mark Sensor, Horizontal Optics, Tri-Color LED, Acrylic	2-127 through 2-134
XMC-1P	21679	X-Mark Sensor, NPN/PNP, M12 Connector, Acrylic	2-127 through 2-134
XMC-1V	21980	X-Mark Sensor, Vertical Optics, Tri-Color LED,	2-127 through 2-134
XMC-1VP	21981	X-Mark Sensor, Vertical Optics, Tri-Color LED, Acrylic	2-127 through 2-134
XMC-2	21680	X-Mark Sensor, NPN, M12 Connector	2-127 through 2-134
XMC-2H	21992	X-Mark Sensor, Horizontal Optics, Tri-Color LED	2-127 through 2-134
XMC-2HP	21993	X-Mark Sensor, Horizontal Optics, Tri-Color LED, Acrylic	2-127 through 2-134
XMC-2P	21681	X-Mark Sensor, NPN, M12 Connector, Acrylic	2-127 through 2-134
XMC-2V	21988	X-Mark Sensor, Vertical Optics, Tri-Color LED,	2-127 through 2-134
XMC-2VP	21989	X-Mark Sensor, Vertical Optics, Tri-Color LED, Acrylic	2-127 through 2-134
XMC-3	21682	X-Mark Sensor, PNP, M12 Connector	2-127 through 2-134
XMC-3H	21977	X-Mark Sensor, Horizontal Optics, Tri-Color LED	2-127 through 2-134
XMC-3HP	22000	X-Mark Sensor, Horizontal Optics, Tri-Color LED, Acrylic	2-127 through 2-134
XMC-3P	21683	X-Mark Sensor, PNP, M12 Connector, Acrylic	2-127 through 2-134
XMC-3V	21996	X-Mark Sensor, Vertical Optics, Tri-Color LED	2-127 through 2-134
XMC-3VP	21997	X-Mark Sensor, Vertical Optics, Tri-Color LED, Acrylic	2-127 through 2-134
XP10I	20376	X-Pro XP10, IR, Cable	2-119 through 2-126
XP10IC	20384	X-Pro XP10, IR, Connector	2-119 through 2-126
XP10W	20414	X-Pro XP10, White, Cable	2-119 through 2-126
XP10WC	20424	X-Pro XP10, White, Connector	2-119 through 2-126
XP10R	20492	X-Pro XP10, Red, Cable	2-119 through 2-126
XP10RC	20403	X-Pro XP10, Red, Connector	2-119 through 2-126
XPC2I	20510	X-Pro, RS-232 MODBUS ASCII, IR	2-73 through 2-80
XPC2R	20518	X-Pro, RS-232 MODBUS ASCII, Red	2-73 through 2-80
XPC2W	20529	X-Pro, RS-232 MODBUS ASCII, White	2-73 through 2-80
XPC4I	20539	X-Pro, RS-485 MODBUS ASCII, IR	2-73 through 2-80
XPC4R	20547	X-Pro, RS-485 MODBUS ASCII, Red	2-73 through 2-80
XPC4W	20558	X-Pro, RS-485 MODBUS ASCII, W	2-73 through 2-80

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 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

Note: Please refer to online Warranty and Terms & Conditions for up-to-date documents.

TRI-TRONICS®

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.

Note: Please refer to online Warranty and Terms & Conditions for up-to-date documents.

TRI-TRONICS®

P.O. Box 25135
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 _____ TTCO Rep _____

Distributor Phone _____ Fax _____ TTCO Rep Phone _____ Fax _____

Customer Phone _____ Fax _____ Delivery Date _____

Model _____ Customer Approcval _____

TRI-TRONICS®

Smart Sensing Solutions Since 1954

NEW PRODUCT LINE!

PHOTOCRAFT

Rotary Optical Encoders

Applications

- Material Handling
- Airport Baggage
- Converting
- Printing
- Door Control
- Elevators
- Motion Control
- Labeling Machines
- Robotics
- Conveyors
- CNC Machines

"...backed by Tri-Tronics Reliability"

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1-630-365-7148
Sales@photocraftencoders.com
Tech@photocraftencoders.com

SUPPLIER MEMBER PMMI Leading companies. Leading solutions.

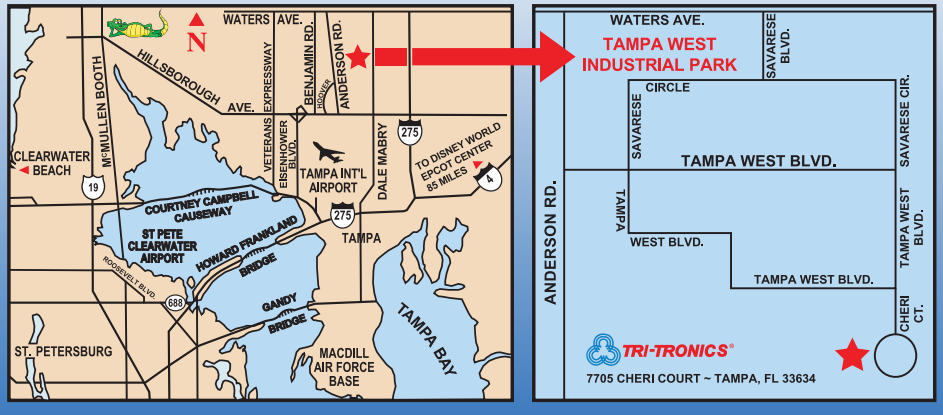
TRI-TRONICS®

Under the same dependable ownership and management since 1954!

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 **800-237-0946** 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

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