



## General Purpose Photoelectric Sensor



**CLASSIC**



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.

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### 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.*

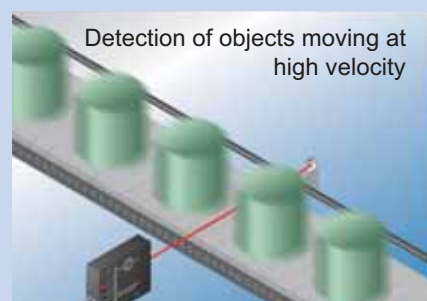
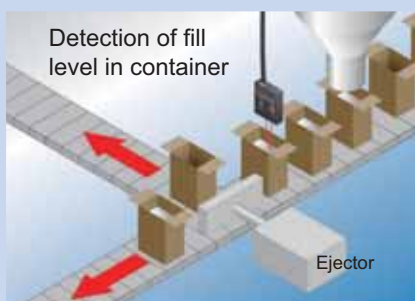
### Red (Visible) Light Source

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.

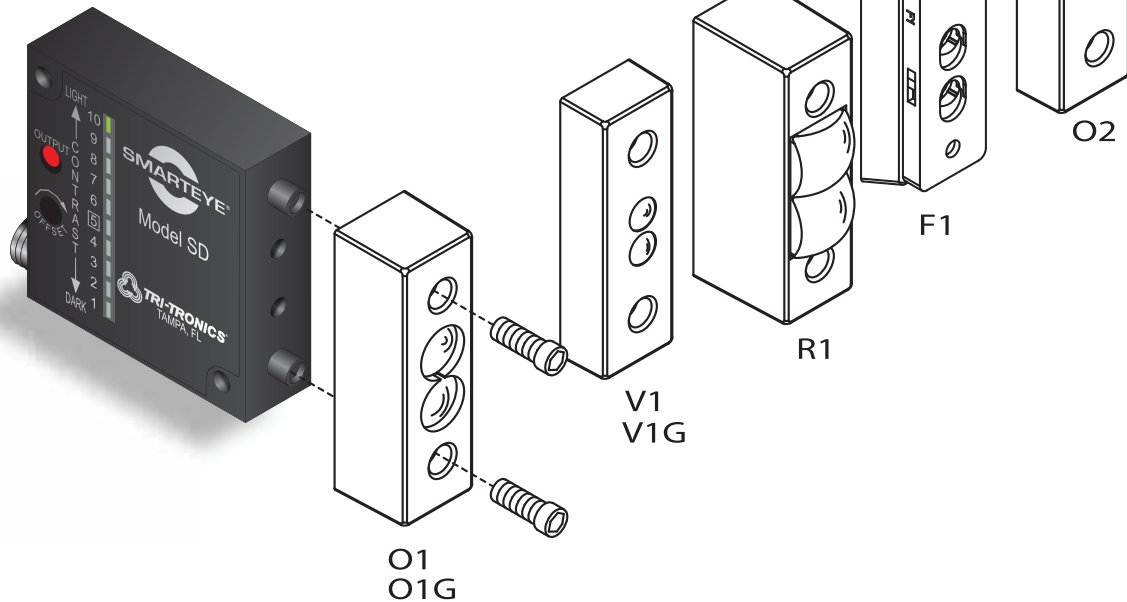
## Typical Applications



# Optical Block Selection



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



**Type F1  
Fiberoptic Adapter**  
Type F1 adapts *SMARTEYE*® CLASSIC to any standard 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 Intensity 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

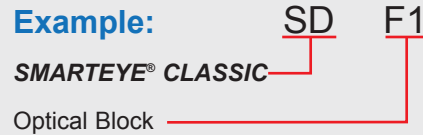
F1 = Fiberoptic

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)



**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

