High Resolution, High Speed Sensor
The SMARTEYE® sensor is a unique pulse modulated sensor that has successfully performed hundreds of intricate low-contrast sensing tasks in critical material handling and automation applications.

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

**4-TURN OFFSET ADJUSTMENT**
Offset vs. gain adjustment maintains sensor high resolution performance regardless of threshold position. Resolving fine differences in returned light increases stability and versatility of the sensor. A 4-turn potentiometer makes it easy to set the sensor to the right threshold setting.

**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 mid-scale reading of 5.

**Features**
- 10-LED Contrast Indicator
- 100µs 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
Models

THREE PERFORMANCE LEVELS

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 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 low contrast applications found in the more difficult sensing tasks. High gain is often necessary in SMARTYE®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 high-speed response. 100µs Beam Make or Beam Break. Maximum input events per second = 5000. Optimized to provide 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 fiber optic light guides.

NOTE: Not recommended for use in close-up sensing or for use in most low contrast applications.

Red (Visible) Light Source
Recommended for sensing transparent/translucent objects. Out performs infrared light in many moderate to low contrast applications. Also recommended for use with plastic fiber optic light guides.

Green (Visible) Light Source
Recommended for use only in applications where the color green provides an obvious advantage. Example: 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

Detection of very small objects
Detection of fill level in container
Detection of objects moving at high velocity
Detection of reflective tape moving at high rapidity
Detection of unwanted condition for product inspection task
Detection of polarized light

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### Optical Block Selection

#### Proximity Blocks

- **O1**
  - Medium to Long Range Proximity
  - Medium to Long Range Proximity

- **O1G**
  - Medium to Long Range Proximity (Glass)
  - Medium to Long Range Proximity

- **O2**
  - Short Range Proximity
  - Useful for short-range sensing.

#### Focused V-Axis Blocks

- **V1**
  - Focused Lens V-Axis

- **V1G**
  - Focused Lens V-Axis (Glass)
  - Direct lens V-axis sensing at close ranges. Use for small part or precise leading edge sensing.

#### Retroreflective Blocks

- **R1**
  - Retroreflective
  - Narrow beam optics designed to sense reflectors or reflective materials.

#### Fiber Optic Blocks

- **F1**
  - Fiber Optic Adapter
  - Fiber optic quick connect

### Sensing Range Guidelines

<table>
<thead>
<tr>
<th>High Gain</th>
<th>LED</th>
<th>Speed</th>
<th>O1, O1G</th>
<th>O2</th>
<th>V1, V1G</th>
<th>R1</th>
<th>F1 (Prox)</th>
<th>F1 (Prox w/ lens)</th>
<th>F1 Opposed</th>
<th>F1 Opposed w/ lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSDL / PHSDL</td>
<td>high IR</td>
<td>1.5ms</td>
<td>6ft (1.8m)</td>
<td>7in (177.8mm)</td>
<td>7in (177.8mm)</td>
<td>35ft (10.7m)</td>
<td>6.5in (166.1mm)</td>
<td>N/A</td>
<td>66in (1.7m)</td>
<td>66in (1.7m)</td>
</tr>
<tr>
<td>SDL / PSDL</td>
<td>infrared</td>
<td>1.5ms</td>
<td>4ft (1.2m)</td>
<td>5.5in (139.7mm)</td>
<td>4.5in (114.3mm)</td>
<td>30ft (9.1m)</td>
<td>5in (127.0mm)</td>
<td>10in (254.0mm)</td>
<td>48in (1.2m)</td>
<td>20ft (6.1m)</td>
</tr>
<tr>
<td>SDLR / PSDLR</td>
<td>red</td>
<td>1.5ms</td>
<td>2.5ft (0.7m)</td>
<td>2.25in (57.1mm)</td>
<td>3in (76.2mm)</td>
<td>30ft (9.1m)</td>
<td>4.5in (114.3mm)</td>
<td>9in (228.6mm)</td>
<td>12in (304.8mm)</td>
<td>13.5ft (4.1m)</td>
</tr>
<tr>
<td>SDLG / PSDLG</td>
<td>green</td>
<td>1.5ms</td>
<td>N/A</td>
<td>N/A</td>
<td>.75in (19mm)</td>
<td>N/A</td>
<td>.25in (6.4mm)</td>
<td>N/A</td>
<td>2.75in (69.9mm)</td>
<td>3ft (0.9m)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Speed</th>
<th>LED</th>
<th>Speed</th>
<th>O1, O1G</th>
<th>O2</th>
<th>V1, V1G</th>
<th>R1</th>
<th>F1 (Prox)</th>
<th>F1 (Prox w/ lens)</th>
<th>F1 Opposed</th>
<th>F1 Opposed w/ lens</th>
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</thead>
<tbody>
<tr>
<td>HSD / PHSD</td>
<td>high IR</td>
<td>500µs</td>
<td>5ft (1.5m)</td>
<td>5.5in (139.7mm)</td>
<td>4.75in (120.6mm)</td>
<td>32ft (9.8m)</td>
<td>5.5in (139.7mm)</td>
<td>10in (254.0mm)</td>
<td>54in (1.4m)</td>
<td>20+ft (6.1m)</td>
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<tr>
<td>SD / PSD</td>
<td>infrared</td>
<td>500µs</td>
<td>3ft (0.9m)</td>
<td>4.5in (114.3mm)</td>
<td>3in (76.2mm)</td>
<td>20ft (6.1m)</td>
<td>3.5in (88.9mm)</td>
<td>7in (177.8mm)</td>
<td>32in (0.9m)</td>
<td>16ft (4.3m)</td>
</tr>
<tr>
<td>SDR / PSDR</td>
<td>red</td>
<td>500µs</td>
<td>1.5ft (0.4m)</td>
<td>1.75in (19.0mm)</td>
<td>2.25in (57.1mm)</td>
<td>12ft (3.6m)</td>
<td>3in (76.2mm)</td>
<td>10in (254.0mm)</td>
<td>6in (152.4mm)</td>
<td>11ft (3.3m)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Very High Speed</th>
<th>LED</th>
<th>Speed</th>
<th>O1, O1G</th>
<th>O2</th>
<th>V1, V1G</th>
<th>R1</th>
<th>F1 (Prox)</th>
<th>F1 (Prox w/ lens)</th>
<th>F1 Opposed</th>
<th>F1 Opposed w/ lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSD / PVSD</td>
<td>infrared</td>
<td>100µs</td>
<td>2ft (0.6m)</td>
<td>2.5in (63.5mm)</td>
<td>16ft (4.9m)</td>
<td>2ft (0.6m)</td>
<td>2in (50.8mm)</td>
<td>6in (152.4mm)</td>
<td>28in (0.7m)</td>
<td>14ft (4.3m)</td>
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</table>

<table>
<thead>
<tr>
<th>Analog</th>
<th>LED</th>
<th>Speed</th>
<th>O1, O1G</th>
<th>O2</th>
<th>V1, V1G</th>
<th>R1</th>
<th>F1 (Prox)</th>
<th>F1 (Prox w/ lens)</th>
<th>F1 Opposed</th>
<th>F1 Opposed w/ lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAL</td>
<td>infrared</td>
<td>1.5ms</td>
<td>4ft (1.2m)</td>
<td>5.5in (139.7mm)</td>
<td>5in (127.0mm)</td>
<td>10in (254.0mm)</td>
<td>9in (228.6mm)</td>
<td>12in (304.8mm)</td>
<td>32in (0.9m)</td>
<td>16ft (4.3m)</td>
</tr>
<tr>
<td>SALR</td>
<td>red</td>
<td>1.5ms</td>
<td>2.5ft (0.8m)</td>
<td>2.25in (57.1mm)</td>
<td>4.5in (114.3mm)</td>
<td>3.5in (88.9mm)</td>
<td>7in (177.8mm)</td>
<td>3in (76.2mm)</td>
<td>10in (254.0mm)</td>
<td>6in (152.4mm)</td>
</tr>
<tr>
<td>SA</td>
<td>infrared</td>
<td>500µs</td>
<td>3ft (0.9m)</td>
<td>4.5in (114.3mm)</td>
<td>3in (76.2mm)</td>
<td>10in (254.0mm)</td>
<td>6in (152.4mm)</td>
<td>2in (50.8mm)</td>
<td>6in (152.4mm)</td>
<td>11ft (3.4m)</td>
</tr>
<tr>
<td>SAR</td>
<td>red</td>
<td>500µs</td>
<td>1.5ft (0.4m)</td>
<td>1.75in (44.45mm)</td>
<td>3in (76.2mm)</td>
<td>10in (254.0mm)</td>
<td>6in (152.4mm)</td>
<td>2in (50.8mm)</td>
<td>6in (152.4mm)</td>
<td>11ft (3.4m)</td>
</tr>
<tr>
<td>HSAQ</td>
<td>high IR</td>
<td>near linear</td>
<td>1ft (0.3m)</td>
<td>1in (25.4mm)</td>
<td>1in (25.4mm)</td>
<td>3.5in (88.9mm)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>SAQ</td>
<td>high IR</td>
<td>near linear</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>1ft (0.3m)</td>
</tr>
</tbody>
</table>

- For more information on useful range, see Fundamentals, Section 1.
- PROXIMITY tests utilized a 90% reflective target.
- RETROREFLECTIVE tests utilized a 3in diam. reflector Model AR3

1 in = 25.4mm / 1 ft = 0.3048 meters

• FIBER OPTIC tests utilized .125in 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

**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

**PNP Output**
- PHSDL: High Gain, High Intensity IR
- PHSD: High Speed, High Intensity IR

**PHSDL**: High Gain IR
**PHSD**: High Speed IR

**Example:**

```
SD F1
SMARTEYE®
Optical Block
```

2. Select Optical Block based on mode of operation required

- **SD**: Fiber optic
- **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)

**Features**

- **OUTPUT STATUS INDICATOR**: Illuminates when outputs are ON.
- **OFFSET ADJUSTMENT**: Sets initial level in relation to switch point of 5 on CONTRAST INDICATOR—also functions as a sensitivity adjustment.
- **CONNECTION**: 6ft (1.85m) 4-wire cable

**Smart Eye**

- **10 LED CONTRAST INDICATOR**: Provides at-a-glance analysis of the sensor's response to Light State vs Dark State sensing conditions.
- **INTERCHANGEABLE OPTICAL BLOCKS**: Choice of 7 Optical Blocks - O1, O1G, O2, R1, F1, V1, V1G

**Hardware & Accessories**

**Mounting Brackets**

- **FMB-1** (8.4 mm diam.): Standard Fiber optic
- **SEB-1**: Stainless L Bracket
- **FMB-2** (5.1 mm diam.): Mini Glass Fiber Optic
- **FMB-3** (3.1 mm diam.): Mini Plastic Fiber Optic
Specifications

**SUPPLY VOLTAGE**
- 12 to 24VDC
- Polarity protected

**CURRENT REQUIREMENTS**
- 75mA (exclusive of load)

**OUTPUTS**

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

**Analogue (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

**Connections and Dimensions**

<table>
<thead>
<tr>
<th>RED</th>
<th>Positive 12 to 24 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHITE</td>
<td>Dark “On”</td>
</tr>
<tr>
<td>GREEN *</td>
<td>Light “On”</td>
</tr>
<tr>
<td>BLACK</td>
<td>Negative</td>
</tr>
<tr>
<td>SHIELD</td>
<td>Ground</td>
</tr>
</tbody>
</table>

* FOR ANALOG MODELS:
  - WHITE - Output
  - GREEN - Not Used

**SMARTEYE® SENSOR**

6-32 x 1/4" socket hd. cap screw (7/64 hex key)

**OPTIONAL MOUNTING BRACKET**
P/N SEB-1 WITH HARDWARE

RoHS Compliant
Product subject to change without notice