



General Purpose Photoelectric Sensor





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

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

Benefits

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

Applications

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

EDR[®] Enhanced Dynamic Range

(Patent No. 5,621,205)



The EDR[®] circuit extends the dynamic operating range to provide unequalled 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.

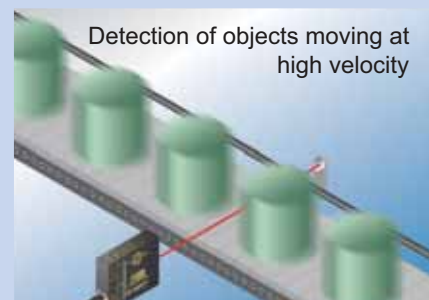
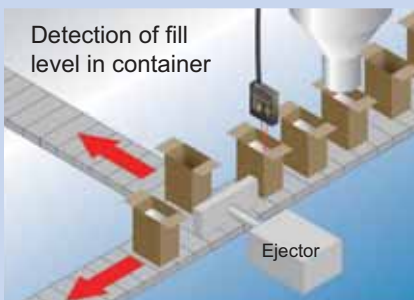
Beam Break Sensing Mode Advantages

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

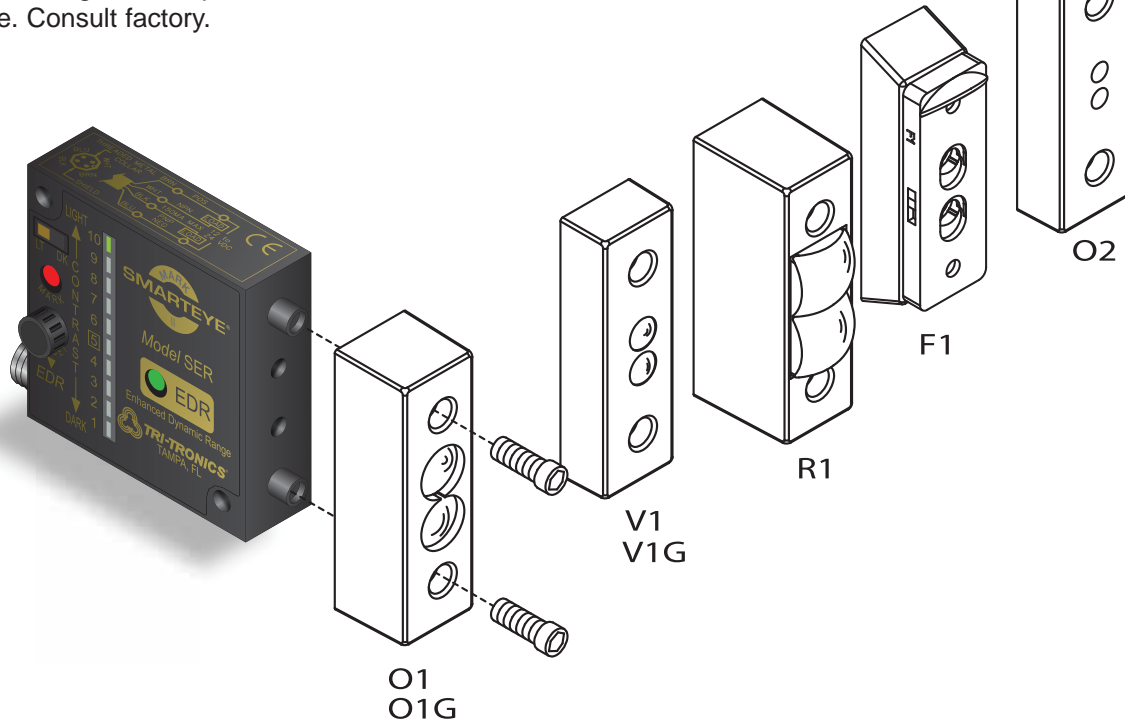
Typical Applications



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
Fiber Optic 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.

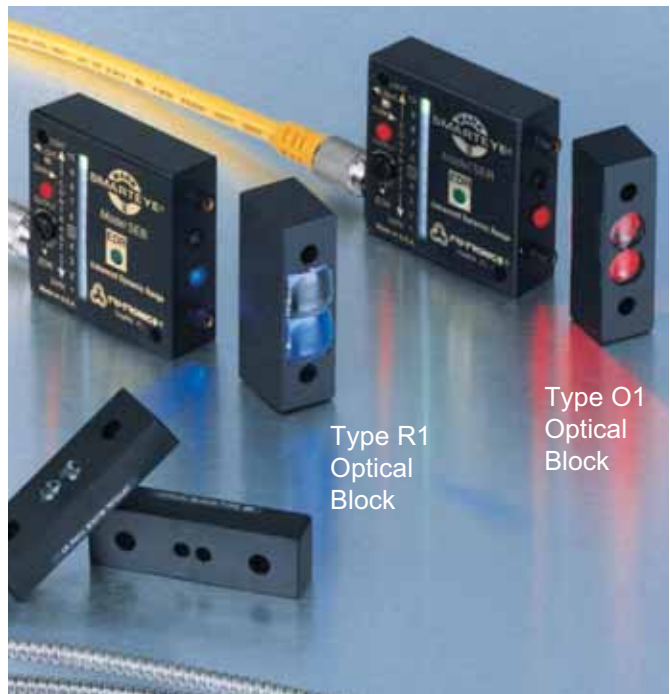
**Type V1, V1G
(Glass)
Focused Lens
"V" Axis**
Type V1, V1G (Glass) is for direct lens "V" axis sensing at close ranges. Used for small part or precise leading edge sensing. Range is dependent on model of the MARK II selected.

**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.

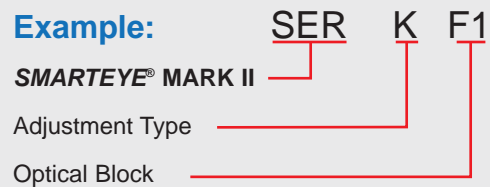


How to Specify



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:



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 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

