Miniature, High Performance
DIN Rail Mountable

SMARTEYE®
MARK III

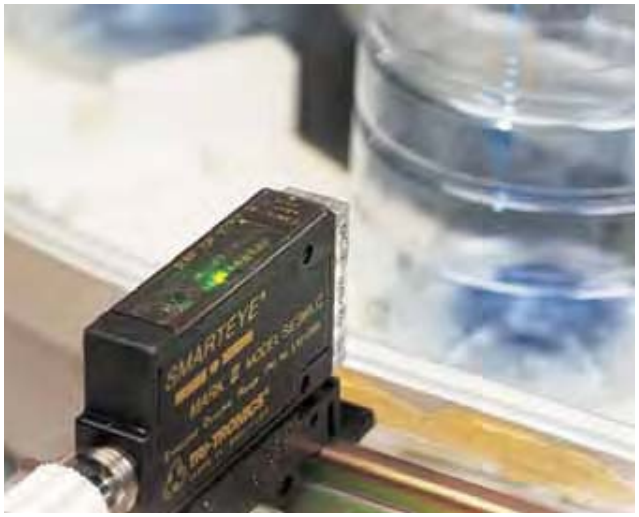
World-Class Versatility *Miniature High Performance Sensor*

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

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

QUICK-CHANGE OPTICAL BLOCK LENSES

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



LED LIGHT SOURCES

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

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

10-LED CONTRAST INDICATOR™

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

EDR® *Enhanced Dynamic Range*

(Patent No. 5,621,205)

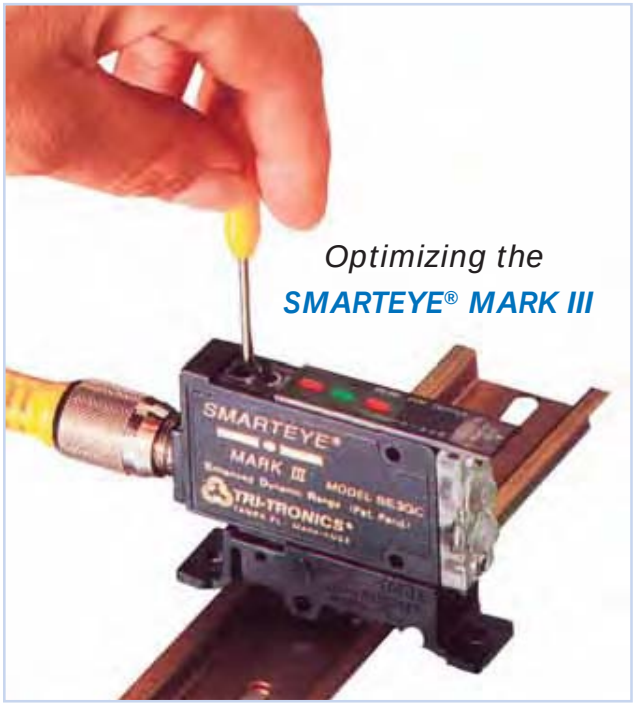
OFFSET/EDR® ADJUSTMENT (Patent No. 5,621,205)

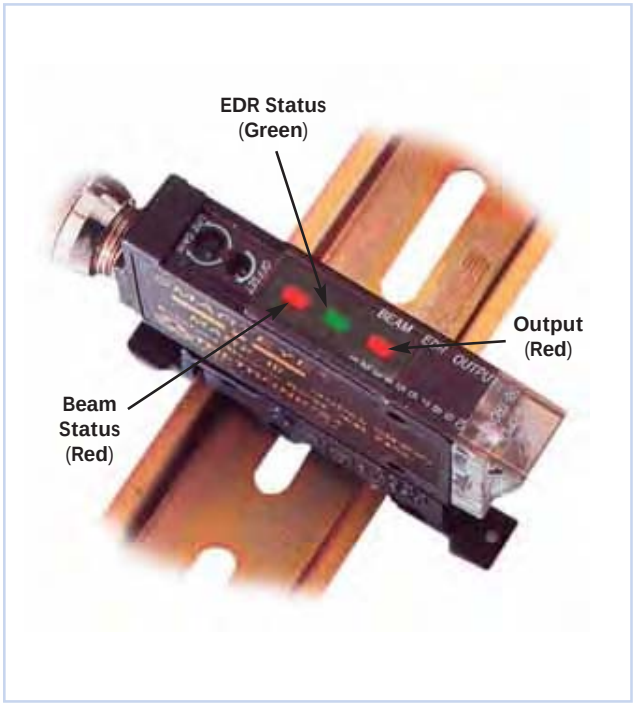
With the Offset/EDR® adjustment feature, the **SMARTEYE MARK III** sensor can resolve very low contrast sensing tasks over a wider range of light intensities, including proper operation at high light levels. In addition, EDR improves background suppression.

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

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

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





Light Source Guidelines

INVISIBLE INFRARED LIGHT SOURCE (880 nm)

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

BLUE LIGHT SOURCE (480 nm)

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

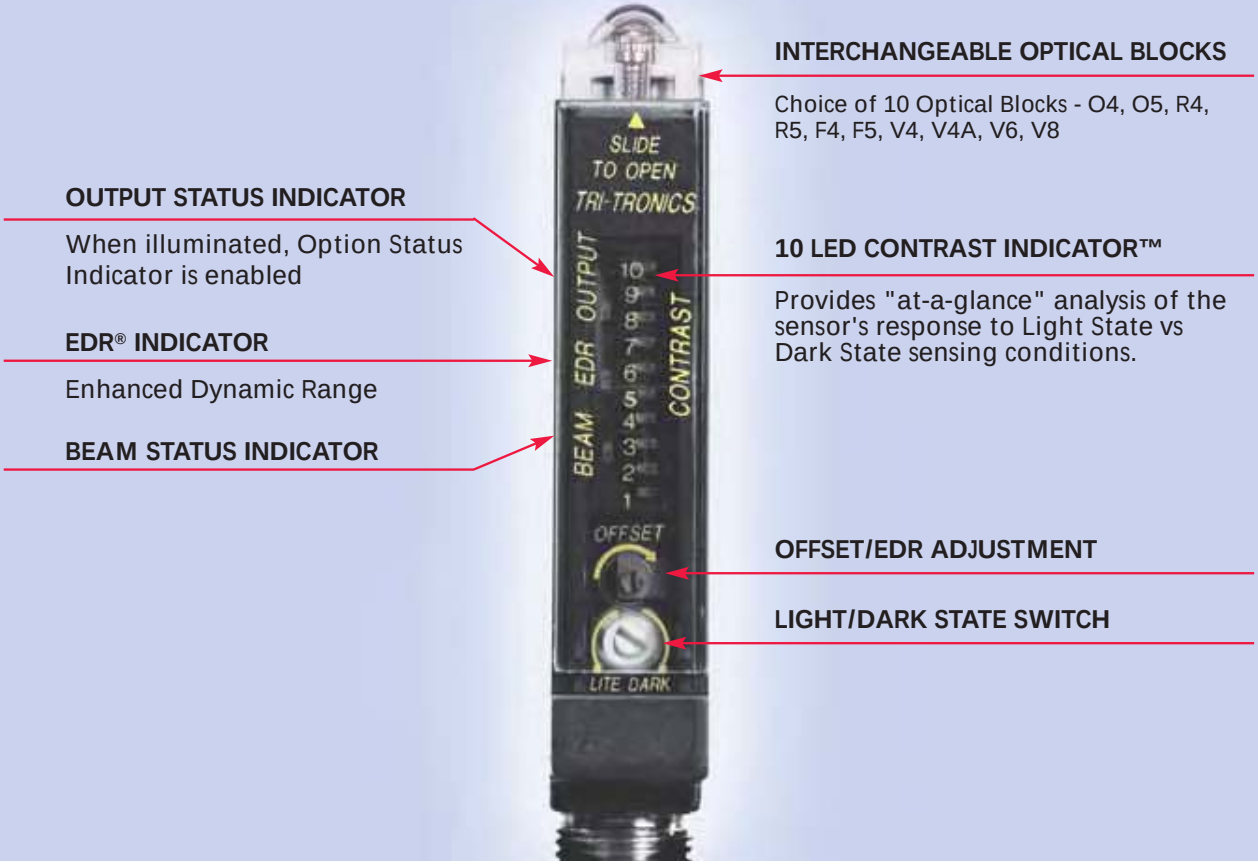
RED LIGHT SOURCE (660 nm)

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

WHITE LIGHT SOURCE

(Broadband Color Spectrum)

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



OUTPUT STATUS INDICATOR

When illuminated, Option Status Indicator is enabled

EDR® INDICATOR

Enhanced Dynamic Range

BEAM STATUS INDICATOR

INTERCHANGEABLE OPTICAL BLOCKS

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

10 LED CONTRAST INDICATOR™

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

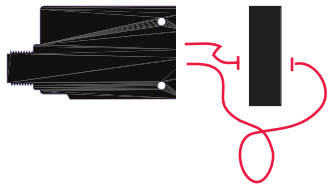
OFFSET/EDR ADJUSTMENT

LIGHT/DARK STATE SWITCH

Selection Guidelines *Opaque Object Sensing*

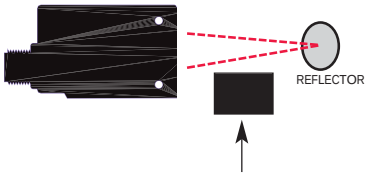
Preferred Mode: Beam Break

Option 1



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

Option 2

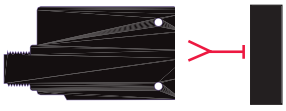


Retroreflective mode. Use with reflector to detect medium to large size opaque objects.
Sensor: Model SE3I/SE3IC with R4 Optical Block (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6 ft) or SEC-15/BSEC-15 (15 ft.)
Reflector: Model 78P, Plastic, 4.4 in. X 1.9 in. screw mounted.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

Alternate Mode: Beam Make (Proximity)

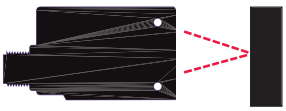
NOTE: Consider proximity mode when installation sensing site conditions preclude using the preferred Beam Break mode.

Option 1



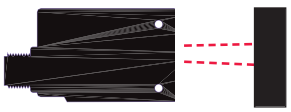
Fiberoptic proximity is used to detect medium to large flat sided opaque objects.
Sensor: Model SE3I/SE3IC with F4 Optical Block (IR Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6 ft.) or SEC-15/BSEC-15 (15 ft.)
Fiberoptic Light Guides: Model BF-A-36T
Sensing Range: Up to 6 in.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

Option 2



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

Option 3

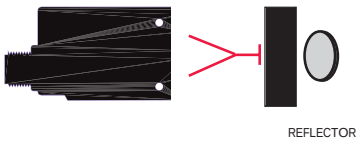


Proximity (divergent beam) mode sensing is useful in detecting some large size opaque objects from longer range. Generally speaking, there must be substantial gaps between objects for this mode to be effective.
Sensor: Model SE3I/SE3IC with O5 Optical Block (IR Light Source)
Cable: Shielded cable w/connector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

Selection Guidelines *Translucent/Transparent Object Sensing*

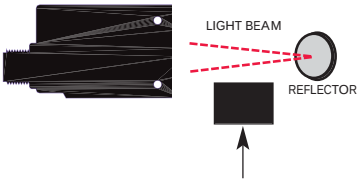
Preferred Mode: Retroreflective Beam Break

Option 1



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

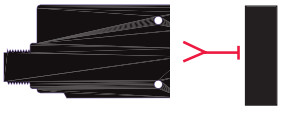
Option 2



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

Alternate Mode: Beam Make (Proximity)

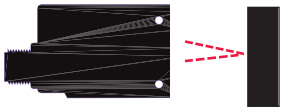
Option 1



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

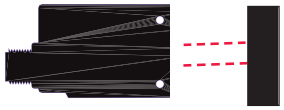
Fiberoptic proximity mode is useful to detect transparent/translucent objects.
Sensor: Model SE3R/SE3RC with F4 Block (Red Light Source)
Cable: Shielded cable w/connector Model SEC-6/BSEC-6 (6ft.) or SEC-15/BSEC-15 (15 ft.)
Fiberoptic Light Guides: Model BF-A-36T
Sensing Range: Up to 4 in.
Accessories: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

Option 2



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

Option 3



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

Optical Block Selection

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

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

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

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

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

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

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

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

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

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

Sensing Range Guidelines

Convergent / Proximity / Retroreflective

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

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

Glass Fiber Optics

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

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

Plastic Fiber Optics

OPTICAL BLOCKS	RED	WHITE
Opposed Mode		
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*

How to Specify

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

2. Select Optical Block based on mode of operation

NOTE: DRB-1 Bracket included

Example: SE3RF4

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

Accessories

Micro Cable Selection Guide, 4-wire, M12

Yellow Shielded Cable Assemblies

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

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

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

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

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

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

Black Shielded Cable Assemblies (Lightweight)

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

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

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

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

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

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

BX-10
10' (3.1 m) Extension cable

BX-25
25' (7.62 m) Extension cable

Grey Unshielded Cable Assemblies

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

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

SEB-3
Stainless “L” Bracket

TA-18
18mm Adapter

DRB-1
Bracket

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

MB-18
18mm Bracket

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

Specifications

SUPPLY VOLTAGE
- 12 to 30 VDC
- Polarity Protected

CURRENT REQUIREMENTS
- 85 mA (exclusive of load)

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

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

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

HYSTERESIS
- Less than 400 millivolts for maximum sensitivity and resolution

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

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

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

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

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

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

Connections and Dimensions SMARTEYE® MARK III PHOTOELECTRIC SENSOR