

Additional information on this product is immediately available online at [www.bannerengineering.com/69943](http://www.bannerengineering.com/69943)

View or download additional information, including excess gain curves, beam patterns and accessories.  
For further assistance, contact a Banner Engineering Applications Engineer at (763) 544-3164 or (888) 373-6767.

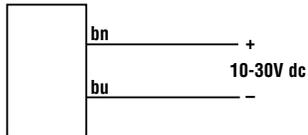


Glass Fiber  
Optic sensor

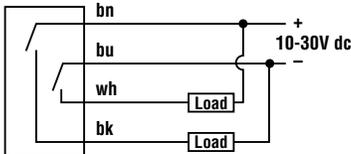


Convergent-mode  
sensor

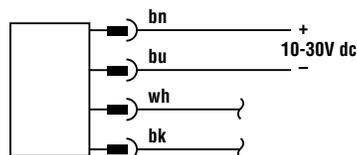
Emitters with Attached Cable



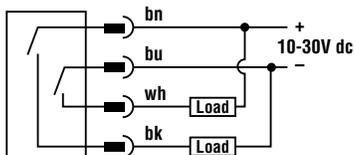
All Other Models  
with Attached Cable



Emitters with Quick Disconnect  
(4-Pin Euro-Style)



All Other Models with Quick Disconnect  
(4-Pin Euro-Style)



NOTES: Output Type for all models is Bipolar NPN/PNP. Load 150 mA max., each output.

Sensing Mode		Range	LED	Model*
	Opposed Emitter	3 m (10')	Infrared 880 nm	SM31E
	Opposed Receiver			SM31R
	Opposed Emitter - Long Range			SM31EL
	Opposed Receiver - Long Range	SM31RL		
	Opposed Emitter Clear Plastic Detection	0 to 300 mm (0 to 12") Actual range varies, depending on the light transmission properties of the plastic material being sensed.		SM31EPD
	Opposed Receiver Clear Plastic Detection			SM31RPD
	Non-Polarized Retroreflective	5 m (15')	Visible Red 650 nm	SM312LV
	Polarized Retroreflective	50 mm to 2 m (2" to 7')		SM312LVAG
	Extended-Range Polarized Retroreflective	10 mm to 3 m (0.4" to 10')		SM312LP
	Diffuse	380 mm (15")	Infrared 880 nm	SM312D
		300 mm (12")		SM312DBZ
	Divergent Diffuse	130 mm (5")		SM312W
	Convergent	16 mm (0.65") Focus	Visible Red 650 nm	SM312C
		43 mm (1.7") Focus		SM312C2
		16 mm (0.65") Focus		SM312CV
		43 mm (1.7") Focus		SM312CV2
		16 mm (0.65") Focus	Visible Blue 475 nm	SM312CVB
		49 mm (1.9") Focus		SM312CV2B
		16 mm (0.65") Focus	Visible Green 525 nm	SM312CVG
		49 mm (1.9") Focus		SM312CV2G
	Glass Fiber Optic	Range varies, depending on sensing mode and fiber optics used.	Infrared 880 nm	SM312F
			Visible Red 650 nm	SM312FV
			Visible Blue 475 nm	SM312FVB
			Visible Green 525 nm	SM312FVG
			Visible Red 650 nm	SM312FP
			Visible Blue 475 nm	SM312FPB
			Visible Green 525 nm	SM312FPG
	Plastic Fiber Optic	Special High-Power Option Plastic Fiber Optic	Visible Red 650 nm	SM312FPH

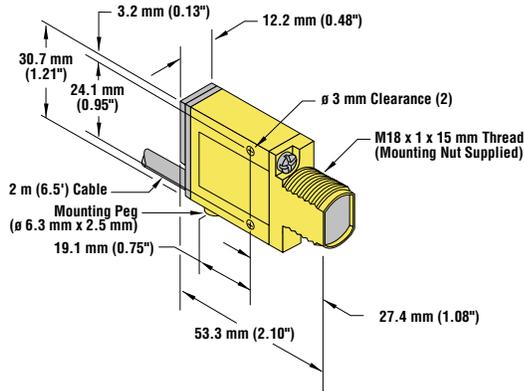
\*Standard 2 m (6.5') cable models are listed.

- 9 m (30') cable: add suffix "W/30" (e.g., SM31EW/30).
- 4-pin Euro QD models: add suffix "QD" (e.g., SM31EQD).
- 150 mm (6") QD Pigtail: add suffix "QDP" (e.g., SM31EQDP).
- For 0.3 ms response: add suffix "MHS" (eg., SM31EMHS).

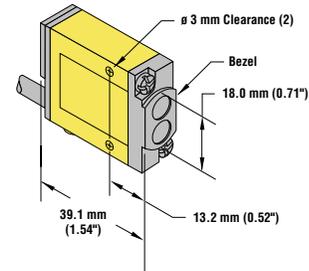
**See Safety Use Warning on Back Page**

Dimensions

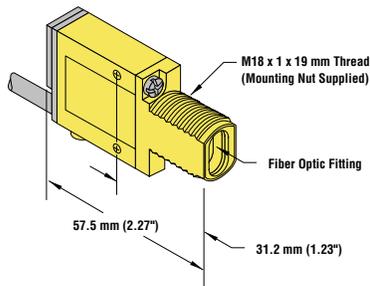
Models with suffix E, EL, EPD, R, RL, RPD, LV, LVAG, LP, D, C, C2, CV, CV2, CVG, CV2G, CVB, and CV2B



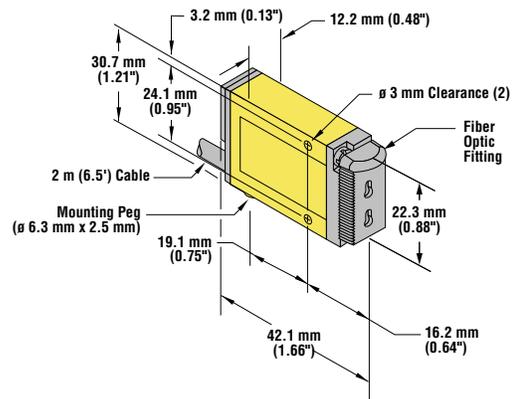
Models with suffix DBZ and W



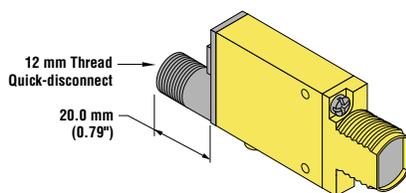
Models with suffix F, FV, FVB, and FVG



Models with suffix FP, FPB, FPG, and FPH

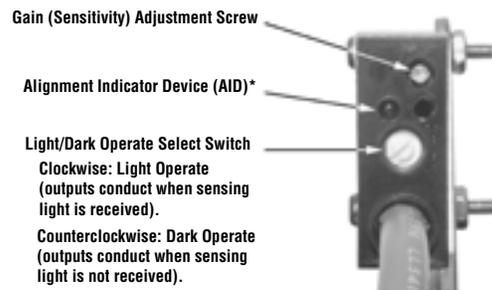


QD Models



Sensor Features

(shown with gasketed acrylic cover removed)



\*U.S. Patent no. 4356393

NOTE: Please observe proper ESD precautions (grounding) when adjusting gain pot or LO/DO switch.

**Sensor Mounting and Alignment**

MINI-BEAM sensors perform most reliably if they are properly aligned and securely mounted. For maximum mechanical stability, final-mount MINI-BEAM sensors through 18 mm diameter holes by their threaded barrel (where available), or use a mounting bracket. A complete selection of mounting brackets is available. Visit [www.bannerengineering.com/69943](http://www.bannerengineering.com/69943), or contact the factory for information on mounting options.

Begin with line-of-sight positioning of the MINI-BEAM sensor to its emitter (opposed-mode sensing) or to its target (all other sensing modes). When using a retroreflective sensor, the target is the retroreflector ("retro target"). For diffuse or convergent sensing modes, the target is the object to be detected.

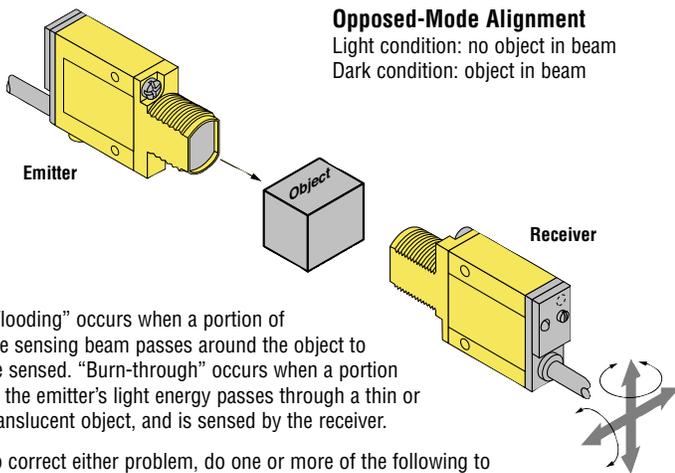
Apply power to the sensor (and to the emitter, if using the opposed mode). Advance the 15-turn Gain control to maximum (clockwise end of rotation), using a small flat-blade screwdriver. The Gain control is clutched at both ends to avoid damage, and will "free-wheel" when either endpoint is reached. See Sensor Features illustration on page 2.

If the MINI-BEAM sensor is receiving its light signal, the red LED Alignment indicator will be ON and flashing at a rate proportional to the signal strength (faster = more signal). Move the sensor (or move the retro target, if applicable) up-down-right-left (including angular rotation) to find the center of the movement zone within which the LED indicator remains ON. Reducing the Gain setting will reduce the size of the movement zone, and enable more precise alignment.

Repeat the alignment motions after each Gain reduction. When optimum alignment is achieved, mount sensor(s) (and the retro target, if applicable) solidly in that position. Increase the Gain to maximum.

Test the sensor by placing the object to be detected in the sensing position, then removing it. The Alignment indicator LED should come ON when the sensing beam is established (Light condition), and go OFF when the beam is broken (Dark condition). If the Alignment indicator LED stays ON for both sensing conditions, consider the following tips for each sensing mode.

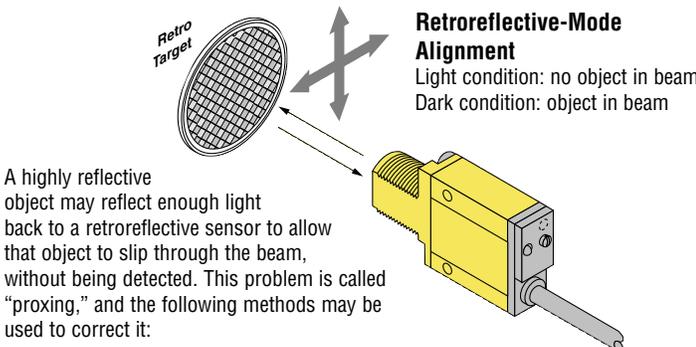
**Alignment Tips**



"Flooding" occurs when a portion of the sensing beam passes around the object to be sensed. "Burn-through" occurs when a portion of the emitter's light energy passes through a thin or translucent object, and is sensed by the receiver.

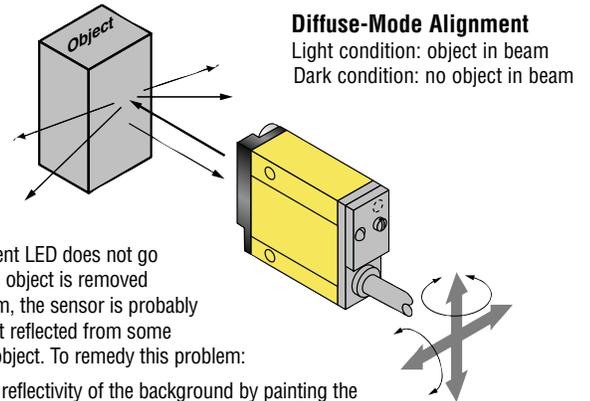
To correct either problem, do one or more of the following to reduce the light energy:

- Reduce the Gain adjustment on the receiver.
- Add an aperture to one or both lenses. (MINI-BEAM apertures, available from Banner, fit neatly inside the lens assembly.)
- Intentionally misalign the emitter and receiver.



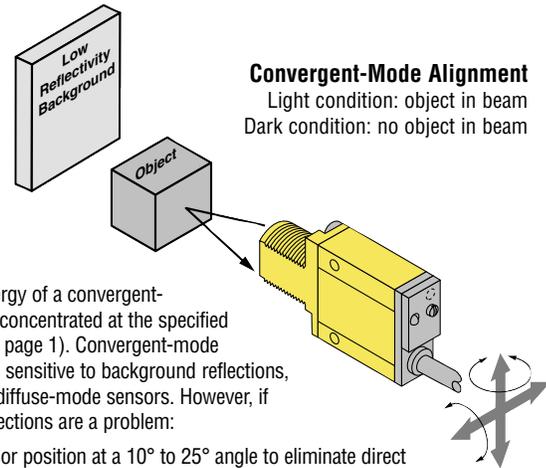
A highly reflective object may reflect enough light back to a retroreflective sensor to allow that object to slip through the beam, without being detected. This problem is called "proxing," and the following methods may be used to correct it:

- Position the sensor and retro target so the beam will not strike a shiny surface perpendicular to the sensor lens.
- Reduce the Gain adjustment.
- Add a polarizing filter (for model SM312LV).



If the Alignment LED does not go OFF when the object is removed from the beam, the sensor is probably detecting light reflected from some background object. To remedy this problem:

- Reduce the reflectivity of the background by painting the surface(s) flat-black, scuffing any shiny surface, or drilling a large hole, directly opposite the diffuse sensor.
- Move the sensor closer to the object to be detected and reduce the Gain adjustment. Rule of thumb for diffuse sensing: The distance to the nearest background object should be at least three times the sensing distance.



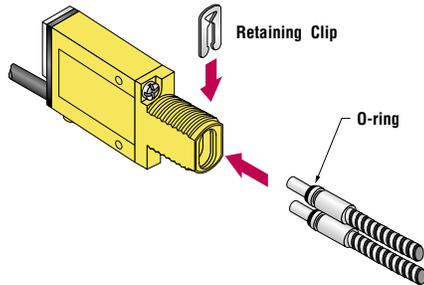
The sensing energy of a convergent-mode sensor is concentrated at the specified focus point (see page 1). Convergent-mode sensors are less sensitive to background reflections, compared with diffuse-mode sensors. However, if background reflections are a problem:

- Skew the sensor position at a 10° to 25° angle to eliminate direct reflections from shiny background surfaces.
- Reduce the reflectivity of the background by painting the surface(s) flat-black, scuffing any shiny surface, or drilling a large hole, directly opposite the sensor.
- Reduce the Gain adjustment.

## Fiber Installation

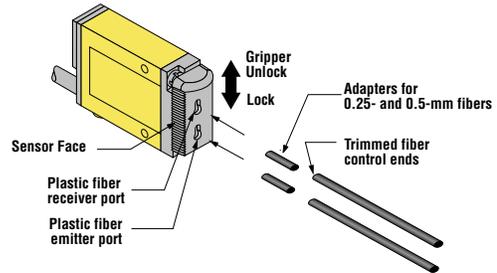
### Glass Fiber Installation

- 1) Install the O-ring (supplied with the fiber) on each fiber end, as shown in the drawing.
- 2) While pressing the fiber ends firmly into the ports on the sensor front, slide the U-shaped retaining clip (supplied with the sensor) into the slot in the sensor's barrel, until it snaps into place.



### Plastic Fiber Installation

- 1) With supplied fiber cutter, make a clean cut at control ends of fibers.
- 2) Unlock the fiber gripper as shown below. Apply appropriate fiber adaptors prior to fiber insertion, if needed.
- 3) Gently insert the prepared fiber ends into the ports, as far as they will go.
- 4) Slide the fiber gripper back to lock, as shown below.



## Specifications

**Supply Voltage and Current** 10 to 30V dc (10% maximum ripple) at less than 25 mA (exclusive of load)

### Supply Protection Circuitry

Protected against reverse polarity and transient voltages

### Output Configuration

Bipolar: One current sourcing (PNP) and one current sinking (NPN) open collector transistor

### Output Rating

150 mA maximum each output at 25° C, derated to 100 mA at 70° C (derate ≈ 1 mA per ° C)

**OFF-state leakage current:** less than 1 microamp

**Output saturation voltage (PNP output):** < 1 volt at 10 mA, < 2 volts at 150 mA

**Output saturation voltage (NPN output):** < 200 millivolts at 10 mA, < 1 volt at 150 mA

### Output Protection Circuitry

Protected against false pulse on power-up and continuous overload or short-circuit of outputs

### Output Response Time

Sensors will respond to either a "light" or "dark" signal of 1 millisecond or longer duration, 500 Hz maximum. Modification for 0.3 millisecond response is available (MHS-suffix models; these models also feature reduced sensitivity range and reduced repeatability.)

NOTE: Outputs are non-conducting during 100 millisecond delay on power-up.

### Repeatability

**Opposed:** 0.14 milliseconds

**Non-Polarized and Polarized Retro, Diffuse, Convergent, Glass Fiber Optic, and**

**Plastic Fiber Optic:** 0.3 milliseconds

Response time and repeatability specifications are independent of signal strength.

### Adjustments

Light/Dark Operate Select switch

15-turn slotted brass screw Gain (sensitivity) adjustment potentiometer (clutched at both ends of travel)

Located on the rear panel, protected by a gasketed, clear acrylic cover.

### Indicators

Patented alignment Indicator Device system (AID™, US patent #4356393) lights a rear-panel-mounted LED indicator when the sensor sees light. Its pulse rate is proportional to the light signal strength (the stronger the signal, the faster the pulse rate).

### Construction

Reinforced thermoplastic polyester housing, totally encapsulated, o-ring sealing, acrylic lenses, stainless steel screws

### Environmental Rating

Meets NEMA standards 1, 2, 3, 3S, 4, 4X, 6, 12, and 13; IEC IP67.

### Connections

PVC-jacketed 4-conductor 2 m (6.5') or 9 m (30') cables, or 4-pin Euro-style QD fitting; QD cables available separately.

### Operating Conditions

**Temperature:** -20° to +70°C (-4° to +158°F)

**Maximum relative humidity:** 90% at 50°C (non-condensing)

### Application Note

The NPN (current sinking) output of dc MINI-BEAM sensors is directly compatible as an input to Banner logic modules, including all non-amplified MAXI-AMP and MICRO-AMP modules. MINI-BEAMs are TTL compatible.

**Certifications** CE SF RUL

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## WARNING . . . Not To Be Used for Personnel Protection

**Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.**

These sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Consult your current Banner Safety Products catalog for safety products which meet OSHA, ANSI and IEC standards for personnel protection.

**WARRANTY:** Banner Engineering Corp. warrants its products to be free from defects for one year. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.