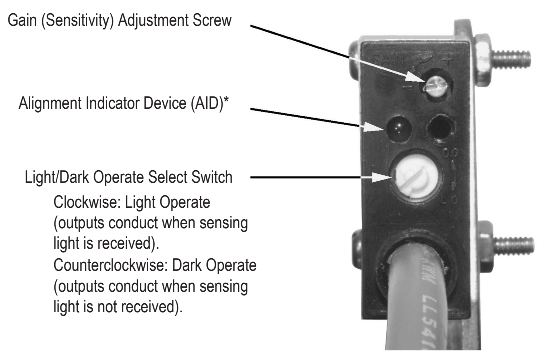
MINI-BEAM® DC Voltage Series

BANNER
more sensors, more solutions

Quick Start Guide

Self-contained photoelectric sensors

Sensor Features



*U.S. Patent no. 4356393

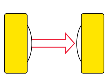
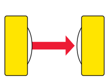
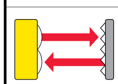
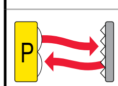
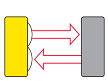
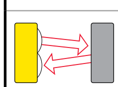
WARNING: Not To Be Used for Personnel Protection

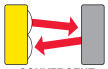
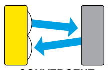
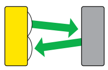
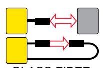
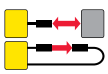
Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Models

Integral 2 m (6.5 ft) unterminated cable models are listed.

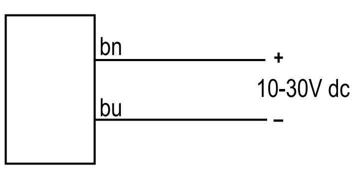
- To order the 9 m (30 ft) PVC cable model, add the suffix "W/30" to the cabled model number. For example, SM31EW/30.
- To order the 4-pin M12/Euro-style QD models, add the suffix “QD” to the model number. For example, SM31EQD.
- To order the 150 mm (6 in) cable with QD, add the suffix “QDP” to the model number. For example, SM31EQDP.
- To order a 0.3 ms response time model, add the suffix “MHS” to the model number. For example, SM31EMHS.

Sensing Mode		Range	LED	Model
 OPPOSED	Opposed Emitter	3 m (10 ft)	Infrared, 880 nm	SM31E
	Opposed Receiver			SM31R
	Opposed Emitter - Long Range	30 m (100 ft)		SM31EL
	Opposed Receiver - Long Range			SM31RL
 OPPOSED	Opposed Emitter - Clear Plastic Detection	0 to 300 mm (0 to 12 in) Actual range varies, depending on the light transmission properties of the plastic material being sensed.	Visible red, 650 nm	SM31EPD
	Opposed Receiver - Clear Plastic Detection			SM31RPD
 RETRO	Non-Polarized Retroreflective	5 m (15 ft)		SM312LV
 POLAR RETRO	Polarized Retroreflective	55 mm to 2 m (2 in to 7 ft)		SM312LVAG
	Extended-Range Polarized Retroreflective	10 mm to 3 m (0.4 in to 10 ft)		SM312LP
 DIFFUSE	Diffuse	380 mm (15 in)	Infrared, 880 nm	SM312D
		300 mm (12 in)		SM312DBZ
	Divergent Diffuse	130 mm (5 in)		SM312W
 CONVERGENT	Convergent	16 mm (0.65 in) Focus		SM312C
		43 mm (1.7 in) Focus		SM312C2

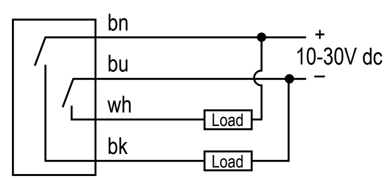
Sensing Mode		Range	LED	Model
		16 mm (0.65 in) Focus	Visible red, 650 nm	SM312CV
		43 mm (1.7 in) Focus		SM312CV2
		16 mm (0.65 in) Focus	Visible blue, 475 nm	SM312CVB
		49 mm (1.9 in) Focus		SM312CV2B
		16 mm (0.65 in) Focus	Visible green, 525 nm	SM312CVG
		49 mm (1.9 in) Focus		SM312CV2G
	Glass Fiber 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
	Plastic Fiber Optic		Visible red, 650 nm	SM312FP
			Visible blue, 475 nm	SM312FPB
			Visible green, 525 nm	SM312FPG
	Special High-Power Option Plastic Fiber Optic		Visible red, 650 nm	SM312FPH

Wiring Diagrams

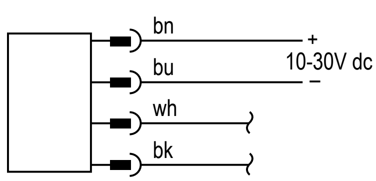
Emitters with Attached Cable



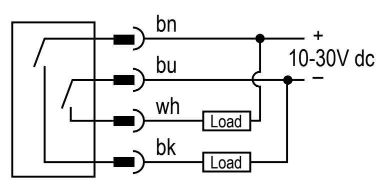
All Other Models with Attached Cable



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



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



The output type for all models is Bipolar NPN/PNP; load 150 mA max., each output.

Sensor Mounting and Alignment

MINI-BEAM sensors perform most reliably if they are properly aligned and securely mounted.

For maximum mechanical stability, 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 *http://www.bannerengineering.com* or contact Banner Engineering 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.

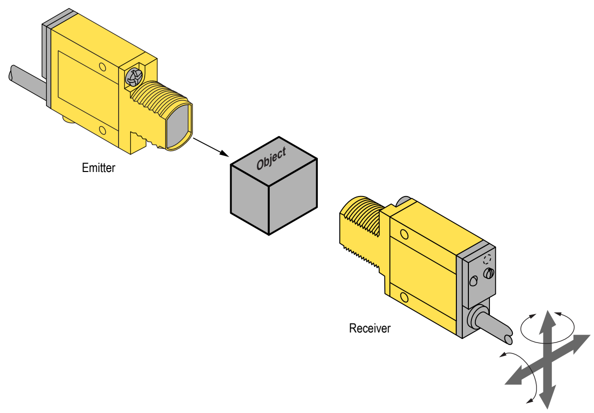
Apply power to the sensor (and to the emitter, if using the opposed mode). Advance the 15-turn Gain control to maximum (clockwise end of rotation) using a small flat-blade screwdriver. The Gain control is clutched at both ends to avoid damage and will "free-wheel" when either endpoint is reached.

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 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 reduces the size of the movement zone for 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) or be ON 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.

Opposed Mode Alignment



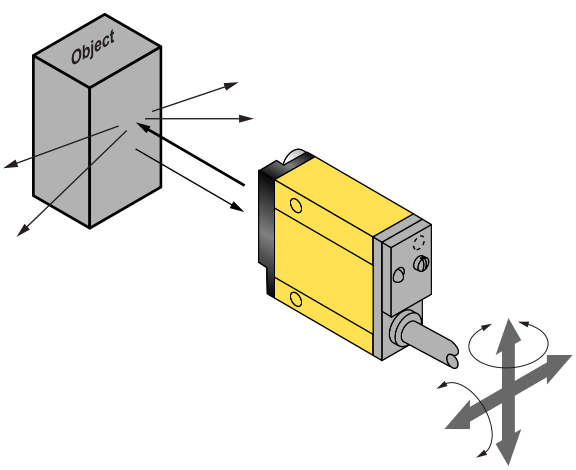
"Flooding" occurs when a portion of the sensing beam passes around the object to be sensed. "Burn-through" occurs when a portion of the emitter's light energy passes through a thin or translucent object, and is sensed by the receiver.

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

Note:
- Light condition: sensor output is ON when there is no object in the beam
- Dark condition: sensor output is ON when there is an object in the beam

Diffuse Mode Alignment

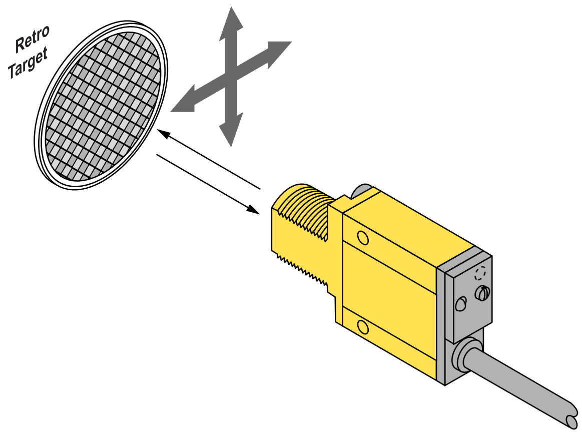


If the Alignment LED does not go OFF when the object is removed from the beam, the sensor is probably detecting light reflected from some background object. To remedy this problem:

- 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

Note:
- Light condition: sensor output is ON when there is no object in the beam
- Dark condition: sensor output is ON when there is an object in the beam

Retroreflective Mode Alignment

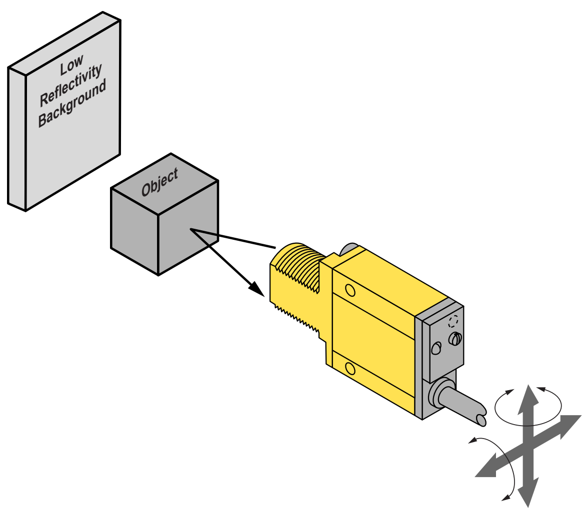


A highly reflective object may reflect enough light back to a retroreflective sensor to allow that object to slip through the beam, without being detected. This problem is called "proxing," and the following methods may be used to correct it:

- 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)

Note:
- Light condition: sensor output is ON when there is no object in the beam
- Dark condition: sensor output is ON when there is an object in the beam

Convergent Mode Alignment

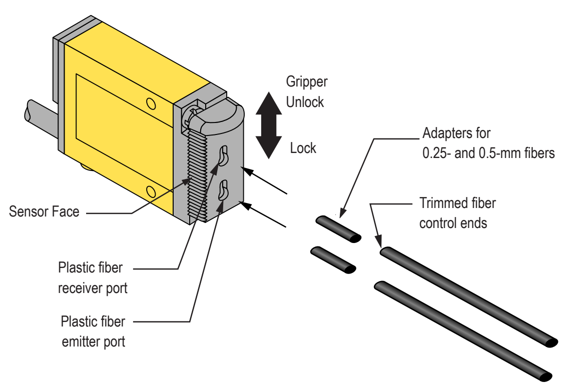


The sensing energy of a convergent mode sensor is concentrated at the specified focus point. Convergent mode sensors are less sensitive to background reflections, compared with diffuse mode sensors. However, if background reflections are a problem:

- 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

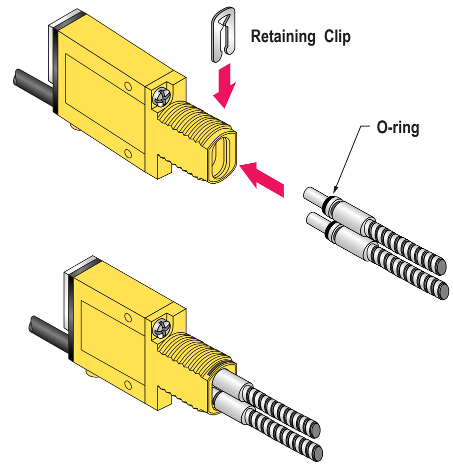
Note:
- Light condition: sensor output is ON when there is no object in the beam
- Dark condition: sensor output is ON when there is an object in the beam

Plastic Fiber Installation



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

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.

Specifications

Supply Voltage and Current
10 to 30 V 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): less than 1 volt at 10 mA, less than 2 volts at 150 mA
Output Saturation Voltage (NPN Output): less than 200 millivolts at 10 mA, less than 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 ft) or 9 m (30 ft) cables, or 4-pin Euro-style QD fitting; QD cables available separately

Operating Conditionsperating Conditions
Temperature: –20 °C to +70 °C (–4 °F to +158 °F)
Humidity: 90% at +50 °C maximum relative humidity (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.

Required Overcurrent Protection

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

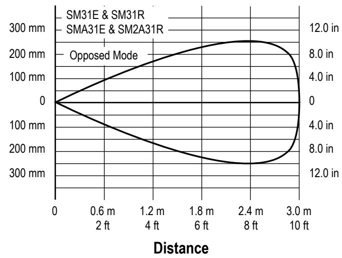
Overcurrent protection is required to be provided by end product application per the supplied table.
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.
Supply wiring leads < 24 AWG shall not be spliced.
For additional product support, go to *www.bannerengineering.com*.

Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

Certifications

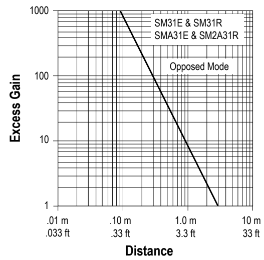
Performance Curves for SM31Ex Emitter and SM31Rx Receiver Models

Beam Pattern for SM31E/R

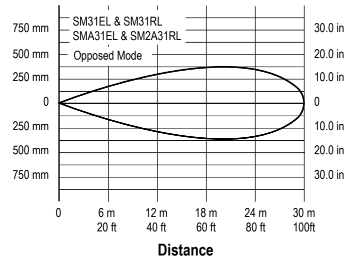


Effective Beam: 3.5 mm

Excess Gain Curve for SM31E/R

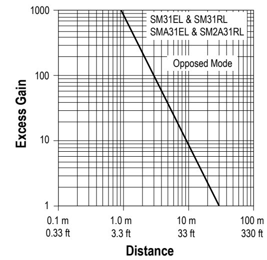


Beam Pattern for SM31EL/RL



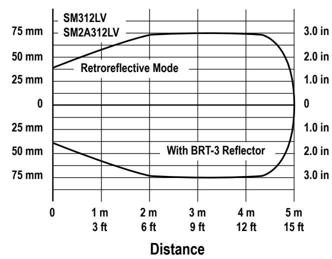
Effective Beam: 13 mm

Excess Gain Curve for SM31EL/RL

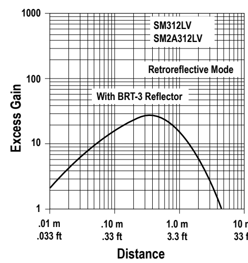


Performance Curves for the SM312Lx Retroreflective Models

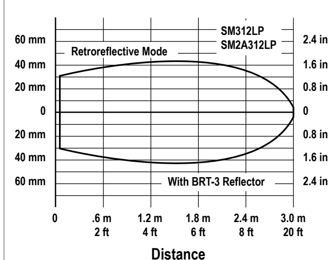
Beam Pattern for SM312LVxx



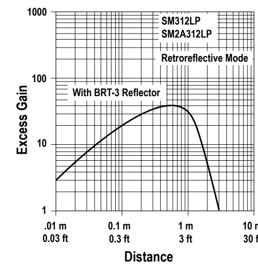
Excess Gain Curve for SM312LVxx

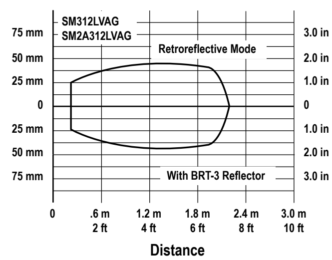


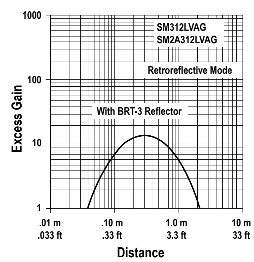
Beam Pattern for SM312LP



Excess Gain Curve for SM312LP

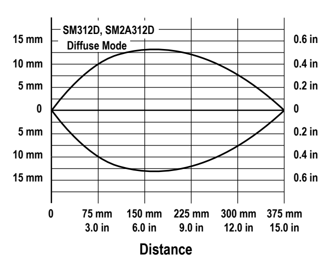




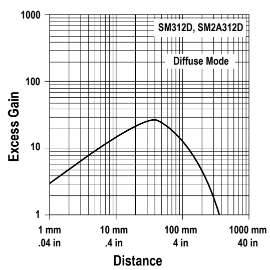


Performance Curves for the SM312Dx and SM312W Diffuse Models

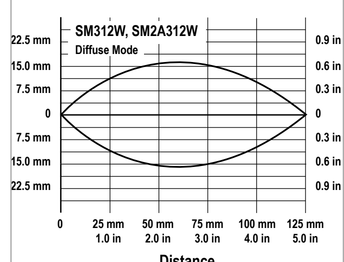
Beam Pattern for SM312Dx



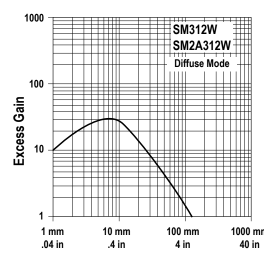
Excess Gain Curve for SM312Dx



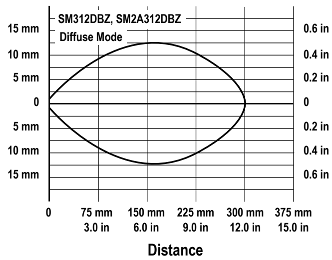
Beam Pattern for SM312W



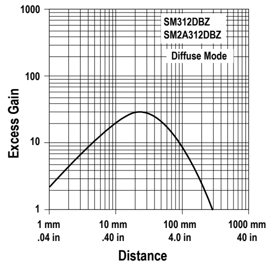
Excess Gain Curve for SM312W



Beam Pattern for SM312Dx



Excess Gain Curve for SM312Dx

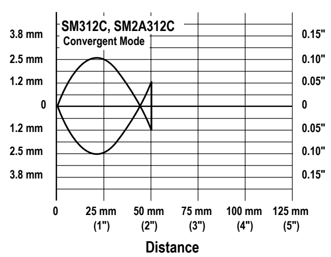


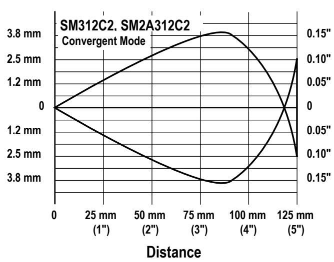
Beam Pattern for SM312W

Excess Gain Curve for SM312W

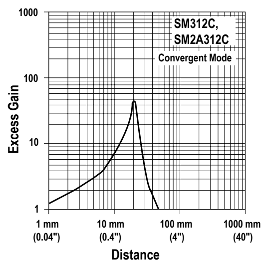
Performance Curves for the SM312Cx Convergent Models

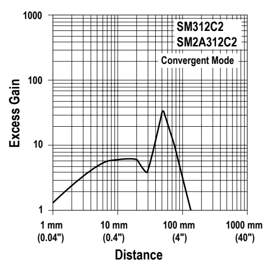
Beam Pattern for SM312C



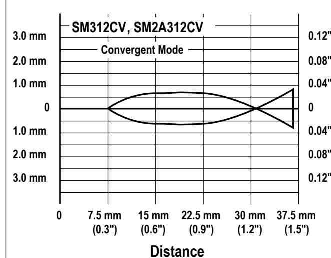


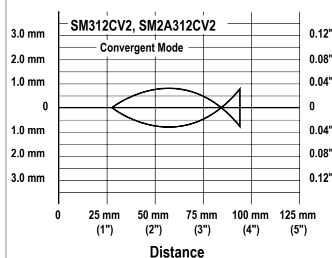
Excess Gain Curve for SM312C



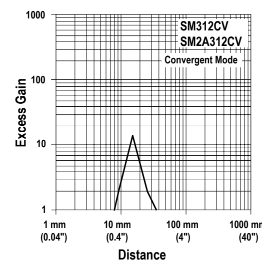


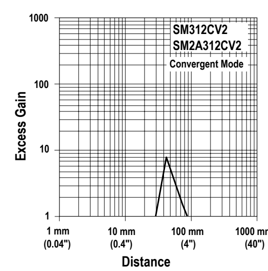
Beam Pattern for SM312CV





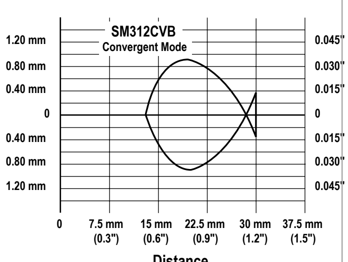
Excess Gain Curve for SM312CV



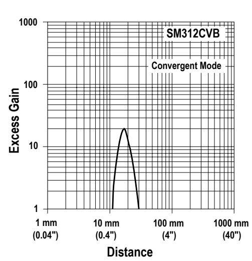


Performance is based on a 90% reflectance white test card.

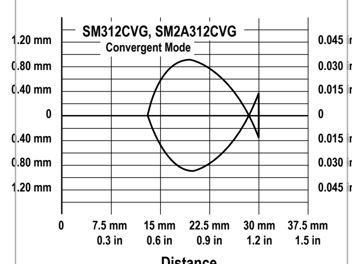
Beam Pattern for SM312CVB



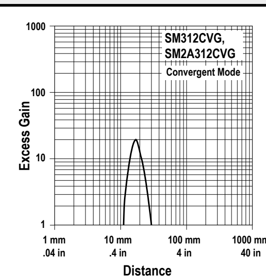
Excess Gain Curve for SM312CVB



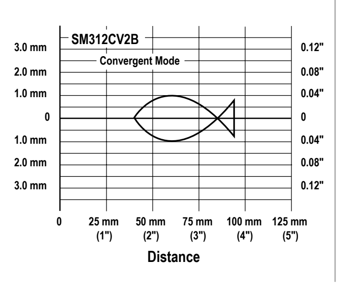
Beam Pattern for SM312CVG

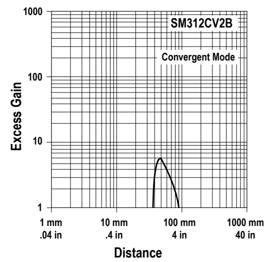


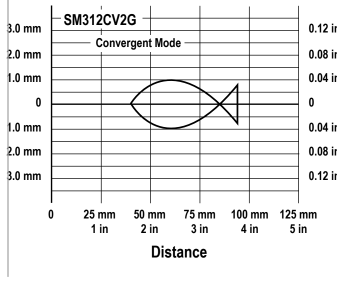
Excess Gain Curve for SM312CVG

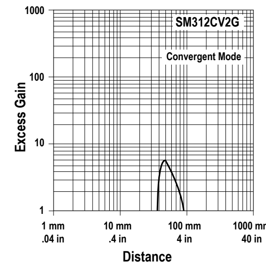


Beam Pattern for SM312CVB	Excess Gain Curve for SM312CVB	Beam Pattern for SM312CVG	Excess Gain Curve for SM312CVG



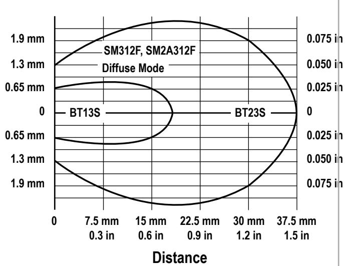


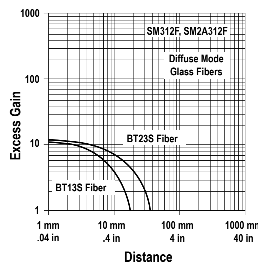


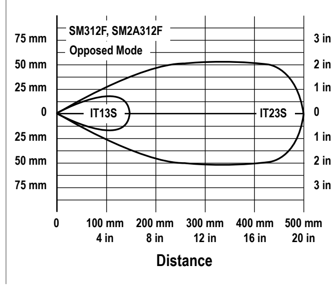


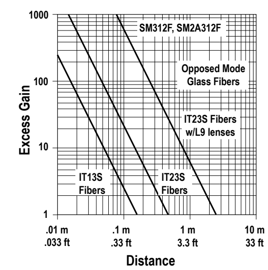
Performance Curves for the SM312F Glass Fiber Optic Models

Diffuse Mode		Opposed Mode	
Beam Pattern for SM312F	Excess Gain Curve for SM312F	Beam Pattern for SM312F	Excess Gain Curve for SM312F

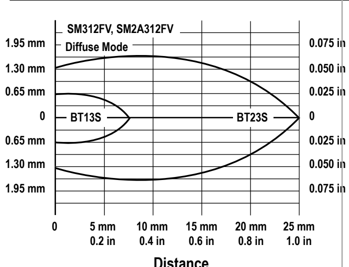


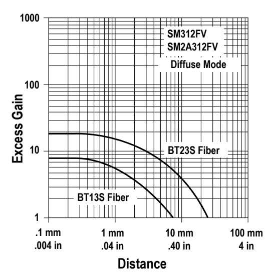


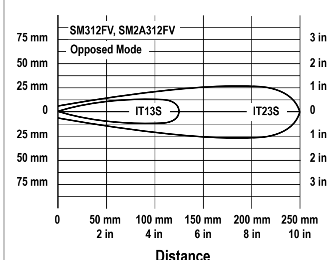


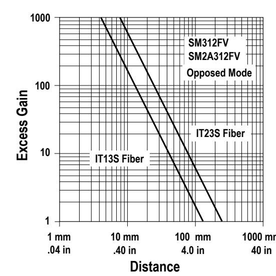


Diffuse Mode		Opposed Mode	
Beam Pattern for SM312FV	Excess Gain Curve for SM312FV	Beam Pattern for SM312FV	Excess Gain Curve for SM312FV

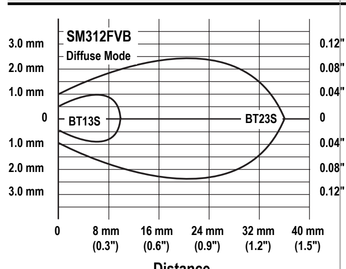


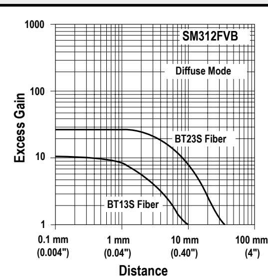


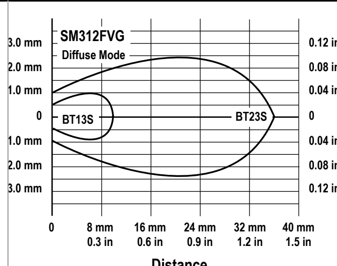


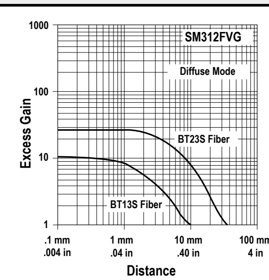


Beam Pattern for SM312FVB	Excess Gain Curve for SM312FVB	Beam Pattern for SM312FVG	Excess Gain Curve for SM312FVG





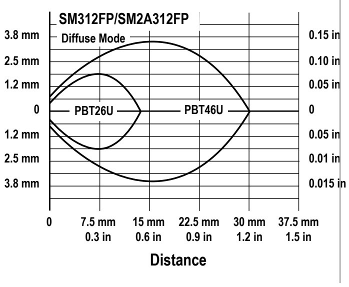




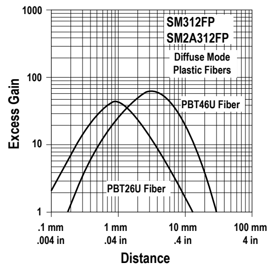
Performance Curves for the SM312FP Plastic Fiber Models

Diffuse Mode

Beam Pattern for SM312FP

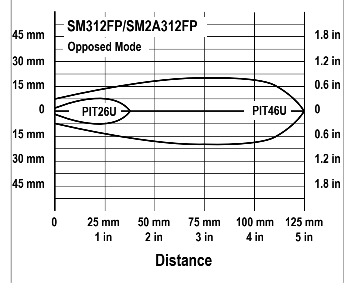


Excess Gain Curve for SM312FP

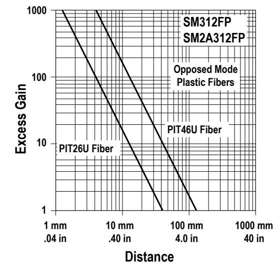


Opposed Mode

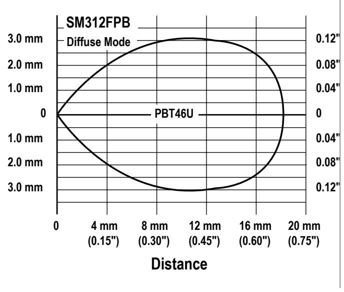
Beam Pattern for SM312FP



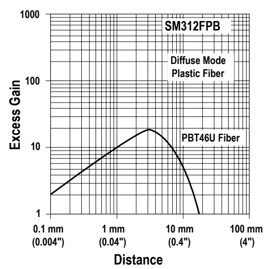
Excess Gain Curve for SM312FP



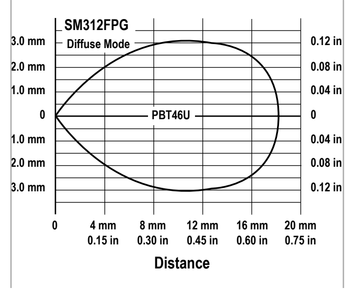
Beam Pattern for SM312FPB



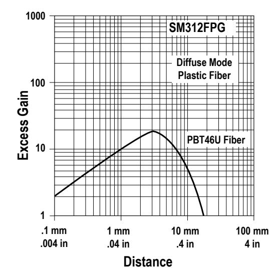
Excess Gain Curve for SM312FPB



Beam Pattern for SM312FPG



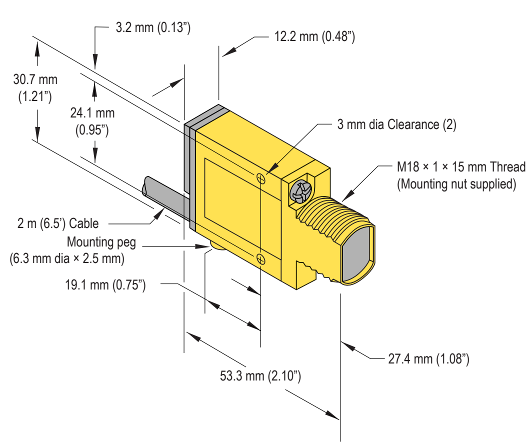
Excess Gain Curve for SM312FPG



Dimensions

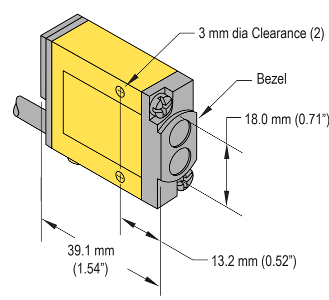
Cabled Models

(Suffix E, EL, EPD, R, RL, RPD, LV, LVAG, LP, LPC, D, C, C2, CV, CV2, CVG, CV2G, CVB, CV2B, CVW)



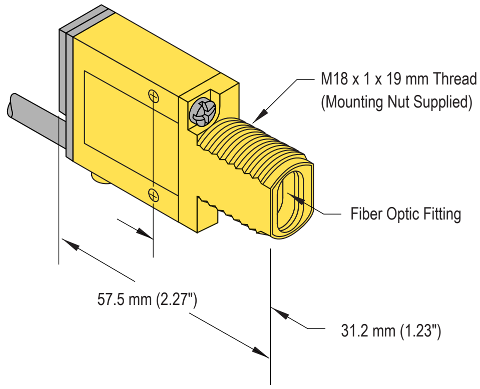
Divergent Diffuse Models

(Suffix DBZ and W)



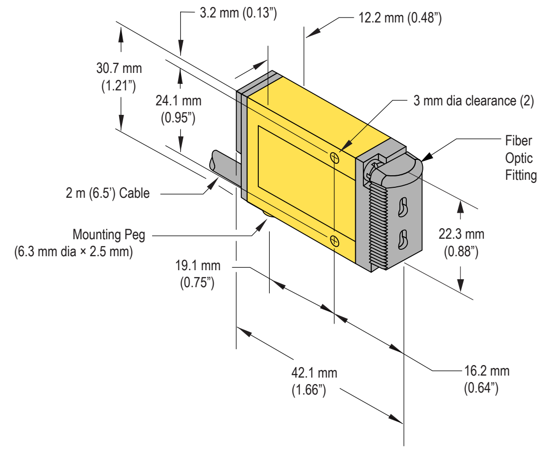
Glass Fiber Models

(Suffix F, FV, FVB, FVG, FVW)

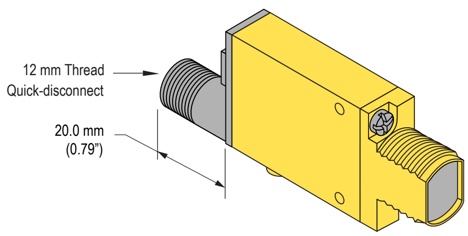


Plastic Fiber Models

(Suffix FP, FPB, FPG, FPH, FPW)



QD Models



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