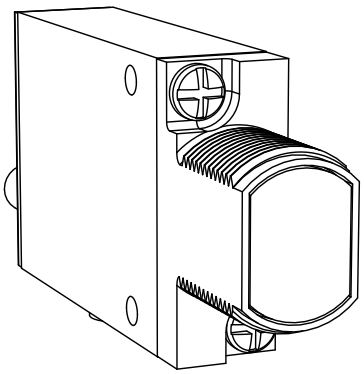
MINI-BEAM SME312 Expert Series

Microprocessor-based TEACH mode photoelectric sensors[1]



- TEACH-mode sensors in the popular MINI-BEAM package
- Easy push-button programming automatically adjusts sensitivity to optimal setting
- Multiple sensing modes include retroreflective, polarized retro, clear object detection, diffuse, divergent, and convergent, plus glass and plastic fiber optic models
- Fast, 500 microsecond (0.5 millisecond) output response
- Bipolar NPN (sinking)/PNP (sourcing) outputs
- Easy output programming eliminates the need for Light or Dark Operate selection
- Separate TEACH input allows remote programming by an external device, such as a switch or a process controller
- LED status indications for received signal strength (using Banner's AID™ function), power ON, and output state
- Green Stability indicator flashes when received signal level approaches the switching threshold, also indicates Power ON
- Integral 2 meter (6.5 foot) cable or 5-pin Euro-style quick-disconnect (QD) connector, depending on model; 9 meter (30 foot) cable models are also available

[1] U.S. patent(s) issued or pending

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.

Retroreflective Models

Sensing Mode	Model *	Range or Focus	Supply Voltage	Output Type
Retroreflective, 650 nm visible red	SME312LV	5 m (15 ft)**	10 to 30V dc	Bipolar NPN/PNP
Polarized retroreflective, 650 nm visible red	SME312LP	10 mm to 3 m** (0.4 in to 10 ft)		
Polarized retroreflective, 650 nm visible red (clear object)	SME312LPC	1 m (3.3 ft) with supplied reflector**		

** Sensing ranges vary according to the efficiency and reflective area of the retroreflector(s) used. (Retroreflective tape is not recommended for use with Clear Object Detection models.) See *Accessories* and the Banner Engineering catalog for more information.

Diffuse Models

Sensing Mode	Model *	Range or Focus	Supply Voltage	Output Type
Diffuse, 880 nm infrared	SME312D	380 mm (15 in)	10 to 30V dc	Bipolar NPN/PNP
Diffuse, 650 nm visible red	SME312DV	1100 mm (43 in)		
Divergent Diffuse, 880 nm infrared	SME312W	130 mm (5 in)		

Convergent Models

Sensing Mode	Model *	Range or Focus	Supply Voltage	Output Type
Convergent, 650 nm visible red	SME312CV	16 mm (0.65 in) Spot Size at Focus: 1.3 mm (0.05 in)	10 to 30V dc	Bipolar NPN/PNP
	SME312CV2	43 mm (1.7 in) Spot Size at Focus: 3.0 mm (0.12 in)		
Convergent, 525 nm visible green	SME312CVG	16 mm (0.65 in) Spot Size at Focus: 1.0 mm (0.04 in)		
Convergent, 475 nm visible blue	SME312CVB	16 mm (0.65 in) Spot Size at Focus: 1.8 mm (0.07 in)		
Convergent, 450-650 nm visible white	SME312CVW			

Glass Fiber Optic Models

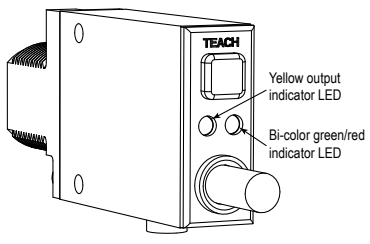
Sensing Mode	Model *	Range or Focus	Supply Voltage	Output Type
Glass Fiber Optic, 880 nm infrared	SME312F	Range varies by sensing mode and fiber optics used	10 to 30V dc	Bipolar NPN/PNP
Glass Fiber Optic, 650 nm visible red	SME312FV			
Glass Fiber Optic, 525 nm visible green	SME312FVG			
Glass Fiber Optic, 475 nm visible blue	SME312FVB			
Glass Fiber Optic, 450-650 nm visible white	SME312FVW			

Plastic Fiber Optic Models

Sensing Mode	Model *	Range or Focus	Supply Voltage	Output Type
Plastic Fiber Optic, 650 nm visible red	SME312FP	Range varies by sensing mode and fiber optics used	10 to 30V dc	Bipolar NPN/PNP
Plastic Fiber Optic, 525 nm visible green	SME312FPG			
Plastic Fiber Optic, 475 nm visible blue	SME312FPB			
Plastic Fiber Optic, 450-650 nm visible white	SME312FPW			

* Standard 2 m (6.5 ft) cable models are listed. To order the 9 m (30 ft) cable model, add suffix “W/30” to the model number (e.g., SME312LV W/30.) To order the 5-pin Euro-style QD models, add suffix “QD” (e.g., SME312LVQD). Models with a QD connector require a mating cable.

Overview



MINI-BEAM® Expert™ is a complete family of sensors, all housed in the popular, robust and compact rectangular housing. Their large push button and easy-to-see indicators provide easy configuration, alignment, and monitoring during use.

Retroreflective and Polarized Retroreflective Mode models are excellent for sensing relatively small items where opposed-mode sensing is not possible. They are recommended for relatively clean environments where high excess gain is not required. Polarized models filter out unwanted reflections.

Polarized Retroreflective Mode – Clear Object Detection models reliably detect the presence of clear objects.

Diffuse Mode models are excellent for sensing objects of adequate size and reflectivity at short range. Divergent models are useful for sensing small items and translucent or transparent materials at close range. The SME312DV sensors effectively sense specular surfaces like semi-conductor wafers, disk drive media, glass and machined surfaces. The collimated optics of the SME312DV also permits the sensor to be mounted against clear container walls, view ports and other types of optical "feed-throughs."

Convergent Mode models are a good choice for counting adjacent radiused objects and for accurate position sensing. Blue, green and white beam models are recommended for color mark sensing.

Glass Fiber Optic models are an excellent option for sensing in tight or otherwise inaccessible areas. Fibers withstand vibration and shock and are immune to electrical noise. Glass fibers withstand high temperatures, extreme moisture and corrosive materials. Glass fibers are not recommended for applications requiring bending or repeated flexing (see plastic fiber models). Visible beam models are recommended for color mark sensing.

Plastic Fiber Optic models are an excellent option for sensing in tight or otherwise inaccessible areas. Fibers withstand vibration and shock and are immune to electrical noise. Plastic fibers function well at temperatures from –30° to +70° C (–20° F to +158° F), and stand up to repeated flexing. Most are easy to shorten in the field, for custom installations. Plastic fibers are not recommended for severe environments (see glass fiber models). Plastic fiber optic sensors are recommended for color mark sensing.

Status Indicators

Normal sensor operation is called RUN mode. Sensor configuration (setting the sensitivity threshold and selecting output ON and OFF conditions) is performed in TEACH mode. The two LED indicators (bi-color green/red and yellow) have distinct roles in the two operation modes. If contrast is marginal, the bi-color indicator will flash green to indicate instability. If this occurs, reconfigure or realign the sensor, or clean the sensor or fiber lenses.

The Signal Strength indicator is Banner's exclusive AID™ (Alignment Indicating Device). Its pulse rate increases as the received light signal strength increases (during programming). This feature simplifies accurate alignment during TEACH mode, and gives a relative indication of sensing contrast between the light and dark conditions.

LED	RUN Mode	TEACH Mode
Solid green	Power is on	
Flashing green	Sensed light level is approaching sensing threshold*	
Solid red		Sensor "sees" its own modulated light source; pulse rate is proportional to the received light signal strength**
Yellow on	Outputs conducting	Ready to TEACH output ON condition
Yellow off	Outputs not conducting	Ready to TEACH output OFF condition

* This is the Stability indicator, which signals when maintenance, realignment, or reconfiguration is needed during RUN mode.

** The faster the pulse rate, the stronger the light signal.

Remote Configuration

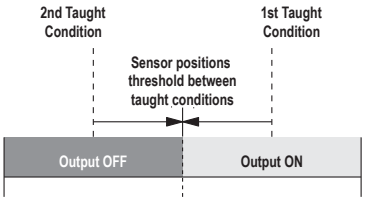
The remote function may be used to configure the sensor remotely or to disable the push button for security. Connect the gray wire of the sensor to ground (0V dc), with a remote programming switch connected between them. Pulse the remote line according to the diagrams in the configuration procedures. The length of the individual programming pulses is equal to the value T where: 0.04 seconds ≤ "T" ≤ 0.8 seconds

Troubleshooting

If the MINI-BEAM Expert's Power LED alternately flashes red/green, this indicates a microprocessor memory error. To clear the error, re-teach the sensor or cycle the power ON and OFF and re-teach the sensor. If this does not solve the problem, or if it occurs frequently, replace the sensor.

Static Teach

The two sensing conditions may be presented in either order. The condition presented first is the condition for which the output will energize (the "Output ON" target).



Sensitivity is automatically set (and optimized) when teaching the sensor the ON and OFF conditions. When the push button is clicked, the sensor samples each sensing condition and registers it into memory. After the second sensing condition is registered, the MINI-BEAM Expert automatically sets the sensitivity to the optimum value for the application, and then returns to RUN mode.

Push button (0.04 seconds ≤ "Click" ≤ 0.8 seconds); Remote line (0.04 seconds ≤ "T" ≤ 0.8 seconds)

1. Access TEACH mode.

Method	Action
Via push button	Press and hold push button until the bi-color (green/red) indicator begins to flash red, or turns OFF.
Via remote line	No action required; sensor is ready for 1st sensing condition.

   Push button method only: The yellow LED is on. The red LED pulses to indicate relative received signal strength. The sensor is ready for the output ON condition.

2. Teach the first sensing condition.

Method	Action
Via push button	Present the first sensing condition and click the push button.
Via remote line	Present the first sensing condition and single-pulse the remote line.

   The yellow LED is off. The red LED pulses to indicate relative signal strength. The sensor registers the output ON condition and is ready for the output OFF condition.

3. Teach the second sensing condition and return to RUN mode.

Method	Action
Via push button	Present the second sensing condition and click the push button.
Via remote line	Present the second sensing condition and single-pulse the remote line.

   If the teach is accepted the green LED is on (or flashes if the signal is close to the switching threshold) and the yellow LED is off until the sensing condition changes; the sensor registers the output OFF condition, positions the threshold, and returns to RUN mode.

   If the teach is not accepted, the yellow LED is on and the red LED pulses to indicate the relative received signal strength. The sensor returns to its wait state and is ready for the first sensing condition.

NOTE: The sensor returns to RUN mode if the first TEACH condition is not registered within 90 seconds. TEACH mode may be cancelled before either the first or second condition by holding the push button depressed for more than two seconds.

Enabling or Disabling the Push Button

In addition to its programming function, the remote line may be used to disable the push buttons for security. Disabling the push buttons prevents undesired tampering with the sensor configuration settings.

1. Connect the sensor's gray wire.
2. Four-pulse the remote line to enable or disable the push button.
   The sensor toggles between enable and disable settings and returns to RUN mode.

Specifications

General	Outputs
Supply Voltage and Current 10 to 30V dc (10% maximum ripple) at less than 45 mA, exclusive of load	**Output Configuration** Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor

General

Supply Protection Circuitry
Protected against reverse polarity and transient voltages

Adjustments
Push-button TEACH mode sensitivity setting; remote TEACH mode input is provided

Indicators
Two LEDs: yellow and bi-color green/red

Construction
Reinforced thermoplastic polyester housing, totally encapsulated, o-ring seal, acrylic lenses, and stainless steel screws.

Connections
PVC-jacketed 5-conductor 2 m (6.5 ft) or 9 m (30 ft) unterminated cable, or 5-pin Euro-style quick-disconnect (QD) fitting are available. QD cables are ordered separately.

Application Notes
The first condition presented during TEACH mode becomes the output ON condition.

Outputs

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 5 µA at 30V dc
ON-state saturation current: less than 1V at 10 mA; less than 1.5V 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 a “dark” signal of 500 microseconds or longer duration, 1 kHz max.
NOTE: 1 second delay on power-up; outputs do not conduct during this time.

Repeatability
100 microseconds (all models)

Environmental

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

Operating Conditions
Temperature: –20° to +70° C (–4° to +158° F)
Max. Relative Humidity: 90% at 50° C (non-condensing)

Certifications

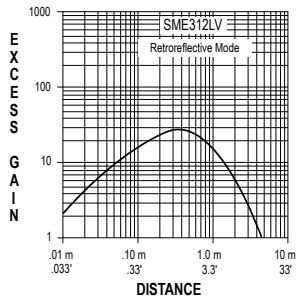
CE

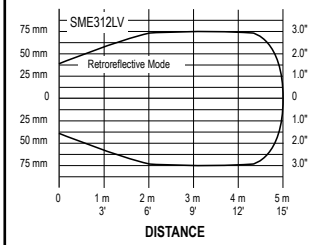
c UL us

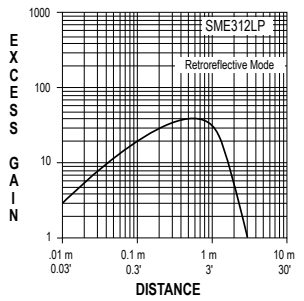
Performance Curves

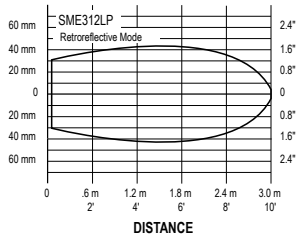
Retroreflective

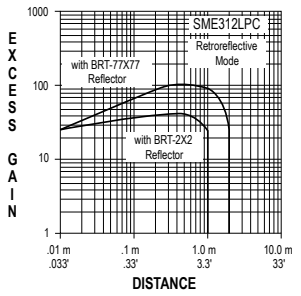
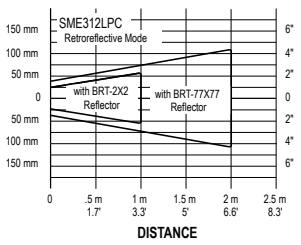
Excess Gain	Beam Pattern	Excess Gain	Beam Pattern









Excess Gain	Beam Pattern	Excess Gain	Beam Pattern
			

Diffuse

Diffuse-mode performance based on 90% reflectance white test card.

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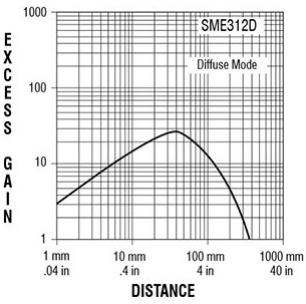
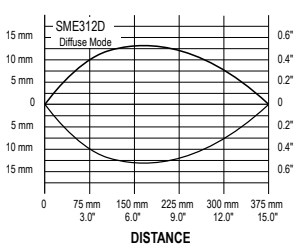
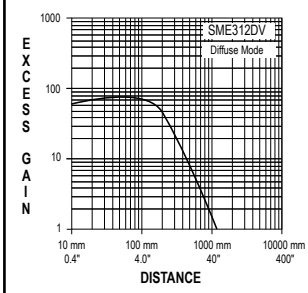
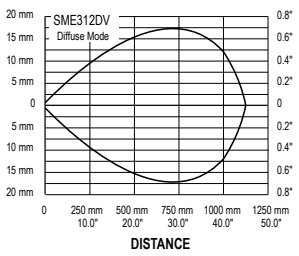
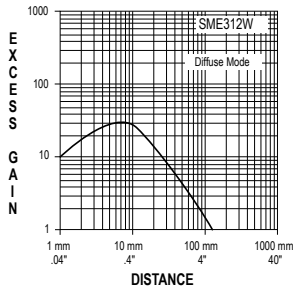
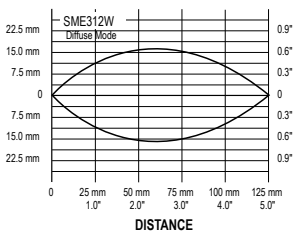
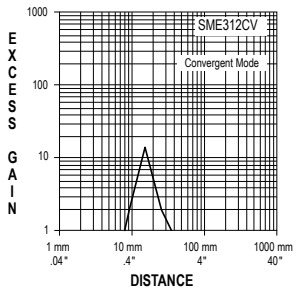
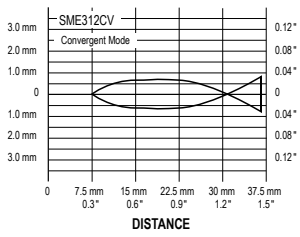
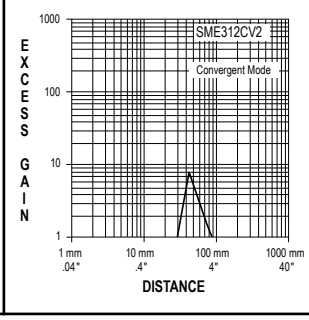
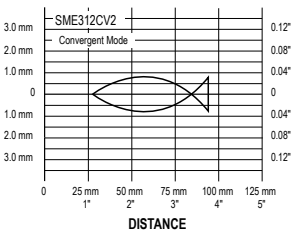
			
			

Convergent

Excess Gain	Beam Pattern	Excess Gain	Beam Pattern
			

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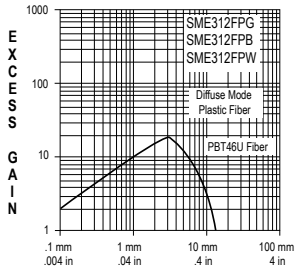
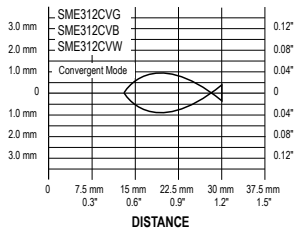
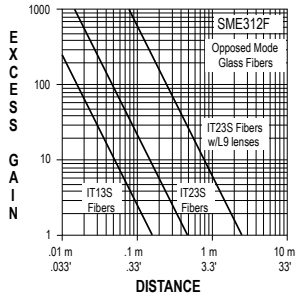
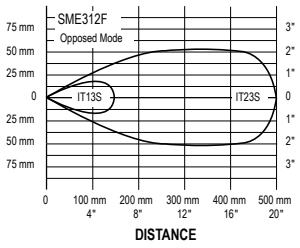
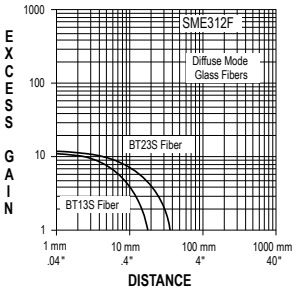
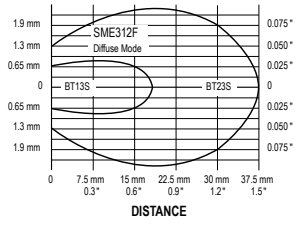
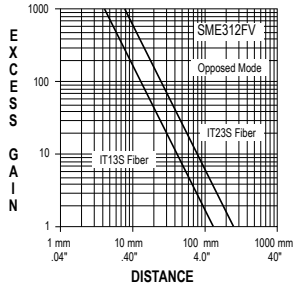
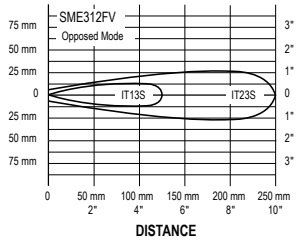
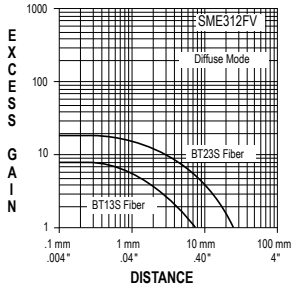
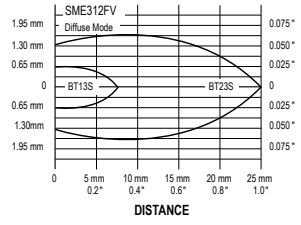
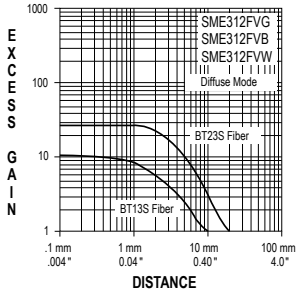
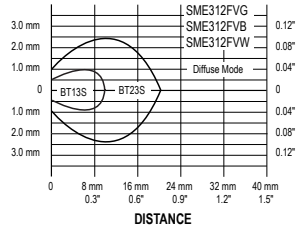
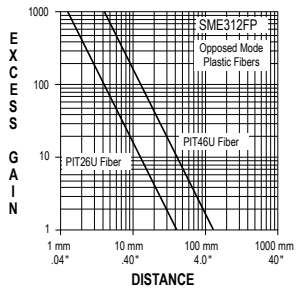
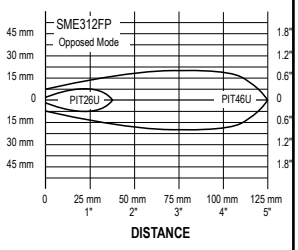
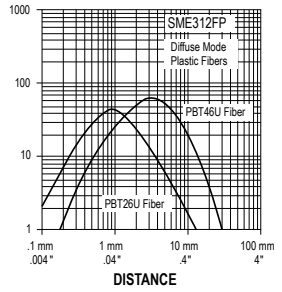
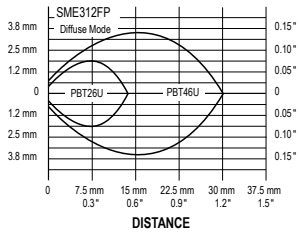
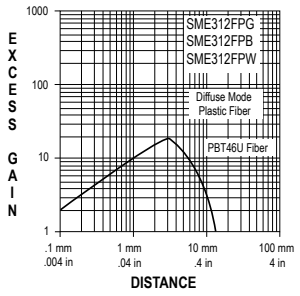
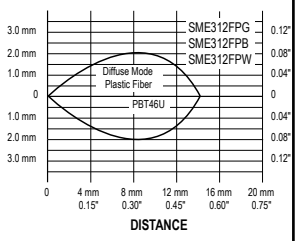
			

Glass Fiber Optic

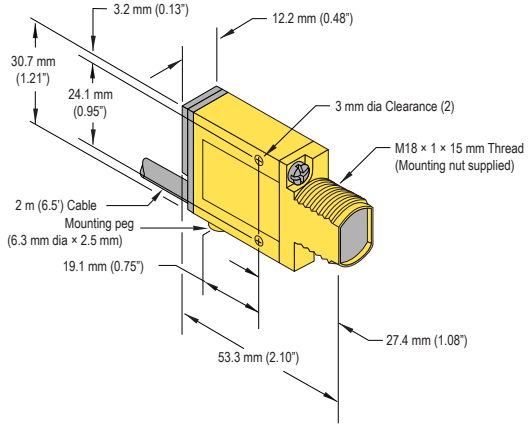
Excess Gain	Beam Pattern	Excess Gain	Beam Pattern
			
			
			

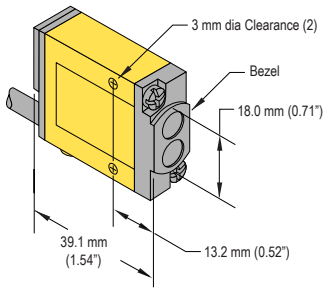
Plastic Fiber Optic

Excess Gain	Beam Pattern	Excess Gain	Beam Pattern
			
			

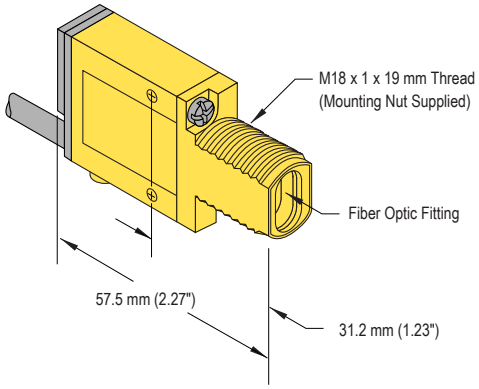
Dimensions

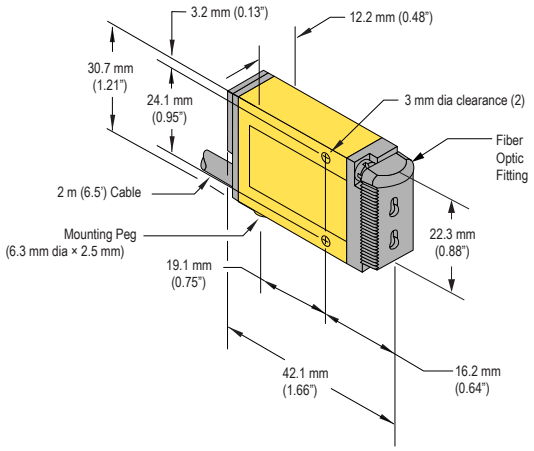
Cabled Models (Suffix E, EL, EPD, R, RL, RPD, LV, LVAG, LP, LPC, D, C, C2, CV, CV2, CVG, CV2G, CVB, CV2B, CVW)	Divergent Diffuse Models (Suffix DBZ and W)



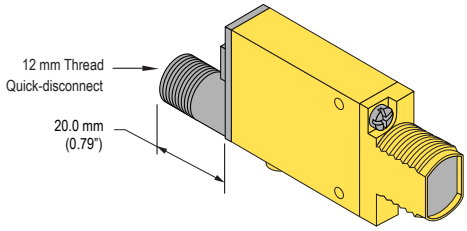


Glass Fiber Models (Suffix F, FV, FVB, FVG, FVW)	Plastic Fiber Models (Suffix FP, FPB, FPG, FPH, FPW)



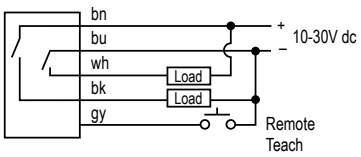


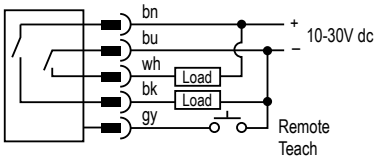
QD Models



Wiring

Cabled Models	QD Models





Accessories

Retroreflective Targets

Banner offers a wide selection of high-quality retroreflective targets. See your current Banner Engineering Corp catalog for complete information on available models. Sensing range will vary, according to the retroreflector's efficiency and reflective area.

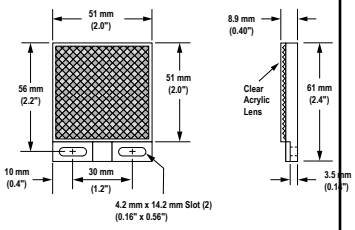
- For high-vibration applications: model BRT-36X40BM (micro-prism geometry) is recommended.
- For long-range applications: model BRT-77X77C reflector provides a range up to 2 m (6.5').
- For clear object detection (low-contrast applications): reflector model BRT-2X2 is recommended; one comes bundled with each SME312LPC(QD) sensor.
- Polarized sensors require corner-cube type retroreflective targets only; reflective tape is not recommended.

Before installing retroreflective tape, clean the mounting surface with an isopropyl alcohol wipe.

Optional brackets for mounting reflective targets are available. See the Accessories section of your current Banner catalog or our website at *www.bannerengineering.com*.

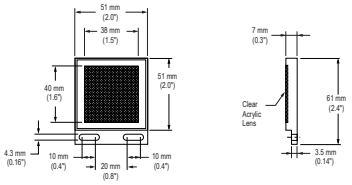
BRT-2X2

- Square, acrylic target
- Reflectivity factor: 1.0
- Max. temperature: +50° C (+122º F)
- Optional brackets are available
- Approximate size: 51 mm x 51 mm



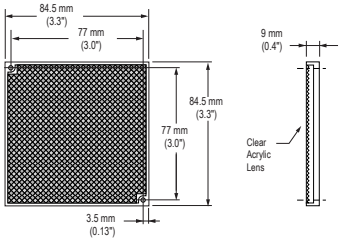
BRT-36X40BM

- Rectangular, acrylic target
- Reflectivity Factor: 1.2
- Max. Temperature: +50° C (120° F)
- Approximate size: 51 mm x 51 mm
- Micro-prism geometry



BRT-77X77C

- Square, acrylic target
- Reflectivity Factor: 2.0
- Temperature: –20° to +60° C (−4° to +140° F)
- Optional brackets are available
- Approximate size: 84.5 mm x 84.5 mm

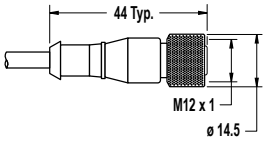
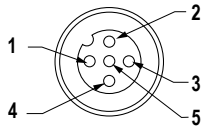
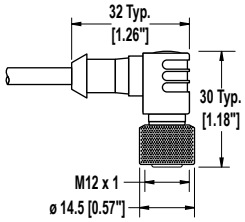


BRT-TVHG

- Reflectivity factor: 0.8
- Max. Temperature: +60ºC (+140ºF)

Retroreflective tape is available in a variety of sizes and shapes; see your Banner Catalog for more information.
Not recommended for use with clear object detection sensors.

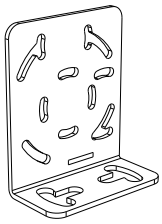
5-Pin Euro-Style Cordsets

5-Pin Threaded M12/Euro-Style Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout**
MQDC1-501.5	0.50 m (1.5 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDC1-506	1.83 m (6 ft)			
MQDC1-515	4.57 m (15 ft)			
MQDC1-530	9.14 m (30 ft)			
MQDC1-506RA	1.83 m (6 ft)	Right-Angle		
MQDC1-515RA	4.57 m (15 ft)			
MQDC1-530RA	9.14 m (30 ft)			

Mounting Brackets

SMB46L

- Right-angle
- L bracket
- 14-ga. 316 stainless steel

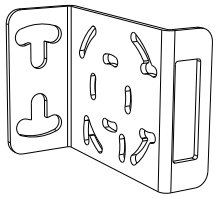


Hole center spacing: A = 16.0

Hole size: A = 16.5 x 18.7

SMB46S

- Right-angle
- S bracket
- 14-ga. 316 stainless steel

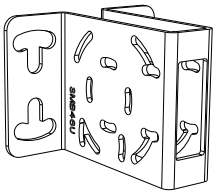


Hole center spacing: A = 16.0

Hole size: A = 16.5 x 18.7, B = 34.0 x 10.0

SMB46U

- Right-angle
- U bracket for sensor protection
- 14-ga. 316 stainless steel

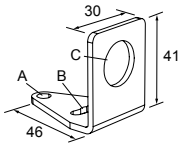


Hole center spacing: A = 16.0

Hole size: A = 16.5 x 18.7, B = 34.0 x 13.0

SMB18A

- Right-angle mounting bracket with a curved slot for versatile orientation
- 12-ga. stainless steel
- 18 mm sensor mounting hole
- Clearance for M4 (#8) hardware

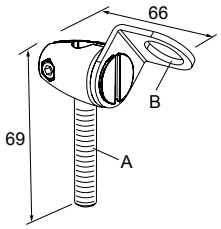


Hole center spacing: A to B = 24.2

Hole size: A = ø 4.6, B = 17.0 x 4.6, C = ø 18.5

SMB18AFA..

- Protective, swivel bracket with tilt and pan movement for precision adjustment
- Easy sensor mounting to extruded rail T-slots
- Metric and inch size bolts available
- Mounting hole for 18 mm sensors



Hole size: B = ø 18.1

Model	Bolt Thread (A)
SMB18AFA	3/8 - 16 x 2"
SMB18AFAM10	M10 - 1.5 x 50

SMB18Q

- Right-angle flanged bracket
- 18 mm sensor mounting hole
- 12-ga. stainless steel

Hole center spacing: A to B = 24.2

Hole size: A = ø 4.6, B = 17.0 x 4.6, C = ø 19.0

SMB18SF

- 18 mm swivel bracket with M18 x 1 internal thread
- Black thermoplastic polyester
- Stainless steel swivel locking hardware included

SMB18UR

- 2-piece universal swivel bracket
- 300 series stainless steel
- Stainless steel swivel locking hardware included

Hole center spacing: A = 36.0
Hole size: A = ø 5.3, B = ø 18.0

- Mounting hole for 18 mm sensor

Hole center spacing: A = 25.4, B = 46.7
Hole size: B = 6.9 x 32.0, C = ø 18.3

SMB312PD

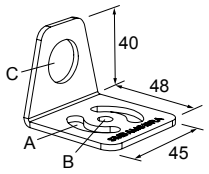
- Right-angle mounting bracket with a curved slot for versatile orientation
- 12-ga. stainless steel
- 18 mm sensor mounting hole
- Clearance for M4 (#8) hardware

NOTE: Not for use with plastic fiber optic sensors

Hole center spacing: A to B = 24.2
Hole size: A = ø 4.6, B = 17 x 4.6, C = ø 18.5

SMBAMS18RA

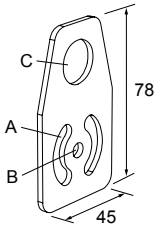
- Right-angle SMBAMS series bracket with 18 mm hole for mounting sensors
- Articulation slots for 90+° rotation
- 12-ga. (2.6 mm) cold-rolled steel



Hole center spacing: A = 26.0, A to B = 13.0
Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 19.0

SMBAMS18P

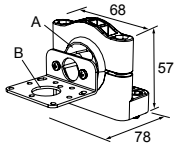
- Flat SMBAMS series bracket with 18 mm hole for mounting sensors
- Articulation slots for 90+° rotation
- 12-ga. (2.6 mm) cold-rolled steel



Hole center spacing: A = 26.0, A to B = 13.0
Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 19.0

SMB30SK

- Flat-mount swivel bracket with extended range of motion
- Black reinforced thermoplastic polyester and 316 stainless steel
- Stainless steel swivel locking hardware included



Hole center spacing: A = 50.8
Hole size: A = ø 7, B = ø 18

SMB3018SC

- 18 mm swivel side or barrel-mount bracket
- Black reinforced thermoplastic polyester
- Stainless steel swivel locking hardware included

Hole center spacing: A = 50.8
Hole size: A = ø 7.0, B = ø 18.0

SMB3018SUS

- Side-mount swivel with extended range of motion
- Black reinforced thermoplastic polyester
- Stainless steel swivel locking hardware included

Hole center spacing: A =
Hole size: A = ø , B = ø

SMB312S

- Stainless steel 2-axis, side-mount bracket

SMB312B

- Stainless steel 2-axis, bottom-mount bracket
- Includes mounting foot

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