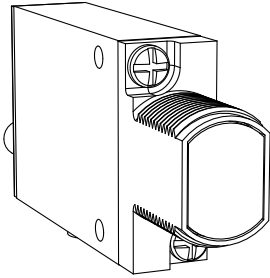


MINI-BEAM SM31E/R Opposed Mode Sensors



Datasheet



- Compact, self-contained opposed mode modulated infrared sensor pairs for 10 to 30 V dc operation
- Standard sensor pairs have 3 m (10 ft) range; long range sensor pairs have 30 m (100 ft) range
- Switch-selectable for light operate or dark operate; highly repeatable, 1 millisecond response
- Both sourcing and sinking outputs (150 mA maximum each)
- Receivers include Banner's exclusive AID™ alignment system, US patent number 4356393
- Rugged, epoxy-encapsulated construction: meets NEMA standards 1, 2, 3, 3S, 4, 4X, 6, 12, and 13, IEC IP67
- Physically and electrically interchangeable with 18 mm barrel-type photoelectrics



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 ¹ ²	Range	Cable	Excess Gain	Beam Pattern
SM31E (Emitter) SM31R (Receiver) SM31EQD (Emitter) SM31ROD (Receiver)	3 m (10 ft)	2 m (6.5 ft) 4-Pin Euro QD		
SM31EL (Emitter) SM31RL (Receiver) SM31ELQD (Emitter) SM31RLQD (Receiver)	30 m (100 ft)	2 m (6.5 ft) 4-Pin Euro QD		

¹ To order the 9 m (30 ft) cable models, add the suffix "W/30" to the model number of any cabled sensor (e.g., SM31EL W/30). To order the 150 mm (6 inch) long pigtail cable with attached QD connector models, add the suffix "QDP" to the model number of any MINI-BEAM sensor (e.g., SM31ELQDP). Models with a QD connector require an accessory mating cable.

² To order emitters and receivers with 0.3 millisecond on/off response, add the suffix "MHS" to the model numbers (e.g., SM31EMHS & SM31RMHS). This modification reduces sensing range (and excess gain).



Installation and Alignment

Proper operation of the sensors requires they be mounted securely and aligned properly. Excessive movement or vibration can cause intermittent or false operation due to loss of alignment. For maximum mechanical stability, final-mount these sensors in 18-mm holes by their threaded barrels or use a mounting bracket .

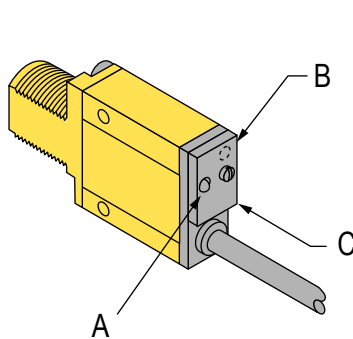


Figure 1. Receiver Adjustments

A - "AID" Indicator LED lights when the sensor sees the reflection of its own modulated light and pulses at a rate proportional to the strength of the received light signal

B - 15 turn gain adjustment and light/dark operate switch

C - Gasketed acrylic cover

Regarding the light/dark operate switch:

- Turn switch fully clockwise for light operate (sensor outputs conduct when sensing light is received)
- Turn switch fully counterclockwise for dark operate (sensor outputs conduct when sensing light is not received)

1) Begin with the emitter mounted securely in place. For small-parts counting applications, stretch a string between the emitter and receiver lenses to ensure the sensing beam passes through the center of the sensing location. For less critical applications, the receiver may be initially positioned by line-of-sight placement. Mount the receiver, leaving a means for movement.

2) Apply power to the emitter and receiver, and advance the receiver's 15-turn GAIN control to maximum (clockwise end of rotation). The GAIN control is clutched at both ends to avoid damage and will "free-wheel" when either endpoint is reached.

If the receiver is "seeing" the emitter's light beam, the receiver alignment LED is on. Move the receiver up-down-right-left (include angular rotation) to obtain the fastest receiver LED pulse rate. If a pulse is not observable (too fast to count), reduce the GAIN control (counterclockwise rotation) to obtain a countable pulse rate of one to five beats per second. Note: to aid alignment at short ranges, it may help to further reduce the strength of the light signal by temporarily masking the emitter and/or receiver lens with tape or a sheet of paper.

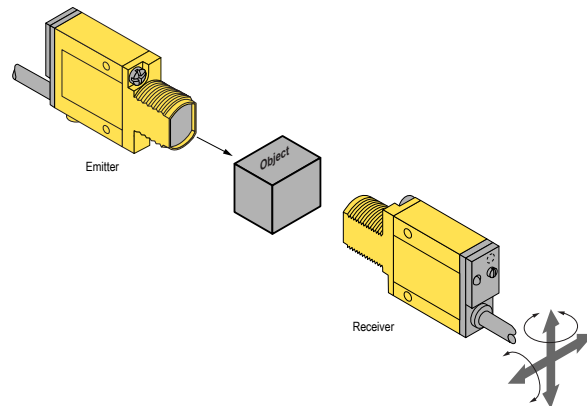


Figure 2. Opposed Mode Alignment. Move the receiver to obtain the fastest LED pulse rate.

3) Repeat the alignment motions after each GAIN reduction. When you have found the receiver orientation that produces the fastest pulse rate, mount the receiver solidly in that position. Remove any masking material, and increase the receiver GAIN to maximum. Test the system by placing the object to be detected into the sensing position. The receiver LED indicator should go off. If it does not go off, the cause is probably either "flooding" or "burn-through".

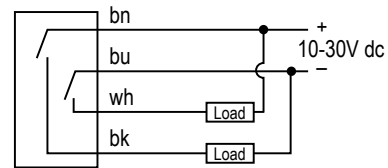
Flooding occurs when a portion of the effective beam passes around the object to be sensed and activates the receiver. Check that the object completely breaks the beam and that the beam is centered on the object. Add apertures, if necessary, to tailor the effective beam to the size or profile of the object being sensed. Burn-through refers to a portion of the emitter's light energy passing through a thin or translucent object and activating the receiver. Try sensing at a reduced GAIN setting or consider an alternative sensing scheme.

Wiring Diagrams

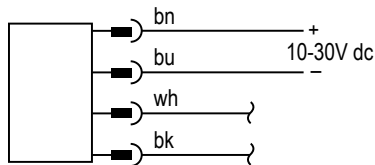
Emitters with Attached Cable



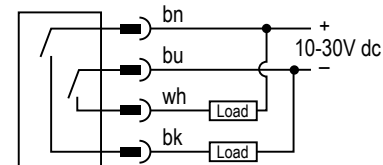
All Other Models with Attached Cable



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.

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: < 1 microamp

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

Output saturation voltage (NPN output): < 200 millivolts at 10 mA and < 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 a "dark" signal of 1 millisecond or longer duration, 500 Hz max. 0.3 millisecond response modification is available. See note below.
(100 millisecond delay on power-up; outputs do not conduct during this time.)

To order dc MINI-BEAMS with 0.3 millisecond on/off response, add the suffix "MHS" to the model numbers (e.g. SM31EMHS & SM31RMHS). This modification reduces sensing range (and excess gain).

Adjustments

LIGHT/DARK OPERATE select switch, and 15-turn slotted brass screw GAIN (sensitivity) adjustment potentiometer (clutched at both ends of travel). Both controls are located on rear panel of sensor and protected by a gasketed, clear acrylic cover.

Indicators

Exclusive, patented Alignment Indicating Device system (AID™, US patent #4356393) lights a rear-panel mounted red LED indicator whenever the sensor sees a "light" condition, with a superimposed pulse rate 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, and 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 quick disconnect (QD) fitting are available. QD cables are ordered separately.

Operating Temperature

Temperature: -20 °C to +70 °C (-4 °F to +158 °F)
Maximum relative humidity: 90% at 50 °C (non-condensing)

Application Notes

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.

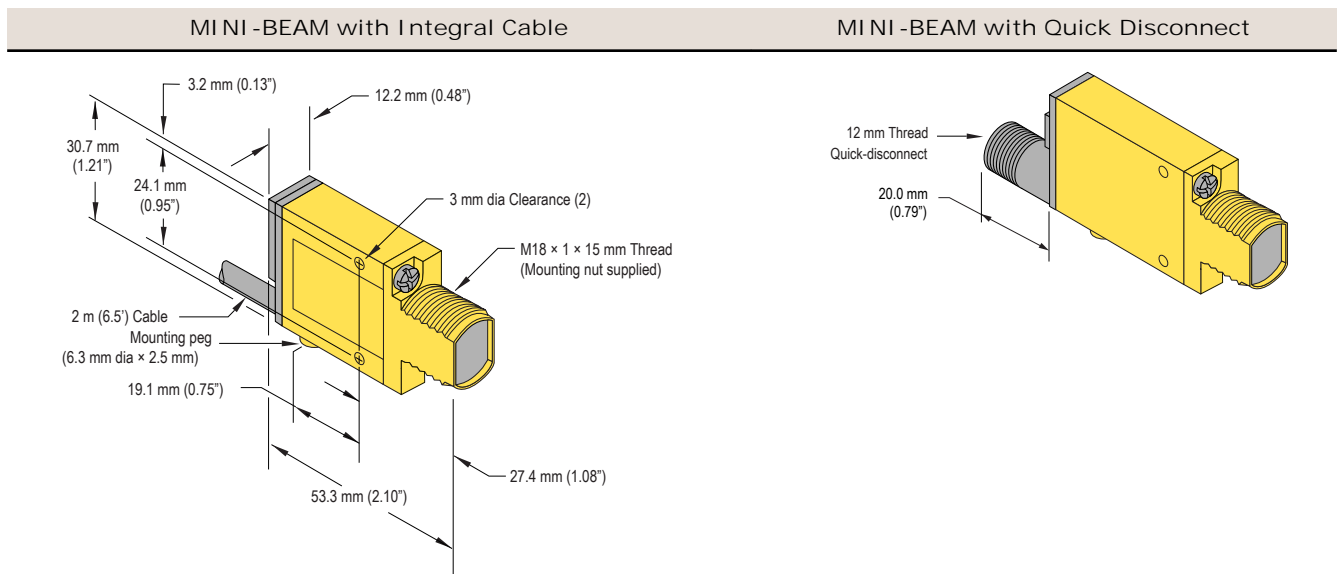
Certifications



MINI-BEAM Model Modifications

Model Suffix	Modification	Description	Example of Model Number
W/30	9 meter (30 ft) cable	All MINI-BEAM sensors may be ordered with an integral 9 m (30 ft) cable in place of the standard 2 m (6.5 ft) cable	SM31E W/30
MHS	Modified for High Speed	Standard dc MINI-BEAM sensors with 1 millisecond output response may be modified for 0.3 millisecond (300 μ s) response. NOTE: Faster response comes at the expense of lower excess gain. Also, the operating temperature range becomes $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ ($-4\text{ }^{\circ}\text{F}$ to $+122\text{ }^{\circ}\text{F}$)	SM31EMHS NOTE: Emitter and receiver must both have MHS modification
QDP	Pigtail Quick Disconnect	All MINI-BEAMS may be built with a 150 mm (6 inch) long integral cable terminated with the appropriate QD connector.	SM31EQDP

Dimensions



Accessories

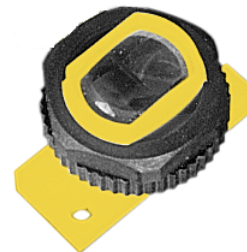
Replacement Lens Assemblies

UC-300E

- Replacement lens for the E/R models

UC-300EL

- Replacement lens for the EL/RL models
- Or extends the range of the E/R models



Right-Angle Reflectors

RAR-300SM

- Side mount reflector
- Profile dimension of 14 mm (0.56 inches) in the direction of the scan

RAR-300FM

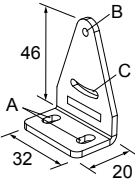
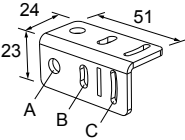
- Front mount reflector that attaches directly to the threaded barrel of most MINI-BEAMS
- Profile dimension of 34 mm (1.35 inches) in the direction of the scan

Apertures

Opposed mode MINI-BEAM sensors may be fitted with apertures which narrow or shape the effective beam of the sensor to more closely match the size or profile of the object to be sensed. A common example is the use of "line" or "slit" type aperture when wire or thread is to be sensed. Each model contains 20 apertures.

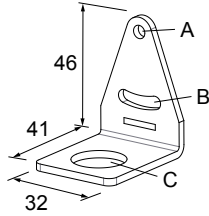
Model	Description	
	Circular	
AP31-020	0.5 mm dia.	
AP31-040	1.0 mm dia.	
AP31-100	2.5 mm dia.	
	Horizontal Slot	
AP31-020H	0.5 x 6.4 mm	
AP31-040H	1.0 x 6.4 mm	
AP31-100H	2.5 x 6.4 mm	
AP31-200H	5.1 x 6.4 mm	
	Vertical Slot	
AP31-020V	0.5 x 12.7 mm	
AP31-040V	1.0 x 12.7 mm	
AP31-100V	2.5 x 12.7 mm	
AP31-200V	5.1 x 12.7 mm	
	Kit	
AP31-DVHX2	2 of each aperture	

Brackets

<p>SMB312S</p> <ul style="list-style-type: none"> • Stainless steel 2-axis, side-mount bracket  <p>A = 4.3 x 7.5, B = diam. 3, C = 3 x 15.3</p>	<p>SMB312B</p> <ul style="list-style-type: none"> • Stainless steel 2-axis, bottom-mount bracket • Includes mounting foot  <p>A = diam. 6.9, B = 4.3 x 10.5, C = 3.1 x 15.2</p>
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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



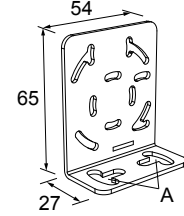
Hole center spacing: A to B = 24.2
 Hole size: A = \varnothing 4.6, B = 17 x 4.6, C = \varnothing 18.5



NOTE: Not for use with plastic fiber optic sensors

SMB46L

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

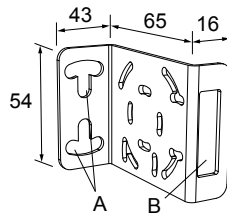


Hole center spacing: A = 16.0

Hole size: A = 16.5 x 18.7

SMB46S

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

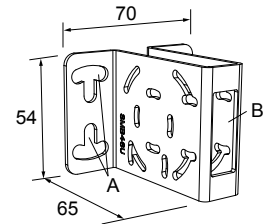


Hole center spacing: A = 16.0

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

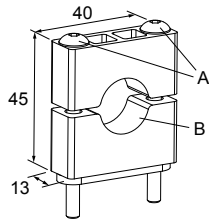


Hole center spacing: A = 16.0

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

SMB18C

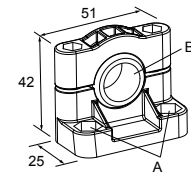
- 18 mm split clamp, black thermoplastic polyester
- Stainless steel mounting hardware included



A = \varnothing 3 mm (2)
 Hole size: B = \varnothing 18 mm

SMB18SF

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



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

Euro-Style Quick-Disconnect Cables

4-Pin Threaded M12/Euro-Style Cordsets				
Model	Length	Style	Dimensions	Pinout
MQDC-406	1.83 m (6 ft)	Straight		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
MQDC-415	4.57 m (15 ft)			
MQDC-430	9.14 m (30 ft)			
MQDC-450	15.2 m (50 ft)			
MQDC-406RA	1.83 m (6 ft)	Right-Angle		
MQDC-415RA	4.57 m (15 ft)			
MQDC-430RA	9.14 m (30 ft)			
MQDC-450RA	15.2 m (50 ft)			

Extension Cables

The following cables are available for extending the length of existing sensor cable. These are 30 m (100 ft) lengths of MINI-BEAM cable, which may be spliced to the existing cable. Connectors, if used, must be customer-supplied.

Model	Type	Used With
EC312-100	4-conductor	MINI-BEAM dc receivers
EC312A-100	2-conductor	MINI-BEAM emitters

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