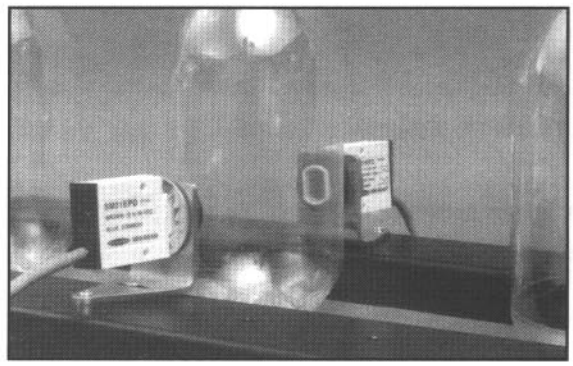
MINI-BEAM® *Clear Plastic Detection System*

BANNER
the photoelectric specialist

Models SM31EPD & SM31RPD: *10 to 30V dc*
Models SMA31EPD & SM2A31RPD: *24 to 240V ac*

- **Senses the presence of clear plastic materials while ignoring all other materials**
- **A highly reliable, cost-saving alternative to ultrasonic sensors**
- **Applications include glass/plastic sorting and clear plastic web break detection**



The Banner MINI-BEAM® Clear Plastic Detection System consists of a special emitter and receiver with a unique optical arrangement that *actively* detects the presence of a clear plastic material in the beam. When a clear plastic material is introduced, there is a dramatic *increase* in the intensity of the light which reaches the receiver. As a result, clear plastic is reliably detected and differentiated from *all* other materials.

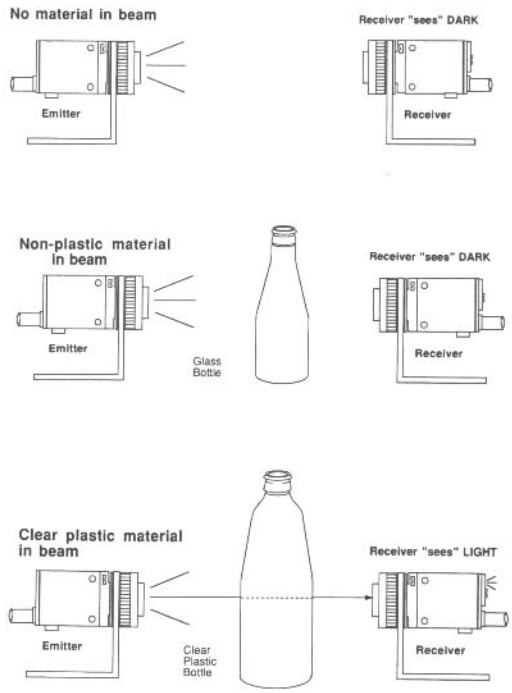
The system uses a powerful modulated visible LED light source, which makes this sensing pair extremely forgiving of dirt buildup and misalignment. The high contrast ratio that results from this sensing method (10 to 1 contrast or more) eliminates the need for critical sensitivity adjustments.

These sensors will detect most transparent plastics, whether clear or colored. However, there are a few materials (some acrylics, for example) that will not be detected due to their molecular structure. This fact makes it possible to sort between some different types of clear plastic materials. Material samples should be evaluated either by sending them to the factory or through on-site testing by your local Banner sales engineer.

Common applications include those involving manufacture or reclamation of plastic bottles and processing of clear plastic webs. This system may also be used to inspect clear plastic containers for label, cap, or product presence. Since a light signal is established through a container only when there is a missing item, there is usually no need for an interrogation scheme.

Setup and alignment is easy, using a temporary retroreflective target supplied with each receiver. Due to response time differences, the dc receiver (model SM31RPD) is compatible only with the dc emitter (SM31EPD). The ac receiver (model SM2A31RPD) will work with either emitter. Models with integral quick-disconnect (QD) connector are available (add the suffix "QD" to the sensor model number). Mating 15-foot QD cables must be ordered separately (p. 4). Refer to the Banner product catalog for further information.

Each sensor is supplied with a stainless steel right-angle mounting bracket and hardware (see Dimension Drawing). These sensors have the same rugged, epoxy-encapsulated design inherent in the entire MINI-BEAM sensor line.



Specifications, DC models SM31EPD & SM31RPD

SUPPLY VOLTAGE: 10 to 30V dc (10% maximum ripple) at less than 25mA (exclusive of load).

RECEIVER OUTPUT CONFIGURATION: one current sourcing (PNP) and one current sinking (NPN) open-collector transistor.

RECEIVER OUTPUT RATING: 150mA maximum each output at 25 degrees C, derated to 100mA at 70 degrees C (derate approximately 1mA per degree C). *Output leakage* less than 1 microamp (off-state). *Output saturation voltage (PNP output)* less than 1 volt at 10mA and less than 2 volts at 150mA load. *Output saturation voltage (NPN output)* less than 200 millivolts at 10mA and less than 1 volt at 150mA load.

(DC specifications continued on next page)

Specifications, AC models SMA31EPD & SM2A31RPD

SUPPLY VOLTAGE: 24 to 240V ac (50/60Hz), 250V ac maximum.

RECEIVER OUTPUT CONFIGURATION: SPST SCR solid-state relay with either normally closed or normally open contact (selectable light/dark operate)

RECEIVER OUTPUT RATING: *minimum load current* 5mA; *maximum steady-state load capacity* is 300mA maximum at up to 50 degrees C (122 degrees F) ambient, derated to 100mA maximum at 70 degrees C (158 degrees F). *Inrush capacity* is 3 amps for 1 second or 10 amps for 1 cycle (non-repeating). *Off-state leakage current* is less than 1.7mA rms. *On-state voltage drop* is ≤5 volts at 300mA, ≤10 volts at 15mA load.

(AC specifications continued on next page)

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Specifications, DC models SM31EPD and SM31RPD (continued):

RECEIVER OUTPUT PROTECTION: protected against false-pulse on power-up, inductive load transients, power supply polarity reversal, and continuous overload or short circuit of outputs.

RECEIVER RESPONSE TIME: sensors will respond to either a "light" or a "dark" signal of 1 millisecond or longer duration independent of signal strength), 500Hz maximum. NOTE: 100 millisecond delay on power-up; outputs are non-conducting during this time.

REPEATABILITY of RESPONSE: .14 millisecond, independent of signal strength.

RANGE: zero to 1 foot (0,3m) minimum. Actual range is dependent upon the light-transmission properties of the clear plastic material being sensed.

CABLE: SM31EPD has PVC-jacketed 2-conductor cable; SM31RPD has PVC-jacketed 4-conductor cable. Standard length is 6 feet (2m). Models SM31EPQD and SM31RPQD have an integral quick-disconnect (QD) connector. Mating cable (required) must be ordered separately (see note, page 4)

ADJUSTMENTS: SM31RPD has 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 the rear panel of the sensor and are protected by a gasketed, clear acrylic cover.

INDICATOR LED: exclusive, patented Alignment Indicating Device (AID™, US patent #4356393) lights a red LED indicator located on the rear of the receiver whenever a "light" condition is sensed, with a superimposed pulse rate proportional to the light signal strength (the stronger the signal, the faster the pulse rate). A red LED indicator on the rear of the emitter indicates "power on" condition.

OPERATING TEMPERATURE: -20 to +70°C (-4 to +158°F).

APPLICATION NOTES: the NPN (current sinking) output of model SM31RPD is directly compatible as an input to Banner logic modules, including all non-amplified MICRO-AMP® modules and CL Series MAXI-AMP™ modules.

Specifications, AC models SMA31EPD & SM2A31RPD (cont.)

RECEIVER OUTPUT PROTECTION: protected against false-pulse on power-up and inductive load transients.

RECEIVER RESPONSE TIME: 2 milliseconds "ON" and 1 millisecond "OFF", independent of signal strength. Does not include load response time of up to 1/2 ac cycle (8.3 milliseconds). NOTE: 300 millisecond delay on power-up; outputs are non-conducting during this time.

REPEATABILITY of RESPONSE: .3 millisecond, independent of signal strength.

RANGE: zero to 1 foot (0,3m) minimum. Actual range is dependent upon the light-transmission properties of the clear plastic material being sensed.

CABLE: PVC-jacketed 2-conductor cable. Standard length is 6 feet (2m). Models SMA31EPQD and SM2A31RPQD have an integral quick-disconnect (QD) connector. Mating cable (required) must be ordered separately (see note, page 4)

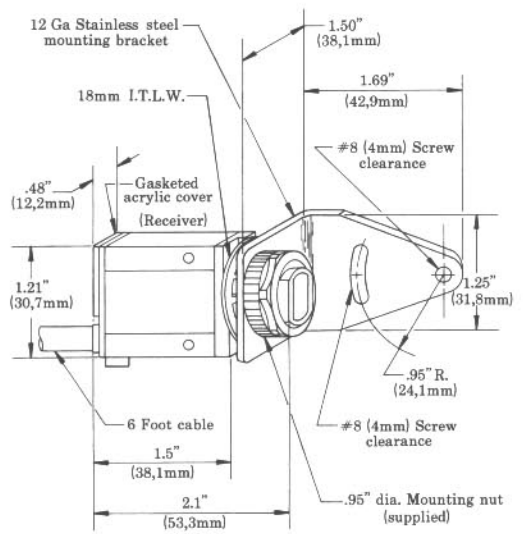
ADJUSTMENTS: SM2A31RPD has LIGHT/DARK operate select switch and 15-turn slotted brass screw GAIN (sensitivity) adjustment potentiometer (clutched at both ends of travel). Both controls are located on the rear panel of the sensor and are protected by a gasketed, clear acrylic cover.

INDICATOR LED: red indicator LED on rear of receiver is "ON" when the output is energized. A red LED indicator on the rear of the emitter indicates "power on" condition.

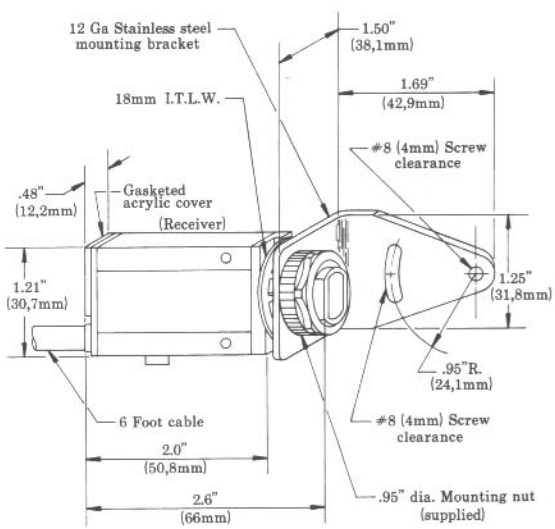
OPERATING TEMPERATURE: -20 to +70°C (-4 to +158°F).

APPLICATION NOTES: (1) Model SM2A31RPD may be destroyed from overload conditions. (2) Use of the ac receiver on low voltage requires careful analysis of the load to determine if leakage current or on-state voltage of the sensor will interfere with proper operation of the load. (3) The false-pulse protection feature may cause momentary dropout of the load when the sensor is wired in series or parallel with mechanical switch contacts (see Hookup Information).

Dimension drawing, DC models SM31EPD & SM31RPD



Dimension drawing, AC models SMA31EPD and SM2A31RPD



NOTE: Bracket may be reversed and/or rotated from the position shown.

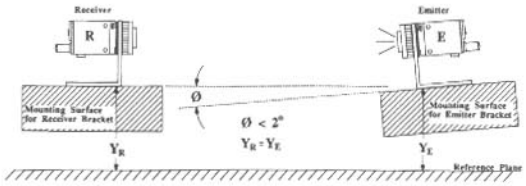
MINI-BEAM Clear Plastic Detection System

Installation and Alignment Procedure

The following setup procedure will assure reliable detection of a clear plastic material:

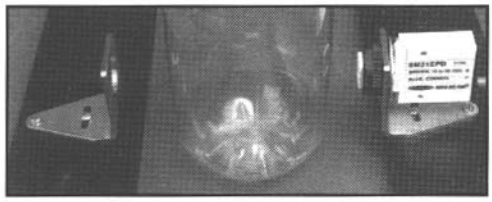
1) Mount the brackets directly opposite each other, using #8 (4mm) bolts. The brackets permit adjustment in only one plane. They should be mounted to surfaces that are parallel to each other to within about 2 degrees, and that are coplanar.

Figure 1. Coplanarity of mounting brackets



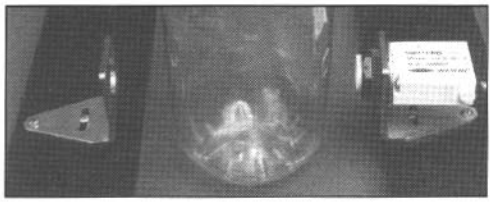
2) Install the emitter in either bracket using an 18mm mounting nut and lockwasher. Place the lockwasher between the bracket and the body of the emitter. The body of the emitter should be either parallel or perpendicular to the length dimension of the plastic part or material to be detected (see photos, below).

Emitter orientation: Parallel to long dimension of material



or

Perpendicular to long dimension of material

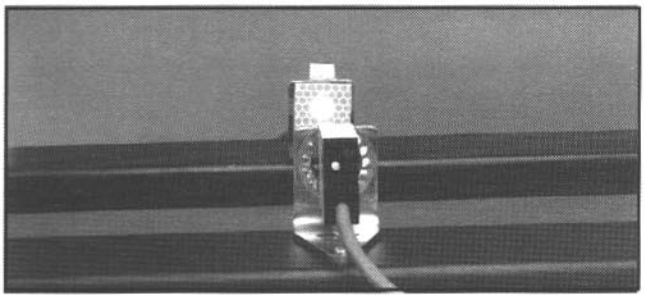


3) Install the receiver on the other bracket and tighten the mounting nut (finger tight only).

4) Connect power to both emitter and receiver (see Hookup Diagrams). Red light should be visible emanating from the emitter lens.

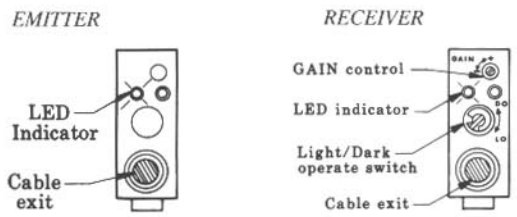
5) Remove the backing from the 1 inch square of adhesive-backed retroreflective tape included with the receiver (save the plastic bag), and attach it to the front of the receiver lens.

6) Loosen the #8 bolts which hold the emitter bracket to its mounting surface. From behind the emitter, sight along the top or side of the emitter housing toward the receiver, and adjust the emitter bracket until the red light image from the emitter is centered on the piece of retroreflective tape. This assures that the emitter is properly aligned to the receiver (see photo, below). Tighten the #8 bolts.



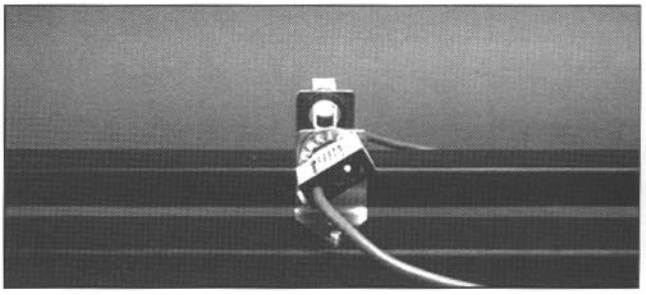
7) Turn the sensitivity (GAIN) adjustment on the receiver fully clockwise (see figure 2). This is a 15-turn potentiometer with a slotted screw adjustment clutched at both ends of rotation. Turning the adjustment 15 or more full clockwise turns assures the maximum GAIN setting.

Figure 2. Sensor indicators and adjustments



8) Rotate the receiver, in its bracket, around the axis of its threaded barrel so that the body of the receiver is at about 45 degrees to the body of the emitter (see photo, below).

Rotate receiver 45 degrees to emitter

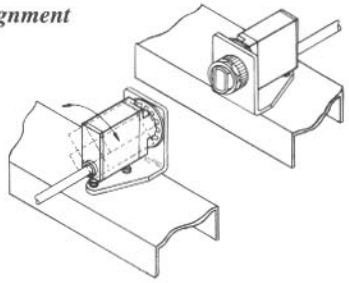


9) Rotate the LIGHT/DARK operate switch on the receiver to the LIGHT operate position (see figure 2). Remove the retroreflective tape from the front of the receiver lens. The alignment indicator on the back of the receiver (figure 2) should now be lighted. Receiver model SM31RPD has the Alignment Indicator Device (AID™) signal strength system which causes a rapid flickering of the alignment indicator LED. The fastest pulse rate of the LED indicates the best alignment of emitter to receiver.

10) Rotate the receiver so that its housing is parallel to the emitter housing. The alignment indicator LED should go "off". Rotate the receiver in both directions from its parallel position and find the point midway between the two angles that cause the alignment indicator to light (figure 3). This is the correct position, and the 18mm nut on the receiver should now be tightened to complete the installation.

Figure 3. Final alignment

Rotate receiver both directions from its parallel position to find the point midway between the two angles that cause the alignment indicator to come "on".



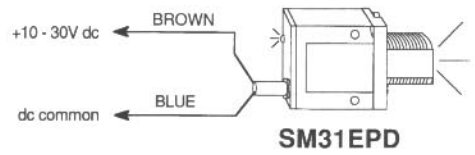
11) To test the system, place the plastic bag that contained the retroreflective tape between the emitter and receiver. The alignment indicator LED should come "on". Next try the actual product to be sensed, and verify that the indicator LED lights and the output changes state when the clear plastic product is in the beam.

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Hookup Information

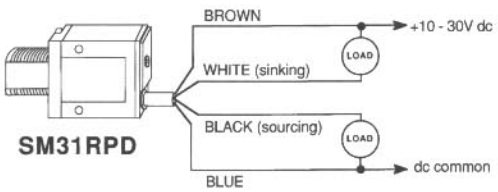
Model SM31EPD DC emitter

Emitter model SM31EPD is powered by 10 to 30V dc at 25 milliamps between the brown (+) and blue (-) wires. Polarity must be observed. Power "on" is verified by the visible red LED light source through the lens and by a red indicator LED on the back of the sensor.



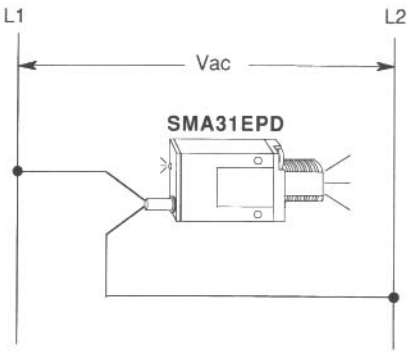
Model SM31RPD DC receiver

Receiver model SM31RPD is powered by 10 to 30V dc at 25 milliamps between the brown (+) and blue (-) wires. There are two outputs: one current sinking (NPN) and one current sourcing (PNP) open-collector transistor switch. Each output is rated at 150 milliamps maximum, and both outputs may be used at the same time. The outputs may be programmed for either normally open or normally closed operation using the LIGHT/DARK operate switch on the back of the receiver.



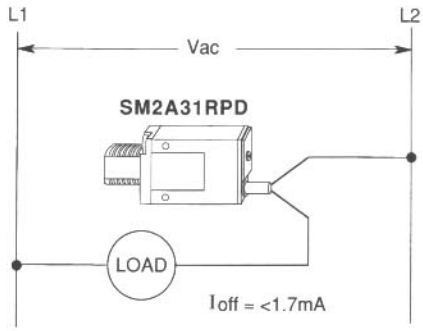
Model SMA31EPD AC emitter

The SMA31EPD wires directly across the ac line, without regard to wire color. Power "on" is verified by the visible light source through the lens and by a red LED indicator on the back of the sensor.



Model SM2A31RPD AC receiver

Model SM2A31RPD is a 2-wire device. It wires in series with an appropriate load, across the ac line. It is not polarity sensitive: hookup is without regard to wire color. The output may be programmed for either normally open or normally closed operation using the LIGHT/DARK operate switch on the back of the receiver. The SM2A31RPD can switch loads which draw up to 300 milliamps. NOTE: damage will result to the sensor if the load becomes a short circuit or draws excessive current. Off-state leakage current is less than 1.7 milliamps (see note, below).



Hookup Notes (see Banner catalog for additional information):

1) The current sinking NPN output (white wire) of model SM31RPD will interface directly as an input to Banner logic modules, including MICRO-AMP® and MAXI-AMP™ CL Series modules.

2) OFF-STATE LEAKAGE CURRENT. Model SM2A31RPD remains powered when the load is "off" by a residual current which flows through the load. This off-state leakage current is always less than 1.7mA. The effect of this leakage current depends upon the characteristics of the load. The voltage which appears across the load in the off-state is equal to the leakage current of the receiver multiplied by the resistance of the load: **V(off) = 1.7 x R(load).**

3) The output of model SM2A31RPD will be destroyed if the load becomes a short circuit.

Cable for MINI-BEAM QD-style Sensors

For AC QD sensors order MQDC-315 cable (straight connector) or MQDC-315RA cable (right-angled connector).

For DC QD sensors order MQDC-415 cable (straight connector) or MQDC-415RA cable (right-angled connector).

Cables are 15 feet long. For more information, see the Banner product catalog or data sheets 03520 (ac) and 03519 (dc).

WARRANTY: *Banner Engineering Corporation warrants its products to be free of defects for a period of one year. Banner Engineering Corporation 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.*

WARNING These photoelectric presence sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in *either* an energized or a de-energized sensor output condition.

Never use these products as sensing devices for personnel protection. Their use as safety devices may create an unsafe condition which could lead to serious injury or death.

Only MACHINE-GUARD and PERIMETER-GUARD Systems, and other systems so designated, are designed to meet OSHA and ANSI machine safety standards for point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices for personnel protection.

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