MULTI-BEAM® 2-wire ac Scanner Blocks

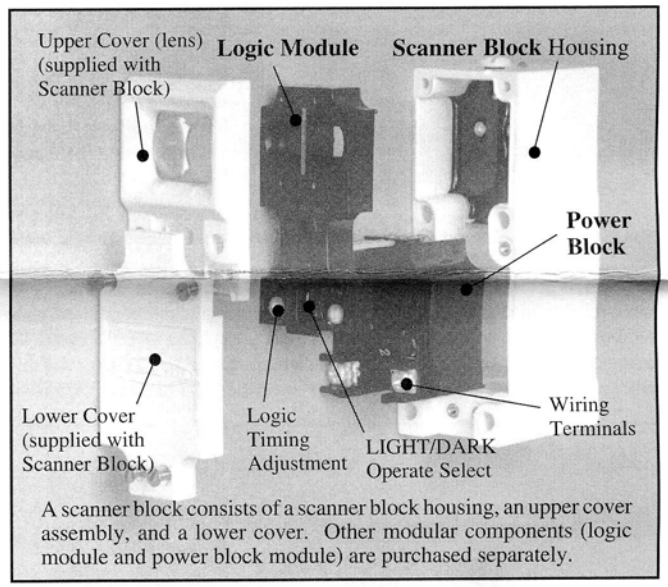
for MULTI-BEAM® 2-wire modular photoelectric sensors

BANNER® the photoelectric specialist

A Banner 2-wire ac MULTI-BEAM Sensor is a compact *modular* self-contained photoelectric switch consisting of three components: a scanner block, a power block, and a logic module. The *scanner block*, described in this data sheet, comprises the housing for the sensor and contains a complete modulated photoelectric amplifier, the emitter and receiver optoelements and lenses, and space for the other modules.

The *power block module* (data sheet P/N 03508) provides the interface between the scanner block and the external circuit. It contains a power supply for the MULTI-BEAM plus a switching device (except in emitter-only power blocks) to interface the sensor to the circuit to be controlled. The *logic module* (data sheet P/N 03507) interconnects the power block and scanner block both electrically and mechanically. It provides the desired timing logic function (if any) plus the ability to program the output for either light- or dark-operate.

The emitters of MULTI-BEAM opposed mode emitter/receiver pairs do not require a logic module. Emitter scanner blocks are supplied with a blade-pin to interconnect the scanner block and power block. Power block and logic modules are purchased separately. This modular design, with field-replaceable power block and logic modules, permits a large variety of sensor configurations, resulting in exactly the right sensor for any 2-wire photoelectric application.



A scanner block consists of a scanner block housing, an upper cover assembly, and a lower cover. Other modular components (logic module and power block module) are purchased separately.

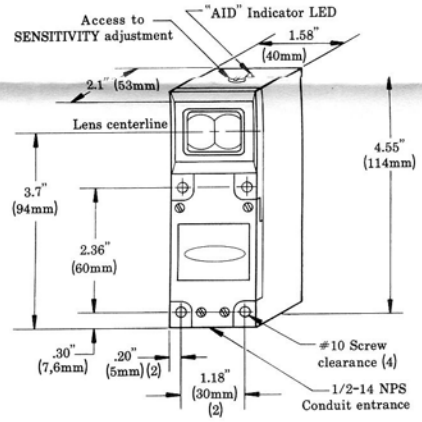
MULTI-BEAM 2-wire sensors connect in series with an ac load, exactly like a heavy-duty limit switch (page 2, bottom). Models are offered in all sensing modes, including glass fiber optic. All have 10-millisecond on-off response time and built-in protection against false pulse on power-up.

The circuitry of all MULTI-BEAM components is encapsulated within rugged, corrosion-resistant VALOX® housings that meet or exceed NEMA 1, 3, 12, and 13 ratings. MULTI-BEAM 2-wire scanner blocks include Banner's exclusive, patented* Alignment Indicating Device (AID™) system, which lights a top-mounted LED when the sensor sees its modulated light source and pulses at a rate proportional to the strength of the received light signal.

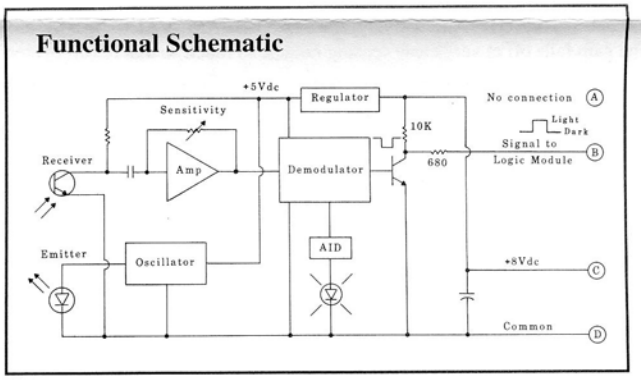
All MULTI-BEAM scanner blocks are totally solid-state for unlimited life.

*US patent 4356393.

Dimensions



Functional Schematic



Specifications

SUPPLY VOLTAGE: connections are made via a 2-wire power block (see product data sheet P/N 03508).

RESPONSE TIME: 10 milliseconds ON and OFF (3000 operations per minute). NOTE: built-in false pulse protection circuit holds output off for 100 milliseconds after power is initially applied. *NOTE: Response/repeatability specs are independent of signal strength.*

REPEATABILITY OF RESPONSE: see individual sensor specs.

SENSITIVITY ADJUSTMENT: easily accessible, located on top of scanner block beneath o-ring gasketed screw cover. 15-turn clutched control (rotate clockwise with a small screwdriver to increase gain).

ALIGNMENT INDICATOR: red LED on top of scanner block. Banner's exclusive, patented Alignment Indicating Device (AID™) circuit lights the LED whenever the sensor detects its own modulated light source, and pulses the LED at a rate proportional to the received light level.

CONSTRUCTION: reinforced VALOX® housing with components totally encapsulated. Stainless steel hardware. Meets NEMA standards 1, 3, 12, and 13.

OPERATING TEMPERATURE RANGE: -40 to +70 degrees C (-40 to +158 degrees F).

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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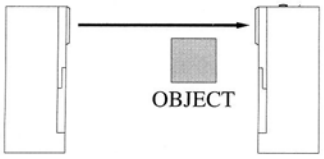
P/N 03498A4A

MULTI-BEAM 2-wire Scanner Blocks

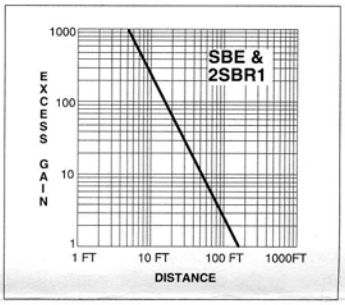
Sensing Mode *Models* *Excess Gain* *Beam Pattern*

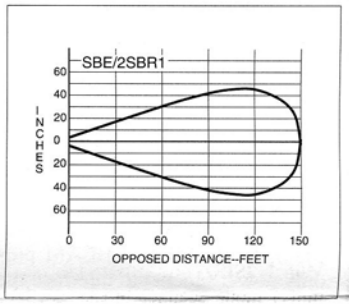
OPPOSED Mode



SBE & 2SBR1

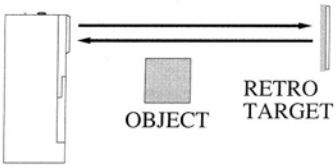
Range: 150 feet (45m)
Response: 10ms on/off
Repeatability: 0.03ms
Beam: infrared, 940nm
Effective beam: 1" dia.





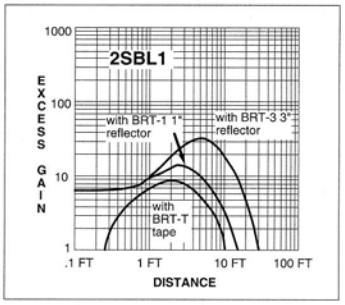
Model **2SBR1** receiver is used with the **SBE** emitter, the same emitter used with the 1 millisecond 3- & 4-wire receiver model SBR1. The response time, however, is determined by the receiver, and is 10 milliseconds. This pair will work reliably in slightly dirty (average manufacturing plant) conditions up to 60 feet opposed, and outdoors up to 20 feet. When more distance (or excess gain) is required, use 3- & 4-wire receiver model SBRX1 with the SBEX emitter. The 2SBR1 will not work with the visible emitter SBEV. Use opposed mode sensors as a first choice in any application, except where the material to be sensed is translucent to light or so small that it will not break the effective beam diameter. The SBE emitter uses a 3 & 4 wire power block. Powerblocks for use with SBE include models PBA-1, PBB-1, PBD-1, PBT-1, and PBT48-1 (see data sheet 03508).

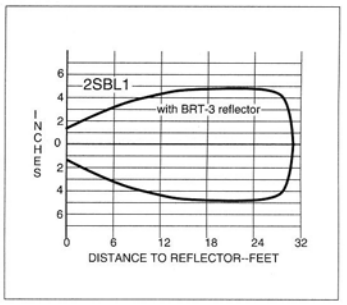
RETROREFLECTIVE MODE



2SBL1

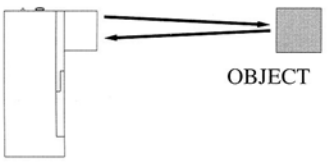
Range: 1 in. to 30 feet (2.5cm to 9m)
Response: 10ms on/off
Repeatability: 2.5ms
Beam: infrared, 940nm





Model **2SBL1** is the retroreflective mode scanner block in the 2-wire MULTI-BEAM family. It has the same excellent optical performance as model SBL1 in the 3- & 4-wire family. If the application calls for breaking a retroreflective beam with shiny objects such as metal cans or cellophane-wrapped packages, mount the 2SBL1 and its retroreflector at an angle of 10 degrees or more to the shiny surface to eliminate any direct reflections from the object itself, or consider using 3- & 4-wire scanner block model SBLVAG1. Alternatively, the MAXI-BEAM, VALU-BEAM, and MINI-BEAM families offer 2-wire ac visible and polarized retroreflective models. The gain falls off at very close sensing ranges, so much so that retroreflectors cannot be used reliably closer than one inch from the sensor.

CONVERGENT Mode

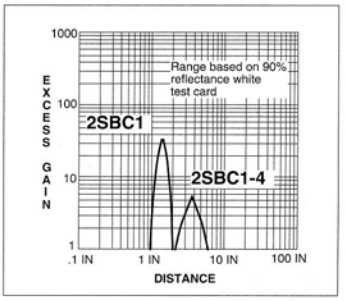


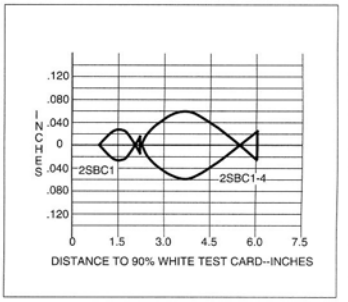
2SBC1

Focus at: 1.5inches (38mm)

2SBC1-4

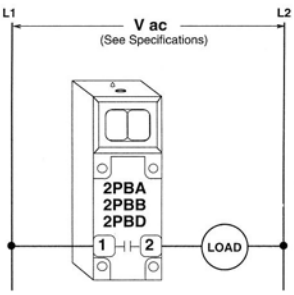
Focus at: 4 inches (10cm)
Response: 10ms on/off
Repeatability: 2.5ms
Beam: infrared, 940nm





These convergent mode 2-wire scanner blocks are identical in performance to their 3- & 4-wire equivalents, except for the 10 millisecond response time. They are designed for 2-wire applications where background objects might be seen by proximity mode sensors, or where the precision of a small focused image is important (e.g.- edge-guiding or position control). Model 2SBC1 provides much more excess gain at its focus point as compared to the diffuse mode sensors. Convergent mode sensors are preferable to diffuse mode sensors if the distance from the sensor to the object to be detected can be kept constant. Models 2SBC1 and 2SBC1-4 may be derived from retro model 2SBL1 by exchange of the upper cover assembly. Model 2SBC1 uses upper cover UC-C, and model 2SBC1-4 uses upper cover model UC-C4. These may be interchanged. A 6-inch convergent model may be created from either model by substituting upper cover UC-C6.

INSTALLATION



MULTI-BEAM 2-wire sensors wire in series with an appropriate load. This combination, in turn, wires directly across the ac line. A 2-wire sensor may be connected exactly like a mechanical limit switch.

The MULTI-BEAM 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 milliamp. 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 sensor multiplied by the resistance of the load:

V (off)= 1mA x R(load)

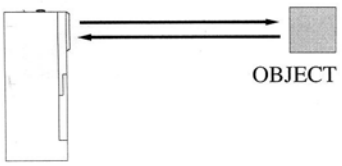
If this resultant off-state voltage is less than the guaranteed turn-off voltage of the load, the interface is direct. If the off-state voltage causes the load to stay "on", an artificial load resistor must be connected in parallel with the load to lower its effective resistance. Most loads, including most programmable logic controller (PLC) inputs, will interface to 2-wire sensors with 1mA leakage current without the need for an artificial load resistor. There is no polarity requirement. Either wire may connect to terminal #1, and the other to terminal #2.

CAUTION: all three components of a MULTI-BEAM 2-wire sensor will be destroyed if the load becomes a short circuit!!

MULTI-BEAM 2-wire Scanner Blocks

Sensing Mode | *Models* | *Excess Gain* | *Beam Pattern*

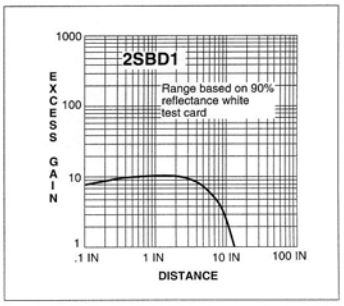
DIFFUSE Mode

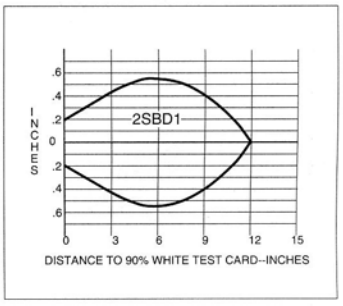


Models 2SBD1 and 2SBDX1 diffuse (proximity) mode scanner blocks are identical except for their lenses. Model 2SBD1 uses upper cover model UC-D, and the 2SBDX1 uses UC-L . While the UC-L lens extends the range to over 30 inches, it creates a "dip" in the excess gain at closer ranges. As a result, the 2SBDX1 may sense a dark colored object at 10 inches, but it may not see it at all at 2 inches. If the application is not completely defined, either scanner block may be ordered, along with the complementary upper cover as an accessory.

2SBD1

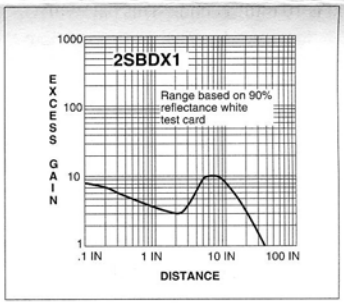
Range: 12 inches (30cm)
Response: 10ms on/off
Repeatability: 2.5ms
Beam: infrared, 880nm

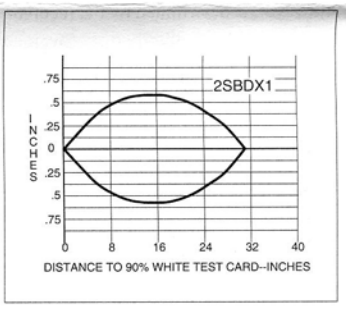




2SBDX1

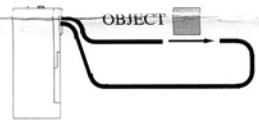
Range: 30 inches (76cm)
Response: 10ms on/off
Repeatability: 2.5ms
Beam: infrared, 880nm



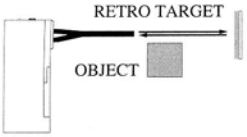


FIBER OPTIC Mode (glass fibers)

OPPOSED MODE



RETROREFLECTIVE MODE



DIFFUSE MODE

The following fiber optic cables and lenses are commonly used with the model 2SBF1 scanner block:

IT13S: individual assembly, .06 inch (1,5 mm) diameter fiber bundle

IT23S: individual assembly, .12 inch (3 mm) diameter fiber bundle

BT13S: bifurcated assembly, .06 inch (1,5 mm) diameter fiber bundles

BT23S: bifurcated assembly, .12 inch (3 mm) diameter fiber bundles

L9: 0.5 inch (12 mm) diameter lens

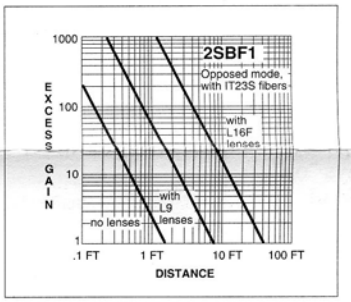
L16F: 1.0 inch (25 mm) diameter lens

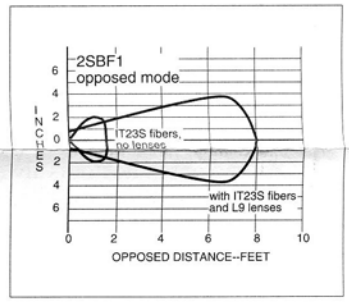
2SBF1

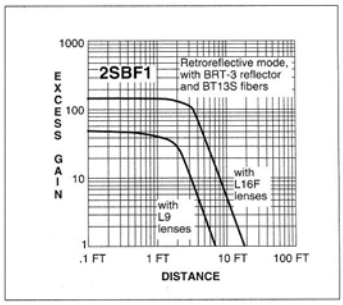
Range: see E.G. curves
Response: 10ms on/off
Repeatability: 2.5ms
Beam: infrared, 880nm

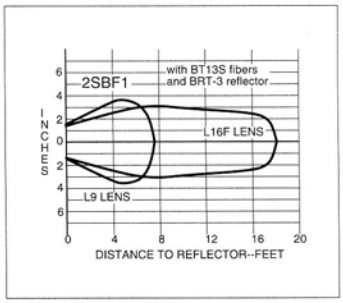
Scanner block 2SBF1 combines the simplicity of 2-wire hookup with the sophistication and versatility of optical fibers. The infrared source of this model will work with any Banner *glass* fiber optic assembly, except bifurcated assemblies with bundle diameters less than 1/16". Since fibers are frequently used for sensing small parts, fast response time is often a consideration. If the application requires response near the 10 millisecond specification of the 2SBF1, consider the faster 3- & 4-wire model SBF1.

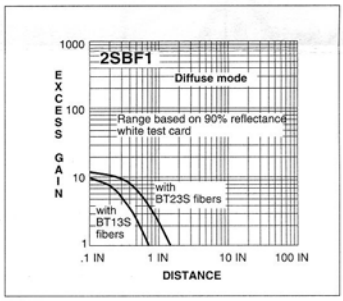
For complete information on glass fiber optic assemblies, see the Banner product catalog.

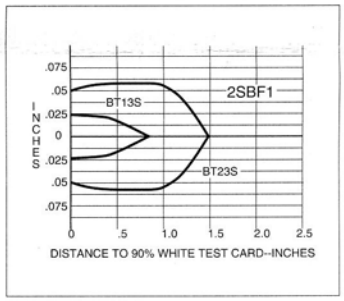












Troubleshooting Table

Symptom	Probable Cause	Correction
Alignment indicator never comes "on", and output never switches the load.	Sensitivity is too low	Turn SENSITIVITY control clockwise to increase gain
	Loose connection	Check wiring and connections to load
	Failure of a sensor component	Test MULTI-BEAM using Banner model LMT. Replace failed module
	Broken or obscured lens(es) or fiber optic assembly	Clean or replace upper cover assembly (or fiber optic assembly)
	OPPOSED mode: emitter & receiver misaligned	Realign using AID™ signal strength indicator
	RETROREFLECTIVE mode: Retro target is outside 2SBL1's field of view	Realign using AID™ signal strength indicator
	DIFFUSE or CONVERGENT mode: Object to be sensed is outside MULTI-BEAM's field of view	Realign to the object using AID™ signal strength indicator
	FIBER OPTIC modes: Fiber bundle diameter is too small for required range	Use fiber optic assembly with larger bundle size
Alignment indicator never comes "on", but output does switch load correctly.	Broken alignment indicator LED (sensor will continue to operate)	Replace scanner block (if alignment indicator is required)
Alignment indicator is always "on", and output never switches load	MULTI-BEAM is responding to "noise"	Use Banner model BT-1 BEAM TRACKER to locate the "noise" source
	Failure of sensor component	Test MULTI-BEAM using Banner LMT. Replace failed module
	OPPOSED mode: "Burnthrough" is occurring	Reduce gain by: turning receiver SENSITIVITY control CCW, intentional misalignment, and/or adding lens aperture on emitter and/or receiver
	Object is too small to break the effective beam	Add lens aperture to shape the effective beam to match the profile of object
	RETROREFLECTIVE mode: False light returned by the object as it passes through the sensing beam	Turn SENSITIVITY control CCW to decrease gain. Angle the sensor if background is shiny.
	DIFFUSE or CONVERGENT mode: False light returned from background object	Turn SENSITIVITY control CCW to decrease gain. Angle the sensor if background is shiny. Use model with shorter range
	Optical crosstalk from broken lens	Turn SENSITIVITY control CCW to decrease gain. Replace the upper cover assembly (see Banner product catalog for model number)
	FIBER OPTIC mode: *Bifurcated fiber assembly* (see DIFFUSE or RETROREFLECTIVE mode, above) -- optical crosstalk from broken fibers inside the bifurcated assembly. *Individual assemblies* -- see OPPOSED mode (above)	Replace the fiber optic assembly
Alignment indicator follows sensing action normally, but output never energizes	Failure of logic module or power block	Test MULTI-BEAM using Banner model LMT. Replace failed module.
SENSITIVITY control cannot be set to sense the difference between the light and dark conditions. The sensitivity is either too high or too low.	OPPOSED mode: "burnthrough" is occurring	Evaluate alternative sensing methods
	Object is too small to break the effective beam	Add lens apertures to shape the effective beam to match the profile of the object
	RETROREFLECTIVE mode: Object is too transparent	Evaluate alternative sensing methods
	Object is too reflective	Angle the sensor to object's shiny surface
	Diffuse or CONVERGENT modes: False light is being returned from background object(s)	Increase difference in reflectivity between the light and dark conditions (e.g. drill a hole through the background). Evaluate alternative sensing methods

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