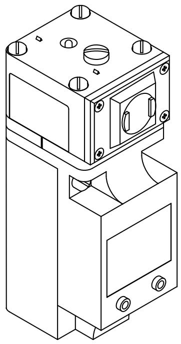
MAXI-BEAM® Fixed-field Sensor Heads

more sensors, more solutions

Datasheet

Models RSBFF50 and RSBFF100, with sharp far-limit cutoff



- Fixed-field proximity mode sensor heads for use with MAXI-BEAM® power blocks
- Two models provide sharp, accurate far-limit cutoff of 50 mm or 100 mm
- Ideal for detecting a part or surface that is only a fraction of an inch in front of another surface
- Top-mounted LED indicator warns of low excess gain
- Sensor heads are rotatable in 90 degree increments
- Rotatable programming ring for selection of light- or dark-operate sensing

WARNING:
- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Overview

Banner MAXI-BEAM® sensors are highly versatile, self-contained, modularized photoelectric sensing controls that are ideally suited to industrial environments. The fixed-field MAXI-BEAM is an ON/OFF switch consisting of three modules (sensor head, power block, and wiring base). A unique, patented, rotatable programming ring enables you to program your choice of light or dark operate mode. The sensing beam has a wavelength of 880 nanometers (infrared).

Interchangeable MAXI-BEAM® sensor heads are rotatable in 90-degree increments around the vertical axis and are also available in retroreflective, diffuse, opposed, convergent, and fiberoptic sensing modes.

Each MAXI-BEAM sensor head requires a compatible power block and a wiring base. The power block interfaces the sensor head to the circuit to be controlled. Sensor head models RSBFF50 and RSBFF100 may be used only with the MAXI-BEAM power blocks (see *Power Block Modules for RSBFF Series Sensor Heads* (p. 4)). The plug-in design of the model RWB4 wiring base enables easy exchange of the entire sensing electronics without disturbing field wiring.

RSBFF sensor heads have a convenient dual-purpose top-mounted red LED indicator that lights whenever an object is detected in the fixed sensing field. Also, this LED flashes whenever the sensor's excess gain in the light condition drops below 1.5x.

MAXI-BEAM sensors are ruggedly constructed of molded PBT to conform to NEMA standards 1, 3, 4, 12, and 13, and have replaceable molded acrylic lenses. Sensor head, power block, and wiring base simply snap and bolt together, with no interwiring necessary. Module interfaces are o-ring and quad-ring sealed for the ultimate in dust, dirt, and moisture resistance. The operating temperature range is –40 °C to +70 °C (–40 °F to +158 °F).

Note: RSBFF sensor heads may not be used with 2-wire ac power blocks, and are not for use with MAXI-BEAM logic modules.

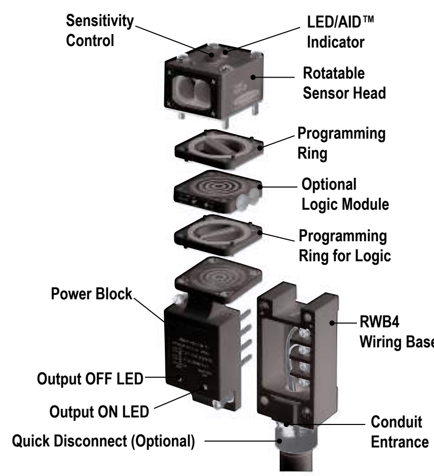
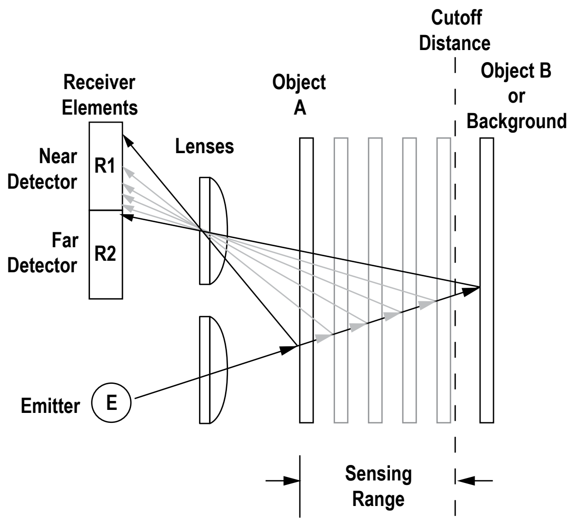


Figure 1. MAXI-BEAM Sensors without Logic Modules

Fixed-Field Sensing – Theory of Operation

The MAXI-BEAM fixed-field sensor head compares the reflections of its emitted light beam (E) from an object back to the sensor's two differently aimed detectors, R1 and R2. See *Figure 2* (p. 2). If the near detector's (R1) light signal is stronger than the far detector's (R2) light signal (see object A in the Figure below, closer than the cutoff distance), the sensor responds to the object. If the far detector's (R2) light signal is stronger than the near detector's (R1) light signal (see object B in the Figure below, beyond the cutoff distance), the sensor ignores the object.

The cutoff distance for the MAXI-BEAM is fixed at 50 mm (2 in, RSBFF50 models) or 100 mm (4 in, RSBFF100 models). Objects lying beyond the cutoff distance are usually ignored, even if they are highly reflective. However, under certain conditions, it is possible to falsely detect a background object (see *Background Reflectivity and Placement* (p. 2)).



Object is sensed if amount of light at R1 is greater than the amount of light at R2

Figure 2. Fixed-Field Concept

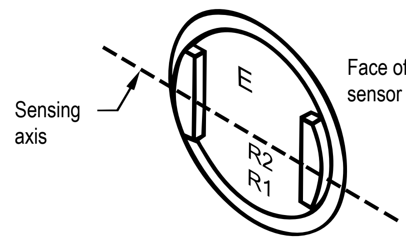


Figure 3. Fixed-Field Sensing Axis

In the drawings and information provided in this document, the letters E, R1, and R2 identify how the sensor's three optical elements (Emitter "E", Near Detector "R1", and Far Detector "R2") line up across the face of the sensor. The location of these elements defines the sensing axis, see *Figure 3* (p. 2). The sensing axis becomes important in certain situations, such as those illustrated in *Figure 6* (p. 3) and *Figure 7* (p. 3).

Background Reflectivity and Placement

Avoid mirror-like backgrounds that produce specular reflections. A false sensor response occurs if a background surface reflects the sensor's light more to the near detector (R1) than to the far detector (R2). The result is a false ON condition (*Figure 4* (p. 2)). Correct this problem by using a diffusely reflective (matte) background, or angling either the sensor or the background (in any plane) so the background does not reflect light back to the sensor (*Figure 5* (p. 2)). Position the background as far beyond the cutoff distance as possible.

An object beyond the cutoff distance, either stationary (and when positioned as shown in *Figure 6* (p. 3)), or moving past the face of the sensor in a direction perpendicular to the sensing axis, may cause unwanted triggering of the sensor if more light is reflected to the near detector than to the far detector. Correct the problem by rotating the sensor 90° (*Figure 7* (p. 3)). The object then reflects the R1 and R2 fields equally, resulting in no false triggering. A better solution, if possible, may be to reposition the object or the sensor.

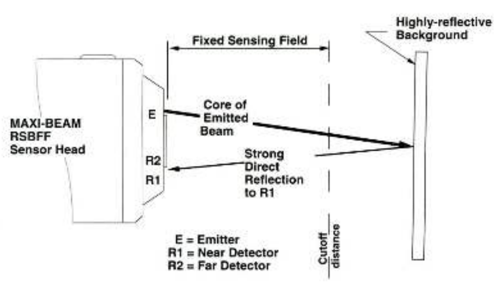


Figure 4. Reflective Background - Problem

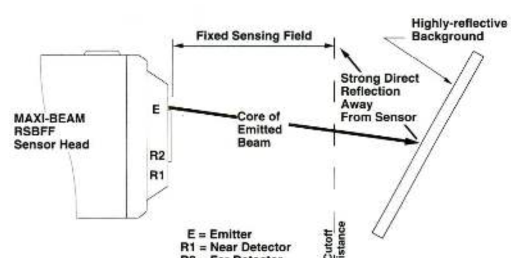
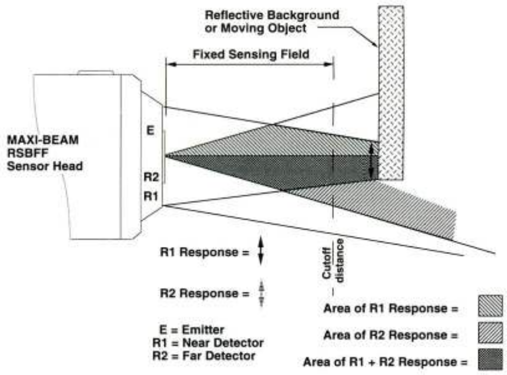
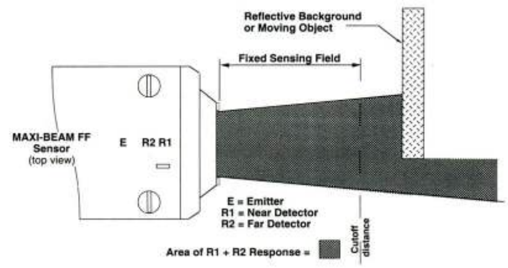


Figure 5. Reflective Background - Solution



A reflective background object in this position or moving across the sensor face in this axis and direction may cause a false sensor response.

Figure 6. Object Beyond Cutoff - Problem



A reflective background object in this position or moving across the sensor face in this axis is ignored.

Figure 7. Object Beyond Cutoff - Solution

Sensing Reliability

The excess gain curve shows excess gain vs. sensing distance for MAXI-BEAM® fixed-field sensors with 50- and 100-millimeter cutoffs. See *Performance Curves* (p. 5). Maximum excess gain for the 50-millimeter models occurs at a lens-to-object distance of about 15 millimeters. Maximum excess gain for the 100-millimeter models occurs at a lens-to-object distance of about 25 millimeters. Sensing at or near these distances makes maximum use of each sensor's available sensing power.

Background surfaces and objects must *always* be placed beyond cutoff distance, if it desired that they be ignored.

The excess gain curve was generated using a white test card of 90% reflectance. Objects with reflectivity of less than 90% reflect less light back to the sensor, and require proportionately more excess gain to be sensed with the same reliability as more reflective objects. When sensing an object of very low reflectivity, it may be important to sense it at or near the distance of maximum excess gain.

The effects of object reflectivity on cutoff distance, though small, may be important for some applications. Sensing of objects of less than 90% reflectivity causes the cutoff distances to be pulled very slightly closer to the sensor. For example, an excess gain of 1 for an object that reflects 1/5 as much light as the 90% white card is represented by the heavy horizontal graph line at excess gain = 5. An object of this reflectivity results in far limit cutoffs of approximately 47 and 90 millimeters (for 50- and 100-mm cutoff units, respectively).

Objects with reflectivity greater than 90% return more light to the sensor. For this reason, highly reflective backgrounds or background objects such as mirrors, polished metal, and other sources of specular reflections require special consideration. If it is necessary to use a highly reflective background, it should be placed as far beyond the cutoff distance as possible and angled to direct reflected light away from the sensor (see *Background Reflectivity and Placement* (p. 2)).

Program Light/Dark Operate

Light-/dark-operate selection is done at the programming ring. In light-operate mode, the sensor's normally open output conducts when the sensor sees light. In dark-operate mode, the normally open output conducts when the sensor sees dark.

1. Loosen the four bolts that hold the sensor head to the power block.
2. Remove and separate the sensor head and programming ring.
3. Rejoin the programming ring to the sensor head so that one of the four programming notches on the programming ring aligns with the 10 ms indication beneath the desired operating mode, either DARK OPERATE or LIGHT OPERATE, on the sensor head label.
4. Reattach the sensor head with programming ring to the power block to lock it in any one of the four 90-degree directions around the sensor's vertical axis.

Specifications

Note: Every RSBFF50 or RSBFF100 sensor head requires a MAXI-BEAM power block and a model RWB4 wiring base (see below). RSBFF sensor heads do not use MAXI-AMP logic modules.

Power Requirements
MAXI-BEAM sensor heads obtain their operating voltage through MAXI-BEAM power blocks.
Only the following listed power block models may be used with the model RSBFF50 and RSBFF100 sensor heads. See datasheet p/n 03418 or *www.bannerengineering.com* for a complete description of power blocks and specifications.
All power blocks (except model RPBTLM) require the model RWB4 wiring base.

Sensing Beam
Infrared, 880 nm

False Pulse Suppression on Power-up
All models

Cutoff Distance
See *Performance Curves* (p. 5)
RSBFF50: 50 mm (2 inches) from sensor face (±10%)
RSBFF100: 100 mm (4 inches) from sensor face (±10%)

Repeatability
3.3 milliseconds

Programming ring
For selection of light- or dark-operate output
Programming ring is included with the sensor head

Construction
Reinforced molded PBT housing, molded acrylic lenses, o-ring and quad-ring gasketed components
Electronic components are fully epoxy encapsulated

Certifications

LED Indicator
Red indicator LED on top of sensor head
Lights whenever an object is detected in the fixed sensing field
Flashes when excess gain in the light condition falls below 1.5x

Environmental Rating
NEMA 1, 3, 4, 12, and 13

Operating Temperature
–40 °C to +70 °C (–40 °F to +158 °F)

Response Time
10 milliseconds

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

Power Block Modules for RSBFF Series Sensor Heads

See data sheet p/n 03418.

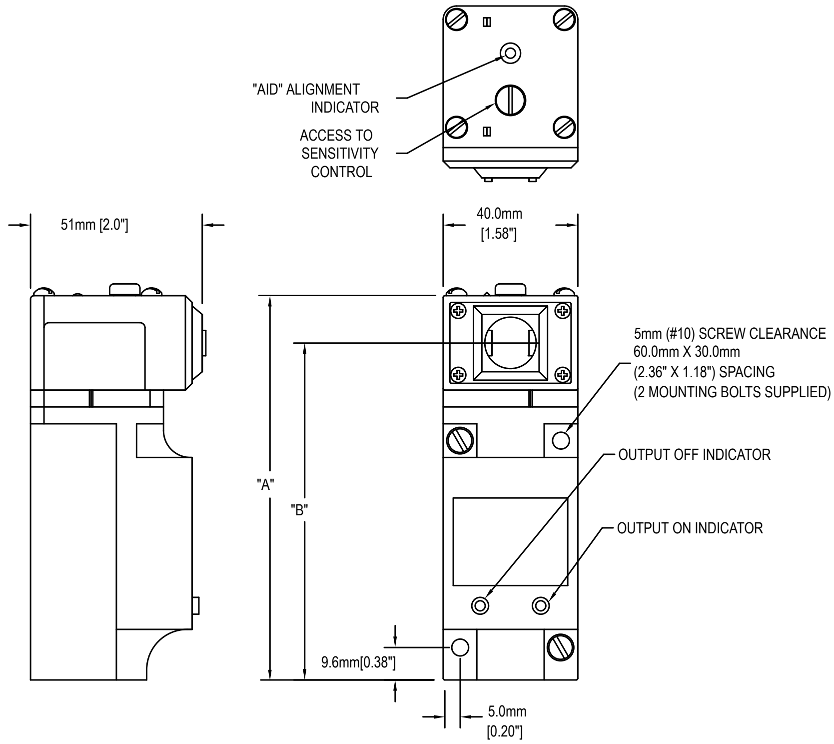
Model	Supply Voltage	Output Type
RPBT	10 V dc to 30 V dc	one sinking and one sourcing solid-state output
RPBTLM	10 V dc to 30 V dc Low-profile power block (requires no RWB4 wiring base)	
RPBA	105 V dc to 130 V ac (50/60 Hz)	SPST solid-state output
RPBB	210 V ac to 250 V ac (50/60 Hz)	SPST solid-state output
RPBU	12 V ac to 250 V ac or 12 V dc to 30 V dc	SPST solid-state output (ac or dc)
RPBR	12 V ac to 250 V ac (50/60 Hz) or 12 V dc to 30 V dc	SPST E/M relay output
RPBR2		SPDT E/M relay output

Wiring Base

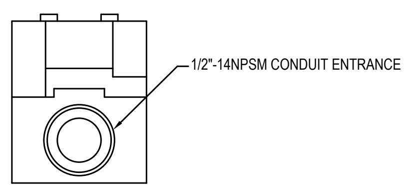
See data sheet p/n 03418.

Model	Description
RWB4	4-terminal wiring base for all models (except RPBTLM)

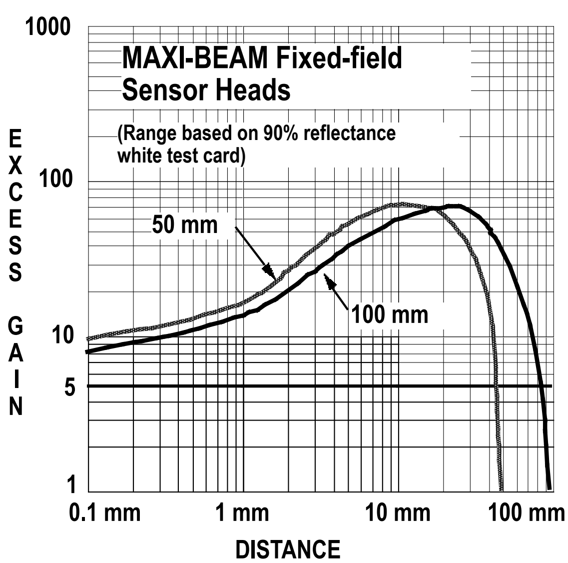
Dimensions



CONFIGURATION	DIMENSION "A"	DIMENSION "B"
WITHOUT LOGIC MODULE	114mm [4.5"]	100mm [3.9"]
WITH LOGIC MODULE	127mm [5.0"]	112mm [4.4"]



Performance Curves



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