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BANNER®
the photoelectric specialist

OMNI-BEAM™ Sensor Heads

The Sensing Component of OMNI-BEAM Modular Photoelectric Sensors



*U.S. Patent 4965548

OMNI-BEAM Features

- Sensor heads feature Banner's D.A.T.A.™ (Display And Trouble Alert) indicator system* which warns of an impending sensing problem before a failure occurs
- 10-element LED array displays sensing contrast and received signal strength and warns of a sensing problem due to any of the following causes:
  - Severe condensation or moisture
  - High temperature
  - Low supply voltage
  - Output overload (dc operation)
  - Too much sensing gain
  - Not enough sensing gain
  - Low optical contrast
- Separate indicators for target sensed and output energized
- Sensor heads are field-programmable for the following response parameters:
  - Sensing hysteresis
  - Signal strength indicator scale factor
  - Light or dark operate of the load output
  - Normally open or closed alarm output
- Choose power blocks for high-voltage ac or low-voltage (10 to 30V) dc operation
- Sensor head and power block plug (and bolt) together quickly and easily
- Optional plug-in output timing modules may be added at any time

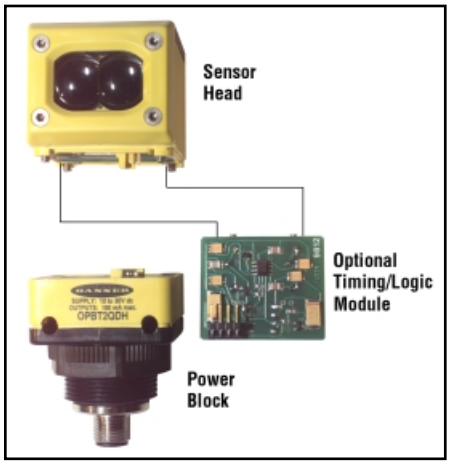


Figure 1. OMNI-BEAM sensor head and power block bolt and plug together quickly and easily; an optional timing logic module may be added at any time.

OMNI-BEAM Overview

Modular Design

OMNI-BEAM is a modular self-contained sensor. It is made up of a sensor head and a power block; an optional plug-in timing logic module may be added easily. The three modular components, sold separately, simply plug and bolt together — without interwiring — to create a complete self-contained photoelectric sensor tailored to a particular application's exact sensing requirements.

The sensor lenses and modular components are all field-replaceable. OMNI-BEAM's modular design makes change-out of any component quick and easy.

WARNING . . . Not To Be Used for Personnel Protection

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.

These sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Consult your current Banner Safety Products catalog for safety products which meet OSHA, ANSI and IEC standards for personnel protection.

OMNI-BEAM Sensor Heads

Sensor Heads
A sensor head module is available for every sensing situation. Sensor heads bolt directly onto the power block, and are fully gasketed for protection against environmental elements. The D.A.T.A. self-diagnostic feature is standard on all OMNI-BEAM sensor heads (except emitters and model OSBFAC). Select from most sensing modes, with infrared or visible red, green or blue sensing beams available.



Figure 2. OMNI-BEAM sensor heads are available for most sensing modes, including fiber optic models.

OMNI-BEAM Sensor Head Models

Model	Sensing Mode	Light Source	Range	Response	Repeatability
OSBE **OSBR**	Opposed emitter Opposed receiver	Infrared, 880 nm	45 m (150')	2 ms	0.01 ms
OSBLV **OSBLVAG**	Non-polarized retroreflective Polarized retroreflective	Visible red 650 nm	0.15 to 9 m (6' to 30') 0.3 to 4.5 m (12" to 15')	4 ms	0.2 ms
OSBLVAGC	Polarized retroreflective, clear object detection	Visible red 650 nm	4 m (12')	4 ms	0.2 ms
OSBD **OSBDX**	Short-range diffuse Long-range diffuse	Infrared, 880 nm	300 mm (12") 2 m (6.5')	2 ms 15 ms	0.1 ms 1 ms
OSBCV **OSBCVG** **OSBCVB**	Convergent	Visible red, 650 nm Visible green, 525 nm Visible blue, 475 nm	38 mm (1.5") Focus	4 ms	0.2 ms
OSBF **OSBFVG** **OSBFVB**	Glass fiber optic –high speed	Infrared, 880 nm Visible green, 525 nm Visible blue, 475 nm	Range varies with fiber optics used	2 ms	0.1 ms
OSBFV	Glass fiber optic –high speed	Visible red, 650 nm	Range varies with fiber optics used	2 ms	0.1 ms
OSBFX	Glass fiber optic –high power	Infrared, 880 nm	Range varies with fiber optics used	15 ms	1 ms
OSBEF **OSBRF**	Glass fiber optic emitter Glass fiber optic receiver	Infrared, 880 nm	Range varies with fiber optics used	2 ms	0.01 ms
OSBFAC	Glass fiber optic –ac-coupled	Infrared, 880 nm	Range varies with fiber optics used	1 ms	0.01 ms
OSBFP **OSBFPG** **OSBFPB**	Plastic fiber optic	Visible red, 650 nm Visible green, 525 nm Visible blue, 475 nm	Range varies with fiber optics used	2 ms	0.1 ms

NOTE: See pages 9 and 10 for Excess Gain and Beam Pattern curves.



Figure 3. **OMNI-BEAM power blocks provide the input and output circuitry for OMNI-BEAM sensor heads. Select models for either ac or dc power.**

Power Blocks

The power block determines the sensor operating voltage and also the sensor output switch configuration. Models are available with a built-in 2 m (6.5') or 9 m (30') cable, or with either Mini-style or Euro-style quick-disconnect ("QD") plug-in cable fittings. Emitter power blocks have no output circuitry.

OMNI-BEAM Power Blocks

Models	Cable	Supply Voltage	Output Type
DC Voltage (see data sheet p/n 03532 packed with the power block)			
OPBT2 **OPBT2QD** **OPBT2QDH**	2 m (6.5') 4-Pin Mini QD 4-Pin Euro QD	10-30V dc	Bi-Modal™ NPN/PNP Two outputs: Load and Alarm
OPBTE **OPBTEQD** **OPBTEQDH**	2 m (6.5') 4-Pin Mini QD 4-Pin Euro QD		No output: for powering emitter only sensor heads
AC Voltage (see data sheet p/n 03531 packed with the power block)			
OPBA2 **OPBA2QD**	2 m (6.5') 5-Pin Mini QD	105-130V ac	SPST solid-state ac relay Two outputs: Load and Alarm
OPBB2 **OPBB2QD**	2 m (6.5') 5-Pin Mini QD	210-250V ac	
0PBAE **OPBAEQD**	2 m (6.5') 5-Pin Mini QD	105-130V ac	No output: for powering emitter only sensor heads
OPBBE **OPBBEQD**	2 m (6.5') 5-Pin Mini QD	210-250V ac	

NOTE: 9 m (30') cables are availabe by adding the suffix "w/30" to the model number of any cabled power block (for example, **OPBT2 w/30**).

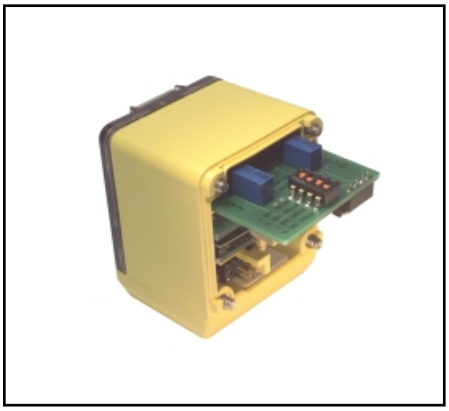


Figure 4. **OMNI-BEAM optional timing logic modules**

Optional Timing Logic Modules

Timing logic may be added at any time, using one of three timing delay and pulse logic modules. Installation is simple and quick; the logic modules simply slide into the sensor head (see Figure 4). Program them for timing functions and ranges via four DIP switches; each module includes easily accessible 15-turn clutched potentiometers for accurate timing adjustments.

OMNI-BEAM Timing Logic Modules (see data sheet p/n 03533 packed with the module)

Models	Type	Logic Function	Timing Ranges
OLM5	Delay Timer Logic Module	ON-DELAY or OFF-DELAY or ON/OFF DELAY	**ON-Delay:** 0.01 to 1 sec, 0.15 to 15 sec, or none **OFF-Delay:** 0.01 to 1 sec, 0.15 to 15 sec, or none
OLM8	Pulse Timer Logic Module	ONE-SHOT pulse timer or DELAYED ONE-SHOT logic timer	**Delay:** 0.01 to 1 sec, 0.15 to 15 sec, or none **Pulse:** 0.01 to 1 sec, 0.15 to 15 sec
OLM8M1	Pulse Timer Logic Module	ONE-SHOT pulse timer or DELAYED ONE-SHOT logic timer	**Delay:** 0.002 to 0.1 sec, 0.03 to 1.5 sec, or none **Pulse:** 0.002 to 0.1 sec, 0.03 to 1.5 sec

Sensor Head Programming

DIP Switch Settings
OMNI-BEAM sensor heads are field-programmable for four operating parameters. To access the four programming DIP switches (see figure 5), remove the sensor block from the power block.

Switch #1, Sensing Hysteresis
ON: Standard hysteresis.
OFF: Low hysteresis; should be used only when all sensing conditions remain completely stable.

Hysteresis is an electronic sensor requirement that the amount of received light needed to energize the sensor's output not be equal to the amount needed to release the output. This differential prevents the sensing output from "buzzing" or "chattering" when the received light signal is at or near the sensing threshold level. The standard setting should be used always, except for low-contrast applications such as the detection of subtle differences in reflectivity.

Switch #2, Alarm Output Configuration
ON: Alarm output is normally open (it conducts with an alarm).
OFF: Alarm output is normally closed (the output opens during an alarm).

Normally closed mode (OFF) is recommended; it allows a system controller to recognize a sensor power loss or an open sensor output as an alarm condition. Normally open alarm mode (ON) should be used when the alarm outputs of multiple OMNI-BEAMs are wired in parallel to a common alarm or alarm input.

Switch #3, Light or Dark Operate
ON: Dark Operate mode; the output energizes (after a time delay, if applicable) when the received light level is less than the sensing threshold (4 or fewer D.A.T.A. lights ON).
OFF: Light Operate mode; the sensor's load output energizes (after a time delay, if applicable) when the received light level is greater than the sensing threshold (5 or more D.A.T.A. lights ON).

Switch #4, Scale Factor for the D.A.T.A. Signal Strength Indicator Display
ON: Fine scale.
OFF: Standard scale.

This switch should always be OFF, except for close differential sensing situations (for example, some color registration applications, which also require the Low hysteresis setting/switch #1 OFF).

Factory Settings
The following are the factory program settings for OMNI-BEAM sensor head DIP switches.
Switch #1: ON (Standard hysteresis)
Switch #2: OFF (Normally Closed alarm output)
Switch #3: OFF (Light Operate load output)
Switch #4: OFF (Standard Scale Factor for signal strength display)

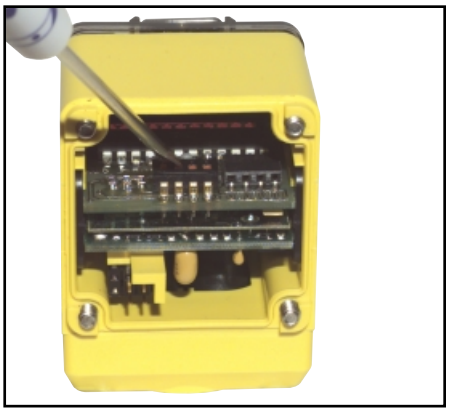


Figure 5. OMNI-BEAM program switches

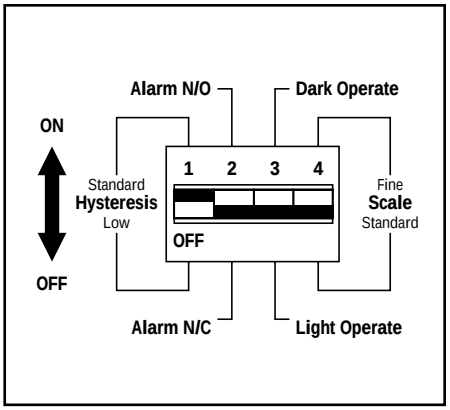


Figure 6. OMNI-BEAM program switch configuration



Figure 6. OMNI-BEAM D.A.T.A. LEDs

Using the D.A.T.A. Sensor Self-Diagnostic Feature

Banner's exclusive D.A.T.A. feature warns of marginal sensing conditions, usually before a sensing failure occurs, by flashing one or more lights in its multiple-LED array, and by sending a warning signal to the system logic controller (or directly to an audible or visual alarm). The chart below describes the meanings of the possible signals.

Flashing LED	Problem	Description
#1	Moisture Alert	Severe moisture is inside the sensor head, caused by condensation or by entry of moisture when the access cover is removed.
#2	High Temperature Alert	The temperature inside the sensor head exceeds +70°C (+158°F).
#3	Low Voltage or Overload Alert	Sensor supply voltage is below the minimum specified for the power block in use. Power block outputs also shut down to prevent damage to the load(s) from low voltage. DC power blocks OPBT2, OPBT2QD, or OPBT2QDH: Either the load output or the alarm output is shorted. Both outputs will be inhibited, and the circuit will "retry" the outputs every 1/10 second. The outputs automatically reset and function normally when the short is corrected.
#9	High Gain Warning	The "dark" signal never goes below #4 on the display; decrease the Gain setting. There are two possible causes: 1) The "dark" signal slowly increases and remains at the #4 level for a predetermined delay time, commonly caused by a gradual increase of unwanted background reflections in reflective sensing modes (such as diffuse or convergent). The alarm will reset as soon as the cause of the unwanted light signal is removed, or if the Gain control setting is reduced to bring the "dark" condition below the #4 level. 2) The "dark" signal does not fall below the #4 level during a sensing event. The alarm automatically resets when the "dark" sensing level falls below the #4 level (accomplished by reducing the Gain control setting and/or by removing the cause of unwanted light return in the "dark" condition).
#10	Low Gain Warning	The "light" signal never goes above #5 on the display; increase the Gain setting. There are two possible causes: 1) The "light" signal slowly decreases to the #5 level and remains at that level for a predetermined delay. This most commonly occurs in opposed or retroreflective sensing systems, caused by a gradual decrease in light in the unblocked condition, due to obscured lenses or sensor misalignment. The alarm will reset when the light signal strength exceeds the #5 level. 2) The "light" signal does not exceed the #5 level during a sensing event. The alarm automatically resets when the "light" signal exceeds the #5 level (accomplished by increasing the GAIN control setting and/or cleaning the lens and realigning the sensor).
#9 and #10	Low Contrast Warning	The lights flash simultaneously to indicate inadequate optical contrast for reliable sensing (the "light" condition is at the #5 level and the "dark" condition is at the #4 level). If this occurs, re-evaluate the application to find ways to increase the differential between the "light" and "dark" conditions. The alarm automatically resets when the "light" signal exceeds the #5 level and the "dark" signal falls below the #4 level.

Sense and Load LED Indicators

The Sense LED indicates when a target has been sensed. When the sensor head is programmed for Light Operate, it lights when the received light signal exceeds the #5 threshold. When programmed for Dark Operate, it lights when the received light signal falls below the #5 threshold. See figure 7.

The Load indicator LED lights whenever the output is energized (after the timing function, if applicable).



Figure 7. Sense and Load indicators

Measuring Excess Gain

OMNI-BEAM's D.A.T.A. indicator display may be used to measure the excess gain and contrast during sensing, installation, or maintenance.

Excess gain is a measurement of the amount of light energy falling on a photoelectric sensor's receiver, over and above the minimum amount needed to operate the sensor's amplifier. Excess gain is expressed as a ratio:

$$\text{Excess gain (E.G.)} = \frac{\text{light energy falling on receiver}}{\text{amplifier threshold}}$$

The amplifier threshold is the point at which the sensor's output switches (corresponding to the #5 level of the D.A.T.A. display). When LEDs #1 through #5 are ON, the excess gain of the received light signal is equal to "1x." The chart below shows how excess gain relates to the D.A.T.A. light array indication.

Relationship Between Excess Gain and D.A.T.A System Lights

D.A.T.A. Light LED Number	STANDARD Scale Factor	FINE* Scale Factor
#1	0.25x Excess Gain	0.5x Excess Gain
#2	0.35x Excess Gain	0.7x Excess Gain
#3	0.5x Excess Gain	0.8x Excess Gain
#4	0.7x Excess Gain	0.9x Excess Gain
#5	1.0x Excess Gain	1.0x Excess Gain
#6	1.3x Excess Gain	1.1x Excess Gain
#7	1.7x Excess Gain	1.2x Excess Gain
#8	2.2x Excess Gain	1.3x Excess Gain
#9	2.9x Excess Gain	1.7x Excess Gain
#10	3.7x Excess Gain (or more)	2.2x Excess Gain (or more)



Figure 8. Dark condition example: D.A.T.A. system LEDs #1 and #2 lit.



Figure 9. Light condition example: D.A.T.A. system LEDs #1 through #8 lit.

Measuring Sensing Contrast

Contrast is the ratio of the amount of light falling on the receiver in the "light" state, compared to the "dark" state (sometimes called "light-to-dark ratio"). Optimizing the contrast in any sensing situation increases the sensing reliability. Contrast may be calculated if excess gain values are known for both the light and dark conditions:

$$\text{Contrast} = \frac{\text{Excess gain (light condition)}}{\text{Excess gain (dark condition)}}$$

To determine the contrast for any sensing application, present both the Light and Dark conditions to the OMNI-BEAM, and note how many LEDs in the D.A.T.A. display are ON for each condition. Compute the ratio from the corresponding excess gain numbers (from the chart on page 6) for the two conditions.

For example, if LEDs #1 through #8 come ON in the Light condition and LEDs #1 and #2 come ON in the Dark condition (assuming Standard scale factor), contrast is calculated as follows:

Light condition: 2.2x excess gain
Dark condition: 0.35x excess gain

$$\text{Contrast} = \frac{2.2x}{0.35x} = 6$$

This value is expressed as 6:1 ("six-to-one").

The best sensor adjustment will cause all ten D.A.T.A. LEDs to come ON for the Light condition, and none in the Dark condition. In this situation (such as an application in which a box breaks the beam of an opposed-mode emitter/receiver pair):

$$\text{Contrast is } \textit{greater than} \quad \frac{3.7x}{0.25x} = 15$$

While it is not always possible to adjust a sensor to maintain this much contrast, it is important to always adjust for the maximum possible contrast. The D.A.T.A. feature makes this easy. The chart below gives general guidelines for contrast values.

Contrast Values and Corresponding Guidelines

Contrast	Recommendation
1.2 or Less	**Unreliable.** Evaluate alternative sensing schemes.
1.2 to 2	**Poor Contrast.** Use the LOW hysteresis setting and the FINE scale factor.
2 to 3	**Low Contrast.** Sensing environment must remain perfectly clean and all other sensing variables must remain stable.
3 to 10	**Good Contrast.** Minor sensing system variables will not affect sensing reliabilty.
10 or Greater	**Excellent Contrast.** Sensing should remain reliable as long as the sensing system has enough excess gain for operation.

OMNI-BEAM Sensor Heads

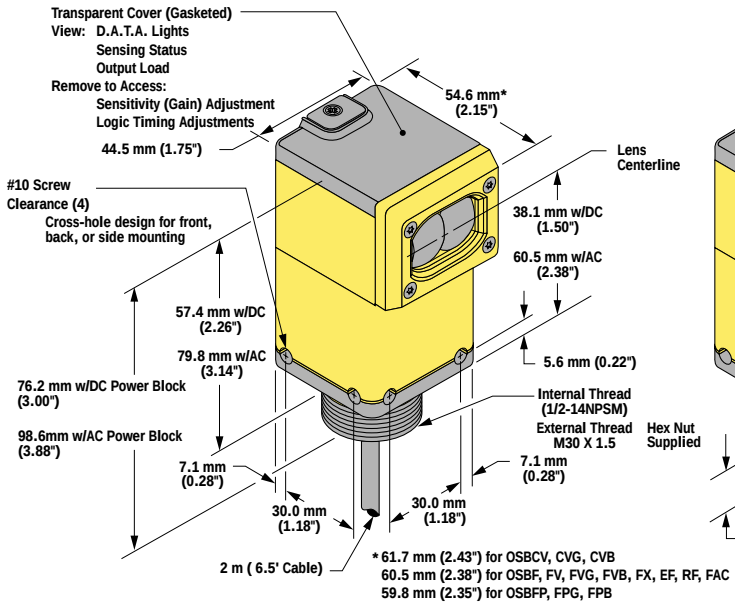
OMNI-BEAM Sensor Head Specifications

Supply Voltage and Current	Supplied by OMNI-BEAM power block
Output Response Time	See individual sensing heads for response times (page 2) 200 millisecond delay on power-up: outputs are non-conducting during this time.
Adjustments	OMNI-BEAM sensor heads are field-programmable for four operating parameters. A set of four programming DIP switches is located at the base of the sensor head and is accessible with the sensor head removed from the power block (see page 4). Switch #1 selects the amount of sensing hysteresis Switch #2 selects the alarm output configuration Switch #3 selects LIGHT operate (switch #3 OFF) or DARK operate (switch #3 ON) Switch #4 selects the STANDARD (switch #4 OFF) or FINE (switch #4 ON) scale factor for the D.A.T.A. light signal strength indicator array 15-turn slotted brass screw Gain (sensitivity) adjustment potentiometer (clutched at both ends of travel)
Indicators	Sense and Load indicator LEDs are located on the top of the sensor head on either side of the D.A.T.A. array. Sense LED indicates when a target has been sensed Load LED lights whenever the load output is energized Also, Banner's exclusive D.A.T.A. sensor self-diagnostic system located on the top of the sensor head warns of marginal sensing conditions usually before a sensing failure occurs (except on model OSBFAC).
Construction	Sensor heads are molded of rugged reinforced thermoplastic polyester; top view window is LEXAN® polycarbonate; acrylic lenses; stainless steel hardware
Environmental Rating	Meets NEMA standards 1, 2, 3, 3S, 4, 12, and 13; IEC IP66 when assembled to power block
Operating Temperature	**Temperature:** -40° to +70°C (-40° to +158°F) **Maximum relative humidity:** 90% at 50°C (non-condensing)
Certifications	

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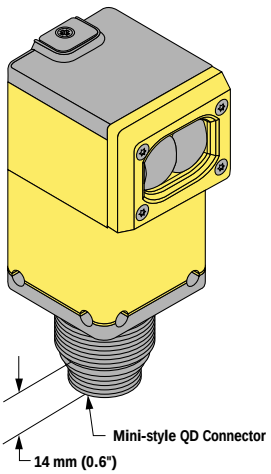
OMNI-BEAM Dimensions – Sensor Head Shown Assembled to Power Block

OMNI-BEAM Sensor with Attached Cable

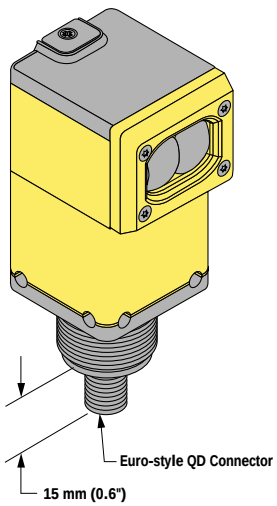


OMNI-BEAM Sensor with Quick Disconnect

Mini-Style

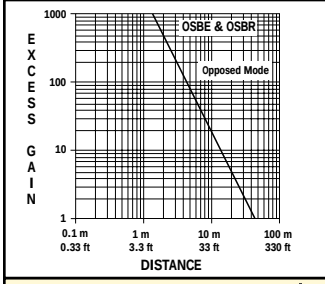


Euro-Style

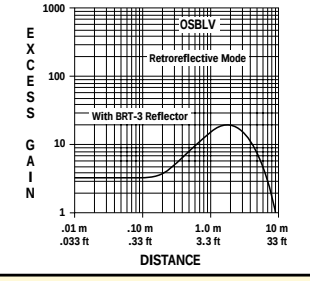


Excess Gain Curves

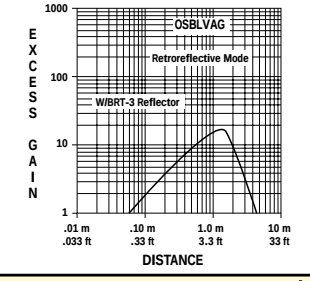
OSBE & OSBR (Opposed)



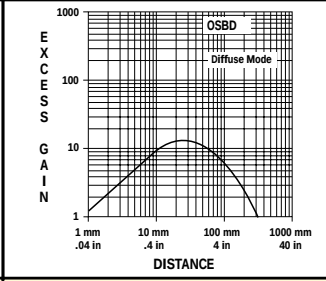
OSBLV (Retroreflective)



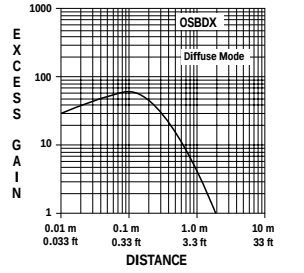
OSBLVAG (Polarized Retroreflective)



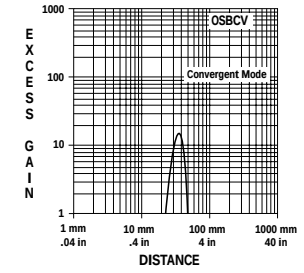
OSBD (Diffuse)



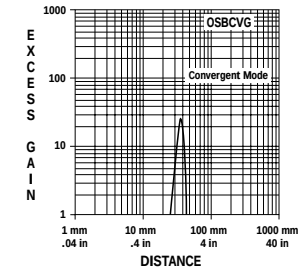
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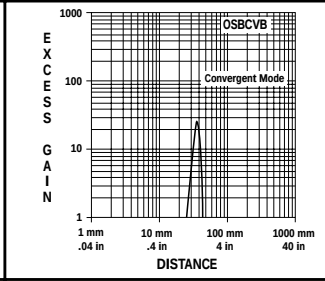
OSBCV (Convergent)



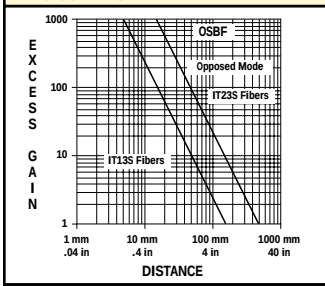
OSBCVG (Convergent)



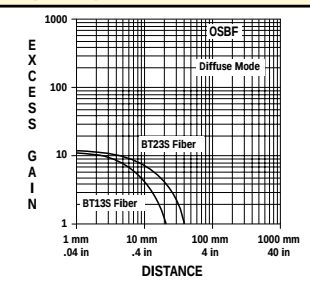
OSBCVB (Convergent)



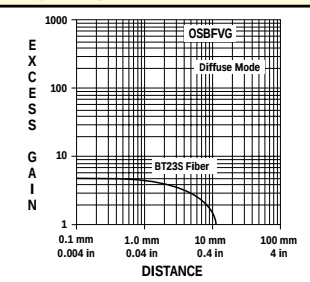
OSBF (Opposed)



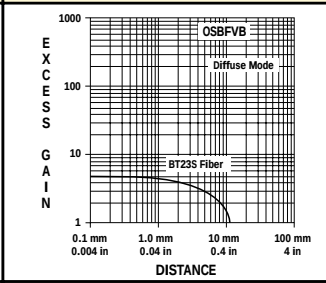
OSBF (Diffuse)



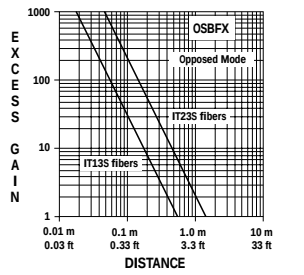
OSBFVG (Diffuse)



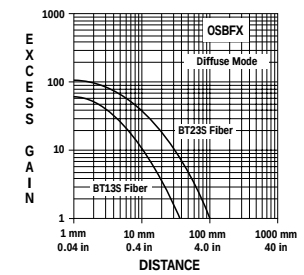
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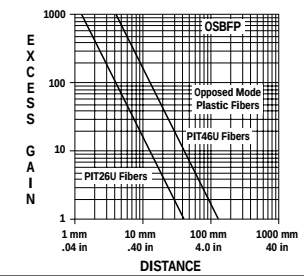
OSBFX (Opposed)



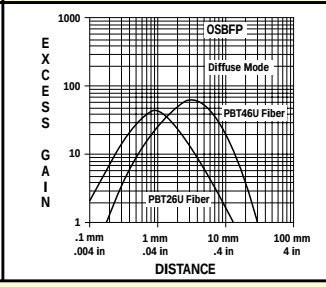
OSBFX (Diffuse)



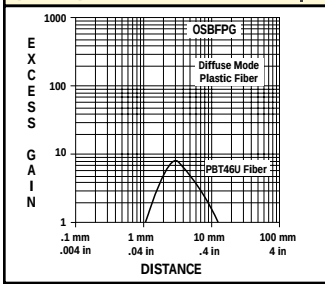
OSBFP (Opposed)



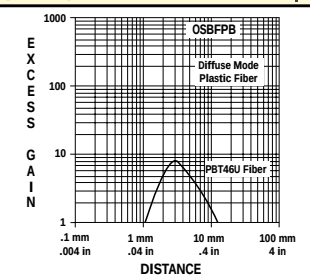
OSBFP (Diffuse)



OSBFPG (Diffuse)



OSBFPB (Diffuse)

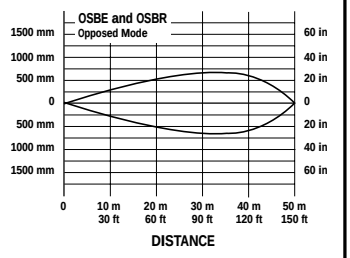


OSBLVAGC:	Refer to data sheet p/n 34151
OSBFV:	Refer to data sheet p/n 03543
OSBEF/OSBRF:	Refer to data sheet p/n 03546
OSBFAC:	Refer to data sheet p/n 03553

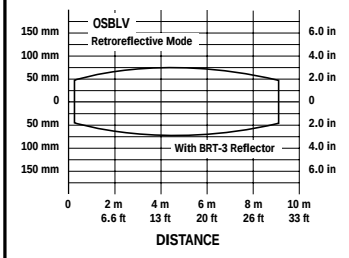
OMNI-BEAM Sensor Heads

Beam Patterns

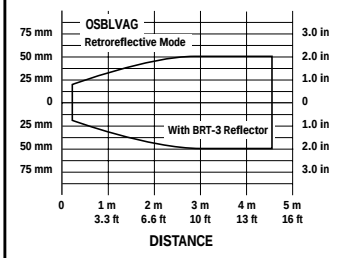
OSBE & OSBR (Opposed)



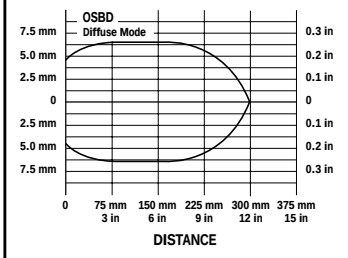
OSBLV (Retroreflective)



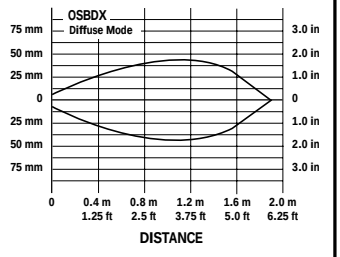
OSBLVAG (Polarized Retroreflective)



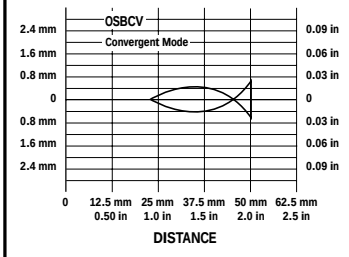
OSBD (Diffuse)



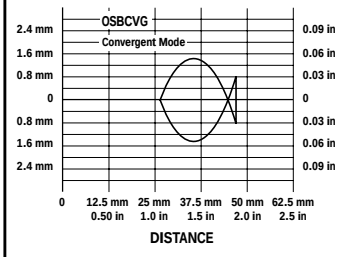
OSBDX (Diffuse)



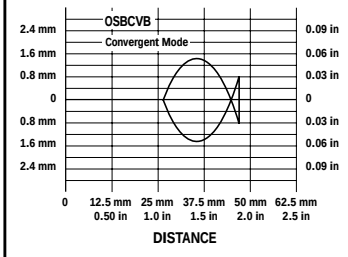
OSBCV (Convergent)



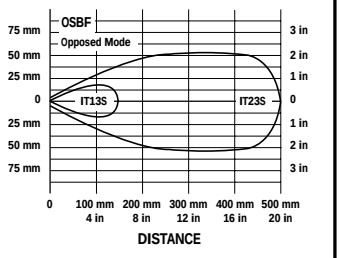
OSBCVG (Convergent)



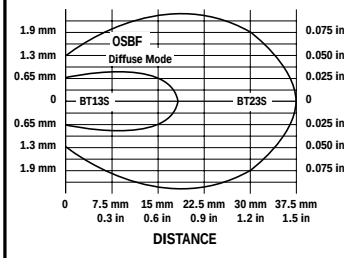
OSBCVB (Convergent)



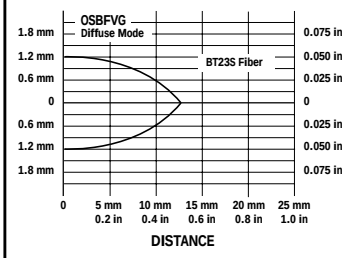
OSBF (Opposed)



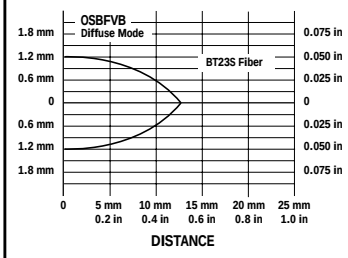
OSBF (Diffuse)



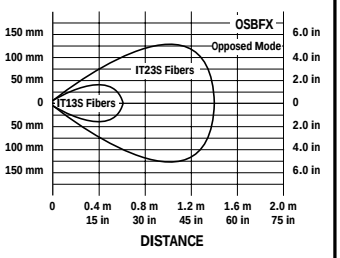
OSBFVG (Diffuse)



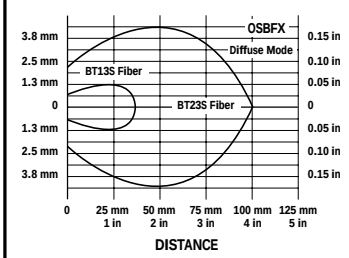
OSBFVB (Diffuse)



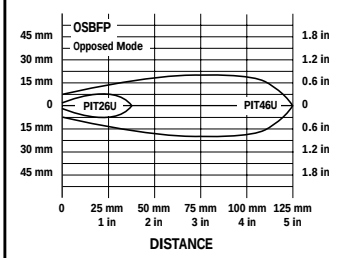
OSBFX (Opposed)



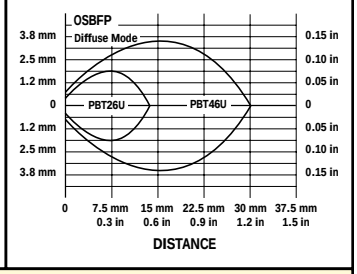
OSBFX (Diffuse)



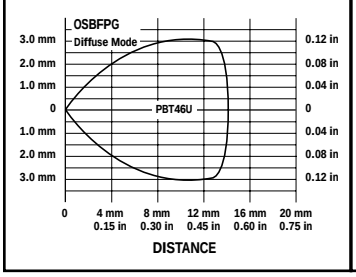
OSBFP (Opposed)



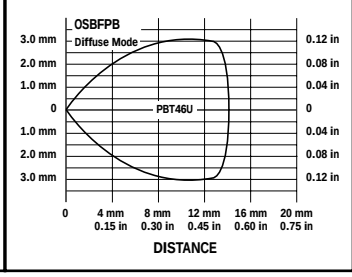
OSBFP (Diffuse)



OSBFPG (Diffuse)



OSBFPB (Diffuse)



OSBLVAGC: Refer to data sheet p/n 34151

OSBFV: Refer to data sheet p/n 03543

OSBEF/OSBRF: Refer to data sheet p/n 03546

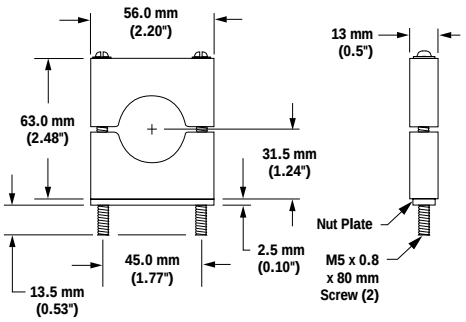
OSBFAC: Refer to data sheet p/n 03553

Accessories

Mounting Brackets

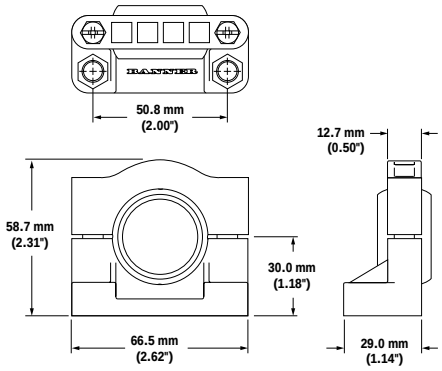
SMB30C

- 30 mm split clamp, black reinforced thermoplastic polyester
- Stainless steel hardware included



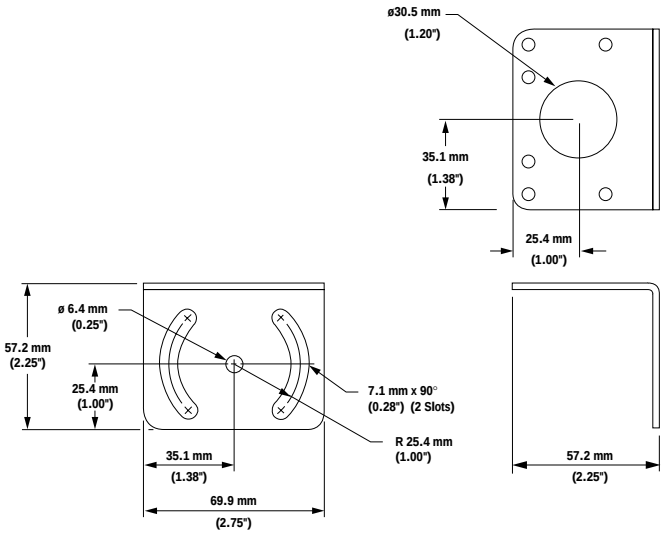
SMB30SC

- Compact 30 mm swivel bracket
- Excellent range of articulation



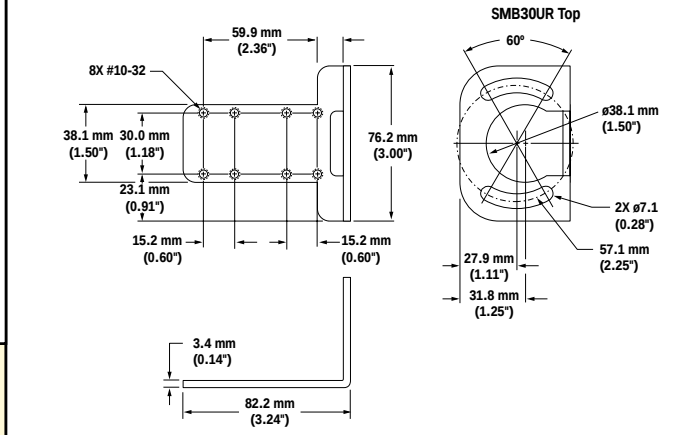
SMB30MM

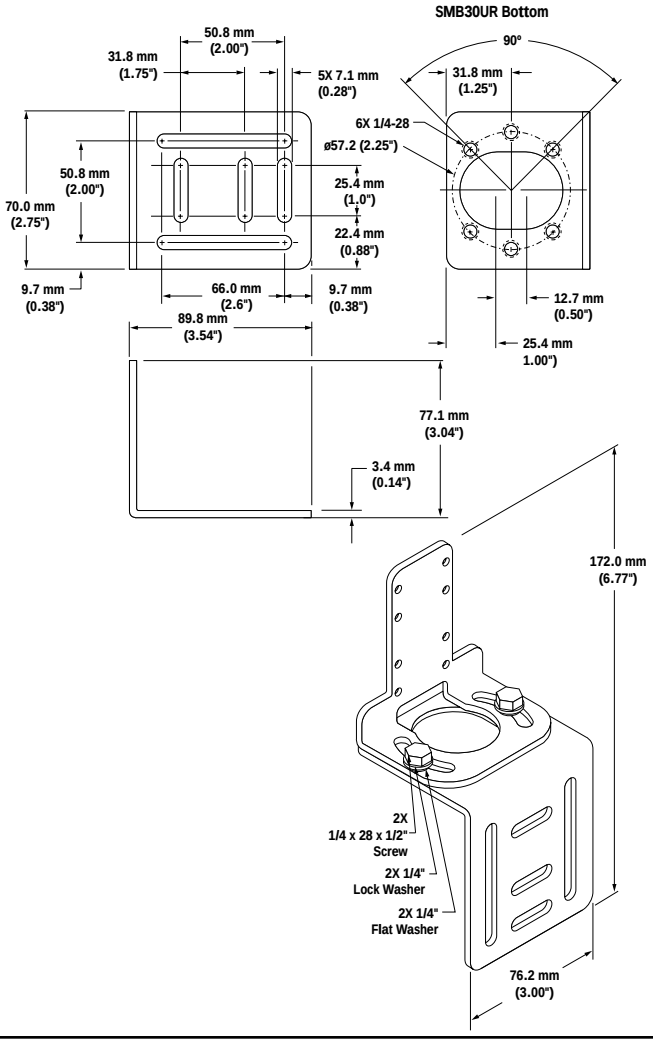
- 30 mm, 11-gauge stainless steel
- Clearance for M6 (1/4") hardware



SMB30UR

- Rugged stainless steel construction
- Swivel mount





OMNI-BEAM Sensor Heads

Retroreflective Targets

Banner offers a wide selection of high-quality retroreflective targets. See Banner Product Catalog for complete information.

Replacement Lenses

OMNI-BEAM lens assemblies are field-replaceable.

Model	Description
OUC-C	Replacement lens for convergent models (model suffix CV)
OUC-D	Replacement lens for short range diffuse models (model suffix D)
OUC-F	Replacement lens for glass fiber optic models (model suffix F, FAC, FV, FX, EF, and RF)
OUC-FP	Replacement lens for plastic fiber optic models (model suffix FP)
OUC-L	Replacement lens for non-polarized retroreflective and opposed models (model suffix DX, LV, E and R)
OUC-LAG	Replacement lens for polarized retroreflective models (model suffix LVAG and LVAGC)

Cable Protector

Model	Description	
HF1-2NPS	• Flexible black nylon cable protector • Includes a neoprene gland that compresses around the OMNI-BEAM cable to provide an additional seal against moisture • Resistant to gasoline, alcohol, oil, grease, solvents and weak acids • Working temperature range of -30° to +100°C (-22° to +212°F)	

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