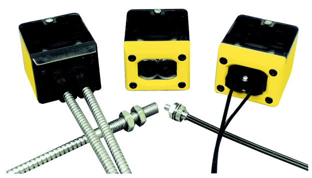
OMNI-BEAM™ Sensor Head

Datasheet



- Separate indicators for target sensed and output energized
- Sensor head and power block plug (and bolt) together quickly and easily
- Choose power blocks for high-voltage ac or low-voltage (10 to 30 V) dc operation
- Optional plug-in output timing modules may be added at any time
- Sensor heads feature Banner's D.A.T.A.™ (Display And Trouble Alert) indicator system[1], 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
- 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

> 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.

Sensor Head Models

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.

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

[1] U.S. Patent 4965548

Model	Sensing Mode	Light Source	Range	Response Time	Repeatability
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	Glass fiber optic emitter	Infrared, 880 nm	Range varies with fiber optics used	2 ms	0.01 ms
OSBRF	Glass fiber optic receiver				
OSBFAC	Glass fiber optic–ac-coupled	Infrared, 880 nm	Range varies with fiber optics used	1 ms	0.01 ms
OSBFP	Plastic fiber optic	Visible red, 650 nm	Range varies with fiber optics used	2 ms	0.1 ms
OSBFPG		Visible green, 525 nm			
OSBFPB		Visible blue, 475 nm			

Power Block Models

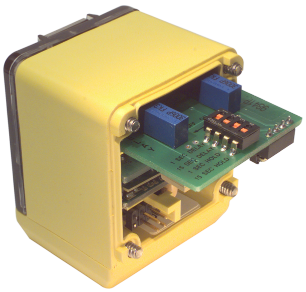
The power block determines the sensor operating voltage and also the sensor output switch configuration. Models are available with a built-in 2 m (6.5 ft) or 9 m (30 ft) cable, or with either Mini-style or Euro-style quick-disconnect (QD) plug-in cable fittings. Emitter power blocks have no output circuitry.

DC Voltage Models (see datasheet 03532 packed with the power block)			
Model	Cable	Supply Voltage	Output Type
OPBT2	2 m (6.5 ft)	10–30 V dc	Bi-Modal™
OPBT2QD	4-Pin Mini QD		NPN/PNP
OPBT2QDH	4-Pin Euro QD		Two outputs: Load and Alarm
OPBTE	2 m (6.5 ft)		No output, for powering emitter only sensor heads
OPBTEQD	4-Pin Mini QD		
OPBTEQDH	4-Pin Euro QD		

AC Voltage Models (see datasheet 03531 packed with the power block)			
Model	Cable	Supply Voltage	Output Type
OPBA2	2 m (6.5 ft)	105–130 V ac	SPST solid-state ac relay Two outputs: Load and Alarm
OPBA2QD	5-Pin Mini QD		
OPBB2	2 m (6.5 ft)	210–250 V ac	
OPBB2QD	5-Pin Mini QD		
0PBAE	2 m (6.5 ft)	105–130 V ac	No output, for powering emitter only sensor heads
OPBAEQD	5-Pin Mini QD		
OPBBE	2 m (6.5 ft)	210–250 V ac	
OPBBEQD	5-Pin Mini QD		

To order the 9 m (30 ft) cable models, add the suffix “w / 30” to the model number of any cabled power block (for example, OPBT2 w / 30).

Optional Timing Logic Module Models



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. Program them for timing functions and ranges via four DIP switches; each module includes easily accessible 15-turn clutched potentiometers for accurate timing adjustments.

See datasheet 03533 packed with the timing logic modules for more information.

Model	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

Overview

OMNI-BEAM is a modular self-contained sensor 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, 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.

Configuration Instructions

Programming the Sensor Head

OMNI-BEAM sensor heads are field-programmable for four operating parameters. To access the four programming DIP switches, remove the sensor block from the power block.

Figure 1. OMNI-BEAM DIP switch location

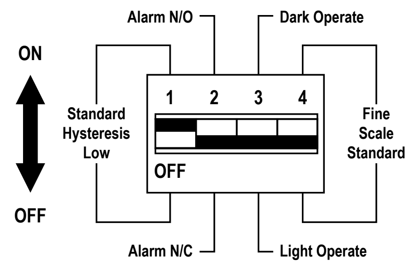


Figure 2. OMNI-BEAM DIP switch configuration

DIP Switch #1 - Sensing Hysteresis

ON: Standard hysteresis (factory default)
OFF: Low hysteresis

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. Low hysteresis should be used only when all sensing conditions remain completely stable.

DIP 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) (factory default)

Normally closed mode (OFF) is recommended, which 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.

DIP Switch #3 - Light or Dark Operate

ON: Dark Operate mode
OFF: Light Operate mode (factory default)

For 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).

For 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).

DIP Switch 4 - Scale Factor for the D.A.T.A Signal Strength Indicator Display

ON: Fine scale
OFF: Standard scale (factory default)

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

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 (LED). When programmed for Dark Operate, it lights when the received light signal falls below the #5 threshold.

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

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:

Excess gain (EG) = Light energy falling on receiver ÷ 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 "1×." The chart below shows how excess gain relates to the D.A.T.A. light array indication.

D.A.T.A. Light LED	Standard Scale Factor	Fine Scale Factor
1	0.25× Excess Gain	0.5× Excess Gain
2	0.35× Excess Gain	0.7× Excess Gain
3	0.5× Excess Gain	0.8× Excess Gain
4	0.7× Excess Gain	0.9× Excess Gain
5	1× Excess Gain	1× Excess Gain
6	1.3× Excess Gain	1.1× Excess Gain
7	1.7× Excess Gain	1.2× Excess Gain
8	2.2× Excess Gain	1.3× Excess Gain
9	2.9× Excess Gain	1.7× Excess Gain
10	3.7× Excess Gain (or more)	2.2× Excess Gain (or more)

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:

Contrast = Excess gain (light condition) ÷ 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: 2.2× excess gain

Dark condition: 0.35× excess gain

Contrast = 2.2× ÷ 0.35×= 6

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

The best sensor adjustment causes 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):

Contrast is greater than 3.7× ÷ 0.25× = 15

Although 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.

Contrast Values and Corresponding Guidelines	
Contrast	Recommendation
10 or greater	Excellent Contrast—Sensing should remain reliable as long as the sensing system has enough excess gain for operation.

Specifications

Supply Voltage and Current
Supplied by the OMNI-BEAM Power Block

Output Response Time
See individual sensing heads for response times
200 millisecond delay on power-up: outputs are non-conducting during this time.

Construction
Sensor heads are molded of rugged reinforced thermoplastic polyester; top view window is 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
−40 °C to +70 °C (−40 °F to +158 °F)
90% at +50 °C maximum relative humidity (non-condensing)

Certifications

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.
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
Banner's exclusive D.A.T.A. sensor self-diagnostic system warns of marginal sensing conditions usually before a sensing failure occurs (except on model OSBFAC).

Required Overcurrent Protection

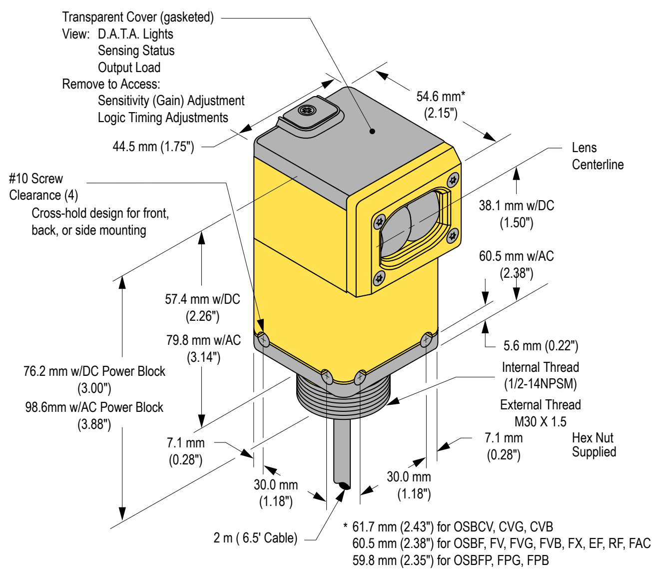
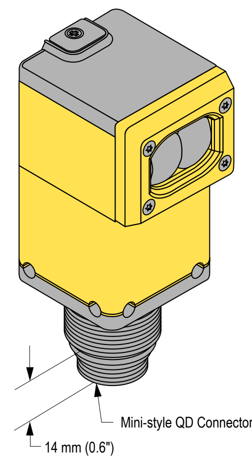
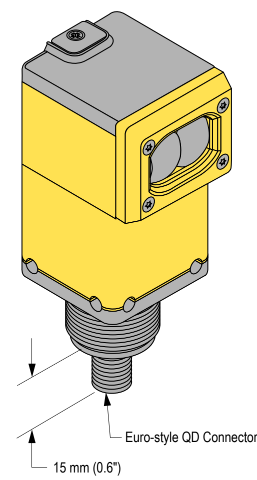
WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

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 *http://www.bannerengineering.com*.

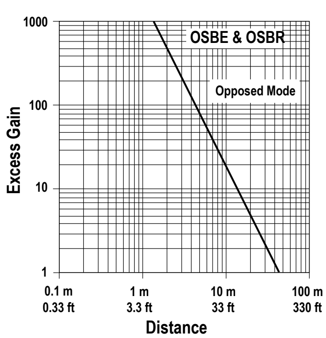
Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

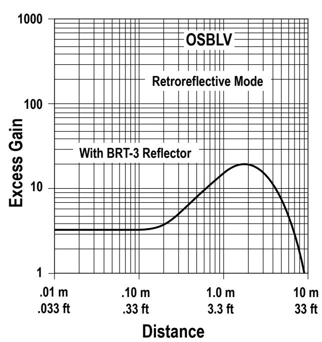
Dimensions

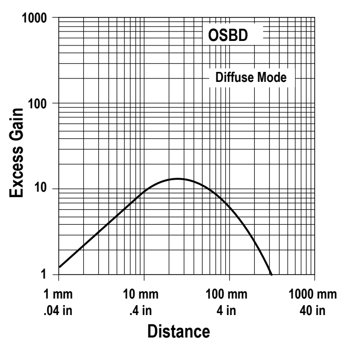
The sensor head is shown assembled to the power block.

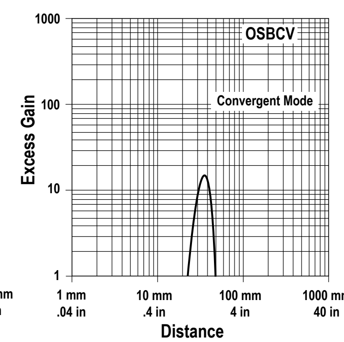
Sensor with Attached Cable	Sensor with Mini-Style QD	Sensor with Euro-style QD
		

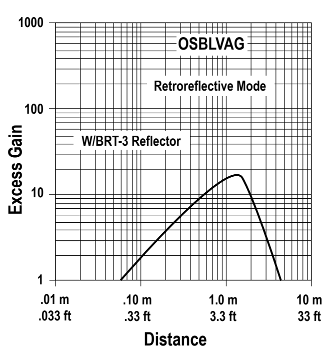
Performance Curves - Excess Gain

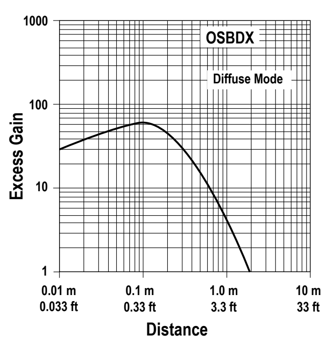


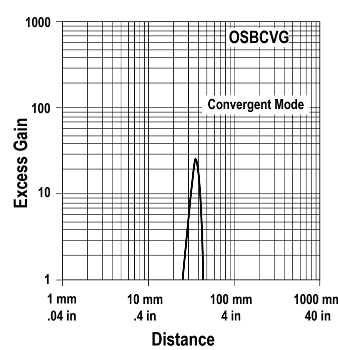


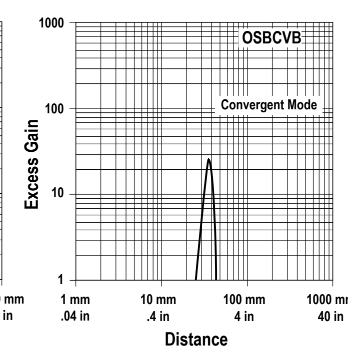




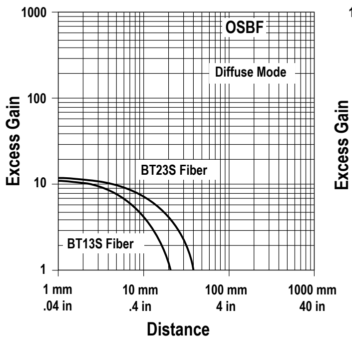


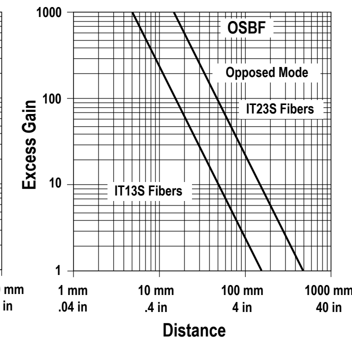


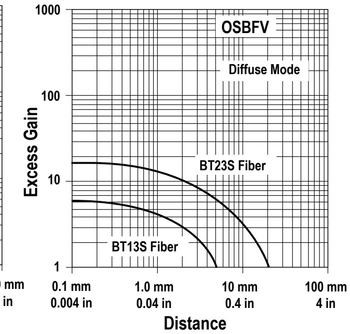


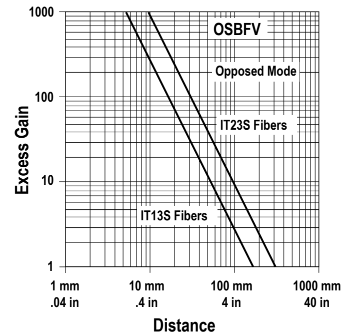


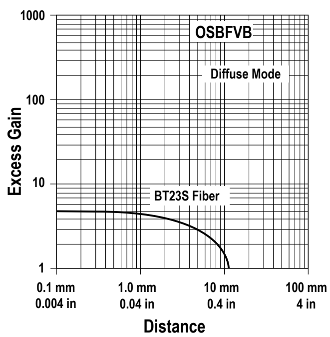
Glass Fiber

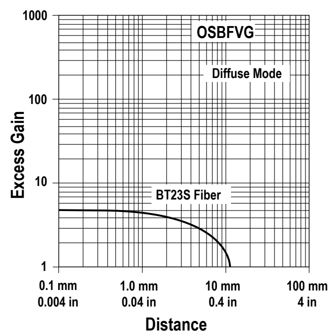


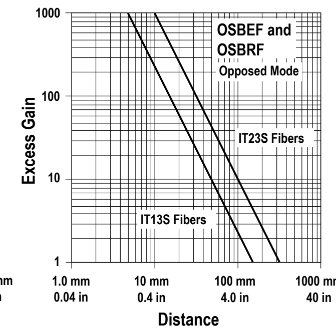


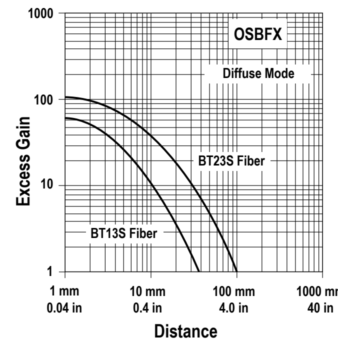


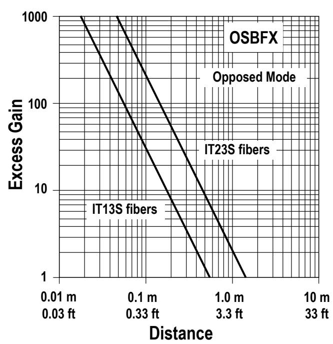






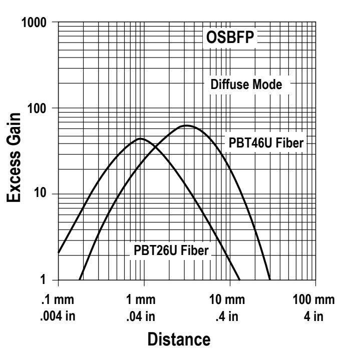


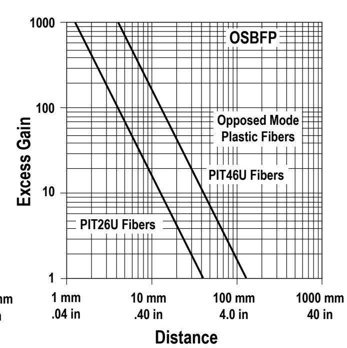


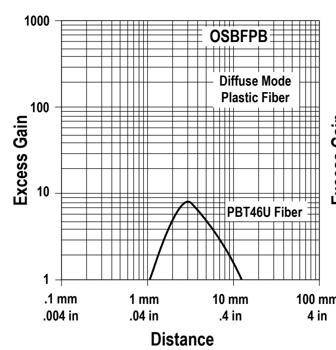


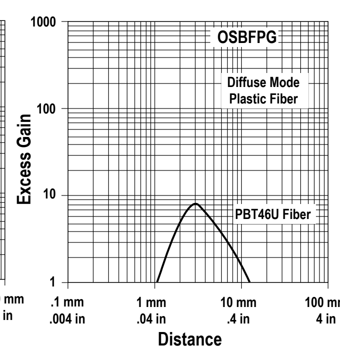
OSBFAC: Refer to datasheet p/n 03553

Plastic Fiber







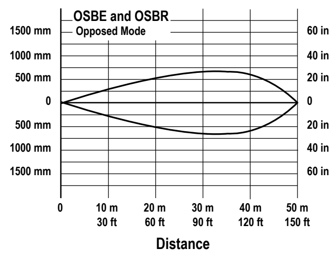


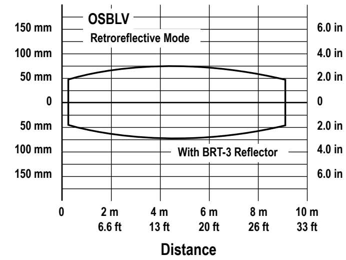
OSBLVAGC: Refer to datasheet p/n 34151

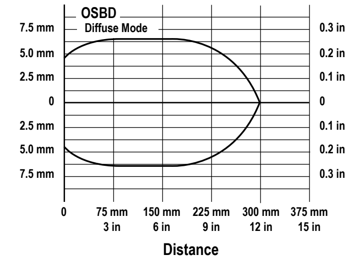
OSBEF/OSBRF: Refer to datasheet p/n 03546

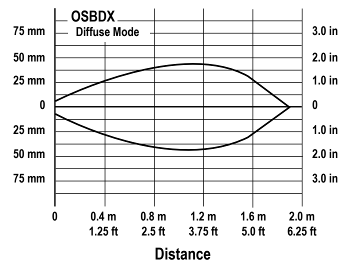
OSBFAC: Refer to datasheet p/n 03553

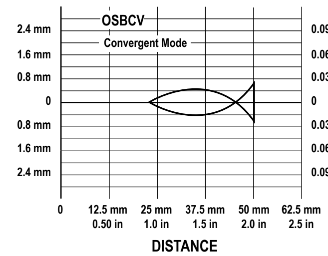
Performance Curves - Beam Pattern

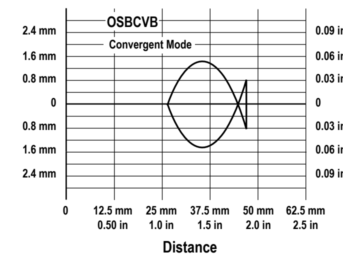


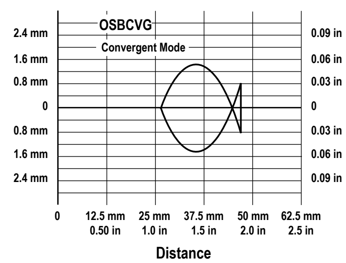


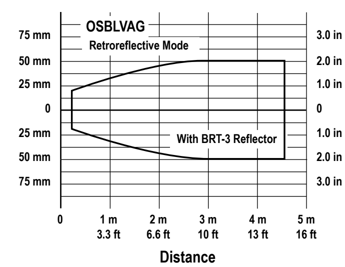






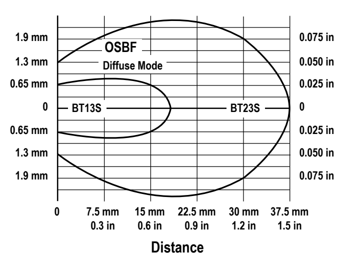


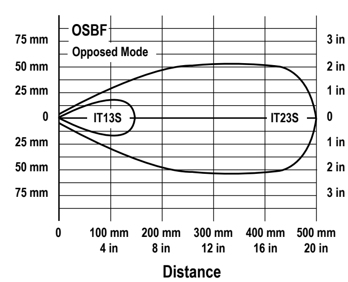


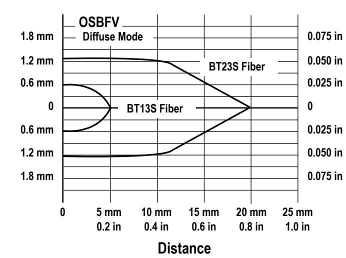


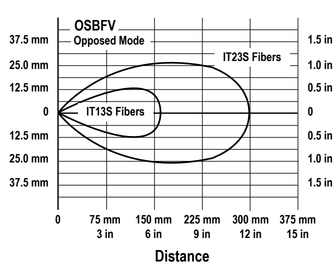
OSBLVAGC: Refer to datasheet p/n 34151

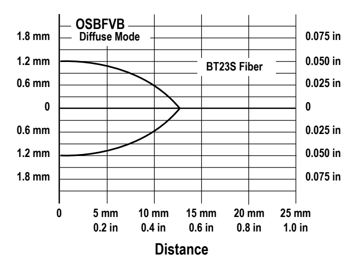
Glass Fiber

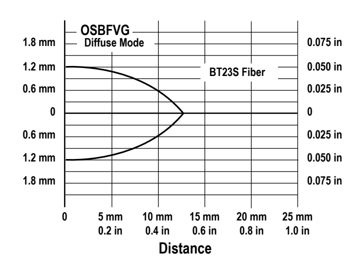




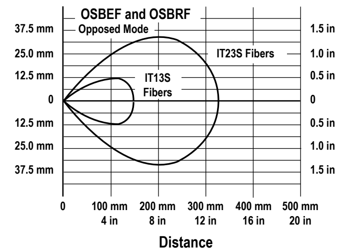


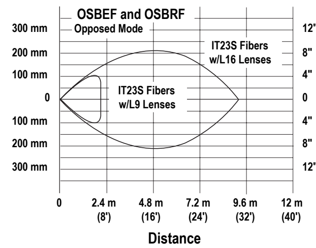


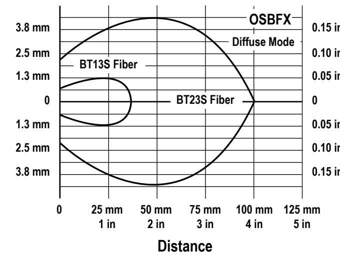


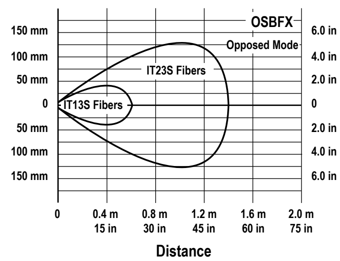


Glass Fiber

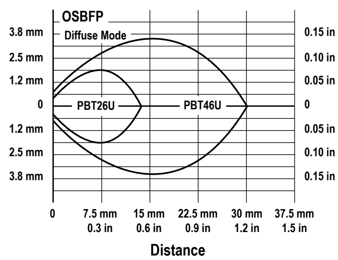


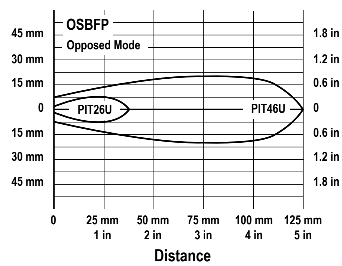


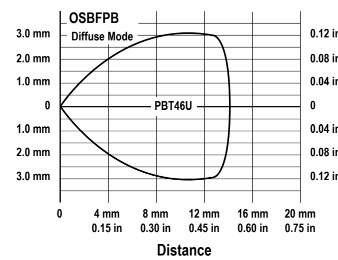


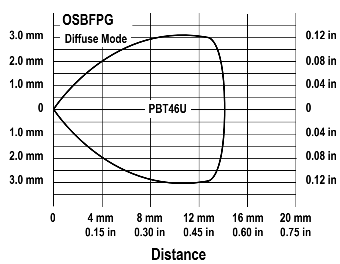


Plastic Fiber









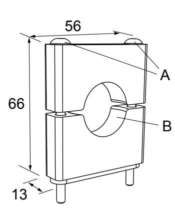
OSBFAC: Refer to datasheet p/n 03553

Accessories

Brackets

SMB30C

- 30 mm split clamp, black PBT bracket
- Stainless steel mounting hardware included
- Mounting hole for 30 mm sensor

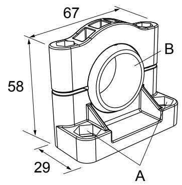
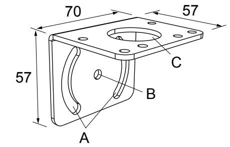


Hole center spacing: A=ø 45
Hole size: B=ø 27.2

SMB30UR

- 2-piece universal swivel bracket for limit-switch style sensors
- 300 series stainless steel
- Stainless steel swivel locking hardware included

Hole center spacing: A to B=31.8, B to C=19.0, A to C=50.8, D=50.8
Hole size: C=6.9x32, D=73.0x6.9

Brackets	
SMB30SC • Swivel bracket with 30 mm mounting hole for sensor • Black reinforced thermoplastic polyester • Stainless steel mounting and swivel locking hardware included  Hole center spacing: A=ø 50.8 Hole size: A=ø 7.0, B=ø 30.0	SMB30MM • 12-ga. stainless steel bracket with curved mounting slots for versatile orientation • Clearance for M6 (¼ in) hardware • Mounting hole for 30 mm sensor  Hole center spacing: A = 51, A to B = 25.4 Hole size: A = 42.6 x 7, B = ø 6.4, C = ø 30.1

Retroreflective Targets — Banner offers a wide selection of high-quality retroreflective targets. See the 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 °C to +100 °C (–22 °F to +212 °F)

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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