# Features

- Advanced one-piece photoelectric sensors with outstanding optical performance and extremely rugged design
- 90 V AC to 250 V AC
- Protected solid-state relay output; 300 mA maximum load at up to 250 V AC
- Multiple sensing modes include: opposed, diffuse, retroreflective and convergent, plus glass and plastic fiber optic models
- Selectable light/dark operate
- Versatile plug-in modules available for output timing logic and/or signal strength display
- Highly visible Power, Signal (AID™ System[1]), and Output indicator LEDs
- Choice of prewired 2 m (6.5 ft) or 9 m (30 ft) unterminated cable, plus Mini-style or Micro-style quick-disconnect fittings
- Versatile mounting options
- Designed to withstand 1200 psi washdown; exceeds its NEMA 6P and IEC IP67 rating



**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.

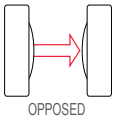
# Models

To order the 9 m (30 ft) PVC cable model, add the suffix "W/30" to the cabled model number. For example, **Q452E W/30**. A model with a quick disconnect (QD) connector requires a mating cable.

For a list of discontinued models, see Discontinued Models.

## Q45W22 Opposed-Mode Emitter (E) and Receiver (R) Models

In opposed-mode sensing, the sensor's emitter and receiver are housed in two separate units. The emitter is placed opposite the receiver so that the light beam goes directly from the emitter to the receiver. An object is detected when it breaks the working part of the light beam, known as the effective beam.




Because of their extremely high excess gain, these opposed-mode sensors are an excellent option for sensing in contaminated or dirty areas, and are also the best choice for long-range sensing.

Sensing beam: Infrared, 880 nm

| Models | Range | Cable | Supply Voltage | Output Type |
|---|---|---|---|---|
| **Q452E** Emitter | 60 m (200 ft) | 2-wire 2m (6.5 ft) | 90 V AC to 250 V AC | SPST Solid-state Relay |
| **Q45BW22R** Receiver | | 3-wire 2m (6.5 ft) | | |
| **Q452EQ** Emitter | | 3-pin Mini QD | | |
| **Q452EQ1** Emitter | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD | | |
| **Q45BW22RQ** Receiver | | 3-pin Mini QD | | |
| **Q45BW22RQ1** Receiver | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD | | |

## Q45BW22 Retroreflective-Mode Models

A retroreflective sensor contains both the emitter and receiver elements. The effective beam is established between the emitter, the retroreflector, and the receiver. As with an opposed-mode sensor, an object is sensed when it interrupts or "breaks" the effective beam.

[1] U.S. Patent no. 4356393

Original Instructions
12-May-26

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

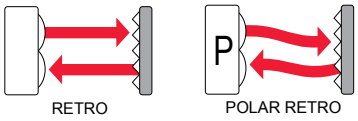
37209
p/n: 37209 Rev. I

ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

The visible red sensing beam of these sensors makes them very easy to align. Model Q45BW22LP polarizes the emitted light and filters out unwanted reflections, making sensing possible in applications otherwise considered unsuited to retroreflective sensing.

Performance is specified using the model BRT-3 3-inch reflector (go to www.bannerengineering.com for more information).

Sensing beam: Visible red, 680 nm

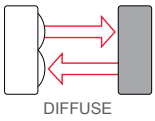



| Non-Polarized Models | | | | |
|---|---|---|---|---|
| **Models** | **Range** | **Cable** | **Supply Voltage** | **Output Type** |
| **Q45BW22LV** | 0.08 to 9 m (3 in to 30 ft) | 3-wire 2 m (6.5 ft) | 90 V AC to 250 V AC | SPST Solid-state Relay |
| **Q45BW22LVQ** | | 3-pin Mini QD | | |
| **Q45BW22LVQ1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD | | |

| Polarized Models | | | | |
|---|---|---|---|---|
| **Models** | **Range** | **Cable** | **Supply Voltage** | **Output Type** |
| **Q45BW22LP** | 0.15 to 6 m (6 in to 20 in) | 3-wire 2 m (6.5 ft) | 90 V AC to 250 V AC | SPST Solid-state Relay |
| **Q45BW22LPQ** | | 3-pin Mini QD | | |
| **Q45BW22LPQ1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD | | |

## Q45BW22 Diffuse-Mode Models

In diffuse-mode sensing, light emitted from the sensor strikes the surface of the object to be detected and is reflected back to the receiver, which is housed with the emitter. With a diffuse-mode sensor, the object is detected when it "makes" the beam, that is, the object reflects the sensor's transmitted light energy back to the sensor.




These diffuse-mode models detect objects by sensing the reflection of their own emitted light. Ideal for use when the reflectivity and profile of the object to be sensed are sufficient to return a large percentage of emitted light back to the sensor.

Model Q45BW22DX is the first choice for diffuse-mode applications when there are no background objects to falsely return light.

Sensing beam: Infrared, 880 nm

| Short Range | | | | |
|---|---|---|---|---|
| **Model** | **Range** | **Cable** | **Supply Voltage** | **Output Type** |
| **Q45BW22D** | 45 cm (18 in) | 3-wire 2 m (6.5 ft) | 90 V AC to 250 V AC | SPST Solid-state Relay |
| **Q45BW22DQ** | | 3-pin Mini QD | | |
| **Q45BW22DQ1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD | | |

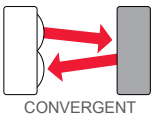
| Long Range | | | | |
|---|---|---|---|---|
| **Model** | **Range** | **Cable** | **Supply Voltage** | **Output Type** |
| **Q45BW22DL** | 1.8 m (6 ft) | 3-wire 2 m (6.5 ft) | 90 V AC to 250 V AC | SPST Solid-state Relay |
| **Q45BW22DLQ** | | 3-pin 7/8 in-16UNF QD | | |
| **Q45BW22DLQ1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD | | |

| High Power | | | | |
|---|---|---|---|---|
| **Model** | **Range** | **Cable** | **Supply Voltage** | **Output Type** |
| **Q45BW22DX** | 3 m (10 ft) | 3-wire 2 m (6.5 ft) | 90 V AC to 250 V AC | SPST Solid-state Relay |
| **Q45BW22DXQ** | | 3-pin 7/8 in-16UNF QD | | |
| **Q45BW22DXQ1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD | | |


© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

## Q45BW22 Convergent-Mode Models

Convergent-mode sensors use a lens system to focus the emitter and receiver elements to an exact point in front of the sensor. Like diffuse-mode and divergent-mode sensors, convergent-mode sensors detect an object when that object completes or "makes" the light beam. This design produces a small, intense, and well-defined sensing area, at a fixed distance from the sensor lens. It is a very efficient use of reflective energy.




These sensors are ideal for reflective sensing of very small parts or profiles, and can accurately sense the position of parts approaching from the side. Ignores all but highly reflective objects that are outside of the sensing range.

Sensing beam: Visible red, 680 nm

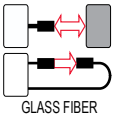
| Models | Focus | Cable | Supply Voltage | Output Type |
|---|---|---|---|---|
| **Q45BW22CV** | 38 mm (1.5 in)<br>Spot Size at Focus: 1.3 mm (0.05 in) | 3-wire 2 m (6.5 ft) | 90 V AC to 250 V AC | SPST Solid-state Relay |
| **Q45BW22CVQ** | | 3-pin Mini QD | | |
| **Q45BW22CV4Q** | 100 mm (4 in)<br>Spot Size at Focus: 1.5 mm (0.06 in) | 3-pin Mini QD | 90 V AC to 250 V AC | SPST Solid-state Relay |

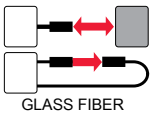
## Q45BW22 Glass Fiber-Optic Models

These models are an excellent choice for glass fiber optic applications where faster sensor response is not important. Their high excess gain means that opposed individual fibers can operate reliably in many very hostile environments.

Also, special miniature bifurcated fiber optic assemblies with bundle sizes as small as 0.5 mm (0.020 in) dia. may be used successfully for diffuse-mode sensing when using sensor model Q45BW22F(Q).

For more information on compatible glass fiber optics, go to www.bannerengineering.com.



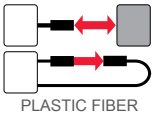




| Infrared, 880 nm | | | | |
|---|---|---|---|---|
| **Models** | **Range** | **Cable** | **Supply Voltage** | **Output Type** |
| **Q45BW22F** | Range varies by sensing mode and fiber optics used | 3-wire 2 m (6.5 ft) | 90 V AC to 250 V AC | SPST Solid-state Relay |
| **Q45BW22FQ** | | 3-pin Mini QD | | |
| **Q45BW22FQ1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD | | |

## Q45BW22 Plastic Fiber-Optic Models

Lower in cost than glass fiber optics, plastic fiber optics are ideal for use in situations where environmental conditions allow (for example, low levels of acids, alkalis, and solvents). Most are easily cut to length in the field, and are available in a variety of sensing end styles.

For more information on compatible plastic fiber optics, go to www.bannerengineering.com.




Sensing beam: Visible red, 660 nm

| Model | Range | Cable | Supply Voltage | Output Type |
|---|---|---|---|---|
| **Q45BW22FP** | Range varies by sensing mode and fiber optics used | 3-wire 2 m (6.5 ft) | 90 V AC to 250 V AC | SPST Solid-state Relay |
| **Q45BW22FPQ** | | 3-pin 7/8 in-16UNF QD | | |
| **Q45BW22FPQ1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD | | |

# Overview

Status indicator LEDs for power, signal, and output are clearly visible beneath a raised dome in the sensor's transparent o-ring-sealed polycarbonate cover. Also located beneath the sensor's o-ring-sealed cover are controls for light/dark operate selection and the sensitivity adjustment.

- The power indicator (green) lights when power is applied to the sensor.
- The signal indicator (red) lights when the sensor sees its modulated light source and pulses at a rate proportional to the strength of the received light signal; this is the AID™ Alignment Indicating Device[(2)].

[(2)] US patent no. 4356393


© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

- The output indicator (amber) lights when the sensor's output is conducting. This indicator is especially useful when a timing logic module is used and signal and output conditions are not concurrent.

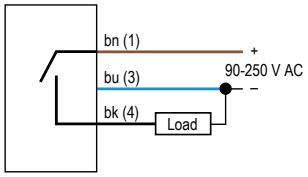
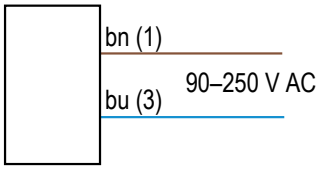
In dark operate (DO) mode, the output is ON when the target returns less light to the sensor than the configured target and OFF when the sensor detects more light than the configured/taught target. In light operate (LO) mode, the output is ON when the target returns the same or more light to the sensor and OFF when the sensor detects less light than the configured/taught target. In **opposed and retroreflective sensing modes**, dark operate is active when the beam is blocked. In **diffuse, fixed field, and adjustable field sensor modes**, dark operate is active when the target is absent.

In light operate (LO) mode, the output is ON when the target returns the same or more light to the sensor and OFF when the sensor detects less light than the configured/taught target. In **opposed and retroreflective sensing modes**, light operate is active when the beam is unblocked. In **diffuse, fixed field, and adjustable field sensor modes**, light operate is active when the target is present.

1. LEDs
   - Green LED: Power on indicator
   - Red LED: Signal indicator
   - Amber LED: Output status indicator
2. Optional LED signal strength display
3. Optional timing adjustment
4. Optional timing adjustment
5. Light/dark operate switch



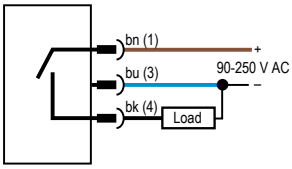
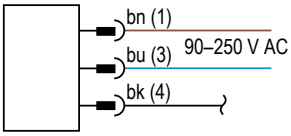
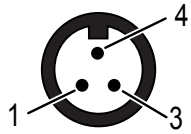

# Wiring Diagram

| Attached Cable | Emitter with Attached Cable | |
|---|---|---|
|  |  | 1 = Brown<br>3 = Blue<br>4 = Black |





*3-pin Mini quick disconnect models*

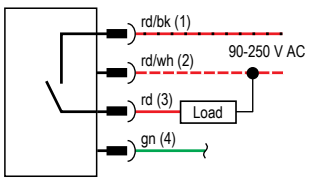
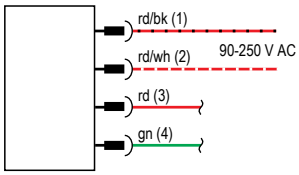
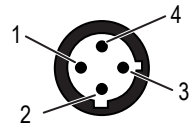
| 3-pin (model suffix Q) | Emitter with 3-pin (model suffix Q) | 3-pin Mini male pinout |
|---|---|---|
|  |  | <br>1 = Brown<br>3 = Blue<br>4 = Black |







*1/2 in-20UNF (1/2-in dual key) quick disconnect models*

| 4-pin QD (model suffix Q1) | Emitter with 4-pin QD (model suffix Q1) | 4-pin male pinout |
|---|---|---|
|  |  | <br>1 = Red and black<br>2 = Red and white<br>3 = Red<br>4 = Green |







# Specifications

**Supply Voltage and Current**

90 V AC to 250 V AC (50 to 60 Hz)

Average current: 20 mA

Peak current: 500 mA at 120 V AC, 750 mA at 250 V AC

**Supply Protection Circuitry**

Protected against transient voltages

**Output Configuration**

Short circuit/overload protected FET solid-state relay


© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

### Repeatability

Opposed mode: 0.25 milliseconds

All other sensing modes: 0.5 milliseconds

Response time and repeatability specifications are independent of signal strength.

### Adjustments

Located under the sensor's transparent cover: Light/Dark Operate select switch; and multi-turn Sensitivity control (allows precise sensitivity setting—turn clockwise to increase gain). Optional logic and logic/display modules have adjustable timing functions.

### Output Rating

Continuous current: 300 mA max. to 50 °C (derate to 200 mA at 70 °C, 5 mA/°C)

Inrush current: 3 A maximum for 100 milliseconds, 5 A maximum for 1 millisecond

Off-state leakage current: <100 microamps

Saturation voltage: <3 V at 200 mA

### Construction

Molded reinforced thermoplastic polyester housing, o-ring-sealed transparent polycarbonate cover, molded acrylic lenses, and stainless steel hardware. Q45s are designed to withstand 1200 psi washdown. The base of cabled models has a 1/2-in NPS integral internal conduit thread.

### Output Protection Circuitry

Manually-resettable output latch-out trips in the event of an output overload or short circuit condition. The green Power LED flashes to indicate the latch-out. To reset the output, remove power to the sensor and load for 5 seconds, then restore power.

### Output Response Time

Opposed mode: 2 milliseconds ON, 1 millisecond OFF

All other sensing modes: 2 milliseconds ON/OFF

**NOTE:** 100 millisecond delay on power-up. Output is non-conducting during this time.

### Indicators

Indicator LEDs are clearly visible beneath a raised transparent polycarbonate dome on top of the sensor.

**Power (green) LED:** Lights whenever 90 V ac to 250 V ac power is applied, and flashes to indicate output overload or output short circuit

**Signal (red) AID™ System LED:** Lights whenever the sensor sees its modulated light source, and pulses at a rate proportional to the strength of the received light signal

**Load (amber) LED:** Lights whenever the output relay is energized

**Optional 7-element LED:** Signal strength display module

### Connections

PVC-jacketed 2 m (6.5 ft), 9 m (30 ft) cables, 3-pin Mini (Q suffix models), or 4-pin 1/2 in-20UNF (1/2-in Dual Key) (Q1 suffix models) quick-disconnect (QD) fittings, depending on the model ordered. QD cables are ordered separately.

### Application Notes

Optional output timing modules are available.

### Operating Conditions

–40 °C to +70 °C (–40 °F to +158 °F)

90% at +50 °C maximum relative humidity (non-condensing)

### Environmental Rating

NEMA 6P, IP67

### Certifications

Banner Engineering BV
Park Lane, Culliganlaan 2F bus 3
1831 Diegem, BELGIUM

### 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.

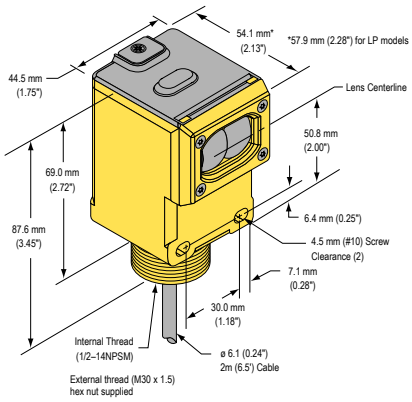
| Supply Wiring (AWG) | Required Overcurrent Protection (A) | Supply Wiring (AWG) | Required Overcurrent Protection (A) |
|---|---|---|---|
| 20 | 5.0 | 26 | 1.0 |
| 22 | 3.0 | 28 | 0.8 |
| 24 | 2.0 | 30 | 0.5 |


© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

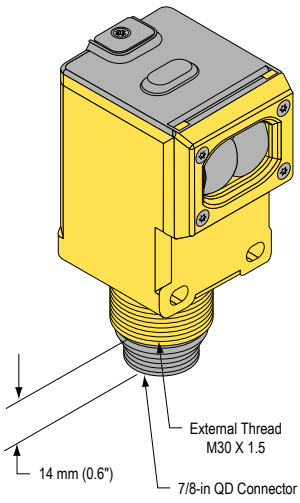
# Dimensions

*Opposed, Retro, and Diffuse Sensing Modes (Model Suffix E, R, D, DL, DX, LP, and LV)*

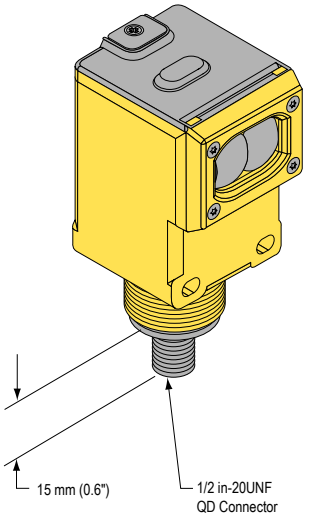
*Cabled models*



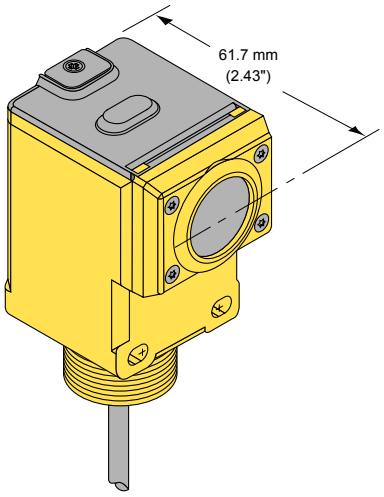

*Mini QD models*



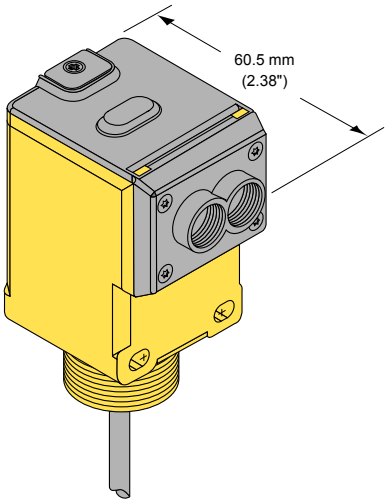

*1/2 in-20UNF (1/2-in Dual Key) QD models*



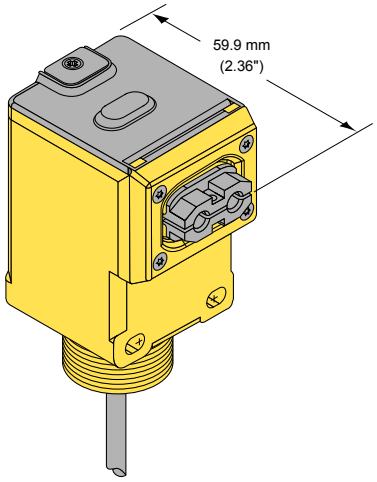

*Convergent Sensor Models (CV and CV4)*




*Glass Fiber Optic Models (F and FV)*




*Plastic Fiber Optic Models (FP)*



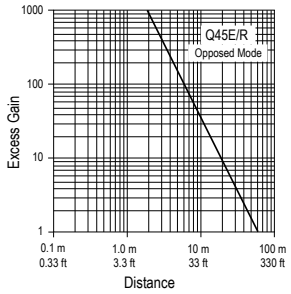


© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

# Performance Curves

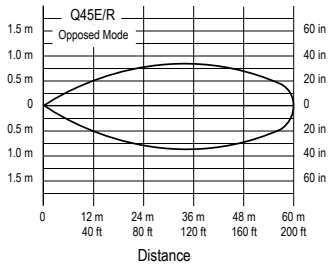
## Opposed

### Excess Gain



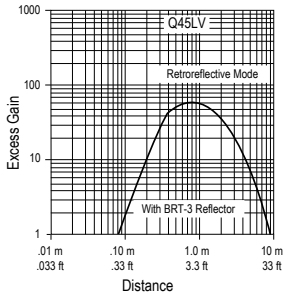

### Beam Pattern

**Effective Beam**: 13 mm

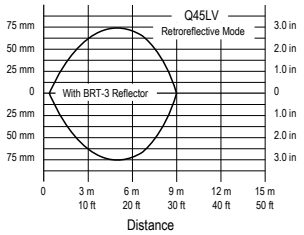



## Retroreflective Non-Polarized

### Excess Gain

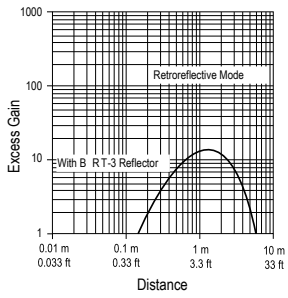



### Beam Pattern

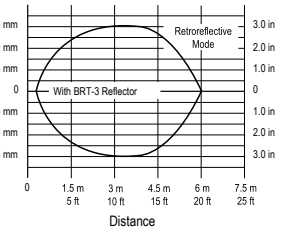



## Retroreflective Polarized

### Excess Gain



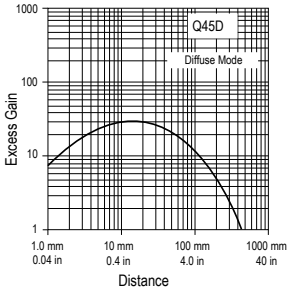

### Beam Pattern



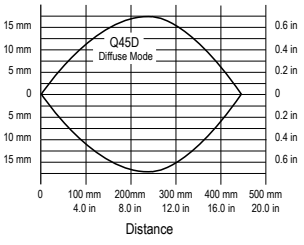

Diffuse-mode performance curves are based on a 90% reflectance white test card.

## Diffuse Short Range

### Excess Gain

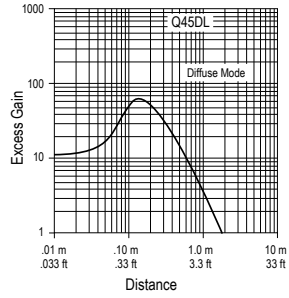



### Beam Pattern

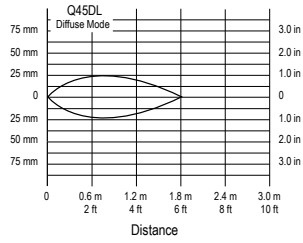



## Diffuse Long Range

### Excess Gain




### Beam Pattern

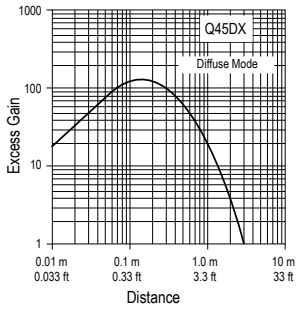




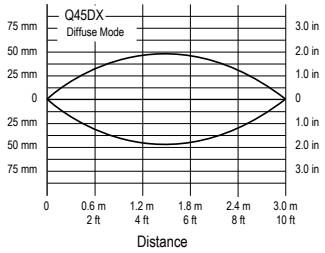
© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

## Diffuse High Power

### Excess Gain



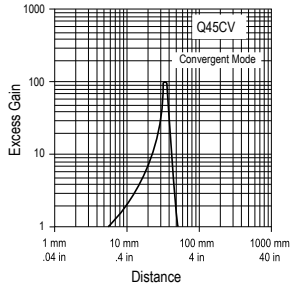

### Beam Pattern



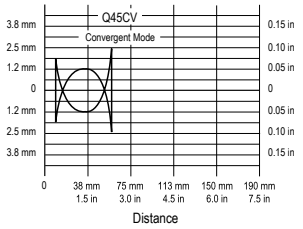

Convergent mode performance curves are based on a 90% reflectance white test card.

## Convergent (CV and CVQ Models)

### Excess Gain

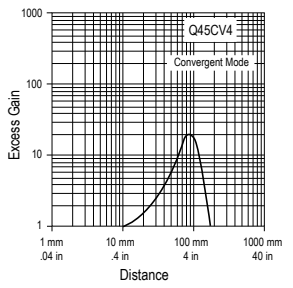



### Beam Pattern

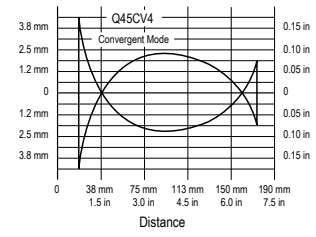



## Convergent (CV4 and CV4Q Models)

### Excess Gain



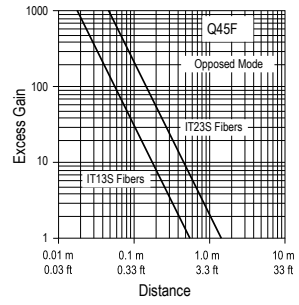

### Beam Pattern



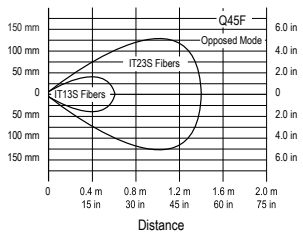

Glass fiber optic diffuse mode performance curves are based on a 90% reflectance white test card.

## Glass Fiber Optic, Infrared (Opposed Mode)

### Excess Gain

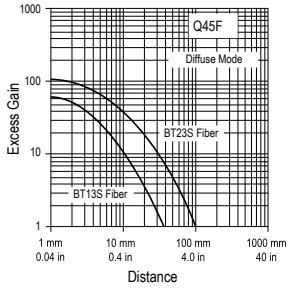



### Beam Pattern

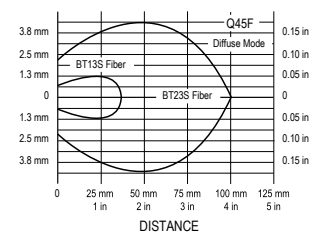



## Glass Fiber Optic, Infrared (Diffuse Mode)

### Excess Gain

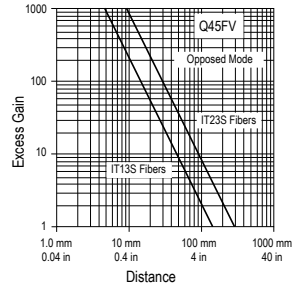



### Beam Pattern

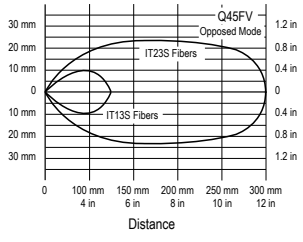



## Glass Fiber Optic, Visible Red (Opposed Mode)

### Excess Gain

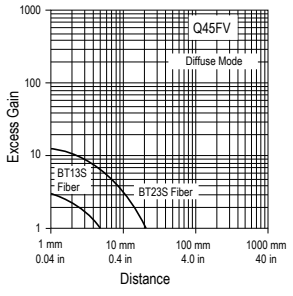



### Beam Pattern

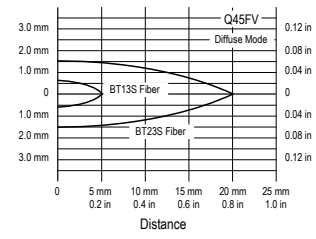



## Glass Fiber Optic, Visible Red (Diffuse Mode)

### Excess Gain

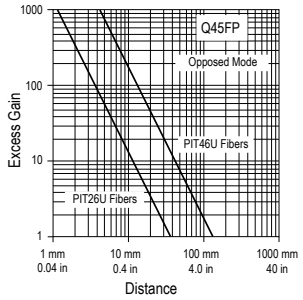
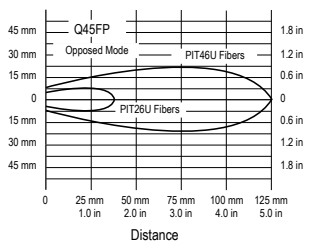
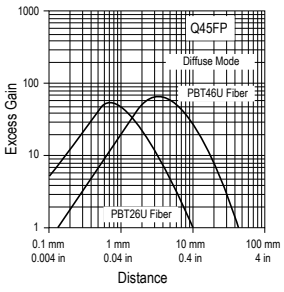
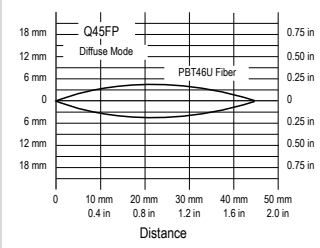



### Beam Pattern



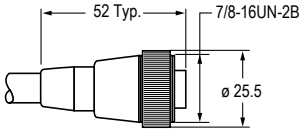
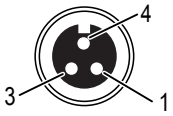

Plastic fiber optic Diffuse mode performance curves are based on a 90% reflectance white test card.

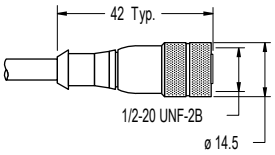

© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

| Plastic Fiber Optic (Opposed Mode) | | Plastic Fiber Optic (Diffuse Mode) | |
|---|---|---|---|
| **Excess Gain** | **Beam Pattern** | **Excess Gain** | **Beam Pattern** |
|  |  |  |  |

# Q45BW22 Accessories

## Cordsets

| 3-pin Single-Ended Mini Female Cordsets | | | | |
|---|---|---|---|---|
| **Model** | **Length** | **Style** | **Dimensions** | **Pinout (Female)** |
| **MBCC-306** | 1.83 m (6 ft) | Straight |  | <br>1 = Brown<br>3 = Blue<br>4 = Black |
| **MBCC-312** | 3.66 m (12 ft) | | | |
| **MBCC-330** | 9.14 m (30 ft) | | | |

| 4-Pin Single-Ended 1/2-in Dual Key Female Cordsets | | | | |
|---|---|---|---|---|
| **Model** | **Length** | **Style** | **Dimensions** | **Pinout (Female)** |
| **MQAC-406** | 2 m (6.56 ft) | Straight |  | <br>1 = Red/Black<br>2 = Red/White<br>3 = Red<br>4 = Green |
| **MQAC-415** | 5 m (16.4 ft) | | | |
| **MQAC-430** | 9.14 m (30 ft) | | | |

## Retroreflective Targets

Banner offers a wide selection of high-quality retroreflective targets. See www.bannerengineering.com for complete information.

**NOTE:** Polarized sensors require corner cube-type retroreflective targets. Non-polarized sensors may use any retroreflective target.

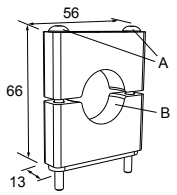



© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

### Brackets

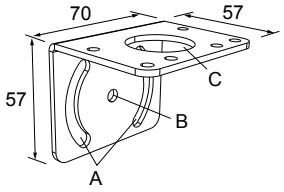
**SMB30C**
- 30 mm split clamp, black PBT bracket
- Stainless steel mounting hardware included
- Mounting hole for 30 mm sensor
- CAD Files: DXF, PDF, IGS, STP

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



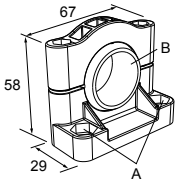

**SMB30MM**
- 12-gauge stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor
- CAD Files: DXF, PDF, IGS, STP

**Hole center spacing:** A=51, A to B=25.4
**Hole size:** A=42.6 × 7, B=ø 6.4, C=ø 30.1




**SMB30SC**
- Swivel bracket with 30 mm mounting hole for sensor
- Black reinforced thermoplastic polyester
- Stainless steel mounting and swivel locking hardware included
- CAD Files: DXF, PDF, IGS, STP

**Hole center spacing:** A=ø 50.8
**Hole size:** A=ø 7.0, B=ø 30.0




## Output Timing Logic and Signal Strength Display Modules

Q45 sensors easily accept the addition of output timing logic and signal strength display functions. Display modules have a seven-element display that gives a more precise indication of excess gain than does the AID™ system LED that is standard on Q45 sensors. The modules listed below may be used with all Q45BW22 sensors. Refer to the module's datasheet for more information.

| Models | Logic and/or Display Function |
|---|---|
| **45LM58** | Programmable output timing logic |
| **45LM58D** | Programmable output timing logic plus signal strength display |
| **45LMD** | Signal strength display only (no timing function) |

# Product Support and Maintenance

## Discontinued Models

The following models are no longer available for order but are still covered by the information in this document.

| Models | Sensing Mode | Cable |
|---|---|---|
| **Q45BW22CV W/30** | Convergent mode sensors; 38 mm (1.5 in); Spot Size at Focus: 1.3 mm (0.05 in) | 3-wire 9 m |
| **Q45BW22CVQ1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD |
| **Q45BW22CV4** | Convergent mode sensors; 100 mm (4 in); Spot Size at Focus: 1.5 mm (0.06 in) | 3-wire 2 m (6.5 ft) cable |
| **Q45BW22CV4 W/30** | | 3-wire 9 m cable |
| **Q45BW22CV4Q1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD |
| **Q45BW22FV** | Glass fiber mode sensors | 3-wire 2 m (6.5 ft) cable |
| **Q45BW22FVQ** | | 3-pin Mini QD |
| **Q45BW22FVQ1** | | 4-pin 1/2 in-20UNF (1/2-in Dual Key) QD |

## 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.

**THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.**


© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to: www.bannerengineering.com.

For patent information, see www.bannerengineering.com/patents.


© Banner Engineering Corp. All rights reserved.
www.bannerengineering.com