Datasheet

Universal voltage photoelectric sensors with isolated solid-state output

- Advanced one-piece photoelectric sensors with outstanding optical performance and extremely rugged design
- Universal supply voltage: 12 V dc to 250 V dc or 24 V ac to 250 V ac
- Opto-isolated solid-state relay output; 300 mA max. load at up to 250 V ac, 250 V dc
- Full line includes opposed, diffuse, retroreflective, convergent, and glass and plastic fiber optic sensing modes
- Selectable light/dark operate
- Versatile plug-in modules available for output timing logic and/or signal strength display
- Highly visible Power, Signal (AID™ System), and Output indicator LEDs
- Choice of prewired 2 m (6.5 ft) or 9 m (30 ft) unterminated cable or Mini-style quick-disconnect fitting
- Versatile mounting options
- Designed to withstand 1200 psi washdown; exceeds its NEMA 6P and IEC IP67 rating

**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.

Models

To order the 9 m (30 ft) cable models, add the suffix "W/30" to the cabled model number. For example: Q453E W/30.

Models with a quick disconnect (QD) connector require a mating cable.

**Opposed Mode Emitter (E) and Receiver (R) Models**

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.

<table>
<thead>
<tr>
<th>Models</th>
<th>Range</th>
<th>Cable</th>
<th>Supply Voltage</th>
<th>Output Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q453E Emitter</td>
<td>60 m (200 ft)</td>
<td>2-wire 2 m (6.5 ft)</td>
<td>Universal 12 to 250 V dc or 24 to 250 V ac</td>
<td>Isolated SPST Solid-state Switch</td>
</tr>
<tr>
<td>Q45BW13R Receiver</td>
<td>60 m (200 ft)</td>
<td>4-wire 2 m (6.5 ft)</td>
<td>Universal 12 to 250 V dc or 24 to 250 V ac</td>
<td>Isolated SPST Solid-state Switch</td>
</tr>
<tr>
<td>Q453EQ Emitter</td>
<td>3-pin Mini QD</td>
<td>3-pin Mini QD</td>
<td>Universal 12 to 250 V dc or 24 to 250 V ac</td>
<td>Isolated SPST Solid-state Switch</td>
</tr>
<tr>
<td>Q45BW13RQ Receiver</td>
<td>4-pin Mini QD</td>
<td>4-pin Mini QD</td>
<td>Universal 12 to 250 V dc or 24 to 250 V ac</td>
<td>Isolated SPST Solid-state Switch</td>
</tr>
</tbody>
</table>

**Retroreflective Mode Models**

The visible red sensing beam of these sensors makes them very easy to align. Model Q45BW13LP 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).

Retroreflective range is specified using one model BRT-3 retroreflector (3-inch diameter). Actual sensing range may be more or less than specified, depending upon the efficiency and reflective area of the retroreflector used.

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U.S. Patent number 4356393

31 January 2017
Diffuse Mode Models

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 Q45BW13DX is the first choice for diffuse-mode applications when there are no background objects to falsely return light.

Infrared, 880 nm

Convergent Mode Models

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. Will ignore all but highly reflective objects that are outside the sensing range.

Visible red, 680 nm
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 .5 mm (.020 in) dia. may be used successfully for diffuse-mode sensing when using sensor model Q45BW13F(Q). For more information on compatible glass fiber optics, go to www.bannerengineering.com.

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®.
- 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.

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Glass Fiber

Visible red, 660 nm

Infrared, 880 nm

Visible red, 650 nm

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.

---

Glass Fiber

Visible red, 660 nm

Infrared, 880 nm

Visible red, 650 nm

Overview

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Visible red, 660 nm

Infrared, 880 nm

Visible red, 650 nm

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Glass Fiber

Visible red, 660 nm

Infrared, 880 nm

Visible red, 650 nm

Overview

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Visible red, 650 nm

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- 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.
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

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**Wiring Diagrams**

**Sensors with Attached Cable and Sensors with Quick-Disconnect 4-Pin Mini (model suffix Q)**

![Wiring Diagram](image)

*NOTE: Connection of dc power is without regard to polarity.*

**Quick disconnect (QD) wiring diagrams are functionally identical.**

**Emitters with Attached Cable**

- brown
  - 24–250 V ac or 12–250 V dc*
- blue

**Emitters with Quick-Disconnect 3-Pin Mini**

- brown
  - 24–250 V ac or 12–250 V dc*
- blue
- black

*Connection of dc power is without regard to polarity.
Specifications

Supply Voltage and Current
Universal voltage: 24 to 250 V ac, 50/60 Hz or 12 to 250 V dc (1.5 watts maximum)

Supply Protection Circuitry
Protected against transient voltages
DC wiring is without regard to polarity

Output Configuration
All models except emitters: Optically isolated SPST solid-state switch

Output Rating
250 V ac, 250 V dc, 300 mA
Output saturation voltage: 3 V at 300 mA, 2 V at 15 mA
Off-state leakage current: <50 microamps
Inrush current: 1 amp for 20 milliseconds, non-repetitive

Output Protection Circuitry
Protected against false pulse on power-up

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.

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.

<table>
<thead>
<tr>
<th>Supply Wiring (AWG)</th>
<th>Required Overcurrent Protection (Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>22</td>
<td>3.0</td>
</tr>
<tr>
<td>24</td>
<td>2.0</td>
</tr>
<tr>
<td>26</td>
<td>1.0</td>
</tr>
<tr>
<td>28</td>
<td>0.8</td>
</tr>
<tr>
<td>30</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Repeatability
Opposed mode: 0.25 milliseconds
All other sensing modes: 0.5 milliseconds
Response time and repeatability specifications are independent of signal strength.

Adjustments
Light/Dark Operate select switch; and multi-turn Sensitivity control on top of sensor beneath a transparent o-ring-sealed Lexan® cover, allows precise sensitivity setting (turn clockwise to increase gain). Optional logic and logic/display modules have adjustable timing functions

Indicators
Indicator LEDs are clearly visible beneath a raised transparent Lexan® dome on top of the sensor.
Power (green) LED lights whenever 24 to 250V ac, or 12 to 250V dc power is applied
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

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 1/20-in NPS integral internal conduit thread.

Environmental Rating
NEMA 6P, IEC IP67

Connections
2 m (6.5 ft) unterminated PVC-jacketed cable or 9 m (30 ft) unterminated PVC-jacketed cable, or Mini quick-disconnect (QD) fittings are available ("Q"-suffix models). QD cables are ordered separately.

Operating Conditions
-25 °C to +55 °C (-13 °F to +131 °F)
90% at +50 °C maximum relative humidity (non-condensing)

Application Notes
Optional output timing modules are available. See page 10 for more information.
Output is not short-circuit protected. Exercise care when making wiring connections.

Certifications

www.bannerengineering.com - Tel: +1-763-544-3164
# Dimensions

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

<table>
<thead>
<tr>
<th>Cabled Models</th>
<th>Quick-Disconnect Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>44.5 mm (1.70&quot;)</td>
<td></td>
</tr>
<tr>
<td>69.0 mm (2.72&quot;)</td>
<td></td>
</tr>
<tr>
<td>87.6 mm (3.45&quot;)</td>
<td></td>
</tr>
<tr>
<td>30.0 mm (1.18&quot;)</td>
<td></td>
</tr>
<tr>
<td>ø 6.1 (0.24&quot;)</td>
<td></td>
</tr>
<tr>
<td>2m (6.5') Cable</td>
<td></td>
</tr>
<tr>
<td>4.5 mm (#10) Screw Clearance (2)</td>
<td></td>
</tr>
<tr>
<td>7.1 mm (0.28&quot;)</td>
<td></td>
</tr>
<tr>
<td>54.1 mm (2.12&quot;)</td>
<td></td>
</tr>
<tr>
<td>50.8 mm (2.00&quot;)</td>
<td></td>
</tr>
<tr>
<td>6.4 mm (0.25&quot;)</td>
<td></td>
</tr>
<tr>
<td>5.0 mm (0.2&quot;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Convergent Sensor Models

**CV and CV4**

- 61.7 mm (2.43")

## Glass Fiber Optic Models

**F and FV**

- 60.5 mm (2.38")

## Plastic Fiber Optic Models

**FP**

- 59.9 mm (2.36")
Accessories

Cordsets

<table>
<thead>
<tr>
<th>Model</th>
<th>Length</th>
<th>Style</th>
<th>Dimensions</th>
<th>Pinout (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBCC-306</td>
<td>1.83 m (6.5 ft)</td>
<td>Straight</td>
<td>ø 25.5</td>
<td>1 - Black, 2 - Brown, 3 - Blue</td>
</tr>
<tr>
<td>MBCC-312</td>
<td>3.66 m (12 ft)</td>
<td>Straight</td>
<td>ø 25.5</td>
<td>1 - Black, 2 - Brown, 3 - Blue</td>
</tr>
<tr>
<td>MBCC-330</td>
<td>9.14 m (30 ft)</td>
<td>Straight</td>
<td>ø 25.5</td>
<td>1 - Black, 2 - Brown, 3 - Blue</td>
</tr>
</tbody>
</table>

4-Pin Mini-Style Cordsets

<table>
<thead>
<tr>
<th>Model</th>
<th>Length</th>
<th>Style</th>
<th>Dimensions</th>
<th>Pinout (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBCC-406</td>
<td>1.83 m (6 ft)</td>
<td>Straight</td>
<td>ø 25.5</td>
<td>1 - Brown, 2 - White, 3 - Blue, 4 - Black</td>
</tr>
<tr>
<td>MBCC-412</td>
<td>3.66 m (12 ft)</td>
<td>Straight</td>
<td>ø 25.5</td>
<td>1 - Brown, 2 - White, 3 - Blue, 4 - Black</td>
</tr>
<tr>
<td>MBCC-430</td>
<td>9.14 m (30 ft)</td>
<td>Straight</td>
<td>ø 25.5</td>
<td>1 - Brown, 2 - White, 3 - Blue, 4 - Black</td>
</tr>
</tbody>
</table>

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.

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

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
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 Q45BW13 sensors. Refer to the module’s datasheet for more information.

<table>
<thead>
<tr>
<th>Models</th>
<th>Logic and/or Display Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>45LM58</td>
<td>Programmable output timing logic</td>
</tr>
<tr>
<td>45LM58D</td>
<td>Programmable output timing logic plus signal strength display</td>
</tr>
<tr>
<td>45LMD</td>
<td>Signal strength display only (no timing function)</td>
</tr>
</tbody>
</table>

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