

# Q45VR2 Series Sensors



## Datasheet



- Advanced one-piece photoelectric sensors with outstanding optical performance and extremely rugged design
- Operate from 90 to 250 V ac (50/60 Hz)
- SPDT electromechanical relay output for economical, high-capacity switching and immunity to electrical noise
- Multiple sensing modes include: opposed, diffuse, retroreflective, and convergent, plus glass and plastic fiber optic models
- Switchable light/dark operate
- Versatile plug-in modules available for output timing logic and/or signal strength display
- Highly visible Power, Signal (AID™ System <sup>1</sup>), 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.

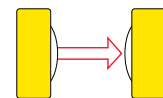
### Opposed-Mode Emitter (E) and Receiver (R) Models

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.

Range: 60 m (200 ft)

Output Type: SPDT Electro-mechanical relay

Effective Beam: 13 mm



**OPPOSED**

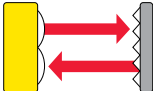
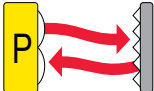
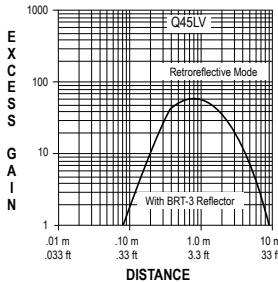
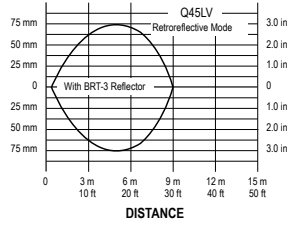
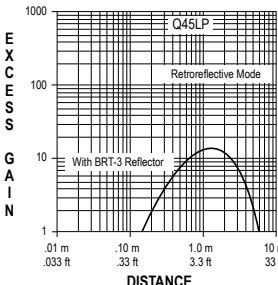
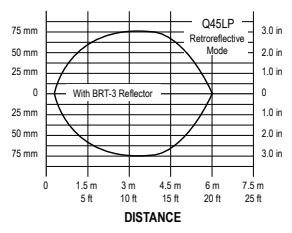
Infrared, 880 nm

Models	Cable	Excess Gain	Beam Pattern
Q452E Emitter	2-wire 2 m (6.5 ft) cable		
Q45VR2R Receiver	5-wire 2 m (6.5 ft) cable		
Q452EQ Emitter	3-Pin Mini-style QD		
Q45VR2RQ Receiver	5-Pin Mini-style QD		

To order the 9 m (30 ft) cable models, add the suffix "W/30" to the cabled model number. (For example: Q452E W/30.) Models with a quick disconnect (QD) connector require a mating cable.

<sup>1</sup> U.S. Patent no. 4356393



Retroreflective-Mode Models			
<p>The visible red sensing beam of these sensors makes them very easy to align. Model Q45VR2LP polarizes the emitted light and filters out unwanted reflections, making sensing possible in applications otherwise considered unsuited to retroreflective sensing. Specified using the model BRT-3 3-inch reflector (see the Accessories section of your current Banner catalog for further information).</p> <p>Output Type: SPDT Electro-mechanical relay</p>		<div><p><b>RETRO</b></p><p>Visible red, 680 nm (non-polarized)</p></div> <div><p><b>POLAR RETRO</b></p><p>Visible red, 680 nm (polarized)</p></div>	
Non-Polarized - Range 0.08 to 9 m (3 in to 30 ft)			
Models	Cable	Excess Gain	Beam Pattern
Q45VR2LV	5-wire 2 m (6.5 ft) cable		
Q45VR2LVQ	5-Pin Mini-style QD		
Polarized - Range 0.15 to 6 m (6 in to 20 ft)			
Models	Cable	Excess Gain	Beam Pattern
Q45VR2LP	5-wire 2 m (6.5 ft) cable		
Q45VR2LPQ	5-Pin Mini-style QD		

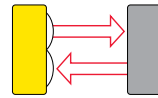
To order the 9 m (30 ft) cable models, add the suffix "W/30" to the cabled model number. (For example: Q45VR2LV W/30.) Models with a quick disconnect (QD) connector require a mating cable.

## 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 Q45VR2DX is the first choice for diffuse-mode applications when there are no background objects to falsely return light.

Performance curves are based on a 90% reflectance white test card.

Output Type: SPDT Electro-mechanical relay



Infrared, 880 nm

## Short Range - 45 cm (18 inches)

Models	Cable	Excess Gain	Beam Pattern
Q45VR2D	5-wire 2 m (6.5 ft) cable		
Q45VR2DQ	5-Pin Mini-style QD		

## Long Range - 1.8 m (6 ft)

Models	Cable	Excess Gain	Beam Pattern
Q45VR2DL	5-wire 2 m (6.5 ft) cable		
Q45VR2DLQ	5-Pin Mini-style QD		

## High Power - 3 m (10 ft) Range

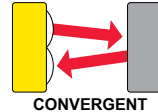
Models	Cable	Excess Gain	Beam Pattern
Q45VR2DX	5-wire 2 m (6.5 ft) cable		
Q45VR2DXQ	5-Pin Mini-style QD		

## 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.

Performance curves are based on a 90% reflectance white test card.

Output Type: SPDT Electro-mechanical relay



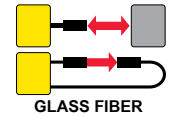
Visible red, 680 nm

Models	Focus	Cable	Excess Gain	Beam Pattern
Q45VR2CV	38 mm (1.5 in) Spot Size at Focus: 1.3 mm (0.05 in)	5-wire 2 m (6.5 ft) cable		
Q45VR2CVQ		5-Pin Mini-style QD		
Q45VR2CV4	100 mm (4 in) Spot Size at Focus: 1.5 mm (0.06 in)	5-wire 2 m (6.5 ft) cable		
Q45VR2CV4Q		5-Pin Mini-style QD		

To order the 9 m (30 ft) cable models, add the suffix "W/30" to the cabled model number. (For example: Q45VR2CV W/30.) Models with a quick disconnect (QD) connector require a mating cable.

## 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 (.020 in) dia. may be used successfully for diffuse-mode sensing when using sensor model Q45VR2F(Q). For more information on compatible glass fiber optics, refer to your current catalog.



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

Range: Range varies by sensing mode and fiber optics used.

Output Type: SPDT Electro-mechanical relay

Infrared, 880 nm and  
Visible red, 650 nm

## Infrared, 880 nm

Models	Cable	Excess Gain	Beam Pattern
Q45VR2F	5-wire 2 m (6.5 ft) cable		
Q45VR2FQ	5-Pin Mini-style QD		

## Visible Red, 650 nm

Models	Cable	Excess Gain	Beam Pattern
Q45VR2FV	5-wire 2 m (6.5 ft) cable		
Q45VR2FVQ	5-Pin Mini-style QD		

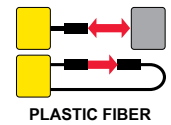
## Plastic Fiber Optic Models

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, refer to your current catalog.

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

Range: Range varies by sensing mode and fiber optics used.

Output Type: SPDT Electro-mechanical relay



Visible red, 660 nm

Models	Cable	Excess Gain	Beam Pattern
Q45VR2FP	5-wire 2 m (6.5 ft) cable		
Q45VR2FPQ	5-Pin Mini-style QD		

To order the 9 m (30 ft) cable models, add the suffix "W/30" to the cabled model number. (For example: Q45VR2FP W/30.) Models with a quick disconnect (QD) connector require a mating cable.

## 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<sup>2</sup>.
- 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.



- Sensitivity adjustment
- LEDs
  - Green LED: Power on indicator
  - Red LED: Signal indicator
  - Amber LED: Output status indicator
- Optional LED signal strength display
- Optional timing adjustment
- Optional timing adjustment
- Light/dark operate switch

<sup>2</sup> US patent no. 4356393

## Specifications

### Supply Voltage and Current

90 to 250 V ac (50/60 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

SPDT (Single-Pole Double-Throw) electromechanical relay output. All models except emitters.

### Output Rating

Max. switching power (resistive load): 150 W, 600 VA  
Max. switching voltage (resistive load): 250 V ac, 30 V dc  
Max. switching current (resistive load): 5 A at 250 V ac  
Min. voltage and current: 5 V dc, 0.1 mA  
Mechanical life of relay: 10,000,000 operations  
Electrical life of relay at full resistive load: 100,000 operations

### Output Protection Circuitry

Protected against false pulse on power-up

### Output Response Time

15 milliseconds ON and OFF  
(NOTE: 100 millisecond delay on power-up. Output is de-energized during this time.)

### Environmental Rating

NEMA 6P, IEC IP67

### Operating Conditions

Temperature: -40 °C to 70 °C (-40 °F to 158 °F)  
Maximum relative humidity: 90% at 50 °C (non-condensing)

### Certifications



### 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 (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 when 90 to 250 V ac power is applied  
Signal (red) AID™ System LED lights when 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 modules

### 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-inch NPS integral internal conduit thread.

### Connections

PVC-jacketed 2-wire (emitters) or 5-wire (all others) 2 m (6.5 ft) or 9 m (30 ft) unterminated cables, or 3-pin (emitters) or 5-pin (all others) Mini-style quick-disconnect (QD) fittings are available ("Q" - suffix models).  
QD cables are ordered separately.

### Application Notes

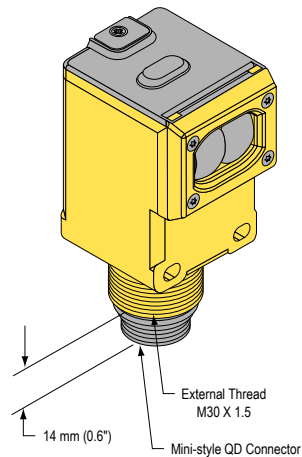
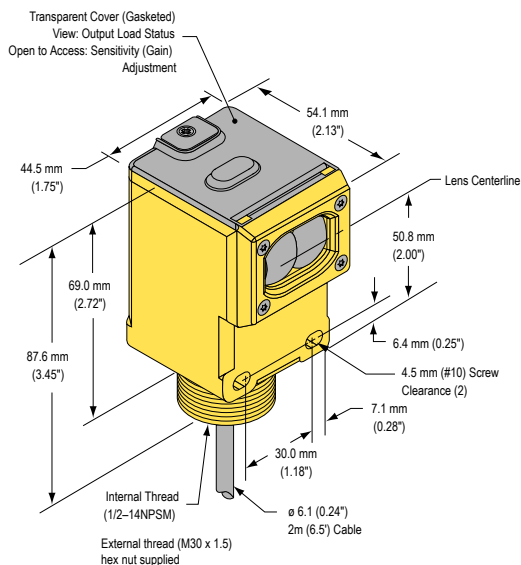
Transient suppression is recommended for contacts switching inductive loads.  
Optional output timing modules are available.

## Dimensions

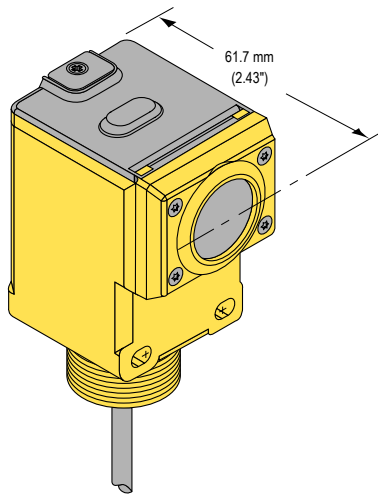
Opposed, Retro, and Diffuse Sensing Modes (Model Suffix E, R, D, DL, DX, LP, and LV)

Cabled Models

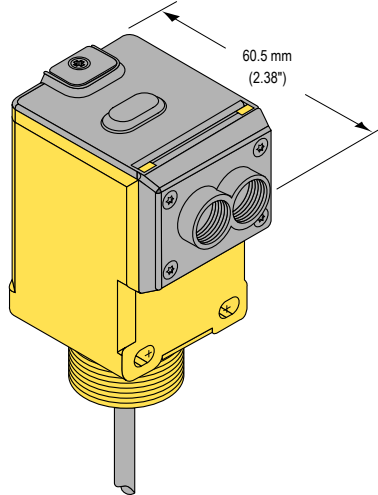
Quick-Disconnect Models



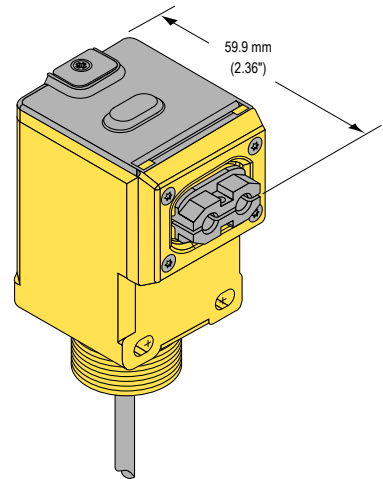
Convergent Sensor Models  
(CV and CV4)



Glass Fiber Optic Models  
(F and FV)

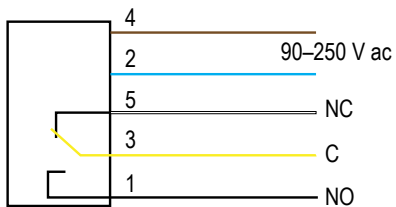


Plastic Fiber Optic Models  
(FP)

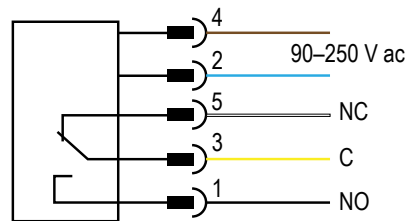


## Wiring Diagrams

Sensors with Attached Cable

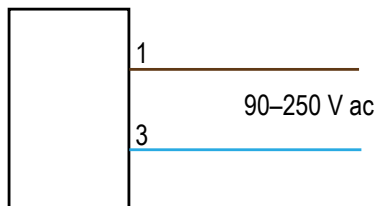


Sensors with Quick-Disconnect 5-Pin Mini-Style (model suffix Q)

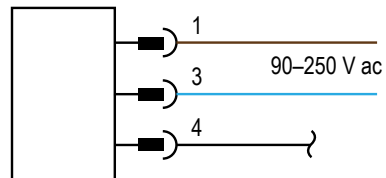


Wire Colors  
1 - Black  
2 - Blue  
3 - Yellow  
4 - Brown  
5 - White

Q452E Emitter with Attached Cable



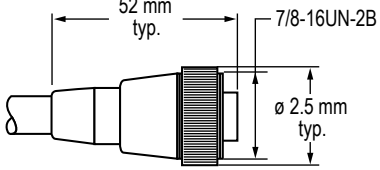
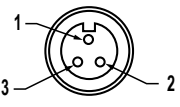
Q452E Emitter with Quick-Disconnect 3-Pin Mini-Style (model suffix Q)

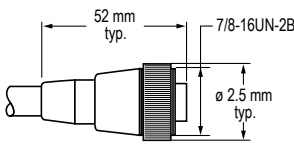
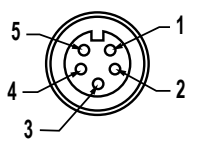


Wire Colors  
1 - Brown  
3 - Blue  
4 - Black



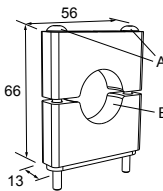
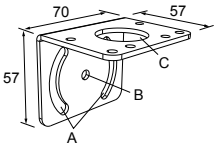
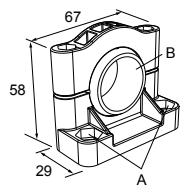
## Accessories

3-Pin Mini-Style Cordsets				
Model	Length	Style	Dimensions	Pinout
MBCC-306	2 m (6.5 ft)	Straight		 <p>1 = Black 2 = Brown 3 = Blue</p>
MBCC-312	3.66 m (12 ft)			
MBCC-330	9.14 m (30 ft)			

5-Pin Mini-Style Cordsets				
Model	Length	Style	Dimensions	Pinout (Female)
MBCC-506	1.83 m (6 ft)	Straight		 <p>1 = Black 2 = Blue 3 = Yellow 4 = Brown 5 = White</p>
MBCC-512	3.66 m (12 ft)			
MBCC-530	9.14 m (30 ft)			



NOTE: For a complete selection of retroreflective targets, see [www.bannerengineering.com](http://www.bannerengineering.com).

Brackets	
<p><b>SMB30C</b></p> <ul style="list-style-type: none"> <li>30 mm split clamp, black PBT bracket</li> <li>Stainless steel mounting hardware included</li> <li>Mounting hole for 30 mm sensor</li> </ul>  <p>Hole center spacing: A=Ø 45 Hole size: B=Ø 27.2</p>	<p><b>SMB30MM</b></p> <ul style="list-style-type: none"> <li>12-ga. stainless steel bracket with curved mounting slots for versatile orientation</li> <li>Clearance for M6 (¼ in) hardware</li> <li>Mounting hole for 30 mm sensor</li> </ul>  <p>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</p>
<p><b>SMB30SC</b></p> <ul style="list-style-type: none"> <li>Swivel bracket with 30 mm mounting hole for sensor</li> <li>Black reinforced thermoplastic polyester</li> <li>Stainless steel mounting and swivel locking hardware included</li> </ul>  <p>Hole center spacing: A=Ø 50.8 Hole size: A=Ø 7.0, B=Ø 30.0</p>	

## 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 Q45VR2 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)

## 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.

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.