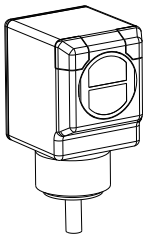
Q40 Sensors - dc-Voltage Series Installation Guide

Self-contained, dc-operated sensors

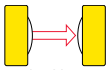
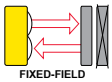
For complete technical information about this product, including dimensions, accessories, and specifications, see http://www.bannerengineering.com/121516



WARNING: Not To Be Used for Personnel Protection

Never use this product as a sensing device for personnel protection. Doing so could lead to serious injury or death. This product 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

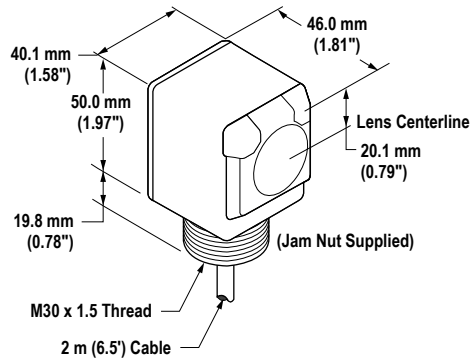
Sensing Mode		Range	LED	Output	Model*
 OPPOSED	**Opposed**	60 m (200')	Infrared 950 nm	-	**Q406E**
				NPN	**Q40SN6R**
				PNP	**Q40SP6R**
 POLAR RETRO	**Polarized Retro-reflective**	6 m (20')	Visible Red 680 nm	NPN	**Q40SN6LP**
				PNP	**Q40SP6LP**
 FIXED-FIELD	**Fixed Field**	200 mm (8") cutoff	Infrared 880 nm	NPN	**Q40SN6FF200**
				PNP	**Q40SP6FF200**
		400 mm (16") cutoff		NPN	**Q40SN6FF400**
				PNP	**Q40SP6FF400**
		600 mm (24") cutoff		NPN	**Q40SN6FF600**
				PNP	**Q40SP6FF600**

* Standard 2 m (6.5') cable models are listed.

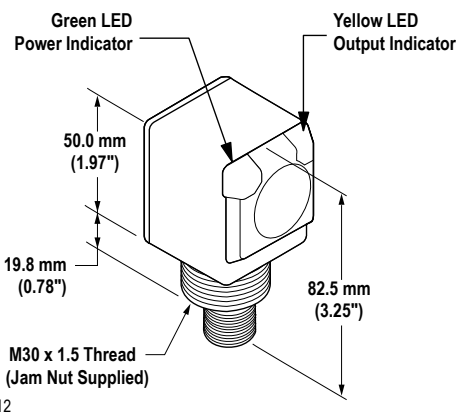
- **9 m (30') cable:** add suffix "**W/30**" (e.g., **Q406E W/30**).
- **4-pin Euro-style QD models:** add suffix "**Q**" (e.g., **Q406EQ**). A model with a QD connector requires a mating cable.

Dimensions

Cabled Models



QD Models



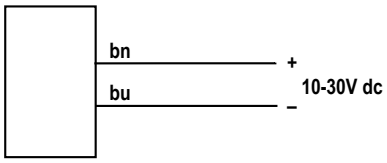
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Hookups

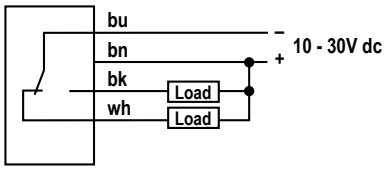
Cabled Emitters



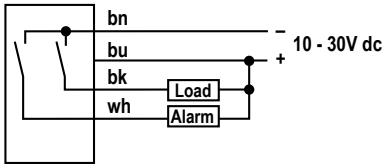
NOTE: QD hookups are functionally identical.

NPN (Sinking) Outputs

Standard Hookup

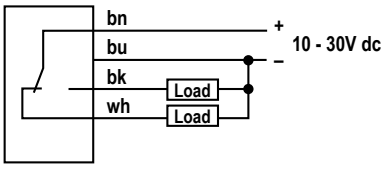


Alarm Hookup

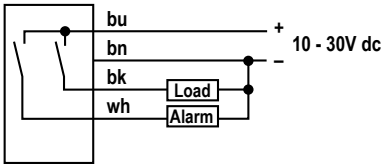


PNP (Sourcing) Outputs

Standard Hookup



Alarm Hookup



Fixed-Field Mode Overview

Q40 Series self-contained fixed-field sensors are small, powerful, infrared diffuse mode sensors with far-limit cutoff. The high excess gain of these sensors makes it possible for them to detect objects of low reflectivity. The fixed-field design makes them ideal for detecting a part or surface that is directly in front of another surface, while ignoring the surface in the background.

Excess Gain

The excess gain curves for these products are available in the Photoelectric Sensors catalog or on the Banner website. They show excess gain vs. sensing distance for sensors with 200 mm, 400 mm, and 600 mm (8", 16", and 24") cutoffs. Maximum excess gain for all models occurs at a lens-to-object distance of about 40 mm (1.57"). Sensing at or near this distance will make maximum use of each sensor's available sensing power.

Backgrounds and background objects must always be placed beyond the cutoff distance.

These excess gain curves were generated using a white test card of 90% reflectance. Objects with reflectivity of less than 90% reflect less light back to the sensor, and thus require proportionately more excess gain in order to be sensed with the same reliability as more reflective objects. When sensing an object of very low reflectivity, it may be especially important to sense it at or near the distance of maximum excess gain.

The effects of object reflectivity on cutoff distance, though small, may be important for some applications. Sensing of objects of less than 90% reflectivity causes the cutoff distances to be "pulled" slightly closer to the sensor. For example, an excess gain of 1 for an object that reflects 1/10 as much light as the 90% white card is represented by the heavy horizontal graph line at excess gain = 10. An object of this reflectivity results in far limit cutoffs of approximately 190 mm, 250 mm, and 390 mm (7.48", 9.84", and 15.4") for the 200 mm, 400 mm, and 600 mm (8", 16", and 24") cutoff models, respectively.

For highest sensitivity, the sensor-to-object distance should be such that the object will be sensed at or near the point of maximum excess gain. The background must be placed beyond the cutoff distance. Following these two guidelines makes it possible to detect objects of low reflectivity, even against close-in reflective backgrounds.

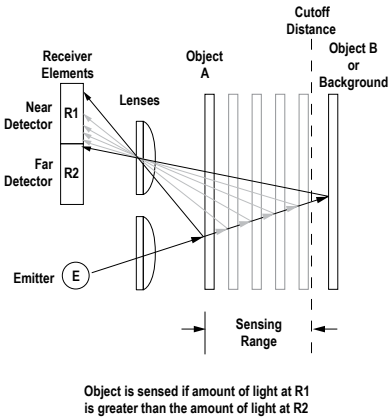
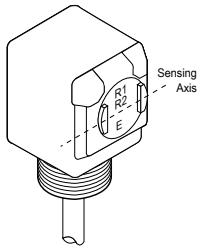


Figure 1. Fixed-field Concept



As a general rule, the most reliable sensing of an object approaching from the side occurs when the line of approach is parallel to the sensing axis.

Figure 2. Fixed-field sensing axis

Set-Up Tips

In the drawings and discussion in *Excess Gain* on page 2 and in *Background Reflectivity and Placement* on page 3, the letters E, R1, and R2 identify how the sensor's three optical elements (Emitter "E," Near Detector "R1," and Far Detector "R2") line up across the face of the sensor. In *Figure 3. Reflective background - problem* on page 3, *Figure 4. Reflective background - solution* on page 3, and *Figure 5. Object beyond cutoff - problem* on page 3, these elements align vertically; in *Figure 6. Object beyond cutoff - solution* on page 3, they align horizontally. Note how the pattern on the sensor's lens helps to define the sensing axis of the sensor (*Figure 2. Fixed-field*

sensing axis on page 2). The sensing axis becomes important in situations like those illustrated in *Figure 5. Object beyond cutoff - problem* on page 3 and *Figure 6. Object beyond cutoff - solution* on page 3.

Background Reflectivity and Placement

Avoid mirror-like backgrounds that produce specular reflections. False sensor response will occur if a background surface reflects the sensor's light more strongly to the near detector (R1) than to the far detector (R2). The result is a false ON condition (*Figure 3. Reflective background - problem* on page 3). Use of a diffusely-reflective (matte) background will cure this problem. Other possible solutions are to angle the sensor or angle the background (in any plane) so the background does not reflect back to the sensor (see *Figure 4. Reflective background - solution* on page 3). Position the background as far beyond the cutoff distance as possible.

An object beyond the cutoff distance, either moving or stationary (and when positioned as shown in *Figure 5. Object beyond cutoff - problem* on page 3), can cause unwanted triggering of the sensor because it reflects more light to the near detector than to the far detector. The problem is easily remedied by rotating the sensor 90° (*Figure 6. Object beyond cutoff - solution* on page 3) to align the sensing axis horizontally. The object then reflects the R1 and R2 fields equally, resulting in no false triggering. A better solution, if possible, may be to reposition the object or the sensor.

Unwanted triggering of the sensor from an object beyond the cutoff can also be caused by attempting to sense a small object that is moving perpendicular to the sensor face, or by an object moving through the off-center position shown in *Figure 5. Object beyond cutoff - problem* on page 3. Making the object larger, centering the sensor relative to the object, or rotating the sensor to place the sensing axis perpendicular to the longer dimension of the object (*Figure 6. Object beyond cutoff - solution* on page 3) will solve the problem.

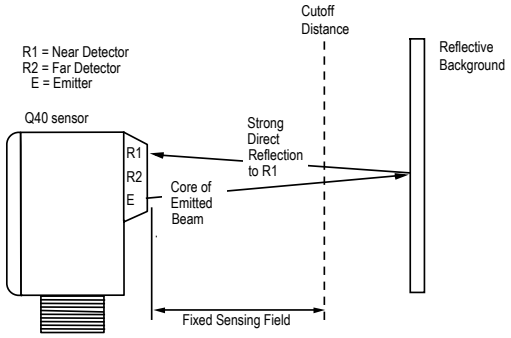


Figure 3. Reflective background - problem

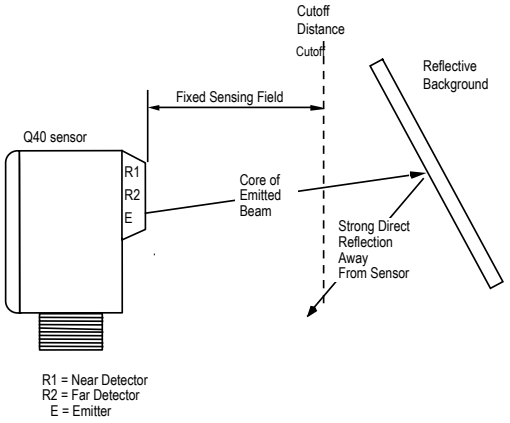


Figure 4. Reflective background - solution

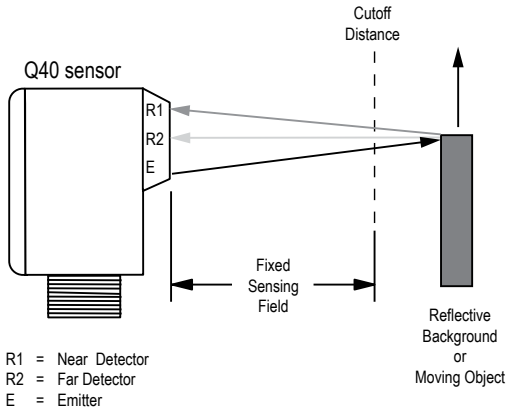


Figure 5. Object beyond cutoff - problem

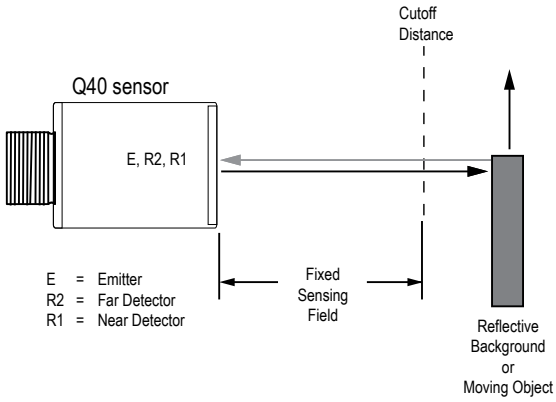


Figure 6. Object beyond cutoff - solution

Specifications

Supply Voltage and Current

10 to 30V dc (10% max. ripple)
Supply current (exclusive of load current):
Emitters: 25 mA
Receivers: 20 mA
Polarized Retroreflective: 30 mA
Fixed-Field: 35 mA

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Repeatability

Opposed mode: 375 µs
Retro and Fixed-Field: 750 µs
Repeatability and response are independent of signal strength

Indicators

Two LEDs (Green and Yellow)
Green ON steady: power to sensor is ON
Green flashing: output is overloaded
Yellow ON steady: N.O. output is conducting
Yellow flashing: excess gain marginal (1 to 1.5x) in light condition

Output Configuration

SPDT solid-state dc switch; Choose NPN (current sinking) or PNP (current sourcing) models

Light Operate: N.O. output conducts when sensor sees its own (or the emitter's) modulated light

Dark Operate: N.C. output conducts when the sensor sees dark; the N.C. (normally closed) output may be wired as a normally open marginal signal alarm output, depending upon hookup to power supply (U.S. patent 5087838)

Output Rating

150 mA maximum (each) in standard hookup.

When wired for alarm output, the total load may not exceed 150 mA.

OFF-state leakage current: < 1 microamp @ 30V dc

ON-state saturation voltage: < 1V at 10 mA dc; < 1.5V at 150 mA dc

Output Protection Circuitry

Protected against false pulse on power-up and continuous overload or short circuit of outputs

Output Response Time

Opposed mode: 3 ms ON, 1.5 ms OFF

Retro and Fixed-Field: 3 ms ON and OFF

NOTE: 100 ms delay on power-up; outputs do not conduct during this time.

Construction

PBT polyester housing; acrylic lens

Environmental Rating

Leakproof design rated NEMA 6P, IEC IP67. QD Models rated IP69K per DIN 40050-9.

Connections

2 m (6.5') or 9 m (30') attached cable, or 4-pin Euro-style quick-disconnect fitting

Operating Conditions

Temperature: -40° to +70°C (-40° to 158°F)

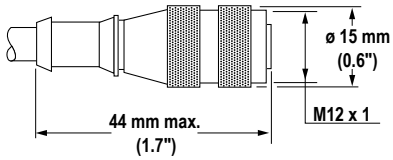
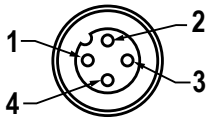
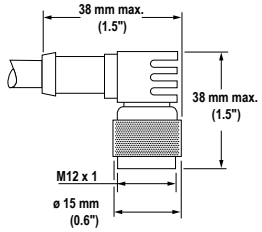
Maximum relative humidity: 90% at 50°C (non-condensing)

Vibration and Mechanical Shock

All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max., double amplitude 0.06" acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)

Certifications

Quick-Disconnect (QD) Cables

4-Pin Threaded M12/Euro-Style Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout**
MQDC-406	1.83 m	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black
MQDC-415	4.57 m			
MQDC-430	9.14 m			
MQDC-450	15.2 m			
MQDC-406RA	1.83 m	Right-Angle		
MQDC-415RA	4.57 m			
MQDC-430RA	9.14 m			
MQDC-450RA	15.2 m			

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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