Q40 DC Voltage Series Sensor Quick Start Guide

Features

Self-contained, DC-operated sensors



This guide is designed to help you set up and install the Q40 Series Sensor. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Product Manual at www.bannerengineering.com. Search for part number 121516 to view the Product Manual. Use of this document assumes familiarity with pertinent industry standards and practices.

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

Opposed mode sensors

Model	Range	Output	Connector
Q406E	60 m (200 ft)	-	2 m (6.5 ft) cable
Q406EQ		-	4-pin M12 male quick disconnect
Q40SN6R		NPN	2 m (6.5 ft) cable
Q40SN6RQ		NPN	4-pin M12 male quick disconnect
Q40SP6R		PNP	2 m (6.5 ft) cable
Q40SP6RQ		PNP	4-pin M12 male quick disconnect

Polarized retroreflective mode sensors

Model	Range	Output	Connector
Q40SN6LPQ	6 m (20 ft)	NPN	4-pin M12 male quick disconnect
Q40SP6LP		PNP	2 m (6.5 ft) cable
Q40SP6LP W/30		PNP	9 m cable
Q40SP6LPQ		PNP	4-pin M12 male quick disconnect

Fixed-field mode sensors

Model	Range	Output	Connector
Q40SN6FF200	200 mm (8 in) cutoff	NPN	2 m (6.5 ft) cable
Q40SN6FF200Q		NPN	4-pin M12 male quick disconnect
Q40SP6FF200		PNP	2 m (6.5 ft) cable
Q40SP6FF200Q		PNP	4-pin M12 male quick disconnect
Q40SN6FF400	400 mm (16 in) cutoff	NPN	2 m (6.5 ft) cable
Q40SN6FF400 W/30		NPN	9 m cable
Q40SN6FF400Q		NPN	4-pin M12 male quick disconnect
Q40SP6FF400		PNP	2 m (6.5 ft) cable
Q40SP6FF400 W/30		PNP	9 m cable
Q40SP6FF400Q		PNP	4-pin M12 male quick disconnect
Q40SN6FF600	600 mm (24 in) cutoff	NPN	2 m (6.5 ft) cable
Q40SN6FF600Q		NPN	4-pin M12 male quick disconnect
Q40SP6FF600		PNP	2 m (6.5 ft) cable
Q40SP6FF600Q		PNP	4-pin M12 male quick disconnect

Original Instructions
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116167
p/n: 116167 Rev C

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A model with a QD connector requires a mating cable.

Fixed-Field Mode Overview

Q40 self-contained fixed-field sensors are small, powerful, infrared diffuse mode sensors with far-limit cutoff (a type of background suppression). Their high excess gain and fixed-field technology allow the detection of objects of low reflectivity while ignoring background surfaces.

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

Installation

In the drawings and discussion in "Q40 DC Excess Gain" on page 5 and in "Background Reflectivity and Placement" on page 2, 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: Reflective background - problem" on page 2, "Figure: Reflective background - solution" on page 2, and "Figure: Object beyond cutoff - problem" on page 3, these elements align vertically; in "Figure: 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: Fixed-field sensing axis" on page 5). The sensing axis becomes important in situations like those illustrated in "Figure: Object beyond cutoff - problem" on page 3 and "Figure: Object beyond cutoff - solution" on page 3.

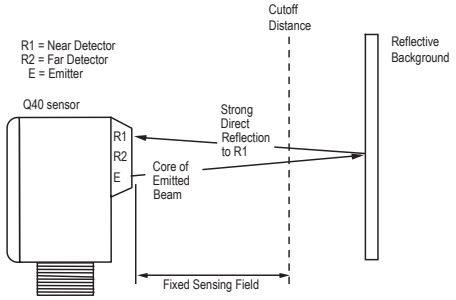
Background Reflectivity and Placement

Avoid mirror-like backgrounds that produce specular reflections. A false sensor response occurs if a background surface reflects the sensor's light more to the near detector (R1) than to the far detector (R2). The result is a false ON condition ("Figure: Reflective background - problem" on page 2). To correct this problem, use a diffusely reflective (matte) background, or angle either the sensor or the background (in any plane) so the background does not reflect light back to the sensor (see "Figure: Reflective background - solution" on page 2). Position the background as far beyond the cutoff distance as possible.

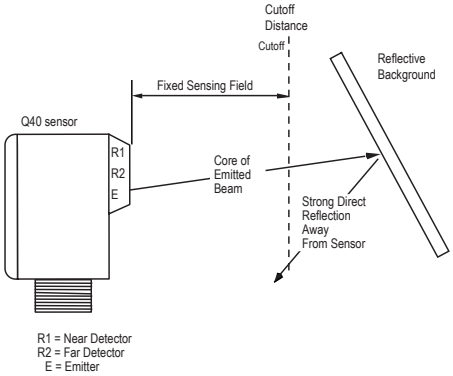
An object beyond the cutoff distance, either stationary (and when positioned as shown in "Figure: Object beyond cutoff - problem" on page 3), or moving past the face of the sensor in a direction perpendicular to the sensing axis, may cause unwanted triggering of the sensor if more light is reflected to the near detector than to the far detector. The problem is easily remedied by rotating the sensor 90° ("Figure: 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: 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: Object beyond cutoff - solution" on page 3) will solve the problem.

Reflective background - problem



Reflective background - solution

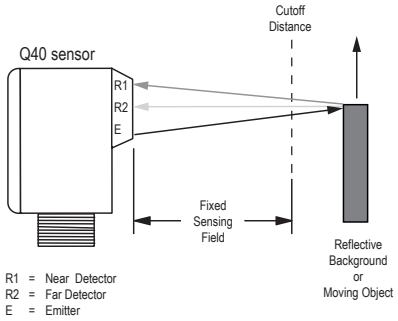


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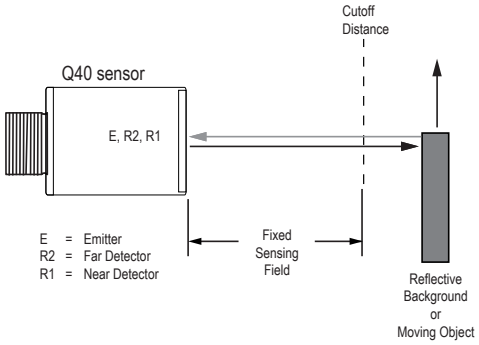
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Object beyond cutoff - problem

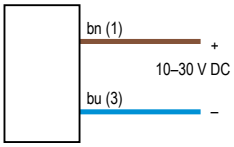
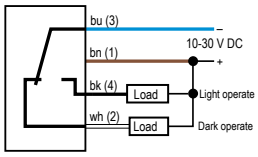
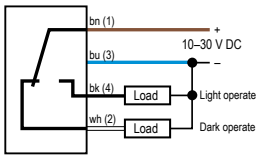
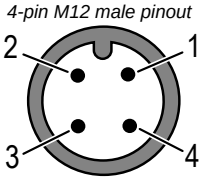
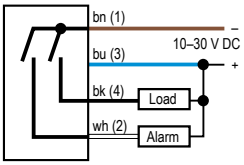
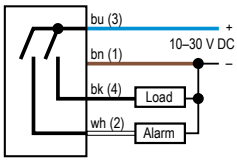


Object beyond cutoff - solution



Wiring

QD wiring connections are functionally identical.

	NPN (Sinking) Outputs	PNP (Sourcing) Outputs
Cabled emitters		
Standard wiring		
4-pin M12 male pinout		
Alarm wiring		

Specifications

Supply Voltage and Current

10 to 30 V 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

Sensing Beam

Opposed mode sensors: Infrared, 950 nm

Polarized retroreflector mode sensors: Visible red, 680 nm

Fixed-field mode sensors: Infrared, 880 nm

Output Configuration

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

Light Operate: N.O. output conducts when the 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 at 30 V DC

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

Output Protection Circuitry

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

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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.

Repeatability

Opposed mode: 375 µs

Retro and Fixed-Field: 750 µs

Repeatability and response are independent of signal strength

Indicators

Two LEDs (Green and Amber)

Green ON steady: power to sensor is ON

Green flashing: output is overloaded

Amber ON steady: N.O. output is conducting

Amber flashing: excess gain marginal (1 to 1.5x) in light condition

Certifications

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Park Lane, Culliganlaan 2F bus 3
1831 Diegem, BELGIUM

Turck Banner LTD Blenheim House
Blenheim Court
Wickford, Essex SS11 8YT
GREAT BRITAIN

Construction

PBT polyester housing; acrylic lens

Connections

2 m (6.5 ft) or 9 m (30 ft) attached cable, or 4-pin M12 quick-disconnect fitting

Environmental Rating

Leakproof design rated NEMA 6P, IP67. QD Models rated IP69K per ISO 20653 per DIN 40050-9.

Operating Conditions

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

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

Vibration and Mechanical Shock

All models meet MIL-STD-202F, Method 201A (Vibration: 10 Hz to 60 Hz maximum, 0.06 inch (1.52 mm) double amplitude, 10G acceleration) requirements. Method 213B conditions H&I. Shock: 75G with device operating; 100G for non-operation

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.

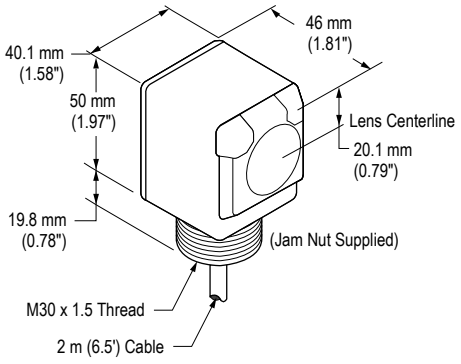
Supply wiring leads < 24 AWG shall not be spliced.

For additional product support, go to www.bannerengineering.com.

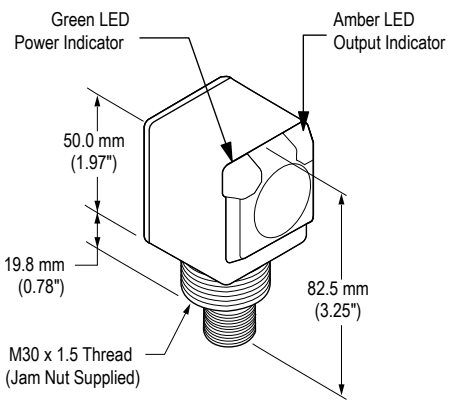
Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

Dimensions

Cabled models



QD models



All measurements are listed in millimeters [inches], unless noted otherwise. The measurements provided are subject to change.

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Excess Gain

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

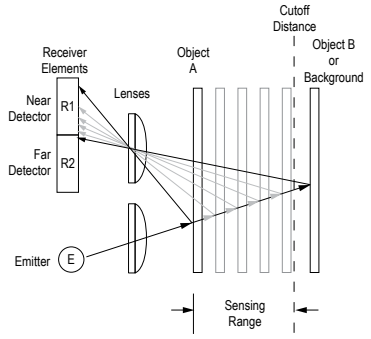
Backgrounds and background objects must always be placed beyond the cutoff distance.

The 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 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 in, 9.84 in, and 15.4 in) for the 200 mm, 400 mm, and 600 mm (8 in, 16 in, and 24 in) cutoff models, respectively.

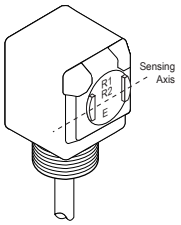
For the highest sensitivity, the sensor-to-object distance should be such that the object will be sensed at or near the point of maximum excess gain. The background must be placed beyond the cutoff distance. Following these two guidelines makes it possible to detect objects of low reflectivity, even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

Fixed-field Concept



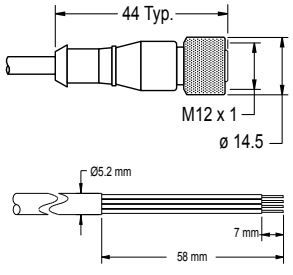
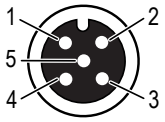
Object is sensed if amount of light at R1 is greater than the amount of light at R2

Fixed-field sensing axis



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.

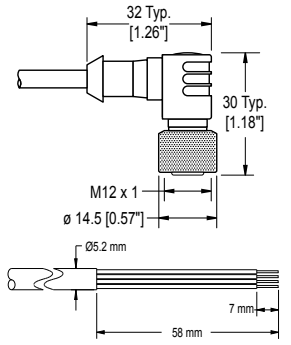
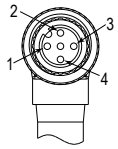
Quick-Disconnect (QD) Cables

4-Pin Single-Ended M12 Female Cordsets					
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**	
MQDC-406	2 m (6.56 ft)	Straight			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Not used
MQDC-415	5 m (16.4 ft)				
MQDC-430	9 m (29.5 ft)				
MQDC-450	15 m (49.2 ft)				

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4-Pin Single-Ended M12 Female Cordsets					
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**	
MQDC-406RA	2 m (6.56 ft)	Right-Angle			
MQDC-415RA	5 m (16.4 ft)				
MQDC-430RA	9 m (29.5 ft)				
MQDC-450RA	15 m (49.2 ft)				

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