

# Q90R2 Radar Sensor Manual

Preliminary



Original Instructions  
p/n: 237883 Rev. 1  
March 20, 2024

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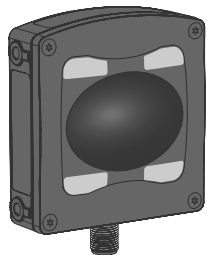
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# Chapter 1



- FMCW radar detects moving and stationary objects
- Adjustable sensing field—ignores objects beyond setpoint
- Easy setup and configuration of range, sensitivity, and output using the Banner Radar Configuration Software
- Sensing functions are immune to wind, fog, steam, and temperature changes and resistant to rain and snow
- Compact, rugged IP69K housing withstands harsh environments
- Highly configurable field of view enables precision positioning and control
- Reliable detection across a broad vertical and horizontal field of view



**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.

**IMPORTANT:** To satisfy RF exposure requirements, this device and its antenna must operate with a separation distance of at least 20 cm from all persons.

## Models

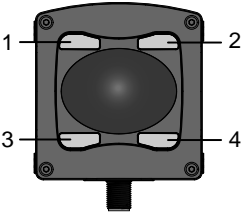
Models	Detection Range	Supply Voltage	Telecom Approved	Output
Q90R2-12040-6KDQ	0.15 m to 20 m (0.5 ft to 65.6 ft)	10 V DC to 30 V DC	US, Canada, Europe	Dual discrete (NPN/PNP, PFM, and IO-Link)

## Overview


The Q90R2 is an industrial radar sensor that uses high-frequency radio waves from its internal antenna to detect and measure distance to objects in its field of view.

The Q90R2 detects a wide variety of materials including metal, liquids, or organic materials. Use the supplied software, IO-Link, or a remote input wire to configure the sensor to sense objects within a specified distance while ignoring objects beyond this distance (background suppression). Or configure the sensor to indicate the presence or absence of objects at a specific (or "taught") distance or range of distances (retroreflective).

# Features and Indicators

		LED	Color	Description
	1	Power	Green	Power ON
	2	Signal Strength	Green	Signal strength indication
	3	Output 1	Amber	Discrete output 1 status
	4	Output 2	Amber	Discrete output 2 status

# Banner Sensor Tool



Use the Banner Sensor Tool software to:

- Set up the sensor in 3 easy steps: set the switch point distance, signal strength threshold, and response time
- Easily monitor device status via the software
- Visualize the application in real-time
- Make adjustments to sensor settings on the fly

For more information, visit [www.bannerengineering.com/us/en/products/sensors/software/radar-configuration.html](http://www.bannerengineering.com/us/en/products/sensors/software/radar-configuration.html).

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Chapter 2

Installation Instructions

Sensor Orientation

Correct sensor-to-object orientation is important to ensure proper sensing.  
Minimize the tilt angle of a target relative to the sensor. The target should be tilted less than half of the beam angle.

Wiring

Quick disconnect wiring diagrams are functionally identical.

Dual Discrete Output

bn (1)

bu (3)

bk (4)

wh (2)

gy (5)

+

10-30 V DC

-

D1\_Out\*/IO-Link

D2\_Out\*/PFM\*\*

Input

Load

Load

Key:

1 = Brown

2 = White

3 = Blue

4 = Black

5 = Gray (Connect for use with remote input or Banner Radar Configuration software)

1

2

3

4

5

\* Push-Pull output. User-configurable PNP/NPN setting.

\*\* Pulse Frequency Modulation

**NOTE:** Banner recommends that the shield wire (quick-disconnect cordsets only) be connected to earth ground or dc common. Shielded cordsets are recommended for all quick-disconnect models.

Mount the Device

1. If a bracket is needed, mount the device onto the bracket.
2. Mount the device (or the device and the bracket) to the machine or equipment at the desired location. Do not tighten the mounting screws at this time.
3. Check the device alignment.
4. Tighten the mounting screws to secure the device (or the device and the bracket) in the aligned position.

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## Chapter 3 Specifications

Response Speed	Fast	Medium	Slow
Response time	48 ms	132 ms	240 ms
Max Velocity	9 m/s	9 m/s	4.5 m/s
Velocity resolution	0.5 m/s	0.25 m/s	0.15 m/s

### Operating Principle

Frequency-modulated continuous-wave (FMCW) radar

### Operating Frequency

60 GHz to 61.5 GHz

### Transmitting Power

peak E.I.R.P: <20 dBm

mean E.I.R.P <20 dBm

### Field of View

Horizontal:  $\pm 60^\circ$

Vertical:  $\pm 20^\circ$

### Distance

0.15 m to 20 m (0.5 ft to 65.6 ft)

### Distance Resolution

0.1 m

### Supply Voltage (Vcc)

10 V DC to 30 V DC

Use only with a suitable Class 2 power supply (UL) or Limited Power Supply (CE)

### Power and Current Consumption, exclusive of load

**Power consumption:** < 2.4 W

**Current consumption:** <100 mA at 24 V DC

### Supply Protection Circuitry

Protected against reverse polarity and transient overvoltages

### Delay at Power-up

< 2 s

### Output Configuration

Discrete Output 1 (Black Wire): IO-Link, push/pull output, configurable PNP or NPN output

Discrete Output 2 (White Wire): Configurable PNP or NPN, or Pulse Frequency Modulated (PFM) output

### Output Protection

Protected against output short-circuit

### Remote Input

Allowable Input Voltage Range: 0 to Vsupply

Active High (internal weak pull-down): High state > (Vsupply - 2.25 V) at 2 mA maximum

Active Low (internal weak pull-up): Low state < 2.25 V at 2 mA maximum

### Indicators

**Power LED:** Green, power on

**Signal Strength LED:**

Green Flash: weak signal

Green Solid: 4x threshold

**Output LEDs:** Amber, target within taught analog span/ discrete output status

### Construction

**Housing:** Aluminum

**Window:** Polycarbonate

### Connections

Integral M12 quick disconnect

Models with a quick disconnect require a mating cordset

### Vibration and Mechanical Shock

All models meet MIL-STD-202G, Method 201A (Vibration: 10 Hz to 60 Hz, 0.06 inch (1.52 mm) double amplitude, 2 hours each along X, Y and Z axes) requirements. Also meets IEC 60947-5-2 (Shock: 30G 11 ms duration, half sine wave) requirements. Method 213B conditions H&I. Shock: 75G with device operating; 100G for non-operation

### Operating Temperature

Standard model:  $-40^\circ\text{C}$  to  $+65^\circ\text{C}$  ( $-40^\circ\text{F}$  to  $+149^\circ\text{F}$ )

### Temperature Effect

$\pm 10$  mm from  $-40^\circ\text{C}$  to  $+65^\circ\text{C}$  ( $-40^\circ\text{F}$  to  $+149^\circ\text{F}$ )

### Environmental Rating

IP67 per IEC60529

IEC IP69K per BS/ISO 20653:2013

### Country of Origin

USA

## Certifications



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



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



ETSI EN 305 550 V2.1.0  
ETSI EN 305 550-1 V.1.2.1  
ETSI EN 305 550-2 V.1.2.1  
FCC ID: UE3Q90R2-6  
IC: 7044A-Q90R26

Install where not accessible by unauthorized personnel.

The device shall only be accessible for adjustment, programming, or maintenance.

The device was evaluated for IK08 impact energy in accordance with IEC 62262.

## Advanced Capabilities



## Output Ratings

Analog Outputs:

- **Current Output (Q90R....-I.. models):** 1 kΩ maximum load resistance at 24 V; maximum load resistance =  $[(V_{cc} - 4.5)/0.02 \Omega]$
- **Voltage Output (Q90R....-U.. models):** 2.5 kΩ minimum load resistance
- **Current rating** = 50 mA maximum each

Black wire specifications per configuration		
IO-Link Push/Pull	Output High	$\geq V_{supply} - 2.5 \text{ V}$
	Output Low	$\leq 2.5 \text{ V}$
PNP	Output High	$\geq V_{supply} - 2.5 \text{ V}$
	Output Low	$\leq 1 \text{ V}$ (loads $\leq 1 \text{ Meg}\Omega$ )
NPN	Output High	$\geq V_{supply} - 2.5 \text{ V}$
	Output Low	$\leq 2.5 \text{ V}$

White wire specifications per configuration		
PNP	Output High	$\geq V_{supply} - 2.5 \text{ V}$
	Output Low	$\leq 2.5 \text{ V}$ (loads $\leq 70 \text{ k}\Omega$ )
NPN	Output High	$\geq V_{supply} - 2.5 \text{ V}$
	Output Low	$\leq 2.5 \text{ V}$

## FCC Part 15 Class A for Intentional Radiators

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

(Part 15.21) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

## Industry Canada Statement for Intentional Radiators

This device contains licence-exempt transmitters(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

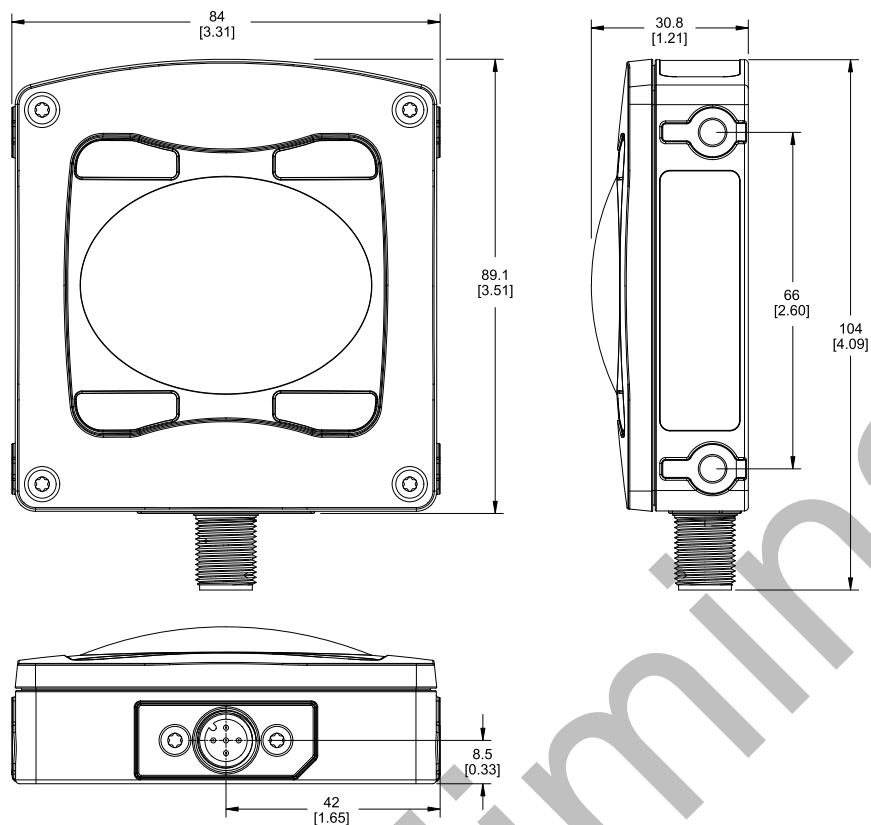
Cet appareil contient des émetteurs/récepteurs exemptés de licence conformes à la norme Innovation, Sciences, et Développement économique Canada. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage.

2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

## Dimensions

All measurements are listed in millimeters [inches], unless noted otherwise.





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# Chapter 4 Accessories

## Cordsets

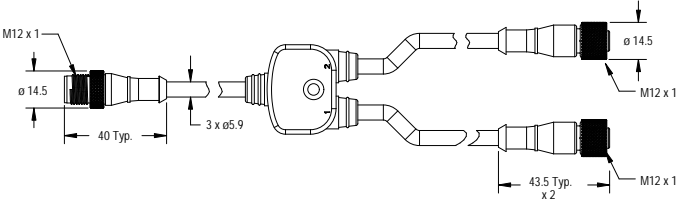
5-Pin Threaded M12 Cordsets with Shield—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQDEC2-506	2 m (6.56 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDEC2-506RA	2 m (6.56 ft)	Right-Angle		

5-Pin Male Threaded and 5-Pin Female Quick Disconnect M12 Cordset with Shield—Double Ended				
Model	Length "L1"	Style	Pinout (Male)	Pinout (Female)
MQDEC3-503SS	0.91 m (2.99 ft)	Female Straight/Male Straight		
MQDEC3-506SS	1.83 m (6 ft)			
			1 = Brown 2 = White 3 = Blue	4 = Black 5 = Gray

5-Pin Threaded M12 Splitter Cordset with Flat Junction				
Model	Trunk (Male)	Branches (Female)	Pinout (Male)	Pinout (Female)
CSB-M1251M1251B	0.3 m (0.98 ft)	0.3 m (0.98 ft)		

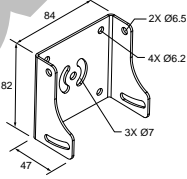
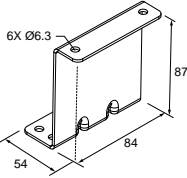

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5-Pin Threaded M12 Splitter Cordset with Flat Junction				
Model	Trunk (Male)	Branches (Female)	Pinout (Male)	Pinout (Female)
			1 = Brown 2 = White 3 = Blue	4 = Black 5 = Gray

**NOTE:** The splitter in the PRO-KIT has two male and one female connectors. The CSB-M1251M1251B splitter has one male and two female connectors. Use the CSB-M1251M1251B to connect the sensor to power and a one of the Banner Pro lights with the Pulse Pro output.

Brackets

<p><b>SMBAMSQ90R</b></p> <ul style="list-style-type: none"><li>Adjustable mounting bracket</li><li>14-Gauge 304 stainless steel</li><li>M6 × 1 mounting hardware included</li></ul>	
<p><b>SMBRAQ90R</b></p> <ul style="list-style-type: none"><li>Right-angle mounting bracket</li><li>14-Gauge 304 stainless steel</li><li>M6 × 1 mounting hardware included</li></ul>	
<p><b>SMBMAG3</b></p> <ul style="list-style-type: none"><li>3.2 inch diameter magnet with 95 lbs pull force</li><li>Use with LMBWLC90PT, SMBAMS70AS, SMBAMSQ90R bracket</li><li>Hardware for mounting to bracket included</li></ul>	

**NOTE:** Use SMBMAG3 with SMBAMSQ90R.

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# Chapter 5      Product Support

## Repairs

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.

**IMPORTANT:** If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

You may be asked to provide the configuration file and the data log file (.cfg) to aid in troubleshooting.

## Contact Us

Banner Engineering Corp. headquarters is located at: 9714 Tenth Avenue North | Minneapolis, MN 55441, USA | Phone: + 1 888 373 6767

For worldwide locations and local representatives, visit [www.bannerengineering.com](http://www.bannerengineering.com).

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