R-GAGE® Q240RA-AF2 Sensor



Datasheet

Radar-Based Dual-Zone Narrow-Beam Sensors for Detection of Moving and Stationary Targets



- · FMCW (true-presence) radar detects moving and stationary objects
- Narrow 11° × 13° beam pattern
- Two independent, adjustable sensing zones detect objects up to 40 meters away (131.2 ft)
- Easy setup and configuration of range, sensitivity, and output with simple DIP switches
- Sensing functions are unaffected by wind, falling rain or snow, fog, humidity, air temperatures, or light
- Sensor operates in Industrial, Scientific, and Medical (ISM) telecommunication band
- Rugged IP67 housing withstands harsh environments

Protected by US patents

Model	Sensing Range	Connection	Supply Voltage	Telecom Approval	Output
Q240RA-US-AF2Q	Two		12 to 30 V dc	Telecom approved for US and Canada	
Q240RA-EU-AF2Q	independent sensing zones; 1 to	5-pin M12 quick disconnect		Telecom approved for Europe, UK, Australia, and New Zealand	DIP-switch- selectable NPN or PNP: N.O. or N.C.
Q240RA-CN-AF2Q	40+ meters (131 ft)	disconnect		Telecom approved for China	1 NI , N.O. OF N.C.



CAUTION: Make No Modifications to this Product

Any modifications to this product not expressly approved by Banner Engineering could void the user's authority to operate the product. Contact Banner Engineering for more information.



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.

Overview

The R-GAGE sensor emits a well-defined beam of high-frequency radio waves from an internal antenna. Some of this emitted energy is reflected back to the receiving antenna. Signal processing electronics determine the distance from the sensor to the object based on the time delay of the return signal. The sensor can be configured to two independent sensing zones.

The two sensing zones are factory pre-set to default distances; they can be reconfigured for different distances using the DIP switches on the side of the sensor. The sensor is plug-in ready for immediate operation.

The sensitivity is precalibrated at the factory, assuming that the sensing field will be clear of obstacles. The sensitivity can be adjusted using the DIP switches on the side of the sensor.





Figure 1. R-GAGE features

- 1. Output LEDs: Yellow (output 1 energized); Red (configuration)
- 2. Output LEDs: Yellow (output 2 energized); Red (configuration)
- 3. Power LED: Green (power ON)
- 4. Signal Strength LED: Red (flashes in proportion to the signal strength)
- 5. DIP switch row A
- 6. DIP switch row B

Access the DIP switches behind the threaded cap on the sensor side



Figure 2. R-GAGE setpoint distances

		EU, CN Model	US Model
Х	Minimum Zone 1 setpoint distance	2 m (6.6 ft)	3.5 m (11.5 ft)
Y	Maximum Zone 1 setpoint distance	30 m (98.4 ft)	30 m (98.4 ft)
Α	Minimum Zone 2 (offset from Zone 1: 2 m to 25 m)	4 m (13.1 ft)	5.5 m (18.0 ft)
В	Maximum Zone 2 (offset from Zone 1: 2 m to 25 m)	55 m (180.4 ft)	55 m (180.4 ft)
D	Dead Zone ¹		

Sensor Configuration

The sensitivity and output configuration can be selected via the DIP switches on the side of the sensor. Use the included spanner to open the screw-off cover on the side of the sensor and access the DIP switches.

Important: Tighten the DIP switch cover a full quarter turn after contact to maintain the watertight seal.

DIP Switch Functions

Switches	Function
A1, A2, A3, A4	Zone 1 Distance (detects objects from sensor face to this point)
A5, A6, A7	Zone 2 Distance, Offset from Zone 1

👖 Typical dead zone: 0.4 m (1.3 ft) for moving and 1.0 m (3.3 ft) for stationary targets, but varies with target reflectivity.

Switches	Function
A8	Polarity
B1, B2, B3	Sensitivity (higher sensitivity sees weaker objects and has a larger beam pattern)
B4, B5, B6	Response Speed
B7	Normally Open/Normally Closed output functionality
B8	Not Used

DIP switch 1 is on the left and DIP switch 8 is on the right.

Distance Settings

	Zone 1 Distance					
4.1	A1 A2 A3 A4	4.0		Dist	Distance	
AI		EU, CN	US			
0	0	0	0	2 m (6.6 ft)	3.5 m (11.5 ft)	
0	0	0	1	2.5 m (8.2 ft)	4 m (13.1 ft)	
0	0	1	0	3 m (9.8 ft)	4.5 m (14.8 ft)	
0	0	1	1	3.5 m (11.5 ft)	5 m (16.4 ft)	
0	1	0	0	4 m (13.1 ft)	5.5 m (18.0 ft)	
0	1	0	1	5 m (16.4 ft)	6 m (19.7 ft)	
0	1	1	0	6 m (19.7 ft)	6.5 m (21.3 ft)	
0	1	1	1	7 m (23.0 ft)	7 m (23.0 ft)	
1*	0*	0*	0*	8 m (26.2 ft)	8 m (26.2 ft)	
1	0	0	1	10 m (32.8 ft)	10 m (32.8 ft)	
1	0	1	0	12 m (39.4 ft)	12 m (39.4 ft)	
1	0	1	1	14 m (45.9 ft)	14 m (45.9 ft)	
1	1	0	0	16 m (52.5 ft)	16 m (52.5 ft)	
1	1	0	1	20 m (65.6 ft)	20 m (65.6 ft)	
1	1	1	0	25 m (82.0 ft)	25 m (82.0 ft)	
1	1	1	1	30 m (98.4 ft)	30 m (98.4 ft)	

* Default settings

Zone 2 Distance Offset from Zone 1					
A5	A6	A7	Offset		
0	0	0	2 m (6.6 ft)		
0	0	1	4 m (13.1 ft)		
0	1	0	6 m (19.7 ft)		
0*	1*	1*	8 m (26.2 ft)		
1	0	0	10 m (32.8 ft)		
1	0	1	15 m (49.2 ft)		
1	1	0	20 m (65.6 ft)		
1	1	1	25 m (82.0 ft)		



NOTE: Highest sensitivity is achieved only if the sensing distance is 36 m (118.1 ft) or less.

Sensitivity Selection

B1	B2	В3	Sensitivity
0	0	0	8 (Highest)
0	0	1	7
0	1	0	6 (High)
0 **	1 **	1 **	5
1 *	0 *	0 *	4 (Medium)
1	0	1	3
1	1	0	2 (Low)
1	1	1	1 (Lowest)

* Default settings for CN and US models

**Default settings for EU model



NOTE: Operation at a high sensitivity not guaranteed for a zone set beyond 45 m (147.6 ft).

Output Configuration

A8	NPN / PNP	B7	Normally Open / Closed
0*	NPN	0*	NO
1	PNP	1	NC

* Default settings

Response Speed

B4	B5	B6	ON Total (ms)	OFF Total (ms)	Total (ms)
0	0	0	15	15	30
0	0	1	30	70	100
0	1	0	30	120	150
0*	1*	1*	50	300	350
1	0	0	50	600	650
1	0	1	30	1000	1030
1	1	0	120	600	720
1	1	1	120	6000	6120

* Default settings

Specifications

Range The sensor is able to detect a proper object (see Detectable Objects) from 1 to 40+ m (3.3 to 131.2+ ft), depending on target Detectable Objects Objects containing metal, water, or similar high-dielectric materials Operating Principle	Indicators Power LED: Green (power ON) Signal Strength LED: Red, flashes in proportion to signal strength. Steady on at 4x excess gain. Only indicates signal amplitude, not target distance. Output LEDs: Yellow (output energized) / Red (configuration) See Overview on page 1
Frequency modulated continuous-wave (FMCW) radar Operating Frequency US Models: 24.075–24.175 GHz, ISM Band EU, CN Models: 24.050–24.250 GHz, ISM Band	Adjustments DIP-switch-configurable sensing distance, sensitivity, response time, and output configuration
Maximum Output Power US, CN Models: ERP: 3.3 mW, 5 dBm, EIRP: 358 mW, 25.5 dBm EU Models: ERP: 0.9 mW, -0.5 dBm, EIRP: 100 mW, 20 dBm	Housing: Polycarbonate Lightpipes: Acrylic Access Cap: Polyester
Supply Voltage 12 to 30 V dc, less than 100 mA, exclusive of load	Operating Temperature - 40° to + 65° C (- 40° to + 149° F)
Supply Protection Circuitry Protected against reverse polarity and transient overvoltages	Environmental Rating IP67
Delay at Power-up Less than 2 seconds	Connections Integral M12 Euro-style QD fitting. QD models require a mating cordset
Output Configuration DIP switch A8 selects Dual NPN (default) or PNP; DIP switch B7 selects N.O. (default) or N.C. operation; 150mA each · Zone 1 output: white wire · Zone 2 output: black wire	Certifications Certifications
Output Protection Protected against short circuit conditions	
Response Time DIP-switch-configurable ON/OFF response time	SIDE 13° TOP 11°

FCC ID: UE3Q240RAUS—This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

IC: 7044A-Q240RA—This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme aux CNR exempts de licence d'Industrie Canada. Son fonctionnement est soumis aux deux conditions suivantes: (1) Ce dispositif ne peut causer des interférences; et (2) Ce dispositif doit accepter toute interférence, y compris les interférences qui peuvent entraîner un mauvais fonctionnement de l'appareil.



Beam Pattern—US and CN Models

NOTE: The effective beam pattern depends on the sensitivity level and target properties.

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Beam Pattern—EU Models



NOTE: The effective beam pattern depends on the sensitivity level and target properties.

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Dimensions

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



Windows

The R-GAGE sensor can be placed behind a glass or a plastic window, but the configuration must be tested and the distance from the sensor to the window must be determined and controlled prior to installation. There is typically a 20% signal reduction when the sensor is placed behind a window.

Polycarbonate at 4 mm thickness performs well in most situations, but the performance depends on filler materials. Thinner (1 to 3 mm) windows have high reflection. The amount of reflection depends on the material, thickness, and distance from the sensor to the window.

Locate the sensor in a position of minimum reflection from the window, which will repeat every 6.1 mm of distance between the sensor and the window. The positions of maximum reflection from the window repeat between the minimums, and decrease in effect until the window is approximately 150 mm (5.9 in) away. Consult the factory for pre-tested window materials which can be used at any distance without issue.

Additionally, the face of the window should be protected from flowing water and ice by use of a flow diverter or hood directly above the window. Falling rain or snow in the air in front of the window, light water mist, or small beads on the face of the window are typically not an issue. However, a thick, continuous surface of water or ice directly on the face of the window can be detected as a dielectric boundary.

The Q240WS is a clip-on hydrophobic weather shield accessory specially designed to meet these requirements.

Wiring



Accessories

Quick Disconnect (QD) Cordsets

5-Pin Threaded M12/Euro-Style Cordsets—with Shield					
Model	Length	Style	Dimensions	Pinout (Female)	
MQDEC2-506	1.83 m (6 ft)		⊣ 44 Typ		
MQDEC2-515	4.57 m (15 ft)				
MQDEC2-530	9.14 m (30 ft)	Straight	Straight M12 x1 - 0145 - 1 - (000 - 000 -		
MQDEC2-550	15.2 m (50 ft)				
MQDEC2-506RA	1.83 m (6 ft)		. 32 Тур.	4	
MQDEC2-515RA	4.57 m (15 ft)			1 = Brown	
MQDEC2-530RA	9.14 m (30 ft)			2 = White 3 = Blue	
MQDEC2-550RA	15.2 m (50 ft)	Right-Angle	M12 x 1	4 = Black 5 = Gray	

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NOTE: Pin 5 is not used.

Brackets and Other Accessories

SMBQ240SS2

- Add-on accessory to be used in conjunction with SMBQ240SS1
- Provides ± 20° of tilt in second axis for maximum control of sensor alignment
- 12 gauge stainless steel



Q240WS

- Coated to help repel water and maximize signal strength
 - Snap-on cover for easy application and replacement



SMBQ240SS1

- Sensor mounting plate and pivoting bracket
- Provides ± 20° of tilt in one axis for enhanced sensor alignment
- 12 gauge stainless steel
- Sensor can mount on bracket horizontally or vertically





Q240RA R-GAGE sensor shown with all three accessories installed.

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