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Client: Banner Engineering, Inc.  
Model: Q120RA-US  
Standard: FCC 15.245  
FCC ID: UE3Q120RAUS  
Report #: 2012355

**Appendix H: Manual**

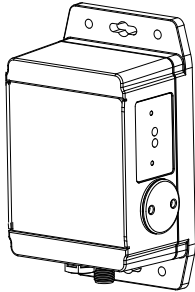
Please refer to the following pages.

# R-GAGE™ Q120RA-AF2 Sensor



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

For complete technical information about this product, including dimensions, accessories, and specifications, see [www.BannerEngineering.com](http://www.BannerEngineering.com) and search 157494\_web



**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 the Factory for more information.**



**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

Model	Sensing Range	Connection	Supply Voltage	Telecom Approval	Output
Q120RA-US-AF2	Two independent sensing zones; 1 to 40+ meters (131 ft)	5-wire 2 m (6.5 ft) Integral cable	12 to 30V dc	Pending approval for United States	DIP-switch-selectable NPN or PNP; N.O. or N.C.
Q120RA-EU-AF2				Pending approval for Europe (except UK) and China	
Q120RA-UK-AF2				Pending approval for UK	

Cabled models only are listed. For integral 5-pin Euro-style (M12) quick-disconnect fitting, add suffix "Q" to the model number (e.g., Q120RA-xx-AF2Q). \*QD models require a mating cordset.

## 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
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

\* Default settings

Zone 1 Distance					
A1	A2	A3	A4	Distance	
				EU	US, UK
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)

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

\* Default settings

B1	B2	B3	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)



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

## Response Speed

\* Default settings

B4	B5	B6	ON Total	OFF Total	Total
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

## Output Configuration

\* Default settings

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

## 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

Frequency modulated continuous-wave (FMCW) radar

### Operating Frequency

24.00 to 24.25 GHz, ISM Band (varies slightly with model, depending on national telecom regulations)

### Supply Voltage

12 to 30V dc, less than 100 mA, exclusive of load

### Supply Protection Circuitry

Protected against reverse polarity and transient overvoltages

### Delay at Power-up

Less than 2 seconds

### 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

### Output Protection

Protected against short circuit conditions

### Response Time

DIP-Switch-configurable ON/OFF response time

### 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)

### Adjustments

DIP-switch-configurable sensing distance, sensitivity, response time, and output configuration

### Construction

**Housing:** ABS/polycarbonate

**Lightpipes:** Acrylic

**Access Cap:** Polyester

### Operating Temperature

-40° to +65° C (-40° to +149° F)

### Environmental Rating

IP67

### Connections

Integral 5-wire 2 m (6.5 ft) cable or M12 Euro-style QD fitting. QD models require a mating cordset

### Certifications

Telecom approvals pending

FCC ID: UE3Q120RAUS—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.

## Windows

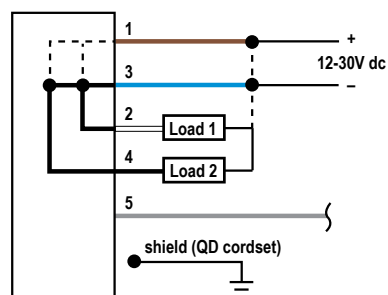
The R-GAGE sensor can be placed behind a glass or a plastic window, but the configuration must be tested and the distance from the sensor to the window must be determined and controlled prior to installation. There is typically a 20% signal reduction when the sensor is placed behind a window.

Polycarbonate at 4mm 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.

## Hookup



### Wiring Key:

- 1 = Brown
- 2 = White
- 3 = Blue
- 4 = Black
- 5 = Gray (Do not connect)



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

## 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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