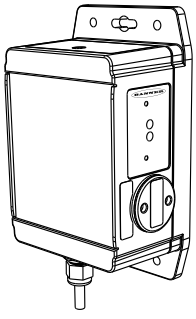
Q120RA-AF2W R-GAGE® Sensor

Features

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



- FMCW radar detects moving and stationary objects
- Narrow beam pattern
- Two independent, adjustable sensing zones detect objects up to 26 meters away
- 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

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

Model[1]	Sensing Range	Connection	Supply Voltage	Telecom Approval	Output
Q120RA-US-AF2W	Two independent sensing zones; 25 meters (82 ft)	5-wire 2 m (6.5 ft) Integral cable	12 to 30 V DC	Telecom approved for US and Brazil	DIP-switch-selectable NPN or PNP; N.O. or N.C.
Q120RA-EU-AF2W				Telecom approved for Europe, UK, Australia, New Zealand, China, and Japan	
120RA-KR-AF2W			12 to 24 V DC	Telecom approved for South Korea	

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.

(1) Cabled models only are listed. To order the integral 5-pin M12 quick-disconnect model, add the suffix "**Q**" to the model number (for example, **Q120RA-xx-AF2WQ**). Quick disconnect models require a mating cordset.

Original Instructions
25-Mar-25

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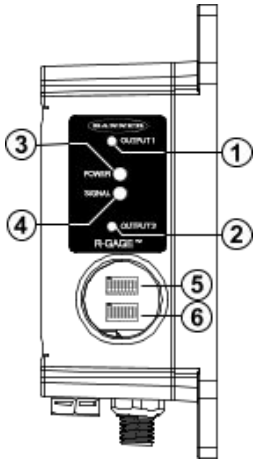
p/n: 189332 Rev. D

ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

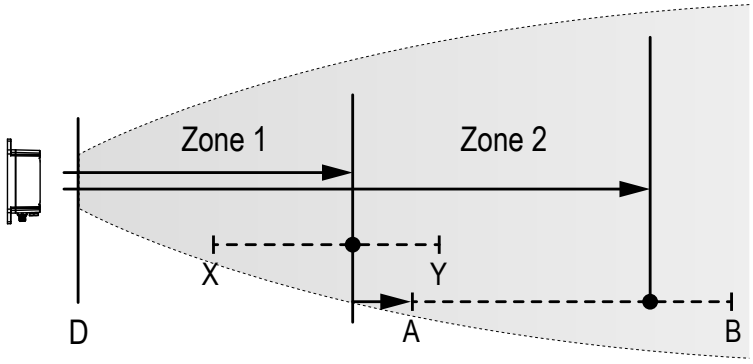
R-GAGE features



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 side of the sensor.

R-GAGE setpoint distances



		EU, KR Models	US Models
X	Minimum Zone 1 setpoint distance	2 m (6.6 ft)	3.5 m (11.5 ft)
Y	Maximum Zone 1 setpoint distance	12 m (39.4 ft)	12 m (39.4 ft)
A	Minimum Zone 2 (offset from Zone 1: 2 m to 14 m)	4 m (13.1 ft)	5 m (16.4 ft)
B	Maximum Zone 2 (offset from Zone 1: 2 m to 14 m)	26 m (85.3 ft)	26 m (85.3 ft)
D	Dead Zone[2]		

Sensor Configuration

Configure the sensor using the DIP switches. Use the included spanner to open the screw-off cover 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

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

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

Continued on page 3

[2] 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.

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Switches	Function
A8	Polarity
B1	Not used
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

Distance Settings

* Default settings

Zone 1 Distance					
A1	A2	A3	A4	Distance	
				EU, KR	US
0	0	0	0	2 m (6.6 ft)	3 m (9.8 ft)
0	0	0	1	2.5 m (8.2 ft)	3.25 m (10.7 ft)
0	0	1	0	3 m (9.8 ft)	3.5 m (11.5 ft)
0	0	1	1	3.5 m (11.5 ft)	3.75 m (12.3 ft)
0	1	0	0	4 m (13.1 ft)	
0	1	0	1	4.5 m (14.8 ft)	
0	1	1	0	5 m (16.4 ft)	
0	1	1	1	5.5 m (18 ft)	
1	0	0	0	6 m (19.7 ft)	
1	0	0	1	6.5 m (21.3 ft)	
1	0	1	0	7 m (23 ft)	
1 *	0 *	1 *	1 *	8 m (26.2 ft)	
1	1	0	0	9 m (29.5 ft)	
1	1	0	1	10 m (32.8 ft)	
1	1	1	0	11 m (36.1 ft)	
1	1	1	1	12 m (39.4 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	7 m (23 ft)
1 *	0 *	0 *	8 m (26.2 ft)
1	0	1	10 m (32.8 ft)
1	1	0	12 m (39.4 ft)
1	1	1	14 m (46 ft)

Sensitivity Selection

* Default settings

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B2	B3	Sensitivity
0*	0*	4 (Highest)
0	1	3 (High)
1	0	2 (Medium)
1	1	1 (Lowest)

Output Configuration

* Default settings

A8	NPN/PNP		B7	Normally Open/Closed
0 *	NPN		0 *	Normally open
1	PNP		1	Normally closed

Discrete Response Speed

* Default settings

B4	B5	B6	ON (ms)	OFF (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

Specifications

Range
The sensor can detect a proper object (see Detectable Objects) from 1 m to 26 m (3.3 ft to 85.3 ft), depending on the target

Detectable Objects
Objects containing metal, water, or similar high-dielectric materials

Operating Principle
Frequency-modulated continuous-wave (FMCW) radar

Operating Frequency
US Models: 24.075–24.175 GHz, ISM Band
EU, KR Models: 24.050–24.250 GHz, ISM Band

Maximum Output Power
ERP: 3.3 mW, 5 dBm
EIRP: 100 mW, 20 dBm

Supply Voltage
US and EU models: 12 V DC to 30 V DC, less than 100 mA, exclusive of load
KR models: 12 V DC to 24 V 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 Protection
Protected against short circuit conditions

Response Time
DIP-switch-configurable ON/OFF response time

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

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 "Q120RA-AF2W Overview" on page 1

Construction
Housing: ABS/polycarbonate
Lightpipes: Acrylic
Access Cap: Polyester

Connections
Integral 5-wire 2 m (6.5 ft) cable or M12 quick disconnect fitting. Quick disconnect 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

Operating Temperature
– 40° to + 65° C (– 40° to + 149° F)

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Environmental Rating

IP67

Certifications

CE

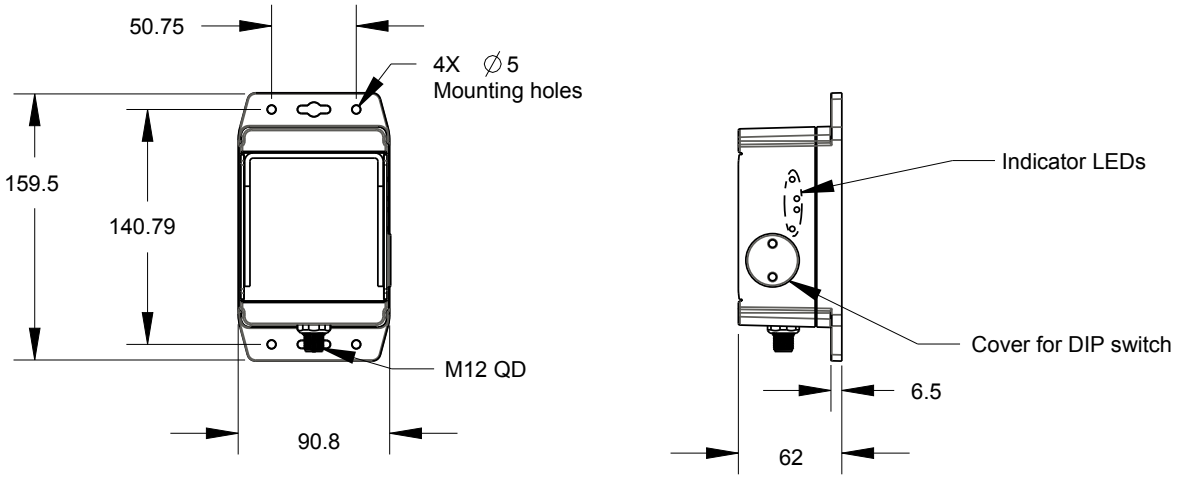
ETSI/EN 300 440
FCC part 15
ANATEL Category II
KC mark - MSIP/RRA
CMIIT Category G
ARIB STD T-73
for others, contact Banner Engineering
Country of Origin: USA

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.

ANATEL Agência Nacional de Telecomunicações 01710-16-04042	Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados.

Dimensions

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



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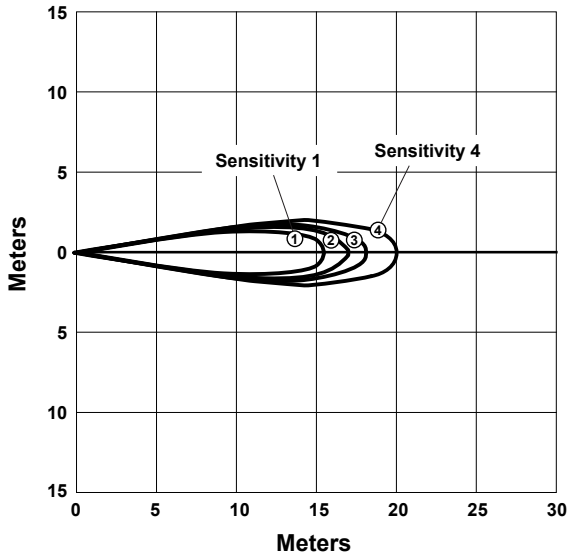
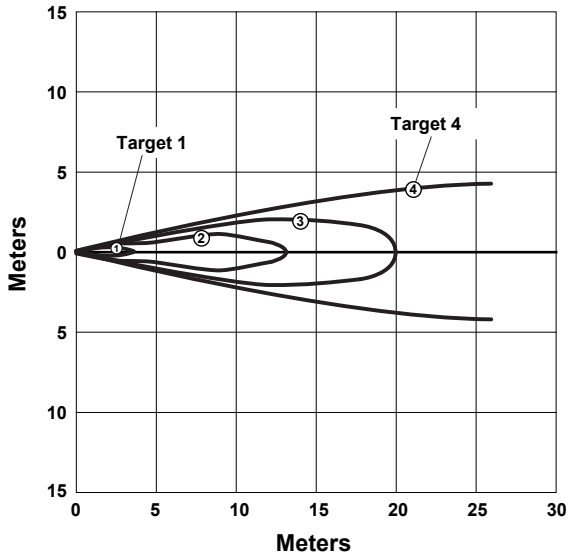
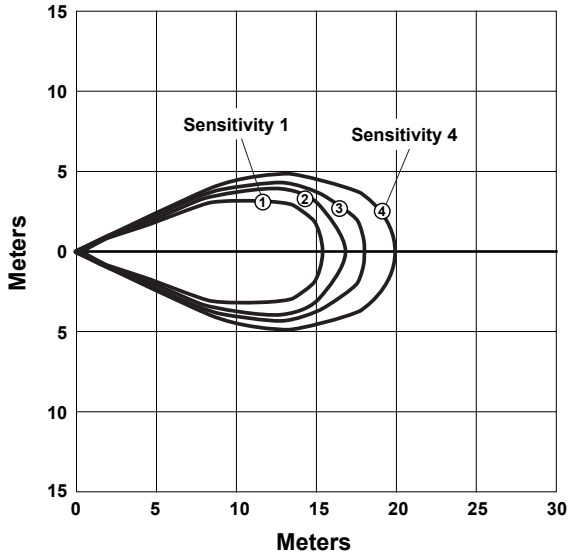
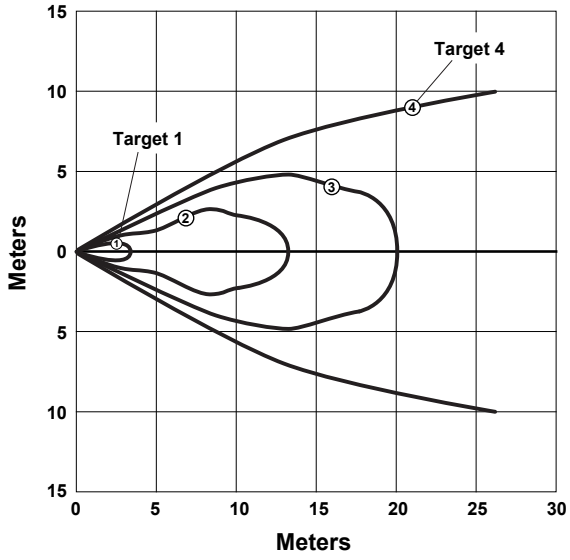
Beam Patterns

Typical Beam Pattern (with BRTR-CC20E Radar Target, Radar Cross Section = 50 m^2)	Typical Beam Pattern (with 4 different targets) at highest sensitivity level)
Horizontal Beam Pattern	Horizontal Beam Pattern
	
Vertical Beam Pattern	Vertical Beam Pattern
	
1–4: Indicates sensitivity level	1. Weak Object (Radar cross section = 0.25 m^2) 2. Car (Radar cross section = 3 m^2) 3. Large Truck (Radar cross section = 50 m^2) 4. Passenger Train (Radar cross section = 300 m^2)

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

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Windows

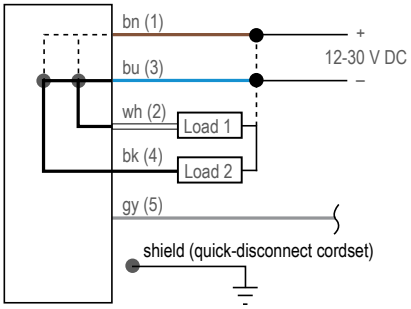
The R-GAGE sensor can be placed behind a glass or a plastic window, but the configuration must be tested and the distance from the sensor to the window must be determined and controlled prior to installation. There is typically a 20% signal reduction when the sensor is placed behind a window.

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.

Wiring



Wiring Key:

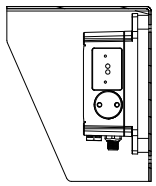
1. Brown
2. White
3. Blue
4. Black
5. Gray (Do not connect)

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.

Accessories

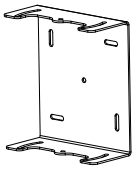
SMBWSQ120

- Rear-mount protective metal enclosure
- Supports both horizontal and vertical sensor mounting
- Required if the R-GAGE is exposed to rain or snow
- Prevents water or ice buildup from interfering with sensor performance



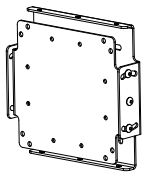
SMBQ240SS2

- 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



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



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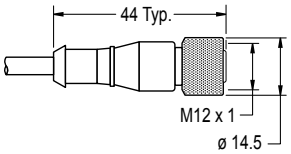
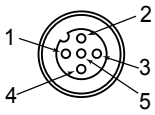
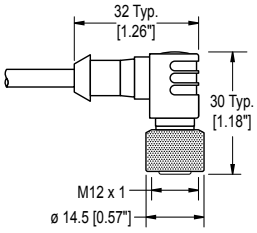
5-Pin Single-Ended M12 Female Shielded Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQDEC2-506	2 m (6.56 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDEC2-515	5 m (16.4 ft)			
MQDEC2-530	9 m (29.5 ft)			
MQDEC2-550	15 m (49.2 ft)			
MQDEC2-575	23 m (75.44 ft)			
MQDEC2-5100	30.5 m (100 ft)			
MQDEC2-506RA	2 m (6.56 ft)	Right-Angle		
MQDEC2-515RA	5 m (16.4 ft)			
MQDEC2-530RA	9 m (29.5 ft)			
MQDEC2-550RA	15 m (49.2 ft)			
MQDEC2-575RA	23 m (75.44 ft)			
MQDEC2-5100RA	31 m (101.68 ft)			

NOTE: Pin 5 is not used.

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