

# R-GAGE® Q130RA-AF Sensor

## Instruction Manual

DRAFT

Original Instructions  
TBD Rev. A  
31 October 2018  
© Banner Engineering Corp. All rights reserved

**BANNER®**  
more sensors, more solutions



TBD

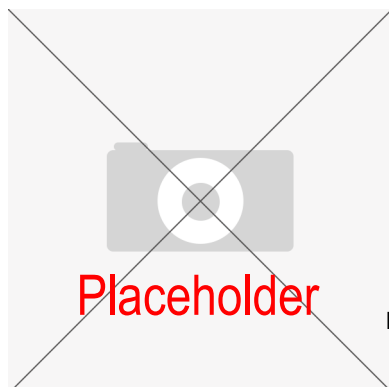
# Contents

|                                                    |           |
|----------------------------------------------------|-----------|
| <b>1 Product Description</b>                       | <b>3</b>  |
| 1.1 Models                                         | 3         |
| 1.2 Overview                                       | 3         |
| 1.3 Features and Indicators                        | 4         |
| <b>2 Installation Instructions</b>                 | <b>5</b>  |
| 2.1 Mount the Device                               | 5         |
| 2.2 Wiring                                         | 5         |
| <b>3 Specifications</b>                            | <b>6</b>  |
| 3.1 Beam Patterns                                  | 6         |
| 3.2 Dimensions                                     | 7         |
| <b>4 Windows</b>                                   | <b>8</b>  |
| <b>5 Accessories</b>                               | <b>9</b>  |
| 5.1 Quick Disconnect (QD) Cordsets                 | 9         |
| 5.2 Brackets and Enclosures                        | 9         |
| <b>6 Banner Engineering Corp. Limited Warranty</b> | <b>10</b> |

DRAFT

# 1 Product Description

*Radar-Based Sensors for Detection of Moving and Stationary Targets*



- FMCW (true-presence) radar detects moving and stationary objects
- Adjustable sensing field — ignores objects beyond setpoint
- Easy setup and configuration of range, sensitivity, and output with simple DIP switches
- Easy setup and configuration of range, sensitivity, and output using a PC
- 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.



## 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.

## 1.1 Models

| Models          | Maximum Range | Beam Angle | Telecom Approval <sup>1</sup>                                             | Output                 | Connection                         |
|-----------------|---------------|------------|---------------------------------------------------------------------------|------------------------|------------------------------------|
| Q130RA-9076-AFQ | 24 m (78 ft)  | 90° × 76°  | Telecom approved for US, Canada and Brazil                                | Bipolar NPN/PNP        | 5-wire 2 m (6.5 ft) Integral cable |
| Q130RA-2450-AFQ |               | 24° × 50°  | Telecom approved for Europe, UK, Australia, New Zealand, China, and Japan | N.O./N.C. Configurable |                                    |

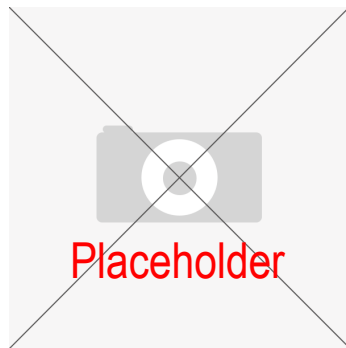
## 1.2 Overview

The R-GAGE sensor emits a well-defined beam of high-frequency radio waves from an internal antenna. Some of this emitted energy reflects back to the receiving antenna. Signal processing electronics in the sensor determine the distance from the sensor to the object based on the time delay of the return signal. The sensor can be configured (using a PC) to sense objects up to a specific distance, ignoring objects beyond this distance (also called background suppression).

<sup>1</sup> For additional countries, contact Banner Engineering.

## 1.3 Features and Indicators

---



*Figure 1. R-GAGE Features*

1. Power LED: Green (power ON)
2. Signal Strength LED: Red (flashes in proportion to the signal strength)
3. Output LEDs: Yellow (output energized); Red (configuration)

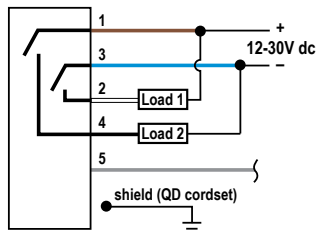
DRAFT

## 2 Installation Instructions

### 2.1 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.

### 2.2 Wiring

**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.

## 3 Specifications

### Range

The sensor is able to detect a proper object (see Detectable Objects) from 1 to 24 m (3.3 to 78.7 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

24.050-24.250 GHz, ISM Band

### Maximum Output Power

ERP: 3.3 mW, 5 dBm  
EIRP: 100 mW, 20 dBm

### Supply Voltage

12 to 30 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 Configuration

Bipolar NPN/PNP output, 150mA; DIP switch 6 selects N.O. (default) or N.C. operation

### Output Protection

Protected against short circuit conditions

### Response Time

DIP switches 7 & 8 select ON/OFF response time

FCC ID: UE3RGAGE1XX—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.

### 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 [Figure 1](#) on page 4

### Construction

**Housing:** ABS/polycarbonate

**Lightpipes:** Acrylic

**Access Cap:** Polyester

### Operating Temperature

-40 °C to +65 °C (-40 °F to +149 °F)

### Environmental Rating

IEC IP67

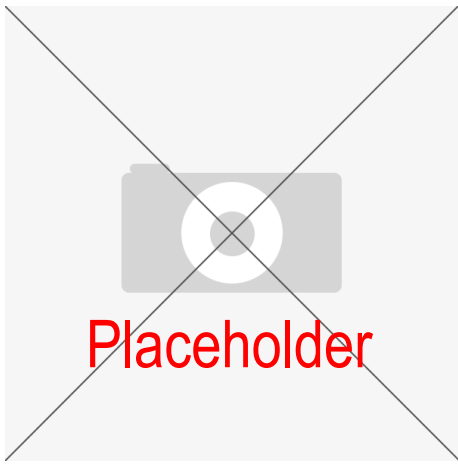
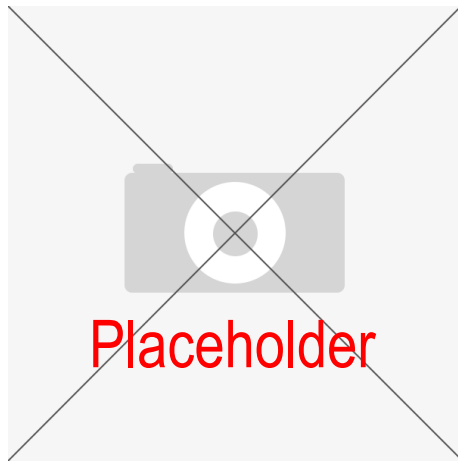
### Connections

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

### Certifications



## 3.1 Beam Patterns

| Typical Beam Pattern (with BRTR-CC20E Radar Target, Radar Cross Section = 50 m <sup>2</sup> )                                                                              | Typical Beam Pattern (with 4 different targets) at highest sensitivity level                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Left-Right Beam Pattern</p>  <p>Distance</p> <p>1-4: Indicates sensitivity level</p> | <p>Left-Right Beam Pattern</p>  <p>Distance</p> <p>1: Weak Object (Radar cross section = 0.25 m<sup>2</sup>)<br/>2: Car (Radar cross section = 3 m<sup>2</sup>)<br/>3: Large Truck (Radar cross section = 50 m<sup>2</sup>)<br/>4: Passenger Train (Radar cross section = 300 m<sup>2</sup>)</p> |

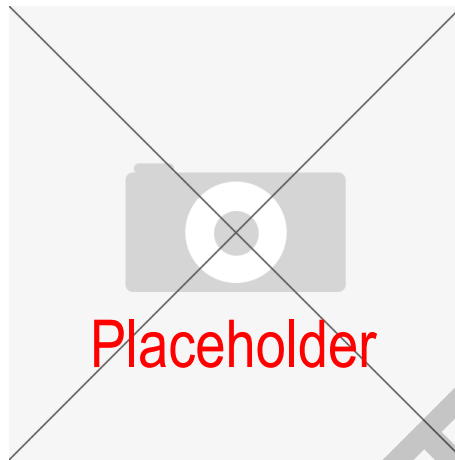


**Note:** The effective beam pattern depends on the sensitivity level and target properties.

## 3.2 Dimensions

---

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



## 4 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.

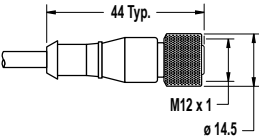
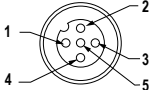
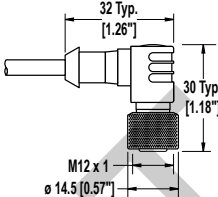
Locate the sensor in a position of minimum reflection from the window, which will repeat every 6.1 mm of distance between the sensor and the window. The positions of maximum reflection from the window repeat between the minimums, and decrease in effect until the window is approximately 150 mm (5.9 in) 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.

DRAFT

## 5 Accessories

### 5.1 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)  | Straight    |                                                                                                                                                             | <br><br>1 = Brown<br>2 = White<br>3 = Blue<br>4 = Black<br>5 = Gray |
| MQDEC2-515                                         | 4.57 m (15 ft) |             |                                                                                                                                                                                                                                               |                                                                                                                                                        |
| MQDEC2-530                                         | 9.14 m (30 ft) |             |                                                                                                                                                                                                                                               |                                                                                                                                                        |
| MQDEC2-550                                         | 15.2 m (50 ft) |             |                                                                                                                                                                                                                                               |                                                                                                                                                        |
| MQDEC2-506RA                                       | 1.83 m (6 ft)  | Right-Angle |  |                                                                                                                                                        |
| MQDEC2-515RA                                       | 4.57 m (15 ft) |             |                                                                                                                                                                                                                                               |                                                                                                                                                        |
| MQDEC2-530RA                                       | 9.14 m (30 ft) |             |                                                                                                                                                                                                                                               |                                                                                                                                                        |
| MQDEC2-550RA                                       | 15.2 m (50 ft) |             |                                                                                                                                                                                                                                               |                                                                                                                                                        |

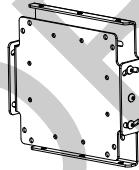


**Note:** Pin 5 is not used.

### 5.2 Brackets and Enclosures

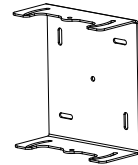
#### SMBQ240SS1

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



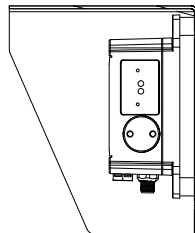
#### SMBQ240SS2

- Add-on accessory to be used in conjunction with SMBQ240SS1
- Provides  $\pm 20^\circ$  of tilt in second axis for maximum control of sensor alignment
- 12 gauge stainless steel



#### 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 buildup of water or ice from interfering with sensor performance



## 6 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.

**THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.**

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to: [www.bannerengineering.com](http://www.bannerengineering.com).

For patent information, see [www.bannerengineering.com/patents](http://www.bannerengineering.com/patents).

DRAFT