R-GAGE® K50R Radar Sensor

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Quick Start Guide

Radar-Based Sensors for Detection and Measurement of Moving and Stationary Targets. Patent pending.

This guide is designed to help you set up and install the R-GAGE K50R sensor. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Instruction Manual at www.bannerengineering.com. Search for p/n 226219 to view the Instruction Manual. Use of this document assumes familiarity with pertinent industry standards and practices.
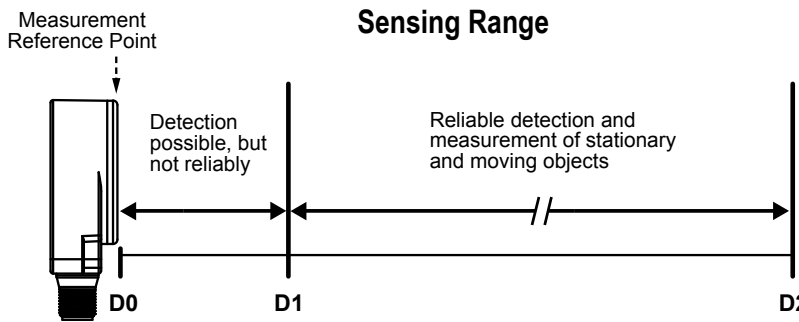
⚠️ **WARNING:**
- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Overview

The K50R is an industrial radar sensor that uses high frequency radio waves from an internal antenna.
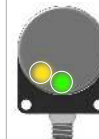

Figure 1. Sensing Range

Sensing Range

Measurement Reference Point

Detection possible, but not reliably

Reliable detection and measurement of stationary and moving objects

D0   D1   D2

Model	D0 (m)	D1 (m)	D2 (m)
K50RxF-8060-LDQ	0	0.1	3.0

Features and Indicators

K50R Standard—Features

Figure 2. K50RF-8060-LDQ Features

		LED	Color	Description
	1	Output 1	Amber	Discrete output status
	2	Power/Signal Strength	Green or Blue	Power ON and signal strength indication
	3	Output 2	Amber	Discrete output status

K50R Standard—Signal Strength and the Indicator LEDs

LED	Color	Description	LED	Color	Description
	ON Green	Power ON. Signal strength is greater than 2x the user-selected threshold		ON Amber	Discrete output 1 status

LED	Color	Description	LED	Color	Description
	Flashing Green	Power ON Signal strength is less than 2x the user-selected threshold		ON Amber	Discrete output 2 status
	ON Blue	Power ON Signal strength is less than 1		Flashing Red	Error

K50R Pro—Features

Figure 3. K50RPF-8060-LDQ Features

The Pro models offer advanced indication of distance thresholds and device states. Options include animation, intensity, patterns, colors, and others.

See the instruction manual for configuration information and instructions.

If all LEDs flash red continually, the sensor is in an error state.

Installation Instructions

Install the Software

Operating System
Microsoft® Windows® operating system version 10 [1]
Hard Drive Space
500 MB

Third-Party Software
.NET
USB Port
Available USB port

> **Important:** Administrative rights are required to install the Banner Radar Configuration software.

1. Download the latest version of the software from www.bannerengineering.com/us/en/products/sensors/software/radar-configuration.html.
2. Navigate to and open the downloaded file.
3. Click **Install** to begin the installation process.
4. Depending on your system settings, a popup window may appear prompting to allow Banner Radar Configuration to make changes to your computer. Click **Yes**.
5. Click **Close** to exit the installer.

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.

[1] Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.

Connect to the Sensor
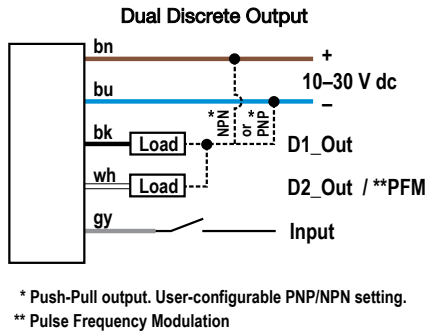
Figure 4. System Components for a Typical Installation
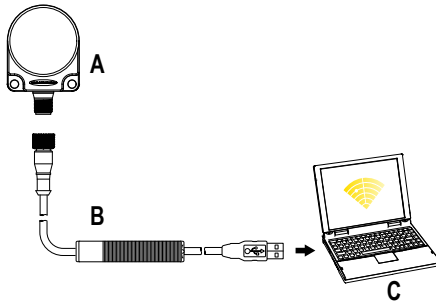
A = K50R
B = Pro Converter Cable (MQDC-506-USB)
C = PC running Banner Radar Configuration software

**Note:** Requires a PC USB port to supply 0.5 A at 5 V.

Wiring

Quick disconnect wiring diagrams are functionally identical.

Dual Discrete Output

bn
+
10–30 V dc
bu
–
bk
D1_Out
wh
D2_Out / **PFM
gy
Input

* NPN or * PNP
Load
Load

* Push-Pull output. User-configurable PNP/NPN setting.
** Pulse Frequency Modulation

Key:
1 = Brown
2 = White
3 = Blue
4 = Black
5 = Gray (Connect for use with remote input or Banner Radar Configuration software)
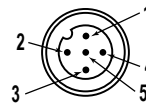
Note: A shielded cable is required if the sensor is mounted outdoors or if the cable is longer than 30 m (98.4 ft).

Getting Started

Power up the sensor, and verify that the power LED is ON green.

Connect to the Sensor

1. Connect the sensor to the Pro Cable.
2. Connect the Pro Converter cable to the PC.
3. Open the Banner Radar Configuration Software.
4. Go to **Sensor** > **Connect** on the **Navigation** toolbar.
   The **Connection** screen displays.
5. Select the correct **Sensor Model** and **Com Port** for the sensor.
6. Click **Connect**.
   The **Connection** screen closes and the sensor data displays.

Software Overview

Easy setup and configuration of range, sensitivity, and output using the Banner Radar Configuration software and Pro Converter Cable.

Figure 5. Banner Radar Configuration Software
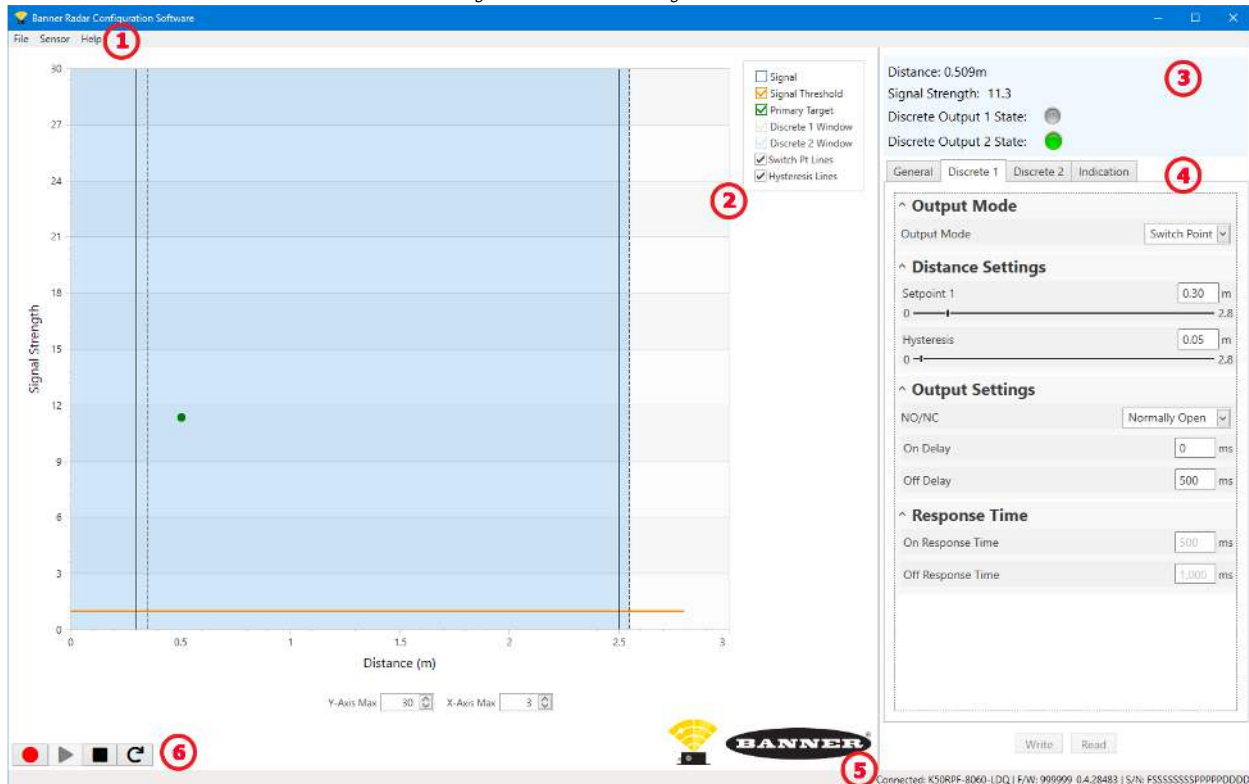
1. Navigation toolbar—Use this toolbar to connect to the sensor, to save or load a configuration, or to reset to factory defaults
2. Live Sensor Data and Legend—Shows the signal strength versus distance for the connected sensor, as well as options to select which data displays on the graph
3. Summary pane—Displays the distance to the target, the signal strength, and the output status
4. Sensor Settings pane—Set the sensor parameters in this pane
5. Status bar—Shows whether the sensor is connected, if a software update is available, and if the sensor data is being recorded to a file
6. Live Sensor Data controls—Use these controls to record, freeze, and play real-time sensor data, and to refresh the sensor connection

Specifications

Range
The sensor can detect an object at the following ranges, depending on the material of the target:
 Standard Mode: 100 mm to 2.5 m (3.9 in to 8.2 ft)
 Faster Response: 150 mm to 1.0 m (6.0 in to 3.3 ft)
 High Power Mode: 500 mm to 3.0 m (19.7 in to 9.8 ft)

Operating Principle
Pulsed coherent radar (PCR)

Operating Frequency
60.5 GHz

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
Standard models:
 Power consumption: <1.0 W at 24 V
 Current consumption: <35 mA at 24 V
Pro models:
 Power consumption: <1.5 W at 24 V
 Current consumption: <55 mA at 24 V

Supply Protection Circuitry
Protected against reverse polarity and transient overvoltages

Linearity
Standard Mode: < ± 8 mm
Faster Response Mode: < ± 4 mm
High Power Mode: < ± 16 mm
Reference target with RCS = 1m²

Delay at Power-up
< 1 s

Output Configuration
Discrete Output 1 (Black Wire): Configurable PNP or NPN output
Discrete Output 2 (White Wire): Configurable PNP or NPN output 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

Response Time
Standard Mode: 200 ms
Faster Response Mode: 100 ms
High Power Mode: 250 ms
Response times given for fast mode. See the Instruction Manual for additional details.

Indicators
Standard models:
 Power LED/Signal Strength: Green or blue depending on sensor state
 Output LEDs: Amber, target within taught discrete output status
Pro models: User configurable

Construction
 Housing: Polycarbonate
 Window: Polycarbonate

Connections
Integral M12 quick disconnect
Models with a quick disconnect require a mating cordset

 Note: A shielded cable is required if the sensor is mounted outdoors or if the cable is longer than 30 m (98.4 ft).

Vibration and Mechanical Shock
All models meet MIL-STD-202F, Method 201A (Vibration: 10 Hz to 60 Hz maximum, 0.06 inch (1.52 mm) double amplitude, 10G acceleration) requirements. Method 213B conditions H&I.Shock: 75G with device operating; 100G for non-operation

Repeatability [2]
    Standard Mode: 10 mm
    Faster Response Mode: 5 mm
    High Power Mode: 20 mm

Maximum Output Power
    EIRP: 10dBm

Operating Temperature
    Standard model: –40 °C to +60 °C (–40 °F to +140 °F)

Temperature Effect
    <±5 mm from –40 °C to +60 °C (–40 °F to +140 °F)

Environmental Rating
    IP67

Output Ratings
    Current rating = 50 mA maximum each

Black wire specifications per configuration		
PNP	Output High	≥ Vsupply - 2.5 V
	Output Low	≤ 1V (loads ≤ 1 MegΩ)
NPN	Output High	≥ Vsupply - 2.5 V
	Output Low	≤ 2.5 V

White wire specifications per configuration		
PNP	Output High	≥ Vsupply - 2.5 V
	Output Low	≤ 2.5 V (loads ≤ 70 kΩ)
NPN	Output High	≥ Vsupply - 2.5 V
	Output Low	≤ 2.5 V

Certifications

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

Turck Banner LTD Blenheim House, Blenheim Court, Wickford, Essex SS11 8YT, Great Britain

Contains FCC ID: 2AQ6KA1001
Contains IC: 24388-A111
for others, contact Banner Engineering

Advanced Capabilities

PULSE® PRO I/O

Country of Origin
    USA

FCC Part 15 Class A

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.

Industry Canada

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.

Beam Patterns

The beam pattern of the radar sensor is dependent on the radar cross section (RCS) of the target.

The beam pattern graphs represent Standard Mode and are guides for representative object detection capabilities based on different sized radar cross sections and corresponding example real world targets. Use the following charts as a starting point in application setup. Note that applications vary.

- Use the Beam Width versus Distance chart to understand where corresponding objects can be detected. Adjusting the signal strength threshold also affects the beam pattern when the target is constant.
- Use the Beam Width versus Degrees chart to help determine how much the target can tilt from 90 degrees while still maintaining detection.

Unless otherwise specified, the following beam patterns are shown with Signal Strength Threshold = 1.

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[2] At medium response time.

Figure 6. Typical beam pattern, in millimeters, on representative targets
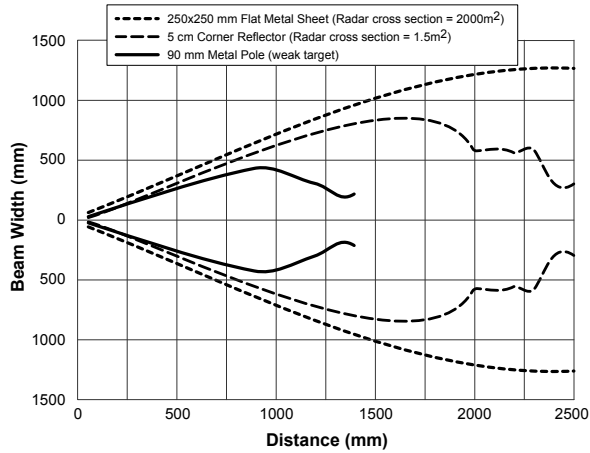

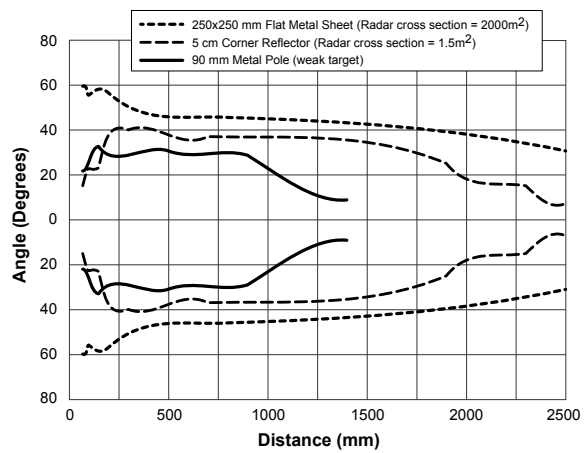Figure 7. Typical beam pattern, in degrees, on representative targets

Figure 8. Typical beam pattern, in millimeters, with 250 × 250 mm Flat Metal Sheet (Radar cross section = 2000m²) and various signal strength thresholds
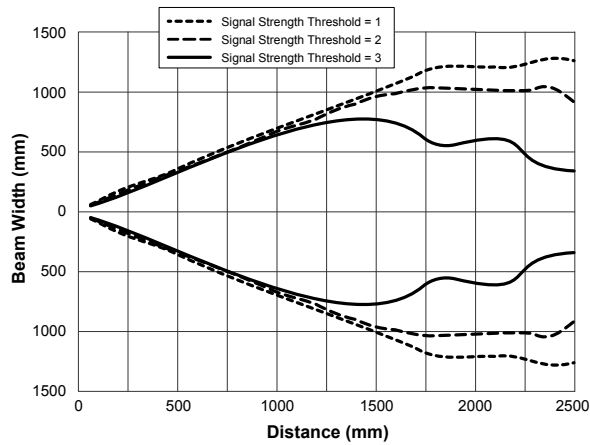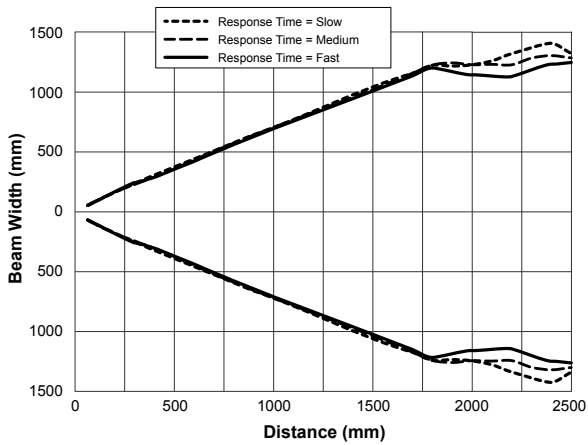

Figure 9. Typical beam pattern, in millimeters, with 250 × 250 mm Flat Metal Sheet (Radar cross section = 2000m²) and various response times

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