R-GAGE® K50R Radar Sensor

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.

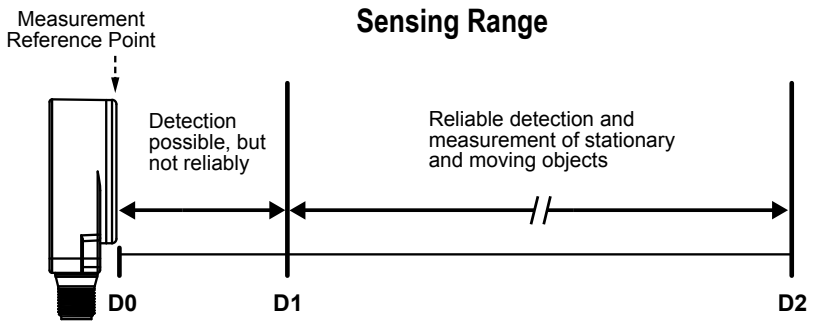
WARNING:

- **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

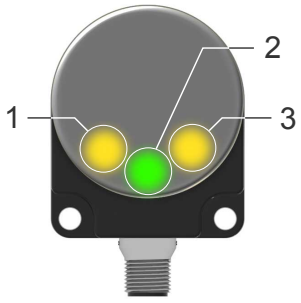


Model	D0 (m)	D1 (m)	D2 (m)
K50RxF-8060-LDQ	0	0.1	2.5

Features and Indicators

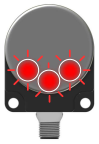
K50R Standard—Features

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
	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]

Third-Party Software
.NET

Hard Drive Space
500 MB

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

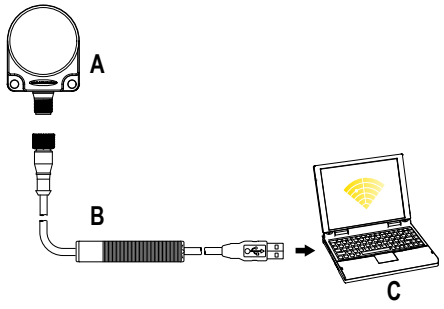
1. If a bracket is needed, mount the device onto the bracket.

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

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.

Connect to the Sensor

Figure 4. System Components for a Typical Installation



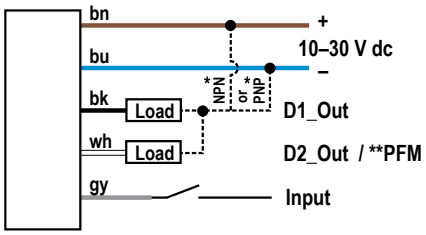
A = K50R
B = Pro Converter Cable (MQDC-506-USB)
C = PC running Banner Radar Configuration software

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

Wiring

Quick disconnect wiring diagrams are functionally identical.

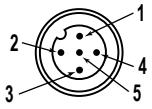
Dual Discrete Output



*** 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.

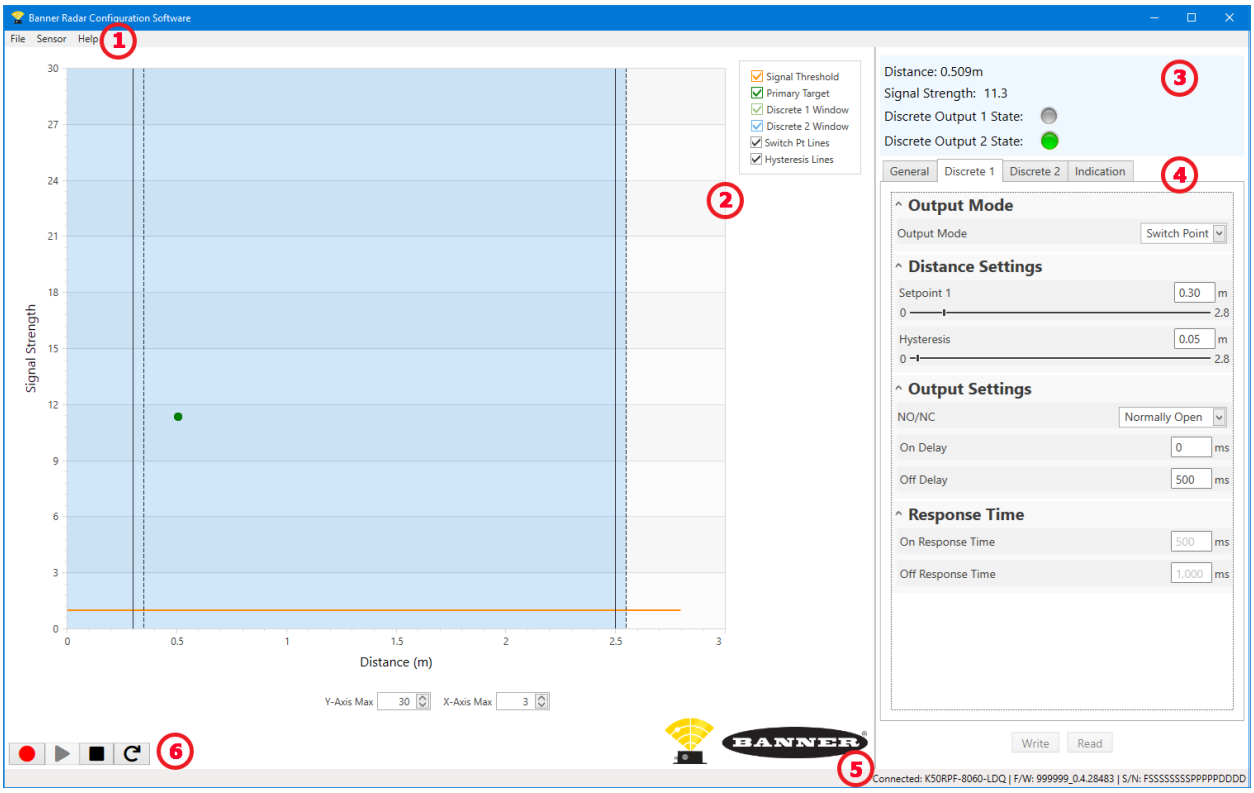
Connect to the Sensor

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: 100 mm to 2.5 m

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
< ± 2 mm from 100 mm to 250 mm
< ± 4 mm from 250 mm to 800 mm
< ± 8 mm from 800 mm to 2.5 m
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 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

Repeatability [2]
4 mm from 100 to 250 mm
8 mm from 250 mm to 800 mm
16 mm from 800 mm to 2.5 m

Maximum Output Power
EIRP: 10dBm

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
Discrete output response: 200 ms
Speeds 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

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

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.

[2] At medium response speed.

Industry Canada

Contains IC: 24388-A111—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 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.

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

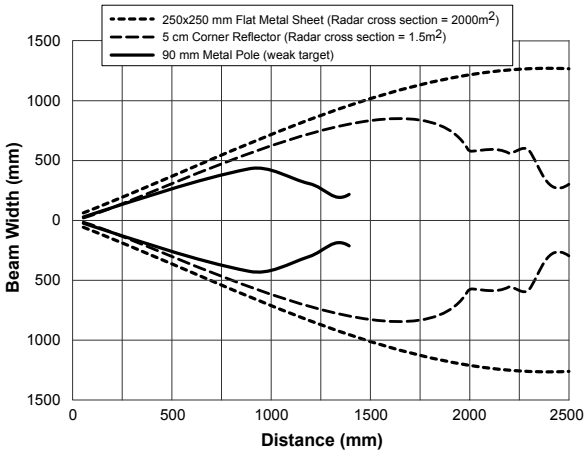


Figure 7. Typical beam pattern, in degrees, on representative targets

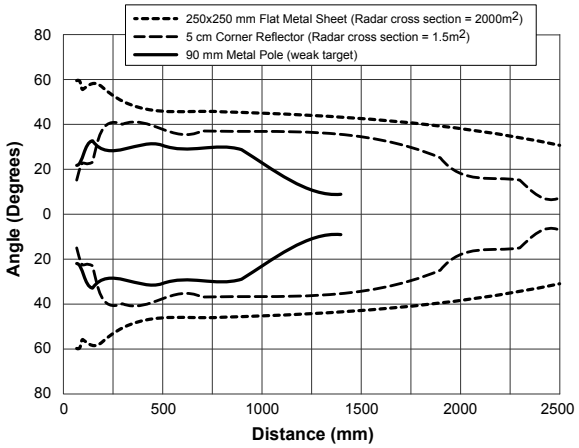


Figure 8. Typical beam pattern, in millimeters, with 250 × 250 mm Flat Metal Sheet (Radar cross section = 2000m²) and various signal strength thresholds

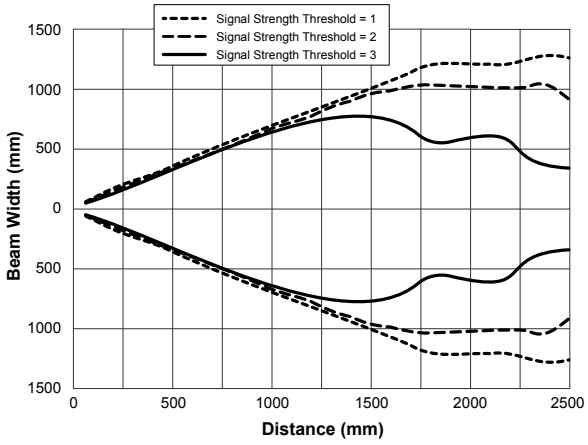
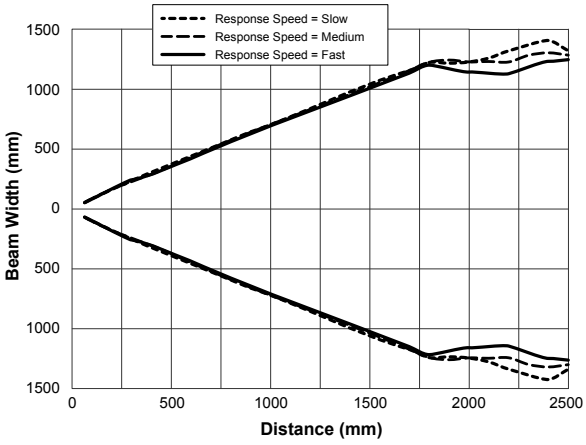


Figure 9. Typical beam pattern, in millimeters, with 250 × 250 mm Flat Metal Sheet (Radar cross section = 2000m²) and various response speeds



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