Sure Cross® Wireless Q45LPDIR Dual Beam Sensor Node Pair

Datasheet

Sure Cross® Wireless Q45 Sensors combine the best of Banner's flexible Q45 sensor family with its reliable, field-proven, Sure Cross wireless architecture to solve new classes of applications limited only by the user's imagination. Containing a variety of sensor models, a radio, and internal battery supply, this product line is truly plug and play.

The Wireless Q45LPDIR Dual Beam Sensor Node Pair is a compact, industrial, battery-powered retroreflective-mode photoelectric sensor pair that wirelessly transmits the totalized count of people entering and exiting an area to a wireless Gateway/Controller. Sensor Pairs report directional counts that are able to distinguish between a person entering or exiting an area by monitoring the order in which the sensors are triggered, giving the user an automated occupancy monitoring solution.

Benefits

- Powerful device that delivers factory automation and IIoT solutions for many applications including but not limited to counting people entering and exiting an area or building
- Battery powered for peel-and-stick functionality with a two-year battery life capability; no need for power or control wires
- Detects objects between 0.15 m (6 in) and 6 m (20 ft) away
- Includes two retroreflective-mode photoelectric Sensor Nodes and four AA batteries (two for each Q45) for quick deployment
- DIP switches for user configuration
- Diagnostics allow user-defined output settings in the unlikely event of lost RF signal
- Frequency Hopping Spread Spectrum (FHSS) technology ensures reliable data delivery within the unlicensed Industrial, Scientific, and Medical (ISM) band
- Aligning the visible red sensing beam is easy when using the optical alignment mode

Important: Please download the complete Wireless Q45LPDIR Dual Beam Sensor Node Pair technical documentation, available in multiple languages, from www.bannerengineering.com for details on the proper use, applications, Warnings, and installation instructions of this device.

Important: Por favor descargue desde www.bannerengineering.com toda la documentación técnica de los Wireless Q45LPDIR Dual Beam Sensor Node Pair, disponibles en múltiples idiomas, para detalles del uso adecuado, aplicaciones, advertencias, y las instrucciones de instalación de estos dispositivos.

Important: Veuillez télécharger la documentation technique complète des Wireless Q45LPDIR Dual Beam Sensor Node Pair sur notre site www.bannerengineering.com pour les détails sur leur utilisation correcte, les applications, les notes de sécurité et les instructions de montage.

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

Models	Frequency	Batteries	Sensing Range [1]	Inputs and Outputs
DX80N2Q45LPDIR	2.4 GHz ISM Band	Includes batteries	0.15 m to 6 m (6 in to 20 ft)	Photoelectric sensor pair with a totalizing and directional counter
DX80N2Q45LPDIR-NB		Batteries not included		
DX80N9Q45LPDIR	900 MHz ISM Band	Includes batteries		
DX80N9Q45LPDIR-NB		Batteries not included		

[1] Performance is specified using the model BRT-3 three-inch reflector (see www.bannerengineering.com for more information).

Storage Mode

While in **storage mode**, the Q45LPDIR's radio does not operate. The Q45LPDIR ships from the factory in storage mode to conserve the battery. To wake the device, press and hold the binding button (inside the housing on the radio board) for five seconds. To put any Q45LPDIR into storage mode, press and hold the binding button for five seconds. The Q45LPDIR is in storage mode when the LEDs stop blinking.

Slow Scan Mode

In slow scan mode, the Q45LPDIR enters a deeper sleep mode to conserve battery power 5 minutes after the Q45LPDIR loses its communication link with its parent or master radio. The Q45LPDIR wakes up every 2.5 minutes to search for its parent radio. If a parent or master radio is not found, the Q45LPDIR goes back to sleep for another 2.5 minutes. If the parent or master radio is detected, the Q45LPDIR exits slow scan mode. To manually exit slow scan mode, press the Q45LPDIR's binding button.

Replace or Install the Batteries

To replace the lithium "AA" cell batteries, follow these steps.

As with all batteries, these are a fire, explosion, and severe burn hazard. Do not burn or expose them to high temperatures. Do not recharge, crush, disassemble, or expose the contents to water. Properly dispose of used batteries according to local regulations by taking it to a hazardous waste collection site, an e-waste disposal center, or other facility qualified to accept lithium batteries.

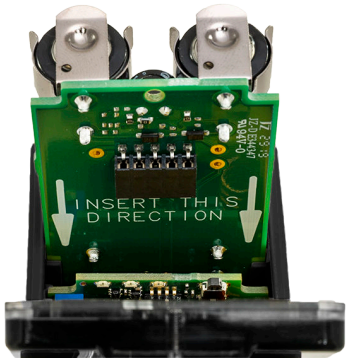


Figure 1. Q45LPDIR battery board

1. Unscrew and lift the plastic cover.
2. Slide the board containing the batteries out of the Q45LPDIR housing.
3. Remove the discharged batteries and replace with new batteries. Use Banner's **BWA-BATT-006** replacement batteries or an equivalent 3.6 V AA lithium batteries, such as Xeno's XL-60F.
4. Verify the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case. Caution: There is a risk of explosion if the battery is replaced incorrectly.
5. Slide the board containing the new batteries back into the Q45LPDIR housing.

Configuration Instructions

Binding Button and LEDs

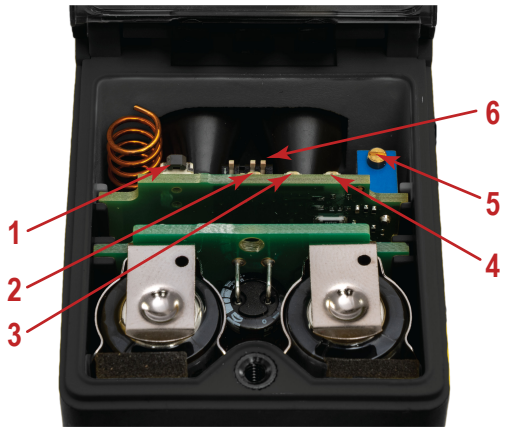


Figure 2. Q45LPDIR features

1. Binding button
2. Red LED (flashing) indicates a radio link error with the Gateway.
3. Green LED (flashing) indicates a good radio link with the Gateway.
4. Amber LED for Alignment or Test Mode. Indicates sensor alignment to the reflector. The amber LED is not used during normal operation.
5. Excess gain potentiometer. Turn clockwise to increase the gain.
6. DIP switches

Configure the DIP Switches

Follow these instructions to access and change the DIP switches.

1. Unscrew the clamp plate.
2. Make the necessary changes to the DIP switches.
3. Press the binding button three times.
   The LEDs oscillate between red and green at a rate of 1 Hz to indicate you successfully changed the settings.
4. Wait one second, then press the binding button twice.
   The Q45LPDIR resets and returns to Run mode with the updated DIP switch configuration.

DIP Switch Settings

Settings	DIP Switch			
	1	2	3	4
900 MHz Transmit Power Level: 1 Watt (30 dBm) (default)	OFF *			
900 MHz Transmit Power Level: 250 mW (24 dBm) (DX80 Compatibility Mode)	ON			
No Counter, 62.5 ms Sample Rate/Change of State Reporting (default)		OFF	OFF	OFF
Counter Enabled, 62.5 ms Sample Rate/60 s Report Rate		OFF	OFF	ON
Counter Enabled, 62.5 ms Sample Rate/User-Defined Report Rate		OFF	ON	OFF
Counter Enabled, 31.25 ms Sample Rate/60 s Report Rate		OFF	ON	ON
Counter Enabled, 31.25 ms Sample Rate/User-Defined Report Rate		ON *	OFF *	OFF *
Counter Enabled, 62.5 ms Sample Rate/60 s Report Rate and Change of State Reporting		ON	OFF	ON
Counter Enabled, 62.5 ms Sample Rate/User-defined Report Rate and Change of State Reporting		ON	ON	OFF
Software Configured (User-Defined)		ON	ON	ON

For user-defined (configured using the User Configuration Software) DIP switch selections, the counter's report rate is defined by the report rate of the sensor. The default report rate is set to 5 minutes for Sensor State and Total Counters (inputs 1 through 4) and 1 minute for the Directional Counter (inputs 5 and 6).

Transmit Power Levels

The 900 MHz radios transmit at 1 Watt (30 dBm) or 250 mW (24 dBm). While the Performance radios operate in 1 Watt mode, they cannot communicate with the older 150 mW radios. To communicate with 150 mW radios, operate this radio in 250 mW mode. For 2.4 GHz models, this DIP switch is disabled. The transmit power for 2.4 GHz is fixed at about 65 mW EIRP (18 dBm), making the 2.4 GHz Performance models automatically compatible with older 2.4 GHz models.

Sample and Report Rates

The sample interval, or rate, defines how often the Sure Cross device samples the input. For battery-powered applications, setting a slower rate extends the battery life.

The report rate defines how often the Node communicates the I/O status to the Gateway. For *Flex*Power® applications, setting the report rate to a slower rate extends the battery life.

Holding Registers

I/O #	Modbus Holding Registers for Sensor A		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Sensor A State	0	1	0	1
2	2	2 + (Node# × 16)	Sensor B State	0	1	0	1
3	3	3 + (Node# × 16)	Total Counter High Word	0	65535	0	65535
4	4	4 + (Node# × 16)	Total Counter Low Word	0	65535	0	65535
5	5	5 + (Node# × 16)	Directional Counter High Word	0	65535	0	65535
6	6	6 + (Node# × 16)	Directional Counter Low Word	0	65535	1	65535
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
...	...	...	...				
13	13	13 + (Node# × 16)	Change of State Reporting	0	65535	0	65535

I/O #	Modbus Holding Registers for Sensor A		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
14	14	14 + (Node# × 16)	Clear Counter	0	1	0	1
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

I/O #	Modbus Holding Registers for Sensor B		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Sensor B State	0	1	0	1
2	2	2 + (Node# × 16)	Sensor A State	0	1	0	1
3	3	3 + (Node# × 16)	Total Counter High Word	0	65535	0	65535
4	4	4 + (Node# × 16)	Total Counter Low Word	0	65535	0	65535
5	5	5 + (Node# × 16)	Directional Counter High Word	0	65535	0	65535
6	6	6 + (Node# × 16)	Directional Counter Low Word	0	65535	1	65535
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
14	14	14 + (Node# × 16)	Clear Counter	0	1	0	1
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

Sensor A State

Shows the current state of sensor A.

A state of 0 indicates the beam is blocked. A state of 1 indicates the beam is not blocked.

Sensor B State:

Shows the current state of sensor B.

A state of 0 indicates the beam is blocked. A state of 1 indicates the beam is not blocked.

Counter

The Q45LPDIR keeps an internal count of how many times the individual sensor is tripped. The Counter High and Low words for the individual sensor count are stored in Modbus registers 3 and 4 respectively.

Directional Counter

The Q45LPDIR Sensor Pairs keep a directional count of people entering or exiting.

Directional Counter A is incremented when sensor B is blocked and sensor A is blocked before B is released. Directional Counter B is incremented when sensor A is blocked and sensor B is blocked before A is released.

Sensor B keeps a count of people entering and Sensor A keeps a count of people exiting. The High and Low words for the directional count are stored in Modbus registers 5 and 6 respectively.

Change of State Reporting

Change of state reporting enables the Directional Counter input to report to the Gateway when the register value increments by a value of 1 or more. Banner recommends enabling change of state reporting when you are monitoring the occupancy level of an area and when the occupancy is getting close to the area limit.

To enable change of state reporting, write a value of 259 (0x0103) to register 13. To disable change of state reporting, write a value of 0 to register 13.

Clear Counter

When set to a value of 1, the Clear Counter register resets the Directional Counter and Total Counter for that sensor. Set the Clear Counter register back to 0 after the counts have been cleared.

Installation Instructions

Installing the Q45LPDIR Sensor Nodes for Occupancy Monitoring

Sensor orientation is critical for correctly monitoring and counting the people entering and exiting the area.

The Wireless Q45LPDIR Dual Beam Sensor Node Pair come in A and B sensor configurations. Sensor pair A has an integrated female M12/Euro-style connector on the base and sensor pair B has a 6-in cable with a male M12/Euro-style connector.

Figure 3. Sensor A has the integrated 5-pin male quick disconnect connector

Figure 4. Sensor B has the integrated 6-inch cable with a female quick disconnect connector

When mounting on the outside of a door, mount Sensor B closest to the door and mount Sensor A farthest from the door. When mounting on the inside of a door, mount Sensor A closest to the door and mount Sensor B farthest from the door, as shown in Figure 5 on p. 5.

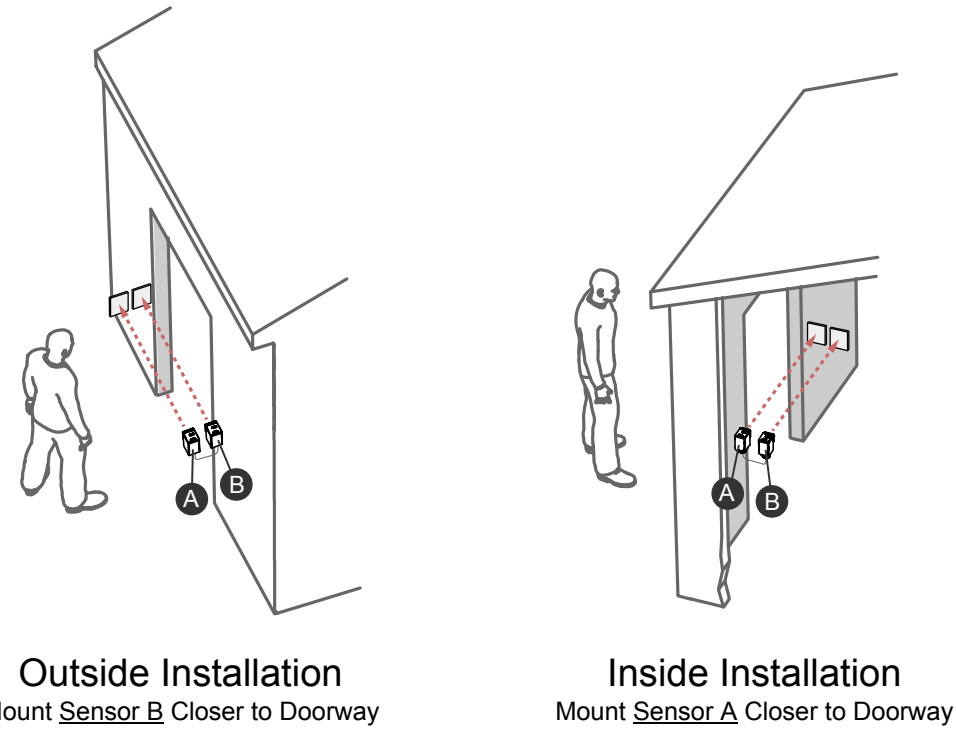


Figure 5. Correct installation for outside or inside a building

Bind to a DXM Gateway and Assign the Node Address

Before beginning the binding procedure, apply power to all the devices. Separate the radios by two meters when running the binding procedure. Put only one DXM Gateway into binding mode at a time to prevent the Q45LPDIR from binding to the wrong Gateway.

1. On the DXM: Use the arrow keys to select the **ISM Radio** menu on the LCD and click **ENTER**.
2. Highlight the **Binding** menu and click **ENTER**.
3. Use the arrow keys to select the Node address to bind the Q45LPDIR to.

   For the recommended list of Node addresses to use, refer to Suggested Node Addresses for the Q45LPDIR Pairs on p. 6.
4. On the Q45LPDIR: Loosen the clamp plate on the top of the Q45LPDIR and lift the cover.
5. Enter binding mode on the Q45LPDIR by triple-clicking the binding button.

The red and green LEDs flash alternately and the sensor searches for a Gateway in binding mode. After the Q45LPDIR binds, the LEDs stay solid momentarily, then they flash together four times. The Q45LPDIR exits binding mode.

6. Label the sensor with the Q45LPDIR's Node address number for future reference.
7. On the DXM: Click **BACK** to exit binding for that specific Node address.
8. Repeat steps 3 through 7 and change the Node address for as many Q45LPDIRs as are needed for your network.
9. On the DXM: After you have finished forming your network, click **BACK** until you reach the main menu.

Suggested Node Addresses for the Q45LPDIR Pairs

For optimal performance, Banner recommends using the following Node ID assignments.

For a 31.25 ms Sample Rate (Recommended)		
Q45LPDIR Pair No.	**Sensor A or Sensor B**	**Assign this Node ID**
1	A	1
2	A	2
1	B	3
2	B	4
3	A	5
4	A	6
3	B	7
4	B	8

For a 62.5 ms Sample Rate		
Q45LPDIR Pair No.	**Sensor A or Sensor B**	**Assign this Node ID**
1	A	1
2	A	2
3	A	3
4	A	4
1	B	5
2	B	6
3	B	7
4	B	8

Align the Q45LPDIR Sensor Node

The Q45LPDIR enters and remains in optical alignment mode for 15 minutes after the binding button is pushed, after the Q45LPDIR exits binding mode, or after the Q45LPDIR is powered up (battery replaced).

During optical alignment mode, the sensor's beam is bright enough to see when aligned with a reflector or target, making alignment and mounting easier to accomplish. During this alignment mode, the sensor's yellow LED lights up whenever the sensor sees the reflector and detects the reflected beam.

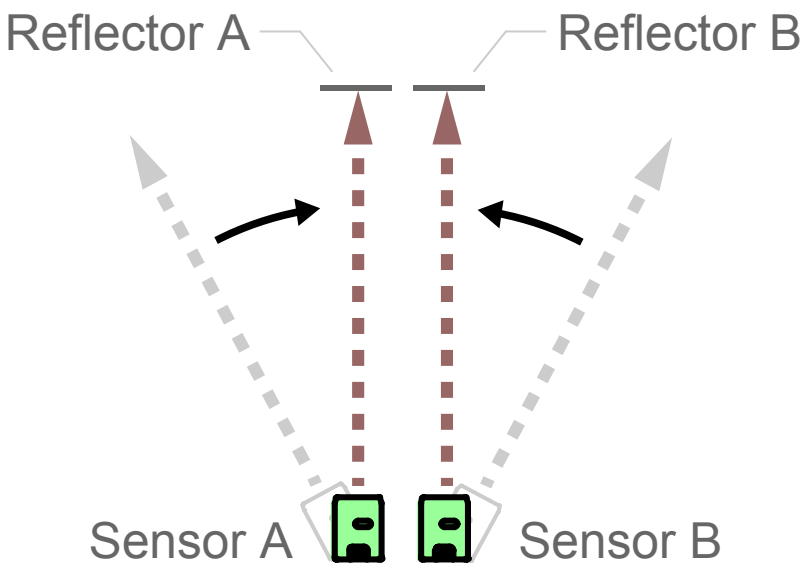


Figure 6. Align the Sensor Nodes

From behind the Sensor Pair, Sensor A may be either to the left or to the right of Sensor B, depending on whether the Sensor Pair is mounted on the left or the right of a door. The alignment process will be the same for either position.

1. Mount the reflectors and bracket opposite the sensor pair and at the same mounting height.
2. Loosen the locknut on the base of the sensor and begin with the sensors facing outward.

   As shown, the starting position is represented in gray.
3. Open the lid of Sensor A and press the button to enter optical alignment mode.
   The front of the sensor will show a bright red LED, which is used to align the sensor to the reflectors.

4. Open the lid of Sensor B and press the button to enter optical alignment mode.
5. From behind Sensor A, rotate the sensor inward toward the reflector until the amber alignment indicator turns on.

   As shown, the sensors in the aligned position is depicted in green.
6. From behind Sensor B, rotate the sensor inward toward the reflector until the amber alignment indicator turns on.
7. Confirm optical alignment by blocking reflector A with a hand or opaque object at the reflector.

   The amber alignment indicator on sensor A should turn off.

   If blocking Reflector A does not turn off the amber alignment indicator on Sensor A, it is likely that Sensor A is seeing Reflector B. Rotate Sensor A outward until it is seeing Reflector A. If the sensors will not optically align to their reflector, contact your local distributor or Banner Engineering for assistance.
8. Confirm optical alignment by blocking reflector B with a hand or opaque object at the reflector.

   The amber alignment indicator on sensor B should turn off.

   If blocking Reflector B does not turn off the amber alignment indicator on Sensor B, it is likely that Sensor B is seeing Reflector A. Rotate Sensor B outward until it is seeing Reflector B. If the sensors will not optically align to their reflector, contact your local distributor or Banner Engineering for assistance.

After 15 minutes, the Q45LPDIR automatically exits optical alignment mode and begins normal operation. After the sensor begins normal operation, the amber alignment indicator LED is inactive.

To exit alignment mode earlier, click the binding button five times.

Specifications

Performance Radio with Internal Antenna Specifications

Radio Range[2]
900 MHz, 1 Watt (Internal antenna): Up to 3.2 km (2 miles) with line of sight
2.4 GHz, 65 mW (Internal antenna): Up to 1000 m (3280 ft) with line of sight

Antenna Minimum Separation Distance
900 MHz, 150 mW and 250 mW: 2 m (6 ft)
900 MHz, 1 Watt: 4.57 m (15 ft)
2.4 GHz, 65 mW: 0.3 m (1 ft)

Radio Transmit Power
900 MHz, 1 Watt: 30 dBm (1 W) conducted (up to 36 dBm EIRP)
2.4 GHz, 65 mW: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP

Spread Spectrum Technology
FHSS (Frequency Hopping Spread Spectrum)

900 MHz Compliance (1 Watt)
FCC ID UE3RM1809: FCC Part 15, Subpart C, 15.247
IC: 7044A-RM1809
IFT: RCPBARM13-2283

2.4 GHz Compliance
FCC ID UE300DX80-2400: FCC Part 15, Subpart C, 15.247
Radio Equipment Directive (RED) 2014/53/EU
IC: 7044A-DX8024

Link Timeout
Gateway: Configurable via User Configuration Software
Node: Defined by Gateway

Q45LPDIR Retroreflective Sensor Specifications

Sensing Range
0.15 m to 6 m (6 in to 20 ft) (with BRT-3)

Default Sample Rate
31.25 ms

Default Report Rate
5 minutes for Sensor State and Total Count inputs
1 minute for Directional Count inputs

Indicators
Red and green LEDs (radio function); amber LED (only for alignment mode)

Adjustments
Multi-turn sensitivity control (allows precise sensitivity setting - turn clockwise to increase gain.

Battery Life
Refer to the Battery Life performance curve for life estimates

Construction
Molded reinforced thermoplastic polyester housing, oring-sealed transparent Lexan® cover, molded acrylic lenses, and stainless steel hardware. Designed to withstand 1200 psi washdown.

Certifications

(NOM approval only applies to 900 MHz models)

Environmental Specifications

Operating Conditions
–40 °C to +70 °C (–40 °F to +158 °F); 90% at +50 °C maximum relative humidity (non-condensing)
Radiated Immunity: 10 V/m (EN 61000-4-3)

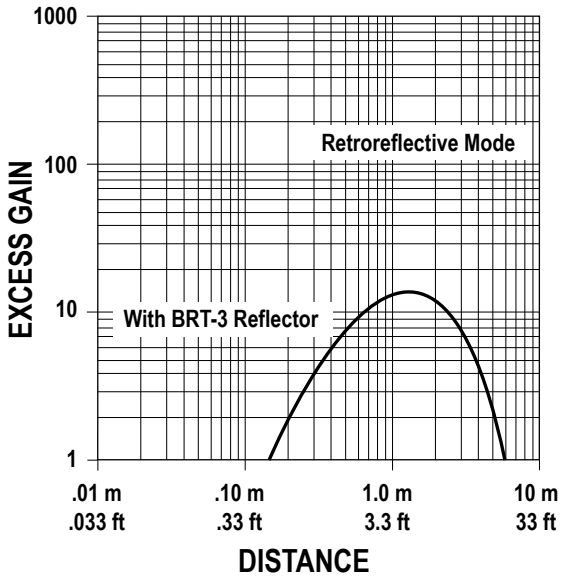
Environmental Rating
NEMA 6P, IEC IP67

Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

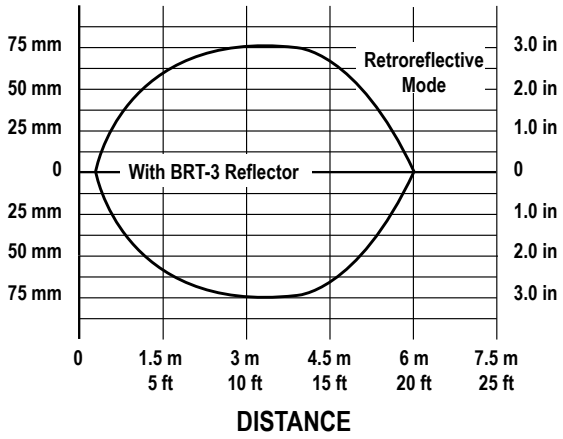
[2] Range depends on the environment and decreases significantly without line of sight. Always verify your wireless network's range by performing a Site Survey.

Performance Curves

Excess Gain



Beam Pattern



Battery Life

Battery life is displayed in months and changes depending on the report time, radio transmit strength, and sample rate.

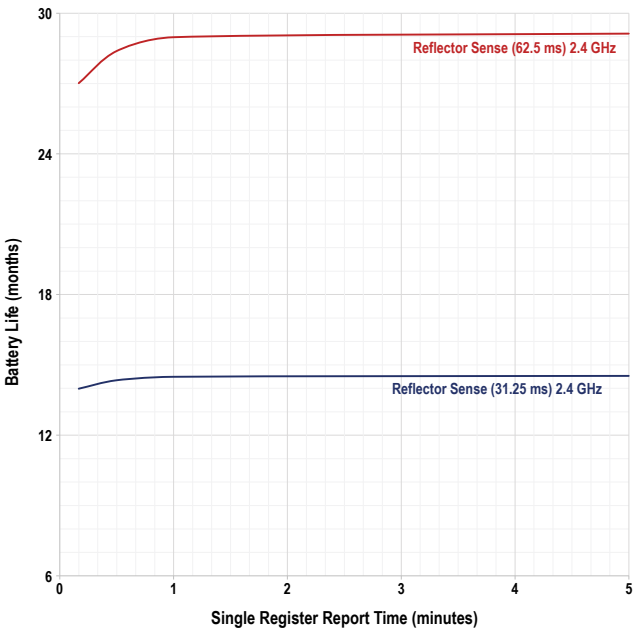


Figure 7. 2.4 GHz Radios

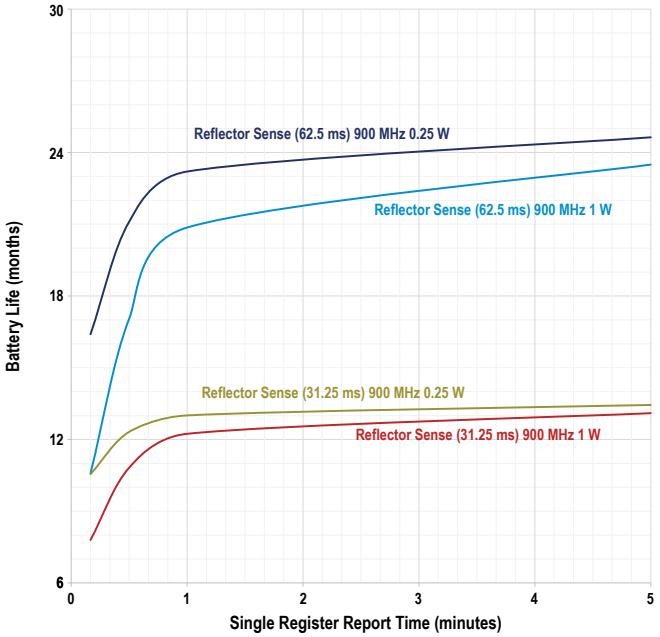


Figure 8. 900 MHz Radios

Accessories

Occupancy Monitoring Kits

Banner's Wireless Q45LPDIR Dual Beam Sensor Node Pairs are designed to work with Banner's Occupancy Solution Kits. Combined with the solutions kits, the Q45LPDIR provide plug and play occupancy monitoring with the ability to distinguish between people entering and exiting an area.

Model Number	Application	ISM Radio Frequency	Batteries
OSK2-1TC NB	Total Count	2.4 GHz	Batteries not included
OSK2-2TC NB			
OSK2-4TC NB			
OSK2-2MC NB	Multiple Count		
OSK2-4MC NB			
OSK9-1TC	Total Count	900 MHz	Includes Batteries
OSK9-2TC			
OSK9-4TC			
OSK9-2MC	Multiple Count		
OSK9-4MC			

Brackets and Reflectors

SMBQ45PC

- Stainless steel right-angle bracket
- M30 clearance holes
- Mounts the Q45LPDIR sensor pair together in the same bracket

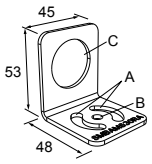
SMBRPC

- Stainless steel right-angle bracket
- Includes two BRT-2x2 reflectors

SMBAMS30RA

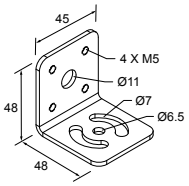
- Right-angle SMBAMS series bracket
- 30 mm hole for mounting sensors
- Articulation slots for 90°+ rotation
- 12-ga. (2.6 mm) cold-rolled steel

Hole center spacing: A=26.0, A to B=13.0
Hole size: A=26.8 x 7.0, B=ø 6.5, C=ø 31.0



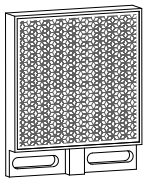
SMBAMSBRA

- Back mounting adapter bracket
- Used with **SMBQ45PC** to mount sensors from behind



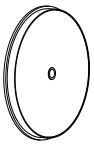
BRT-2X2

- Square, acrylic target
- Reflectivity factor: 1.0
- Max. temperature: +50 °C (+122 °F)
- Optional brackets are available
- Approximate size: 51 mm × 51 mm



BRT-3

- Round, acrylic target
- Reflectivity Factor: 1.0
- Temperature: –20 °C to +60 °C (–4 °F to +140 °F)
- Optional brackets are available
- Size: 84 mm diameter
- Mounting Hole: 4.8 mm diameter



Replacement Batteries

BWA-BATT-006—3.6 V Lithium AA cell for Wireless Q45 Sensors, 2 batteries

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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Exporting Sure Cross® Radios

Exporting Sure Cross® Radios. It is our intent to fully comply with all national and regional regulations regarding radio frequency emissions. **Customers who want to re-export this product to a country other than that to which it was sold must ensure the device is approved in the destination country.** The Sure Cross wireless products were certified for use in these countries using the antenna that ships with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies. This device has been designed to operate with the antennas listed on Banner Engineering's website and having a maximum gain of 9 dBm. Antennas not included in this list or having a gain greater that 9 dBm are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen such that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication. Consult with Banner Engineering Corp. if the destination country is not on this list.

Notas Adicionales

Información México: La operación de este equipo está sujeta a las siguientes dos condiciones: 1) es posible que este equipo o dispositivo no cause interferencia perjudicial y 2) este equipo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

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Antenas SMA	Modelo
Antena, Omni 902-928 MHz, 2 dBd, junta de caucho, RP-SMA Macho	**BWA-9O2-C**
Antena, Omni 902-928 MHz, 5 dBd, junta de caucho, RP-SMA Macho	**BWA-9O5-C**

Antenas Tipo-N	Modelo
Antena, Omni 902-928 MHz, 6 dBd, fibra de vidrio, 1800mm, N Hembra	**BWA-9O6-A**
Antena, Yagi, 900 MHz, 10 dBd, N Hembra	**BWA-9Y10-A**

Mexican Importer

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