Sure Cross® Wireless Q45D Sensor Node (Diffuse)

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 Q45D is a compact, industrial, battery-powered diffuse-mode photoelectric sensor that can be used to wirelessly transmit presence/absence inputs and a totalized count to a wireless Gateway/Controller. An object is detected when it reflects the sensor's transmitted light energy back to the sensor. No reflector or receiver is needed to detect objects.

Benefits

- Powerful device that delivers factory automation and IIoT solutions for many applications including but not limited to:
  - Presence/absence
  - Pallet completion
  - Part count totalizing up to 960 parts/minute
  - Part rate monitoring and Overall Equipment Effectiveness (OEE)
  - Machine status monitoring (jams, diverts, etc.) and cycle count
  - Rotational speed
- **Easy installation**—Battery powered for peel-and-stick functionality with a two-year battery life capability; no need for power or control wires
- **Reduce complexity**—Machine or process reconfiguration made easier; great for retrofit applications and remote locations where implementing a wired solution would be difficult, impractical, or cost prohibitive



- Detects objects up to 300 mm (12 in) away
- Includes the diffuse-mode photoelectric sensor, a wireless Node, and an internal battery to make it easy to install
- Counts up to 960 parts per minute
- Transceivers provide bidirectional communication between the Gateway and Node, including fully acknowledged data transmission
- 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

Models

Models	Frequency	Sensing Range	Inputs and Outputs
DX80N2Q45D	2.4 GHz ISM Band	300 mm (12 in)	Photoelectric sensor with event counter
DX80N9Q45D	900 MHz ISM Band		

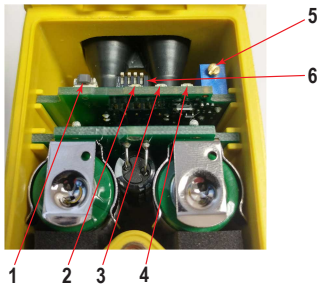
Storage Mode

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

ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

Configuration Instructions

Binding Button and LEDs



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 function (optical sensor models) or when input 1 is active (dry contact models). The amber LED is not used during normal operation.
5. Excess gain potentiometer. Turn clockwise to increase the gain.
6. DIP switches

DIP Switches

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 Sensor IN 1		ON	OFF	ON
Counter Enabled, 62.5 ms Sample Rate/User-defined Report Rate and Change of State Reporting on Sensor IN 1		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 Sensor IN 1.

Transmit Power Levels

The 900 MHz radios transmit at 1 Watt (30 dBm) or 250 mW (24 dBm). The 250 mW mode reduces the radio's range but improves the battery life in short range applications. 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).

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 battery-powered applications, setting the report rate to a slower rate extends the battery life.

Modbus Registers

I/O #	Modbus Holding Register		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 IN 1 State	0	1	0	1
2	2	2 + (Node# × 16)	Reserved				
3	3	3 + (Node# × 16)	Counter High Word	0	65535	0	65535
4	4	4 + (Node# × 16)	Counter Low Word	0	65535	0	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

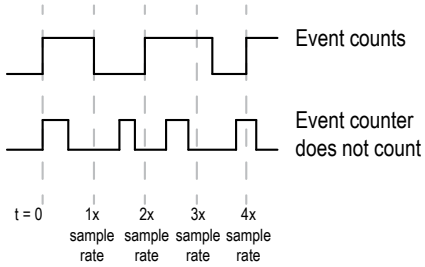
I/O #	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

Using the Event Counter

The counter "counts" when the input is on for a minimum of the sample rate. The counter input is off when the input is off for a minimum of the sample rate.

For example, if your sample rate is set to 62.5 ms, the counter input is on, and therefore counts, when the input is on for at least 62.5 ms. If the input is not on for 62.5 ms, the counter does not increment.

Figure 1. Event counter



To clear the counter when you are not using a host-controlled system, write a 1 to the Node's output register 14. Clearing the counter requires that this register goes from a 0 to a 1. If there is already a 1 in the register, first write a 0, then write the 1. You can use the Gateway I/O mapping to map an input, such as a button, to clear the counter value.

To clear the counter when you are using a host-controlled system, send a control message to Node register 15. Control messages on Node register 15 are acknowledged with the same value echoed to Node register 7.

1. Write 5388 (0x150C) to Node register 15.
2. Read Node register 7 until it echoes the Node register 15 value.

Installation Instructions

Bind to the Gateway and Assign the Node Address

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

1. On the Gateway: Enter binding mode.
   - For housed DX80 Gateways, triple-click button 2 on the Gateway. Both LEDs flash red.
   - For Gateway board modules, triple-click the button. The green and red LED flashes.
2. Assign the Q45 a Node address using the Gateway's rotary dials. Use the left rotary dial for the left digit and the right rotary dial for the right digit. For example, to assign your Q45 to Node 10, set the Gateway's left dial to 1 and the right dial to 0. Valid Node addresses are 01 through 47.



3. On the Q45: Loosen the clamp plate on the top of the Q45 and lift the cover.
4. Enter binding mode on the Q45 by triple-clicking the Q45's button.
   The red and green LEDs flash alternately and the sensor searches for a Gateway in binding mode. After the Q45 is bound, the LEDs stay solid momentarily, then they flash together four times. The Q45 exits binding mode.
5. Label the sensor with the Q45's Node address number for future reference.
6. Repeat steps 2 through 5 for as many Q45s as are needed for your network.
7. On the Gateway: After binding all Q45s, exit binding mode.
   - For housed DX80 Gateways, double-click button 2.
   - For board-level DX80 Gateways, double-click the button.

For Gateways with single-line LCDs: After binding your Q45 to the Gateway, make note of the binding code displayed under the Gateway's *DVCFG menu, XADR submenu on the LCD. Knowing the binding code prevents having to re-bind all Q45s if your Gateway is ever replaced.

Optical Alignment Mode (Diffuse)

In diffuse-mode sensing, light emitted from the sensor strikes the surface of the object to be detected and is diffused back, sending some light back to the receiver, which is usually housed with the emitter. With a diffuse-mode sensor, the object is detected when it "makes" the beam, that is, the object reflects the sensor's transmitted light energy back to the sensor.

The Wireless Q45 Sensor enters and remains in optical alignment mode for 15 minutes after the button is pushed, after the Wireless Q45 Sensor exits binding mode, or after the Q45 is powered up (battery replaced).

During optical alignment mode, the sensor's yellow LED lights up whenever the sensor detects the reflected beam.

After 15 minutes, the Wireless Q45 Sensor automatically exits optical alignment mode and begins normal operation. After the sensor begins normal operation, the amber/yellow sensor state LED is inactive. To exit alignment mode earlier, click the button five times.

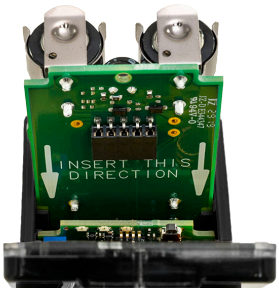


Apply Power to the Q45

Follow these instructions to install or replace the lithium "AA" cell batteries.

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 2. Q45 battery board



1. Loosen the clamp plate with a small Phillips screwdriver and lift the cover.
2. Slide the battery board out of the Q45 housing.
3. If applicable, remove the discharged batteries.
4. Install the 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.
5. 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.
6. Slide the board containing the new batteries back into the Q45 housing.
7. Close the cover and gently tighten the clamp plate with the small Phillips screwdriver.

Specifications

Performance Radio with Internal Antenna Specifications

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

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

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

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

NOM NYCE

(NOM approval only applies to 900 MHz models)

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
ANATEL: 15966-21-04042 Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para maiores informações, consulte o site da ANATEL www.gov.br/anatel/pt-br/

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

Q45D Diffuse Sensor Specifications

Report Rate
On Change of State

Default Sample Rate
62.5 milliseconds

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.

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

Sensing Range
300 mm (12 in)

Battery Life (Typical for 900 MHz, 1 Watt)
With no counter and change-of-state reporting of greater than 5 minutes: 2.1 years
With no counter and change-of-state reporting of about 30 s: 1.6 years
With a counter set to 62.5 ms sample rate and 60 s report rate: 1.5 years
With a counter set to 31.25 ms sample rate and 60 s report rate: 1 year

Battery Life (Typical for 2.4 GHz)
With no counter and change-of-state reporting of greater than 5 minutes: 2.6 years
With no counter and change-of-state reporting of about 30 s: 2.5 years
With a counter set to 62.5 ms sample rate and 60 s report rate: 2.3 years
With a counter set to 31.25 ms sample rate and 60 s report rate: 1.2 year

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)

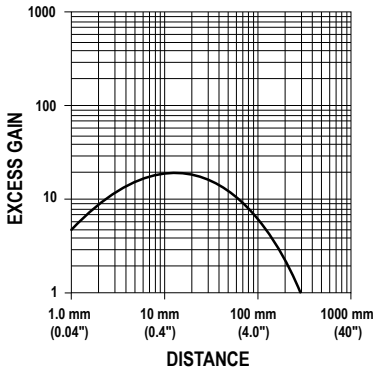
Environmental Rating
NEMA 6P, IP67

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

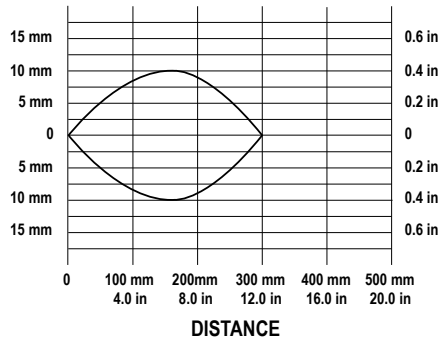
Performance Curves

Performance curves are based on a 90% reflectance white test card.

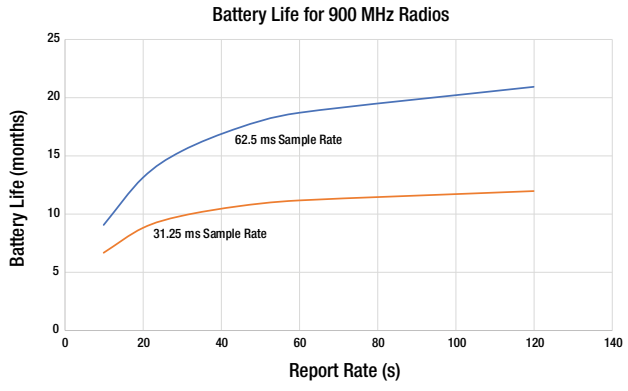
Excess Gain

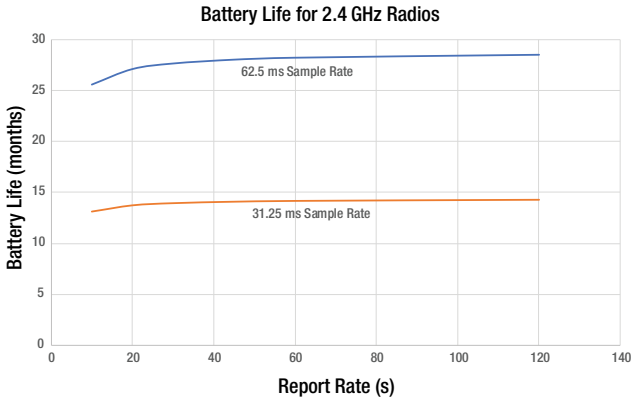


Beam Pattern



Battery Life





Warnings

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.

Important: Please download the complete Wireless Q45 Sensor Node 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 Q45 Sensor Node, 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 Q45 Sensor Node 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.

Important:

- **Electrostatic discharge (ESD) sensitive device**
- ESD can damage the device. Damage from inappropriate handling is not covered by warranty.
- Use proper handling procedures to prevent ESD damage. Proper handling procedures include leaving devices in their anti-static packaging until ready for use; wearing anti-static wrist straps; and assembling units on a grounded, static-dissipative surface.

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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.

Banner es una marca registrada de Banner Engineering Corp. y podrán ser utilizadas de manera indistinta para referirse al fabricante. "Este equipo ha sido diseñado para operar con las antenas tipo Omnidireccional para una ganancia máxima de antena de 6 dBd y Yagi para una ganancia máxima de antena 10 dBd que en seguida se enlistan. También se incluyen aquellas con aprobación ATEX tipo Omnidireccional siempre que no excedan una ganancia máxima de antena de 6dBd. El uso con este equipo de antenas no incluidas en esta lista o que tengan una ganancia mayor que 6 dBd en tipo omnidireccional y 10 dBd en tipo Yagi, quedan prohibidas. La impedancia requerida de la antena es de 50 ohms."

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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San Pedro Garza Garcia Nuevo Leòn, C. P. 66269

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