Sure Cross® Wireless Q45LP Sensor Node (Retroreflective)

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 Q45LP is a compact, industrial, battery-powered retroreflective-mode photoelectric sensor that can be used to wirelessly transmit presence/absence inputs and a totalized count to a wireless Gateway/Controller.

Benefits

- Powerful device that delivers factory automation and IIoT solutions for many applications including but not limited to:
  - Presence/absence
  - Pallet completion
  - Part count totaling 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

The sensor polarizes the emitted light and filters out unwanted reflections, making sensing possible in applications otherwise considered unsuited to retroreflective sensing.

- Detects objects between 0.15 m (6 in) and 6 m (20 ft) away
- Includes the retroreflective-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 within the unlicensed Industrial, Scientific, and Medical (ISM) band
- Aligning the visible red sensing beam is easy

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.

Models

<table>
<thead>
<tr>
<th>Models</th>
<th>Frequency</th>
<th>Sensing Range</th>
<th>Inputs and Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX80N2Q45LP</td>
<td>2.4 GHz ISM Band</td>
<td>0.15 m to 6 m (6 in to 20 ft)</td>
<td>Photoelectric sensor with event counter</td>
</tr>
<tr>
<td>DX80N9Q45LP</td>
<td>900 MHz ISM Band</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Performance is specified using the model BRT-3 3-inch reflector (see the Accessories section of your current Banner catalog for further information).

Storage Mode for the Q45

While in storage mode, the Q45’s radio does not operate. The Q45 ships from the factory in storage mode to conserve the battery. To wake the device, press and hold the button for five seconds. To put any Q45 into storage mode, press and hold the button for five seconds. The Q45 is in storage mode when the LEDs stop blinking.
Configuration Instructions

Button and LEDs

1. 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

<table>
<thead>
<tr>
<th>Settings</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>900 MHz Transmit Power Level: 1 Watt (30 dBm) (default)</td>
<td>OFF *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>900 MHz Transmit Power Level: 250 mW (24 dBm) (DX80 Compatibility Mode)</td>
<td>ON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Counter, 62.5 ms Sample Rate/Change of State Reporting (default)</td>
<td>OFF *</td>
<td>OFF *</td>
<td>OFF *</td>
<td></td>
</tr>
<tr>
<td>Counter Enabled, 62.5 ms Sample Rate/60 s Report Rate</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>Counter Enabled, 62.5 ms Sample Rate/User-Defined Report Rate</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>Counter Enabled, 31.25 ms Sample Rate/60 s Report Rate</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>Counter Enabled, 31.25 ms Sample Rate/User-Defined Report Rate</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>Counter Enabled, 62.5 ms Sample Rate/60 s Report Rate and Change of State Reporting on Sensor IN 1</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>Counter Enabled, 62.5 ms Sample Rate/User-defined Report Rate and Change of State Reporting on Sensor IN 1</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>UCT-Configured (User-Defined)</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

For User-defined (UCT configured) 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). 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 FlexPower® applications, setting the report rate to a slower rate extends the battery life.

Modbus Registers

<table>
<thead>
<tr>
<th>I/O #</th>
<th>Modbus Holding Register</th>
<th>I/O Type</th>
<th>I/O Range</th>
<th>Holding Register Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gateway</td>
<td>Any Node</td>
<td>Sensor IN 1 State</td>
<td>Min. Value</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1 + (Node# × 16)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2 + (Node# × 16)</td>
<td>Reserved</td>
<td></td>
</tr>
</tbody>
</table>
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.

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.

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.

Installation Instructions

Bind the Q45 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. Enter binding mode on the Gateway.
   - For housed DX80 Gateways, triple-click button 2 on the Gateway. Both LEDs flash red.
   - For board-level DX80 Gateways, triple-click the binding button on the Gateway. 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. 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 binding 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 Q45 as are needed for your network.
7. After binding all Q45, exit binding mode on the Gateway.
   - For housed DX80 Gateways, double-click button 2 on the Gateway.
   - For board-level DX80 Gateways, double-click the binding button on the Gateway.

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 (Retroreflective)

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 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 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.

Replacing the Batteries

To replace the lithium "AA" cell battery, 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.

1. Lift the plastic cover.
2. Slide the board containing the batteries out of the Q45 housing.
3. Remove the discharged batteries and replace with new batteries. Use two 3.6 V AA lithium batteries, such as Xeno’s XL-60F or equivalent.
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 Q45 housing.

Replacement battery model number: BWA-BATT-006. For pricing and availability, contact Banner Engineering.

Specifications

Performance Radio with Internal Antenna Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>900 MHz, 1 Watt (Internal antenna): Up to 3.2 km (2 miles) with line of sight</th>
<th>2.4 GHz, 65 mW (Internal antenna): Up to 1000 m (3280 ft) with line of sight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna Minimum Separation Distance</td>
<td>900 MHz, 150 mW and 250 mW: 2 m (6 ft)</td>
<td>900 MHz, 1 Watt: 4.57 m (15 ft)</td>
</tr>
<tr>
<td></td>
<td>2.4 GHz, 65 mW: 0.3 m (1 ft)</td>
<td></td>
</tr>
<tr>
<td>Radio Transmit Power</td>
<td>900 MHz, 1 Watt: 30 dBm (1 W) conducted (up to 36 dBm EIRP)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.4 GHz, 65 mW: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP</td>
<td></td>
</tr>
<tr>
<td>Spread Spectrum Technology</td>
<td>FHSS (Frequency Hopping Spread Spectrum)</td>
<td></td>
</tr>
</tbody>
</table>

900 MHz Compliance (1 Watt)

- FCC ID UE3RM1809: This device complies with FCC Part 15, Subpart C, 15.247
- IC: 7044A-RM1809

2.4 GHz Compliance

- FCC ID UE300DX80-2400: This device complies with FCC Part 15, Subpart C, 15.247
- ETSI EN 300 328: V1.8.1 (2012-06)
- IC: 7044A-DX8024

Link Timeout

Gateway: Configurable via User Configuration Tool (UCT) software
Node: Defined by Gateway

Radiated Immunity HF

- 10 V/m (EN 61000-4-3)

---

Range depends on the environment and decreases significantly without line of sight. Always verify your wireless network’s range by performing a Site Survey.
Q45LP Retroreflective Sensor Specifications

Sensing Range
0.15 m to 6 m (6 in to 20 ft)

Default Sample Rate
62.5 milliseconds

Default Report Rate
On Change of State

Construction
Molded reinforced thermoplastic polyester housing, oring-sealed transparent Lexan® cover, molded acrylic lenses, and stainless steel hardware. Q45s are designed to withstand 1200 psi washdown.

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.

Environmental Rating
NEMA 6P, IEC IP67

Operating Conditions
–40 °C to +70 °C (–40 °F to +158 °F); 90% at +50 °C maximum relative humidity (non-condensing)

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

Performance Curves

**Excess Gain**

<table>
<thead>
<tr>
<th>DISTANCE (m)</th>
<th>0.01</th>
<th>0.10</th>
<th>1.00</th>
<th>10.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTANCE (ft)</td>
<td>.033</td>
<td>.33</td>
<td>3.3</td>
<td>33</td>
</tr>
<tr>
<td>EXCESS GAIN</td>
<td>1</td>
<td>10</td>
<td>100</td>
<td>1000</td>
</tr>
</tbody>
</table>

**Beam Pattern**

With BRT-3 Reflector
Battery Life

Battery Life for 900 MHz Radios

Battery Life (months) vs Report Rate (s)

62.5 ms Sample Rate

31.25 ms Sample Rate

Battery Life for 2.4 GHz Radios

Battery Life (months) vs Report Rate (s)

62.5 ms Sample Rate

31.25 ms Sample Rate

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 the 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 supersedes that which is provided in any other language. For the most recent version of any documentation, refer to: www.bannerengineering.com.

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. A list of approved countries appears in the Radio Certifications section of the product manual. 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. Consult with Banner Engineering Corp. if the destination country is not on this list.