Q45DD and Q45LPD All-in-One D-Cell Photoelectric Sensor Node

Features

Sure Cross® Wireless Q45 Sensors combine the best of Banner's flexible 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 an internal battery supply, this product line is truly plug-and-play.

The Q45 All-in-One D-cell Photoelectric Sensor Nodes are compact, industrial, battery-powered photoelectric sensors that can be used to wirelessly transmit presence/absence inputs and a totalized count to a wireless Gateway/Controller. The Photoelectric Sensor Nodes come in two sensing modes: Diffuse and Retroreflective.

- Diffuse mode All-in-One Sensor Nodes detect an object when it reflects the sensor's transmitted light energy back to the sensor without the need for a reflector.
- Retroreflective mode All-in-One Sensor Nodes require a reflector and detect an object when the reflected light energy is blocked.

Benefits

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

Q45DD



- Combines a diffuse-mode or retroreflective-mode photoelectric sensor, a wireless Node, and an internal battery to make it easy to install
- DIP switches for user configuration
- Diagnostics allow user-defined output settings in the unlikely event of a lost radio signal
- Frequency Hopping Spread Spectrum (FHSS) technology ensures reliable data delivery
- Selectable transmit power levels of 250 mW or 500 mW for 900 MHz models and 65 mW for 2.4 GHz models

Q45LPD



Models

Models	Frequency	Sensing Mode	Sensing Range
DX80N2Q45DD NB (ships without a battery	2.4 GHz ISM Band	Diffuse	300 mm (12 in)
DX80N9Q45DD	900 MHz ISM Band		
DX80N9Q45DD NB (ships without a battery)			
DX80N9Q45LPD		Retroreflective	0.15 m (6 in) to 6 m (20 ft) (1)
DX80N9Q45LPD NB (ships without a battery)			

If you purchase a model without the battery, Banner Engineering recommends battery model **BWA-BATT-011**.

The following models are no longer available for order, but are still covered by the information in this document.

Models	Frequency	Sensing Mode	Sensing Range
DX80N2Q45DD	2.4 GHz ISM Band	Diffuse	300 mm (12 in)

Continued on page 2

(1) Performance is specified using the model **BRT-3** three-inch reflector.

Original Instructions
26-Feb-25

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223998
p/n: 223998 Rev. D

ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

Continued from page 1

Models	Frequency	Sensing Mode	Sensing Range
DX80N2Q45LPD		Retroreflective	0.15 m (6 in) to 6 m (20 ft) [2]
DX80N2Q45LPD NB (ships without a battery)			

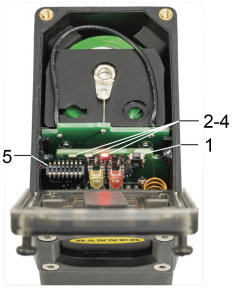
Storage Mode

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.

Configuration Instructions

Binding Button and LEDs

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



DIP Switches

The DIP switches are in the OFF position, by default. To turn a DIP switch on, push the switch toward the battery pack. DIP switches one through four are numbered from left to right.

After making any changes to any DIP switch position, reboot the Q45 by triple-clicking the binding button, waiting a second, then double-clicking the binding button.

The factory default sample rate is 62.5 ms with change of state reporting.

Settings	DIP Switch			
	1	2	3	4
900 MHz Transmit Power Level: 500 mW (27 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 DX80 Performance Configuration Software) DIP switch selections, the counter's report rate is defined by the report rate of Sensor IN 1 and can be modified for a custom report rate.

Transmit Power Levels

The 900 MHz radios have a high output option that will transmit at 500 mW (27 dBm). The low output option transmits at 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).

[2] Performance is specified using the model **BRT-3** three-inch reflector.

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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.

Apply Power to the Q45 D-Cell Models

Follow these instructions to install or replace the lithium D-cell batteries.

CAUTION:

- **As with all batteries, these are fire, explosion, and severe burn hazards. There is a risk of explosion if the battery is replaced incorrectly.**
- Do not burn or expose them to high temperatures. Do not recharge, crush, disassemble, or expose the contents to water.
- Verify the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case.
- Properly dispose of used batteries according to local regulations by taking them to a hazardous waste collection site, an e-waste disposal center, or another facility qualified to accept lithium batteries.





1. Loosen the clamp plate with a small Phillips screwdriver and lift the cover.
2. Use the black pull wire to pull the battery board out of the Q45 housing.
3. If applicable, remove the discharged battery.
4. Install the new battery. Use Banner's **BWA-BATT-011** replacement battery or an equivalent 3.6 V D-cell lithium battery, such as Xeno's XL-205F.
5. Verify the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case.
6. Slide the board containing the new battery back into the Q45 housing.
7. Close the cover and gently tighten the clamp plate with the small Phillips screwdriver.

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 the 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.

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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.

Holding Registers

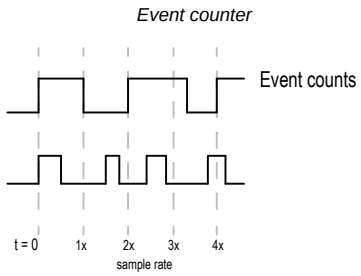
I/O #	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Sensor State	0	1	0	1
2	2	2 + (Node# × 16)	Reserved				
3	3	3 + (Node# × 16)	Counter High Word	0	65535	0	65535
4	4	4 + (Node# × 16)	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
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

Sensor State—A value of 0 indicates the sensor beam is not blocked. A value of 1 indicates the sensor beam is blocked.

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 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 IO 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.

Principles of Operation for the Q45DD and LPD Models

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

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

Diffuse Sensing Mode (Q45DD)

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 housed with the emitter.

With a diffuse-mode sensor, the object is detected when the object reflects the sensor’s transmitted light energy back to the sensor. During optical alignment mode, the sensor’s amber LED lights up whenever the sensor detects the reflected beam.

Retroreflective Sensing Mode (Q45LPD)

In retroreflective-mode sensing, light emitted from the sensor strikes a reflector and is reflected back to the receiver, which is housed with the emitter.

With a retroreflective-mode sensor, the object is detected when it blocks the light path to the reflector. 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 amber LED lights up when the sensor detects the reflected beam (no object present).

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Specifications

Radio Range

A 2 dB antenna ships with this device.

Transmit power and range are subject to many factors, including antenna gain, installation methods, characteristics of the application, and environmental conditions.

Please refer to the following documents for installation instructions and high-gain antenna options.

Installing Your Sure Cross® Radios (151514)
Conducting a Site Survey (133602)
Sure Cross® Antenna Basics (132113)

Radio Transmit Power (900 MHz, 500 mW radios)

Conducted: 27 dBm (500 mW)

EIRP with the supplied antenna: < 36 dBm

Radio Transmit Power (2.4 GHz radios)

Conducted: < 18 dBm (65 mW)

EIRP with the supplied antenna: < 20 dBm (100 mW)

Antenna Minimum Separation Distance

900 MHz radios transmitting at ≥ 500 mW: 4.57 m (15 ft) with the supplied antenna

2.4 GHz radios transmitting at 65 mW: 0.3 m (1 ft) with the supplied antenna

Sensing Range

Diffuse models: 300 mm (12 in)

Retroreflective models: 0.15 m (6 in) to 6 m (20 ft)

Report Rate

On Change of State

Default Sample Rate

62.5 milliseconds

Adjustments

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

Indicators

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

Construction

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

Link Timeout (Performance)

Gateway: Configurable via User Configuration Software

Node: Defined by Gateway

Spread Spectrum Technology

FHSS (Frequency Hopping Spread Spectrum)

900 MHz Compliance (SX7023EXT Radio Module)

Radio module is indicated by the product label marking

Contains FCC ID: UE3SX7023EXT

Contains IC: 7044A-SX7023EXT

2.4 GHz Compliance (DX80-2400 Radio Module)

Radio module is indicated by the product label marking

Contains FCC ID: UE300DX80-2400

Radio Equipment Directive (RED) 2014/53/EU

Contains IC: 7044A-DX8024

2.4 GHz Compliance (SX243 Radio Module)

Radio module is indicated by the product label marking

Contains FCC ID: UE3SX243

Radio Equipment Directive (RED) 2014/53/EU

Contains IC: 7044A-SX243

Battery Life (Typical for 900 MHz, 1 Watt)

With no counter and change-of-state reporting of greater than 5 minutes: 7.3 years

With no counter and change-of-state reporting of about 30 s: 5.6 years

With a counter set to 62.5 ms sample rate and 60 s report rate: 5.2 years

With a counter set to 31.25 ms sample rate and 60 s report rate: 3.5 year

Battery Life (Typical for 2.4 GHz)

With no counter and change-of-state reporting of greater than 5 minutes: 9.1 years

With no counter and change-of-state reporting of about 30 s: 8.7 years

With a counter set to 62.5 ms sample rate and 60 s report rate: 8 years

With a counter set to 31.25 ms sample rate and 60 s report rate: 4.2 year

Certifications

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

Turck Banner LTD Blenheim House
Blenheim Court
Wickford, Essex SS11 8YT
GREAT BRITAIN

CE/UKCA approval only applies to 2.4 GHz models

FCC Part 15 Class A for Intentional Radiators

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.

(Part 15.21) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Industry Canada Statement for Intentional Radiators

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:

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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.

Environmental Specifications for the Q45

Operating Conditions

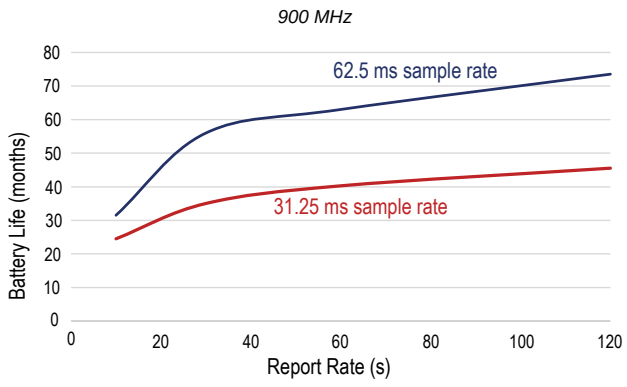
–40 °C to +70 °C (–40 °F to +158 °F); 90% at +50 °C maximum relative humidity (non-condensing)
Radiated Immunity: 10 V/m (EN 61000-4-3)

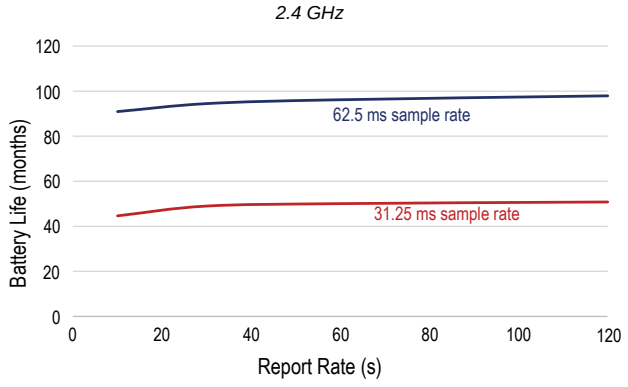
Environmental Rating

NEMA 6P
IP67

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

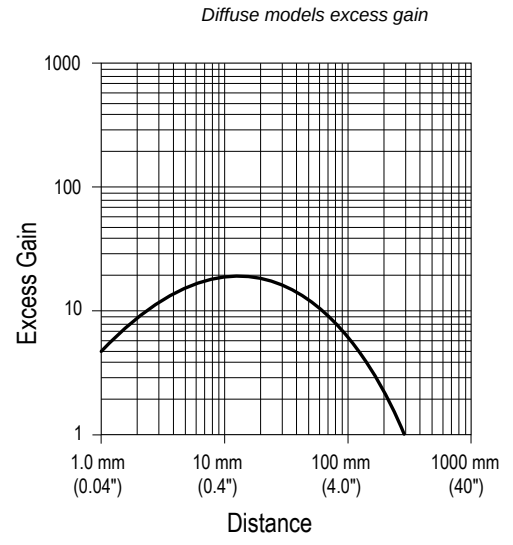
Battery Life for the Q45DD and LPD Models

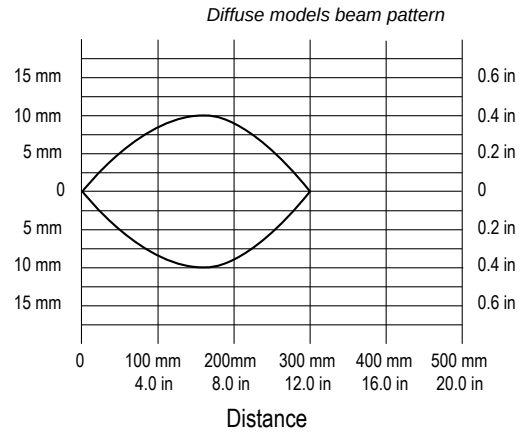




Performance Curves for the Q45DD and LPD Models

For the diffuse models, performance curves are based on a 90% reflectance white test card.





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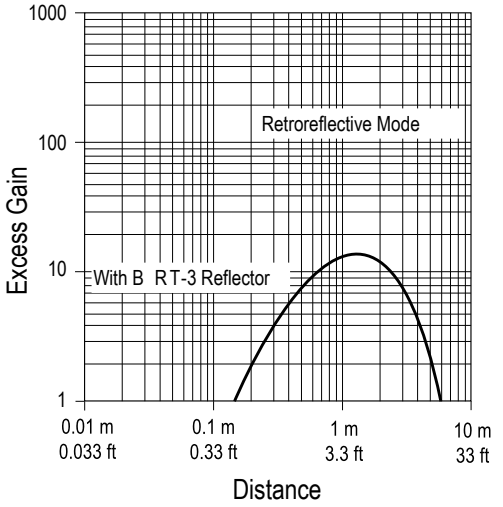
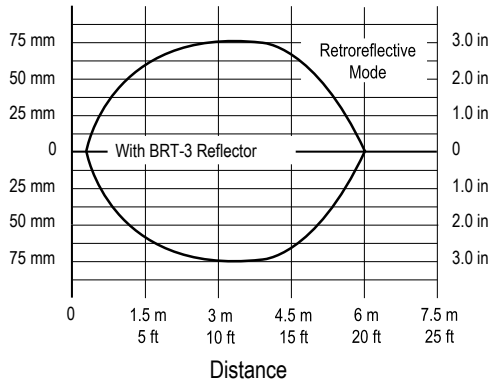
Retroreflective models excess gain

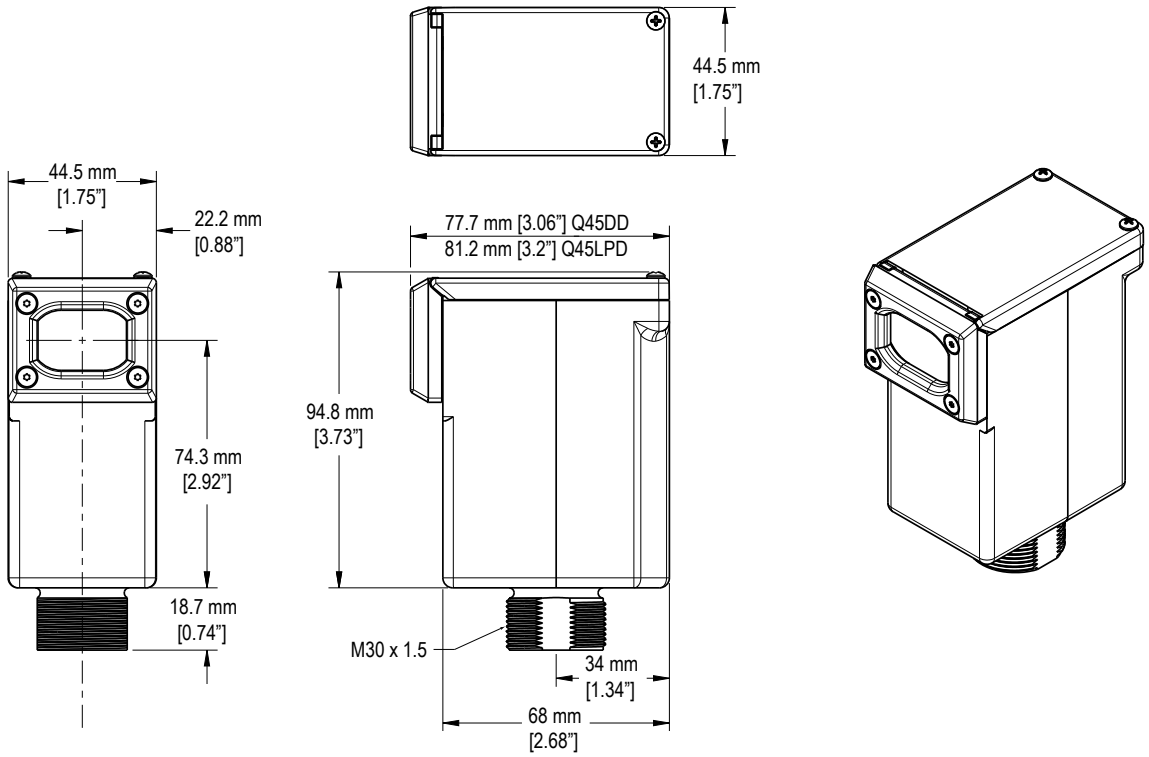


Retroreflective models beam pattern



Dimensions for the Q45DD and LPD Models

Dimensions for the Q45DD and LPD models



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Accessories

Replacement Batteries

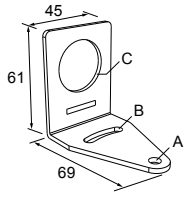
BWA-BATT-011
- 3.6 V Lithium D cell for non-hazardous locations only
- 19000 mAH
- One battery



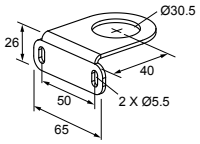
Brackets for the Q45DD and LPD Models

SMB30A
- Right-angle bracket with curved slot for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor
- 12-gauge stainless steel

Hole center spacing: A to B=40
Hole size: A=ø 6.3, B= 27.1 × 6.3, C=ø 30.5



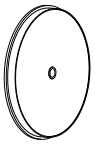
LMB30LP
- Low profile
- 30 mm mounting hole
- 300 series stainless steel



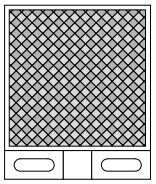
Reflectors for the Q45 LPD Model

These reflectors are required for the retroreflective model only.

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



BRT-2X2LVC
- Square, acrylic target
- Reflectivity Factor: 1.0
- Temperature: –20 °C to +60 °C (–4 °F to +140 °F)
- Optional brackets are available
- Approximate size: 51 mm × 51 mm



Warnings (Internal Antenna Models)

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.** Consult with Banner Engineering Corp. if the destination country is not on this list.

IMPORTANT: Please download the complete Wireless Q45DD and Q45LPD All-in-One D-Cell 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 Q45DD and Q45LPD All-in-One D-Cell 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 Q45DD and Q45LPD All-in-One D-Cell 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.

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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.

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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Approved Antennas

BWA-9O2-C--Antena, Omni 902-928 MHz, 2 dBd, junta de caucho, RP-SMA Macho
BWA-9O5-C--Antena, Omni 902-928 MHz, 5 dBd, junta de caucho, RP-SMA Macho
BWA-9O6-A--Antena, Omni 902-928 MHz, 6 dBd, fibra de vidrio, 1800mm, N Hembra
BWA-9Y10-A--Antena, Yagi, 900 MHz, 10 dBd, N Hembra

Mexican Importer

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