Sure Cross® Wireless Q45 Sensor Node - Vibration/Temperature

Datasheet

The Sure Cross® Wireless Q45VT Node is a compact, industrial, battery-powered device that wirelessly communicates vibration and temperature data collected from Banner's 1-wire serial VT1 vibration sensor to any Sure Cross Performance Gateway. Banner's VT1 vibration sensors work on a variety of machines to provide vibration and temperature measurements to effectively monitor and predict when maintenance of critical equipment is needed.

Benefits

- Delivers pre-processed high accuracy vibration values for monitoring rotating equipment such as:
  - Motors
  - Pumps
  - Rotary compressors
  - Exhaust or HVAC fan motors
  - Spindles
- Easy-to-use rugged device that can be easily mounted to equipment
- Use with the DXM Wireless Controller to track and trend vibration characteristics in real time to predict the need for maintenance, potential component failure, and to avoid unplanned downtime

- **Eliminate control wires**—the Sure Cross wireless system is a radio frequency network with integrated I/O that removes the need for power and control wires
- **Reduce complexity**—machine or process reconfiguration made easier, great for retrofit applications
- **Deploy easily**—simplify installation on existing equipment to enable deployment in remote and hard to access locations where implementing a wired solution would be difficult, impractical or not cost-effective
- Battery powered for "peel and stick" functionality with 2+ years of battery life
- Selectable transmit power levels of 250 mW or 1 Watt for 900 MHz models and 65 mW for 2.4 GHz models
- DIP switches for user configuration of alarm levels
- Frequency Hopping Spread Spectrum (FHSS) technology ensures reliable data delivery
- Transceivers provide bidirectional communication between the Gateway and Node, including fully acknowledged data transmission
- Diagnostics allow user-defined output settings in the unlikely event of lost RF signal

Models

Model	Radio Frequency	Description
DX80N2Q45VT	2.4 GHz ISM Band	Must be paired with QM30VT1 Vibration and Temperature Sensor (sold separately)

General Operation

For the first 15 minutes after power up, the Node samples the sensor every two seconds (fast sample mode). After 15 minutes, the Node defaults to 5 minute sample intervals. **Activate fast sample mode by single clicking the button (the amber LED is solid).**

- The amber LED on the front of the Q45 Node flashes when the vibration threshold limit set in I/O 1 is met. To minimize false vibration triggering, two consecutive samples must be above the threshold before the output condition is satisfied.
- The red LED on the front of the Q45 Node flashes when the temperature threshold limit set in I/O 4 is met. Only one reading above the established threshold is required to trigger this alert.

Set the vibration thresholds using the DIP switches or using the DX80 User Configuration Software to define the Threshold parameter. The DIP switch vibration thresholds were determined using the guidance of Vibration Severity per ISO 10816.

The default setting for the temperature threshold is 80 °C. Change the temperature threshold using the software and defining the Threshold parameter.

- Class I: Small (up to 15 kW) machines and subassemblies of larger machines.
- Class II: Medium size (15 kW to 75 kW) machines without special foundations, or machines up to 300 kW rigidly mounted on special foundations.
- Class III: Large rotating machines rigidly mounted on foundations which are stiff in the direction of vibration measurement.
- Class IV: Large rotating machines mounted on foundations which are flexible in the direction of vibration measurement.

ISO 10816 provides guidance for evaluating vibration velocity severity motors, pumps, fans, compressors, gear boxes, blowers, dryers, presses, and other machines that operate in the 10 to 1000 Hz frequency range.

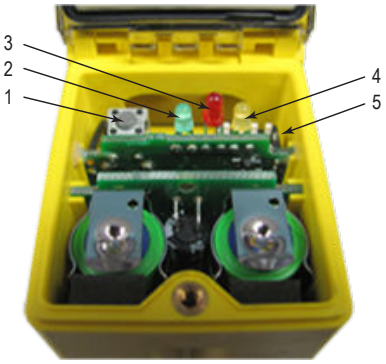
Figure 1. Vibration Severity per ISO 10816

Machine			Class I Small Machines	Class II Medium Machines	Class III Large Rigid Foundation	Class IV Large Soft Foundation
Vibration Velocity Vrms	in/s	mm/s				
	0.01	0.28				
	0.02	0.45				
	0.03	0.71		good		
	0.04	1.12				
	0.07	1.80				
	0.11	2.80		satisfactory		
	0.18	4.50				
	0.28	7.10		unsatisfactory		
	0.44	11.2				
	0.70	18.0				
	1.10	28.0		unacceptable		
	1.77	45.9				

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.

Button, LEDs, and DIP Switches



1 Button
2 Green LED (flashing) indicates a good radio link with the Gateway.
3 Red LED (flashing) indicates a radio link error with the Gateway.
4 Amber LED (flashing) indicates fast sample mode.
5 DIP Switches

DIP Switch Settings

After making any changes to any DIP switch position, reboot the Wireless Q45 Sensor by triple-clicking the button, waiting a second, then double-clicking the button. You may also reboot the device by removing the battery pack, then re-installing it. As shown in the image above, the DIP switches are in the OFF position. To turn a DIP switch on, push the switch toward the battery pack. DIP switches one through four are numbered from left to right.

Description	DIP Switches			
	1	2	3	4
Vibration Alarm at 0.15 in/sec (default setting)	ON	OFF	OFF	OFF
Vibration Alarm at 0.25 in/sec	ON	OFF	OFF	ON
Vibration Alarm at 0.35 in/sec	ON	OFF	ON	OFF
Vibration Alarm at 0.55 in/sec	ON	OFF	ON	ON
Local Light Disabled (conserves battery)	OFF			
UCT Configurable		ON	ON	OFF

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.

Modbus Register Table

The temperature = (Holding register value) ÷ 20.

I/O #	Modbus Holding Register		I/O Type *	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min.	Max.	Min.	Max.
1	1	1 + (Node# × 16)	Input 1: Z-Axis RMS Velocity (in/sec)	0	6.5535	0	65535
2	2	2 + (Node# × 16)	Input 2: Z-Axis RMS Velocity (mm/sec)	0	65.535	0	65535
3	3	3 + (Node# × 16)	Input 3: Temperature (°F)	–1638.4	1638.3	–32768	32767
4	4	4 + (Node# × 16)	Input 4: Temperature (°C)	–1638.4	1638.3	–32768	32767
5	5	5 + (Node# × 16)	Input 5: X-Axis RMS Velocity (in/sec)	0	6.5535	0	65535
6	6	6 + (Node# × 16)	Input 6: X-Axis RMS Velocity (mm/sec)	0	65.535	0	65535
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
9	9	9 + (Node# × 16)	Discrete OUT 1: Red Light [1]	0	1	0	1
10	10	10 + (Node# × 16)	Discrete OUT 2: Yellow Light [1]	0	1	0	1
11	11	11 + (Node# × 16)	Discrete OUT 3: Green Light [1]	0	1	0	1
12	12	12 + (Node# × 16)	Discrete OUT 4: Blue Light [1]	0	1	0	1
		...					
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

* These are the default data types that output from the QM30VT1 serial sensor, corresponding to inputs 1 through 6 of the Q45 Node. If necessary, configure the QM30VT1 output data types using the Sensor Configuration Software and adapter cable **BWA-USB1WIRE-001** (datasheet 170020). Refer to the QM30VT1 datasheet (p/n 212568) for optional output data types with their corresponding I/O ranges and holding register representations.

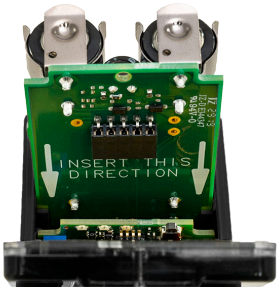
Apply Power to the Q45

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.

[1] Not available when the vibration/temperature sensor is used with the P6 Node.

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 2.4 GHz Radio Specifications for Internal Antennas

Radio Range [2]
2.4 GHz, 65 mW: Up to 1000 m (3280 ft) with line of sight (internal antenna)

Antenna Minimum Separation Distance
2.4 GHz, 65 mW: 0.3 m (1 ft)

Radio Transmit Power
2.4 GHz: 65 mW

Spread Spectrum Technology
FHSS (Frequency Hopping Spread Spectrum)

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

Wireless Q45VT Specifications

Default Sensing Interval
5 minutes

Indicators
Red and green LEDs (radio function)

Connection
One 5-pin M12 female quick-disconnect connector

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

Typical Battery Life
Up to 3 years, typical
Battery life is reduced to 1.5 years when the sample/report rate is increased to 64 seconds

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.

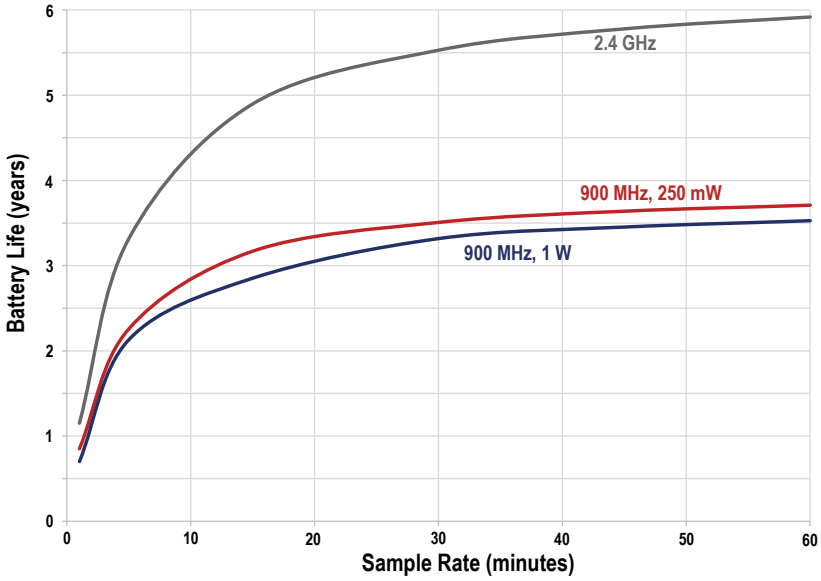
Battery Life for a Q45VA or Q45VT/Q45U Node with 1-Wire Serial Sensor

This is the battery life curve for the following models:

- Q45VT or Q45U 1-Wire Serial Interface Node connected to a 1-wire serial sensor (such as a VT1 Vibration/Temperature sensor)
- Q45VTP Node

[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.

Figure 3. Battery life for the Q45VA, VT, and U Nodes



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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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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