Sure Cross® QM30VT1 Vibration and Temperature Sensor

Datasheet

Continuously monitor machine health, run time, and detect unexpected machine failures such as early bearing failure, unbalance, misalignment, etc. with the Sure Cross Vibration and Temperature QM30VT1 Sensor. The QM30VT1 works in a variety of machines to identify and predict failures in rotating machinery. Paired with a Sure Cross wireless Node, the QM30VT1 becomes the ultimate predictive maintenance tool for wireless vibration and temperature monitoring.



- Dual-axis vibration detection up to 4 kHz bandwidth
- Output actionable data such as RMS Velocity, RMS High Frequency Acceleration, Peak Velocity, etc., which is pre-processed from the vibration waveforms in the sensor
- Provides high accuracy vibration and temperature measurements
- Industrial grade sensor with small form factor to fit into tight locations
- Manufactured with a sealed aluminum housing
- Connects to Sure Cross Wireless Nodes for easy set-up, fast installation, and long battery life in even the most rugged, hard-to-reach locations
- Designed to work with 1-Wire Serial Interface Nodes

For additional information, updated documentation, and a list of accessories, refer to Banner Engineering's website, *www.bannerengineering.com*.

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

Model	Supply Voltage	Connections and Cable	I/O
QM30VT1	3.6 V dc to 5.5 V dc	2.09 m (6.85 ft) cable with a 5-pin M12/Euro-style male quick disconnect (QD)	Vibration and temperature using a 1-wire serial interface

The Sensor Configuration Software offers an easy way to manage sensor parameters, retrieve data, and visually show sensor data from a number of different sensors. The Sensor Configuration Software runs on any Windows machine and uses an adapter cable to connect the sensor to your computer. Download the most recent version of the software from Banner Engineering's website: *www.bannerengineering.com* and select **Software** from the **Products** drop-down list.

Configure this sensor using the *Sensor Configuration Software* (instruction manual p/n *170002*) and USB-to-RS-232 1-Wire adapter cable model **BWA-USB1WIRE-001** (datasheet p/n *170020*).

Installation Instructions

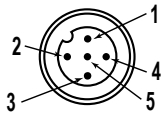
Connecting the Vibration/Temperature Sensor

To install the sensor to a device with a 5-pin M12/Euro-style female connector:

1. Align the notch in the female connector with the key in the sensor's male connector.
2. Gently slide the sensor end into the connector.
3. Rotate the threaded nut to tighten the sensor down.

Wiring

This sensor is designed to be plugged directly into compatible Nodes. The Node powers the sensor and periodically requests data using the 1-wire serial interface. Refer to the Class I Division 2 control drawings (p/n *143086*) for wiring specifications and limitations.

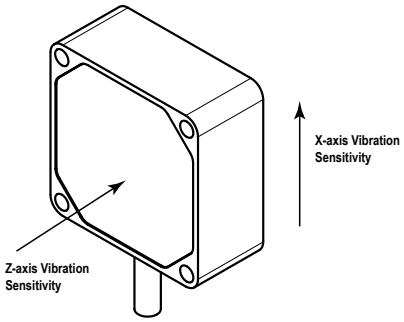
5-pin M12/Euro-style Connector (Male)	Pin	Wire Color	Sensor Connection
	1	Brown	Power IN (+), 3.6 to 5.5 V dc
	2	White	1-Wire serial device select (sinking input to sensing device)
	3	Blue	Ground (-)
	4	Black	Not used/reserved
	5	Gray	1-Wire serial communications

Installing the Sensor

The vibration sensors have an X and Z axis indication on the face of the sensor. The Z axis goes in a plane through the sensor while the X is parallel to the sensor.

- Install the X axis in line with the shaft of the motor or axially.
- Install the Z axis to go into or through the motor or radial.

For the best results, install the sensor as close to the motor bearing as possible. If this is not possible, install the sensor on a surface that is in rigid connection with vibration characteristics of the motor. Using a cover shroud or other flexible mounting location may result in reduced accuracy or reduced ability to detect certain vibration characteristics.



After determining the sensor direction and location, mount the sensor for the best possible vibration sensing accuracy.

Mounting Options	Applicable QM Models	Description
BWA-BK-014	QM30VT1, QM30VT2	Flat bracket with direct screw mount to motor and sensor
BWA-BK-012	QM30VT2-SS-9M	When available, directly mounting the bracket to the motor using an M4 × 0.7 bolt provides a rigid surface with the highest sensor accuracy and frequency response. This mounting option offers flexibility for future sensor and bracket movement.
BWA-BK-014	QM30VT1, QM30VT2	Flat bracket epoxied to motor and sensor screwed to bracket
BWA-BK-012	QM30VT2-SS-9M	Recommend using an epoxy designed for accelerometer mounting, such as Loctite Depend 330 and 7388 activator. Epoxying a bracket to a motor provides a permanent installation of the bracket to which the sensor can be attached. This more rigid mounting solution ensures some of the best sensor accuracy and frequency response, but is not flexible for future adjustments.
BWA-BK-013	QM30VT1, QM30VT2, QM30VT2-SS-9M	Flat magnet bracket Gives a solid, strong, and adjustable mount to a motor, but with a motor's curved surface it may not provide the best connection if the motor is too small for the magnet to get a full connection with the motor housing. Magnet mounts are susceptible to accidently rotation or change in sensor location if an outside force bumps or moves the sensor. This can lead to a change in sensor information that differs from the time-trended data from the previous location.
Thermally Conductive Adhesive tape	QM30VT1, QM30VT2, QM30VT2-SS-9M	Often provides a more than sufficient mounting type but does introduce some additional flex that reduces accuracy

Holding Registers

By default, the sensor's sample rate is every two and a half minutes. If connected to a Node, then the sample rate is dictated by the Node's sample rate. Use the Sensor Configuration Software to adjust the sensor's sample rate if a different value is needed. The default configuration is shown. The sensor register output data types are user configurable. Use the Sensor Configuration Software to change the output types. All optional output types are listed below. Temperature values outside the operating range of the device are forced to the maximum or minimum values.

The six sensor outputs are read into input registers 1 through 6 of the connected Node as they appear in the User Configuration Software. Sensor outputs can either be configured automatically using DIP switches on some Nodes, such as the Q45VTP, or manually configured by adjusting the Nodes' input register serial addresses with the configuration software. The serial addresses correspond to particular sensor outputs shown in the table below. To view the DIP switch configurations and for more information on how to manually set up Nodes, refer your Node's datasheet.

Sensor Register	Output Type	I/O Range		Holding Register Representation	
		Min	Max	Min (Dec)	Max (Dec)
1	Z-Axis RMS Velocity (in/sec) [1, 5]	0	6.5535	0	65535
2	Z-Axis RMS Velocity (mm/sec) [2, 5]	0	65.535	0	65535
3	Temperature (°F) [3]	–1638.4	1638.3	–32768	32767
4	Temperature (°C) [3]	–1638.4	1638.3	–32768	32767
5	X-Axis RMS Velocity (in/sec) [1, 5]	0	6.5535	0	65535
6	X-Axis RMS Velocity (mm/sec) [2, 5]	0	65.535	0	65535

[1] Value = Register value ÷ 10000
[2] Value = Register value ÷ 1000
[3] Value = Register value ÷ 20
[4] Value = Register value ÷ 10
[5] Measurement bandwidth = 10 Hz to 1 kHz
[6] Measurement bandwidth = 1 kHz to 4 kHz

Serial Address	Optional Output Types	I/O Range		Holding Register Representation	
		Min	Max	Min (dec)	Max (dec)
16	Z-Axis RMS Velocity (in/sec) [1, 5]	0	6.5535	0	65535
25	Z-Axis RMS Velocity (mm/sec) [2, 5]	0	65.535	0	65535
192	Temperature (°F) [3]	–327.68	327.67	–32768	32767
193	Temperature (°C) [3]	–327.68	327.67	–32768	32767
64	X-Axis RMS Velocity (in/sec) [1, 5]	0	6.5535	0	65535
73	X-Axis RMS Velocity (mm/sec) [2, 5]	0	65.535	0	65535
20	Z-Axis Peak Acceleration (G) [2, 6]	0	65.535	0	65535
68	X-Axis Peak Acceleration (G) [2, 6]	0	65.535	0	65535
19	Z-Axis Peak Velocity Component Frequency (Hz) [4, 5]	0	6553.5	0	65535
66	X-Axis Peak Velocity Component Frequency (Hz) [4, 5]	0	6553.5	0	65535
19	Z-Axis RMS Acceleration (G) [2, 5]	0	65.535	0	65535
67	X-Axis RMS Acceleration (G) [2, 5]	0	65.535	0	65535
24	Z-Axis Kurtosis [2, 6]	0	65.535	0	65535
72	X-Axis Kurtosis [2, 6]	0	65.535	0	65535
37	Z-Axis Crest Factor [2, 6]	0	65.535	0	65535
69	X-Axis Crest Factor [2, 6]	0	65.535	0	65535
17	Z-Axis Peak Velocity (in/sec) [1, 5]	0	6.5535	0	65535
23	Z-Axis Peak Velocity (mm/sec) [2, 5]	0	65.535	0	65535
65	X-Axis Peak Velocity (in/sec) [1, 5]	0	6.5535	0	65535
71	X-Axis Peak Velocity (mm/sec) [2, 5]	0	65.535	0	65535
22	Z-Axis High-Frequency RMS Acceleration (G) [2, 6]	0	65.535	0	65535
70	X-Axis High-Frequency RMS Acceleration (G) [2, 6]	0	65.535	0	65535
27	Full Bandwidth RMS Acceleration Z-Axis (G) [2, 6]	0	65.535	0	65535
75	Full Bandwidth RMS Acceleration X-Axis (G) [2, 6]	0	65.535	0	65535
28	Full Bandwidth Peak Acceleration Z-Axis (G) [2, 7]	0	65.535	0	65535
76	Full Bandwidth Peak Acceleration X-Axis (G) [2, 7]	0	65.535	0	65535

[1] Value = Register value ÷ 10000
[2] Value = Register value ÷ 1000
[3] Value = Register value ÷ 100
[4] Value = Register value ÷ 10
[5] Measurement bandwidth = 10 Hz to 1 kHz
[6] Measurement bandwidth = 1 kHz to 4 kHz
[7] Measurement Bandwidth = 10 Hz to 4 kHz

Specifications

Supply Voltage
3.6 V dc to 5.5 V dc

Current
Active comms: 3 mA

Communication
Interface:1-wire serial
Baud rates: 9.6k, 19.2k (default), or 38.4k
Data format: 8 data bits, no parity (default), 1 stop bit (even or odd parity available)

Mounting Options
The sensor can be mounted using a variety of methods, including M4 × 0.7 hex screw, epoxy, thermal tape, or magnetic mount.

Shock
MIL-STD-202G, Method 213B, Condition I (100G 6x along X, Y and Z axes, 18 shocks), with device operating

Certifications

CE

Vibration Sensor
Measuring Range: 0 to 46 mm/sec or 0 to 1.8 in/sec RMS
Frequency Range: 10 Hz to 4 kHz
Accuracy: ±10% at 25 °C
Sampling Frequency: 20 kHz (default)
Record Length: 8192 points (default)
Sample Duration: 0.4 s (default)

Temperature Sensor
Measuring Range: –40 °C to +105 °C (–40 °F to +221 °F)
Resolution: 1 °C
Accuracy: ± 3 °C
Operating the sensor at higher voltages can induce internal heating that can reduce the accuracy.

Environmental Rating
IEC IP67

Operating Temperature
–40 °C to +105 °C (–40 °F to +221 °F) [1]

Battery Life for a P6 Node Connected to a Vibration and Temperature (VT1) Sensor

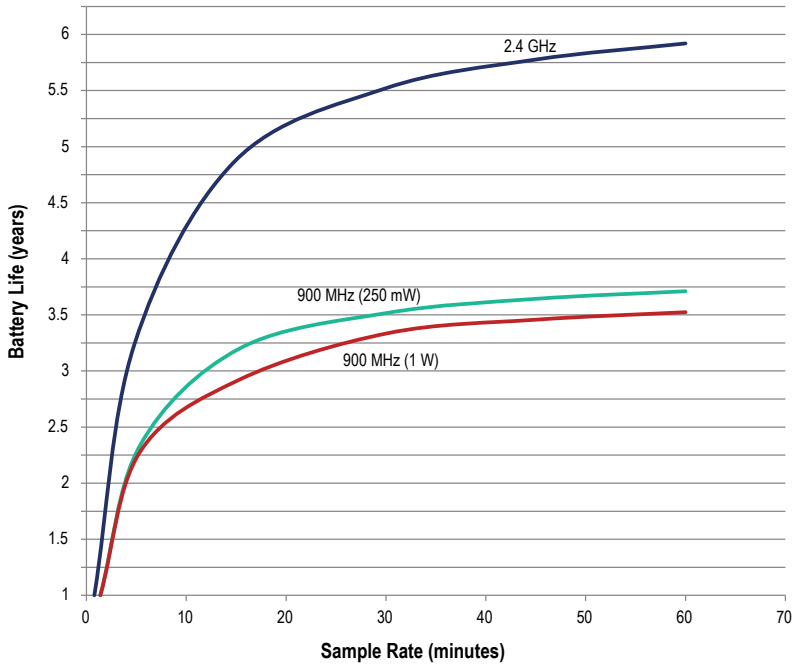
The following battery life estimates use the default configuration of the Performance P6 Node, which is a 5 minute sample and report rate.

900 MHz 1 Watt: 2.5 years
900 MHz 250 mW: 3.4 years
2.4 GHz: 4.3 years

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



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

Vibration Severity Per ISO 10816

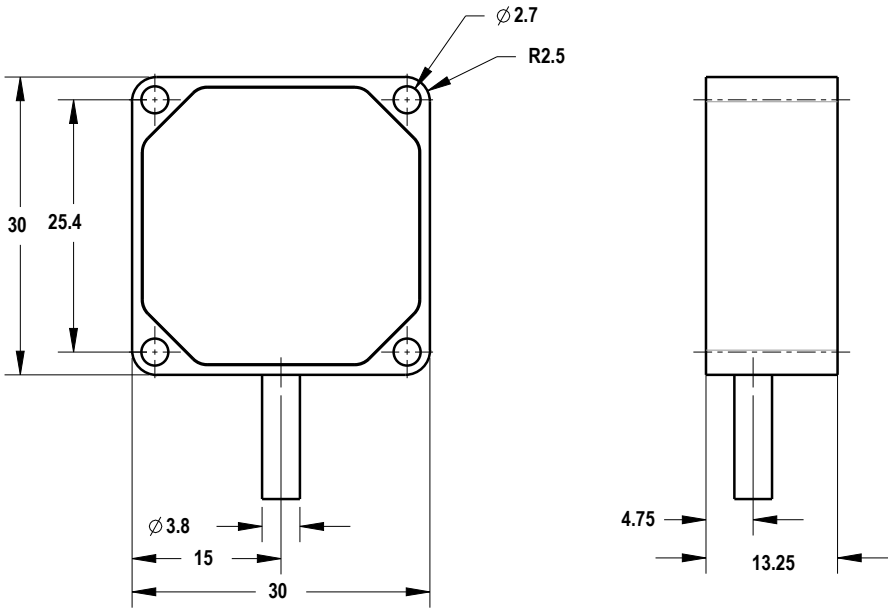
ISO 10816 provides guidance for evaluating vibration velocity severity motors, pumps, fans, compressors, gear boxes, blowers, dryers, presses, and other machines that operate in the 10 to 1000 Hz frequency range.

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				

Figure 1. Vibration Severity per ISO 10816

Dimensions

All measurements are listed in millimeters [inches], unless noted otherwise.

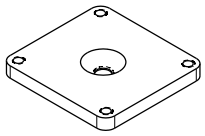


Vibration and Temperature Sensor Accessories

Included with Sensor

BWA-BK-014

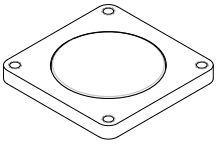
- Use when measuring high frequency vibrations or when mounting the sensor to curved surfaces
- Includes **SMBQM30** aluminum bracket, four mounting screws, one M4 × 0.7 screw mount, and one piece of 3M™ thermally conductive adhesive transfer tape
- 30 mm × 30 mm
- Refer to the Bracket Assembly Quick Start Guide for installation instructions (p/n *213323*)



Available for Order

BWA-BK-013

- Includes magnetic mounting bracket **SMBQM30** and four mounting screws (two sets of mounting screws for both the aluminum and stainless steel models)
- 30 mm × 30 mm
- Refer to the Bracket Assembly Quick Start Guide for installation instructions (p/n *213323*)



BWA-USB1WIRE-001

- PC USB to 1-wire serial interface converter
- Use with the Sensor Configuration Software to communicate directly with 1-wire serial interface sensors
- Datasheet: *170020*



Nodes Available

- Battery powered DX80N*X1S-P6 or DX80N*X1W-P6L Datsheet: 157189
- Condition Monitoring Node DX80N*X1W-CM1L Datsheet: 209565
- Wireless Q45 DX80N*Q45VTP Datsheet: 208637
- 10 to 30 V dc power DX80N*X6S-P6 Datsheet: 157189
- MultiHop DX80DR*M-H6 Datsheet: 152725

All models are available for either 900 MHz or 2.4 GHz; substitute a 9 (900 MHz) or a 2 (2.4 GHz) for the * shown in the model number.

Banner Engineering Corp. Limited Warranty

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For patent information, see *www.bannerengineering.com/patents*.

FCC Part 15 and CAN ICES-3 (B)/NMB-3(B)

This device complies with part 15 of the FCC Rules and CAN ICES-3 (B)/NMB-3(B). Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules and CAN ICES-3 (B)/NMB-3(B). These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the manufacturer.

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