

## Datasheet

The Sure Cross Vibration and Temperature Sensor works in a variety of machines to identify and predict failures in rotating machinery.



- Detects dual-axis vibration
- Provides high accuracy vibration and temperature measurements
- Manufactured with a robust zinc alloy housing
- Functions as a Modbus slave device via RS-485



### 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.

For additional information, updated documentation, and a list of accessories, refer to Banner Engineering's website, [www.bannerengineering.com](http://www.bannerengineering.com).

## Models

Model	Power Requirements	Connection and Cable	I/O
QM42VT2	3.6 to 5.5 V dc or 10 to 24 V dc	3 m cable with a 5-pin M12/Euro-style male quick disconnect (QD)	Vibration and temperature via RS-485 Modbus
QM42VT2QP		150 mm (6 in) PVC cable with a 5-pin M12/Euro-style male quick disconnect	

Configure this sensor using the [Sensor Configuration Software](#) and adapter cable BWA-HW-006 (datasheet [140377](#)).

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	Machine		Class I	Class II	Class III	Class IV
	in/s	mm/s	Small Machines	Medium Machines	Large Rigid Foundation	Large Soft Foundation
Vibration Velocity Vrms	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



## Installation Instructions

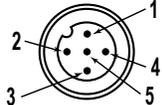
### Connecting the Vibration/Temperature Sensor

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 for use as a Modbus slave. This sensor can be plugged into any Modbus RS-485 network, including compatible MultiHop Data Radios.

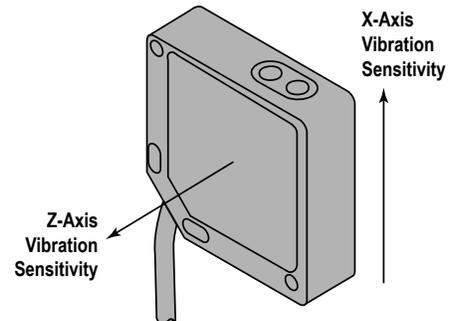
5-pin M12/Euro-style Male Connector	Pin	Wire Color	Sensor Connection
	1	Brown	Power IN (+). Either 3.6 to 5.5 V dc or 10 to 24 V dc
	2	White	RS485 / D1 / B / +
	3	Blue	Ground (-)
	4	Black	RS485 / D0 / A / -
	5	Gray	Not Used (default) or Discrete NPN Select Line (optional) When updating the firmware, you must ground pin 5 by connecting it to pin 3.

### Installing the VT1 or VT2 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 in order from least effective to most effective are as follows:

Mounting Options	Effectiveness	Description
<b>BWA-HW-057</b> Thermally Conductive Adhesive tape	Least effective	Often provides a more than sufficient mounting type but does introduce some additional flex that reduces accuracy
<b>BWA-BK-001</b> Flat magnet sensor 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 accidentally 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.
<b>BWA-BK-008</b> Curved surface magnet attached to sensor bracket via 1/4-28 bolt		Curved surface magnet mounts may provide a stronger mount to smaller curved motor surfaces than a flat magnet mount and need to be oriented in the correct direction for the strongest mount.  If the magnet feels loose, rotate the magnet 45° or 90° and check again for the strongest connection. Magnet mounts are susceptible to accidentally 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.

Mounting Options	Effectiveness	Description
<b>BWA-BK-002</b> or <b>BWA-BK-005</b> Flat bracket epoxied to motor and sensor screwed to bracket  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.
<b>BWA-BK-002</b> or <b>BWA-BK-005</b> Flat bracket with direct screw mount to motor and sensor	Most effective	When available, directly mounting the bracket to the motor using a ¼-28 bolt provides a rigid surface with the highest sensor accuracy and frequency response.  This mounting option offers flexibility for future sensor and bracket movement.

## Configuration Instructions

### Sensor Configuration Software

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](http://www.bannerengineering.com) and select **Software** from the **Products** drop-down list.

The Sensor Configuration Software currently supports the following sensors:

Sensor Type	Model	USB Adapter Cable
Temperature and Humidity	M12FTH3Q, M12FTH5Q, and M12FT3Q	USB-to-RS-485 adapter cable model <b>BWA-HW-006</b> OR USB to RS-485 adapter cable model <b>BWA-UCT-900</b> (datasheet p/n <a href="#">140377</a> )
	M12FTH4Q, M12FTH6Q, and M12FT4Q	USB-to-RS-232 1-Wire adapter cable model <b>BWA-USB1WIRE-001</b> (datasheet p/n <a href="#">170020</a> )
Vibration and Temperature	QM42VT1	USB-to-RS-232 1-Wire adapter cable model <b>BWA-USB1WIRE-001</b> (datasheet p/n <a href="#">170020</a> )
	QM42VT2	USB-to-RS-485 adapter cable model <b>BWA-HW-006</b> OR USB to RS-485 adapter cable model <b>BWA-UCT-900</b> (datasheet p/n <a href="#">140377</a> ). When updating the firmware, you must use one of the two USB to RS-485 adapter cables plus a splitter pigtail cable p/n 83265.
	QM30VT1	USB-to-RS-232 1-Wire adapter cable model <b>BWA-USB1WIRE-001</b> (datasheet p/n <a href="#">170020</a> )
	QM30VT2	USB to RS-485 adapter cable model <b>BWA-UCT-900</b> (datasheet p/n <a href="#">140377</a> ). When updating the firmware, you must use one of the two USB to RS-485 adapter cables plus a splitter pigtail cable p/n 83265.
GPS	GPS50M	USB-to-RS-485 adapter cable model <b>BWA-HW-006</b> AND a field-wireable M12/Euro-style connector or connector with pigtail OR USB to RS-485 adapter cable model <b>BWA-UCT-900</b> AND a field-wireable M12/Euro-style connector or connector with pigtail (datasheet p/n <a href="#">140377</a> )
U-GAGE K50U Ultrasonic	K50UX1CRA	USB-to-RS-232 1-Wire adapter cable model <b>BWA-USB1WIRE-001</b> (datasheet p/n <a href="#">170020</a> )
	K50UX2CRA	USB-to-RS-485 adapter cable model <b>BWA-HW-006</b> OR USB to RS-485 adapter cable model <b>BWA-UCT-900</b> (datasheet p/n <a href="#">140377</a> )
	K50UX1ARA	USB-to-RS-232 1-Wire adapter cable model <b>BWA-USB1WIRE-001</b> (datasheet p/n <a href="#">170020</a> )
	K50UX2ARA	USB-to-RS-485 adapter cable model <b>BWA-HW-006</b> OR USB to RS-485 adapter cable model <b>BWA-UCT-900</b> (datasheet p/n <a href="#">140377</a> )

Refer to the Sensor Configuration Software Instruction Manual (p/n [170002](#)) to update your sensor's firmware.

### Holding Registers

By default, data is sampled every five seconds. Use the Sensor Configuration Tool to adjust the sensor's sample rate if a different value is needed. Aliased register addresses are user configurable. Aliased addressed registers are sequenced to be read with one single Modbus read. Temperature values outside of the operating range of the device are forced to the maximum or minimum values.

Modbus Register Alias Address	Modbus Register Address	Description	I/O Range		Holding Register Representation	
			Min	Max	Min (dec)	Max (dec)
45201	42401	Z-Axis RMS Velocity (in/sec) <sup>1, 5</sup>	0	6.5535	0	65535
45202	42403	Z-Axis RMS Velocity (mm/sec) <sup>2, 5</sup>	0	65.535	0	65535
45203	40049	Temperature (°F) <sup>3</sup>	-327.68	327.67	-32768	32767

Modbus Register Alias Address	Modbus Register Address	Description	I/O Range		Holding Register Representation	
			Min	Max	Min (dec)	Max (dec)
45204	40043	Temperature (°C) <sup>3</sup>	-327.68	327.67	-32768	32767
45205	42451	X-Axis RMS Velocity (in/sec) <sup>1, 5</sup>	0	6.5535	0	65535
45206	42453	X-Axis RMS Velocity (mm/sec) <sup>2, 5</sup>	0	65.535	0	65535
45207	42407	Z-Axis Peak Acceleration (G) <sup>2, 6</sup>	0	65.535	0	65535
45208	42457	X-Axis Peak Acceleration (G) <sup>2, 6</sup>	0	65.535	0	65535
45209	42405	Z-Axis Peak Velocity Component Frequency (Hz) <sup>4, 5</sup>	0	6553.5	0	65535
45210	42455	X-Axis Peak Velocity Component Frequency (Hz) <sup>4, 5</sup>	0	6553.5	0	65535
45211	42406	Z-Axis RMS Acceleration (G) <sup>2, 5</sup>	0	65.535	0	65535
45212	42456	X-Axis RMS Acceleration (G) <sup>2, 5</sup>	0	65.535	0	65535
45213	42409	Z-Axis Kurtosis <sup>2, 6</sup>	0	65.535	0	65535
45214	42459	X-Axis Kurtosis <sup>2, 6</sup>	0	65.535	0	65535
45215	42408	Z-Axis Crest Factor <sup>2, 6</sup>	0	65.535	0	65535
45216	42458	X-Axis Crest Factor <sup>2, 6</sup>	0	65.535	0	65535
45217	42402	Z-Axis Peak Velocity (in/sec) <sup>1, 5</sup>	0	6.5535	0	65535
45218	42404	Z-Axis Peak Velocity (mm/sec) <sup>2, 5</sup>	0	65.535	0	65535
45219	42452	X-Axis Peak Velocity (in/sec) <sup>1, 5</sup>	0	6.5535	0	65535
45220	42454	X-Axis Peak Velocity (mm/sec) <sup>2, 5</sup>	0	65.535	0	65535
45221	42410	Z-Axis High-Frequency RMS Acceleration (G) <sup>2, 6</sup>	0	65.535	0	65535
45222	42460	X-Axis High-Frequency RMS Acceleration (G) <sup>2, 6</sup>	0	65.535	0	65535
	46101	Baud	0=9.6k, 1=19.2k (default), 2=38.4k			
	46102	Parity	0=none (default), 1=odd, 2=even			
	46103	Modbus Slave Address	1 (default) through 247			
	42601	Rotational Speed (RPM) (default = 1725 RPM) -- Used in vibration spectral band measurements	0	65535	0	65535
	42602	Rotational Speed (Hz) (default = 29 Hz) -- Used in vibration spectral band measurements	0	65535	0	65535

<sup>1</sup> Value = Register value ÷ 10000

<sup>2</sup> Value = Register value ÷ 1000

<sup>3</sup> Value = Register value ÷ 100

<sup>4</sup> Value = Register value ÷ 10

<sup>5</sup> Measurement bandwidth = 10 Hz to 1 kHz

<sup>6</sup> Measurement bandwidth = 1 kHz to 4 kHz

## Vibration Spectral Band Measurements

To use vibration spectral band measurements, follow the instructions in the Vibration Spectral Band Measurement Start Guide (p/n [b\\_4510565](#)).

## Specifications

### Supply Voltage

3.6 to 5.5 V dc or 10 to 24 V dc

### Current

Active comms: 8.8 mA at 24 V dc

### Communication

Interface: RS-485 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)  
 Protocol: Modbus RTU

### Vibration Sensor

Mounted base resonance: 4.5 kHz nominal  
 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)

### Indicators

Green flashing: Power ON  
 Amber flicker: Serial Tx

**Mounting Options**

The sensor can be mounted using a variety of methods, including 1/4"-28 hex screw, epoxy, thermal tape, or magnetic mount.

**Shock**  
400G



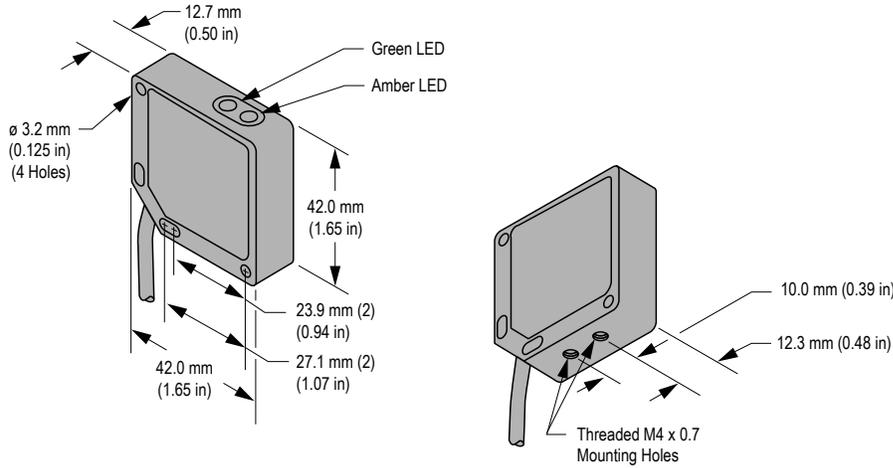
**Temperature Sensor**

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.

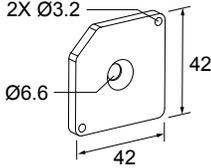
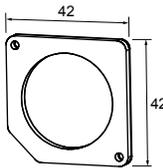
**Environmental Rating**  
IEC IP67

**Operating Temperature**  
-40 °C to +105 °C (-40 °F to +221 °F) †

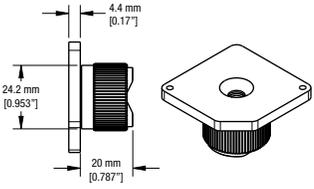
**Dimensions**



**Vibration and Temperature Sensor Accessories**

Included with Sensor	Available for Order
<p><b>BWA-BK-005</b></p> <ul style="list-style-type: none"> <li>Use when measuring high frequency vibrations or when mounting the sensor to curved surfaces</li> <li>Includes <b>SMB42FLAT</b> stainless steel bracket, 1/4"-28 screw mount, and one piece of 3M™ thermally conductive adhesive transfer tape</li> </ul> 	<p><b>BWA-BK-001</b></p> <ul style="list-style-type: none"> <li>Includes magnetic mounting bracket <b>SMB42FLM12</b> and 2 mounting screws</li> </ul> 
<p><b>BWA-HW-057</b></p> <ul style="list-style-type: none"> <li>3M™ Thermally Conductive Adhesive Transfer Tape 8820</li> <li>Provides a heat-transfer path between heat-generating components and heat sinks or other cooling devices</li> <li>3 pieces per pack</li> <li>Tape is 20 mils (0.50 mm) thick; liner is 1.5-2 mil (37.5-50 µm) thick</li> <li>Thermally conductive ceramic filler</li> <li>Dual liner using silicone-treated polyester: easy-release PET liner is clear, tight side PET liner is blue</li> </ul>	<p><b>BWA-HW-006</b></p> <ul style="list-style-type: none"> <li>Adapter cable, USB to RS-485</li> <li>Use with the User Configuration Software</li> <li>Requires BWA-HW-026 to work with 1 Watt Radios</li> <li>Datasheet: <a href="#">140377</a></li> </ul> 

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

Included with Sensor	Available for Order
	<p><b>BWA-BK-008</b></p> <ul style="list-style-type: none"> <li>• Magnetic coaxial mount for round objects</li> <li>• Includes <b>SMB42FLAT</b> stainless steel bracket, 1/4"-28 screw mount, and 1 piece of 3M™ thermally conductive adhesive transfer tape</li> <li>• 42 mm × 42 mm</li> </ul> 

## 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 this 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 supersede that which is provided in any other language. For the most recent version of any documentation, refer to: [www.bannerengineering.com](http://www.bannerengineering.com).

For patent information, see [www.bannerengineering.com/patents](http://www.bannerengineering.com/patents).