

Sure Cross® Vibration and Temperature Sensor



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/wireless.

Models

Model	Power Requirements	I/O
QM42VT2	3.6 to 5.5 V dc or 10 to 24 V dc	Vibration and temperature via RS-485 Modbus

Configure this sensor using the [Sensor Configuration Tool](#) 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.

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

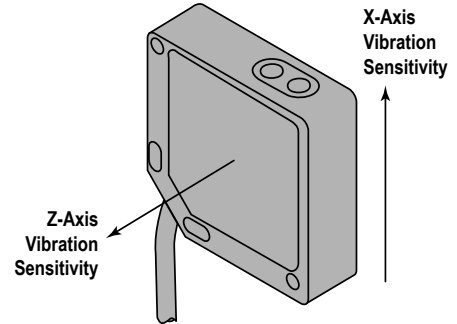


Installation Instructions

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 Nodes and 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)

Configuration Instructions

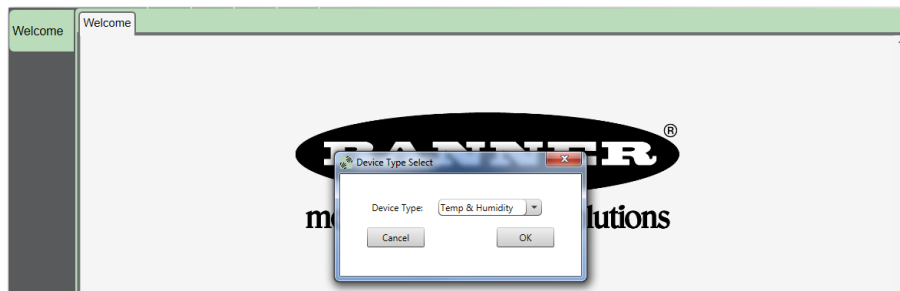
Sensor Configuration Tool

The Sensor Configuration Tool offers an easy way to manage sensor parameters, retrieve data, and visually show sensor data from a number of different sensors. The Sensor Configuration Tool 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 Sensor Configuration Tool from Banner Engineering's website: www.bannerengineering.com/wireless. The Sensor Configuration Tool currently supports the following sensors:

Sensor Type	Model	USB Adapter Cable
Temperature and Humidity	M12FTH3Q and M12FT3Q	Model BWA-HW-006: USB-to-RS-485 adapter cable
	M12FTH4Q and M12FT4Q	Model BWA-USB1WIRE-001: USB-to-RS-232 1-Wire adapter cable
Vibration and Temperature	QM42VT1	Model BWA-USB1WIRE-001: USB-to-RS-232 1-Wire adapter cable
	QM42VT2	Model BWA-HW-006: USB-to-RS-485 adapter cable
GPS	GPS50M	Model BWA-HW-006: USB-to-RS-485 adapter cable AND a field-wireable M12/Euro-style connector or connector with pigtail
U-GAGE K50U Ultrasonic	K50UX1RA	Model BWA-USB1WIRE-001: USB-to-RS-232 1-Wire adapter cable
	K50UX2RA	Model BWA-HW-006: USB-to-RS-485 adapter cable

Launch the Sensor Configuration Tool and from the drop-down list, select your sensor type and click OK.



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.

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) ^{1, 5}	0	6.5535	0	65535
45202	42403	Z-Axis RMS Velocity (mm/sec) ^{2, 5}	0	65.535	0	65535
45203	40049	Temperature (°F) ³	-327.68	327.67	-32768	32767
45204	40043	Temperature (°C) ³	-327.68	327.67	-32768	32767
45205	42451	X-Axis RMS Velocity (in/sec) ^{1, 5}	0	6.5535	0	65535
45206	42453	X-Axis RMS Velocity (mm/sec) ^{2, 5}	0	65.535	0	65535
45207	42407	Z-Axis Peak Acceleration (G) ^{2, 6}	0	65.535	0	65535
45208	42457	X-Axis Peak Acceleration (G) ^{2, 6}	0	65.535	0	65535
45209	42405	Z-Axis Peak Velocity Component Frequency (Hz) ^{4, 5}	0	6553.5	0	65535
45210	42455	X-Axis Peak Velocity Component Frequency (Hz) ^{4, 5}	0	6553.5	0	65535
45211	42406	Z-Axis RMS Acceleration (G) ^{2, 5}	0	65.535	0	65535
45212	42456	X-Axis RMS Acceleration (G) ^{2, 5}	0	65.535	0	65535
45213	42409	Z-Axis Kurtosis ^{2, 6}	0	65.535	0	65535
45214	42459	X-Axis Kurtosis ^{2, 6}	0	65.535	0	65535
45215	42408	Z-Axis Crest Factor ^{2, 6}	0	65.535	0	65535
45216	42458	X-Axis Crest Factor ^{2, 6}	0	65.535	0	65535
45217	42402	Z-Axis Peak Velocity (in/sec) ^{1, 5}	0	6.5535	0	65535
45218	42404	Z-Axis Peak Velocity (mm/sec) ^{2, 5}	0	65.535	0	65535
45219	42452	X-Axis Peak Velocity (in/sec) ^{1, 5}	0	6.5535	0	65535
45220	42454	X-Axis Peak Velocity (mm/sec) ^{2, 5}	0	65.535	0	65535
45221	42410	Z-Axis High-Frequency RMS Acceleration (G) ^{2, 6}	0	65.535	0	65535
45222	42460	X-Axis High-Frequency RMS Acceleration (G) ^{2, 6}	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

Aliased register addresses are user configurable. Aliased addressed registers are sequenced to be read with one single Modbus read.

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

Vibration Spectral Band Measurements

To use vibration spectral band measurements, enter the rotational speed of the machinery to monitor into the Sure Cross Vibration and Temperature Sensor in one of two ways:

- Use the Sensor Configuration Tool application, or
- Write the rotational speed in RMS to Modbus register 42601 or in Hz to Modbus register 42602.

Table 1: Values in Inches/Second

Rotational Speed Multiplier	Modbus Register Address (Floating Point Modbus) (IEEE 754 format)				Description
	Z-Axis		X-Axis		
	Upper	Lower	Upper	Lower	
1x	43501	43502	43531	43532	Band Total RMS Velocity (in/s)

Rotational Speed Multiplier	Modbus Register Address (Floating Point Modbus) (IEEE 754 format)				Description
	Z-Axis		X-Axis		
	Upper	Lower	Upper	Lower	
	43503	43504	43533	43534	Band Peak Velocity Component RMS (in/s)
	43505	43506	43535	43536	Band Peak Velocity Component Bin (index)
	43507	43508	43537	43538	Band Peak Velocity Component Frequency (Hz)
	43509	43510	43539	43540	Band Peak Velocity Component RPM
2x	43511	43512	43541	43542	Band Total RMS Velocity (in/s)
	43513	43514	43543	43544	Band Peak Velocity Component RMS (in/s)
	43515	43516	43545	43546	Band Peak Velocity Component Bin (index)
	43517	43518	43547	43548	Band Peak Velocity Component Frequency (Hz)
	43519	43520	43549	43550	Band Peak Velocity Component RPM
3x-10x	43521	43522	43551	43552	Band Total RMS Velocity (in/s)
	43523	43524	43553	43554	Band Peak Velocity Component RMS (in/s)
	43525	43526	43555	43556	Band Peak Velocity Component Bin (index)
	43527	43528	43557	43558	Band Peak Velocity Component Frequency (Hz)
	43529	43530	43559	43560	Band Peak Velocity Component RPM

Table 2: Values in Millimeters/Second

Rotational Speed Multiplier	Modbus Register Address (Floating Point Modbus) (IEEE 754 format)				Description
	Z-Axis		X-Axis		
	Upper	Lower	Upper	Lower	
1x	43561	43562	43591	43592	Band Total RMS Velocity (mm/s)
	43563	43564	43593	43594	Band Peak Velocity Component RMS (mm/s)
	43565	43566	43595	43596	Band Peak Velocity Component Bin (index)
	43567	43568	43597	43598	Band Peak Velocity Component Frequency (Hz)
	43569	43570	43599	43600	Band Peak Velocity Component RPM
2x	43571	43572	43601	43602	Band Total RMS Velocity (mm/s)
	43573	43574	43603	43604	Band Peak Velocity Component RMS (mm/s)
	43575	43576	43605	43606	Band Peak Velocity Component Bin (index)
	43577	43578	43607	43608	Band Peak Velocity Component Frequency (Hz)
	43579	43580	43609	43610	Band Peak Velocity Component RPM
3x-10x	43581	43582	43611	43612	Band Total RMS Velocity (mm/s)
	43583	43584	43613	43614	Band Peak Velocity Component RMS (mm/s)
	43585	43586	43615	43616	Band Peak Velocity Component Bin (index)
	43587	43588	43617	43618	Band Peak Velocity Component Frequency (Hz)
	43589	43590	43619	43620	Band Peak Velocity Component RPM

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

Connector

3 meter cable with 5-pin M12 fitting

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

Certifications



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.

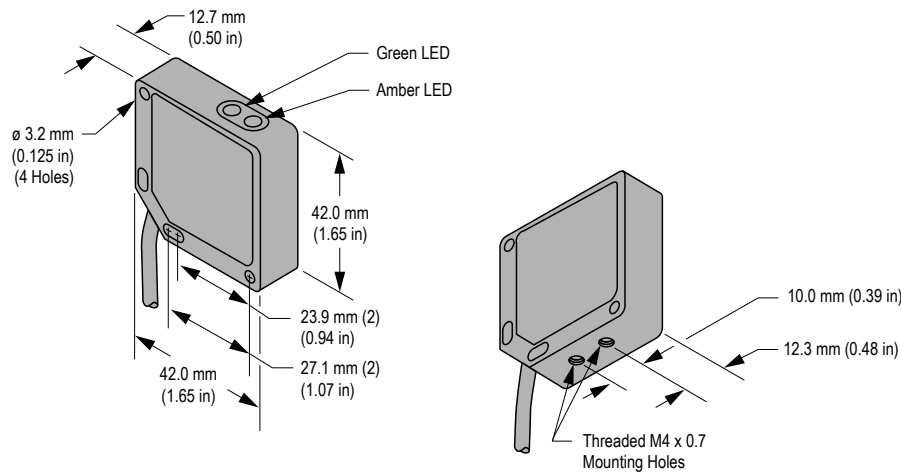
Environmental Rating

NEMA 6P, IEC IP67

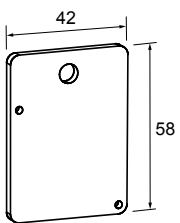
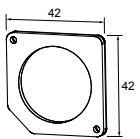
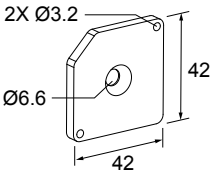
Operating Temperature

-40 °C to +105 °C (-40 °F to +221 °F) 1

Dimensions



Vibration and Temperature Sensor Accessories

Included with Sensor	Available for Order
<p>BWA-BK-002</p> <ul style="list-style-type: none"> Includes SMB42FL stainless steel bracket, 1/4"-28 screw mount, and 1 piece of 3M™ thermally conductive adhesive transfer tape 	<p>BWA-BK-001</p> <ul style="list-style-type: none"> Includes magnetic mounting bracket SMB42FLM12 and 2 mounting screws 
<p>BWA-HW-057</p> <ul style="list-style-type: none"> 3M™ Thermally Conductive Adhesive Transfer Tape 8820 Provides a heat-transfer path between heat-generating components and heat sinks or other cooling devices 3 pieces per pack Tape is 20 mils (0.50 mm) thick; liner is 1.5-2 mil (37.5-50 µm) thick Thermally conductive ceramic filler Dual liner using silicone-treated polyester: easy-release PET liner is clear, tight side PET liner is blue 	<p>BWA-HW-006</p> <ul style="list-style-type: none"> PC USB to RS-485 converter Use with the Sensor Configuration Tool software to communicate directly with RS-485 sensors Refer to datasheet 140377 for more information about wiring the adapter cable to this sensor
	<p>BWA-BK-005</p> <ul style="list-style-type: none"> Use when measuring high frequency vibrations or when mounting the sensor to curved surfaces Includes SMB42FLAT stainless steel bracket, 1/4"-28 screw mount, and 1 piece of 3M™ thermally conductive adhesive transfer tape 

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

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