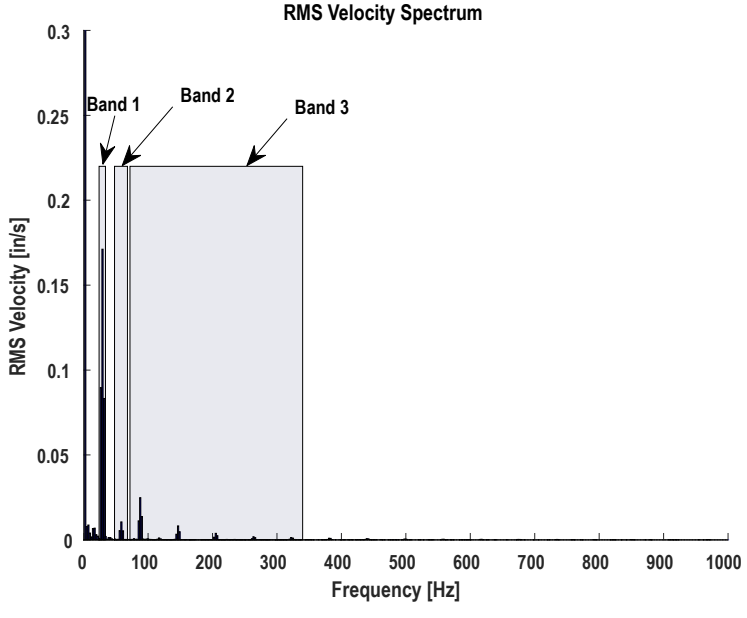
VT2 Vibration Spectral Band Configuration

Configuration for Advanced User Diagnostics

Vibration Spectral banding is a valuable diagnostic option for advanced users. The bands give the user the ability to split the wide band FFT to get RMS Velocity or RMS Acceleration data for very specific frequency bands in addition to the wider band (10-1000Hz and 1000-4000Hz) scalar data available from the VT2.

The band frequencies can be automatically generated based on a static or dynamic speed input or be manually entered. The purpose of the spectral bands is to aid in diagnosing an issue with a rotating asset by focusing on specific frequency bands. Band spacing of 1×, 2×, and 3× to 10× is available on units prior to firmware version 1.5 released in September 2018. Units with firmware version 1.5 or newer will have the additional band spacing options described in this document.

For any firmware version older than version 1.8, see *Registers for Firmware Version Prior to 1.8* on p. 6.



Configuring the Dynamic Spectral Band

To configure the vibration spectral band measurements, write to Modbus registers 42601, 42602, and 42607–42613 to select the appropriate settings for your application.

These parameters can configure up to 20 user-defined spectral bands (typically 10 for the z-axis and 10 for the x-axis; Modbus registers 43501–43700). When using Banner's *Sensor Configuration Software* or other configuration software, you can remove the "4" at the beginning of the register number. For example, refer to register 42601 as 2601.

Enter the rotational frequency in either RPM (2601) or Hz (2602). Do not enter data into both registers. After you enter data into one register, the system automatically calculates it for the other based on Hz = RPM ÷ 60. Each time a new value is entered in either register, the band start and stop frequencies are recalculated. This register can only be updated at a rate of once per hour.

Table 1: Spectral Band Parameter Settings

Description	Modbus Address	Value (Written)
Rotational Speed (RPM)	42601	Running speed of the motor in RPM (write triggers update of 42602 and bands 1–20)
Rotation Frequency (Hz)	42602	Running speed of the motor in Hz (write triggers update of 42601 and bands 1–20)

To configure the automatically generated bands based on rotation frequency input, use registers 42607–42613. Bands are generated around a centered frequency with a default bandwidth of 5 Hz around that centered frequency.

Each multiple of speed increases the bandwidth around the centered frequency by that multiple. For example, at 1× band and 60 Hz, the band would cover 60Hz ± 2.5 Hz but at the 3× band and 60 Hz the band would cover 180 Hz ± 7.5 Hz. After the bands are configured, the vibration data is written to registers 43501 through 43700 based on the configuration in these registers.

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Table 2: Spectral Band Parameter Settings

Description	Modbus Address	Value (Written)
Band Spacing Configuration	42607	0 = 1×, 2×, 3×–10× (Default) * 1 = 1×, 2×, 3×, 4×, 5×, 6×, 7×, 8×, 9×, 10× * 2 = User Configurable (enables registers 42610–42613 to be writable) **
Auto-configurable Band Units (US, Metric, SI)	42608	0 = US (g, in/s) (Default) 1 = Metric (g, mm/s) 2 = SI (m/s^2, m/s)
Auto-configurable Band Source Spectrum (Velocity vs Acceleration)	42609	0 = None (Disabled) 1 = Acceleration Spectrum 2 = Velocity Spectrum (Default)
User-configurable Band Selection	42610	1–20 = Band to be configured by 42611, 42612, and 42613 **
User-configurable Start Multiple Input	42611	1–20 = Band starting multiple **
User-configurable Stop Multiple Input	42612	1–20 = Band ending multiple **
User-configurable Axis Input	42613	Axis for the band selected in register 42610. ** 0 = z-axis 1 = x-axis

* For firmware versions 1.5.0 and 1.6.0 (released Sep. 2018 through May 2019): 0 = 1×, 2×, 3×, 4×, 5×, 6×, 7×, 8×, 9×, 10× (Default) and 1 = 1×, 2×, 3×–10×

** Firmware version 1.8.0 (released Jun 2019) and newer.

Term	Definition
Band Spacing	The starting and ending frequency of the vibration spectral band that is based on a multiple of the rotational frequency. (Example 2× band with 60 Hz rotational frequency would be centered on 120 Hz with a starting frequency of 115 Hz and ending of 125 Hz).
Band Units	Sets the outputs for the unit for either Acceleration or Velocity measurements for all 20 bands.
Band Source Spectrum	Sets all 20 bands as either Acceleration or Velocity output.
User Configurable Spacing	If register 42607 is set to a 2, this allows a user to define their own band spacing. It enables registers 42610–42613 for individual configuration of each band 1–20. As an example, a user could define band 1 to have a starting multiple of 1×–3× (42610 = 1, 42611 =1, 42612 = 3, 42613 = 0) , band 2 to 4× only (42610 = 2, 42611 and 42612 = 4, 42613 = 0) and band 3 to 5×–15× (42610 = 3, 42611 =5, 42612 = 15, 42613 = 0) all for the Z-Axis and then either repeat the same multiple on bands 4–6 for the X-Axis or setup completely custom multiples for that axis.

After configuring the sensor with the above registers, if new a value is input in 42601 or 42602, the starting and stopping frequencies are automatically generated for each band in the following table. The configuration will not change when a new value is input into 42601 or 42602, only the starting and stopping frequencies will change in the bands. Every time the vibration sensor takes a measurement, the data is available in the registers in the following table. To read this information into the DXM, read both the high and low word of the data into the floating-point registers starting at 1001.

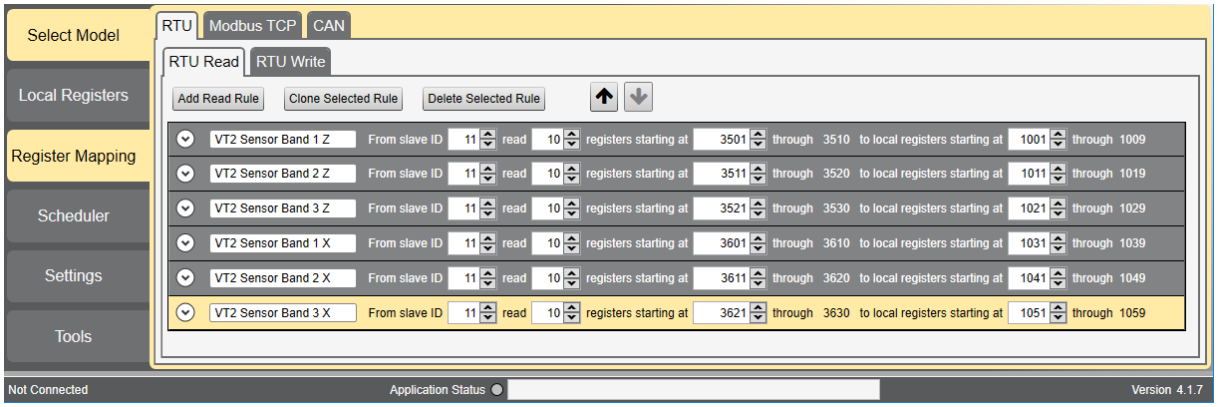


Table 3: Vibration Spectral Band Measurements (for firmware version 1.8 (released Jun 2019) and newer)

Configuration Band Mode (42607)	Rotational Frequency Multiple	Modbus Register Address (Floating Point Modbus) (IEEE 754 Format)				Description
		Z-Axis		X-Axis		
		Upper	Lower	Upper	Lower	
Value: 0 1x, 2x, 3x–10x (Default)	1x Band(s) 1(Z), 11(X)	43501	43502	43601	43602	Total RMS Amplitude
		43503	43504	43603	43604	Peak Component RMS Amplitude
		43505	43506	43605	43606	Peak Component Bin (index)
		43507	43508	43607	43608	Peak Component Frequency (Hz)
		43509	43510	43609	43610	Peak Component RPM
	2x Band(s) 2(Z), 12(X)	43511	43512	43611	43612	Total RMS Amplitude
		43513	43514	43613	43614	Peak Component RMS Amplitude
		43515	43516	43615	43616	Peak Component Bin (index)
		43517	43518	43617	43618	Peak Component Frequency (Hz)
		43519	43520	43619	43620	Peak Component RPM
	3x–10x Band(s) 3(Z), 13(X)	43521	43522	43621	43622	Total RMS Amplitude
		43523	43524	43623	43624	Peak Component RMS Amplitude
		43525	43526	43625	43626	Peak Component Bin (index)
		43527	43528	43627	43628	Peak Component Frequency (Hz)
		43529	43530	43629	43630	Peak Component RPM
Value: 1 1x, 2x… 10x	1x Band(s) 1(Z), 11(X)	43501	43502	43601	43602	Total RMS Amplitude
		43503	43504	43603	43604	Peak Component RMS Amplitude
		43505	43506	43605	43606	Peak Component Bin (index)
		43507	43508	43607	43608	Peak Component Frequency (Hz)
		43509	43510	43609	43610	Peak Component RPM
	2x Band(s) 2(Z), 12(X)	43511	43512	43611	43612	Total RMS Amplitude
		43513	43514	43613	43614	Peak Component RMS Amplitude
		43515	43516	43615	43616	Peak Component Bin (index)
		43517	43518	43617	43618	Peak Component Frequency (Hz)
		43519	43520	43619	43620	Peak Component RPM
	...	...	...	...	...	...
	10x Band(s) 10(Z), 20(X)	43591	43592	43691	43692	Total RMS Amplitude
		43593	43594	43693	43694	Peak Component RMS Amplitude
		43595	43596	43695	43696	Peak Component Bin (index)
		43597	43598	43697	43698	Peak Component Frequency (Hz)
		43599	43600	43699	43700	Peak Component RPM

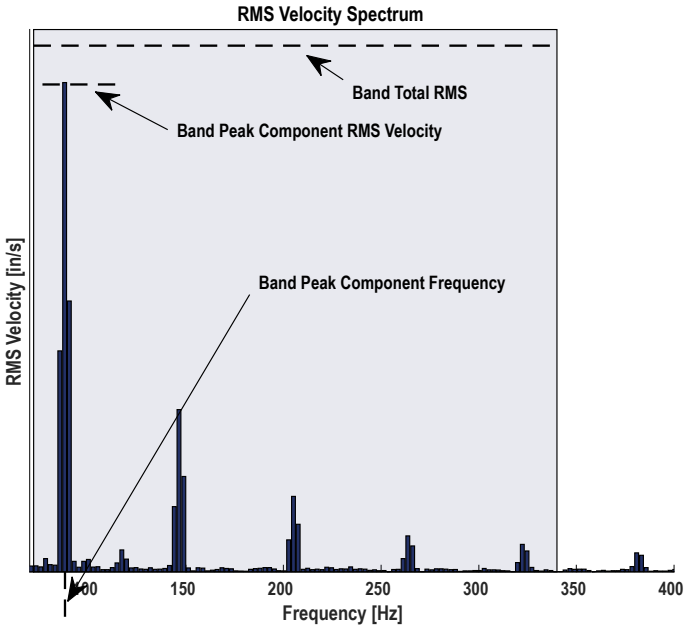
Table 4: User-configured Vibration Spectral Band Measurements (for firmware version 1.8 (released Jun 2019) and newer)

Configuration Band Mode (42607)	Band Number [1]	Modbus Register Address (Floating Point Modbus) (IEEE 754 Format)		Description[2]
		Upper	Lower	
Value: 2 User Configurable Band Spacing	1	43501	43502	Total RMS Amplitude
		43503	43504	Peak Component RMS Amplitude
		43505	43506	Band Peak Component Bin (index)
		43507	43508	Band Peak Component Frequency (Hz)
		43509	43510	Band Peak Component RPM
	2	43511	43512	Total RMS Amplitude
		43513	43514	Peak Component RMS Amplitude
		43515	43516	Band Peak Component Bin (index)
		43517	43518	Band Peak Component Frequency (Hz)
		43519	43520	Band Peak Component RPM
	...	...	...	...
	... where X is the band number	43501 + 10 × (X-1)	43502 + 10 × (X-1)	Total RMS Amplitude
		43503 + 10 × (X-1)	43504 + 10 × (X-1)	Peak Component RMS Amplitude
		43505 + 10 × (X-1)	43506 + 10 × (X-1)	Band Peak Component Bin (index)
		43507 + 10 × (X-1)	43508 + 10 × (X-1)	Band Peak Component Frequency (Hz)
		43509 + 10 × (X-1)	43510 + 10 × (X-1)	Band Peak Component RPM

Band 1 starts at 43501 and in groups of 10 registers per band up to 43700. The upper and lower band registers = 435xx + 10 × (X-1), where X is the band number. For example: Band 15 = Registers 43641–43650.

Term	Definition
Band Total RMS Amplitude	The aggregate Root Mean Square of all spectral components within the band.
Band Peak Component RMS	The RMS of the peak spectral component, which is defined as the spectral component with the greatest RMS value in the band.
Band Peak Component Frequency	The frequency (Hz) of the peak spectral component, which is defined as the spectral component with the greatest RMS value in the band.
Band Peak Component RPM	The RPM of the peak spectral component, which is defined as the spectral component with the greatest RMS value in the band.
Band Peak Velocity Component RPM	Band Peak Velocity Component Frequency * 60
Band Peak Component Bin	The FFT bin index of the peak spectral component, which is defined as the spectral component with the greatest RMS value in the band.

[1] The rotational multiple is set by the user in registers 42611–42612
[2] The units and spectrum is configured in registers 42608–42609.



Configuring the Fixed Manual Band

Fixed manual band mode is intended for a fixed speed asset with no dynamic speed input to the sensor.

Manually set a fixed starting and stopping frequency for each band and configure the spectrum and units using the following table. These values remain fixed but are erased if a value is entered into registers 42601 or 42602.

Table 5: Fixed manual band parameters

Sensor Modbus Register	Description	User Entered Value
43201	Band 1 - Source Spectrum	0 = None (Disabled) 1 = Acceleration Spectrum 2 = Velocity Spectrum
43202	Band 1 - Source Axis	0 = Z Axis 1 = X Axis
43203	Band 1 - Start Frequency (Hz)	
43204	Band 1 - Stop Frequency (Hz)	
43205	Band 1 - Normalization Mode	0 = Leave at default value of 0
43206	Band 1 - Units	0 = US (g, i/s) 1 = Metric (g, mm/s) 2 = SI (m/s^2, m/s)
43207	Band 1 - Reserved	
43208	Band 1 - Reserved	
43209	Band 1 - Reserved	
43210	Band 1 - Reserved	
…	…	…
43391	Band 20 - Source Spectrum	0 = None (Disabled) 1 = Acceleration Spectrum 2 = Velocity Spectrum
43392	Band 20 - Source Axis	0 = Z Axis 1 = X Axis
43393	Band 20 - Start Frequency (Hz)	

Sensor Modbus Register	Description	User Entered Value
43394	Band 20 - Stop Frequency (Hz)	
43395	Band 20 - Normalization Mode	0 = Leave at default value of 0
43396	Band 20 - Units	0 = US (g, i/s) 1 = Metric (g, mm/s) 2 = SI (m/s^2, m/s)
43397	Band 20 - Reserved	
43398	Band 20 - Reserved	
43399	Band 20 - Reserved	
43400	Band 20 - Reserved	

Registers for Firmware Version Prior to 1.8

The following vibration spectral band registers are available with firmware versions 1.5 and 1.6 (released on devices between Sept 2018 and May 2019).

Table 6: Vibration Spectral Band Measurements (for firmware version 1.5 and 1.6

Configuration Band Mode (42607)	Rotational Frequency Multiplier	Modbus Register Address (Floating Point Modbus) (IEEE 754 Format)				Description
		Z-Axis		X-Axis		
		Upper	Lower	Upper	Lower	
Value: 0 1x, 2x... 10x (Default)	1x Band(s) 1(Z), 11(X)	43501	43502	43601	43602	Total RMS Amplitude
		43503	43504	43603	43604	Peak Component RMS Amplitude
		43505	43506	43605	43606	Peak Component Bin (index)
		43507	43508	43607	43608	Peak Component Frequency (Hz)
		43509	43510	43609	43610	Peak Component RPM
	2x Band(s) 2(Z), 12(X)	43511	43512	43611	43612	Total RMS Amplitude
		43513	43514	43613	43614	Peak Component RMS Amplitude
		43515	43516	43615	43616	Peak Component Bin (index)
		43517	43518	43617	43618	Peak Component Frequency (Hz)
		43519	43520	43619	43620	Peak Component RPM
	...	...	...	...	...	...
	10x Band(s) 10(Z), 20(X)	43591	43592	43691	43692	Total RMS Amplitude
		43593	43594	43693	43694	Peak Component RMS Amplitude
		43595	43596	43695	43696	Peak Component Bin (index)
		43597	43598	43697	43698	Peak Component Frequency (Hz)
		43599	43600	43699	43700	Peak Component RPM
Value: 1 1x, 2x, 3x–10x	1x Band(s) 1(Z), 11(X)	43501	43502	43601	43602	Total RMS Amplitude
		43503	43504	43603	43604	Peak Component RMS Amplitude
		43505	43506	43605	43606	Peak Component Bin (index)
		43507	43508	43607	43608	Peak Component Frequency (Hz)
		43509	43510	43609	43610	Peak Component RPM
	2x Band(s) 2(Z), 12(X)	43511	43512	43611	43612	Total RMS Amplitude
		43513	43514	43613	43614	Peak Component RMS Amplitude
		43515	43516	43615	43616	Peak Component Bin (index)

Configuration Band Mode (42607)	Rotational Frequency Multiplier	Modbus Register Address (Floating Point Modbus) (IEEE 754 Format)				Description
		Z-Axis		X-Axis		
		Upper	Lower	Upper	Lower	
		43517	43518	43617	43618	Peak Component Frequency (Hz)
		43519	43520	43619	43620	Peak Component RPM
	3x–10x Band(s) 3(Z), 13(X)	43521	43522	43621	43622	Total RMS Amplitude
		43523	43524	43623	43624	Peak Component RMS Amplitude
		43525	43526	43625	43626	Peak Component Bin (index)
		43527	43528	43627	43628	Peak Component Frequency (Hz)
		43529	43530	43629	43630	Peak Component RPM

The following vibration spectral band registers are available with firmware versions prior to 1.5 (released on devices before Sep 2018).

Table 7: Values in Inches/Second (for firmware versions prior to 1.5 released in Sep 2018)

Rotational Frequency Multiplier	Modbus Register Address (Floating Point Modbus) (IEEE 754 format)				Description
	Z-Axis		X-Axis		
	Upper	Lower	Upper	Lower	
1x	43501	43502	43531	43532	Total RMS Velocity (in/s)
	43503	43504	43533	43534	Peak Velocity Component RMS (in/s)
	43505	43506	43535	43536	Peak Velocity Component Bin (index)
	43507	43508	43537	43538	Peak Velocity Component Frequency (Hz)
	43509	43510	43539	43540	Peak Velocity Component RPM
2x	43511	43512	43541	43542	Total RMS Velocity (in/s)
	43513	43514	43543	43544	Peak Velocity Component RMS (in/s)
	43515	43516	43545	43546	Peak Velocity Component Bin (index)
	43517	43518	43547	43548	Peak Velocity Component Frequency (Hz)
	43519	43520	43549	43550	Peak Velocity Component RPM
3x–10x	43521	43522	43551	43552	Total RMS Velocity (in/s)
	43523	43524	43553	43554	Peak Velocity Component RMS (in/s)
	43525	43526	43555	43556	Peak Velocity Component Bin (index)
	43527	43528	43557	43558	Peak Velocity Component Frequency (Hz)
	43529	43530	43559	43560	Peak Velocity Component RPM

Table 8: Values in Millimeters/Second (for firmware versions prior to 1.5 released in Sep 2018)

Rotational Frequency Multiplier	Modbus Register Address (Floating Point Modbus) (IEEE 754 format)				Description
	Z-Axis		X-Axis		
	Upper	Lower	Upper	Lower	
1x	43561	43562	43591	43592	Total RMS Velocity (mm/s)
	43563	43564	43593	43594	Peak Velocity Component RMS (mm/s)
	43565	43566	43595	43596	Peak Velocity Component Bin (index)
	43567	43568	43597	43598	Peak Velocity Component Frequency (Hz)
	43569	43570	43599	43600	Peak Velocity Component RPM

Rotational Frequency Multiplier	Modbus Register Address (Floating Point Modbus) (IEEE 754 format)				Description
	Z-Axis		X-Axis		
	Upper	Lower	Upper	Lower	
2x	43571	43572	43601	43602	Total RMS Velocity (mm/s)
	43573	43574	43603	43604	Peak Velocity Component RMS (mm/s)
	43575	43576	43605	43606	Peak Velocity Component Bin (index)
	43577	43578	43607	43608	Peak Velocity Component Frequency (Hz)
	43579	43580	43609	43610	Peak Velocity Component RPM
3x–10x	43581	43582	43611	43612	Total RMS Velocity (mm/s)
	43583	43584	43613	43614	Peak Velocity Component RMS (mm/s)
	43585	43586	43615	43616	Peak Velocity Component Bin (index)
	43587	43588	43617	43618	Peak Velocity Component Frequency (Hz)
	43589	43590	43619	43620	Peak Velocity Component RPM

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