Remote Monitoring for Business

ADVANCED VIBRATION

ALTA® Wireless Advanced Vibration Meter

General Description

The ALTA® Wireless Advanced Vibration Meter uses an accelerometer to measure vibration and frequency on three axes (x,y,z). The meter reports Vibration (Acceleration, Velocity, Displacement, or Acceleration Peak), Frequency (Hz/RPM), Crest Factor on all three axes, Duty Cycle (how much of the report interval vibration was present), and Temperature. This sensor can monitor vibration in assembly lines, machines, and many other applications.

Features

- Three-axis measurement
- Capable of measuring Acceleration root mean square (RMS), Velocity RMS, Displacement, or Acceleration Peak
- Configurable Frequency Range
- Configurable Hanning filter
- Measure up to 4200 Hz / 252,000 RPM
- Configurable Measurement Interval as low as one second
- Configurable critical Vibration Aware Threshold
- Runtime indication via Duty Cycle

Principle of Operation

The ALTA Advanced Vibration Meter measures Vibration (Acceleration, Velocity, Displacement, or Acceleration Peak), Frequency (Hz/RPM), Crest Factor on all three axes, Duty Cycle (how much of the report interval vibration was present), and Temperature of the attached system. The meter uses an accelerometer to capture g-force on all axes and then calculates vibration, frequency, and crest factor from that acceleration data. The Advanced Vibration Meter reports the duty cycle as a percentage of how long the vibration was present during the Heartbeat. A single measurement during a configurable Measurement Interval consists of gathering 256 acceleration data points, analyzing those data points to produce vibration data, then taking a temperature measurement. You can configure data to produce the most current, max, or average data.

Example Applications

- Vibration monitoring for nearly anything
- Motor, pump, system door, and fan monitoring
- Smart machines, structures, and materials monitoring
- Wind turbine and utility pole monitoring
- Assembly line monitoring
- Air conditioner and heat pump monitoring
- Additional applications

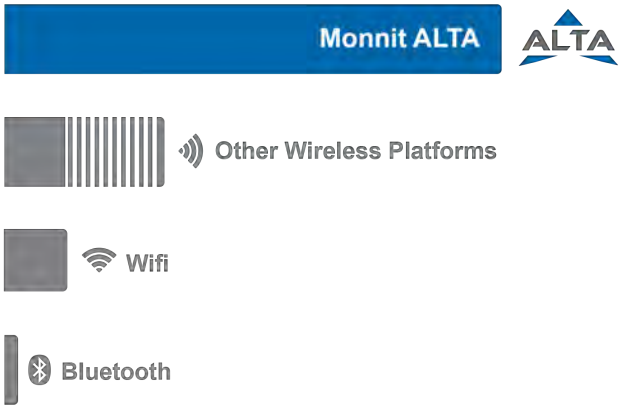
Features of Monnit ALTA Sensors

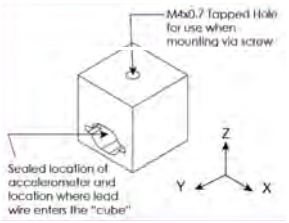
- Wireless range of 1,200+ feet through 12+ walls [1]
- Frequency-Hopping Spread Spectrum (FHSS)
- Best-in-class interference immunity
- Best-in-class power management for longer battery life [2]
- Encrypt-RF® Security (Diffie-Hellman Key Exchange + AES-128 CBC for sensor data messages)
- All ALTA Sensors store up to 3200 readings:
  - 10-minute Heartbeats = ~ 22 days
  - 2-hour Heartbeats = ~ 266 days
- Over-the-air updates (future proof)
- The iMonnit Premiere Cloud-Based Wireless Sensor Management & Monitoring Software is free for 45 days to configure sensors, view data, and set up alerts to be sent via SMS text, email, or voice call. The system will automatically default to the free iMonnit Basic version if you don't purchase an annual subscription of iMonnit Premiere.

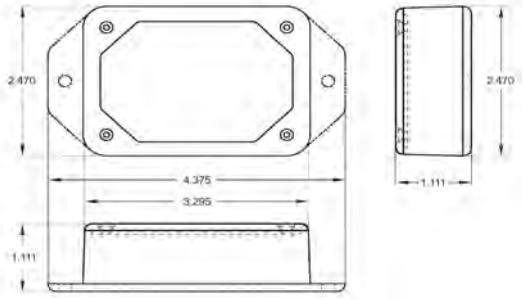
[1] Actual range may vary depending on the environment.

[2] Battery life is determined by sensor reporting frequency and other variables. Other power options are also available.

Wireless Range Comparison

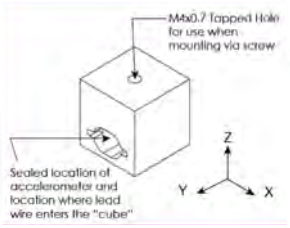


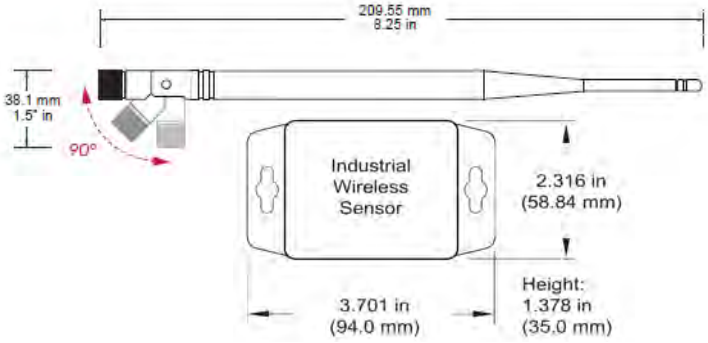




ALTA Commercial Advanced Vibration Meter | Technical Specifications	
Battery	2x 1.5V AA Alkaline Batteries (Included)[1]
Battery voltage range	2.0 - 3.8 VDC [2]
DC power supply (Only available if Line Powered option selected) [3]	North America (A) or International (A,C,G,I): Input (90~264VAC, 47~63 Hz) Output (5V, 1.2A, 100mVp-p ripple/noise), 2A inner fuse Cable (1.5m length) DC Plug (2.1x5.5x9.5 mm barrel jack)
DC power supply requirements (Line Powered option only)	Output: 5.0 - 12.0 VDC, greater than 0.1A, less than 100mVp-p noise
Operating humidity	5 to 85% RH (non-condensing)
Operating temperature range with given power sources	-18°C to 55°C (0°F to 130°F) - AA Alkaline Batteries -25°C to 60°C (-13°F to 140°F) - AA Lithium L91 Batteries 0°C to 40°C (32°F to 104°F) - US 5V Power Supply 10°C to 40°C (50°F to 104°F) - International 5V Power Supply
Wireless antenna type	1/4-wave, 20 gauge wire whip, 3.5" (900/868MHz), 7" (433MHz)
Weight	5.53 oz (157 g) without batteries

1. 1.5 V lithium AA batteries can also be used with this sensor. Due to differences in discharge curves between alkaline and lithium batteries the battery percent indicated in software may not be correct when using lithium batteries.
2. The sensor will function properly as long as the batteries can supply within this voltage range while under a 40 mA load.
3. Batteries will provide backup power in case of loss of power at DC power supply.





ALTA Industrial Advanced Vibration Meter | Technical Specifications	
Battery	3.6V, Lithium Thionyl Chloride (Included and pre-installed)
Battery voltage range	2.0 - 3.8 VDC [1]
Operating humidity	5 to 95% RH (non-condensing)
Operating temperature range	-25°C to 80°C (-13°F to 176°F)
Enclosure rating	NEMA 1, 2, 4, 4x, 12, and 13 rated, sealed, and weatherproof
UL rating	UL Listed to UL508-4x specifications (File E194432)
Wireless antenna type	1/2-wave, waterproof dipole, RP-SMA male connector; dBi of 3.0 (900/868MHz) or 2.5 (433 MHz); length of 8.25" (209.55mm) (900/868MHz) or 7.68" (195mm) (433 MHz); diameter at thickest point is 0.55" (14mm); weight of 0.65 oz (16 g) (900/868MHz) or 0.50 oz (12 g) (433 MHz)
Weight	6.98 ounces (198 g) with battery without antenna

1. The sensor will function properly as long as the battery can supply within this voltage range while under a 40 mA load.

Technical Specifications Common to Both Commercial and Industrial Advanced Vibration Meters	
Operating altitude (non-pressurized environments)	-15.2 to 1,982 m (-50 to 6,500 ft) [1]
Storage altitude (non-pressurized environments)	-15.2 to 3,048 m (-50 to 10,000 ft) [1]
Data logging	Sensor logs 2000 to 4000 readings if gateway connection is lost (non-volatile flash, persists through power cycling): 10-minute Heartbeats = ~22 days - 2-hour Heartbeats = ~266 days
Wireless protocol	ALTA Proprietary Frequency-Hopping Spread Spectrum (FHSS)
Wireless transmission power	50 mW (900MHz), 25 mW (868 MHz), 10 mW (433 MHz)
Wireless range	1,200+ ft non-line-of-sight
Security	Encrypt-RF® (256-bit key exchange and AES-128 CTR)
Certifications	900 MHz sensors: **FCC ID: ZTL-G2SC1** and **IC: 9794A-G2SC1**. 868 and 433 MHz sensors tested and comply with: **EN 55032**: 2015/A11:2020; **EN 55035**:2017/A11:2020; **ETSI EN 300 220** V3.2.1 (2018-06); **ETSI EN 301 489-3** V2.2.0. (2021-11); and **ETSI EN 303 645**. All sensors tested and comply with: **EN 61010-1** and **EN 60950** and meet **RoHS 2015/863** and **REACH 224** (June 2022), according to **IEC 63000**:2016/AMD1:2022.

1. Operating and storage altitude without DC power supply is -30.48 to 9144 m (-100 to 30000 ft)

Mechanical Specifications	
Cube	Dimensions: 0.75" x 0.75" x 0.75" Weight: 17 g (Cube with electronics and epoxy) Mounting Hole: M4 x 0.7 Tapped Threads, 7 mm hole depth Composition: Aluminum and accelerometer PCA potted with black 2 part epoxy. Operating Temperature: -40° to +105° C (Electronics only) Operating Humidity: 0 to 100% (Electronics are sealed inside cube so moisture conditions have no effect)
Lead	Dimensions: 10' Length Composition: Black, shielded, PVC insulated cable. Operating Temperature: -25° C to 80°C Voltage Rating: 300 V

Accelerometer Specifications

The accelerometer is a MEMs-based, capacitive, tri-axis accelerometer.

Parameter		Units	Typical
Vibration Variation over Temperature		%/°C	0.01 (xy), 0.03 (z)
Cross Axis Sensitivity		%	2
Noise [1]	RMS	mg	0.7
	Density	µg/√(SampleRate)	130

1. Noise increases as sample rate increases. Noise spikes of 2000 mm/s^2 are not uncommon when measuring at 12800 Hz sample rate. See typical noise tables for more information on noise.

Sensor Data		
Data	**Presentation**	**Description**
Data Mode	Most Recent, Max, or Average	The data mode of the sensor at the time the data point is produced.
Frequency	Frequency is calculated by running the sampled acceleration data through an FFT then finding the largest peak energy in that data set that is within the configured bandwidth for the configured vibration type.	
Fundamental Frequency	X: xxxx.x Hz	The frequency within the configured bandwidth with the most vibration energy.
Fundamental Frequency	Y: xxxx.x Hz	The frequency within the configured bandwidth with the most vibration energy.
Fundamental Frequency	Z: xxxx.x Hz	The frequency within the configured bandwidth with the most vibration energy.
Vibration	The Vibration mode is configurable to Acceleration, Velocity, or Displacement. The meter or sensor will only produce data in the mode selected. The sensor takes 256 acceleration samples, per axis, every measurement at the configured sample rate to reproduce the vibration waveform for analysis. Using this waveform, and in some cases an FFT, the sensor calculates the vibration.	
Mode: Acceleration		
Acceleration Peak	X: xxxxxx mm/s^2	The peak acceleration in the time domain.
Acceleration Peak	Y: xxxxxx mm/s^2	The peak acceleration in the time domain.
Acceleration Peak	Z: xxxxxx mm/s^2	The peak acceleration in the time domain.
Acceleration RMS	X: xxxxxx mm/s^2	The combined RMS total of all acceleration energy within the configured bandwidth.
Acceleration RMS (Y-Axis)	Y: xxxxxx mm/s^2	The combined RMS total of all acceleration energy within the configured bandwidth.
Acceleration RMS (Y-Axis)	Z: xxxxxx mm/s^2	The combined RMS total of all acceleration energy within the configured bandwidth.
Mode: Velocity RMS		
Velocity RMS (X-Axis)	X: xxx.xx mm/s	The combined RMS total of all velocity energy within the configured bandwidth.
Velocity RMS (Y-Axis)	Y: xxx.xx mm/s	The combined RMS total of all velocity energy within the configured bandwidth.
Velocity RMS (Y-Axis)	Z: xxx.xx mm/s	The combined RMS total of all velocity energy within the configured bandwidth.
Mode: Displacement p-p		
Displacement (X-Axis)	X: xxx.xx mm p-p	The combined RMS total of all displacement energy within the configured bandwidth converted to a peak to peak value.
Displacement (Y-Axis)	Y: xxx.xx mm p-p	The combined RMS total of all displacement energy within the configured bandwidth converted to a peak to peak value.
Displacement (Z-Axis)	Z: xxx.xx mm p-p	The combined RMS total of all displacement energy within the configured bandwidth converted to a peak to peak value.
Crest Factor	The Peak Acceleration / RMS Acceleration. Typical value for a perfect sinusoidal vibration waveform is 1.41. As this value increases above 1.41, it is a sign that non-fundamental vibrations are contributing to the overall vibration and machine health may be declining. If the value is below 1.41, it is a sign there is clipping of the vibration signal, which means the vibration signal may be greater than the G-range configuration of the sensor.	
Crest Factor (X-Axis)	X: x.xx	The peak acceleration / RMS acceleration. (Unitless since it is a ratio)
Crest Factor (Y-Axis)	Y: x.xx	The peak acceleration / RMS acceleration. (Unitless since it is a ratio)
Crest Factor (Z-Axis)	Z: x.xx	The peak acceleration / RMS acceleration. (Unitless since it is a ratio)
Duty Cycle	Duty Cycle is the percentage of time since the previous Heartbeat that the vibration level, in Gs, was above the Sensitivity Threshold configuration. The sensor calculates this percentage in conjunction with the Measurement Interval configuration. If the Measurement Interval is 6 seconds and the Heartbeat is 1 minute, there will be up to 10 measurements per Heartbeat. If 7 of these 10 measurements detects vibration levels on any axis or combination of axes above the Sensitivity Threshold, then the Duty Cycle will be 70%.	
Duty Cycle (All Axes)	xxx %	Percent indicating how much of the Heartbeat that vibration was present.
Temperature	There is a temperature sensing element embedded in the cube that measures the temperature of the electronics in the cube.	
Temperature	xxx.x° C	The temperature of the cube.

1. All units are the default units for the sensor. Units are configurable via software.

Data Specifications			
Data	**Range**	**Resolution**	**Accuracy**
Frequency [1]	(X,Y) 0.4 Hz to 4200 Hz (Z) 0.4 Hz to 2900 Hz	0.1 Hz	+/- (0.2 Hz + 2% of Reading)
Acceleration Peak	0 to 156912 mm/s^2 [5]	10 mm/s^2	Typical: +/- 10% of Reading[2]
Acceleration RMS	0 to 110954 mm/s^2 [5]	10 mm/s^2	Typical: +/- 10% of Reading[2]
Velocity RMS	0.00 to 655.36 mm/s [4,5]	0.01 mm/s	Typical: +/- 15% of Reading[2,3]
Displacement Peak to Peak	0.00 to 655.36 mm p-p [4,5]	0.01 mm	Typical: +/- 20% of Reading[2,3]
Crest Factor	0.00 to 3.95	0.02	Typical: +/- 10% of Reading
Duty Cycle	0 to 100 %	1 % [6]	Varies[6]
Temperature	0.0 to 125.0 C	0.1 C	+/- 1 C

1. The range is configuration dependent. See the Frequency Measurement Range table for full characterization of the frequency range.
2. Accuracy may vary with frequency of signal. See footnotes under Frequency Measurement Range table for more information on this variation.
3. Velocity and Displacement are derived from acceleration and frequency so they tend to be less accurate than direct acceleration measurements.
4. Velocity and Displacement ranges are inversely related to frequency. So, for the same acceleration signal these values will increase as frequency decreases. General Velocity = Acceleration / (2*Pi*Freq), General Displacement = Acceleration / (2*Pi*Freq)^2. The user software configurable Bandwidth of the sensor affects the practical range possible.
5. Acceleration Range is user software configurable to 2, 4, 8, or 16 G. This affects the practical range possible.
6. Duty Cycle resolution and accuracy will vary based on measurement interval and Heartbeat configurations. Refer to the description of Duty Cycle for more information.

Accurate Frequency Measurement Range [3]						
	ACC RMS/AccPeak		**Velocity**		**Displacement**	
Sample Rate (Hz)	Min Freq (Hz)	Max Freq (Hz)	Min Freq (Hz)	Max Freq (Hz)	Min Freq (Hz)	Max Freq (Hz)
12800	200	4200[1,2]	300	4800	400	4800
6400	100	2400	150	2400	200	2400
3200	50	1200	75	1200	100	1200
1600	25	600	37.5	600	50	600
800	12.5	300	18.75	300	25	300
400	6.25	150	9.375	150	12.5	150
200	3.125	75	4.6875	75	6.25	75
100	1.5625	37.5	2.34375	37.5	3.125	37.5
50	0.78125	18.75	1.171875	18.75	1.5625	18.75
25	0.390625	9.375	0.5859375	9.375	0.78125	9.375

1. On the X and Y axes, above 3200 Hz the sensor experiences gradual signal loss reaching -3 dB at ~4200 Hz. Above 4200 Hz the loss increases rapidly. Do not recommend using sensor with signals above 4200 Hz. On the Z axis, above 2000 Hz, the sensor experiences gradual signal loss reaching -3 dB at ~2900 Hz. We do not recommend using the Z-axis with signals above 2900 Hz.
2. On the X and Y axes, between 1000 Hz and 3200 Hz the sensor may experience a gradual signal increase peaking at about 2 dB at ~2000 Hz then returning to no increase at ~3200 Hz. On the Z axis this increase occurs between 1000 Hz and 2100 Hz and is usually below 2 dB. This increase generally peaks at ~1700 Hz
3. The measurement range is configurable. The software will default to the most accurate range when the Sample Rate or Vibration Mode is changed, but manually adjusting above and below these limitations is possible via the software UI.

Typical RMS Noise				
	Power Mode			
Sample Rate	**High**	**Medium**	**Low**	**Units**
12800	1007	1007	1007	mm/s^2
6400	507	507	507	mm/s^2
3200	257	257	257	mm/s^2
1600	132	132	132	mm/s^2
800	70	70	70	mm/s^2
400	38	64	104	mm/s^2
200	23	41	68	mm/s^2
100	15	29	51	mm/s^2
50	11	23	42	mm/s^2
25	9	20	38	mm/s^2

Typical Peak Noise				
	Power Mode			
Sample	**High**	**Medium**	**Low**	**Units**
12800	2010	2010	2010	mm/s^2
6400	1010	1010	1010	mm/s^2
3200	510	510	510	mm/s^2
1600	260	260	260	mm/s^2
800	135	135	135	mm/s^2
400	73	119	188	mm/s^2
200	41	72	118	mm/s^2
100	26	48	83	mm/s^2
50	18	37	65	mm/s^2
25	14	31	56	mm/s^2

Configurable Features		
Feature	**Configurable Options or Range**	**Description**
Vibration Mode	Acceleration Peak, Acceleration RMS, Velocity RMS, Displacement	The meter is user configurable to produce one of four different vibration data types.
Vibration Aware Threshold (VAT)	0 to 65530 mm/s^2 for Acceleration, 0 to 655.35 mm/s for Velocity, 0 to 655.35 mm for Displacement	The meter reports immediately when it crosses this threshold (in either direction). This threshold works in conjunction with the Measurement Interval since the sensor can only detect a change after taking a measurement. When the sensor goes above this threshold it will report Aware. When the sensor goes below, it will report Not Aware.
Vibration Hysteresis (VH)	The lesser of 0 to 25% of VAT or 0 to 1000	This feature is used in conjunction with the VAT and is only used when the sensor is already in an Aware state. This feature prevents rapid triggering when the vibration is hovering near the VAT. In order for the sensor to go not aware when already aware, it must go below VAT - VH.
Window Filter Function	No Filter, Hanning	The Hanning filter reduces the start and end of the sampled waveform to 0 to minimize spectral leakage that can occur when the sampling of the vibration waveform doesn't start and end at the same point in the waveform.
Accelerometer Range	2, 4, 8, 16 g	The Accelerometer Range can be decreased to increase resolution at lower amplitudes or increased to capture higher amplitude vibrations. If the range is set lower than the input signal, the peaks of the vibration waveform may be clipped, distorting the data and usually resulting in a Crest Factor below 1.41.
Measurement Interval	Lesser of 1 to 43200 s or the Aware Heartbeat	This is how often the meter takes a measurement.
Sample Rate	25, 50, 100, 200, 400, 800, 1600, 3200, 6400, or 12800 Hz	This determines how fast the accelerometer samples acceleration data during a measurement. Every measurement, the sensor takes 256 samples to reproduce the vibration waveform, this configuration determines the rate at which those 256 samples are gathered. Noise levels increase as the sample rate is increased. See Noise in the Electronic Specifications table for more details.
Frequency Range (Min/Max)	See Accurate Frequency Measurement table for ranges	The Min/Max frequency configurations define the bandwidth of the sensor. The sensor can only assess frequencies within this bandwidth for Vibration RMS, Velocity RMS, and Displacement mode. Acceleration Peak mode vibration amplitude measurements are conducted in the time domain so it is possible to get frequency measurements that don't match with the vibration signal in this case.
Power Mode	Low, Medium, High Performance	This feature controls the number of samples the accelerometer averages when the Sample Rate is below 800 Hz. At 800 Hz and above these power modes perform the same and consume the same power. Below 800 Hz, lower power modes consume less current but will have higher noise levels than the higher power modes. See Noise in the Electronic Specifications table for more details.
Data Mode	Most Recent, Average, Maximum	This feature controls how the data the sensor reports is computed. With Most Recent mode, the sensor reports the results of the last measurement prior to the Heartbeat only. Using Average mode, the sensor reports the mean of the frequency, vibration, and crest factor readings that occurred since the last Heartbeat. The temperature reading is just the most recent reading when in Average mode. Using Maximum mode, the sensor reports the frequency, crest factor, and the temperature associated with the largest vibration measurement in the Heartbeat.

Commercial-Grade Sensors

Monnit commercial-grade sensors are designed for applications in ordinary environments (normal room temperature, humidity, and atmospheric pressure). Don't use these sensors under the following conditions as these factors can deteriorate the product characteristics and cause failures and burnout.

- Corrosive gas or deoxidizing gas: chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas, nitric oxide gas, etc.
- Volatile or flammable gas
- Dusty conditions
- Low-pressure or high-pressure environments
- Wet or excessively humid locations
- Places with salt water, oils, chemical liquids, or organic solvents
- Where there are excessively strong vibrations
- Other places where similar hazardous conditions exist

Use these products within the specified temperature range. Higher temperature may cause deterioration of the characteristics or the material quality.

Industrial-Grade Sensors | Type 1, 2, 4, 4X, 12, and 13 NEMA-Rated Enclosure

Monnit's industrial sensors are enclosed in reliable, weatherproof NEMA-rated enclosures. Our NEMA-rated enclosures are constructed for both indoor or outdoor use and protect the sensor circuitry against the ingress of solid foreign objects like dust and the damaging effects of water.

- Safe from falling dirt
- Protects against wind-blown dust
- Protects against rain, sleet, snow, splashing water, and hose-directed water
- Increased level of corrosion resistance
- Will remain undamaged by ice formation on the enclosure

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