ALTA by MONNIT

Remote Monitoring for Business

ADVANCED VIBRATION

ALTA® Wireless Advanced Vibration Meter

General Description

ALTA® Wireless Advanced Vibration Meters use a tri-axis accelerometer and temperature sensor to monitor system vibration health.

Key Features

- Three-axis measurement:
  - Acceleration root mean square (RMS), Velocity (RMS), Displacement, or Acceleration Peak
  - Frequency
  - Crest Factor
- Measures Duty Cycle and Temperature
- Configurable Frequency Range
- Configurable Hanning filter
- Measure up to 4200 Hz / 252,000 RPM
- Configurable measurement interval as low as 1 second
- Configurable thresholds for critical condition monitoring

Principles of Operation

The ALTA Wireless Advanced Vibration Meter uses an accelerometer to measure a suite of tri-axis vibration data in addition to sensor duty cycle (a percentage of activity) and temperature. It reports this data on a user-configurable time interval or Heartbeat. In addition, the sensor can report the current, max, or average data. These measurements are sent to the gateway, making the data available in iMonnit or another approved data service.

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

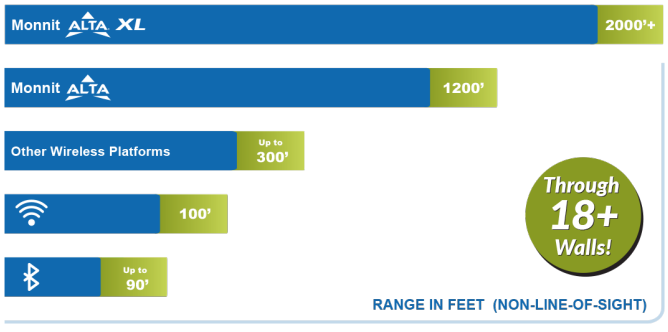
Features of Monnit ALTA Sensors

- Wireless range of 2,000+ feet through 18+ 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 + Advanced Encryption Standard (AES)-128 Cipher Block Chaining (CBC) for sensor data messages)
- Sensor logs 2000 to 4000 readings if the gateway connection is lost (non-volatile flash, persists through power cycling):
  - 10-minute Heartbeats = ~ 22 days
  - 2-hour Heartbeats = ~ 266 days
- Automatic over-the-air updates to sensor firmware (future-proof)
- Free iMonnit Basic Online Wireless Sensor Monitoring and Notification System to configure sensors, view data, and send alerts via SMS text, email, and voice call

1 Actual range may vary depending on the environment and gateway.

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

Wireless Range Comparison



Technical Specification | ALTA® Wireless Advanced Vibration Meter			
Accelerometer	Vibration Variation over Temperature		0.01 %/°C (0.018%/°F)(xy), 0.03 %/°C (0.054%/°F)(z)
	Cross Axis Sensitivity		2%
	General Noise[1]	RMS	0.7 mg
		Density	130 µg/√(SampleRate)
Temperature	Transducer Type		10 KOhm NTC Thermistor (β = 3455 K)
	Calibrated accuracy		± 1°C (±1.8°F)
	Resolution		0.1°C (0.18°F)
	Response time		50 seconds (10 second time constant)[2]
Cube	Dimensions		0.75" x 0.75" x 0.75"
	Weight		17g (cube with electronics and epoxy)
	Mounting Hole		M4 x 0.7 Tapped Threads, 7mm hole depth
	Composition		Aluminum and accelerometer potted with black epoxy
	Operating Temperature		-40°C to 105°C (-40°F) to 221°F) (Electronics only)
	Operating Humidity		0 to 100% (Electronics sealed inside)
Lead	Wire details		6-conductor, 28 AWG, stranded copper
	Operating Temperature		-25°C to 85°C (-13°F to 185°F)
	Length		3 m (10 ft)
	Insulation / Jacket		PVC (black), 0.010"
	Shield		Yes
	Overall Diameter		4.5 mm (0.177")
	Ratings / Approvals		UL AWM STYLE 2464, cUL AWM I/IEC RoHS/Reach Compliant
	Temperature Rating		-20°C to 85°C (-4°F to 185°F)[3]
	Voltage Rating		300 V Max
	Dielectric Strength		1500 V RMS
ALTA Wireless	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 (EIRP)		50 mW (900MHz), 25 mW (868 MHz), 10 mW (433 MHz)
	Wireless range		2,000+ ft. through 18+ walls with the ALTA XL® Gateway
	Security		Encrypt-RF® (256-bit key exchange and AES-128 CTR)
General	Battery voltage range		2.0 to 3.8 VDC
	Operating altitude (non-pressurized environments)		-15.2 to 1,982 m (-50 to 6,500 ft)[4]
	Storage altitude (non-pressurized environments)		-15.2 to 3,048 m (-50 to 10,000 ft)[4]
	Operating humidity		5 to 85% RH (non-condensing)
	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**

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.
2. Response time defined as five time constants for 99.3% of actual temperature.
3. Temperatures colder than the rating are acceptable if the cable is not moving or vibrating.
4. Operating and storage altitude without DC power supply is -30.48 to 9144 m (-100 to 30000 ft).

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%	Varies[6]
Temperature	0.0°C 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

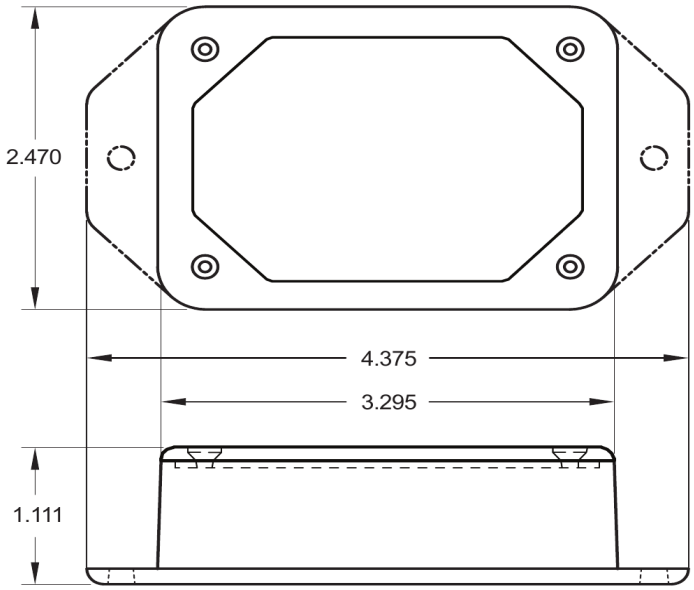
1. On the X and Y axes, above 3200 Hz the sensor experiences gradual signal loss reaching -3 dB at ~4200 Hz. Above 4200 Hz the loss increases rapidly. Do not recommend using sensor with signals above 4200 Hz. On the Z axis, above 2000 Hz, the sensor experiences gradual signal loss reaching -3 dB at ~2900 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.

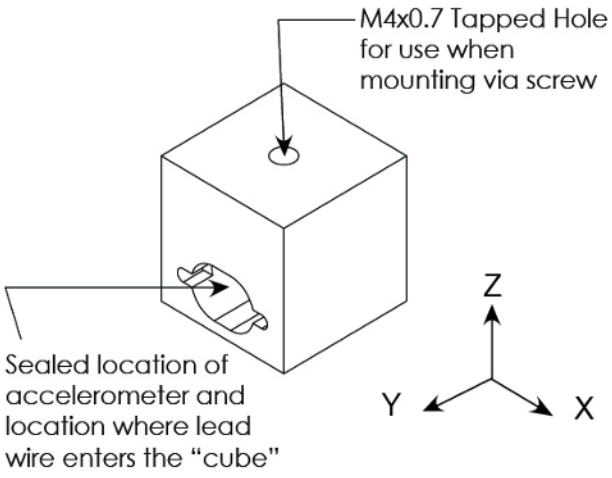
Typical RMS Noise				
	Power Mode			
Sample Rate	High	Medium	Low	Units
12800	321	321	321	mm/s^2
6400	271	271	271	mm/s^2
3200	151	151	151	mm/s^2
1600	132	132	132	mm/s^2
800	70	70	70	mm/s^2
400	54	100	411	mm/s^2
200	45	106	409	mm/s^2
100	23	110	406	mm/s^2
50	20	105	425	mm/s^2
25	13	95	474	mm/s^2

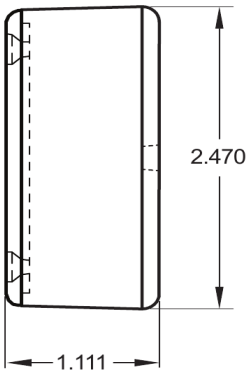
Typical Peak Noise				
	Power Mode			
Sample Rate	High	Medium	Low	Units
12800	755	755	755	mm/s^2
6400	640	640	640	mm/s^2
3200	363	363	363	mm/s^2
1600	319	319	319	mm/s^2
800	213	213	213	mm/s^2
400	121	298	1125	mm/s^2
200	107	311	1162	mm/s^2
100	76	345	1253	mm/s^2
50	62	316	1213	mm/s^2
25	30	246	1119	mm/s^2

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 and then finding the largest peak energy in that data set 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 64 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. The 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. Conversely, 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	The 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. For example, 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 detect 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 %	The percent indicates how much of the Heartbeat vibration was present.
Temperature	A temperature-sensing element embedded in the cube 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.

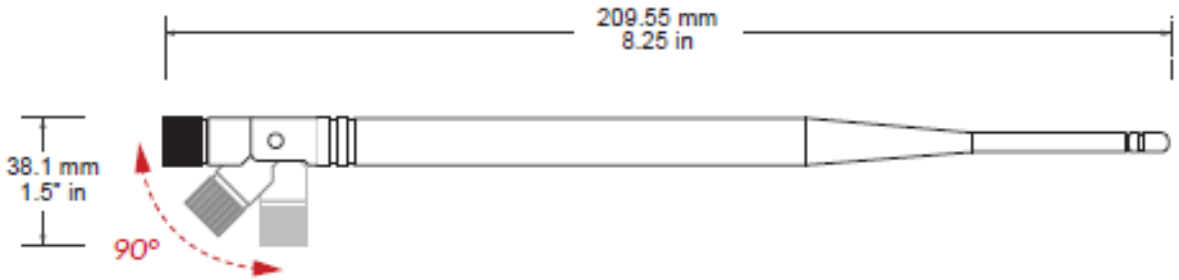


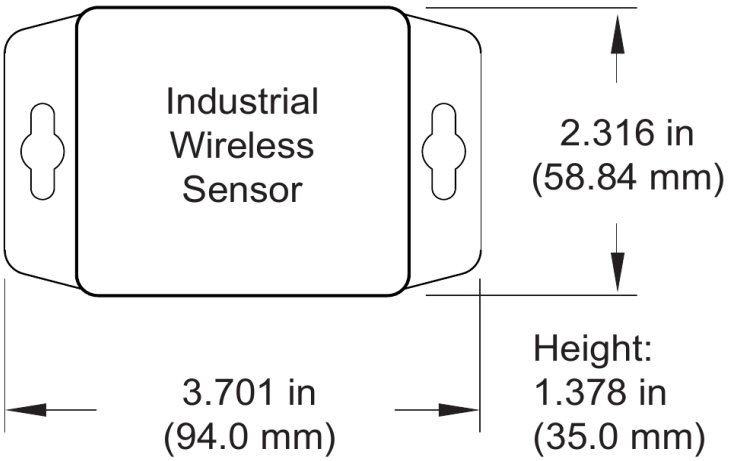


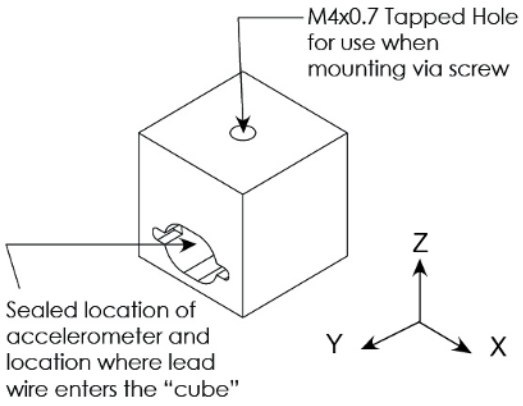


Technical Specifications | ALTA® Enterprise	
Battery[1]	2x 1.5V AA Alkaline, 1500 mAh, (standard) 2x 1.5V AA Lithium, 3000 mAh, (optional)
Battery Life	10+ years expected
External line-power option[2]	Input voltage: 5.0-12.0 V Power jack: 2.1 x 5.5 mm barrel, center positive
Operating temperature range[3]	-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. Hardware cannot withstand negative voltage. Please take care when inserting and removing batteries.
2. Batteries will provide backup power in the case the external power is removed.
3. Operating below 0°C (-32°F) degrees will reduce battery life.







Technical Specifications | ALTA® Industrial	
Battery	1x 3.6V AA Lithium Thionyl Chloride, 1500mAh, pre-installed
Battery Life	10+ years expected
Operating temperature range (non-leaded measurement range)[1]	-40°C to 85°C (-40°F to 185°F)
Wireless antenna type	1/2-wave waterproof dipole with RP-SMA connector and swivel neck; dBi of 3.0 (900/868MHz) or 2.5 (433 MHz); length of 8.27" (210mm) (900/868MHz) or 7.68" (195mm) (433 MHz); diameter at thickest point of 0.55" (14mm)
Weight	4.7 oz. (133 g) with 0.15 m (6.0") lead 5.2 oz. (147 g) with 0.9 m (3.0') lead
Enclosure rating	IP-65 (dust-proof and waterproof but not submersible) NEMA 1, 2, 4, 4x, 12, and 13 rated, sealed, and weatherproof UL Listed to UL508-4x specifications (File E194432)

1. Operating below 0°C (-32°F) degrees will reduce battery life.

Commercial-Grade Sensors

Monnit commercial-grade sensors are designed for applications in ordinary environments (normal room temperature, humidity, and atmospheric pressure). Do not 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 temperatures 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 indoor and 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

MONNIT

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