



# ECHO<sup>®</sup> WIRELESS VIBRATION MONITORING



## PERFORMANCE

Why use valuable manpower to collect vibration data on healthy machines? Why settle for measurements once a month when you can have them multiple times daily? Why have people venture into unsafe areas to collect routine measurements? Echo® Wireless Vibration Sensors can safely “look” at the machine’s health several times per day and provide immediate notification when warning or critical levels are reached. This frees up technical experts, like certified vibration analysts, for higher value tasks such as fault analysis.

The Echo® Wireless Vibration Sensor and the EchoPlus® Wireless Junction Box make the set of overall vibration measurements, listed below, that provide early warning of most common machine faults. In addition to these measurements, Echo® provides accurate battery status. Using a user-programmable vibration threshold, Echo® can detect if the machine is not running and if not, skip a measurement to conserve battery power.

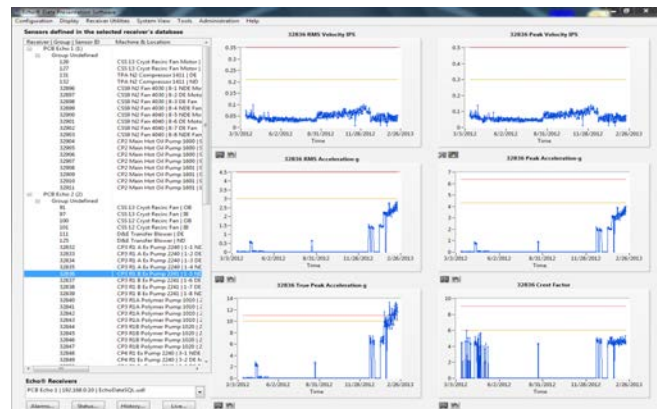
## HIGHLIGHTS

- Easily integrates with legacy vibration and plant monitoring systems via Modbus®
- Transmits long distances, eliminating expensive cable runs
- Runs standalone or with junction box
- Stores data in ODBC format
- Requires no repeaters, gateways, or mesh



## SIX PRIMARY MEASUREMENTS

- **RMS Velocity:** RMS Velocity is the average of all velocity values captured within the sampling window and identifies low frequency faults such as unbalance and misalignment.
- **Peak Velocity:** Peak Velocity is RMS Velocity multiplied by 1.414 and identifies low frequency faults such as unbalance and misalignment.
- **RMS Acceleration:** RMS Acceleration is the average of all acceleration values captured within the sampling window and identifies high frequency faults such as broken rotor bars in electric motors.
- **Peak Acceleration:** Peak Acceleration is RMS Acceleration multiplied by 1.414 and identifies high frequency faults such as broken rotor bars in electric motors.
- **True Peak Acceleration:** True Peak Acceleration is the highest acceleration value captured within the sampling window and identifies high-frequency, impulsive faults such as rolling element bearing defects and some gear defects.
- **Crest Factor:** Crest Factor is the ratio of True Peak to RMS Acceleration and is used as an indicator of fault severity with caution.



# SYSTEM COMPONENTS



## WIRELESS VIBRATION SENSOR

MODELS 670A01 & CS670A01 (916 MHz)  
MODEL 670A02 (868 MHz)

- Transmits long distances
- Eliminates expensive cable runs
- Installs easily

The Echo® Wireless Vibration Sensor is a stand-alone, battery powered industrial vibration sensor. Echo® has an LED that provides visual feedback on the status of the sensor, including: on, off, measuring, transmitting or changing states. The sensor has an embedded magnetic switch and can be activated or deactivated by holding a strong magnet next to the sensor. Upon activation, the sensor makes and transmits a set of measurements.

The Echo® Wireless Vibration Sensor is also offered in a hazardous area certified variation (CSA approval of 916 MHz version only.) Model CS670A01 can be used in hazardous area requiring Class 1, Division 2 certification. The model can be used in hazardous applications, such as oil wellheads, for remote wireless vibration monitoring on these machines.



## WIRELESS JUNCTION BOX

MODELS 672A01 & CS672A01 (916 MHz)  
MODEL 672A02 (868 MHz)

- Instantly converts existing sensors to wireless
- Runs independently or with existing junction box
- Uses 24 VDC or battery power

The EchoPlus® Wireless Junction Box is an 8-channel junction box that instantly converts installed industrial sensors to wireless operation. This incredibly economical device periodically powers each sensor, makes the same set of overall measurements and transmits them wirelessly. The default transmission interval is 8 hours, but it is user-programmable. Additionally, it operates as a standard junction box allowing full data collection with a portable data collector at the box. It can be powered using either standard 24 VDC or any battery between 6 and 13 VDC. The unit can be used by itself or in conjunction with an existing junction box by simply jumping wires between them.

The EchoPlus® Wireless Junction Box is also offered in a hazardous area certified variation (CSA approval of 916 MHz version only). Model CS672A01 can be paired with hazardous certified ICP® accelerometers for wireless vibration transmission in hazardous areas requiring Class I, Division 2 certification. When combined with an appropriate intrinsic safety barrier, the EchoPlus® can be used in applications such as refinery pumps, fans, motors and gas compressors to trend and alarm machine vibration levels.



## RECEIVER

MODEL 673B01 (916 MHz)  
MODEL 673B02 (868 MHz)

- Requires no repeaters, gateways, or mesh
- Outputs to Ethernet
- Installs easily

The Echo® Receiver is a stand-alone unit that communicates point-to-point with Echo® Wireless Vibration Sensors and EchoPlus® Wireless Junction Boxes. Using an ultra-narrow bandwidth filter with Extended Range RF (ERRF) technology, it has unprecedented -145 dBm sensitivity and can detect and decode RF signals as low as about a millionth of a billionth of a milliwatt. This results in very long distance point-to-point communications in plants, eliminating the need for repeaters or complicated mesh networks. Actual tests in a typical power plant achieved successful signal transmission distances of over 1200 ft (365 m) and even through buildings. Outdoor tests have achieved transmission distances measured in miles and transmissions are at only 0.75 mW ERP using very little battery power.



## LOW COST ICP® ACCELEROMETERS FOR EchoPlus® JUNCTION BOX

MODELS (EX)602M138, (EX)603M170, (EX)607M140



## 6 dBi ANTENNA (868 & 916 MHz)

MODEL 070A90



## 8 dBi ANTENNA (916 MHz ONLY)

MODEL 070A91

# ON DEMAND AND MOBILE APPLICATIONS

## ECHO® ON DEMAND

- Wirelessly capture overall vibration data on demand with EchoPlus® Remote Trigger (with or without Wireless Remote)
- Monitor non-continuously running rotating assets
- Eliminate difficult data collection within dangerous locations

## APPLICATIONS

- Overhead cranes
- Pumps in tailings ponds
- Intermittent machines
- Machines in restricted areas
- Equipment in hard-to-reach areas

## ECHO® MOBILE

The Echo® Wireless Vibration Monitoring System is simple and compact with few components, so it can be easily transported for use in the most difficult/remote applications. An Echo® Receiver paired with a laptop (running Echo® Monitoring Software) creates a receiving station that can easily fit into a rugged case and be used in a vehicle for mobile wireless data collection.

## APPLICATIONS

- Tailings ponds
- Remote crusher spreads
- Long conveyor belts/runs
- Other remote hazardous areas



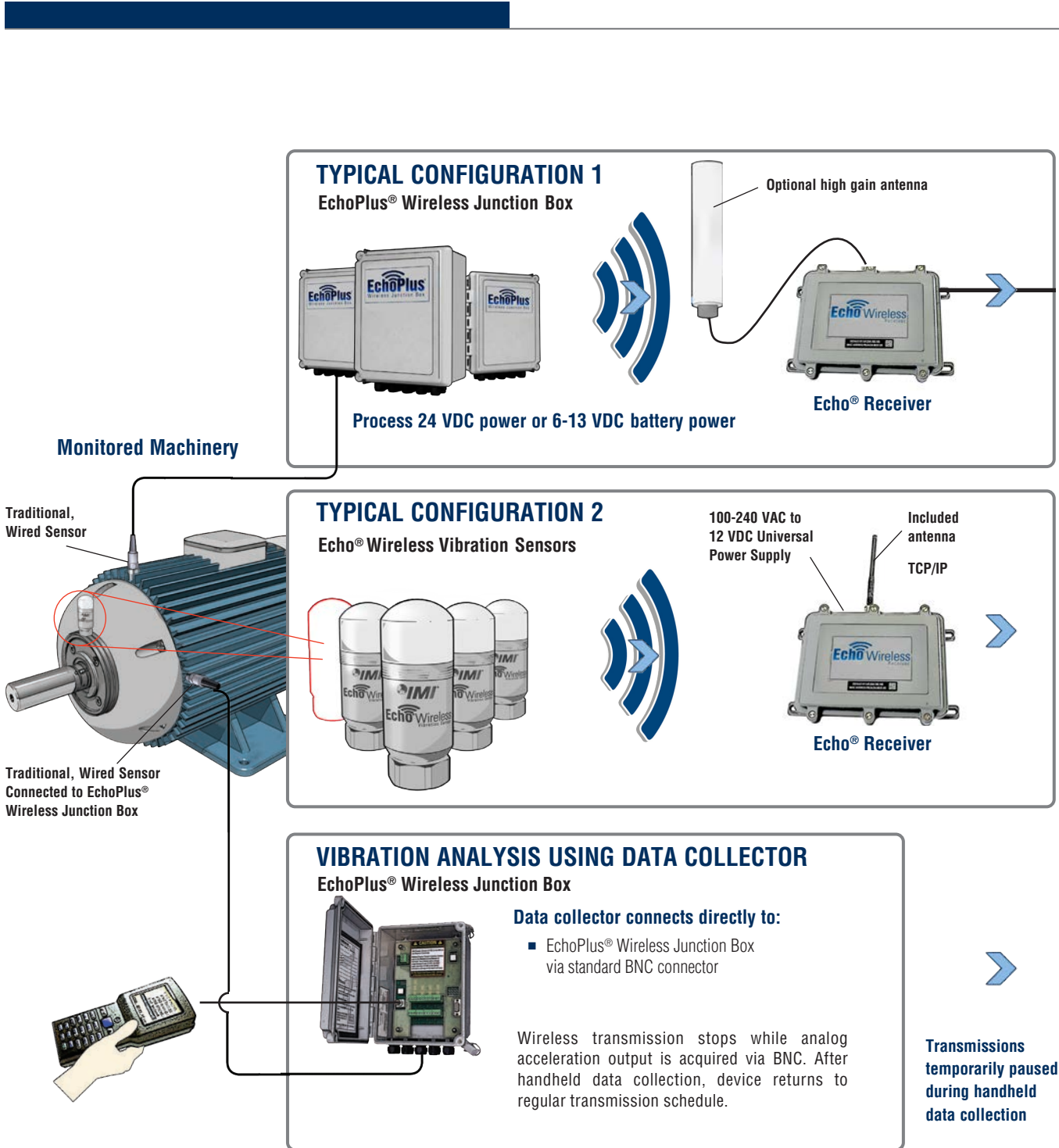
**WIRELESS REMOTE**  
MODEL 070A00 (916 MHz ONLY)

## ECHOPLUS® REMOTE TRIGGER

MODEL 070B97 (868 OR 916 MHz)  
(PICTURED WITH ECHOPLUS® WIRELESS JUNCTION BOX)

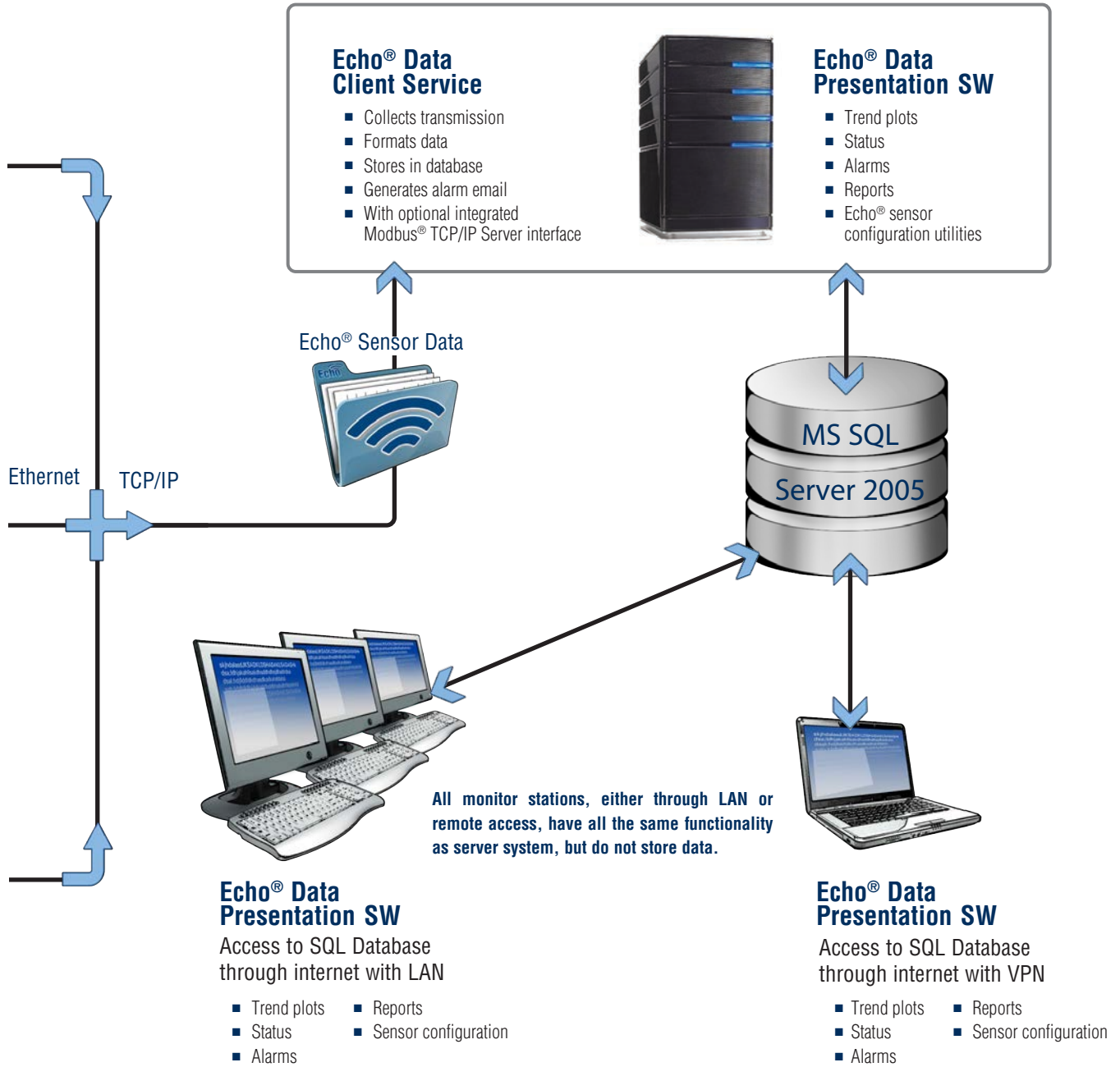


# CONFIGURATION SCHEMATIC



The Echo® Wireless Vibration Monitoring System is simple in design, easy to install, cost-effective and flexible in configuration. With over 400 points per receiver, the system can monitor over 3,500 points even within the same RF coverage area. Outside the same coverage area, the number is even higher. Stand-alone Echo® Sensors and EchoPlus® Junction Boxes can be mixed and matched as desired.

EchoPlus® provides a raw vibration output via cable to a data collector for detailed fault analysis. Echo® Monitoring Software provides standard monitoring features, such as: machine status, reports, trend plots and email alerts. It can be run single or multi-user at no additional charge per user.





# ECHO<sup>®</sup> MONITORING SOFTWARE

Echo<sup>®</sup> sensor data is collected and stored by the Echo<sup>®</sup> Data Client Service software in a Microsoft SQL database. The database structure is available from IMI so it can be accessed by users directly using any ODBC-compliant application. The Echo<sup>®</sup> Data Client Service can also be configured as a Modbus<sup>®</sup> TCP/IP Server to service Modbus<sup>®</sup> requests from an existing Modbus<sup>®</sup> Client application.

Echo<sup>®</sup> data can also be exported from the Echo<sup>®</sup> Data Presentation Software to a tab delimited spreadsheet file that is suitable for use with Excel or other data viewing applications for post processing.

## ECHO<sup>®</sup> DATA CLIENT SERVICE

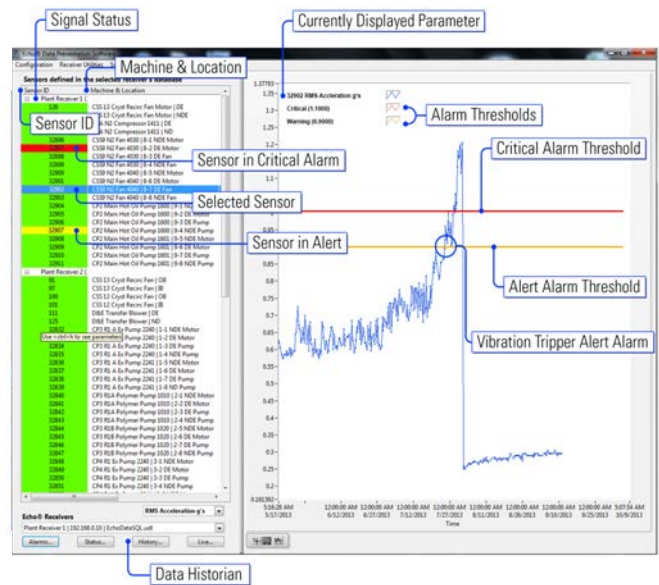
- Installs locally or on a server  
(It is highly recommended that the service is installed on a dedicated PC or Server running 24/7)
- Runs continuously whether a user is logged on or not
- SQL Database interface and/or Modbus<sup>®</sup> TCP/IP
- Provides email alerts if SQL interface is enabled
- Service Status application runs from notification tray to view service / receiver status



**SENSOR VIBRATION ALARM PANEL & VIBRATION TREND PLOT SCREENSHOT**

## ECHO<sup>®</sup> DATA PRESENTATION SOFTWARE

- This software application is used to characterize and display data collected by the system. It runs in single or multi-user environments and provides:
  - System level status & alerts
  - Sensor history and trend plots
  - Sensor level status and alarms
  - System, database, and sensor configuration utilities with administrative access



**ECHO<sup>®</sup> MONITORING SYSTEM OVERVIEW SCREENSHOT**

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EXCEL IS A REGISTERED TRADEMARK OF MICROSOFT CORPORATION



# SPECIFICATIONS

System Information	
Model Number	673B01      673B02
<b>Data Received Per Transmission</b>	
Date	MM/DD/YYYY
Time	HH:MM:SS
<b>Vibration</b>	
RMS Velocity	Arithmetic Average of Velocity Value Samples
Peak Velocity	1.414 x RMS Velocity
RMS Acceleration	Arithmetic Average of Acceleration Value Samples
Peak Acceleration	1.414 x RMS Acceleration
True Peak Acceleration	3.7 sec sample @ 61.4 kHz
Crest Factor	True Peak/ RMS Acceleration
<b>Sensor</b>	
Sensor ID	Factory Set Unique Number
Battery Status	1 to 4 (4 = best, 1 = worst)
Signal Status	1 to 4 (4 = best, 1 = worst)
Average Power	Average Transmission Power (dBm)
Noise Power	Background Noise Level (dBm)
Average SNR	Difference between Average Power and Noise (dB)
<b>Radio Specifications</b>	
Radio Standard	Proprietary Extended Range RF
Modulation	Narrowband FSK
Transmission Range	Line-of-Sight tested up to 1 mile 1200 ft (365 m) in typical industrial environments
Transmission Interval	Programmable, 1 min to 24 hrs (Default of 8 Hours)
Certifications	FCC, IC, ANATEL      CE
Radio Sensitivity	-145 dBm
Frequency Band	902 - 928 MHz      868.0 - 868.8 MHz
Number of Independent RF Bands	12      9
Maximum Power (ERP)	0.75 mW
RF Data Rate	20 bps

Echo® Receiver	
Model Number	673B01      673B02
<b>Performance</b>	
MAC Address	Unique and Factory Set
IP Address (Programmable)	Dynamic or Static
Sensors per receiver	400 at 3 Transmissions/Day, 1% miss 1200 at 1 Transmission/Day, 1% miss
<b>Electrical</b>	
Power	12 VDC
<b>Environmental</b>	
Enclosure Rating	IP67 NEMA 1, 2, 4, 4X, 12, 13
Temperature Range	-6 to 138 °F -21 to +59 °C
<b>Physical</b>	
Enclosure Material	Die Cast Aluminum
Power Connector	Bayonet Multi-Pin MIL
Programming Connector	Bayonet Multi-Pin MIL
Ethernet Connector	RJ-45
Antenna Connector	N-female
Dimensions	7.87 x 6.65 x 1.97 in 199.9 x 168.9 x 50.0 mm
Weight	2.37 lb 1.08 kg

ECHO® Wireless Vibration Sensor		
Model Number	(CS)670A01	670A02
<b>Performance</b>		
Velocity Range	0 - 4 ips rms	
Velocity Linearity (0 - 1 ips rms)	<1%	
Velocity Linearity (1 - 4 ips rms)	<8.5%	
Velocity Frequency Range (+3 db)	4 to 2300 Hz	
Velocity HP Filter	2 Hz, 1-pole RC	
Velocity LP Filter	2.4 kHz, 3-pole Chebyshev	
Velocity Resolution	0.001 ips rms	
Acceleration Range	0 - 20 g pk	
Acceleration Linearity	<1%	
Acceleration Frequency Range (+3 db)	2.3 to 15 kHz	
Acceleration HP Filter	2 kHz, 4-pole Chebyshev	
Acceleration LP Filter	15 kHz, 3-pole Chebyshev + 1-pole RC	
Acceleration Resolution	0.007 g pk	
Transverse Sensitivity	≤7%	
<b>Environmental</b>		
Shock Limit (through base)	1000 g	
Temperature Range	-6 to 158 °F -21 to 70 °C	
Enclosure Rating	IP66	
Hazardous Area Approval	CSA (CS only)	N/A
<b>Electrical</b>		
Power	7.2 V Lithium Battery Pack, Replaceable	
Battery Operating Temperature	-76 to 185 °F -60 to 85 °C	
Battery Life (Room Temperature)	1 year @ 3 measurements/day	
Electrical Isolation (Case)	>10 <sup>8</sup> ohm	
<b>Physical</b>		
Sensing Element	Ceramic	
Sensing Geometry	Shear	
Housing and Base Material	Stainless Steel	
Cap Material	Polycarbonate	
Mechanical Isolator Material	Urethane	
Mounting	1/4-28 Female	
Mounting Torque	2 to 5 ft-lb	
Dimensions (Diameter x Height)	1.66 x 4.40 in 42 x 112 mm	
Base Size	1-3/8" Hex	
Weight	15.9 oz 450 g	

ECHOPLUS® Wireless Junction Box		
Model Number	(CS)672A01	672A02
<b>Performance</b>		
Velocity Range	0 - 4 ips	
Velocity Linearity (0-1 ips rms)	<1%	
Velocity Linearity (1-4 ips rms)	<7%	
Velocity Frequency Range (+3 dB)	4 to 2300 Hz	
Velocity HP Filter	2 Hz, 1-pole RC	
Velocity LP Filter	2.4 kHz, 3-pole Chebyshev	
Velocity Resolution	0.001 ips rms	
Acceleration Range	0 - 40 g pk	
Acceleration Linearity	<1%	
Acceleration Frequency Range (+3 dB)	2.3 to 15 kHz	
Acceleration HP Filter	2 kHz, 4-pole Chebyshev	
Acceleration LP Filter	15 kHz, 3-pole Chebyshev + 1-pole RC	
Acceleration Resolution	0.005 g pk	
<b>Environmental</b>		
Temperature Range	-6 to 158 °F -21 to 70 °C	
Enclosure Rating	IP66, NEMA 4X	
Hazardous Area Approval	CSA (CS only)	N/A
<b>Electrical</b>		
Power (External)	23 to 25 VDC	
Power (Battery)	6 to 13 VDC	
Current Consumption	<150 mA	
Sensor Power Supplied	24 VDC @ 2.2 mA constant current	
Channel Gain	Programmable, Default for 100 mV/g	
<b>Physical</b>		
Enclosure Material	Fiberglass Polyester (CS only)	Fiberglass
Cord Grips	Ten PGME07 Ten M16 (CS only)	Ten PGME07
Raw Vibration Connector	BNC Jack, Internal	
Dimensions	8 x 6 x 4 in 203 x 152 x 102 mm 10.24 x 3.54 x 6.30 in (CS only) 261 x 90 x 160 mm (CS only)	8 x 6 x 4 in 203 x 152 x 102 mm
Weight	2.88 lb 1.3 kg 5.2 lb (CS only) 2.4 kg (CS only)	2.88 lb 1.3 kg



 **IMI SENSORS**  
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IMI Sensors, a division of PCB Piezotronics, Inc. manufactures industrial vibration monitoring instrumentation, such as accelerometers, vibration transmitters and switches that feature rugged stainless steel housings and survive in harsh environments like paper and steel mills, mines, gas turbines, water treatment facilities and power plants. Integrating with portable analyzers and PLC's, IMI instrumentation helps maintenance departments reduce downtime and protect critical machinery. Visit IMI Sensors at [www.pcb.com](http://www.pcb.com). PCB Piezotronics, Inc. is a wholly owned subsidiary of MTS Systems Corporation. Additional information on MTS can be found at [www.mts.com](http://www.mts.com).

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