



ECHO® WIRELESS VIBRATION MONITORING

 **IMI SENSORS**
A PCB PIEZOTRONICS DIV.

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ECHO® WIRELESS VIBRATION MONITORING SYSTEM

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.

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
- CSA Class 1, Div. 2 certified for use in hazardous areas!



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.

FAULT DETECTION

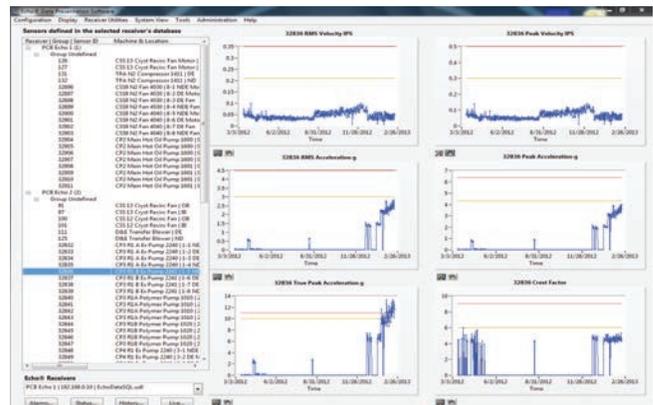
The Echo® Wireless Vibration Sensor and the EchoPlus® Wireless Junction Box make the set of overall vibration measurements, listed below, that provide early warning of most common machine faults. In addition to these measurements, Echo® provides accurate battery status. Using a user-programmable vibration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



ECHO[®] WIRELESS VIBRATION SENSOR

THE 6 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.





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.

Many applications ideally suited for wireless technology are located in classified hazardous environments, and they require specialized certifications for electronic instrumentation. IMI now offers a version of the Echo® Wireless Vibration Sensor that is certified by CSA to a Class I, Division 2 rating (Groups A, B, C, D). The new model CS670A01 can be used in hazardous applications, such as oil wellheads, for remote wireless vibration monitoring on these machines.



WIRELESS VIBRATION SENSOR

MODEL 670A01

- Transmits long distances
- Eliminates expensive cable runs
- Installs easily
- CSA Class 1 Division 2 certified version available (Model CS670A01)



WIRELESS JUNCTION BOX

MODEL 672A01

- Instantly converts existing sensors to wireless (See back cover for recommended sensor options)
- Runs independently or with existing junction box
- Uses 24 VDC or battery power
- CSA Class 1 Division 2 certified version available (Model CS672A01)

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. Model CS672A01 can be paired with hazardous certified ICP® accelerometers for wireless vibration transmission in hazardous areas requiring Class 1, 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.



The Echo® Receiver is a stand-alone unit that communicates point-to-point with Echo® Wireless Vibration Sensors and EchoPlus® Wireless Junction Boxes. Operating in the 916 MHz range, 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 1/3 mile 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.



RECEIVER

MODEL 673B01

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

ECHO® WIRELESS ACCESSORIES

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



ECHO® REPLACEMENT BATTERY KIT

MODEL 073A20

- Battery pack, O-ring, silicon grease, foam compressor



900 MHz ANTENNA, 8 dBi

MODEL 070A91

- 900 MHz, 8 dBi omnidirectional antenna



800/900 MHz ANTENNA, 6 dBi

MODEL 070A90

- 800/900 MHz, 6 dBi omnidirectional antenna



WIRELESS REMOTE

MODEL 070A99



ECHOPLUS® REMOTE TRIGGER

MODEL 070B97

(PICTURED WITH ECHOPLUS® WIRELESS JUNCTION BOX)

GET WIRELESS MEASUREMENTS ON-DEMAND!

- Monitor non-continuously running rotating assets
- Wirelessly capture overall vibration data On-Demand
- Eliminate difficult data collection within dangerous locations



LOW COST ICP® ACCELEROMETERS IDEAL FOR ECHOPLUS®

MODEL 602M138, MODEL 603M170, MODEL 607M140

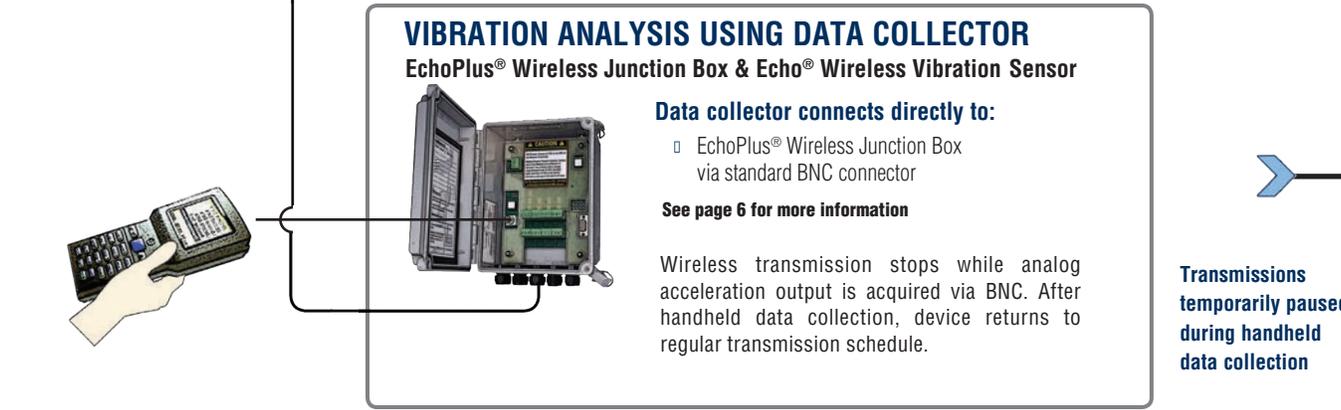
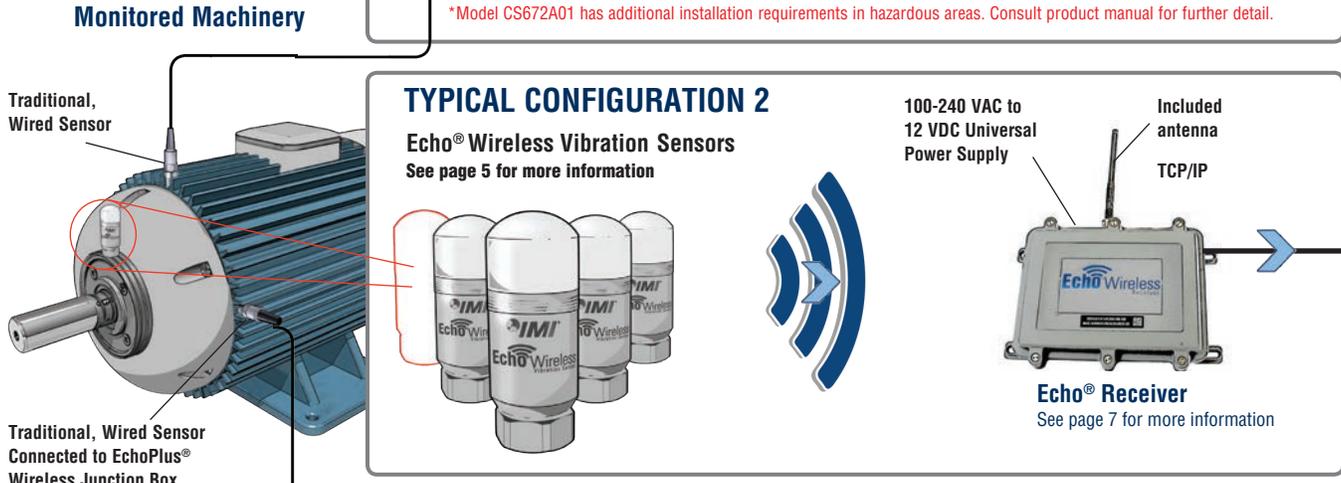
APPLICATIONS

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

ECHO® WIRELESS VIBRATION MONITORING SYSTEM

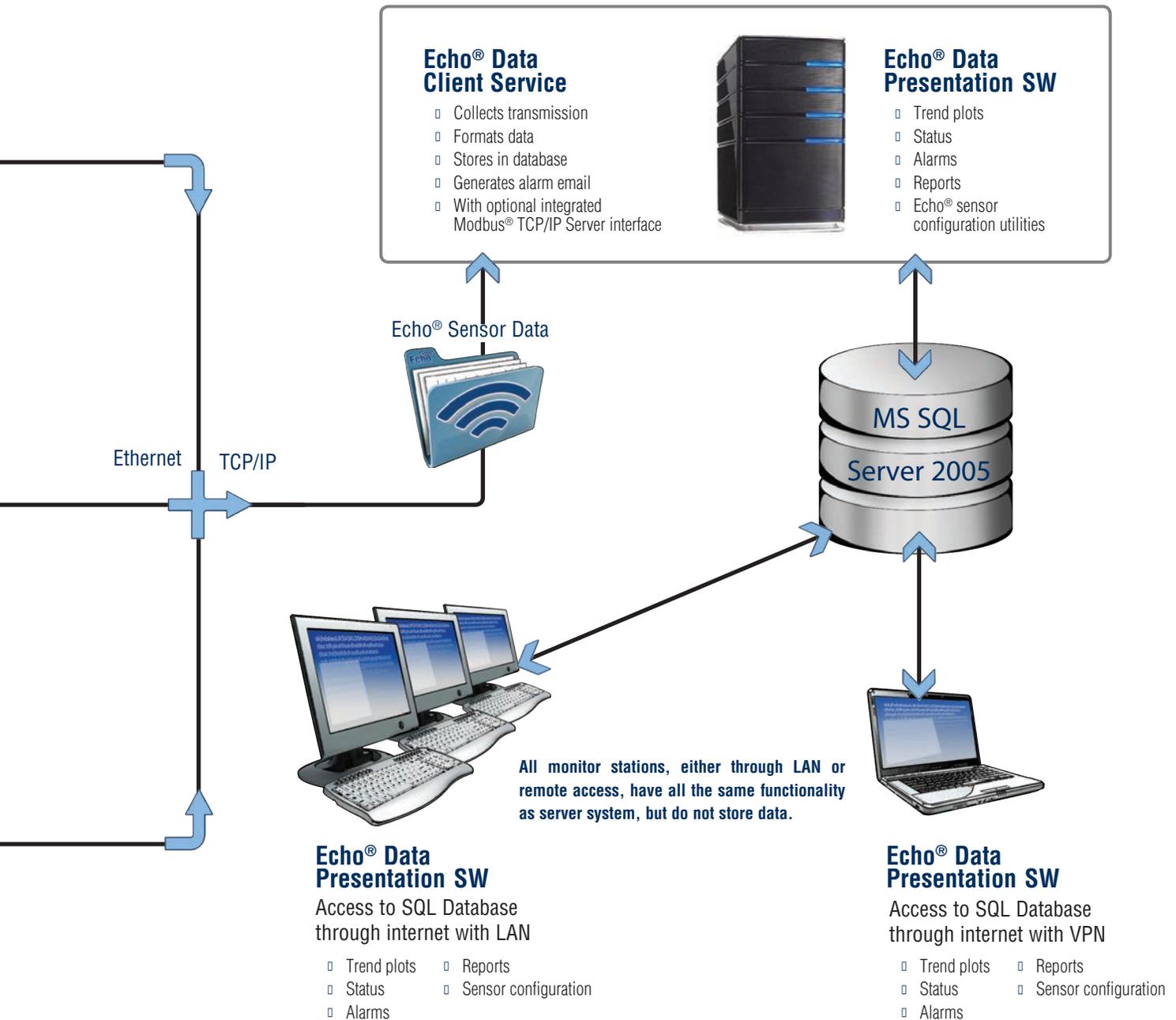
DIRECT POINT TO POINT TRANSMISSION TYPICAL DISTANCE = 1/3 TO 1/2 MILE RADIUS

Actual distances can vary widely based on conditions. Receiver has DHCP or static IP addressing



The Echo® Wireless Vibration Monitoring System is simple in design, easy to install, cost-effective and flexible in configuration. With 12 independent RF bands and over 400 points per receiver, the system can monitor over 5,000 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® MONITORING SOFTWARE

Echo® sensor data is stored by the Echo® 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® Data Client Service can also be configured as a Modbus® TCP/IP Server to service Modbus® requests from an existing Modbus® Client application.

Echo® data can also be exported from the Echo® Data Presentation Software to a tab delimited spreadsheet file that is suitable for use with Excel or other data viewing applications for post processing. Contact IMI® to discuss other interfaces to legacy condition monitoring programs and plant monitoring systems.

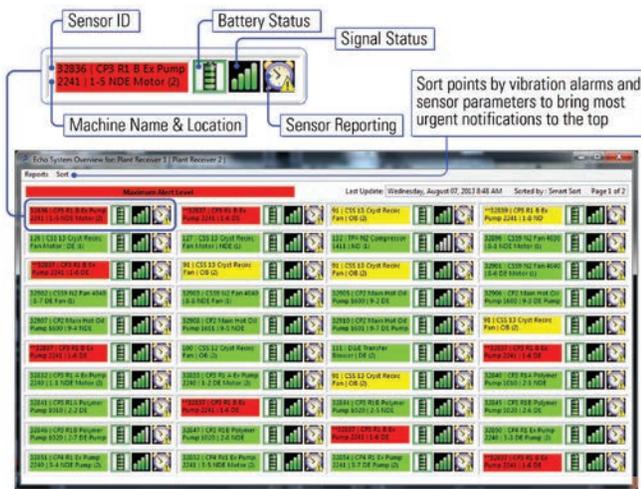
THE ECHO® MONITORING SOFTWARE PROVIDES TWO MAJOR FUNCTIONS:

- Collect transmission data reported by the receiver and store in the SQL database and/or Modbus® response file
- Present Echo® sensor data to the user through an intuitive and concise interface that includes:
 - Configuration utilities to setup a machinery database and set alarms levels
 - Tabular displays to view live and historical data
 - System level sensor status display to warn of low batteries, low RF signal, or missed measurements
 - Alarm reporting - graphically via system status screens and electronically via email
 - Single and multi-sensor plot displays with alarm levels to show trends
 - Hard copy report generation for last transmission and alarm events
 - Additional utilities to query and program
 - Echo® Sensors, EchoPlus® Junction Boxes and Echo® Receivers



ECHO® DATA CLIENT SERVICE

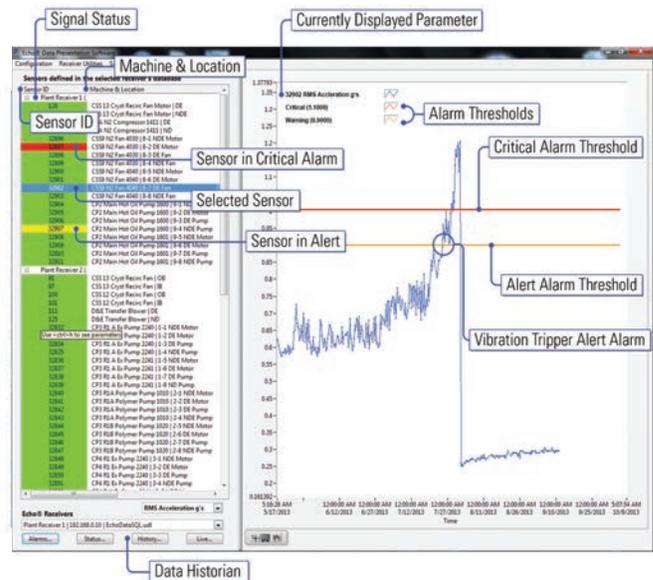
- Installs locally or on a server
(It is highly recommended that the service is installed on a dedicated PC or Server running 24/7)
- Runs continuously whether a user is logged on or not
- SQL Database interface and/or Modbus® TCP/IP
- Provides email alerts if SQL interface is enabled
- Service Status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



SENSOR VIBRATION ALARM PANEL & VIBRATION TREND PLOT SCREENSHOT

ECHO® DATA PRESENTATION SOFTWARE

- This software application is used to characterize and display data collected by Echo® sensors. 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® MONITORING SYSTEM OVERVIEW SCREENSHOT

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EXCEL IS A REGISTERED TRADEMARK OF MICROSOFT CORPORATION

SPECIFICATIONS

| ECHO® WIRELESS VIBRATION SENSOR - Model 670A01 | |
|---|---|
| Performance | |
| 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 - 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) | 2.2 - 15 kHz |
| Acceleration HP Filter | 2 kHz, 4-pole Chebyshev |
| Acceleration LP Filter | 15 kHz, 3-pole Chebyshev + 1-pole RC |
| Acceleration Linearity | <1% |
| Acceleration Resolution | 0.005 g pk |
| Electrical | |
| Power | 7.2 V Lithium Battery Pack, Replaceable |
| Battery Operating Temperature | -60 to 85 °C (-76 to 185 °F) |
| Battery Life | |
| Electrical Isolation (Case) | >10 ⁸ ohm |
| Environmental | |
| Enclosure Rating | IP66 |
| Temperature Range | -20 to 70 °C (-4 to 158 °F) |
| Humidity Range | 5% - 100% |
| Shock Limit (through base) | 1000 g |
| Physical | |
| Dimensions | 1.66 x 1.66 x 4.40 in (42 x 42 x 112 mm) |
| Weight | 450 g (15.9 oz) |
| Base Size | 1-3/8" Hex |
| Housing and Base Material | 304L Stainless Steel |
| Cap Material | Polycarbonate |
| Mechanical Isolator Material | Urethane |
| Mounting | 1/4-28 Stud, Removable |
| Mounting Torque | 2 to 5 ft-lb |
| Sensing Element | Piezoelectric Ceramic Shear |
| Hazardous Area Version - Model CS670A01 | |
| Certifications (CSA Approved) | CI I, Div 2, Groups A, B, C, D |
| * All specifications for the CS version are identical to the base model unless noted differently above | |

| ECHOPLUS® Wireless Junction Box - Model 672A01 | |
|---|---|
| Performance | |
| Velocity Range | 0 - 4 ips |
| Velocity Linearity (0-1 ips rms) | <1% |
| Velocity Linearity (1-4 ips rms) | <7% |
| Velocity Frequency Range | 4 - 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 | 2.2 - 15 kHz |
| Acceleration HP Filter | 2 kHz, 4-pole Chebyshev |
| Acceleration LP Filter | 15 kHz, 3-pole Chebyshev + 1-pole RC |
| Acceleration Linearity | <1% |
| Acceleration Resolution | 0.005 g pk |
| Electrical | |
| Power (External DC) | 24 VDC +1 V |
| Power (External Battery) | 6 - 13 VDC |
| Sensor Power Supplied | 24 VDC @ 2.2 mA constant current |
| Channel Gain | Programmable, Default for 100 mV/g |
| Environmental | |
| Enclosure Rating | NEMA-4X, IP66 |
| Temperature Range | -20 to 70 °C (-4 to 158 °F) |
| Humidity Range | 5% - 100% |
| Physical | |
| Dimensions | 8 x 6 x 4 in (203 x 152 x 102 mm) |
| Weight | 2.88 lb (1.3 kg) |
| Enclosure Material | Fiberglass |
| Cord Grips | 10 Individual, PGME07 |
| Raw Vibration Connector | BNC Jack, Internal |
| Hazardous Area Version - Model CS672A01 | |
| Certifications (CSA Approved) | CI I, Div 2, Groups A, B, C, D T4 |
| Enclosure Material | Polyester |
| Dimensions | 10.24" x 3.54" x 6.30" |
| Weight | 5.2 lbs (2.4 kg) |
| Cord Grips | 10, M16 |
| * All specifications for the CS version are identical to the base model unless noted differently above | |



| Echo® Receiver - Model 673B01 | |
|--------------------------------------|--|
| Performance | |
| MAC Address | Unique and Factory Set |
| IP Address | Dynamic or Static via Programming |
| Sensors per receiver | 400 at 3 Transmissions/Day, 1% miss |
| | 1200 at 1 Transmission/Day, 1% miss |
| Electrical | |
| Power | 110 VAC with supplied adaptor |
| Environmental | |
| Enclosure Rating | IP67 NEMA 1, 2, 4, 4x, 12, 13 |
| Temperature Range | -6 to 138 °F -21 to +59 °C |
| Physical | |
| Enclosure Material | Die Cast Aluminum |
| Dimensions | 7.87" x 6.65" x 1.97" (199.9 x 168.9 x 50.0 mm) |
| Weight | 2.37 lb (1.08 kg) |
| Power Connector | Bayonet Multi-pin MIL |
| Programming Connector | Bayonet Multi-pin MIL |
| Ethernet Connector | RJ-45 |
| Antenna Connector | N-female |

| SYSTEM INFORMATION | |
|--|--|
| Data received per transmission | |
| Date | MM/DD/YYYY |
| Time | HH:MM:SS |
| Vibration | |
| 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 |
| Sensor | |
| 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) |
| Radio Specifications | |
| Radio Standard | Proprietary Extended Range RF |
| Modulation | Narrowband FSK |
| Transmission Range | Line-of-Sight tested up to 5 miles 1000 ft to 1/2 mile in typical industrial environments |
| Transmission Interval | Programmable, 1 min to 24 hrs (Default of 8 Hours) |
| Certifications* | FCC: ZOC-IMI67XXXX, IC: 9732A-IMI67XXXX |
| Radio Sensitivity | -145 dBm |
| Frequency Band | 902 - 928 MHz ISM Band |
| Number of RF Bands | 12 Independent Band Options |
| Maximum Power (ERP) | 0.75 mW |
| RF Data Rate | 20 bps |
| *Not Stored in Microsoft SQL Database *XXXX* Represents Various Model Numbers | |



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