Now Class 1, Division 2 Approved For Use in Hazardous Areas!

Echo® Wireless Vibration Monitoring System

A Simple, Affordable, Effective Wireless Vibration Monitoring System

IMI SENSORS
A PCB PIEZOTRONICS DIV.

visit us at www.imi-sensors.com ☎ Toll-Free in the USA 800-959-4464 ☎ 716-684-0003

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.

- Easily integrates with legacy vibration and plant monitoring systems via Modbus®
- Eliminates expensive cable runs
- Transmits long distances
- Runs standalone or with junction box
- Stores data in ODBC format
- Requires no repeaters, gateways, or mesh
- **Class 1, Division 2 Certified for use in hazardous areas!**

Performance

The Echo® Wireless Vibration Monitoring System has been tested and found to perform particularly well in a number of different types of plants including: power, steel, food processing, paper, chemical and automotive. The system has performed reliably and provided accurate and useful data regarding machinery health.

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.

The four primary measurements that the Echo® system transmits are:

- RMS Velocity - for "Balance-of-plant" faults such as imbalance, misalignment and flow problems
- RMS Acceleration - for higher frequency faults and high frequency energy (HFE) detection such as high speed gear mesh, broken rotor bars and loss of bearing lubrication
- True Peak Acceleration - for bearing, gear and impulsive faults, including looseness
- Crest Factor - for fault severity indication

Echo® Wireless Vibration Monitoring System

Echo® Wireless Vibration Sensor

Wireless Vibration Sensor

Model 670A01

- Transmits long distances
- Eliminates expensive cable runs
- Installs easily
- **Class 1 Division 2 Certified Version Available (Model CS670A01)**

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.

Echo® Wireless Vibration Monitoring System

EchoPlus® Wireless Junction Box

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
- **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 as Echo® 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 now even more versatile with the hazardous certification option. The new CS672A01 can be paired with hazardous certified ICP® accelerometers (such as EX603C01) 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.

Echo® Wireless Receiver

Receiver
Model 673A01

- 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. 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.

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Wireless Remote
Model 070A99

EchoPlus® Remote Trigger
Model 070A97
(pictured with EchoPlus® Wireless Junction Box)

EchoPlus REMOTE TRIGGER

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

The Perfect Method to Collect Vibration Data On:

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

EchoPlus® Wireless Junction Box

Ideal sensors for use with EchoPlus®
(Model 672A01)

Low Cost Side Exit ICP® Accelerometer
Model 602D01

Low Cost ICP® Accelerometer
Model 603C01

Low Cost ICP® Accelerometer with Integral Cable
Model 608A11

Ideal sensors for use with EchoPlus® For Hazardous Locations
(Model CS672A01)

Class I, Div. 2 Low Cost Side Exit ICP® Accelerometer
Model EX602D01

Class I, Div. 2 Low Cost ICP® Accelerometer
Model EX603C01

Class I, Div. 2 Low Cost ICP® Accelerometer with Integral Cable
Model EX608A11

Echo® Wireless Vibration Monitoring System

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.

Direct point to point transmission typical distance = 1/3 to 1/2 mile radius

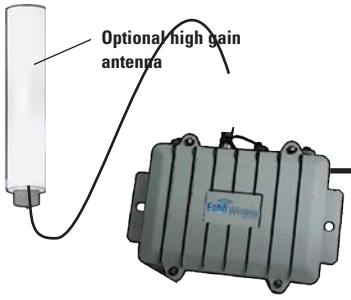
Actual distances can vary widely based on conditions

Receiver has DHCP or static IP addressing

Typical Configuration 1*

EchoPlus® Wireless Junction Box

See page 4 for more information



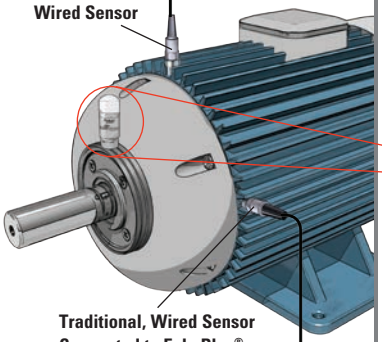
Process 24 VDC power or 6-13 VDC battery power

Echo® Receiver

See page 4 for more information

*Model CS672A01 has additional installation requirements in hazardous areas. Consult product manual for further detail.

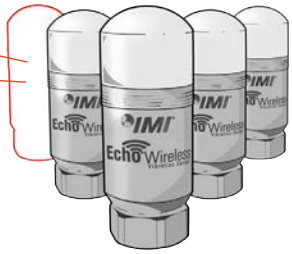
Monitored Machinery

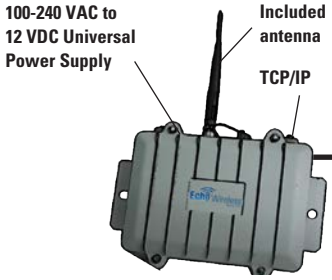


Typical Configuration 2

Echo® Wireless Vibration Sensors

See page 3 for more information





Echo® Receiver

See page 4 for more information

Vibration Analysis Using Data Collector

EchoPlus® Wireless Junction Box & Echo® Wireless Vibration Sensor

Data collector connects directly to:

- EchoPlus® Wireless Junction Box via standard BNC connector

See page 4 for more information

Wireless transmission stops while analog acceleration output is acquired via BNC. After handheld data collection, device returns to regular transmission schedule.

Transmissions temporarily paused during handheld data collection

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Echo® Monitoring Software

See page 8 for more information

Echo® Data Client Service

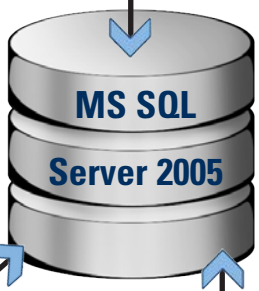
- Collects transmission
- Formats data
- Stores in database
- Generates alarm email
- With optional integrated Modbus® TCP/IP Server interface

Echo® Data Presentation SW

- Trend plots
- Status
- Alarms
- Reports
- Echo® sensor configuration utilities

Echo® Sensor Data

Ethernet **TCP/IP**



All monitor stations, either through LAN or remote access, have all the same functionality as server system, but do not store data.

Echo® Data Presentation SW

Access to SQL Database through internet with LAN

- Trend plots
- Status
- Alarms
- Reports
- Sensor configuration

Echo® Data Presentation SW

Access to SQL Database through internet with VPN

- Trend plots
- Status
- Alarms
- Reports
- Sensor configuration

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.

Monitor Your Entire Plant At-A-Glance!

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

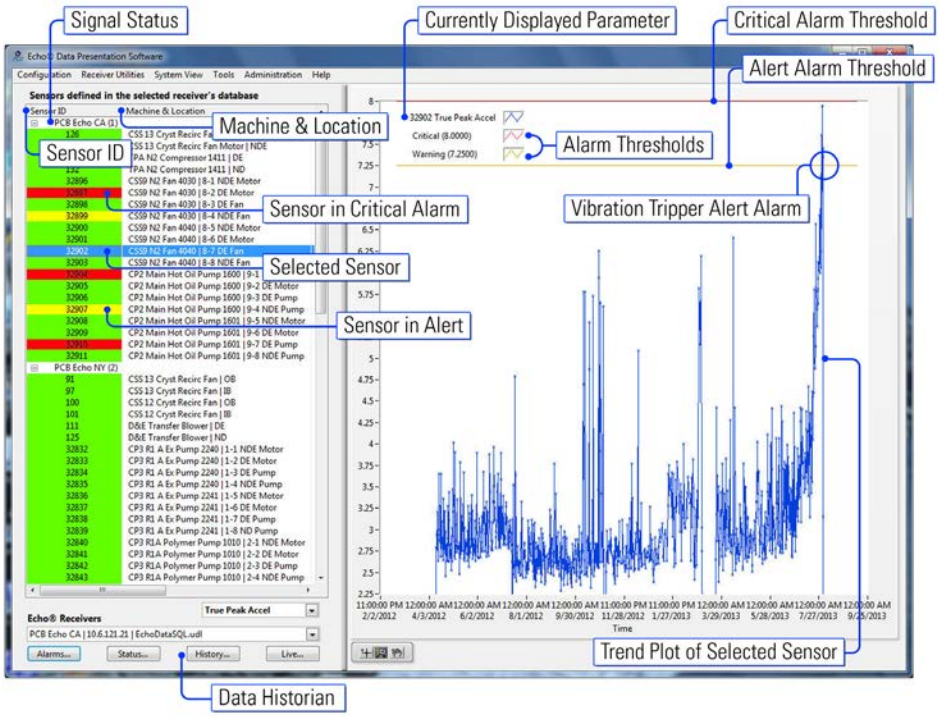
- Installs locally or on a server

  (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

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 senor configuration utilities with administrative access



Sensor Vibration Alarm Panel & Vibration Trend Plot Screenshot

Echo® Monitoring System Overview Screenshot

Echo® Wireless Vibration Monitoring System Specifications

- System Information
- Echo® Wireless Vibration Sensor
- EchoPlus® Wireless Junction Box
- Echo® Receiver

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)

*Not Stored in Microsoft SQL Database

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

*"XXXX" Represents Various Model Numbers

All specifications are at room temperature unless otherwise specified

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Echo® Wireless Vibration Monitoring System

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 627A01

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 Individual, M16

*** All specifications for the CS version are identical to the base model unless noted differently above**

Echo® Receiver - Model 673A01

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	MIL-STD-810, Method 506.4, Procedure 1
	MIL-STD-810F, Method 510.4, Procedures 1&2
Temperature Range	-27 to 120 F (-33 to 49 C)
Physical	
Enclosure Material	Die Cast Aluminum
Dimensions	8.4" x 7.2" x 2.1"
Weight	2.84 lb (1.23 kg)
Power Connector	Bayonet Multi-pin MIL
Programming Connector	Bayonet Multi-pin MIL
Ethernet Connector	RJ-45
Antenna Connector	N-female

Visit www.imi-sensors.com for complete specifications and product manuals

Echo® Wireless Accessories

- Programming and antenna cables
- Multiple antenna options
- Replacement batteries
- Sensors for EchoPlus®

Echo® Replacement Battery Kit
Model 073A20

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

900 MHz Antenna, 8 dBi
Model 070A91

- 800/900 MHz, 8 dBi omnidirectional antenna

900 MHz Antenna, 6 dBi
Model 070A90

- 800/900 MHz, 6 dBi omnidirectional antenna

Echo® Mobile
Portable Wireless Vibration Monitoring System

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.

Typical Applications Include:

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

IDEAL FOR MINING APPLICATIONS

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Website www.imi-sensors.com

ISO 9001 CERTIFIED ■ A2LA ACCREDITED to ISO 17025

IMI-ECHO-1116

Printed in U.S.A.

IMI Sensors designs and manufactures a full line of accelerometers, sensors, vibration switches, vibration transmitters, cables and accessories for predictive maintenance, continuous vibration monitoring, and machinery equipment protection. Products include rugged industrial ICP® accelerometers, 4-20 mA industrial vibration sensors and transmitters for 24/7 monitoring, electronic and mechanical vibration switches, the patented Bearing Fault Detector, high temperature accelerometers to +1300 °F (+704 °C), 2-wire Smart Vibration Switch, and the patented Reciprocating Machinery Protector. CE approved and intrinsically safe versions are available for most products.

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