



MINING EQUIPMENT MONITORING & PROTECTION SOLUTIONS

RELIABILITY, UP-TIME AND SAFETY

Mining operation involves a variety of heavy rotating machinery that is used for exploration and processing of precious metals, minerals and material extracted from the earth. This industrial machinery is subjected to moderate, and in some cases, extreme vibration levels while in use. It's critical to trend these vibration levels to ensure equipment health reliability and to avoid unscheduled downtime.

IMI Sensors offers a full line of piezoelectric accelerometers, wireless solutions, transmitters, switches, enclosures, microphones, sound level meters, cable assemblies and accessories that are used within the mining industry to safely monitor and protect critical rotating assets.

RELIABILITY VIBRATION

- Underground (MSHA and ATEX M1 Approved Sensors)
- Hazardous Approved Sensors, Transmitters & Switches
- Sensors for Harsh, Corrosive & High Temperature Environments
- Wireless Solutions for Dangerous and Hard to Reach Areas
- General Purpose Sensors, Transmitters & Switches

INDUSTRIAL HYGIENE

- Worker Safety Products
- Environmental & Handheld Equipment
- Wireless Telemetry
- Acoustic Calibrators

ACCESSORIES

- Cable Assemblies & Connectors
- Safety Equipment
- Enclosures
- Mounting Hardware
- Portable Reference and Calibration Units

HAZARDOUS AREA APPROVALS

For use in hazardous areas, the "EX" prefix designates a vibration sensor compliant with the National Electric Code (North America) and the ATEX directive (Europe), when used with a properly installed, intrinsic safety barrier in environments shown on the table below.

HAZARD LEVEL		
Presence of ignitable substances under normal operating conditions	Division Scheme	Zone Scheme
Continuous	Division 1	Zone 0 / Zone 20
Intermittent		Zone 1 / Zone 21
Unlikely	Division 2	Zone 2 / Zone 22

ATMOSPHERE GROUPS			
Substance	Hazard Class	Division Scheme	Zone Theme
Acetylene	Class I Gases	Group A	IIC
Hydrogen		Group B	IIB+H2
Ethylene		Group C	IIB
Propane		Group D	IIA
Methane		Group D	IIA
Combustible Metal Dusts	Class II Dusts	Group E	IIIC
Combustible Carbonaceous Dusts		Group F	IIIB
Combustible Dusts Not in Groups E or F (Flour, Grain, Wood)		Group G	IIIB
Combustible Fibers and Flyings	Class III Fibers & Flyings	N/A	IIIA



UNDERGROUND MINING APPROVED SENSORS

Mining is inherently a dangerous industry where the health and safety is of the utmost importance to the miners and their organizations. Thus, the mining industry has invested a great deal of time and money to develop safety procedures and training to assure the health of their miners. Within the United States, The Mine Safety and Health Administration (MSHA) is dedicated to “Protecting Miners” by developing regulations that will assure the health and safety of the US miners. Organizations like MSHA are also found in other countries and like MSHA, have developed strict regulations and guidelines to assure the safety and well being of their miners. For underground mining where methane gas can present the possibility of an explosive atmosphere, IMI Sensors offers Mine Safety and Health Administration (MSHA) and ATEX Approved intrinsically safe accelerometers.

- Ideal for route-based PdM data collection
- High frequency response up to 15 kHz ($\pm 3\text{dB}$)
- 2-pin MIL or integral cable options available



MSHA APPROVED PRECISION ICP® ACCELEROMETER

MODEL MS622A01 & MS622A11

- MSHA compliant limits for sensor power, temperature and seal
- Certified to MSHA Designation: Sensor Class K

ATEX MINING APPROVED PRECISION ICP® ACCELEROMETER

MODEL EX622B01 & EX622B11

- ATEX compliant limits for sensor power, temperature and seal
- Certified to ATEX Designation: I M1 Ex ia

SENSORS FOR HAZARDOUS AND EXTREME ENVIRONMENTS

Mining equipment reliability monitoring now requires instrumentation that is approved for hazardous environments. In addition to underground mining approved sensors (MSHA), IMI® has a full line of PdM sensors and related technologies, such as intrinsic safety barriers that, when used together, will meet CSA, ATEX, and IECEx approvals.



PRECISION ACCELEROMETER

MODEL EX622B01 & EXHT622B01

- High frequency response 15 kHz (+/- 3dB)
- Sensitivity (+/-5%) 100 mV/g
- High temperature option



PRECISION ACCELEROMETER

MODEL EX625B01

- High frequency response 10 kHz (+/- 3dB)
- Sensitivity (+/-5%) 100 mV/g



TOP EXIT ACCELEROMETER

MODEL EX628F01

- Quartz sensing element
- Thermo stability (sudden temperature change)



COMPACT ACCELEROMETER

MODEL EX603C01

- Small installation footprint
- IMI's most popular top-exit low cost general purpose accelerometer



SIDE EXIT ACCELEROMETER

MODEL EX602D01

- Low profile thru bolt design
- IMI's most popular side-exit low cost accelerometer



SWIVELER® ACCELEROMETER

MODEL EX607A11

- Submersible / extremely low profile
- Patented swivel mount



FULLY-SUBMERSIBLE ACCELEROMETER

MODEL EX608A11

- Extremely small installation footprint



TRIAxIAL ACCELEROMETER

MODEL EX604B31

- Triaxial design (horizontal, vertical & axial measurement directions)
- Low profile thru bolt design

SENSORS FOR CORROSIVE AND HIGH TEMPERATURE ENVIRONMENTS

In harsh, caustic, or high temperature areas, IMI Sensors offers a series of industrial ICP® sensors and cable assemblies that will withstand these rigorous environments. Cables and connectors made of material such as PTFE and FKM are available for higher temperature and/or caustic mining environments. Industry exclusive, ICP® sensors are available with temperature ratings up to 325 °F (162 °C). For temperatures greater than 325 °F (162 °C), IMI® has designed charge output sensors with inline electronics and appropriate cable assemblies that can hold up to temperatures up to 1200 °F (649 °C).



CE

HIGH TEMPERATURE ICP® ACCELEROMETER

MODEL HT622B01

- Temperature response up to 325 °F (162 °C)
- High frequency response 15 kHz (+/- 3dB)



CE



HIGH TEMPERATURE ICP® ACCELEROMETER

MODEL HT602D01

- 2-pin MIL connector
- Industry Exclusive temperature response up to 325 °F (162 °C)



CE

HIGH TEMPERATURE ICP® ACCELEROMETER

MODEL HT628F01

- Temperature response up to 325 °F (162 °C)
- Quartz sensing element for better thermo stability

HIGH TEMPERATURE OR CORROSIVE RESISTANT CABLE ASSEMBLIES



CE

MOLDED COMPOSITE 2-SOCKET MIL-STYLE TO BLUNT CUT

MODEL 055PAXXBZ

- 2-conductor twisted pair, shielded
- 2-Pin MIL molded straight composite connector with blunt cut termination



CE

MOLDED COMPOSITE RIGHT ANGLE 2-SOCKET MIL-STYLE TO BLUNT CUT

MODEL 055PBXXBZ

- 2-conductor twisted pair, shielded
- 2-Pin MIL molded right angle composite connector to blunt cut



CE

FKM ENVIRONMENTAL PUSH-ON BOOT 2-SOCKET MIL-STYLE TO BLUNT CUT

MODEL 055M05/XXX

- 2-conductor twisted pair, shielded,
- Ideal for corrosive environments, and temperatures up to 250 °F (121 °C)

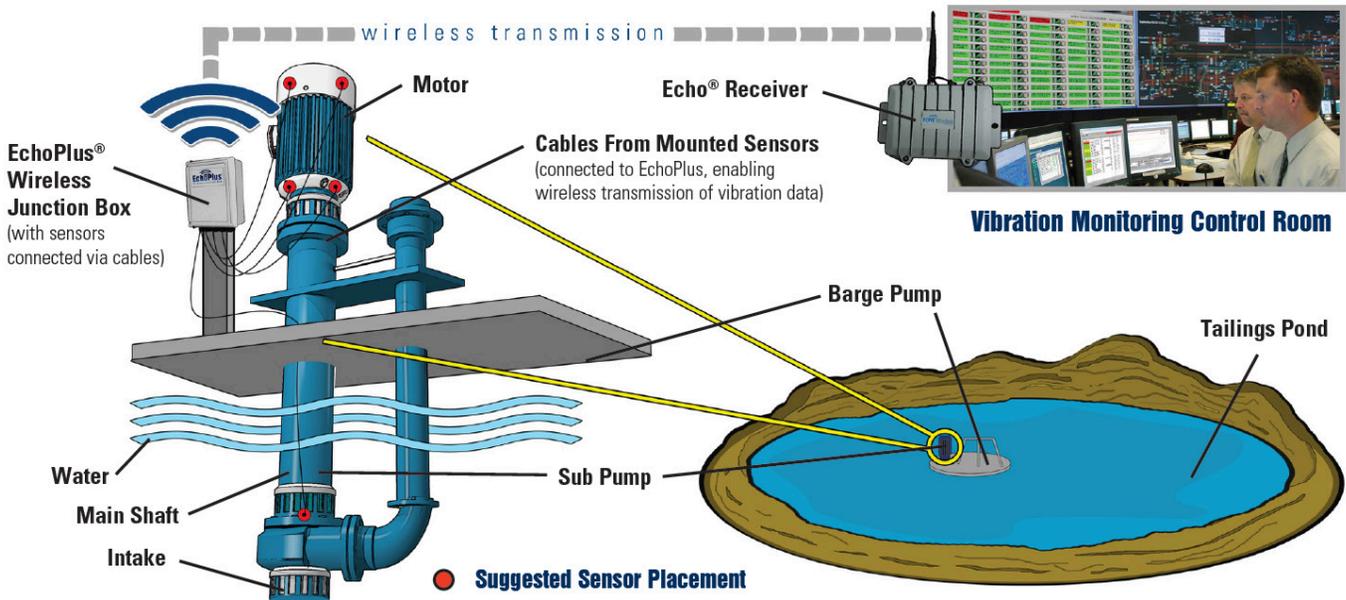
WIRELESS VIBRATION MONITORING FOR MINING APPLICATIONS

Why have people risk injury and venture into unsafe areas to collect vibration data on healthy machines? IMI Sensors offers the Echo® Wireless Vibration Monitoring System that can automatically collect machinery health data in dangerous areas without having a miner venture into those areas. Using this alarm based system, personal intervention is only required when the system identifies a problem.

- Easily integrates with legacy vibration and plant monitoring systems via Modbus®
- Eliminates expensive cable runs
- Transmits distances of 1/3 - 1/2 miles in typical industrial environments, through obstructions (Up to 5 mile radius in direct line-of-sight tests)
- Temperature monitoring available
- Runs stand alone or with junction box
- Stores data in an ODBC compliant database
- Requires no repeaters, gateways, or mesh

WIRELESS MONITORING OF PUMPS IN TAILINGS PONDS

Barge pumps in tailings ponds are critical to the operation of a mine. These ponds can be very acidic and dangerous, as well as inaccessible, which is why most plants don't monitor them. Because it takes a host of people, safety gear, and a lot of time to get a crew safely to the pump to take vibration readings, the Echo® Wireless Vibration Monitoring System can be used to safely collect machinery health data.

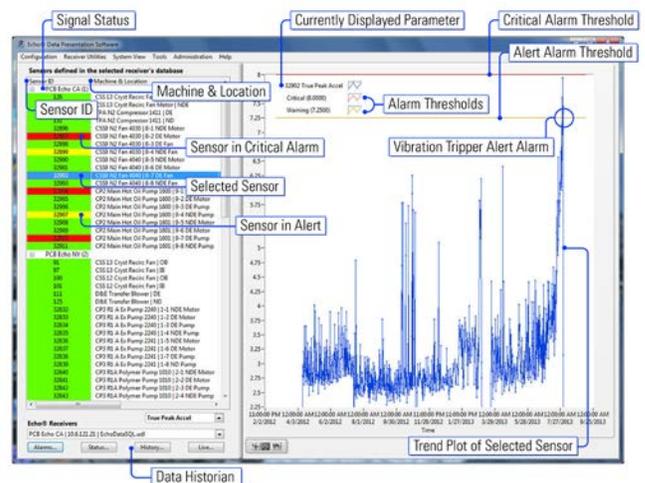
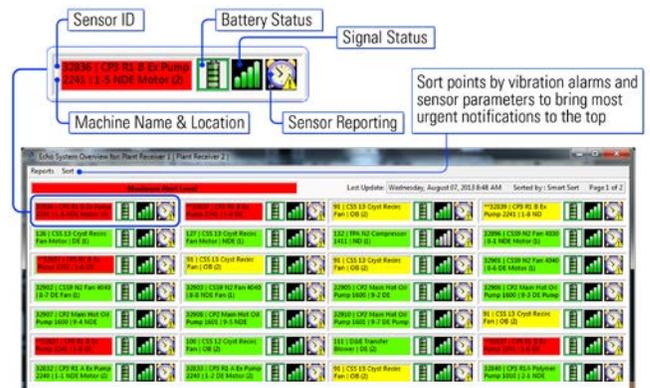




ECHO WIRELESS MONITORING SOFTWARE:

- **Vibration Alarm Panel:** See your machine health at-a-glance for all vibration sensors from a single receiver, as well as machine name and location details.
- **Vibration Trend Plot:** View and analyze the trend history and alarm levels of a single parameter for any sensor.
- **System Overview:** See your machine health and sensor status at-a-glance in a graphical presentation for all sensors and receivers.
- **Email Alerts:** Receive alerts about your machine's health and vibration level wherever you are, so you can always be on top of the situation.

This data is also stored in a Microsoft SQL database and can also be input to a PLC or DCS using a Modbus® communication interface. Contact IMI® to discuss software feature details and additional data interface options.



4-20 mA TRANSMITTERS & VIBRATION SWITCHES

Continuous monitoring and protection of critical assets has become a common practice in today's mining industry. IMI Sensors meet these continuous monitoring needs by offering a series of transmitters, switches and detectors that can be integrated within a facility's control room to monitor critical machinery parameters 24-7.



4-20 mA TRANSMITTER

SERIES 640X

- 24V loop powered that interfaces directly with a PLC, DCS and SCADA systems
- Multiple ranges available
- Peak or RMS, acceleration or velocity output options
- Explosion proof versions available



BEARING FAULT DETECTOR

MODEL 682C05

- Provides early warning of rolling element bearings (RFB) faults
- Outputs 4-20 mA signals for peak acceleration and overall unbalance vibration
- Requires ICP® accelerometer input



4-20 mA TRANSMITTER

MODEL 682C03

- Outputs 4-20mA signal proportional to acceleration, velocity, or displacement
- Requires ICP® accelerometer input
- Analog vibration output via BNC allows point to be used in PdM route
- Not USB Programmable

VIBRATION SWITCHES



LINEAR ADJUST MECHANICAL VIBRATION SWITCH

SERIES (EX)685AX9

- ATEX, IECEx, & CSA approvals available
- Fully adjustable linear sensitivity technology provides superior trip accuracy
- Manual and remote reset options offered



ELECTRONIC VIBRATION SWITCH

SERIES 685B

- Dual set points with individual alert and alarm relays
- On-board or external ICP® accelerometer options available
- Optional analog vibration output via BNC ideal for PdM routes



USB PROGRAMMABLE SMART SWITCH

SERIES (EX)686

- Hazardous area approved options
- USB programmable alarm thresholds, relay action (NO, NC) and 3 time delays
- Hermetically sealed to hold up to harsh environments



PORTABLE CALIBRATORS



CE

HANDHELD VIBRATION SHAKER

MODEL 699B02

- Can perform up to 1,600 operating cycles in field without loss of battery power
- Calibrates permanently mounted accelerometers at the machine
- Confirms operation of cables, switching devices, and monitoring systems
- Meets NIST traceability requirements
- Outputs 1g pk or rms; operates at 159.2 Hz
- Accepts sensors up to 250 gm (8.8 oz)



CE

PORTABLE VIBRATION CALIBRATOR

MODEL 699B06

- Small and completely self-contained, ideal for field check of accelerometers, velocity transducers and proximity probes
- Ruggedized, weatherproof enclosure dramatically improves durability and portability
- Battery-powered unit offers extended life and enhanced protection against full discharge
- Precision quartz reference accelerometer and conditioning electronics for superior control and stability
- Provides NIST traceable transducer verification across a wide frequency and amplitude range

NOISE EXPOSURE & MONITORING

WORKER EXPOSURE - MSHA & OSHA COMPLIANCE

Mines can be a very noisy environment where employers have a responsibility to protect workers from noise induced hearing damage. To help access the noise exposure risk and verify the effectiveness of a hearing protection program, Larson Davis offers a line of noise dosimeters, sound level meters, and software to measure noise exposure. Because exposure to vibration has also been shown to be a health risk, we offer the HVM100 with all the necessary sensors to measure human exposure to vibration.



HUMAN VIBRATION MONITOR

MODEL HVM100

- Whole body vibration monitoring
- Hand-arm vibration monitoring
- Complete line of sensors and software



INTRINSICALLY SAFE NOISE DOSIMETERS

MODEL 706RC, 705+, 703+X

- UL913 and MSHA approvals
- Proven, reliable technology
- Durable, strong metal housing (Model 705+)

MINING NOISE MONITORING - NOISE EMISSION IN RESIDENTIAL AREAS

Designed with the needs of the safety officer in mind, SoundTrack includes the features you need to ensure your hearing protection program is adequate for protecting workers and complying with regulations. Because SoundExpert is fully compliant with sound level meter standards and ships fully calibrated, you can trust the results.



NOISETUTOR NMS

MODEL NMS021

- Available in Class 1 or Class 2
- Dose and exposure computation & SLM Utility G3 software included
- USB interface to control data download



NOISETUTOR NMS

MODEL NMS021

- Class 1 sound level meter compliant with IEC 61672-1 and ANSI S1.4
- Demonstrate compliance with noise emission requirements
- WiFi or cellular network access for real time data
- Publish noise data to your website, and email and SMS alerts for noise events
- Data automatically sent to your server
- Options to record event sound and/or continuous sound

WIRELESS TELEMETRY FOR MINING APPLICATIONS - ROTOR MEASUREMENTS OF DRIVESHAFT TORQUE & MOTOR TEMPERATURE

An RF power supply in the receiver provides power to the primary coil of an RF air gap transformer (the stationary pickup). The transmitter receives this power by secondary coils embedded inside the transmitter housing, and provides DC power to the strain gage sensor on the shaft and to the transmitter electronics. The strain gage converts shaft strain to mV output, which is amplified, anti-alias filtered, and digitized before transmitting the data to the receiver. The receiver outputs a +/- 10 V analog signal, thereby providing a direct measurement of the shaft strain (which is used to indicate the torque).



AT-4500 EASYAPP

- Ideal for torque monitoring of large vehicle driveshafts (mill driveshaft & coupling)
- Continuously monitors stress levels in drivetrain components by wireless reporting of strain gage measurements-- maximizing production output
- Measurement feedback can be used to pinpoint causes of damage by understanding mean and transient torsional stresses.
- Aramid strap mounting allows easy application to varied shaft diameters.
- The use of induction power allows long term monitoring, regardless of whether the shaft or coupling is at standstill or high RPM.
- Contact us for continuous monitoring of large motor rotor temperatures (via single or multi-channel wireless telemetry) for thermocouple or RTD measurement. Maximize your production throughput, while providing valuable predictive maintenance for your machinery.

SOUNDEXPERT® LXT NMS (NOISE MONITORING SYSTEM) - NMS-SE-RI

The SoundExpert NMS is a great solution for unattended noise monitoring for up to two week using only eight D-cell batteries. When you need to make a site surveys or quick noise level check, the SoundExpert LxT is easily removed and used as a handheld sound level meter. Using the included SLM Utility G3 software, SoundExpert can be fully configured and data downloaded for analysis and reporting.



- Class 1 sound level meter compliant with IEC 61672-1 and ANSI S1.4
- Logging and community noise standard
- Lightweight, compact and affordable
- 2 weeks runtime using eight D-cell batteries
- 1/1 and 1/3 Octave filters standard
- SLM Utility G3 software included
- Designed for unattended, outdoor use in harsh environments
- Made to easily deploy, retrieve and download data
- Traceable calibration so you can trust your data



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