Industrial Vibration Sensors, Switches & Instrumentation

Accelerometers, Vibration Transmitters & Switches, Pressure Sensors and Accessories

IMI SENSORS
A PCB PIEZOTRONICS DIV.

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

IMI SENSORS
A PCB PIEZOTRONICS DIV.

Predictive Maintenance

IMI® Sensors is a global leader in the manufacture of low cost industrial accelerometers for machinery condition monitoring and predictive maintenance requirements. General purpose, precision, low frequency, high frequency, seismic and multi-axis applications are supported with an extensive product offering including piezoelectric accelerometers, cables and accessories.

IMI's industrial accelerometers are relied on throughout the world to help optimize machinery performance and to keep maintenance expense and downtime to a minimum. IMI® serves a wide range of industries, including those with intrinsically safe requirements; virtually all of our products are available with certifications for us in hazardous areas through ATEX and CSA.

Energy & Power Generation

IMI® Sensors specializes in the design and manufacture of innovative sensors and associated signal conditioning instrumentation to meet the demanding requirements of the energy, power generation, reciprocating equipment, oil & gas and petrochemical industries.

In particular, IMI's instrumentation is ideally suited to detect and measure dynamic pressure and vibration of gas turbines in extreme heat environments. Our high temperature pressure sensors and accelerometers are intrinsically safe for measuring combustion dynamics and vibration levels in gas turbines.

Process Monitoring & Protection

IMI's line of 4-20 mA vibration transmitters will interface directly with your PLC, DCS or SCADA system so data can be easily monitored and analyzed. Our electronic vibration switches and smart switches eliminate false trips, making it a technically superior option to traditional mechanical switches.

IMI's impact detection products offer the ultimate machine protection, including the Bearing Fault Detector, which provides early warning of impending bearing failure. In addition, IMI's DIN rail devices are designed to facilitate vibration monitoring with equipment that is familiar to the process control technician. Signals representing overall vibration levels are monitored with threshold points providing the judgment for alarm, control, or shutdown.

Table of Contents

IMI Sensors: A Division of PCB Piezotronics, Inc.

IMI® industrial sensors are used to spot imbalance, bearing faults and misalignment by measuring machine vibration, providing early fault diagnosis thus reducing downtime. Our vast product line interfaces directly with data acquisition equipment including online systems and handheld data collectors.

IMI® offers a full line of piezoelectric accelerometers, pressure sensors, velocity sensors, 4-20 mA vibration transmitters, switches, relays, cables, displays and accessories. Virtually all of our products are available with hazardous area certifications through CSA and ATEX. We are proud to state that all of our sensors are made in the USA and backed by our Total Customer Satisfaction policy.

At IMI Sensors we have experienced, dedicated staff members ready and waiting to exceed your expectations. This customer oriented organization makes it easier for you to find the best product and get technical support as fast as possible. Please call our dedicated hotline at any time at 800-959-4464; we look forward to helping you be successful.

IMI Sensors: Product Catalog

Using this Catalog

Welcome to the newest edition of the IMI Sensors Product Catalog. We have made a number of improvements and additions to this catalog that we hope will enhance the usability, as well as provide a valuable resource beyond the purchasing of our products.

This catalog has two main sections (Application and technology) to give you insight beyond the products and into the applications for which they are designed. You will also find helpful "Tips from Techs" throughout the catalog to offer deeper insight into common issues with various applications and product categories.

The third section provides valuable technical information on sensor selection, hazardous area approvals, mounting techniques and sensor construction.

Products By Application

The Application Section of this catalog provides overviews of the most typical applications of IMI Sensors. Each application features products that are proven for the specific needs of the given application. You will also find useful information on the methods for taking measurements, as well as a Sensor Placement Illustration to give you an overview of suggested measurement points for that application. You can also request individual applications in brochure form by contacting an IMI® representative, or by visiting www.imi-sensors.com.

Products By Technology

The Products By Technology Section of this catalog focuses on the different sensing technologies that IMI Sensors offers, grouped by product type (ie: Precision ICP®, Low Frequency ICP®, Pressure Sensors, Cables & Connectors, Enclosures). You will find complete information on each product including: complete specifications, technical drawings and in some cases "actual size" product photographs.

Technical Information

The Technical Section features useful reference materials to assist you in selecting sensors, as well as installation and mounting techniques. The Accelerometer Selection Worksheet will help you choose the right sensor for your needs. You will also find illustrations of typical Industrial Vibration Measurement Systems to provide an overview of the components needed for specific systems.

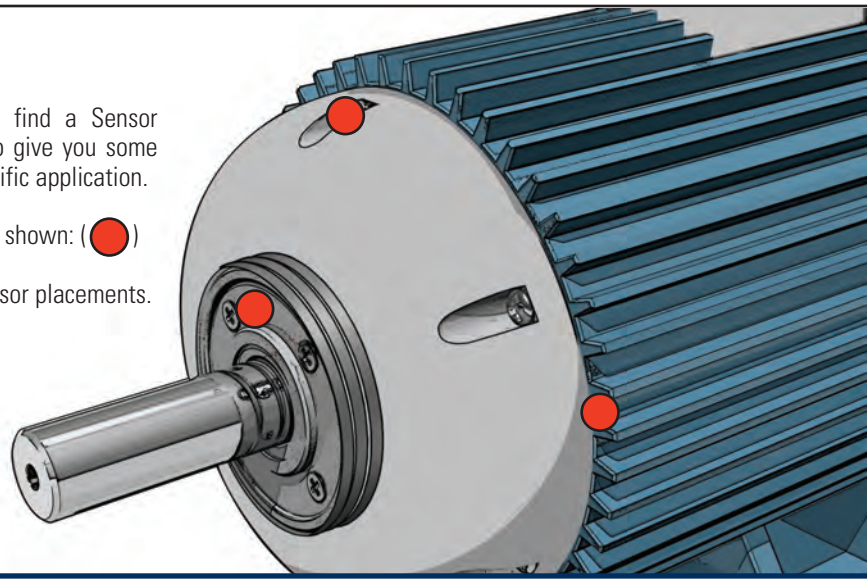
Sensor Placement Illustrations

At the beginning of each application section you will find a Sensor Placement Illustration. These illustrations are designed to give you some insight into some typical measurement points for that specific application.

Suggested sensor placement is indicated using the red dot shown: ( )

Please note that illustrations represent only suggested sensor placements.

Please contact an IMI® application engineer for complete information.



Model Number Index

This index provides page references for accelerometers, signal conditioners and test equipment. For cables, mounting hardware and accessory items, please check the appropriate sections listed in the table of contents.

Red Part Numbers Indicate Platinum Stock Products

PCB® Platinum Products are available with our Lifetime Warranty and fast delivery. If any PCB® Platinum Product ever fails, PCB® will repair, replace or exchange the product at no charge. For U.S. customers orders up to 10 units will ship in three days or less and orders over ten units will ship in thirty days or less. IF NOT, YOUR SHIPPING IS FREE! Visit www.imi-sensors.com for complete details.

Our Platinum products represent some of our most popular models and can be used in a wide range of applications. As you browse this catalog, you will find Platinum products indicated with the "Platinum Shield" icon (right).

IMI Sensors
Model Number Guide

Decoding IMI Sensors' Model Numbers:

Series Number
601, 623, etc.

Revision Number
A, B, C, etc.

Optional Version Prefix
Intrinsically Safe (EX) & Metric (M)
Options are available on most products

Product Technology
Indicates specific division of PCB Piezotronics.

- 0 = Accessory
- 1 = Pressure - Test
- 2 = Strain / Force - Test
- 3 = Vibration - Test
- 4 = Signal Conditioner - Test
- 5 = (Unassigned)
- 6 = Vibration - Industrial

Category

- 0 = Low cost ICP® sensor
- 1 = High temperature charge output
- 2 = Precision ICP® sensor
- 3 = Precision ICP® sensor
- 4 = 4-20 mA sensor
- 5 = (Unassigned)
- 6 = Embeddable sensor
- 7 = Wireless
- 8 = Signal conditioner/ Transmitter
- 9 = Enclosure/shaker

Electrical Connector / Integral Cable Type (Sensors Only)

- 0 = 2-pin MIL
- 1 = Integral polyurethane jacketed cable
- 2 = Integral FEP jacketed cable
- 3 = Bayonet MIL
- 4 = 10-32 top exit
- 5 = 10-32 side exit
- 6 = Integral armored polyurethane jacketed cable
- 7 = Terminal block
- 8 = Mini MIL

Sensitivity
(ICP® Accelerometers Only)

- 0 = 10 mV/g
- 1 = 100 mV/g
- 2 = 500 mV/g
- 3 = 1 V/g
- 4 = 10 V/g
- 5 = 50 mV/g

Example Model Number

Intrinsically Safe Option

Series 603
Low Cost Industrial ICP® Accelerometer

Revision C

Integral 2-pin MIL Cable

100 mV/g

Sensor Options

Option "EX"

ATEX Approved Intrinsically Safe (e.g., EX622A01)

For use in hazardous areas, the CS option designates a vibration sensor certified by the Canadian Standards Association as intrinsically safe, when used with a properly installed, intrinsic safety barrier in environments shown on the table to the right.

CSA Approved Hazardous Environments	
Division 1	**Continuous or Intermittent Hazards**
Class 1	**Gases and Vapors**
Group A	Acetylene
Group B	Hydrogen
Group C	Ethylene
Group D	Methane
Temperature Code T4	**+135 °C Maximum Surface Temperature**

Model 602D01, Model 603C01, Model 607A01, Model 607A11, Model 608A11, Model 607A61
Class I, Div 1, Groups A, B, C, D
Class II, Div 1, Groups E, F, G
Class III, Div 1
Exia IIC T4
AExia IIC T4
Class I, Div 2, Groups A, B, C, D
ExnL IIC T4
AExnA IIC T4
Ex ia IIC T4, -40°C ≤ Ta ≤ 121°C, II 1 G
Ex nL IIC T4, -40°C ≤ Ta ≤ 121°C, II 3 G
GOST-R: 0ExiaIICT4 X

Model 628F01
EEx ia IIC T4, -54 °C≤Ta≤121 °C, II 1 G

Model 640B01, Model 640B02, Model 641B01, Model 641B02, Model EX640B71, Model EX640B72
DIV II, CL I, GRPS A-D, ExnL, AExnA, IIC T4
EEx ia IIC T4, -40 °C≤Ta≤80 °C, II 1 G
EEx nL IIC T4, -40 °C≤Ta≤80 °C, II 3 G
DIV I, CL I, II, III, GRPS A-G, Exia, AExia, IIC T4

Model 686B01, Model 686B02, Model 686B11
Current Rating (Relay Closed) 100 mA
Hazardous Area Approval Cl I, Div 2, Groups A, B, C, D
Ex nL IICT3, AEx nA IICT3 Power Required 10 to 30 VDC
Relay 10 to 30 VDC, 100 mA

Option "M"

Metric Installation (e.g., M603C01)

This option permits installation of the vibration sensor into a tapped hole having a metric thread. It simply designates a change in the supplied mounting stud, screw, or bolt. Metric mounting studs are adaptor studs that have an English thread on the end that screws into the sensor base and a metric thread on the other end that screws into the test specimen. Metric screws or bolts are used for through-hole mounted sensors.

Supplied Accessories for Option "M"

Model 601A01, Model 601A02, Model 608A11, Model 627A01, Model 628F01, Series 640B
Model M081A61 Mounting Stud
1/4-28 to M6 X 1 (1) replaces
Model 081A40

Model 607A11, Model 626B01, Model 626B02
Model M080A159 Mounting stud,
1/2-20 to M6 x 1 (1) replaces Model
080A156

Model 649A01, Model EX649A71
Model M081A61 Mounting Stud
1/4-28 to M6 X 1 (1) replaces
Model 081A41

Model 603C01, Model 622B01, Model 686B01
Model M081A61 Mounting Stud
1/4-28 to M6 X 1 (1)

Model 604B31, Model 605B01, Model 606B01
Model M081A68 Captive mounting bolt
M6 x 1 (1) replaces Model 081A68

Model 607A01, Model 625B02
Model M080A163 (1)
replaces Model 080A162

Model 625B01
Model M081A73 Mounting Bolt
M6 x 1.00 replaces 081A73

Model 602D01
Model M081A97 Captive mounting bolt,
M6 x 1 x 25.4 mm long, hex head (1)
replaces 081A97

Model 624B01
Model M081A67 Captive mounting bolt
M6 x 1 (1) replaces Model 081A67

Model 102
Model 065A40 Seal ring
0.435" OD x 0.397"ID x 0.030"
thk brass (3) replaces Model 118B11

USB Programmable Smart Vibration Sensors

IMI Sensors advances the industry exclusive USB Programmable Vibration Sensors with 2 additional products. The 649A03 4-20 mA output Bearing Condition Monitor offers a high level of bearing fault monitoring in the small package of a typical sensor housing. Five selectable measurement methods and selectable sensing range increase reliability and accuracy in every application. The 649A04 4-20 mA Output Universal Transmitter brings USB programmability to IMI's tried and true current output vibration sensor line. Selectable displacement, velocity, or acceleration measurement coupled with selectable range scaling brings flexibility and "in field" programming.

USB PROGRAMMABLE

Programmable 4-20 mA Universal Transmitter
Model 649A04
See page 123 for more information

Programmable 4-20 mA Bearing Condition Transmitter
Model 649A03
See page 122 for more information

NEW!

Scan with smart phone for more information on new product releases from IMI Sensors

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High Temperature Accelerometers

Get the best high temperature performance of any industrial ICP® accelerometer on the market with IMI's new line of high temperature, low profile sensors. Integral FEP jacketed cable versions are also ideal for acidic applications. IMI's EX600B13 and EX600B14 accelerometers can measure vibration in areas up to 900 °F.

High Temperature Accelerometer with FEP Jacketed Cable
Model HT602D11
See page 100 for more information

High Temperature Accelerometer with Armored Integral Cable
Model HT602D61
See page 100 for more information

High Temperature Accelerometer
Model HT602D01
See page 100 for more information

High Temperature Accelerometer
Model EX600B13
See page 106 for more information

NEW! Industry Exclusive!

Echo® Wireless

Vibration Monitoring System

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☎ Toll-Free in USA 800-959-4464 ☎ 716-684-0003

Forget Cables, Go Wireless!

Wireless Vibration Sensor
Model 670A01

- Batteries last over 5 years
- Transmits long distances
- Eliminates expensive cable runs

See page 142 for more information

Receiver
Model 673A01

- Requires no repeaters, gateways, or mesh
- Outputs to ethernet
- Receives Echo® and EchoPlus® Signals

See page 143 for more information

Product Spotlight

EchoPlus®
Wireless Junction Box

Instantly Converts Installed Sensors to Wireless!

Wireless Junction Box
Model 672A01

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

See page 143 for more information

Products By

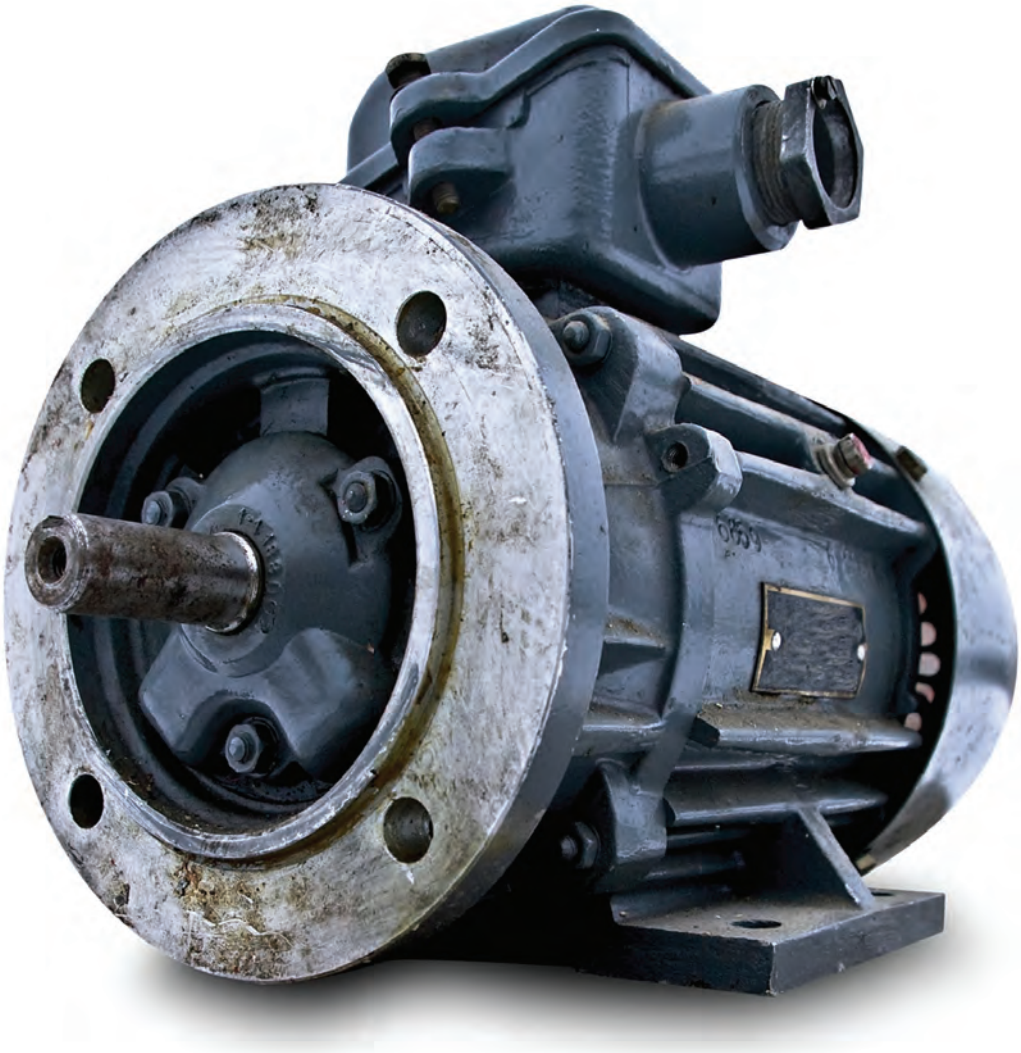
Application

www.imi-sensors.com/sure

Industrial Vibration Measurements?

We Do!™

We do it all - sensors to measure vibration, acoustics, force, pressure, load, strain, shock and torque - Sure we do!



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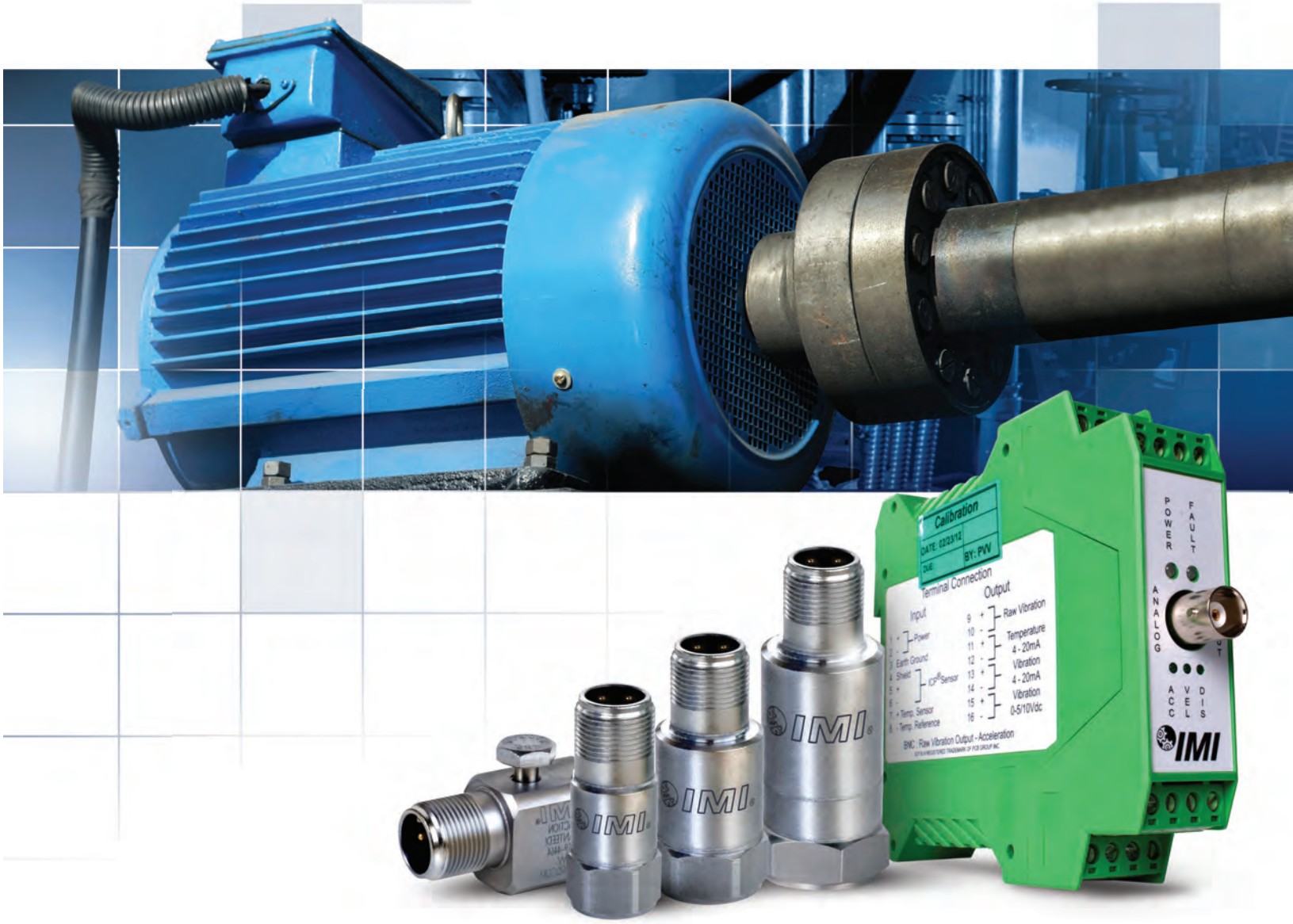
Motor Vibration

Detect Mechanical & Electrical Motor Faults with Vibration Monitoring Instrumentation



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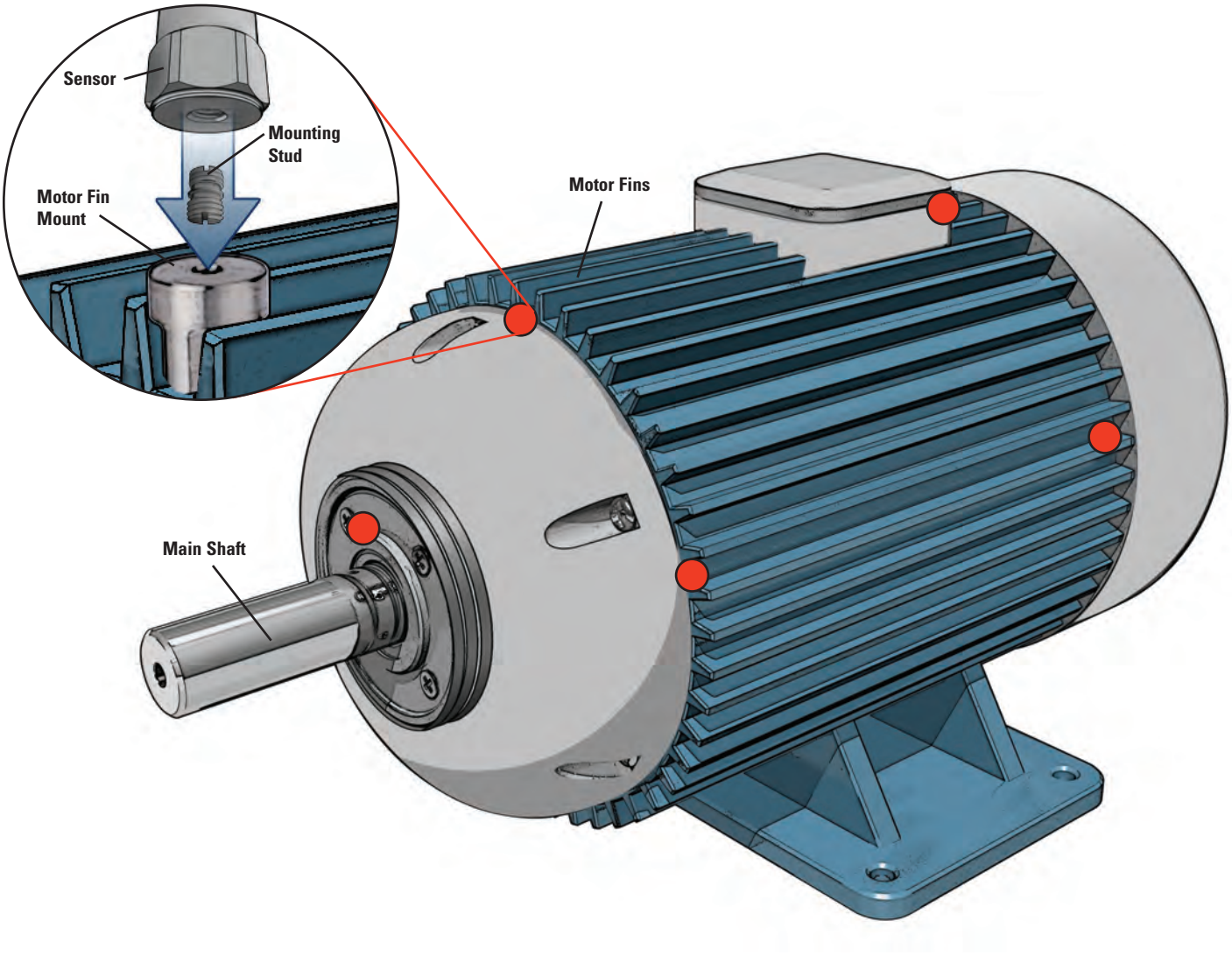
Predictive Maintenance

Motor Vibration

Monitoring vibration on induction motors forms part of the core of any predictive maintenance program. Typical applications demand vibration measurements in the horizontal, vertical and axial direction on both the inboard and outboard motor bearings. Aside from typical mechanical issues, such as misaligned couplings and unbalance, the vibration analyst can also detect electrical issues that cause mechanical vibrations. Some common electrical faults include air gap variation, broken rotor bars and bearing fluting.

Vibration analysts can use one accelerometer, mounted magnetically and rotate it around the motor to capture various data collection points. In some cases the motor is in an inaccessible location and thus permanent mount sensors are used and routed to a junction box for walk up data collection. Accelerometers are permanently mounted by drilling and tapping into the motor housing or they can be adhesively affixed or welded using a mounting pad.



Suggested Sensor Placement

ICP® Accelerometers - Predictive Maintenance

Low Cost ICP® Accelerometer
Model 602D01

- Easy installation in tight spaces
- Through-bolt aides in cable orientation
- Low profile, less than 1 in. height

See page 82 for more information

Low Cost ICP® Accelerometer
Model 603C01

- General purpose, hermetically sealed
- IMI's most popular accelerometer
- Small footprint

See page 82 for more information

Precision Accelerometer
Model 622B01

- Full frequency sweep calibration: 5% sensitivity deviation tolerance
- 15 kHz high frequency response ideal for early detection of bearing fluting conditions
- Ideal for route-based data collection

See page 92 for more information

Product Spotlight

Triaxial Accelerometers

Monitor motor bearing vibration in all three axes with a single accelerometer

Low Cost Triaxial Accelerometer
Model 604B31

- General purpose, hermetically sealed accelerometer
- Perfect for permanent mount applications

See page 90 for more information

Precision Triaxial Accelerometer
Model 629A31

- Ideal for route-based data collection, magnet mount
- Full frequency sweep calibration, superior frequency response

Page 90 for more information

Process Monitoring & Protection

Motor Vibration

Electric motors driving capital machinery and ancillary equipment are critical plant processes. Unscheduled shutdowns or failures result in costly downtime, equipment damage and possible safety hazards for personnel. Although your maintenance engineers can't be everywhere at once, IMI® vibration and fault transmitters provide continuous protection and early detection of issues such as soft foot, imbalance, bearing faults, bearing fluting and misalignment. Using a 4-20 mA signal, our transmitters directly communicate with customer PLC, PI, SCADA, or DCS systems and data can be easily trended, managed, with proper alerts and notifications to keep your process up and running.

4-20 mA Transmitters - Process Monitoring & Protection

Vibration Transmitter

Model 682B03

- Outputs 4-20 mA signal proportional to acceleration, velocity, or displacement
- ICP® accelerometer input
- Analog vibration output via front BNC

See page 121 for more information

4-20 mA Output Sensor

Model 640B01

- Available in top or side exit casings
- Peak or RMS, or velocity
- Intrinsically safe/explosion proof versions available

See page 112 for more information

24 VDC Power Supply

Model 682A01

- 120 to 230 VAC powered
- 1000 mA maximum

See page 154 for more information

DIN Rail Enclosure

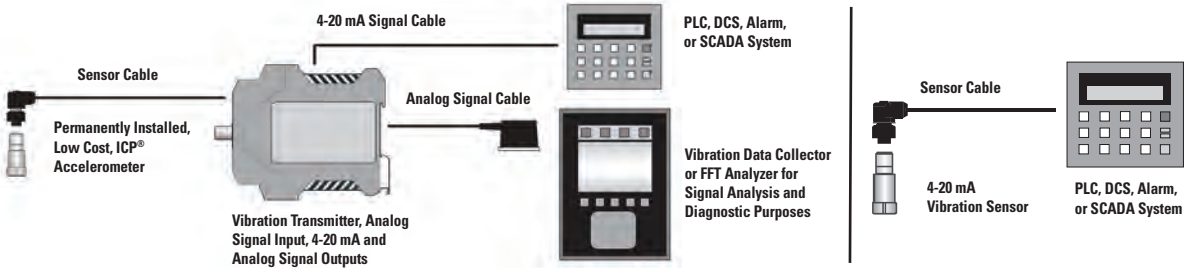
Model 682A00

- Strong fiberglass construction
- NEMA 4X rating

Visit www.imi-sensors.com for more information

Tips From Techs

Recommended Components for a Typical Installation



Bearing Fault Detector - Process Monitoring & Protection

Tips From Techs

Bearing Fluting in Electric Motors

Bearing fluting occurs when current is passed through the motor bearing instead of a grounded source. PWM (Pulse Width Modulated) drive switching frequencies result in undesirable motor shaft currents, a side effect that causes bearing damage including pitting and fluting. The pitting and fluting will result in undesirable bearing vibration. Because the Bearing Fault Detector's additional fault output is extremely sensitive to high frequency impacting, it provides an early indication that pitting or fluting has occurred. This will allow your motor to be serviced before catastrophic damage occurs.

Industry Exclusive!

Bearing Fault Detector

Model 682B05

- Provides early warning of bearing and gear faults
- Operates with PLC, DCS, SCADA, alarm and control systems
- Outputs 4-20 mA signals for peak acceleration and overall vibration

See page 124 for more information

Motor Vibration

Accessories

Cables & Connectors

Polyurethane Cabling with Right Angle MIL-Style Connector
052BQXXXBZ

Polyurethane Cabling with MIL-Style Connector
052BRXXXBZ

FEP Cabling with Right Angle MIL-Style Connector
053BQXXXBZ

FEP Cabling with MIL-Style Connector
053BRXXXBZ

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

Mounting Hardware

Sensor Mounting Pad
Model 080A93: Ø0.75″
Model 080A118: Ø1.0″

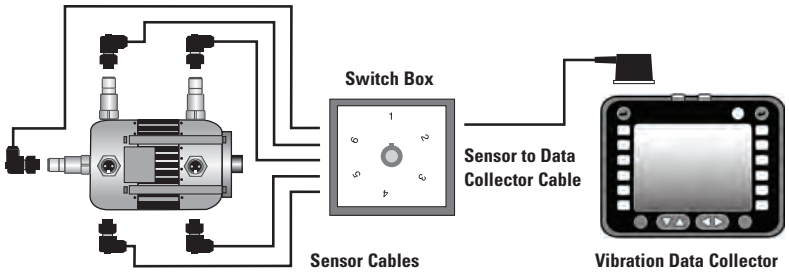
Curved Surface Magnet
Model 080A131: Ø1.0″
Model 080A132: Ø1.5″

Small Adhesive Kit
Model 075A05

Tips From Techs

Typical Inaccessible Motor Monitoring System

Permanently Installed, Low cost ICP® Accelerometers for Axial and Radial Vibration Monitoring



Product Spotlight

BNC Switch Boxes & Termination Enclosures

Safe, Convenient, Centralized Access for Efficient Data Collection

- Consolidate up to 48 channels of outputs into one enclosure
- Switch boxes save time and extend cable life; connect once, change the channel
- Factory installed cord grips provide simple, quick and convenient installation

Pumps & Submersible Pumps

Highlighting Hermetic Sensors for Pump Cavitation, Recirculation & Resonance

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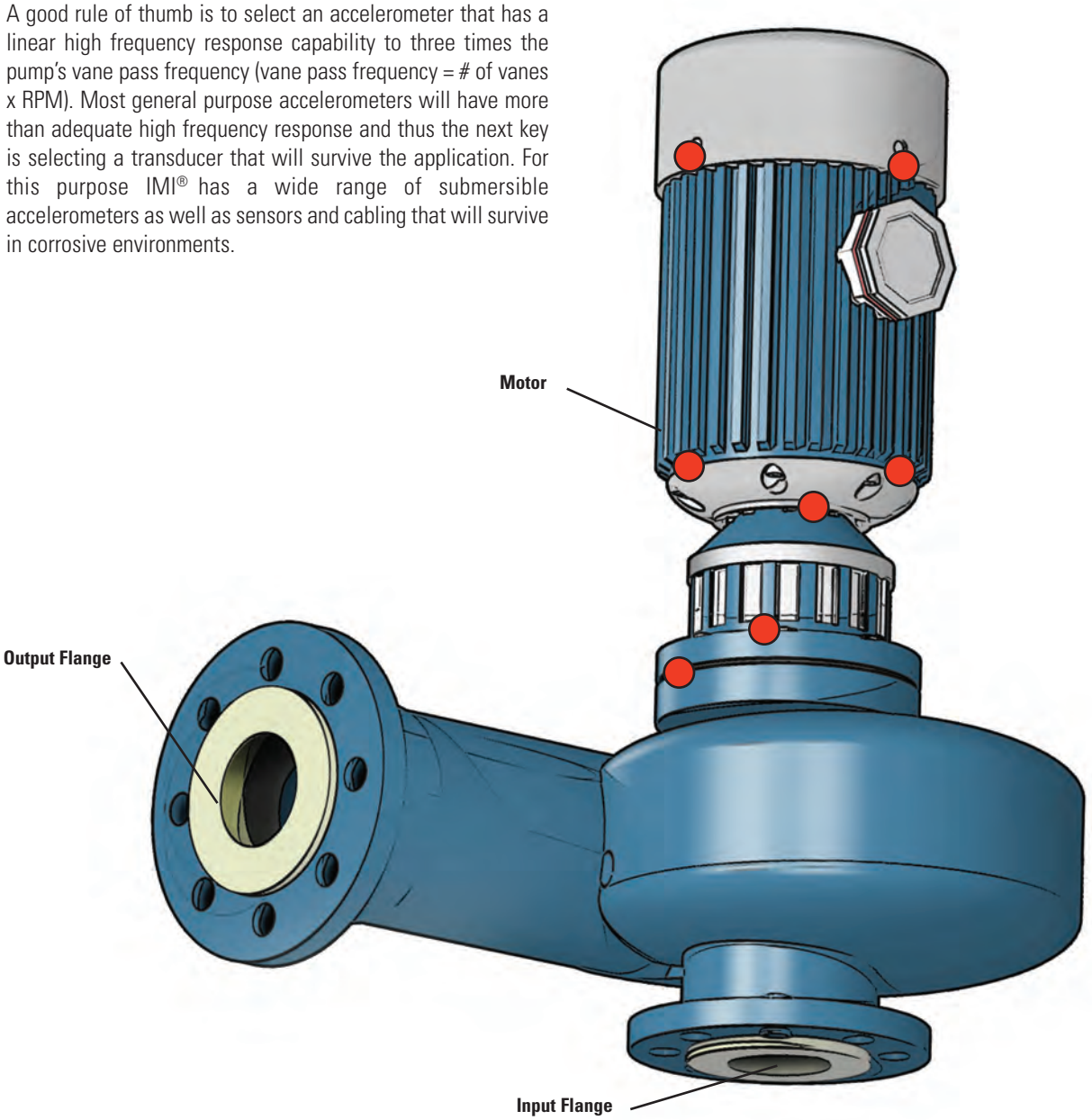
Predictive Maintenance

Pumps & Submersible Pumps

There are dozens of different types of pumps and a seemingly endless list of applications but industrial accelerometers can often help the maintenance professional diagnose sometimes tricky issues with pump operation. Using vibration monitoring in your predictive maintenance program can help identify pump problems such as cavitation, recirculation and resonance.

A good rule of thumb is to select an accelerometer that has a linear high frequency response capability to three times the pump's vane pass frequency (vane pass frequency = # of vanes x RPM). Most general purpose accelerometers will have more than adequate high frequency response and thus the next key is selecting a transducer that will survive the application. For this purpose IMI® has a wide range of submersible accelerometers as well as sensors and cabling that will survive in corrosive environments.



Suggested Sensor Placement

ICP® Accelerometers - Predictive Maintenance

Low Cost ICP® Accelerometer
Series 607A

- Ideal for submersible applications
- Smallest true industrial accelerometer on the market
- Armored integral cable options available

See page 84 for more information

Low Cost ICP® Accelerometer
Model 608A11

- Ideal for submersible applications
- Small installation footprint
- Stock integral cable lengths of **10 ft**, 20 ft, **30 ft** and 50 ft

See page 84 for more information

Tips From Techs

Corrosive Applications

In some cases accelerometers installed on pumps must survive in acidic applications. In these situations its best to use FEP jacketed cables. Special attention should be given to materials used to make the cable connector. For example, polyurethane cable and a connector that uses a silicone boot will degrade rapidly in most corrosive applications. Connectors made out of ryton or FKM are generally recommended for corrosive applications. Please contact an IMI® Applications Engineer for a proper chemical compatibility study.

Sensors for Corrosive Environments - PdM

Low Cost ICP® Accelerometer
Model 603C01

- General purpose, hermetically sealed
- IMI's most popular accelerometer
- Small installation footprint

See page 82 for more information

Accessories for Corrosive Environments

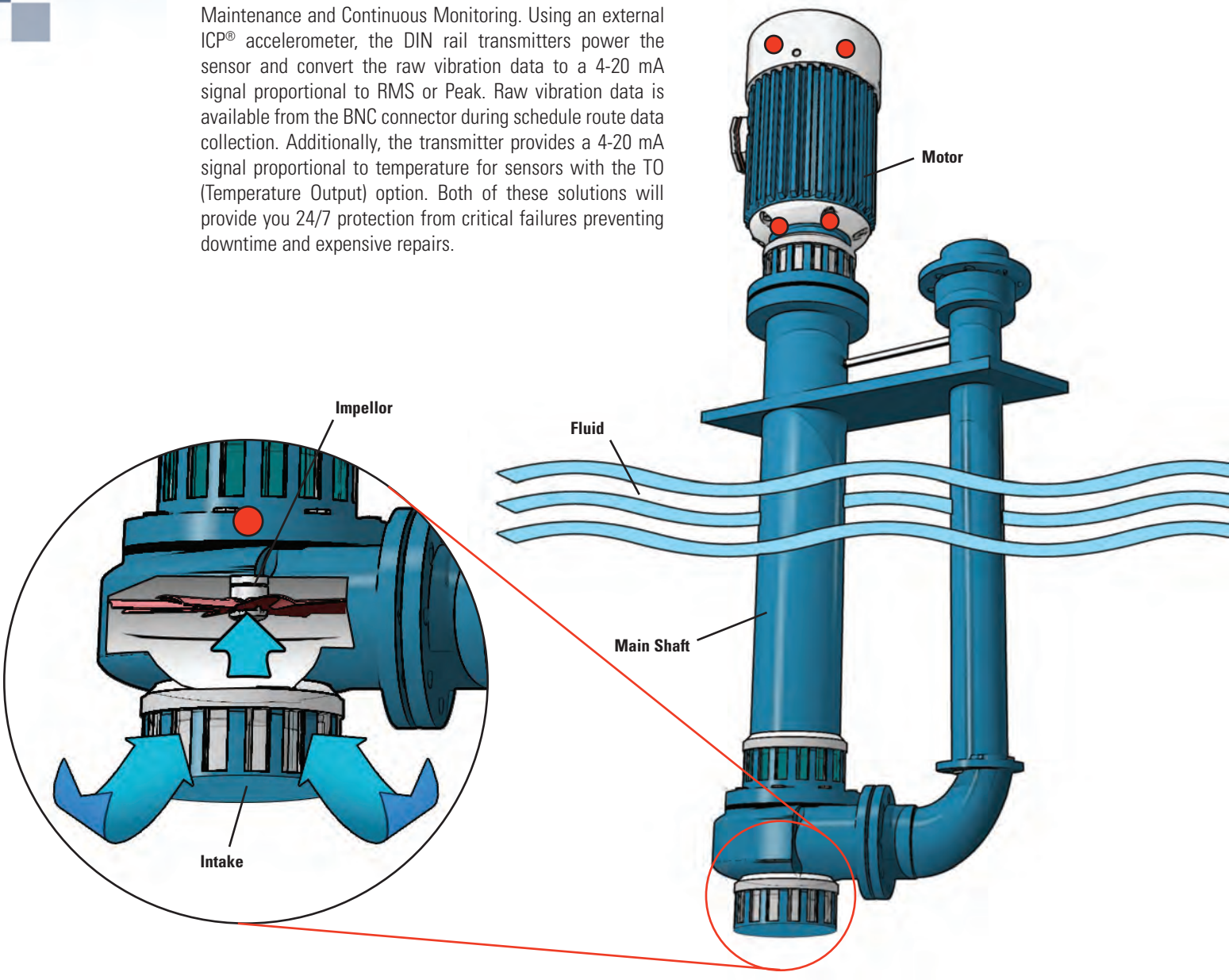
FEP Jacketed Cable with Right Angle PPS 2-pin MIL-style Connector
055PBXXXBZ

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

Process Monitoring & Protection

Pumps & Submersible Pumps

Pump failure can lead to costly unexpected shutdowns and expensive damage to plant processes and equipment. IMI's low cost current output (mA) transmitters offer continuous protection to critical equipment and provide maintenance professionals information between scheduled walk-around data collection. IMI's 4-20 mA loop powered transmitters provide an easy and low cost continuous monitoring solution and are directly compatible with PLC, DCS, SCADA and PI systems. External DIN rail transmitters are an excellent solution for customers interested in both Predictive Maintenance and Continuous Monitoring. Using an external ICP® accelerometer, the DIN rail transmitters power the sensor and convert the raw vibration data to a 4-20 mA signal proportional to RMS or Peak. Raw vibration data is available from the BNC connector during schedule route data collection. Additionally, the transmitter provides a 4-20 mA signal proportional to temperature for sensors with the TO (Temperature Output) option. Both of these solutions will provide you 24/7 protection from critical failures preventing downtime and expensive repairs.



4-20 mA Sensors - Process Monitoring & Protection

4-20 mA Output Transmitter
Series 640

- Multiple ranges available
- Peak or RMS, acceleration or velocity
- Intrinsically safe / explosion proof versions available
- Temperature output and raw vibration output options available
- 24 volt Loop Powered

See page 112-119 for more information

ICP® DIN Rail Transmitters - Process Monitoring & Protection

DIN Rail Enclosure
Model 682A00

Visit www.imi-sensors.com for more information

Low Cost ICP® Accelerometer
Series 607A

See page 84 for more information

Low Cost ICP® Accelerometer
Model 608A11

See page 84 for more information

Vibration Transmitter
Model 682B03

- Outputs 4-20 mA signal proportional acceleration, velocity, or displacement
- ICP® accelerometer input
- Analog vibration output via front BNC

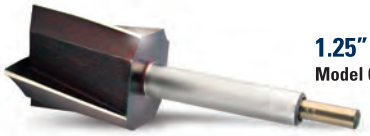
See page 121 for more information

Pump & Submersible Pumps

Accessories

Mounting Hardware

Sensor Mounting Pad
Model 080A93: Ø0.75"
Model 080A118: Ø1.0"



1.25" Spot Face Tool
Model 080A128

Cables & Connectors

Polyurethane Cabling with Right Angle MIL-Style Connector
052BQXXXBZ

Polyurethane Cabling with MIL-Style Connector
052BRXXXBZ

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

Enclosures

BNC Termination Enclosure
Model 691A51/04

BNC Termination Enclosure
Model 691A50/12

BNC Switch Box
Model 691B42

Product Spotlight

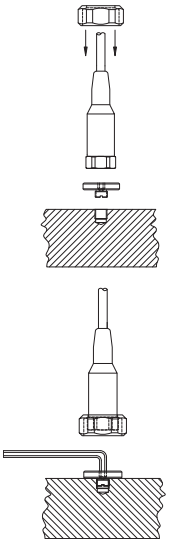
Model 608A11 Easy-mount Method

Easy installation of sensors with a long integral cable

- Permits mounting and dismounting without twisting sensor and integral cable
- Speeds sensor dismount for routine sensitivity verification or system troubleshooting

Mounting Stud
Model 080A162

Floating Hex Nut
Model 080A165

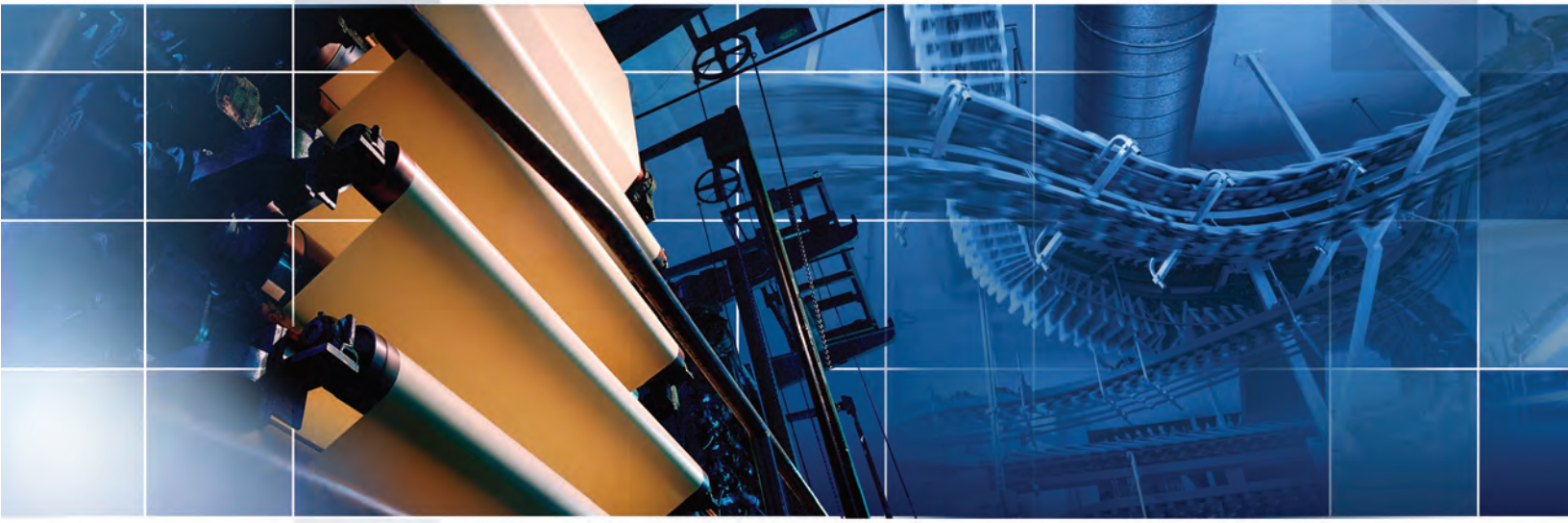


Mounting hole is prepared into machine surface to accept sensor's mounting stud. Sensor integral cable is threaded through the floating hex nut.

Mounting stud is tightened to recommended torque with appropriately sized hex Allen key.

Paper Machines & Conveyors

Sensors Built to Survive Hot, Wet and Debris Filled Environments



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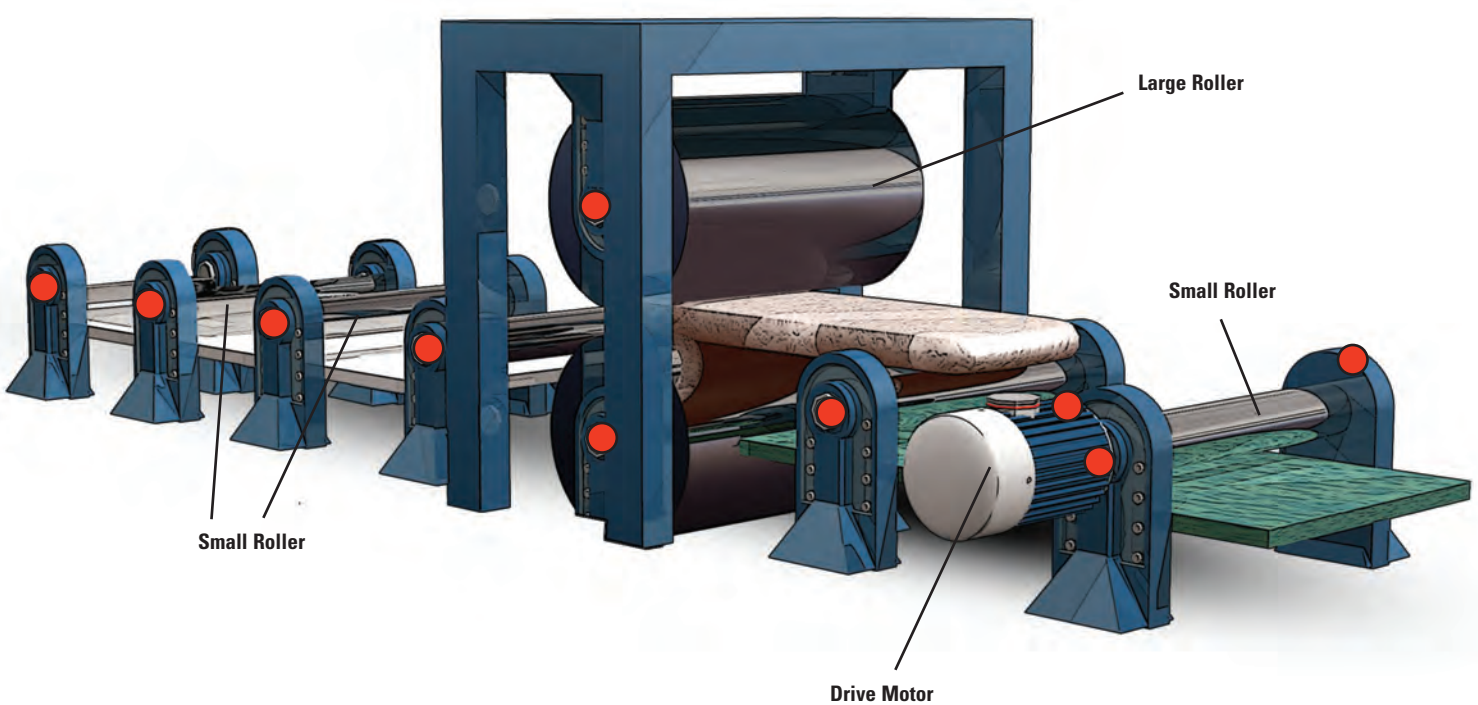
Predictive Maintenance

Paper Machines & Conveyors

Rolling-element bearings are the life blood of many industrial processes including the manufacturing of paper and plastics as well as mining. Often these bearings are located in hot, wet or dangerous areas that are inaccessible to the predictive maintenance professional. Using permanent mount accelerometers will allow the vibration analyst an opportunity to detect critical bearing faults such as pitting or spalling as well as lubrication issues before they cause a critical shutdown.

High temperature ICP® accelerometers outlined on page 17 allow for affordable protection. These designs offer the best high temp capability of any industrial sensor in the industry without an external charge amplifier. Integrated circuit high temp accelerometers can be routed straight to portable data collectors, saving the company money and providing a simple, clean installation.



Suggested Sensor Placement

Accelerometers for Dryer Section - Predictive Maintenance

325°F (162 °C)

High Temp ICP® Accelerometer
Model HT602D01

- Ceramic sensing element
- Low profile design
- Through-bolt mount

See page 100 for more information

325°F (162 °C)

High Temp ICP® Accelerometer
Model HT622A01

- Ceramic sensing element
- Short settling time
- Welded hermetic

Visit www.imi-sensors.com for more information

325°F (162 °C)

High Temp ICP® Accelerometer
Model HT628F01

- Quartz sensing element
- Excellent thermal stability
- Welded hermetic

See page 101 for more information

Product Spotlight

High Temperature ICP® Accelerometers
Model HT602D11 & Model HT602D61

- Ideal for high temp applications to 325 °F (163 °C)
- Hermetically sealed with integral FEP jacketed cable (optional armor jacket)
- Low profile design eliminates concerns about cable bend radius

See page 100 for more information

Predictive Maintenance

Paper Machines & Conveyors

Often in paper and plastics manufacturing locations rolling-element bearings are difficult to monitor because of their slow speeds. The 1x running speed of the bearing may be lower in frequency than the low frequency range of a typical piezoelectric accelerometer.

For these applications IMI Sensors offers low frequency accelerometers. In these models the discharge time constant has been extended, thus allowing the sensor to monitor slower speeds down to 12 CPM (0.2 Hz). These sensors are ideal for both permanent mount applications and route-based applications. They are all welded hermetic, case isolated construction and built to survive harsh environments.

Accelerometers for Slow Speed - Predictive Maintenance

Precision ICP® Accelerometer

Model 625B01

- Side exit, ring-style
- Low frequency response to 12 cpm (0.2 Hz)
- Ceramic sensing element

See page 92 for more information

Precision ICP® Accelerometer

Model 626B01

- Low noise floor
- Low frequency response to 12 cpm (0.2 Hz)
- Full sweep calibration

See page 94 for more information

Tips From Techs

Low Frequency, 500 mV/g Accelerometers

Slow speed applications such as slow moving roller element bearings in a paper mill produce lower vibration levels. Consider increasing the sensor's sensitivity to 500 mV/g, thus increasing signal resolution in these applications.

Low Cost Industrial ICP® Accelerometer

Model 601A02

- Low Noise

See page 88 for more information

Low Frequency Industrial ICP® Accelerometer

Model 625B02

- Full sweep calibration certificate provided

See page 94 for more information

Low Frequency Industrial ICP® Accelerometer

Model 626B02

- Full sweep calibration certificate provided

See page 94 for more information

General Purpose Accelerometers - Predictive Maintenance

Low Cost ICP® Accelerometer
Model 602D01

- Easy installation in tight spaces
- Through-bolt aides in connector orientation
- Less than 1 in. height

See page 82 for more information

Low Cost ICP® Accelerometer
Model 603C01

- Cost-effective sensor option
- IMI's most popular accelerometer
- Small footprint

See page 82 for more information

Low Cost ICP® Accelerometer
Series 607A

- Unique 360° swivel design
- Allows for easy cable orientation
- Integral or armored integral cable options available

See page 84 for more information

Mining Industry, Conveyors - Predictive Maintenance

Low Cost ICP® Accelerometer
Model 607A61

- Unique 360° swivel design
- Allows for easy cable orientation
- Armored integral cable

See page 85 for more information

Process Monitoring & Protection

Paper Machines & Conveyors

The continuous monitoring of bearing health is critical to the uptime and safety of paper machines and conveyor systems. IMI's Bearing Fault Detector directly interfaces with PLC, DCS, PI and other control systems providing an easy continuous monitoring solution. Not only does the Bearing Fault Detector provide overall RMS and Peak vibration, but also provides a 4-20 mA signal proportional to True Peak acceleration that is sensitive to early bearing faults. Paper machines and other conveyor processes often expose accelerometers and transmitters to extreme environments including high temperature, debris and caustic chemicals. IMI® offers ICP® accelerometers able to handle the harshest of environments with temperatures up to 325 °F and integral armor jacketed cable.

Complete Bearing Detection - Process Monitoring & Protection

Bearing Fault Detector
Model 682B05

- Provides early warning of bearing and gear faults
- Operates with PLC, DCS, SCADA, alarm and control systems
- Outputs 4-20 mA signals for peak acceleration and overall vibration

See page 124 for more information

High Temperature ICP® Accelerometer
Model HT602D11

See page 100 for more information

DIN Rail Enclosure
Model 682A00

- Strong fiberglass construction
- NEMA 4X rating

Visit www.imi-sensors.com for more information

High Temperature ICP® Accelerometer
Model HT602D61

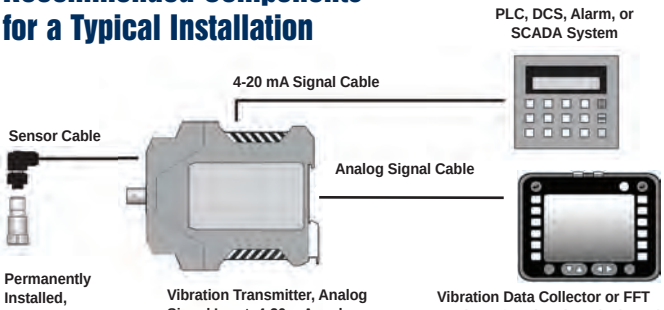
See page 100 for more information

Low Cost ICP® Accelerometer
Model 607A11

See page 84 for more information

Tips From Techs

Recommended Components for a Typical Installation



Combustion Dynamics Instrumentation

For the Most Demanding Gas Turbine Measurement & Monitoring Requirements

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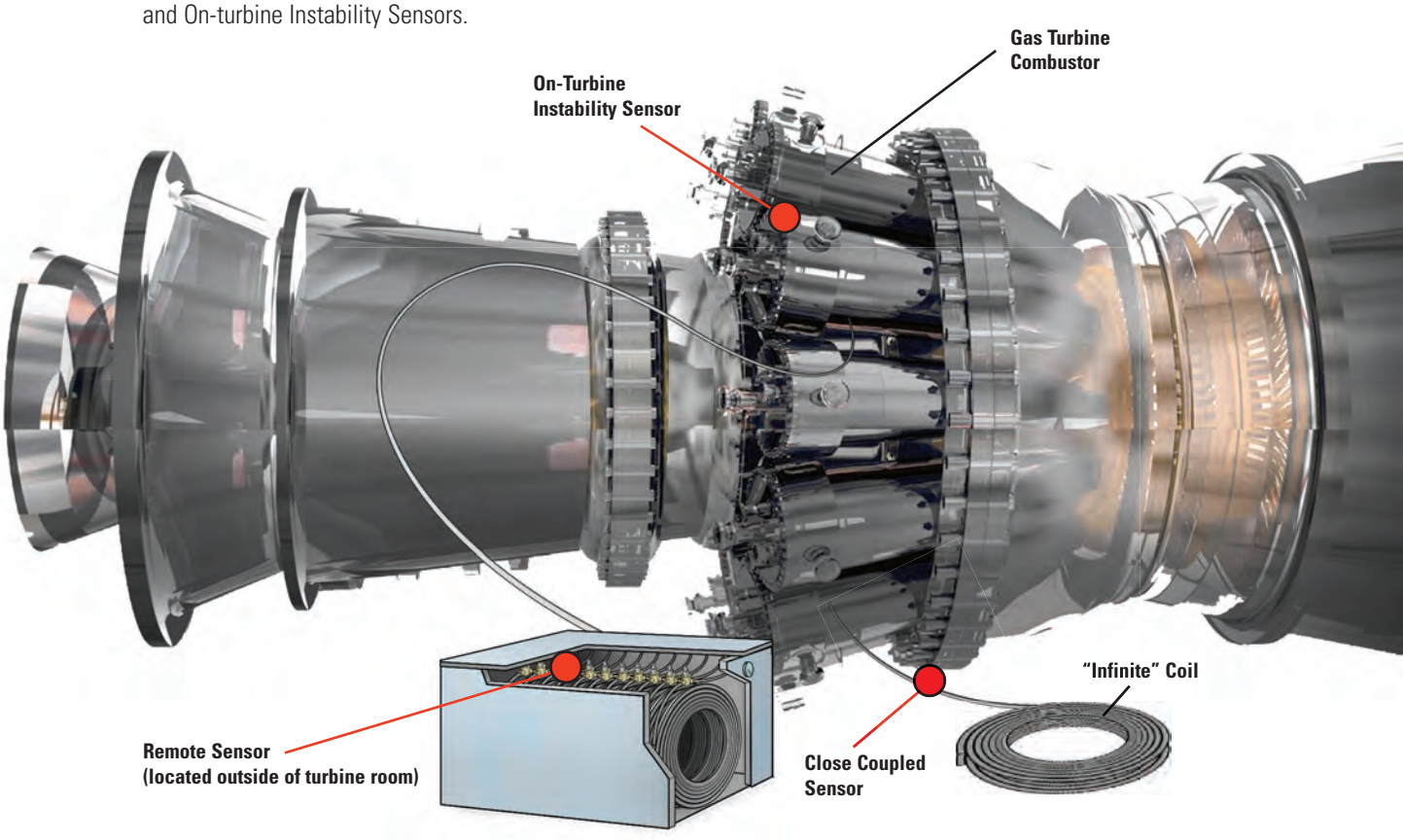
Energy & Power Generation

Combustion Dynamics Instrumentation

For more than 40 years, PCB®. has specialized in the design and manufacture of innovative sensors and measurement systems for the gas turbine market. In those four decades, our expertise in combustion dynamics instrumentation has met the industry's most demanding requirements for dynamic combustion measurement and turbine engine monitoring.

With the move toward increased fuel efficiency and lower exhaust emissions, today's gas turbine engines are based on technological innovation yet also bring potential problems. Burning a leaner flame keeps NOx emissions low but at the same time increases instability (combustion dynamics) in the gas turbine engine. This instability can damage components in the combustion chamber such as nozzles, baskets and transition pieces, as well as downstream components such as blades, resulting in downtime and loss of revenue.

IMI's instrumentation is designed to detect and measure dynamic pressure spikes, pulsations and surges in gas turbine engines. Our pressure sensors have three basic applications for detecting and measuring dynamic pressure phenomena and combustion instability in gas turbine engines: remote sensors, close coupled sensors and On-turbine Instability Sensors.



The diagram above shows a typical setting for a gas turbine in a power generation plant. Shown within the illustration are the three standard methods of measuring pressure; Remote, Close Coupled and On-Turbine Instability Sensor (OTIS). The red bullets indicate the location of the actual sensor for each different method.

Suggested Sensor Placement

Remote Sensors - Energy & Power Generation

ICP® Pressure Sensor
Model 102M205

- Sensitivity: 10 to 100 mV/psi (1.45 to 14.5 mV/kPa)
- Measurement range: 50 to 5000 psi
- 316 stainless steel diaphragm
- 3/8-24 UNF fitting

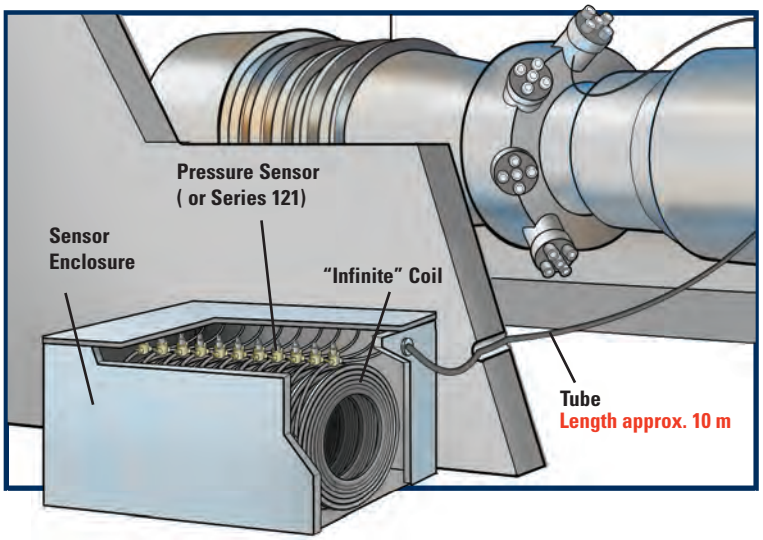
See page 138 for more information

ICP® Pressure Sensor
Model 121A44

- Sensitivity: 1 to 100 mV/psi (0.145 to 14.5 mV/kPa)
- Measurement range: 50 to 500 psi
- 316 stainless steel diaphragm
- 1/4" NPT fitting

See page 138 for more information

These pressure sensors have either a portable or permanent configuration. Portable systems consist of pressure sensors that are connected to sensing lines running to some or all of the combustors. Similar to the portable systems, permanent systems provide sensors mounted outside the turbine enclosure.



The sensors are then connected through sensing lines (tubing) to each combustor. Because of the long sensing lines involved, the ability to "purge" condensation is required. There are advantages to this simple, Low Cost approach. Because the sensors are mounted outside the turbine enclosure, the conditions the sensors must endure are relatively mild, thus allowing for the use of less expensive sensors with longer life expectancy. In addition, these sensors can be serviced while the turbine is online.

Energy & Power Generation

Combustion Dynamics Instrumentation

Close Coupled Sensors - Energy & Power Generation

Close coupled sensors permanently mounted to a gas turbine are ideal for monitoring combustion dynamics (instability). Operating at a wider frequency range than remote sensors, the high sensitivity and higher-temperature capability of these sensors allow for precision measurement in turbine locations where the application of other instrumentation is not possible.

Close coupling of the sensors to the combustor enables the measurement and detection of dynamic pressure phenomena such as high frequency events that can cause damage to downstream components such as blades. Like the portable and permanent remote sensors, close coupled sensors also require a purging system to eliminate condensation.

500 °F (260 °C)

High Sensitivity Pressure Sensor
Series 171

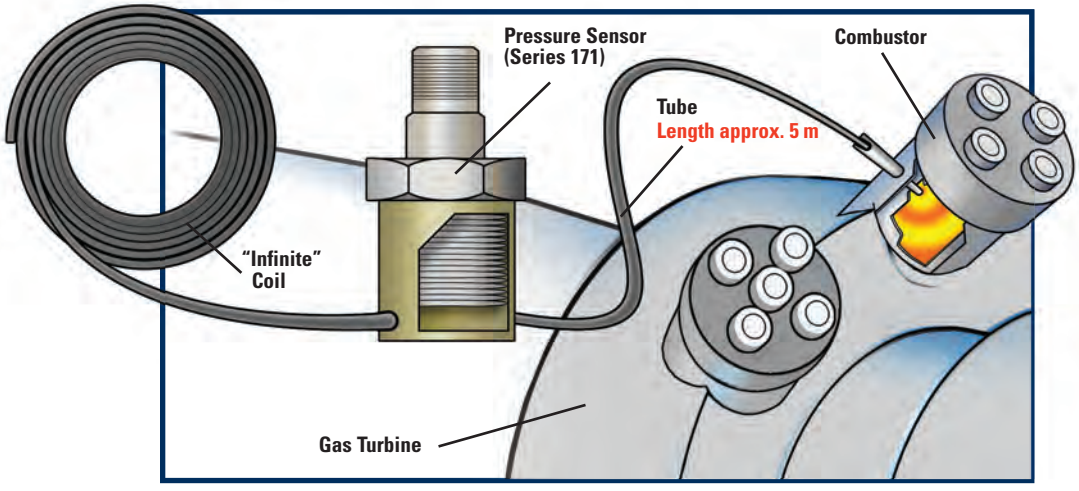
- Measurement range: 10 psi (68.9 kPa)
- Sensitivity: 1100 pC/psi (160 pC/kPa)
- 2-pin connector, 1-1/8"-12 UNF-2A port
- Weight: 6.5 oz (185 gm)

See page 141 for more information

In-Line Charge Converter
Model 422E55/D

- Output voltage: (at specified measurement range) ±5 Vpk
- Sensitivity: (charge conversion) 0.5 mV/pC
- Frequency range (±5%) 0.5 Hz to 100 kHz
- Housing material: stainless steel

See page 159 for more information



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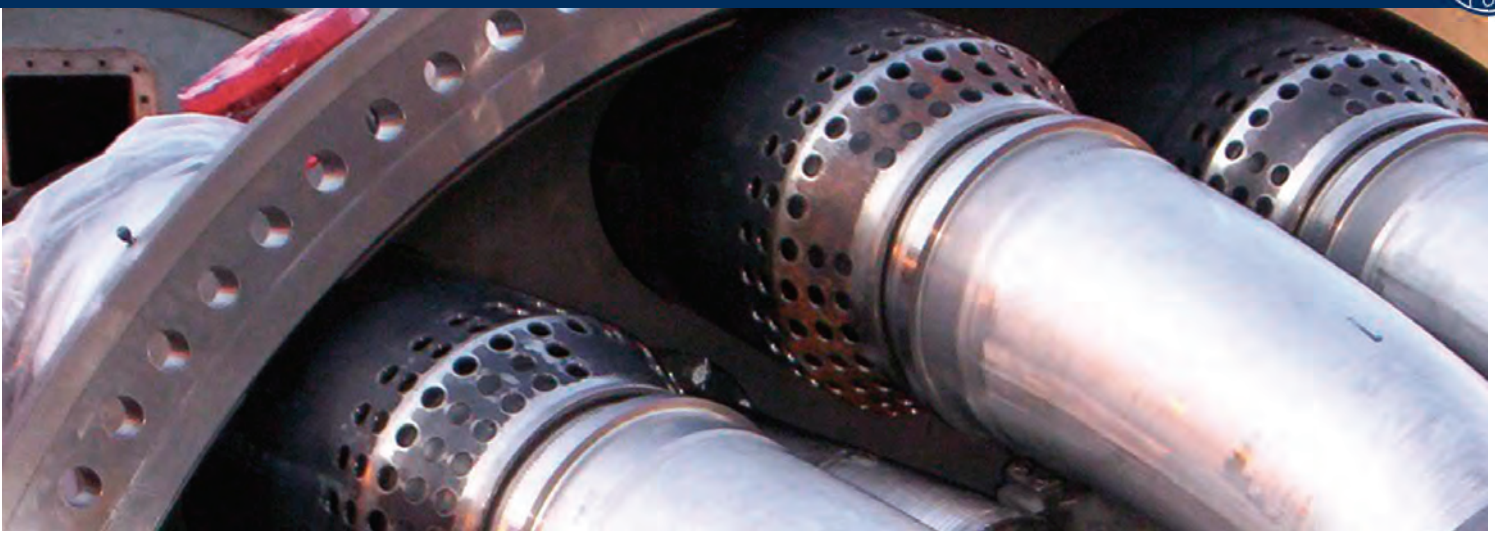


On-Turbine Instability Sensors - Energy & Power Generation

986°F (530 °C)

High Temperature Pressure Sensor
Series 176M0X

- Sensitivities to 17 pC/psi
- Measurements to 20 psi

See page 140 for more information

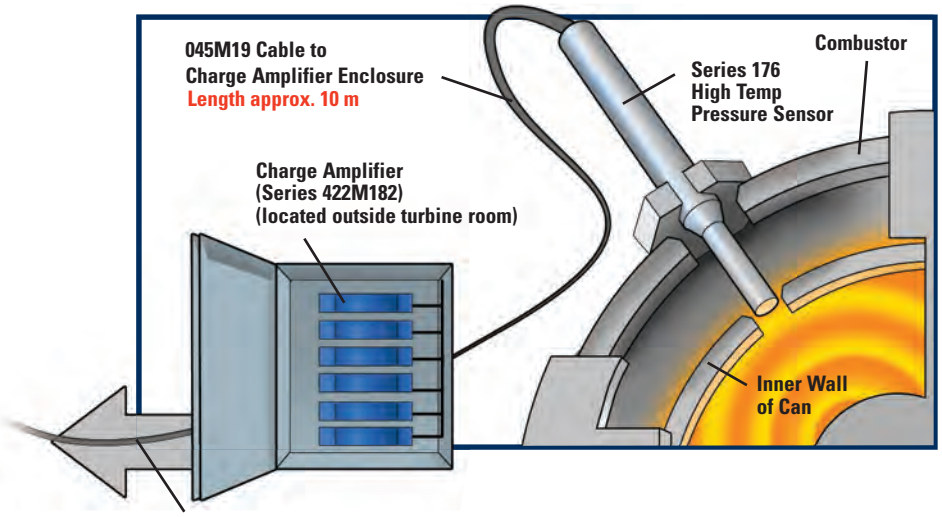
986°F (530 °C)

High Temperature Pressure Sensor
Series 176MXX

- Sensitivities to 17 pC/psi
- Measurements to 20 psi

See page 140 for more information

High temperature sensors directly mounted to the combustor basket provide 24/7, consistent, reliable combustion dynamics data monitoring so that tuning changes can be made at anytime. On-Turbine Instability Sensors allow for diagnostics, part fatigue analysis and the ability to continuously monitor and control emissions. The higher frequency capability of the OTIS sensors enable the use of auto-tuning and online diagnostic monitoring systems. In addition, these sensors provide an output that can easily connect to legacy combustion dynamics monitoring systems. By having sensors directly mounted to the combustor, operators save time during combustion analysis.



Differential Charge Amplifier
Model 422M182

- Sensitivity 4 mV/pC
- Frequency Range from 2 Hz to 30 kHz

See page 158 for more information

Energy & Power Generation

Combustion Dynamics Instrumentation

High Temperature Accelerometers - Energy & Power Generation

Vibration monitoring of gas turbines can provide crucial information to diagnose potential problems, leading to an increase in uptime and a decrease in unplanned maintenance, catastrophic failures and accidents.

325°F (162 °C)

ICP® Accelerometer with High Temperature Range Option

Model HT622A01

- Sensitivity: (±5%) 100 mV/g (10.2 mV/(m/s²))
- Frequency Range: (±3dB) 12 to 480k cpm (0.2 to 8 kHz)
- Measurement Range: ±50 g (±490 m/s²)
- Electrical Connector: 2-Pin MIL-C-5015

Visit www.imi-sensors.com for more information

550°F (288 °C)

High Temperature Industrial Charge Accelerometer

Model 612A01

- Sensitivity: (±10%) 26 pC/g (2.6 pC/(m/s²))
- Temperature Range: (Operating) -65 to +500 °F (-54 to +260 °C)
- Electrical Connector: 2-Pin MIL-C-5015
- Electrical Connection Position: Top

Visit www.imi-sensors.com for more information

900°F (482 °C)

Very High Temperature Accelerometer

Series EX600B1X

- Sensitivity: 10 to 100 mV/g (1.02 mV/(m/s2) to 10.2 mV/(m/s2))
- Frequency Range: (±5%) 282 to 240000 cpm (4.7 to 4 kHz)
- Measurement Range: ±50 to 500 g peak (±490 to 4900 m/s2)
- Mounting: Through Holes (3)

See page 106 for more information

Innovations in high temperature accelerometer technology for gas turbine monitoring now enable vibration measurement in extreme heat environments up to +1200 °F (+649 °C). IMI's high-temp accelerometers come in a variety of frequencies, temperature ranges and configurations. Integral charge amplifiers allow for use with standard data acquisition equipment.

1200°F (649 °C)

Extreme Temperature Charge Accelerometer with Integral Hardline Cable

Series 357D9X

- Sensitivity: (±10%) 5 pC/g (.51 pC/(m/s²))
- Measurement Range: ±1000 g pk (±9800 m/s² pk)
- Frequency Range: (±5%) 2.5 kHz
- Electrical Connector: Integral Hardline Cable

See page 108 for more information

Combustion Dynamics Instrumentation

Accessories

Accessories - For Remote Sensors

Low Noise, TFE, Coaxial Cable 10-32 Coaxial Plug to BNC Plug
003CXX Cabling

Polyurethane, Twisted Pair Cable with Composite 2-Socket MIL-style Connector to BNC Plug
052FVXXXAC Cabling

For Close Coupled Sensors

Low noise, PFA, Twisted Pair Cable 2-Socket MIL to BNC Plug
045ERXXXAC Cabling

Accessories - For On-Turbine Instability Sensors

Polyurethane Cable, BNC Plug to Pig Tails
052ACXXXAD Cabling

Low Noise, PFA Cable, 2-socket 7/16 MIL to 2-Socket MIL-C-5015
045M19 Cabling

Polyurethane Cable, Composite 2-Socket MIL-style Connector to BNC Plug
052BRXXXAC Cabling

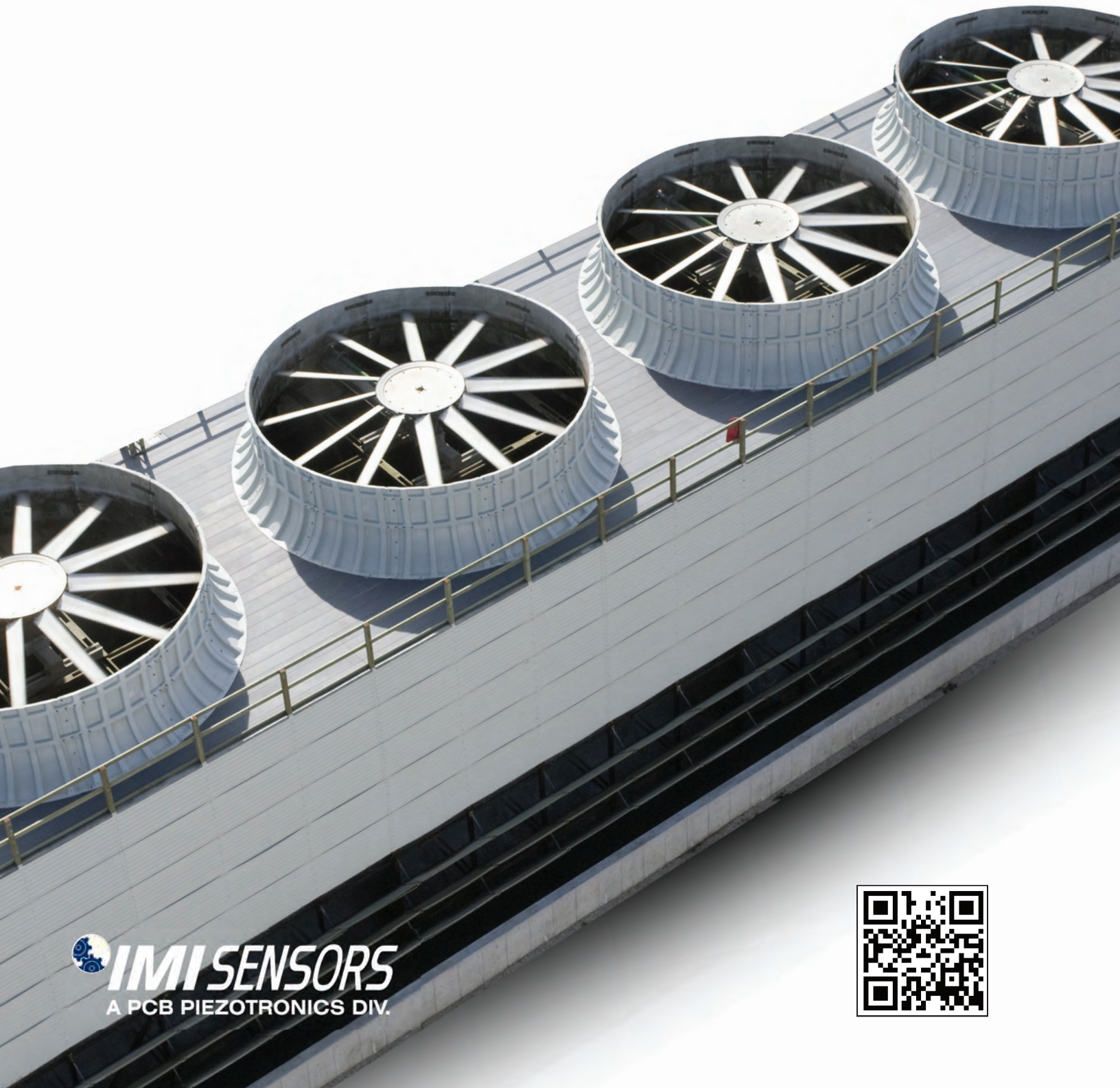
XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

www.imi-sensors.com/sure

Cooling Tower Measurements?

We Do!™

We do it all - sensors to measure vibration, acoustics, force, pressure, load, strain, shock and torque - Sure we do!



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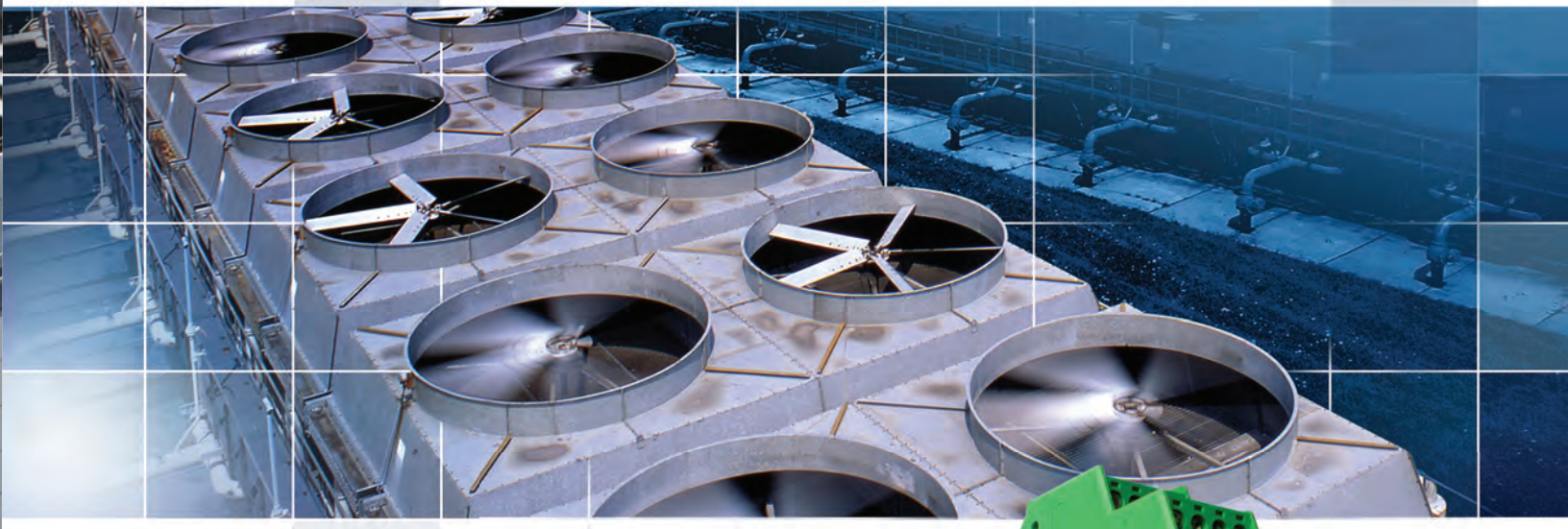
Protecting Cooling Towers & HVAC Systems

Reliable and Cost-Effective Vibration Monitoring Solutions for Cooling Fans and Other Low Frequency Equipment



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Process Monitoring & Protection

Protecting Cooling Towers

Cooling Towers are a critical component of production in many industries today. Most towers use the same design, which is a horizontal electric motor driving a jack shaft into a right angle gearbox with vertical output to a large fan. Vibration monitoring of this drive train is essential to provide signals for early warning or provide shutdown when vibration levels exceed a predetermined threshold. The classic legacy solution involved the use of "earthquake" mechanical switches. These devices utilize a spring and magnet concept and are designed to mechanically trip during high vibration. Reliability becomes an issue with mechanical switches due to harsh cooling tower environments, especially in critical applications.

The next generation 686B Smart Vibration Switches are USB programmable and employ piezoelectric sensing elements coupled with field adjustable threshold settings. Also integrated programmable time delays virtually eliminate false trips. When streaming vibration data is required, the 685B Series electronic vibration switch provides 4-20 mA output as well as analog vibration data output for data analysis. Two separate relay outputs, for alert and alarm, are field adjustable with separate time delays for each relay. Other IMI® solutions include 4-20 mA output sensors for continuous monitoring in conjunction with existing PLCs, DCS and SCADA systems. All products are available with hazardous area approvals.

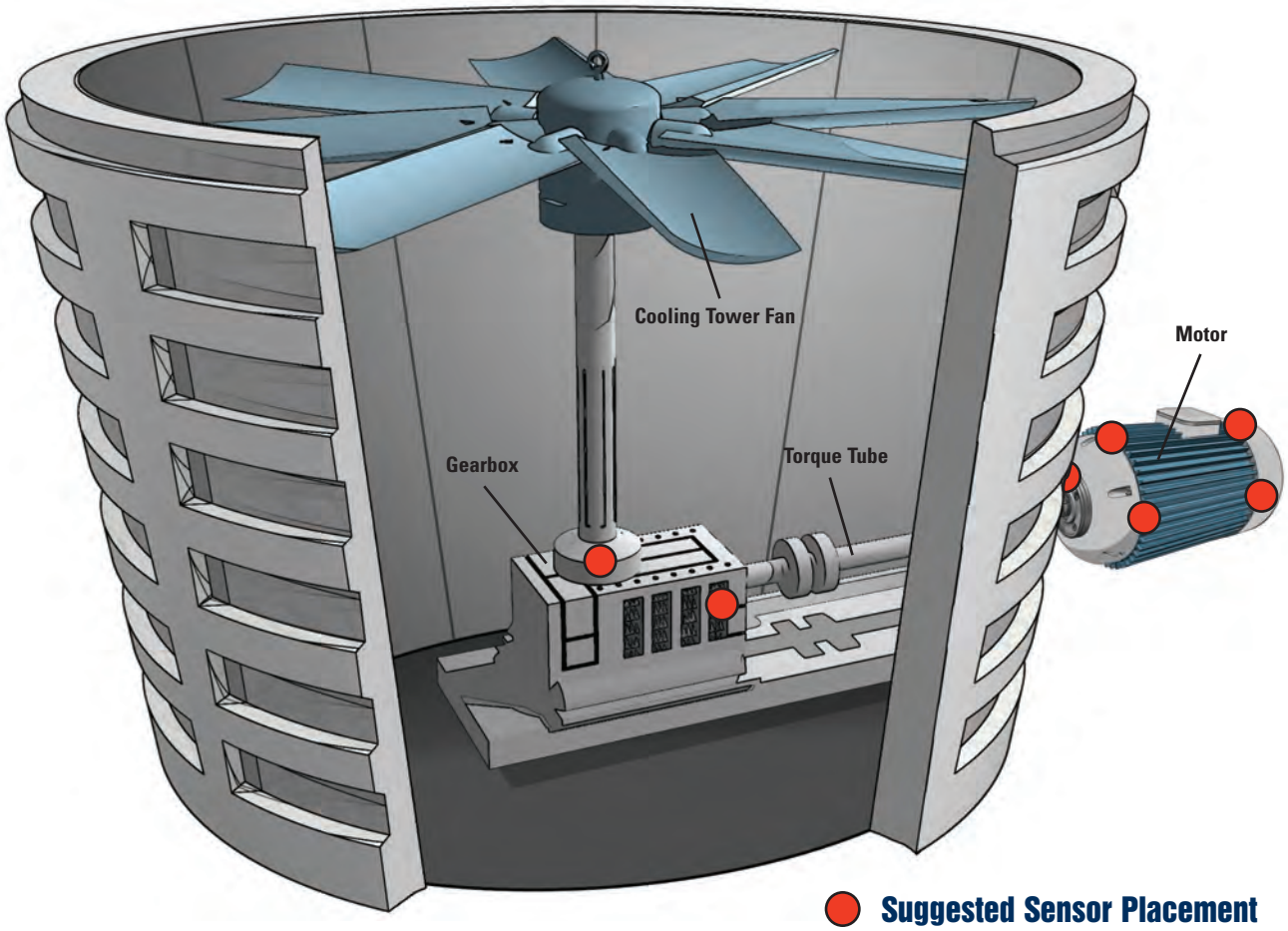


Photo Courtesy of Midwest Tower, Inc

Electronic Vibration Switches - Process Monitoring & Protection

Electronic Vibration Switch
Series 685B

- Lower cost than competitive models
- Dual set points (relays)
- Explosion proof options available
- On-board or remote piezoelectric accelerometer

See page 132 for more information

USB PROGRAMMABLE

Industry Exclusive!

USB Programmable Smart Switch
Model 686B01

- Programmable delays eliminate false trips
- Competitive price compared to mechanical switches
- Hazardous area approvals available

See page 130 for more information

Mechanical Vibration Switches - Process Monitoring & Protection

Mechanical Vibration Switch
Model 685A07

- Cost-effective protection for less critical applications
- Utilizes spring-loaded, magnetically coupled mechanism
- External reset button

See page 134 for more information

Mechanical Vibration Switch
Model 685A08

- Weatherproof & CSA/UL approved, explosions proof
- Cost-effective protection for less-critical applications
- Requires no power

See page 135 for more information

Process Monitoring & Protection

Heating, Ventilation & Air Conditioning (HVAC)

In other cooling applications there may be a need for vibration trending or route based inspection of critical bearing and critical gearbox conditions. It this case vibration switches may not be the correct solution. IMI Sensors supplies industry leading general purpose vibration sensors to interface with any data collector used for classic condition monitoring applications. For 24/7 vibration trending the 640 Series 4-20 mA output sensors provide current signals to interface with any PLC, SCADA, or DCS panel. These sensors are available in several measurement ranges RMS or Peak and various measurement methods (displacement, velocity, acceleration). For the best of both worlds, IMI's din-rail transmitters output 4-20 mA signals for trending plus voltage signals for time waveform and spectral analysis.

Sensors for Cooling Towers - Process Monitoring & Protection

Low Cost ICP® Accelerometer
Model 603C01

- Cost-effective sensor option
- IMI's most popular accelerometer
- Small footprint

See page 82 for more information

Low Cost ICP® Accelerometer
Model 608A11

- Excellent sensor for submersible applications
- Small size (9/16" footprint)
- Integral cable easily connects to boxes

See page 84 for more information

Low Cost 4-20 mA Output Sensor
Model 640B01

- Continuous monitoring
- Outputs acceleration or velocity
- Designed to work with any PLC, DCS, or SCADA system

See page 112 for more information

Vibration Transmitter
Model 682B03

- Outputs 4-20 mA signal proportional to acceleration, velocity, or displacement
- ICP® accelerometer input
- Analog vibration output via front BNC

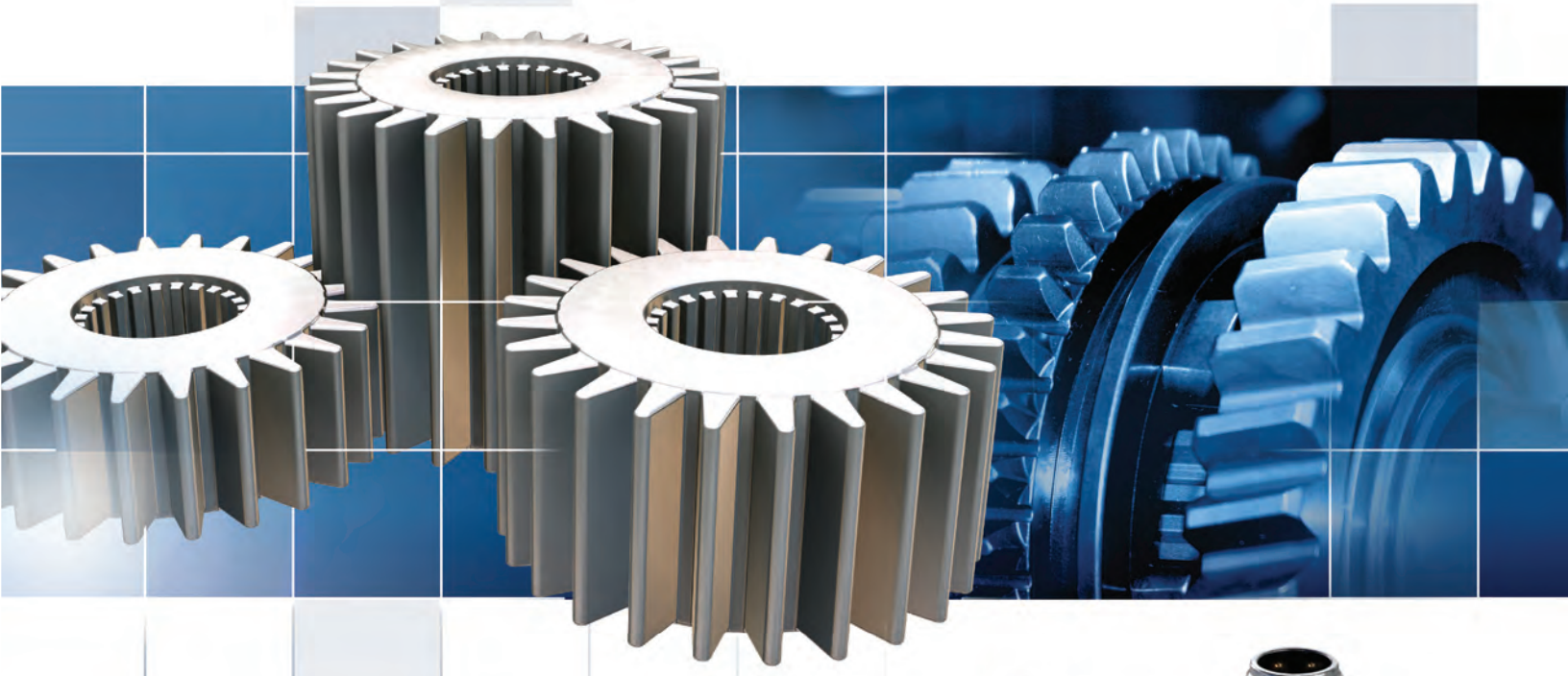
See page 121 for more information

FEP Jacketed Cable with MIL-Style Connector
053BRXXXBZ Cable

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

Gearboxes

Instrumentation Built to Survive in Grease & Grime and Pickup Gear Mesh Faults



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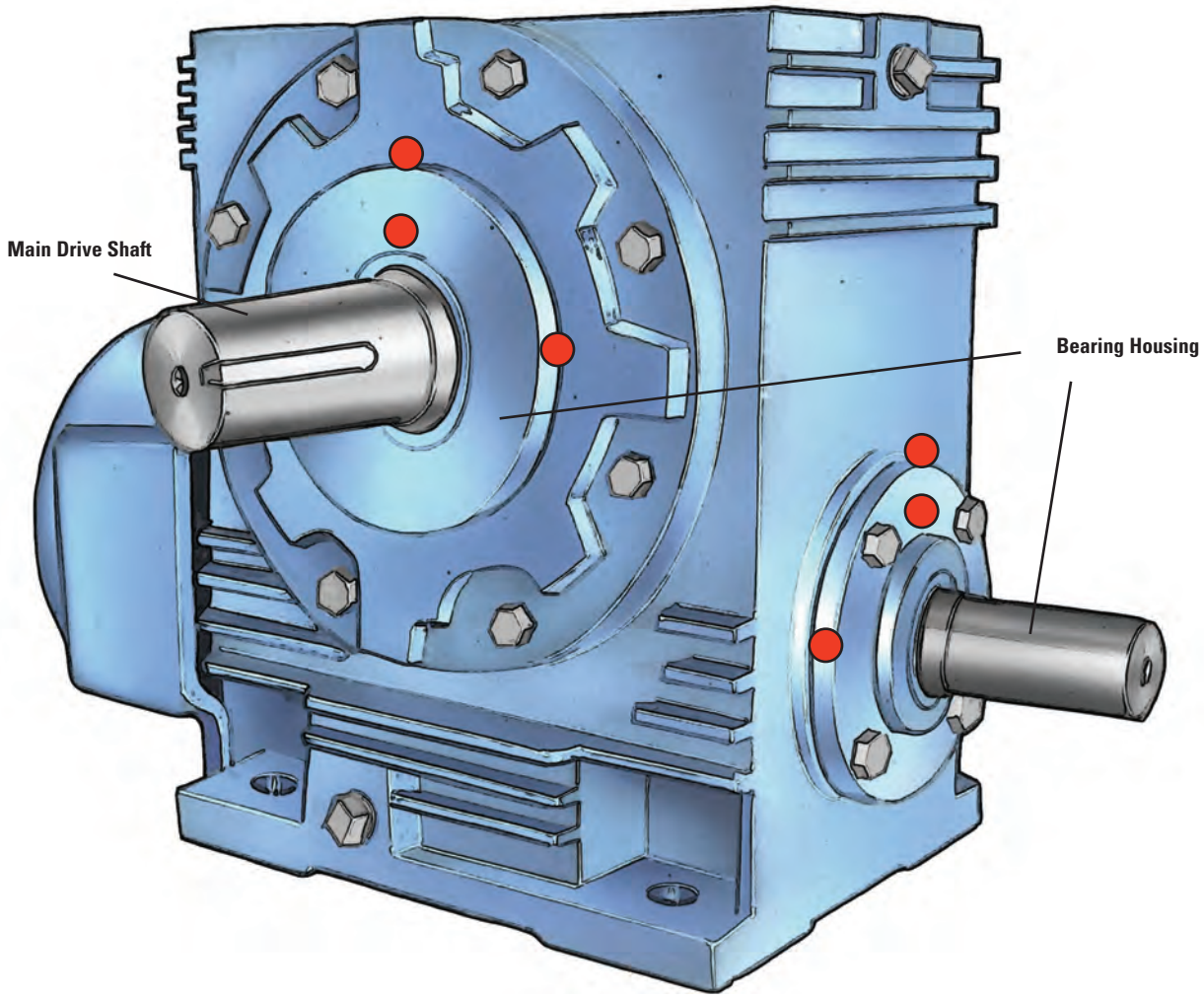
Predictive Maintenance

Gearboxes

The sensor has to be chosen based on calculated gear mesh frequency and bearing defect frequencies. The gear mesh frequency is easily determined by multiplying the number of teeth on a gear by the rotational frequency. For example, a motor with 1800 rpm (30 Hz) and a gear with 50 teeth results in a gear mesh frequency of 1500 Hz. This result multiplied by a factor of 3.25 will provide the maximum frequency the sensor should be able to measure for best results. If the number of teeth on a gear is unknown, as a rule of thumb, the maximum sensor frequency should be assumed to be 200 times rpm (in Hz). Typically high speed input and low speed output frequencies need to be measured near shaft bearings. Sensors should not be mounted on resonance frequency prone housing locations to improve accuracy of the readings. Sensors can be placed in radial, ideally two sensors with a 90 degree angle and axial locations. Radial sensors can be used to spot imbalance and axial sensors will best analyze gear mesh and bearing faults. Most IMI® sensors can be offered with an option to safely affix them inside of the gear housing for best measurement results. Sensors can be pressure tested, can withstand oils and chemicals inside of the case and are available in high temperature versions. Advanced vibration monitoring systems in combination with experienced analysis can deliver a broad range of results. Tooth wear, gear eccentricity & misalignment, damaged teeth and other potential problems can be spotted instantly while the transmission is in service.



Reducer / Slow Speed - Predictive Maintenance

Precision ICP® Accelerometer
Model 625B01

- Side exit, ring-style
- Ceramic sensing element
- Available with intrinsically safe, velocity output

See page 92 for more information

Precision ICP® Accelerometer
Model 626B01

- High sensitivity
- 12 cpm
- Available with temperature output

See page 94 for more information

High Speed / Gear Mesh - Predictive Maintenance

Low Cost ICP® Accelerometer
Model 603C00

- 10 mV/g sensitivity
- 500 g measurement range
- Small footprint

See page 88 for more information

Low Cost ICP® Accelerometer
Model 607A11

- Unique 360° swivel design
- Allows for easy cable orientation
- Integral or armored integral cable options available

See page 84 for more information

Precision ICP® Accelerometer
Model 622B01

- Full frequency sweep calibration: 5% sensitivity deviation tolerance
- 15 kHz high frequency response ideal for early detection of bearing fluting conditions
- Ideal for route-based data collection

See page 92 for more information

Gearboxes

Accessories

Cables & Connectors

Polyurethane Cabling with MIL-Style Connector
052BRXXXBZ

Polyurethane Cabling with Right Angle MIL-Style Connector
052BQXXXBZ

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

Mounting Hardware

Sensor Mounting Pad
Model 080A93: Ø0.75"
Model 080A118: Ø1.0"

Flat Surface Magnet
Model 080A157

Small Adhesive Kit
Model 075A05

Product Spotlight

Very High Frequency Accelerometer Kit

Model 600A12

Industry Exclusive!

This high frequency 10 mV/g accelerometer kit features a very small accelerometer with a magnet and cable assembly

- High frequency response to 30 kHz, even when mounted magnetically
- Supplied with 5 ft. cable with BNC plug termination
- Kit features Model 621B40 accelerometer, with titanium housing

Wind Turbine Condition Monitoring & Assessment

Sensors and Instrumentation for Permanent Installation and Testing of Wind Turbines and Turbine Components

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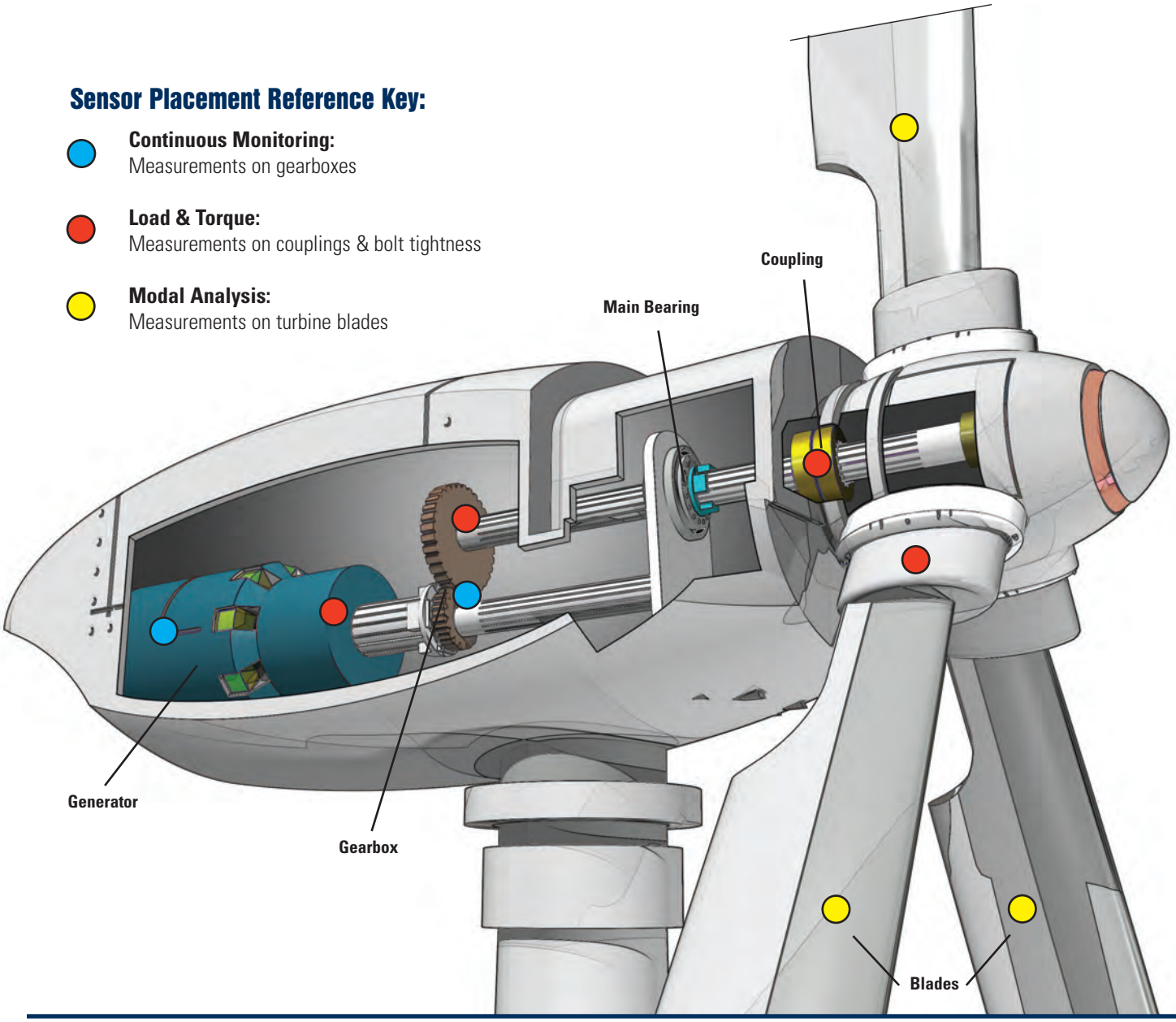
Energy & Power Generation

Wind Turbine Condition Monitoring

Some of the world's largest wind farms rely on IMI Sensors to keep their wind turbine operations at optimal performance by increasing reliability and reducing downtime. A broad range of industrial grade sensors from PCB® measure vibration, strain, torque and noise in new and existing wind turbines, providing measurements that are crucial to keep the operating health of these systems in tip-top shape.

Sensor Placement Reference Key:

- **Continuous Monitoring:** Measurements on gearboxes
- **Load & Torque:** Measurements on couplings & bolt tightness
- **Modal Analysis:** Measurements on turbine blades



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Condition Monitoring Accelerometers - Energy & Power Generation

Low Cost ICP® Accelerometer
Series 607A

- Unique 360° swivel design
- Allows for easy cable orientation
- Integral or armored integral cable options available

See page 84 for more information

Low Cost ICP® Accelerometer
Model 602D01

- Easy installation in tight spaces
- 360° connector orientation
- Integral or armored integral cable options available

See page 82 for more information

Low Cost ICP® Accelerometer
Model 603C01

- General purpose, hermetically sealed
- IMI's most popular accelerometer
- Small footprint

See page 82 for more information

Low Cost ICP® Accelerometer
Series 601

- Low noise
- Ceramic shear
- 100 mV/g or 500 mV/g

See page 82 and 88 for more information

Low Frequency ICP® Accelerometer
Model 626B01

- Ideal for slow rotating equipment
- Low noise floor
- High output sensitivity

See page 94 for more information

Embeddable Accelerometer
Series 660

- ICP®, charge and low power versions available
- Easily designed into PC boards
- Variety of sensitivities

See page 110 for more information

Wind Turbine Assessment

Wind turbines and towers utilize literally thousands of fasteners. Selecting the proper tools and applying the correct amount of torque to each fastener is imperative for optimizing the costs of operation.

RS Technologies, a division of PCB Load & Torque, Inc., serves the product assembly and fastener manufacturing communities with a complete line of rotary and stationary torque sensors, hand torque wrenches, measuring instruments and threaded fastener torque-tension testing systems. For more information on any of these products, please visit www.pcbloadtorque.com

Hand Torque Wrenches - Energy & Power Generation

Torque Wrench
Series HT7000

- Durable ergonomic construction
- Lightweight and high strength
- Excellent accuracy of measurements
- Compatible with most data collectors

Visit www.pcbloadtorque.com for more information

RS Technologies, a division of PCB Load & Torque, Inc, manufactures a complete line of lightweight, precision hand torque wrenches that are among the lightest in the industry and durable enough to be used in the toughest industrial environments.
Auditing the torque applied to tightened fasteners is an important part of assembly and maintenance of wind turbines. Monitoring the residual torque in assembled fasteners can be accomplished by using Series HT7000 Hand Torque Wrenches along with Model 920 Portable Digital Transducer Instrument.

Rotary Torque Transducers - Energy & Power Generation

Rotary Torque Transducer
Series PC9000

- Industrial-rated for power and pulse tools
- Measure torque only or torque and angle
- 2 mV/V output with matched shunt calibration

Visit www.pcbloadtorque.com for more information

Series PC9000 Rotary Torque Sensors are widely used in the fastener assembly market to verify the performance of hand and power torque tools. These strain gage-based transducers are fitted on the output drive of a power tool and measure the torque applied by the tool to the fastener on an actual assembly. When equipped with a Model 920 Portable Digital Transducer Instrument this measurement provides important information about tool shut off and can assist in establishing specifications for proper assembly.

Portable Transducer, Model 962 - Energy & Power Generation

Portable Data Recorder
Model 962

- Battery operated
- Cost-effective option
- Easy to operate
- Print both numeric and graphic data

Visit www.pcbloadtorque.com for more information

Model 962 Portable Data Recorder Instrument can be used with other RS Technologies' products such as the Stationary Torque Transducer, Rotary Torque Transducers, Hand Torque Wrenches and more. The instrument is powerful and accurate enough to be used as a primary standard for auditing most torque applications in manufacturing and quality departments. When connected to a Rotary Torque Transducer, the unit can be used to test the capability of power tools, verify the accuracy of hand tools, monitor the capability of a fastening process, or audit the quality of an assembled joint.

Microphones & Preamplifiers - Energy & Power Generation

Microphones are used to measure the noise from the wind turbine both internally and externally. The gearbox and the main bearing are typical noise sources which should be measured internally, while the overall turbine noise is monitored externally. Larson Davis, a division of PCB Piezotronics, manufacturers various Sound Level Meters and Microphones which can be used to make these different types of acoustic measurements.

By utilizing the built-in narrow band FFT analysis option on Model 831, higher frequency components can be analyzed to predict possible machine faults. An analysis of the source of the audible noise can result in gearbox modifications so that the equipment runs quietly and efficiently. In addition, the low frequency content of blade generated noise can be quantified using octave analysis.

- High-temperature (120 °C) 248 °F preamplifier for prepolarized microphones
- Type 1 compliant, modern prepolarized (0 V) and externally polarized (200 V) microphones
- Value oriented array microphones
- TEDS compliant with IEEE standards

Visit www.pcb.com/acoustics for more information

Sound Level Meters - Energy & Power Generation

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

For environmental noise monitoring and building acoustics, Larson Davis offers a full line of instruments, accessories and software. For personal noise and vibration exposure monitoring, Larson Davis complements this with sound level meters, personal noise dosimeters, human vibration meters, audiometric calibration systems and hearing conservation programs.

The rugged, ergonomic design of the Larson Davis Sound Level Meter, Model 831, is ideal for one handed operation and its large display can be read in any lighting conditions. The 831 can also be used with a complete range of microphones and preamplifiers including weather-resistant units for unattended and semi-permanent wind turbine monitoring applications. Advances in technology provide 2GB of internal memory, with superior performance and a reliable design. The inclusion of Weather Parameters allows all environmental noise data to be integrated in one common report.

Sound Level Meter
Model 831

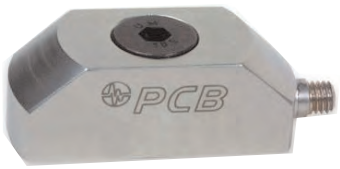
- Over 16 hours of runtime on 4 AA batteries
- USB 2.0 peripheral connectors
- 120dB dynamic range
- 2 GB memory standard
- RMS & peak A, C & Z frequency weighting
- RMS slow, fast & impulse detection characteristics
- Real time 1/1 & 1/3 octave frequency analysis
- 6400 line FFT analysis
- .WAV sound recording for source identification
- Automatic data logging (20ms to 24 hours)
- Complete environmental packages available

Visit www.larsondavis.com for more information

Wind Turbine Assessment

Instrumentation that can provide voltage excitation and bridge completion is ideal for this measurement. Strain gages can be placed anywhere on the blade, but the distribution varies with the amount of sensors. These sensors should be in a configuration to optimally model the stress on the blade, taking measurements from both the flap-wise and edge-wise directions.

Load, Strain & Torque - Energy & Power Generation



ICP® Strain Sensor
Model RHM240A02

- Measure Longitudinal Strain on Machinery Structures
- Monitor Quality, Safety and Reliability
- Robust Construction Endures Harsh, Industrial Environments
- Simple Installation is Non-Invasive to Process

Visit www.pcb.com for more information

PCB Piezotronics, Inc. Model RHM240A02 single axis ICP® Strain Sensor is structured with a quartz sensing element and microelectronic circuitry in a low profile titanium housing, making this sensor ideal for high resolution measurements of dynamic strain on wind turbine blades. This unit is compatible with PCB's ICP® Sensor signal conditioners and is capable of driving long cables.

PCB LOAD & TORQUE
A PCB GROUP COMPANY

PCB Load & Torque, Inc., designs and manufactures a full line of load cell and torque sensors for numerous industries including: aerospace & defense, automotive, medical rehabilitation, material testing, textile, process control, robotics & automation and more. PCB Load & Torque offers exceptional customer service, 24-hour technical assistance and a Total Customer Satisfaction guarantee.

Load Cells
Series 1200 & Series 1400

- Low deflection, high accuracy
- Low profile for easy installation
- NIST traceable, A2LA accredited calibration to ISO 17025
- Temperature & pressure compensated

Visit www.pcbloadtorque.com for more information

PCB Load & Torque, Inc. manufactures a wide range of high accuracy, strain gage load cells. The 1200 and 1400 series load cells are compact and are available various capacities from 250 lbf and up. While the 1200 series is a general purpose load cell with a cycle life of 10 million plus reversing cycles, the 1400 series is a fatigue rated load cells with a life cycle of 100 million plus reversing cycles. The 1400 series load cell is available in both single and dual bridge configurations.

TORKDISC® Rotary Torque Sensor System
Series 5300

- Digital system alleviates noise & data corruption
- Immune to RF & EMI
- Maintenance free

Visit www.pcbloadtorque.com for more information

PCB Load & Torque, Inc. Series 5300 TORKDISC® in-line rotary torque sensor systems are designed for test applications requiring a robust rotary torque transducer where axial space is at a premium.

Single Channel Telemetry Systems - Energy & Power Generation

PCB LOAD & TORQUE
A PCB GROUP COMPANY

PCB Load & Torque, Inc., designs and manufactures a full line of load cells, torque sensors and telemetry systems for numerous industries including: aerospace & defense, automotive, energy & power generation, material testing, textile, process control, robotics & automation and more.

PCB Load & Torque, Inc. single channel telemetry systems provide a simple, accurate method of conditioning and transmitting strain signals on rotating or moving machinery while operating in a completely contactless mode. Power is transferred inductively and the signal is RF-transferred between the moving and static component - no brushes or wires required. This method guarantees an absolute maintenance free continuous operation and accurate transmission of measured data. Series 8180 performs a remote shunt calibration when the unit is powered up.

- Factory configurable for strain, thermocouple, voltage, or ICP®
- Easy to use, wear & maintenance free
- Extremely robust, dust & waterproof, yet compact and lightweight
- Contact-free signal transmission and power supply for continuous operation
- Remote shunt calibration
- Adjustable output

Receiving Unit
Model 8180-CUTO

- Extremely robust, dust and waterproof
- Remote shunt calibration
- Factory configurable for strain, thermocouple, voltage,or ICP®

Visit www.pcbloadtorque.com for more information

Rotor Electronics
Model 8180-RE110A

- Compact size, light weight
- Easy to use, wear and maintenance free
- Contact free signal transmission and power supply

Visit www.pcbloadtorque.com for more information

Stator Head
Model 8180-SH2

- Compact size, light weight
- Inductive power
- Distance to shaft 10 mm

Visit www.pcbloadtorque.com for more information

Stator Head
Model 8180-SH4

- Compact size, light weight
- Inductive power
- Distance to shaft 200 mm

Visit www.pcbloadtorque.com for more information

Wind Turbine Assessment

Test engineers have used the principles of modal analysis, using PCB Piezotronics, Inc. ICP® accelerometers, Modally Tuned® Impulse Hammers and ICP® quartz force sensors to determine the strength and structural integrity. Single axis and triaxial MEMS DC accelerometers are placed on the tip of each blade. The photo on page 45 shows a wind turbine blade mounting in a dynamically controlled, hydraulic structural loading machine, along with the various sensors and cables mounted on the blade.

Modal Shakers & Hammers - Energy & Power Generation

ICP® Impact Hammer
Model 086D20

- Sensitivity: (±15%) 1 mV/lbf (0.23 mV/N)
- Measurement Range: ±5000 lbf pk (±22,240 N pk)
- Hammer Mass: 2.4 lb (1.1 kg)

Visit www.pcb.com for more information

THE MODAL SHOP INC. A PCB GROUP CO.

The Modal Shop, a PCB Group Company based in Cincinnati, Ohio, USA, offers a complete line of electrodynamic modal and vibration shakers ideal for applications ranging from experimental modal analysis and general vibration testing to accelerometer calibration. Shakers are also available through the TMS Rental Program in addition to accelerometers, force sensors, hammers, microphones and sound level meters. As a global leader in sound and vibration, The Modal Shop is PCB Group's focal point for a comprehensive product range of dynamic calibration systems.

Modal Shaker
Model 2100E11

- Through-hole armature provides simple setup with modal stingers
- Lightweight and portable – weighing just 33 lbs (15 kg)
- Trunnion base provides flexibility when choosing best exciter location(s)
- 1" stroke supplies adequate input energy for most modal test applications

Visit www.modalshop.com for more information

For structural excitation, Modally Tuned® ICP® impulse hammers and shakers are also available, allowing PCB® to be a complete, front-end instrumentation provider. If the excitation is coming from a shaker, The Modal Shop, a PCB Group Company, offers a full line of modal and vibration shakers. The Model 2100E11, a lightweight electrodynamic modal exciter, is capable of providing up to 100 lbf (440 N) of peak force excitation in a small footprint weighing just 33 pounds (15 kg).

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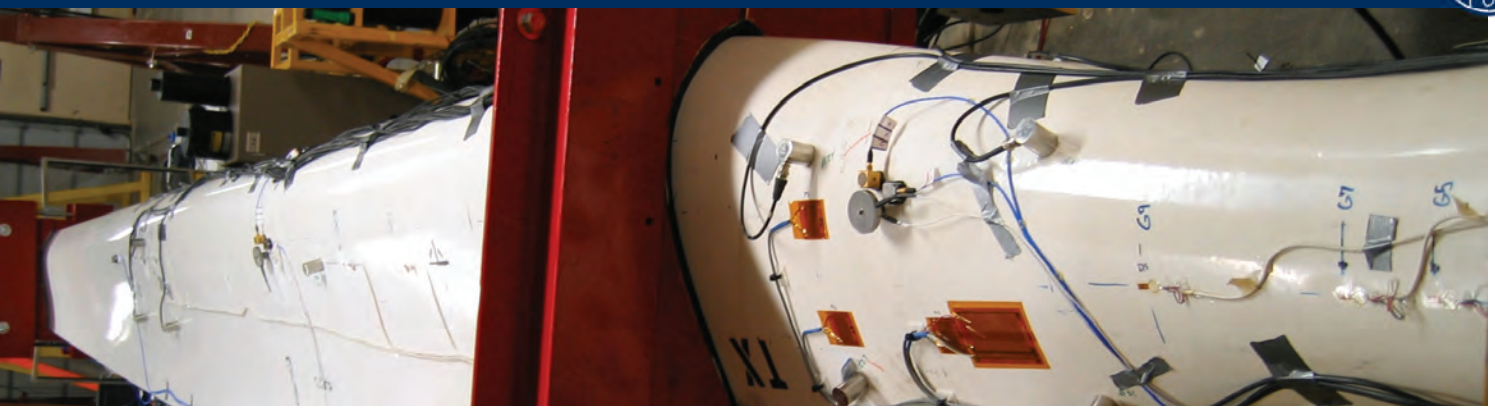


MEMS DC Response - Energy & Power Generation

Series 3711 (singe-axis), 3713 (triaxial) and 3741(single-axis) MEMS DC response accelerometers are designed to measure low frequency vibration and motion and are offered in full-scale ranges from ± 2 to ± 200 g to accommodate a variety of testing requirements. The units feature gas-damped, silicon MEMS sensing elements for uniform, repeatable performance and offer high frequency overload protection. Electrically, the units offer a single ended or differential output signal with power, signal and ground leads for each channel. Supply voltage regulation permits operation from + 6 to + 30 VDC and the low-noise, low-impedance output signal may be transmitted over long cable lengths without degradation.

Single-axis MEMS DC Accelerometer
Series 3711

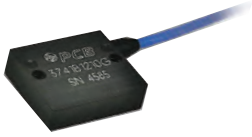
- Hermetically sealed
- Robust titanium housing
- Single ended output

Visit www.pcb.com for more information

Triaxial MEMS DC Accelerometer
Series 3713

- Hermetically sealed
- Robust titanium housing
- Single ended output

Visit www.pcb.com for more information



Single-axis MEMS DC Accelerometer
Series 3741

- Low profile and low mass
- Anodized aluminum housing
- Differential output

Visit www.pcb.com for more information

Blade Pitch Control

Blade mounted pressure sensors can provide a signal to a blade pitch controller, which uses the signal to adjust the blade pitch to an acceptable level. PCB Piezotronics, Inc. pressure transducers, Series 1500, achieve the accuracy, repeatability and stability requirements of wind turbine measurement and control.

Pressure Transducers - Energy & Power Generation

PCB® pressure sensors have been specifically designed to provide high accuracy, excellent repeatability and unmatched long term stability. This is achieved by a unique thin-film process, which "atomically fuses" sensitive resistive material directly to the pressure sensing element. This process eliminates the traditional use of adhesives, as well as the need for a "fluid fill." The pressure sensing element is mated to an integrated circuit, programmed to provide the required span, zero and output configuration. Then, to ensure reliability, the sensing cores are encapsulated by an all-welded, corrosion resistant, stainless steel diaphragm and housing.

Pressure Transducers & Transmitters
Series 1500

- Available in guage, absolute, and sealed guage
- High precision final assembly
- Configure with a variety of electrical connectors and integral cables

Visit www.pcb.com for more information

www.imi-sensors.com/sure

Oil & Gas Pipeline Measurements?

We Do!™ **We do it all** - sensors to measure vibration, acoustics, force, pressure, load, strain, shock and torque - Sure we do!

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A PCB PIEZOTRONICS DIV.

Oil & Gas Wells and Pipelines

Sensors for Natural Gas Supply & Petrochemical Industry

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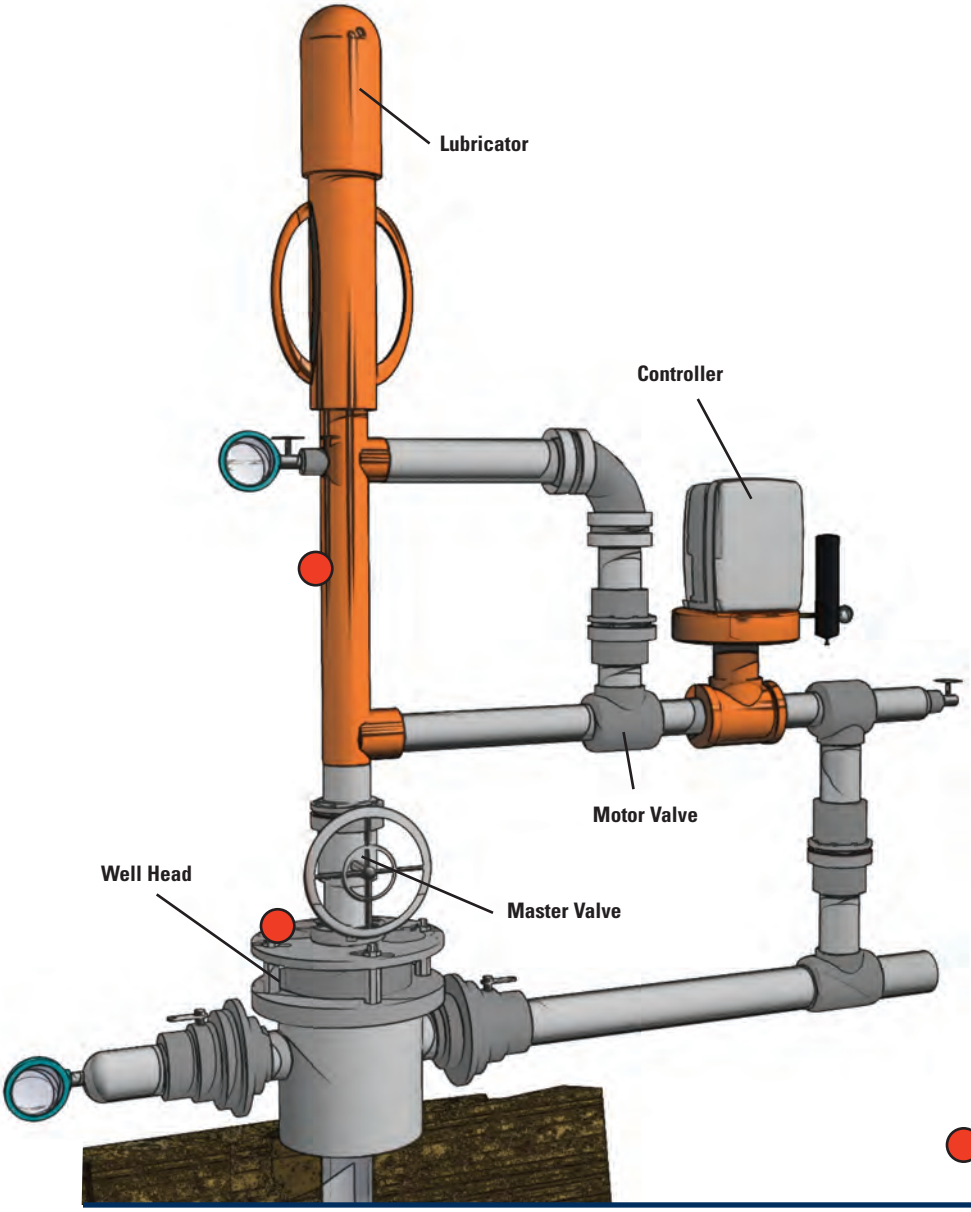
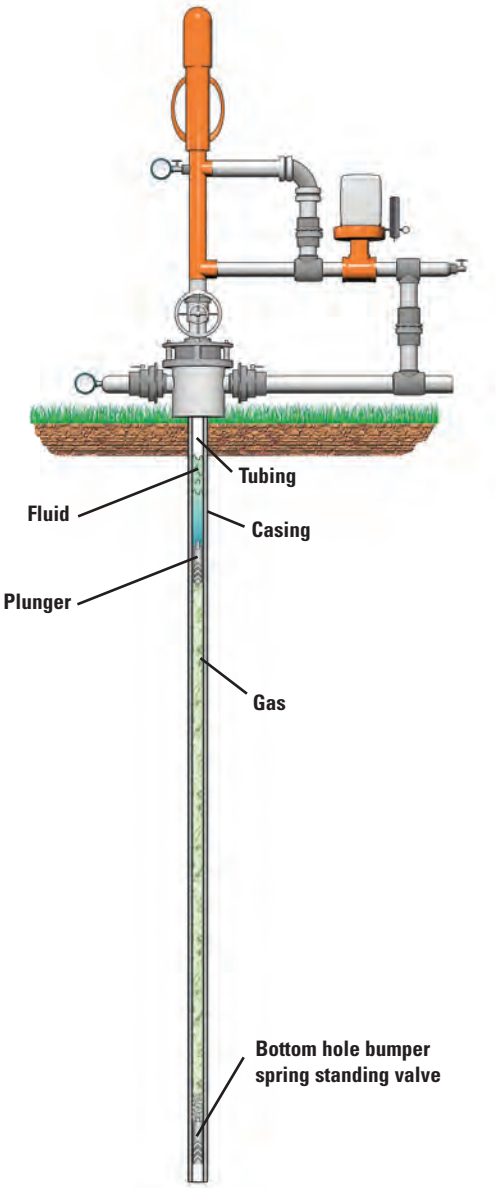
Energy & Power Generation

Oil & Gas Wells and Pipelines

Sensors that offer hazardous area approvals are widely used on gas and oil well heads, supply lines, natural gas power engines, multi-stage gas compressors and other machinery operating in hazardous environments. Piezoelectric pressure sensors offer the capability to detect and monitor dynamic pressure spikes, pulsations and surges in gaseous or liquid media. Engine pressure sensors offer walk-around or permanent monitoring capability, allowing engine balancing and emissions control. Vibration monitoring has proven effective for determining machinery health, planning maintenance intervals, reducing downtime and avoiding catastrophic loss.





Suggested Sensor Placement

Sensors for Motors & Pumps - Energy & Power Generation

4-20 mA Vibration Transmitter
Series EX640

- Available in velocity or acceleration output
- ATEX / CSA approved with explosion proof conduit
- Top exit, 2-pole terminal block

See page 116 for more information

Low Cost ICP® Accelerometer
Series 607

- Unique 360° Swivel Design
- Allows for easy cable orientation
- Integral or Armored Integral Cable options available

See page 84 for more information

Sensors for Compressors - Energy

4-20 mA Pressure Transmitter
Series 1503

- Ranges from 300 to 10,000 psi
- Withstands sour gas environments
- 1/2" NPT fitting

Visit www.pcb.com for more information

Sensors for Well Heads - Energy

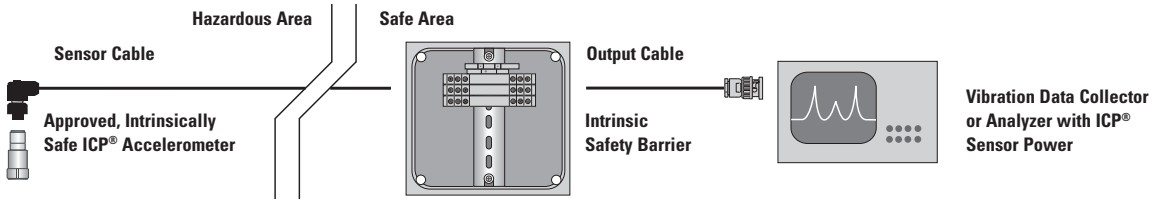
ICP® Pressure Sensor
Model 121A44

- Sensitivity: 10 to 100 mV/psi (1.45 to 14.5 mV/kPa)
- Measurement range: 50 to 500 psi
- 316 stainless steel diaphragm
- 1/4" NPT fitting

See page 138 for more information

TipsFromTechs

Typical Intrinsically Safe Installation



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Conveyor Vibration Measurements?

We Do!™

We do it all - sensors to measure vibration, acoustics, force, pressure, load, strain, shock and torque - Sure we do!

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Vibratory Screens & Feeders

Meeting the Demands of Environmental Vibration Measurement & Trending Applications

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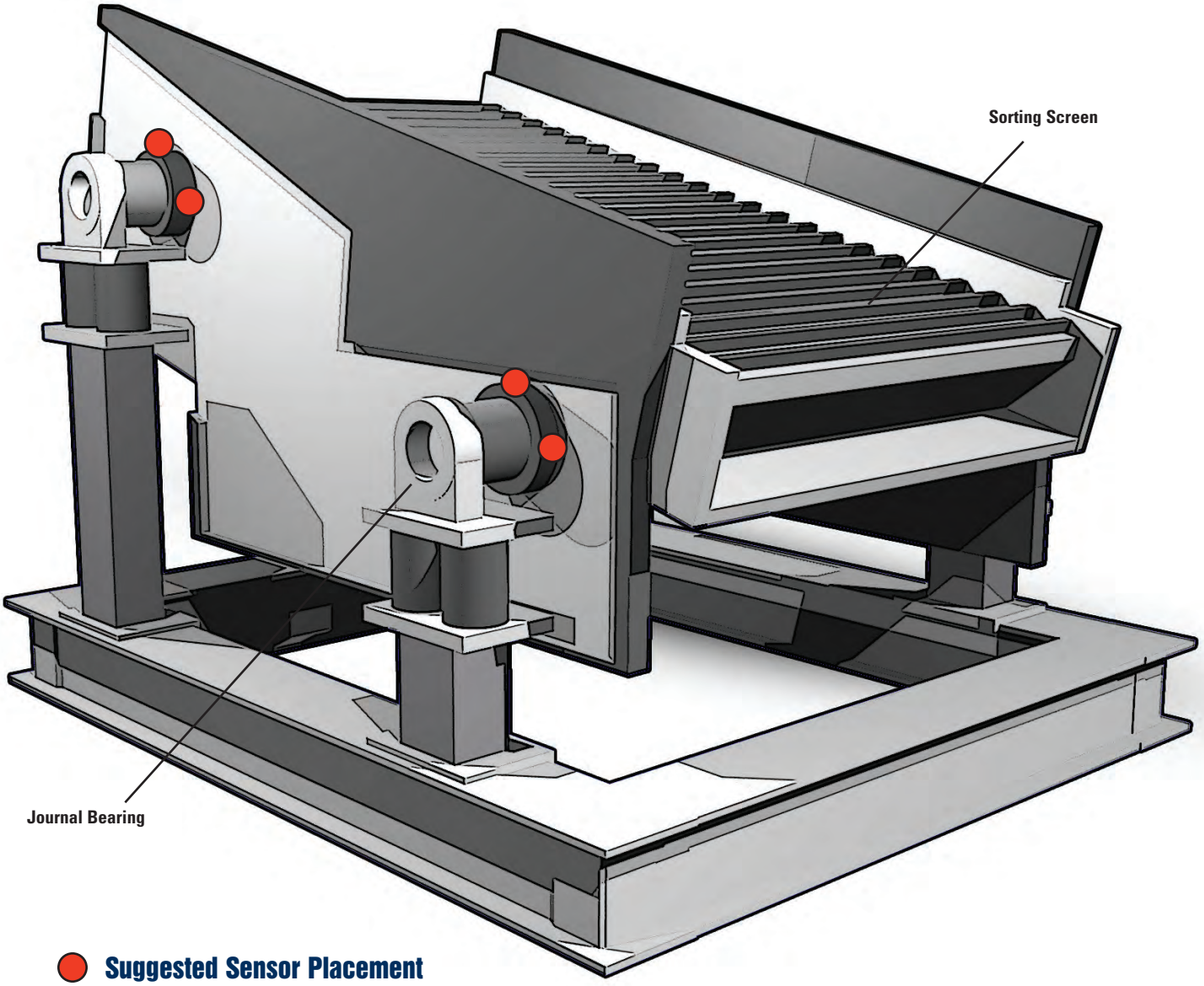
Process Monitoring & Protection

Vibratory Screens & Feeders

Vibration monitoring of vibrating screens and feeders is critical to determining machinery health and preventing overloading or catastrophic damage to equipment. Because this type of equipment is intended to operate with high levels of vibration, low sensitivity high range sensors are optimal. Because these types of processes are often dirty, wet and debris may damage cables, armor jacketed cables are recommended.



Suggested Sensor Placement

4-20 mA Transmitters - Process Monitoring & Protection

4-20 mA Output Transmitter
Series 642

- Cost-effective 4-20 mA output sensor
- Available in top or side exit casings
- Ruggedized industrial design

See page 118 for more information

Intrinsically Safe 4-20 mA Output Transmitter
Model EX640B71

- Available in velocity or acceleration output
- ATEX / CSA approved with explosion proof conduit
- Top exit, 2-pole terminal block

See page 116 for more information

4-20 mA Sensor Retransmit Module
Model 682B03

- Accepts ICP® sensor input, outputs 4-20 mA proportional to vibration
- Selectable displacement, velocity, or acceleration output
- Analog vibration output via front BNC for fault diagnostics

See page 121 for more information

Vibration Switches - Process Monitoring & Protection

Electronic Vibration Switch
Series 685B

- Lower cost than competitive models
- Dual set points (relays)
- Explosion proof options available

See page 132 for more information

USB Programmable Smart Switch
Model 686B01

- Programmable delays eliminate false trips
- Competitive price compared to mechanical switches
- Explosion proof options available

See page 130 for more information

Vibratory Screens & Feeders

Accessories

Accessories for 4-20 mA Transmitters

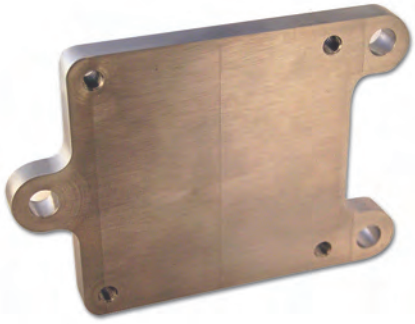
Armor Jacketed, FEP Cable with MIL Connector to Blunt Cut
048BPXXXBZ

Sensor Mounting Pad
Model 080A91: Ø1.375"

Mounting Stud for Side Exit Transmitters
Model 080A162

Accessories for Vibration Switches

Polyurethane Cabling with Right Angle MIL-Style Connector
052BQXXXBZ



Adapter Plate for Model 685B
Model 080A209

USB Programming Kit for Model 686B
600A15 Kit

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

Reciprocating Machinery

Sensors Optimized for the Unique Challenges of Protecting & Monitoring Reciprocating Machinery

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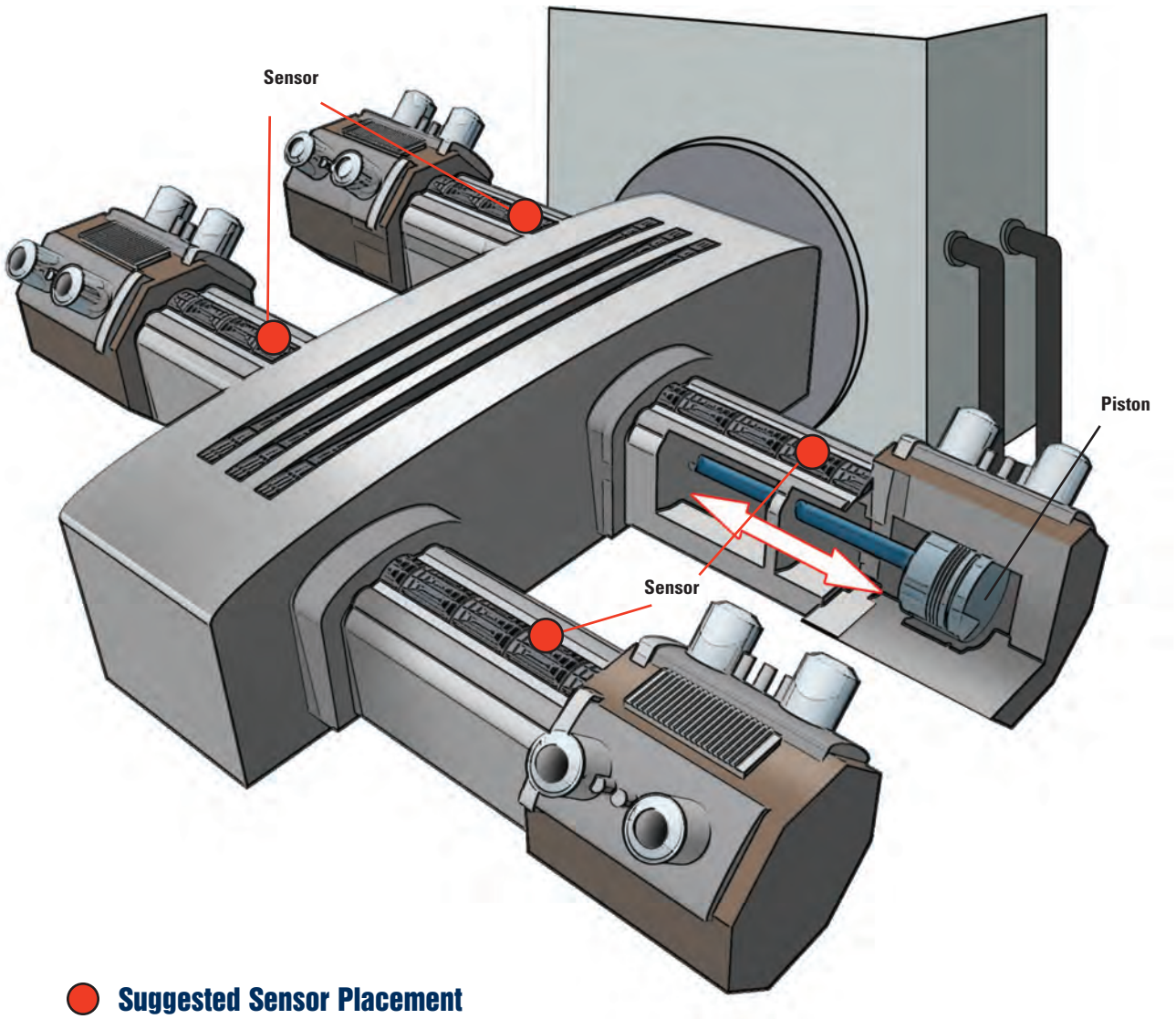
Process Monitoring & Protection

Reciprocating Machinery

Years of frustrating unanticipated reciprocating compressor failures have lead to the development of the new line of IMI® Reciprocating Machinery Protectors. We have learned that the proven successful methods of condition monitoring on rotating equipment do not yield good results on reciprocating devices. IMI® has developed the RMP product line to detect impacts caused by looseness of internal parts. Depending on the amplitude of the impact and how many times the impact occurs within a specified time window, the appropriate 4-20 mA signal is provided. The industry leading USB Programming capability makes it easy to match the RMP to any reciprocating application. For properly running machinery, the IMI® RMP allows you to trend peak acceleration data.



Suggested Sensor Placement

Sensors for Compressors - Process Monitoring & Protection

4-20 mA Pressure Sensor
Series 1503

- Mounts on the compressor
- Withstands sour gas environments
- 1/2" NPT fitting

Visit www.pcb.com for more information

USB PROGRAMMABLE

Industry Exclusive!

Reciprocating Machinery Protector
Model 649A01

- Detects faults / mechanical looseness in reciprocating compressors
- Outperforms impact transmitters
- Continuous trending, with alarm & alert levels for early warning

See page 126 for more information

Product Spotlight

USB Programming Kits

- Customize settings on your USB programmable sensor
- Power-on, startup, & operating delays
- Kit includes CD-ROM software & cable adapters

See page 136 for more information

Industry Exclusive!

USB PROGRAMMABLE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Machine Tool
Measurements?
We Do!™
We do it all - sensors to measure vibration, acoustics, force, pressure, load, strain, shock and torque - Sure we do!
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Machine Tool Spindles

Eliminate the Guesswork, Use Vibration Trends to Change Tooling Efficiently

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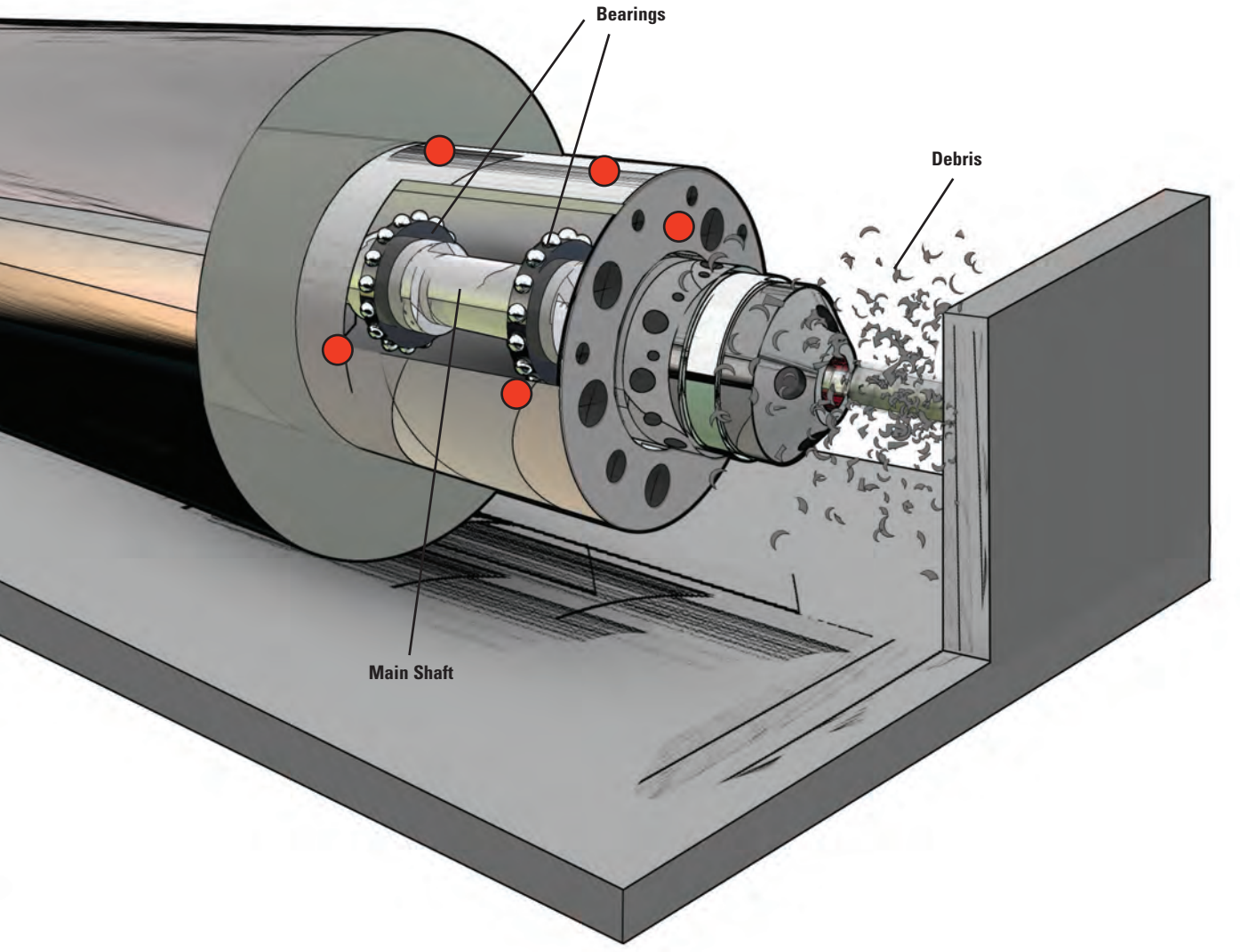
Predictive Maintenance

Machine Tool Spindles

Vibration monitoring of machine tools is useful for the analysis of tool life, tool integrity, part quality and preventing unexpected tool failure causing unscheduled downtime. Machining processes, like cutting, generate very high levels of vibration, therefore a 100 mV/g accelerometer or less is always recommended. Furthermore, cutting operations often leave the accelerometer exposed to large amounts of cutting fluids and razor sharp chips and metal scrap. To prevent damage, it is always recommended to utilize a sensor with integral armor jacketed cable in this environment.



Suggested Sensor Placement

ICP® Accelerometers - Predictive Maintenance

Low Cost ICP® Accelerometer
Model 602D01

- Easy installation in tight spaces
- No cable/connector clearance required
- Less than 1 in height

See page 82 for more information

Low Cost ICP® Accelerometer
Model 603C01

- General purpose, hermetically sealed
- IMI's most popular accelerometer
- Small footprint

See page 82 for more information

Low Cost ICP® Accelerometer
Model 607A61

- Unique 360° swivel design
- Allows for easy cable orientation
- Integral or armored integral cable options available

See page 85 for more information

High Frequency ICP® Accelerometer
Model 623C01

- 15 kHz high frequency response
- 10 mV/g or 100 mV/g options
- Intrinsically safe models available

See page 96 for more information

Precision ICP® Accelerometer
Model 625B01

- Side exit, ring-style
- Low frequency response to 12 cpm (0.2 Hz)
- Ceramic sensing element

See page 92 for more information

Precision ICP® Accelerometer
Model 625B61

- 5% sensitivity tolerance
- Through-hole mounting
- Intrinsically safe, velocity output versions

Visit www.imi-sensors.com for more information

Machine Tool Spindles

Accessories

Cables & Connectors

Armor Jacketed, FEP Cable with MIL Connector to Blunt Cut
048BPXXXBZ

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

Mounting Hardware

Sensor Mounting Pad
Model 080A93: Ø0.75″
Model 080A118: Ø1.0″

Flat Surface Magnet
Model 080A120: Ø0.75″
Model 080A121 Ø1.0″

1/2-20 to 1/4-28 Mounting Stud
Model 080A156

Spot Face Tools
Model 080A128
Model 080A129

Product Spotlight

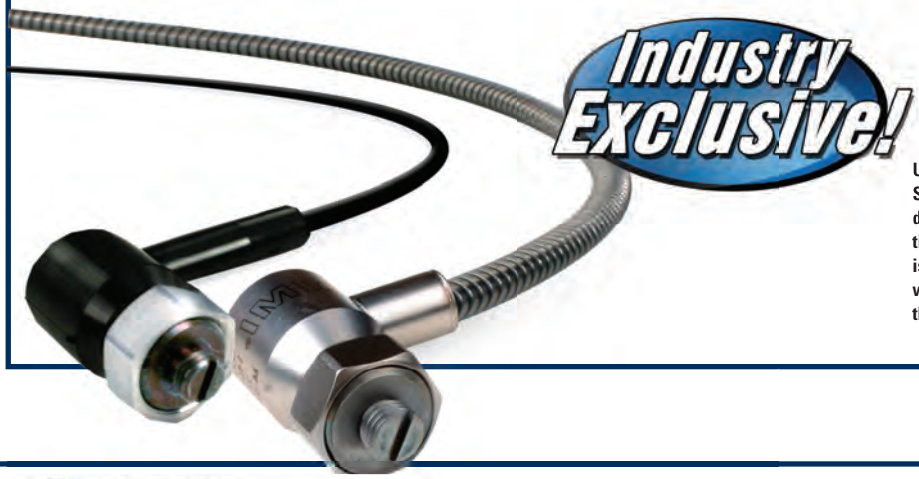
Swiveler® & Spindler® Accelerometers

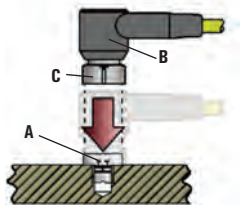
Model 607A11 Model 607A61

This industry exclusive product is innovative in both its small size and its convenient swiveling mounting method

- Patented 360° swivel mount allows for convenient cable orientation (US Patent #6,435,902)
- Lower cost alternative to through-bolt sensors
- Small footprint & very low profile for installation in tight spaces

See page 84 & 85 for more information



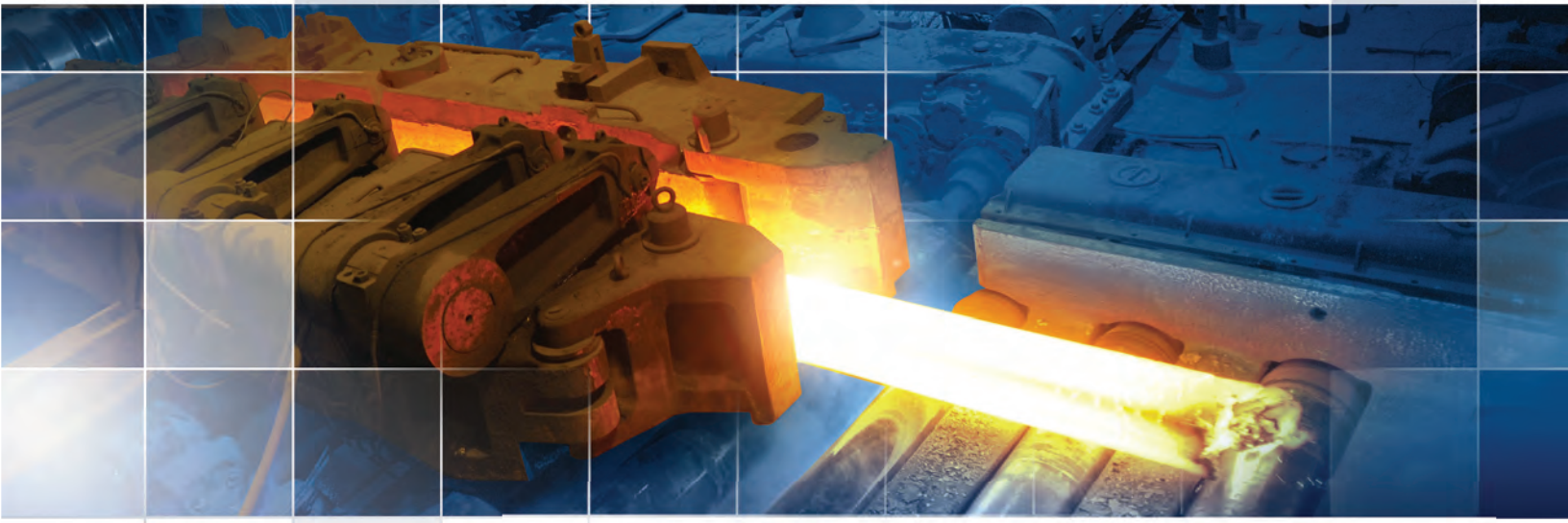


Mounting hole is prepared into machine surface to accept sensor's mounting stud (A). Stud is then tightened to recommended torque with hex Allen key. Sensor (B) hex nut (C) is threaded onto mounting stud.

Using the 360° capabilities of the Swiveler®, the cable is positioned into desired orientation & temporarily hand tightened. Using a wrench, the hex nut is tightened to the recommended torque while holding the cable or connector in the desired location.

Steel Rolling & Annealing

Sensors that stand up to the harsh, high temperature and extreme environments of steel mills



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Predictive Maintenance

Steel Rolling & Annealing

Steel Mills not only have typical fans, pumps, compressors, gearboxes and cooling towers but also have machines and processes unique to the steel industry. The machine sizes, machine designs, operating speeds, cycle times, batch operations and harsh mill environments often command the use of carefully selected sensors and methods for effective equipment monitoring. Iron making and steel making areas often have an abundance of large belt conveyors, critical ultra-low speed machines with limited rotation, critical large EOT cranes and large volume turbo blowers coupled with >2300 ºF hot blast air, molten liquid iron, red hot slabs, often carbon monoxide risks and of course, rolling mills.

Sensor Selection - IMI® recognizes the varied needs and challenges of the steel industry and has successfully designed a wide variety of transducers and accessories to help meet the needs of their customers. While most sensors can be used in a wide range of applications, some sensors are better suited for the harsh conditions encountered in steel mill applications and have been pointed out in this section.

Cold Rolling Areas - Process Monitoring & Protection

Cold Rolling Mills have similar operating and cyclic challenges as hot rolling, but add in large numbers of roll "chock" bearings that are inherently difficult to instrument, run at varying speeds/loads in batch cycles. These “chocks” are removed and reinstalled into the mill with new rolls many times a day, after only minutes of operation at times. Couple this with stringent product quality critical requirements and again, many more extreme monitoring challenges are raised.

Precision ICP® Accelerometer
Model 626B01

- Low noise floor
- Low frequency response to 12 cpm (0.2 Hz)
- Full sweep calibration

See page 94 for more information

4-20 mA Output Sensor
Model 640B01

- Available in top or side exit casings
- Peak or RMS, acceleration or velocity
- Intrinsically safe / explosion proof versions available

See page 112 for more information

Low Cost ICP® Accelerometer
Model 608A11

- Ideal for submersible applications
- Small installation footprint
- Stock integral cable lengths of **10 ft**, 20 ft, **30 ft** and 50 ft

See page 84 for more information

Bearing Fault Detector
Model 682B05

- Provides early warning of bearing and gear faults
- Operates with PLC, DCS, SCADA, alarm and control systems
- Outputs 4-20 mA signals for peak acceleration and overall vibration

See page 124 for more information

Hot Rolling Machines - Predictive Maintenance

Hot Rolling Mills have large low speed gearboxes, pinion stands, drive shafts and large diameter rolls in bearings to reduce the thickness of red hot steel slabs. Running these at variable loads/speeds and cycle times which may last only 30 seconds during speed variations of >500% presents challenges. Environmental factors here include reheat furnace temperatures, steam and scale from cooling water sprays and of course coiling red hot steel traveling at thousands of feet per minute.

325°F (162 °C)

High Temperature ICP® Accelerometer

Model HT602D01

- Ceramic sensing element
- Low profile design
- Through-bolt mount

See page 100 for more information

Model 600A02

High Temperature Accelerometer Kit

- Includes accelerometer, cable and charge amplifier
- Sensor temperature range up to 500 °F (260 °C)
- Compatible with ICP® signal conditioners

Visit www.imi-sensors.com for more information

325°F (162 °C)

High Temperature Precision ICP® Accelerometer

Model HT628F01

- Quartz sensing element
- Excellent thermal stability
- Welded hermetic

See page 101 for more information

900°F (482 °C)

Very High Temperature Accelerometer

Series EX600B1X

- Sensitivity: 10 to 100 mV/g (1.02 mV/(m/s2) to 10.2 mV/(m/s2))
- Frequency Range: (±5%) 282 to 240,000 cpm (4.7 to 4 kHz)
- Measurement Range: ±50 to 500 g peak (±490 to 4900 m/s2)
- Mounting: Through Holes (3)

See page 106 for more information

Predictive Maintenance

Steel Rolling & Annealing

Annealing and Coated Products - Predictive Maintenance

Annealing and coated product operations often run at quite low speeds and also have product quality critical requirements. Temperatures from annealing furnaces and molten zinc and aluminizing baths add many temperature, personnel safety and monitoring concerns as well.

Low Cost ICP® Accelerometer
Model 603C01

- General purpose, hermetically sealed
- IMI's most popular accelerometer
- Small footprint

See page 82 for more information

Low Cost ICP® Accelerometer
Model 607A11

- Ideal for submersible applications
- Smallest true industrial accelerometer on the market
- Armored integral cable options available

See page 84 for more information

Precision Accelerometer
Model 622B01

- Full frequency sweep calibration: 5% sensitivity deviation tolerance
- 15 kHz high frequency response ideal for early detection of bearing fluting conditions
- Ideal for route-based data collection

See page 92 for more information

Universal Transmitter
Model 682A16

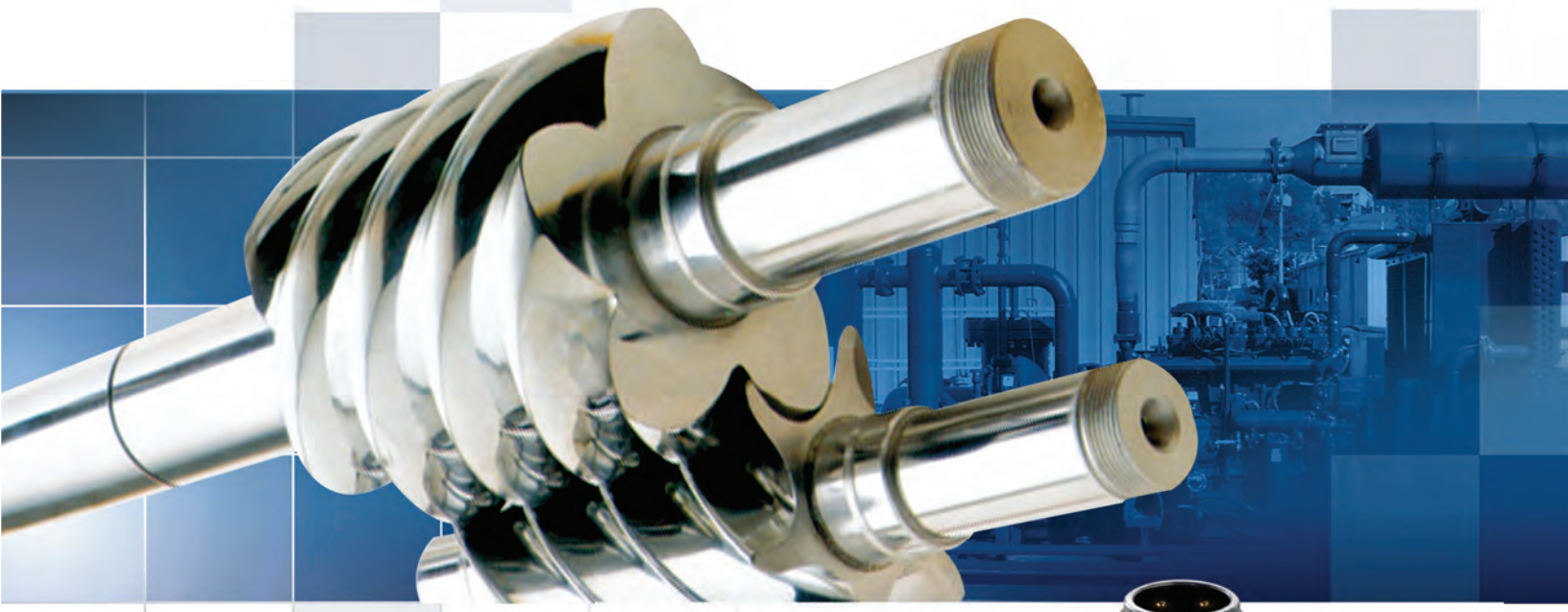
NEW!

- Optional front panel programmer with LCD display
- Provides ICP® sensor power
- Accepts mA, ohm, RTD and thermocouple

See page 157 for more information

Rotary Screw Compressors

High Frequency Accelerometers Capable of Capturing Rotor Mesh and Bearing Faults



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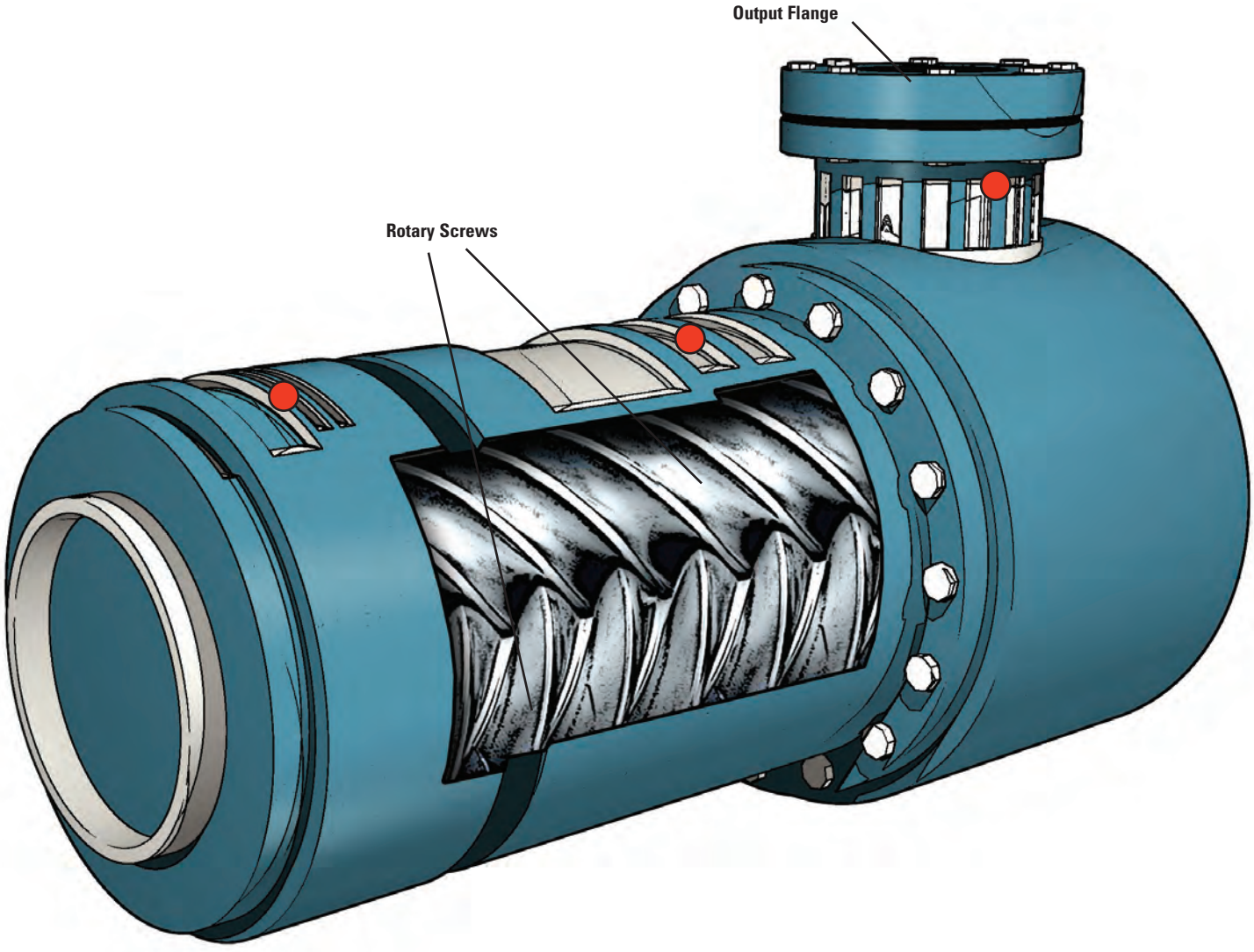
Predictive Maintenance

Rotary Screw Compressors

Rotary screw compressors, both oil-free and oil-flooded, can provide a unique set of challenges to the predictive maintenance professional. Accelerometers used in these applications must be capable of detecting vibration through a very wide frequency band allowing the user to pickup faults such as pitting in the race of the bearings, oil injection issues or rotor mesh. Mounting is generally recommended on the casing of the compressor as close to the radial bearings as possible. A comprehensive predictive maintenance program that includes monitoring vibration on typically critical rotary screw compressors can improve downtime and increase efficiency with maintenance scheduled in advance of catastrophic failure.



Suggested Sensor Placement

Photo Courtesy of Abby Services, Inc.

ICP® Accelerometers - Predictive Maintenance

Very High Frequency Accelerometer
Model 621B40

- 30 kHz frequency, even with magnet
- Titanium housing
- Smallest available footprint

See page 96 for more information

Precision Accelerometer
Model 622B01

- Full frequency sweep calibration: 5% sensitivity deviation tolerance
- 15 kHz high frequency response ideal for early detection of bearing fluting conditions
- Ideal for route-based data collection

See page 92 for more information

Product Spotlight

Very High Frequency Accelerometer Kit
Model 600A12

Industry Exclusive!

This high frequency 10 mV/g accelerometer kit features a very small accelerometer with a magnet and cable assembly

- High frequency response to 30 kHz, even when mounted magnetically
- Supplied with 5 ft. cable with BNC plug termination
- Kit features Model 621B40 accelerometer, with titanium housing

Rotary Screw Compressors

Accessories

Cables & Connectors

Coiled TPE Cable with BNC Plug to 2-Pin MIL Connector
050LQ006AC Cabling

Polyurethane Cable with BNC Plug to 2-Pin MIL-style Connector
052BR010AC Cabling

Lightweight Coaxial Cable with BNC Plug to 5-44 Microdot Plug
018C05 Cabling

Mounting Hardware

Sensor Mounting Pad
Model 080A93: Ø0.75″
Model 080A118: Ø1.0″

Flat Surface Magnet
Model 080A121

Curved Surface Magnet
Model 080A131: Ø1.0″
Model 080A132: Ø1.5″

High Frequency Magnet
Model 080A157

Enclosures

BNC Termination Enclosure
Model 691A51/04

BNC Termination Enclosure
Model 691A50/12

BNC Switch Box
Model 691B41

BNC Switch Box
Model 691B42

Nuclear Power Instrumentation

Sensors featuring the radiation hardened approvals necessary for nuclear power environments

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Energy & Power Generation

Nuclear Power Instrumentation

- High temperature vibration measurements
- Steam turbine testing
- Monitoring of boiling water reactors

PCB®'s Charge Output accelerometers utilize piezo ceramic sensing elements to directly output an electrostatic charge signal that is proportional to applied acceleration. Charge output accelerometers do not contain built-in signal conditioning electronics. As a result, external signal conditioning is required to interface their generated measurement signals to readout or recording instruments. The sensor's charge output signals can be conditioned with an in-line, fixed charge converter.

Since there are no electronics built into Charge Output accelerometers, they can operate and survive exposure to very high temperatures (up to +1200 °F/+649 °C for some models). In addition, Charge Output accelerometers are used for thermal cycling requirements or to take advantage of existing charge amplifier signal conditioning equipment. It is important to note that measurement resolution and low frequency response for charge output, acceleration sensing systems are dependent upon the noise floor and discharge time constant characteristics of the signal conditioning and readout devices used.

Charge Output Radiation Hardened Accelerometers - Energy & Power Generation

- Survives integrated gamma flux to 10^8 rads
- Survives integrated neutron flux to 10^{10} N/cm^2

Charge Output Accelerometer
Model 357B53

- Sensitivity: (±15%) 100 pC/g (10.2 pC/(m/s^2))
- Measurement Range: ±150 g pk (±1470 m/s^2 pk)
- Frequency Range: (+5%) 3 kHz
- Electrical Connector: 10-32 Coaxial Jack

See page 102 for more information

Charge Output Accelerometer
Model 357B54

- Sensitivity: (±15%) 100 pC/g (10.2 pC/(m/s^2))
- Measurement Range: ±150 g pk (±1470 m/s^2 pk)
- Frequency Range: (+5%) 3 kHz
- Electrical Connector: 10-32 Coaxial Jack

See page 102 for more information

Hardline Cable, Radiation Hardened

10-32 Coaxial Plug
Model FZ

Shielded Hardline Cable
Model 023

10-32 Coaxial Jack
Model GA

In-line Charge Converters, Radiation Hardened

In-line Charge Converter
Model 422E65/A

- Sensitivity: (Charge Conversion) 1 mV/pC
- Output Voltage: ±5 V
- Temperature Range: (Operating) -65 to +250 °F (-54 to +121 °C)

See page 159 for more information

In-line Charge Converter
Model 422E66/A

- Sensitivity: (Charge Conversion) 10 mV/pC
- Output Voltage: ±5 V
- Temperature Range: (Operating) -65 to +250 °F (-54 to +121 °C)

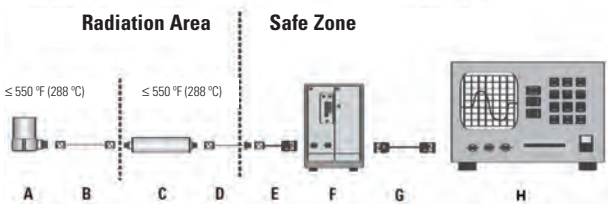
See page 159 for more information

Tips From Techs

Recommended Components for a Typical Installation

A Charge output, radiation hardened accelerometer
B Model 023FZXXXFZ cable assembly, 10-32 plug to 10-32 plug
C In-line charge converter, Model 422E65/A or 422E66/A
D Model 023FZXXXGA cable assembly, 10-32 plug to 10-32 jack
E Model 003C03 cable, 10-32 plug to BNC plug
F ICP® sensor signal conditioner
G Model 012A03 output cable, BNC plug each end
H Readout, recording, or data acquisition device

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)



Energy & Power Generation

Nuclear Power Instrumentation

High Temperature Charge Output Accelerometers, Radiation Hardened

Charge Output Accelerometer
Model 357B61

- Sensitivity: (±10%) 10 pC/g (1.02 pC/(m/s²))
- Measurement Range: ±1000 g pk (±9810 m/s² pk)
- Frequency Range: (±5%) 5 kHz
- Electrical Connector: 10-32 Coaxial Jack

See page 105 for more information

Charge Output Accelerometer
Model 357B69

- Sensitivity: (±10%) 3.5 pC/g (.357 pC/(m/s²))
- Measurement Range: ±500 g pk (±4950 m/s² pk)
- Frequency Range: (±5%) 6 kHz
- Electrical Connector: 10-32 Coaxial Jack

See page 105 for more information

Hardline Cable, Radiation Hardened

Hardline Cable with 10-32 Plug to 10-32 Jack
Model 023A10

Supplied Accessory for 357B61 & 357B69

In-line Charge Converter, Radiation Hardened

In-line Charge Converter
Model 422E65/A

- Sensitivity: (Charge Conversion) 1 mV/pC
- Output Voltage: ±5 V
- Temperature Range: (Operating) -65 to +250 °F (-54 to +121 °C)

See page 159 for more information

In-line Charge Converter
Model 422E66/A

- Sensitivity: (Charge Conversion) 10 mV/pC
- Output Voltage: ±5 V
- Temperature Range: (Operating) -65 to +250 °F (-54 to +121 °C)

See page 159 for more information

Tips From Techs

Recommended Components for a Typical Installation

A High temperature, radiation hardened accelerometer, Model 357B61 or 357B69
B Model 023A10 cable assembly, 10-32 plug to 10-32 jack
C Model 003EBXXXAL cable, 10-32 plug to 10-32 jack
D In-line charge converter, Model 422E65/A or 422E66/A
E Model 003D03, BNC plug to BNC plug
F ICP® sensor signal conditioner
G Model 012A03 output cable, BNC plug each end
H Readout, recording, or data acquisition device

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

High Temperature Radiation Hardened Accelerometers - Energy & Power Generation

900 °F (482 °C)

Charge Output Accelerometer
Model 357C71

- Sensitivity: (±5%) 10 pC/g (1.02 pC/(m/s²))
- Measurement Range: ±1000 g pk (±9810 m/s² pk)
- Frequency Range: (±5%) 4 kHz
- Electrical Connector: 7/16-27 2-Pin

See page 104 for more information

900 °F (482 °C)

Charge Output Accelerometer
Model 357C72

- Sensitivity: (±5%) 50 pC/g (5.1 pC/(m/s²))
- Measurement Range: ±500 g pk (±4905 m/s² pk)
- Frequency Range: (±5%) 2.5 kHz
- Electrical Connector: 7/16-27 2-Pin

See page 104 for more information

900 °F (482 °C)

Charge Output Accelerometer
Model 357C73

- Sensitivity: (±5%) 100 pC/g (10.2 pC/(m/s²))
- Measurement Range: ±300 g pk (±2943 m/s² pk)
- Frequency Range: (±5%) 2 kHz
- Electrical Connector: 7/16-27 2-Pin

See page 104 for more information

Hardline Cable, Radiation Hardened

2-socket Plug, 7/16-27 thd
Model GN

2-conductor Hardline Cable
Model 013

2-pin Jack, 7/16-27 thd
Model GP

PFA Jacketed Cable

PFA Cable with ET Connector to EP Connector (25 ft cable)
045M19 Cabling

Differential Charge Converters

Differential Charge Converter
Model 422M182

- Sensitivity: 4 mV/pC
- Output Voltage: ±5 VpK
- Temperature Range: -60 to 185 °F

See page 158 for more information

Differential Charge Converter
Model 422M183

- Sensitivity: 6 mV/pC
- Output Voltage: ±5 VpK
- Temperature Range: -60 to 185 °F

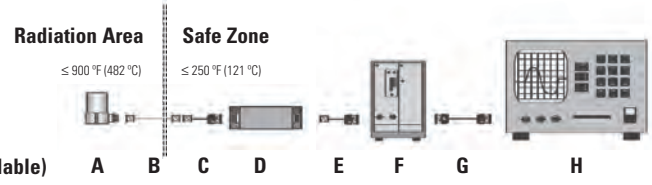
Visit www.pcb.com for more information

Tips From Techs

Recommended Components for a Typical Installation

A High temperature, radiation hardened accelerometer, Model 357C71, Model 357C72, Model 357C73
B Model 013GNXXXGP cable assembly, 2 socket plug, 7/16 to 2 pin jack
C Model 045M19, FEP cable with ET connector to EP connector
D Model 422M182, or Model 422M183
E Model 003D03, BNC plug to BNC plug
F ICP® sensor signal conditioner
G Model 012A03 output cable, BNC plug each end
H Readout, recording, or data acquisition device

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)



Energy & Power Generation

Nuclear Power Instrumentation

Very High Temp Charge Output Accelerometers, Radiation Hardened

Axis of Measurement
Model 357D90

Axis of Measurement
Model 357D91

1200°F (649 °C)

Charge Output Accelerometer
Model 357D90

- Resonant frequency over 14 kHz
- 10 ft integral, hardline cable to 10-32 jack
- Measurement range: ± 1000 g pk
- Sensitivity: (±10%) 5 pC/g (.51 pC/(m/s²))
- Output into sensor base

See page 108 for more information

1200°F (649 °C)

Charge Output Accelerometer
Model 357D91

- Sensitivity in the transverse direction
- Resonant frequency over 14 kHz
- 10 ft integral, hardline cable to 10-32 jack
- Sensitivity: (±10%) 5 pC/g (.51 pC/(m/s²))
- Output perpendicular to sensor base

See page 108 for more information

TFE Jacketed Cable

TFE Cable with 10-32 Plug to 10-32 Plug
Model 003AXX

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)

In-Line Charge Converter, Radiation Hardened

In-line Charge Converter
Model 422E35

- Sensitivity: (Charge Conversion) 1 mV/pC
- Output Voltage: ±2.5 V
- Temperature Range: (Operating) -65 to +250 °F (-54 to +121 °C)

See page 159 for more information

In-line Charge Converter
Model 422E36

- Sensitivity: (Charge Conversion) 10 mV/pC
- Output Voltage: ±2.5 V
- Temperature Range: (Operating) -65 to +250 °F (-54 to +121 °C)

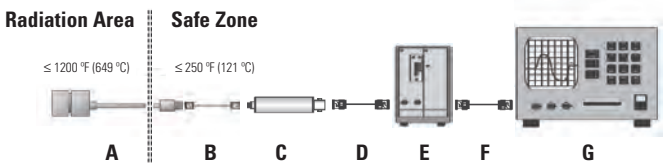
See page 159 for more information

Tips From Techs

Recommended Components for a Typical Installation

A High temperature, radiation hardened accelerometer
B Model 003AXX cable assembly, 10-32 plug to 10-32 jack
C In-line charge converter, Model 422E35/A or 422E36/A
D 003DXX BNC plug to BNC plug
E ICP® sensor signal conditioner.
F Model 012A03 output cable, BNC plug each end
G Readout, recording, or data acquisition device

XXX = Denote cable length, 010 = 10 feet (Metric lengths available)



Shock Monitoring

Miniature Embeddable Accelerometers for Monitoring Shock in Critical Shipping Containers

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Process Monitoring & Protection

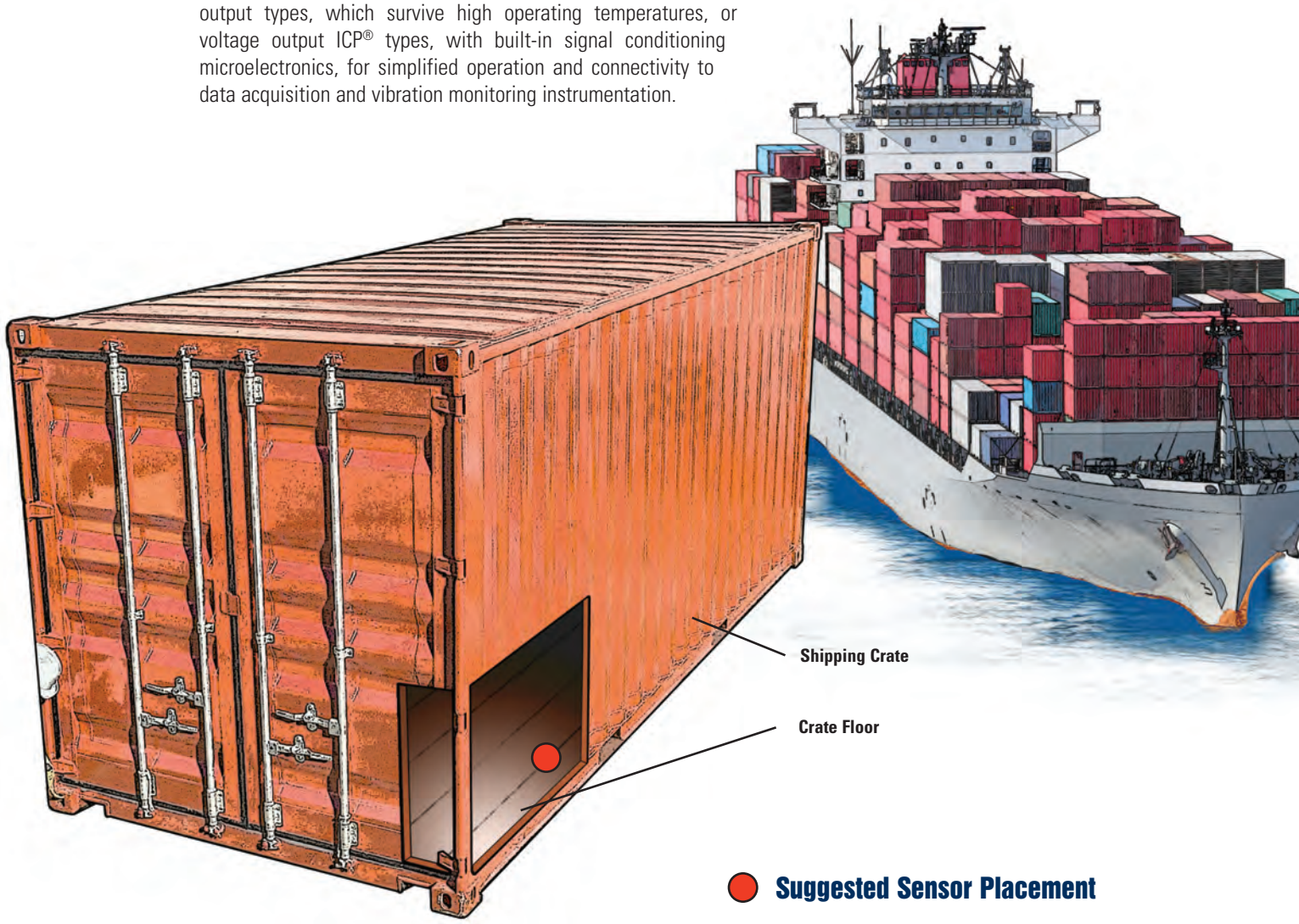
Shock Monitoring

Reusable ocean going shipping containers sometimes carry critical cargo that can be exposed to high shock levels during loading and unloading. It has become necessary to monitor shock and vibration loading to prevent damage and provide a record of these events.

IMI's line of embeddable miniature accelerometers in conjunction with other geographical logging devices provides vibration and shock signals to logging devices creating a dock to dock record of events occurring during the shipment cycle.

Series 660 low cost embeddable accelerometers offer an affordable solution for vibration and shock measurements in high volume and commercial OEM applications. The units are particularly well suited for shock and impact detection of packages or components, as well as bearing and gear mesh vibration measurements in predictive maintenance and condition monitoring requirements. The compact designs may be embedded into machinery at the OEM level to provide value added monitoring protection.

The units employ field proven, solid state, piezoelectric sensing elements for durability and broadband performance. Choose from charge output types, which survive high operating temperatures, or voltage output ICP® types, with built-in signal conditioning microelectronics, for simplified operation and connectivity to data acquisition and vibration monitoring instrumentation.



Low-power Pellet Accelerometers - Process Monitoring & Protection

- Choice of standard TO-5 or TO-8 transistor style packages
- Variety of sensitivities to accommodate a wide range of applications
- Charge output piezoelectric, voltage output ICP® and 3-wire low power options
- Mountable via adhesive or soldering and choice of either integral cable or solder pin electrical connections
- Broadband width, high shock survivability, wide operating temperature range, high resolution and large dynamic range

Embeddable Accelerometer
Low Profile TO-5
See page 110 for more information

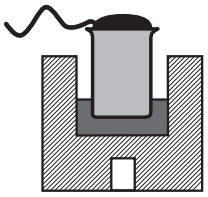
Embeddable Accelerometer
TO-5
See page 110 for more information

Embeddable Accelerometer
TO-8
See page 110 for more information

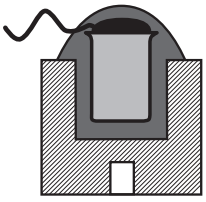
Tips From Techs

Embeddable Accelerometer Mounting Examples

IMI's embeddable accelerometers are an excellent choice for monitoring shock and vibration in a very small package. Examples to the right show different options for potting or complete encapsulation into mounting hardware, creating the optimal solution.



Potted Sensor Installation



Encapsulated Sensor Installation

Products By

Technology

General Purpose

Low Cost ICP® Accelerometers

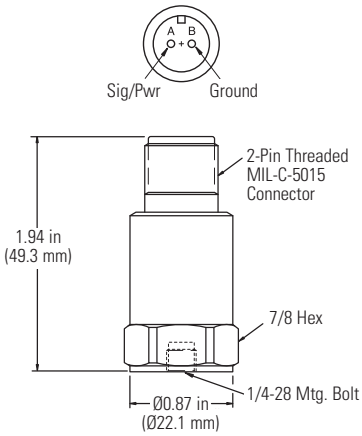
- Economical designs ideal for permanent mounting
- Rugged stainless steel housings with hermetic sealing
- Case isolated electronics eliminate noise issues

Low Cost Industrial ICP® Accelerometer

Model 601A01

- 100 mV/g (50 g measurement range)
- Frequency range: 16 to 600,000 cpm (0.27 to 10 kHz)
- Very good signal to noise ratio
- Integral cable option available

Product shown at actual size

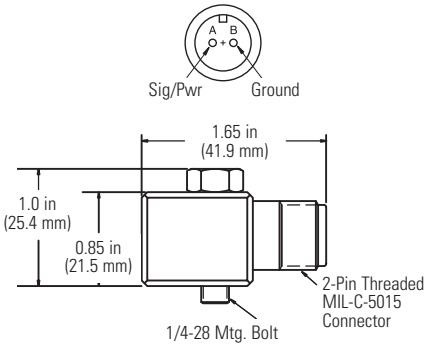


Low Cost Industrial ICP® Accelerometer

Model 602D01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 480,000 cpm (0.5 to 8 kHz)
- Side exit, through-bolt design
- Available in high temperature (+325 °F) & dual temperature/vibration output

Product shown at actual size

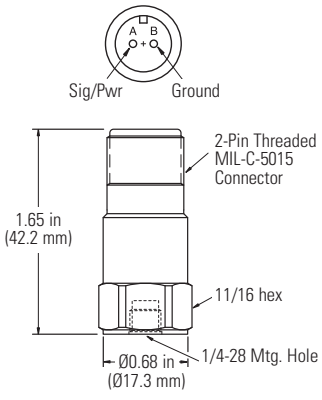


Low Cost Industrial ICP® Accelerometer

Model 603C01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Also available in 10, 50 and 500 mV/g

Product shown at actual size

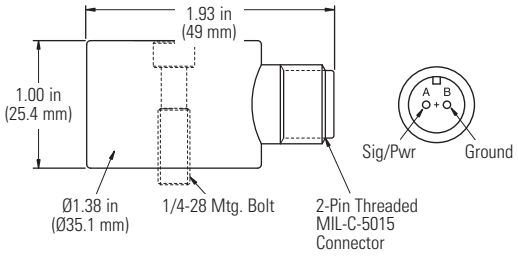


Low Cost Industrial ICP® Accelerometer

Model 606B01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 300,000 cpm (0.5 to 5 kHz)
- Side exit, through-bolt design

Product shown at actual size

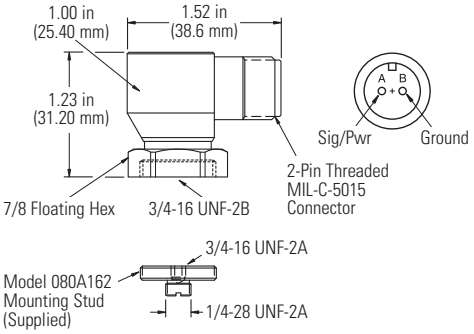


Swiveler® Industrial ICP® Accelerometer

Model 607A01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Electrical Connector: 2-pin MIL-C-5015
- Patented swivel mounting base for ease of cable orientation (US patent #6,435,902)

Product shown at actual size



Technical Specifications

Model Number	601A01	602D01	603C01	606B01	607A01
Performance					
Sensitivity	100 mV/g				
	10.2 mV/(m/s²) [2]				
Sensitivity Tolerance	±20 %	±10 %		±20 %	±15 %
Measurement Range	±50 g				
	±490 m/s²				
Frequency Range (±3 dB)	16 to 600,000 cpm	30 to 480,000 cpm	30 to 600,000 cpm		
	0.27 to 10 kHz [4]	0.5 to 8 kHz [4]	0.5 to 10 kHz [4]		
Resonant Frequency	960 kcpm	1,500 kcpm			1,080 kcpm
	16 kHz [5]	25 kHz [5]			18 kHz [5]
Broadband Resolution (1 to 10 kHz)	50 µg	350 µg			
	491 µm/sec² [5]	3,434 µm/sec² [5]			
Non-linearity	±1 % [6]				
Transverse Sensitivity	≤ 7 %				
Environmental					
Overload Limit (Shock)	5,000 g pk				
	49,050 m/s² pk				
Temperature Range	-65 to 250 °F				
	-54 to 121 °C				
Enclosure Rating	IP68				
Electrical					
Settling Time (within 1% of bias)	≤ 4.0 sec	≤ 2.0 sec			
Discharge Time Constant	≥ 0.6 sec	≥ 0.3 sec			
Excitation Voltage	18 to 28 VDC				
Constant Current Excitation	2 to 20 mA				
Output Impedance	<150 ohm				
Output Bias Voltage	8 to 12 VDC				
Spectral Noise (10 Hz)	3.2 µg/√Hz	8.0 µg/√Hz			
	31.0 (µm/sec²)/√Hz [5]	78.5 (µm/sec²)/√Hz [5]			
Spectral Noise (100 Hz)	1.0 µg/√Hz	5 µg/√Hz			
	9.81 (µm/sec²)/√Hz [5]	49.1 (µm/sec²)/√Hz [5]			
Spectral Noise (1 kHz)	0.7 µg/√Hz	4 µg/√Hz			
	6.94 (µm/sec²)/√Hz [5]	39.2 (µm/sec²)/√Hz [5]			
Electrical Isolation (Case)	>10⁸ ohm				

Model Number	601A01	602D01	603C01	606B01	607A01
Physical					
Size - Hex	7/8 in	N/A	11/16 in	N/A	7/8 in
	22 mm		18 mm		22 mm
Size - Diameter	N/A			1.38 in	N/A
				35.1 mm	
Size - Height	1.94 in	0.845 in	1.65 in	1.00 in	1.23 in
	49.3 mm	21.5 mm	42.2 mm	25.4 mm	31.2 mm
Size - Length	N/A	1.65 in	N/A	1.93 in	1.52 in
		41.9 mm		49 mm	38.6 mm
Size - Width	N/A	0.74 in	N/A		
		18.8 mm			
Weight	2.8 oz	2.61 oz	1.8 oz	4.4 oz	3.7 oz
	80 gm	74.0 gm	51 gm	124 gm	105 gm
Mounting Thread	1/4-28 Female				
Mounting Torque	2 to 5 ft-lb				
	2.7 to 6.8 N-m				
Sensing Element	Ceramic Shear				
Housing Material	Stainless Steel				
Sealing	Welded Hermetic				
Electrical Connector	2-pin MIL-C-5015				
Supplied Accessories					
	Model 081A40 Mounting Stud (1)	Model 081A97 Through-bolt 1/4-28 (1)	Model 081A40 Mounting Stud	Model 081A68 Captive Mounting Bolt 1/4-28 x .90" (1)	Model 080A162 Mounting Stud (1)
	Model ICS-2 NIST-traceable single-axis single-point amplitude response calibration at 6000 cpm (100 Hz) [1]				

Notes

All specifications are at room temperature unless otherwise specified

[1] 1/4-28 has no equivalent in S.I. units.
[2] Conversion Factor 1g = 9.81 m/s².
[3] For CE reference PCB® Declaration of Conformance PS023 for details.
[4] The high frequency tolerance is accurate within ±10% of the specified frequency.
[5] Typical.
[6] Zero-based, least-squares, straight line method.
[7] Twisted shielded pair.
[8] Stainless steel armor jacket over twisted shielded pair.

Optional Versions

EX - Hazardous Area Approval
For Models: 602D01, 603C01, 607A01
M - Metric Mount
For Models: 601A01, 602D01, 603C01, 606B01, 607A01
TO - Temperature Output
For Models: 602D01, 603C01, 607A01

Accessories & Cables: Pages 162-176

Submersible

Low Cost ICP® Accelerometers

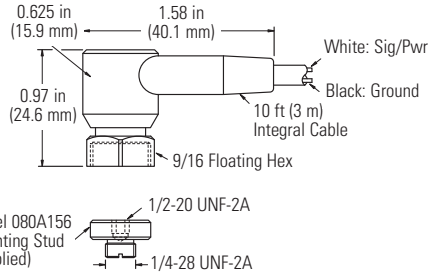
- Integral cable designs meet IP68 qualification
- Save conduit and tray space with smaller diameter polyurethane cable
- Smallest footprints of any true industrial accelerometer

Swiveler® Industrial ICP® Accelerometer

Model 607A11

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Versions with **10 ft** and **30 ft** integral cable are available in stock
- Patented swivel mounting base for ease of cable orientation (US Patent #6,435,902)

Product shown at actual size

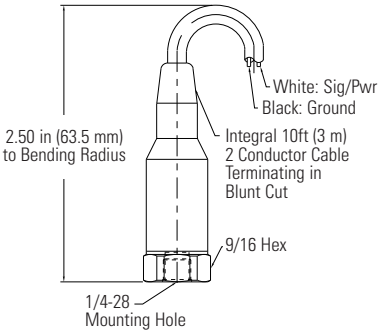


Low Cost Industrial ICP® Accelerometer

Model 608A11

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Versions with **10 ft**, 20 ft, **30 ft** and 50 ft integral cable are available in stock

Product shown at actual size



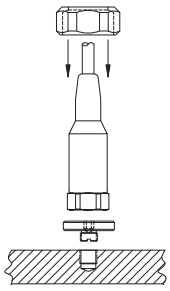
Tips From Techs

Alternate Mounting Method for 608A11

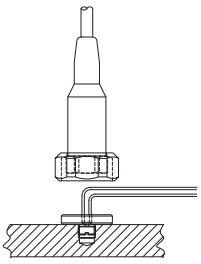
When stud mounting the model 608A11 we suggest taking a look at a couple accessories that might make the job easier: Model 080A165 floating hex nut and Model 080A162 mounting stud. Simply drill and tap into the machine and then screw down the 080A165 mounting stud, then slide the floating hex nut over the end of the integral cable. The hex nut mates with the stud and allows the installer to lock the sensor in place, turning the nut from the side. It is sometimes preferred in lieu of turning down the entire sensor and it's integral cable.

Patented Mounting of Swiveler® and Spindler® Accelerometers

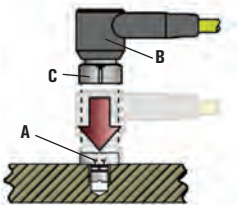
Models 607A11 and 607A61 feature a unique mounting system patented to IMI Sensors (US Patent #6,435,902). First, screw down the supplied mounting stud. Then simply get the sensor started on the thread. At this point one can orient the integral cable in any direction. Finally, lock the sensor down with 2 to 5 ft-lbs of torque. This locks the cable in place and provides a secure mount that will not come loose.



Mounting stud is tightened to recommended torque with appropriately sized hex Allen key.



Mounting hole is prepared into machine surface to accept sensor's mounting stud. Sensor integral cable is threaded through the floating hex nut.



Mounting hole is prepared into machine surface to accept sensor's mounting stud (A). Stud is then tightened to recommended torque with hex Allen key. Sensor (B) hex nut (C) is threaded onto mounting stud.

Using the 360° capabilities of the Swiveler®, the cable is positioned into desired orientation & temporarily hand tightened. Using a wrench, the hex nut is tightened to the recommended torque while holding the cable or connector in the desired location.

Technical Specifications

Model Number	607A11	607A61	608A11
Performance			
Sensitivity (± 15 %)	100 mV/g		
	(10.2 mV/(m/s²)) [3]		
Measurement Range	± 50 g		
	± 490 m/s²		
Frequency Range (± 3 dB)	30 to 600,000 cpm		
	0.5 to 10 kHz		
Resonant Frequency	1,500 kcpm		1,320 kcpm
	25 kHz [8]		22 kHz [8]
Broadband Resolution (1 to 10 kHz)	350 µg		
	3,434 µm/sec² [8]		
Non-linearity	±1 % [9]		
Transverse Sensitivity	≤ 7 %		
Environmental			
Overload Limit (Shock)	5,000 g pk		
	49,050 m/s² pk		
Temperature Range	-65 to +250 °F		
	-54 to +121 °C		
Enclosure Rating	IP68		
Electrical			
Settling Time (within 1% of bias)	≤ 2.0 sec		
Discharge Time Constant	≥ 0.3 sec		
Excitation Voltage	18 to 28 VDC		
Constant Current Excitation	2 to 20 mA		
Output Impedance	<150 ohm		
Output Bias Voltage	8 to 12 VDC		
Spectral Noise (10 Hz)	8 µg/√Hz		
	78.5 (µm/sec²)/√Hz [8]		
Spectral Noise (100 Hz)	5 µg/√Hz		
	49.1 (µm/sec²)/√Hz [8]		
Spectral Noise (1 kHz)	4 µg/√Hz		
	39.2 (µm/sec²)/√Hz [8]		
Electrical Isolation (Case)	>10^8 ohm		
Physical			
Size (Hex)	9/16 in	9/16 in	9/16 in
	14 mm	14 mm	14 mm
Size (Height)	0.97 in	1.0 in	2.5 in
	24.6 mm	25.4 mm	64 mm
Weight	1.1 oz		3.5 oz
	31 gm [4]		99.3 gm
Mounting	Stud		
Mounting Thread	1/4-28 [1]		
Mounting Torque (stud)	7 to 8 ft-lb		2 to 5 ft-lb
	9.5 to 10.8 N-m [2][6]		2.7 to 6.8 N-m
Mounting Torque (hex nut)	2 to 5 ft-lb		N/A
	2.7 to 6.8 N-m		
Sensing Element	Ceramic Shear		
Housing Material	Stainless Steel		
Sealing	Welded Hermetic		Molded
Electrical Connector	Molded Integral Cable	Integral Armored Cable	Molded Integral Cable
Electrical Connector Position	Side		Top
Cable Length	10 ft		
	3.0 m		
Cable Type	Polyurethane [7]	Polyurethane [10]	Polyurethane [7]
Supplied Accessories			
	Model 080A156 Mounting Base (1)		Model 081A40 Mounting Stud (1)
	Model ICS-2 NIST-traceable single-axis single-point amplitude response calibration at 6000 cpm (100 Hz) (1)		

Notes

All specifications are at room temperature unless otherwise specified

[1] 1/4-28 has no equivalent in S.I. units.
[2] 1/8" hex Allen key required for English version, 4 mm hex Allen key required for Metric version.
[3] Conversion Factor 1g = 9.81 m/s².
[4] Measured with mounting stud.
[5] For CE reference PCB® Declaration of Conformance PS023 or PS060 for details.
[6] Stud torque must exceed sensor hex nut torque to ensure proper dismantling.
[7] Twisted shielded pair.
[8] Typical.
[9] Zero-based, least-squares, straight line method.
[10] Stainless steel armor jacket over twisted shielded pair

Optional Versions

EX - Hazardous Area Approval
For Models: 607A11, 607A61, 608A11
M - Metric Mount
For Models: 607A11, 607A61, 608A11
T0 - Temperature Output
For Models: 607A11, 607A61, 608A11

Accessories & Cables: Pages 162-176

Armored Integral Cable

Low Cost Accelerometers

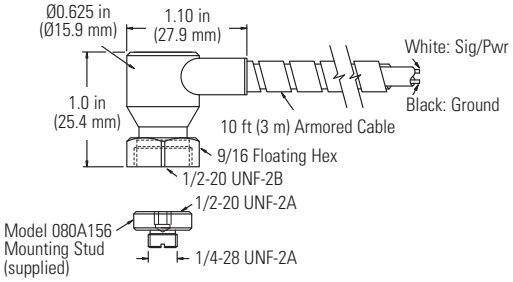
- Rugged design ideal for machine tool monitoring or mining applications
- Smallest footprint and profile of any industrial accelerometer
- Thin armor jacket for easy handling and installation

Low Cost Spindler® Industrial ICP® Accelerometer

Model 607A61

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Selectable armor length and overall cable length

Product shown at actual size



Hazardous Area Approved

Low Cost ICP® Accelerometers

- CSA & ATEX approvals for use in hazardous areas
- Use with or without energy limiting barriers depending upon area classification
- Trend critical vibration data from a safe location

Low Cost Industrial ICP® Accelerometer

Model EX602D01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 480,000 cpm (0.5 to 8 kHz)
- Side exit, through-bolt design

Product shown at actual size

See page 83 for complete specifications

Low Cost Industrial ICP® Accelerometer

Model EX603C01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Also available in 10, 50 and 500 mV/g

Product shown at actual size

See page 83 for complete specifications

Low Cost Industrial ICP® Accelerometer

Model EX608A11

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Selectable cable length in meters or feet

Product shown at actual size

See page 85 for complete specifications

Model EX607A11

Swiveler® Industrial ICP® Accelerometer

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Supplied with 10 ft. integral cable
- Selectable cable length in meters or feet

Product shown at actual size

See page 85 for complete specifications

Model EX607A61

Low Cost Spindler® Industrial ICP® Accelerometer

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Selectable armor length and overall cable length

Product shown at actual size

See page 85 for complete specifications

Technical Specifications for Hazardous Area Approved and Dual Temperature & Vibration Output sensors are equal to thier standard model equivalent.

See page 83 and 85 for complete specifications

Tips From Techs

Hazardous Area Approvals

IMI Sensors' low cost accelerometers carry CSA & ATEX approvals as follows. Div 1 or Zone 0 or 1 installations require an energy limiting barrier. Div 2 or Zone 2 installations do not require an energy limiting barrier if an approved sensor power supply is used.

Class I, Div 1, Groups A, B, C, D
Class II, Div 1, Groups E, F, G
Class III, Div 1
Exia IIC T4
AExia IIC T4
Class I, Div 2, Groups A, B, C, D
ExnL IIC T4
AExnA IIC T4
Ex ia IIC T4, -40°C ≤ Ta ≤ 121°C, II 1 G
Ex nL IIC T4, -40°C ≤ Ta ≤ 121°C, II 3 G
GOST-R: 0ExiaIICT4 X

Dual Temperature & Vibration Output

Low Cost ICP® Accelerometers

- Simultaneously measure vibration and temperature levels
- For use with multi-channel data acquisition systems
- Simple to read DC voltage temperature output

Low Cost Industrial ICP® Accelerometer

Model TO603C01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- 3-pin MIL connector

Product shown at actual size

See page 83 for complete specifications

Swiveler® Industrial ICP® Accelerometer

Model TO607A11

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Supplied with 10 ft. integral cable
- Selectable cable length in meters or feet

Product shown at actual size

See page 85 for complete specifications

Low Cost Spindler® Industrial ICP® Accelerometer

Model TO607A61

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Selectable armor length and overall cable length

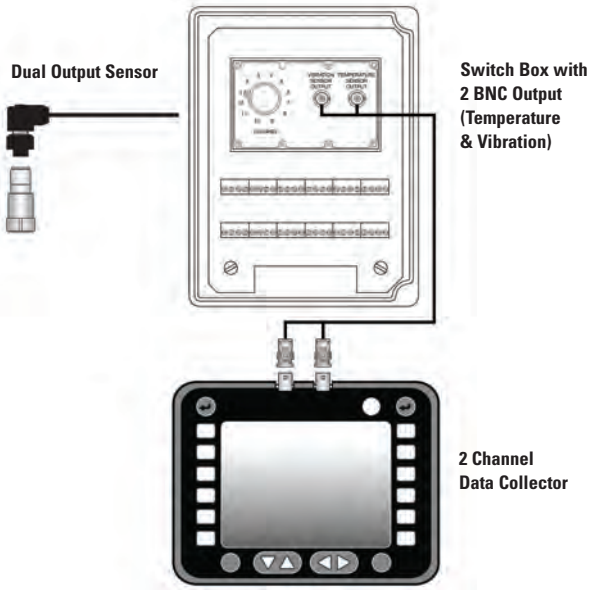
Product shown at actual size

See page 85 for complete specifications

Tips From Techs

Dual Temperature & Vibration Output Sensors

IMI's dual temperature and vibration output sensors are an excellent asset for technicians using a 2 channel data collector or online monitoring system. The temperature output is a simple DC voltage scaled from 0 to 120 °C with 10 mV/°C sensitivity thus a 0 to 1.2 VDC output. One can send the temperature output to a 0-5 VDC input channel and scale it properly by making the full scale range 500 °C. The temperature sensor draws its power from the vibration electronics and can only be read when ICP® power is being applied to the vibration leads. All IMI® switch boxes come standard with two BNC's for each channel: one for temperature and one for vibration.



Alternate Sensitivity

Low Cost ICP® Accelerometers

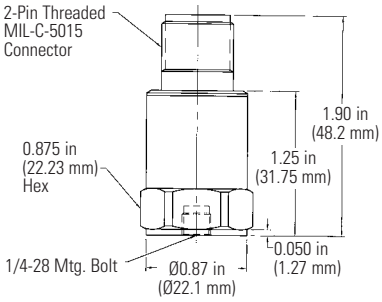
- Increase sensitivity for greater resolution on slow speed applications
- Decrease sensitivity for increased range on impacting applications
- Low frequency response down to 12 cycles per minute

Low Cost Industrial ICP® Accelerometer

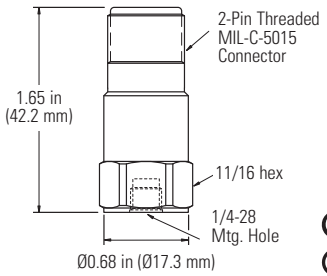
Model 601A02

- 500 mV/g (10 g measurement range)
- Low frequency response down to 12 CPM
- Best value of any slow speed industrial accelerometer

Product shown at actual size



Model 603C00 & Model 603C02



Technical Drawing
Model 603C00 & Model 603C02

Low Cost Industrial ICP® Accelerometer

Model 603C00

- 10 mV/g (500 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Monitor high speed, high vibration applications without worrying about saturation

Product shown at actual size

Low Cost Industrial ICP® Accelerometer

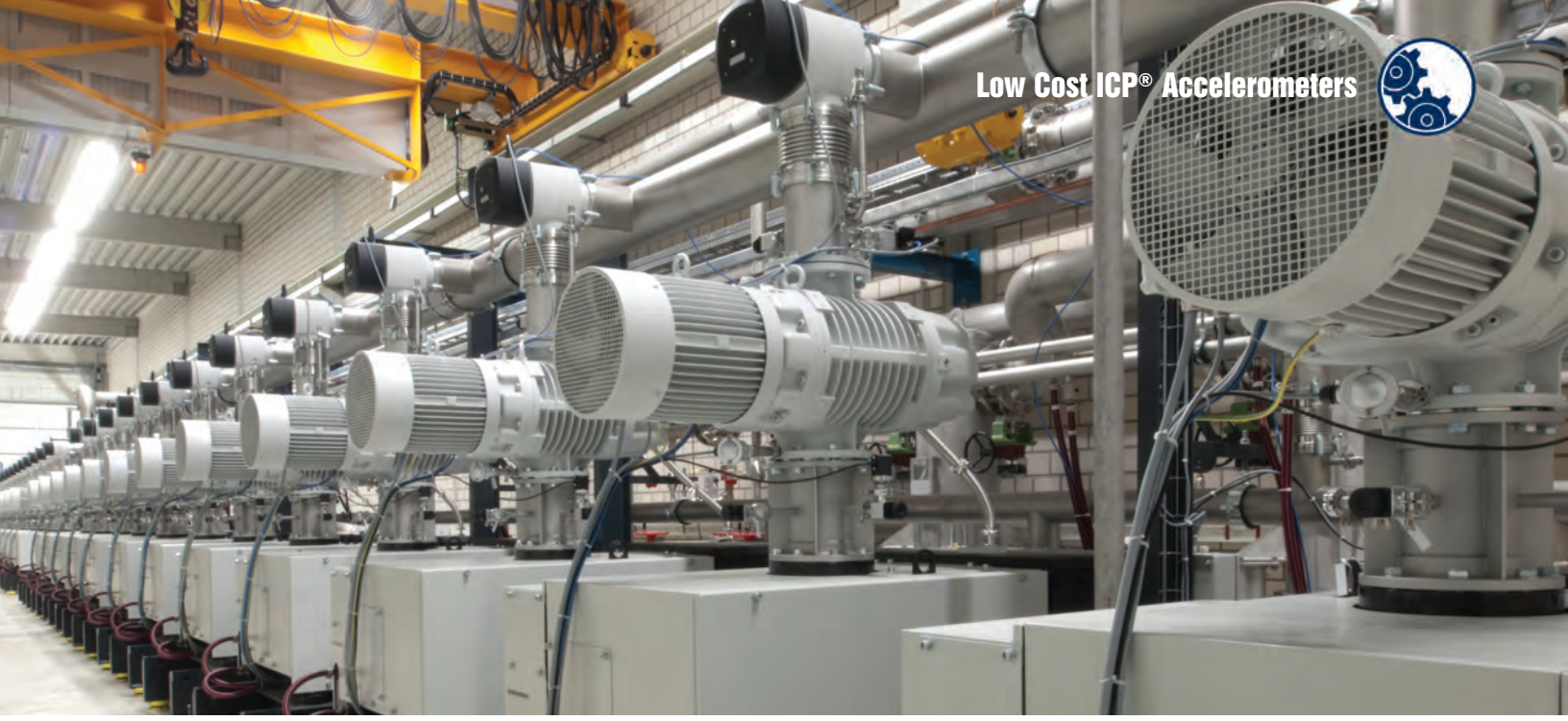
Model 603C02

- 500 mV/g (10 g measurement range)
- Frequency Range: (±3dB) 30 to 600,000 cpm (0.5 to 10 kHz)
- Increased resolution for slow speed applications

Product shown at actual size

Low Cost, Same High Quality

There is no "entry level" spending point with IMI Sensors industrial accelerometers. In fact, most of our Application Engineers – certified vibration analysts – recommend "low cost" sensors to customers as their first sensor option. Despite their economical moniker, low-cost accelerometers are ideal for applications where sensors will be permanently mounted to trend vibration 24/7, monthly or even quarterly. No matter how often data is taken one can count on low cost accelerometers to hold their sensitivity year after year, giving the analyst quality data from which to compare values from last collection. Low cost accelerometers are all hermetically sealed in stainless steel housings and most are covered by IMI Sensors' Lifetime Warranty Plus program.



Technical Specifications

Model Number	601A02	603C00	603C02
Performance			
Sensitivity (±20 %)	500 mV/g	10 mV/g	500 mV/g
	51 mV/(m/s²) [2]	1.02 mV/(m/s²) [2]	51.0 mV/(m/s²) [2]
Measurement Range	±10 g	±500 g	±10 g
	±98 m/s²	±4,905 m/s²	±98 m/s²
Frequency Range (±3 dB)	10 to 600,000 cpm [4]	30 to 600,000 cpm	30 to 180,000 cpm
	0.17 to 10 kHz	0.5 to 10 kHz [4]	0.5 to 3 kHz [4]
Frequency Range (±5 %)	28 to 240,000 cpm	N/A	
	0.47 to 4 kHz [4]		
Frequency Range (±10 %)	20 to 300,000 cpm	N/A	
	0.33 to 5 kHz		
Resonant Frequency	N/A	1,500 kcpm	
		25 kHz [5]	
Broadband Resolution (1 to 10 kHz)	35 µg	2,000 µg	300 µg
	343 µm/sec² [5]	19,620 µm/sec² [5]	2,943 µm/sec² [5]
Non-linearity	±1 % [6]		
Transverse Sensitivity	≤ 7 %		
Environmental			
Overload Limit (Shock)	5,000 g pk		
	49,050 m/s² pk		
Temperature Range	-65 to 250 °F		
	-54 to 121 °C		
Enclosure Rating	IP68		
Electrical			
Settling Time (within 1% of bias)	≤ 10 sec	≤ 3.0 sec	≤ 5.0 sec
Discharge Time Constant	≥ 1.0 sec	≥ 0.4 sec	≥ 0.3 sec
Excitation Voltage	18 to 28 VDC		
Constant Current Excitation	2 to 20 mA		
Output Impedance	<150 ohm		
Output Bias Voltage	8 to 12 VDC		
Spectral Noise (10 Hz)	3.2 µg/√Hz	85 µg/√Hz	8 µg/√Hz
	29.4 (µm/sec²)/√Hz [5]	834 (µm/sec²)/√Hz [5]	78.5 (µm/sec²)/√Hz [5]
Spectral Noise (100 Hz)	0.7 µg/√Hz	20 µg/√Hz	3 µg/√Hz
	6.9 (µm/sec²)/√Hz [5]	196 (µm/sec²)/√Hz [5]	29.4 (µm/sec²)/√Hz [5]
Spectral Noise (1 kHz)	0.5 µg/√Hz [5]	5 µg/√Hz	3 µg/√Hz
	4.9 (µm/sec²)/√Hz	49.1 (µm/sec²)/√Hz [5]	29.4 (µm/sec²)/√Hz [5]
Electrical Isolation (Case)	>10⁸ ohm		

Model Number	601A02	603C00	603C02
Physical			
Size - Hex	7/8 in	11/16 in	
	22 mm	18 mm	
Size - Height	1.94 in	1.65 in	
	49.3 mm	42.2 mm	
Weight	2.8 oz	1.8 oz	
	80 gm	51 gm	
Mounting	1/4-28 Female [1]		
Mounting Torque	2 to 5 ft-lb		
	2.7 to 6.8 N-m		
Sensing Element	Ceramic Shear		
Housing Material	Stainless Steel		
Sealing	Welded Hermetic		
Electrical Connector	2-pin MIL-C-5015		
Supplied Accessories			
	Model M081A61 Mounting Stud 1/4-28 to M6 X 1 (1) replaces Model 081A40		

Notes

All specifications are at room temperature unless otherwise specified

[1] 1/4-28 has no equivalent in S.I. units.
[2] Conversion Factor 1g = 9.81 m/s².
[3] For CE reference PCB® Declaration of Conformance PS023 or PS060 for details.
[4] The high frequency tolerance is accurate within ±10% of the specified frequency.
[5] Typical.
[6] Zero-based, least-squares, straight line method.

Optional Versions

EX - Hazardous Area Approval
For Models: 603C00, 603C02
M - Metric Mount
For Models: 601A02, 603C00, 603C02
TO - Temperature Output
For Models: 603C02

Accessories & Cables: Pages 162-176

Multi-axis ICP® Accelerometers

- Triaxial designs measure vibration in horizontal, vertical and axial directions
- Side exit, through-bolt mount designs ideal for spaces with limited clearance and cable orientation
- Ideal for route-based PdM with 2 or 3 channel data collector

Multi-axis accelerometers contain two or three independent acceleration sensing elements within one housing. The sensing elements are oriented in mutually perpendicular geometries in order to respond to vibration in independent, orthogonal directions. Biaxial accelerometers contain two sensing elements, whereas triaxial versions contain three. Each sensing axis contains a dedicated, Built in , low noise, microelectronic signal amplifier whose output signal is delivered to an independent cable lead or connector pin.

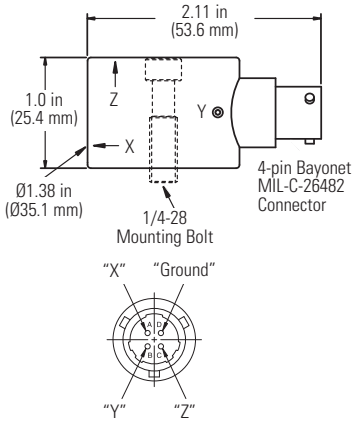
Multi-axis measurements are useful for radial vs. axial bearing vibration monitoring, machinery foundation troubleshooting, and structural impulse and response studies. Styles for low cost and precision requirements are differentiated by their sensitivity tolerances and extent of supplied NIST-traceable calibration.

Low Cost Triaxial Industrial ICP® Accelerometer

Model 604B31

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 300,000 cpm (0.5 to 5 kHz)
- Side exit, through-bolt design

Product shown at actual size

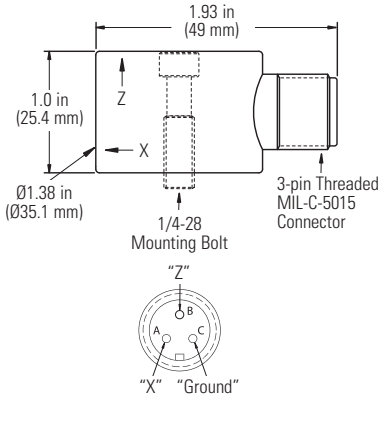


Low Cost Biaxial Industrial ICP® Accelerometer

Model 605B01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 30 to 300,000 cpm (0.5 to 5 kHz)
- Side exit, through-bolt design

Product shown at actual size

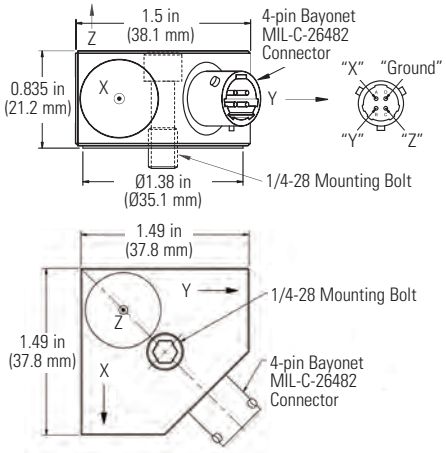


Precision Triaxial Industrial ICP® Accelerometer

Model 629A31

- 100 mV/g (50 g measurement range)
- Frequency Range: (+/- 3dB) 48 to 480,000 cpm (0.8 to 8 kHz)
- Full frequency sweep calibration on all three axes

Product shown at actual size



IMI SENSORS
A PCB PIEZOTRONICS DIV.

visit us online at www.imi-sensors.com

☎ Toll-Free in USA 800-959-4464 ☎ 716-684-0003

Technical Specifications

Model Number	604B31	605B01	629A31
Performance			
Sensitivity (±20 %)	100 mV/g 10.2 mV/(m/s²) [2]		N/A
Sensitivity (±5 %)	N/A		100 mV/g 10.2 mV/(m/s²) [2]
Measurement Range	±50 g ±490 m/s²		
Frequency Range (±5%)	N/A		144 to 120,000 cpm 2.4 to 2 kHz [4]
Frequency Range (±10%)	N/A		102 to 300,000 cpm 1.7 to 5 kHz
Frequency Range (±3 dB)	30 to 300,000 cpm 0.5 to 5 kHz [4]		48 to 480,000 cpm 0.8 to 8 kHz
Resonant Frequency	600 kcpm 10 kHz [5]		1,200 kcpm 20 kHz [5]
Broadband Resolution (1 to 10 kHz)	350 µg 3,434 µm/sec² [5]		100 µg 981 µm/sec² [5]
Non-linearity	±1 % [6]		
Transverse Sensitivity	≤ 5 %		≤ 7 %
Environmental			
Overload Limit (Shock)	5,000 g pk 49,050 m/s² pk		
Temperature Range	-65 to 250 °F -54 to 121 °C		
Enclosure Rating	IP68		N/A
Electrical			
Settling Time (within 1% of bias)	≤ 2.0 sec		≤ 3.0 sec
Discharge Time Constant	≥ 0.3 sec		≥ 0.2 sec
Excitation Voltage	18 to 28 VDC		
Constant Current Excitation	2 to 20 mA		
Output Impedance	<150 ohm		<100 ohm
Output Bias Voltage	8 to 12 VDC		
Spectral Noise (10 Hz)	8 µg/√Hz 78.5 (µm/sec²)/√Hz [5]		7 µg/√Hz 68.7 (µm/sec²)/√Hz [5]
Spectral Noise (100 Hz)	5 µg/√Hz 49.1 (µm/sec²)/√Hz [5]		2.8 µg/√Hz 27.5 (µm/sec²)/√Hz [5]
Spectral Noise (1 kHz)	4 µg/√Hz 39.2 (µm/sec²)/√Hz [5]		1 µg/√Hz 9.8 (µm/sec²)/√Hz [5]

Model Number	604B31	605B01	629A31
Physical			
Size - Diameter	1.38 in 35.1 mm		N/A
Size - Length	N/A		1.5 in 38.1 mm
Size - Width	N/A		1.5 in 38.1 mm
Size - Height	1.00 in 25.4 mm		0.82 in 20.8 mm
Weight	4.4 oz 124 gm	3.9 oz 110.6 gm	4.9 oz 139 gm
Mounting	Through Hole		
Mounting Thread	1/4-28 Male	1/4-28 UNF	1/4-28 Male [1]
Mounting Torque	2 to 5 ft-lb 2.7 to 6.8 N-m		
Sensing Element	Ceramic Shear		
Housing Material	Stainless Steel		
Sealing	Welded Hermetic		
Electrical Connector	4-pin MIL-C-26482	3-pin MIL-C-5015	4-pin MIL-C-26482
Electrical Connection Position	Side		
Electrical Connections (Pin A)	X-axis		
Electrical Connections (Pin B)	Y-axis		
Electrical Connections (Pin C)	Z-axis	Ground	Z-axis
Electrical Connections (Pin D)	Ground	N/A	Ground

Supplied Accessories

	Model 081A68 Captive mounting bolt 1/4-28 x .90" (1)	Model 081A56 Captive mounting bolt 1/4-28 x .75"
	Model ACS-2T NIST Traceable Single Point Calibration at 100 Hz for Each Axis (1)	Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency

Notes

All specifications are at room temperature unless otherwise specified

[1] 1/4-28 has no equivalent in S.I. units.
[2] Conversion Factor 1g = 9.81 m/s².
[3] For CE reference PCB® Declaration of Conformance PS023 for details.
[4] The high frequency tolerance is accurate within ±10% of the specified frequency.
[5] Typical.
[6] Zero-based, least-squares, straight line method.
[7] Division 1; Class I; Group C & D; Temperature Code T4

Optional Versions

CS - Canadian Standards Association Approved Intrinsically Safe
For Models: 604B31

M - Metric Mount
For Models: 604B31, 605B01, 629A31

Accessories & Cables: Pages 162-176

Precision ICP® Accelerometers

- Full frequency sweep calibration data provided
- Additional Built in RF & EMI protection
- Tighter sensitivity tolerances
- Quartz elements available with superior thermal stability
- Velocity output options with integral integration

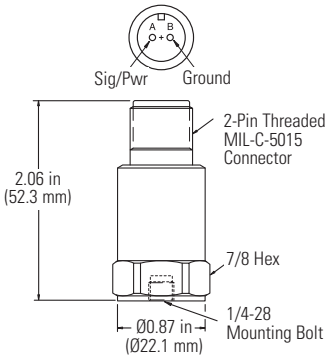
Precision industrial ICP® accelerometers are recommended for route-based vibration data collection and quantitative diagnostic measurements on industrial machinery. These sensors are directly compatible with most commercially available vibration data collectors and FFT analyzers that supply excitation power for ICP® sensors. These precision, shear structured sensors offer tighter sensitivity tolerances than low cost series units and are supported with full NIST-traceable calibration data that encompasses an extensive frequency range. All units are laser welded and leak tested to ensure a truly hermetic seal. Shock protection to 5,000 g (49 k m/s^2) guards against damage due to accidental overloads. A host of available options, including velocity and temperature outputs and hazardous area approvals adapt units for virtually any machinery vibration monitoring requirement.

Precision Industrial ICP® Accelerometer

Model 622B01

- Sensitivity (±5%) 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 12 to 900,000 cpm (0.2 to 15 kHz)
- Optional hazardous area approved model available (Model EX622A01)

Product shown at actual size

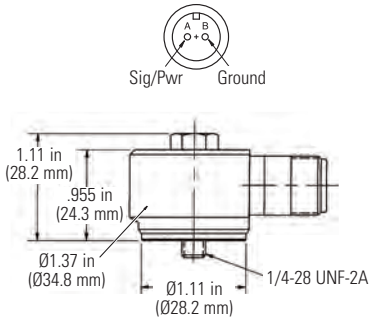


Precision Quartz Industrial ICP® Accelerometer

Model 624B01

- Sensitivity (±5%) 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 48 to 600,000 cpm (0.8 to 10 kHz)
- Electrical Connector: 2-pin MIL-C-5015
- Side exit, through-bolt design

Product shown at actual size

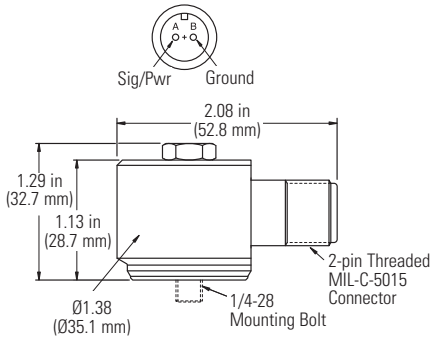


Precision Industrial ICP® Accelerometer

Model 625B01

- Sensitivity (±5%) 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 12 to 630,000 cpm (0.2 to 10.5 kHz)
- Electrical Connector: 2-pin MIL-C-5015
- Side exit, through-bolt design

Product shown at actual size



Technical Specifications

Model Number	622B01	624B01	625B01
Performance			
Sensitivity (±5 %)	100 mV/g		
	10.2 mV/(m/s²) [2]		
Measurement Range	±50 g		
	±490 m/s²		
Frequency Range (±5 %)	35 to 360,000 cpm	144 to 300,000 cpm	30 to 390,000 cpm
	0.58 to 6 kHz [4]	2.4 to 5 kHz [4]	0.5 to 6.5 kHz [4]
Frequency Range (±10 %)	25 to 600,000 cpm	102 to 420,000 cpm	22 to 450,000 cpm
	0.42 to 10 kHz	1.7 to 7 kHz	0.37 to 7.5 kHz
Frequency Range (±3 dB)	12 to 900,000 cpm	48 to 600,000 cpm	12 to 630,000 cpm
	0.2 to 15 kHz	0.8 to 10 kHz	0.2 to 10.5 kHz
Resonant Frequency	1,800 kcpm	1,080 kcpm	1,500 kcpm
	30 kHz [5]	18 kHz [5]	25 kHz [5]
Broadband Resolution (1 to 10 kHz)	50 µg	1,000 µg	50 µg
	490 µm/sec² [5]	9,810 µm/sec² [5]	491 µm/sec² [5]
Non-linearity	±1 % [6]		
Transverse Sensitivity	≤ 5 %		
Environmental			
Overload Limit (Shock)	5,000 g pk		
	49,050 m/s² pk		
Temperature Range	-65 to 250 °F		
	-54 to 121 °C		
Enclosure Rating	IP68		
Electrical			
Settling Time (within 1% of bias)	≤ 5.0 sec	≤ 10 sec	≤ 8.0 sec
Discharge Time Constant	≥ 0.8 sec	≥ 0.2 sec	≥ 1.0 sec
Excitation Voltage	18 to 28 VDC		
Constant Current Excitation	2 to 20 mA		
Output Impedance	<100 ohm		
Output Bias Voltage	8 to 12 VDC		
Spectral Noise (10 Hz)	4.0 µg/√Hz	50 µg/√Hz	2.5 µg/√Hz
	39.2 (µm/sec²)/√Hz [5]	491 (µm/sec²)/√Hz [5]	24.5 (µm/sec²)/√Hz [5]
Spectral Noise (100 Hz)	0.8 µg/√Hz	20 µg/√Hz	0.8 µg/√Hz
	7.85 (µm/sec²)/√Hz [5]	196 (µm/sec²)/√Hz [5]	7.8 (µm/sec²)/√Hz [5]
Spectral Noise (1 kHz)	0.4 µg/√Hz	6 µg/√Hz	0.5 µg/√Hz
	3.92 (µm/sec²)/√Hz [5]	59 (µm/sec²)/√Hz [5]	4.9 (µm/sec²)/√Hz [5]
Electrical Protection	RFI/ESD		
Electrical Isolation	>10^8 ohm		

Model Number	622B01	624B01	625B01
Physical			
Size - Hex	7/8 in	N/A	
	22 mm		
Size - Diameter	N/A	1.37 in	1.36 in
		34.8 mm	35.1 mm
Size - Height	2.06 in	.955 in	1.13 in
	52.3 mm	24.3 mm	28.7 mm
Weight	3.3 oz	4.2 oz	5.1 oz
	94 gm	120 gm	145 gm
Mounting			Through Hole
Mounting Thread	1/4-28 Female [1]	1/4-28 Male [1]	
Mounting Torque	2 to 5 ft-lb		
	2.7 to 6.8 N-m		
Sensing Element	Ceramic Shear	Quartz Shear	Ceramic Shear
Housing Material	Stainless Steel		
Sealing	Welded Hermetic		
Electrical Connector	2-pin MIL-C-5015		
Electrical Connection Position	Top	Side	
Supplied Accessories			
	Model 081A40 Mounting Stud Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency (1)	Model 081A67 Captive mounting bolt 1/4-28 x 1.12"(1) Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency	Model 080B45 Thermal Boot(1) Model 081A73 Captive mounting bolt 1/4-28 x 1.34"(1) Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency

Notes

All specifications are at room temperature unless otherwise specified

[1] 1/4-28 has no equivalent in S.I. units.
[2] Conversion Factor 1 g = 9.81 m/s².
[3] For CE reference PCB® Declaration of Conformance PS023 for details.
[4] The high frequency tolerance is accurate within ±10% of the specified frequency.
[5] Typical.
[6] Zero-based, least-squares, straight line method.

Optional Versions

CS - Canadian Standards Association Approved Intrinsically Safe
For Models: 625B01
M - Metric Mount
For Models: 622B01, 624B01, 625B01
TO - Temperature Output
For Models: 624B01, 625B01

Accessories & Cables: Pages 162-176

Low Frequency

Precision ICP® Accelerometers

Low amplitude vibration levels go hand-in-hand with low frequency vibration measurements. For this reason, IMI Sensors offers accelerometers combining extended low frequency response with high output sensitivity. This is in order to obtain desired resolution characteristics and strong output signal levels, necessary for conducting low frequency vibration measurements and analysis.

The most sensitive IMI Sensors low frequency accelerometers are known as seismic accelerometers. These models are larger in size to accommodate their larger seismic, internal masses necessary to generate a stronger output signal. These sensors have limited amplitude range, which renders them unsuitable for many general purpose industrial vibration measurement applications. However, when measuring vibration of slow, rotating machinery, buildings, bridges and large structures, these low frequency, low noise accelerometers will provide characteristics required for successful results.

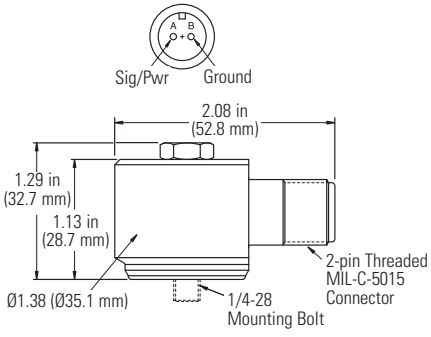
Low frequency industrial ICP® accelerometers benefit from the same advantages offered by IMI Sensors general purpose industrial accelerometers: rugged, laser welded, stainless steel housing with ability to endure dirty, wet, or harsh environments; hermetically sealed military connector or sealed integral cable; and a low noise, low-impedance, voltage output signal with long distance, signal transmission capability.

Precision Industrial ICP® Accelerometer

Model 625B02

- Sensitivity: 500 mV/g (10 g measurement range, ±5%)
- Frequency Range: (±3dB) 12 to 360,000 cpm (0.2 to 6 kHz)
- Electrical Connector: 2-pin MIL-C-5015

Product shown at actual size

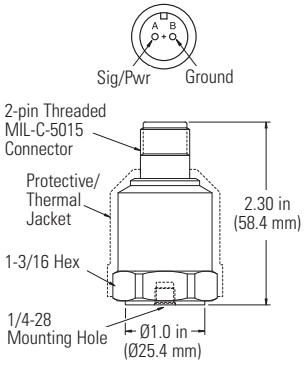


Precision Industrial ICP® Accelerometer

Model 626B01

- Sensitivity: 100 mV/g (50 g measurement range, ±5%)
- Frequency Range: (±3dB) 12 to 600,000 cpm (0.2 to 10 kHz)
- Electrical Connector: 2-pin MIL-C-5015

Product shown at actual size

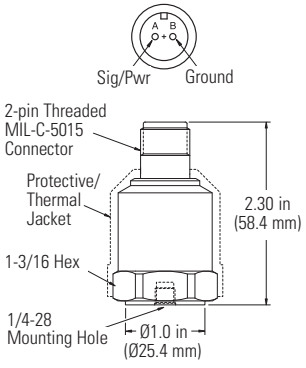


Precision Industrial ICP® Accelerometer

Model 626B02

- Sensitivity: 500 mV/g (10 g measurement range, ±5%)
- Frequency Range: (±3dB) 12 to 360,000 cpm (0.2 to 6 kHz)
- Electrical Connector: 2-pin MIL-C-5015

Product shown at actual size



IMI SENSORS
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Technical Specifications

Model Number	625B02	626B01	626B02
Performance			
Sensitivity (±5 %)	500 mV/g	100 mV/g	500 mV/g
	51 mV/(m/s²) [2]	10.2 mV/(m/s²) [2]	51 mV/(m/s²) [2]
Measurement Range	±10 g	±50 g	±10 g
	±98 m/s²	±490 m/s²	±98 m/s²
Frequency Range (±5 %)	30 to 120,000 cpm	30 to 300,000 cpm	30 to 120,000 cpm
	0.5 to 2 kHz [4]	0.5 to 5 kHz [4]	0.5 to 2 kHz [4]
Frequency Range (±10 %)	22 to 240,000 cpm	22 to 420,000 cpm	22 to 240,000 cpm
	0.37 to 4 kHz	0.37 to 7 kHz	0.37 to 4 kHz
Frequency Range (±3 dB)	12 to 360,000 cpm	12 to 600,000 cpm	12 to 360,000 cpm
	0.2 to 6 kHz	0.2 to 10 kHz	0.2 to 6 kHz
Resonant Frequency	720 kcpm	1,380 kcpm	720 kcpm
	12 kHz [5]	23 kHz [5]	12 kHz [5]
Broadband Resolution (1 to 10 kHz)	15 µg	100 µg	20 µg
	147 µm/sec² [5]	981 µm/sec² [5]	196 µm/sec² [5]
Non-linearity	±1 % [6]	±1 %	±1 % [6]
Transverse Sensitivity	≤ 7 %	≤ 5 %	≤ 7 %
Environmental			
Overload Limit (Shock)	2,500 g pk	5,000 g pk	2,500 g pk
	24,525 m/s² pk	49,050 m/s² pk	24,525 m/s² pk
Temperature Range	-65 to 250 °F	-65 to 250 °F	-65 to 250 °F
	-54 to 121 °C	-54 to 121 °C	-54 to 121 °C
Enclosure Rating	IP68	IP68	IP68
Electrical			
Settling Time (within 1% of bias)	≤ 4.5 sec	≤ 5.0 sec	≤ 3.0 sec
Discharge Time Constant	≥ 1.0 sec		
Excitation Voltage	18 to 28 VDC		
Constant Current Excitation	2 to 20 mA		
Output Impedance	<100 ohm		
Output Bias Voltage	8 to 12 VDC		
Spectral Noise (1 Hz)	N/A	15 µg/√Hz	N/A
		147.2 (µm/sec²)/√Hz [5]	
Spectral Noise (10 Hz)	0.9 µg/√Hz	4.0 µg/√Hz	0.9 µg/√Hz
	8.8 (µm/sec²)/√Hz [5]	39.2 (µm/sec²)/√Hz [5]	8.8 (µm/sec²)/√Hz [5]
Spectral Noise (100 Hz)	0.7 µg/√Hz	1.5 µg/√Hz	0.7 µg/√Hz
	7.0 (µm/sec²)/√Hz [5]	14.7 (µm/sec²)/√Hz [5]	7.0 (µm/sec²)/√Hz [5]
Spectral Noise (1 kHz)	0.3 µg/√Hz	0.7 µg/√Hz	0.3 µg/√Hz
	3.1 (µm/sec²)/√Hz [5]	6.9 (µm/sec²)/√Hz [5]	3.1 (µm/sec²)/√Hz [5]
Electrical Protection	RFI/ESD		
Electrical Isolation (Case)	>10⁸ ohm		

Model Number	625B02	626B01	626B02
Physical			
Size - Diameter	1.3 in	N/A	
	35.1 mm		
Size - Hex	N/A	1 3/16 in	
		30.2 mm	
Size - Height	1 1/8 in	2 3/16 in	
	28.7 mm	55.6 mm	
Weight	6.1 oz	5.3 oz	7.0 oz
	173 gm	150 gm	199 gm [1]
Mounting	Through Hole	N/A	
Mounting Thread	1/4-28 Male [1]	1/4-28 UNF	
Mounting Torque	2 to 5 ft-lb	2 to 5 ft-lb	
	2.7 to 6.8 N-m	2.7 to 6.8 N-m	
Sensing Element	Ceramic Shear		
Housing Material	Stainless Steel		
Sealing	Welded Hermetic		
Electrical Connector	2-pin MIL-C-5015		
Electrical Connector Position	Side	Top	

Supplied Accessories

Model 080B45 Thermal Boot (1)	
Model 081A73 Captive mounting bolt 1/4-28 x 1.34" (1)	Model 081A40 Mounting Stud (1)
	Model 085A31 Protective Thermal Jacket (1)
Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency	Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency

Notes

All specifications are at room temperature unless otherwise specified

[1] 1/4-28 has no equivalent in S.I. units.
[2] Conversion Factor 1 g = 9.81 m/s².
[3] For CE reference PCB® Declaration of Conformance PS023 for details
[4] The high frequency tolerance is accurate within ±10% of the specified frequency.
[5] Typical.
[6] Zero-based, least-squares, straight line method.

Optional Versions

M - Metric Mount
For Models: 625B02, 626B01, 626B02
T0 - Temperature Output
For Models: 625B02, 626B01

Accessories & Cables: Pages 162-176

High Frequency

Precision ICP® Accelerometers

- Increased dynamic range
- Superior high frequency response
- Full frequency sweep NIST-traceable calibration

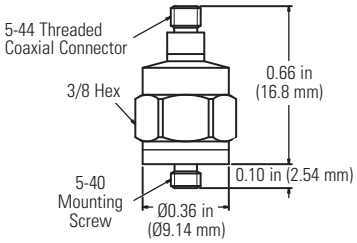
Vibration measurements in applications that involve high speed metal-to-metal contact, such as gearboxes and screw compressors, sometimes call for accelerometers with greater linear high frequency response or reduced sensitivity. These applications often produce higher vibration levels and shock events. Accurate measurement hinges on the sensor's dynamic range and high frequency response. By lowering the sensitivity to 10 mV/g one is able to achieve 500 g acceleration measurement range.

Very High Frequency ICP® Accelerometer

Model 621B40

- Sensitivity: 10 mV/g (500 g measurement range)
- High Frequency Range to 1,800,000 cpm (30 kHz)
- Weighs just 0.10 oz (2.8 grams)

Product shown at actual size

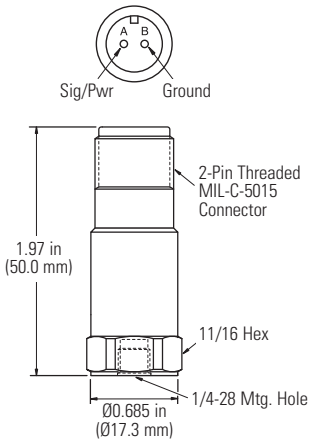


High Frequency Industrial ICP® Accelerometer

Model 623C00

- Sensitivity: 10 mV/g (500 g measurement range)
- High Frequency Range to 900,000 cpm (15 kHz)
- Case-isolated design with RF/EMI blocker

Product shown at actual size

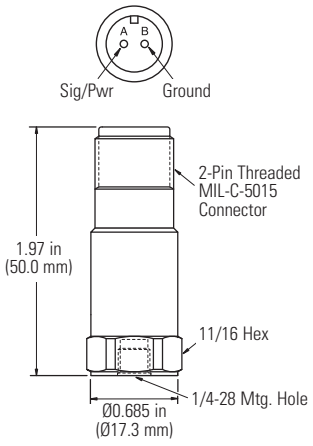


High Frequency Industrial ICP® Accelerometer

Model 623C01

- Sensitivity: 100 mV/g (50 g measurement range)
- High Frequency Range to 900,000 cpm (15 kHz)
- Case-isolated design with RF/EMI blocker

Product shown at actual size



Technical Specifications

Model Number	621B40	623C00	623C01
Performance			
Sensitivity (±5 %)	N/A	10 mV/g	100 mV/g
		1.0 mV/(m/s²) [2]	10.2 mV/(m/s²)
Sensitivity (±10 %)	10 mV/g	N/A	N/A
	1.02 mV/(m/s²) [2]		
Measurement Range	±500 g	±500 g	±50 g
	±4,905 m/s²	±4,905 m/s²	±490 m/s²
Frequency Range (±5 %)	N/A	144 to 480,000 cpm	
		2.4 to 8 kHz [4]	
Frequency Range (±10 %)	204 to 1,080,000 cpm	102 to 600,000 cpm	
	3.4 to 18 kHz [4][7]	1.7 to 10 kHz	
Frequency Range (±3 dB)	96 to 1,800,000 cpm	48 to 900,000 cpm	
	1.6 to 30 kHz [4][7]	0.8 to 15 kHz	
Resonant Frequency	5,100 kcpm	2,400 kcpm	
	85 kHz [5][8]	40 kHz [5]	
Broadband Resolution (1 to 10 kHz)	1.2 mg	300 µg	100 µg
	1,176 µm/sec² [5]	2,943 µm/sec² [5]	981 µm/sec² [5]
Non-linearity	±1 % [6]		
Transverse Sensitivity	≤ 5 %		
Environmental			
Overload Limit (Shock)	10,000 g pk	5,000 g pk	
	98,100 m/s² pk	49,050 m/s² pk	
Temperature Range	-65 to 250 °F		
	-54 to 121 °C		
Enclosure Rating	N/A	IP68	
Electrical			
Settling Time (within 1% of bias)	≤ 3.0 sec		≤ 2.0 sec
Discharge Time Constant	≥ 0.1 sec	≥ 0.2 sec	
Excitation Voltage	18 to 28 VDC		
Constant Current Excitation	2 to 20 mA		
Output Impedance	<100 ohm		
Output Bias Voltage	8 to 12 VDC		
Spectral Noise (10 Hz)	100 µg/√Hz	12 µg/√Hz	7.0 µg/√Hz
	980 (µm/sec²)/√Hz [5]	117 (µm/sec²)/√Hz [5]	68.7 (µm/sec²)/√Hz [5]
Spectral Noise (100 Hz)	30 µg/√Hz	4.5 µg/√Hz	2.8 µg/√Hz
	294 (µm/sec²)/√Hz [5]	44 (µm/sec²)/√Hz [5]	27.5 (µm/sec²)/√Hz
Spectral Noise (1 kHz)	10 µg/√Hz	2.7 µg/√Hz	0.5 µg/√Hz
	98.1 (µm/sec²)/√Hz [5]	26.5 (µm/sec²)/√Hz [5]	4.9 (µm/sec²)/√Hz [5]
Electrical Protection	RFI/ESD		
Electrical Isolation	N/A	>10⁸ ohm	

Model Number	621B40	623C00	623C01
Physical			
Size - Hex	3/8 in	11/16 in	
	9.6 mm	17.5 mm	
Size - Height	0.66 in	1.97 in	
	16.8 mm	50 mm	
Weight	0.10 oz	1.80 oz	
	2.8 gm	51 gm	
Mounting Thread	5-40 Male	1/4-28 Female [1]	
	M3 x 0.50 Male		
Mounting Torque	18 to 20 in-lb	2 to 5 ft-lb	
	203 to 226 N-cm	2.7 to 6.8 N-m	
Sensing Element	Ceramic Shear		
Housing Material	Titanium	Stainless Steel	
Sealing	Welded Hermetic		
Electrical Connector	5-44 Coaxial Jack	2-pin MIL-C-5015	
Electrical Connection Position	Top		
Supplied Accessories			
	Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency	Model 081A40 Mounting Stud (1) Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency (1)	

Notes

All specifications are at room temperature unless otherwise specified

[1] 1/4-28 has no equivalent in S.I. units.
[2] Conversion Factor 1g = 9.81 m/s².
[3] For CE reference PCB® Declaration of Conformance PS023 or PS061 for details.
[4] The high frequency tolerance is accurate within ±10% of the specified frequency.
[5] Typical.
[6] Zero-based, least-squares, straight line method.
[7] Frequency response with adhesive base.
[8] Mounted resonance (nominal) without magnet.

Optional Versions

EX - ATEX Approved Intrinsically Safe Hazardous Area Approval
For Models: 623C00. 623C01
CS - Canadian Standards Association Approved Intrinsically Safe
For Models: 623C00. 623C01
M - Metric Mount
For Models: 621B40, 623C00. 623C01

Accessories & Cables: Pages 162-176

Quartz ICP® Accelerometers

- Ideal for permanent installations & online monitoring systems
- Promote safety when installed in hazardous or inaccessible locations
- Connect through switch or junction box for route-based data collection

Low Cost Quartz Industrial ICP® Accelerometer

Model 627A01

- 100 mV/g (50 g measurement range, +/-15%)
- Frequency Range: (±3dB)
  20 to 600,000 cpm (0.33 to 10 kHz)
- Electrical Connector: 2-pin MIL-C-5015

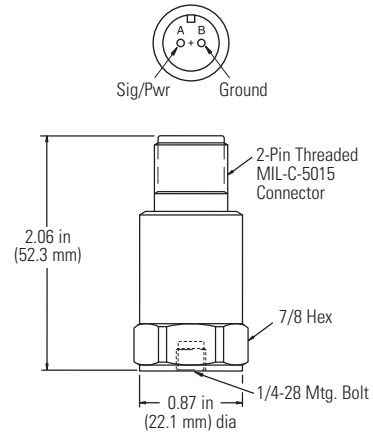
Product shown at actual size

Precision Quartz Industrial ICP® Accelerometer

Model 628F01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB)
  20 to 720,000 cpm (0.33 to 12 kHz)
- Available in high temperature version (325 °F)

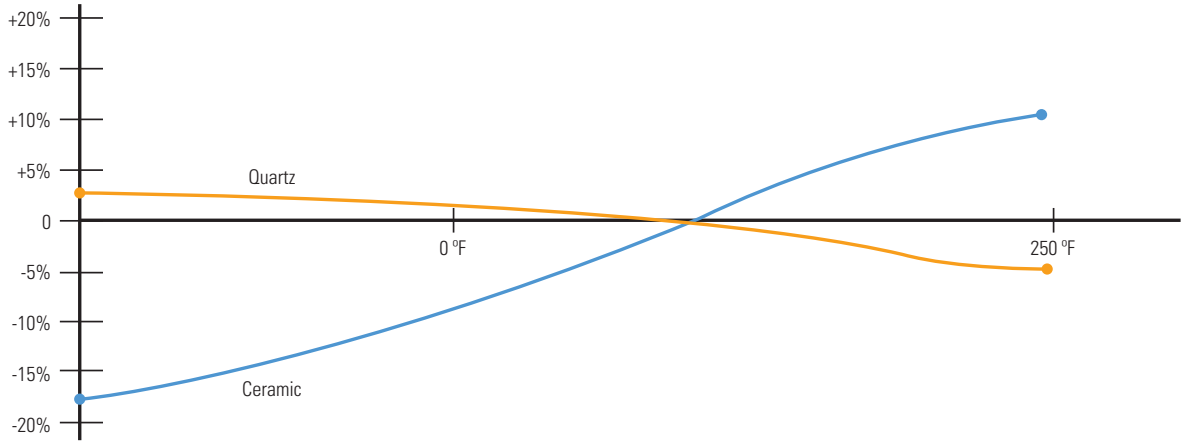
Product shown at actual size

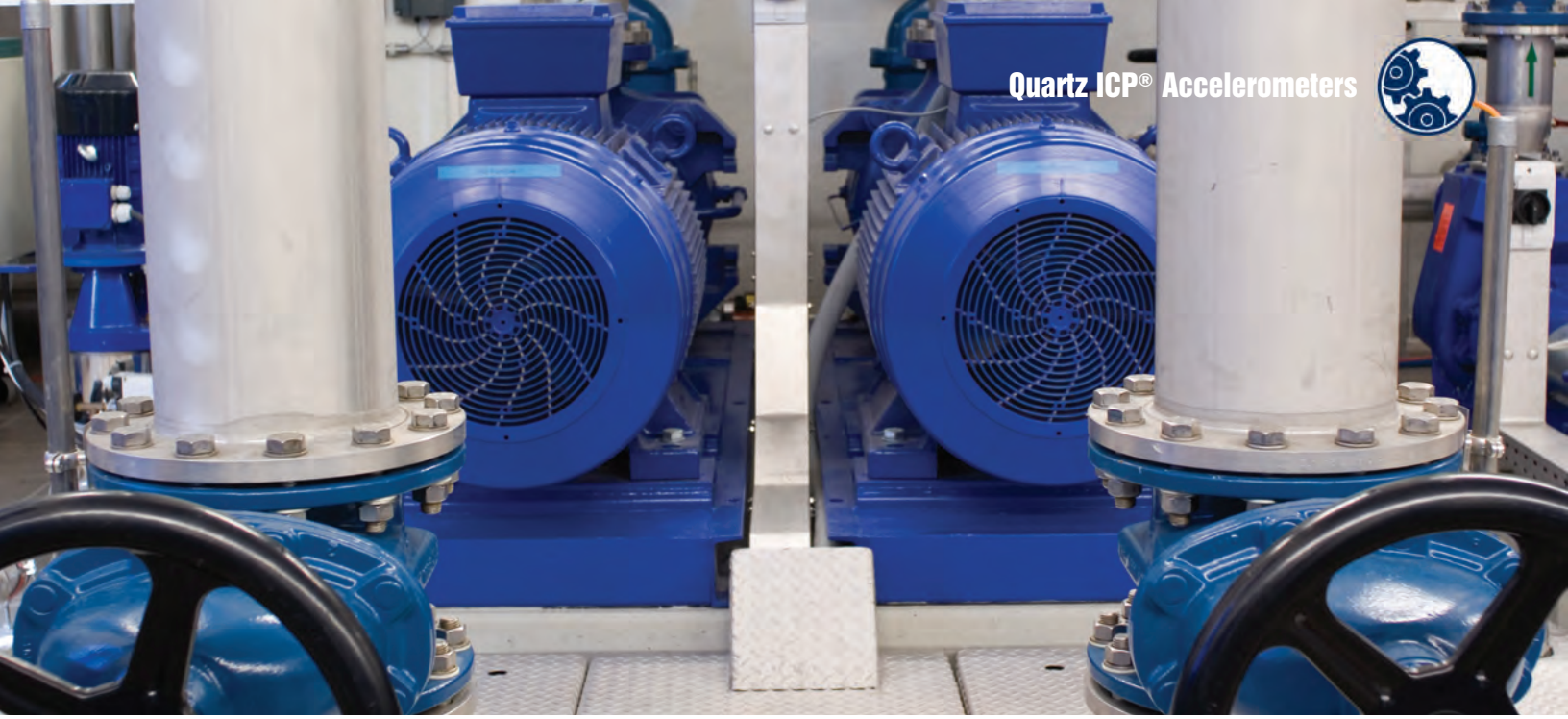


Tips From Techs

Piezoelectric Accelerometers: Benefits of Quartz vs. Ceramic

Piezoelectric materials emit a unit of electrical charge when compressed, stressed or sheared and form the core of most industrial accelerometers. Many sensors utilize artificially piezoelectric ceramics as their sensing element. An alternate option is to use quartz which is naturally piezoelectric and thus exhibits some technical advantages. Quartz sensors remain more linear in environments where temperature fluctuates. They also exhibit superior stability over time. In fact, quartz sensors that are recalibrated as much as a decade later sometimes show no sensitivity deviation from when they were originally made.





Technical Specifications

Model Number	627A01	628F01
Performance		
Sensitivity (±15 %)	100 mV/g 10.2 mV/(m/s²) [2]	N/A
Sensitivity (±5 %)	N/A	100 mV/g 10.2 mV/(m/s²) [2]
Measurement Range	±50 g ±490 m/s²	
Frequency Range (±3 dB)	20 to 600,000 cpm 0.33 to 10 kHz [4]	20 to 720,000 cpm 0.33 to 12 kHz
Frequency Range (±5 %)	N/A	60 to 240,000 cpm 1 to 4 kHz [4]
Frequency Range (±10 %)	N/A	40 to 390,000 cpm 0.67 to 6.5 kHz
Resonant Frequency	1,080 kcpm 18 kHz [5]	
Broadband Resolution (1 to 10 kHz)	1,000 µg 9,810 µm/sec² [5]	
Non-linearity	±1 % [6]	
Transverse Sensitivity	≤ 5 %	
Environmental		
Overload Limit (Shock)	5,000 g pk 49,050 m/s² pk	
Temperature Range	-65 to 250 °F -54 to 121 °C	
Enclosure Rating	IP68	
Electrical		
Settling Time (within 1% of bias)	≤ 10 sec	
Discharge Time Constant	≥ 0.5 sec	
Excitation Voltage	18 to 28 VDC	
Constant Current Excitation	2 to 20 mA	
Output Impedance	<100 ohm	
Output Bias Voltage	8 to 12 VDC	
Spectral Noise (10 Hz)	50 µg/√Hz 491 (µm/sec²)/√Hz [5]	
Spectral Noise (100 Hz)	20 µg/√Hz 196 (µm/sec²)/√Hz [5]	
Spectral Noise (1 kHz)	6 µg/√Hz 59 (µm/sec²)/√Hz [5]	
Electrical Protection	RFI/ESD	
Electrical Isolation (Case)	>10⁸ ohm	

Model Number	627A01	628F01
Physical		
Size - Hex	7/8 in 22 mm	
Size - Height	2.06 in 52.3 mm	
Weight	3.3 oz 94 gm	
Mounting Thread	1/4-28 Female [1]	
Mounting Torque	2 to 5 ft-lb 2.7 to 6.8 N-m	
Sensing Element	Quartz Shear	
Housing Material	Stainless Steel	
Sealing	Welded Hermetic	
Electrical Connector	2-pin MIL-C-5015	
Electrical Connection Position	Top	
Supplied Accessories		
	Model 081A40 Mounting Stud (1)	Model 081A40 Mounting Stud (1) Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency

Notes

All specifications are at room temperature unless otherwise specified

[1] 1/4-28 has no equivalent in S.I. units.
[2] Conversion Factor 1 g = 9.81 m/s².
[3] See PCB® Declaration of Conformance PS023 for details.
[4] The high frequency tolerance is accurate within ±10% of the specified frequency.
[5] Typical.
[6] Zero-based, least-squares, straight line method.

Optional Versions

EX - ATEX Approved Intrinsically Safe Hazardous Area Approval
For Models: 628F01
CS - Canadian Standards Association Approved Intrinsically Safe
For Models: 628F01
M - Metric Mount
For Models: 627A01, 628F01

Accessories & Cables: Pages 162-176

High Temperature Accelerometers

- Industry leading high temperature performance in ICP® designs
- Variety of rugged connector and integral cable options
- Top and side exit versions available for easy installation

IMI Sensors is the industry leader in high temperature accelerometers. Our high temperature accelerometers with internal electronics (ICP®) have the best temperature capability of any design on the market today. Often used by predictive maintenance departments in the industry of paper, plastics and steel manufacturing, these accelerometers provide critical machinery data that prevents failures and reduces downtime.

All of these high temperature ICP® accelerometers are capable of withstanding continuous temperatures of 325 °F (162 °C). For applications that exceed these temperatures we have a variety of charge mode accelerometers that can reach 1200 °F (649 °C).

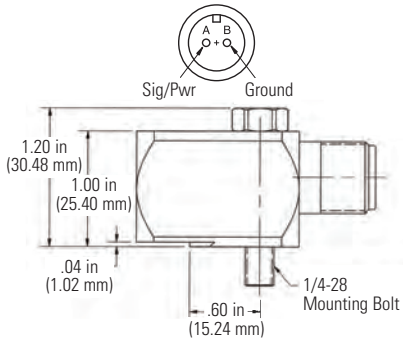
325°F (162 °C)

High Temperature Industrial ICP® Accelerometer

Model HT602D01

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 48 to 480,000 cpm (0.8 to 8 kHz)
- Low profile, through-bolt design
- 2-pin MIL connector

Product shown at actual size



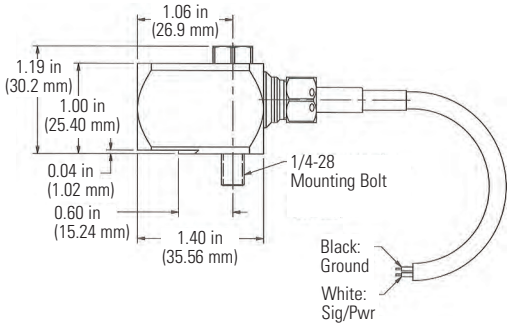
325°F (162 °C)

High Temperature Industrial ICP® Accelerometer

Model HT602D11

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 48 to 480,000 cpm (0.8 to 8 kHz)
- Low profile, through-bolt design
- Integral FEP cable

Product shown at actual size



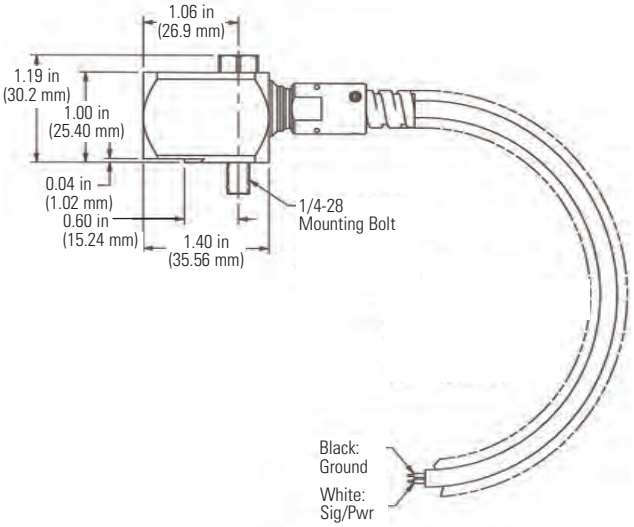
325°F (162 °C)

High Temperature Industrial ICP® Accelerometer

Model HT602D61

- 100 mV/g (50 g measurement range)
- Frequency Range: (±3dB) 48 to 480,000 cpm (0.8 to 8 kHz)
- Low profile, through-bolt design
- Armored integral, FEP jacketed cable

Product shown at actual size



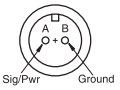
325°F (162 °C)

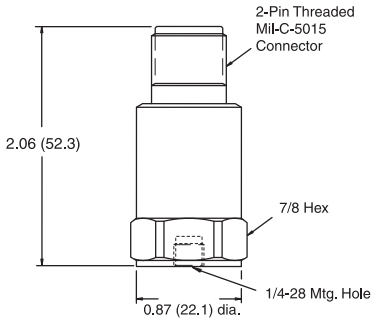
High Temperature Industrial ICP® Accelerometer

Model HT628F01

- Sensitivity: (±10%) 100 mV/g
- Measurement Range: ±50 g pk
- Frequency Range: (±3dB) 12 kHz
- Electrical Connector: 2-pin MIL-C-5015

Product shown at actual size





Technical Specifications

Model Number	HT602D01	HT602D11	HT602D61	HT628F01
Performance				
Sensitivity (±10 %)	100 mV/g			
	10.2 mV/(m/s²) [2]			
Measurement Range	±50 g			
	±490 m/s²			
Frequency Range (±5%)	N/A			144 to 180,000 cpm
				2.4 to 3 kHz [4]
Frequency Range (±10%)	102 to 180,000 cpm	N/A		102 to 300,000 cpm
	1.7 to 3 kHz [4][7]			1.7 to 5 kHz
Frequency Range (±3 dB)	48 to 480,000 cpm			
	0.8 to 8 kHz [4][7]			
Resonant Frequency	1,500 kcpm			1,080 kcpm
	25 kHz [5]			18 kHz [5]
Broadband Resolution (1 to 10 kHz)	150 µg			1 mg
	1,472 µm/sec² [5]			3,434 µm/sec² [5]
Non-linearity	±1 % [6]	±1 % [5]	±1 % [6]	±1 % [4]
Transverse Sensitivity	≤ 5 %			
Environmental				
Overload Limit (Shock)	5,000 g pk			1,000 g pk
	49,050 m/s² pk			981 m/s² pk [9]
Temperature Range	-65 to 325 °F			
	-54 to 162 °C			
Temperature Range (survivable limit)	N/A			350 °F
				176 °C
Enclosure Rating	IP68	IP67		IP68
Electrical				
Settling Time (within 1% of bias)	≤ 2.0 sec			≤ 3 sec
Discharge Time Constant	≥ 0.2 sec			
Excitation Voltage	18 to 28 VDC			
Constant Current Excitation	2 to 20 mA			2 to 10 mA [8]
Output Impedance	<150 ohm			<500 Ohm
Output Bias Voltage	8 to 12 VDC			
Spectral Noise (10 Hz)	9.0 µg/√Hz			50 µg/√Hz
	88.3 (µm/sec²)/√Hz [5]			491 (µm/sec²)/√Hz [3]
Spectral Noise (100 Hz)	4.0 µg/√Hz			20 µg/√Hz
	39.2 (µm/sec²)/√Hz [5]			196 (µm/sec²)/√Hz [3]
Spectral Noise (1 kHz)	2.0 µg/√Hz			6 µg/√Hz
	19.6 (µm/sec²)/√Hz [5]			59 (µm/sec²)/√Hz [3]
Electrical Isolation (Case)	>10⁸ ohm			

Model No.	HT602D01	HT602D11	HT602D61	HT628F01
Physical				
Size - Hex	N/A			7/8 in
				22.2 mm
Size - Length	2.1 in			N/A
	53.3 mm			
Size - Width	1.0 in			N/A
	25.4 mm			
Size - Height	1.0 in			2.06 in
	25.4 mm			52.3 mm
Weight (without cable)	5.4 oz			3.2 oz
	153 gm			91 gm
Mounting	1/4-28 UNF [1]			
Mounting Torque	2 to 5 ft-lb			
	2.7 to 6.8 N-m			
Sensing Element	Ceramic Shear			Quartz Shear
Housing Material	Stainless Steel			
Sealing	Welded Hermetic			
Electrical Connector	2-pin MIL-C-5015 (side)	Integral Cable (side)	Armored Integral Cable (side)	MIL-C-5015 (top)
Cable Termination	N/A	Blunt Cut		N/A
Electrical Connections	Signal/Power (Pin A)	Signal/Power (White)		Signal/Power (Pin A)
	Ground (Pin B)	Ground (Black)		Ground (Pin B)
Cable Length	N/A	10 ft		N/A
		3 m		
Cable Type	N/A	FEP Jacketed		N/A

Supplied Accessories

	Model 081A73 Captive mounting bolt 1/4-28 x 1.34" (1)	Model 081A40 Mounting Stud (1)
		Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency

Notes

All specifications are at room temperature unless otherwise specified

[1] 1/4-28 has no equivalent in S.I. units.
[2] Conversion Factor 1g = 9.81 m/s².
[3] For CE reference PCB® Declaration of Conformance PS023 for details.
[4] The high frequency tolerance is accurate within ±10% of the specified frequency.
[5] Typical.
[6] Zero-based, least-squares,straight line method.
[7] 1Hz = 60 cpm (cycles per minute).
[8] Constant current should be reduced to ≤6 mA when operating sensor above 250°F.
[9] Not recommended for use with magnetic mounting base.

Optional Versions

M - Metric Mount
For Models: HT602D01, HT602D11, HT602D61, HT628F01

Accessories & Cables: Pages 162-176

High Temperature Accelerometers

- 550 °F (288 °C) accelerometer
- Electrically ground isolated
- 10/32 connector (side or top exit)

These units are structured with a piezoelectric ceramic sensing element, operating in a shear mode geometry, for stable operation in the presence of thermal transients and base bending. Welded, hermetically sealed, titanium construction prevents any influx of dirt or moisture. Electrical ground isolation prevents ground loop problems and noise pick-up from the surface of the monitored device.

Since the output of these accelerometers is at a very high impedance, a high degree of insulation resistance is required of the signal transmission path. Low noise cables are recommended for routine, high temperature applications and hardline cables are advised for radiation environments. The use of an in-line charge converter is recommended to convert the measurement signal to a low-impedance voltage for long distance transmission.

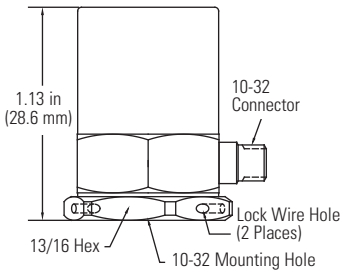
550 °F (288 °C)

High Temperature Charge Output Accelerometer

Model 357B53

- Sensitivity: (±15%) 100 pC/g
- Measurement Range: ±150 g pk
- Frequency Range: (±5%) 3 kHz
- Electrical Connector: 10-32 coaxial jack

Product shown at actual size



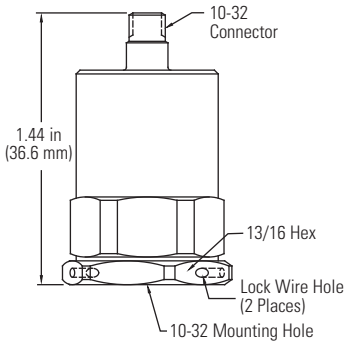
550 °F (288 °C)

High Temperature Charge Output Accelerometer

Model 357B54

- Sensitivity: (±15%) 100 pC/g
- Measurement Range: ±150 g pk
- Frequency Range: (±5%) 3 kHz
- Electrical Connector: 10-32 coaxial jack

Product shown at actual size



Technical Specifications

Model Number	357B53	357B54
Performance		
Sensitivity (± 15 %)	100 pC/g	
	10.2 pC/(m/s²)	
Measurement Range	± 150 g pk	
	± 1,470 m/s² pk	
Frequency Range (+5 %)	3 kHz [2]	
Frequency Range (+10 %)	3.5 kHz [2]	
Frequency Range (+3 dB)	5.5 kHz [2]	
Resonant Frequency	≥ 12 kHz	
Non-linearity	≤ 1 % [3]	
Transverse Sensitivity	≤ 5 %	
Environmental		
Overload Limit (Shock)	± 2,000 g pk	
	± 19,600 m/s² pk	
Temperature Range	-100 °F to 550 °F	
	-73 °C to 288 °C	
Base Strain Sensitivity	0.0002 g/μ	
	0.002 (m/s²)/μ [1]	
Radiation Exposure Limit (Integrated Gamma Flux)	≤ 10^8 rad	
Radiation Exposure Limit (Integrated Neutron Flux)	≤ 10^{10} N/cm²	
Electrical		
Capacitance	930 pF [1]	
Insulation Resistance (at 550°F)	≥ 10^8 ohm [1]	
Insulation Resistance (at 70° F [21°C])	≥ 10^{12} ohm	
Output Polarity	Negative	
Electrical Isolation (Base)	≥ 10^8 ohm	
Physical		
Sensing Element	Ceramic	
Sensing Geometry	Shear	
Housing Material	Titanium	
Sealing	Hermetic	
Size (Hex x Height)	3/4 in x 1.13 in	3/4 in x 1.43 in
	3/4 in x 28.7 mm	3/4 in x 36.3 mm
Weight	1.80 oz	
	51 gm [1]	
Electrical Connector	10-32 Coaxial Jack (side)	
Mounting Thread	10-32 Female	
Supplied Accessories		
	Model 081B05 Mounting Stud (10-32 to 10-32) (1) Model ACS-1 NIST traceable frequency response (10 Hz to upper 5% point). (1) Model M081B05 Mounting Stud 10-32 to M6 X 0.75 (1)	
Notes		
All specifications are at room temperature unless otherwise specified		
[1] Typical. [2] Low frequency response is determined by external signal conditioning electronics. [3] Zero-based, least-squares, straight line method.		

Accessories & Cables: Pages 162-176

Technical Specifications

Model Number	357B81	357B82	357B83
Performance			
Sensitivity (± 5 %)	20 pC/g	50 pC/g	100 pC/g
	2.04 pC/(m/s²)	5.1 pC/(m/s²)	10.2 pC/(m/s²)
Measurement Range	± 2,000 g pk	± 1,000 g pk	± 500 g pk
	± 19,620 m/s² pk	± 9,810 m/s² pk	± 4,905 m/s² pk
Frequency Range (± 5 %)	9 kHz	6 kHz	
Resonant Frequency	≥ 35 kHz	≥ 20 kHz	
Non-linearity (2000 g, 19620 m/s²)	≤ 1 %	N/A	
Non-linearity (1,000 g, 9800 m/s²)	N/A	≤ 1 %	N/A
Non-linearity (500 g, 4900 m/s²)	N/A		≤ 1 %
Transverse Sensitivity	≤ 5 % [2]		
Environmental			
Overload Limit (Shock)	± 4,000 g pk	± 2,000 g pk	± 1,000 g pk
	± 39,240 m/s² pk	± 19,620 m/s² pk	± 9810 m/s² pk
Temperature Range (Maximum)	550 °F		
	288 °C		
Base Strain Sensitivity	.004 g/µ	.001 g/µ	
	.04 (m/s²)/µ [1]	.01 (m/s²)/µ [1]	
Radiation Exposure Limit (Integrated Neutron Flux)	1E10 N/cm²		
Radiation Exposure Limit (Integrated Gamma Flux)	1E8 rad		
Temperature Range (Maximum)	550 °F		
	288 °C		
Electrical			
Capacitance (Pin to Pin)	2,400 pF [1]	2,300 pF [1]	10,000 pF [1]
Capacitance (Pin to Case)	30 pF [1]		
Capacitance (Unbalance Between Pins)	≤ 2 pF		
Insulation Resistance (Pin to Case at 70°F [21°C])	≥ 1 Gohm		
Insulation Resistance (Pin to Pin at 500°F [260°C])	≥ 10 Mohm		
Insulation Resistance (Pin to Pin at 70°F [21°C])	≥ 1 Gohm		
Insulation Resistance (Pin to Case at 500°F [260°C])	≥ 50 Mohm		
Output Polarity	Differential		
Physical			
Sensing Element	Ceramic Shear		
Housing Material	Stainless Steel		
Sealing	Hermetic		
Size (Height x Diameter)	1.00 in x .75 in		
	25.4 mm x 19 mm		
Weight (Maximum)	1.75 oz		
	50 gm [1]		
Electrical Connector	7/16-27 2-pin		
Electrical Connection Position	Side		
Mounting	Through Holes (3)		
Supplied Accessories			
	Model 081A99 Cap Screw (3) Model ACS-1 NIST traceable frequency response (10 Hz to upper 5% point). (1)		

Notes

All specifications are at room temperature unless otherwise specified

[1] Typical.
[2] Transverse sensitivity is typically ≤ 3%.

Accessories & Cables: Pages 162-176

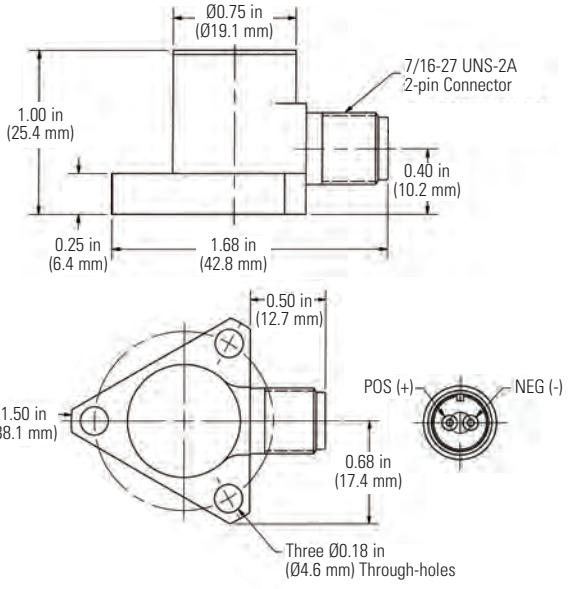
550 °F (288 °C)

High Temperature Charge Output Accelerometer

Series 357B8X

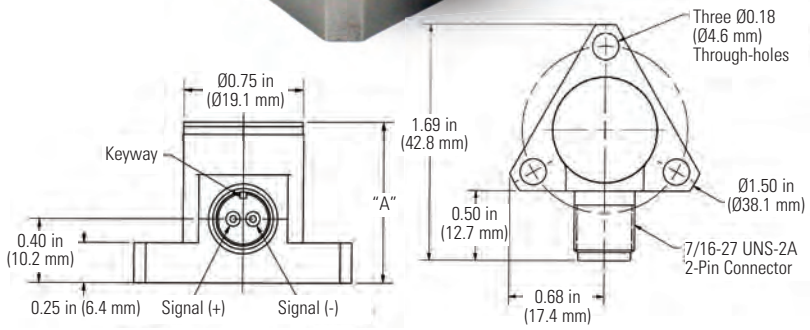
- Sensitivity: (±5%)
  Model 357B81: 20 pC/g
  Model 357B82: 50 pC/g
  Model 357B83: 100 pC/g
- Measurement Range:
  Model 357B81: ±2,000 g pk
  Model 357B82: ±1,000 g pk
  Model 357B83: ±500 g pk
- Frequency Range: (±5%)
  Model 357B81: 9,000 Hz
  Model 357B82: 6 kHz
  Model 357B83: 6 kHz
- Electrical Connector: 7/16-27 2-pin

Product shown at actual size



High Temperature Accelerometers

- Case isolated charge output accelerometers
- Available with hazardous area approvals
- Differential output for long term monitoring



900°F (482 °C)

High Temperature Charge Output Accelerometer

Series 357C7X

- Sensitivity: (±5%)
  Model 357C71: 10 pC/g
  Model 357C72: 50 pC/g
  Model 357C73: 100 pC/g
- Measurement Range:
  Model 357C71: ±1,000 g pk
  Model 357C72: ±500 g pk
  Model 357C73: ±300 g pk
- Frequency Range: (±5%)
  Model 357C71: 4 kHz
  Model 357C72: 2,500 Hz
  Model 357C73: 2 kHz
- Electrical Connector: 7/16-27 2-pin

Product shown at actual size

Case Height (Value A)
Model 357C73 = 1.48 in (37.6 mm)
Model 357C72 = 1.25 in (31.8 mm)
Model 357C71 = 1.00 in (25.4 mm)

Technical Specifications

Model Number	357C71	357C72	357C73
Performance			
Sensitivity (± 5 %)	10 pC/g 1.02 pC/(m/s²)	50 pC/g 5.1 pC/(m/s²)	100 pC/g 10.2 pC/(m/s²)
Measurement Range	± 1,000 g pk ± 9,810 m/s² pk	± 500 g pk ± 4,905 m/s² pk	± 300 g pk ± 2,943 m/s² pk
Frequency Range (± 5 %)	4 kHz [2]	2.5 kHz [2]	2 kHz [2]
Resonant Frequency	≥ 25 kHz	≥ 13 kHz	≥ 11 kHz
Non-linearity	≤ 1 % [3]		
Transverse Sensitivity	≤ 5 % [4]		
Environmental			
Overload Limit(Shock)	± 2,000 g pk ± 19,620 m/s² pk		± 1,000 g pk ± 9810 m/s² pk
Base Strain Sensitivity	0.033 g/µ 0.32 (m/s²)/µ [1]		
Radiation Exposure Limit (Integrated Neutron Flux)	1 E10 N/cm²		
Radiation Exposure Limit (Integrated Gamma Flux)	1 E8 rad		
Temperature Range	-65 to +900 °F -54 to +482 °C		
Electrical			
Capacitance (Pin to Pin)	525 pF [1]	945 pF [1]	1575 pF [1]
Capacitance (Pin to Case)	26 pF [1]		
Capacitance (Unbalance Between Pins)	≤ 2 pF		
Insulation Resistance (Pin to Case 70°F)	>10⁸ ohm [1]		
Insulation Resistance (Pin to Pin 70°F)	>10⁹ ohm		
Insulation Resistance (Pin to Pin 900°F)	>100 kohm		
Output Polarity	Differential		

Model Number	357C71	357C72	357C73
Physical			
Sensing Element	Ceramic		
Sealing	Hermetic		
Size (Height x Diameter)	1.0 in x 0.75 in 25.4 mm x 19 mm	1.25 in x 0.75 in 31.8 mm x 19 mm	1.48 in x 0.75 in 37.6 mm x 19 mm
Weight	2.6 oz 75 gm [1]	3.15 oz 90 gm [1]	3.8 oz 110 gm [1]
Electrical Connector	7/16-27 2-pin		
Electrical Connection Position	Side		
Mounting	Through Holes (3)		
Supplied Accessories			
	Model 081A99 Cap Screw (3) Model ACS-1 NIST traceable frequency response (10 Hz to upper 5% point).		
Notes			
All specifications are at room temperature unless otherwise specified			

[1] Typical.
[2] Low frequency response is determined by external signal conditioning electronics.
[3] Zero-based, least-squares, straight line method.
[4] Transverse sensitivity is typically ≤ 3%.
[5] For CE reference PCB® Declaration of Conformance PS081 for details.

Optional Versions

EX - ATEX Approved Intrinsically Safe Hazardous Area Approval
For Models: 357C71, 357C72

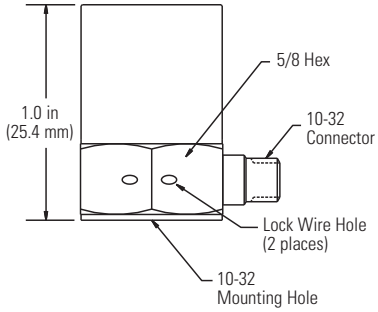
Accessories & Cables: Pages 162-176

High Temperature Charge Output Accelerometer

Model 357B61

- Sensitivity: (±10%) 10 pC/g
- Measurement Range: ±1,000 g pk
- Frequency Range: (±5%) 5 kHz
- Electrical Connector: 10-32 coaxial jack

Product shown at actual size

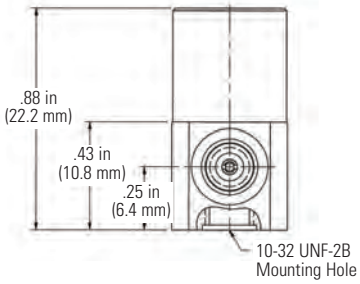


Charge Output Accelerometer

Model 357B69

- Sensitivity: (±10%) 3.5 pC/g (.357 pC/(m/s²))
- Measurement Range: ±500 g pk (±2450 m/s² pk)
- Frequency Range: (±5%) 6 kHz
- Electrical Connector: 10-32 Coaxial Jack

Product shown at actual size



Technical Specifications

Model Number	357B61	357B69
Performance		
Sensitivity (± 10 %)	10 pC/g	3.5 pC/g
	1.02 pC/(m/s²)	.357 pC/(m/s²)
Measurement Range	± 1,000 g pk	± 500 g pk
	± 9,810 m/s² pk	± 2,450 m/s² pk
Frequency Range (+5 %)	5 kHz [2]	6 kHz
Resonant Frequency	≥ 24 kHz	≥ 35 kHz
Non-linearity	≤ 1 % [3]	≤ 1 %
Transverse Sensitivity	≤ 3 %	≤ 5 %
Environmental		
Overload Limit (Shock)	± 5,000 g pk	± 3,000 g pk
	± 49,050 m/s² pk	± 29,420 m/s² pk
Temperature Range	-65 to +900 °F	
	-54 to +482 °C	
Base Strain Sensitivity	0.001 g/μ	0.0008 g/με
	0.01 (m/s²)/μ [1]	0.008 (m/s²)/με [1]
Radiation Exposure Limit (Integrated Gamma Flux)	1 E10 N/cm²	
Radiation Exposure Limit (Integrated Neutron Flux)	1 E8 rad	
Electrical		
Capacitance	630 pF [1]	196 pF [1]
Insulation Resistance (900° F [482° C])	>100 kohm	
Insulation Resistance (at 70° F [21°C])	>10⁸ ohm	>1 Gohm
Output Polarity	Negative	

Model Number	357B61	357B69
Physical		
Sensing Element	Ceramic	N/A
Sensing Geometry	Compression	
Housing Material	Inconel	
Sealing	Hermetic	
Size (Hex x Height)	5/8 in x 1.0 in	.875 in x .45 in
	5/8 in x 25.4 mm	22.2 mm x 11.4 mm
Weight	1.1 oz	0.56 oz
	30 gm [1]	16 gm [1]
Electrical Connector	10-32 Coaxial Jack	
Electrical Connection Position	Side	
Mounting Thread	10-32 Female	
Mounting torque	N/A	18 in-lb
		2 N-m
Supplied Accessories		
	Model 023A10 Hardline cable, 10-ft,10-32 plug to 10-32 jack (1) Model 081A107 Mounting stud(10-32 to 10-32) (1) Model ACS-1 NIST traceable frequency response (10 Hz to upper 5% point). (1) Model M081A107 Metric mounting stud(10-32 to M6 x 0.75) (1)	
Notes		
All specifications are at room temperature unless otherwise specified		
[1] Typical. [2] Low frequency response is determined by external signal conditioning electronics. [3] Zero-based, least-squares, straight line method.		
Optional Versions		
	P - Positive Output Polarity For Model 357B69	

Accessories & Cables: Pages 162-176

High Temperature Accelerometers

- One piece construction with hermetically sealed integral hardline cable
- Hazardous area approvals
- Multiple sensitivities available

Very High Temperature ICP® Accelerometer

Model EX600B13

- Sensitivity: (±5%) 100 mV/g
- Measurement Range: ±50 g pk
- Frequency Range: (±5%) 4 kHz
- Electrical Connector: 2-pin MIL-C-5015

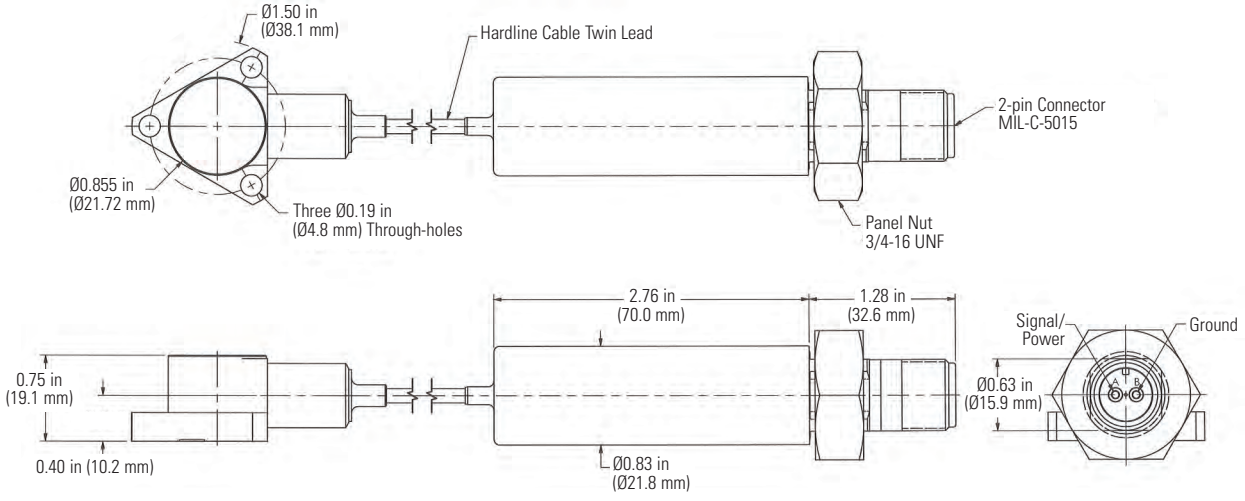
Product shown at actual size

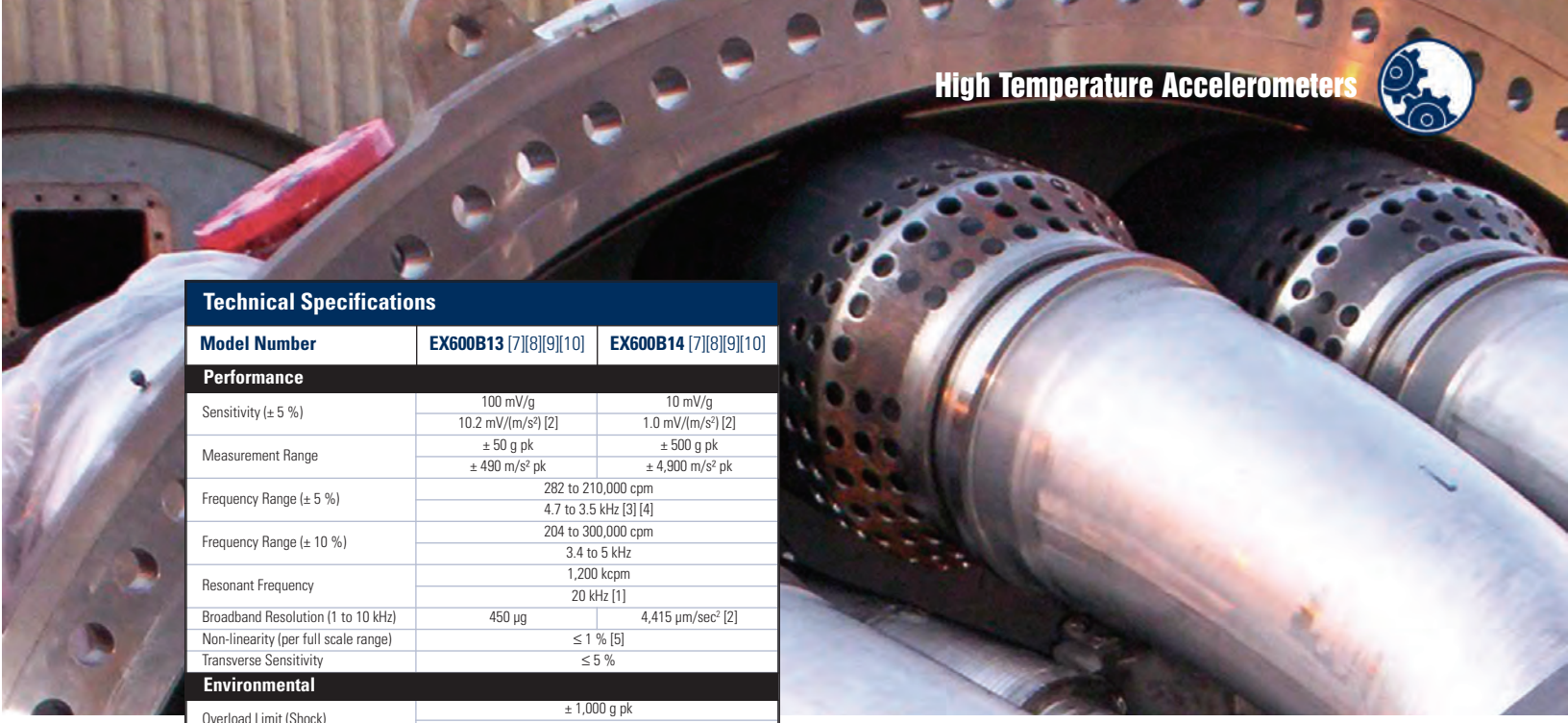
Very High Temperature ICP® Accelerometer

Model EX600B14

- Sensitivity: (±5%) 10 mV/g
- Measurement Range: ±500 g pk
- Frequency Range: (±5%) 4 kHz
- Electrical Connector: 2-pin MIL-C-5015

Product shown at actual size





Technical Specifications

Model Number	EX600B13 [7][8][9][10]	EX600B14 [7][8][9][10]
Performance		
Sensitivity (± 5 %)	100 mV/g	10 mV/g
	10.2 mV/(m/s²) [2]	1.0 mV/(m/s²) [2]
Measurement Range	± 50 g pk	± 500 g pk
	± 490 m/s² pk	± 4,900 m/s² pk
Frequency Range (± 5 %)	282 to 210,000 cpm	
	4.7 to 3.5 kHz [3] [4]	
Frequency Range (± 10 %)	204 to 300,000 cpm	
	3.4 to 5 kHz	
Resonant Frequency	1,200 kcpm	
	20 kHz [1]	
Broadband Resolution (1 to 10 kHz)	450 µg	4,415 µm/sec² [2]
Non-linearity (per full scale range)	≤ 1 % [5]	
Transverse Sensitivity	≤ 5 %	
Environmental		
Overload Limit (Shock)	± 1,000 g pk	
	± 9,810 m/s² pk [2]	
Temperature Range (Accelerometer)	-65 to 900 °F	
	-54 to 482 °C	
Temperature Range (Charge Amplifier)	-60 to 250 °F	
	-51 to 121 °C	
Base Strain Sensitivity	≤ 0.006 g/µε	≤ 0.06 (m/s²)/µε [2]
Electrical		
Settling Time (@ 70 °F within 1% bias)	≤ 1.0 sec	
Discharge Time Constant	≥ .10 sec	
Excitation Voltage	22 to 28 VDC	
Constant Current Excitation	2.2 to 20 mA	
Output Impedance	<1,000 ohm [1]	
Output Bias Voltage	12 to 16 VDC	
Spectral Noise (10 Hz)	30 µg/√Hz	
	294 (µm/sec²)/√Hz [1][2]	
Spectral Noise (100 Hz)	8 µg/√Hz	
	78 (µm/sec²)/√Hz [1][2]	
Spectral Noise (1 kHz)	4 µg/√Hz	
	39 (µm/sec²)/√Hz [1][2]	
Electrical Isolation (Case)	>10⁸ ohm	
Physical		
Size (Diameter x Height)	1.5 in x 0.75 in	
	38.1 mm x19.1 mm	
Weight (without cable)	9.5 oz	
	270 gm	
Electrical Connector	2-pin MIL-C-5015	
Cable Length	10 ft	
	3 m	
Cable Type	Integral Hardline	
Mounting	Through Holes (3)	
Supplied Accessories		
	Model 081A99 Cap Screw (3) Model ICS-1 NIST-traceable single-axis amplitude response calibration from 600 cpm (10 Hz) to upper 5% frequency (1)	
Optional Versions		

All specifications are at room temperature unless otherwise specified

[1] Typical
[2] Conversion Factor 1g = 9.81 m/s²
[3] 1Hz = 60 cpm (cycles per minute)
[4] The high frequency tolerance is accurate within ±10% of the specified frequency.
[5] Zero-based, least-squares,straight line method
[6] For CE reference PCB® Declaration of Conformance PS023 for details
[7] Class I, Div. 1, Groups A, B, C and D; Class II, Div. 1, Groups E, F and G; Class III, Div. 1
[8] Class I, Div. 1, Groups A, B, C, D
[9] Ex ia IIC T4
[10] Ex nL IIC T1, II 3 G

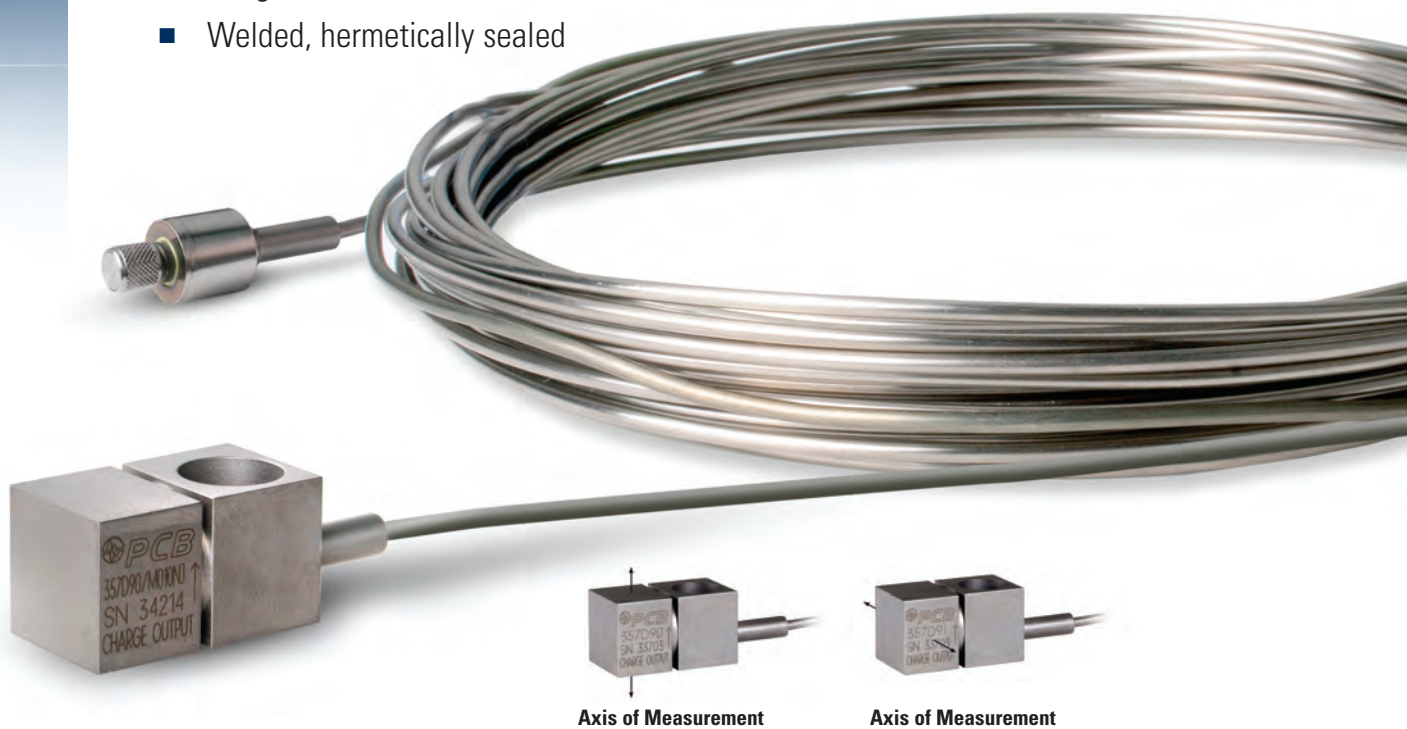
Accessories & Cables: Pages 162-176

Single Ended vs. Differential Output

Many operating engine environments generate temperatures in excess of 550 °F (288 °C). Above this temperature, many of the design features and materials used in high temperature accelerometers change considerably. For 550 °F to 1,200 °F (288 °C to 650 °C) operating environments, PCB® offers a range of both single ended output (measurement output as a signal and ground) and differential output (measurement output as a plus and minus signal) sensors. The former tend to be smaller and more suitable for short term testing needs, while the latter are more appropriate for long term monitoring applications. Obviously, the environments in which these sensors operate are challenging. In fact, in some of the highest temperature operating environments, the operating sensor measures vibration signatures while glowing red hot. These sensors are complemented by both lab grade and in-line charge amplifier systems. This differential charge amplifier is suitable for interfacing to any of PCB's differential charge output accelerometers.

High Temperature Accelerometers

- Sensors operating to 1,200 ºF (649 ºC)
- Ideal for monitoring gas turbines
- Integral hardline cable
- Welded, hermetically sealed



Axis of Measurement
Model 357D90

Axis of Measurement
Model 357D91

High Temperature Charge Output Accelerometer

Model 357D90

- Sensitivity: (±10%) 5 pC/g
- Measurement Range: ±1,000 g pk
- Frequency Range: (±5%) 2.5 kHz
- Electrical Connector: Integral hardline cable

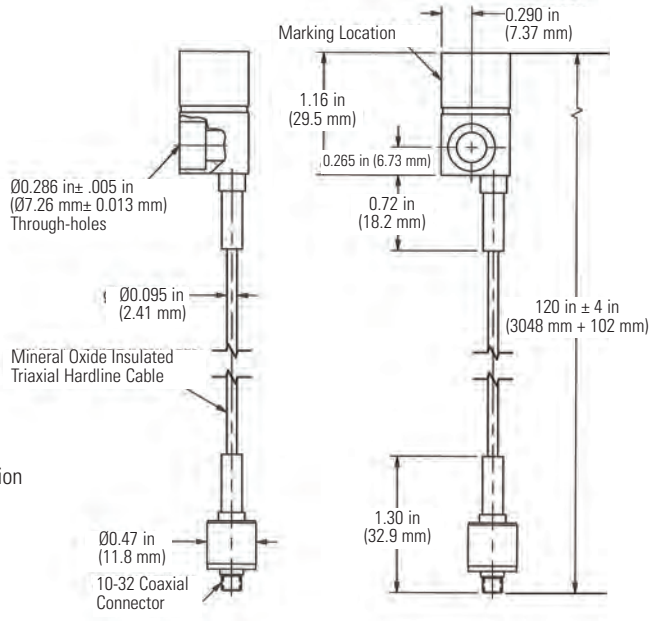
Product shown at actual size

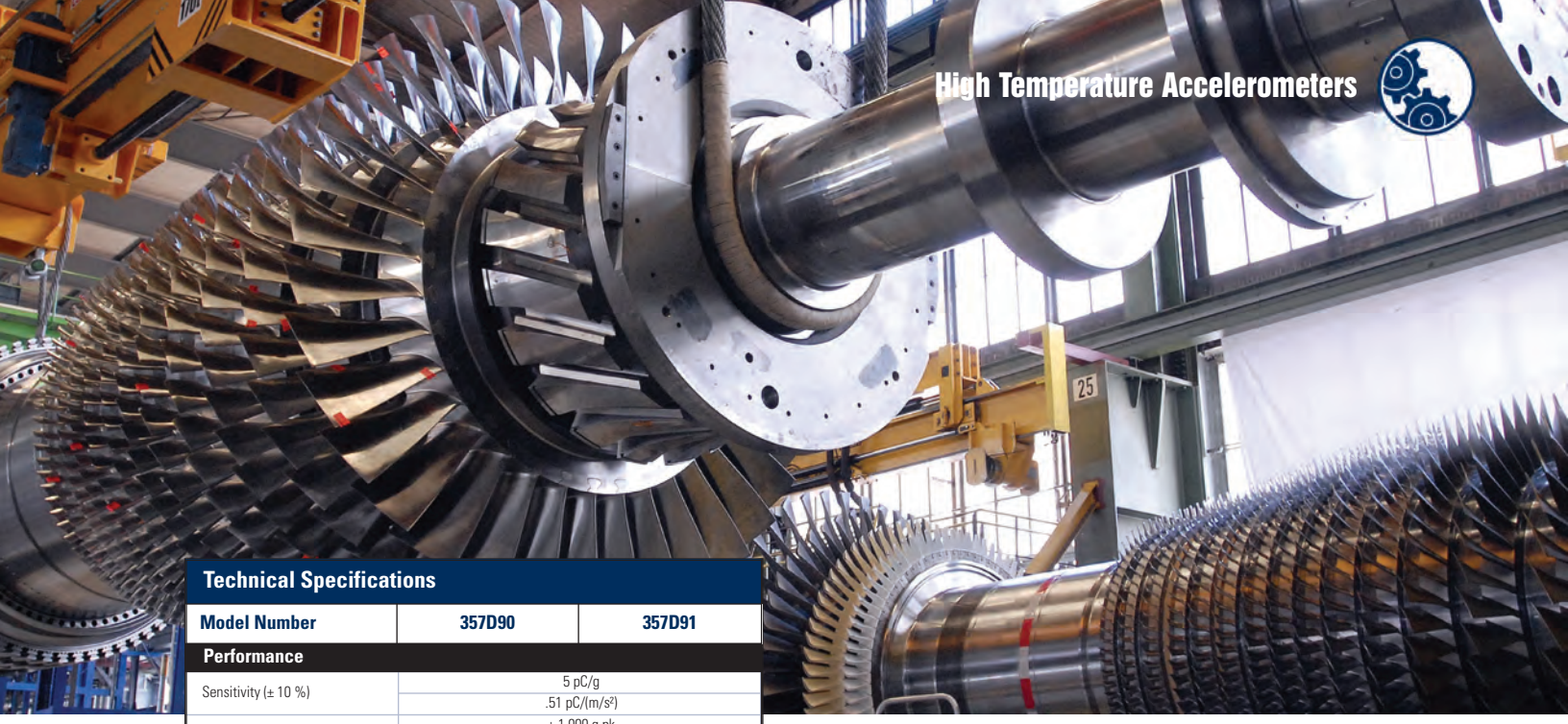
High Temperature Charge Output Accelerometer

Model 357D91

- Sensitivity: (±10%) 5 pC/g
- Measurement Range: ±1,000 g pk
- Frequency Range: (±5%) 2.5 kHz
- Sensitivity in the transverse direction

Product shown at actual size





Technical Specifications

Model Number	357D90	357D91
Performance		
Sensitivity (± 10 %)	5 pC/g	
	.51 pC/(m/s²)	
Measurement Range	± 1,000 g pk	
	± 9,800 m/s² pk	
Frequency Range (± 5 %)	2.5 kHz	
Frequency Range (± 1 dB)	4 kHz	
Resonant Frequency	≥ 14 kHz	≥ 13.5 kHz
Non-linearity (per full scale range)	≤ 2.5 %	
Transverse Sensitivity	≤ 5 %	
Environmental		
Overload Limit (Shock)	± 2,000 g pk	
	± 19,600 m/s² pk	
Temperature Response	± 15 % [1]	
Temperature Range (Survivable Limit)	-67 to 1,400 °F	
	-55 to 760 °C	
Temperature Range (Cable Termination)	-67 to 900 °F	
	-55 to 482 °C	
Temperature Range (Operating)	-67 to 1,200 °F	
	-55 to 649 °C	
Electrical		
Capacitance	990 pF [1]	1,000 pF [1][2]
Insulation Resistance (@ 1,200 °F [649 °C])	≥ 10 kohm	
Insulation Resistance (@ 70° F [21°C])	≥ 100 Mohm	
Output Polarity	Negative	
Electrical Isolation	Signal isolated from case	
Physical		
Sensing Geometry	Shear	
Housing Material	Inconel	
Sealing (Sensor Housing)	Hermetic	
Sealing (Connector)	Welded Hermetic	
Size (Height x Length x Width)	.66 in x 1.26 in x .66 in	
	16.7 mm x 32.0 mm x 16.7 mm	
Weight (without cable)	1.8 oz	
	50 gm [1]	
Electrical Connector	Integral Hardline Cable	
Cable Length	10 ft	10 ft
	3.05 m	
Cable Type	MI Hardline Cable	
Cable Termination	10-32 Coaxial Jack	
Mounting	Through Hole	
Supplied Accessories		
	Model 081B108 Mounting Screw, 1/4-28x1 (1) Model ACS-1 NIST traceable frequency response (10 Hz to upper 5% point). (1)	
Notes		
All specifications are at room temperature unless otherwise specified		
[1] Typical. [2] Additional cable length will add approximately 100 pF/ft		

Accessories & Cables: Pages 162-176

High Temperature Sensing Technology

It is often necessary to monitor vibration levels of rotating machinery operating at elevated temperatures or in high temperature environments. Such circumstances place extreme demands on vibration sensors and require use of accelerometers with special design characteristics that extend their useable temperature range beyond that of other conventional units. For these demanding situations, IMI Sensors offers two styles of high temperature industrial vibration sensors.

A variety of ICP® piezoelectric industrial accelerometers are available with high temperature "HT" option, which extends their usable range to +325 ˚F (+163 ˚C). This option replaces their standard, internal signal conditioning circuitry with circuitry specifically designed and tested to reliably withstand elevated temperatures. These accelerometers, though equipped with the "HT" option, will operate in the same manner and with the same cable, data collection and signal conditioning equipment as standard, ICP® industrial accelerometers.

For extreme, high temperature requirements, charge output accelerometers are recommended. Designed to withstand temperatures to 1,200 ˚F (649 ˚C), charge output accelerometers do not contain internal signal conditioning circuits which impose temperature limits on standard piezoelectric ICP® accelerometers. However, since there is no signal conditioning circuitry within charge output accelerometers, alternative cable and signal conditioning equipment are required. To simplify installation of these sensors, IMI Sensors offers complete kits that include the necessary low noise cable and in-line charge converter to adapt a charge output accelerometer to conventional ICP® sensor signal conditioners and data collection equipment.

Embeddable Accelerometers

- Choice of standard TO-5 or TO-8
- Choice of charge mode piezoelectric, voltage mode ICP®, and 3-wire low power varieties
- Range of sensitivities to accommodate a variety of applications

The Series 660 low cost accelerometers offer an affordable solution for vibration and shock measurements in high volume and commercial OEM applications. The units are particularly well suited for shock and impact detection of packages or components, as well as bearing and gear mesh vibration measurements in predictive maintenance and condition monitoring requirements. The compact designs may be imbedded into machinery at the OEM level to provide value added monitoring protection.

The units employ field proven, solid state, piezoelectric sensing elements for durability and broadband performance. Choose from either charge mode types, which achieve high operating temperatures or voltage mode ICP® types, with Built in signal conditioning microelectronics, for simplified operation and connectivity to data acquisition and vibration monitoring instrumentation.

How To Order 660 Series, Low Cost, Embeddable Accelerometer

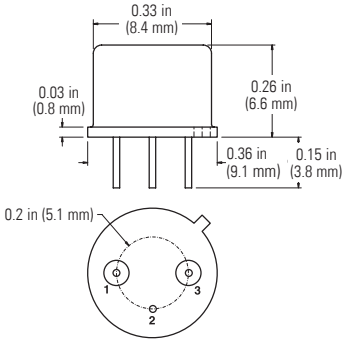
Sensor Configuration Number				
See "Technical Specifications" Table on page 111				
	Orientation/Polarity			
	PZ	Positive output for acceleration along z-axis (in upward direction when pin mounted)		
	NZ	Negative output for acceleration along z-axis (in upward direction when pin mounted)		
		Electrical Connection		
		1	Header Pins	
		2	Integral 1 ft. (0.3 m) cable	
			Options	
			XX	Overall integral cable length in "XX" ft (other than standard 1 ft.)
			MXX	Overall integral cable length in "XX" meters (other than standard 0.3 m)
Example				
66162A	PZ	1		(66162APZ1) Low cost, Low Profile TO-5, 1 mV/g, 5000g, 2 wire ICP® accelerometer with positive polarity and header pin connections

Pellet Type Accelerometer

Low Profile T-05, Model 66103PPZ1

- 3-wire voltage output (power, signal, ground)
- Sensitivity: (±20%) 10 mV/g
- Low power consumption

Product shown at actual size

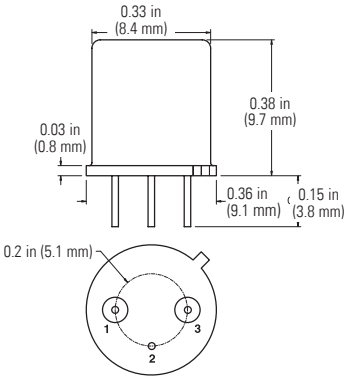


Pellet Type Accelerometer

Standard T-05, Model 66292CNZ1

- 2-wire charge output (signal, ground)
- Sensitivity: (±20%) 11 pC/g
- Power supply not required

Product shown at actual size

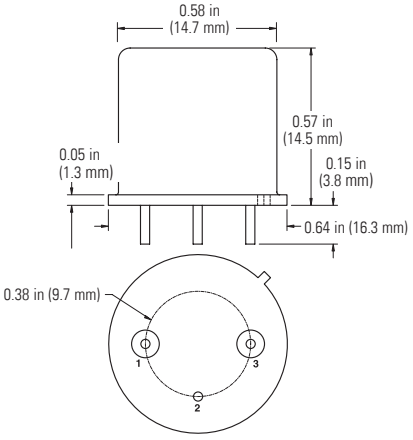


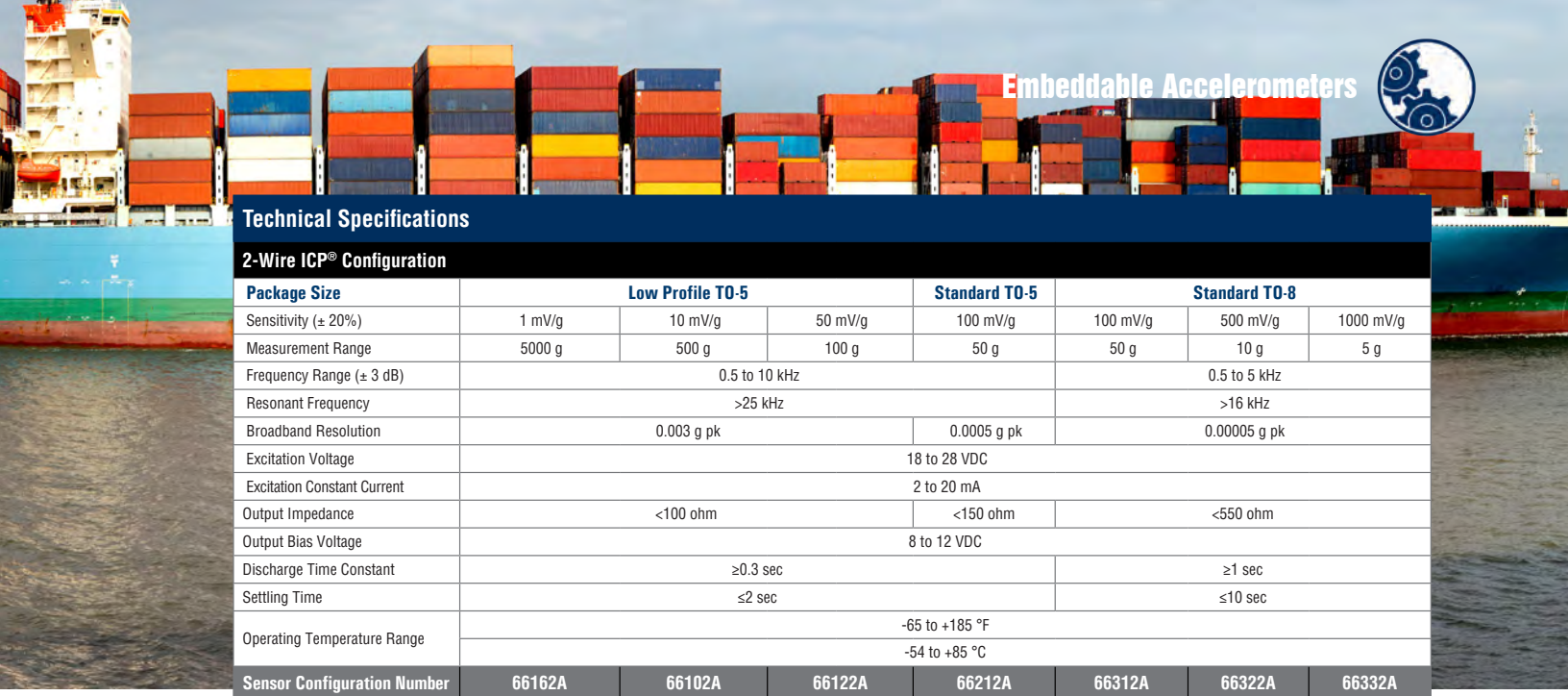
Pellet Type Accelerometer

Standard T-08, Model 66332APZ1

- 2-wire ICP® power (power/signal, ground) current regulated power
- Sensitivity: (±20%) 1,000 mV/g
- High resolution

Product shown at actual size





Technical Specifications

2-Wire ICP® Configuration

Package Size	Low Profile TO-5			Standard TO-5	Standard TO-8		
Sensitivity (± 20%)	1 mV/g	10 mV/g	50 mV/g	100 mV/g	100 mV/g	500 mV/g	1000 mV/g
Measurement Range	5000 g	500 g	100 g	50 g	50 g	10 g	5 g
Frequency Range (± 3 dB)	0.5 to 10 kHz				0.5 to 5 kHz		
Resonant Frequency	>25 kHz				>16 kHz		
Broadband Resolution	0.003 g pk			0.0005 g pk	0.00005 g pk		
Excitation Voltage	18 to 28 VDC						
Excitation Constant Current	2 to 20 mA						
Output Impedance	<100 ohm			<150 ohm	<550 ohm		
Output Bias Voltage	8 to 12 VDC						
Discharge Time Constant	≥0.3 sec				≥1 sec		
Settling Time	≤2 sec				≤10 sec		
Operating Temperature Range	-65 to +185 °F						
	-54 to +85 °C						
Sensor Configuration Number	**66162A**	**66102A**	**66122A**	**66212A**	**66312A**	**66322A**	**66332A**

3-Wire Low Power Configuration

Package Size	Low Profile TO-5	Standard TO-5		Standard TO-8		
Sensitivity (± 20%)	10 mV/g	50 mV/g	100 mV/g	100 mV/g	500 mV/g	1000 mV/g
Measurement Range *	200 g	20 g	20 g	20 g	4 g	2 g
Frequency Range (± 3 dB)	0.5 to 10 kHz			0.5 to 5 kHz		
Broadband Resolution	0.007 g pk	0.002 g pk		.001 g pk		
Excitation Voltage	3 to 12 VDC					
Excitation Constant Current	0.75 mA					
Output Impedance	<100 ohm					
Output Bias Voltage	0.5 x Excitation Voltage					
Discharge Time Constant	≥0.3 sec			≥0.4 sec		
Settling Time	≤2.5 sec			≤2 sec		
Operating Temperature Range	-65 to +185 °F					
	-54 to +85 °C					
Sensor Configuration Number	**66103P**	**66203P**	**66213P**	**66313P**	**66323P**	**66333P**

2-Wire Charge Mode Configuration

Package Size	Low Profile TO-5	Standard TO-5	Standard TO-8
Sensitivity (± 20%)	5 pC/g	11 pC/g	100 pC/g
Frequency Range (± 3 dB)	10 kHz		5 kHz
Capacitance	350 pF		2700 pF
Operating Temperature Range	-65 to +185 °F		-65 to +250 °F
	-54 to +85 °C		-54 to +121 °C
Sensor Configuration Number	**66192C**	**66292C**	**66392C**

Common Configuration

Package Size	Low Profile TO-5	Standard TO-5	Standard TO-8
Resonant Frequency	>25 kHz		>16 kHz
Non-Linearity	≤1 %		
Transverse Sensitivity	≤7 %		
Over Limit (Shock)	5000 g pk		
Temperature Coefficient	0.10%/°F		
	0.18%/°C		
Housing Material	Stainless Steel		
Sealing	Hermetic		
Mounting	Adhesive or Solder		
Weight	0.08 oz	0.1 oz	0.88 oz
	2.2 gm	3 gm	25 gm
Size	0.36 x 0.26 in	0.36 x 0.38 in	0.64 x 0.57 in
	9.1 x 6.6 mm	9.1 x 9.7 mm	16.3 x 14.5 mm

Notes

* Measurement range achieved is dependent upon excitation voltage supplied, i.e. : Measurement Range = (0.5 x Excitation Voltage) - 0.5 V / Sensitivity (V/g)

Accessories & Cables: Pages 162-176

Vibration Transmitters

- 4-20 mA sensors for permanent installation that interface directly to a PLC, DCS and SCADA systems
- Provides continuous, 24/7 monitoring of critical machinery
- Cost-effective monitoring solution

4-20 mA Output Transmitter
Model 640B01

- Measurement range: 0 to 1 in/sec pk (0 to 25.4 mm/s pk)
- Frequency range: (±10%) 180 to 60,000 cpm (3 to 1 kHz)
- Raw vibration or temperature output signal options, intrinsically safe options available

Product shown at actual size

4-20 mA Output Transmitter
Model 640B02

- Measurement range: 0 to 2 in/sec pk (0 to 50.8 mm/s pk)
- Frequency range: (±10%) 180 to 60,000 cpm (3 to 1 kHz)
- Raw vibration or temperature output signal options, intrinsically safe options available

Product shown at actual size

4-20 mA Output Transmitter
Model 641B01

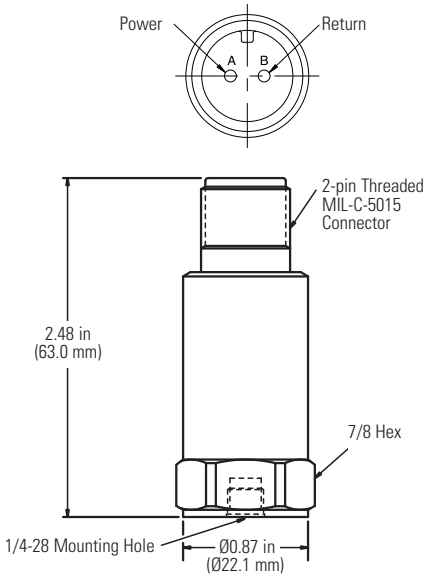
- Measurement range: 0 to 1 in/sec rms (0 to 25.4 mm/s rms)
- Frequency range: (±10%) 600 to 60,000 cpm (10 to 1 kHz)
- Raw vibration or temperature output signal options, intrinsically safe options available

Product shown at actual size

4-20 mA Output Transmitter
Model 641B02

- Measurement range: 0 to 2 in/sec rms (0 to 25.4 mm/s rms)
- Frequency range: (±10%) 600 to 60,000 cpm (10 to 1 kHz)
- Raw vibration or temperature output signal options, intrinsically safe options available

Product shown at actual size



4-20 mA Output Transmitter
Model 645B00

- Measurement range: 0 to 5 g rms (0 to 49 m/s² rms)
- Frequency range: (±10%) 180 to 60,000 cpm (3 to 1 kHz)
- Raw vibration or temperature output signal options, intrinsically safe options available

Product shown at actual size

4-20 mA Output Transmitter
Model 646B02

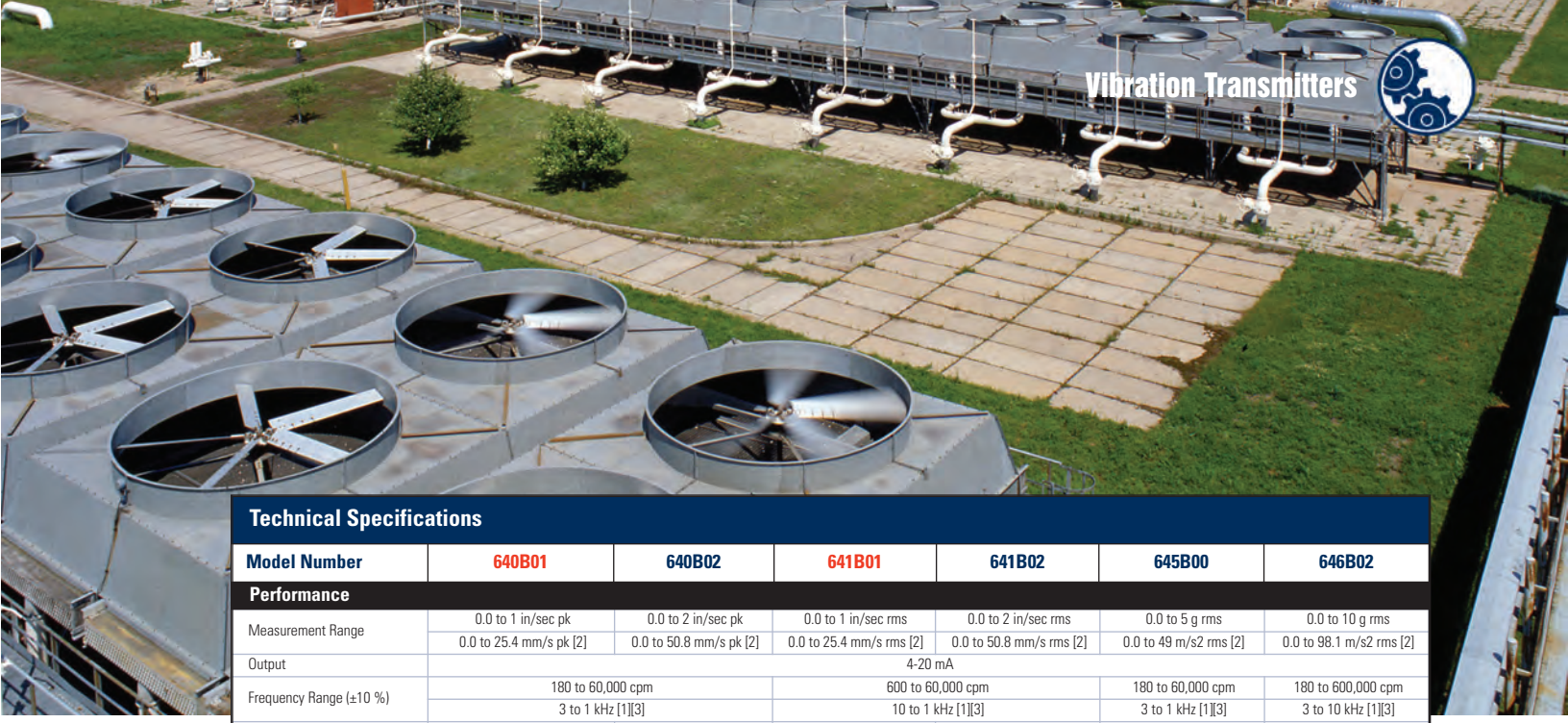
- Measurement range: 0 to 10 g rms (0 to 98.1 m/s² rms)
- Frequency range: (±10%) 180 to 600,000 cpm (3 to 10 kHz)
- Raw vibration or temperature output signal options, intrinsically safe options available

Product shown at actual size

Tips From Techs

Getting Started with Loop Powered Vibration Sensors

Starting a vibration monitoring program is not always easy. It requires investing human resources for training and capital dollars to obtain data acquisition equipment. But most plants already have PLC, DCS or SCADA systems in place monitoring pressure, flow and temperature. IMI's loop-powered 4-20 mA vibration transmitters are "plug and play" with today's plant control systems. Thus 4-20 mA vibration transmitters are an excellent way to monitor vibration and protect critical equipment without the expense of additional costly data acquisition systems. While 4-20 mA sensors cannot perform diagnostic tasks they provide early warnings that help maintenance technicians avoid catastrophic failure.



Technical Specifications

Model Number	640B01	640B02	641B01	641B02	645B00	646B02
Performance						
Measurement Range	0.0 to 1 in/sec pk	0.0 to 2 in/sec pk	0.0 to 1 in/sec rms	0.0 to 2 in/sec rms	0.0 to 5 g rms	0.0 to 10 g rms
	0.0 to 25.4 mm/s pk [2]	0.0 to 50.8 mm/s pk [2]	0.0 to 25.4 mm/s rms [2]	0.0 to 50.8 mm/s rms [2]	0.0 to 49 m/s2 rms [2]	0.0 to 98.1 m/s2 rms [2]
Output	4-20 mA					
Frequency Range (±10 %)	180 to 60,000 cpm		600 to 60,000 cpm		180 to 60,000 cpm	180 to 600,000 cpm
	3 to 1 kHz [1][3]		10 to 1 kHz [1][3]		3 to 1 kHz [1][3]	3 to 10 kHz [1][3]
Broadband Resolution	0.005 in/sec pk	0.01 in/sec pk	0.005 in/sec rms	0.01 in/sec rms	0.025 g rms	0.05 g rms
	0.13 mm/s pk [5]	0.26 mm/s pk [5]	0.13 mm/s rms [5]	0.26 mm/s rms [5]	0.24 m/s2 rms [5]	0.49 m/s2 rms
Non-linearity	±1 %					
Environmental						
Temperature Range	-40 to 185 °F					
	-40 to 85 °C					
Electrical						
Excitation Voltage	12 to 30 VDC					
Load Resistance	50 (Vs-12) ohms					
Settling Time (within 2% of value)	<15 sec					
Electrical Isolation (Case)	$>10^8$ ohm					
Physical						
Size - Hex	1.0 in					
	25.4 mm					
Size - Height	2.6 in					
	66 mm					
Weight	4.7 oz					
	131 gm					
Mounting Thread	1/4-28 UNF					
Mounting Torque	3 to 5 ft-lb					
	4 to 7 N-m					
Sensing Element	Ceramic Shear					
Housing Material	Stainless Steel					
Sealing	Welded Hermetic					
Electrical Connector	2-pin MIL-C-5015 (Top)					
Electrical Connections (Pin A)	4-20 mA Pos (+)					
Electrical Connections (Pin B)	4-20 mA Neg (-)					

Supplied Accessories

Model 081A40 Mounting Stud (1)
Model ICS-4 NIST-traceable single-axis amplitude response calibration from 0 cpm (0 Hz) to upper 10% frequency for 4 - 20 mA output vibration sensor (1)

Notes

All specifications are at room temperature unless otherwise specified

[1] 1Hz = 60 cpm (cycles per minute).
[2] Conversion Factor 1 in/sec = 0.0254 m/sec.
[3] Current will fluctuate at frequencies below 5 Hz.
[4] For CE reference PCB® Declaration of Conformance PS039 or PS053 for details.
[5] Typical.

Optional Versions

EX - Hazardous Area Approval
For Models: 640B01, 640B02, 641B01, 641B02
M - Metric Mount
For Models: 640B01, 640B02, 641B01, 641B02
RV - Buffered Analog Signal Output 100 mV/g (±20%)
For Models: 640B01, 640B02, 641B01, 641B02
RVVO - Buffered Analog Signal Output 100 mV/in/sec (±20%)
For Models: 640B01

Accessories & Cables: Pages 162-176

Displacement

Vibration Transmitters

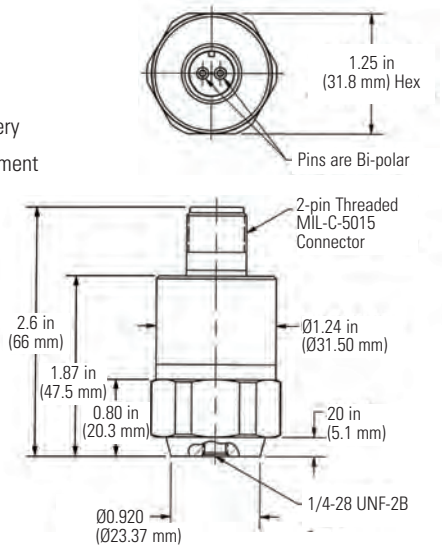
- Industry leading low frequency response
- Interface directly to PLC, DCS and SCADA systems
- Superior signal resolution on slow speed machinery

4-20 mA Output Transmitter

Model 653A01

- Effective on slow speed machinery
- Measures absolute p-p displacement
- Accurate down to 90 cpm

Product shown at actual size



Product Spotlight

4-20 mA Indicator / Alarm

Model 683A

The model 683A panel meter can be used with either ICP® sensors or 4-20 mA vibration transmitters depending on the options selected. Each display also features two programmable relays with time delays and optional 4-20 mA re-transmit.

- Provides 24 VDC excitation for loop powered 4-20 mA sensors, or ICP® power
- Up to four programmable set-point relays
- Highly visible, fully scalable LED display and user friendly, menu-driven setup

4-20 mA Alarm Enclosure

Series 684A

- Houses 1 to 8 panel meters
- Fiberglass NEMA 4X enclosure
- BNC's for walk up analysis when ICP® option is selected

Technical Specifications

Model Number	653A01
Performance	
Measurement Range	2 to 40 mil pk - pk
	0.05 to 1.02 mm pk - pk [2]
Output	4-20 mA
Frequency Range (±3 dB)	90 to 18,000 cpm
	1.5 to 300 Hz [1]
Non-linearity	±2%
Environmental	
Temperature Range	-60 to 250 °F
	-54 to 121 °C
Overload Limit	2,500 g pk
Electrical	
Excitation Voltage	12 to 30 VDC
Load Resistance	50 (Vs-12) ohms
Settling Time	60 sec [3]
Electrical Isolation (Case)	$>10^8$ ohm
Physical	
Size - Hex	1.25 in
	31.75 mm
Size - Height	2.6 in
	66 mm
Weight	5.36 oz
	152 gm
Mounting Thread	1/4-28 UNF
Mounting Torque	3 to 5 ft-lb
	4 to 7 N-m
Sensing Element	Ceramic
Sensing Geometry	Flexural
Housing Material	Stainless Steel
Sealing	Welded Hermetic
Electrical Connector	2-pin MIL-C-5015 (Top)
Electrical Connections (Pin A)	4-20 mA Pos (+)
Electrical Connections (Pin B)	4-20 mA Neg (-)
Supplied Accessories	
	Model 081A41 Mounting stud 1/4-28 socket head set screw brass tip stainless steel 5/8" long (1)

Notes

All specifications are at room temperature unless otherwise specified

[1] 1Hz = 60 cpm (cycles per minute).
[2] Conversion Factor 1 in/sec = 0.0254 m/sec.
[3] Typical

Optional Versions

M - Metric Mount
For Model 653A01

Accessories & Cables: Pages 162-176

Ultra Low Frequency Displacement Sensor

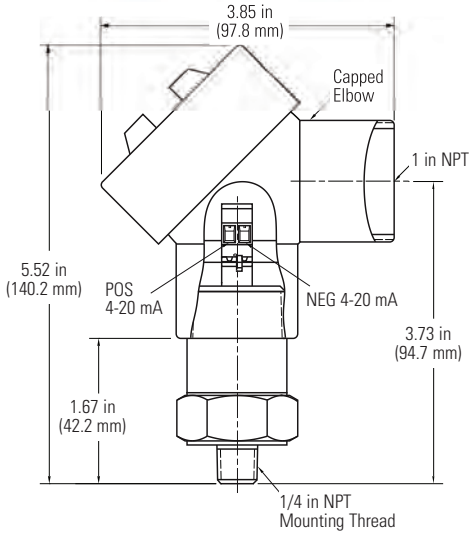
Until now users that wanted to monitor equipment turning at speeds below 180 cpm (3 Hz) with one simple sensor were limited in the frequency bands and scale which they could measure. IMI's 4-20 mA displacement sensor changes the game, allowing user's to trend vibration in displacement at speeds as low as 90 CPM (1.5 Hz). Displacement, as opposed to the traditionally offered velocity and acceleration scales, offers the best signal resolution at speeds below 600 CPM (10 Hz) and is ideal for detecting an unbalance condition in slow speed equipment such as fans.

The model 653A01 has a vibration range of 40 mils peak to peak. Its frequency span is 90 CPM to 18,000 CPM (1.5 Hz to 300 Hz), giving it the best low frequency response of any 4-20 mA sensor on the market today. The Ultra Low Frequency Displacement Sensor is available with industry standard 2-pin MIL connector or is fully submersible when ordered with integral cable.

Hazardous Area Approved

Vibration Transmitters

- CSA / ATEX D approved
- Supplied with explosion proof conduit elbow
- Electrical connector: terminal block



Loop Powered 4-20 mA Vibration Transmitter

Model EX640B71

- Measurement Range: 0 to 1 in/sec pk (0 to 25.4 mm/s pk)
- Frequency Range: (±10%) 180 to 60,000 cpm (3 to 1 kHz)
- Raw vibration or temperature output signal options

Product shown at actual size

Loop Powered 4-20 mA Vibration Transmitter

Model EX640B72

- Measurement Range: 0 to 2 in/sec pk (0 to 50.8 mm/s pk)
- Frequency Range: (±10%) 180 to 60,000 cpm (3 to 1 kHz)
- Raw vibration and temperature output signal options

Product shown at actual size

Loop Powered 4-20 mA Vibration Transmitter

Model EX641B71

- Measurement Range: 0 to 1 in/sec rms (0 to 25.4 mm/s rms)
- Frequency Range (± 10%) 600 to 600,000 cpm (10 to 1 kHz)
- Raw vibration and temperature output options available

Product shown at actual size

Loop Powered 4-20 mA Vibration Transmitter

Model EX641B72

- Measurement Range: 0 to 2 in/sec rms (0 to 50.8 mm/s pk)
- Frequency Range (± 10%) 600 to 600,000 cpm (10 to 1 kHz)
- Raw vibration and temperature output options available

Product shown at actual size

Technical Specifications

Model Number	EX640B71	EX640B72	EX641B71	EX641B72
Performance				
Measurement Range	0.0 to 1 in/sec pk	0.0 to 2.0 in/sec pk	0.0 to 1 in/sec rms	0.0 to 2.0 in/sec rms
	0.0 to 25.4 mm/s pk [1]	0.0 to 50.8 mm/s pk [1]	0.0 to 25.4 mm/s rms [1]	0.0 to 50.8 mm/s rms [1]
Output	4-20 mA	4-20 mA	4-20 mA	4-20 mA
Frequency Range(± 3 dB)	180 to 60,000 cpm		600 to 60,000 cpm	
	3 to 1 kHz [2][3]		10 to 1 kHz [2][3]	
Broadband Resolution	0.005 in/sec pk	0.01 in/sec pk	0.005 in/sec rms	0.01 in/sec rms
	0.13 mm/s pk [4]	0.26 mm/s pk [4]	0.13 mm/s rms [4]	0.26 mm/s rms [4]
Non-linearity	± 1 %			
Environmental				
Temperature Range	-40 to 176 °F			
	-40 to 80 °C			
Electrical				
Excitation Voltage	12 to 30 VDC			
Settling Time (within 2% of value)	<15 sec			
Electrical Isolation(Case)	$>10^8$ ohm			
Physical				
Size (Hex x Height)	3.85 in x 5.52 in			
	98 mm x 140 mm			
Weight	1.2 lb			
	544 gm			
Mounting Thread	1/4 NPT			
Sensing Element	Ceramic Shear			
Housing Material	Stainless Steel			
Electrical Connector	Removable Screw Terminals			
Electrical Connection Position	Top			
Electrical Connections(Tab 1)	4-20 mA Pos (+)			
Electrical Connections(Tab 2)	4-20 mA Neg (-)			
Screw Terminal Wire Size	12-24 AWG			
	3.0 - .2mm²			
Supplied Accessories				
	Model ICS-4 NIST-traceable single-axis amplitude response calibration from 0 cpm (0 Hz) to upper 10% frequency for 4-20 mA output vibration sensor (1)			

Notes

All specifications are at room temperature unless otherwise specified

[1] Conversion Factor 1 in/sec = 0.0254 m/sec.
[2] Current will fluctuate at frequencies below 5 Hz.
[3] 1Hz = 60 cpm (cycles per minute).
[4] Typical.
[5] For CE reference PCB® Declaration of Conformance PS039 or PS053 for details

Optional Versions

Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

EX - Hazardous Area Approval
For Models: EX640B71, EX640B72, EX641B71, EX641B72
RV - Buffered Analog Signal Output 100 mV/g (±20%)
For Models: EX640B71, EX640B72, EX641B71, EX641B72

Accessories & Cables: Pages 162-176

Easy Implementation

IMI® 4-20mA Vibration Transmitters are particularly well suited for 24/7 vibration monitoring of critical rotating equipment. Simply install the transmitter on the bearing housing and run a cable to the nearest PLC, DCS, SCADA, or any plant information system. That is all it takes to begin continuous vibration monitoring and avoid costly unexpected down time. Using the reliable 4-20mA trending signal enables the user to schedule diagnostic testing based on real data rather than using time scheduled route based testing. This practice saves time and reduces overall costs of predictive maintenance.

These transmitters employ field proven solid state piezoelectric sensing technologies and are available in many measurement ranges of acceleration, velocity or displacement. Optional hazardous area approved models also available.

Vibration Transmitters

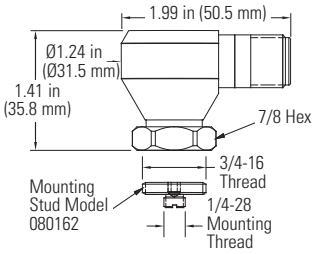
- 4-20 mA sensors for permanent mount installation that interface directly to a PLC, DCS, SCADA, or any PI systems
- Side exit versions allows for simple mounting in tight spaces
- Swivel mounting mechanism eliminates spinning sensors during installation

Loop Powered 4-20 mA Vibration Transmitter

Model 642A01

- Low profile, side exit
- Measurement range 0-1.0 ips velocity pk (0-25.4 mm/sec peak)
- 2-pin MIL-C-5015 connector

Product shown at actual size

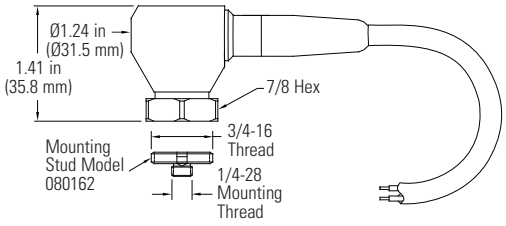


Loop Powered 4-20 mA Vibration Transmitter

Model 642A11

- Measurement range 0-1.0 ips velocity pk (0-25.4 mm/sec peak)
- 10 ft (3 m) of Integral Cable
- Submersible

Product shown at actual size

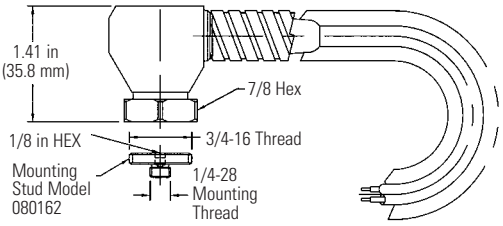


Loop Powered 4-20 mA Vibration Transmitter

Model 642A61

- Measurement range 0-1.0 ips velocity pk (0-25.4 mm/sec peak)
- 10 ft (3 m) of Integral Armored Cable
- Useful in exceedingly rough environments

Product shown at actual size



Technical Specifications

Model Number	642A01	642A11	642A61
Performance			
Measurement Range	0.0 to 1 in/sec pk		
	0.0 to 25.4 mm/s pk [1]		
Output	4-20 mA		
Frequency Range (± 3 dB)	180 to 60,000 cpm		
	3 to 1 kHz [1][3]		
Broadband Resolution	0.005 in/sec pk		
	0.13 mm/s pk [4]		
Non-linearity	± 1 %		
Environmental			
Temperature Range	-40 to 185 °F		
	-40 to 85 °C		
Electrical			
Excitation Voltage	12 to 30 VDC		
Settling Time (within 2% of value)	<15 sec		
Load Resistance	50 (Vs-12) ohms		
Electrical Isolation (Case)	$>10^8$ ohm		
Physical			
Size (Hex x Height)	0.875 in x 1.41 in		
	22.2 mm x 35.8 mm		
Weight	3.8 oz (without cable)		
	108 gm (without cable)		
Mounting Thread	1/4-28 UNF		
Mounting Torque	3 to 5 ft-lb		
	4 to 7 N-m		
Sensing Element	Ceramic Shear		
Housing Material	Stainless Steel		
Electrical Connector	2-pin MIL-C-5015	Integral Cable	
Electrical Connection Position	Side	Side	
Cable Termination	N/A	Pigtail Ends	
Cable Length	N/A	10 ft	
		3.0 m	
Cable Type	N/A	Polyurethane	
Electrical Connections	Pin A - 4-20 mA Pos (+)	Red - 4-20 mA Pos (+)	
	Pin B - 4-20 mA Neg (-)	Blue - 4-20 mA Neg (-)	

Supplied Accessories

Model 080A162 Mounting Stud (1)

Model ICS-4 NIST-traceable single-axis amplitude response calibration from 0 cpm (0 Hz) to upper 10% frequency for 4-20 mA output vibration sensor (1)

Notes

All specifications are at room temperature unless otherwise specified

[1] 1Hz = 60 cpm (cycles per minute).
[2] Conversion Factor 1 in/sec = 0.0254 m/sec.
[3] Current will fluctuate at frequencies below 5 Hz.
[4] For CE reference PCB® Declaration of Conformance PS039 or PS053 for details.
[5] Typical

Optional Versions

EX - Hazardous Area Approval
For Models: 642A01, 642A11, 642A61
M - Metric Mount
For Models: 642A01, 642A11, 642A61
RV - Buffered Analog Signal Output
For Models: 642A01, 642A11, 642A61

Accessories & Cables: Pages 162-176

Vibration Transmitters

- ICP® in-line transmitter
- Converts ICP® sensors to loop powered transmitters
- Compact size fits easily in cable trays

Another IMI Sensors industry first, Model 682A09 installs in-line with any industrial accelerometer and converts the vibration signal to a 4-20 mA velocity output that can be trended with today's PLC, DCS and SCADA systems. Its sleek design installs right into the cable run, no DIN rails, cabinets or special power required. With a 3-pin output connector you can still gather dynamic vibration signals with a vibration analyzer while the PLC monitors overall trends. Now you can take your existing accelerometers and turn them into 24/7 vibration monitoring devices for your most critical machinery.

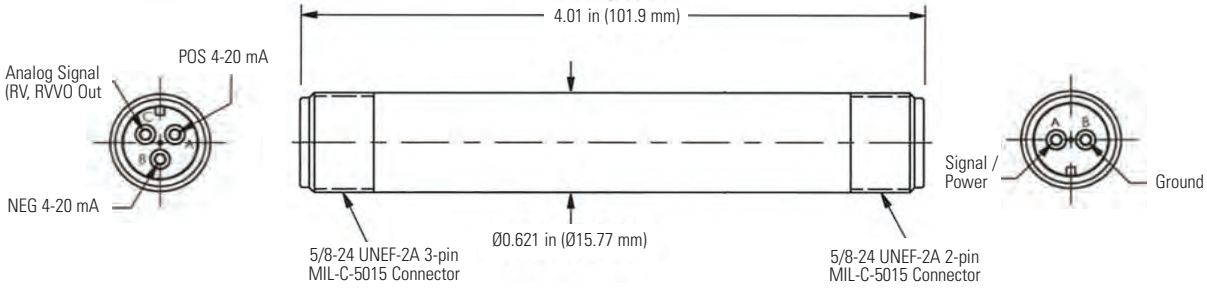
NEW!

ICP® In-Line Vibration Transmitter

Model 682A09

- Outputs 4-20 mA proportional to velocity plus analog raw vibration output
- Measurement Range: 0.0 to 1.0 in/sec pk (0.0 to 25.4 mm/s pk)
- Interfaces directly with plant control systems

Product shown at actual size



Technical Specifications

Model Number	682A09
Performance	
Input Signal (ICP® Accelerometer)	100 mV/g
	10.2 mV/(m/s²)
Frequency Response (-3dB ±2dB)	600 to 60,000 cpm
	10 to 1 kHz
Measurement Range	0.0 to 1.0 in/sec pk
	0.0 to 25.4 mm/s pk
Output Range	4 to 20 mA
Broadband Resolution	0.01 in/sec pk
	0.26 mm/s pk
Environmental	
Temperature Range	-40 to 185 °F
Temperature Response (Sensitivity Deviation)	≤ 15 %
Electrical	
Excitation Voltage	20 to 30 VDC
Electrical Isolation (Case)	>108 ohm
Settling Time (within 2% of value)	<60 sec
Load Resistance	50 (Vs-20) ohm

Model Number	682A09
Physical	
Size - Height	4.0 in
	101.6 mm
Size - Diameter	0.621 in
	15.8 mm
Weight	2.5 oz
	71 gm
Housing Material	Stainless Steel
Electrical Connector (#1)	2-pin MIL-C-5015
Electrical Connection Position (#1)	Sensor End
Electrical Connections (#1) (Pin A)	AC IN Pos
Electrical Connections (#1) (Pin B)	AC IN Neg
Electrical Connector (#2)	3-pin MIL-C-5015
Electrical Connection Position (#2)	Output End
Electrical Connections (#2) (Pin A)	4-20 mA Pos (+)
Electrical Connections (#2) (Pin B)	4-20 mA Neg & AC OUT Neg
Electrical Connections (#2) (Pin C)	AC OUT Pos
Sealing	Welded Hermetic

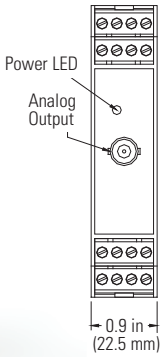
Accessories & Cables: Pages 162-176

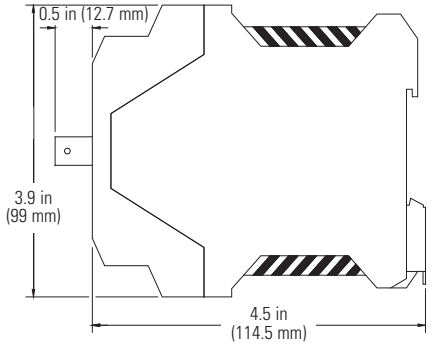
ICP® Sensor to 4-20 mA Transmitter

Model 682B03

- Provides constant current ICP® sensor excitation
- 24 VDC powered, DIN rail mount
- Analog vibration output for fault diagnostics (through BNC or terminals)
- Adjustable low pass and high pass filtering, selectable acceleration, velocity, or displacement output signal

Product shown at actual size





Technical Specifications

Model Number	682B03
Performance	
Channels	1
Input Signal (Vibration)	±100 mV/g [10]
	±10.2 mV/(m/s²)
Input Signal (Temperature)	0 to 1.2 VDC [11]
Output Signal (DC Vibration)	4 to 20 mA [9]
Output Signal (DC Vibration)	0 to 5 VDC [4][6]
Output Signal (DC Vibration)	0 to 10 VDC [4][6]
Output Signal (Temperature)	4 to 20 mA [11]
Output Signal (±0.01 %) (AC Vibration)	100 mV/g [2]
	10.2 mV/(m/s²)
Frequency Range (-3 dB) (Acceleration)	180 to 600,000 cpm [3][13][14]
	3 to 10 kHz
Frequency Range (-3 dB) (Velocity)	210 to 600,000 cpm [3][13][14]
	3.5 to 10 kHz
Frequency Range (-3 dB) (Displacement)	210 to 60,000 cpm [3][8][14]
	3.5 to 1 kHz
Output Range (DC Acceleration)	0 to 5.00 g pk or rms [5][6][10]
	0 to 49.03 m/s² pk or rms
Output Range (DC Acceleration)	0 to 10.00 g pk or rms [5][6][10]
	0 to 98.06 m/s² pk or rms
Output Range (DC Acceleration)	0 to 20.00 g pk or rms [5][6][10]
	0 to 196.12 m/s² pk or rms
Output Range (DC Velocity)	0 to 0.5 in/sec pk or rms [5][6][10]
	0 to 12.7 mm/s pk or rms
Output Range (DC Velocity)	0 to 1.00 in/sec pk or rms [5][6][10]
	0 to 25.4 mm/s pk or rms
Output Range (DC Velocity)	0 to 2.00 in/sec pk or rms [5][6][10]
	0 to 50.8 mm/s pk or rms
Output Range (DC Displacement)	0 to 10.0 mil pk - pk [5][6][10]
	0 to 0.254 mm pk - pk
Output Range (DC Displacement)	0 to 20.0 mil pk - pk [5][6][10]
	0 to 0.508 mm pk - pk
Output Range (DC Displacement)	0 to 40.0 mil pk - pk [5][6][10]
	0 to 1.02 mm pk - pk
Environmental	
Temperature Range (Operating)	32 to 158 °F
	0 to 70 °C
Temperature Range (Storage)	-40 to 257 °F
	-40 to 125 °C
Humidity Range (Non-Condensing)	0 to 95 %

Model Number	682B03
Electrical	
Power Required	DC power
DC Power	23 to 25 VDC
DC Power (maximum)	100 mA
Settling Time	<2 min
Excitation Voltage (delivered to sensor)	17 to 19 VDC
Constant Current Excitation (delivered to sensor)	3 to 5 mA [1][7]
Output Span (±5.0 %) (DC Vibration Current Output)	16 mA
Output Span (±5.0 %) (Temperature Output)	16 mA
Output Span (±5.0 %) (DC Vibration Voltage Output)	5 or 10 VDC [6]
Physical	
Electrical Connector (input/output)	Removable Screw Terminals
Electrical Connector (raw vibration output)	BNC Jack
Housing Material	Polyamide
Size - Height	3.9 in
	99 mm
Size - Width	0.9 in
	22.5 mm
Size - Depth	4.5 in
	114.5 mm
Weight (Maximum)	6.4 oz
	127
Screw Terminal Wire Size	24-14 AWG
Din Rail Mount	1.38 in
	35 mm
Status Indicator (Power "on")	Green LED
Status Indicator (Input Fault)	Red LED
Status Indicator (Measurement Mode - Acceleration)	Green LED
Status Indicator (Measurement Mode - Velocity)	Green LED
Status Indicator (Measurement Mode - Displacement)	Green LED

Notes

[1] 4 mA constant current diode is internal to 9330VT
[2] Achieved with 100 mV/g ICP® accelerometer input.
[3] Attenuation is -40 dB/decade.
[4] Factory set, 0-5 VDC.
[5] Factory set, 1 in/sec peak.
[6] Internal Dip switch selectable
[7] Jumper selectable for 18 VDC regulated, 24 VDC power supply voltage or ICP® sensor excitation disabled
[8] Maximum 1 kHz for displacement.
[9] Output current voltage will fluctuate at frequencies below 5 Hz.
[10] Output measurement range is based upon input from 100 mV/g ICP® accelerometer and will be scaled inversely proportional to any percentage deviation of this input.
[11] Requires use of accelerometer with "TO" temperature output option.
[12] For CE reference PCB® Declaration of Conformance PS051 for details.
[13] The high frequency tolerance is accurate within ± 0.5 kHz of the specified frequency.
[14] The low frequency tolerance is accurate within ± 0.5 Hz of the specified frequency.

Accessories & Cables: Pages 162-176

Programmable Vibration Transmitters

- Cost-effective 4-20 mA Loop Powered Transmitters
- Provide Continuous protection
- Work with PLCs, DCS and SCADA Plant information Systems

IMI Sensors advances the industry exclusive USB Programmable Vibration Sensors with 2 additional products. The 649A03 4-20 mA output Bearing Condition Monitor offers a high level of bearing fault monitoring in the small package of a typical sensor housing. Five selectable measurement methods and selectable sensing range increase reliability and accuracy in every application. The 649A04 4-20 mA output sensor brings USB programmability to IMI's tried and true current output vibration sensor line. Selectable displacement, velocity, or acceleration measurement coupled with selectable range scaling brings flexibility and "in field" programming.

NEW!

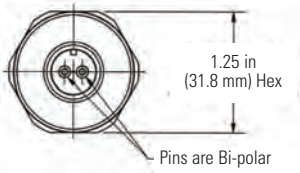
USB PROGRAMMABLE

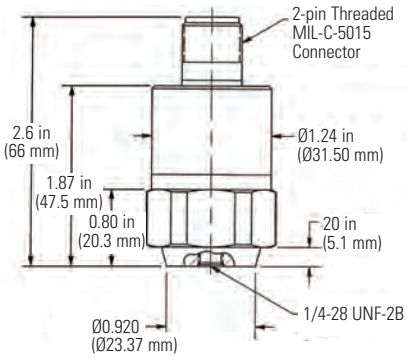
Programmable 4-20 mA Bearing Condition Transmitter

Model 649A03

- Offers proven 4-20 mA bearing fault vibration technologies in a standard sensor housing package
- Industry exclusive USB programming technology
- Effective monitoring of constant speed and variable speed systems

Product shown at actual size





Technical Specifications

Model Number	649A03
Performance	
Output (Loop Power)	4-20 mA
Sampling Time	1 sec
Measurement Range (with HPF 250 Hz)	0-2 to 0-50 g pk [1][2]
(with HPF 2,500 Hz)	0-2 to 0-50 RMS [1][2]
(Compensation pk)	1 to 16 [1]
Crest Factor (with HPF 250 Hz)	1 to 16 [1]
Crest Factor Plus	1 to 16 [1]
Bearing Diameter	1.57 to 39.37 in
	40 to 1,000 mm
Bearing Rotation Speed	600 to 3,600 RPM
	10 to 60 Hz
Linearity	10%
Environmental	
Temperature Range	-40 to +212 °F
	-40 to +100 °C
Storage Temperature Range	-40 to 257 °F
	-40 to 125 °C
Electrical	
Excitation Voltage	15 to 30 VDC
Load Resistance	50 (Vs-15) ohm
Electrical Isolation (Case)	$>10^8$ ohm
Physical	
Size (Height x Hex)	2.60 in x 1.25 in
	66 mm x 32 mm
Weight	6 oz
	170 gm
Mounting Thread	1/4-28 UNF
Mounting Torque	3 to 5 ft-lb
	4 to 7 N-m
Sensing Element	Piezoelectric Accelerometer
Housing Material	Stainless Steel
Sealing	Welded Hermetic
Electrical Connector	2-pin MIL-C-5015
Electrical Connection Position	Top
Electrical Connections (Pin A)	4-20 mA Pos (+)
Electrical Connections (Pin B)	4-20 mA Neg (-)
Overload Limit (Shock)	5,000 g pk
	49,050 m/s² pk
Supplied Accessories	
Model 081A41 Mounting stud 1/4-28 socket head set screw brass tip stainless steel 5/8" long (1)	
Notes	
All specifications are at room temperature unless otherwise specified	
[1] Customer programmable parameters [2] With 0.1g step	[3] For CE reference PCB® Declaration of Conformance PS039 or PS053 for details
Optional Versions	
	Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used. **M - Metric Mount** For Model 649A03

Accessories & Cables: Pages 162-176

Technical Specifications

Model Number	649A04
Performance	
Measurement Range (Velocity)	0.5 to 3 in/sec pk [1][2][3][4]
	12.7 to 76.2 mm/s pk [1][2][3][4]
Measurement Range (Acceleration)	1 to 10 g pk
	0.0 to 98.1 m/s²
Measurement Range (Displacement)	4 to 20 mil pk - pk [6][2][4]
	0.1 to 0.5 mm pk - pk [6][2][4]
Output (± 5 %)	4-20 mA
Frequency Range (-6 dB)	180 to 60,000 cpm
	3 to 1 kHz [7][8][4][9]
USB Programmable Options for Frequency Range	180 to 300,000 cpm
	3 to 5 kHz [7][8][4]
	180 to 600,000 cpm
	3 to 10 kHz [7][8][4]
	600 to 60,000 cpm
	10 to 1 kHz [7][8][4]
	600 to 300,000 cpm
	10 to 5 kHz [7][8][4]
	600 to 600,000 cpm
	10 to 10 kHz [7][8][4]
Environmental	
Temperature Range	-40 to +185 °F
	-40 to +85 °C
Electrical	
Excitation Voltage	12 to 30 VDC
Settling Time(within 2% of value)	<30 sec
Electrical Isolation (Case)	>10⁸ ohm
Physical	
Size (Height x Length x Width)	1.0 in x 2.6 in
	25.4 mm x 66 mm
Weight	3.7 oz
	3.7 oz [10]
Mounting Thread	1/4-28 UNF
	N/A
Mounting Torque	3 to 5 ft-lb
	4 to 7 N-m
Sensing Element	Ceramic
Sensing Geometry	Shear
Housing Material	Stainless Steel
Sealing	Welded Hermetic
Electrical Connector	2-pin MIL-C-5015
Electrical Connection Position	Top
Electrical Connections (Pin A)	4-20 mA Pos (+)
Electrical Connections (Pin B)	4-20 mA Neg (-)
Supplied Accessories	
	Model 081A40 Mounting Stud (1)

Notes

All specifications are at room temperature unless otherwise specified

[1] Conversion Factor 1 in/sec = 25.4 mm/sec.
[2] FS - Full Scale.
[3] Factory set, 1 in/sec peak.
[4] USB Programmable with 600A21 kit.
[5] Conversion Factor 1g = 9.81 m/s².
[6] Conversion Factor 1 mil = 0.0254 mm
[7] Current will fluctuate at frequencies below 5 Hz.
[8] 1Hz = 60 cpm (cycles per minute).
[9] Factory Set
[10] Typical.

Optional Versions

Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

M - Metric Mount
For Model 649A04
RV - Buffered Analog Signal Output
For Model 649A04

Accessories & Cables: Pages 162-176

Programmable 4-20 mA Vibration Transmitters

NEW!

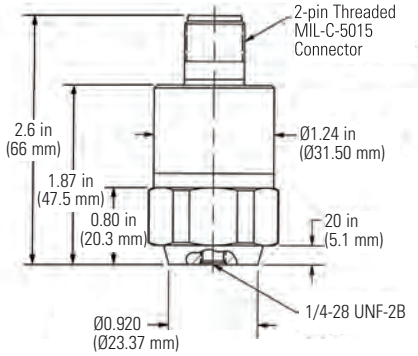
USB PROGRAMMABLE

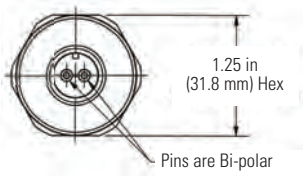
Programmable 4-20 mA Vibration Transmitter

Model 649A04

- Output signal proportional to displacement, velocity or acceleration
- Selectable high pass and low pass filters, selectable full scale range
- Compatible with plant information systems

Product shown at actual size





Bearing Fault Detector

- Bearing condition transmitter
- Provides early warning of bearing and gear faults
- Detects impacting associated with spalling cracking and lubrication problems

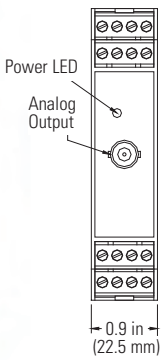
Model 682A05 Bearing Fault Detector (BFD) is an advanced vibration signal conditioner designed to provide the earliest warning of imminent machinery failure. The unit works with a 100 mV/g ICP® accelerometer and serves to deliver two, 4-20 mA output signals that are proportional to the measured vibration levels of operating rotating machinery. In order to enable detection of a wide variety of machinery faults, the 4-20 mA signals are conditioned to characterize two unique vibration measurements; one containing high frequency peak data and the other containing low frequency rms data. These 4-20 mA signals may be monitored, alongside other plant process variables, using familiar PLC, DCS, SCADA, alarm and control systems. An additional analog voltage output signal is provided for spectral analysis of the monitored vibration for fault diagnostic purposes.

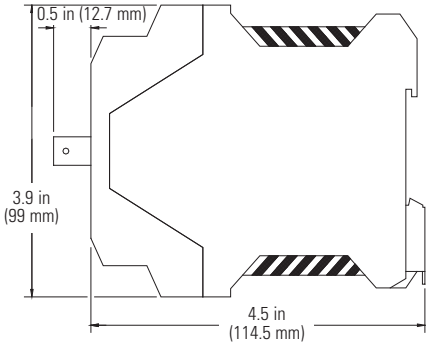
The unit employs a patented signal conditioning technique (US Patent #6,889,553) that provides the unique ability to detect bearing and gear problems at their earliest stages, thus permitting ample maintenance planning to avert a catastrophic failure. The simplified 4-20 mA signal monitoring approach represents a cost-effective alternative to complex vibration monitoring instrumentation and associated training.

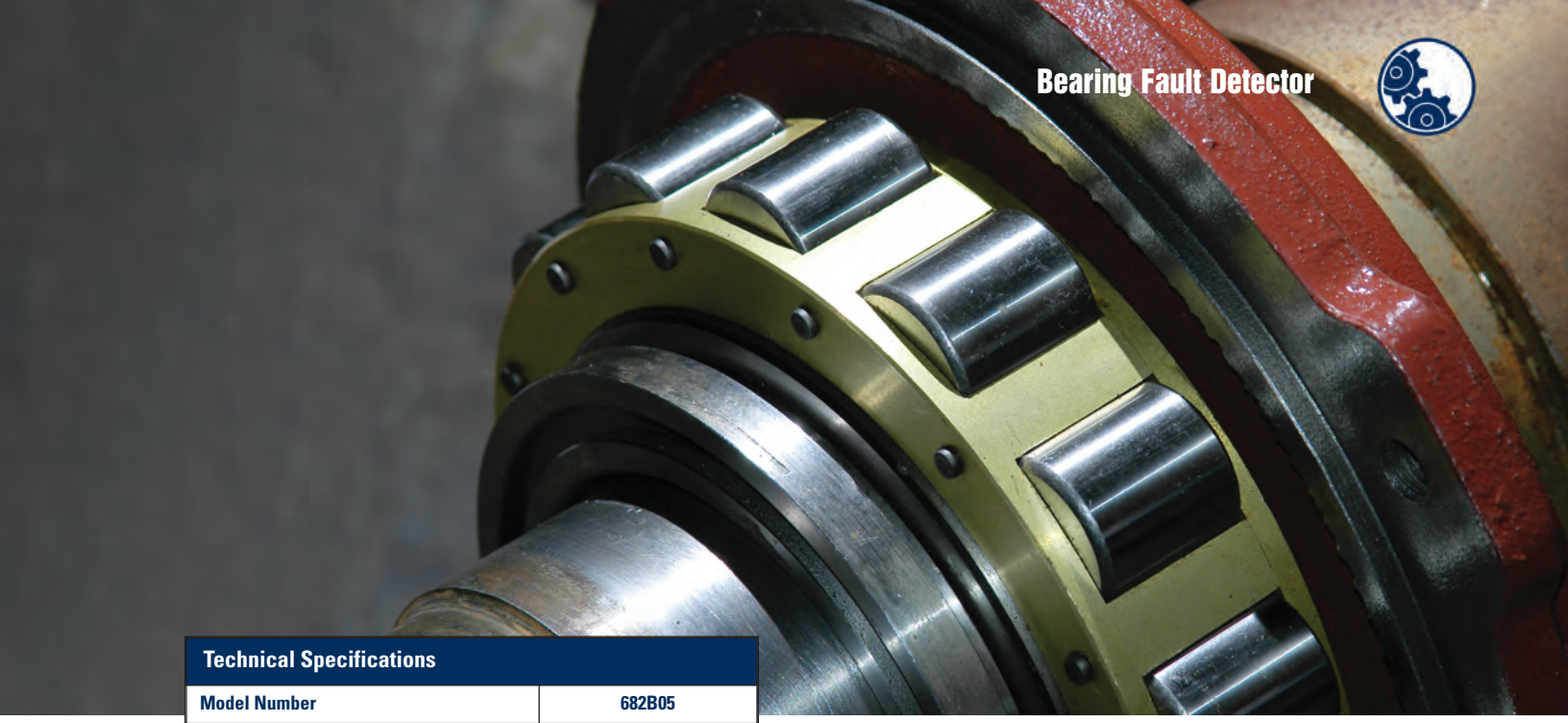
Bearing Fault Detector
Model 682B05

- Provides early warning of bearing and gear faults
- Operates with PLC, DCS, SCADA, alarm, and control systems
- Outputs 2 discreet 4-20 mA signals; one proportional to peak acceleration, the other proportional to overall vibration

Product shown at actual size







Technical Specifications

Model Number	682B05
Performance	
Input Signal	100 mV/g
	10.2 mV/(m/s²)
Frequency Response (±3 dB) (Overall Vibration)	10 to 1k Hz
Frequency Response (±3 dB) (Fault)	1 or 5 to 100 kHz [1]
Measurement Range (Fault Detector)	50 g
Output Range (Linear Scale)	4 to 20 mA [1][2]
Output Range (Linear Scale)	4 to 20 mA
Sampling Time	7 sec
Span (±5 %)	16 mA
Control Interface	
Power LED	Green
Environmental	
Warm Up	<2 minutes
Temperature Range (Operating)	32 to 158 °F
	0 to 70 °C
Temperature Range (Storage)	-40 to 257 °F
	-40 to 125 °C
Humidity Range (Non-Condensing)	<95 %
Electrical	
Supply Voltage	24 VDC
Current Consumption	≤ 150 mA
Excitation Voltage (±1 V)	24 VDC
Constant Current Excitation (±1 mA)	4 mA
Raw Vibration Output	+/- 0.01% of Input Vibration
Load Resistance	500 ohm
Physical	
Load Resistance	500 ohm
	22.5 mm
Size - Height	3.9 in
	99 mm
Size - Depth	4.5 in
	114.5 mm
Weight	5.2 oz
	145.2 gm
Housing Material	Polyamide
Screw Terminal Wire Size	24-14 AWG
	0.2 - 2.5 mm2
Electrical Connector (input/output)	Removable Screw Terminals
Electrical Connector (Output, Vibration)	BNC Jack
Din Rail Mount	1.38 in
	35 mm

Notes

All specifications are at room temperature unless otherwise specified

[1] Internal dip switch selectable
[2] Output current voltage will fluctuate at frequencies below 5 Hz.
[3] For CE reference PCB® Declaration of Conformance PS051 for details

Accessories & Cables: Pages 162-176

Early Impact Detection

IMI Sensors Model 682B05 Bearing Fault Detector (US Patent 6,889,553) senses impacts within rolling element bearings caused by bearing faults. Typical bearing faults, such as cracked races, spalling, brinelling, fatigue failure, looseness and loss of lubrication result in impacts and high frequency vibrations inside the bearing. The impacts are represented as high amplitude, narrow peaks on the acceleration time waveform and add very little energy to the overall vibration level. As a result, they are often missed in normal trending analysis. The Bearing Fault Detector accurately measures these impacts and other high frequency vibrations, providing early warning of potential problems. This unit is also effective for monitoring other problems that produce similar impacts and vibrations data, such as a chipped tooth on a gear.

The Bearing Fault Detector is a DIN rail mount vibration transmitter that works in conjunction with a typical ICP® accelerometer. It supplies the constant current power required by the accelerometer, processes data and has the following three outputs: 4-20 mA proportional to peak amplitude, 4-20 mA proportional to overall vibration level and raw vibration signal via BNC connector for diagnostic analysis. To obtain peak amplitude (measured in a 7 second window) the signal is passed through a high pass filter, rectified and run through a high speed peak detection circuit. To obtain overall vibration level, the signal is passed through a low pass filter, integrated when velocity is required, processed through a true rms circuit and scaled, depending on the desired output type (rms or calculated peak). Bearing Fault Detector output is compatible with any vibration monitoring device or plant equipment that accepts a 4-20 mA signal. It can provide 24/7 protection when used with a PLC, DCS, or SCADA system. It can also be used with numerous off-the-shelf meters, alarms and recorders.

Reciprocating Machinery Protector

- Loop Powered 4-20 mA output reciprocating machinery protector (RMP)
- Outperforms impact transmitters
- Provides early warning of faults and mechanical looseness

USB PROGRAMMABLE

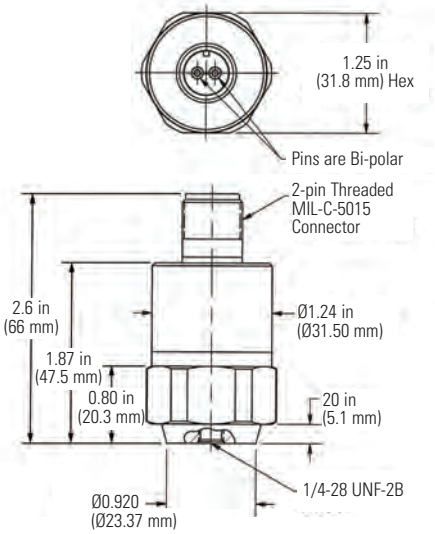
Reciprocating Machinery Protector

Model 649A01

- Output Range: 4-20 mA
- Machinery RPM Range: 150 to 4,800 cpm (2.5 to 80 Hz)
- Sampling Time: 0.2 to 6.4 sec

Product show at actual size

Industry Exclusive!

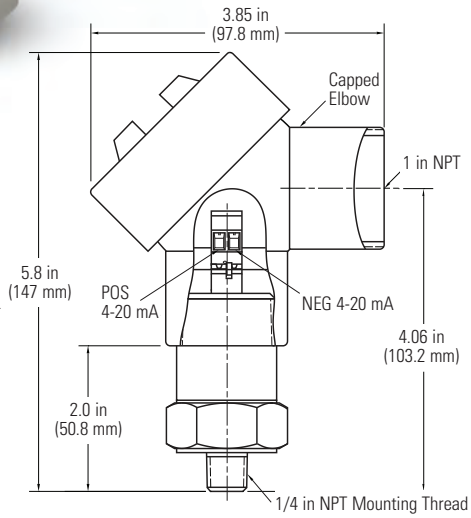


Reciprocating Machinery Protector

Model EX649A71

- CSA/ATEX Approved
- Supplied with explosion proof conduit elbow
- Electrical Connector: Terminal bloc..

Product shown at actual size



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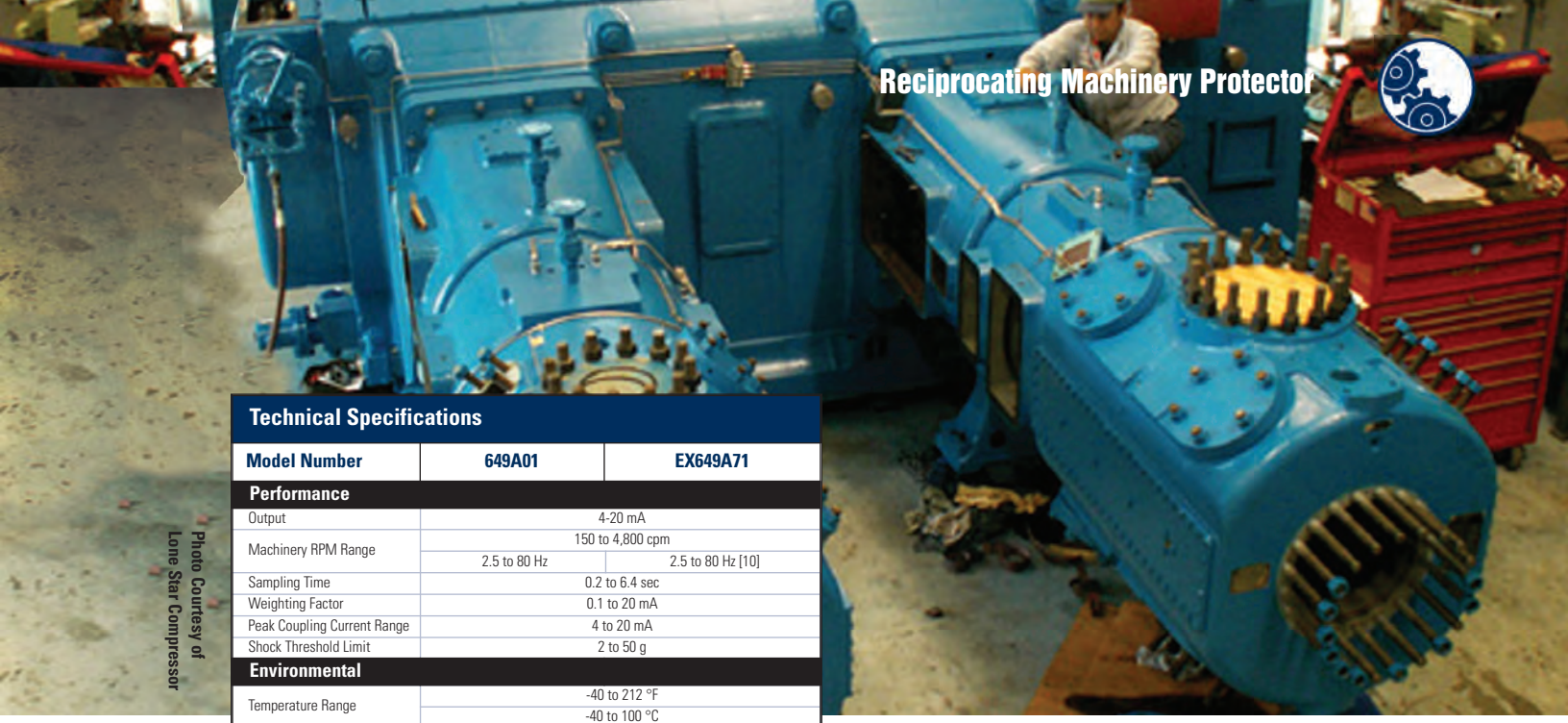


Photo Courtesy of Lone Star Compressor

Technical Specifications

Model Number	649A01	EX649A71
Performance		
Output	4-20 mA	
Machinery RPM Range	150 to 4,800 cpm	
	2.5 to 80 Hz	2.5 to 80 Hz [10]
Sampling Time	0.2 to 6.4 sec	
Weighting Factor	0.1 to 20 mA	
Peak Coupling Current Range	4 to 20 mA	
Shock Threshold Limit	2 to 50 g	
Environmental		
Temperature Range	-40 to 212 °F	
	-40 to 100 °C	
Storage Temperature Range	-40 to 257 °F	
	-40 to 125 °C	
Electrical		
Excitation Voltage	15 to 30 VDC	
Load Resistance	50(Vs-15) ohm	
Electrical Isolation	$>10^8$ ohm	
Physical		
Size - Hex	1.25 in	1.375 in
	32 mm	35 mm
Size - Height	2.60 in	5.8 in
	66 mm	147 mm
Size - Width	N/A	3.85 in
		98 mm
Weight	7 oz	1.1 lb
	198 gm	500 gm
Mounting Thread	1/4-28 UNF	1/4 NPT
Mounting Torque	3 to 5 ft-lb	N/A
	4 to 7 N-m	
Sensing Element	Piezoelectric Accelerometer	
Housing Material	Stainless Steel	
Sealing	Welded Hermetic	N/A
Electrical Connector	MIL-C-5015 (Top)	
Electrical Connections (Pin A)	4-20 mA Pos (+)	
Electrical Connections (Pin B)	4-20 mA Neg (-)	
Overload Limit (Shock)	5,000 g pk	
	49,050 m/s² pk	
Screw Terminal Wire Size	N/A	12-24 AWG
		3.0 - .2mm²
Conduit Housing Thread	N/A	1" NPT Female
Supplied Accessories		
	Model 081A41 Mounting stud 1/4-28 socket head set screw brass tip stainless steel 5/8" long (1)	

Notes

All specifications are at room temperature unless otherwise specified

[1] For CE reference PCB® Declaration of Conformance PS039 or PS053 for details.
[2] AEx ia IIC T4
[3] AEx nA IIC T4
[4] Class I, Div. 1, Groups A, B, C and D; Class II, Div. 1, Groups E, F and G; Class III, Div. 1
[5] Class I, Div. 2, Groups A, B, C, D
[6] Ex ia IIC T4, II IG
[7] Ex ia IIC T4.
[8] Ex nL IIC T4, II 3 G
[9] Ex nL IIC T4.
[10] 1Hz = 60 cpm (cycles per minute)

Optional Versions

EX - Hazardous Area Approval
Contact factory for specific approvals
For Models: 649A01, EX649A71

M - Metric Mount
For Models: 649A01, EX649A71

Accessories & Cables: Pages 162-176

Impact Detection: Preventing Failure

Although overall vibration trending is an excellent tool for monitoring the health of rotating machinery, it is not generally effective for monitoring reciprocating machinery. Since impacts generally have little effect on overall vibration level, common faults are not detected at an early stage. As a result, abnormalities are not diagnosed until damage has occurred and it is too late to take simple corrective measures. There are several reciprocating machinery faults which do not significantly increase a machine's overall vibration level until damage has reached a severe level, including: loose or broken bolts, excessive clearance in connecting pins, loose or cracked rod nuts, liquid or debris in the cylinder, cracked connecting or piston rod, scoring in the cylinder, excessive crosshead/slipper clearance and other broken parts.

The patented IMI Sensors Reciprocating Machinery Protector (RMP) Model 649A01 (US Patent #7,171,313) is very sensitive to these faults in their early stages of development. For this reason, the RMP is particularly effective in monitoring reciprocating compressors. Model 649A01 is a loop powered device which detects mechanical shock events occurring in or near the machine's cylinder assembly. The Reciprocating Machinery Protector continuously outputs the peak acceleration value, as long as there is no fault condition detected. When a threshold is exceeded, the RMP recognizes a potential fault condition and accurately outputs a computed Reciprocating Fault Index (RFI) proportional to the severity of the fault. With configurable speed parameters, adjustable sampling time and ability to customize alarm levels, the RMP is a powerful tool for reciprocating machinery protection.

Vibration Switches

- Provides continuous machinery protection
- Electronic & mechanical switches available
- Single or dual relay versions
- Responds to acceleration, velocity, or displacement
- Adjustable time delays to prevent false trips
- Works with PLC, DCS and SCADA systems for data trending

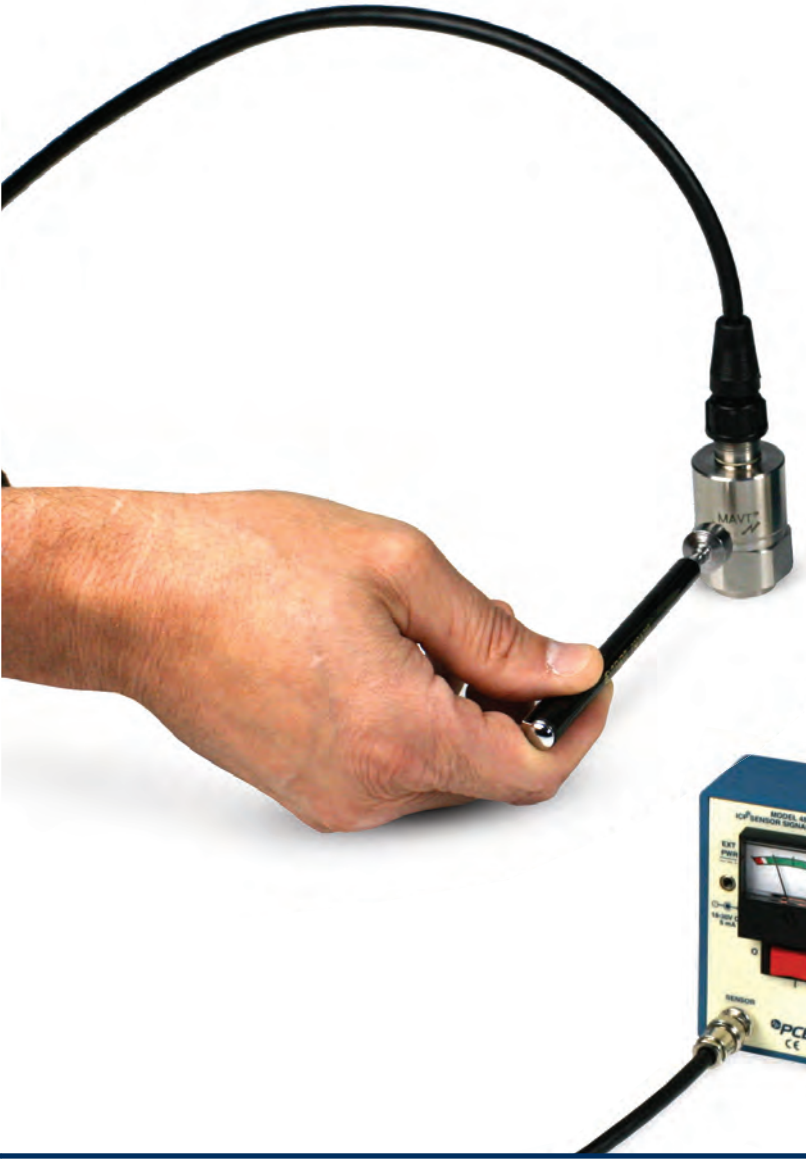
A vibration switch is a simple protection device that senses vibration and triggers an alarm or shuts down a machine if the vibration exceeds a preset threshold level. The vibration switch can sense vibration due to faults such as imbalance, misalignment, looseness, worn bearings, cracked gears or lack of lubrication. IMI Sensors offers a complete selection of electronic and mechanical vibration switches to suit many applications and installations. Mechanical switches provide basic protection at a low cost for less critical machinery. These switches are easy to install, do not require power to operate and are the most basic type of vibration switch protection available.

For more critical machinery, electronic vibration switches use a Built in precision accelerometer to accurately monitor vibration levels. An electronic switch consists of an accelerometer, circuit board and one or more electromechanical or solid state relays for alarm and shutdown protection. The internal circuitry monitors the sensor's vibration level and compares it to a preset threshold or alarm value. When the vibration level exceeds this threshold, the relay is then activated. A typical electronic vibration switch has several advantages over a mechanical unit. It has no moving parts, is more reliable and has a much higher degree of accuracy and repeatability. Time delays can be used to avoid false trips during switch power up, equipment startup, operational changes and the chance occurrences of short term vibration increases.

Electronic Vibration Switch Series 685B

Smart Vibration Switch with MAVT™ Option Series 686B

Mechanical Vibration Switch Series 685A



Exclusive MAVT™ on the Model 686B Smart Vibration Switch

The Alarm Threshold Level (set point) can be set either numerically through USB programming, or if enabled, using Magnetically Adjustable Vibration Threshold (MAVT™). This feature can be enabled by the user via USB programming or, if requested, enabled by the factory.

The Exclusive MAVT™ feature can be used to automatically set the alarm threshold level in the field without knowing anything about the equipment's actual vibration level. Mount the Smart Vibration Switch on an operating machine and touch the magnet (contained in the USB Switch Programmer Kit) to the sensor to start the process. Caution should be taken to disconnect the Smart Vibration Switch from the machine's trip circuit when using this feature. This convenient feature permits any machine to become vibration switch protected within seconds. MAVT™ can also be used with the switch mounted on a calibrated vibration shaker for precise setting of the alarm threshold value. The MAVT™ circuit should always be disabled in the USB programming screen once the switch is reconnected to the motor control circuit.

Smart Vibration Switches

- Low cost fully USB Programmable vibration switch that replaces unreliable mechanical vibration switches
- 2-wire operation uses existing mechanical switch wires
- Features the accuracy and small footprint of a piezoelectric accelerometer

The all new electronic Smart Vibration Switch from IMI Sensors is highly versatile, fully user programmable via USB, low cost and a drop-in replacement for most popular mechanical vibration switches. The Smart Vibration Switch includes an embedded piezoelectric accelerometer for accurate measurement, monitors vibration velocity for more consistent results and provides the reliability not found in mechanical switches. It is a lower cost alternative when single relay action is required vs. higher cost dual relay models.

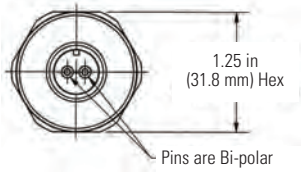
In addition to being a more reliable device than mechanical vibration switches, the unique Series 686B Smart Vibration Switch is a much lower cost solution for many conventional electronic vibration switch applications as well. The Smart Vibration Switch is a great choice in applications where a single relay provides sufficient protection and/or an overall vibration output (typically 4-20 mA) is not required. Multiple Smart Vibration Switches can be used in series or parallel to monitor several points or machines as necessary. They can also be used in conjunction with external SPST and DPDT relays to increase current capacity or when such relays are required.

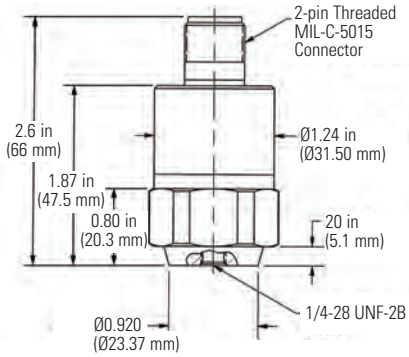
USB Programmable Electronic Vibration Switch

Model 686B01

- 2-pin MIL-C-5015 connector
- Programmable alarm threshold, relay action (NO, NC) and 3 time delays
- Monitors in velocity

Product shown at actual size



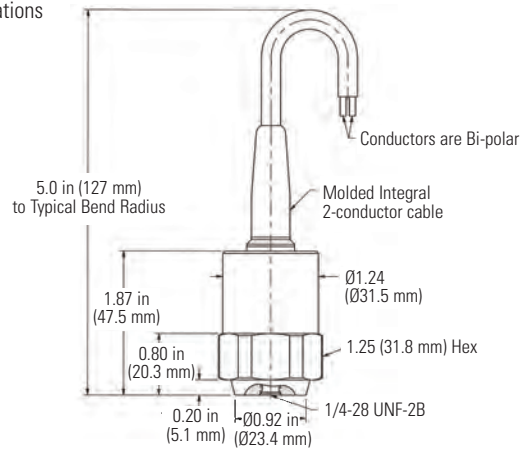


USB Programmable Electronic Vibration Switch

Model 686B11

- Integral cable version for harsh environments
- Ideal for submersible applications
- Remote reset standard

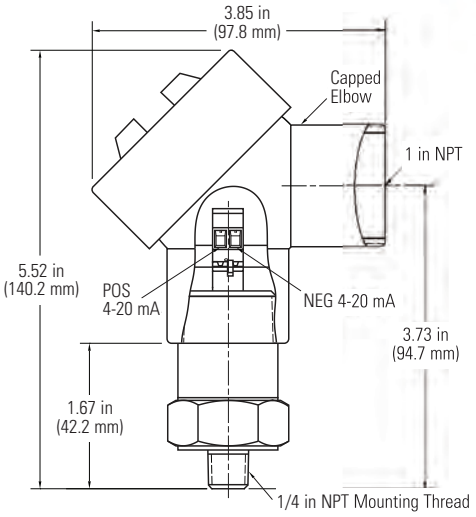
Product shown at actual size



USB Programmable Electronic Vibration Switch

Model EX686B71

- 2-pin removable terminal block
- CSA and ATEX D hazardous area approvals
- 1/4" NPT integral mounting stud



Technical Specifications

Model Number	686B01	686B11	EX686B71
Performance			
Alarm Threshold (±10 %)	0.25 to 5 in/sec pk		
	4.5 to 90 mm/s rms [2]		
Frequency Range (±3 dB)	180 to 60 kcpm		
	3 to 1 kHz		
Hysteresis (% < Alarm Threshold)	3; 6; or 10 % [2]		
Residual Vibration Level (Reference)	Dependent or Independent [2]		
Residual Vibration Level (% Alarm Threshold)	1 to 40 % [2]		
MAVT (Sets Alarm Threshold to 2X actual vibration)	Enabled or Disabled [2]		
Transverse Sensitivity	<7 %		
Power On Delay (±1 sec)	3 or 20 sec [2]		
Startup Delay (±1 sec or 1 min) (Time)	1 to 60 sec or 1 to 30 min [2]		
Startup Delay (x Alarm Threshold)	x2; x4; x8; Blocked [2]		
Startup Delay (Active)	Enabled or Disabled [2]		
Operational Delay (±1 sec)	1 to 60 sec [2]		
Relay	SPST, Form A or B MOSFET		
Relay	Latching / Non-Latching [2]		
Relay	Normally Open / Closed [2]		
Environmental			
Temperature Range (Operating)	-40 to 185 °F		
	-40 to 85 °C		
Temperature Range (Storage)	-40 to 257 °F		
	-40 to 125 °C		
Overload Limit (Shock)	5,000 g pk		
	49,050 m/s² pk		
Enclosure Rating	IP68		
Electrical			
Power Required	24 to 240 V DC/AC 50/60 Hz		
Current Rating (Relay Closed)	500 mA		
Leak Current (Relay Open)	≤ 1 mA		
Electrical Isolation (Case)	>10⁸ ohm		

Model Number	686B01	686B11	EX686B71
Physical			
Size - Hex	1.25 in		1.38 in
Size - Height	2.6 in		3.68 in
	66 mm		94 mm
Weight	5.2 oz		7.0 oz
	148 gm		200 gm
Mounting Torque	3 to 5 ft-lb		N/A
	4 to 7 N-m		
Mounting Thread	1/4-28 Female		1/4 NPT
Sensing Element (Internal)	Piezoelectric Accelerometer		
Housing Material	Stainless Steel		
Sealing	Welded Hermetic		N/A
Electrical Connector	2-pin MIL-C-5015	Molded Integral Cable	Terminal Block
Cable Length	N/A	10 ft	N/A
		3 m	
Cable Termination	N/A	Blunt cut	N/A
Electrical Connection Position	Top		
Screw Terminal Wire Size	N/A		12-24 AWG
			3.0 - .2 mm²
Cable Type	N/A	Polyurethane (Model 052)	N/A

Supplied Accessories

Model 081A41 Mounting stud 1/4-28 socket head set screw brass tip stainless steel 5/8" long (1)

Notes

All specifications are at room temperature unless otherwise specified

[1] For CE reference PCB® Declaration of Conformance PS096 for details.
[2] USB Programmable - See configuration sheet supplied with switch for exact setting.

Optional Versions

EX - Hazardous Area Approval -
Contact factory for specific approvals
For Models: 686B01, 686B11, EX686B71
M - Metric Mount
For Models: 686B01, 686B11
EP - Explosion Proof
For Models: EX686B71

Accessories & Cables: Pages 162-176

Electronic
Vibration Switches

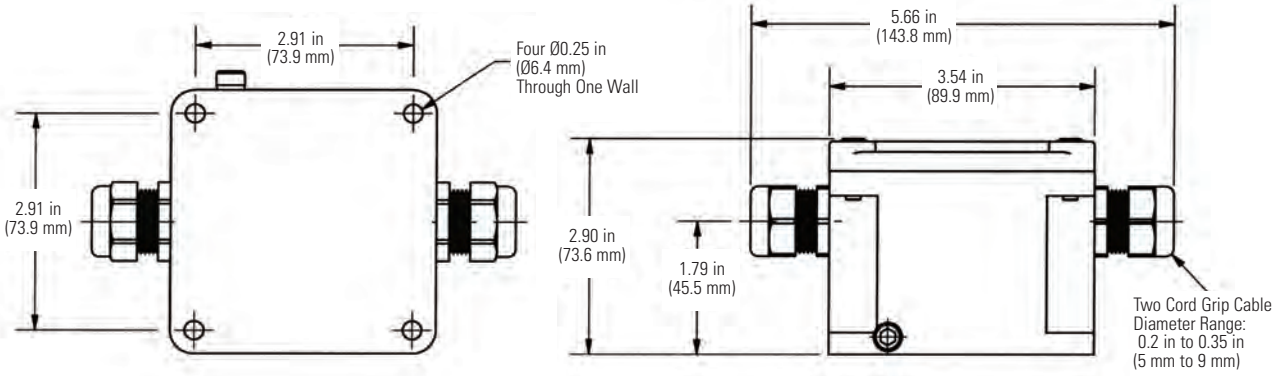
- Offers two set points with individual alert and alarm relays
- 4-20 mA output signal for vibration monitoring
- Explosion proof models available

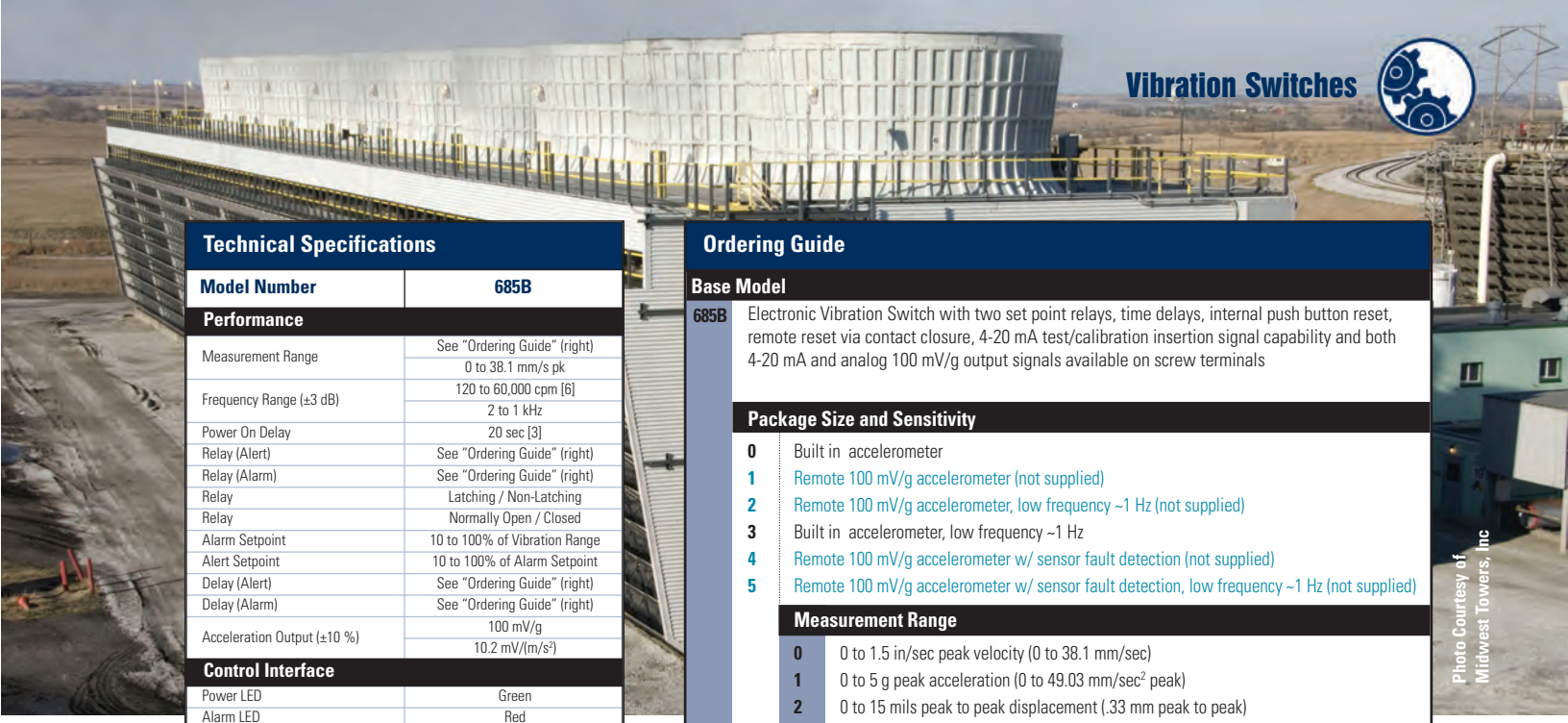
Inside View

Electronic Vibration Switch
Series 685B

- Internal piezoelectric accelerometer
- Various measurement ranges available
- 85-245 VAC power or 24 VDC power

Product shown at actual size





Technical Specifications

Model Number	685B
Performance	
Measurement Range	See "Ordering Guide" (right)
	0 to 38.1 mm/s pk
Frequency Range (±3 dB)	120 to 60,000 cpm [6]
	2 to 1 kHz
Power On Delay	20 sec [3]
Relay (Alert)	See "Ordering Guide" (right)
Relay (Alarm)	See "Ordering Guide" (right)
Relay	Latching / Non-Latching
Relay	Normally Open / Closed
Alarm Setpoint	10 to 100% of Vibration Range
Alert Setpoint	10 to 100% of Alarm Setpoint
Delay (Alert)	See "Ordering Guide" (right)
Delay (Alarm)	See "Ordering Guide" (right)
Acceleration Output (±10 %)	100 mV/g
	10.2 mV/(m/s²)
Control Interface	
Power LED	Green
Alarm LED	Red
Alert LED	Yellow
Time Delay Adjustment	Single Turn Potentiometer
Reset Function	Momentary Pushbutton Switch [4]
Self Test Function	Momentary Pushbutton Switch
Environmental	
Temperature Range (Operating)	-22 to 158 °F
	-30 to 70 °C
Temperature Range (Storage)	-40 to 257 °F
	-40 to 125 °C
Enclosure Rating	Nema 4X
	IP66
Electrical	
Power Required	See "Ordering Guide" (right)
Current Consumption	<150 mA
Output Current	4-20 mA [2]
External Calibration Input	4-20 mA [1]
Physical (not applicable to enclosure type C1)	
Size - Width	3.5 in
	90 mm
Size - Height	2.8 in
	70 mm
Size - Depth	3.5 in
	90 mm
Weight	1.85 lb
	839 gm
Mounting Torque (Cover Screw)	4.1 ft-lb
	5.7 N-m
Mounting Torque (Base)	2 to 5 ft-lb
	3 to 7 N-m
Sensing Element (Internal)	100 mV/g ICP® Accelerometer
Housing Material	Aluminum Alloy
Electrical Connector	Screw Terminals
Enclosure	See "Ordering Guide" (right)
Screw Terminal Wire Size	24-14 AWG
	0.2 - 2.5 mm²
Cable Input	See "Ordering Guide" (right)
Mounting Hole Size	0.21 in
	5.4 mm

Notes

All specifications are at room temperature unless otherwise specified

[1] Active only during calibration mode
[2] Current will fluctuate at frequencies below 5 Hz.
[3] Factory Set
[4] Reset can also be engaged via external connection to common
[5] For CE reference PCB® Declaration of Conformance PS051 for details.
[6] To obtain 60,000 cpm (1 kHz) frequency response, grease must be applied to all mechanical couplings. Otherwise, frequency response is limited to approximately 30000 cpm (500 Hz)

Accessories & Cables: Pages 162-176

Ordering Guide

Base Model

685B Electronic Vibration Switch with two set point relays, time delays, internal push button reset, remote reset via contact closure, 4-20 mA test/calibration insertion signal capability and both 4-20 mA and analog 100 mV/g output signals available on screw terminals

Package Size and Sensitivity

- **0** Built in accelerometer
- **1** Remote 100 mV/g accelerometer (not supplied)
- **2** Remote 100 mV/g accelerometer, low frequency ~1 Hz (not supplied)
- **3** Built in accelerometer, low frequency ~1 Hz
- **4** Remote 100 mV/g accelerometer w/ sensor fault detection (not supplied)
- **5** Remote 100 mV/g accelerometer w/ sensor fault detection, low frequency ~1 Hz (not supplied)

Measurement Range

- **0** 0 to 1.5 in/sec peak velocity (0 to 38.1 mm/sec)
- **1** 0 to 5 g peak acceleration (0 to 49.03 mm/sec² peak)
- **2** 0 to 15 mils peak to peak displacement (.33 mm peak to peak)
- **3** 0 to 50 mils peak to peak displacement (1.27 mm peak to peak)
- **4** 0 to 3.0 in/sec peak velocity (0 to 76.2 mm/sec)

Power Required

- **0** 85 to 245 VAC, 50/60 Hz
- **1** 24 VDC +/- 10%

Relay Type (two provided)

- **0** Triac, 5 amp, 230 VAC, 0-45 sec adjustable time delay
- **1** Electromechanical relay, 10 amp Form C, SPDT, 30 VDC/240 VAC, 0-45 sec adjustable time delay
- **2** Triac, 5 amp, 230 VAC, 0-12 sec adjustable time delay
- **3** Electromechanical relay, 10 amp Form C, SPDT, 30 VDC/240 VAC, 0-12 sec adjustable time delay

Enclosure Type

- **A1** Standard enclosure, NEMA 4X, CSA class 1 div 2 approved, internal reset and analog signal
- **A2** Same as A1 plus external pushbutton reset
- **A3** Same as A1 plus external BNC jack for analog vibration signal output
- **A4** Same as A1 plus external pushbutton reset and external BNC jack for analog vibration signal output
- **A5** Same as A3 plus LCD readout panel with velocity in inches per second
- **C1** CSA approved explosion proof for class 1 div 1 installations

Enclosure Connection Ports

- **0** Two ports with cord grips
- **1** Two ports with 1/2" NPT conduit hubs
- **2** One port with cord grip
- **3** One port with 1/2" NPT conduit hub
- **4** Two 1/2" NPT ports **must select C1 enclosure type
- **5** Two ports, cord grip left, conduit right
- **6** Two ports, cord grip right, conduit left

Example

685B	0	0	0	1	A1	1

Electronic vibration switch with Built in sensor, CSA class 1 div 2 approved, 0 to 1.5 in/sec peak velocity range 85 to 245 VAC powered two Form C SPDT relays with 0-45 sec adjustable time delays, standard NEMA 4X enclosure with two 1/2" NPT conduit hubs

Selections in blue are not available with CSA class 1 div 2 hazardous area approval
CSA class 1 div 2 approval supplied standard for switches where all options are black

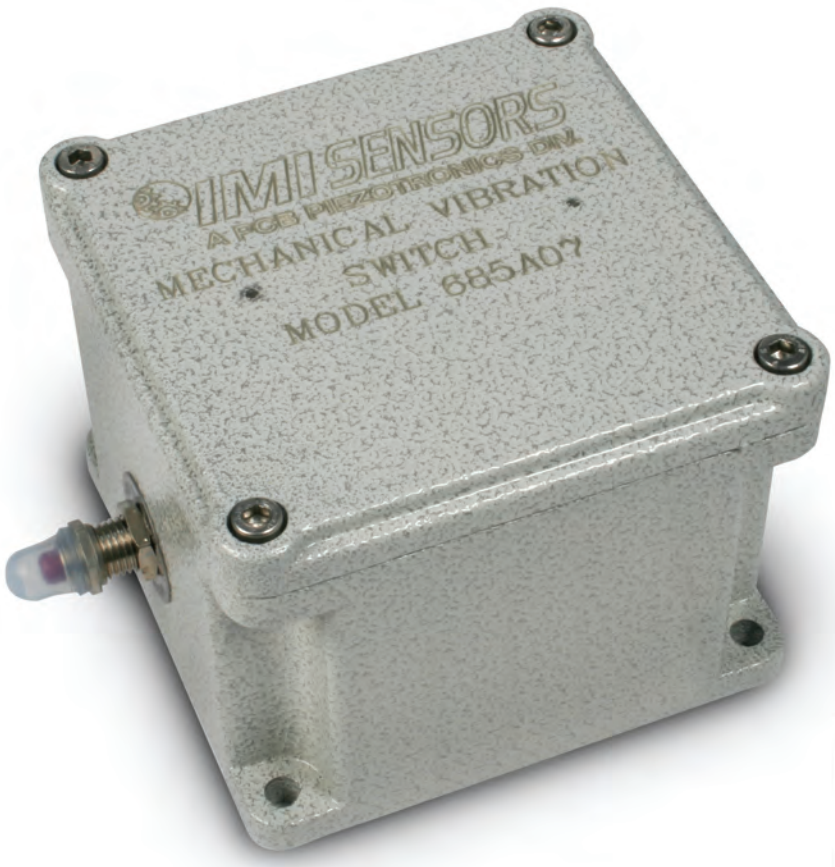
Mechanical

Vibration Switches

- Offers cost-effective protection for less critical situations
- Utilizes spring-loaded, magnetically coupled sensor
- Provides single set point electromechanical relay
- Requires no power
- Weatherproof and explosion proof versions

Mechanical switches do not require power and utilize the resistive force and travel of a spring as a measure of vibration amplitude. When the travel of a spring exceeds the predetermined threshold, the switch is actuated and latched by magnetic attraction. The threshold value is adjustable by changing the proximity of the magnet to the spring and hence the spring travel required for actuation. Switch reset is accomplished manually by disengaging the magnet from the spring.

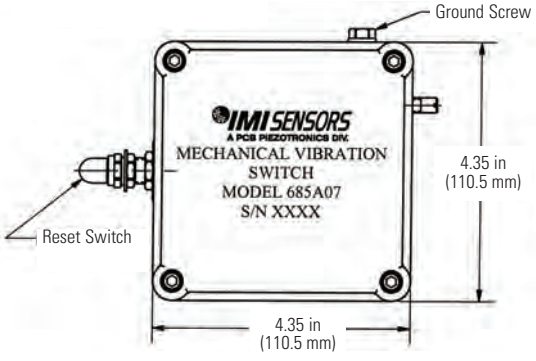
For machines requiring simplified contact closure protection, Models 685A07 and 685A08 offer a cost-effective approach to vibration protection. They offer the smallest mechanical switch footprint available in either NEMA 4 or explosion proof housings. The 3-axis protection allows confident, reliable monitoring of small plant equipment in less critical situations, where the precision of an electronic switch isn't necessarily required. Both the weatherproof and explosion proof versions contain manual internal adjustability with an external reset switch for ease of operation.

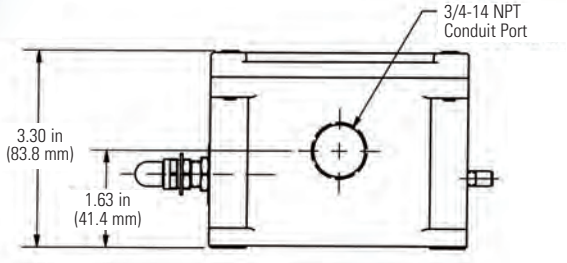


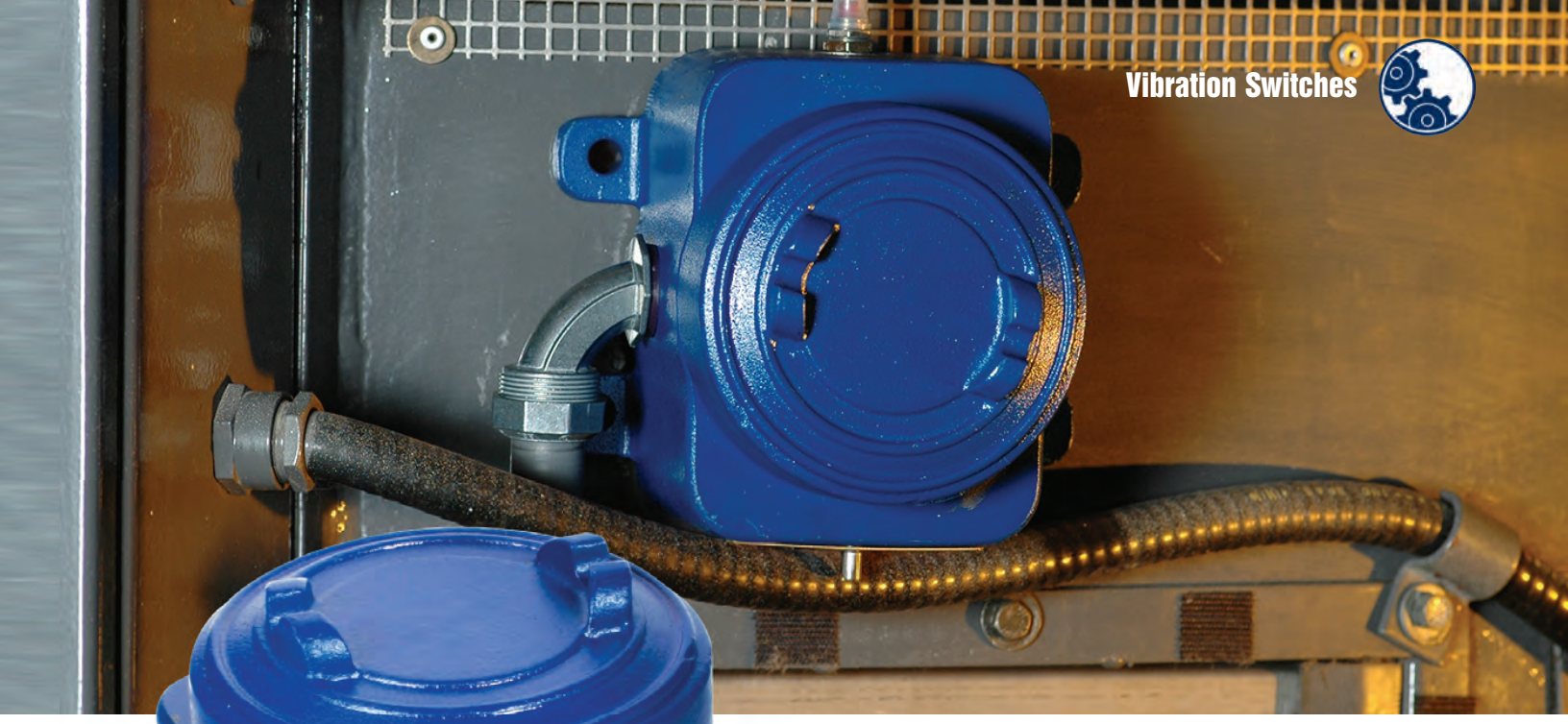
Mechanical Vibration Switch

Model 685A07

- Weatherproof (NEMA 4) version
- Single Form C electromechanical relay
- Pushbutton reset



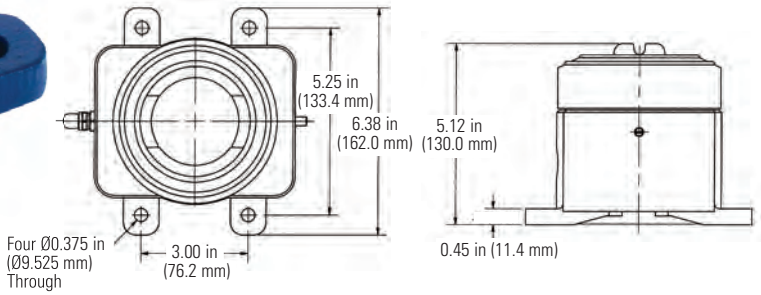




Mechanical Vibration Switch

Model 685A08

- Weatherproof & CSA / UL approved, explosion proof
- Cost-effective protection for less critical applications
- Requires no power



Technical Specifications

Model Number	685A07	685A08
Performance		
Measurement Range	0 to 7 g pk	
	0 to 68.7 m/s² pk	
Frequency Range	0 to 6,000 cpm	
	0 to 100 Hz	
Relay	5A Form C 480 VAC	5A Form C 480 VAC/2A Resistive,1A Inductive @ 30 VDC
Relay	Latching	
Relay	Normally Open / Closed	
Control Interface		
Reset Function	Momentary Pushbutton Switch	
Environmental		
Temperature Range (Operating)	-40 to 140 °F	
	-40 to 60 °C	
Enclosure Rating	IP50	
Hazardous Area Approval	N/A	CSA Class I Div 1, Groups C & D
		UL 516U Explosion Proof, Flame Proof

Model Number	685A07	685A08
Physical		
Size - Width	4.35 in	6.38 in
	110.5 mm	162 mm
Size - Height	3.30 in	4.88 in
	83.8 mm	124 mm
Size - Depth	4.35 in	5.63 in
	110.5 mm	143 mm
Weight	2.1 lb	4.5 lb
	953 gm	2.04 kg
Sensing Element	Magnet	
Housing Material	Aluminum Alloy	
Electrical Connector	Screw Terminals	
Screw Terminal Wire Size	24-14 AWG	14 AWG
	0.2 - 2.5 mm2	2.5 mm2
Cable Input	3/4-14 NPT	1/2-14 NPT
Mounting Hole Size	0.25 in	0.38 in
	6.4 mm	
Sensing Geometry	Inertial Element	
Notes		
All specifications are at room temperature unless otherwise specified		

USB Programming Kits

- Customize settings on your USB programmable sensor
- Kits include CD-ROM software & cable adapters
- Free software updates available at www.imi-sensors.com

USB Programming Kits for IMI's exclusive line of USB programmable sensors include all the hardware and software needed. Use the programming cable to connect the sensors to any PC with the software installed and follow the simple programming steps to complete the process. Each software package allows the user to enter the variables available to customize the sensor to the specific application resulting in the most accurate output results.

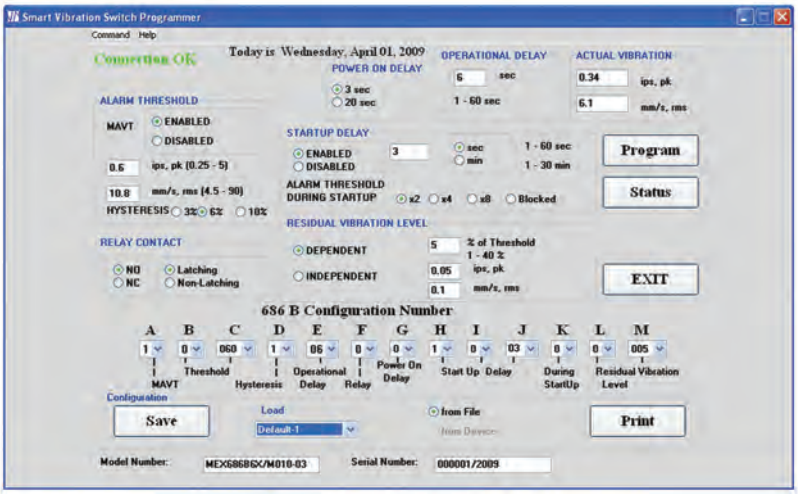
USB Programming Kit
Kit 600A16

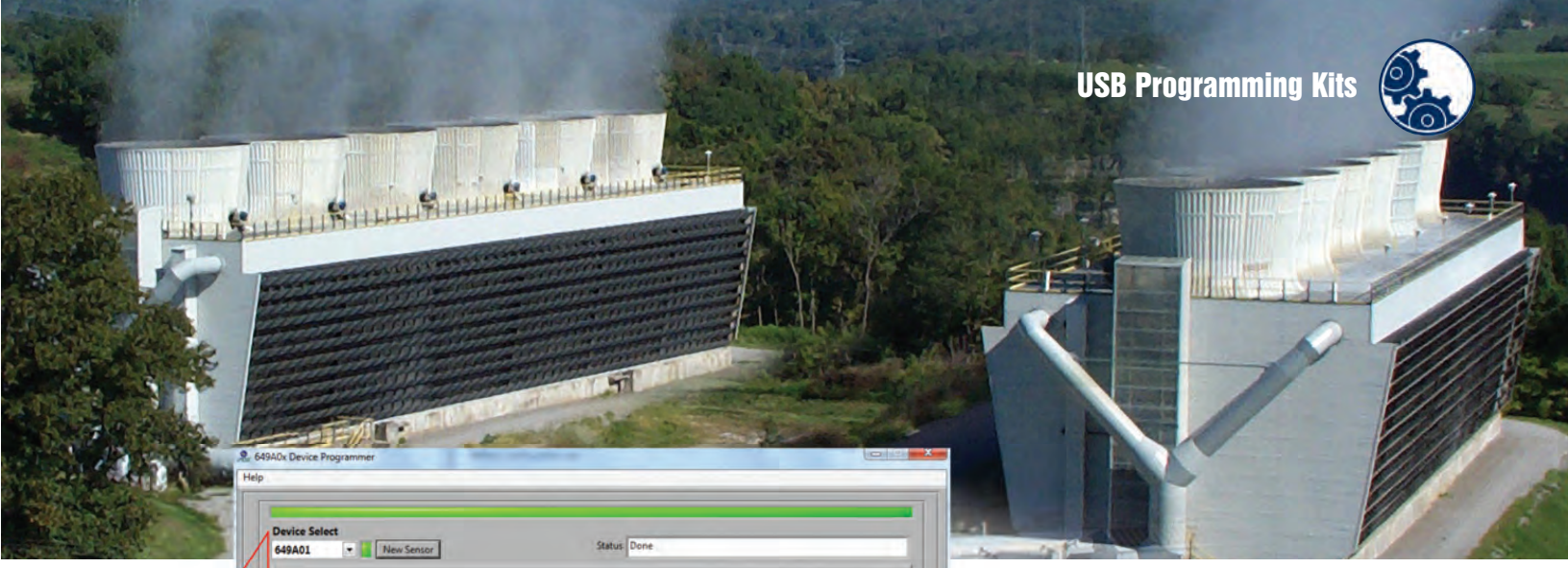
USB Programming Kit
Kit 600A15

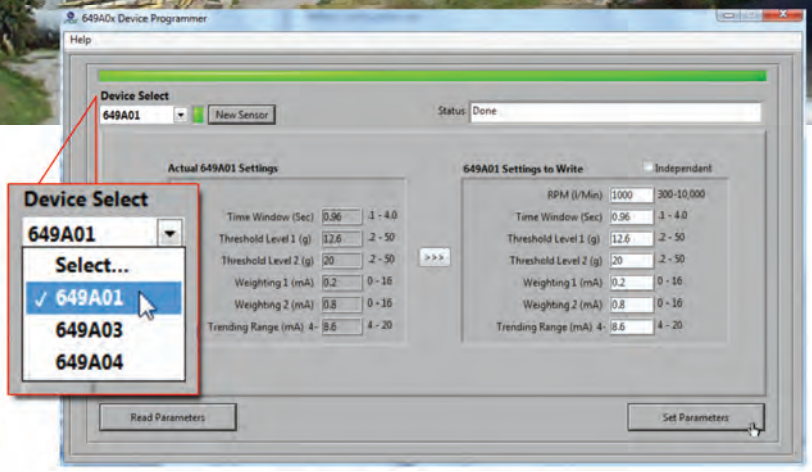
- Includes additional adaptor for use with integral cable and terminal block sensors

686B01 Smart Switch Programming Kit

- Program the alarm threshold, normally open, normally closed, latching or non-latching relay action
- Time delays for power up, start up and operation create high reliability
- Kit includes 2-pin MIL to USB cable, terminal block adapter and CD-ROM software
- Programming screen creates a unique configuration part number for use when programming multiple sensors
- **Kit 600A15** includes an additional adapter for use with integral cable and terminal block sensor connections
- **Kit 600A16** is used on 2-pin MIL connections

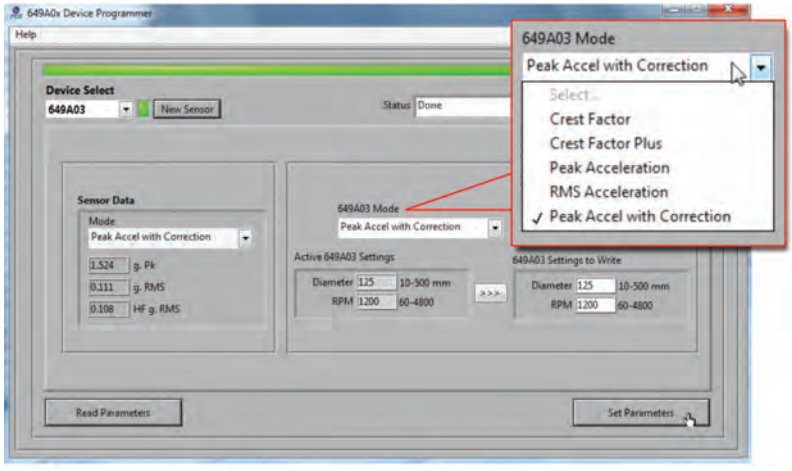






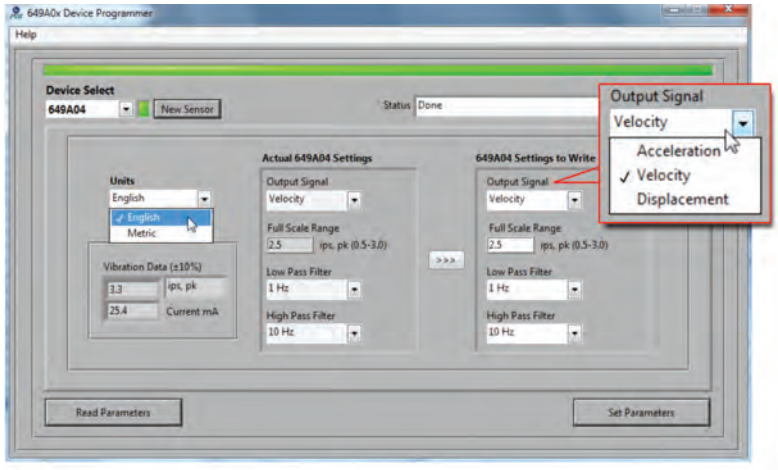
649A01 Reciprocating Machinery Protector Programming Kit

- Use programming **Kit 600A21** for 2-pin MIL sensor connection. Use programming kit 600A24 for integral cable and terminal block sensor connection
- Simply enter the compressor RPM and let the software recommend all settings or independently setting each parameter
- Program 2 alarm levels with the related weighting values
- Kit can be used to program multiple RMP units



649A03 Bearing Condition Monitor Programming Kit

- Use programming **Kit 600A21** for 2-pin MIL sensor connection. Use programming kit 600A24 for integral cable and terminal block sensor connection
- Choose from Acceleration Peak, Acceleration RMS, Acceleration with compensation, Crest Factor or Crest Factor Plus based on your unique application
- Choose whatever full scale range suits the specific application providing the most resolution
- Kit can be used to program multiple Bearing Condition Monitors



649A04 Programmable 4-20 mA Transmitter Programming Kit

- Use programming **Kit 600A21** for 2-pin MIL sensor connection. Use programming kit 600A24 for integral cable and terminal block sensor connection
- Choose Displacement, Velocity or Acceleration measurement method
- Set full scale range
- Choose high pass and low pass filter options
- Kit can be used to program multiple Programmable 4-20 mA output transmitters

Pressure Sensors

- Detect and monitor pulsations, instability, surges, turbulence and acoustics
- Hazardous location troubleshooting, predictive maintenance and process improvement
- For gas compressors, chemical plants, power generation and other hazardous processes

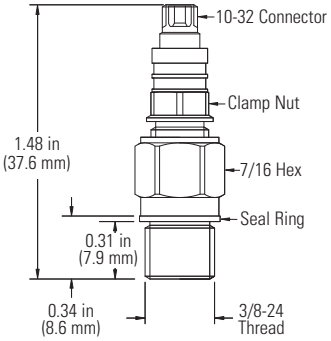
Piezoelectric pressure sensors offer the unique ability to respond to very rapid pressure spikes, pulsations and surges. They can also sense minute pressure fluctuations, while subjected to very high static pressures. Series 121A44 case isolated and 102M205 ground isolated Hazardous Area Approved, dynamic ICP® pressure sensors satisfy such measurement requirements in monitoring, diagnostic, troubleshooting and control applications typical of hazardous factory environments.

Applications include monitoring dynamic pressure events such as surges, pulsations, spikes, leak detection,combustion instability; and acoustics found in operation of compressors, pumps, pipelines and gas turbines. Sensors may be used with ICP® signal conditioning and permit use of a variety of inexpensive 2-wire cable systems. The low-impedance signal may be transmitted over long cable distances and sensors may be used in dirty environments without signal degradation. PCB® Model 121A44 case isolation eliminates all electrical noise from both environment and structure. Model 102M205 ground isolation eliminates electrical noise from the structure under test.

ICP® Pressure Sensor
Model 102M205

- Sensitivity: 50 mV/psi (7.25 mV/kPa)
- Measurement range: 100 psi
- 316 stainless steel diaphragm
- 3/8-24 UNF fitting

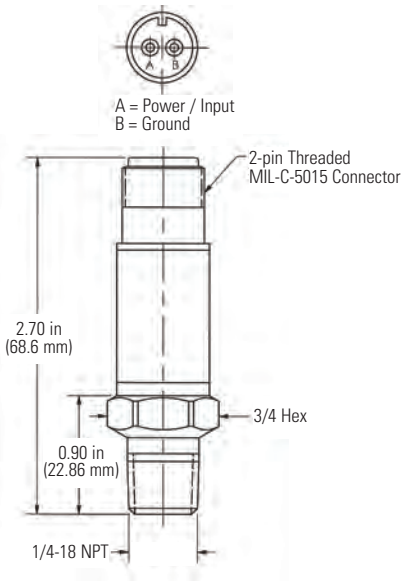
Product shown at actual size

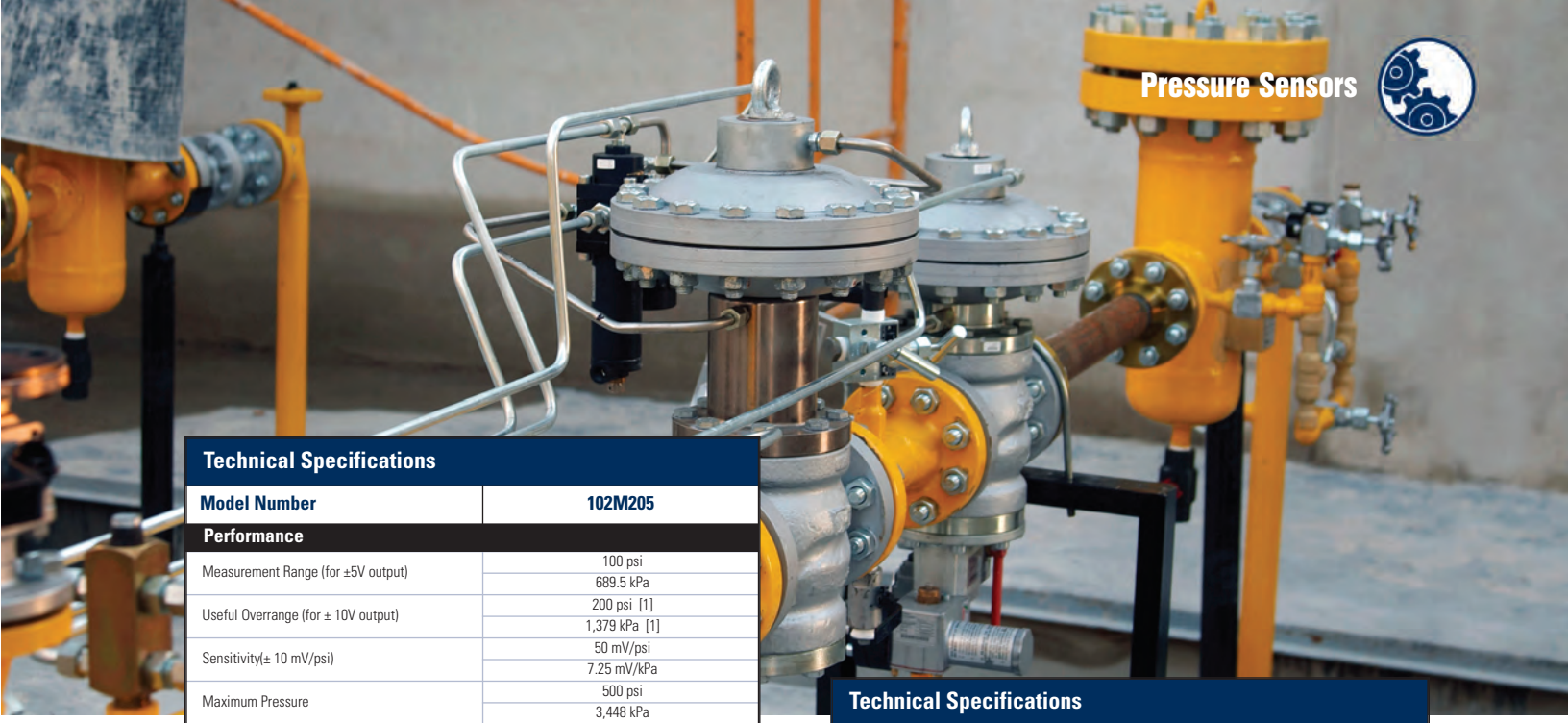


ICP® Pressure Sensor
Model 121A44

- Sensitivity: 0 to 110 mV/psi (1.45 to 14.5 mV/kPa)
- Measurement range: 50 to 500 psi
- 316 stainless steel diaphragm
- 1/4" NPT fitting

Product shown at actual size





Technical Specifications

Model Number	102M205
Performance	
Measurement Range (for ±5V output)	100 psi 689.5 kPa
Useful Overrange (for ± 10V output)	200 psi [1] 1,379 kPa [1]
Sensitivity(± 10 mV/psi)	50 mV/psi 7.25 mV/kPa
Maximum Pressure	500 psi 3,448 kPa
Resolution	2 mpsi 0 0138 kPa
Resonant Frequency	≥ 250 kHz
Rise Time	≤ 2 µ sec
Low Frequency Response (-5 %)	0.50 Hz
Non-linearity	≤ 1 % FS [2]
Environmental	
Acceleration Sensitivity	≤ 0.002 psi/g ≤ 0 0014 kPa/(m/s²)
Temperature Range (Operating)	-100 to +275 °F -73 to +135 °C
Temperature Coefficient of Sensitivity	≤ 0.1 %/°F ≤ 0.18 %/°C
Maximum Flash Temperature	3,000 °F 1 649 °C
Maximum Vibration	2,000 g pk 19,614 m/s² pk
Maximum Shock	20,000 g pk 196,140 m/s² pk
Electrical	
Output Polarity (Positive Pressure)	Positive
Discharge Time Constant (at room temp)	≥ 1 sec
Excitation Voltage	20 to 30 VDC
Constant Current Excitation	2 to 20 mA
Output Bias Voltage	8 to 14 VDC
Physical	
Sensing Element	Quartz
Housing Material	17-4 Stainless Steel
Diaphragm	316L Stainless Steel [3]
Sealing	Welded Hermetic
Electrical Connector	10-32 Coaxial Jack
Weight	0.4 oz 11 gm
Supplied Accessories	
Model 065A44 Seal ring 0.435" OD x 0.377" ID x 0.030" thk Cu (3)	

Notes

All specifications are at room temperature unless otherwise specified

[1] For +10 volt output, minimum 24 VDC supply voltage required. Negative 10 volt output may be limited by output bias.
[2] Zero-based, least-squares, straight line method.
[3] Diaphragm with ablative coating.
[4] For CE reference PCB® Declaration of Conformance PS023 for details.

Optional Versions

M - Metric Mount
Supplied Accessory : Model 065A40 Seal ring 0.435" OD x 0.397" ID x 0.030" thk brass (3)
For Model 121M205

W- Water Resistant Cable
For Model 121M205

Accessories & Cables: Pages 162-176

Technical Specifications

Model Number	121A44
Performance	
Measurement Range (for ±5V output)	50 psi 344.8 kPa
Sensitivity (± 10 mV/psi)	100 mV/psi 14.5037 mV/kPa
Maximum Pressure	8 kpsi [8] 55.16 MPa [8]
Resolution	0.5 mpsi 0.003 kPa
Resonant Frequency	≥ 60 kHz
Rise Time (Reflected)	≤ 4 µ sec
Low Frequency Response (-5 %)	0.5 Hz
Non-linearity	≤ 2.0 % FS [9]
Environmental	
Acceleration Sensitivity	≤ 0.05 psi/g ≤ 0.035 kPa/(m/s²)
Temperature Range (Operating)	-65 to +250 °F -54 to +121 °C
Hazardous Area Approval	CSA (C-US) NRTL - Canadian Standards Association [1][2][3][4] ATEX [5][6][7]
Electrical	
Output Polarity (Positive Pressure)	Positive
Discharge Time Constant (at room temp)	≥ 1 sec
Excitation Voltage	22 to 28 VDC
Constant Current Excitation	2 to 20 mA
Output Bias Voltage	10 to 15 VDC
Electrical Isolation	≥ 10^8 ohm
Physical	
Sensing Geometry	Compression
Sensing Element	Quartz
Housing Material	316L Stainless Steel
Diaphragm	316L Stainless Steel
Sealing	Welded Hermetic
Electrical Connector	2-pin MIL-C-5015
Weight	2.7 oz 75.6 gm

Notes

All specifications are at room temperature unless otherwise specified

[1] AEx ia IIC T4, DIV1 CL1 GR A-D
[2] Ex ia IIC T4, DIV1 CL1 GR A-D
[3] AEx nA IIC T4, DIV2 CL1 GR A-D
[4] Ex nL IIC T4, DIV2 CL1 GR A-D
[5] Ex ia IIC T4.
[6] Ex nL IIC T4.
[7] Ex nA IIC T4.
[8] Due to high sensitivity, the static pressure should be applied and removed very slowly. Rate should prevent more than 10 Volt change in output until Output Bias Voltage returns to normal (approximately 15 times discharge time constant).
[9] Zero-based, least-squares, straight line method.
[10] For CE reference PCB® Declaration of Conformance PS059 for details.

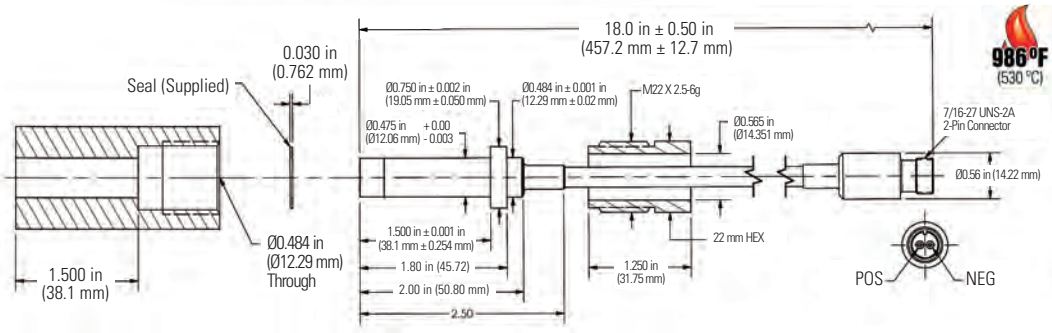
Accessories & Cables: Pages 162-176

Pressure Sensors

- On-Turbine Instability Sensor (OTIS)
- Detects and measures dynamic pressure phenomena
- Various configurations available

When directly mounted to a gas turbine's combustor, IMI's Series 176 high temperature dynamic pressure sensors provide 24/7, consistent, reliable combustion dynamics data monitoring to help control instability which can damage components in the combustion chamber as well as downstream equipment.

By mounting the Series 176 high temperature dynamic pressure sensors to the combustor, gas turbine operators can rely on critical diagnostics, part fatigue analysis and the ability to continuously monitor and control emissions.



Model 176M03 & Model 176M09 Technical Drawing

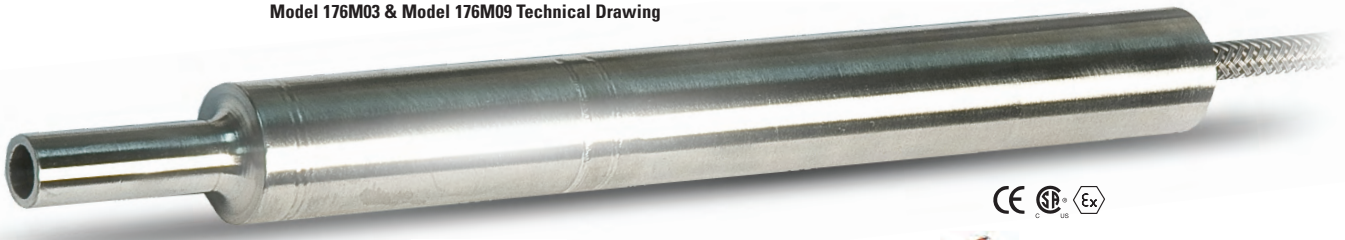
986°F (530 °C)

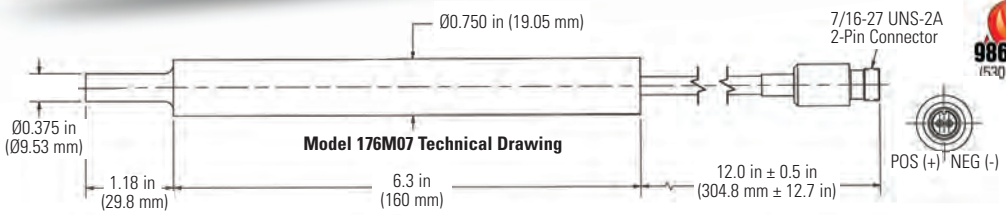
High Temperature Dynamic Pressure Sensor

Series 176M0X

- Sensitivities to 17 pC/psi
- Dynamic measurement range 20 psi
- Removable clamp nut

Product shown at actual size





Model 176M07 Technical Drawing

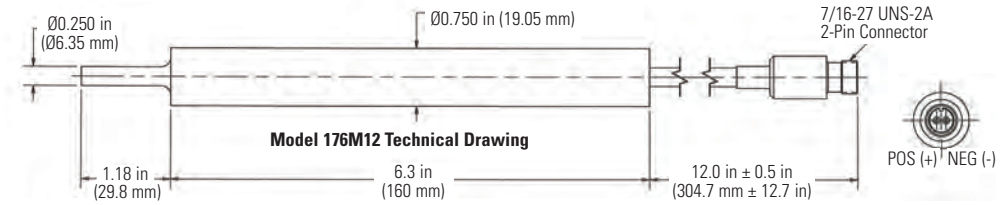
986°F (530 °C)

High Temperature Dynamic Pressure Sensor

Series 176MXX

- Sensitivities to 17 pC/psi
- Dynamic measurement range 20 psi
- Various tip diameters available

Product shown at actual size



Model 176M12 Technical Drawing

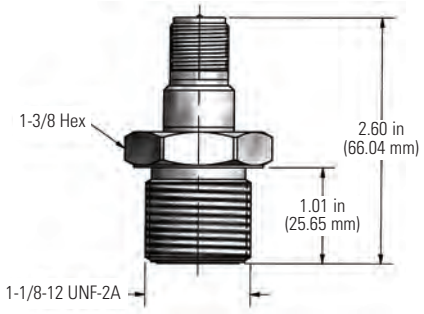
500°F (260 °C)

High Sensitivity Pressure Sensor

Model 171M01

- Dynamic measurement range: 10 psi
- Sensitivity: 1,100 pC/psi (160 pC/kPa)
- 2-pin connector, 1-1/8"-12 UNF-2A port

Product shown at actual size



Technical Specifications

Model Number	176M03	176M09	176M07	176M12
Performance				
Sensitivity (± 20 %)	17 pC/psi 2.47 pC/kPa			
Measurement Range	20 psi 137.9 kpa			
Maximum Pressure (static)	400 psi 2,758 kPa			
Resonant Frequency	>50 kHz			
Non-linearity	≤ 1 % FS [10]			
Environmental				
Acceleration Sensitivity	<0.01 psi/g <0.007 kPa/(m/s²)			
Temperature Range (Continuous)	986 °F 530 °C			
Temperature Range (Intermittent)	1,040 °F 560 °C			
Temperature Range (Receptacle)	500 °F 260 °C			
Temperature Coefficient of Sensitivity	≤ 0.01 %/°F ≤ 0.02 %/°C			
Hazardous Area Approval	ATEX [3][4][6][8] CSA (C-US) NRTL - Canadian Standards Association [1][2][5][7]			
Electrical				
Capacitance	<165 pF			
Internal Resistance (room temp)	≥ 1.0xE^{12} ohm			
Internal Resistance (986 °F/527 °C)	≥ 50 kohm			
Insulation Resistance (986 °F/527 °C)	≥ 100 kohm			
Physical				
Sensing Geometry	Compression			
Housing Material	Inconel			
Sealing	Welded Hermetic			
Electrical Connector	2-pin			
Weight	4.9 oz 140 gm	8.3 oz 235 gm	11.1 oz 315 gm	
Cable Type	2-conductor			
Supplied Accessories				
	Model 30498-01 Clamp nut (1) Model 30736-01 Seal-G-.75-.50-.030 (3)			

Notes

All specifications are at room temperature unless otherwise specified

[1] AEx nA IIC T1, DIV2 CL1 GR A-D
[2] AEx nA IIC T4, DIV2 CL1 GR A-D
[3] Ex ia IIC T1, II IG
[4] Ex ia IIC T4, II IG
[5] Ex nL IIC T1, DIV2 CL1 GR A-D
[6] Ex nL IIC T1, II 3 G
[7] Ex nL IIC T4, DIV2 CL1 GR A-D
[8] Ex nL IIC T4, II 3 G
[9] For CE reference PCB® Declaration of Conformance PS058 for details.
[10] Zero-based, least-squares, straight line method.
[11] Typical

Accessories & Cables: Pages 162-176

Technical Specifications

Model Number	171M01
Performance	
Sensitivity (± 20 %)	1,100 pC/psi 160 pC/kPa
Measurement Range	10 psi 68.9 kPa
Maximum Pressure (static)	600 psi 4,136 kPa
Resonant Frequency	≥ 25 kHz
Rise Time (Reflected)	≤ 10 µ sec
Non-linearity	≤ 1.0 % FS [2]
Environmental	
Acceleration Sensitivity	<0.01 psi/g <0.007 kPa/(m/s²)
Temperature Range (Operating)	0 to 500 °F -18 to 260 °C
Temperature Coefficient of Sensitivity	≤ 0.08 %/°F ≤ 0.144 %/°C
Maximum Shock	1,000 g pk
Electrical	
Output Polarity (Positive Pressure)	Positive
Capacitance	12,000 pF [1]
Electrical Isolation	≥ 10^{8} ohm
Internal Resistance (room temperature)	≥ 1 Gohm
Internal Resistance (@500 °F)	≥ 500 kohm
Physical	
Sensing Geometry	Compression
Housing Material	316L Stainless Steel
Diaphragm	316L Stainless Steel
Sealing	Welded Hermetic
Electrical Connector	2-pin MIL-C-5015
Weight	6.5 oz 185 gm [1]
Supplied Accessories	
Model 31061-01 SEAL, 1.370" OD x 1.130" ID x.030", BRASS (2)	

Notes

All specifications are at room temperature unless otherwise specified

[1] Typical
[2] Zero-based, least-squares, straight line method

Accessories & Cables: Pages 162-176

Echo® Wireless Vibration System

Performance

The Echo® Wireless Vibration System has been tested and found to perform very 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 are sure to 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. It also has an optional Raw Vibration Output (requires optional Model 070A86 cable) for use with a portable data collector.

- 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 Sensor

Wireless Vibration Sensor

Model 670A01

- Batteries last over 5 years
- Transmits long distances
- Eliminates expensive cable runs

Product shown at actual size

The Echo® Wireless Vibration Sensor is a stand alone, battery powered, industrial vibration sensor. At the default setting of three measurements per day (user programmable) battery life is greater than 5 years. A Raw Vibration (RV) output version includes an integral connector that can be used with an optional cable and a standard vibration data collector for fault analysis. The sensor can be programmed via RS-232 to set the transmission (collection) interval and a Residual Vibration Level (RVL) if desired. 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.

Wireless Junction Box

Model 672A01

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

EchoPlus® Wireless Junction Box

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 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.

Receiver

Model 673A01

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

Echo® Wireless Receiver

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.

Echo® Wireless Vibration System

The Echo® Wireless Vibration 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® and optional RV Echo® provide 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

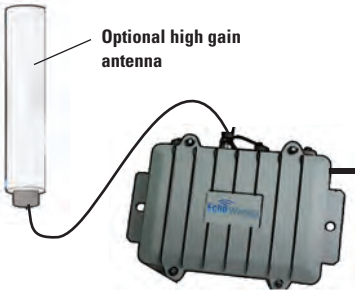
Actual distances can vary widely based on conditions

Receiver has DHCP or static IP addressing

Typical Configuration 1

EchoPlus® Wireless Junction Box

See page 143 for more information

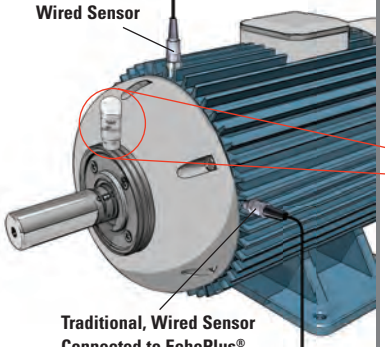


Echo® Receiver

See page 143 for more information

Process 24 VDC power or 6-13 VDC battery power

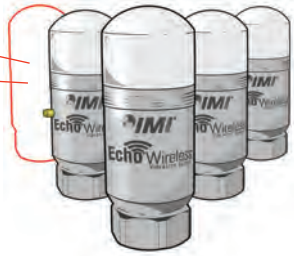
Monitored Machinery

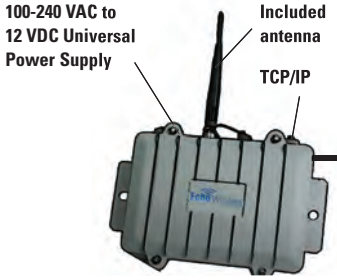


Typical Configuration 2

Echo® Wireless Vibration Sensors

See page 142 for more information



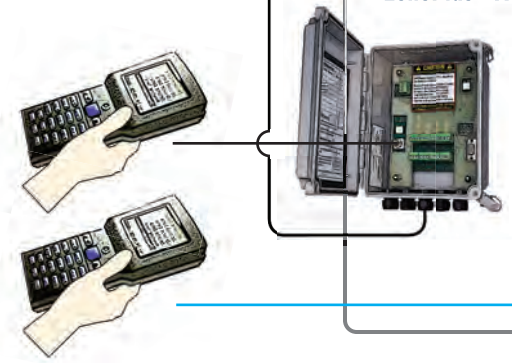


Echo® Receiver

See page 143 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
- Echo® Wireless Vibration Sensor with optional RV output and 070A86 cable

See page 142 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

Echo® Monitoring Software

See page 146 for more information

Echo® Data Client Service

- Collects transmission
- Formats data
- Stores in database
- Generates alarm email
- Integrated or standalone Modbus TCP/ICP 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 2005 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. The Modbus capability can coexist with the SQL database capability or function as a standalone application without the SQL database. However, the SQL interface is required if the Echo® Data Presentation Software is to be used.

Echo® Wireless Monitoring Software

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.

Echo® Monitoring Software
Model 600A20

Echo® Data Client Service

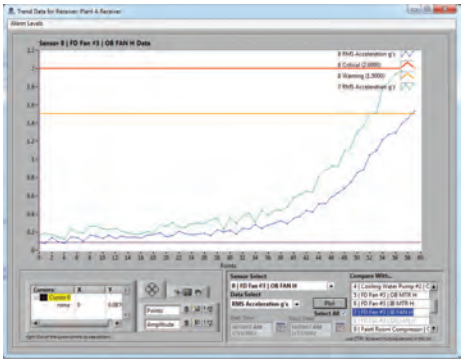
- Installs locally or on a server
  It is highly recommended that the service is installed on a dedicated PC or Server running 24/7
- Runs continuously whether a user is logged on or not
- SQL Database interface and/or Modbus TCP/IP
- Provides email alerts if SQL interface is enabled
- Service Status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

Echo® Data Presentation Software

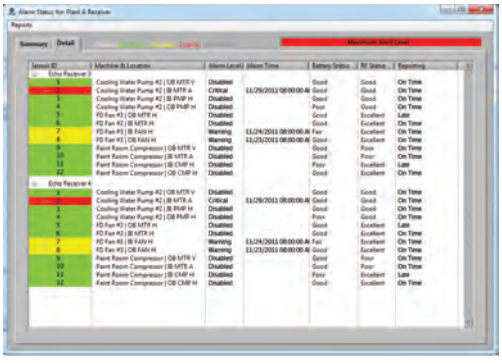
- Runs in single or multi-user environments, and does not affect the Data Client Service that collects
  Ideally a dedicated PC would also be used to run the Presentation Software continuously for constant monitoring of the alarm display
- Provides data alarms, trend plots and history
- Provides sensor status and configuration utility
- Live data window to view receiver activity

The Echo® Monitoring Software provides two major functions

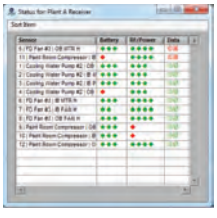
- Collect transmission data reported by the receiver and store in the SQL database and/or Modbus response file
- Present Echo® sensor data to the user through an intuitive and concise interface that includes:
  - Configuration utilities to setup a machinery database and set alarms levels
  - Tabular 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
  - Hardcopy report generation for last transmission and alarm events
  - Additional utilities to query and program Echo® Sensors, EchoPlus® Junction Boxes and Echo® Receivers.



Sensor Vibration Trend Plot



Sensor Alarm Panel



Sensor Status Window

Technical Specifications

Measurements	Details
Echo® RMS Velocity (±3 dB)	4 Hz to 2.3 kHz
Echo® RMS Acceleration (±3 dB)	2.2 kHz to 15 kHz
EchoPlus® RMS Velocity (±3 dB)	4 Hz to 2.3 kHz, may be limited by sensor FR
EchoPlus® RMS Acceleration (±3 dB)	2.2 kHz to 15 kHz, may be limited by sensor FR
True Peak Acceleration	of 2 kHz HP filtered acceleration
Battery voltage at maximum load	For battery status report
System Information Provided	
Date	
Time	
Sensor ID	Factory set unique ID
RMS Velocity	
Derived Peak Velocity	1.414 x RMS Velocity
RMS Acceleration	2 kHz high pass filtered for improved HFE detection
Derived Peak Acceleration	1.414 x RMS Acceleration
True Peak Acceleration	3.7 sec time sample @ 61.4 kHz sample rate, 2 kHz HPF
Filtered Crest Factor	True Peak / RMS Acceleration Maximum Value = 16
Battery Status	4-levels, status based on previous transmission @ max load
RF Status	4 levels
Noise Power	Background noise level (dBm)
Average Power	Average transmission power (dBm)
Average SNR	Difference between Noise and Average Power (dB)
Radio & Standard	**Specifications**
Radio Standard	Proprietary
Modulation	Narrowband FSK
Transmission Range	~250' to >1 mile radius, installation dependent
Transmission Interval	Programmable from 12 sec to 24 hours in 4 sec increments (default = 8 hours)
Certifications	FCC, IC
Minimum Noise Floor	-155 dBm
Radio Sensitivity	-145 dBm
Frequency Band	900 MHz ISM Band
Number of RF Bands	12 (User selectable)
Maximum Power (ERP)	0.75 mW
Signal Attenuation	-45 dBm, user selectable for sensors close to receiver
RF Data Rate	20 bps
Programming	RS-232 (Echo® sensor requires optional 070A87 adapter. EchoPlus® uses standard 9-pin serial cable.)
Number of receivers handled by a single computer	Limited Only by End User Network and Computer Hardware
Sensors per receiver @ 3 meas/day, 1% miss rate, measurement spaced	~400
Sensors per receiver @ 3 meas/day, 5% miss rate, measurements	~2,000
Antenna	Integral 1/2" Ceramic
Performance	
RMS Velocity	Analog Integration, FFT Sum
Velocity HP Filter	2 Hz, 1-pole RC
Velocity LP Filter	2400 Hz, 3-pole Chebyshev
Velocity Resolution	0.001 ips rms
Velocity Range	4.0 ips rms
Echo® Velocity Linearity (0 to 1 ips rms)	<1%
Echo® Velocity Linearity (0 to 4 ips rms)	<8.5%
EchoPlus® Velocity Linearity (0 to 1 ips rms)	<1%
EchoPlus® Velocity Linearity (1 to 4 ips rms)	<7%
Derived peak velocity	1.414 x RMS Velocity
RMS Acceleration (HP filtered)	Time Sample Average @ 61.4 kHz
Acceleration HP Filter	2 kHz, 4-pole Chebyshev
Acceleration LP Filter	15k Hz, 3-pole Chebyshev + 1-pole RC
Acceleration Resolution	0.005 g
Echo® Acceleration Range	20 g pk
EchoPlus® Acceleration Range	40 g pk (for 100 mV/g accelerometer)

Performance	Specification
Echo® Acceleration Linearity (0 to 20 g pk)	<1%
EchoPlus® Acceleration Linearity (0 to 20 grms)	<1%
Derived Peak Acceleration	1.414 x RMS Acceleration
Minimum True Peak Acceleration Pulse Width	~50 s
Modified Crest Factor (~2 kHz HPF)	True Peak / RMS Acceleration, Maximum Value = 16
ADC/dynamic range	16 bit / >90 dB
Residual Vibration Level (RVL)	
If RVL = 0	Collect on normal transmission period
If RVL > 0	Check at normal transmission period and collect data only if RMS velocity ≥ RVL
Operation Status Indicator	LED
Echo® Sensor Activation/Deactivation	Magnetic Switch
Environmental	
Echo® Mechanical Shock Limit	1,000 g through mounting base
Temperature Range	-20° to 70° C (-4 to 158° F)
Humidity	5% - 100%
Echo® Enclosure Rating	IP 66
Echo® Electrical	
Echo® Power	7.2V Lithium Battery (073A20 battery replacement kit)
Replaceable	Yes
Battery Operating Temperature	-60° to 85° C (-76 to 185° F)
Battery Life	>5 years @ 3-measurements per day, room temperature
Electrical Isolation (Case)	$>10^8$ ohm
Echo® Physical	
Dimensions	
Base Assembly	1-3/8" Hex
Housing	1.66" Dia
Height (overall)	4.40"
Weight (including battery pack)	450 g (15.9 Oz)
Mounting Thread	1/4-28 Female
Mounting Torque	2 to 5 ft-lb
Sensing Element	Piezo Ceramic Shear
Material	
Base	304L Stainless Steel
Housing Material	304L Stainless Steel
Housing Cap	Polycarbonate
Mechanical Isolator	Urethane
Mounting	1/4-28 Stud
Sealing	O-ring
EchoPlus® Parameter	
Channels per Box	8
Channels Active	User selectable in any combination
Channel ID	Individual factory set unique ID per channel
Sensors Supported	ICP® (≤2 sec settling time, 10, 50, 100, 500 mV/g)
Sensor Power Supplied	24 VDC @ 2.2 mA constant current
Channel Gain	Set per channel for sensor normalization (Default set for 100 mV/g accelerometer)
Buffered Sensor Analog Output	BNC, push SELECT SENSOR
Sensor Select timeout	15 min of non-use
External DC Power	24 VDC ±1 V
External Battery Power (battery not supplied)	6 to 13 VDC
Over Voltage Protection on Battery Terminals	14 to 30 VDC (Fuse auto resets after voltage removed)
Reverse Polarity Protection	Yes
Transmission Interval	Programmable in 4 sec increments up to 24 hours, default = 8 hours, minimum dependent on the number of active channels
EchoPlus® Physical	
Enclosure Rating	NEMA 4X, IP 66
Input Connector	Terminal strip
Enclosure Material	Fiberglas
Size (Height x Width x Depth)	8 x 6 x 4 in (203 x 152 x 102 mm)
Weight	2.88 lb (1.3 kg)
Cord Grips	10 Individual, PGME07

All specifications are at room temperature unless otherwise specified

Echo® Receiver Measurements

Receiver Identification	Specification
Receiver ID	Factory set unique, readable using supplied utility software
MAC Address	Factory set unique, supplied by factory
IP Address	Dynamic (default), static capable using supplied utility software
Radio & Standard	
Radio Standard	Proprietary Extended Range RF
Modulation	Narrowband FSK
Minimum Noise Floor	-155 dBm
Radio Sensitivity	-145 dBm
Frequency ISM Band	902 - 928 MHz ISM Band
Number of RF Bands	12 (Default RF Band 1)
Number of RF Bands	12 (User selectable)
RF Data Receive Rate	20 bps
Number of receivers handled by a single computer	Limited Only by End User Network and Computer Hardware
Sensors per receiver @ 3 meas/day, 1% miss rate, measurements spaced	~400
Sensors per receiver @ 3 meas/day, 5% miss rate, measurements spaced	~2,000
Electrical	
Power/RS232 Connectors (interchangeable)	12 VDC, 15 W max, Using supplied AC power adapter
Power	PN CBL-0043 (supplied with receiver)
RS-232	Model number 009M201 (Optional)
LED	Power indicator
Physical	
Enclosure Material	Die Cast Aluminum
Size Overall (Length x Width x Height)	8.4 x 7.2 x 2.1 in (213 x 182 x 53 mm) (without mounting bracket)
Weight (without mounting bracket)	2.84 lb (1.23 kg)
Weight (with mounting bracket)	3.76 lb (1.71 kg)
Antennal Connector	N-female
Ethernet Connector	RJ-45 Waterproof (with mating connector cover)
Interface	Ethernet TCP/IP packet containing XML text
Antenna supplied	916 MHz, Whip SMA w/N connector adapter
Enclosure Rating	MIL-STD-810 Method 506.4 Procedure 1 Blowing Rain MIL-STD-810F, Method 510.4, Procedures I and II, Sand & Dust

Echo® Wireless Accessories

- Programming and antenna cables
- Multiple antenna options
- Replacement batteries

Echo® RV Output Cable
Model 070A86

Model 070A86 is a 4-pin mini connector to BNC power adapter and cable. When used in conjunction with a portable data collector, this cable converts standard sensor power to low voltage power required by Echo® Wireless Vibration Sensors. It also allows normal cabled broadband data collection when used with the RV Echo® Sensor, Model RV670A01.

Echo® Programming Cable
Model 070A87

Model 070A87 is a special RS-232 adapter cable with a DB9 connector to a Micro USB connector that allows serial communication with Echo® Wireless Vibration Sensors. The cable's Micro USB connector mates with a Micro USB connector in the in the sensor and is used to read and program the units.

Echo® Receiver Serial Cable
Model 009M201

Model 009M201 is a special RS-232 serial cable with a DB9 connector to a MIL-style bayonet connector that allows serial communication with Echo® Receivers. The cable's MIL-style connector mates with a MIL-style connector on the receiver and is used to read and program the units.

Echo® RV Shorting Cap
Model 070A88

Model 070A88 is a shorting cap that is used with the RV670A01 Echo® Wireless Vibration Sensor for normal wireless use. When removed, a Model 070A86, Echo® RV Output Cable can be used to obtain Raw Vibration output from the sensor for input to a portable data collector for diagnostic analysis.

Echo® Replacement Battery Kit
Model 073A20

Model 073A20 is a battery replacement kit that includes a battery pack, O-ring, silicon grease, foam compressor and instructions.

Low Loss Antenna Cable
Model 009M205

Model 009M205/xxx is a high performance, low loss antenna cable with N-Male to N-Male connectors. xxx is the length in feet. Valid Models are as follows:

009M205/002 (2')
009M205/004 (4')
009M205/010 (10')
009M205/020 (20')
009M205/025 (25')
009M205/030 (30')
009M205/040 (40')
009M205/050 (50')
009M205/075 (75')
009M205/100 (100')

900 MHz Antenna, 8 dBi
Model 070A91

Model 070A91 is an 800/900 MHz, 8 dBi omnidirectional antenna & bracket for use with the Echo® Wireless Vibration System

900 MHz Antenna, 6 dBi
Model 070A90

Model 070A90 is an 800/900 MHz, 6 dBi omnidirectional antenna & bracket for use with the Echo® Wireless Vibration System

900 MHz Antenna, 13 dBi
Model 070A92

Model 070A92 is a 900 MHz, 13 dBi directional Yagi antenna with N female connector

www.imi-sensors.com/Echo_Wireless

Wireless Vibration Measurements?

We Do!™

We do it all - sensors to measure vibration, acoustics, force, pressure, load, strain, shock and torque - Sure we do!

Scan with smart phone for more information on the Echo® Wireless Vibration System

IMI SENSORS
A PCB PIEZOTRONICS DIV.

BNC Termination Boxes

Enclosures

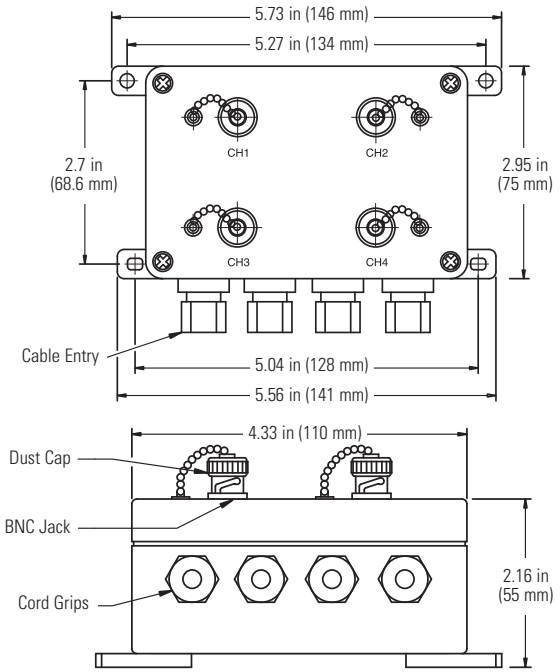
- Access vibration data from remote accelerometers at a safe location
- Provides central collection point saving time during route-based analysis
- Installed cord grips make for easy sensor hookup

Small BNC termination boxes offer a simple, economical and safe method for accessing up to four sensors that are installed in remote locations. Each features a wall mountable, fiberglass, NEMA 4X (IP65) enclosure, an internal terminal strip for connection to pigtailed sensor cables and externally mounted BNC jack connectors for interface to data collection equipment. BNC termination boxes do not supply sensor excitation power. Simply connect a data collector, with sensor excitation power, to the BNC jack of the sensor channel of interest to access that sensor's measurement signal.

BNC Termination Box

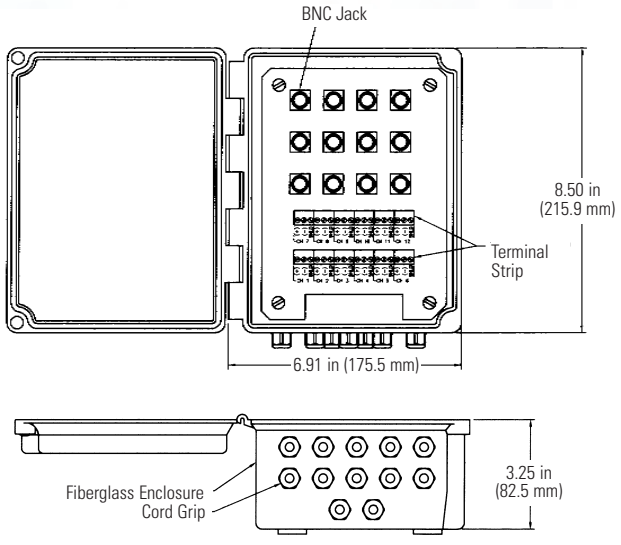
Series 691A51

- For use with data collectors that supply ICP® sensor power
- 1-4 input channels via terminal strip
- 1-4 output channels via BNC



Technical Specifications

Model Number	691A51/01	691A51/02	691A51/03	691A51/04
Performance				
Channels	1	2	3	4
Environmental				
Enclosure Rating	NEMA 4X			
Physical				
Electrical Connector (Input)	Terminal Block			
Electrical Connector (Output)	BNC Jack			
Cable Input	PGME07			
Housing Material	Fiberglass			
Size - Height	4.33 in 110 mm			
Size - Width	2.95 in 80 mm			
Size - Depth	2.16 in 55 mm			
Weight	.90 lb .41 kg	.96 lb .44 kg	1.1 lb .50 kg	
Notes				
All specifications are at room temperature unless otherwise specified				



BNC termination enclosures offer a simple, economical and safe method for accessing up to 12 sensors that are installed in remote locations. Each features a wall mountable, fiberglass NEMA 4X (IP66) enclosure, an internal terminal strip for connection to pigtailed sensor cables and internally mounted BNC jack connectors for interface to data collection equipment. BNC termination enclosures do not supply sensor excitation power turn on.Simply open the enclosure door and connect a data collector, with sensor excitation power turned on, to the BNC jack of the sensor channel of interest to access that sensor's measurement signal.

BNC Termination Box

Series 691A50

- Consolidate up to 12 channels in a centralized location
- Connections protected by NEMA 4X enclosure
- Includes installed cord grips

Technical Specifications

Model Number	691A50/06	691A50/12
Performance		
Channels	6	12
Environmental		
Enclosure Rating	NEMA 4X IP66	
Physical		
Electrical Connector (Input)	Terminal Block	
Electrical Connector (Output)	BNC Jack	
Cable Input	PGME07	
Housing Material	Fiberglass	
Size - Height	8 in 203 mm	
Size - Width	6 in 152 mm	
Size - Depth	4 in 102 mm	
Weight	2.5 lb 1.14 kg	
Notes		
All specifications are at room temperature unless otherwise specified		

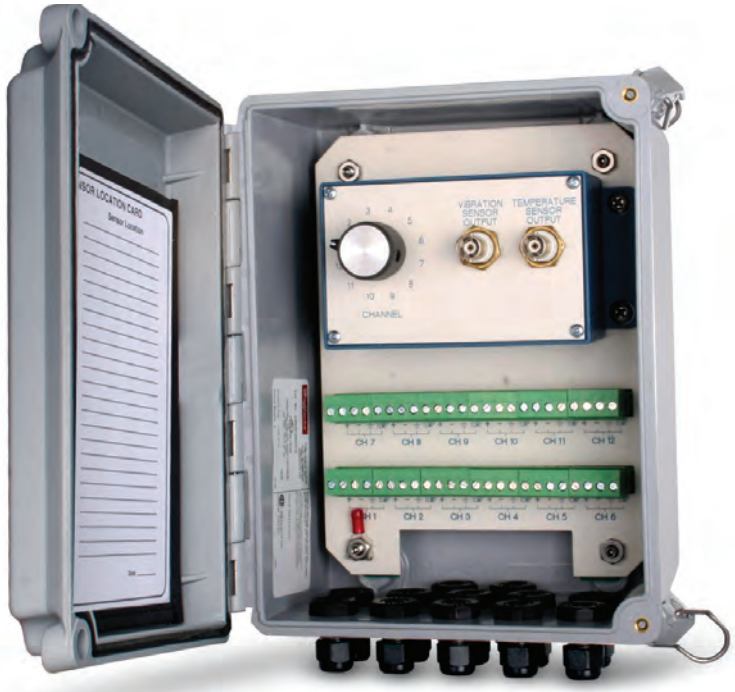
Switch Boxes

Enclosures

- Enclosures provide a convenient, centralized data collection point
- Improve efficiency with temperature & vibration outputs in one enclosure
- Help extend cable life by reducing the number of connections needed

Switch boxes assist with route-based data collection by terminating the cables of permanently installed sensors at convenient, safe, data collection locations.

The unit does not contain a power supply rather it relies on transferring excitation power provided by the vibration data collector or signal conditioner to connected sensors. Since excitation power is presented to each sensor when its measurement channel is selected, the sensor's settling time must be considered prior to taking measurements. Models 691B41 and 691B42 are available with a variety of cord grip options. When cord grips are ordered, the enclosure will be provided with holes drilled for the appropriate cord grips.



Rotary Switch Box

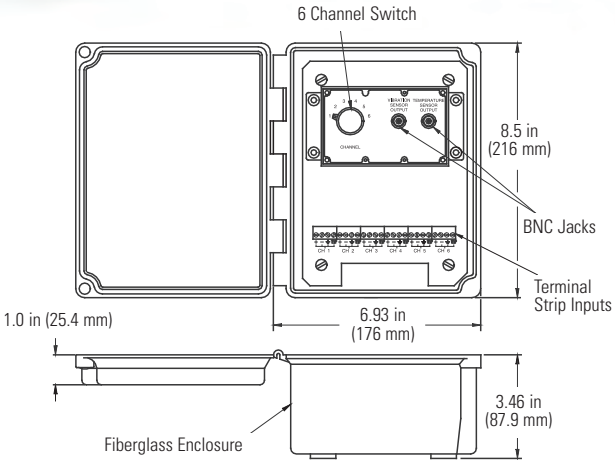
Model 691B41

- Dual BNC connector for vibration and temperature output
- Variety of cord grip options available
- Fiberglass or painted steel enclosure

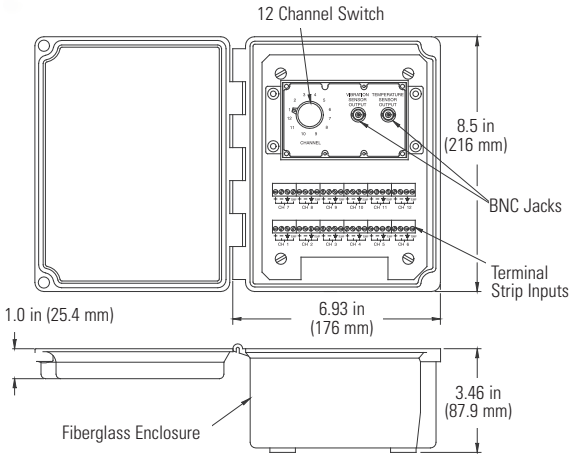
Rotary Switch Box

Model 691B42

- 12 input channels
- Fiberglass enclosure
- For use with data collectors that supply ICP® power



Model 691B41 Technical Drawing



Model 691B42 Technical Drawing

Technical Specifications

Model Number	691B41	691B41/691010	691B42	691B42/691020
Performance				
Channels	6	6	12	12
Environmental				
Enclosure Rating	NEMA 4X			
	IP66			
Physical				
Electrical Connector (Input)	Terminal Block			
Electrical Connector (Output)	BNC Jack			
Housing Material	Fiberglass			
Size - Height	8 in			
	203 mm			
Size - Width	6 in			
	152 mm			
Size - Depth	4 in			
	102 mm			
Weight	5 lb			
	2.3 kg			
Cable Entry	None	Cord Grips	None	Cord Grips
Supplied Accessories				
	Model 080A192 4-socket terminal block (1)			
Optional Versions				
	691010 - 6 Individual Cord Grips, PGME07		691020 - 12 Individual Cord Grips, PGME07	
	691011 - 1 Individual Cord Grip, PGME29		691021 - 2 Individual Cord Grips, PGME29	
	691012 - 1 Individual Cord Grip, PGME13		691022 - 2 Individual Cord Grips, PGME13	
	691013 - 1 Conduit Fitting, 1.5 Inch.		691023 - 1 Individual Cord Grip, PGME36	
	691014 - 2 Individual Cord Grips, PGME13		691024 - 1 Individual Cord Grip, PGME21	
			691025 - 1 Conduit Fitting, 1.5 Inch.	
			691026 - 2 Conduit Fittings, 1.5 Inch	
			691027 - 1 Individual Cord Grip, PGME29	
	Enclosure Versions			
	PS - Painted Steel	Enclosure Rating	NEMA 12	
			IP65	
		Weight	7 lb	
			3.2 kg	
	SS - Stainless Steel	Enclosure Rating	NEMA 4X	
			IP66	
		Weight	8 lb5	
			3.6 kg	

All specifications are at room temperature unless otherwise specified

Signal Conditioners

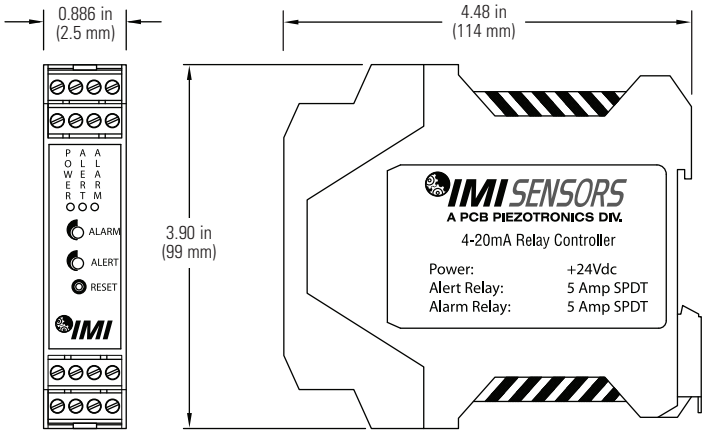
- Conveniently mounts to any standard DIN rail
- Capable of powering transmitters & ICP® sensors
- Easy to use terminal strip connection

DIN Rail Mounting Power Supply

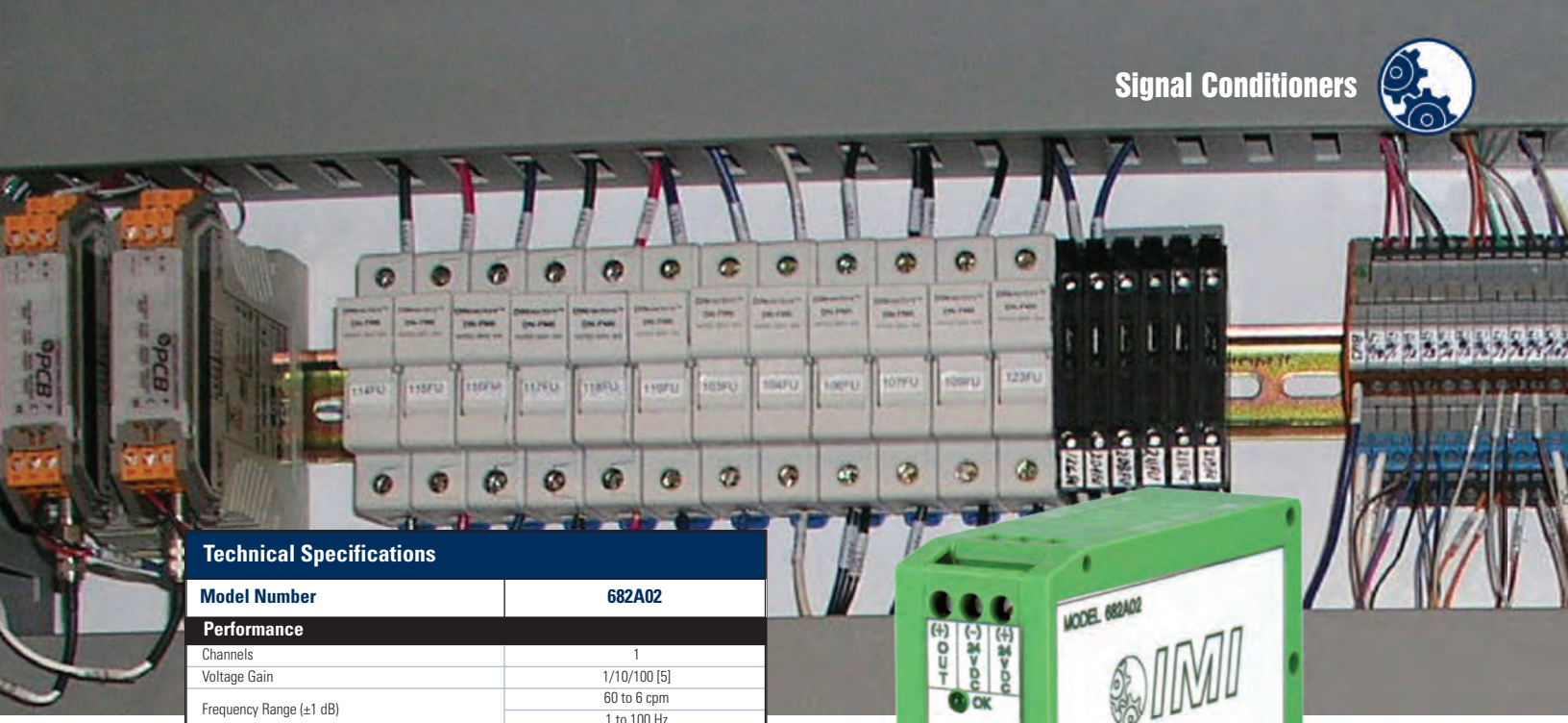
Model 682A01

- Provides 24 VDC, 1.0 amps power
- Operates from 120 to 230 VAC line power
- Powers transmitters, signal conditioners, and alarm modules

Product shown at actual size



Technical Specifications	
Model Number	**682A01**
Performance	
MTBF	>500,000h
Efficiency	>80%
Control Interface	
Display	LED
Environment	
Temperature Range (Operating)	-13 to 158 °F
	-25 to 70 °C
Temperature Range (Storage)	-40 to 185 °F
	-40 to 85 °C
Humidity Range (Non-Condensing)	<95 %
Electrical	
Power Required	85-264 VAC / 95-350 VDC
Output Voltage	24 VDC
Output Current	1.0 amps
Input Frequency	45 to 63 Hz
Inrush Current (@ 25 deg C)	<15A
Current Consumption (230/120 VAC)	0.3/0.5A
Fuse	1.25A / 250V
Mains Buffering	>20/110ms (120/230 VAC)
Surge Voltage Protection	Varistor
´0-90% Load Tolerance	+/- 3%
Turn On Delay	<0.5/1s (230/120 VAC)
Turn Off Delay	<150ms
Internal Surge Voltage Protection	35 VDC +/- 5%
Parallel Switching	Redundant Systems Only
Ripple Voltage	<100 mV pp
Maximum Power Loss	0.9/4.5W (No Load/Load)
DC OK (Active)	24V / 20mA
Fuse	1.25A/250V
Insulation Voltage	3kV
Physical	
Size - Height	3.90 in
	99 mm
Size - Width	0.89 in
	22.5 mm
Size - Depth	4.51 in
	114.5 mm
Weight	7.4 oz
	0.21 kg
Conductor Cross Section	AWG 14-24
	0.2-2.5mm^2
Vibration (10Hz-150Hz)	2g
	0.15mm
Shock (3 directions for 18 ms)	30g
Notes	
All specifications are at room temperature unless otherwise specified.	
[1] In the case of DC applications it is necessary to connect an adequate fuse in series [2] For CE reference PCB® Declaration of Conformance for details [3] This device is in compliance with the EMC guideline 89/336/EEC and the low voltage guideline 73/23/EEC [4] This device must be installed in accordance with the specifications of EN60950. It must be possible to switch off the device using a suitable disconnecting device outside the power supply. For example, primary side line protection could be used.	



Technical Specifications

Model Number	682A02
Performance	
Channels	1
Voltage Gain	1/10/100 [5]
Frequency Range (±1 dB)	60 to 6 cpm
	1 to 100 Hz
Non-linearity	≤ 2 %
Environmental	
Temperature Range	32 °F
	0 °C
Electrical	
Power Required (Standard)	DC power
Excitation Voltage (±1 VDC) (To Sensor)	18 VDC [4]
DC Power	24 VDC
	60 mA
Constant Current Excitation (To Sensor)	4/10 mA [5]
Spectral Noise (10 Hz)	0.8 µV/√Hz [1]
Spectral Noise (100 Hz)	0.5 µV/√Hz [1]
Spectral Noise (1 kHz)	0.5 µV/√Hz [1]
Spectral Noise (10 kHz)	0.6 µV/√Hz [1]
Broadband Electrical Noise (1 to 10 kHz) (Gain x1)	50 µV
Spectral Noise (10 Hz)	7.5 µV/√Hz [2]
Spectral Noise (100 Hz)	3.6 µV/√Hz [2]
Spectral Noise (1 kHz)	3.2 µV/√Hz [2]
Spectral Noise (10 kHz)	6.0 µV/√Hz [2]
Broadband Electrical Noise (1 to 10 kHz) (Gain x10)	400 µV
Spectral Noise (10 Hz)	80 µV/√Hz [3]
Spectral Noise (100 Hz)	40 µV/√Hz [3]
Spectral Noise (1 kHz)	32 µV/√Hz [3]
Spectral Noise (10 kHz)	50 µV/√Hz [3]
Broadband Electrical Noise (1 to 10 kHz) (Gain x100)	3.5 mV
Fuse	1 A
Physical	
Size - Height	3.1 in
	78.7 mm
Size - Width	0.97 in
	24.6 mm
Size - Depth	3.3 in
	83.8 mm
Weight	0.194 lb
	0.088 kg
Electrical Connector (ICP® Sensor Input)	Screw Terminals
Electrical Connector (Output)	Screw Terminals
Electrical Connector (DC Power Input)	Screw Terminals
Mounting	DIN Rail

Notes

All specifications are at room temperature unless otherwise specified

[1] Gain x1
[2] Gain x10
[3] Gain x100
[4] If unit is used in conjunction with a sensor having a bias over 13 VDC, full scale output may be affected or sensor may not power up.
[5] Jumper selectable on internal circuit board.

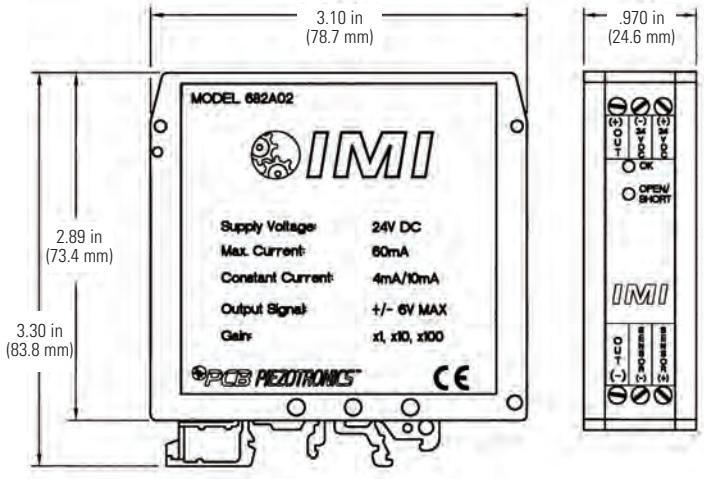
Accessories & Cables: Pages 162-176

ICP® Signal Conditioner

Model 682A02

- Frequency range: 1 Hz to 100 kHz
- Single channel
- 24 VDC input

Product shown at actual size



Signal Conditioners

- Accepts mA, VDC, RTD, TC, Linear Resistance and Potentiometer input signals
- Delivers either current or voltage output signals
- Offers two set points with Form A relay outputs (2 Amp AC, 1 Amp DC)

Model 682A06 is a DIN rail mounted, general purpose, universal transmitter for industrial monitoring, control and alarm requirements. It accepts a variety of sensor input signals and provides excitation voltage for 2-wire loop powered sensors and transmitters. This unit is especially well-suited for industrial machinery protection and vibration monitoring applications with IMI Sensors' Series 640 loop powered 4-20 mA output vibration sensors.

Model 682A06 operated as a blind transmitter and delivers VDC, isolated mA and relay outputs; however, it may be fitted with an optional display module (Model 070A80) to view measurement data. The display module also offers pushbutton programmability of many setup parameters, including: zero, span, set point threshold, set point hysteresis and relay action time delay, as well as TC and RTD linearization. The unit also supports password protection for security purposes and memory retention of all set up parameters, to permit common setup of additional transmitters for quick deployment.

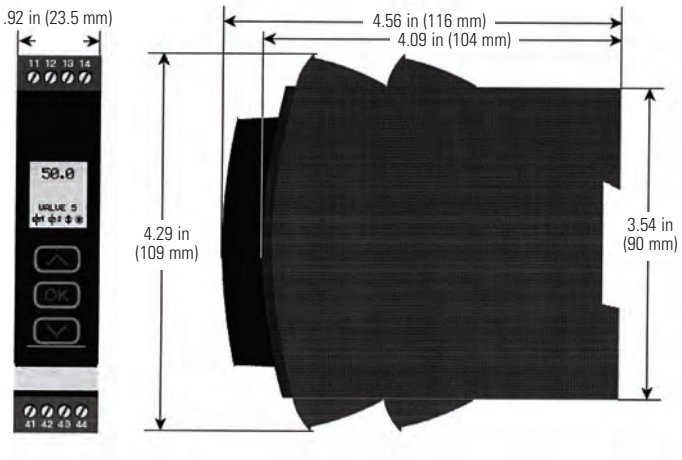
Model 682A16 (see page 157) provides ICP® power for voltage output sensors and provides all the same output technology found in the 682A06

Programming / Display Module
Model 070A80

Universal Transmitter
Model 682A06

- 24 VDC loop power for 4-20 mA sensors
- Offers two set points with Form A relay outputs (2 amp AC, 1 amp DC)
- Optional, removable programming / display module 070A80

Product shown at actual size



Model 682A06 & Model 682A16 Technical Drawing

NEW! Industry Exclusive!

Universal Transmitter
Model 682A16

- Provides ICP® power for sensors
- Offers two set points with Form A relay outputs (2 amp AC, 1 amp DC)
- Optional, removable programming / display module 070A80

Product shown at actual size

Programming / Display Module
Model 070A80

Technical Specifications

Model Number	682A06	682A16
Environmental		
Temperature Range (Operating)	-04 to 140 °F	
	-20 to 60 °C	
Electrical		
Supply Voltage	19.2 to 300 VDC	
Current Consumption	≤ 2.5 W	
Excitation Voltage (delivered to sensor)	24 V Loop Power	23 to 25 VDC
Constant Current Excitation (delivered to sensor)	N/A	3 to 5 mA

Model Number	682A06	682A16
Physical		
Size - Height	4.29 in	
	109 mm	
Size - Width	0.93 in	
	23.5 mm	
Size - Depth	4.09 in	
	104 mm	
Weight	6.00 oz	
	170 gm	

Notes

All specifications are at room temperature unless otherwise specified

[1] For CE reference appropriate Declaration of Conformance for details

In-line Charge Converters

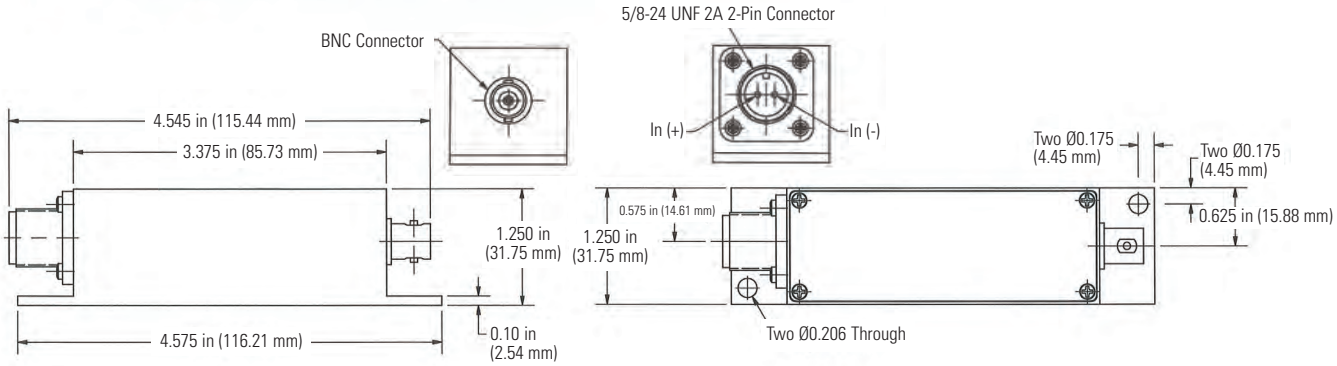
- All charge converters shown are ICP® powered
- Industry standard input and output connectors
- Specifically designed for use with charge mode sensors

Differential Charge Converter

Model 422M182

- Sensitivity: 4 mV/pC
- Output Voltage: ±5 Vpk
- Temperature Range: -60 to 185 ºF

Product shown at actual size



Technical Specifications

Model Number	422M182
Performance	
Sensitivity (± 5 %) (Charge Conversion)	4 mV/pC
Low Frequency Response (-5 %)	2 Hz
High Frequency Response (2.2 mA)	30 kHz [2]
High Frequency Response (4 mA)	45 kHz [2]
High Frequency Response (20 mA)	30 kHz [2]
Non-linearity	≤ 1.0 % FS
Environmental	
Temperature Range (Operating)	-60 to +185 °F
	-51 to +85 °C
Temperature Response (Sensitivity Deviation)	<1 %
Electrical	
Excitation Voltage	22 to 28 VDC
Constant Current Excitation	2.2 to 20 mA
Output Voltage (at specified measurement range)	± 5 Vpk
Output Impedance	<250 ohm
Output Bias Voltage	12 to 16 VDC
Broadband Electrical Noise (1 to 10 kHz)	28 µV [1]
	-91 dB

Model Number	422M182
Electrical	
Spectral Noise (1 Hz)	10.0 µV/√Hz [1]
	-100 dB
Spectral Noise (10 Hz)	3.2 µV/√Hz [1]
	-110 dB
Spectral Noise (100 Hz)	1.0 µV/√Hz [1]
	-120 dB
Spectral Noise (1 kHz)	0.56 µV/√Hz [1]
	-125 dB
Spectral Noise (1 kHz)	0.56 µV/√Hz [1]
	-125 dB
Discharge Time Constant	0.25 sec
Resistance (Minimum required at input)	50,000 ohm
Source Capacitance Loading	0.0009 %/pF
Physical	
Housing Material	Aluminum
Electrical Connector (Input)	2-pin
Electrical Connector (Output)	BNC Jack
Weight	3.5 oz
	109 gm
Notes	
All specifications are at room temperature unless otherwise specified	
[1] Tested using voltage source and input capacitor equal to the feedback capacitor, to simulate a charge output sensor.	
[2] Above stated frequency, the amplifier becomes slew rate limited.	

Technical Specifications

Model Number	422E35	422E36	422E55/D	422E65/A	422E66/A
Performance					
Sensitivity (± 2 %) (Charge Conversion)	1 mV/pC	10 mV/pC	N/A	1 mV/pC	10 mV/pC
Sensitivity (± 2.5 %) (Charge Conversion)	N/A		0.5 mV/pC	N/A	
Input Range	± 2,500 pC	± 250 pC	± 2,500 pC	± 5,000 pC	± 500 pC
Low Frequency Response (-5 %)	5 Hz [2]		.05 Hz	5 Hz	10 Hz
High Frequency Response (-5 %)	N/A		100 kHz [6]	N/A	
High Frequency Response (2.2 mA)	30 kHz [3]	50 kHz [3]	30 kHz [4]	N/A	
High Frequency Response (4 mA)	60 kHz [3]	75 kHz [3]	60 kHz [4]	35 kHz [1][7]	90 kHz [1]
High Frequency Response (20 mA)	100 kHz [3]			N/A	
Non-linearity	≤ 1.0 % FS				
Environmental					
Temperature Range (Operating)	-65 to +250 °F				
	-54 to +121 °C				
Temperature Response (Sensitivity Deviation)	<2%				
Maximum Shock	1,000 g pk				
	9,810 m/s² pk				
Humidity Range	100%				
Radiation Exposure Limit (Integrated Gamma Flux)	N/A			≤ 1 Mrad	
Radiation Exposure Limit (Integrated Neutron Flux)	N/A			≤ 1010 N/cm²	
Electrical					
Excitation Voltage	+18 to 28 VDC				
Constant Current Excitation	2.2 to 20 mA				
Settling Time	<6 min			N/A	
Output Voltage	± 2.5 V			± 5 V	
Output Polarity	Inverted				
Output Impedance	<10 ohm			<20 ohm	
Output Bias Voltage	12 to 15 VDC			9 to 13 VDC	
Maximum Input Voltage	30 V			N/A	
Broadband Electrical Noise (1 to 10 kHz)	14 µV	26 µV	14 µV	7.0 µV [1]	17 µV
	-97 dB	-92 dB	-97 dB	-103 dB	-95 dB
Spectral Noise (1 Hz)	8.9 µV/√Hz [1]	13 µV/√Hz [1]	9.8 µV/√Hz [5]	5.0 µV/√Hz [1]	10 µV/√Hz [1]
	-101 dB	-98 dB	-100 dB	-106 dB	-100 dB
Spectral Noise (10 Hz)	0.85 µV/√Hz [1]	2.2 µV/√Hz [1]	3 µV/√Hz [5]	1.0 µV/√Hz [1]	2 µV/√Hz [1]
	-121 dB	-113 dB	-110 dB	-120 dB	-114 dB
Spectral Noise (100 Hz)	0.31 µV/√Hz [1]	0.5 µV/√Hz [1]	0.8 µV/√Hz [5]	0.1 µV/√Hz [1]	0.3 µV/√Hz [1]
	-130 dB	-126 dB	-122 dB	-140 dB	-130 dB
Spectral Noise (1 kHz)	0.17 µV/√Hz [1]	0.19 µV/√Hz [1]	0.4 µV/√Hz [5]	0.1 µV/√Hz [1]	0.05 µV/√Hz [1]
	-135 dB	-134 dB	-128 dB	-140 dB	-146 dB
Spectral Noise (10 kHz)	0.07 µV/√Hz [1]	0.1 µV/√Hz [1]	0.2 µV/√Hz [5]	0.05 µV/√Hz [1]	
	-143 dB	-140 dB	-134 dB	-146 dB	
Capacitance (Maximum allowable at input)	20,000 pF	2,000 pF		20,000 pF	
Discharge Time Constant	N/A		≥ 0.1 sec		≥ 0.05 sec
Resistance (Minimum required at input)	10,000 ohm				
Source Capacitance Loading	<0.0005 %/pF		-0.0005 %/pF	<0.0005 %/pF	
Physical					
Housing Material	Stainless Steel				
Sealing	Welded		Epoxy	Welded	
Electrical Connector (Input)	10-32 Coaxial				
Electrical Connector (Output)	BNC Jack			10-32 Coaxial	
Size (Diameter x Length)	0.52 in x 3.4 in			0.50 in x 3.0 in	
	13 mm x 86 mm			13 mm x 76 mm	
Weight	1.1 oz		1.15 oz	0.8 oz	
	31 gm		32.7 gm	23 gm	

Notes

All specifications are at room temperature unless otherwise specified

[1] Tested using voltage source and input capacitor equal to the feedback capacitor, to simulate a charge output sensor.
[2] The low frequency tolerance is accurate within ±10% of the specified frequency.
[3] Above stated frequency, the amplifier becomes slew rate limited.
[4] For CE reference PCB® Declaration of Conformance PS024 for details. A low-impedance connection from case to earth ground is required to maintain CE compliance.
[5] Typical
[6] High frequency response may be limited by supply current and output cable length.
[7] Slow rate limiting may result at higher frequencies

Optional Versions

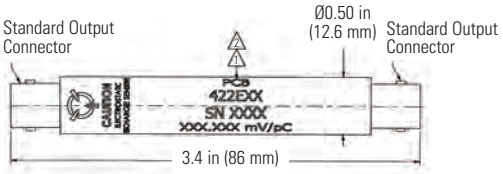
T - TEDS Capable of Digital Memory and Communication Compliant with IEEE P1451.4 For Models: 422E35, 422E36		N/A
Temperature Range (Operating)	-40 to +185 °F	N/A
	-40 to +85 °C	

Accessories & Cables: Pages 162-176

In-line Charge Converter

Model 422E55/D

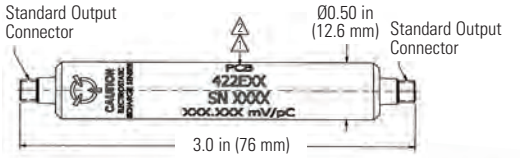
- Sensitivity: (±25%) 0.5 mV/pC
- Low frequency 0.5 Hz (-5%)
- 33 µV broadband electrical noise
- Common BNC connectors



In-line Charge Converter for Radiation Hardened Sensors

Model 422E65/A
Model 422E66/A

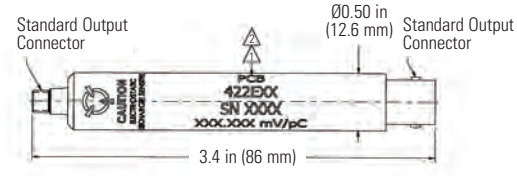
- Sensitivity: (±2%) (Charge Conversion)
  Model 422E65/A: 1 mV/pC
  Model 422E66/A: 10 mV/pC
- Output Voltage: ±5 V
- Temperature Range: (Operating)
  -65 to +250 °F (-54 to +121 °C)



In-line Charge Converter for High Temperature Sensors

Model 422E35
Model 422E36

- Sensitivity: (±2%) (Charge Conversion)
  Model 422E35: 1 mV/pC
  Model 422E36: 10 mV/pC
- Output Voltage: ±2.5 V
- Temperature Range: (Operating)
  -65 to +250 °F (-54 to +121 °C)



Portable Calibration Units

- Quickly verify sensor sensitivity while working in the field
- Lightweight designs transport easily
- Long battery life, rechargeable options

Industrial Portable Vibration Calibrator

Model 699A06

- Perform variable frequency & amplitude calibration
- Calibrate proximity probes with optional adaptor kit
- Portable, plug in or use battery power

best of sensors expo 2012 — 2012 WINNER

The 699A06 Industrial Portable Vibration Calibrator is the ideal tool to field check accelerometers, velocity transducers and proximity probes over a wide operating frequency and amplitude range. The unit is a small, handy, completely self-contained vibration reference source which can be conveniently used to validate the entire channel of transducers through measurement, monitoring or recording systems. Packaged in a ruggedized, weatherproof enclosure with two press and pull latches and padlockable clasps, the 699A06 is always ready for travel to test sites. With an integral, precision quartz reference accelerometer, the shaker table is built with robust carbon fiber composite armature flexure supports. Closed loop level control gives the 699A06 superior quality vibration calibration from 7 Hz to 10 kHz compared with other portable field calibrators.

Technical Specifications

Model Number	699A06
Performance	
Frequency Range (operating, 100 gram payload)	7 Hz to 10 kHz
	420 to 600,000 cpm
Maximum Amplitude (100 Hz with no payload)	20 g pk (196 m/s² pk)
	15 in/s pk (380 mm/s pk)
	50 mils pk-pk (1.27 mm pk-pk)
Maximum Payload [1]	Maximum Payload[1] 800 gram
Accuracy of Readout (measured with 10 gram quartz reference accelerometer)	
Acceleration (30 Hz to 2 kHz)	±3%
Acceleration (7 Hz to 2 kHz)	±1 dB
Velocity (30 Hz to 500 Hz)	±3%
Displacement (30 Hz to 150 Hz)	±3%
Amplitude Linearity (100 gram payload, 100 Hz)	<1% up to 10 g pk
Waveform Distortion (100 gram payload, 30 Hz to 2 kHz)	5% THD up to 5 g pk
Units of Readout	
Acceleration	g pk, g rms, m/s² pk, m/s² rms
Velocity	in/s pk, mm/s pk
Displacement	mils pk-pk, mm pk-pk
Frequency	Hz, CPM
Power Requirements	
Internal Battery (sealed solid gel lead acid)	12 VDC, 4 amp hours
AC Power (for recharging battery)	110-240 Volts, 50-60 Hz
Operating Battery Life [2]	
100 gram payload, 100 Hz 1 g pk	18 hours
100 gram payload, 100 Hz 10 g pk	1 hour

Model Number	699A06
Temperature	
Operating	32 to 122 °F
	0 to 50 °C
Physical	
Dimensions (H x W x D)	8.5" x 12" x 10"
	22 cm x 30.5 cm x 28 cm
Weight	18 lbs
	8.2 kg
Sensor Mounting Platform Thread Size	1/4-28
Notes	
[1] Operating range reduced at higher payloads. Reference manual for full details [2] As shipped from factory in new condition	
Accessory Products for 699A06	
600A22	Proximity probe adaptor kit, supports probes with common case threads ranging from M6 to 3/8". Includes Mitutoyo micrometer (metric) and nickel plated 4140 steel target.
600A23	Proximity probe adaptor kit, supports probes with common case threads ranging from M6 to 3/8". Includes Mitutoyo micrometer (metric) and nickel plated 4140 steel target.
600A24	Mounting accessory kit for 699A06 Portable Vibration Calibrators to adapt to 1/4-28 threaded mounting platforms. Includes studs/inserts (1/4-28, 10-32, 6-32 and 5-40) and bases (for adhesive, magnetic and custom thread patterns)
600A25	18 Volt, 1 amp power supply/charger for 9100D Portable Vibration Calibrator, universal 100-240 V, 50/60 Hz
9100-BAT01	Replacement battery for 699A06 Portable Vibration Calibrators

This handheld, portable shaker delivers a controlled, 1.0 g rms or 1 g pk vibration, at 159.2 Hz, for verifying vibration sensor operation and sensitivity. The unit accommodates sensors weighing up to 250 grams and is powered by four standard "AA" type batteries. An automatic shut off feature preserves battery life, however, continuous operation is switch selectable and an external DC power supply (Model 073A16) is available. Included is a nylon carry pouch with carry strap/belt loop.

Portable Reference Shaker

Model 699A02

Industry Exclusive!

- Calibrates permanently mounted accelerometers at the machine
- Verifies system performance
- Confirms operation of cables, switching devices and monitoring systems
- Can perform up to 1,600 operating cycles without loss of battery power

Technical Specifications

Model Number	699A02
Performance	
Operating Frequency (± 1 %)	159.2 Hz
Acceleration Output (± 3 %)	1 g rms
	9.81 m/s² rms [4]
Velocity Output	0.39 in/sec rms
	9.81 mm/s rms [5]
Displacement Output	0.39 mil rms
	9.81 mil rms [5]
Transverse Output	≤ 3 %
Distortion (0 to 250 grams load)	≤ 7 % [6]
Maximum Load	8.8 oz
	250 gm [7]
Automatic Switch Off Time	1.0 to 2.5 minutes [8]
Calibration Cycles (250 gram load)	90 cycles [3]
Environmental	
Temperature Range (Operating)	15 to 130 °F
	-10 to 55 °C
Electrical	
Ramp-Up time	≤ 3 sec [1]
Power Required (Standard)	Internal Battery
Power Required (Alternate)	DC power
Internal Battery (Quantity)	4
Internal Battery (Type)	AA [2]
DC Power (± 5 %)	to 10 VDC
DC Power	to 2.4 amps
Battery Life (250 gram load)	2.3 hours [3]

Model Number	699A02
Physical	
Size (Diameter x Height)	2.2 in x 7.8 in
	56 mm x 200 mm
Weight (with batteries)	31 oz
	900 gm [1]
Mounting Thread	1/4-28 Female [9][10]
Mounting Torque (Maximum)	to 10 in-lb [9]
Supplied Accessories	
	Model 073A15 Battery Pack (1) Model 081A40 Mounting Stud (1) Model M081A19 Mounting stud, 1/4-28 to M6 x 1, SS with shoulder (1)

Notes

All specifications are at room temperature unless otherwise specified

[1] Typical
[2] Alkaline type recommended for longest service life
[3] Approximate values, based on automatic switch off time and dependent on type of batteries
[4] Unit supplied set to rms; see manual for peak selection
[5] Calculated values for reference only
[6] Typical max for range
[7] For sensors weighing <75 grams add Model 080A136 mass
[8] Unit supplied set to auto shut off; see manual for continuous use selection
[9] Transducer to shaker table
[10] Test sensor should be hand tightened (without tools)
[11] For CE reference PCB® Declaration of Conformance PS022 for details

Mounting Hardware

Magnetic mounting offers the most convenient method of temporary sensor installation for route-based measurements and data collection. IMI Sensors magnetic mounting bases feature rare-earth magnet elements to achieve high attraction forces to the test structure. This aids in high frequency transmissibility and assures attraction for weighty sensors and conditions of high vibration. Rail mount styles are utilized for curved surfaces, such as motor housings and pipes. Knurled housings aid in gripping for removal.

Note: Exercise caution when installing magnetically mounted sensors by engaging the edge of the magnet with the structure and carefully rolling the sensor/magnet assembly to an upright position. Never allow the magnet to impact against the structure as this may create shock acceleration levels that saturate the sensor. When the sensor is saturated users should wait a few seconds for the accelerometer to settle prior to taking data.

Flat Surface Magnet
Model 080A120

Flat Surface Magnet
Model 080A121

Flat Surface Magnet
Model 080A122

Curved Surface Magnet
Model 080A130

Curved Surface Magnet
Model 080A131

Curved Surface Magnet
Model 080A132

Curved Surface Magnet
Model 080A133

Magnetic Mounting Bases			
Model Number	**Diameter**	**Thread**	**Pull Strength**
For Flat Surface			
Model 080A120*	0.75 in (19 mm)	1/4-28 (M6 x 1.0) stud	15 lb (67 N)
Model 080A121*	1 in (25 mm)	1/4-28 (M6 x 1.0) stud	35 lb (156 N)
Model 080A122*	1.5 in (38 mm)	1/4-28 (M6 x 1.0) stud	50 lb (222 N)
For Curved Surface			
Model 080A130*	0.75 in (19 mm)	1/4-28 (M6 x 1.0) stud	15 lb (67 N)
Model 080A131*	1 in (25 mm)	1/4-28 (M6 x 1.0) stud	35 lb (156 N)
Model 080A132*	1.5 in (38 mm)	1/4-28 (M6 x 1.0) stud	55 lb (245 N)
Model 080A133*	2 in (51 mm)	1/4-28 (M6 x 1.0) stud	85 lb (378 N)
Notes			
* For models with metric dimensions, please use "M" prefix with model number listed above.			

These mounting pads may be adhesively bonded or welded to machinery surfaces at specific vibration sensor installation points. The pads ensure that periodic measurements are always taken from the exact same location, lending to more accurate and repeatable measurement data. Pads with tapped holes are for use with stud mounted sensors whereas the untapped pads are intended for use with magnetically mounted sensors. For permanent installations, the pads facilitate mounting of sensors without actually machining the surface onto which they are to be installed. Untapped pads may be utilized to achieve magnetic attraction on non-ferrous surfaces. All mounting pads are manufactured from resilient, stainless steel.

Sensor Mounting Pad
Model 080A91

Sensor Mounting Pad
Model M080A118

Sensor Mounting Pad
Model 080A93

Mounting Pad
Model 080A92

Mounting Pad
Model 080A94

The quick disconnect adhesive pad and mating connector system allows for 1/4-turn mounting of sensors during route-based measurements. Simply install the adhesive pad at your monitoring locations and screw the mate onto the bottom of the accelerometer. The system shortens data collection time while providing a target for consistent sensor placement.

Quick-connect Mounting Base
Model 080A69

Quick-connect Mounting Stud
Model 081A69

1/4-28 Mounting Stud
Model 081A40

1/2-20 to 1/4-28 Mounting Stud
Model 080A156

1/2-20 to M6x1 Mounting Stud
Model M080A159

1/4-28 to M6x1 Mounting Stud
Model M081A61

1/4-28 Through-bolt
Model 081A73

M6x1 Through-bolt
Model M081A73

1/4-28 Through-bolt
Model 081A97

M6x1 Through-bolt
Model M081A97

Sensor Mounting Pads

Model Number	Diameter	Tapped Hole
Model 080A91	1.375 in (35 mm)	1/4-28 Stud (M6 x 1.0)
Model 080A118*	1 in (25 mm)	
Model 080A93	0.75 in (19 mm)	
Model 080A92	1.375 in (35 mm	N/A
Model 080A94	0.75 in (19 mm)	

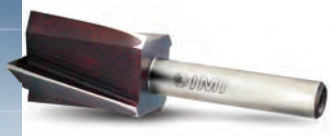
Notes
* For models with metric dimensions, please use "M" prefix with model number listed above.

Sensor Mounting Studs

Model Number	Thread	Comments
Model 081A40	1/4-28	SS with brass tip, socket head, .375 in
Model 080A156	1/2-20 to 1/4-28	For use with 607A11 and 607A61
Model M080A159	1/2-20 to M6x1	For use with M607A11 and M607A61
Model M081A61	1/4-28 to M6x1	BeCu, no shoulder
Model 081A73	1/4-28 to 1.34 in	For use with Series 625B
Model M081A73	M6x1 to 34 mm	For use with Series 625B
Model 081A97	1/4-28 x 1.0 in	For use with Series 602 and Model 635A01
Model M081A97	M6x1 x 25.4 mm	For use with Series M602 and Model M635A01

Mounting Hardware

Spot face tools install into a drill and prepare the machine surface for accelerometer mounting, creating a smooth surface and pilot hole. The pilot hole is then tapped to fit the sensor's mounting thread.



1" Spot Face Tool
Model 080A137

1.25" Spot Face Tool
Model 080A128

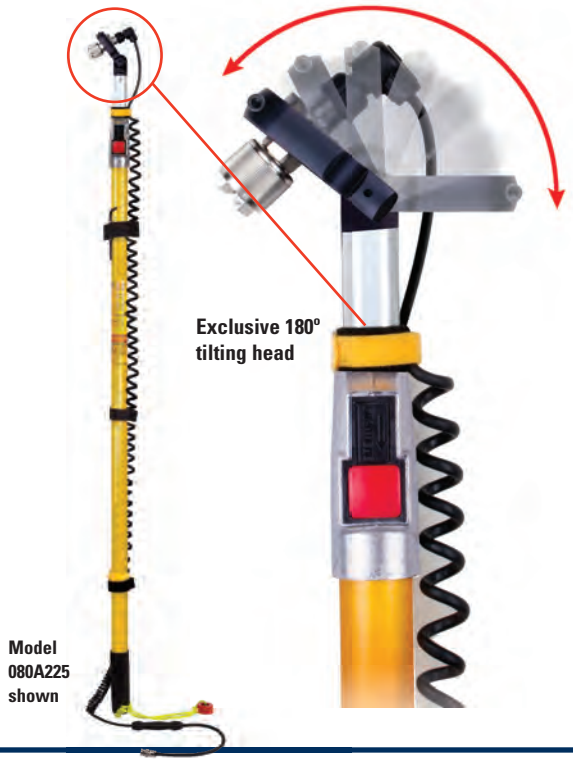
1.5" Spot Face Tool
Model 080A129

These epoxy kits provide a secure means for mounting accelerometers and adhesive mounting bases to machine structures. The small kit is intended for mounting approximately 10 sensors; and the large kit is intended for approximately 100 senors.

Small Adhesive Kit
Model 075A05

Large Adhesive Kit
Model 075A06

IMI Sensors offers Data Collection Extension Poles which allow vibration technicians the ability to stay on the ground, away from heat sources, while collecting the data required to maintain the reliability of your machinery. The extension pole also offers quick access to measurement points, contributing to the overall efficiency of your routes.



The data collection poles are designed to be flexible to your specific applications and equipment. IMI® supplies cables & connectors to perfectly fit any modern data collector/analyzer manufacturer. High temperature bushings are included to adapt to your preferred sensor.

Data Collection Extension Pole

Model 080A225: 4-7 ft
Model 080A226: 6-11 ft

- Keeps technicians on the ground and away from heat sources, reducing the need for safety harnesses and other equipment
- Non-conductive properties reduce the risk of electric shock
- Includes multiple high temperature bushings to fit your preferred vibration sensor
- Spring loaded head tilts 180º for proper sensor placement (US Patent #27,076,138)

Sensor Bushings

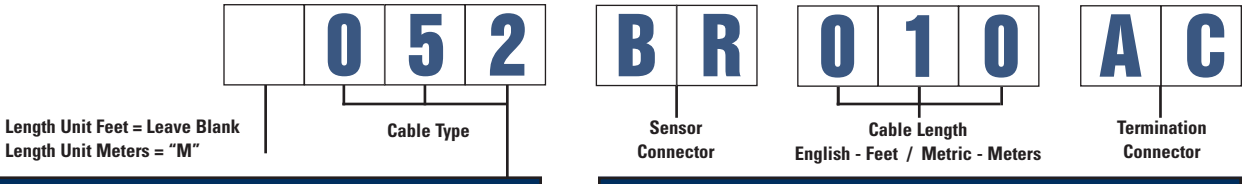
400 ºF (204 ºC) High Temp Bushings, 70 Durometer

1/2" Outer Diameter
5/8" Outer Diameter
7/8" Outer Diameter
1" Outer Diameter
1 1/4" Outer Diameter

Cables & Connectors

How To Order Custom Cables:

1. First determine whether the cable shall be ordered in English or Metric unit lengths
2. Choose the desired cable. (See "Standard Cable Types" below for cable specifications)
3. Find the connector that mates to the sensor.
4. Determine the length of cable required
5. Choose the cable termination connector. (See "Standard Connector Types" below)
6. Fill the squares with appropriate letter or number designation:



Standard Cable Types

		Shielded, Twisted Pair	Diameter	Max Temp.
	044	Coiled, polyurethane jacket	0.170 in (4.6 mm)	+ 176 °F (+80 °C)
	045	High temperature, PFA jacket	0.204 in (5.2 mm)	+ 500 °F (+260 °C)
	047	Steel armored, polyurethane	0.410 in (10.4 mm)	+ 250 °F (+121 °C)
	048	Steel armored, high temperature FEP	0.268 in (6.8 mm)	+ 392 °F (+200 °C)
	050	Coiled, lightweight, TPE jacket	0.210 in (5.3 mm)	+ 176 °F (+80 °C)
CE	052	General purpose, polyurethane jacket	0.250 in (6.4 mm)	+ 250 °F (+121 °C)
CE	053	High temperature, FEP jacket	0.157 in (4 mm)	+ 392 °F (+200 °C)
	055	High temperature, FEP jacket	0.190 in (4.8 mm)	+ 392 °F (+200 °C)
CE	058	Coiled, heavy duty, polyurethane	0.250 in (6.4 mm)	+ 250 °F (+121 °C)
		Shielded, Multi-conductor		
	043	Steel armored, 4-cond., polyurethane	0.410 in (10.4 mm)	+ 250 °F (+121 °C)
	046	16 pair (32-conductor), PVC jacket	0.70 in (17.8 mm)	+ 221 °F (+105 °C)
	049	12 pair (24-conductor), PVC jacket	0.60 in (15.2 mm)	+ 220 °F (+105 °C)
	056	3-conductor, FEP jacket	0.190 in (4.8 mm)	+ 392 °F (+200 °C)
	057	4-conductor, FEP jacket	0.190 in (4.8 mm)	+ 392 °F (+200 °C)
CE	059	4-conductor, polyurethane jacket	0.250 in (6.4 mm)	+ 250 °F (+121 °C)

Notes

* CE indicates that cable maintains CE conformance

Example:

Model 052BR010AC defines a 10 ft, general purpose, polyurethane jacketed, shielded, twisted pair cable with a 2-pin socket MIL-style MS3106 composite sensor connector and a BNC plug termination connector.

Standard Connector Types

Code	Connector
2-socket Plugs	
AE	MIL-style connector MS3106 with environmental boot
AM	MIL connector MS3106
AP	MIL connector MS3106 with strain relief
BP	MIL connector MS3106 for high temperatures with strain relief
BQ	MIL-style connector MS3108 right angle, composite
BR	MIL-style connector MS3106, composite
CJ	MIL-style connector MS3116 Bayonet style
DN	MIL-style connector MS3106, composite, with stainless steel clamp ring
EC	MIL-style connector MS3106 with environmental boot, lock ring and adaptor
ER	MIL-style connector for high temperatures
FV	MIL connector with environmentally sealed boot
ET	MIL-style connector "mini MIL" 7/16-27 Thread
LQ	2-socket MIL connector extended strain relief
LU	3-pin half of break-away connector (mates with LV)
LV	3-socket half of break-away connector (mates with LU)
PA	High temperature 2-socket MIL connector
PB	High temperature right angle 2-socket MIL connector
Other Multi-pin or Socket	
AN	4-socket, MIL connector MS3116
BV	3-socket, MIL-style connector MS3106
BY	28-pin Bayonet, for switch box MO option 691B47
CE	MIL-style connector with strain relief
CV	25-pin D style for CSI data collector interface
CW	25-pin D style for SKF data collector interface
DP	7-pin LEMO style for Entek data collector interface
DR	4-socket MIL-style connector MS3116 Bayonet style
DS	3-pin MIL-style connector MS3106 with environmental boot
EF	3-socket, MIL-style connector MS3106, nylon
EG	Multi-pin bayonet
FY	3-socket, MIL-style connector with environmental boot
GV	11-pin Fischer style for DLI data collector interface
HC	4-socket, MIL-style connector MS3116
HM	6-pin Fischer style for DLI data collector interface
HX	5-pin Turck for CSI 2130 DAQ
LG	Two BNC double splice, BNC's labeled vib & temp
NF	Three BNC triple splice, BNC's labeled x, y, z, shield grounded
Coaxial	
AB	BNC jack
AC	BNC plug
Miscellaneous Terminations	
AD	Pigtail (leads stripped and tinned)
BZ	Blunt cut

Cables & Connectors

Polyurethane Cable, 2-conductor Twisted Pair, Shielded

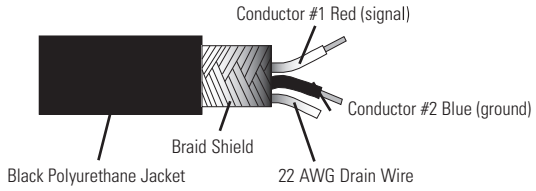
Model 052 Cable

- Flexible cable, durable and easy to work with.
- Braided shield twists into drain wire
- Seals out moisture

Cable Information & Cordset Options

Model 052 Cable

Cable Construction



Technical Specifications

Cable Jacket Material	Polyurethane
Temperature Range	-58 to 250 °F
	-50 to 121 °C
Capacitance	36 pF/ft
	118 pF/m
Cable Jacket Diameter	.250 in
	6.35 mm
Number of Conductors	2
Shield Type	Braid (90% minimum coverage)
AWG (Gauge)	20

Popular Cable Assemblies

Molded Composite 2-socket MIL to Blunt Cut
Model 052BRXXXBZ

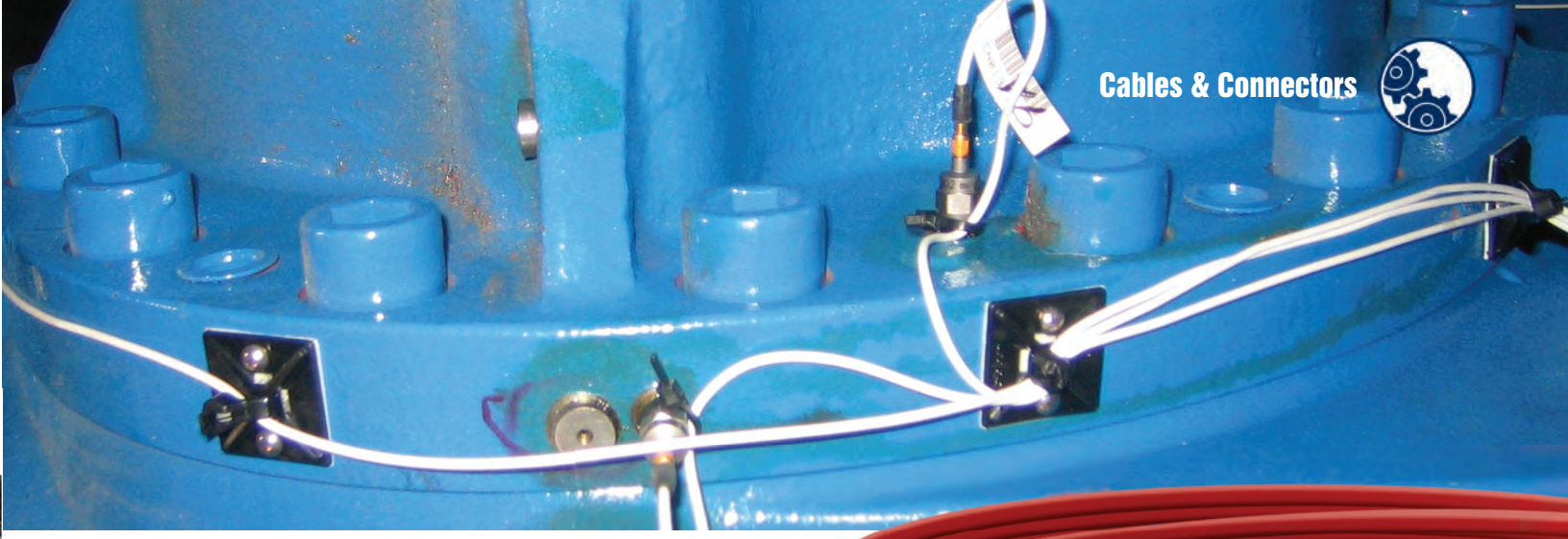
Silicone Environmental Push-On Boot 2-socket MIL to Blunt Cut
Model 052AEXXXBZ

Molded Composite Right Angle 2-socket MIL To BNC Plug
Model 052BQXXXAC

Molded Composite Right Angle 2-socket MIL to Blunt Cut
Model 052BQXXXBZ

Molded Composite 2-socket MIL To BNC Plug
Model 052BRXXXAC

Performance	Typical Usage	Stock Cable Lengths
052BQXXXBZ	Indoor/outdoor permanent mount sensor applications where low profile is required	10 ft, 30 ft, 50 ft
052AEXXXBZ	Indoor/outdoor applications where sensor will need to endure extreme wet conditions	30 ft, 50 ft
052BRXXXAC	Straight cable with BNC for route-based data collection or permanent mount installations	10 ft
052BQXXXAC	Straight cable with BNC and right angle 2-socket MIL for route-based data collection	Built to order



High Temperature FEP Cable 2-conductor Twisted Pair with Drain, Shielded

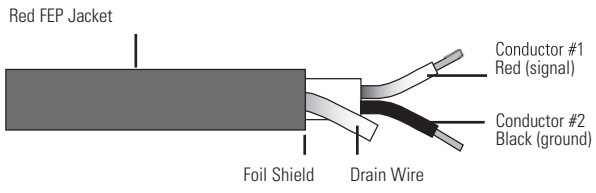
Model 053 Cable

- Thin, slides easily, ideal for pulling through conduit & cable trays
- Drain wire attached to foil shield
- High temperature capability when paired with proper connector

Cable Information & Cordset Options

Model 053 Cable

Cable Construction



Technical Specifications

Cable Jacket Material	FEP
Temperature Range	-90 to 392 °F -70 to 200 °C
Capacitance	51 pF/ft 167.3 pF/m
Cable Jacket Diameter	.154 in 3.91 mm
Number of Conductors	2
Shield Type	Aluminum / Mylar
AWG (Gauge)	18

Popular Cable Assemblies

Molded Composite 2-socket MIL to Blunt Cut
Model 053BRXXXBZ

Silicone Environmental Push-On Boot 2-socket MIL-style to Blunt Cut
Model 053AEXXXBZ

Molded Composite Right Angle 2-socket MIL-style to Blunt Cut
Model 053BQXXXBZ

Aluminum 2-socket MIL with Collar Strain Relief to Blunt Cut
Model 053BPXXXBZ

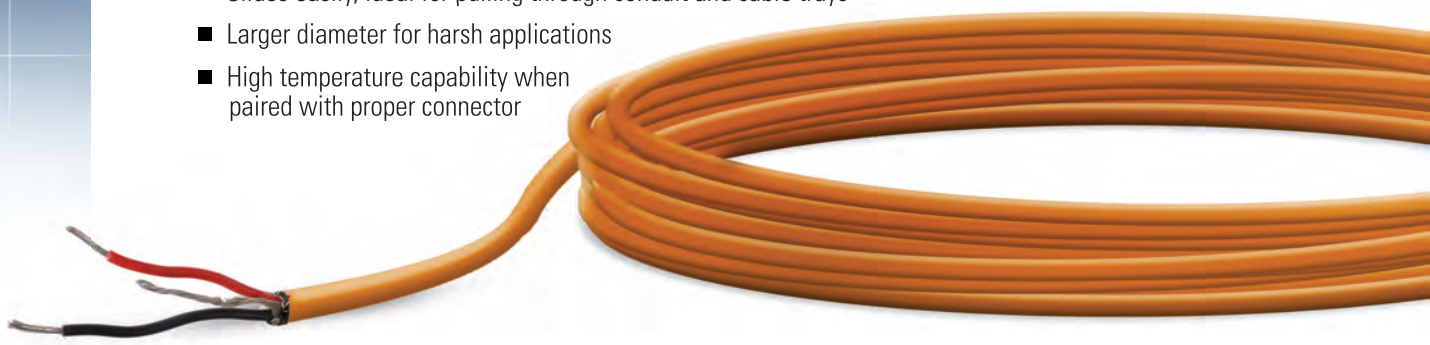
Performance	Typical Usage	Stock Cable Lengths
053BRXXXBZ	Indoor/Outdoor permanent mount sensor applications	10 ft, 20 ft, 30 ft, 50 ft
053BQXXXBZ	Indoor/Outdoor permanent mount sensor applications where low profile is required	Built to order
053AEXXXBZ	High temperature installations (over 250 °F) and extreme wet conditions	Built to order
053BPXXXBZ	High temperature installations (over 250 °F) where metal sensor connector is preferred	Built to order

Cables & Connectors

High Temperature FEP Cable 2-conductor Twisted Pair, Shielded

Model 055 Cable

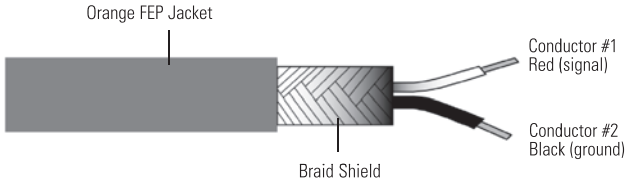
- Slides easily, ideal for pulling through conduit and cable trays
- Larger diameter for harsh applications
- High temperature capability when paired with proper connector



Cable Information & Cordset Options

Model 055 Cable

Cable Construction



Technical Specifications

Cable Jacket Material	FEP
Temperature Range	-85 to 392 °F -65 to 200 °C
Capacitance	27 pF/ft 89 pF/m
Cable Jacket Diameter	.19 in 4.83 mm
Number of Conductors	2
Shield Type	Braid (85% minimum coverage)
AWG (Gauge)	20

Popular Cable Assemblies

High Temperature Molded Composite 2-socket MIL-style to Blunt Cut
Model 055PAXXXBZ

Silicone Environmental Push-on Boot 2-socket MIL-style to Blunt Cut
Model 055AEXXXBZ

Aluminum 2-socket MIL with Collar Strain Relief to Blunt Cut
Model 055BPXXXBZ

High Temperature Molded Composite Right Angle 2-socket MIL-style to Blunt Cut
Model 055PBXXXBZ

Silicone Environmental Push-On Boot with Steel Locking Ring 2-socket MIL-style to Blunt Cut
Model 055ECXXXBZ

FKM Environmental Push-On Boot 2-socket MIL-style to Blunt Cut
Model 055M05/XXX

Performance	Typical Usage	Stock Cable Lengths
055PAXXXBZ	High temperature (over 250 °F) permanent mount sensor applications	Built to order
055PBXXXBZ	High temperature (over 250 °F) permanent mount sensor applications where low profile is required	30 ft, 50 ft
055AEXXXBZ	High temperature installations (over 250 °F) and extreme wet conditions	Built to order
055ECXXXBZ	High temperature installations (over 250 °F), extreme wet conditions, cable must be locked on sensor	Built to order
055BPXXXBZ	High temperature installations (over 250° F) where metal sensor connector is preferred	Built to order
055M05	Acidic or corrosive installations	Built to order

Very High Temperature Low Noise PFA Cable 2-conductor Twisted Pair, Shielded

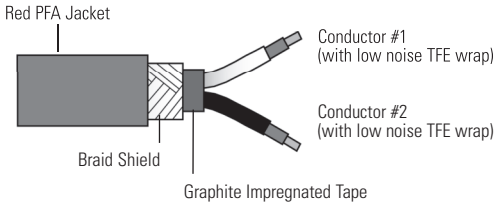
Model 045 Cable

- Designed for extreme high temperature applications
- Slides easily, ideal for pulling through conduit & cable trays
- Larger diameter for harsh applications

Cable Information & Cordset Options

Model 045 Cable

Cable Construction



Technical Specifications

Cable Jacket Material	PFA
Temperature Range	-130 to 500 °F
	-90 to 260 °C
Capacitance	35 pF/ft
	114.83 pF/m
Cable Jacket Diameter	.204 in
	5.18 mm
Number of Conductors	2
Shield Type	Braid (85% minimum coverage)
AWG (Gauge)	22

Popular Cable Assemblies

Extreme High Temperature 2-socket MIL to Blunt Cut
Model 045ERXXXBZ

Extreme High Temperature 2-socket Mini-MIL to Blunt Cut
Model 045ETXXXBZ

Performance	Typical Usage	Stock Cable Lengths
045ERXXXBZ	Extreme high temperature installations up to 500 °F	Built to order
045ETXXXBZ	Connects to on-turbine combustion dynamics pressure sensors	Built to order

Cables & Connectors

High Temperature Armor Jacketed FEP Cable 2-conductor, Twisted Pair with Drain, Shielded

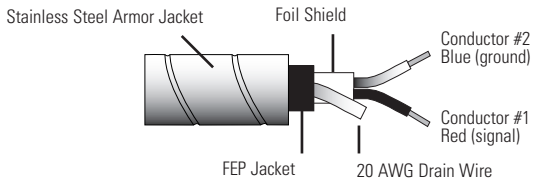
Model 048 Cable

- Armor jacket protects cable from abuse
- Small diameter armor jacket makes for easy handling and installation
- High temperature capability when paired with proper connector

Cable Information & Cordset Options

Model 048 Cable

Cable Construction



Technical Specifications

Cable Jacket Material	FEP
Temperature Range	-90 to 392 °F
	-70 to 200 °C
Capacitance	51 pF/ft
	167.3 pF/m
Cable Jacket Diameter	.154 in
	3.91 mm
Number of Conductors	2
Shield Type	Aluminum / Mylar
AWG (Gauge)	18

Popular Cable Assemblies

Aluminum 2-socket MIL with Collar Strain Relief to Blunt Cut
Model 048APXXXBZ

Silicone Environmental Push-On Boot 2-socket MIL-style to Blunt Cut
Model 048AEXXXBZ

High Temperature Aluminum 2-socket MIL with Collar Strain Relief to Blunt Cut
Model 048BPXXXBZ

Silicone Environmental Push-On Boot with Steel Locking Ring 2-socket MIL-style to Blunt Cut
Model 048ECXXXBZ

Performance	Typical Usage	Stock Cable Lengths
048APXXXBZ	Rugged installations where metal sensor connector is preferred	Built to order
048BPXXXBZ	Rugged high temperature installations (over 250 °F) where metal sensor connector is preferred	Built to order
048AEXXXBZ	Rugged high temperature installations (over 250 °F) and extreme wet conditions	Built to order
048ECXXXBZ	Rugged high temperature installations (over 250 °F), extreme wet conditions, cable must be locked on sensor	Built to order

Armor Jacketed Polyurethane Cable, 2-conductor Twisted Pair, Shielded

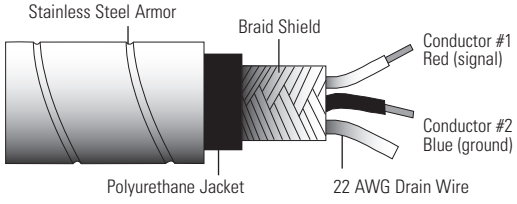
Model 047 Cable

- Armor jacket protects cable from abuse
- Largest diameter armor jacket
- Heat-shrink at blunt end seals out moisture

Cable Information & Cordset Options

Model 047 Cable

Cable Construction



Technical Specifications

Cable Jacket Material	Polyurethane
Temperature Range	-58 to 250 °F
	-50 to 121 °C
Capacitance	36 pF/ft
	118 pF/m
Cable Jacket Diameter	.250 in
	6.35 mm
Number of Conductors	2
Shield Type	Braid (90% minimum coverage)
AWG (Gauge)	20

Popular Cable Assemblies

Aluminum 2-socket MIL to Blunt Cut
Model 047AMXXXBZ

Silicone Environmental Push-On Boot with Steel Locking Ring 2-socket MIL-style to Blunt Cut
Model 047ECXXXBZ

Performance	Typical Usage	Stock Cable Lengths
047AMXXXBZ	Rugged installations where metal sensor connector is preferred	Built to order
047ECXXXBZ	Rugged installations (over 250 °F), wet conditions, cable must be locked on sensor	Built to order

Cables & Connectors

General Purpose, Coiled Polyurethane Jacket Twisted Pair, Shielded

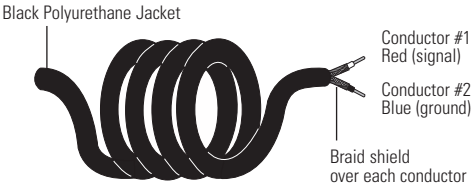
Model 050 Cable

- Ideal for route-based predictive maintenance with portable analyzer
- Many major data collector terminations available for immediate delivery
- Stays coiled despite heavy usage

Cable Information & Cordset Options

Model 050 Cable

Cable Construction



Technical Specifications

Cable Jacket Material	Thermoplastic Elastomer
Temperature Range	-22 to 176 °F
	-30 to 80 °C
Capacitance	31 pF/ft
	102 pF/m
Cable Jacket Diameter	.21 in
	5.33 mm
Number of Conductors	2
Shield Type	Braid (90% minimum coverage)
AWG (Gauge)	23

Popular Cable Assemblies

2-socket MIL with Extended Strain Relief Ergonomic Design to BNC Plug
Model 050LQXXXAC

2-socket MIL with Extended Strain Relief to 25-pin D-Sub
Model 050FVXXXCW

7-pin Connector to BNC Plug
Model 050DPXXXAC

2-socket MIL with Extended Strain Relief Ergonomic Design to 5-pin Connector
Model 050LQXXXHX

2-socket MIL with Extended Strain Relief to 6-pin Connector
Model 050FVXXXHM

Five-pin Connector to BNC Plug
Model 050HXXXXAC

2-socket MIL with Extended Strain Relief Ergonomic Design to 7-pin Connector
Model 050LQXXXDP

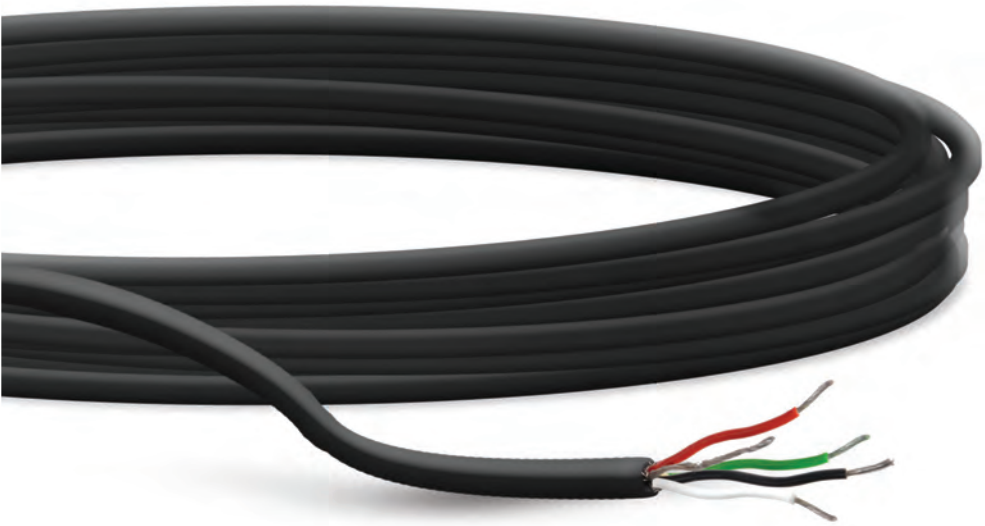
BNC Plug to BNC Plug
Model 050ACXXXAC

BNC Plug to 25-pin D-sub
Model 050ACXXXCV

2-socket MIL with Extended Strain Relief to 25-pin D-Sub
Model 050FVXXXCV

See Page 176 for Information on Optional
Breakaway Safety Connector

Performance	Typical Usage	Stock Cable Lengths
050LQXXXAC	Commtest & Datastick analyzers	6 ft & 10 ft
050LQXXXHX	Emerson/CSI 2130 analyzer	6 ft & 10 ft
050LQXXXDP	Rockwell/Entek Datapak/Enpac analyzers	6 ft
050FVXXXCV	Emerson/CSI 2110, 2115 & 2120 analyzers	Built to order
050FVXXXCW	SKF Microlog® analyzers	Built to order
050FVXXXHM	SKF GX® series & Azima-DLI DCA-31 analyzers	Built to order
050ACXXXAC	Connect accelerometer switch box outputs to Commtest & Datastick analyzers	Built to order
050DPXXXAC	Connect accelerometer switch box outputs to Rockwell/Entek Datapak/Enpac analyzers	Built to order
050HXXXXAC	Connect accelerometer switch box outputs to Emerson/CSI 2130 analyzer	Built to order
050ACXXXCV	Connect accelerometer switch box outputs to Emerson/CSI 2110, 2115 & 2120 analyzers	Built to order



4-conductor, Shielded, Polyurethane Jacketed Cable

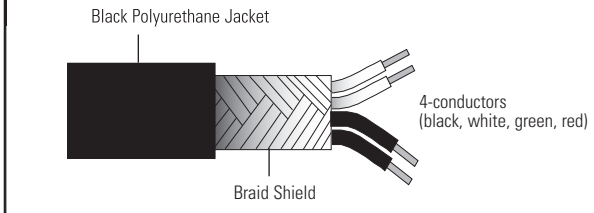
Model 059 Cable

- Four conductor cable for use with triaxial, biaxial, dual temperature and vibration accelerometers
- Ideal for 4-20 mA loop-powered sensors with additional raw vibration or temperature output
- Braided shield twists into drain wire

Cable Information & Cordset Options

Model 059 Cable

Cable Construction



Technical Specifications

Cable Jacket Material	Polyurethane
Temperature Range	-58 to 250 °F
	-50 to 121 °C
Capacitance	36 pF/ft
	118 pF/m
Cable Jacket Diameter	.250 in
	6.35 mm
Number of Conductors	4
Shield Type	Braid (90% minimum coverage)
AWG (Gauge)	20

Popular Cable Assemblies

Aluminum 4-socket MIL to Blunt Cut
Model 059ANXXXBZ

Molded Composite 3-socket MIL-style to Blunt Cut
Model 059BVXXXBZ

Aluminum 3-socket MIL to Blunt Cut
Model 059GTXXXBZ

Aluminum 4-socket MIL to 3 BNC's Labeled X, Y, Z, Shield Grounded
Model 059ANXXXNF

Molded Composite 3-socket MIL-style to 2 BNC's Labeled Temperature & Vibration
Model 059BVXXXLH

Aluminum 4-socket MIL to Blunt Cut
Model 059HCXXXBZ

Aluminum 4-socket MIL to 5-pin Connector
Model 059ANXXXHX

Molded Composite 3-socket MIL-style to Blunt Cut
Model 059EFXXXBZ

Aluminum 4-socket MIL to 11-pin Connector
Model 059ANXXXGV

Molded Composite 3-socket MIL-style to 2 BNC's Labeled X & Y
Model 059EFXXXLG

Performance	Typical Usage	Stock Cable Lengths
059ANXXXBZ	Triaxial accelerometers to terminal block	Built to order
059ANXXXNF	Triaxial accelerometers to DAQ with BNC jack input	10 ft
059ANXXXHX	Triaxial accelerometers to CSI 2130 analyzer	Built to order
059ANXXXGV	Triaxial accelerometers to Azima-DLI DCX analyzer	Built to order
059BVXXXBZ	Dual temperature & vibration accelerometers, 4-20 mA transmitters with raw vibration to terminal block	Built to order
059BVXXXLG	Dual temperature & vibration accelerometers, 4-20 mA transmitters with raw vibration to DAQ with BNC jack input	Built to order
059EFXXXBZ	Bi-axial accelerometers to terminal block	Built to order
059EFXXXLG	Bi-axial accelerometers to DAQ with BNC jack input	Built to order
059GTXXXBZ	Rugged connection of temperature & vibration, bi-axial or 4-20 with raw vibration to terminal block	Built to order
059HCXXXBZ	4-20 mA vibration transmitters with temperature output (TO64 series)	Built to order

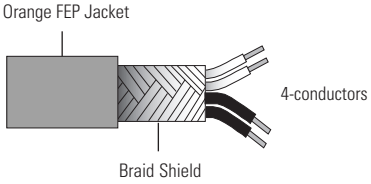
Cables & Connectors

Contact IMI Sensors for more information on configurations for the cables featured on this page

High Temperature FEP Cable 4-conductor, Shielded

Model 057 Cable

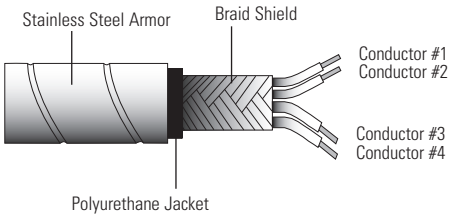
- Four-conductor cable for use with triaxial, biaxial, dual temperature and vibration accelerometers
- Ideal for 4-20 mA loop-powered sensors with additional raw vibration or temperature output
- For corrosive and high temperature applications when paired with proper connector



Armor Jacketed, Polyurethane Cable, 4-conductor, Shielded

Model 043 Cable

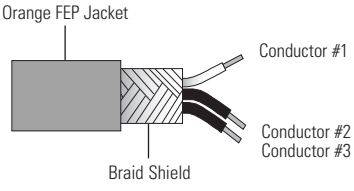
- Four-conductor cable for use with triaxial, biaxial, dual temperature and vibration accelerometers
- Ideal for 4-20 mA loop-powered sensors with additional raw vibration or temperature output
- Armor jacket protects cable from abuse



High Temperature FEP Cable, 3-conductor Twisted, Shielded

Model 056 Cable

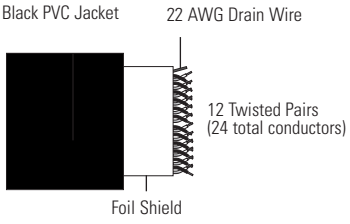
- Three-conductor cable for use with triaxial, biaxial, dual temperature and vibration accelerometers
- Ideal for 4-20 mA loop-powered sensors with additional raw vibration or temperature output
- For corrosive and high temperature applications when paired with proper connector



24-conductor Cable with Overall Shield and PVC Jacket

Model 049 Cable

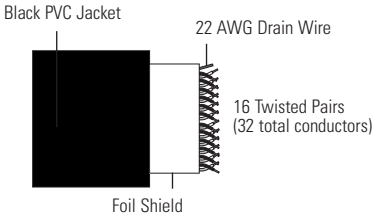
- Consolidate up to 12 channels worth of data into one cable bundle
- For use with cable interface boxes and cable-consolidating switch boxes
- Saves money and space over long cable runs to control room



PVC Cable, 32-conductor, Twisted Pairs, Overall Shielded

Model 046 Cable

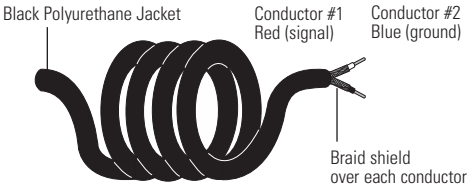
- Consolidate up to 16 channels worth of data into one cable bundle
- For use with model 691B47 16 channel cable-consolidating switch box
- Saves money and space over long cable runs to control room



Coiled, Lightweight, Shielded, 2-conductor

Model 044 Cable

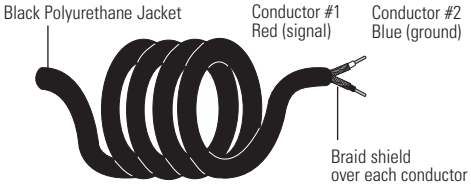
- Ideal for route-based predictive maintenance with portable analyzer
- Lightweight, easy to carry and handle
- Stays coiled despite heavy usage



Coiled, Heavy Duty, Shielded, Twisted

Model 058 Cable

- Ideal for route-based predictive maintenance with portable analyzer
- Heavy duty, thick cable designed for very rugged situations
- Stays coiled despite heavy usage



Technical Specifications

Model Number	057 Cable	043 Cable	056 Cable	049 Cable	046 Cable	044 Cable	058 Cable
Cable Jacket Material	FEP	Polyurethane	FEP	Polyvinyl Chloride	Polyvinyl Chloride	Polyurethane	Polyurethane
Temperature Range	-85 to 392 °F	-58 to 250 °F	-85 to 392 °F	-40 to 221 °F	-40 to 221 °F	-76 to 176 °F	-58 to 250 °F
	-65 to 200 °C	-50 to 121 °C	-65 to 200 °C	-40 to 105 °C	-40 to 105 °C	-60 to 80 °C	-50 to 121 °C
Capacitance	24 pF/ft	36 pF/ft	27 pF/ft	23 pF/ft	23 pF/ft	20 pF/ft	36 pF/ft
	79 pF/m	118 pF/m	89 pF/m	76 pF/m	76 pF/m	66 pF/m	118 pF/m
Cable Jacket Diameter	.19 in	.250 in	.19 in	.61 in	.70 in	.17 in	.250 in
	4.83 mm	6.35 mm	4.83 mm	15.5 mm	17.8 mm	4.32 mm	6.35 mm
Number of Conductors	4	4	3	24	32	2	2
Shield Type	Braid (85% minimum coverage)	Braid (90% minimum coverage)	Braid (85% minimum coverage)	Aluminum / Mylar	Aluminum / Mylar	Spiral (90% minimum coverage)	Braid (97% minimum coverage)
AWG (Gauge)	22	20	20	20	20	20	20

Breakaway Safety Connector

Breakaway Safety Connector

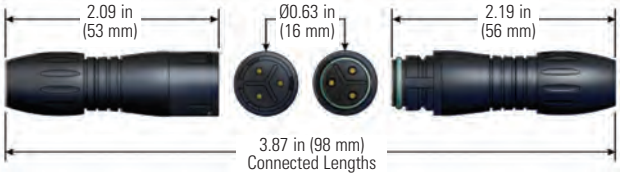
- Prevents technicians from being pulled into rotating machinery
- Flexible ordering options allows for quick, in-field adaptations
- Many popular data collector terminations in stock

Product shown at actual size

Cable Information & Cordset Options

Breakaway Safety Connector

Cable Construction



Technical Specifications

Connector Style	Circular Breakaway
Connector Type	3 Socket (female) / 3 Pin (male)
Coupling Method	Snap-On
Strain Relief	Potted
Temperature Range	-40 to +176 °F
	-40 to +80 °C
Shell Protection	IP67
Housing Material	Plastic
Size (OD x Length)	0.75 in x 2.2 in
	19 mm x 57 mm
Weight	0.39 oz
	11.1 gm

6 ft. Coiled Cable, 2-socket MIL with Extended Strain Relief to 3-pin Half Breakaway Connector
Model 050LQ006LU Cable*

***Model 050LQ006LU required. Choose option below that corresponds with your data acquisition equipment.**

3-socket Half Breakaway Connector to 5-pin Connector
Model 052LVXXXHX

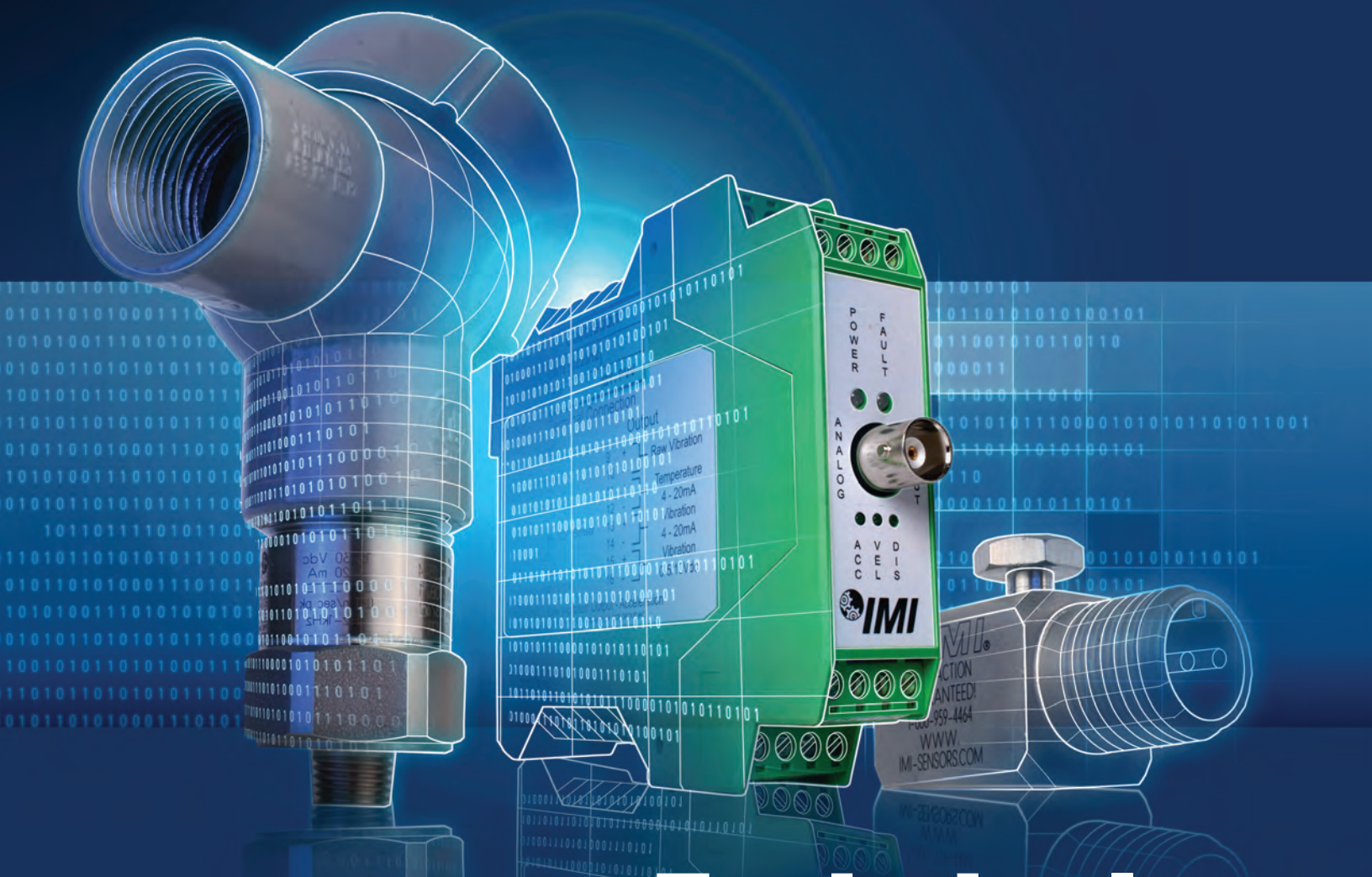
3-socket Half Breakaway Connector to 7-pin Connector
Model 052LVXXXDP

3-socket Half Breakaway Connector to BNC Plug
Model 052LVXXXAC

3-socket Half Breakaway Connector to 6-pin Connector
Model 052LVXXXHM

3-socket Half Breakaway Connector to 25-pin D-Sub
Model 052LVXXXCV

3-socket Half Breakaway Connector to 25-pin D-Sub
Model 052LVXXXCW



Technical Information

Accelerometer Selection Worksheet

Answering the following questions will help define the sensor best suited for a particular application. Refer to the following pages on "Accelerometer Selection Guidelines", for detailed information regarding each of the questions below.

1. Measurement Range / Sensitivity

Enter the highest overall acceleration level to be measured. _____ g (m/sec^2)

If < 10 g (98 m/sec^2), choose 100 mV/g (most commonly used).
If > 10 g (98 m/sec^2), choose 10 mV/g.
If < 0.001g (0.0098 m/sec^2), choose 500 m V/g.
If monitoring slow speed machinery, <500 cpm (8 Hz) or seismic (e.g., building or bridge vibrations), choose 500 mV/g or higher sensitivity.

2. Frequency Range

Lowest frequency to be analyzed _____cpm (Hz)
Highest frequency to be analyzed _____ cpm (Hz)

3. Broadband Resolution

(select the smallest of the two)
Lowest vibration amplitude of interest
_____ g (m/sec^2)
Smallest change in vibration level to be resolved
_____ g (m/sec^2)

4. Temperature Range (select one)

Normal Temperature ___ <250 °F (121 °C)
High Temperature ___ <325 °F (162 °C)
Very High Temperature ___ <500 °F (260 °C)
Cryogenic (contact IMI) ___ <-65 °F (-54 °C)

5. Size

Max footprint allowable _____ in (mm)
Max height allowable (clearance) _____ in (mm)

6. Duty (accuracy/sensitivity tolerance required)

___ Permanent mount
___ Walk-a-round

7. Cable

Integral cable required ____ Yes ____ No
If Yes, enter length _____ ft (m)
Temperature Range:
For -58 to 250 °F (-50 to 121 °C), use polyurethane jacketed cable, (Models 042 or 052) or equivalent.
For -90 to 392 °F (-70 to 200 °C), use (FEP) jacketed cable, Model 053.
For -130 to 500 °F (-90 to 260 °C), use (PFA) jacketed cable, Model 045.
Armored Cable Required ____ Yes ____ No

8. Submersion

If used in a submersed application up to 750 psi (51.7 bar), select an integral polyurethane cable (Models 042, 052, or 059). Note: Any accelerometer, whose model number includes a one (1) in the second to last character, is supplied with an integral polyurethane cable, (e.g. Model 623C10).

9. Intrinsically Safe / Explosion Proof

Intrinsically safe required ____ Yes ____ No
____ "EP"—Explosion Proof Condulet Enclosure
____ "EX"— Intrinsically Safe Approved
____ "MS"— Mine Safety Administration Approved Intrinsically Safe
____ "MX"— CENELEC Approved Intrinsically Safe for Mining

Accelerometer Selection Guidelines

There will usually be several accelerometer models that will meet the required measurement parameters, so the question naturally arises, which should be used? This section provides detailed explanations for the questions on the "Accelerometer Selection Worksheet" on page 178. Use the information provided here to help answer the questions on the Worksheet as accurately as possible. This will result in a set of key specifications required for the accelerometer. For detailed specifications on these sensors, refer to the "Products by Technology Section" (pages 81-176).

1. Measurement Range / Sensitivity — Determine the maximum peak vibration amplitude that will be measured and select a sensor with an appropriate measurement range. For a typical accelerometer, the maximum measurement range is equal to ±5 volts divided by the sensitivity. For example, if the sensitivity is 100 mV/g then the measurement range is (5 V / 0.1 V/g) = ±50 g. Allow some overhead in case the vibration is a little higher than expected.

2. Frequency Range — Determine the lowest and highest frequencies to be analyzed. If you are not sure what the upper frequency range should be, use the following table showing "Recommended Frequency Spans" as a guideline.

Recommended Frequency Spans (Upper Frequency)

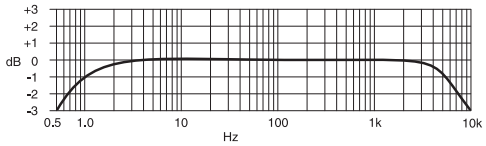
Shaft Vibration	10 x RPM
Gearbox	3 x GMF
Rolling Element Bearings	10 x BPFI
Pumps	3 x VP
Motors / Generators	3 x (2 x LF)
Fans	3 x BP
Sleeve Bearings	10 x RPM

RPM — Revolutions Per Minute
GMF — Gear Mesh Frequency
BPFI — Ball Pass Frequency Inner race
VP — Vane Pass frequency
LF — Line Frequency (60 Hz in USA)
BP — Blade Pass frequency

The above table was taken from Eshleman, Ronald L., Basic Machinery Vibrations: An Introduction to Machine Testing, Analysis, and Monitoring, VIPress, Incorporated, 1999 p. 2.4.

Select an accelerometer that has a frequency range that encompasses both the low and high frequencies of interest. In some cases, it may not be possible to measure the entire range of interest with a single accelerometer. In such a case, select the sensor that comes the closest to what is needed.

High Frequency Caution — Many machines, such as pumps, compressors, and some spindles, generate high frequencies beyond the measurement range of interest. Even though these vibrations are out of the range of interest, the accelerometer is still excited by them. Since high frequencies are usually accompanied by high accelerations, they will often drive higher sensitivity accelerometers (100 and 500 mV/g models) into saturation causing erroneous readings. If a significant high frequency vibration is suspected or if saturation occurs, a lower sensitivity (typically 10 or 50 mV/g) accelerometer should be used. For some applications, IMI offers higher sensitivity accelerometers with built in low pass filters. These sensors filter out the unwanted high frequency signals and thus provide better amplitude resolution at the frequencies of interest. Contact an IMI® Application Specialist for assistance if you experience this problem.



Typical Accelerometer Frequency Response Plot for a Filtered Sensor

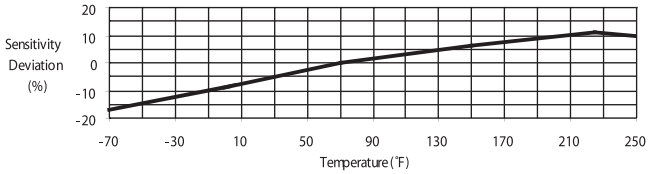
To determine if you have a condition that will overdrive (saturate) the accelerometer, look at the raw vibration signal in the time domain on a data collector, spectrum analyzer, or oscilloscope. Set the analyzer for a range greater than the maximum rated output of the accelerometer. If the amplitude exceeds the maximum rated measurement range of the accelerometer (typically 5 volts or 50 g for a 100 mV/g unit), then a lower sensitivity sensor should be selected. If the higher sensitivity sensor is used, clipping of the signal and saturation of the electronics is likely to occur. This will result in false harmonics, "ski slope" as well as many other serious measurement errors.

3. Broadband Resolution (Noise) — Determine the amplitude resolution that is required. This will be the smaller of either the lowest vibration level or the smallest change in amplitude that must be measured. Select a sensor that has a broadband resolution value equal to or less than this value. For example, if measuring a precision spindle with 0.0001 g minimum amplitude, choose an accelerometer with 100 g or better resolution. If the known vibration levels are in velocity (in/s) or displacement (mils), convert the amplitudes to acceleration (g) at the primary frequencies.
Note: The lower there solution value, the better the resolution is. Generally, ceramic sensing elements have better resolutions (less noise) than do quartz.

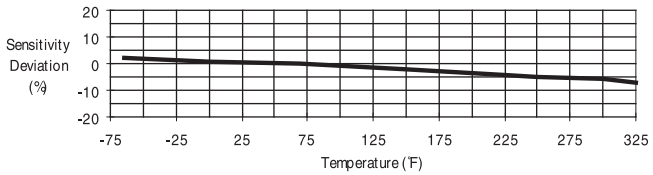
Accelerometer Selection Guidelines

4. Temperature Range — Determine the highest and lowest temperatures that the sensor will be subjected to and verify that they are within the specified range for the sensor.

Temperature Transients — In environments where the accelerometer will be subjected to significant temperature transients, quartz sensors may achieve better performance than ceramic. Ceramic sensing elements are subject to the pyroelectric effect, which can cause significant changes in the sensitivity and result in erroneous outputs with changes in temperature. These outputs typically occur as drift (very low frequency) and usually cause significant "ski slope" in the velocity spectrum. Accelerometer temperature response curves, as shown below, are provided throughout this catalog. If temperature transients are suspected, refer to these graphs.



Typical Ceramic Accelerometer Temperature Response

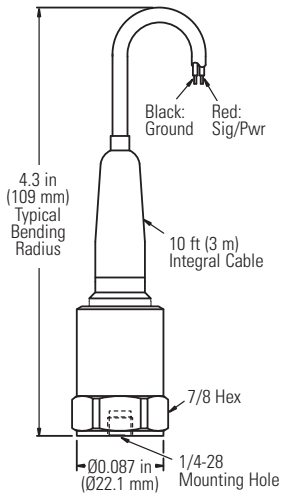


Typical Quartz Accelerometer Response

5. Size — In many cases, the style of the sensor used can be restricted by the amount of space that is available on a machine to mount the sensor. There are typically two parameters that govern which sensors will fit, the footprint and the clearance. The footprint is the area covered by the base of the sensor. The clearance is the height above the surface required to fit the sensor and cable. As an example, a top exit sensor will require more clearance than a side exit model. Footprint (hex, length, width) and clearance (height) values are provided in this catalog.

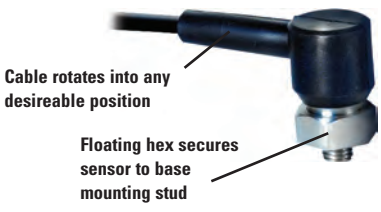
Space Constraints —Select a sensor that will fit into the space that is available. Basic dimensions are provided in this catalog for that purpose. Caution: Before machining any surfaces or tapping any holes, contact IMI for a current installation drawing. One of the main reasons for different accelerometer designs (top exit, side exit, swivel mount, etc). is the need to fit the accelerometer into a particular space on a machine. For example, top exit models are typically more cost effective than side exit models but require much more clearance space than side exit models.

Orientation — Cable orientation is another consideration. Ring style, side exit models can be oriented 360°, however, in some very tight spaces, even these may be difficult to install. For example, there may not be enough height clearance to fit a wrench to tighten the unit. In that case, a Series 607A swivel mount style accelerometer may be required.

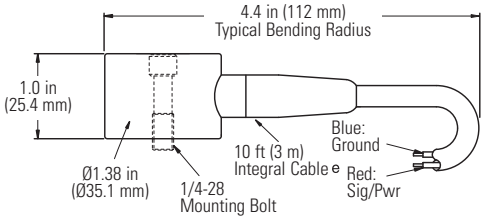


Top Requires More Clearance

Side Exit Accelerometer



Swivel Mount Accelerometer



6. Duty (Accuracy, Sensitivity Tolerance, and Safety)—The duty refers to the type of use that a sensor will see. The most typical uses for predictive maintenance applications are either in a walk around application, as with a portable data collector, or permanently mounted to a particular machine. In permanent mount applications, the sensor may terminate at a junction box where measurements are taken with a portable data collector or tied to an on-line monitoring system. 4-20 mA output sensors would usually be tied to existing plant systems such as a PLC.

Sensitivity Tolerance (Absolute Accuracy) — Sensitivity tolerance is the maximum deviation that the actual sensitivity of an accelerometer can vary from its published nominal sensitivity and still be within specification. IMI offers accelerometers with ±5%, ±10%, ±15%, and ±20% tolerances on sensitivity. Thus, a nominal 100 mV/g sensor with a ±5% tolerance could have an actual sensitivity between 95 and 105 mV/g. A ±20% tolerance unit could vary between 80 and 120 mV/g. If the nominal sensitivity is used to convert to engineering units (e.g., the calibration used with a data collection device), then a looser tolerance sensor will be less accurate, in general, than a tighter tolerance model. However, if the actual calibration value that is supplied with the sensor is used, then both readings will be equally accurate. In applications were absolute accuracy is important (e.g., in acceptance testing) then either higher tolerance sensors or actual calibration factors should be used. Lower tolerance sensors are typically provided with a single point calibration rather than full calibration. This, coupled with the looser tolerance, helps keep costs down and allows them to be offered at a much more economical price. Normally, these sensors are selected for permanent mount applications where larger numbers of accelerometers are needed.

Repeatability—All IMI® sensors, regardless of their sensitivity tolerance, are very repeatable. That means, a given measurement will repeat time and again, thus giving very accurate trends. If trend data is of primary importance, any IMI sensor will work fine even when using the nominal sensitivity.

Calibration Interval — Due to the inherent stability of quartz, accelerometers with quartz sensing elements have a longer recommended calibration interval than do ceramic sensors. The recommended time between calibrations is 1 year for ceramic sensors and 5 years for quartz. As a practical matter, however, it may not be possible to send ceramic sensors in for yearly recalibration. As long as the sensor is permanently mounted and not going through severe thermal transients on a regular basis, its sensitivity should remain fairly stable. However, if it is seeing repeated shocks (as with magnetic mounting in a walk around system) or severe thermal transients, it is highly recommended that the sensor be recalibrated yearly. One advantage of quartz sensors is its long-term stability even in high shock and thermally transient environments. It may also be advantageous to purchase a portable shaker for in-place sensitivity verification. See the Model 699A02 Portable Shaker on page 161.

Accessibility, Safety, and Production Considerations—Monitoring locations on machines are often inaccessible due to shrouds, space constraints, or other physical obstacles. Additionally, they may be in hazardous areas or have limited access due to pressing production schedules. In cases like these, low-cost, permanent mount accelerometers should be selected. This provides a fast, easy, and safe way to collect vibration data. When selecting these sensors, remember to also select the appropriate cabling, connectors, and switch or termination boxes.

7. Cable — It is recommended, in most cases, that connector style accelerometers be used rather than ones with integral cable. Cables are very susceptible to damage and are usually the source of most sensor problems, therefore, it is much easier and more cost effective to replace a cable rather then the entire accelerometer/cable assembly. Integral cable models are recommended in submersible applications where sealing is of prime importance. Armored cable is recommended in applications where sharp objects could cut the cable, such as metal chips in machining operations.

Integral Cable

Armor Jacketed Integral Cable

8. Submersion — If the accelerometer is used in a submersed application, it is generally recommended to use an integral cable. For submersed applications up to 750 psi (51.7 bar), select an integral polyurethane cable (IMI cable model numbers 042, 052, 059, or 062). Note: Any accelerometer, whose model number includes a one (1) in the second to last character, is supplied with an integral polyurethane cable (e.g., Model 623C10).

9. Intrinsically Safe/Explosion Proof—Many sensor models are approved for use in hazardous areas when used with a properly installed intrinsic safety (I.S.) barrier. Approval authorities include Canadian Standards Association, CENELEC, Factory Mutual, and Mine Safety Administration. Check the specification table of the sensor of interest to see which I.S. approvals are available for that model. IMI 4-20 mA models are also available with an explosion proof condulet enclosure.

10. Factory Assistance—When questions arise, do not hesitate to contact the factory to speak with an Application Specialist about your requirements.

Technical Information

Accelerometers

Piezoelectric Sensing Materials

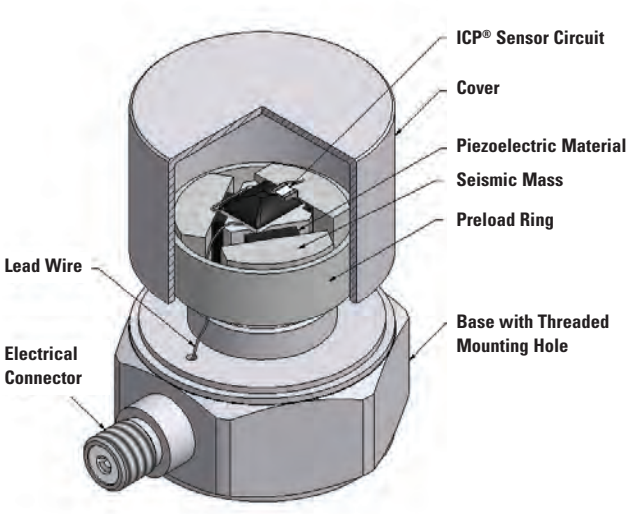
Two categories of piezoelectric materials predominantly used in accelerometer designs are quartz and polycrystalline ceramics. Quartz is a naturally occurring crystal. However, the quartz used in sensors today is produced by a process that creates material free from impurities. Ceramic materials, on the other hand, are man-made. Different specific ingredients yield ceramic materials that possess certain desired sensor properties. Each material offers distinct benefits, and material choice depends on the particular performance features desired of the accelerometer.

Quartz

Quartz is widely known for it ability to perform accurate measurements tasks and contributes heavily in everyday applications for time and frequency measurements, such as wrist watches, radios, computers, and home appliances. Accelerometers also benefit from several unique characteristics of quartz. Since quartz is naturally piezoelectric, it has not tendency to relax to an alternative state and is considered the most stable of all piezoelectric materials. Quartz-based sensors, therefore, make consistent, repeatable measurements and continue to do so over long periods of time. Also, quartz has not output occurring from temperature fluctuations, a formidable advantage when placing sensors in thermally active environments. Because quarts has a low capacitance value, the voltage sensitivity is relatively high compared to most ceramic materials, making it ideal for ruse in voltage-amplified systems. Conversely, the charge sensitivity of quartz is low, limiting its usefulness in charge-amplified systems, where low noise is an inherent feature.

Ceramics

A wide variety of ceramic materials are used for accelerometers, and which material to use depends on the requirements of the particular application. All ceramic materials are man made and are forced to become piezoelectric by a polarization process. This process, known as "poling," exposes the material to a high-intensity electrical field, which aligns the electric dipoles, causing the material to become piezoelectric. Ceramics offer a higher output than quartz when using similar size crystals. They are an ideal for use with a large output is required from a very small sensor. Different ceramic packages may be used to determine such factors as charge sensitivity, voltage sensitivity, and temperature range. Charge output ceramics may be mated with built-in charge amplifier circuits to achieve high output signals, high resolution, and an excellent signal to noise ratio. High temperature ceramics are now being incorporated into charge mode accelerometers to operate to temperatures exceeding 900 °F (482 °C).



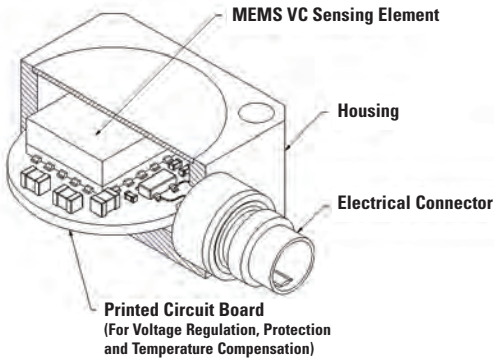
Shear Mode Accelerometer

Structures for Piezoelectric Accelerometers

A variety of mechanical structures are available to perform the transduction principles required of a piezoelectric accelerometer. These configurations are defined by the nature in which the inertial force of an accelerated mass acts upon the piezoelectric material. Such terms as compression mode, flexural mode and shear mode describe the nature of the stress acting upon the piezoelectric material. Current designs of IMI® accelerometers utilize, almost exclusively, the shear mode of operation for their sensing elements. Therefore, the information provided herein is limited to that pertaining to shear mode accelerometers.

Shear Mode

Shear mode accelerometer designs feature sensing crystals attached between a center post and a seismic mass. A compression ring or stud applies a pre-load force to the element assembly to insure a rigid structure and linear behavior. Under acceleration, the mass causes a shear stress to be applied to the sensing crystals. This stress results in a proportional electrical output by the piezoelectric material. The output is collected by electrodes and transmitted by lightweight lead wires to either the built-in signal conditioning circuitry of ICP® sensors, or directly to the electrical connector for charge mode types. By having the sensing crystals isolated from the base and housing, shear mode accelerometers excel in rejecting thermal transient and base-bending effects. Also, the shear geometry lends itself to small size, which promotes high frequency response while minimizing mass loading effects on the test structure. With this combination of ideal characteristics, shear mode accelerometers offer optimum performance.



MEMS DC Accelerometer

Sensor Mounting and Frequency Response

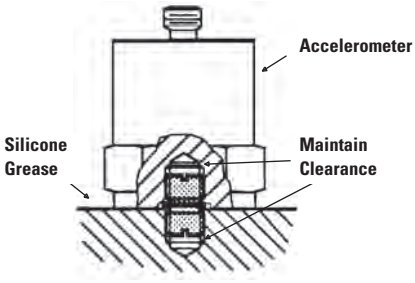
One of the most important considerations in dealing with accelerometer mounting is the effect the mounting technique has on the accuracy of the usable frequency response. The accelerometer's operating frequency range is determined, in most cases, by securely stud mounting the test sensor directly to the reference standard accelerometer. The direct, stud mounted coupling to a very smooth surface generally yields the highest mounted resonant frequency and therefore, the broadest usable frequency range. The addition of any mass to the accelerometer, such as an adhesive or magnetic mounting base, lowers the resonant frequency of the sensing system and may affect the accuracy and limits of the accelerometer's usable frequency range. Also, compliant materials, such as a rubber interface pad, can create a mechanical filtering effect by isolating and damping high-frequency transmissibility.

Surface Preparation

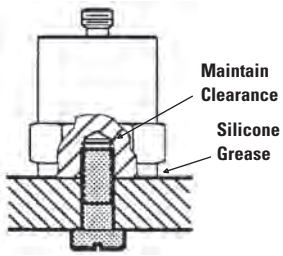
For best measurement results, especially at high frequencies, it is important to prepare a smooth and flat machined surface where the accelerometer is to be attached. Inspect the area to ensure that no metal burrs or other foreign particles interfere with the contacting surfaces. The application of a thin layer of silicone grease between the accelerometer base and the mounting surface also assists in achieving a high degree of intimate surface contact required for best high-frequency transmissibility.

Stud Mounting

For permanent installations, where a very secure attachment of the accelerometer to the test structure is preferred, stud mounting is recommended. First, grind or machine on the test object a smooth, flat area at least the size of the sensor base, per the manufacturer's specifications. Then, prepare a tapped hole in accordance with the supplied installation drawing, ensuring that the hole is perpendicular to the mounting surface. Install accelerometers with the mounting stud and make certain that the stud does not bottom in either the mounting surface or accelerometer base. Most IMI® mounting studs have depth-limiting shoulders that ensure that the stud cannot bottom-out into the accelerometer's base. Each base incorporates a counterbore so that the accelerometer does not rest on the shoulder. Acceleration is transmitted from the structure's surface into the accelerometer's base. Any stud bottoming or interfering between the accelerometer base and the structure inhibits acceleration transmission and affects measurement accuracy. When tightening, apply only the recommended torque to the accelerometer. A thread-locking compound may be applied to the threads of the mounting stud to safeguard against loosening.



Stud Mounted Accelerometer



Screw Mounted Accelerometer

Technical Information

Accelerometers

Screw Mounting

When installing accelerometers onto thin-walled structures, a cap screw passing through a hole of sufficient diameter is an acceptable means for securing the accelerometer to the structure. The screw engagement length should always be checked to ensure that the screw does not bottom into the accelerometer base. A thin layer of silicone grease at the mounting interface ensures high-frequency transmissibility.

Adhesive Mounting

Mounting by stud or screw may not always be practical., Adhesive mounting offers an alternative mounting method. The use of separate adhesive mounting bases is recommended to prevent the adhesive from damaging the accelerometer base or clogging the mounting threads. Miniature accelerometers that normally contain integral mounting studs may have the stud machined off to form a flat base. Most adhesive mounting bases available from PCB® also provide electrical isolation. This eliminates potential noise pick-up and ground loop problems.

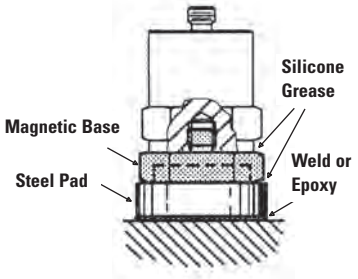
The type of adhesive recommended depends on the particular application. Petro Wax (available from PCB®) offers a very convenient, easily removable approach for room temperature use. Two-part epoxies offer stiffness, which maintains high-frequency response and as the installation becomes a permanent mount. Other adhesives, such as dental cement, hot glues, instant glues, and duct putty are also viable options with a history of success. There is no one "best" adhesive for all applications because of the many different structural and environmental considerations, such as temporary or permanent mount, temperature, type of surface finish, and so forth.

To avoid damaging the accelerometers mounted with permanent adhesives, a debonding agent must be applied to the adhesive prior to sensor removal. With so many adhesives in use (everything from super glues, dental cement, epoxies, etc), there is no universal debonding agent available. The debonder for the Loctite 454 adhesive that PCB® Suggests is Acetone. If you are using anything other than Loctite 454, you will have to check with the individual manufactures for their debonding recommendations. The debonding agent must be allowed to penetrate the surface in order to properly react with the adhesive, so, after the application of the agent, it is advisable to wait a few minutes before removing the sensor. Once the debonding agent has set, you can use an ordinary open-end wrench applied to the hex or square base and, with a gentle shear (or twisting) motion (by hand only) the sensor can be removed from the test structure. Base or square base, or miniature teardrop accelerometers are supplied with a removal tool for use in the shearing motion.

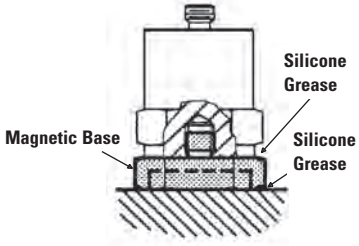
Magnetic Mounting

Magnetic mounting bases offer a very convenient, temporary attachment to magnetic surfaces. Magnets offering high pull strengths provide best high-frequency response. Wedged dual-rail magnetic bases are generally used for installations on curved surfaces, such as motor and compressor housings and pipes. However, dual-rail magnets usually significantly decrease the operational frequency range of an accelerometer. For best results, the magnetic base should be attached to a smooth, flat surface. A thin layer of silicone grease should be applied between the sensor and magnetic base, as well as between the magnetic base and the structure to improve surface contact continuity. When surfaces are uneven or non-magnetic, steel pads can be welded or epoxied in place to accept the magnetic base.

Caution: Magnetically mounting an accelerometer has the potential to generate very high and very damaging acceleration levels. To prevent such damage, exercise caution when attaching the magnet to your test structure and gently "rock" or "slide" the assembly in place. Do not allow the magnet to "snap" on to the test structure as excessive "shocks" are generated. These "shocks" could damage the sensor. Another more ideal mounting method is to attach the magnetic base to your test structure first, and then screw the accelerometer on to the magnetic base.



Magnet Mounted to Steel Pad



Magnet Mounted Directly to Test Structure

Technical Information

Pressure Sensors

Typical Piezoelectric System Output

Piezoelectric pressure sensors measure fast responding, microsecond dynamic pressure events. They are not suited for longer, static events. Dynamic pressure measurements including turbulence, blast, ballistics and engine combustion may require sensors with special capabilities. Fast response, ruggedness, high stiffness, extended ranges, and the ability to also measure "quasi-static" pressures are standard features associated with PCB® quartz pressure sensors. The following information presents some of the design and operating characteristics of PCB® pressure sensors to help you better understand how they function, which, in turn, helps you make better dynamic measurements.

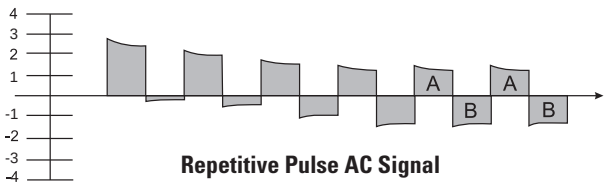
Types of Pressure Sensors

Piezoelectric pressure sensors are available in various shapes and thread configurations to allow suitable mounting for various applications. IMI® manufactures two types of piezoelectric sensors. Charge mode pressure sensors generate a high-impedance charge output. ICP® (Integrated Circuit Piezoelectic) voltage mode-type sensors feature built-in microelectronic amplifiers, which convert the high-impedance charge into a low-impedance voltage output. (ICP® is a registered trademark of PCB Group, Inc.)

Why Can Dynamic Pressure Only Be Measure with Piezoelectric Pressure Sensors?

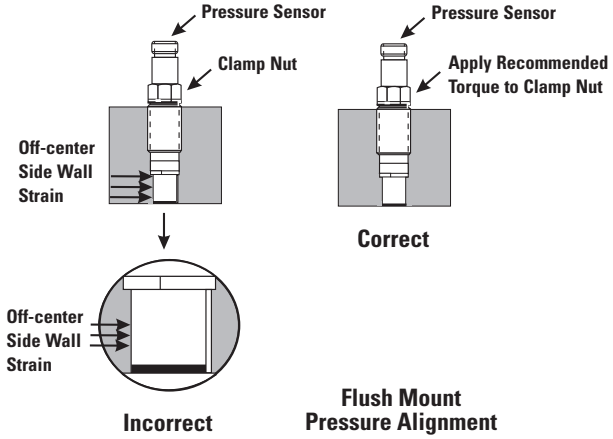
The quartz crystals of a piezoelectric pressure sensor generate a charge when pressure is applied. However, even though the electrical insulation resistance is quite large, the charge eventually leaks to zero. The leakage rate is dependent on the electrical insulation resistance. In a pressure sensor with built-in ICP® electronics, the resistance and capacitance of the crystal and the built-in ICP® electronics normally determine the leakage rate. In a charge mode pressure sensor used with a voltage amplifier, the leakage rate is fixed by values of capacitance and resistance in the sensor, by low-noise cable, and by the external source follower voltage amplifier used. In the case of a charge mode pressure sensor used with a charge amplifier, the leakage rate is fixed by the electrical feedback resistor and capacitor in the charge amplifier.

The output characteristic of piezoelectric pressure sensor systems is that of an AC-coupled system, where repetitive signals decay until there is an equal area above and below the original base line. As magnitude levels of the monitored event fluctuate, the output remains stabilized around the base line with the positive and negative areas of the curve remaining equal. The graph (right) represents an AC signal following this curve. (Output from sensors operating in DC mode follow this same pattern but over an extended time frame associated with system discharge time constant values.)



Repetitive Pulse AC Signal

Assume that a 0 to 3 volt output signal is generated from an AC-coupled pressure application with a one-second steady-state pulse rate and one second between pulses. The frequency remains constant, but the natural decay associated with a piezoelectric sensors will cause the signal to quickly decay negatively until the signal centers around the original base line. Eventually the signal reaches an equilibrium point, where the area above the baseline equals the area below the (area A = area B. The original output signal remains the same, though one is now reading a peak to peak output , from -1 Volt to +1 Volt, instead of an output from 0 to 3 Volts.



Technical Information

Pressure Sensors

High Frequency Response

Most PCB® piezoelectric pressure sensors are constructed with either compression mode quartz crystals preloaded in a rigid housing, or unconstrained tourmaline crystals. These designs give the sensors microsecond response times and resonant frequencies in the hundreds of kHz, with minimal overshoot or ringing. Small diaphragm diameters ensure spatial resolution of narrow shockwaves. High-frequency response and rise time can be affected by mounting port geometry and associated electronics. Check all system component specifications before making measurements, or contact PCB® for application assistance.

Installation

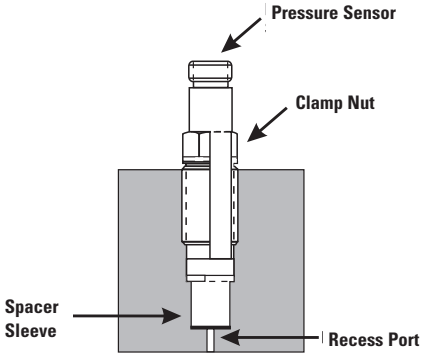
Precision mounting of pressure sensors is essential for good pressure measurements. Although some mounting information is shown in this catalog, always check the installation drawings supplied in the product manual, or contact PCB® to request detailed mounting instructions. Good machining practices will improve the drilling and threading of mounting ports. Use the proper mounting torque, as noted on the specification sheet and/or installation drawing, during sensor installation.. Mounting hardware is supplied with PCB® sensors, as noted on a product specification sheet. Various standard thread adaptors are available to simplify sensor installations. For free field blast applications, try to use "aerodynamically clean" mounts, minimizing unwanted reflections from mounting brackets or tripods.

The sensing crystals of many pressure sensors described in this catalog are located in the diaphragm end of the sensor. Side loading of this part of the sensor during a pressure measurement creates distortions in the signal output.

Also important is the avoidance of unusual side loading stresses and strains on the upper body of the sensor. Proper installation minimizes distortions in the output signal. A taut cable pulling at right angles to the electrical connector or a heavy electrical adaptor added to a smaller sensor connector are two examples of putting a side strain into the body. In the later case, the added connector mass, when used in a high vibration environment may cause the connector to break away from the sensor housing. In some applications, such as free-field blast measurements, a pressure sensor mounted in a thin plate can be subjected to side loading stresses caused when the plate flexes, under pressure. Use of an O-ring mounts suited to withstand the pressure levels under test minimizes this effect.

Flush vs. Recess Mounting

Flush mounting of pressure sensors in a plate or wall is desirable for maximizing the sensors frequency response, minimizing turbulence, avoiding a cavity effect, or avoiding an increase in a chamber volume. Recess mounting is more desirable in applications where the diaphragm end of the pressure sensor is likely to be subjected to potential damage, possibly from heat, excessive flash temperatures or particle impingement. Most PCB® pressure sensors are supplied with seal rings for flush mounting. Certain models can be provided with seal sleeves for recess mounting ports, as shown in the illustration (right). Consider ordering enough spare seal rings or sleeves, particularly in applications that require frequent removal and reinstallation of the pressure sensor. Before reinstalling a pressure sensor, be sure to check the mounting port to be sure that an old, distorted seal ring is not still in the mounting hole. If you are using PCB® pressure sensors and find that you have lost or misplaced the seals, call PCB® and request that the needed items be sent out as no-charge samples. Various mounting adaptors facilitate mounting of the pressure sensors. Note that pressure sensors and adaptors with straight machined threads use a seal ring as a pressure seal. Pipe thread adaptors have a tapered thread, which results in the threads themselves creating the pressure seal.



Typical Recess Mount

Flush vs. Recess Mounting (continued)

Control of the location of the pressure sensor diaphragm is achieved with a straight thread/seal ring mount. Reference the sensors installation instructions for proper mounting hole preparation instructions to achieve a flush mount. Pipe thread mounts do not allow a precision positioning of the depth of the sensor since the seal is provided by progressive tightening of threads in the tapered hole until the required thread engagement is reached. However, pipe threads do offer a convenience of an easier machined port than straight threads. Pipe thread mounts are well suited for some general applications.

Thermal Shock

Thermal shock can be in the form of a radiant heat, such as the flash from an explosion, heat from convection of hot gasses passing over a pressure sensor's diaphragm, or conductive heat from a hot liquid.Virtually all piezoelectric pressure sensors are sensitive to thermal shock. As mentioned, most PCB® pressure sensors use quartz as the sensing crystal. Quartz, itself, is thermally insensitive to thermal transients. However, the crystals are preloaded between parts within the sensor itself, the sensors element package. When heat strikes the diaphragm of a piezoelectric pressure sensor, the heat can cause an expansion of the material surrounding the internal crystals. Although quartz crystals are not significantly sensitive to thermal shock, the case expansion causes a lessening of the preload force on the crystals, which will cause the signal to drift as a result of this change in preload. Usually, as heat goes up, sensor sensitivity will decrease causing a negative-going signal output drift. Precautions can be made to the test setup in an effort to minimize or delay thermal shock from distorting the intended output signal.

Certain PCB quartz pressure sensors feature thermal isolation designs to minimize the effects of thermal shock. Some feature baffled diaphragms. Other models designed for maximizing the frequency response may require thermal protection coating, recess mounting, or a combination to lessen the effects of thermal shock. Examples of coatings include silicone grease, which may also be used to fill a recess mounting hole, RTV silicone rubber, vinyl electrical tape, and ceramic coatings. The RTV and tape are used as ablatives, while the ceramic coating is also used to protect some diaphragms from corrosive gasses and particle impingements.

Crystals other than quartz are used in some PCB® sensors. Tourmaline is used for shock tube and underwater blast sensors because of its superior frequency characteristics. In shock tube measurements, the duration of the pressure measurement is usually so short that a layer of vinyl tape is sufficient to delay the thermal event from affecting the desired pulse for the duration of the desired measurement. In underwater blast applications, heat transfer through the water is not significant.

Note that thermal shock effects do not relate to the "temperature coefficient" pressure sensor specification. The temperature coefficient specification refers to the change in sensitivity of the sensor relative to the static, ambient temperature of the sensor. Unfortunately, since the thermal shock effects cannot be easily quantified, they must be anticipated and minimized by one of the above mentioned techniques in order to ensure better measurement data.

Polarity

When a positive pressure is applied to the diaphragm of an ICP® pressure sensor, the sensor yields a positive voltage. The polarity of PCB® charge mode pressure sensors is just the opposite: when a positive pressure is applied, the sensor yields a negative output. Charge output sensors are usually used with external charge amplifiers that invert the signal. Therefore, the resulting system output polarity of a charge output sensor used with a charge amplifier will produce a positive going output for a positive event. (Reverse polarity sensors are also available.)

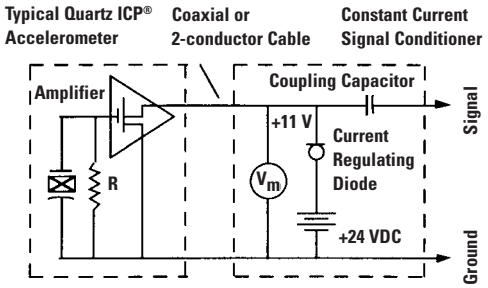
Technical Information

Strain Sensors

Introduction

ICP® quartz strain sensors incorporate a built-in MOSFET microelectronic amplifier. This serves to convert the high impedance charge output into a low impedance voltage signal for analysis or recording. ICP® quartz strain sensors, powered from a separate constant current source, operate over long ordinary coaxial or ribbon cable without signal degradation. The low impedance voltage signal is not affected by triboelectric cable noise or environmental contaminants. Power to operate ICP® sensors is generally in the form of a low cost, 24-27 VDC, 2-20 mA constant current supply. The illustration belows depicts a typical ICP® strain sensor system. PCB® offers a number of AC or battery-powered, single or multi-channel power/signal conditioners, with or without gain capabilities for use with strain sensors. In addition, many data acquisition systems now incorporate constant current power for directly powering ICP® sensors. Because static calibration or quasi-static short-term response lasting up to a few seconds is often required, PCB® manufactures signal conditioners that provide DC coupling.

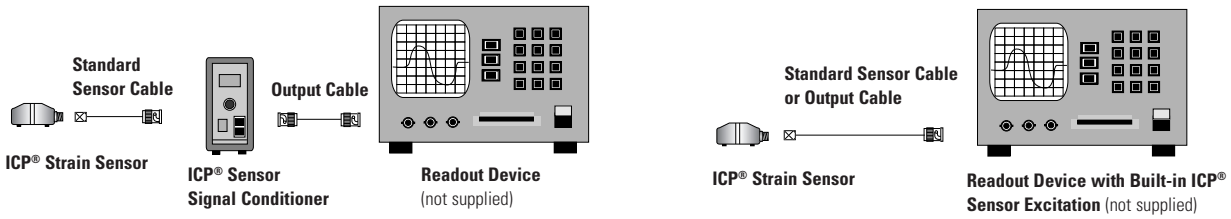
ICP® quartz strain sensors are well suited for continuous, unattended strain monitoring in harsh factory environments. Also, ICP® sensor cost-per-channel is substantially lower, since they operate through standard, low-cost coaxial cable, and do not require expensive charge amplifiers. Refer to the installation/outline drawing and specification for details and dimensions of the particular sensor model number(s) purchased.



ICP® Sensor System Schematic

Description

240 series quartz strain sensors are used to monitor the dynamic response of crimping, stamping, punching, forming and any other applications where it is crucial to maintain process control. These sensors are ideal in applications where mounting directly in the load path with a force sensor is not possible. Instead, the sensor can be mounted in an area that will provide the highest mechanical stress for the process to be monitored. Strain sensors are mounted to a structure by means of a supplied socket flat head screw, which threads into a corresponding tapped hole, and is then fastened securely. When used with a constant current signal conditioner, the sensor output voltage can be resolved in units of strain and then related to specific events that must be monitored in the process. After defining a signature voltage response for properly manufactured parts, the user can then determine an acceptable upper and lower control limit in order to maintain process control thereby preventing the acceptance of non-conforming products as finished goods. Versions offering full-scale measurements of 10 μ to 300 μ are available. When powered by a constant current power supply and subjected to an input strain, an ICP® strain sensor will provide a corresponding output voltage. A positive output voltage indicates that the structure being monitored is being subjected to a tensile force in the sensor mounting area and can also be resolved in units of strain. Likewise, a compressive force in this area will result in a negative output voltage.

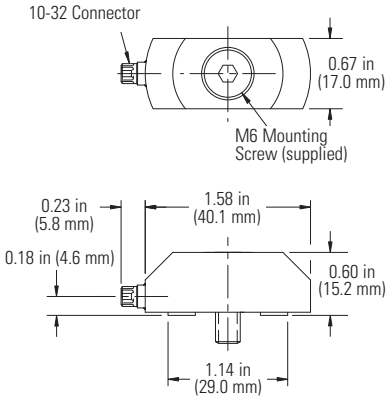


Typical ICP® Strain Sensor System

General Installation

Refer to the Installation Drawing for specific outline dimensions and installation details for your particular model.

It is important that the mounting surface is clean and free of paint, oil, or other coatings that could prevent the proper transfer of strain into the mounting pads of the sensor. Poor surface contact may affect sensor sensitivity and result in erroneous data. Prior to mounting, it is recommended that the machine surface and the mounting pads of the sensor be cleaned with acetone. This will maintain proper coupling with these mating surfaces and prevent slippage at peak strain. Connect one end of the coaxial cable to the sensor connector and the other end to the XDCR jack on the signal conditioner. Make sure to tighten the cable connector to the sensor. DO NOT spin the sensor onto the cable, as this fatigues the cable's center pin, resulting in a shorted signal and a damaged cable. If the cable cannot be attached prior to sensor installation, the protective cap should remain on the connector to prevent contamination or damage.



Strain Sensor Installation

For installation in dirty, humid, or rugged environments, it is suggested that the connection be shielded against dust or moisture with shrink tubing or other protective material. Strain relieving the cable/sensor connection can also prolong cable life. Mounting cables to a test structure with tape, clamps, or adhesives minimizes the chance of damage.

Strain Sensor Installation

The illustration (left) displays the sensor mounted using the supplied mounting screw to a minimum torque of 10 N-m. Allow for the static component of the signal to discharge prior to calibration. Installations not preloaded to the recommended value, or that utilizes a screw of different material and/or dimensions than the supplied screw, may yield inaccurate output readings. The supplied screw allows proper strain transmission to the sensor while holding the sensor in place. Properly machined holes for the mounting screw will ensure proper vertical orientation of the sensor. Refer to the installation drawing for additional mounting details. Consult a PCB® applications engineer for calibration and output recommendations.

Industrial ICP® Strain Sensors
Series M240

Polarity

Extension of the mounting area of an ICP® strain sensor produces a positive-going voltage output. The retraction of the mounting area produces a negative-going voltage output.

Low Frequency Monitoring

Strain sensors used for applications in short term, steady-state monitoring, such as sensor calibration, or short term, quasistatic testing should be powered by signal conditioners that operate in DC-coupled mode. PCB® Series 484 Signal Conditioner operates in either AC or DC-coupled mode and may be supplied with gain features or a zero "clamped" output often necessary in repetitive, positive polarity pulse train applications.

If you wish to learn more about ICP® sensors, consult PCB's General Signal Conditioning Guide, a brochure outlining the technical specifics associated with piezoelectric sensors. This brochure is available from PCB® by request, free of charge.

Low Frequency Monitoring

Strain sensors are calibrated relative to a strain gage reference sensor. A calibration certificate is supplied with each strain sensor providing its relative voltage sensitivity (mV/μ). A calibration must be performed once strain sensors are installed in the specific equipment being measured. This is necessary so that a direct comparison of relative data can be made thereby allowing the user to set control limits and properly monitor a specific event as well as the entire process.

Services & Qualifications

Lifetime Warranty Plus / Total Customer Satisfaction – IMI Sensors guarantees Total Customer Satisfaction through its "Lifetime Warranty Plus", Toll-free Customer Service, and 24-hour SensorLine℠. Contact IMI® for a complete statement of our warranty or view our warranty online at http://www.imi-sensors.com/NoRiskPolicy.aspx

Toll-free Customer Service – IMI® offers direct, Toll-free telephone numbers for customer use. Specific numbers are available for the area in which your product interest lies. When uncertain, call our general number at 800-959-4464. Customer Service Representatives and Application Engineers are available to assist with requests for product literature, price quotations, discuss application requirements, orders, order status, expedited delivery, troubleshooting equipment, or arranging for returns. Our general fax number is: 716-684-3823. We look forward to hearing from you.

24-hour SensorLine℠ – IMI® offers to all customers, at no charge, 24-hour emergency product or application support, day or night, seven days per week, anywhere in the world. To reach a IMI® SensorLine℠ Customer Service Representative, call 716-684-0003.

Website - www.imi-sensors.com – Visit us online at www.imi-sensors.com to view a broader selection of products, newly released products, complete product specifications, product drawings, technical information, and literature. Additional Test & Measurement equipment can also be found on the PCB® web site at www.pcb.com. Sound level meters, noise dosimeters and acoustic measurement systems are featured on Larson Davis' web site at www.larsondavis.com.

AS9100 and ISO 9001 Certifications – IMI® is registered by the Underwriters Laboratory, Inc. as an AS9100:2016 QMS certified by DQS, Inc. and ISO 9001:2015 QMS certified by DQS, Inc. facility and maintains a quality assurance system dedicated to resolving any concern to ensure Total Customer Satisfaction. IMI® also conforms to the former MIL-STD-45662 and MIL-Q-9858.

A2LA Accredited Calibration Facility – PCB Piezotronics microphones, accelerometers, pressure and force transducers are calibrated with full traceability to NIST (National Institute of Standards & Technology) to ensure conformance to published specifications. Certificates of calibration are furnished which include actual measured data. Calibration systems utilized are kept in full compliance with ISO 9001:2015 QMS certified by DQS, Inc. standards. Calibration methods are accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories, as well as AS9100:2016 QMS certified by DQS, Inc. and ISO 10012-1 standards. PCB® also meets requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

Delivery Policy – IMI® is committed to making every effort possible to accommodate all delivery requests. Our extensive in-house production capabilities permit us to manufacture most products to order in a timely fashion. In the event that a specific model is unavailable in the time frame that you need, we can usually offer a comparable unit, for sale or loan, to satisfy your urgent requirements. Many products are available from stock for immediate shipment. Standard cable assemblies and accessory hardware items are always stocked for immediate shipment and IMI® never requires a minimum order amount. If you have urgent requirements, call a factory representative and every effort will be made to fulfill your needs.

Custom Products – IMI® prides itself on being able to respond to customers' needs. Heavy investment in machinery, capabilities, and personnel allow us to design, test, and manufacture products for specialized applications. Please contact us to discuss your special needs.

CE Marking CE – Many IMI® products are designed, tested, and qualified to bear CE marking in accordance with European Union EMC Directive. Products that have earned this qualification are so indicated by the CE logo.

Hazardous Area Use – Certain equipment is available with CSA and/or ATEX certifications to enable use in hazardous environments. Contact IMI® for detailed specifications, which will identify the specific approved environments for any particular model.

Accuracy of Information – IMI® has made a reasonable effort to ensure that the specifications contained in this catalog were correct at the time of printing. In the interest of continuous product improvement, IMI® reserves the right to change product specifications without notice at any time. Dimensions and specifications in this catalog may be approximate and for reference purposes only. Before installing sensors, machining any surfaces, or tapping any holes, contact a IMI® application specialist to obtain a current installation drawing and the latest product specifications.

Routine Modification of Standard Models – In addition to the product options noted in our catalogues, customers from all business sectors regularly request adjustments for their specific implementation and measurement needs. IMI® has accommodated customers by making numerous standard adjustments to thousands of sensors, as well as to associated electronics. These adjustments to sensitivity, range, frequency response, resolution, grounding issues, mounting, cabling, and electrical requirements can often be made for a certain premium over the base model.

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IMI® Contact Guide

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IMI® 24-Hour SensorLine℠:
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PCB PIEZOTRONICS INC. With more than 40 years of products, innovation and customer service, PCB Piezotronics is a global leader in the design and manufacture of force, torque, load, strain, pressure, acoustic, shock and vibration sensors, as well as the pioneer of ICP® technology. Core competencies include ICP® and charge output piezoelectric, piezoresistive, strain gage, MEMS and capacitive sensors and instrumentation. To address the growing need for sensors and related instrumentation in the target market areas of test & measurement, industrial vibration, automotive, aerospace & defense, environmental noise monitoring and industrial hygiene, PCB® has established a series of focused divisions, with dedicated sales, marketing, engineering, and customer service resource support tailored to the needs of customers in these very specific areas. PCB® divisions and their core competencies include:

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