



Model EX621C40

High freq ceramic shear ICP® accelerometer, 10 mV/g, 1.6 to 30k Hz, SS case, top exit, 5-44 connector, frequency sweep ISO 17025 acc cal, off ground, hazardous area app

Installation and Operating Manual

For assistance with the operation of this product,
contact the PCB Piezotronics, Inc.

Toll-free: 800-959-4464

24-hour SensorLine: 716-684-0001

Fax: 716-684-3823

E-mail: imi@pcb.com

Web: www.imi-sensors.com



Repair and Maintenance

PCB guarantees Total Customer Satisfaction through its “Lifetime Warranty Plus” on all Platinum Stock Products sold by PCB and through its limited warranties on all other PCB Stock, Standard and Special products. Due to the sophisticated nature of our sensors and associated instrumentation, **field servicing and repair is not recommended and, if attempted, will void the factory warranty.**

Beyond routine calibration and battery replacements where applicable, our products require no user maintenance. Clean electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the material of construction. Observe caution when using liquids near devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth—never saturated or submerged.

In the event that equipment becomes damaged or ceases to operate, our Application Engineers are here to support your troubleshooting efforts 24 hours a day, 7 days a week. Call or email with model and serial number as well as a brief description of the problem.

Calibration

Routine calibration of sensors and associated instrumentation is necessary to maintain measurement accuracy. We recommend calibrating on an annual basis, after exposure to any extreme environmental influence, or prior to any critical test.

PCB Piezotronics is an ISO-9001 certified company whose calibration services are accredited by A2LA to ISO/IEC 17025, with full traceability to SI through N.I.S.T. In addition to our standard calibration services, we also offer specialized tests, including: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For more information, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

Returning Equipment

If factory repair is required, our representatives will provide you with a Return Material Authorization (RMA) number, which we use to reference any information you have already provided and expedite the repair process. This number should be clearly marked on the outside of all returned package(s) and on any packing list(s) accompanying the shipment.

Contact Information

PCB Piezotronics, Inc.
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Depew, NY14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine: (716) 684-0001
General inquiries: info@pcb.com
Repair inquiries: rma@pcb.com

For a complete list of distributors, global offices and sales representatives, visit our website, www.pcb.com.

Safety Considerations

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the precautions required to avoid injury. While our equipment is designed with user safety in mind, the protection provided by the equipment may be impaired if equipment is used in a manner not specified by this manual.

Discontinue use and contact our 24-Hour Sensorline if:

- Assistance is needed to safely operate equipment
- Damage is visible or suspected
- Equipment fails or malfunctions

For complete equipment ratings, refer to the enclosed specification sheet for your product.

Definition of Terms and Symbols

The following symbols may be used in this manual:



DANGER

Indicates an immediate hazardous situation, which, if not avoided, may result in death or serious injury.

**CAUTION**

Refers to hazards that could damage the instrument.

**NOTE**

Indicates tips, recommendations and important information. The notes simplify processes and contain additional information on particular operating steps.

The following symbols may be found on the equipment described in this manual:



This symbol on the unit indicates that high voltage may be present. Use standard safety precautions to avoid personal contact with this voltage.



This symbol on the unit indicates that the user should refer to the operating instructions located in the manual.



This symbol indicates safety, earth ground.



PCB工业监视和测量设备 - 中国RoHS2公布表

PCB Industrial Monitoring and Measuring Equipment - China RoHS 2 Disclosure Table

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
住房	0	0	0	0	0	0
PCB板	X	0	0	0	0	0
电气连接器	0	0	0	0	0	0
压电晶体	X	0	0	0	0	0
环氧	0	0	0	0	0	0
铁氟龙	0	0	0	0	0	0
电子	0	0	0	0	0	0
厚膜基板	0	0	X	0	0	0
电线	0	0	0	0	0	0
电缆	X	0	0	0	0	0
塑料	0	0	0	0	0	0
焊接	X	0	0	0	0	0
铜合金/黄铜	X	0	0	0	0	0
本表格依据 SJ/T 11364 的规定编制。						
0：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。						
X：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。						
铅是欧洲RoHS指令2011/65/ EU附件三和附件四目前由于允许的豁免。						

CHINA RoHS COMPLIANCE

Component Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Chromium VI Compounds (Cr(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Housing	O	O	O	O	O	O
PCB Board	X	O	O	O	O	O
Electrical Connectors	O	O	O	O	O	O
Piezoelectric Crystals	X	O	O	O	O	O
Epoxy	O	O	O	O	O	O
Teflon	O	O	O	O	O	O
Electronics	O	O	O	O	O	O
Thick Film Substrate	O	O	X	O	O	O
Wires	O	O	O	O	O	O
Cables	X	O	O	O	O	O
Plastic	O	O	O	O	O	O
Solder	X	O	O	O	O	O
Copper Alloy/Brass	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials for this part is above the limit requirement of GB/T 26572.

Lead is present due to allowed exemption in Annex III or Annex IV of the European RoHS Directive 2011/65/EU.



INDUSTRIAL MONITORING INSTRUMENTATION DIVISION

Piezoelectric ICP® Accelerometers Operating Guide

Operating Guide with Enclosed Warranty Information

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***MANUAL NUMBER: 18405
MANUAL REVISION: A***

ECN NUMBER: 49766

General
OPERATING GUIDE

for use with

PIEZOELECTRIC ICP® ACCELEROMETERS

SPECIFICATION SHEET, INSTALLATION DRAWING AND CALIBRATION INFORMATION ENCLOSED

IMI ASSUMES NO RESPONSIBILITY FOR DAMAGE CAUSED TO THIS PRODUCT AS A RESULT OF PROCEDURES THAT ARE INCONSISTENT WITH THIS OPERATING GUIDE

1.0 INTRODUCTION

Congratulations on the purchase of a quality ICP® industrial sensor. In order to ensure the highest level of performance for this product, it is imperative that you properly familiarize yourself with the correct mounting and installation techniques before attempting to operate this device. If, after reading this manual, you have any additional questions concerning this sensor or its application, feel free to call an Application Engineer at **716-684-0003** or **800-959-4464**.

Proper sensor selection requires special attention to three main areas: sensor design, dynamic expectations, and application environment.

Sensor design encompasses the actual sensing element, the physical material, and component selection for the sensor. Preferred industrial accelerometers employ a shear sensing element with either a quartz or ceramic crystal.

Quartz sensing elements are typically used when long-term stability and minimum output shifts due to temperature changes are desired. Ceramic sensing elements provide excellent resolution and durability in noisy environments, and can be designed to supply low-frequency and high-frequency measurements. Shear-design sensors are preferred because of their inherent insensitivity to adverse environmental influences, such as case or base strain and thermal transients. Internal case isolation and shielding is important in avoiding erroneous signals resulting from ground loops and pick-up of electromagnetic and radio frequency interference. Other critical material selection criteria include non-magnetic stainless steel housing, hermetic sealing, and industrial military connectors. See Figure 1.



Figure 1. Typical Industrial Shear Mode Accelerometer

Dynamic expectations are application-specific and refer to the frequency range of measurement and the anticipated amplitudes of vibration. After careful review of the machinery to be monitored, minimum and maximum measurement frequency ranges may be established. The minimum measurement frequency is normally related to any sub-harmonics of running speed or any lower frequencies where vibration data is to be collected. The maximum measurement frequency of interest is determined by the maximum number of harmonics of an event like running speed, bearing frequencies, or gear mesh. This measurement frequency range should be well within the specified frequency range of the sensor.

Amplitude range refers to the anticipated levels of vibration to be measured. These values are related to the alarm levels set for the machine. By carefully evaluating the idiosyncrasies of the machinery, the predictive maintenance engineer can estimate the minimum expected vibration levels and ensure that the electrical noise floor of the accelerometer is less than those levels.

The environment of the application is a critical consideration during program implementation. The sensor chosen must be capable of surviving the wide range of conditions to which it is subjected; therefore, take time to evaluate potential conditions, such as high temperatures and chemical contaminants. The specified temperature range of the sensor must conform to the fluctuations of the environmental temperature. If harsh industrial chemicals are present, the sensor requires hermetic sealing and construction that resists corrosion. Finally, specific location of the sensor within the environment must be sensible, as both cable and sensor may be damaged by imprudent installation in heavily traveled, physically punishing areas.

2.0 ICP® ACCELEROMETERS

Enclosed in the back of this guide is a Specification Sheet, which lists the complete performance characteristics of the particular sensor.

All ICP® sensors require a constant current power source for proper operation. A typical sensing system includes an ICP® sensor, ordinary two conductor cable and a basic constant current power supply (as shown in Figure 2).



Figure 2. Typical Sensor System

The signal conditioner consists of a well-regulated 18 to 30 VDC source (battery or line-powered), a current-regulating diode (or equivalent constant current circuit), and a capacitor for decoupling (removing the bias voltage) the signal.

The current-regulating device is used in place of a resistor for several reasons. The very high dynamic resistance of the diode yields a source follower gain which is extremely close to unity and independent of

input voltage. Also, the diode can be changed to supply higher currents for driving long cable lengths. Constant current diodes, as shown in Figure 3, should be used in ICP® signal conditioners. **(The correct orientation of the diode within the circuit is critical for proper operation.)** Except for special models, standard ICP® sensors require a minimum of 2 mA for proper operation.



Figure 3. Constant Current Diode

The typical limits for this type of diode are to a 4 mA maximum rating; however, several diodes can be placed in parallel for higher current levels. All line-powered signal conditioners should use higher capacity (up to 20 mA) constant current circuits in place of the diodes, particularly when driving long signal cables (see Section 5).

Decoupling of the data signal occurs at the output stage of the signal conditioner. A 10 to 30 µF capacitor coupled with a resistor shifts the signal level to essentially eliminate the sensor bias voltage. The result is a drift-free AC mode of operation.

3.0 OPTIONAL FEATURES

In addition to standard features, a variety of options are also available. When listed before the model number, the following prefix letters indicate that the sensor is manufactured or supplied with optional features:

- CS - Canadian Standards Association Approved Sensor
- D - Dummy, non-working sensor for display purposes
- EX - Cenelec Approved Sensor
- FM - Factory Mutual Approval Sensor
- HT - High temperature accelerometer (325 °F)
- LB - Low Bias electronics
- LC - Limited Calibration (one point calibration)
- LP - Low Pass filter
- M - Metric mounting hardware and cable length
- U - Usable demonstration sensor (does not meet one or more minor specifications)
- VO - Velocity Output Sensors

MS – Mine Safety Approved Sensors
 TO – Temperature Output Sensor

Note: *Not all sensors are available with the optional prefixes. Contact the factory to discuss special features that may be needed.*

4.0 INSTALLATION OVERVIEW

When choosing a mounting method, consider closely both the advantages and disadvantages of each technique. Characteristics like location, ruggedness, amplitude range, accessibility, temperature, and portability are extremely critical. However, the most important and often overlooked consideration is the effect the mounting technique has on the high-frequency operating range of the accelerometer.

Shown in Figure 4 are six possible mounting techniques and their effects on the performance of a typical piezoelectric accelerometer. (**Note:** *Not all of the mounting methods may apply to your particular sensor.*) The mounting configurations and corresponding graph demonstrate how the high-frequency response of the accelerometer may be compromised as mass is added to the system and/or the mounting stiffness is reduced.

Note: *The low-frequency response is unaffected by the mounting technique. This roll-off behavior is typically fixed by the sensor's built-in electronics. However, when operating AC-coupled signal conditioners with readout devices having an input impedance of less than one megaohm, the low frequency range may be affected.*



Figure 4. Assorted Mounting Configurations and Their Effects on High Frequency

4.1 STANDARD STUD MOUNT

This mounting technique requires smooth, flat contact surfaces for proper operation and is recommended for permanent and/or secure installations. Stud mounting is also recommended when testing at high frequencies.

Note: *Do NOT attempt mounting on curved, rough, or uneven surfaces, as the potential for misalignment and limited contact surface may significantly reduce the sensor's upper operating frequency range.*



	1/4-28 Stud	1/4-28 Captive Screw
A (in.)	.250	.250
B (in.)	.350	.350
Torque (ft-lb)	2 to 5	2 to 5

Figure 5. Mounting Surface Preparation

STEP 1: First, prepare a smooth, flat mounting surface and then drill and tap a mounting hole in the center of this area as shown in Figure 5.

A precision-machined mounting surface with a minimum finish of 63 μin (0.0016 mm) is recommended. (If it is not possible to properly prepare the machine surface, consider using an adhesive mounting pad as a possible alternative.) Inspect the area, checking that there are no burrs or other foreign particles interfering with the contact surface.

STEP 2: Wipe clean the mounting surface and spread on a light film of grease, oil, or similar coupling fluid prior to installation. See Figure 6.



Figure 6. Mounting Surface Lubrication

Adding a coupling fluid improves vibration transmissibility by filling small voids in the mounting surface and increasing the mounting stiffness. For

semi-permanent mounting, substitute epoxy or another type of adhesive.

STEP 3: Hand-tighten the sensor/mounting stud to the machine, then secure the sensor with a torque wrench to the mounting surface by applying the recommended mounting torque. (See enclosed specification data sheet for proper mounting torque.)

It is important to use a torque wrench during this step. Under-torqueing the sensor may not adequately couple the device; over-torqueing may result in stud failure and possibly permanent damage.

4.2 ADHESIVE MOUNT

Adhesive mounting is often used for temporary installation or when the machine surface cannot be adequately prepared for stud mounting. Adhesives like hot glue or wax work well for temporary mounts; two-part epoxies and quick-bonding gels provide a more permanent mount.

Note: *Adhesively-mounted sensors often exhibit a reduction in high-frequency range. Generally, smooth surfaces and stiff adhesives provide the best frequency response. Contact the factory for recommended epoxies.*

METHOD 1 – Adhesive mounting base

This method involves attaching a base to the machine surface, then securing the sensor to the base. This allows for easy removal of the accelerometer.

STEP 1: Prepare a smooth, flat mounting surface. A minimum surface finish of 63 μin (0.0016 mm) generally works best.

STEP 2: Stud-mount the sensor to the appropriate adhesive mounting base according to the guidelines set forth in **STEPS 2** and **3** of the Stud Mount Procedure.

STEP 3: Place a small portion of adhesive on the underside of the mounting base. Firmly press down on the assembly to displace any extra adhesive remaining under the base. See Figure 7.



Figure 7. Mounting Base: Adhesive Installation

METHOD 2 – Direct Adhesive Mount

For restrictions of space or for convenience, most sensors (with the exception of integral stud models) can be adhesive-mounted directly to the machine surface.

STEP 1: Prepare a smooth, flat mounting surface. A minimum surface finish of 63 μin (0.0016 mm) generally works best.

STEP 2: Place a small portion of adhesive on the underside of the sensor. Firmly press down on the top of the assembly to displace any adhesive. Be aware that excessive amounts of adhesive can make sensor removal difficult. See Figure 8.



Figure 8. Direct Adhesive Mounting

4.3 MAGNETIC MOUNT

Magnetic mounting provides a convenient means for making portable measurements and is commonly used for machinery monitoring and other portable or trending applications.

Note: *The correct magnet choice and an adequately prepared mounting surface are critical for obtaining reliable measurements, especially at high frequencies. Poor installations can cause as much as a 50% drop in the sensor frequency range.*

Not every magnet is suitable for all applications. For example, rare earth magnets are commonly used because of their high strength. Flat magnets work well on smooth, flat surfaces, while dual-rail magnets are required for curved surfaces. In the case of non-magnetic or rough surfaces, it is recommended that the user first weld, epoxy, or otherwise adhere a steel mounting pad to the test surface. This provides a smooth and repeatable location for mounting.

STEP 1: After choosing the correct magnet type, inspect the unit, verifying that the mounting surfaces are flat and smooth. See Figure 9.



Figure 9. Magnet Types

STEP 2: Stud-mount the accelerometer to the appropriate magnet according to the guidelines set forth in **STEPS 2** and **3** of the Stud Mount Procedure.

STEP 3: Prepare a smooth, flat mounting surface. A minimum surface finish of 63 μin (0.0016 mm) generally works best. After cleaning the surface and checking for burrs, wipe on a light film of silicone grease, machine oil, or similar-type coupling fluid.

STEP 4: Mount the magnet/sensor assembly to the prepared test surface by gently “rocking” or “sliding” it into place. See Figure 10.



Figure 10. Magnet Mounting

Note: *Magnetically mounting accelerometers carelessly has the potential to generate very high (and very damaging) g levels. To prevent damage, install the assembly gently. If unsure, please contact the factory for assistance.*

4.4 HANDHELD OR PROBE TIP MOUNT

This method is NOT recommended for most applications. It is generally used where access to machinery may be a safety concern. Both the accuracy and repeatability at low (<5 Hz) and high frequency (>1 kHz) ranges are questionable.

5.0 CABLING

The selection of connectors and cables has a direct impact on the ruggedness and reliability of the sensor installation. A consideration when dealing with cables is the way in which the cable conductors are terminated.

ICP® accelerometers are internally amplified, two-wire accelerometers. Connections to the sensor require two leads: one for the power and signal, and the other for the common and signal return. Often, coaxial cables are used since only two conductors are needed. Coaxial cables are less expensive. With coaxial cables, however, erroneous signals can be introduced into sensor systems through ground loops, electromagnetic interference, or radio frequency interference (EMI or RFI). To avoid ground loops, there should only be one ground in the system.

It is recommended for permanent installations that the sensor be case-isolated and internally shielded with a dual-case design and use a two-conductor shielded cable to insure clean vibration signal transmission. Two-conductor shielded cables allow the signal and the signal return (common) to be fully shielded from the sensor to the readout equipment. To insure that ground loop signals are not induced, the shield should only be terminated at one end. Typically, the shield of a two-conductor shielded cable is left open or not connected at the sensor end and is tied to earth ground at the instrumentation end.

Operation over long cables may affect the frequency response of ICP® accelerometers, and introduce low frequency noise and high frequency distortion when an insufficient current is available to drive cable capacitance.

Unlike charge mode systems, where the system noise is a function of cable length, ICP® sensors provide a high voltage, low impedance output well-suited for driving long cables through harsh environments. While there is virtually no increase in noise with ICP® sensors, the capacitive loading of the longer cable may be distort or filter higher frequency signals depending on the supply current and the output impedance of the sensor.

Generally, this signal distortion is not a problem with lower frequency testing within a range up to 1,000 Hz. However, when monitoring higher frequency vibrations traveling over cables longer than 500ft, the possibility of signal distortion exists.

The maximum frequency that can be transmitted over a given cable length is a function of both the cable capacitance and the ratio of the peak signal voltage to the current available from the signal conditioner according to:



$$f_{\max} = \frac{10^9}{2\pi CV} \quad (\text{Equation 1})$$

[L_c-1]

Where, f_{\max} = maximum frequency (hertz)
C = cable capacitance (picofarads)
V = maximum peak output from sensor (volts)
 L_c = constant current from signal conditioner (mA)
 10^9 = scaling factor to equate units

Note that in this equation, 1 mA is subtracted from the total current supplied to sensor (L_c). This is done to compensate for powering the internal electronics. Also, note that these are typical values only.

When driving long cables, Equation 1 shows that, as the length of the cable, peak voltage output or maximum frequency of interest increases, a greater constant current will be required to drive the signal.

The nomograph on page 12 of this manual provides a simple, graphical method for obtaining the expected maximum frequency capability of an ICP® measurement system. The maximum peak signal voltage amplitude, cable capacitance and supplied constant current must be known or presumed.

For example, when running at 100 ft (30.5 m) cable with a capacitance of 30 pF/ft, the total capacitance is 3,000pF. This value can be found along the diagonal cable capacitance lines. Assuming the sensor operates at a maximum output range of 5 volts and the constant current available from the power supply is 2 mA, the ratio on the vertical axis can be calculated to equal 5. The intersection of the total cable capacitance and this ratio result in a maximum frequency of approximately 10.2 kHz.

The nomograph does not indicate whether the frequency amplitude response at a point is flat, rising or falling. For precautionary reasons, it is good general practice to increase the constant current (if possible) to the sensor (within its maximum limit) so that the frequency determined from the nomograph is approximately 1.5 to 2 times greater than the maximum frequency of interest.

Note: Higher current levels will deplete battery-powered signal conditioners at a faster rate. Also, any current not used by the cable goes directly to power the internal electronics and will create heat. This may cause the sensor to

exceed its maximum temperature specification. For this reason, do not supply excessive current over short cable runs or when testing at elevated temperatures.

5.1 CABLE CONNECTOR PROCEDURE

Care and attention to installation is essential, as the reliability and accuracy of your system is no better than that of the output cable.

STEP 1: Ascertain that you have ordered the correct cable type.

As with sensors, no cable can satisfy all applications. Special low-noise cabling should be used with high impedance, charge-output devices. ICP® sensors usually operate with any ordinary tow-wire cable. Industrial applications often require twisted/shielded cables to reduce the effects of EMI and RFI. PTFE-jacketed cabling may be necessary to withstand corrosive environments.

STEP 2: Connect the cable to the accelerometer. A small amount of thread-locking compound placed on the connector prior to attachment helps secure the cable during testing. In harsh environments, the connection can be sealed with silicone rubber, O-rings, and flexible heat-shrink tubing.

STEP 3: Plug the connector of the cable into the mating sensor connector. Then, holding the sensor stationary, secure the connector in place by tightening down the attached threaded cable sleeve.

STEP 4: Route the cable to the signal conditioner, making certain to stress-relieve the sensor/cable connection and minimize motion by clamping the cable at regular intervals.

Common sense should be used to avoid physical damage and minimize electrical noise. For instance, avoid routing cables near high-voltage wires. Do not route cables along floors or walkways where they be stepped on or become contaminated. Shielded cables should have the shield grounded at one end only, normally at the instrumentation end.

STEP 5: Finally, connect the remaining cable end to the signal conditioner or readout device. To dissipate charge that may have accumulated in the cable short the signal to ground prior to attachment.

6.0 POWERING

All ICP® sensors require constant current excitation for proper operation. For this reason only use approved constant-current sources. A typical system schematic is shown in Figure 11.



Figure 11. Typical System Schematic

The power supply consists of a regulated 18 to 30 VDC source. In general, battery-powered devices offer versatility for portable, low-noise measurements, whereas line-powered units provide the capability for continuous monitoring. This power is regulated by a current-limiting circuit, which provides the constant-current excitation required for proper operation of sensors with integral electronics.

Note: Under no circumstances should a voltage be supplied to an ICP® accelerometer without a current-regulating diode or equivalent electrical circuit.

A capacitor at the output stage of the device removes the sensor output bias voltage from the measurement signal. This provides a zero-based, AC-coupled output compatible with most standard readout devices.

Today, many FFT analyzers, data acquisition modules, and data collectors have constant-current excitation for direct use with ICP® sensors. However, before using this feature, check that the supply voltage and constant current are adequate for use with your sensor. Please contact the respective signal conditioner manufacturer or check the product manual for more information.

7.0 OPERATING

After completing the system setup, switch on the conditioner, the meter (or LED) and allow the sensor to power up. If a faulty condition is monitored, first check all system connections, then check the functionality of the cable and signal conditioner. If

the system still does not operate properly, consult an IMI Application Engineer.

Note: Always operate the accelerometer within the limitations listed on the Specification Sheet of your sensor. Operating the device outside of its parameters can cause temporary or permanent damage to the sensor.

8.0 ACCELEROMETER CALIBRATION

Note: It is good measurement practice to verify the performance of each accelerometer before and after each measurement.

Accelerometers are precision measuring instruments. They are highly engineered to provide accurate electrical signals representative of the vibration being monitored. Each sensor is calibrated by comparison to a known acceleration level. Some calibrations include frequency response curves, resonant frequency measurements, transvers sensitivity, and many other valuable tests. Applications requiring a high degree of accuracy or those in plants requiring certification and traceability require full calibration test results.



Figure 12. Typical Calibration Certificate

Some applications have much less stringent requirements for calibration certification. Simple sensitivity measurements at a single frequency may be sufficient; operational verification and certificates of conformance to published specifications may satisfy many plants' calibration needs. Reducing the final calibration requirements reduces the cost of manufacturing the sensor and should lower the price for predictive maintenance users.

Periodic recalibration may be required by plants with strict certification and traceability requirements. It is always recommended that the user has the sensor recalibrated periodically, particularly if the sensor has experienced a very high shock level or extreme temperatures for extended periods of time. Some plants develop in-house calibration capabilities for periodically verifying the performance of accelerometers. Products are available that provide a set 1 g-acceleration level at a fixed frequency for quick sensor checking.

For these reasons, it is recommended that a recalibration cycle be established for each accelerometer. This schedule is unique and is based on a variety of factors, such as extent of use, environmental conditions, accuracy requirements, trend information obtained from previous calibration records, contractual regulations, frequency of “cross-checking” against other equipment, manufacturer recommendation, and any risk associated with incorrect readings. International standards, such as ISO 10012-1, provide insight and suggested methods for determining recalibration intervals for most measuring equipment. With the above information in mind and under “normal” circumstances, a conservative suggestion of 12 to 24 month recalibration cycle for most piezoelectric accelerometers is advised.

8.1 SENSOR CALIBRATION

Accelerometer recalibration services are typically performed by IMI’s internal metrology laboratory. (Other international and private laboratories are also available.) The IMI laboratory is certified to ISO 9001, complies with ISO 10012-1 (and former MIL-STD-45662A), and uses equipment directly traceable to NIST. This assures an accurate calibration of relevant specifications.

The following includes a broad overview of the Back-to-Back Calibration technique normally used when calibrating accelerometers. This technique provides a quick and easy method for determining the sensitivity of a test accelerometer over a wide frequency range.

8.2 BACK-TO-BACK CALIBRATION THEORY

Back-to-back calibration is perhaps the most common method for determining the sensitivity of

piezoelectric accelerometers. This method relies on a simple comparison to a previously calibrated accelerometer, typically referred to as a reference standard, as shown in Figure 12.



Figure 12. Reference Standard Accelerometer

These high-accuracy devices, which are directly traceable to a recognized standards laboratory, are designed for stability, as well as configured to accept a test accelerometer. By mounting a test accelerometer to the reference standard and then connecting this combination to a suitable vibration source, it is possible to vibrate both devices and compare the data as shown in Figure 13. (Test setups may be automated and vary, depending on the type and number for accelerometers being calibrated.)



Figure 13. Typical Back-to-Back Calibration System

Because the acceleration is the same on both sensors, the ratio of their outputs (V_T/V_R) must also be the ratio of their sensitivities. With the sensitivity of the reference standard (S_R) known, the exact sensitivity of the test sensor (S_T) is easily calculated by using the following equation:

$$S_T = S_R \left(\frac{V_T}{V_R} \right)$$

By varying the frequency of the vibration, the sensor may be calibrated over its entire operating frequency range. The typical response of an unfiltered accelerometer is shown in Figure 14.



Figure 14. Typical Test Accelerometer Response

9.0 TROUBLESHOOTING

Piezoelectric sensors are dynamic measuring equipment. They use piezoelectric sensing elements to convert or transduce the mechanical phenomena to an electrical signal. The mechanical parameter may be force, pressure or vibration. The raw electrical signal from a piezoelectric charge element is a high impedance signal. This charge signal is normally converted to a low impedance voltage signal by either an external charge amplifier or an external voltage amplifier. The cables between the charge sensor and the amplifier must be high quality, low noise cable and must be kept as short as possible. Figure 15 shows a typical high impedance system.



Figure 15. High Impedance System Connection

Internally amplified sensors employ miniature amplifiers to convert the high impedance charge signal into a low impedance voltage signal. These amplifiers are internal to the sensor, and therefore, do not require low noise cables or external amplifiers. These amplifiers have set gain so that output sensitivities are standardized.



Figure 16. Sensor with Integral Electronics System Connector

ICP® sensors are two-wire sensors. They are powered with a constant current DC source. The power supply is typically 18 to 30 volts DC current limited via a constant current between 2 and 20 mA. Typical battery operated supplies offer 2mA of constant current to extend battery life while continuous monitoring systems offer more current in order to drive longer cables. Figure 16 shows a typical system for a sensor with integral electronics.

The signal output of a sensor with integral electronics is a low impedance voltage signal proportional to the dynamic measurement such as force, pressure, or vibration. This voltage signal is carried on a DC bias voltage. The AC dynamic signal is superimposed on the DC bias voltage and is allowed to swing between the supply voltage and ground as shown in Figure 17. Unlike an operational amplifier that requires a plus and minus supply and allows the signal to “ride” on ground and “swing” between the plus and minus “rails,” the sensor with integral electronics requires the output signal to be DC biased.



Figure 17. Sensor DC Bias Voltage

This DC bias voltage is an excellent diagnostic tool. The voltage provides a means of verifying that the amplifier is “turned on.” Typical input/output power supplies will block this DC bias voltage at the output via a blocking capacitor in order to AC couple the signal to readout devices. By “teeing” off the input into a DC volt meter, as shown in Figure 18, the bias voltage can be measured.

While measuring the supply voltage, the bias voltage can be measured after the sensor is plugged in. If the meter stays at supply, something in the system is open or not connected. If the meter reads “0,” something in the system is shorted. If the meter reads within the bias voltage range of the sensor, then the sensor and cabling are functioning properly.



Figure 18. DC Bias Voltage Measurement

10.0 REPAIR/RETURN PROCEDURE

Because of the nature of most IMI instrumentation, field repair is typically NOT recommended and may void any warranty. If factory service is required, contact IMI for a **RETURN MATERIAL AUTHORIZATION (RMA)** number prior to sending equipment to the factory. Please have information available, such as model and serial number. Also, to insure efficient service, be sure to include a written description of the symptoms and problems with the equipment to a local sales representative or distributor, or contact IMI if none are located in your area.

Customers outside the U.S. should consult their local IMI distributor for information on returning equipment. For exceptions, please contact the International Sales department at IMI to request shipping instructions and an

RMA. For assistance, please call **(716) 684-0003**, or fax us at **(716) 684-3823**. You may also receive assistance via e-mail at imi@pcb.com or visit our website at www.pcb.com.

11.0 CUSTOMER SERVICE/WARRANTY

IMI, a division of PCB Piezotronics, guarantees **Total Customer Satisfaction**. If, at any time, for any reason, you are not completely satisfied with any IMI product, IMI will repair, replace or exchange it at no charge. You may also choose to have your purchase price refunded.

IMI instrumentation is warranted against defective material workmanship for 1 year unless otherwise expressly specified. Damage to instruments caused by incorrect power or misapplication, is not covered by warranty. *If there are any questions regarding power, intended application, or general usage, please consult with your local sales contact or distributor.* Batteries or expendable hardware items are not covered by warranty.

IMI offers to all customers, at no charge, 24-hour phone support. This service makes product or application support available to our customers, day or night, seven days a week. When unforeseen problems or emergency situations arise, call the **IMI Hot Line at (716) 684-0003**, and an application specialist will assist you.

Cable Driving Nomograph



PCB Piezotronics Inc. claims proprietary rights in the information disclosed hereon. Neither it nor any reproduction thereof will be disclosed to others without the written consent of PCB Piezotronics Inc.

SCHEDULE DRAWING

NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO THE NOTIFIED BODY

69021

REVISIONS

REV	DESCRIPTION	DIN
NR	RELEASED TO DRAFTING	47008

- 6.) CONNECTION METHOD TO THE EQUIPMENT SHOULD COMPLY WITH THE REQUIREMENT OF NEC AND CEC FOR NORTH AMERICAN CERTIFICATION.
- 5.) MODEL NUMBER EX(XX)621XYYY CERTIFICATE ITS 18 ATEX 23198X.
MODEL NUMBER EX(XX)621XYYY CERTIFICATE IECEX ETL 18.0009X.
MODEL NUMBER EX(XX)621XYYY CERTIFICATE ETL C/US LISTED INTERTEK 5010230

4 SHIELDS TO BE EARTHED AT BARRIER ENDS.

3 THE INSTALLER SHALL INSURE THAT THE TRANSDUCER MOUNTING STRUCTURE IS AT THE SAME GROUNDING POTENTIAL AS THE BARRIER GROUND. TOTAL EARTH LOOP IMPEDANCE SHALL BE LESS THAN 1 OHM. USE AN OFFGROUND TO THE SENSOR HOUSING IF A NON ISOLATION BARRIER IS USED.

2 BARRIER WILL BE MOUNTED IN AN ENCLOSURE THE SUITABILITY OF WHICH WILL BE DETERMINED BY LOCAL AUTHORITIES. USE AN ISOLATION BARRIER IF THE TRANSDUCER HOUSING IS MOUNTED TO A GROUNDING STRUCTURE.

INSTALLATION IN CLASSIFIED HAZARDOUS LOCATION TO BE PERFORMED PER INSTALLATION REQUIREMENTS OF IECEX, ATEX, NEC, AND CEC.

WARNING/ATTENTION: EQUIPMENT DOES NOT MEET REQUIREMENT OF 6.3.13 OF IEC 60079-1:2011 16TH EDITION FOR DI-ELECTRIC TESTING. APPLICABLE FOR EN, UL AND CSA STANDARDS AS WELL.

L'ÉQUIPEMENT NE SATISFAIT PAS À L'EXIGENCE DE 6.3.13 DE LA NORME CSA C22.2 NO 60079-11 POUR LES ESSAIS DIÉLECTRIQUES.

NORTH AMERICA CERTIFICATION STANDARDS:

- UL 913:2013 ED.8 +R:16OCT2015
- UL 60079-0 ED.6 2013
- UL 60079-11 ED.6 2013
- CSA C22.2#60079-0:2015 ED.3
- CSA C22.2#60079-11:2014 ED.2
- CAN/CSA-22.2 NO. 157-92 (R2016)

1 **ENTITY APPLICATION**

BARRIER	I.S. APPARATUS
Voc/Uo	≤ VMAX / UI
Isc/Io	≤ IMAX/ II
Ca/Co	> CI + CCABLE
La/Lo	> LI + LCABLE
Po	≤ PI (CENELEC ONLY)

BARRIERS WITHIN THE SPECIFIED LIMITATIONS ARE PERMITTED

ENTITY PARAMETERS

EX621xyyy/aaa or EXM621xyyy/aaa

- Ui = 28V
- Ii = 93mA
- Pi = 0.65W
- Ci = 6.5nF
- Li = 0H

CERTIFIED BY THE APPROPRIATE APPROVAL AUTHORITY FOR CONNECTION TO THE FOLLOWING AREAS:

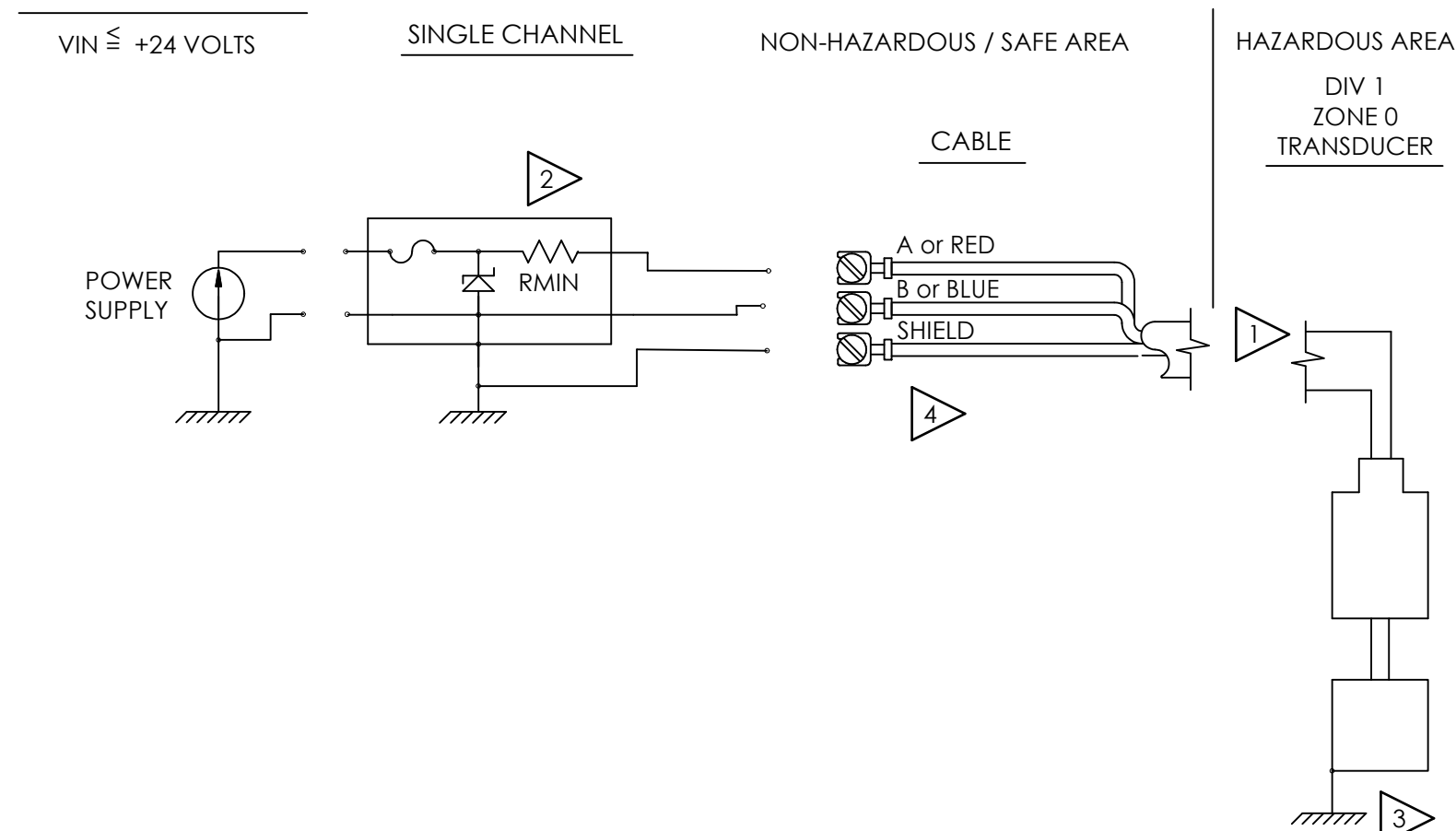
NORTH AMERICA

ZONE 0
Ex ia IIC T4 Ga
AEx ia IIC T4 Ga

DIV 1
CLASS I, GROUPS A,B,C,D, T4
CLASS II, GROUPS E,F,G, T275°C
CLASS III, T4

EUROPE

ZONE 0
Ex ia IIC T4 Ga



NO CHANGES WITHOUT INTERTEK APPROVAL

UNLESS OTHERWISE SPECIFIED		DRAWN		CHECKED		ENGINEER		PCB PIEZOTRONICS	
DIMENSIONS ARE IN INCHES		JDM	4/9/19	JDM	4/9/19	GGG	4/9/19	3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0002 E-MAIL: sales@pcb.com	
DECIMALS	X ± .05	TITLE		APPROVAL		CODE		DWG. NO.	
	XX ± .01	INTERCONNECTION		DRAWING		IDENT. NO.		69021	
	XXX ± .005	SCALE:		NONE		SHEET		1 OF 1	
	XXXX ± .0005								
	ANGLES ± 2 DEGREES								
	FILLETS AND RADII .003 - .005								
	HEX DIMENSIONS ARE:								
	≤ .5 + .000 / - .003								
	> .5 + .000 / - .005								
	INTERNAL THREAD DEPTH MIN.								
	REMOVE ALL BURRS								
	SHARP = R.000 - R.003								

	ENGLISH	SI	
Performance			
Sensitivity(± 10 %)	10 mV/g	1.02 mV/(m/s ²)	[1]
Measurement Range	± 500 g	± 4,905 m/s ²	
Frequency Range(± 10 %)	204 to 1,080,000 cpm	3.4 to 18,000 Hz	[2][3]
Frequency Range(± 3 dB)	96 to 1,800,000 cpm	1.6 to 30,000 Hz	[2][3]
Resonant Frequency	4,500 kcpm	75 kHz	[4][5]
Broadband Resolution(1 to 10,000 Hz)	1.2 mg rms	1,176 µm/sec ²	[4]
Non-Linearity	± 1 %	± 1 %	[6]
Transverse Sensitivity	≤ 5 %	≤ 5 %	
Environmental			
Overload Limit(Shock)	10,000 g pk	98,100 m/s ² pk	
Temperature Range	-65 to +250 °F	-54 to +121 °C	
Temperature Response	See Graph	See Graph	[4]
Electrical			
Settling Time(within 1% of bias)	≤ 3.0 sec	≤ 3.0 sec	
Discharge Time Constant	≥ 0.1 sec	≥ 0.1 sec	
Excitation Voltage	18 to 28 VDC	18 to 28 VDC	
Constant Current Excitation	2 to 20 mA	2 to 20 mA	
Output Impedance	< 100 Ohm	< 100 Ohm	
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	
Spectral Noise(10 Hz)	100 µg/√Hz	980 (µm/sec ²)/√Hz	[4]
Spectral Noise(100 Hz)	30 µg/√Hz	294 (µm/sec ²)/√Hz	[4]
Spectral Noise(1 kHz)	10 µg/√Hz	98.1 (µm/sec ²)/√Hz	[4]
Electrical Isolation(Base)	≥ 10 ⁸ Ohm	≥ 10 ⁸ Ohm	
Physical			
Size (Hex x Height)	.438 in x 0.847 in	11.125 mm x 21.51 mm	
Weight	0.29 oz	8.17 gm	[7]
Mounting Thread	5-40 Male	5-40 Male	
Mounting Torque	7 to 8 in-lb	79 to 90 N-cm	
Sensing Element	Ceramic	Ceramic	
Sensing Geometry	Shear	Shear	
Housing Material	Stainless Steel	Stainless Steel	
Sealing	Welded Hermetic	Welded Hermetic	
Electrical Connection Position	Top	Top	
Electrical Connections	5-44 Coaxial Jack	5-44 Coaxial Jack	


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 Mounting Thread	M3 x 0.50 Male	M3 x 0.50 Male

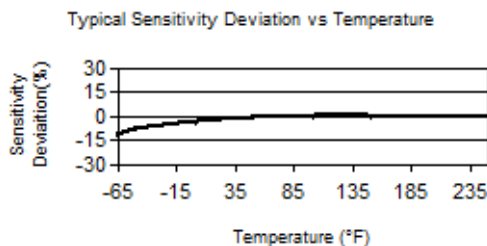
NOTES:

[1] Conversion Factor 1g = 9.81 m/s².
 [2] The high frequency tolerance is accurate within ±10% of the specified frequency.
 [3] Frequency response with magnetic base.
 [4] Typical value.
 [5] Mounted resonance (nominal) without magnet.
 [6] Zero-based, least-squares, straight line method.
 [7] Typical.
 [8] See PCB Declaration of Conformance PS023 for details.
 [9] See Model's "Instructions For Use" (IFU) for North American Conformity and Certification Statements.

SUPPLIED ACCESSORIES:
 Model ICS-6 NIST traceable single axis amplitude response calibration from 10 Hz to upper +/- 3dB point. (1)

Entered: ND	Engineer: gs	Sales: KWW	Approved: BAM	Spec Number:
Date: 11/04/2022	Date: 11/04/2022	Date: 11/04/2022	Date: 11/04/2022	71241

	Phone: 800-959-4464 Fax: 716-684-3823 E-Mail: imi@pcb.com
3425 Walden Avenue, Depew, NY 14043	

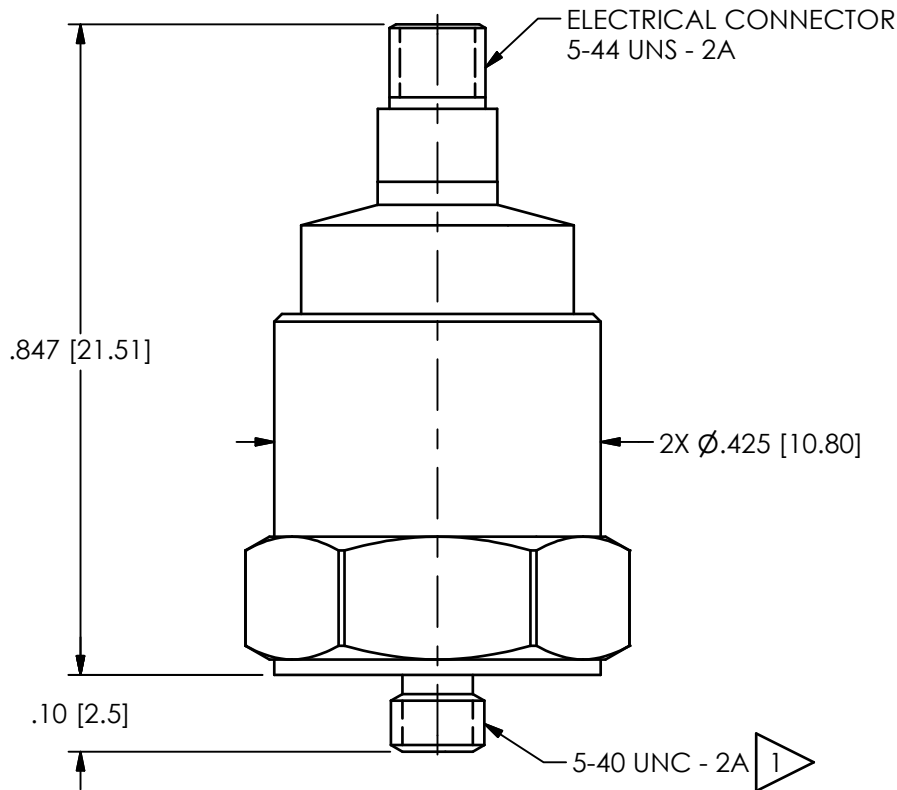
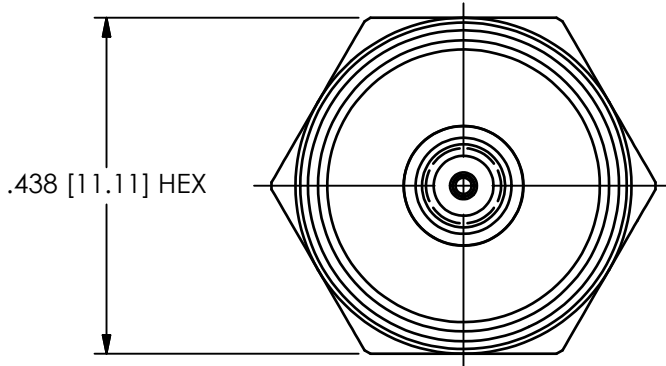


All specifications are at room temperature unless otherwise specified.
 In the interest of constant product improvement, we reserve the right to change specifications without notice.
 ICP® is a registered trademark of PCB Piezotronics, Inc.

PCB Piezotronics Inc. claims proprietary rights in the information disclosed hereon. Neither it nor any reproduction thereof will be disclosed to others without the written consent of PCB Piezotronics Inc.

REVISIONS		
REV	DESCRIPTION	DIN
A	UPDATED TITLE BLOCK, ADDED NOTE	53107

71228



1 M3x.5-6g FOR SENSOR WITH METRIC OPTION

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN		CHECKED		ENGINEER		PCB PIEZOTRONICS AN AMPHENOL COMPANY 3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 E-MAIL: sales@pcb.com	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]	NJF	08/12/22	JDM	08/12/22	GGG	08/12/22		
DECIMALS XX ±.03 XXX ±.010 ANGLES ± 2 DEGREES	DECIMALS X ± 0.8 XX ± 0.25 ANGLES ± 2 DEGREES	TITLE						52681	71228
CABLE TOLERANCES IN ENGLISH 1" ≤ LENGTH < 1' = +1"/ - 0 1' ≤ LENGTH < 5' = +2"/ - 0 5' ≤ LENGTH < 100' = +6"/ - 0 100' ≤ LENGTH = +1' / - 0	CABLE TOLERANCES IN METRIC 2.54cm ≤ LENGTH < 30.5cm = +2.54cm/ - 0 30.5cm ≤ LENGTH < 1.5m = +5.1cm/ - 0 1.5m ≤ LENGTH < 30.5m = +15.2cm/ - 0 30.5m ≤ LENGTH = +30.5cm/ - 0							OUTLINE DRAWING EX621C40 SERIES ACCELEROMETER	
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13								

2

1

AUTHORIZATION TO MARK

This authorizes the application of the Certification Mark(s) shown below to the models described in the Product(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to multiple listee model(s) identified on the correlation page of the Listing Report.

This document is the property of Intertek Testing Services and is not transferable. The certification mark(s) may be applied only at the location of the Party Authorized To Apply Mark.

Applicant: PCB Piezotronics Inc
Address: 3425 WALDEN AVE. DEPEW, NY 14043
Country: USA
Contact: Carrie Termin
Phone: (800) 959-4464 X 2667
FAX: (800) 959-4464
Email: ctermin@pcb.com

Manufacturer: PCB Piezotronics Inc
Address: 3425 WALDEN AVE. DEPEW, NY 14043
Country: USA
Contact: Carrie Termin
Phone: (800) 959-4464 X 2667
FAX: (800) 959-4464
Email: ctermin@pcb.com

Party Authorized To Apply Mark: Same as Manufacturer
Report Issuing Office: Cortland, New York

Control Number: 5010230

Authorized by: *Dean Davidson*
for Dean Davidson, Certification Manager



This document supersedes all previous Authorizations to Mark for the noted Report Number.

This Authorization to Mark is for the exclusive use of Intertek's Client and is provided pursuant to the Certification agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this Authorization to Mark. Only the Client is authorized to permit copying or distribution of this Authorization to Mark and then only in its entirety. Use of Intertek's Certification mark is restricted to the conditions laid out in the agreement and in this Authorization to Mark. Any further use of the Intertek name for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. Initial Factory Assessments and Follow up Services are for the purpose of assuring appropriate usage of the Certification mark in accordance with the agreement, they are not for the purposes of production quality control and do not relieve the Client of their obligations in this respect.

Intertek Testing Services NA Inc.
545 East Algonquin Road, Arlington Heights, IL 60005
Telephone 800-345-3851 or 847-439-5667 Fax 312-283-1672

Standard(s):	<p>Explosive Atmospheres – Part 0: Equipment – General Requirements [UL 60079-0:2013 Ed.6+R:20Oct2017]</p> <p>Explosive Atmospheres - Part 11: Equipment Protection By Intrinsic Safety 'i' [UL 60079-11:2013 Ed.6 +R:28Mar2014]</p> <p>Intrinsically Safe And Non-Incendive Equipment For Use In Hazardous Locations (R2016) [CSA C22.2#157:1992 Ed.3+G1;U2]</p> <p>Explosive Atmospheres - Part 0: Equipment - General Requirements [CSA C22.2#60079-0:2015 Ed.3]</p> <p>Explosive Atmospheres - Part 11: Equipment Protection By Intrinsic Safety "I" [CSA C22.2#60079-11:2014 Ed.2]</p>
Product:	<p>EX Vibration Sensors for use in EX ia IIC T4 Ga CLASS I ZONE 0 AEX ia IIC T4 Ga CLASS I, DIV 1 GROUPS A.-D T4 CLASS II DIV 1 GROUPS E-G, T275'C CLASS III, T4 -54°C < TAMB < 121°C</p>
Brand Name:	<p>IMI Vibration Sensors</p>
Models:	<p>EX621 or EXM621; followed by one letter; followed by 00 to 999; followed by /; followed by 000 to 999.</p>

EU Declaration of Conformity PS185
In Accordance with ISO/IEC 17050

Manufacturer: PCB Piezotronics, Inc. 3425 Walden Avenue Depew, New York 14043 USA	Authorized European Representative: PCB Piezotronics Europe GmbH Porschestrasse 20-30 41836 Hückelhoven, Germany
--	---

Certifies that type of equipment: ICP® Vibration Sensor(s)

Whose Product Models Include: EX(M)621xyyy/aaa Series

Where:

- (M) - Represents optional Metric mounting hardware and cable
- x – Represents one Letter A to Z
- yyy – Represents two or three Numbers 00 to 999
- aaa - Designates cable length and/or connector type

This declaration is applicable to all Vibration Sensor(s) of the above series which have the CE & (EX) ATEX mark on their data sheets and where those data sheets refer to this declaration of conformity. The data sheets for all model numbers referenced above, which include the CE & (EX) ATEX mark on such data sheets and refer to this Declaration of Conformity are hereby incorporated by reference into this Declaration.

Conform to the following EU Directive(s) when installed per product documentation:	2014/30/EU 2014/34/EU 2011/65/EU w/2015/863/EU	EMC Directive ATEX Directive RoHS Directive
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Standards to which Conformity is Declared:

Harmonized Standards	EN 61326-1:2013 EN 61326-2-3:2013 EN 60079-0:2012 +A11:2013 EN 60079-11:2012 EN 63000:2018	Electrical Equipment for Measurement, Control and Laboratory Use- EMC Requirements – Part 1: General Requirements Electrical Equipment for Measurement, Control and Laboratory Use- EMC Requirements – Part 2-3: Particular Requirements Explosive Atmospheres – Part 0: Equipment – General Requirements Explosive Atmospheres – Part 11: Equipment Protection by Intrinsic Safety “i” Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
Emissions Test Standards	EN 55011:2009+ A1:2010	Industrial, Scientific and Medical Equipment - Radio frequency Disturbance Characteristics - Limits and Methods of Measurement
Other Standards Applied (non-OJEU) Immunity Test Standards	EN 61000-6-1:2007 EN 61000-6-2:2005	Electromagnetic Compatibility (EMC) - Generic standards — Immunity for residential, commercial and light-industrial environments Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments Explosive Atmospheres
Test Reports	EMC Reports Safety Reports	GM29028c, GM29030c, GM29045c GM29029s, GM29031s, GM29046s
EC Type Examination	ATEX Certification	ITS 18 ATEX 23198X Ex ia IIC T4 Ga, II 1 G

Notified Body Name		Intertek Testing & Certification Ltd
Notified Body's Address		Intertek House Cleeve Road Leatherhead Surrey KT22 7SB United Kingdom

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) Standard(s)

Place: Depew, NY
Date: 08/21/2021

Signature: 
Name: Carrie Termin
Title: Regulatory Affairs and Product Certification Specialist

EU TYPE-EXAMINATION CERTIFICATE

1. EU type-examination Certificate (Module B)
2. Equipment or Protective System intended for use in potentially explosive atmospheres (Directive 2014/34/EU)



3. EU type examination certificate Nr **ITS18ATEX23198X**

4. **Product:** Vibration Sensors EX-621 and EXM-621

5. **Manufacturer:** PCB Piezotronics, Incorporated

Applicant: PCB Piezotronics, Incorporated

6. **Address:** 3425 Walden Avenue, Depew
NY 14043-2495, USA

Address: 3425 Walden Avenue, Depew
NY 14043-2495, USA

7. This product and any acceptable variation thereto are specified in the schedule to this certificate and therein referred to.

8. INTERTEK ITALIA S.p.A., Notified Body n° 2575 in accordance with article 17 of the Directive 2014/34/EU of the European Parliament and Council of the 26 February 2014, certifies that the equipment or protective system has been found to comply with the essential Health and Safety Requirements relating to the design and construction of equipment and protective system intended for use in potentially explosive atmosphere, given in Annex II of the Directive.

The examination and tests results are recorded in confidential technical evaluation Intertek Testing and Certification Report Nr. 103117575CRT-002d to -002f issue dated 06/28/2018.

9. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-0:2012+A11:2013, EN 60079-11:2012 except in respect of those requirements referred to at item 18 of the Schedule.

10. If the sign X is placed after the certificate number, it indicates that the product is subject to Special Conditions for Safe Use specified in the schedule to this certificate.

11. This EU-Type Examination Certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

12. The marking of the product shall include the following:



II 1 G Ex ia IIC T4 Ga

Certificate issue date

25 March 2019

Gian Paolo Tondetta

Certification Manager ATEX
Intertek Italia S.p.A. (NB 2575)



PDR N° 277B

Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC

Signatory of EA, IAF and ILAC Mutual Recognition Agreements

This certificate is the transfer of the certificate issued by Intertek Testing & Certification Ltd. (NB 0359) having the same number.



This Certificate is for the exclusive use of Intertek's client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this Certificate. Only the Client is authorized to permit copying or distribution of this Certificate and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek.

Intertek Italia S.p.A. Via Miglioli, 2/A - 20063 Cernusco sul Naviglio, Milano - Italy



13. SCHEDULE

14. EU TYPE EXAMINATION CERTIFICATE NUMBER: **ITS18ATEX23198X**

15. DESCRIPTION OF THE EQUIPMENT OR PROTECTIVE SYSTEM

EX621 and EXM621 (M with Metric Option) are vibration sensor designed and manufactured by PCB piezotronics Inc. These sensors are evaluated for use in Zone 0 environment. They are evaluated for Ex ia IIC T4 Ga classified hazardous locations. Construction of both EX621 and EXM621 is electrical same. Mechanically EXM has M-type of connection for power while EX621 sensor are equipped with other type threaded connector. Sensor is powered in classified area using EX certified Barrier. Sensor incorporates Piezo element for sensing vibration. These signals are amplified internally on amplifier board

CE Marking shall be accompanied by the identification number of the Notified Body responsible for surveillance of production.

16. DRAWINGS AND DOCUMENTS

TITLE	DOCUMENT Nr	LEVEL	DATE
Technical File Intrinsic Safety ATEX, IECEX and ETL"ia"	69019	NR	05/30/2018

Copies of the above listed documents are kept at Intertek Italia S.p.A. archive.

17. SPECIAL CONDITIONS FOR SAFE USE

Equipment does not comply with requirement of EN 60079-11:2012 clause 6.3.13 for di-electric testing.

18. ESSENTIAL HEALTH AND SAFETY REQUIREMENTS

The relevant essential Health and Safety Requirements have been identified and assessed in Intertek Testing and Certification Report Nr. 103117575CRT-002d to -002f issue dated 06/28/2018.

19. ROUTINE (FACTORY) TESTS

None.

20. DETAIL OF CERTIFICATE CHANGES

None.

EU-Type Examination Certificate



Intertek

Valued Quality. Delivered.

1. **EU-TYPE EXAMINATION CERTIFICATE**
2. **Equipment or Protective System Intended for use in Potentially Explosive Atmospheres Directive 2014/34/EU**
3. **EU-Type Examination Certificate Number: ITS18ATEX23198X**
4. **Product:** Vibration Sensors
5. **Manufacturer:** EX-621 and EXM-621
6. **Address:** PCB Piezotronics, Incorporated
3425 Walden Avenue, Depew, NY 14043-2495, USA.
7. This product and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
8. Intertek Testing and Certification Limited, Notified Body number 0359 in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council dated 26 February 2014, certifies that the product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential Intertek Report 103117575CRT-002d to -002f Ref Issue dated 27 June 2018.
9. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-0: 2012+A11:2013, EN 60079-11: 2012 except in respect of those requirements referred to at item 16 of the Schedule.
10. If the sign "X" is placed after the certificate number, it indicates that the product is subject to Specific Conditions of Safe Use specified in the Schedule to this certificate.
11. This EU-Type Examination Certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.
12. The marking of the product shall include the following:



Ex ia IIC T4 Ga

Ui: 28V, Ii: 93 mA, Pi: 0.65W, Ci: 6.5nF, Li: 0μH

-56°C < Tamb < +121°C

Intertek Testing & Certification Limited
Intertek House, Cleeve Road, Leatherhead, Surrey, KT22 7SB
Tel: +44 (0)1372 370900 Fax: +44 (0)1372 370977
www.intertek.com

Registered No 3272281 Registered Office: Academy Place, 1-9 Brook Street, Brentwood, Essex, CM14 5NQ.

Kevin J. Wolf
Certification Officer
29 June 2018

Page 1 of 4

This certificate may only be reproduced in its entirety and without any change, schedule included and is subject to Intertek Testing and Certification's Conditions for Granting Certification.

RFT-EU-NB-OP-23k1 June 29, 2016

Intertek Intertek Intertek Intertek Intertek

EU-Type Examination Certificate



Intertek

Valued Quality. Delivered.

SCHEDULE

EU-TYPE EXAMINATION CERTIFICATE NUMBER ITS17ATEX42429

13. Description of Equipment or Protective System

EX621xyyy/aaa or EXM621xyyy/aaa Vibration Sensors are vibration sensor designed and manufactured by PCB piezotronics Inc. These sensors are evaluated for use in Zone 0 environment. They are evaluated for Ex ia IIC T4 Ga classified hazardous locations. Construction of both EXM621 and EX(XX)621 is electrical same. Mechanically EXM has M-type of connection for power while EX(XX) sensor are equipped with other type threaded connector. Sensor is powered in classified area using EX certified Barrier. Sensor incorporates Piezo element for sensing vibration. These signals are amplified internally on amplifier board.

14. Report Number

Intertek Report 103117575CRT-002d to -002f Ref Issue dated 27 June 2018

15. Special Conditions of Certification

(a). Specific Conditions of Safe Use

- Equipment does not comply with requirement of EN 60079-11:2012 clause 6.3.13 for di-electric testing.

(b). Conditions of Manufacture - Routine Tests

- ...NONE



IECEX Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEX Scheme visit www.iecex.com

Certificate No.: IECEx ETL 18.0009X Issue No: 0 Certificate history:
Issue No. 0 (2018-06-29)

Status: Current Page 1 of 3

Date of Issue: 2018-06-29

Applicant: PCB Piezotronics, Inc.
3425 Walden Avenue, Depew, New York 14043-2495
United States of America

Equipment: Intrinsically Safe Vibration Sensor
Optional accessory: None.

Type of Protection: Intrinsic Safety' Ia'

Marking: Ex ia IIC T4 Ga
Ui: 28V, Ii: 93 mA, Pi: 1 W, Ci: 6.5 nF, Li: 0 mH
-56°C < Ta < +121°C
IECEX ETL 18.0009X

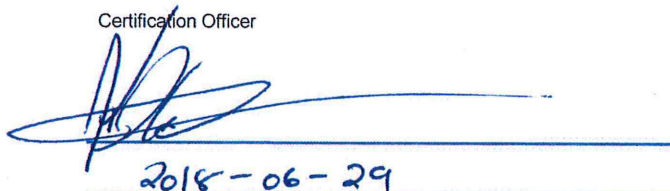
Approved for issue on behalf of the IECEX
Certification Body:

Kevin J. Wolf

Position:

Certification Officer

Signature:
(for printed version)



2018-06-29

Date:

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the [Official IECEX Website](http://www.iecex.com).

Certificate issued by:

Intertek
165 Main Street
Cortland NY 13045-2995
United States of America



IECEX Certificate of Conformity

Certificate No: IECEX ETL 18.0009X Issue No: 0
Date of Issue: 2018-06-29 Page 2 of 3
Manufacturer: PCB Piezotronics, Incorporated
3425 Walden Avenue, Depew, New York 14043-2495
United States of America

Additional Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEX Quality system requirements. This certificate is granted subject to the conditions as set out in IECEX Scheme Rules, IECEX 02 and Operational Documents as amended.

STANDARDS:

The apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2011 Explosive atmospheres - Part 0: General requirements
Edition:6.0
IEC 60079-11 : 2011 Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "I"
Edition:6.0

This Certificate does not indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.

TEST & ASSESSMENT REPORTS:

A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

[US/ETL/ExTR18.0013/00](#)

Quality Assessment Report:

[NL/DEK/QAR14.0004/02](#)



IECEX Certificate of Conformity

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Schedule

EQUIPMENT:

Equipment and systems covered by this certificate are as follows:

EX621 or EXM621 Vibration Sensors are vibration sensor designed and manufactured by PCB piezotronics Inc. These sensors are evaluated for use in Zone 0 environment. They are evaluated for Ex ia IIC T4 Ga classified hazardous locations. Construction of both EXM621 and EX 621 is electrical same. Mechanically EXM has M-type of connection for power while EX 621 sensor are equipped with other type threaded connector. Sensor is powered in classified area using EX certified Barrier. Sensor incorporates Piezo element for sensing vibration. These signals are amplified internally on amplifier board.

Marking of Ex equipment present in Instruction Manual due to limited real estate on the product. Refer Annex for details on Marking and Warnings.

SPECIFIC CONDITIONS OF USE: YES as shown below:

1. Equipment does not meet requirement of 6.3.13 for Di-electric Testing per requirement of IEC 60079-11:2011 6th Edition.

Annex:

[Annex for IECEx Certificate of Conformity .pdf](#)



Annex to IECEx Certificate of Conformity

Certificate No:	IECEX ETL 18.0009X	Issue No. 00
Annex No. 1		

Title:	Drawing No.:	Rev. Level:	Date:
*Technical File Intrinsic Safety ATEX, IECEx and ETL "ia".	69019	NR	05/30/2018