



Model EX356A73

Charge output triaxial accelerometer with UHT-12™ element for environments up to +900 F, 3.2 pC/g, 500 g measurement range, ±5% frequency range up to 4 kHz, three 10-32 side connectors, case isolated

Installation and Operating Manual

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

**Toll-free: 716-684-0001
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.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.
3425 Walden Ave.
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.

General OPERATING GUIDE

for use with

PIEZOELECTRIC CHARGE MODE ACCELEROMETERS

SPECIFICATION SHEET, INSTALLATION DRAWING AND CALIBRATION INFORMATION ENCLOSED

PCB 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 PCB charge mode accelerometer. 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 716-684-0001 or the closest PCB representative.

2.0 CHARGE MODE ACCELEROMETERS

Ceramic and UHT 12 shear-structured accelerometers offer high performance for precision vibration measurements in high-temperature environments. The use of sensing crystals, operating in the shear mode, reduces erroneous output due to base strain, thermal transients, and transverse motion.

Charge mode accelerometers output a strong, high-impedance charge signal directly from their sensing element. They do not contain built-in signal conditioning electronics; the signal is conditioned externally by either a laboratory-style charge amplifier or in-line charge converter prior to being analyzed by a readout or recording device. The absence of built-in electronics permits operation to elevated temperatures of 500 °F (260 °C) for most ceramic crystal models and typically 900 °F (482 °C) and extreme application up to 1200 °F (650 °C) for UHT-12.

These accelerometers are ideal for structural testing, machine monitoring, and vehicular shock and vibration measurement tasks where high temperatures preclude the use of accelerometers with built-in microelectronics.

Enclosed is a **Specification Sheet**, which lists the complete performance characteristics of the particular accelerometer.

3.0 OPTIONAL FEATURES

In addition to these 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: *A* option- adhesive mount; *J* option- electrical ground isolation; *M* option- metric mounting thread; *P* option- positive polarity output (for use with non-inverting, signal conditioning amplifiers); and *W* option- water-resistant cable connection.

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 performance of the accelerometer.

Shown hereafter are six possible mounting techniques and their effects on the performance of a typical piezoelectric accelerometer. (Note that 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. Its roll-off behavior is dependent*

upon the coupling type or time constant of the external charge amplifying device. This characteristic may be fixed or adjustable, depending on the charge amplifier. Please refer to the appropriate charge amplifier specification sheet for information on low-frequency characteristics.

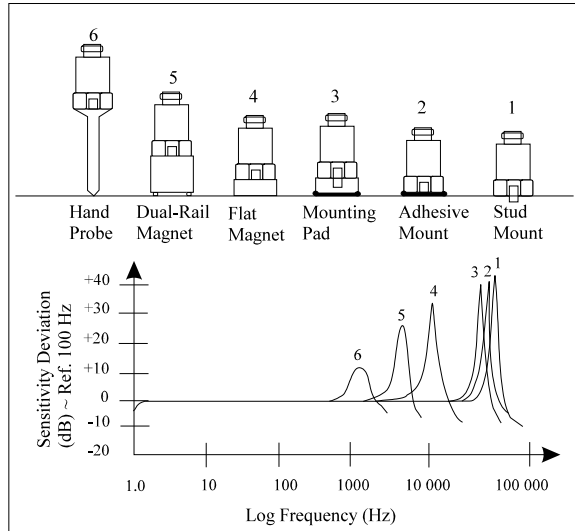


Figure 1. Assorted Mounting Configurations and Their Effects on High Frequency

4.1 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.

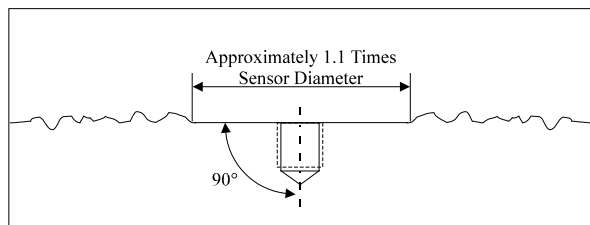


Figure 2. Mounting Surface Preparation

STEP 1: First, prepare a smooth, flat mounting surface, then drill and tap a mounting hole in the center of this area as shown in Figure 2 and in accordance with the **Installation Drawing** for the specific sensor that is being mounted.

A precision-machined mounting surface with a minimum finish of 63 μin (0.00016 mm) is recommended. (If it is not possible to properly prepare the test structure mounting surface, consider adhesive mounting 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.



Figure 3. 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: Screw the mounting stud into the base of the accelerometer and hand-tighten. Then, screw the sensor/stud assembly into the prepared tapped hole and tighten to the recommended mounting torque as indicated on the **Installation Drawing**.

Note: It is important to use a torque wrench during this step. Under-torquing the sensor may not adequately couple the device; over-torquing may result in stud failure.

4.2 ADHESIVE MOUNT

Adhesive mounting is often used for temporary installation or when the test object surface cannot be adequately prepared for stud mounting. Adhesives like hot glue and 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.

METHOD 1 - Adhesive Mounting Base

This method involves attaching a base to the test structure, then securing the sensor to the base. This allows for easy removal of the accelerometer. Also, since the bases are of a “hard-coated” aluminum design, they provide electrical isolation to eliminate ground loops and reduce electrical interference that may be present on the surface of the test object.

STEP 1: Prepare a smooth, flat mounting surface. A minimum surface finish of 63 μin (0.00016 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.

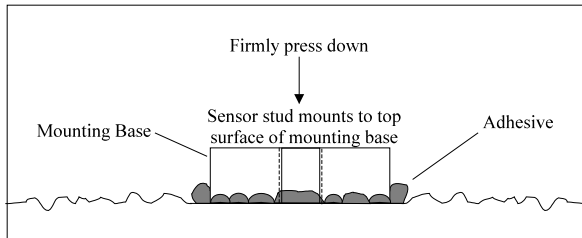


Figure 4. Mounting Base: Adhesive Installation

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 test structure.

STEP 1: Prepare a smooth, flat mounting surface. A minimum surface finish of 63 μin (0.00016 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.



Figure 5. Direct Adhesive Mounting

4.3 HANDHELD OR PROBE TIP MOUNT

This method is NOT recommended for most applications. It is generally used only for machinery monitoring and other portable trending applications. Both the accuracy and repeatability at low (<5 Hz) and high frequency (>1 kHz) ranges are questionable.

5.0 CABLING

Care and attention to installation is essential, as the reliability and accuracy of your system is no better than that of the output cable. Charge mode sensors require the use of low noise cables. Cables and connectors must be kept clean and dry to maintain high insulation resistance. In the event that the insulation resistance is compromised, inspect, clean, and bake cables and connectors to restore insulation resistance.

STEP 1: Ascertain that you have ordered the correct cable type. Use only PCB Series 003 Low-Noise Cable (or equivalent) with charge-output accelerometers. Some integral-cable units use Series 030 Cable, which is also low noise. Keep connections clean to maintain insulation resistance and good low-frequency response.

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.

TYPE 1: Coaxial Connectors

First, plug the male connector of the cable into the mating female sensor connector. Then, holding the sensor stationary, secure the connector in place by tightening down the attached cable sleeve.

TYPE 2: Pigtail Connections

“Pigtail” connections are convenient for easy field repair of cable connections. Simply solder the stripped cable to the exposed pins on the sensor. (Check the **Installation Drawing** to determine signal and ground

pins.) In many cases, it is also helpful to protect the solder joint with heat-shrink tubing or epoxy.

Note: *If you do not have the experience or resources to attach pigtail leads, consult PCB to discuss factory attachment. Damage caused by excessive heat is not covered by warranty.*

STEP 3: 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.

Certain precautions 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 may be stepped on or become contaminated. Shielded cables should have the shield grounded at one end only.

STEP 4: Finally, connect the remaining cable end to the signal conditioner. To dissipate charge that may have accumulated in the cable, short the signal lead to the ground lead prior to attachment.

6.0 POWERING

A conventional method for conditioning the high-impedance signal generated by a charge output sensor is to use a laboratory-style charge amplifier. The charge amplifier converts the high-impedance charge signal generated by the sensor to a low-impedance voltage signal that can then be transmitted to a readout or a recording device for analysis. Before connecting the low-noise cable from the accelerometer to the charge amplifier, be sure to ground both the charge amplifier and the cable. This ensures that an excessive static charge that may have accumulated across the accelerometer or cable is harmlessly discharged. Failure to observe this precaution can result in the destruction of the input FET of certain amplifiers.



Once each element is connected, allow a few minutes for the system to thermally stabilize. Place the switch on the charge amplifier in the OPERATE position and proceed with the measurement.

It is often convenient to normalize the accelerometer and charge amplifier system to a precise sensitivity, such as 10.0 or 100.0 mV/g for ease of data analysis. This is accomplished with most PCB laboratory charge amplifiers and some miniature in-line units as well.

For fixed sensitivity in-line charge converters, such as the PCB Series 422, the system sensitivity (mV/g) is determined as the product of the charge amplifier sensitivity (mV/pC) and the charge sensitivity of the accelerometer (pC/g).

Note: *When using charge-amplified systems, the noise floor of the system is dependent on the input capacitance to the charge amplifier. Since the cable adds to the capacitance and to minimize the noise threshold, keep the cable length between the accelerometer and the charge amplifier to a minimum. Cable length does not affect the system sensitivity of charge-amplified systems.*

Since charge amplifier operation varies, please contact the respective signal conditioner manufacturer or check the product manual for additional information.

7.0 ACCELEROMETER CALIBRATION

Accelerometer calibration provides, with a definable degree of accuracy, the necessary link between the physical quantity being measured and the electrical signal generated by the sensor. In addition, other useful information concerning operational limits, physical parameters, electrical characteristics, or environmental influences may also be determined. Without this link, analyzing data becomes a nearly impossible task. PCB provides a calibration record that documents the exact characteristics of each sensor. (The type and amount of data varies depending on the sensor type, contractual regulations, and other special requirements.)

Under normal operating conditions, piezoelectric sensors are extremely stable, and their calibrated performance characteristics do not change over time. However, harsh environments or other unusual conditions that cause the sensor to experience dynamic phenomena outside of its specified operating range may temporarily or permanently affect the sensor. This change manifests itself in a variety of ways, including a shift of the sensor resonance due to a cracked crystal, or a temporary loss of low-frequency measuring capability due to a drop in insulation resistance.

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, PCB conservatively suggests a 12- to 24-month recalibration cycle for most piezoelectric accelerometers.

Note: *It is good measurement practice to verify the performance of each accelerometer with a Handheld Shaker or other calibration device before and after each measurement. The PCB Model 394C06 Handheld Shaker operates at a fixed frequency and known amplitude (1.0 g) to provide a quick check of sensor sensitivity.*

7.1 SENSOR RECALIBRATION

Accelerometer recalibration services are typically performed by PCB’s internal metrology laboratory. (Other international and private laboratories are also available.) The PCB laboratory is certified to ISO 9001, accredited by A2LA to ISO 17025, complies with ISO 10012-1 (and former MIL-STD-45662A), and uses equipment directly traceable to N.I.S.T. This assures an accurate calibration of relevant specifications.

In addition, many companies choose to purchase the equipment necessary to perform the recalibration procedure themselves. While this may result in both a savings of time and money, it has also been attributed to incorrect readings and costly errors. Therefore, in an effort to prevent the common mistakes associated with customer-performed calibration, this document includes a broad overview of the Back-to-Back Calibration technique. This technique provides a quick and easy method for determining the sensitivity of a test accelerometer over a wide frequency range.

7.2 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.

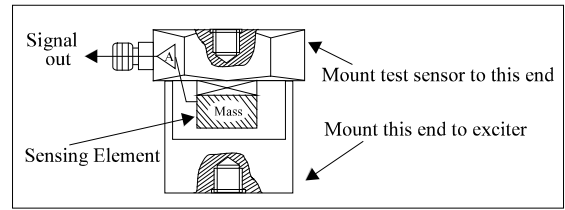


Figure 9. Reference Standard Accelerometer

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 10. (Test set-ups may be automated and vary, depending on the type and number of accelerometers being calibrated.)

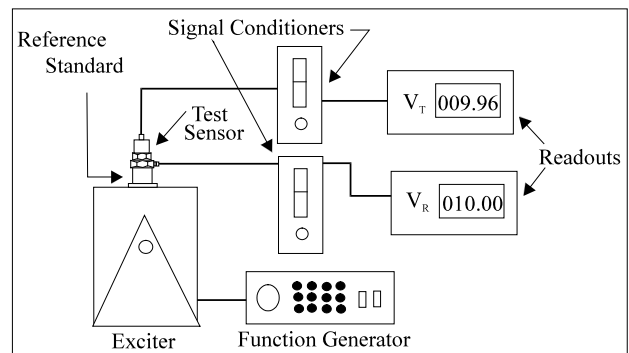


Figure 10. Typical Back-to-Back Calibration System

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:

$$S_T = S_R (V_T/V_R)$$

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 11.

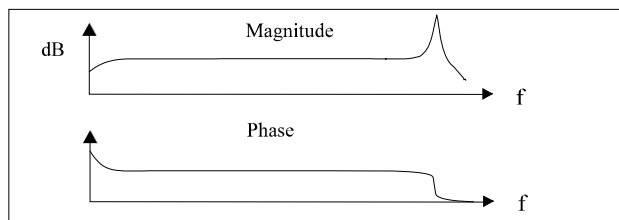


Figure 11. Typical Test Accelerometer Response

7.3 PCB CALIBRATION PROCEDURE

Numerous precautions are taken at PCB to insure accurate and repeatable results. This section provides a brief overview of the primary areas of concern.

Since the Back-to-Back Calibration technique relies on each sensor experiencing an identical acceleration level, proper mounting of the test sensor to the reference standard is imperative. Sensors with mounting holes are attached directly to the reference standard with a stud tightened to the recommended mounting torque. A shouldered mounting stud is typically used to prevent the stud from “bottoming out” in the hole.

Both mounting surfaces are precision-machined and lapped to provide a smooth, flat interface according to the manufacturer’s specification. A thin layer of silicone grease is placed between the mating surfaces to fill any imperfections and increase the mounting stiffness. The cables are stress-relieved by first routing them to the shaker head, securing them with tape or cable ties, then routing them to a nearby stationary location. This reduces cable motion, which is especially important when testing charge output sensors and helps to prevent extraneous noise or stresses from being imparted into the system. A typical set-up is shown in Figure 12.

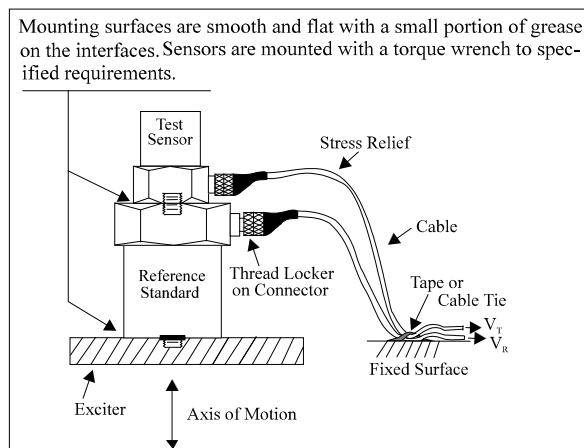


Figure 12. Typical Calibration Set-Up

Adhesively mounted sensors use similar practices. However, in this case, a small portion of quick-bonding gel or similar temporary adhesive is used to attach the test sensor to a reference standard designed with a smooth, flat mounting surface.

In addition to mounting, the selection of the proper equipment is critical. Some of the more important considerations include: 1) the reference standard must be specified and previously calibrated over the frequency and/or amplitude range of interest; 2) the shaker should be selected to provide minimal transverse (lateral) motion and minimal distortion; and 3) the quality of the meters, signal generator, and other devices should be selected so as to operate within the limits of permissible error.

7.4 COMMON MISTAKES

Most calibration errors are caused by simply overlooking some of the fundamental principals of dynamics. This section attempts to address some of the more common concerns.

For stud-mount sensors, always mount the accelerometer directly to the reference standard. Ensure that the mounting surfaces are smooth, flat, and free of any burrs. Always use a coupling fluid, such as silicone grease, in the mounting interface to maintain a high mounting stiffness. Mount the sensor according to the manufacturer’s recommended mounting torque. DO NOT use any intermediate mounting adaptors, as the mounted resonant frequency may be reduced and thereby compromise the high-frequency performance. If necessary, use adaptor studs.



Figure 13. Stud Mounting

For adhesive mount sensors, use a thin, stiff layer of temporary adhesive such as quick-bonding gel or superglue. **DO NOT** use excessive amounts of glue or epoxy, as the mounting stiffness may be reduced and compromise high-frequency performance. It may also damage the sensor during removal.



Figure 14. Incorrect Adhesive Mounting

Triaxial accelerometers should always be mounted directly to the reference standard. Unless absolutely required, **DO NOT** use adaptors to re-orient the sensor

along the axis of motion, as the mounting stiffness may be altered. The vibration at the test sensor sensing element may differ from the vibration at the reference standard due to a “cantilever” effect, seen in Figure 15.



Figure 15. Mounting Triaxial Sensors (Incorrect)

Understand Back-to-Back Calibration limitations. Do not expect the uncertainty of calibration to be any better than $\pm 2\%$. (In fact, the uncertainty may be as high as $\pm 3\%$ or $\pm 4\%$ for frequencies < 10 Hz or > 2 kHz.) Since large sensors may affect high-frequency accuracy, verify that the test sensor does not mass load the reference standard. Validate your calibration system with another accelerometer prior to each calibration session. Check with the manufacturer for exact system specifications.

7.5 CONCLUSIONS

Without an adequate understanding of dynamics, determining what, when, and how to test a sensor is a difficult task. Therefore, each user must weigh the cost, time, and risk associated with self-calibration versus the services of an accredited laboratory.

3425 Walden Avenue, Depew,
Toll Free: 888-684-0013 • 24-



0001 • FAX: 716-685-3886

E-mail: vibration@pcb.com • Website: www.pcb.com

NY 14043
hour SensorLineSM: 716-684-

Model Number
EX356A73

TRIAxIAL CHARGE OUTPUT ACCELEROMETER

Revision: B
ECN #: 54101

	ENGLISH	SI	
Performance			
Sensitivity(± 10 %)	3.1 pC/g	.32 pC/(m/s ²)	
Measurement Range	500 g pk	4,905 m/s ² pk	
Frequency Range(+/- 5 %)	4 kHz	4 kHz	[1]
Resonant Frequency	≥ 25 kHz	≥ 25 kHz	
Non-Linearity	≤ 1 % FS	≤ 1 % FS	[2]
Transverse Sensitivity	≤ 5 %	≤ 5 %	
Environmental			
Overload Limit(Shock)	3,000 g pk	29,400 m/s ² pk	
Temperature Range	-67 to 900 °F	-55 to 482 °C	
Temperature Response	See Graph	See Graph	[3]
Base Strain Sensitivity	.003 g/με	.029 (m/s ²)/με	[3]
Radiation Exposure Limit(Integrated Neutron Flux)	1E10 N/cm ²	1E10 N/cm ²	
Radiation Exposure Limit(Integrated Gamma Flux)	1E8 rad	1E8 rad	
Electrical			
Capacitance	120 pF	120 pF	[3]
Insulation Resistance(at 70° F [21° C])	> 1 GOhm	> 1 GOhm	
Insulation Resistance(at 900°F)	> 100 kohm	> 100 kohm	
Electrical Isolation(Case)	> 1E6 Ohm	> 1E6 Ohm	
Output Polarity	Positive	Positive	
Physical			
Sensing Element	UHT-12™	UHT-12™	
Sensing Geometry	Shear	Shear	
Housing Material	Nickel Alloy	Nickel Alloy	
Sealing	Hermetic	Hermetic	
Size (Length x Width x Height)	1.35 in x 1.35 in x 1.00 in	34.3 mm x 34.3 mm x 25.4 mm	
Weight	6.0 oz	170 gm	[3]
Electrical Connector	10-32 Coaxial Jack	10-32 Coaxial Jack	
Mounting	Through Hole	Through Hole	
Mounting Torque	18 to 20 in-lb	2 to 2.3 Nm	

OPTIONAL VERSIONS

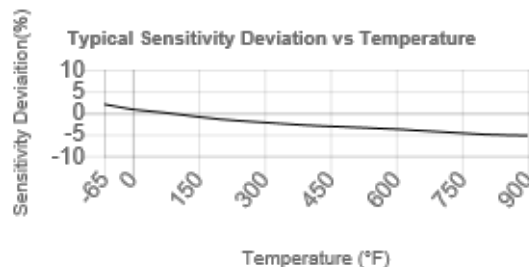
Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

NOTES:

- [1] Low frequency response is determined by external signal conditioning electronics.
- [2] Zero-based, least-squares, straight line method.
- [3] Typical.
- [4] See PCB Declaration of Conformance PS187 for details.

SUPPLIED ACCESSORIES:

Model 62491-01 Mounting screw, 8-32 UNC-2A x 7/8", Inconel 718 (2)
Model ACS-1 NIST traceable frequency response (10 Hz to upper 5% point). (1)



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.

Entered: ND	Engineer: JJD	Sales: RWM	Approved: NJF	Spec Number:
Date: 07/26/2023	Date: 07/26/2023	Date: 07/26/2023	Date: 07/26/2023	62478

PCB PIEZOTRONICS Phone: 716-684-0001
AN AMPHENOL COMPANY Fax: 716-684-0987
E-Mail: info@pcb.com

3425 Walden Avenue, Depew, NY 14043

2

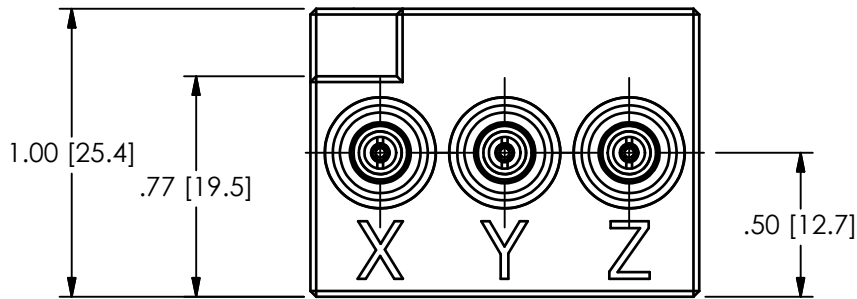
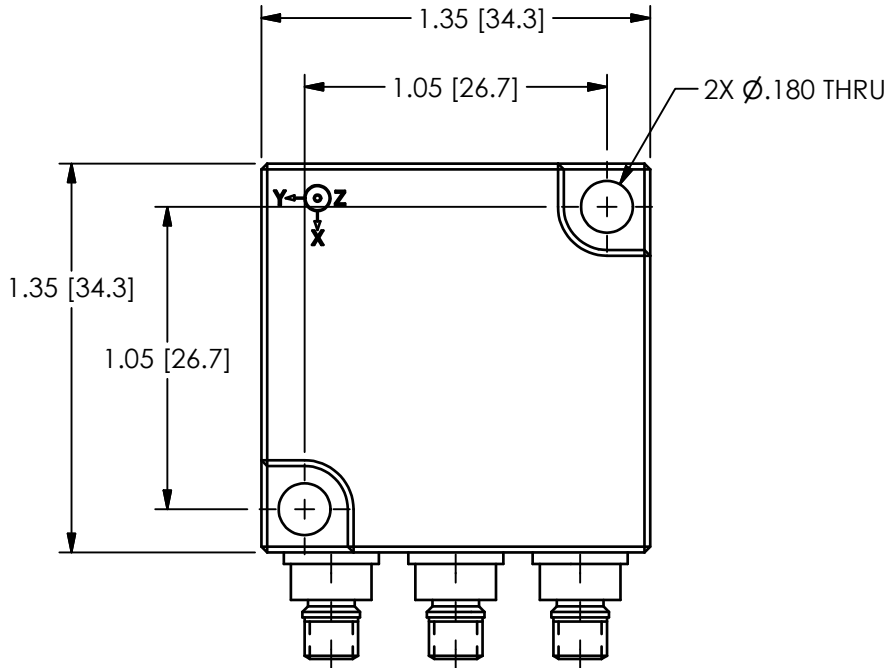
1

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REVISIONS

REV	DESCRIPTION	DIN
NR	RELEASED TO DRAFTING	48007

62485



UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:

DRAWN		CHECKED		ENGINEER	
KRM	8/9/18	KRM	8/9/18	JJD	8/9/18



3425 WALDEN AVE. DEPEW, NY 14043
(716) 684-0001 E-MAIL: sales@pcb.com

DIMENSIONS IN INCHES
DECIMALS XX ±.03
XXX ±.010
ANGLES ± 2 DEGREES

DIMENSIONS IN MILLIMETERS [IN BRACKETS]
DECIMALS X ± 0.8
XX ± 0.25
ANGLES ± 2 DEGREES

TITLE
OUTLINE DRAWING
MODEL 356A73
TRIAxIAL ACCELEROMETER

CODE IDENT. NO. 52681
DWG. NO. 62485

FILLETS AND RADII .003 - .005

FILLETS AND RADII 0.07 - 0.13

SCALE: 1.5X SHEET 1 OF 1

2

1



LCIE

ATTESTATION D'EXAMEN UE DE TYPE EU TYPE EXAMINATION CERTIFICATE



1 Version : 00

LCIE 18 ATEX 3009 X

Issue : 00

Directive 2014/34/UE

Directive 2014/34/EU

2 Appareil ou Système de Protection destiné à être utilisé en Atmosphères Explosibles

Equipment or Protective System Intended for use in Potentially Explosive Atmospheres

3 Produit :
Accéléromètres triaxiaux haute température

Product :
Triaxial high temperature accelerometers

Type: EX356XXXX/MNNZZ

4 Fabricant :

Manufacturer :

PCB Piezotronics

5 Adresse :

Address :

3425 Walden avenue
Depew, New York 14043
USA

6 Ce produit et ses variantes éventuelles acceptées sont décrits dans l'annexe de la présente attestation et dans les documents descriptifs cités en référence.

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

7 Le LCIE, Organisme Notifié sous la référence 0081 conformément à l'article 17 de la directive 2014/34/UE du Parlement européen et du Conseil du 26 février 2014, certifie que ce produit est conforme aux Exigences Essentielles de Sécurité et de Santé pour la conception et la construction de produits destinés à être utilisés en atmosphères explosibles, données dans l'annexe II de la Directive.

LCIE, Notified Body number 0081 in accordance with article 17 of the Directive 2014/34/EU of the European Parliament and the Council of 26 February 2014 certifies that 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.

Les résultats des vérifications et essais figurent dans le(s) rapport(s) confidentiel(s) N° :

The examination and test results are recorded in confidential report(s) N°:

138887-679774-01

8 Le respect des Exigences Essentielles de Sécurité et de Santé est assuré par la conformité à :

Compliance with the Essential Health and Safety Requirements has been assured by compliance with :

EN 60079-0:2012 + A11:2013
EN 60079-11:2012

9 Le signe « X » lorsqu'il est placé à la suite du numéro de l'attestation, indique que cet appareil est soumis aux conditions particulières d'utilisation, mentionnées dans l'annexe de cette attestation.

If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Specific Conditions of Use specified in the schedule to this certificate.

10 Cette Attestation d'Examen UE de Type concerne uniquement la conception et la construction du produit spécifié. Des exigences supplémentaires de la directive sont applicables pour la fabrication et la fourniture du produit. Ces dernières ne sont pas couvertes par la présente attestation.

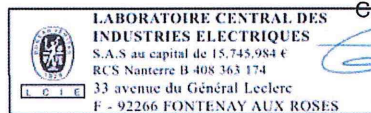
This EU Type Examination Certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

11 Le marquage du produit est mentionné dans l'annexe de cette attestation.

The marking of the product is specified in the schedule to this certificate.

Fontenay-aux-Roses, le 23 février 2018

Responsable de Certification



Certification Officer
Julien Gauthier

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CERT-ATEX-FORM 04 Rev. 02

Page 1 / 4

LCIE

Laboratoire Central des Industries Electriques

Une société de Bureau Veritas

33 Avenue du Général Leclerc

92260 Fontenay-aux-Roses

FRANCE

WWW.LCIE.FR

12 DESCRIPTION DU PRODUIT

L'accéléromètre triaxial haute température est composé d'une enveloppe en alliage à base de nickel avec un ensemble de cristaux piézoélectriques, de connecteurs et de câbles.

Il y a deux versions :

- 1) Accéléromètre triaxial avec connecteurs.
- 2) Accéléromètre triaxial avec câbles intégrés.

Paramètres spécifiques des modes de protection concernés :

DESCRIPTION OF PRODUCT

Triaxial high temperature accelerometer is composed of a nickel-based alloy enclosure with a set of piezoelectric crystals, connectors and cables.

There are two versions :

- 1) Triaxial accelerometer with connectors.
- 2) Triaxial accelerometer with integral cables.

Specific parameters of the concerned protection modes:

Version <i>Version</i>	Paramètres électriques de sécurité intrinsèque <i>Intrinsic safety electrical parameters</i>
Connecteurs / <i>Connectors</i>	<i>U_i</i> : 28 V, <i>I_i</i> : 120 mA, <i>P_i</i> : 1 W, <i>C_i</i> : 750 pF, <i>L_i</i> : 0 ou/ou <i>U_i</i> : 15 V, <i>I_i</i> : 900 mA, <i>P_i</i> : 1 W, <i>C_i</i> : 750 pF, <i>L_i</i> : 0
Câbles intégrés / <i>Integral cables</i>	<i>U_i</i> : 28 V, <i>I_i</i> : 120mA, <i>P_i</i> : 1W, <i>C_i</i> : 6 nF, <i>L_i</i> : 30µH ou/ou <i>U_i</i> : 15 V, <i>I_i</i> : 900mA, <i>P_i</i> : 1W, <i>C_i</i> : 6 nF, <i>L_i</i> : 30µH

DETAIL DE LA GAMME

EX356 X YYY / MNNZZ

Spécifie le type de connecteur et la longueur du câble – en option.

Specifies connectors type and cable length – optional.

Type de variation (numéro séquentiel qui avec la lettre X, constitue le numéro de modèle).

Variation type (sequential number that together with the letter X make up the model number).

Type de famille (désigné sous la forme d'une lettre A à Z).

Family type (assigned as a letter A to Z).

RANGE DETAILS

M Présent uniquement pour longueur métrique pour la version de câble intégral.

Present only for metric length for integral cable version.

NNN Spécifie la longueur du câble (32 pieds ou 10 mètres max) (trois chiffres).

Specifies cable length (32 feet or 10 meters max) (three numbers).

ZZ Spécifie le type de connecteurs (deux lettres).

Specifies connectors type (two letters).

MARQUAGE

Le marquage du produit doit comprendre :

PCB Piezotronics
 Adresse : ...
 Type : EX356XXXX/MNNZZ (1)
 N° de fabrication : ...
 Année de fabrication : ...
 Ⓜ II 1 G
 Ex ia IIC T6...482°C Ga (2)
 LCIE 18 ATEX 3009 X
 $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +472^{\circ}\text{C}$
 $U_i: \dots\text{V}; I_i: \dots\text{mA}; P_i: \dots\text{mW}; C_i: \dots\ \mu\text{F}; L_i: \dots\ \mu\text{H}$ (3)
 (1): complété par la désignation de type.
 (2): voir le tableau des températures.
 (3): complétées par les paramètres électriques de sécurité intrinsèque de la version concernée.

Le marquage peut être réduit ainsi :

PCB Piezotronics
 Adresse : ...
 Type : EX356XXXX/MNNZZ
 N° de fabrication : ...
 Année de fabrication : ...
 Ⓜ II 1 G
 Ex ia IIC T6...482°C Ga
 LCIE 18 ATEX 3009 X
 $U_i: \dots\text{V}; I_i: \dots\text{mA}; P_i: \dots\text{mW}; C_i: \dots\ \mu\text{F}; L_i: \dots\ \mu\text{H}$

Tableau des températures / *Temperatures table*

Température ambiante <i>Ambient temperature</i>	Classe de température <i>Temperature class</i>
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +80^{\circ}\text{C}$	T6
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +95^{\circ}\text{C}$	T5
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +130^{\circ}\text{C}$	T4
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +195^{\circ}\text{C}$	T3
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +290^{\circ}\text{C}$	T2
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +440^{\circ}\text{C}$	T1
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +472^{\circ}\text{C}$	482°C

L'appareil doit également comporter le marquage normalement prévu par les normes de construction qui le concernent sous la responsabilité du fabricant.

MARKING

The marking of the product shall include the following:

PCB Piezotronics
 Address : ...
 Type : EX356XXXX/MNNZZ (1)
 Serial number : ...
 Year of construction : ...
 Ⓜ II 1 G
 Ex ia IIC T6...482°C Ga (2)
 LCIE 18 ATEX 3009 X
 $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +472^{\circ}\text{C}$
 $U_i: \dots\text{V}; I_i: \dots\text{mA}; P_i: \dots\text{mW}; C_i: \dots\ \mu\text{F}; L_i: \dots\ \mu\text{H}$ (3)
 (1): completed with type designation.
 (2): see temperatures table.
 (3): completed by intrinsic safety electrical parameters of version concerned.

The marking can be reduce as following:

PCB Piezotronics
 Address : ...
 Type : EX356XXXX/MNNZZ
 Serial number : ...
 Year of construction : ...
 Ⓜ II 1 G
 Ex ia IIC T6...482°C Ga
 LCIE 18 ATEX 3009 X
 $U_i: \dots\text{V}; I_i: \dots\text{mA}; P_i: \dots\text{mW}; C_i: \dots\ \mu\text{F}; L_i: \dots\ \mu\text{H}$

The equipment shall also bear the usual marking required by the product standards applying to such equipment under the manufacturer responsibility.

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ATTESTATION D'EXAMEN UE DE TYPE - ANNEXE

EU TYPE EXAMINATION CERTIFICATE - SCHEDULE

1 Version : 00

LCIE 18 ATEX 3009 X

Issue : 00

13 CONDITIONS PARTICULIERES D'UTILISATION

- a. L'appareil ne doit être raccordé qu'à des matériels de sécurité intrinsèque certifiés. Cette association doit être compatible vis-à-vis de la sécurité intrinsèque.
- b. Température ambiante d'utilisation : -55°C à +472°C.
- c. Le montage de l'appareil dans une installation doit être effectué de telle sorte que le corps métallique de l'accéléromètre triaxial à haute température et le blindage du câble soient reliés de manière fiable à la terre du système.
- d. L'appareil devra être installé comme défini dans le plan n°62991 rév. NR du 02/02/2018.
- e. Le câble utilisé doit avoir une température d'utilisation compatible avec l'environnement dans lequel l'appareil est installé.

SPECIFIC CONDITIONS OF USE

The apparatus must only be connected to associated intrinsically safe certified equipment. This combination must be compatible as regard the intrinsic safety rules.

Operating ambient temperature: -55°C to +472°C.

The mounting of the apparatus into an installation must be carried out in such a way that metallic body of the triaxial high temperature accelerometer and cable shield are reliably connected to the system earth.

The apparatus must be installed per drawing n°62991 rev. NR dated 2018/02/02.

The cable used must have an operating temperature compatible with the environment in which the equipment is installed.

14 EXIGENCES ESSENTIELLES DE SANTE ET DE SECURITE

Couvertes par les normes listées au point 8.

ESSENTIAL HEALTH AND SAFETY REQUIREMENTS

Covered by standards listed at 8.

15 DOCUMENTS DESCRIPTIFS

DESCRIPTIVE DOCUMENTS

N°	Description	Reference	Rev.	Date	Page(s)
1.	Dossier technique / <i>Technical file</i>	62977	NR	2018/02/02	11
2.	Notice d'instruction / <i>Instruction manual</i>	67111	---	---	3

16 INFORMATIONS COMPLEMENTAIRES

Essais individuels

Néant.

Conditions de certification

Les détenteurs d'attestations d'examen UE de type doivent également satisfaire les exigences de contrôle de production telles que définies à l'article 13 de la Directive 2014/34/UE.

ADDITIONAL INFORMATION

Routine tests

None.

Conditions of certification

Holders of EU type examination certificates are also required to comply with the production control requirements defined in article 13 of Directive 2014/34/EU.

17 DETAILS DES MODIFICATIONS

Version 00 : Evaluation de l'accéléromètre triaxial à haute température type EX356XYYY/MNNZZ selon les normes EN 60079-0:2012+A11:2013 et EN 60079-11:2012.

DETAILS OF CHANGES

Issue 00 : Assessment of triaxial high temperature accelerometer type EX356XYYY/MNNZZ according to EN 60079-0:2012+A11:2013 and EN 60079-11:2012 standards.

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CERT-ATEX-FORM 04 Rev. 02

EU Declaration of Conformity PS187

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: **High Temperature Triaxial Charge Mode Accelerometer(s)**

Whose Product Models Include: **EX356YYYY Series**

Note: "X," is a place holder for one letter indicating Model or Special Configuration
 "YYY," is a place holder for up to three numbers

For Example: EX356A73

These letters and numbers are included in the model numbers of the series. For details see the related data sheets.

This declaration is applicable to all High Temperature Accelerometer(s) of the above series which have the CE & 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 & 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:

2014/34/EU
 2011/65/EU w/2015/863/EU

ATEX Directive
 RoHS Directive

Standards to which Conformity is Declared:

Harmonized Standards	EN 60079-0:2012+ A11:2013 EN 60079-11:2012 EN 63000:2018	Explosive atmospheres - Part 0: Equipment - General requirements Explosive atmospheres - Part 11: Equipment protection by intrinsic safety Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
EC Type Examination	ATEX Certification	LCIE 18 ATEX 3009 X Ex ia IIC T6...482°C Ga, II 1 G
Voluntary Certification	Voluntary Type Examination Certificate	LCIE 18 ATEX 6032 X Ex nA IC T6...482°C Gc, II 3 G
Other International Certifications	IECEx Certification	IECEx LCIE 18.0006X Ex ia IIC T6...482°C Ga IECEx LCIE 18.0007X Ex nA ICT6...482°C Gc
Notified Body Name		Laboratoire Central des Industries Electriques (0081)
Notified Body's Address		FONTENAY-AUX-ROSES (Head Office) 33, avenue du Général Leclerc FR- 92260 Fontenay-aux-Roses Tel. : + 33 1 40 95 60 60 Fax : + 33 1 40 95 86 56

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

Place: Depew, NY **Date:** 07/27/2023

Signature: 

Name: Wendy Willard

Title: Regulatory Affairs and Product Certification Specialist



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 LCIE 18.0007X Issue No: 0 Certificate history:
Issue No. 0 (2018-02-23)

Status: **Current** Page 1 of 3

Date of Issue: **2018-02-23**

Applicant: **PCB Piezotronics**
3425 Walden avenue
Depew, New York 14043
United States of America

Equipment: **Triaxial high temperature accelerometers - Type : EX356YYYY/MNNZZ**
Optional accessory:

Type of Protection: **Ex nA**

Marking:
Ex nA IIC T6...482°C Gc
Refer to the attachment for full marking.

Approved for issue on behalf of the IECEX
Certification Body:

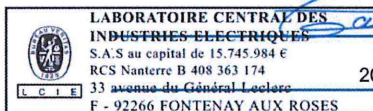
Julien Gauthier

Position:

Certification Officer

Signature:
(for printed version)

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:

Laboratoire Central des Industries Electriques (LCIE)
33 Avenue du General Leclerc
FR-92260 Fontenay-aux-Roses
France





IECEX Certificate of Conformity

Certificate No: IECEx LCIE 18.0007X

Issue No: 0

Date of Issue: 2018-02-23

Page 2 of 3

Manufacturer: **PCB Piezotronics**
3425 Walden avenue
Depew, New York 14043
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 electrical 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 60079-15 : 2010 Explosive atmospheres - Part 15: Equipment protection by type of protection "n"
Edition:4

*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:

[FR/LCIE/ExTR18.0009/00](#)

Quality Assessment Report:

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



IECEX Certificate of Conformity

Certificate No: IECEx LCIE 18.0007X

Issue No: 0

Date of Issue: 2018-02-23

Page 3 of 3

Schedule

EQUIPMENT:

Equipment and systems covered by this certificate are as follows:

Triaxial high temperature accelerometer is composed of a nickel-based alloy enclosure with a set of piezoelectric crystals, connectors and cables.

There are two versions:

1. Triaxial accelerometer with connectors.
2. Triaxial accelerometer with integral cables.

Refer to the attachment for full description.

SPECIFIC CONDITIONS OF USE: YES as shown below:

1. The electrical parameters of power supply can be connected to the triaxial high temperature accelerometer must not exceed the electrical parameters defined.
2. Operating ambient temperature: -55°C to +472°C.
3. For final installation, the triaxial high temperature accelerometer must be connected in compliance with requirements of IEC 60079-14 standard, providing and maintaining degree of protection at least IP54.
4. The mounting of the apparatus into an installation must be carried out in such a way that metallic body of the triaxial high temperature accelerometer and cable shield are reliably connected to the system earth.
5. The apparatus must be installed per drawing n°62991 rev. NR dated 2018/02/02.
6. The cable used must have an operating temperature compatible with the environment in which the equipment is installed.

Annex:

[IECEX LCIE 18.0007X issue 00 Annex 01-PCB Piezotronics .pdf](#)



Annex 01 to Certificate IECEX LCIE 18.0007X issue 00



FULL EQUIPMENT DESCRIPTION

Triaxial high temperature accelerometer is composed of a nickel-based alloy enclosure with a set of piezoelectric crystals, connectors and cables.

There are two versions :

- 1) Triaxial accelerometer with connectors.
- 2) Triaxial accelerometer with integral cables.

Title	Reference	Rev. Level	Date
Technical file	62980	NR	2018/02/02
Instruction manual	67111		

MARKING

PCB Piezotronics

Address: ...

Type : EX356XYYY/MNNZZ (1)

Serial number: ...

Year of construction: ...

Ex nA IIC T6...482°C Gc (2)

IECEX LCIE 18.0007 X

$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +472^{\circ}\text{C}$

$U \leq \dots\text{V}, I \leq \dots\text{mA}, P \leq \dots\text{mW}$ (3)

(1): completed with type designation.

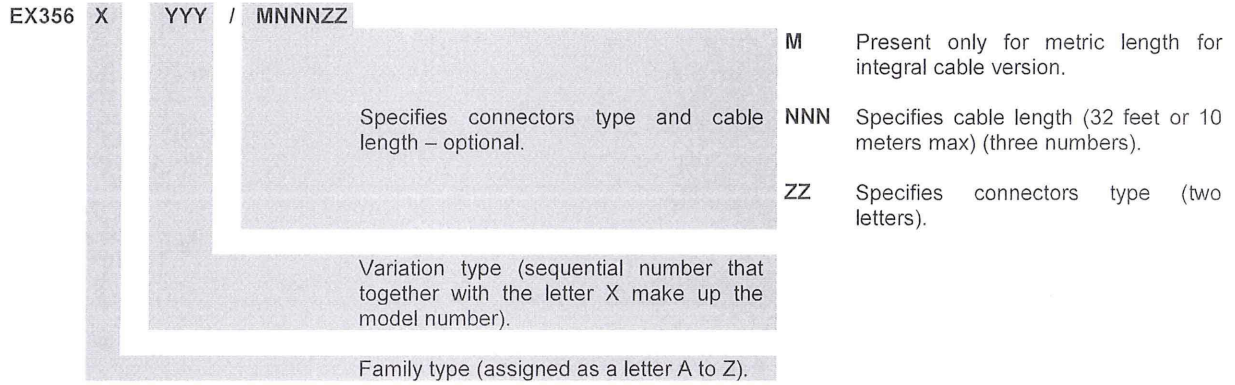
(2): see temperatures table.

(3): completed by electrical parameters.

Temperatures table

Ambient temperature	Temperature class
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +80^{\circ}\text{C}$	T6
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +95^{\circ}\text{C}$	T5
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +130^{\circ}\text{C}$	T4
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +195^{\circ}\text{C}$	T3
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +290^{\circ}\text{C}$	T2
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +440^{\circ}\text{C}$	T1
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +472^{\circ}\text{C}$	482°C

RANGE DETAILS



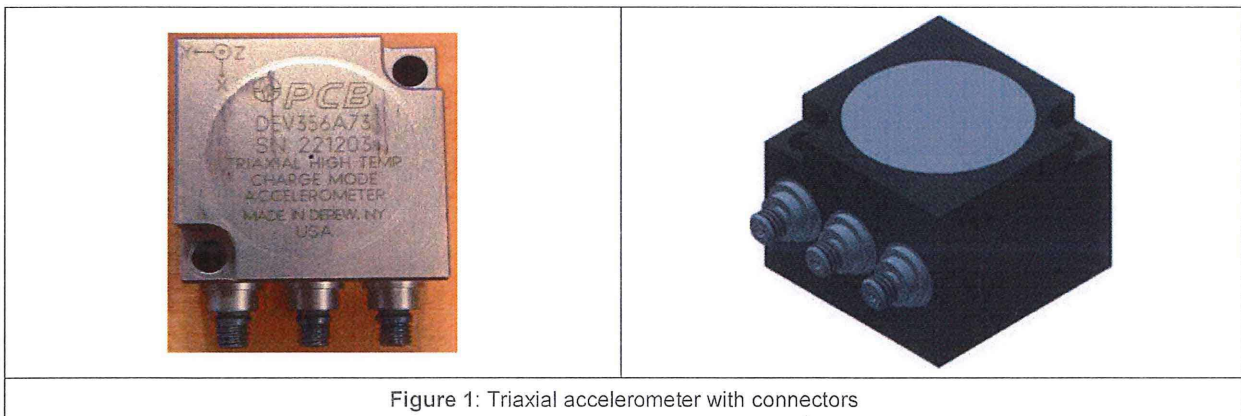
RATINGS

Version	Electrical parameters
Connectors	$U \leq 28 \text{ V}, I \leq 120 \text{ mA}, P \leq 1 \text{ W}$ or $U \leq 15 \text{ V}, I \leq 900 \text{ mA}, P \leq 1 \text{ W}$
Integral cables	

ROUTINE TESTS

According to clause 23.2.1 of IEC 60079-15 standard, each apparatus must be submitted to a dielectric strength test under 500 Volts during 60s.

APPARATUS OVERVIEW





Certificate of Compliance

Certificate: 70181221

Master Contract: 184981

Project: 70181221

Date Issued: 2018-07-12

Issued to: PCB Piezotronics
3425 Walden Ave
Depew, New York 14043
USA
Attention: Carrie Termin

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.



Issued by: *Anil Sodhi*
Anil Sodhi

PRODUCTS

CLASS 2258 04 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe Entity - For Hazardous Locations

CLASS 2258 84 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe Entity - For Hazardous Locations -
Certified to US Standards

Class I, Div. 1, Group A, B, C & D;

Ex ia IIC T6 ...482°C Ga;

Class I, Zone 0, AEx ia IIC T6 ...482°C Ga

Models EX356XXXX/MNNZZ series High Temperature Accelerometer; intrinsically safe with combined entity parameters for three axis as shown below; must be installed as per installation drawing 62992; temperature code as shown below. Ambient temperature -55°C to +472°C



Certificate: 70181221
Project: 70181221

Master Contract: 184981
Date Issued: 2018-07-12

Entity Parameters	Temperature Code
<u>Version with Connectors</u> Ui: 28 V, Ii: 120 mA, Pi: 1 W, Ci: 750 pF, Li: 0 or Ui: 15 V, Ii: 900 mA, Pi: 1 W, Ci: 750 pF, Li: 0	T6 (-55°C to +80°C) T5 (-55°C to +95°C) T4 (-55°C to 130°C) T3 (-55°C to 195°C)
<u>Version with integral cables</u> Ui: 28 V, Ii: 120mA, Pi: 1 W, Ci: 6nF, Li: 30 µH or Ui: 15 V, Ii: 900 mA, P1: 1W, Ci: 6 nF, Li: 30 µH	T2 (-55°C to 290°C) T1 (-55°C to 440°C) 482°C (-55°C to 472°C)

CLASS 2258 02 - PROCESS CONTROL EQUIPMENT - For Hazardous Locations

CLASS 2258 82 - PROCESS CONTROL EQUIPMENT - For Hazardous Locations – Certified to U.S. Standards

Class I, Div. 2, Group A, B, C and D;

Ex nA IIC T6 ...482°C Gc ;

Class I, Zone 2, AEx nA IIC T6 ...482°C Gc:

Models EX356YYYY/MNNNZZ series High Temperature Accelerometer; must be installed as per installation drawing 62992. Ambient temperature -55°C to +472°C.

Electrical ratings: 28Vdc, 120mA max. 1W max.

Conditions of Acceptability:

1. For Canadian Installations, sensor case must be bonded to ground according to the requirements of CEC, Part 1.
2. For US Installations, sensor case must be bonded to ground according to the requirements of NEC.
3. The sensor must only be connected to a certified associated apparatus.
4. The cable used must have an operating temperature compatible with the environment in which the sensor is installed.
5. The combined Entity parameters for EX356YYYY/MNNNZZ shall not exceed the safe limit requirements for Gas Group IIC.
6. The above accelerometer model EX356YYYY/MNNNZZ is certified as a component for use in the final assembly. The final application shall be subjected to approval of local authority having jurisdiction.



Certificate: 70181221

Master Contract: 184981

Project: 70181221

Date Issued: 2018-07-12

APPLICABLE REQUIREMENTS

CAN/CSA-C22.2 No. 60079-0:15	Explosive Atmospheres - Part 0: Equipment - General Requirements
CAN/CSA-C22.2 No. 60079-11:14	Explosive Atmospheres - Part 11: Equipment Protection By Intrinsic Safety "I"
CAN/CSA C22.2 No. 60079-15:12	Electrical apparatus for explosive gas atmospheres - Part 15: Construction, test and marking of type of protection "n"
CAN/CSA-C22.2 No. 61010-1-12	Safety Requirements For Electrical Equipment For Measurement, Control, And Laboratory Use - Part 1: General Requirements
ANSI/ISA-60079-0-2013	Explosive Atmospheres - Part 0: Equipment - General Requirements
ANSI/ISA-60079-11-2014	Explosive Atmospheres - Part 11: Equipment Protection By Intrinsic Safety "I"
ANSI/ISA-60079-15 -2012	Explosive atmospheres – Part 15: Equipment protection by type of protection "n"
ANSI/ISA-61010-1 Third Edition	Safety Requirements For Electrical Equipment For Measurement, Control, And Laboratory Use - Part 1: General Requirements
C22.2 No. 213-17	Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations
ANSI/ISA-12.12.01-2015	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations



Supplement to Certificate of Compliance

Certificate: 70181221

Master Contract: 184981 (103164_0_000)

*The products listed, including the latest revision described below,
are eligible to be marked in accordance with the referenced Certificate.*

Product Certification History

Project	Date	Description
70181221	2018-07-12	Original Certification (cCSAus) for Triaxial high temperature accelerometers model EX356XXXX/MNNZZ for following markings: Ex ia IIC T6...482°C Ga; Class I, Zone 0, AEx ia IIC T6...482°C Ga; Class I, Division 1, Groups ABCD Ta : -55°C ≤ Tamb ≤ +472°C; Ex nA IIC T6...482°C Gc; Class I, Zone 2, AEx nA IIC T6...482°C Gc; Class I Division 2, Groups ABCD Ta : -55°C ≤ Tamb ≤ +472°C.



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 LCIE 18.0006X Issue No: 0 Certificate history:
Issue No. 0 (2018-02-23)

Status: Current Page 1 of 3

Date of Issue: 2018-02-23

Applicant: PCB Piezotronics
3425 Walden avenue
Depew, New York 14043
United States of America

Equipment: Triaxial high temperature accelerometers - Type : EX356XYYY/MNNNZZ
Optional accessory:

Type of Protection: Ex ia

Marking: Ex ia IIC T6...482°C Ga
Refer to the attachment for full marking.

Approved for issue on behalf of the IECEX
Certification Body:

Julien Gauthier

Position:

Certification Officer

Signature:
(for printed version)

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:

Laboratoire Central des Industries Electriques (LCIE)
33 Avenue du General Leclerc
FR-92260 Fontenay-aux-Roses
France





IECEX Certificate of Conformity

Certificate No: IECEX LCIE 18.0006X

Issue No: 0

Date of Issue: 2018-02-23

Page 2 of 3

Manufacturer: **PCB Piezotronics**
3425 Walden avenue
Depew, New York 14043
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 electrical 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:

[FR/LCIE/ExTR18.0008/00](#)

Quality Assessment Report:

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



IECEx Certificate of Conformity

Certificate No: IECEx LCIE 18.0006X

Issue No: 0

Date of Issue: 2018-02-23

Page 3 of 3

Schedule

EQUIPMENT:

Equipment and systems covered by this certificate are as follows:

Triaxial high temperature accelerometer is composed of a nickel-based alloy enclosure with a set of piezoelectric crystals, connectors and cables.

There are two versions :

1. Triaxial accelerometer with connectors.
2. Triaxial accelerometer with integral cables.

Refer to the attachment for full description.

SPECIFIC CONDITIONS OF USE: YES as shown below:

1. The apparatus shall only be connected to associated intrinsically safe certified equipment. This combination must be compatible as regard the intrinsic safety rules.
2. Operating ambient temperature: -55°C to +472°C
3. The mounting of the apparatus into an installation must be carried out in such a way that metallic body of the triaxial high temperature accelerometer and cable shield are reliably connected to the system earth.
4. The apparatus must be installed per drawing n°62991 rev. NR dated 2018/02/02.
5. The cable used must have an operating temperature compatible with the environment in which the equipment is installed.

Annex:

[IECEx LCIE 18.0006X issue 00 Annex 01-PCB Piezotronics .pdf](#)



Annex 01 to Certificate IECEX LCIE 18.0006X issue 00



FULL EQUIPMENT DESCRIPTION

Triaxial high temperature accelerometer is composed of a nickel-based alloy enclosure with a set of piezoelectric crystals, connectors and cables.

There are two versions :

- 1) Triaxial accelerometer with connectors.
- 2) Triaxial accelerometer with integral cables.

Title	Reference	Rev. Level	Date
Technical file	62979	NR	2018/02/02
Instruction manual	67111		

MARKING

PCB Piezotronics

Address: ...

Type : EX356XYYY/MNNZZ (1)

Serial number: ...

Year of construction: ...

Ex ia IIC T6...482°C Ga (2)

IECEX LCIE 18.0006 X

$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +472^{\circ}\text{C}$

U_i : ... V; I_i : ... mA; P_i : ... mW; C_i : ... μF ; L_i : ... μH (3)

(1): completed with type designation.

(2): see temperatures table.

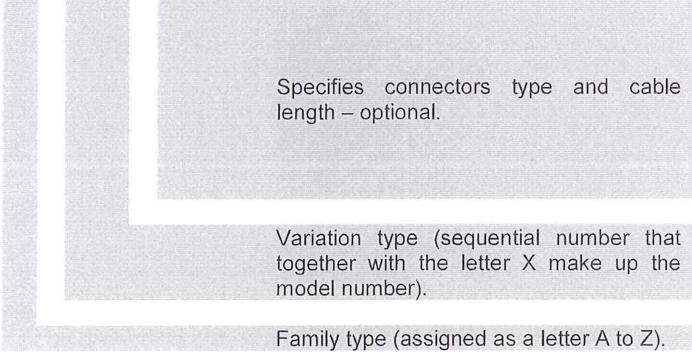
(3): completed by intrinsic safety electrical parameters of version concerned.

Temperatures table

Ambient temperature	Temperature class
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +80^{\circ}\text{C}$	T6
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +95^{\circ}\text{C}$	T5
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +130^{\circ}\text{C}$	T4
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +195^{\circ}\text{C}$	T3
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +290^{\circ}\text{C}$	T2
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +440^{\circ}\text{C}$	T1
$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +472^{\circ}\text{C}$	482°C

RANGE DETAILS

EX356 X YYY / MNNZZ



- M Present only for metric length for integral cable version.
- NNN Specifies cable length (32 feet or 10 meters max) (three numbers).
- ZZ Specifies connectors type (two letters).

RATINGS

Version	Intrinsic safety electrical parameters
Connectors	U_i : 28 V, I_i : 120 mA, P_i : 1 W, C_i : 750 pF, L_i : 0 or U_i : 15 V, I_i : 900 mA, P_i : 1 W, C_i : 750 pF, L_i : 0
Integral cables	U_i : 28 V, I_i : 120mA, P_i : 1W, C_i : 6 nF, L_i : 30μH or U_i : 15 V, I_i : 900mA, P_i : 1W, C_i : 6 nF, L_i : 30μH

ROUTINE TESTS

None.

APPARATUS OVERVIEW

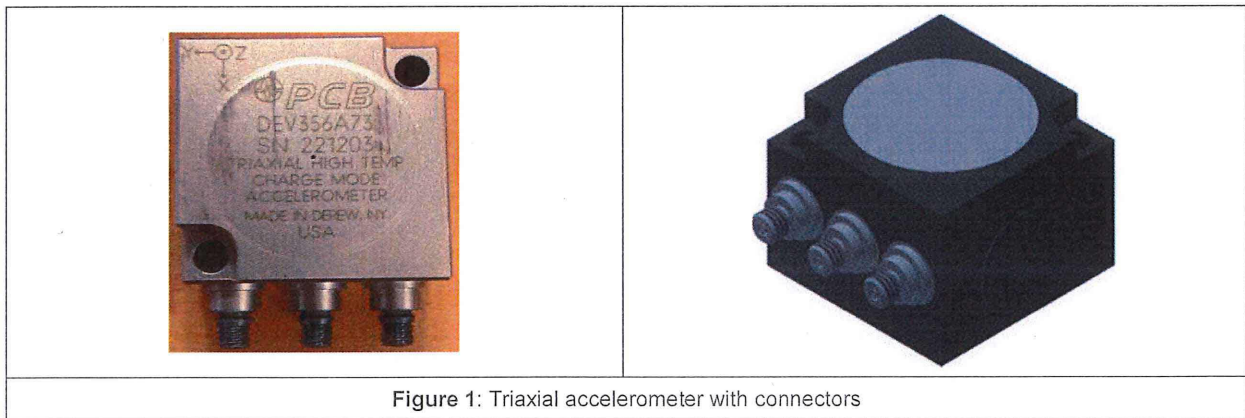


Figure 1: Triaxial accelerometer with connectors



ATTESTATION D'EXAMEN DE TYPE

TYPE EXAMINATION CERTIFICATE



1 Version : 00

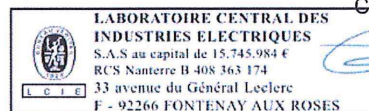
LCIE 18 ATEX 1004 X

Issue : 00

- | | | |
|--|---|---|
| 2 | Directive 2014/34/UE
Appareil ou Système de Protection destiné à être utilisé en Atmosphères Explosibles | Directive 2014/34/EU
Equipment or Protective System Intended for use in Potentially Explosive Atmospheres |
| 3 | Produit :
Accéléromètres triaxiaux haute température | Product :
Triaxial high temperature accelerometers |
| Type: EX356XXXX/MNNZZ | | |
| 4 | Fabricant : | Manufacturer : |
| 5 | Adresse : | Address : |
| PCB Piezotronics
3425 Walden avenue
Depew, New York 14043
USA | | |
| 6 | Ce produit et ses variantes éventuelles acceptées sont décrits dans l'annexe de la présente attestation et dans les documents descriptifs cités en référence. | This product any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to. |
| 7 | Le LCIE certifie que ce produit est conforme aux Exigences Essentielles de Sécurité et de Santé pour la conception et la construction de produits destinés à être utilisés en atmosphères explosibles, données dans l'annexe II de la Directive.
Les résultats des vérifications et essais figurent dans le(s) rapport(s) confidentiel(s) N° : | LCIE certifies that 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 report(s) N° : |
| 138887-679774-02 | | |
| 8 | Le respect des Exigences Essentielles de Sécurité et de Santé est assuré par la conformité à : | Compliance with the Essential Health and Safety Requirements has been assured by compliance with : |
| EN 60079-0:2012 + A11:2013
EN 60079-15:2010 | | |
| 9 | Le signe « X » lorsqu'il est placé à la suite du numéro de l'attestation, indique que cet appareil est soumis aux conditions particulières d'utilisation, mentionnées dans l'annexe de cette attestation. | If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Specific Conditions of Use specified in the schedule to this certificate. |
| 10 | Cette Attestation d'Examen de Type concerne uniquement la conception et la construction du produit spécifié.
Des exigences supplémentaires de la directive sont applicables pour la fabrication et la fourniture du produit. Ces dernières ne sont pas couvertes par la présente attestation. | This 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. |
| 11 | Le marquage du produit est mentionné dans l'annexe de cette attestation. | The marking of the product is specified in the schedule to this certificate. |

Fontenay-aux-Roses, le 23 février 2018

Responsable de Certification



Certification Officer
Julien Gauthier

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Page 1 of 4

LCIE

Laboratoire Central des Industries Electriques

Une société de Bureau Veritas

33 Avenue du Général Leclerc

92260 Fontenay-aux-Roses

FRANCE

WWW.LCIE.FR

12 DESCRIPTION DU PRODUIT

L'accéléromètre triaxial haute température est composé d'une enveloppe en alliage à base de nickel avec un ensemble de cristaux piézoélectriques, de connecteurs et de câbles.

Il y a deux versions :

- 1) Accéléromètre triaxial avec connecteurs.
- 2) Accéléromètre triaxial avec câbles intégrés.

Paramètres spécifiques des modes de protection concernés :

DESCRIPTION OF PRODUCT

Triaxial high temperature accelerometer is composed of a nickel-based alloy enclosure with a set of piezoelectric crystals, connectors and cables.

There are two versions :

- 1) Triaxial accelerometer with connectors.
- 2) Triaxial accelerometer with integral cables.

Specific parameters of the concerned protection modes:

Version <i>Version</i>	Paramètres électriques <i>Electrical parameters</i>
Connecteurs / <i>Connectors</i>	U ≤ 28 V, I ≤ 120 mA, P ≤ 1 W ou/or
Câbles intégrés / <i>Integral cables</i>	U ≤ 15 V, I ≤ 900 mA, P ≤ 1 W

DETAIL DE LA GAMME

EX356 X YYY / MNNZZ

Spécifie le type de connecteur et la longueur du câble – en option.

Specifies connectors type and cable length – optional.

Type de variation (numéro séquentiel qui avec la lettre X, constitue le numéro de modèle).

Variation type (sequential number that together with the letter X make up the model number).

Type de famille (désigné sous la forme d'une lettre A à Z).

Family type (assigned as a letter A to Z).

RANGE DETAILS

M Présent uniquement pour longueur métrique pour la version de câble intégral.

Present only for metric length for integral cable version.

NNN Spécifie la longueur du câble (32 pieds ou 10 mètres max) (trois chiffres).

Specifies cable length (32 feet or 10 meters max) (three numbers).

ZZ Spécifie le type de connecteurs (deux lettres).

Specifies connectors type (two letters).

MARQUAGE

Le marquage du produit doit comprendre :

PCB Piezotronics
 Adresse : ...
 Type : EX356XYYY/MNNZZ (1)
 N° de fabrication : ...
 Année de fabrication : ...

 Ex II 3 G

Ex nA IIC T6...482°C Gc (2)

LCIE 18 ATEX 1004 X

-55°C ≤ T_{amb} ≤ +472°C

U ≤ ...V, I ≤ ...mA, P ≤ ...mW (3)

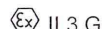
(1): complété par la désignation de type.

(2): voir le tableau des températures.

(3): complétées par les paramètres électriques.

Le marquage peut être réduit ainsi :

PCB Piezotronics
 Adresse : ...
 Type : EX356XYYY/MNNZZ
 N° de fabrication : ...
 Année de fabrication : ...

 Ex II 3 G

Ex nA IIC T6...482°C Gc

LCIE 18 ATEX 1004 X

U ≤ ...V, I ≤ ...mA, P ≤ ...mW

MARKING

The marking of the product shall include the following:

PCB Piezotronics
 Address : ...
 Type : EX356XYYY/MNNZZ (1)
 Serial number : ...
 Year of construction : ...

 Ex II 3 G

Ex nA IIC T6...482°C Gc (2)

LCIE 18 ATEX 1004 X

-55°C ≤ T_{amb} ≤ +472°C

U ≤ ...V, I ≤ ...mA, P ≤ ...mW (3)

(1): completed with type designation.

(2): see temperatures table.

(3): completed by electrical parameters.

The marking can be reduce as following:

PCB Piezotronics
 Address : ...
 Type : EX356XYYY/MNNZZ
 Serial number : ...
 Year of construction : ...

 Ex II 3 G

Ex nA IIC T6...482°C Gc

LCIE 18 ATEX 1004 X

U ≤ ...V, I ≤ ...mA, P ≤ ...mW

Tableau des températures / *Temperatures table*

Température ambiante <i>Ambient temperature</i>	Classe de température <i>Temperature class</i>
-55°C ≤ T _{amb} ≤ +80°C	T6
-55°C ≤ T _{amb} ≤ +95°C	T5
-55°C ≤ T _{amb} ≤ +130°C	T4
-55°C ≤ T _{amb} ≤ +195°C	T3
-55°C ≤ T _{amb} ≤ +290°C	T2
-55°C ≤ T _{amb} ≤ +440°C	T1
-55°C ≤ T _{amb} ≤ +472°C	482°C

L'appareil doit également comporter le marquage normalement prévu par les normes de construction qui le concernent sous la responsabilité du fabricant.

The equipment shall also bear the usual marking required by the product standards applying to such equipment under the manufacturer responsibility.

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 CERT-ATEX-FORM 05 Rev. 02

13 CONDITIONS PARTICULIERES D'UTILISATION

- a. Les paramètres électriques de l'alimentation peuvent être connectés à l'accéléromètre triaxial haute température ne doit pas dépasser les paramètres électriques définis.
- b. Température ambiante d'utilisation : -55°C à +472°C.
- c. Pour l'installation finale, l'accéléromètre triaxial haute température doit être raccordé conformément aux exigences de la norme EN 60079-14, fournissant et maintenant le degré de protection IP54.
- d. Le montage de l'appareil dans une installation doit être effectué de telle sorte que le corps métallique de l'accéléromètre triaxial à haute température et le blindage du câble soient reliés de manière fiable à la terre du système.
- e. L'appareil devra être installé comme défini dans le plan n°62991 rév. NR du 02/02/2018.
- f. Le câble utilisé doit avoir une température d'utilisation compatible avec l'environnement dans lequel l'appareil est installé.

SPECIFIC CONDITIONS OF USE

The electrical parameters of power supply can be connected to the triaxial high temperature accelerometer must not exceed the electrical parameters defined.

Operating ambient temperature: -55°C to +472°C.

For final installation, the triaxial high temperature accelerometer must be connected in compliance with requirements of EN 60079-14 standard, providing and maintaining degree of protection at least IP54.

The mounting of the apparatus into an installation must be carried out in such a way that metallic body of the triaxial high temperature accelerometer and cable shield are reliably connected to the system earth.

The apparatus must be installed per drawing n°62991 rev. NR dated 2018/02/02.

The cable used must have an operating temperature compatible with the environment in which the equipment is installed.

14 EXIGENCES ESSENTIELLES DE SANTE ET DE SECURITE

Couvertes par les normes listées au point 8.

ESSENTIAL HEALTH AND SAFETY REQUIREMENTS

Covered by standards listed at 8.

15 DOCUMENTS DESCRIPTIFS

DESCRIPTIVE DOCUMENTS

N°	Description	Reference	Rev.	Date	Page(s)
1.	Dossier technique / <i>Technical file</i>	62978	NR	2018/02/02	11
2.	Notice d'instruction / <i>Instruction manual</i>	67111			3

16 INFORMATIONS COMPLEMENTAIRES

Essais individuels

Conformément au paragraphe 23.2.1 de la norme EN 60079-15, chaque exemplaire de l'appareil doit être soumis à un essai de rigidité diélectrique sous 500 Volts pendant 60s.

ADDITIONAL INFORMATION

Routine tests

According to clause 23.2.1 of EN 60079-15 standard, each apparatus must be submitted to a dielectric strength test under 500 Volts during 60s.

17 DETAILS DES MODIFICATIONS

Version 00 : Evaluation de l'accéléromètre triaxial à haute température type EX356XYYY/MNZZ selon les normes EN 60079-0:2012+A11:2013 et EN 60079-15:2010.

DETAILS OF CHANGES

Issue 00: Assessment of triaxial high temperature accelerometer type EX356XYYY/MNZZ according to EN 60079-0:2012+A11:2013 and EN 60079-15:2010 standards.