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Model 394A11

calibration system

Installation and Operating Manual

This manual contains the 301A11, 482A23 installation and operating manuals that comprise a Model 394A11 calibration system kit.

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

Toll-free: 800-828-8840
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.com





Service, Repair, and Return Policies and Instructions

The information contained in this document supersedes all similar information that may be found elsewhere in this manual.

Service – Due to the sophisticated nature of the sensors and associated instrumentation provided by PCB Piezotronics, user servicing or repair is not recommended and, if attempted, may void the factory warranty. Routine maintenance, such as the cleaning of electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the physical material of construction, is acceptable. Caution should be observed to ensure that liquids are not permitted to migrate into devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth and never submerged or have liquids poured upon them.

Repair – In the event that equipment becomes damaged or ceases to operate, arrangements should be made to return the equipment to PCB Piezotronics for repair. User servicing or repair is not recommended and, if attempted, may void the factory warranty.

Calibration – Routine calibration of sensors and associated instrumentation is recommended as this helps build confidence in measurement accuracy and acquired data. Equipment calibration cycles are typically established by the users own quality regimen. When in doubt about a calibration cycle, a good "rule of thumb" is to recalibrate on an annual basis. It is also good practice to recalibrate after exposure to any severe temperature extreme, shock, load, or other environmental influence, or prior to any critical test.

PCB Piezotronics maintains an ISO-9001 certified metrology laboratory and offers calibration services, which are accredited by A2LA to ISO/IEC 17025, with full traceability to SI through N.I.S.T. In addition to the normally supplied calibration, special testing is also available, such as: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For information on standard recalibration services or special testing, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

Returning Equipment – *Following these procedures will ensure that your returned materials are handled in the most expedient manner*. Before returning any equipment to PCB Piezotronics, contact your local distributor, sales representative, or factory customer service representative to obtain a Return **Warranty, Service, Repair, and Return Policies and Instructions** Materials Authorization (RMA) Number. This RMA number should be clearly marked on the outside of all package(s) and on the packing

list(s) accompanying the shipment. A detailed account of the nature of the problem(s) being experienced with the equipment should also be included inside the package(s) containing any returned materials.

A Purchase Order, included with the returned materials, will expedite the turn-around of serviced equipment. It is recommended to include authorization on the Purchase Order for PCB to proceed with any repairs, as long as they do not exceed 50% of the replacement cost of the returned item(s). PCB will provide a price quotation or replacement recommendation for any item whose repair costs would exceed 50% of replacement cost, or any item that is not economically feasible to repair. For routine calibration services, the Purchase Order should include authorization to proceed and return at current pricing, which can be obtained from a factory customer service representative.

Contact Information – International customers should direct all inquiries to their local distributor or sales office. A complete list of distributors and offices can be found at www.pcb.com. Customers within the United States may contact their local sales representative or a factory customer service representative. A complete list of sales representatives can be found at www.pcb.com. Toll-free telephone numbers for a factory customer service representative, in the division responsible for this product, can be found on the title page at the front of this manual. Our ship to address and general contact numbers are:

PCB Piezotronics, Inc.
3425 Walden Ave.
Depew, NY14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine^{SM}: (716) 684-0001
Website: www.pcb.com
E-mail: info@pcb.com

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	O	O	O	O	O	O
PCB板	X	O	O	O	O	O
电气连接器	O	O	O	O	O	O
压电晶体	X	O	O	O	O	O
环氧	O	O	O	O	O	O
铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
本表格依据 SJ/T 11364 的规定编制。						
O： 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.

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Model 394Axx VIBRATION CALIBRATION SYSTEM

1-1.0 INTRODUCTION

The most convenient and universally accepted method of calibrating sensors, such as accelerometers, velocity and displacement sensors, is the back-to-back comparison method. The PCB Model 394Axx Vibration Calibration System affords a convenient means for converting nearly any existing shaker table to a precision calibration facility.

1-2.0 DESCRIPTION

This manual covers the four Back-To-Back standards offered by PCB:

- Model 394A03
- Model 394A04
- Model 394A10
- Model 394A11

Refer to the specification pages for detailed equipment listing.

1-2.1 MODEL 301Axx SENSOR

The Model 301Axx Sensor contains a quartz sensing element mounted in an inverted position below the top mounting surface. This arrangement subjects the test sensor to precisely the same motion as the standard Model 301Axx Sensor and is essential for faithful calibration at all frequencies within the range of the system.

The housing is designed to be extremely rugged and stiff, resulting in a sensor with high natural frequency and low susceptibility to mass loading.

The Model 301Axx contains built-in impedance converting electronics (ICP®) to convert the high-impedance charge signal from the quartz crystal to a low-impedance voltage signal, making the output impervious to cable motion and noise pickup.

If you wish to learn more about sensors with built-in microelectronic circuitry, known as ICP® sensors, consult PCB's "General Operating Guide for use with Piezoelectric ICP® Accelerometers," a brochure outlining the technical specifics associated with piezoelectric sensors. Topics covered include charge versus voltage mode systems, sensor time constants, effect of discharge time constant on low frequency response, and power requirements.

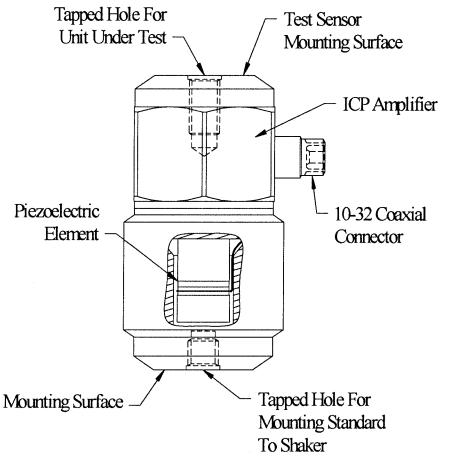


Figure 1-1 Model 301AXX Quartz Sensor

1-2.2 MODEL 482A23 SIGNAL CONDITIONER

The Model 482A23 Signal Conditioner supplies constant-current power to the sensor and extracts the signal information from the same line.

The sensitivity levels of Models 301A03 and 301A04 sensors are set nominally at 10mV/g. The sensitivity levels of Models 301A10 and 301A11 sensors are set nominally at 100mV/g. The Model 482A23 Signal

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Conditioner contains an adjustable attenuator to allow the system sensitivity to be set at precisely 100 mV/g. This is a factory adjustment and should not be changed in the field. To do so invalidates the factory system calibration. For more information on the signal conditioner, see the 482A23 Signal Conditioner section of this manual.

1-3.0 INSTALLATION

Install the Model 301Axx sensor to the armature of the shaker as shown in the Installation Drawing.

NOTE: The sensor must be mounted as shown in the Installation Drawing, with the hex end away from the shaker armature. Do not mount it with the hex end toward the shaker, as the calibration is not valid for this type of mounting.

The Model 301Axx is designed to mount onto an armature with either a 10-32 or ¼-28 tapped hole having a minimum depth of 3/16 inches of perfect thread.

Use the Model 081B20 Mounting Stud to mount with the ¼-28 hole and the Model 081A08 stud for 10-32 installation.

NOTE: The armature surface should be reasonably flat and free from burrs or foreign objects, such as metal chips. Inspect the mounting surface carefully before mounting the sensor.

Thread the appropriate stud into the bottom mounting hole in the sensor as far as it can go. Next, thread the sensor into the mounting hole. Tighten, using the appropriate amount of torque for the mounting stud as detailed on the specification sheet.

Attach the Model 003C10 Input Cable to the 10-32 coaxial connector on the sensor. This connection must be very secure to avoid resonance. A slight dab of breakable thread locker on the threads prevents this connection from loosening during use. Epoxy can cause damage when removed.

Connect the other end of the Model 003C10 Cable to the XDCR jack at the rear of the Model 482A23 Signal Conditioner. Connect the one end of the Model 003D03 BNC Cable to the OUTPUT jack at the rear of the signal conditioner, and connect the other end of this cable to the readout equipment (see Section 1-4.0, Operation).

Plug the 488A04 and power cord set between the signal conditioner and a source of 100 to 240 VAC, 50 to 60 Hz power, and turn the power switch on. Allow several minutes for warm-up.

1-4.0 OPERATION

Mount the test sensor to the top surface of the Model 301Axx, using a layer of silicone grease (DC-4 or equivalent) between the mating surfaces.

Some standards have different thread sizes. For the correct thread size, refer to our line drawing for the appropriate stud to use for each model.

Sensor cables should be tied down to some convenient stationary point near the armature to prevent cable motion forces from affecting the reading of the test and/or standard sensor. Leave enough slack to allow for smooth motion of the armature.

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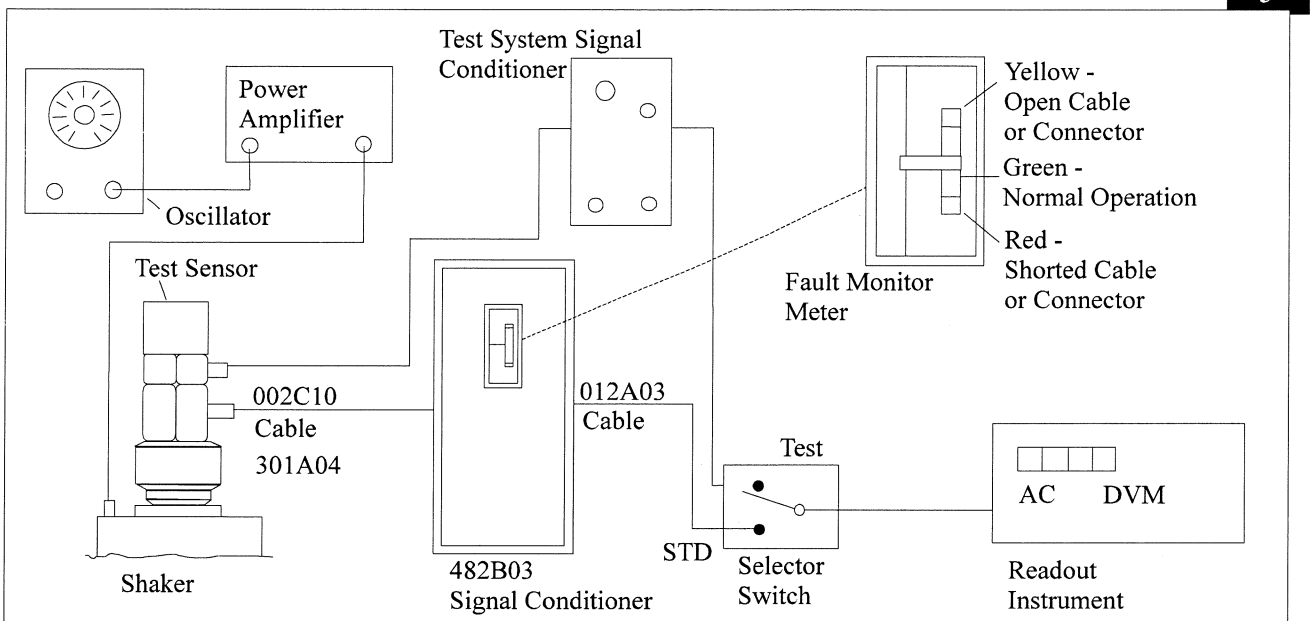


Figure 1-2 Typical Calibration Installation

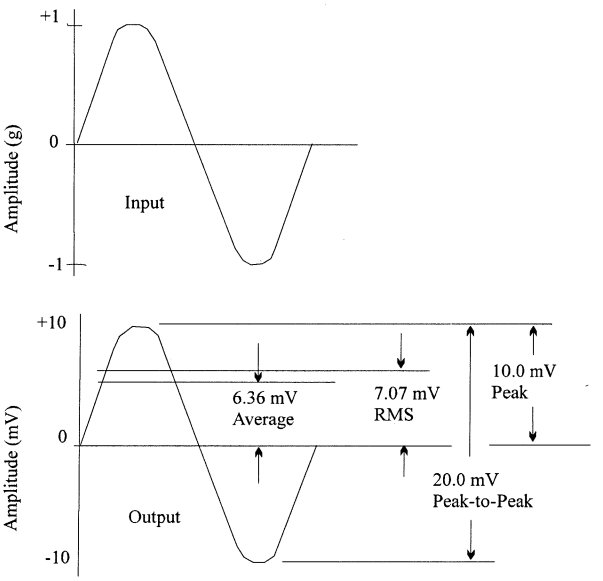
Refer to figure 1-2 for a suggested method of layout for the Model 394A11 System. An AC digital volt meter (DVM) is shown here for simplicity; but many other readout possibilities exist. Some AC meters having conventional panel meter readouts also produce a DC output voltage proportional to the AC value of the input signal. A meter such as this, used in conjunction with a DC DVM, also makes a desirable readout combination.

The selector switch not only eliminates one set of readout instrumentation but also eliminates the tracking error between two readout instruments.

To use the system, select a frequency within the range of the system. Always start with a low g-level to prevent damage to the sensors and shaker. Adjust the g-level using the readout from the standard system, and read the corresponding output from the test system. In this manner, a complete frequency response calibration may be performed.

1-4.1 WAVEFORM CONSIDERATIONS

Since piezoelectric sensors are calibrated with sinusoidal inputs, it is informative to consider the relationships between peak-to-peak, peak, RMS and average values of a sine wave.



Typical Transfer Characteristics

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The above figure illustrates the transfer characteristics of the 100 mV/g System, along with the constants of proportionality for the various values. The constants hold true only for pure sinusoidal waveforms. These characteristics are based on a 1-g input.

NOTE: Most AC meters actually respond to the average value of the full-wave rectified waveform but are calibrated to read RMS.

1-4.1.1 DISTORTED SINUSOIDAL INPUT WAVEFORMS

Refer to the set-up as shown in Figure 1-2, where the selector switch and one read-out instrument are used. It is not essential that the input waveform be purely sinusoid. With some shaker systems, some distortion may be present at low frequencies and, while the absolute g-level of the calibration may be in error by several percent, the comparison calibration is valid if both respond in a like manner to the input waveform.

Even with badly distorted input motion, a somewhat less-precise calibration can be performed, substituting a DC-coupled oscilloscope for the meter shown in Figure 1-2. Use the peak-to-peak values for the comparison calibration.

1-4.2 LOW FREQUENCY CONSIDERATIONS

The low-frequency response of the Model 394Axx System is governed by the discharge time constant of the Model 301Axx Sensor (depending upon sensor ≥1.0 second). This yields a lower -5% frequency of 0.5 Hz.

Since the output of the Model 482A23 Signal Conditioner is AC (capacitor) coupled through a 10 μF coupling capacitor, care must be exercised to avoid low-frequency response degradation by excessive loading of the amplifier output.

A 1-megohm readout load at the output of the Model 482A23 gives a 10-second coupling time constant, which is sufficient to maintain the low-frequency response of the basic system. Avoid lower resistance readout loads. The readout device used should have an input that is greater than or equal to 1 megaohm.

Also, check to see that other AC coupling time constants in the system (such as in AC oscilloscopes and AC-coupled amplifiers and recorders) are not so short that they cannot maintain the 0.5 Hz low-frequency response.

1-4.3 MASS LOADING EFFECTS

The frequency response curve supplied with the Model 394A11 system is plotted using a NIST-traceable PCB Model 301A05 transfer standard.

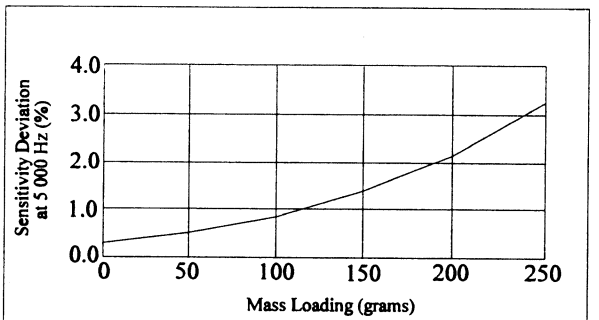


Figure 1-4 Deviation Due to Mass Loading

The virtual sensitivity of any back-to-back vibration standard is sensitive to increased mass loading, but particularly so at higher frequencies. The rigid housing of these sensor models minimizes this effect, and for mass loading of the standard sensor up to 200 grams, the sensitivity change is insignificant and does not affect the calibration accuracy over the specified frequency range of the system.

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1-5.0 RECALIBRATION

The purchase price of the Model 394A11 System includes two free factory recalibrations performed after two successive, approximate 6-month intervals. This service includes calibration and lapping of sensor mounting surfaces, along with a complete system check.

1-6.0 MAINTENANCE AND REPAIR

There is essentially no maintenance necessary on the Model 394A11 System. With the system sensitivity being pre-set at the factory, there are no adjustments to be performed.

Should a problem occur, contact the factory for assistance and for shipping instructions should it be deemed necessary to return the system to the factory for repair. Please include a brief note describing the problem along with all units returned for repair. There is no charge for inspection and estimation of repair.

MODEL 482A23 LINE-POWERED SIGNAL CONDITIONER

Included with Model 394A03, 394A04, 394A10 & 394A11 Vibration Calibration Systems

2-1.0 SPECIFICATIONS

Please turn to the end of this manual for a product specification sheet and outline drawing.

2-1.1 SAFETY CONSIDERATIONS

WARNING 1: *The power supply/signal conditioner should not be opened by anyone other than qualified service personnel.* This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury.

WARNING 2: This equipment is designed with user safety in mind; however, the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by PCB Piezotronics, Inc.

Caution 1: *Cables can kill your equipment.* High voltage electrostatic discharge can damage electrical devices. Similar to a capacitor, a cable can hold a charge caused by triboelectric transfer, such as that which occurs in the following:

- Laying on and moving across a rug.
- Any movement through air.
- The action of rolling out a cable.
- Contact with a non-grounded person.

The solution for product safety: 1) Connect the cables only with the AC power off. 2) Temporarily "short" the end of the cable before attaching it to any signal input or output.

Caution 2: *ESD considerations should be made prior to performing any internal adjustments on the equipment.* Any piece of electronic equipment is vulnerable to ESD when opened for adjustments. Internal adjustments should therefore be done ONLY at an ESD-safe work area. Many products have ESD protection, but the level of protection may be exceeded by extremely high voltage.

The **Caution** heading used in this manual explains hazards that could damage the instrument.

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2-1.2 INTRODUCTION

The Model 482A23 is a single-channel, line-operated signal conditioner for use with ICP® sensors. This unit provides constant current excitation to the built-in transducer amplifier and decouples the signal from the DC bias voltage.

This unit also contains provisions for channel fault monitoring, as well as a provision for externally varying the constant current over a 2 to 20 mA range. This model is factory set at 4 mA.

Important Note: When used as part of a sensor calibration system like the Model 394A11, do not make any adjustment using the sensor normalization potentiometer located on the front panel of the Model 482A23. All settings are preset during the factory system calibration.

2-2.0 DESCRIPTION

The Model 482A23 is powered externally by the Model 488A04 Universal Power Supply. The rear panel contains a BNC jack for transducer signal INPUT and a BNC jack for signal OUTPUT connection. The signal information is decoupled from the sensor bias via a coupling capacitor and brought out to the OUTPUT jack. The bias monitor located on the front panel consists of a color-coded panel meter that permanently monitors the sensor bias level. Refer to the sensor specification for correct bias level.

2-3.0 INSTALLATION/OPERATION

See the included Outline Drawing for outline dimensions, as well as jack and control locations. Plug the five-pin DIN output connector of the Model 488A04 Universal Power Supply into the DC INPUT located on the rear panel of the Model 482A23.

Note: For battery operation use Model 488A07 in place of Model 488A04.

Plug the three-wire line cord of the Model 488A04 into a source of 85 to 264 VAC, 47 to 440 Hz power and switch the power on the Model 482A23.

With no transducer connected to the INPUT connector, the front panel bias indicator meter indicates full scale (yellow), which corresponds to open circuit power supply voltage (see Fault Monitor Table below).

Meter Reading	Yellow	Green	Red
Condition	Open	Ok	Short

With an ICP® sensor (or in-line amplifier) connected to the INPUT jack, the front monitor meter indicates approximately midscale (green) if the sensor or amplifier is functioning properly. It does not read midscale if the transducer bias is 3 to 5 volts.

If a cable is faulty (open), or the sensor's built-in amplifier is open, the meter indicates a yellow (full scale) reading. When a cable or sensor is shorted, the meter indicates zero volts (red).

Immediately after connecting a readout instrument (oscilloscope, meter, or recorder) to the OUTPUT jack, the coupling capacitor begins charging through the input resistance of the readout instrument. This charging causes an apparent "drifting" of the output signal until the capacitor is fully charged. The normal amount of leakage through the coupling capacitor usually results in a <20 mV maximum DC offset.

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2-3.1 COUPLING TIME CONSTANT, AC COUPLED

The coupling time constant (TC) is the product of the conditioner's coupling capacitor (47 μF) and the input resistance of the readout instrument, in parallel with the 274 kilohm shunt resistor. Typically, this is ten seconds, assuming the input resistance of the readout measurement is one megohm.

In most cases, it is desirable to keep the coupling TC long, with respect to the sensor discharge TC, to minimize the effect of the coupling TC on low frequency response.

2-3.2 DRIVING LONG CABLES

When driving long cables, it may be necessary to increase the constant-current drive to the sensor. The Model 482A23 Power Unit is normally supplied with the constant current output to the sensor set at 4 mA nominal. This is adequate for most laboratory and field applications. Special situations, such as driving long cables (beyond 100 ft) with high frequency or fast rise time pulses, may require increasing the drive current to higher current levels (20 mA max).

When driving fast rise time pulses over long lines, system performance may be optimized by "tuning" the drive current to the line; i.e., by finding the best current setting for the particular set of physical parameters established by the sensor, line length, line termination, pulse rise time, etc.

The optimum current setting is best determined by experimentation with your particular test setup. A good rule of thumb is to use the lowest current consistent with satisfactory results to minimize sensor self-heating and noise.

Another technique requires the use of the Model 073A Impedance Matching Resistor connected immediately after the sensor. This variable resistor is then used to "tune" the current to the line. One of the best approaches is to test the long line with a signal generator set at a frequency of interest.

2-3.3 SETTING THE CONSTANT CURRENT

To set the constant current, locate the current adjust potentiometer on the rear panel. Connect a 0 to 30 mA DC ammeter (or multimeter) to the INPUT jack. The constant current value is read directly on the ammeter. Using a small regular screwdriver, vary the setting of the current adjust pot to set the current at a new level.

CAUTION: It may be possible to exceed 20 mA slightly. Do not do so; as operation of an ICP® sensor or amplifier above 20 mA may damage the equipment.

2-4.0 WARRANTY

PCB offers a Total Customer Satisfaction guarantee. PCB strives to provide superior, unmatched customer service. Should you at any time find yourself dissatisfied with any PCB product for any reason, consult a PCB application engineer to discuss repair, refund, or exchange procedures.

PCB instrumentation is warranted against defective material and workmanship for one 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 contact a PCB application engineer (or your local sales contact).

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2-5.0 MAINTENANCE AND REPAIR

Because of the sophisticated nature of PCB instrumentation, field repair of the equipment is not recommended. Most PCB sensors are of modular construction and are factory repairable. A repair or replacement quotation is available at no charge. Before returning equipment for repair, it is strongly suggested that the user confer with a factory application engineer (or local sales contact) concerning the difficulty and to ascertain if an on-site procedure rectifies the problem.

If repair is indicated, contact PCB to request a Return Materials Authorization (RMA) number from the factory. An advanced authorization to proceed with the repair, permitting charges of up to 50% of a new item, greatly expedites repair.

For the most efficient service, please provide a detailed, written description of the malfunction encountered with the returned equipment, together with your specific application and setup procedures. Customers outside the U.S. should consult their local sales contact for information on returning equipment. For exceptions, please contact the International Sales Department at PCB to request shipping instructions and an RMA. For assistance, please call (716) 684-0001, or fax us at (716) 684-0987. You may also receive assistance via e-mail at **sales@pcb.com** or our web site at **www.pcb.com.**

Models 394A03, 394A04, 394A10 & 394A11 Vibration Calibration Systems

Manual Number 19201
Manual Revision: B
ECN Number: 18486

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Model 482A23

Vibration calibration standard system, 100 mV/g, 10-32 sensor mtg (CE

Installation and Operating Manual

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contact PCB Piezotronics, Inc.

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Contact Information – International customers should direct all inquiries to their local distributor or sales office. A complete list of distributors and offices can be found at www.pcb.com. Customers within the United States may contact their local sales representative or a factory customer service representative. A complete list of sales representatives can be found at www.pcb.com. Toll-free telephone numbers for a factory customer service representative, in the division responsible for this product, can be found on the title page at the front of this manual. Our ship to address and general contact numbers are:

PCB Piezotronics, Inc.
3425 Walden Ave.
Depew, NY14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine^{SM}: (716) 684-0001
Website: www.pcb.com
E-mail: info@pcb.com

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	O	O	O	O	O	O
PCB板	X	O	O	O	O	O
电气连接器	O	O	O	O	O	O
压电晶体	X	O	O	O	O	O
环氧	O	O	O	O	O	O
铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
本表格依据 SJ/T 11364 的规定编制。						
O： 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.

DOCUMENT NUMBER: 21354
*DOCUMENT REVISION: **D***
ECN: 46162

1.0 Introduction and Specifications

A specification sheet and outline drawing are located in the rear of this manual.

1.1 Introduction: Safety Considerations

WARNING 1: *The power supply/signal conditioner should not be opened by anyone other than qualified service personnel.* This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury.

WARNING 2: This equipment is designed with user safety in mind; however, the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by PCB Piezotronics, Inc.

Caution 1: *Cables can kill your equipment.* High voltage electrostatic discharge can damage electrical devices. Similar to a capacitor, a cable can hold a charge caused by triboelectric transfer, such as that which occurs in the following:

- Laying on and moving across a rug.
- Any movement through air.
- The action of rolling out a cable.
- Contact with a non-grounded person.

The solution for product safety: 1) Connect the cables only with the AC power off. 2) Temporarily "short" the end of the cable before attaching it to any signal input or output.

Caution 2: *ESD considerations should be made prior to performing any internal adjustments on the equipment.* Any piece of electronic equipment is vulnerable to ESD when opened for adjustments. Internal adjustments should therefore be done ONLY at an ESD-safe work area. Many products have ESD protection, but the level of protection may be exceeded by extremely high voltage.

WARNING SYMBOLS AND TERMS

The following symbols and terms may be found on the equipment described in this manual.

 This symbol on the unit indicates that the user should refer to the operating instructions located in the 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 indicates safety, earth ground.

The **WARNING** heading used in this manual explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **Caution** heading used in this manual explains hazards that could damage the instrument.

1.2 Introduction

Model 482A21 is a single-channel, line-operated signal conditioner for ICP® transducer systems. This unit provides constant current excitation to the built-in transducer amplifier and decouples the signal from the DC bias voltage.

The unit also contains provision for fault monitoring the channel, as well as provision for externally varying the constant current output over a 2 to 20 mA range. This model is factory set at 4 mA.

2.0 Description

Model 482A21 is powered externally by universal power supply model 488B04. The rear panel contains a BNC jack for transducer signal INPUT and a BNC jack for signal OUTPUT connections.

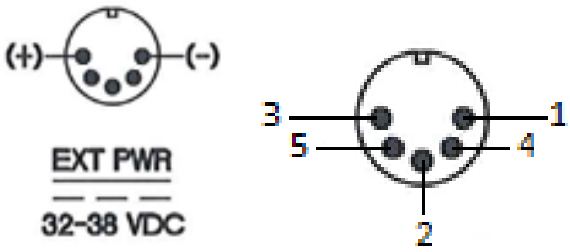
The AC signal information is decoupled from the sensor bias by a coupling capacitor and brought out to the OUTPUT jack.

The bias monitor located on the front panel consists of a color-coded panel meter that permanently monitors the sensor bias level. See sensor specification for correct sensor bias level.

3.0 Installation

See the included outline drawing for dimensions, as well as jack and control locations. Plug the five-pin DIN output connector on 488B04 into the DC INPUT located on the rear panel of 482A21.

Plug the three-wire line cord of the 488B04 into a source of 85 to 264 VAC, 47 to 440 Hz power and switch the power on for 482A21.



Pins 3 and 5 are (+)
Pins 1, 2 and 4 are (-)
Outside shell is earth/chassis ground

Figure 1: External Power Connector and Pin Numbers

Note: For battery operation use model 488B07 in place of model 488B04.

With no transducer connected to the INPUT connector, the front panel bias indicator meter indicates full scale (yellow), which corresponds to open circuit power supply voltage. See Figure 2.

Meter Reading	Yellow	Green	Red
Condition	Open	Ok	Short

Figure 2: Fault Monitor Table

When an ICP® transducer (or in-line amplifier) is connected to the INPUT jack, the front monitor meter indicates approximately midscale (green) if the transducer or amplifier is functioning properly. It does not read midscale if the transducer bias is 3 to 5 volts.

If a cable is faulty (open), or the sensor's built-in amplifier is open, the meter indicates a yellow (full scale) reading. When a cable or transducer is shorted, the meter indicates zero volts (red).

Immediately after connecting a readout instrument (oscilloscope, meter, or recorder) to the OUTPUT jack, the coupling capacitor begins charging through the input resistance of the readout instrument. This charging causes an apparent "drifting" of the output signal until the capacitor is fully charged. The normal amount of leakage through the coupling capacitor usually results in a <20 mV maximum DC offset.

4.0 Coupling Time Constant, AC Coupled

The coupling time constant (TC) is the product of the coupling capacitor (47 µF) and the input resistance of the readout instrument, in parallel with the 274 kilohm shunt resistor. Typically, this is ten seconds, assuming the input resistance of the readout measurement is one megohm.

In most cases, it is desirable to keep the coupling TC long, with respect to the transducer discharge TC, to minimize the effect of the coupling TC on low frequency response.

4.1 Driving Long Cables

When driving long cables, it may be necessary to increase the constant current drive to the transducers. 482A21 is normally supplied with the constant current output to the transducer set at 4 mA nominal. This is adequate for most laboratory and field applications. Special situations, such as driving long cables (beyond 100 ft) with high frequency or fast rise time pulses, may require increasing the transducer drive current up to 20 mA.

When driving fast rise time pulses over long lines, system performance may be optimized by "tuning" the drive current to the line; i.e., by finding the best current setting for the particular set of physical parameters established by the transducer, line length, line termination, pulse rise time, etc.

The optimum current setting is best determined by experimentation with your particular test setup. A good rule of thumb is to use the lowest current consistent with satisfactory results to minimize transducer self-heating and noise.

Another technique requires the use of impedance matching resistor model 073A connected immediately after the transducer. This variable resistor is then used to "tune" the current to the line.

One of the best approaches is to test the long line with a signal generator set at a frequency of interest.

4.2 Setting the Constant Current

To set the constant current, locate the current adjust potentiometer on the rear panel. Connect a 0 to 30 mA DC ammeter (or multimeter) to the INPUT jack (as shown in Figure 3). The constant current value is read directly on the ammeter. Using a small regular screwdriver, vary the setting of the current adjust pot to set the current at a new level.

CAUTION: It may be possible to exceed 20 mA slightly. Do not do so; to operate an ICP® transducer or amplifier above 20 mA may damage the equipment.

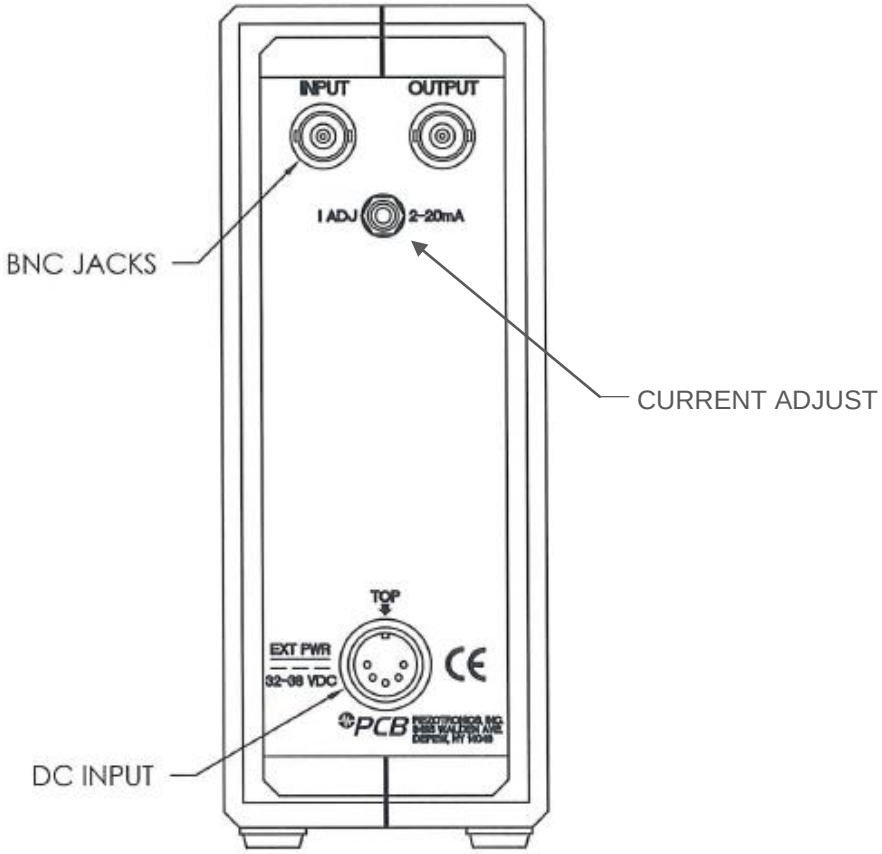


Figure 3: Constant Current Adjust

5.0 Maintenance and Repair

Because of the sophisticated nature of PCB instrumentation, field repair of the equipment is not recommended. Most PCB signal conditioners are of modular construction and are factory repairable. A repair or replacement quotation is available at no charge. Before returning equipment for repair, it is advisable that the user confers with a factory application engineer (or international representative) concerning the difficulty to ascertain if an on-site procedure rectifies the problem.

If repair is indicated, contact PCB to request a Return Materials Authorization (RMA) number from the factory. An advanced authorization to proceed with the repair, permitting charges of up to 50% of a new item, greatly expedites repair.

For the most efficient service, please provide a detailed, written description of the malfunction encountered with the equipment you are returning, together with your specific application and setup procedures. International customers should return PCB equipment to their representative. For exceptions, please contact the International Sales department at PCB to request shipping instructions and an RMA.

482A21 and 482A22 Troubleshooting Guide

Problem	**Test/Solution**
Unit does not appear to be powered up/ No meter movement.	- Power switch in the on position. - Test 'sensor' excitation current. Measure the current on the 'sensor' input BNC from the center conductor to the shell. Adjust 'Iadj' (rear panel) with screwdriver turning both clockwise and counterclockwise. Reference section 'Setting the Constant Current.' - Make sure the bias monitor channel select matches the channel of interest.
Output signal seems to drift.	- Make sure the input impedance of the readout device, scope or data acquisition system is approximately 1 MΩ.
Low frequency response not meeting specification or amplitude is attenuated.	- The input impedance of the readout device may be too low. May need to use a buffered signal conditioner, for example 482C16.
Meter does not seem to show sensor bias voltage.	- Match the channel select with channel of interest. - Measure the sensor bias while the sensor is attached to the unit. This requires a 'T' connector to allow both the sensor and the measuring device to be attached. If problem persists, return for repair.

MANUAL NUMBER: 19179
MANUAL REVISION:
ECO NUMBER:

Model 301A11

ICP® Accelerometer

Installation and Operating Manual

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

Toll-free: 800-828-8840
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.com





Service, Repair, and Return Policies and Instructions

The information contained in this document supersedes all similar information that may be found elsewhere in this manual.

Service – Due to the sophisticated nature of the sensors and associated instrumentation provided by PCB Piezotronics, user servicing or repair is not recommended and, if attempted, may void the factory warranty. Routine maintenance, such as the cleaning of electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the physical material of construction, is acceptable. Caution should be observed to ensure that liquids are not permitted to migrate into devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth and never submerged or have liquids poured upon them.

Repair – In the event that equipment becomes damaged or ceases to operate, arrangements should be made to return the equipment to PCB Piezotronics for repair. User servicing or repair is not recommended and, if attempted, may void the factory warranty.

Calibration – Routine calibration of sensors and associated instrumentation is recommended as this helps build confidence in measurement accuracy and acquired data. Equipment calibration cycles are typically established by the users own quality regimen. When in doubt about a calibration cycle, a good "rule of thumb" is to recalibrate on an annual basis. It is also good practice to recalibrate after exposure to any severe temperature extreme, shock, load, or other environmental influence, or prior to any critical test.

PCB Piezotronics maintains an ISO-9001 certified metrology laboratory and offers calibration services, which are accredited by A2LA to ISO/IEC 17025, with full traceability to SI through N.I.S.T. In addition to the normally supplied calibration, special testing is also available, such as: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For information on standard recalibration services or special testing, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

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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

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压电晶体	X	O	O	O	O	O
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铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
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O： 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

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DOCUMENT NUMBER: 21354
*DOCUMENT REVISION: **D***
ECN: 46162

General
OPERATING GUIDE

for use with

PIEZOELECTRIC ICP® 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, ICP® acceleration 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 a factory Application Engineer at 716-684-0001 or your nearest PCB sales representative.

2.0 ICP® ACCELEROMETERS

Powered by simple, inexpensive, constant-current signal conditioners, these sensors are easy to operate and interface with signal analysis, data acquisition and recording instruments. The following features further characterize ICP® sensors:

- Fixed voltage sensitivity, regardless of cable type or length.
- Low-impedance output signal, which can be transmitted over long cables in harsh environments with virtually no loss in signal quality.
- Two-wire operation with low cost coaxial cable, two-conductor ribbon wire or twisted-pair cabling.
- Low-noise, voltage-output signal compatible with standard readout, signal analysis, recording, and data acquisition equipment.
- Low cost per-channel - ICP® accelerometers require only an inexpensive, constant-current signal conditioner to operate.
- Intrinsic self-test feature – monitoring the sensor's output bias voltage provides an indication of proper operation, faulty condition, and bad cables.

In the rear of this manual you will find a **Specification Sheet**, which provides the complete performance characteristics of your particular sensor.

3.0 OPTIONAL FEATURES

Many sensors are supplied with standard, optional features. When listed before the model number, the following prefix letters indicate that the sensor is manufactured or supplied with a particular optional feature: **"A"** option: adhesive mount; **"HT"** option: extended high temperature range; **"J"** option: electrically ground isolated; **"M"** option: metric mounting thread; **"Q"** option: extended discharge time constant; **"T"** option: built-in transducer electronic data sheet (TEDS); and **"W"** option: attached, water-resistant cabling. Other prefix letters, such as **"K"**, **"KR"**, **"GK"**, **"GKR"**, **"KL"**, and **"GKL"**, indicate that the sensor is ordered in kit form, including interconnect cabling and signal conditioner. If you have any questions or concerns regarding optional features, consult the Vibration Division's product catalog or contact a PCB factory representative.

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.

® ICP is a registered trademark of PCB Group, Inc., which uniquely identifies PCB sensors that incorporate built-in microelectronics.

Shown in figure 1 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. 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 megohm, the low frequency range may be affected. If necessary, contact a factory representative for further assistance.*

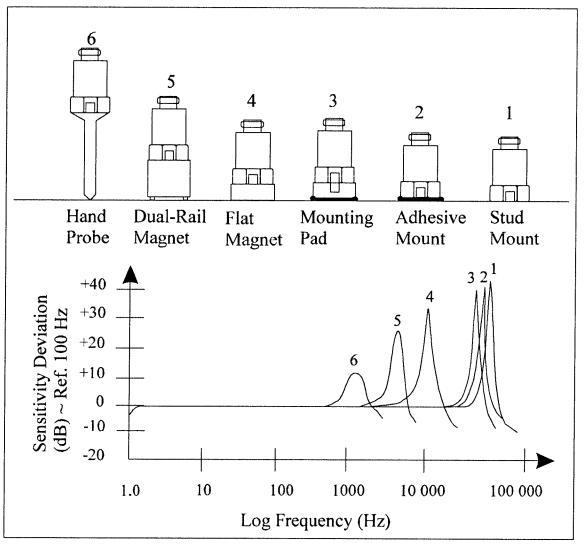


Figure 1. Assorted Mounting Configurations and Their Effects on High Frequency

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.*

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 enclosed **Installation Drawing**.

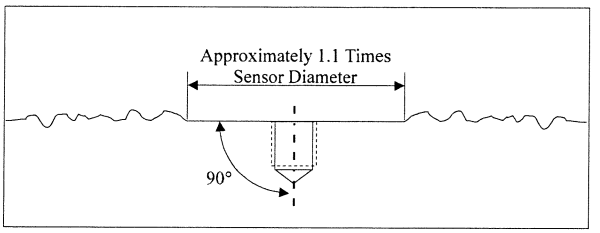


Figure 2. Mounting Surface Preparation

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.

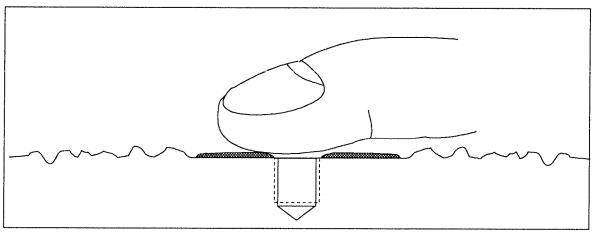


Figure 3. Mounting Surface Lubrication

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 accelerometer and hand-tighten (this step is unnecessary for units having an integral mounting stud). Then, screw the sensor into the tapped hole that was prepared in the test object. Tighten the unit in place by applying, with a torque wrench, the recommended mounting torque, as listed on the enclosed **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 perform well for temporary installations whereas two-part epoxies and quick-bonding gels (super glue) provide a more permanent installation. Two

techniques are used for adhesive mounting; they are via an adhesive mounting base (method 1 below) or direct adhesive mounting (method 2 below).

NOTE: *Adhesively mounted sensors often exhibit a reduction in high-frequency range. Generally, smooth surfaces and stiff adhesives provide the best high 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 many bases are manufactured of "hard-coated" aluminum, they provide electrical isolation to eliminate ground loops and reduce electrical interference that may propagate from 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 flat side of the appropriate adhesive mounting base according to the guidelines set forth in **STEPS 2** and **3** of the Stud Mount Procedure presented above.

STEP 3: Place a small portion of adhesive on the underside of the mounting base (the underside is discernable by the concentric grooves which are designed to accept the adhesive). Firmly press down on the assembly to displace any extra adhesive remaining under the base.

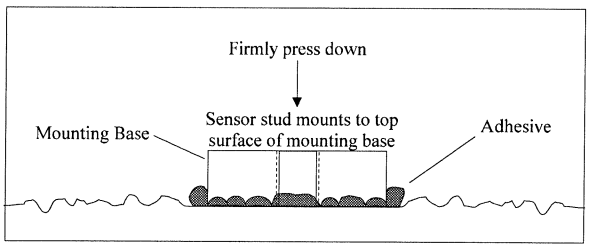


Figure 4. Mounting Base: Adhesive Installation

METHOD 2 - Direct Adhesive Mount

For restrictions of space or for convenience, most sensors can be adhesive-mounted directly to the test structure (an exception being units having integral mounting studs).

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. Also, adhesive that may invade the tapped mounting hole in the base of the sensor will compromise future ability to stud mount the unit.

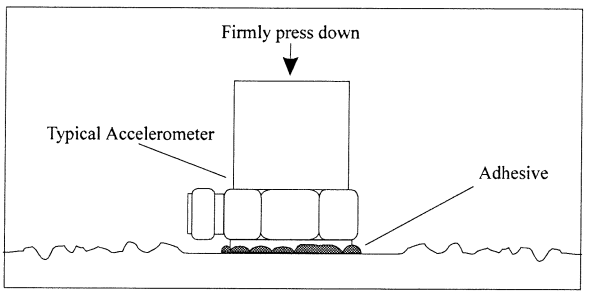


Figure 5. Direct Adhesive Mounting

4.2-1 ADHESIVE MOUNT REMOVAL (other than wax)

NOTE: *A debonder should always be used to avoid sensor damage.*

To avoid damaging the accelerometer, a debonding agent must be applied to the adhesive prior to sensor removal. With so many adhesives in use (everything from super glues, dental cement, epoxies, etc), there is no universal debonding agent available. The debonder for the Loctite 454 adhesive that PCB offers is Acetone. If you are using anything other than Loctite 454, you will have to check with the individual manufacturers for their debonding recommendations. The debonding agent must be allowed to penetrate the surface in order to properly react with the adhesive, so it is advisable to wait a few minutes before removing the sensor.

After the debonding agent has set, you can use an ordinary open-end wrench if the accelerometer has a hex base or square base, or the supplied removal tool for teardrop accelerometers. After attaching either, use a gentle shearing (or twisting) motion (by hand only) to remove the sensor from the test structure.

4.3 MAGNETIC MOUNT

Magnetic mounting provides a convenient means for making quick, portable measurements and is commonly used for machinery condition monitoring, predictive maintenance, spot checks, and vibration 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 such as motor housings and pipes. 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 location for mounting and a target to insure that subsequent measurements for trending purposes are taken at the same location.

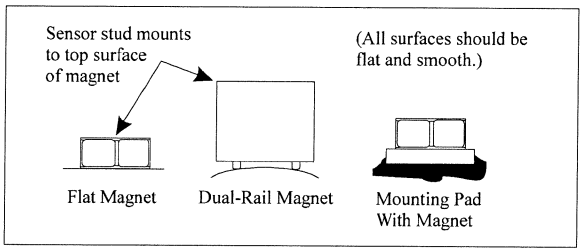


Figure 6. Magnet Types

STEP 1: Prepare a smooth, flat mounting surface. A minimum surface finish of 63 µin (0.00016 mm) generally works best. After cleaning the surface and checking for burrs, apply a light film of silicone grease, machine oil, or similar-type coupling fluid.

STEP 2: After choosing the correct magnet type, inspect the magnet, verifying that its mounting surfaces are flat and smooth.

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

STEP 4: To avoid damage to the sensor, install the magnet/sensor assembly to the prepared test surface by gently "rocking" or "sliding" it into place.

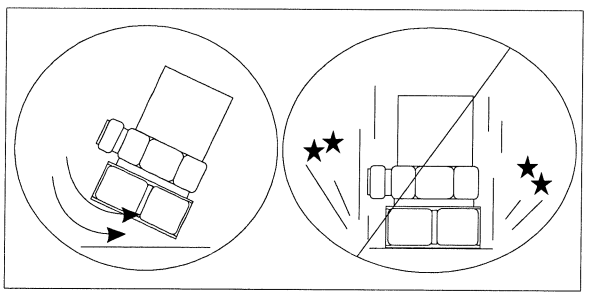


Figure 7. Magnet Mounting

CAUTION: *Magnetically mounting of an accelerometer has the potential to generate very high (and very damaging) acceleration (g) levels. To prevent such damage, exercise caution and install the assembly gently by rocking it into place. If shock is expected to be a particular concern, use a sensor with built-in shock protection. For further assistance, contact a factory representative.*

4.4 HANDHELD OR PROBE TIP MOUNT

This method is NOT recommended for most applications. Both the accuracy and repeatability at low (<5 Hz) and high frequency (>1 kHz) ranges are questionable. It is generally used only for machinery condition monitoring, when installation space is restricted, or other portable trending applications. The technique, however, can be useful for initially determining locations of greatest vibration to establish a permanent sensor installation point.

5.0 CABLING

Care and attention to cable installation and cable condition is essential as the reliability and accuracy of any measurement system is no better than that of its weakest link. Do to the nature of vibration measurements, all sensor cables will ultimately fatigue and fail. Good installation practice will extend the life of a cable, however, it is highly recommended to keep spare cables on hand to enable continuation of the test in the event of a cable failure.

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

One cable type cannot satisfy all applications. ICP® sensors can be operated with any ordinary two-wire or coaxial cable. Special, low-noise cables that are typically recommended for use with high-impedance, charge-output sensors can also be used. For applications requiring conformity to CE, low noise cables are essential. Industrial applications often require shielded, twisted-pair cables to reduce the effects of EMI and RFI that is present near electrical motors and machinery. Teflon-jacketed cabling may be necessary to withstand corrosive environments and higher temperatures. Consult the Vibration Division's product catalog for more information about cables or feel free to contact a factory representative for a specific recommendation on cables that are best suited for your application.

STEP 2: Connect the cable to the accelerometer.

A small amount of thread-locking compound placed on the connector threads prior to attachment helps secure the cable during testing. In wet, oily, or dirty environments, the connection can be sealed with silicone rubber sealant, O-rings, and flexible, heat-shrink tubing.

Coaxial Cables: Make connection by inserting the cable's connector pin into the sensor's mating socket. Then thread the connector into place by turning the cable connector's outer shell onto the accelerometer's electrical connector.

NOTE: *Do not spin the accelerometer while holding the cable connector stationary, as this will cause undue*

friction on the center pin of the cable connector and lead to premature fatigue.

Multi-pin connectors: Make connection by inserting the sensor's mating pins onto the cable connector's mating sockets. Then thread the connector into place by turning the cable connector's outer shell onto the accelerometer's electrical connector.

Pigtail Connections: Certain miniature accelerometers and shock sensors are provided with lightweight cables attached to "Pigtail" connections. This type of connection reduces overall weight and incidence of connection intermittency under shock conditions. In the event of a cable or connection failure, the cables may be repaired in the field simply by re-soldering the stripped leads 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 to internal electronics may be caused by excessive heat during soldering and such failure is not covered by warranty.*

STEP 3: Route the cable to the signal conditioner, making certain to relieve stress on the sensor/cable connection. Also, minimize cable motion by securing it with tape, clamps or ties 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 may be stepped on or become contaminated. To avoid ground loops, shielded cables should have the shield grounded at one end only, typically at the signal conditioner.

STEP 4: Finally, connect the remaining cable end to the signal conditioner. It is good practice to dissipate any electrical charge that may have accumulated in the cable by shorting the signal pin to the ground pin or shell prior to attachment.

6.0 POWERING

All ICP® sensors require constant current excitation for proper operation. For this reason, use only PCB constant-current signal conditioners or other approved constant-current sources. A typical system schematic is shown in Figure 8.

NOTE: *Damage to the built-in electronics resulting from the application of incorrect power, or the use of an unapproved power source, is NOT covered by warranty.*

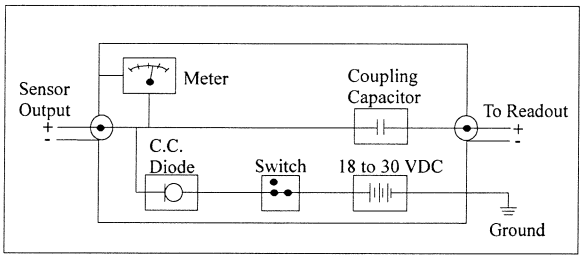


Figure 8. Typical System Schematic

The power supply consists of a current-regulated, 18 to 30 VDC source. This power is regulated by a current-limiting circuit, which provides the constant-current excitation required for proper operation of ICP® sensors. In general, battery-powered devices offer versatility for portable, low-noise measurements, whereas line-powered units provide the capability for continuous monitoring. Consult the Vibration Division's product catalog for more information about signal conditioners.

NOTE: *Under no circumstances should a voltage be supplied to an ICP® accelerometer without a current-regulating diode or equivalent electrical circuit. This may include ohmmeters, multi-meters and continuity testers.*

Meters or LEDs are used on PCB signal conditioners to monitor the bias voltage on the sensor output signal, to check sensor operation, and detect cable faults. Normally, a "yellow" reading indicates an open circuit; "green" indicates normal operation; and "red" indicates either a short or overload condition. Finally, 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 signal that is compatible with most standard readout devices.

NOTE: *Units having a low bias voltage may be in the "red," when actually they are working properly. If suspect, the bias voltage can be checked with a voltmeter attached to a "T" connector installed on the input connector to the signal conditioner.*

Note: *For readout devices having an input impedance near one gigohm (as encountered with some A to D converters), it may be necessary to place a one megohm resistor in parallel to the readout input to eliminate slow turn-on and signal drift.*

Today, many FFT analyzers, data acquisition modules, and data collectors have the proper constant-current excitation built-in for direct use with ICP® sensors. Before using this feature, however, check that the supply voltage and constant current are within acceptable limits for use with your particular sensor. (Check enclosed **Specification Sheet**). 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 signal conditioner and allow 1 to 2 minutes for the system to stabilize. The meter (or LED) on the signal conditioner should be reading "green." This indicates proper operation and you may begin taking measurements. If a faulty condition is indicated (red or yellow reading), first check all system connections, then check the functionality of the cable and signal conditioner. If the system still does not operate properly, consult a PCB factory representative.

NOTE: *Always operate the accelerometer within the limitations listed on the enclosed* ***Specification Sheet****. Operating the device outside these parameters can cause temporary or permanent damage to the sensor.*

8.0 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. Fortunately, most sensor manufacturers provide a calibration record that documents the exact characteristics of each sensor. (The type and amount of data varies depending on the manufacturer, sensor type, contractual regulations, and other special requirements).

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

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 suggest 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 Handheld Shaker operates at a fixed frequency and known amplitude (1.0 g) to provide a quick check of sensor sensitivity.*

8.1 RECALIBRATION SERVICE

PCB offers recalibration services for our piezoelectric accelerometers, as well as units produced by other manufacturers. Our internal metrology laboratory is certified to ISO 9001, accredited by A2LA to ANSI/IEC 17025 and ANSI/NCSL Z540-1, complies with ISO 10012-1 (and former MIL-STD-45662A), and uses equipment directly traceable to NIST. Our investment in equipment, traceability and conformance to industry standards ensures accurate calibration against relevant specifications, in a timely fashion.

8.2 BACK-TO-BACK CALIBRATION THEORY

Many companies choose to purchase the equipment necessary to perform the recalibration procedure in house. 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.

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.

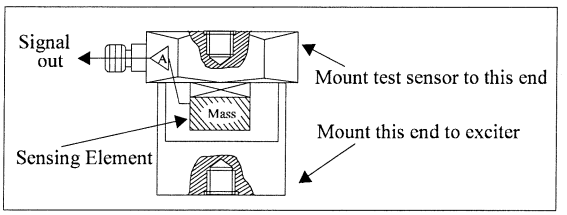


Figure 9. Reference Standard Accelerometer

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).

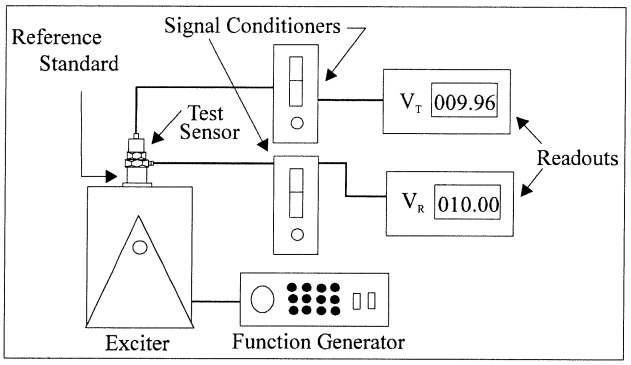


Figure 10. Typical Back-to-Back Calibration System

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.

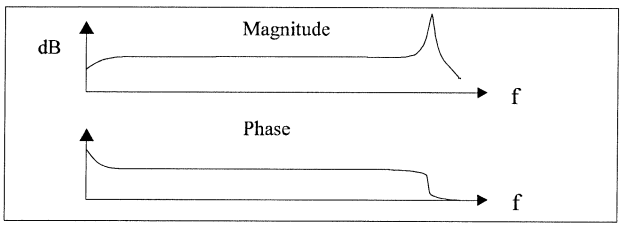


Figure 11. Typical Test Accelerometer Response

8.3 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, then to a nearby stationary location. This reduces cable motion, which is especially important when testing charge output sensors, and helps to prevent extraneous motion or stresses from being imparted into the system. A typical set-up is shown in Figure 12.

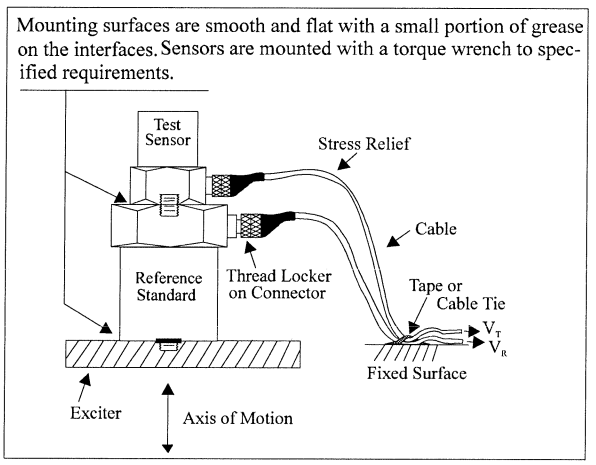


Figure 12. Typical Calibration Set-Up

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.

8.4 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.

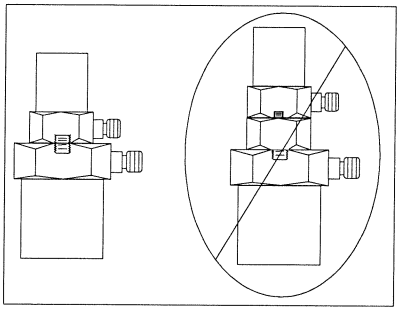


Figure 13. Stud Mounting

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.

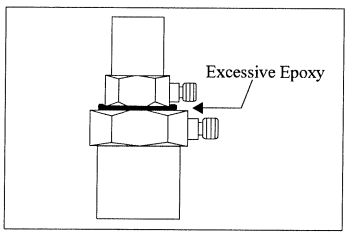


Figure 14. Incorrect Adhesive Mounting

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's sensing element may differ from the vibration at the reference standard due to a "cantilever" effect, seen in Figure 15.

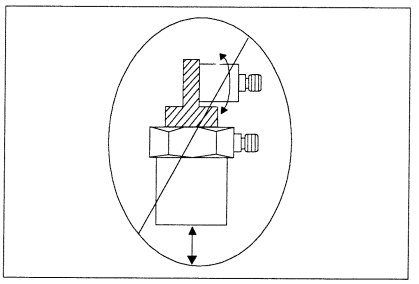


Figure 15. Mounting Triaxial Sensors (Incorrect)

Understand Back-to-Back Calibration limitations. Do not expect the uncertainty of calibration to be any better than ±2%. (In fact, the uncertainty may be as high as ±3% or ±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.

8.5 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 utilizing the services of an accredited laboratory.

9.0 SERVICE

See the supplement sheet, contained in this manual, for information on our warranty, service, repair, and return policies and instructions.

When unexpected measurement problems arise, call our 24-hour SensorLine[SM] to discuss your immediate dynamic instrumentation needs with a factory representative.
Dial 716-684-0001.

PCB PIEZOTRONICS INC
VIBRATION DIVISION

3425 Walden Avenue, Depew, NY 14043-2495 USA **Vibration Division toll-free** 888-684-0013
24-hour SensorLine[SM] 716-684-0001 **FAX** 716-685-3886 **E-mail** vibration@pcb.com **Website** www.pcb.com

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Manual Number: 18292
Manual Revision: B
ECN Number: 19829

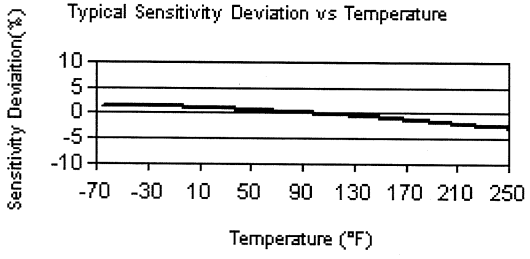
VIB-ICPMANUAL-0

Printed in U.S

Model Number	ICP® ACCELEROMETER	Revision: G
301A11		ECN #: 20986

Performance	ENGLISH	SI	
Sensitivity (± 2.0 %)	100 mV/g	10.2 mV/(m/s^2)	
Measurement Range	± 50 g pk	± 490 m/s^2 pk	
Frequency Range (± 5 %)	0.5 to 10,000 Hz	0.5 to 10,000 Hz	
Frequency Range (± 10 %)	0.3 to 14,000 Hz	0.3 to 14,000 Hz	
Frequency Range (± 3 dB)	0.2 to 20,000 Hz	0.2 to 20,000 Hz	
Resonant Frequency	≥ 35 kHz	≥ 35 kHz	
Broadband Resolution	0.004 g rms	0.039 m/s^2 rms	[1]
Non-Linearity	≤ 1 %	≤ 1 %	[2]
Transverse Sensitivity	≤ 3 %	≤ 3 %	
Environmental			
Overload Limit	± 5000 g pk	± 49,050 m/s^2 pk	
Temperature Range	-65 to 250 °F	-54 to 121 °C	
Temperature Response	See Graph	See Graph	
Electrical			
Excitation Voltage	23 to 30 VDC	23 to 30 VDC	
Constant Current Excitation	2 to 20 mA	2 to 20 mA	
Output Impedance	<100 ohm	<100 ohm	
Output Bias Voltage	11 to 17 VDC	11 to 17 VDC	
Discharge Time Constant	2.0 to 5.0 sec	2.0 to 5.0 sec	
Settling Time (within 10% of bias)	<12.0 sec	<12.0 sec	
Spectral Noise (10 Hz)	65 µg/√Hz	638 (µm/s^2)/√Hz	[1]
Spectral Noise (100 Hz)	20 µg/√Hz	196 (µm/s^2)/√Hz	[1]
Spectral Noise (1 kHz)	15 µg/√Hz	147 (µm/s^2)/√Hz	[1]
Physical			
Sensing Element	Quartz	Quartz	
Sensing Geometry	Shear	Shear	
Housing Material	316L Stainless Steel	316L Stainless Steel	
Sealing	Welded Hermetic	Welded Hermetic	
Size (Hex x Height)	1 3/16 in x 1 1/2 in	30.2 mm x 38.1 mm	
Weight	6.2 oz	176 gm	[1]
Electrical Connector	10-32 Coaxial Jack	10-32 Coaxial Jack	
Electrical Connection Position	Side	Side	
Mounting Thread (Shaker Mount)	1/4-28 Female	1/4-28 Female	
Mounting Thread (Unit Under Test Mount)	10-32 Female	10-32 Female	

CE [3]



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 Group, Inc.

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 [4]

NOTES:

[1] Typical.
[2] Zero-based, least-squares, straight line method.
[3] See PCB Declaration of Conformance PS023 for details.
[4] Sensitivity referenced at 159.2 Hz.

SUPPLIED ACCESSORIES:

Model 080A149 Calibration adaptor, 10-32 to 5-40 (for Model 394A11 calibration standard) (1)
Model 081A08 Mounting Stud (10-32 to 1/4-28) (2)
Model 081A90 Mounting stud, 10-32 to 5-40 (2)
Model 081B05 Mounting Stud (10-32 to 10-32) (2)
Model 081B20 Mounting Stud, with shoulder (1/4-28 to 1/4-28) (2)
Model ACS-1 NIST traceable frequency response (10 Hz to upper 5% point). (1)
Model ACS-4 Single-axis, low frequency phase and amplitude response calibration. (1)
Model M080A149 Mounting adaptor (10-32 to M3 x 0.50) (1)
Model M081B05 Mounting Stud 10-32 to M6 X 0.75 (2)
Model M081B20 Mounting Stud 1/4-28 to M6 X 0.75 (2)

Entered: BLS	Engineer: [illegible]	Sales: WR	Approved: [illegible]	Spec Number:
Date: 11-23-04	Date: 11-23-04	Date: 11/23/04	Date: 11/24/04	11291

PCB PIEZOTRONICS
VIBRATION DIVISION
3425 Walden Avenue, Depew, NY 14043

Phone: 716-684-0001
Fax: 716-685-3886
E-Mail: vibration@pcb.com

Model 394A11

calibration system

Installation and Operating Manual

This manual contains the 301A11, 482A23 installation and operating manuals that comprise a Model 394A11 calibration system kit.

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

Toll-free: 800-828-8840
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.com





Service, Repair, and Return Policies and Instructions

The information contained in this document supersedes all similar information that may be found elsewhere in this manual.

Service – Due to the sophisticated nature of the sensors and associated instrumentation provided by PCB Piezotronics, user servicing or repair is not recommended and, if attempted, may void the factory warranty. Routine maintenance, such as the cleaning of electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the physical material of construction, is acceptable. Caution should be observed to ensure that liquids are not permitted to migrate into devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth and never submerged or have liquids poured upon them.

Repair – In the event that equipment becomes damaged or ceases to operate, arrangements should be made to return the equipment to PCB Piezotronics for repair. User servicing or repair is not recommended and, if attempted, may void the factory warranty.

Calibration – Routine calibration of sensors and associated instrumentation is recommended as this helps build confidence in measurement accuracy and acquired data. Equipment calibration cycles are typically established by the users own quality regimen. When in doubt about a calibration cycle, a good "rule of thumb" is to recalibrate on an annual basis. It is also good practice to recalibrate after exposure to any severe temperature extreme, shock, load, or other environmental influence, or prior to any critical test.

PCB Piezotronics maintains an ISO-9001 certified metrology laboratory and offers calibration services, which are accredited by A2LA to ISO/IEC 17025, with full traceability to SI through N.I.S.T. In addition to the normally supplied calibration, special testing is also available, such as: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For information on standard recalibration services or special testing, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

Returning Equipment – *Following these procedures will ensure that your returned materials are handled in the most expedient manner*. Before returning any equipment to PCB Piezotronics, contact your local distributor, sales representative, or factory customer service representative to obtain a Return **Warranty, Service, Repair, and Return Policies and Instructions** Materials Authorization (RMA) Number. This RMA number should be clearly marked on the outside of all package(s) and on the packing

list(s) accompanying the shipment. A detailed account of the nature of the problem(s) being experienced with the equipment should also be included inside the package(s) containing any returned materials.

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Contact Information – International customers should direct all inquiries to their local distributor or sales office. A complete list of distributors and offices can be found at www.pcb.com. Customers within the United States may contact their local sales representative or a factory customer service representative. A complete list of sales representatives can be found at www.pcb.com. Toll-free telephone numbers for a factory customer service representative, in the division responsible for this product, can be found on the title page at the front of this manual. Our ship to address and general contact numbers are:

PCB Piezotronics, Inc.
3425 Walden Ave.
Depew, NY14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine^{SM}: (716) 684-0001
Website: www.pcb.com
E-mail: info@pcb.com

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	O	O	O	O	O	O
PCB板	X	O	O	O	O	O
电气连接器	O	O	O	O	O	O
压电晶体	X	O	O	O	O	O
环氧	O	O	O	O	O	O
铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
本表格依据 SJ/T 11364 的规定编制。						
O： 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.

DOCUMENT NUMBER: 21354
*DOCUMENT REVISION: **D***
ECN: 46162

Model Number 394A11	CALIBRATION SYSTEM	Revision: H ECN #: 50036

Performance	ENGLISH	SI	
Sensitivity(± 0.5 %)(Voltage)	100 mV/g	10.2 mV/(m/s²)	[1]
Measurement Range(± 5V)(Output)	50 ±g pk	490 ±m/s² pk	
Frequency Range(± 2 %)	5 to 5,000 Hz	5 to 5,000 Hz	
Frequency Range(± 5 %)	0.5 to 10,000 Hz	0.5 to 10,000 Hz	
Frequency Range(± 10 %)	0.3 to 14,000 Hz	0.3 to 14,000 Hz	
Resonant Frequency(Mounted)	≥ 35 kHz	≥ 35 kHz	
Broadband Resolution(1 Hz to 10 kHz)	0.004 g rms	0.039 m/s² rms	[2]
Amplitude Linearity	≤ 1 %	≤ 1 %	[3]
Transverse Sensitivity	≤ 3 %	≤ 3 %	
Sensitivity(Base Strain)	0.0001 g/με	0.001 (m/s²)/με	
Environmental			
Warm Up	< 12.0 sec	< 12.0 sec	
Temperature Range(Operating)	-65 to +250 °F	-54 to +121 °C	
Electrical			
Spectral Noise(1 Hz)	235 (μm/s²)/√Hz	2,303	[2]
Spectral Noise(10 Hz)	55 (μm/s²)/√Hz	539	[2]
Spectral Noise(100 Hz)	18 (μm/s²)/√Hz	176	[2]
Spectral Noise(1 kHz)	12 (μm/s²)/√Hz	118	[2]
Physical			
Sensing Element	Quartz/Shear	Quartz/Shear	
Housing Material	Stainless Steel/Welded	Stainless Steel/Welded	
Size (Hex x Height x Width x Depth)	1.19 in x 1.5 in x 6.3 in x 2.4 in x 11.0 in	30.2 mm x 38.1 mm x 16 cm x 6.1 cm x 28 cm	
Weight	6.2 oz	176 gm	[2]
Electrical Connector	10-32 Coaxial/Side	10-32 Coaxial/Side	
Mounting Thread(Standard)	1/4-28 UNF	1/4-28 UNF	
Mounting Thread(Unit Under Test)	10-32 UNF	10-32 UNF	
Mounting Torque	20 to 30 in-lb	225 to 338 N-cm	
Power(± 5%)(Required)	36 VDC	36 VDC	[4]
Weight	1.51 lb	685 gm	[2]
Cable Connector(Input)	BNC Jack/Rear	BNC Jack/Rear	
Cable Connector(Output)	BNC Jack/Rear	BNC Jack/Rear	

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In the interest of constant product improvement, we reserve the right to change specifications without notice.

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. [5]

M - Metric Mount

Sensitivity± 0.5	10 mV/(m/s²)	98 mV/g

NOTES:

[1]All sensor specifications are valid only when used with matched power supply.
[2]Typical.
[3]Zero-based, least-squares, straight line method.
[4]Provided by 488A04.
[5]Measured at 159 Hz.

SUPPLIED ACCESSORIES:

Model 003C10 Low-noise, blue, coaxial, PTFE cable, 10-ft, 10-32 coaxial plug to BNC plug (1)
Model 003D03 Low-noise, blue, coaxial, PTFE cable, 3-ft, BNC plug to BNC plug (1)
Model 017AXX Power Cord (1)
Model 080A149 Calibration adaptor, 10-32 to 5-40 (for Model 394A11 calibration standard) (1)
Model 081A08 Mounting Stud (10-32 to 1/4-28) (2)
Model 081A90 Mounting stud, 10-32 to 5-40 (2)
Model 081B05 Mounting Stud (10-32 to 10-32) (2)
Model 081B20 Mounting Stud, with shoulder (1/4-28 to 1/4-28) (2)
Model 301A11 Calibration ICP® accel., 100 mV/g, 50g, 0.5 to 10 kHz, 10-32 side conn., 1/4-28 thd on bottom, 10-32 thd on top (1)
Model 482A23 1-channel, line-powered, ICP® sensor signal cond., BNC input/output conn. X0.9 to x1.1 gain, (for use in 394A10/394A11 systems) (1)
Model 488B04 Power Supply, 100 to 125 VAC or 200 to 250 VAC input, 27 VDC @ 20 mA output. (1)
Model ACS-1 NIST traceable frequency response (10 Hz to upper 5% point).
Model ACS-10/ACS-4 NIST Tracable frequency sweep (0.5 Hz to upper 5% point) (1)
Model ACS-4 Single axis, low frequency phase and amplitude response cal (from 0.5 to 10Hz)
Model M080A149 Mounting adaptor (10-32 to M3 x 0.50) (1)
Model M081B05 Mounting Stud 10-32 to M6 X 0.75 (2)
Model M081B20 Mounting Stud 1/4-28 to M6 X 0.75 (2)

Entered: LK	Engineer: CPH	Sales: WDC	Approved: DY	Spec Number:
Date: 10/18/2019	Date: 10/18/2019	Date: 10/18/2019	Date: 10/18/2019	11307

PCB PIEZOTRONICS
3425 Walden Avenue, Depew, NY 14043
Phone: 716-684-0001
Fax: 716-684-0987
E-Mail: info@pcb.com

Model 482A23

Vibration calibration standard system, 100 mV/g, 10-32 sensor mtg (CE

Installation and Operating Manual

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

Toll-free: 800-828-8840
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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	O	O	O	O	O	O
PCB板	X	O	O	O	O	O
电气连接器	O	O	O	O	O	O
压电晶体	X	O	O	O	O	O
环氧	O	O	O	O	O	O
铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
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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

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

DOCUMENT NUMBER: 21354
*DOCUMENT REVISION: **D***
ECN: 46162

Model Number	POWER SUPPLY	Revision: A
488B04		ECN #: 32528

Environmental	ENGLISH	SI
Temperature Range(Operating)	32 to 104 °F	0 to 40 °C
Humidity Range(Non-Condensing)	0 to 95 %	0 to 95 %
Electrical		
Output Voltage	32 - 38 VDC	32 - 38 VDC
Output Current	0.54 amps	0.54 amps
AC Power(50 to 60 Hz)	100 to 240 VAC	100 to 240 VAC
(50 to 60 Hz)	0.6 amps	0.6 amps
AC Ripple(Peak to Peak)	<350 mV	<350 mV
Physical		
Electrical Connector(AC Power Input)	IEC 320	IEC 320
(Output DC)	DIN 5 Pin (Male)	DIN 5 Pin (Male)
Size (Height x Width x Depth)	1.3 in x 2.13 in x 3.76 in	33 mm x 54.1 mm x 955 mm
Weight	1.25 lb	0.57 kg

CE [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.

ICP® is a registered trademark of PCB Group, Inc.

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.

488B04/NC - Does not incluce a 017AXX Power Cord

NOTES:

[1] See PCB Declaration of Conformance PS024 for details.

SUPPLIED ACCESSORIES:

Model 017AXX Power Cord (1)

Entered:	Engineer:	Sales:	Approved:	Spec Number:
Date: 3-5-10	Date: 3-3-10	Date: 2-26-10	Date: 3-9-10	45177

PCB PIEZOTRONICS
ELECTRONICS DIVISION
3425 Walden Avenue, Depew, NY 14043

Phone: 716-684-0001
Fax: 716-684-0987
E-Mail: electronics@pcb.com

Model Number	SIGNAL CONDITIONER, LINE (OR DC) POWERED	Revision: E
482A23		ECN #: 43617

Performance	**ENGLISH**	**SI**	
Channels	1	1	
Voltage Gain(± 1 %)	0.9 to 1.1	0.9 to 1.1	[6]
Low Frequency Response(-5 %)	<0.1 Hz	<0.1 Hz	[3][4]
High Frequency Response(-5 %)	>1000 kHz	>1000 kHz	
Fault/Bias Monitor/Meter	26 V FS	26 V FS	
Environmental			
Temperature Range	32 to 120 °F	0 to 50 °C	
Electrical			
Power Required(Standard)	DC power	DC power	
Excitation Voltage(To Sensor)	25 to 27 VDC	25 to 27 VDC	
DC Offset(Maximum)	<20 mV	<20 mV	
DC Power	+32 to 38 VDC	+32 to 38 VDC	[1]
DC Power	0.12 Amps	0.12 Amps	[1]
Constant Current Excitation(To Sensor)	2 to 20 mA	2 to 20 mA	[2]
Discharge Time Constant(0 to +50%)	10 sec	10 sec	[3][4]
Broadband Electrical Noise(1 to 10,000 Hz)	17.8 µV	-95 dB	
Spectral Noise(1 Hz)	3.7 µV/√Hz	-109 dB	[5]
Spectral Noise(10 Hz)	0.10 µV/√Hz	-137 dB	[5]
Spectral Noise(100 Hz)	0.05 µV/√Hz	-146 dB	[5]
Spectral Noise(1 kHz)	0.08 µV/√Hz	-142 dB	[5]
Spectral Noise(10 kHz)	0.03 µV/√Hz	-150 dB	[5]
Physical			
Electrical Connector(Input, sensor)	BNC Jack	BNC Jack	
Electrical Connector(Output)	BNC Jack	BNC Jack	
Electrical Connector(DC Power Input)	DIN Jack	DIN Jack	
Size (Height x Width x Length)	6.3 in x 2.4 in x 11 in	16 cm x 6.1 cm x 28 cm	
Weight	1.51 lb	685 gm	

CE[7]

All specifications are at room temperature unless otherwise specified.
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OPTIONAL VERSIONS

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NOTES:

[1]Provided by supplied external DC power supply.
[2]User adjustable, factory set at 4 mA (± 0.5 mA). One control adjusts all channels.
[3]With ≥ 1M ohm input impedance of readout device.
[4]Un-buffered output, read out device input impedance affects discharge time constant and low frequency response of unit.
[5]Typical.
[6]Factory set at 1:1, except when part of a calibration system, the gain is set with specific sensor to normalize system sensitivity.
[7]See PCB Declaration of Conformance PS024 for details.

SUPPLIED ACCESSORIES:

Model 017AXX Power Cord
Model 488B04/NC Power Convertor

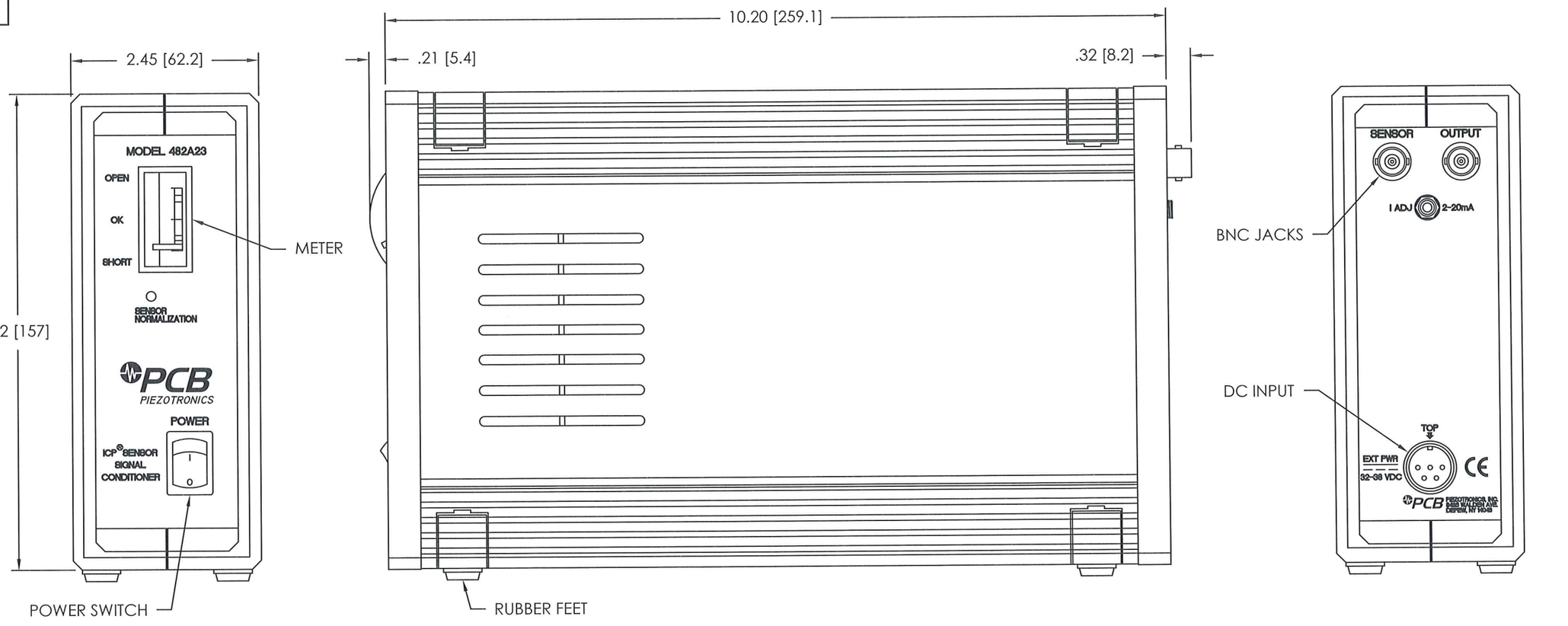
Entered: AP	Engineer: CPH	Sales: ML	Approved: JWH	Spec Number:
Date: 1/28/2015	Date: 1/28/2015	Date: 1/28/2015	Date: 1/28/2015	**11146**

PCB PIEZOTRONICS
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E-Mail: info@pcb.com

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REVISIONS		
REV	DESCRIPTION	DIN
A	CHANGED ARTWORK	37737

11278



UNLESS SPECIFIED TOLERANCES	
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
FILLETS AND RADII .003 - .005	FILLETS AND RADII [0.07 - 0.13]

DRAWN		CHECKED		ENGINEER	
SMB	12/15/11	ECB	12/16/11	KEN L	12/15/11

TITLE

OUTLINE DRAWING
MODEL 482A23
ICP® SENSOR SIGNAL CONDITIONER

PCB PIEZOTRONICS INC
3425 WALDEN AVE. DEPEW, NY 14043
(716) 684-0001 EMAIL: SALES@PCB.COM

CODE IDENT. NO.	DWG. NO.
52681	11278
SCALE: 1.5X	SHEET 1 OF 1

Model 394A11

calibration system

Installation and Operating Manual

This manual contains the 301A11, 482A23 installation and operating manuals that comprise a Model 394A11 calibration system kit.

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

Toll-free: 800-828-8840
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
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Depew, NY14043 USA
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24-hour SensorLine^{SM}: (716) 684-0001
Website: www.pcb.com
E-mail: info@pcb.com

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	O	O	O	O	O	O
PCB板	X	O	O	O	O	O
电气连接器	O	O	O	O	O	O
压电晶体	X	O	O	O	O	O
环氧	O	O	O	O	O	O
铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
本表格依据 SJ/T 11364 的规定编制。						
O： 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.

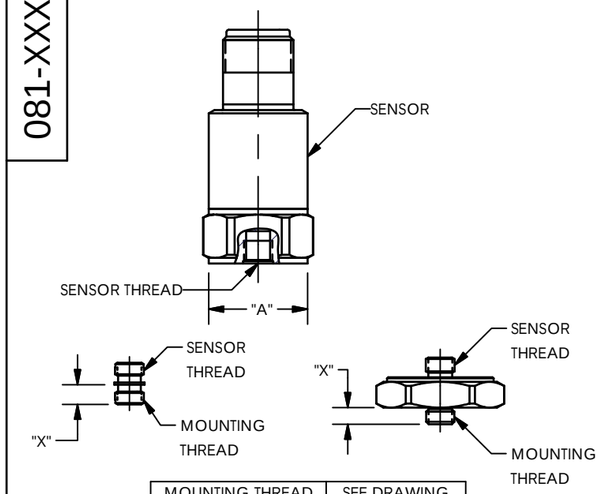
X: Indicates that said hazardous substance contained in at least one of the homogeneous materials for this part is above the limit requirement of GB/T 26572.
Lead is present due to allowed exemption in Annex III or Annex IV of the European RoHS Directive 2011/65/EU.

DOCUMENT NUMBER: 21354
*DOCUMENT REVISION: **D***
ECN: 46162

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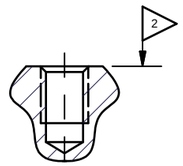
081-XXXX-90

STANDARD STUD MOUNT



MOUNTING THREAD	SEE DRAWING
5-40	A
M3 X 0.50	B
10-32	C
M5 X 0.80	D
1/4-28	E
M6 X 1.00	F

"A"
5-40
MOUNTING INSTRUCTIONS
(METRIC DIMENSIONS IN BRACKETS)

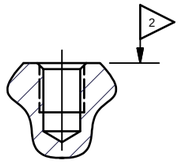


MOUNTING HOLE PREPARATION:

1. Ø.101[Ø2.57]
   X .20[5.1]↧ MIN.
   5-40 UNC-2B
   X .15[3.8]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
4-5 INCH POUNDS
[45-55 NEWTON CENTIMETERS].

"B"
M3 X 0.50
MOUNTING INSTRUCTIONS
(ENGLISH DIMENSIONS IN BRACKETS)

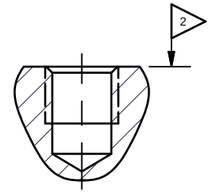


MOUNTING HOLE PREPARATION:

1. Ø2.5[Ø.099]
   X 4.6 [1.8]↧ MIN.
   M3 X 0.50-6H
   X 3.3[.13]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
45-55 NEWTON CENTIMETERS
[4-5 INCH POUNDS].

"C"
10-32
MOUNTING INSTRUCTIONS
(METRIC DIMENSIONS IN BRACKETS)

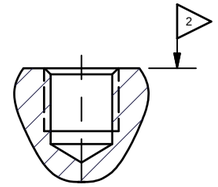


MOUNTING HOLE PREPARATION:

1. Ø.159[Ø4.04]
   X .23[5.8]↧ MIN.
   10-32 UNF-2B
   X .15[3.8]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
10-20 INCH POUNDS
[113-225 NEWTON CENTIMETERS].

"D"
M5 X 0.80
MOUNTING INSTRUCTIONS
(ENGLISH DIMENSIONS IN BRACKETS)



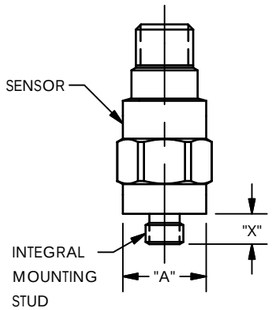
MOUNTING HOLE PREPARATION:

1. Ø4.22[Ø.166]
   X 7.62 [.300]↧ MIN.
   M5 X 0.8-6H
   X 5.08[.200]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
113-225 NEWTON CENTIMETERS
[10-20 INCH POUNDS].

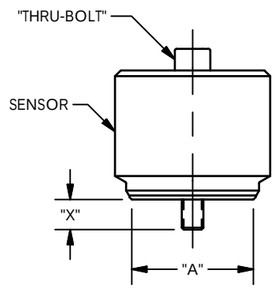
REVISIONS		
REV	DESCRIPTION	DIN
P	UPDATE DRAWING	25686

INTEGRAL STUD MOUNT



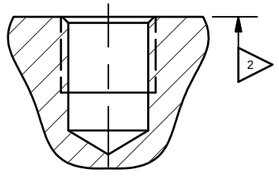
MOUNTNG THREAD	SEE DRAWING
5-40	A
M3 X 0.50	B
10-32	C
M5 X 0.80	D
1/4-28	E
M6 X 1.00	F

"THRU-BOLT" STUD MOUNT



BOLT THREAD	SEE DRAWING
10-32	C
M5 X 0.80	D
1/4-28	E
M6 X 1.00	F
M8 X 1.25	F

"E"
1/4-28
MOUNTING INSTRUCTIONS
(METRIC DIMENSIONS IN BRACKETS)

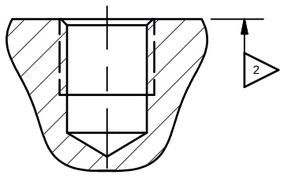


MOUNTING HOLE PREPARATION:

1. Ø.218[Ø5.54]
   X .300[7.62]↧ MIN.
   1/4-28 UNF-2B
   X .200[5.08]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
2-5 FOOT POUNDS
[3-7 NEWTON METERS].

"F"
M6 X 0.75, M6 X 1.00, M8 X 1.25
MOUNTING INSTRUCTIONS
(ENGLISH DIMENSIONS IN BRACKETS)



M6 X 0.75
MOUNTING HOLE PREPARATION:

1. Ø5.31[Ø.209]
   X 7.62 [.300]↧ MIN.
   M6 X 0.75-6H
   X 5.08[.200]↧ MIN.

M6 X 1.0
MOUNTING HOLE PREPARATION:

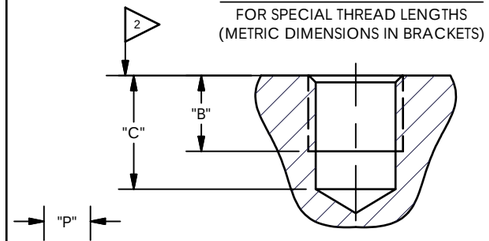
1. Ø5.05[Ø.199]
   X 8.10 [.320]↧ MIN.
   M6X 1.0-6H
   X 6.35[.250]↧ MIN.

M8 X 1.25
MOUNTING HOLE PREPARATION:

1. Ø6.75[Ø.266]
   X 8.64 [.340]↧ MIN.
   M8 X 1.25-6H
   X 5.00[.197]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
3-7 NEWTON METERS [2-5 FT POUNDS].

"G"
MOUNTING INSTRUCTIONS
FOR SPECIAL THREAD LENGTHS
(METRIC DIMENSIONS IN BRACKETS)



MOUNTING HOLE PREPARATION:

1. Ø DRILL DIA.
   X "C"↧ MIN.
   TAP
   X "B"↧ MIN.

THREAD DEPTH : B= X + 1 THREAD PITCH
DRILL DEPTH : C= B + 3 THREAD PITCH
SEE A-F FOR APPROPRIATE DRILL AND TAP
THREAD PITCH= 1/TPI [P]

3.) FOR BEST RESULTS, PLACE A THIN LAYER OF SILICONE GREASE (OR EQUIVALENT) ON INTERFACE PRIOR TO MOUNTING.

2. MOUNTING SURFACE SHOULD BE FLAT TO WITHIN .001(0.03) TIR OVER DIM 'A' WITH A 63[1.61] OR BETTER FINISH FOR BEST RESULTS.

1. DRILL PERPENDICULAR TO MOUNTING SURFACE TO WITHIN ± 1˚.

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]
DECIMALS XX ±.01 XXX ±.005	DECIMALS X ± 0.3 XX ± 0.13
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13

DRAWN		CHECKED		ENGINEER	
JDM	3/9/07	ECB	3/9/07	JJD	3/9/07

TITLE
INSTALLATION DRAWING
FOR STANDARD
081 SERIES MOUNTING

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

CODE IDENT. NO. 52681
DWG. NO. 081-XXXX-90
SCALE: N.T.S.
SHEET 1 OF 1

Service, Repair, and Return Policies and Instructions

The information contained in this document supersedes all similar information that may be found elsewhere in this manual.

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压电晶体	X	O	O	O	O	O
环氧	O	O	O	O	O	O
铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
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CHINA RoHS COMPLIANCE

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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.

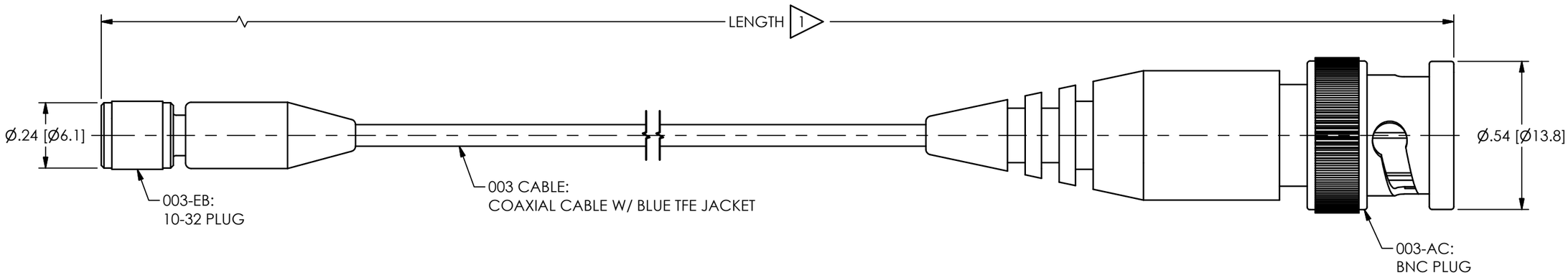
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Lead is present due to allowed exemption in Annex III or Annex IV of the European RoHS Directive 2011/65/EU.

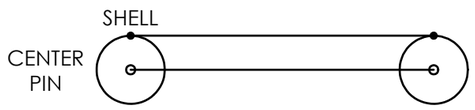
DOCUMENT NUMBER: 21354
*DOCUMENT REVISION: **D***
ECN: 46162

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72526

REVISIONS		
REV	DESCRIPTION	DIN
NR	RELEASED TO DRAFTING	50133





SCHEMATIC DIAGRAM

CABLE LENGTH TOLERANCE 1	
LENGTH	TOLERANCE
1"-11"	+1"/-0"
1'-4'	+4"/-0"
5'-99'	+6"/-0"
99'+	+1'/-0"

1 LENGTH WILL VARY IN FEET OR METERS DEPENDING ON THE MODEL

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN		CHECKED		ENGINEER	
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	JES	1/3/20	JES	1/3/20	BAM	1/3/20
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13						

TITLE
OUTLINE DRAWING
003CXX SERIES & 003EBXXXAC SERIES
COAXIAL CABLE W/ 10-32 & BNC PLUGS

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

CODE IDENT. NO.	DWG. NO.	
52681	72526	
SCALE: 2.5X	SHEET 1 OF 1	

Model 394A11

calibration system

Installation and Operating Manual

This manual contains the 301A11, 482A23 installation and operating manuals that comprise a Model 394A11 calibration system kit.

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

Toll-free: 800-828-8840
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.com





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3425 Walden Ave.
Depew, NY14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine^{SM}: (716) 684-0001
Website: www.pcb.com
E-mail: info@pcb.com

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	O	O	O	O	O	O
PCB板	X	O	O	O	O	O
电气连接器	O	O	O	O	O	O
压电晶体	X	O	O	O	O	O
环氧	O	O	O	O	O	O
铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
本表格依据 SJ/T 11364 的规定编制。						
O： 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.

DOCUMENT NUMBER: 21354
*DOCUMENT REVISION: **D***
ECN: 46162

APPLICATION		
NEXT ASS'Y	USED ON	VAR

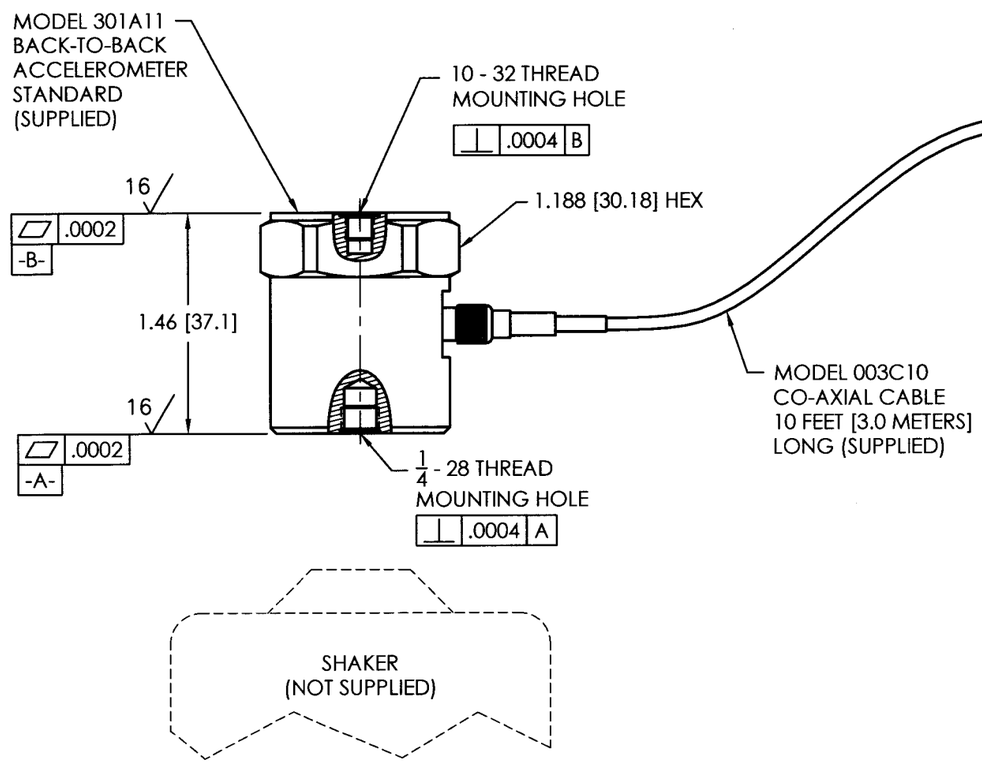
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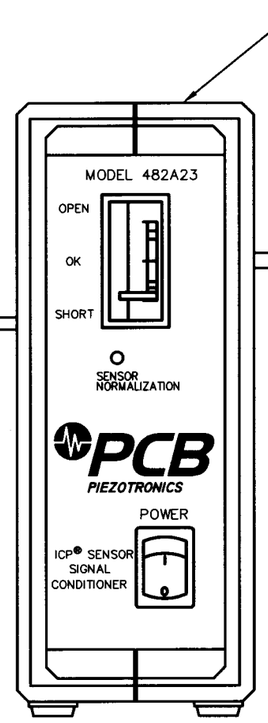
REVISIONS					
ZONE	REV	DESCRIPTION	ECN	DATE	APP'D
	C	CHANGED MODEL NUMBER	11809	5/1/00	DM
	D	UPDATED TO MEET ISO 16063-21 SPECS	24050	4/10/06	DM 4/10/06

11312

MOUNTING STUD TABLE	
MODEL	THREAD
081B05	10-32 TO 10-32
081A90	10-32 TO 5-40
081B20	1/4-28 TO 1/4-28
081A08	10-32 TO 1/4-28
M081B20	1/4-28 TO M6 X 0.75
M081B05	10-32 TO M6 X 0.75
MOUNTING ADAPTOR	
080A149	10-32 TO 5-40
M080A149	10-32 TO M3 X 0.50

1







2.) SUPPLIED WITH MODEL 488A04, EXTERNAL AC POWER(NOT SHOWN)

1 TWO OF EACH MOUNTING STUD SUPPLIED.

UNLESS SPECIFIED TOLERANCES	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]
DECIMALS XX ±.03 XXX ±.010 ANGLES ±2 DEGREES	DECIMALS X ±0.8 XX ±0.25 ANGLES ±2 DEGREES
FILLETS AND RADII .003 – .005	FILLETS AND RADII [0.07 – 0.13]

DRAWN	SSS	4/10/06	MFG	WSS	4/10/06
CHK'D	DM	4/10/06	ENGR	[illegible]	4/10/06
APP'D	[illegible]	4/10/06	SALES	[illegible]	4/10/06

TITLE: OUTLINE DRAWING
MODEL 394A11
CALIBRATION SYSTEM

PCB PIEZOTRONICS™
3425 WALDEN AVE. DEPEW, NY 14043
(716) 684-0001 EMAIL: SALES@PCB.COM

CODE IDENT. NO. 52681 | DWG. NO. 11312

SCALE: FULL | SHEET 1 OF 1

Model 301A11

ICP® Accelerometer

Installation and Operating Manual

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

Toll-free: 800-828-8840
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.com





Service, Repair, and Return Policies and Instructions

The information contained in this document supersedes all similar information that may be found elsewhere in this manual.

Service – Due to the sophisticated nature of the sensors and associated instrumentation provided by PCB Piezotronics, user servicing or repair is not recommended and, if attempted, may void the factory warranty. Routine maintenance, such as the cleaning of electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the physical material of construction, is acceptable. Caution should be observed to ensure that liquids are not permitted to migrate into devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth and never submerged or have liquids poured upon them.

Repair – In the event that equipment becomes damaged or ceases to operate, arrangements should be made to return the equipment to PCB Piezotronics for repair. User servicing or repair is not recommended and, if attempted, may void the factory warranty.

Calibration – Routine calibration of sensors and associated instrumentation is recommended as this helps build confidence in measurement accuracy and acquired data. Equipment calibration cycles are typically established by the users own quality regimen. When in doubt about a calibration cycle, a good "rule of thumb" is to recalibrate on an annual basis. It is also good practice to recalibrate after exposure to any severe temperature extreme, shock, load, or other environmental influence, or prior to any critical test.

PCB Piezotronics maintains an ISO-9001 certified metrology laboratory and offers calibration services, which are accredited by A2LA to ISO/IEC 17025, with full traceability to SI through N.I.S.T. In addition to the normally supplied calibration, special testing is also available, such as: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For information on standard recalibration services or special testing, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

Returning Equipment – *Following these procedures will ensure that your returned materials are handled in the most expedient manner*. Before returning any equipment to PCB Piezotronics, contact your local distributor, sales representative, or factory customer service representative to obtain a Return **Warranty, Service, Repair, and Return Policies and Instructions** Materials Authorization (RMA) Number. This RMA number should be clearly marked on the outside of all package(s) and on the packing

list(s) accompanying the shipment. A detailed account of the nature of the problem(s) being experienced with the equipment should also be included inside the package(s) containing any returned materials.

A Purchase Order, included with the returned materials, will expedite the turn-around of serviced equipment. It is recommended to include authorization on the Purchase Order for PCB to proceed with any repairs, as long as they do not exceed 50% of the replacement cost of the returned item(s). PCB will provide a price quotation or replacement recommendation for any item whose repair costs would exceed 50% of replacement cost, or any item that is not economically feasible to repair. For routine calibration services, the Purchase Order should include authorization to proceed and return at current pricing, which can be obtained from a factory customer service representative.

Contact Information – International customers should direct all inquiries to their local distributor or sales office. A complete list of distributors and offices can be found at www.pcb.com. Customers within the United States may contact their local sales representative or a factory customer service representative. A complete list of sales representatives can be found at www.pcb.com. Toll-free telephone numbers for a factory customer service representative, in the division responsible for this product, can be found on the title page at the front of this manual. Our ship to address and general contact numbers are:

PCB Piezotronics, Inc.
3425 Walden Ave.
Depew, NY14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine^{SM}: (716) 684-0001
Website: www.pcb.com
E-mail: info@pcb.com

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	O	O	O	O	O	O
PCB板	X	O	O	O	O	O
电气连接器	O	O	O	O	O	O
压电晶体	X	O	O	O	O	O
环氧	O	O	O	O	O	O
铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
本表格依据 SJ/T 11364 的规定编制。						
O： 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。						
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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.

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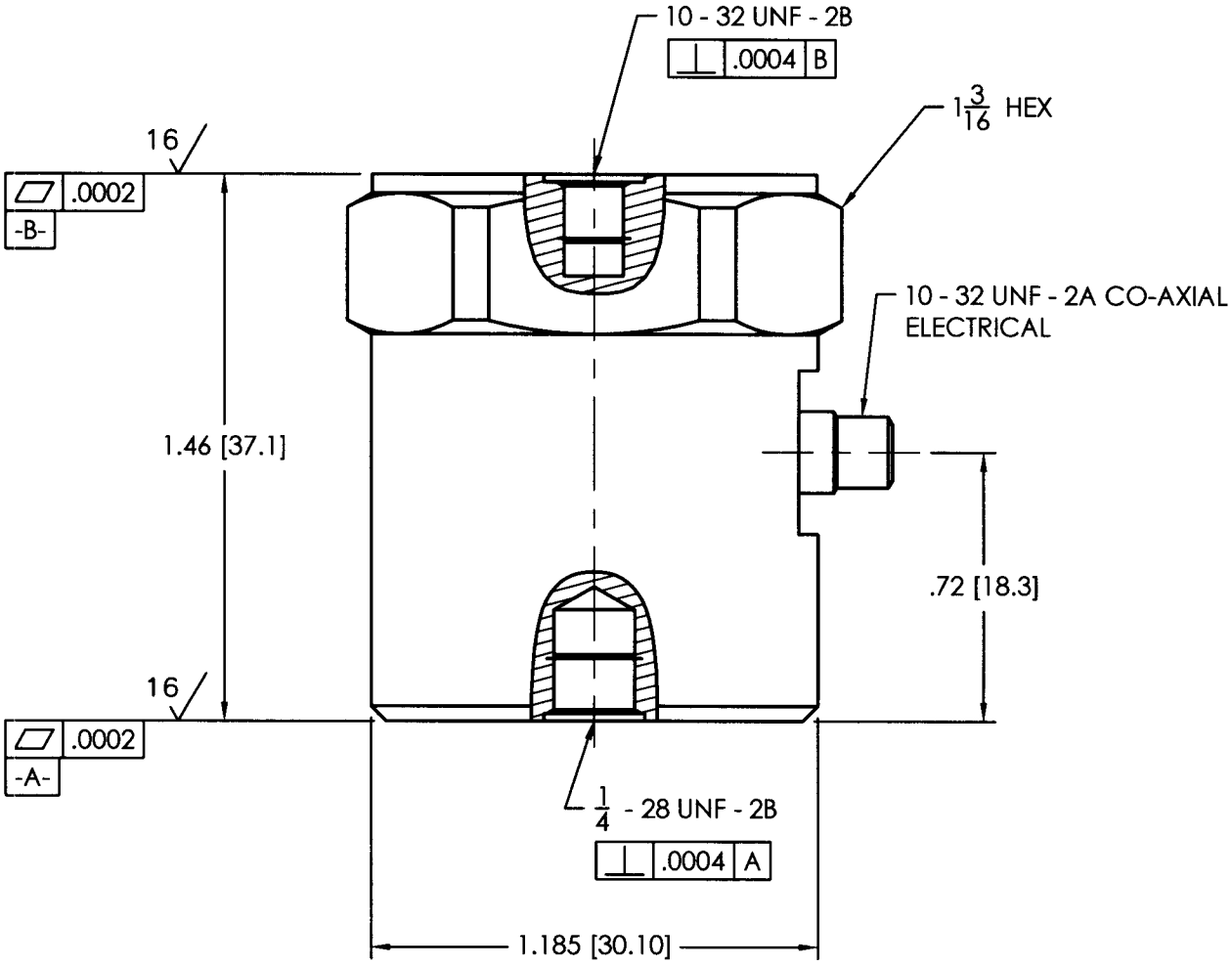
DOCUMENT NUMBER: 21354
*DOCUMENT REVISION: **D***
ECN: 46162

APPLICATION		
NEXT ASS'Y	USED ON	VAR

REVISIONS				
REV	DESCRIPTION	ECN	DATE	APP'D
NR	RELEASED TO DRAFTING		7/9/99	DM
A	UPDATED TO MEET ISO 16063-21 SPECS	24050	4/10/06	DM 4/10

11296

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UNLESS SPECIFIED TOLERANCES	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]
DECIMALS XX ±.03 XXX ±.010 ANGLES ±2 DEGREES	DECIMALS X ±0.8 XX ±0.25 ANGLES ±2 DEGREES
FILLETS AND RADII .003 – .005	FILLETS AND RADII [0.07 – 0.13]

DRAWN	[illegible]	4/10/06	MFG	[illegible]	4/10/06
CHK'D	DM	4/10/06	ENGR	[illegible]	4/10/06
APP'D	[illegible]	4/10/06	SALES	[illegible]	4/10/06

TITLE: OUTLINE DRAWING
MODEL 301A11
ACCELEROMETER

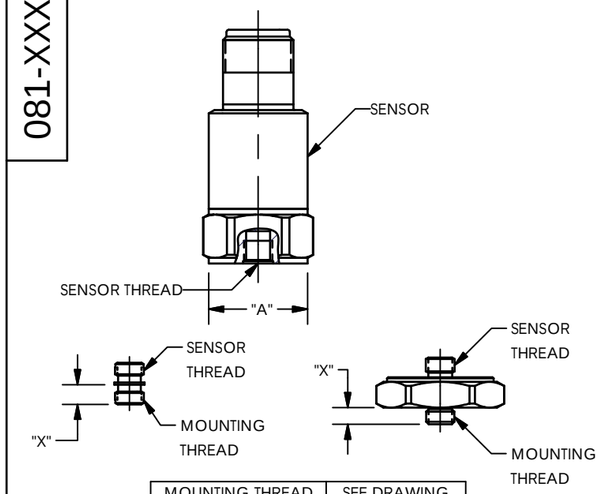
PCB PIEZOTRONICS
3425 WALDEN AVE. DEPEW, NY 14043
(716) 684–0001 EMAIL: SALES@PCB.COM

CODE IDENT. NO.	DWG. NO.
52681	11296
SCALE: 2X	SHEET 1 OF 1

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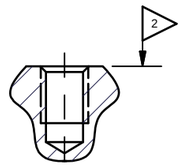
081-XXXX-90

STANDARD STUD MOUNT



MOUNTING THREAD	SEE DRAWING
5-40	A
M3 X 0.50	B
10-32	C
M5 X 0.80	D
1/4-28	E
M6 X 1.00	F

"A"
5-40
MOUNTING INSTRUCTIONS
(METRIC DIMENSIONS IN BRACKETS)

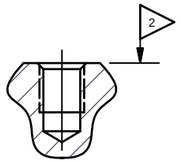


MOUNTING HOLE PREPARATION:

1. Ø.101[Ø2.57]
   X .20[5.1]↧ MIN.
   5-40 UNC-2B
   X .15[3.8]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
4-5 INCH POUNDS
[45-55 NEWTON CENTIMETERS].

"B"
M3 X 0.50
MOUNTING INSTRUCTIONS
(ENGLISH DIMENSIONS IN BRACKETS)

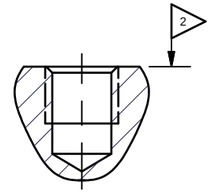


MOUNTING HOLE PREPARATION:

1. Ø2.5[Ø.099]
   X 4.6 [1.8]↧ MIN.
   M3 X 0.50-6H
   X 3.3[.13]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
45-55 NEWTON CENTIMETERS
[4-5 INCH POUNDS].

"C"
10-32
MOUNTING INSTRUCTIONS
(METRIC DIMENSIONS IN BRACKETS)

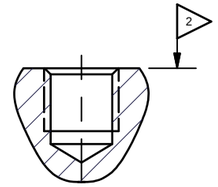


MOUNTING HOLE PREPARATION:

1. Ø.159[Ø4.04]
   X .23[5.8]↧ MIN.
   10-32 UNF-2B
   X .15[3.8]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
10-20 INCH POUNDS
[113-225 NEWTON CENTIMETERS].

"D"
M5 X 0.80
MOUNTING INSTRUCTIONS
(ENGLISH DIMENSIONS IN BRACKETS)



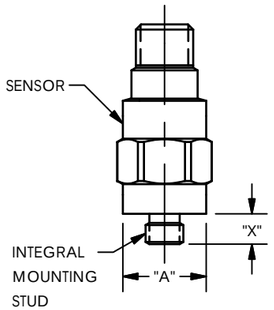
MOUNTING HOLE PREPARATION:

1. Ø4.22[Ø.166]
   X 7.62 [.300]↧ MIN.
   M5 X 0.8-6H
   X 5.08[.200]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
113-225 NEWTON CENTIMETERS
[10-20 INCH POUNDS].

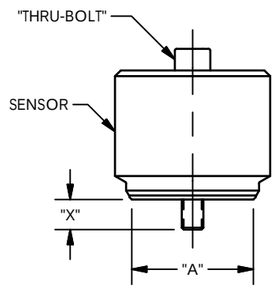
REVISIONS		
REV	DESCRIPTION	DIN
P	UPDATE DRAWING	25686

INTEGRAL STUD MOUNT



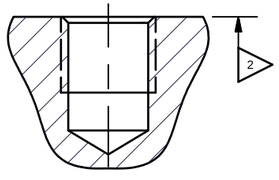
MOUNTNG THREAD	SEE DRAWING
5-40	A
M3 X 0.50	B
10-32	C
M5 X 0.80	D
1/4-28	E
M6 X 1.00	F

"THRU-BOLT" STUD MOUNT



BOLT THREAD	SEE DRAWING
10-32	C
M5 X 0.80	D
1/4-28	E
M6 X 1.00	F
M8 X 1.25	F

"E"
1/4-28
MOUNTING INSTRUCTIONS
(METRIC DIMENSIONS IN BRACKETS)

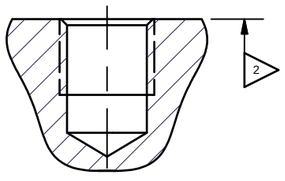


MOUNTING HOLE PREPARATION:

1. Ø.218[Ø5.54]
   X .300[7.62]↧ MIN.
   1/4-28 UNF-2B
   X .200[5.08]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
2-5 FOOT POUNDS
[3-7 NEWTON METERS].

"F"
M6 X 0.75, M6 X 1.00, M8 X 1.25
MOUNTING INSTRUCTIONS
(ENGLISH DIMENSIONS IN BRACKETS)



M6 X 0.75
MOUNTING HOLE PREPARATION:

1. Ø5.31[Ø.209]
   X 7.62 [.300]↧ MIN.
   M6 X 0.75-6H
   X 5.08[.200]↧ MIN.

M6 X 1.0
MOUNTING HOLE PREPARATION:

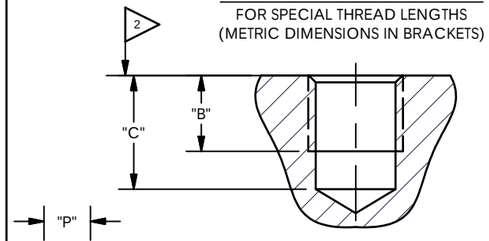
1. Ø5.05[Ø.199]
   X 8.10 [.320]↧ MIN.
   M6X 1.0-6H
   X 6.35[.250]↧ MIN.

M8 X 1.25
MOUNTING HOLE PREPARATION:

1. Ø6.75[Ø.266]
   X 8.64 [.340]↧ MIN.
   M8 X 1.25-6H
   X 5.00[.197]↧ MIN.

4.) RECOMMENDED MOUNTING TORQUE,
3-7 NEWTON METERS [2-5 FT POUNDS].

"G"
MOUNTING INSTRUCTIONS
FOR SPECIAL THREAD LENGTHS
(METRIC DIMENSIONS IN BRACKETS)



MOUNTING HOLE PREPARATION:

1. Ø DRILL DIA.
   X "C"↧ MIN.
   TAP
   X "B"↧ MIN.

THREAD DEPTH : B= X + 1 THREAD PITCH
DRILL DEPTH : C= B + 3 THREAD PITCH
SEE A-F FOR APPROPRIATE DRILL AND TAP
THREAD PITCH= 1/TPI [P]

3.) FOR BEST RESULTS, PLACE A THIN LAYER OF SILICONE GREASE (OR EQUIVALENT) ON INTERFACE PRIOR TO MOUNTING.

2. MOUNTING SURFACE SHOULD BE FLAT TO WITHIN .001(0.03) TIR OVER DIM 'A' WITH A 63[1.61] OR BETTER FINISH FOR BEST RESULTS.

1. DRILL PERPENDICULAR TO MOUNTING SURFACE TO WITHIN ± 1˚.

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]
DECIMALS XX ±.01 XXX ±.005	DECIMALS X ± 0.3 XX ± 0.13
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13

DRAWN		CHECKED		ENGINEER	
JDM	3/9/07	ECB	3/9/07	JJD	3/9/07

TITLE
INSTALLATION DRAWING
FOR STANDARD
081 SERIES MOUNTING

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

CODE IDENT. NO. 52681
DWG. NO. 081-XXXX-90
SCALE: N.T.S.
SHEET 1 OF 1

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