



**ELECTRONICS  
DIVISION**

**Model 482A22**  
**ICP® Sensor Signal Conditioner**  
**Installation and Operating Manual**

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

**Division toll-free 888-684-0015**

**24-hour SensorLine<sup>SM</sup> 716-684-0001**

**Fax 716-684-0987**

**E-mail [electronics@pcb.com](mailto:electronics@pcb.com)**



 **PCB** *PIEZOTRONICS*<sup>INC.</sup>  
**ELECTRONICS DIVISION**

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

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

**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 insure 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 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 insure 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

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.

**Warranty** – All equipment and repair services provided by PCB Piezotronics, Inc. are covered by a limited warranty against defective material and workmanship for a period of one year from date of original purchase. Contact

PCB for a complete statement of our warranty. Expendable items, such as batteries and mounting hardware, are not covered by warranty. Mechanical damage to equipment due to improper use is not covered by warranty. Electronic circuitry failure caused by the introduction of unregulated or improper excitation power or electrostatic discharge is not covered by warranty.

**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](http://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](http://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, NY 14043 USA  
Toll-free: (800) 828-8840  
24-hour SensorLine<sup>SM</sup>: (716) 684-0001  
Website: [www.pcb.com](http://www.pcb.com)  
E-mail: [info@pcb.com](mailto:info@pcb.com)

## 1.0 Introduction and Specifications

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

### 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 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

The Model 482A22 is a four-channel, line-operated signal conditioner for ICP<sup>®</sup> sensor systems. This unit provides constant current excitation to the built-in sensor amplifier and decouples the AC signal from the DC bias voltage.

The unit also contains provision for channel fault monitoring, 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

The Model 482A22 is powered externally by the Model 488A04 Universal Power Supply. The rear panel contains BNC jacks for sensor INPUTS and BNC jacks for signal OUTPUT connections.

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

The bias monitor consists of a color-coded front panel meter and a four-position selector switch. The switch selects the bias voltage at each channel and displays it on the front panel meter. See the sensor data sheet for specific sensor bias voltage and additional specification.

### 3.0 Installation

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 482A22.

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 482A22.

With no sensor 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 1.

Meter Reading	Yellow	Green	Red
Condition	Open	Ok	Short

Figure 1: Fault Monitor Table

When an ICP<sup>®</sup> sensor (or in-line amplifier) is 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.

### 4.0 Coupling Time Constant, AC Coupled

The coupling time constant (TC) is the product of the conditioner's coupling capacitor (47  $\mu$ F) 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.

### 4.1 Driving Long Cables

When driving long cables, it may be necessary to increase the constant-current drive to the sensor. The Model 482A22 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.

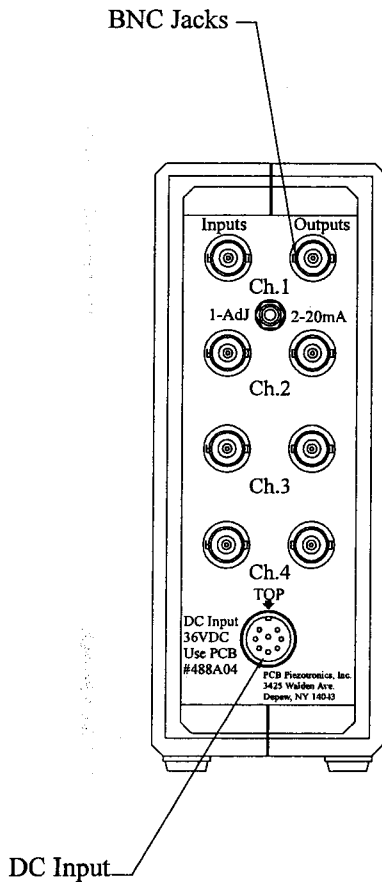
The optimum current setting is best determined by experimentation with your particular test setup. A good rule of thumb is to use the lowest current consistent with satisfactory results to minimize sensor self-heating and noise.

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.

### 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 2). 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<sup>®</sup> sensor or amplifier above 20 mA may damage the equipment.



**Figure 2: Constant Current Adjust**

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 email at [sales@pcb.com](mailto:sales@pcb.com) or our web site at [www.pcb.com](http://www.pcb.com).

## 5.0 Warranty

PCB offers an unconditional guarantee for customer satisfaction. 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).

## 6.0 Maintenance and Repair

482A21/ A22 Troubleshooting Guide

Problem	Test/ Solution
Unit does not appear to be powered up/ No meter movement.	<ul style="list-style-type: none"> <li>- Power switch in the on position.</li> <li>- Test "Sensor" excitation current. Measure current on the "Sensor" input BNC from center conductor to shell. Adjust "Iadj" (rear panel) with screwdriver turning both clockwise and counterclockwise. Reference section "Setting the Constant Current".</li> <li>- Make sure the Bias monitor channel select matches the channel of interest.</li> </ul>
Output signal seems to Drift	<ul style="list-style-type: none"> <li>- Make sure the input impedance of the readout device, scope or data acquisition system is approximately 1 M<math>\Omega</math></li> </ul>
Low frequency response not meeting specification or amplitude is attenuated	<ul style="list-style-type: none"> <li>- The input impedance of readout device may be too low. May need to use a buffered signal conditioner, for example 482A16.</li> </ul>
Meter does not seem to show sensor bias voltage.	<ul style="list-style-type: none"> <li>- Match the channel select with channel of interest.</li> <li>- 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 persist, return for repair.</li> </ul>

MANUAL NUMBER: 19174

MANUAL REVISION: A

ECN NUMBER: 18206

Model Number  
482A22

# SENSOR SIGNAL CONDITIONER

Revision: G  
ECN #: 26375

**Performance**

Channels 4  
Voltage Gain(± 1 %) 1:1  
Low Frequency Response(-5 %) <0.1 Hz  
High Frequency Response(-5 %) >1000 kHz  
Fault/Bias Monitor/Meter 26 V FS

**Environmental**

Temperature Range 32 to 120 °F

**Electrical**

Power Required(Standard) DC power  
DC Power(± 5 %) 36 VDC  
DC Power 0.12 amps  
Excitation Voltage(To Sensor) 25 to 27 VDC  
Constant Current Excitation(To Sensor) 2 to 20 mA  
DC Offset(Maximum) <20 mV  
Discharge Time Constant(0 to +50%) 10 sec  
Broadband Electrical Noise(1 to 10,000 Hz) 3.25 µV  
Spectral Noise(1 kHz) 0.04 µV/√Hz  
Spectral Noise(10 kHz) 0.03 µV/√Hz  
Spectral Noise(1 Hz) 1.11 µV/√Hz  
Spectral Noise(100 Hz) 0.14 µV/√Hz

**Physical**

Electrical Connector(Input, sensor) BNC Jack  
Electrical Connector(Output) BNC Jack  
Electrical Connector(DC Power Input) DIN Jack  
Size (Height x Width x Length) 6.3 in x 2.4 in x 11 in  
Weight 1.67 lb

**ENGLISH**

Channels 4  
Voltage Gain(± 1 %) 1:1  
Low Frequency Response(-5 %) <0.1 Hz  
High Frequency Response(-5 %) >1000 kHz  
Fault/Bias Monitor/Meter 26 V FS  
Temperature Range 0 to 50 °C  
Power Required(Standard) DC power  
DC Power(± 5 %) 36 VDC  
DC Power 0.12 amps  
Excitation Voltage(To Sensor) 25 to 27 VDC  
Constant Current Excitation(To Sensor) 2 to 20 mA  
DC Offset(Maximum) <20 mV  
Discharge Time Constant(0 to +50%) 10 sec  
Broadband Electrical Noise(1 to 10,000 Hz) 3.25 µV  
Spectral Noise(1 kHz) 0.04 µV/√Hz  
Spectral Noise(10 kHz) 0.03 µV/√Hz  
Spectral Noise(1 Hz) 1.11 µV/√Hz  
Spectral Noise(100 Hz) 0.14 µV/√Hz

**SI**

Channels 4  
Voltage Gain(± 1 %) 1:1  
Low Frequency Response(-5 %) <0.1 Hz  
High Frequency Response(-5 %) >1000 kHz  
Fault/Bias Monitor/Meter 26 V FS  
Temperature Range 0 to 50 °C  
Power Required(Standard) DC power  
DC Power(± 5 %) 36 VDC  
DC Power 0.12 amps  
Excitation Voltage(To Sensor) 25 to 27 VDC  
Constant Current Excitation(To Sensor) 2 to 20 mA  
DC Offset(Maximum) <20 mV  
Discharge Time Constant(0 to +50%) 10 sec  
Broadband Electrical Noise(1 to 10,000 Hz) 3.25 µV  
Spectral Noise(1 kHz) 0.04 µV/√Hz  
Spectral Noise(10 kHz) 0.03 µV/√Hz  
Spectral Noise(1 Hz) 1.11 µV/√Hz  
Spectral Noise(100 Hz) 0.14 µV/√Hz

**OPTIONAL VERSIONS**

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

**NOTES:**

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

**SUPPLIED ACCESSORIES:**

Model 017A01 Power Cord  
Model 488A04 Universal AC power source

Entered: JH	Engineer: MH	Sales: JDM	Approved: EJ	Spec Number: 6520
Date: 5-3-07	Date: 5/4/07	Date: 5/4/07	Date: 5/4/07	



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.



3425 Walden Avenue, Depew, NY 14043

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



Model Number  
**488A04**

# TABLE TOP UNIVERSAL POWER SOURCE

Revision: B  
ECN #: 12419

## GENERAL SPECIFICATIONS

Efficiency	65% Minimum at 30 W Output
Hold-Up Time	10 m sec Minimum at 115 VAC
Line Regulation	±0.5% Maximum at Full Load
Inrush Current	15 Amps at 115 VAC -or- 30 Amps at 230 VAC at 25 °C Cold Start
Withstand Voltage	3,000 VAC from Input to Output 1,500 VAC from Input to Ground 500 VAC from Output to Ground
Insulation Resistance	10 M ohm Minimum from Output to Ground
Operating Temperature	0 to 70 °C *
Storage Temperature	-40 to +85 °C
Mean Time Between Failure	100,000 Hours Minimum at Full Load at 25 °C Ambient
EMI Requirements	Meets Conduction Limits of: a) FCC 20780 Level B b) VDE 0878 Level B
Safety Requirements	Meets or Exceeds: a) UL 1950 b) CSA C22.2 No. 234 c) IEC 950

## INPUT SPECIFICATIONS

Input Voltage	85 to 264 VAC
Input Frequency	47 to 440 Hz
Input Current	0.85 A (rms) for 115 VAC 0.50 A (rms) for 230 VAC
Safety Ground Leakage Current	0.85 mA Maximum at 240 VAC 50 Hz

## OUTPUT SPECIFICATIONS

Output Voltage	36 V ±2%
Output Current	0.9 A ±2%
Output Power Range	0 to 30 Watts
Ripple and Noise	1% Peak to Peak Maximum
Overvoltage Protection	Provided on Output #1 Only; Set at 112-132% of Nominal Output Voltage
Overcurrent Protection	All Outputs Protected to Short Circuit Conditions
Temperature Coefficient	All Outputs ±0.04%/°C Maximum
Transient Response	Maximum Excursion of 4% on All Models Recovering to 1% Final Value Within 500 μ sec After a 25% Step Load Change

## PHYSICAL SPECIFICATIONS

Connectors:	AC Input	IEC 320 Jack
	DC Output	DIN Plug (5-Pin)
Pin 1, 2, 4 - Return		
Pin 3, 5 - Output +36 V ±2%		
Size (H x W x D):		1.65 x 2.95 x 5.79 inches [42 x 75 x 147 millimeters]
Weight		1.1 pounds [500 grams]

\* Derate linearly from 100% load at 50 °C to 50% load at 70 °C.

## SUPPLIED ACCESSORIES:

Model 017 AC Line Cord  
Ferrite Bead (part number 100-2973-30)

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

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



Drawn	<i>[Signature]</i>	DATE	9/26/00	Spec No. <b>6527</b>
Engineer	<i>[Signature]</i>	DATE	9/26/00	
Sales	<i>[Signature]</i>	DATE	9/26/00	Sheet 1 of 1
Approved	<i>[Signature]</i>	DATE	9/26/00	

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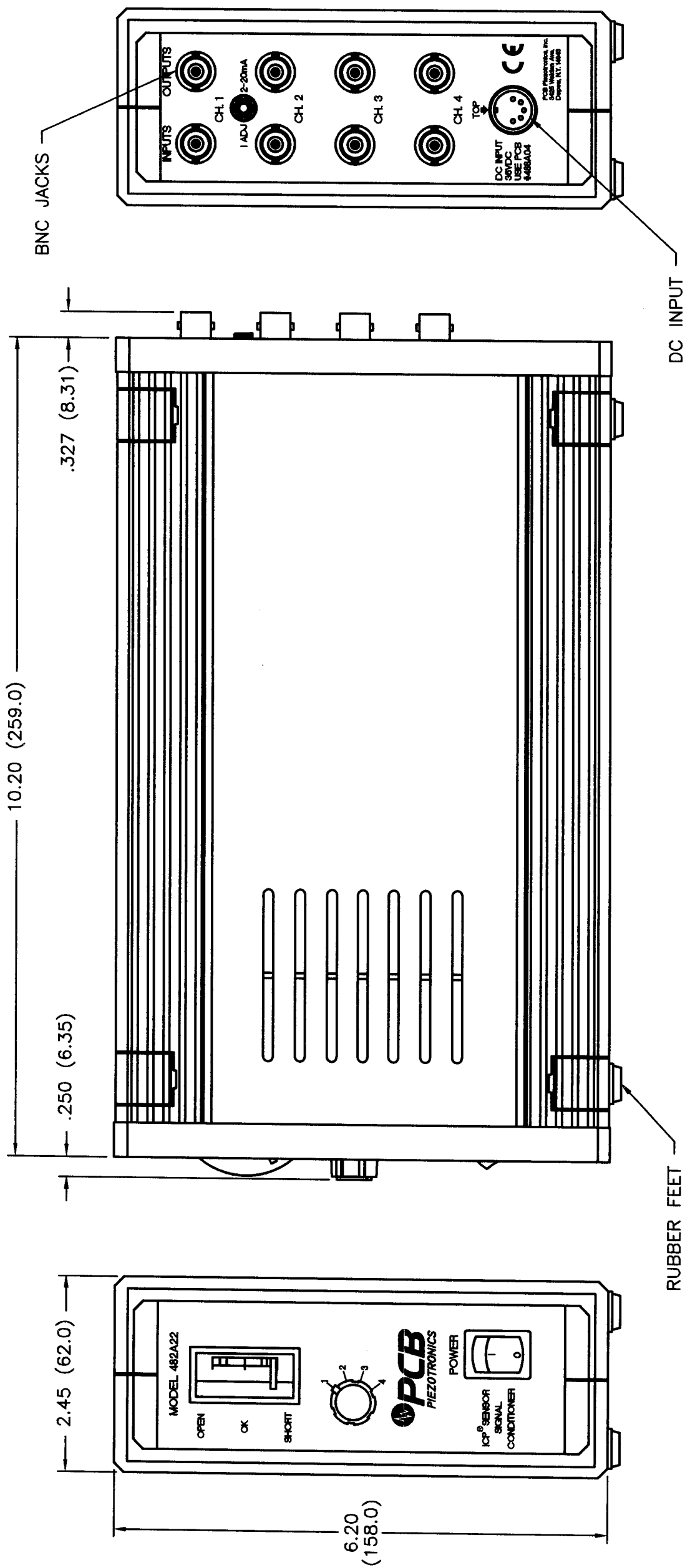
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APPLICATION	
NEXT ASSY	USED ON
	VAR

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REVISIONS					
ZONE	REV	DESCRIPTION	ECN	DATE	APP'D
	A	REDESIGN F.P. & REDRAWN	11995	7/6/00	APW/L

6541



RUBBER FEET

DC INPUT

BNC JACKS

A

C

B

A

C

B

UNLESS SPECIFIED TOLERANCES		DIMENSIONS IN MILLIMETERS (IN PARENTHESES)		DRAWN		MFG	
DIMENSIONS IN INCHES	DECIMALS XX ±.01	DECIMALS XX ±0.3	XXX ±0.13	CHK'D	ENGR	DATE	DATE
ANGLES ±2 DEGREES	XXX ±.005	XXX ±0.13	XXX ±0.13	APP'D	ENGR	DATE	DATE
FILLETS AND RADII .003 - .005	ANGLES ±2 DEGREES	ANGLES ±2 DEGREES	FILLETS AND RADII (0.07 - 0.13)	TITLE			
DD012 REV. B 03/13/98				ICP <sup>®</sup> SENSOR SIGNAL CONDITIONER			
MODEL 482A22				OUTLINE DRAWING			
DWG. NO. 6541				SCALE: 1=1.5			
DEPT. NO. 52681				SHEET 1 OF 1			
PCB PIEZOTRONICS				PCB PIEZOTRONICS			
3425 WALDEN AVE. DEPEW, NY 14043				3425 WALDEN AVE. DEPEW, NY 14043			
(716) 884-0001 EMAIL: SALES@PCB.COM				(716) 884-0001 EMAIL: SALES@PCB.COM			

D

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