



**Model 480C02**

**Battery-Powered Signal Conditioner for ICP® Sensor**

**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](mailto:info@pcb.com)  
Web: [www.pcb.com](http://www.pcb.com)**



**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

The Models 480C02/480C are portable power sources for ICP® transducers. Both units are powered by three 9V transistor batteries which supply constant current to the built-in transducer amplifier (or to in-line and adaptor amplifiers), and decouple the signal from the power.

**NOTE: The only difference between the models is that the 480C02 unit features BNC connectors while the 480C unit features microdot connectors.**

## 2.0 DESCRIPTION

The Models 480C02/480C contain three 9V batteries connected in series to provide a 27V power source. The transducer is operated by a constant current of 2 mA set by a constant current diode. The front panel contains a color-coded fault monitor voltmeter, the "XDCR" jack, the signal output jack labeled "SCOPE", an "ON-OFF BATT TEST" rock switch, an external power jack for inputs up to 27V, and a battery charger receptacle. An internal 10 $\mu$ F coupling capacitor decouples the signal information from the +9V (may be 5V with low noise electronics) to +12 VDC transducer bias level.

## 3.0 OPERATION

With no transducer connected to the Model 480C02/480C, move power switch to "ON" position. The front panel voltmeter will read the battery voltage (+27 volts for fresh batteries). The voltmeter is scaled to read 27 volts full scale. (See Figure 1).

When an ICP® transducer is connected to the input "XDCR" jack, the meter will indicate approximately mid-scale (+11V nominal) if the transducer's built-in amplifier is functioning properly and cables are intact. Some transducers use a 5V turn on and in this case meter will read at lower edge of green region.

If the transducer's cable is open or the transducer's built-in amplifier is open, the meter will indicate in the full scale (yellow) area.

Should the cable or transducer be shorted, the meter will indicate zero volts (red area).

Immediately after connecting readout instrument, (oscilloscope, meter, recorder, etc.) to the output jack, the 10 $\mu$ F coupling capacitor will begin charging through the input resistance of the readout instrument. This charging will cause an apparent "drifting" of the output signal until the capacitor is fully charged. Such drifting is quite normal.

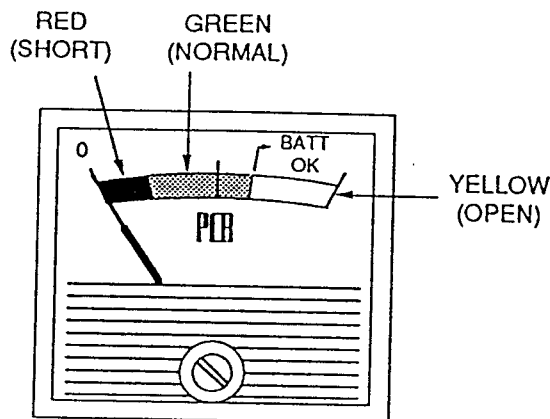


Figure 1  
Fault Monitor Meter

## 3.1 COUPLING TIME CONSTANT, AC COUPLED

The coupling discharge time constant (DTC) is the product of the coupling capacitor (10 $\mu$ F) and the input resistance of the readout instrument. (See Figure 2).

(EQ 1)

$$TC \text{ (sec)} = C_c \text{ (farads)} \times R_{in} \text{ (ohms)}$$

### 3.2 ALTERNATE CONNECTION FOR BEST LOW-FREQUENCY RESPONSE

With the 480C02/480C connected as shown in Figure 3, the low-frequency response of the coupling circuit is determined by the relationship.

(EQ 2)

$$\text{-3dB FREQ., } f_o = \frac{.16}{(R_{in}) \times 10\mu\text{F}} \text{ Hz}$$

Equation 2 gives the frequency at which the coupling circuit will be -3dB down.

The coupling discharge time constant (DTC), as previously stated in Equation 1 is:

(EQ 3)

$$\text{TC} = (R_{in}) \times (10\mu\text{F}) \text{ seconds}$$

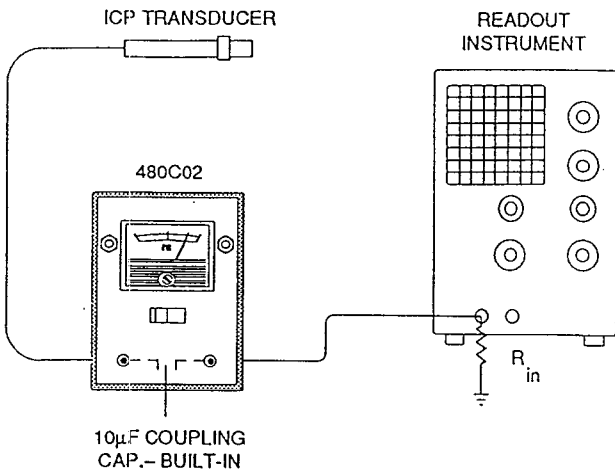


Figure 2  
Standard (AC) Coupling Mode

**Figure 2**  
**Standard (AC) Coupling Mode**

The small amount of leakage through the 10µF coupling capacitor will typically result in a +30 mV maximum offset with a 1 MEGOHM read-out load.

Normally, it is desirable to keep the coupling discharge time constant (DTC) long with respect to the transducer discharge TC to minimize the effect of the coupling distance TC on low frequency response.

Typical coupling discharge time constants for various values of readout input resistance are:

R <sub>in</sub>	TC
10 megohm	100 sec
1 megohm	10 sec
100 K ohms	1 sec
10 K ohms	.1 sec
1 K ohms	.01 sec

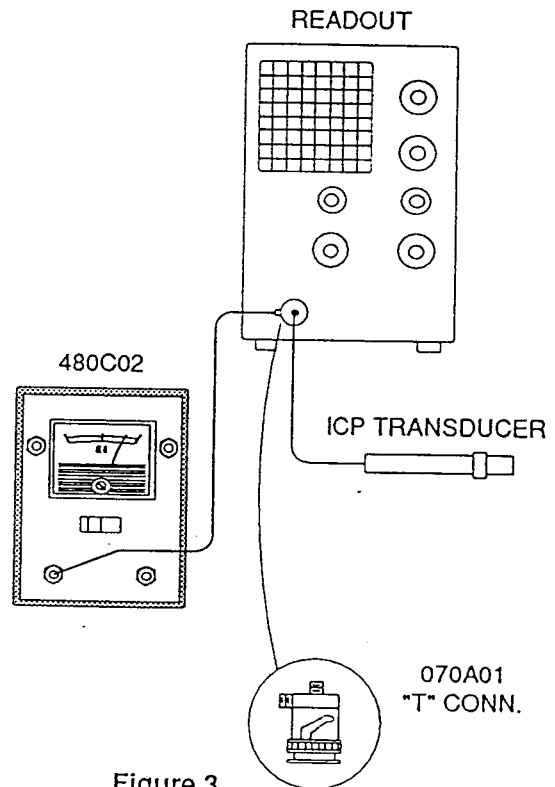


Figure 3  
Direct Coupled Mode

### 3.3 OUTPUT VOLTAGE LIMITATIONS

Certain ICP transducers are capable of a 10-volt output voltage swing. The Model 480C02/480C with its 27V supply will allow the positive-going side of the signal to go to +14 volts. The negative-going side of the signal is capable of -8 volts assuming a 10 volt turn-on for the transducer.

### 3.4 CURRENT DRIVE LIMITATIONS

In the interest of battery life, the current output of the Model 480C02/480C is fixed at 2 mA. This current will adequately handle high-frequency signals in cables up to approximately 100-feet long. Longer cables can be driven, but with sacrifice of high-frequency response. Line power units providing 20 mA current are required for long cable driving.

### 3.5 BATTERY TEST

The Model 480C02/480C incorporates a momentary battery test rocker switch as part of the ON/OFF switch.

When the rocker switch is depressed, the meter switches from the "XDCR" jack to the battery high side.

Normal circuit operation is not affected by this action, and releasing the rocker returns the meter to the transducer fault monitor function.

Replace or recharge batteries when meter pointer does not move to "BATT OK" mark on meter when power is "ON" and "BATT TEST" rocker is depressed. A slightly low reading will limit the usable range of the transducer, but will not cause damage to either the transducer or the 480C02/480C.

### 3.6 CHANGING THE BATTERIES

Following is a procedure for removing the batteries when the front panel fault monitor meter indicates they should be replaced: Remove the one screw at the rear panel of the 480C02/480C and remove the unit from its plastic case. Unsnap battery from connectors

and remove batteries. Connect new 9-volt batteries in place, replace plastic case and the one screw.

Used normally, the life expectancy of the batteries is over 100 hours. Turn unit off when not using to conserve battery life.

### 3.7 BATTERY CHARGING

Plug 488A02 charger into front panel jack and with unit off, recharge for 14 hours. Charger supplies 10 mA constant current to batteries.

#### CAUTION

**Do not use charger unless unit has rechargeable batteries installed (VARTA TR7/8 or Eveready N88). the standard 488A02 is for 110V; "F" is for 220V (F488A02).**

### 3.8 EXTERNAL POWER CONNECTION

The external battery connector (which takes a #750 Switchcraft phone plug) is intended for use when longer battery life is desired. Model 073A05 Long Life Battery Pack uses 6V lantern batteries connected in series to provide 24 volts to the unit.

### 3.9 MAINTENANCE AND REPAIR

Aside from battery replacement, no maintenance is required for these units. In case of difficulty, contact the factory for assistance.

If the unit must be returned for repairs, please include a brief note describing the problem.

Since the location of the 480C02/480C power unit in the circuit does not affect signal/noise ratio, it should be placed near the readout instrument. (See Figure 4).

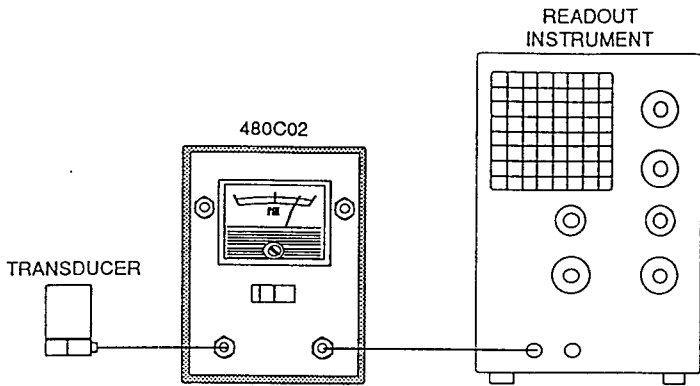


Figure 4  
Typical Circuit Connection

Other battery power units available from PCB include:

- |        |                                |
|--------|--------------------------------|
| 480E06 | with gain x1, x10, x100        |
| 480E09 | 480E06 with all BNC connectors |
| 480B10 | Dual Integrating Power Unit    |

Line power units with or without gain in single or multichannels are also available.

MANUAL NUMBER: 19175  
MANUAL REVISION: NR

Model Number  
480C02

# BATTERY-POWERED SIGNAL CONDITIONER FOR ICP® SENSOR

Revision: L  
ECN #: 39050

	ENGLISH	SI	
<b>Performance</b>			
Channels	1	1	
Frequency Range(-5 %)	0.05 to 500,000 Hz	0.05 to 500,000 Hz	[4]
Voltage Gain(± 2 %)	1:1	1:1	
Fault/Bias Monitor/Meter(± 1 V)(midscale)	13 VDC	13 VDC	
<b>Environmental</b>			
Temperature Range	32 to 122 °F	0 to 50 °C	
<b>Electrical</b>			
Excitation Voltage(To Sensor)	25 to 29 VDC	25 to 29 VDC	
Constant Current Excitation(To Sensor)	2.0 to 3.2 mA	2.0 to 3.2 mA	[1]
Discharge Time Constant	>7 sec	>7 sec	[2]
DC Offset	<30 mV	<30 mV	[2]
Spectral Noise(1 Hz)	0.25 µV/√Hz	-132 dB	
(10 Hz)	0.07 µV/√Hz	-143 dB	
(100 Hz)	0.05 µV/√Hz	-146 dB	
(1 kHz)	0.04 µV/√Hz	-148 dB	
(10 kHz)	0.03 µV/√Hz	-150 dB	
Broadband Electrical Noise(1 to 10,000 Hz)(Gain x1)	3.25 µV rms	-110 dB rms	
Power Required(Standard)	Internal Battery	Internal Battery	
Internal Battery(Type)	9V	9V	
Battery Life(Standard Alkaline)	100 hours	100 hours	
(Rechargeable Ni Cad)	36 hours	36 hours	
Power Required(Alternate)	DC power	DC power	
DC Power	5 mA	5 mA	[3]
Internal Battery(Quantity)	3	3	
DC Power	25 to 29 VDC	25 to 29 VDC	[3]
<b>Physical</b>			
Electrical Connector(Input, sensor)	BNC Jack	BNC Jack	
(Output, scope)	BNC Jack	BNC Jack	
(External Power, DC)	3.5 mm Diameter Miniature Jack	3.5 mm Diameter Miniature Jack	
(Battery Charger)	#722 Switchcraft Jack	#722 Switchcraft Jack	
Size (Depth x Height x Width)	4 in x 2.9 in x 2.2 in	10 cm x 7.4 cm x 5.6 cm	
Weight(Including Batteries)	0.7 lb	0.3 Kg	

**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] Through internal current limiting diode.  
[2] With 1M ohm load.  
[3] Provided by optional external DC power supply.  
[4] Low frequency response specified into 1M ohm load.  
[5] See PCB Declaration of Conformance PS024 for details.

**OPTIONAL ACCESSORIES:**  
Model 400A81 (3) 9 V ultralife lithium batteries  
Model 488A02 Tabletop battery charger, selectable input voltage, 110 & 220 VAC (for Series 480 battery signal conditioners)  
Model 488A03 AC power source (for Series 480 battery signal conditioners - based on Model 488A02)



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.  
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Entered: <i>Let</i>	Engineer: <i>KL</i>	Sales: <i>JM</i>	Approved: <i>BAM</i>	Spec Number:
Date: <i>4-24-12</i>	Date: <i>4-11-12</i>	Date: <i>4-13-12</i>	Date: <i>4-17-12</i>	480-3020-80

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480-3020-95

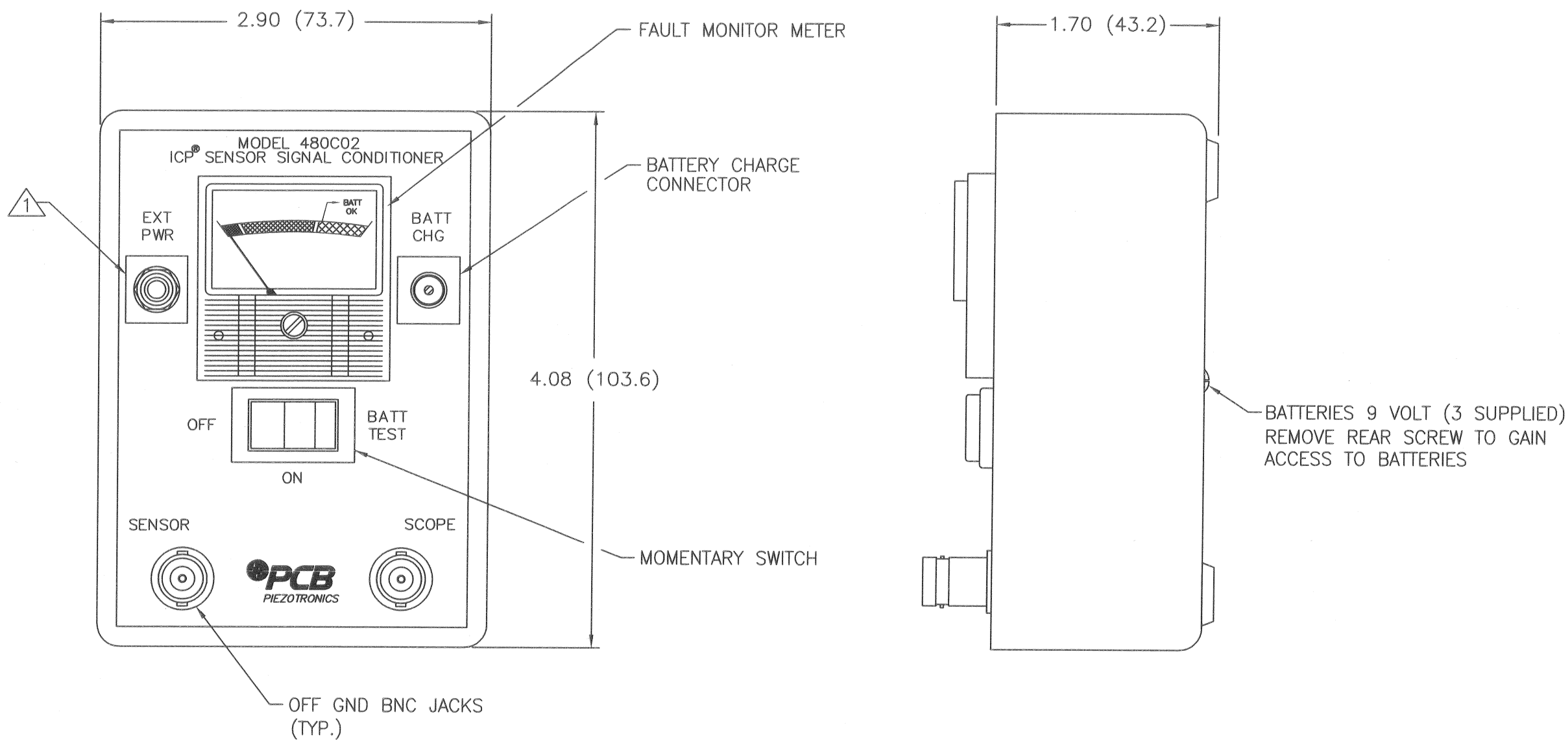
APPLICATION

NEXT ASS'Y	USED ON	VAR

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REVISIONS

ZONE	REV	DESCRIPTION	ECN	DATE	APP'D
	B	CHANGED NOTE	17892	7/7/03	DM7/03



1 FOR USE WITH 488A03 AC POWER SOURCE

UNLESS SPECIFIED TOLERANCES		DRAWN	TC	7-8-03	MFG	BD	7/10/03	 3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 EMAIL: SALES@PCB.COM
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS (IN PARENTHESIS)	CHK'D	DM	7/10/03	ENGR	PH	7/10/03	
DECIMALS XX ±.01 XXX ±.005	DECIMALS XX ±0.3 XXX ±0.13	APP'D	DM	7/10/03				
ANGLES ±2 DEGREES	ANGLES ±2 DEGREES	TITLE		OUTLINE DRAWING MODEL 480C02 ICP® SENSOR SIGNAL CONDITIONER		CODE IDENT. No.	DWG. No.	
FILLETS AND RADII .003 - .005	FILLETS AND RADII (0.07 - 0.13)	DD012 REV. B 03/13/98				52681	480-3020-95	SCALE: FULL SHEET 1 OF 1