



Model 442A102
ICP® Sensor Signal Conditioner
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



Repair and Maintenance

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

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

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

Calibration

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

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

Returning Equipment

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

Contact Information

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Repair inquiries: rma@pcb.com

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

Safety Considerations

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

Discontinue use and contact our 24-Hour Sensorline if:

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

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

Definition of Terms and Symbols

The following symbols may be used in this manual:



DANGER

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

**CAUTION**

Refers to hazards that could damage the instrument.

**NOTE**

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

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



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



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



This symbol indicates safety, earth ground.



PCB工业监视和测量设备 - 中国RoHS2公布表

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

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

CHINA RoHS COMPLIANCE

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

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

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

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

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

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6.0 Model 442A101

The Model 442A101 ICP Sensor Signal Conditioning module features an AC coupled output for standard operation with systems involving ICP sensors, as well as a DC mode for calibration or ultra-low frequency operation.

The output amplifier in the Model 442A101 provides gain of x1, x10, and x100. This unit supplies from 1 to 20 mA constant current to ICP sensors or amplifiers.

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.

6.1 DESCRIPTION

The Model 442A101 supplies a regulated 24-volt DC power supply and an adjustable 1 to 20 mA constant-current source to supply power to a single sensor or ICP amplifier.

In the AC mode, the signal information is AC coupled from the +4 to +16 VDC sensor bias level and fed through the selectable gain buffer amplifier. The coupling time constant in the AC mode is greater than 10 seconds and is independent of the output load.

In the DC mode, the signal is directly coupled from the sensor signal / power lead and distributed first to a level shifting circuit, then to the gain buffer amplifier. In this mode, the sensor discharge time constant is not compromised and full advantage may be taken of long-time-constant sensors for calibration purposes or for special situations where extra-long duration events must be measured. The latter can usually only be accomplished in thermally stable environments.

The front panel contains a mode switch for AC or DC mode selection. A DC-adjust knob is provided to adjust the DC zero at the output jack when the unit is in the DC mode. The front panel also contains the sensor jack (SENSOR) and the output jack (OUTPUT). A gain knob sets the gain at x1, x10, or x100.

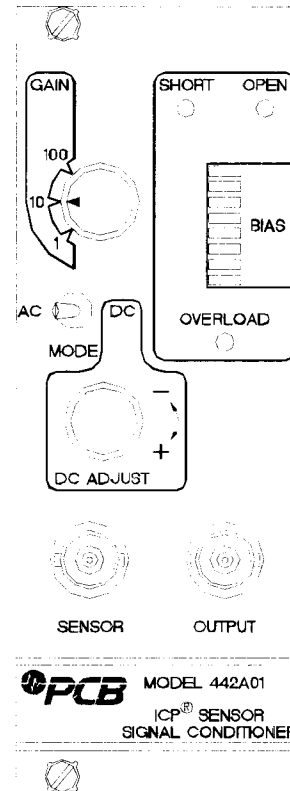


Figure 1. Model 442A101 Module Front Panel

A fault monitor is located on the front panel to give the user a means to check circuit continuity and operation. The bias level bar graph shows graduations of increasing bias. Input faults, such as overload, open, and short are indicated by LED-illuminated fault words.

6.2 INSTALLATION

Connect the sensor to the SENSOR jack of the Model 442A101 using the appropriate cable.

NOTE: Since ICP sensors operate at a low-impedance level, it is not necessary to use low-noise or other shielded cable. In some cases, it is desirable to use twisted pair and other types of two-wire cable.

Connect the readout to the OUTPUT jack using a BNC to BNC cable. Many types of connector adaptors are available from PCB to simplify difficult installation situations. Consult the factory for details.

6.3 OPERATION

Observe the fault monitor on the front panel. The bias level bar graph shows graduations of increasing bias. Input faults are indicated by LED-illuminated faults. With an ICP® sensor connected to the input jack, no input fault lights are illuminated and the graph registers at approximately mid-scale for normal operation. However, if the sensor or cable is open, a light illuminates under the word OPEN on the front panel. If the cable or sensor is shorted, a light illuminates under the word SHORT indicating zero volts. Finally, if the input signal exceeds ± 10 volts, the led illuminates under the word OVERLOAD.

NOTE: If this unit is used in conjunction with a sensor having a bias over 14 VDC, the OPEN light may be illuminated. Higher bias, up to 18 VDC, may be tolerated with reduced dynamic signal range.

6.4 Coupling Mode Switch

For most normal measurements, the coupling mode switch should be placed in the AC position. In this position, the switch AC couples the system internally with a greater-than-10-second coupling time constant (TC). This gives a low-frequency response as follows:

1%	down at	11 Hz
5%	down at	.05 Hz
30% (-3 dB)	down at	.016 Hz

NOTE: This table applies to a sensor system where the discharge TC of the sensor is greater than 100 seconds. Shorter-TC sensors shorten the overall system TC accordingly.

The AC mode is desirable for standard operation since long-term thermal drifting of long-TC sensors is nullified by the internal AC coupling. In the AC mode, the DC offset at the output is, at the maximum, +50 mV. The front panel zero control has no effect on output zero with the mode switch in AC.

The DC mode is provided for system calibration purposes and for situations where it is necessary to measure long-duration events with long-TC sensors. In this mode, the low-frequency response is determined by the sensor only since the Model 442A101 direct-couples the signal to the output.

6.5 Zero Control

The front panel zero control knob functions with the coupling mode switch in the DC position. After the system is adequately warmed, adjust the zero control to zero the output voltage. Clockwise rotation shifts the

voltage positively; counterclockwise rotation moves it negatively.

After longer periods of operation, it may be necessary to recheck and reset the zero slightly. This is considered normal.

6.6 Setting the Constant Current

The Model 442A101 is normally supplied with the constant-current output set at 4 mA nominal. This is adequate for most laboratory and field applications. Special situations, such as driving extra-long (beyond 1000 ft) cables having high frequency or fast rise-time pulses, may require increasing the sensor drive current above 4 mA.

CAUTION

To avoid damage to the sensor, DO NOT EXCEED 20 mA.

When driving fast rise-time pulses over long lines, system performance can be optimized by "tuning" the drive current to the line. Find the best current setting for the particular set of physical parameters (line length, line termination, or pulse rise time) established by the sensor. 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.

PCB Model 401A04 ICP Sensor Simulator consists of a unity gain, noninverting, impedance-converting voltage amplifier similar to those found in many ICP sensors. When used in conjunction with a signal generator, the electrical characteristics of long cables can be easily determined.

To set the constant current adjustment potentiometer, turn R19 clockwise to increase current or counterclockwise to decrease current.

Gently push the unit back into the enclosure and connect a 0 to 30 mA meter to the sensor input jack center conductor. Read the constant current, returning the negative probe to chassis ground.

MANUAL NUMBER: 19402
MANUAL REVISION: NR

Model Number
442A102

ICP® SENSOR SIGNAL CONDITIONER

Revision: B
ECN #: 23396

ICP® SIGNAL CONDITIONER

Sensor Excitation Voltage	VDC	24 ±0.5V	
Sensor Excitation Current	mA	1-20 (factory set at 4)	
Coupling Time Constant	sec	>10	
DC Offset	mV	<20	
Sensor Bias Display Range	VDC	4-16 ±1V	[1]
Voltage Gain	VAC	X1 ±1%	
Frequency Response (-5%): AC Coupled	Hz	0.05-100,000	
Spectral Noise - AC - Gain 1:			
1 Hz	mV/√Hz [dB]	0.40 [-128,00]	
10 Hz	mV/√Hz [dB]	0.09 [-140,35]	
100 Hz	mV/√Hz [dB]	0.06 [-144,00]	
1 kHz	mV/√Hz [dB]	0.08 [-141,79]	
10 kHz	mV/√Hz [dB]	0.07 [-142,67]	
Noise Broadband (1 Hz - 10 kHz)	mV [dB]	7.20 [-102,89]	
Output Range	V	>±10	
Output Impedance	ohms	100 ±10%	
Total Power Required (maximum)	watts	1.25	[3]

ENVIRONMENTAL

Operating Temperature Range °F [°C] 32 to +120 [0 to +50]

PHYSICAL

Connectors:	Input	type	BNC	
	Output	type	BNC	
Size (H x W):		in [mm]	5.05 x 1.8 [128,27 x 45,72]	[2]
Weight		lb [kg]	0.45 [0,20]	

NOTES:

- [1] High bias sensors with bias voltages beyond the display range will function up to the sensor excitation voltage limit, although the open LED will illuminate.
- [2] Single width unit.
- [3] Maximum number of 442A102 ICP® Sensor Signal Conditioners that can be powered by (1) 441A101 is (24). Other combinations of modules must be calculated not to exceed total power of 30 watts.
- [4] See PCB Declaration of Conformance PS024 for details.



All specifications are at room temperature unless otherwise specified.

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

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

Drawn: <i>[Signature]</i>	Engineer: <i>PLA</i>	Sales: <i>wa</i>	Approved: <i>FEJ</i>	Spec Number:
Date: <i>1-24-06</i>	Date: <i>1/24/06</i>	Date: <i>1/24/06</i>	Date: <i>1/24/06</i>	7958



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