



Model 121A23
ICP® Pressure 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
Web: 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. 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:

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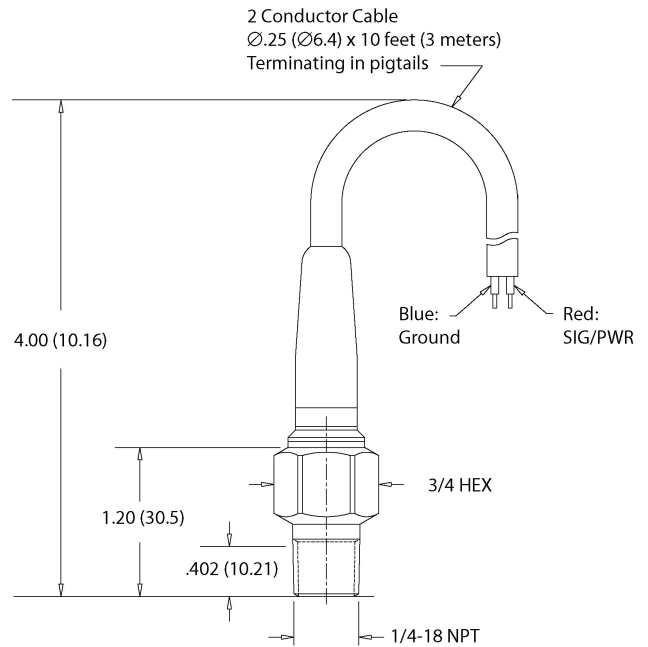
OPERATION MANUAL FOR
ICP® INDUSTRIAL PRESSURE SENSOR
Series 121
Models 121A21, 121A22, 121A23, 121A24
Models 121A31, 121A32, 121A33, 121A34

1.0 INTRODUCTION

The Series 121 consists of eight ruggedized quartz sensors designed for dynamic pressure measurements in harsh environments. Models 121A21-24 have two-pin MIL connectors, and Models 121A31-34 are provided with a molded integral cables, 10 feet (3 m) long.

The high impedance voltage signal produced by the quartz element in the Series 121 is impressed across the input of a built-in miniature source follower amplifier (actually an impedance converter with unity voltage gain) which converts the signal a low impedance voltage less than 100Ω, able to be fed directly into readout instruments such as oscilloscopes, peak meters, etc. over long cables.

Series 121 are designed for permanent installation by Original Equipment Manufacturers in pumps, compressors and pipelines for monitoring pressure fluctuations and/or surges.



Series 121A30 Industrial Pressure Sensor

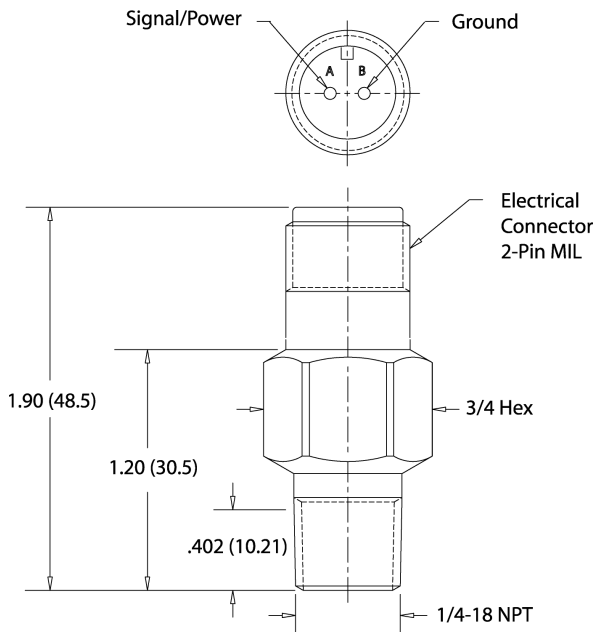
The models are dimensionally the same, and are designed to cover a pressure range from 125 to 10,000 psi. The temperature range is from -100 to 275°F (-73 to 135°C).

2.0 DESCRIPTION

See the installation drawing at the front of this manual for dimensional details of the Series 121A20 and 121A30.

The Series 121A20 and 121A30 have an integral housing diaphragm machined in stainless steel. The sensor incorporates 1/4 NPT mounting, and terminates in either a two-pin MIL or integral cable.

Quartz plates are stacked in a thickness compression mode to produce a relatively high natural frequency. When pressure is applied to the diaphragm of the sensor, the quartz element produces a high impedance voltage signal which the miniature amplifier converts to a low impedance level voltage (<100 Ω) which can



Series 121A20 Industrial Pressure Sensor

OPERATION MANUAL FOR
ICP® INDUSTRIAL PRESSURE SENSOR
Series 121
Models 121A21, 121A22, 121A23, 121A24
Models 121A31, 121A32, 121A33, 121A34

be read out on an oscilloscope or digital voltmeter. Power to operate the integrated circuit amplifier and the output signal are both conducted over a single coaxial cable.

When the source terminal at the IC amplifier receives a 2 to 20mA constant current from a +18 to 24VDC supply the amplifier bias at the source will be +11 volts (nominal) and independent of supply voltage or current. The output voltage signal from the quartz element is added to the bias voltage at the source terminal (See General Guide to ICP® Signal Conditioning, G-0001).

3.0 INSTALLATION

For details of mounting hole preparation, refer to the installation drawing accompanying this manual.

Stay within the recommended torque range [(5-7 ft-lbs (0.6-0.8 Nm)] when mounting the sensor. It is advisable to use pipe joint compound to assure a tight seal.

Use good machining practice in preparing the mounting port. Make sure the seal surface is free of tool chatter marks.

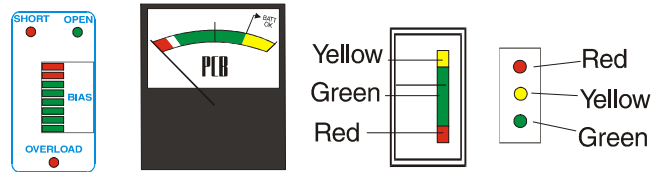
Note: Nicks, scratches, or other discontinuities in the surface can cause leaks at high pressures.

3.4 CABLE INSTALLATION

Series 121A20 has an integral 2-pin MIL connector. Connect one end of an industrial cable to the sensor and the other to the sensor input jack on an ICP® sensor signal conditioner (or equivalent). Series 121A30 is provided with an integral twisted pair cable (red is signal, blue is GND). This can be conveniently connected to a terminal strip on an ICP® compatible data acquisition system or can be ordered with a BNC connector to connect to an ICP® sensor signal conditioner (or equivalent).

4.0 OPERATION

If a PCB signal conditioner is being used, turn the power on and observe the voltmeter (or LED's) on the front panel. Typical indicators are marked as shown in the figure below.



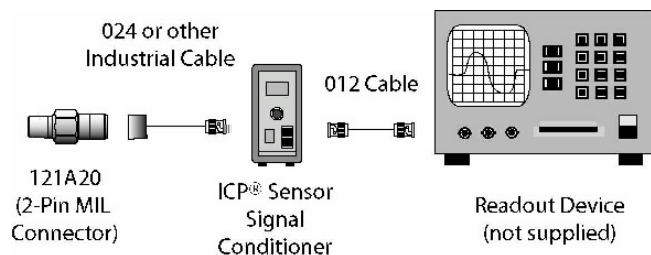
The green area (or LED) indicates the proper bias range for the ICP sensor and the correct cable connectors. A red color indicates a short condition in the sensor, cable or connections. Yellow means the excitation voltage is being monitored and is an indication of an open circuit.

Note: Most PCB pressure sensors have an output bias of 8-14 V. Refer to the specification sheet in this manual for the bias range of the model you are using. If you are using a low bias sensor, the indicator will be at the bottom end of the green portion of the dial indicator, and may even be in the red portion. This is the expected range and indicates proper operation.

Allow the instrument to warm up and thermally stabilize.

When the output from the power unit is connected to readout instrument, a signal drift will be noticed. This drift is due to charging of the coupling capacitor in the power unit and will cease within several minutes.

OPERATION MANUAL FOR
ICP® INDUSTRIAL PRESSURE SENSOR
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Typical ICP® Connection

4.1 POLARITY

The 121 Series Pressure Sensors produce a positive-going output voltage in response to pressure on the diaphragm.

5.0 CALIBRATION

The discharge time constant of the Series 121 is too short to allow calibration of the sensor by static means. The 121 series can, however, be calibrated by dynamic means using a pulse calibrator such as the Model 903B02. By this method, the sensor is subjected to a series of calibrated step changes in which a linear graph can be plotted over the full range of the unit.

PCB provides recalibration service on request. If such service is needed or desired, consult the factory for details.

Four sensors in the 121 Series (121A21, 121A22, 121A23, and 121A24) have discharge time constants of sufficient duration (100 secs.) to use dead weight testers for calibration.

Following is a brief laboratory procedure for calibrating a pressure sensor using dead weights.

5.1 STATIC CALIBRATION PROCEDURE FOR TIME CONSTANTS OF MORE THAN 100 BUT LESS THAN 500 SECONDS

1. Place sensor on test fixture with coaxial cable connected to oscilloscope.
2. Apply known pressure to sensor diaphragm (within range of instrument) using dead weight.
3. Remove weight and read change in output voltage (mV) corresponding to input pressure (psi).
4. Repeat Steps 2 through 4 in 20% increments within range of sensor.
5. Plot readings on x-y graph (voltage on the y-axis verses pressure on the x-axis).
6. The slope of the line and the sensor sensitivity is mV/psi.

6.0 PRECAUTIONS

1. To avoid destroying the built-in amplifier, do not apply a voltage to the sensor without a current limiting device (20 mA maximum) in the line such as those incorporated in all PCB units.
2. Do not subject sensor to temperatures exceeding 250°F (121°C).
3. Do not exceed maximum pressure rating.

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Model Number
121A23

ICP® PRESSURE SENSOR

Revision: D
ECN #: 25749

Performance

Measurement Range(for ±5V output)
Sensitivity(± 20 %)
Maximum Pressure(Total)
Resolution
Resonant Frequency
Rise Time(Reflected)
Low Frequency Response(-5 %)
Non-Linearity

ENGLISH

5 kpsi
1 mV/psi
7.2 kpsi
40 mpsi
≥ 2.5 μsec
0.005 Hz
≤ 2 % FS

SI

34.473 kPa
0.145 mV/kPa
49,642 kPa
0.276 kPa
≥ 200 kHz
≤ 2.5 μ sec
0.005 Hz
≤ 2 % FS

[1]

Environmental

Acceleration Sensitivity
Temperature Range(Operating)
Temperature Coefficient of Sensitivity

ENGLISH

≤ 0.2 psi/g
-65 to +250 °F
≤ 0.08 %/°F

SI

≤ 0.14 kPa/(m/s²)
-54 to +121 °C
≤ 0.144 %/°C

Electrical

Output Polarity(Positive Pressure)
Discharge Time Constant(at room temp)
Excitation Voltage
Constant Current Excitation
Output Impedance
Output Bias Voltage
Electrical Isolation

ENGLISH

Positive
≥ 100 sec
20 to 30 VDC
2 to 20 mA
≤ 100 ohm
8 to 12 VDC
≥ 10⁸ ohm

SI

Positive
≥ 100 sec
20 to 30 VDC
2 to 20 mA
≤ 100 ohm
8 to 12 VDC
≥ 10⁸ ohm

Physical

Sensing Geometry
Sensing Element
Housing Material
Diaphragm
Sealing
Electrical Connector
Weight

ENGLISH

Compression
Quartz
Stainless Steel
Stainless Steel
Welded Hermetic
2-Pin MIL-C-5015
2.08 oz

SI

Compression
Quartz
Stainless Steel
Stainless Steel
Welded Hermetic
2-Pin MIL-C-5015
59 gm



[2]

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

Maximum Pressure(Total) 10 kpsi 68,947
Supplied Accessory : Model 065A15 Seal, .624" OD x .553" ID x .080", brass (3)

NOTES:

[1] Zero-based, least-squares, straight line method.
[2] See PCB Declaration of Conformance PS023 for details.

Entered: BLS	Engineer: AF	Sales: DPC	Approved: NIL	Spec Number:
Date: 12/29/07	Date: 1/29/07	Date: 1/29/07	Date: 1/29/07	17149



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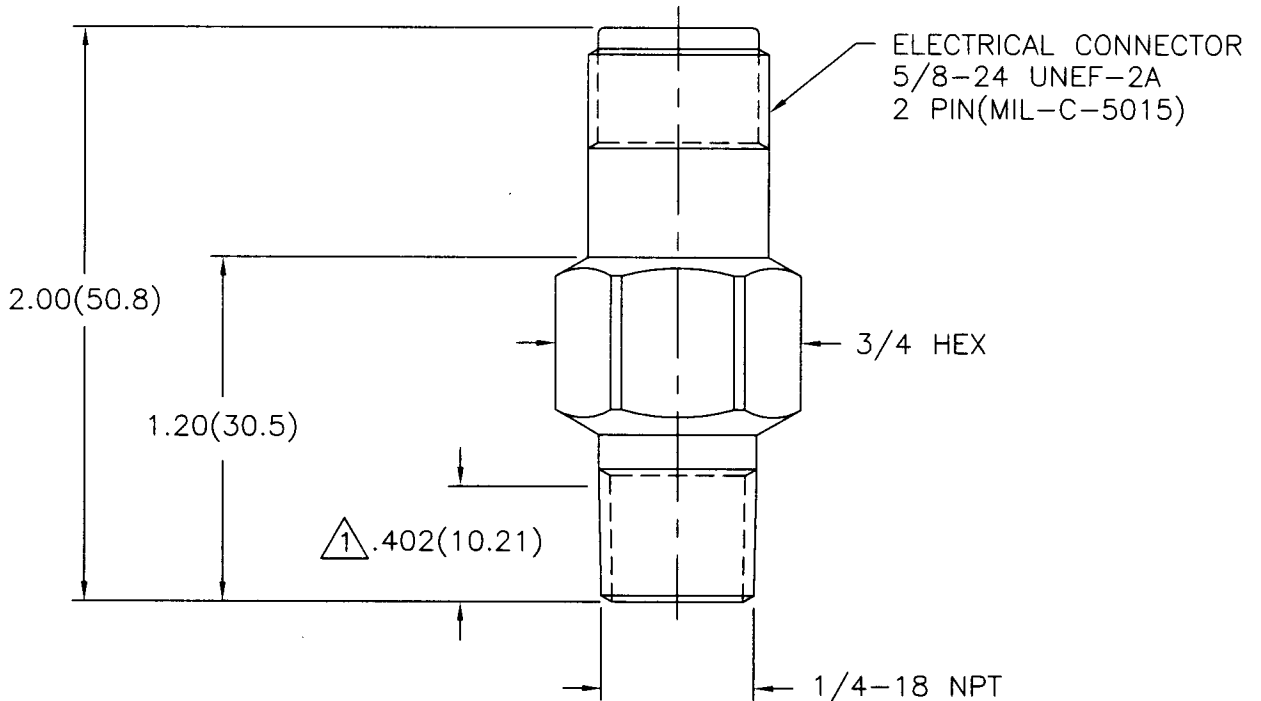
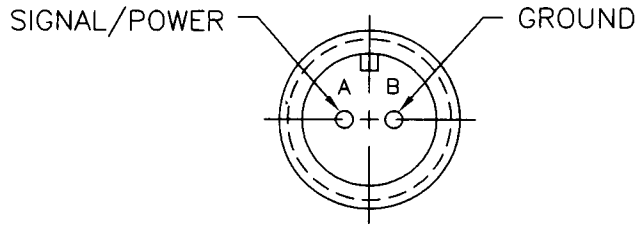
15411

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APPLICATION		
NEXT ASS'Y	USED ON	VAR

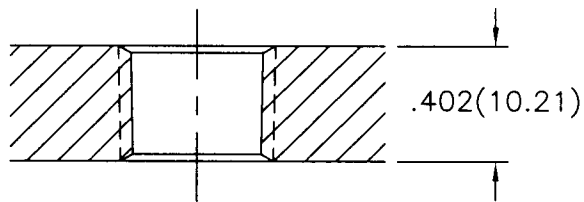
REVISIONS				
REV	DESCRIPTION	ECN	DATE	APP'D
A	REVISED PER ECN	13362	4/10/01	Om4/jj

TOP VIEW OF CONNECTOR



MOUNTING HOLE PREPARATION:

- ∅.437(∅ 11.10)
- X .402(10.21) ∇ MIN.
- TAP 1/4-18 NPT
- X .402(10.21) ∇



2.) USE PIPE JOINT COMPOUND TO ASSURE TIGHT SEAL.

△ MAXIMUM INSERTION OF THREAD INTO MOUNTING HOLE.

UNLESS SPECIFIED TOLERANCES		DRAWN <i>rw</i> 4/10/01 MFG <i>Dec</i> 4/10/01		 3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 EMAIL: SALES@PCB.COM
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS (IN PARENTHESIS)	CHK'D <i>sm</i> 4/10/01	ENGR <i>BSH</i> 4/10/01	
DECIMALS XX ±.01 XXX ±.005	DECIMALS XX ±0.3 XXX ±0.13	APP'D <i>WSH</i> 4/10/01	TITLE	CODE IDENT. NO. 52681
ANGLES ±2 DEGREES	ANGLES ±2 DEGREES	INSTALLATION DRAWING MODEL 121A23 PRESSURE SENSOR		DWG. NO. 15411
FILLETS AND RADII .003 - .005	FILLETS AND RADII (0.07 - 0.13)	DD011 REV. B 03/13/98		SCALE: 1.5X SHEET 1 OF 1