



## **Model 124A24**

**Rocket motor ICP® pressure sensor, 1000 psi, 5 mV/psi, water-cooled, 1/2-  
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)**



## 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

PCB Piezotronics, Inc.  
3425 Walden Ave.  
Depew, NY14043 USA  
Toll-free: (800) 828-8840  
24-hour SensorLine: (716) 684-0001  
General inquiries: [info@pcb.com](mailto:info@pcb.com)  
Repair inquiries: [rma@pcb.com](mailto:rma@pcb.com)

For a complete list of distributors, global offices and sales representatives, visit our website, [www.pcb.com](http://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	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
<p>This table is prepared in accordance with the provisions of SJ/T 11364.</p> <p>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.</p> <p>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.</p> <p>Lead is present due to allowed exemption in Annex III or Annex IV of the European RoHS Directive 2011/65/EU.</p>						

# OPERATION MANUAL FOR ICP® WATER-COOLED PRESSURE SENSORS MODELS 124A21, A22, A24

1

## 1.0 INTRODUCTION

The series of sensors described in this guide is designed to measure dynamic pressures in intense thermal environments typified by rocket engine combustion chambers.

These sensors feature acceleration-compensated piezoelectric pressure probes, mounted in a water-cooled adaptor and an internal signal conditioner to provide a directly usable output voltage.

## 2.0 DESCRIPTION

The Models 124A21, A22 and A24 contain built-in impedance converter electronic circuits which convert the high-impedance voltage from the quartz crystal to a low-impedance voltage signal that can be fed directly into most common indicating or recording instruments.

The outer body of this series is 17-4 PH hardened stainless steel and features a ceramic-coated tip for protection against erosion by hot gasses when the sensor is flush-mounted directly in combustion chambers.

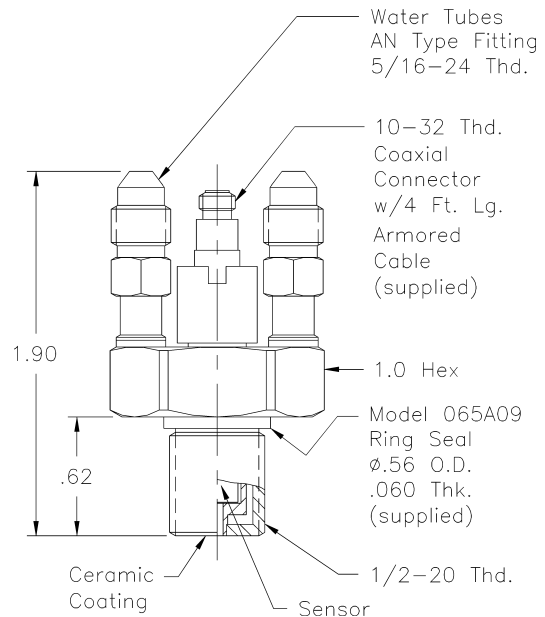
NOTE: The sensor probe in this series is factory installed at a precise depth in the outer body. Do not attempt removal of this probe. Contact the factory should any questions or problems arise concerning the sensor probe.

The probes in all models are electrically ground isolated from the outer housing.

## 3.0 INSTALLATION

Prepare mounting port in accordance with instructions on installation drawing 124-1210-90.

Inspect the mounting port for burrs and tool marks at the seal surface.



### Series 124A: Water-Cooled Rocket Motor, ICP® and Charge Sensors

Use recommended mounting torque when installing sensors. Do not overtorque as damage to seal surface could result.

Especially in the presence of high vibration, support water supply tubes by clamping to rigid surfaces with adequate strain relief on loop to avoid stressing tubes.

Either water tube may be used as the inlet tube.

Use at least a 50 psi source of clean water for cooling.

# OPERATION MANUAL FOR ICP® WATER-COOLED PRESSURE SENSORS MODELS 124A21, A22, A24

The Models 124A21, A22 and A24 sensors use low output impedance probes (ICP®) and will not require the extreme insulation resistance precaution commonly associated with charge mode sensors.

Connect the sensor cable to the appropriate ICP® power unit and check the front panel monitor meter for continuity of cable connections and internal amplifier. Consult Guide G-0001B, "General Guide to ICP® Instrumentation" for installation and usage hints for ICP® instruments.

## 4.0 OPERATION

Consult Guide G-0001B for a complete description of the low-impedance concept in instrumentation.

All PCB power units designed for ICP® sensors use contain built-in fault monitor meters to aid in locating circuit faults (shorts or opens) and to identify normal operation of the miniature impedance converting amplifier built into the sensor.

Do not attempt to apply voltage directly to the input pin of the sensor from any other source. The input current must be limited to 20 mA maximum and the input voltage must not be higher than 30 volts. If it is desired to build a power unit, rather than to use one of those available from PCB, contact the factory for approval of this change.

The Models 124A21, 124A22 and 124A24 are identical except for sensitivity.

The Model 124A21 has a sensitivity of 20 mV/psi which gives a full-scale range (for  $\pm 5\%$  out) of 250 psi.

The Model 124A22 has a sensitivity of 1.0 mV/psi and a full-scale range of 5000 psi.

The Model 124A24 has a sensitivity of 5.0 mV/psi and a full-scale range of 1000 psi.

## 5.0 CALIBRATION

Because of the shorter time constants built into these models, static calibration methods are difficult to employ.

Pressures must be applied rapidly and readout must be made with fast recording devices such as storage oscilloscopes or similar types of data acquisition hardware.

A pneumatic (compressed air) system with quick opening valve and reference gage is an excellent method of calibrating these sensors.

To take full advantage of the time constant built into the sensor, use a DC-coupled power unit such as the PCB Model 484B.

## 6.0 MAINTENANCE

The sealed construction and miniature size of these sensors make field repair impractical.

Contact factory for assistance should problems arise.

®ICP is a registered trademark of PCB Piezotronics

Model Number

124A24

ICP<sup>®</sup> PRESSURE SENSOR SPECIFICATIONS

Revision: E

ECN #: 15285

**Performance**Measurement Range (for  $\pm 5$  V output)Useful Overrange (for  $\pm 10$  V output)Sensitivity ( $\pm 15\%$ )

Maximum Pressure (static)

Resolution

Resonant Frequency

Rise Time (Reflected)

Low Frequency Response ( $-5\%$ )

Non-Linearity

**Environmental**

Acceleration Sensitivity

Temperature Range (Operating)

Temperature Coefficient of Sensitivity

Maximum Flash Temperature

Maximum Shock

**Electrical**

Output Polarity (Positive Pressure)

Discharge Time Constant (at room temp)

Excitation Voltage

Constant Current Excitation

Output Impedance

Output Bias Voltage

Electrical Isolation

**Physical**

Sensing Geometry

Sensing Element

Housing Material

Diaphragm

Sealing

Electrical Connector

Weight

Cable Type

Cable Length

Water Flow Rate (at 50 psi)

**ENGLISH**

1 kpsi

2 kpsi

5.0 mV/psi

5 kpsi

20 mpsi

 $\geq 15$  kHz $\leq 30$   $\mu$  sec

0.005 Hz

 $\leq 1.0\%$  FS $\leq 0.002$  psi/g-100 to +250  $^{\circ}$ F $\leq 0.03\%$   $^{\circ}$ F5000  $^{\circ}$ F

10000 g pk

Positive

 $\geq 100$  sec

20 to 30 VDC

2 to 20 mA

 $\leq 100$  ohms

8 to 14 VDC

 $10^8$  ohms

Compression

Quartz

Stainless Steel

Invar

Welded Hermetic

10-32 Coaxial Jack

3.9 oz

006 Ruggedized Low Noise

4 ft

1.2 gal/min

**SI**

6895 kPa

13790 kPa

0.725 mV/kPa

34475 kPa

0.14 kPa

 $\geq 15$  kHz $\leq 30$   $\mu$  sec

0.005 Hz

 $\leq 1.0\%$  FS $\leq 0.0014$  kPa/(m/s<sup>2</sup>)-73 to +121  $^{\circ}$ C $\leq 0.054\%$   $^{\circ}$ C2760  $^{\circ}$ C98070 m/s<sup>2</sup> pk

Positive

 $\geq 100$  sec

20 to 30 VDC

2 to 20 mA

 $\leq 100$  ohms

8 to 14 VDC

 $10^8$  ohms

Compression

Quartz

Stainless Steel

Invar

Welded Hermetic

10-32 Coaxial Jack

110 gm

006 Ruggedized Low Noise

1.3 m

1.2 gal/min

**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

Supplied Accessory : Model 065A16 Seal ring 0.624" OD x 0.553" ID x 0.060" thk brass (3) replaces Model 065A09

**N** - Negative Output Polarity**S** - Stainless Steel Diaphragm

Diaphragm

316L Stainless Steel

316L Stainless Steel

**NOTES:**

[1] Refers to operating temperature of the internal sensor without cooling.

[2] Zero-based, least-squares, straight line method.

[3] See PCB Declaration of Conformance PS023 for details.

**SUPPLIED ACCESSORIES:**

Model 065A09 Seal ring 0.560" OD x 0.500" ID x 0.060" thk brass (3)

Model 070A08 Cable adaptor (micro 10-32 jack to BNC jack) (1)

Entered: DJ Engineer: BSA Sales: DPC Approved: WSA Spec Number:Date: 4/25/02 Date: 4/26/02 Date: 4/26/02 Date: 4/26/02 5668

[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<sup>®</sup> is a registered trademark of PCB Group, Inc.**PCB PIEZOTRONICS****PRESSURE DIVISION**

3425 Walden Avenue, Depew, NY 14043

Phone: 716-684-0001

Fax: 716-686-9129

E-Mail: pressure@pcb.com

124-1210-90

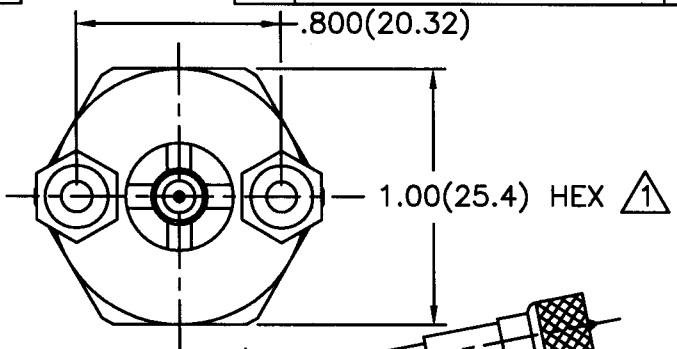
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# APPLICATION

NEXT ASS'Y	USED ON	VAR

# REVISIONS

REV	DESCRIPTION	ECN	DATE	APP'D
D	REVISED PER ECR	20202	7/14/04	DM7/04



ELECTRICAL CONNECTOR  
CO-AXIAL 10-32 UNF-2A

MODEL 006EB004EB  
ARMORED CABLE  
4 FT(1.2M) LG.  
(SUPPLIED)

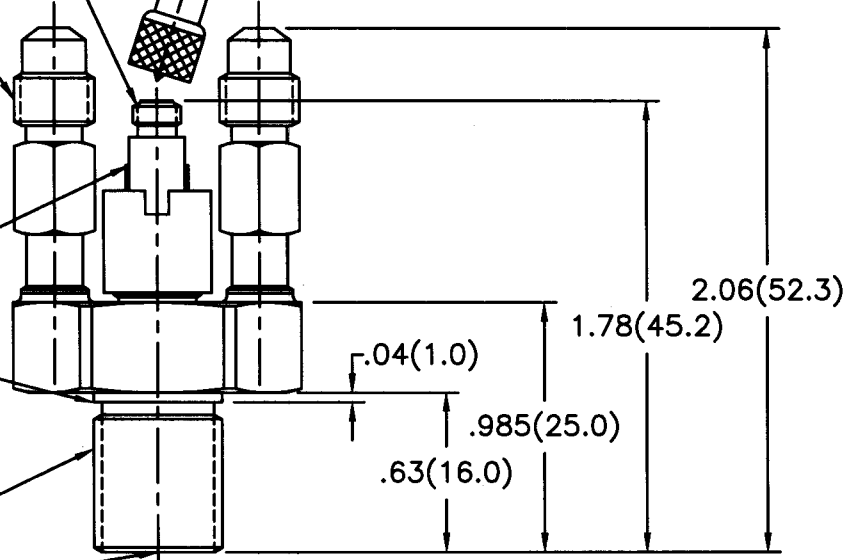
WATER INLET TUBES  
Ø.109 I.D.  
5/16-24 UNF-3A  
(REF:M\$33656E2)

SENSOR

MODEL 065A09 SEAL  
.56 O.D. X .06 THK.  
(SUPPLIED)

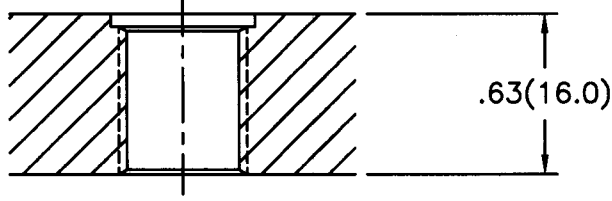
1/2-20 UNF-2A

ROKIDE COATING



## MOUNTING HOLE PREPARATION:

Ø.453  
THRU  
1/2-20 UNF-2B  
THRU  
□Ø.562  
X .050 ▽2



2 SEAL SURFACE MUST BE FLAT AND FREE OF TOOL MARKS WITH AT LEAST 63/ FINISH.

1 MOUNTING TORQUE ON 1.00 HEX 10-15 FT. LBS.

## UNLESS SPECIFIED TOLERANCES

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

DRAWN	EB	7/14/04	MFG	KL6	7/14/04
CHK'D	DM	7/14/04	ENGR	BJH	7/14/04
APP'D	RF	7/14/04	SALES	DPC	7/14/04
TITLE OUTLINE DRAWING MODEL 124A21, A22, A24 WATER COOLED SENSOR					

PCB PIEZOTRONICS™	
3425 WALDEN AVE. DEPEW, NY 14043	
(716) 684-0001 EMAIL: SALES@PCB.COM	
CODE IDENT. NO. 52681	DWG. NO. 124-1210-90
SCALE: 1.33X	SHEET 1 OF 1