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
Web: www.pcb.com

PCB PIEZOTRONICS INC.
A PCB GROUP COMPANY

Warranty, Service, Repair, and Return Policies and Instructions

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 traceablility 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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DOCUMENT NUMBER: 21354
DOCUMENT REVISION: B
ECN: 17900

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

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.

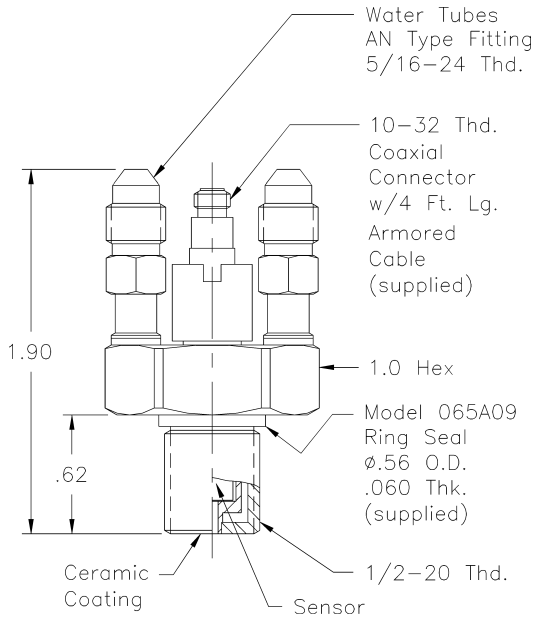
NOTE: The sensor probe in this series is factory installed at a precise depth in the outer body. Do not attempt removal of this probe. Contact the factory should any questions or problems arise concerning the sensor probe.

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.

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 ±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.

Model Number	ICP® PRESSURE SENSOR SPECIFICATIONS	Revision: E
124A24		ECN #: 15285

Performance	ENGLISH	SI	
Measurement Range (for ± 5 V output)	1 kpsi	6895 kPa	
Useful Overrange (for ± 10V output)	2 kpsi	13790 kPa	
Sensitivity (±15 %)	5.0 mV/psi	0.725 mV/kPa	
Maximum Pressure (static)	5 kpsi	34475 kPa	
Resolution	20 mpsi	0.14 kPa	
Resonant Frequency	≥15 kHz	≥ 15 kHz	
Rise Time (Reflected)	≤30 μ sec	≤30 μ sec	
Low Frequency Response (-5 %)	0.005 Hz	0.005 Hz	
Non-Linearity	≤1.0 % FS	≤1.0 % FS	[2]
Environmental			
Acceleration Sensitivity	≤0.002 psi/g	≤ 0.0014 kPa/(m/s²)	
Temperature Range (Operating)	-100 to +250 °F	-73 to +121 °C	[1]
Temperature Coefficient of Sensitivity	≤0.03 %/°F	≤ 0.054 %/°C	
Maximum Flash Tempurature	5000 °F	2760 °C	
Maximum Shock	10000 g pk	98070 m/s² pk	
Electrical			
Output Polarity (Positive Pressure)	Positive	Positive	
Discharge Time Constant (at room temp)	≥100 sec	≥100 sec	
Excitation Voltage	20 to 30 VDC	20 to 30 VDC	
Constant Current Excitation	2 to 20 mA	2 to 20 mA	
Output Impedance	≤100 ohms	≤100 ohms	
Output Bias Voltage	8 to 14 VDC	8 to 14 VDC	
Electrical Isolation	10^8 ohms	10^8 ohms	
Physical			
Sensing Geometry	Compression	Compression	
Sensing Element	Quartz	Quartz	
Housing Material	Stainless Steel	Stainless Steel	
Diaphragm	Invar	Invar	
Sealing	Welded Hermetic	Welded Hermetic	
Electrical Connector	10-32 Coaxial Jack	10-32 Coaxial Jack	
Weight	3.9 oz	110 gm	
Cable Type	006 Ruggedized Low Noise	006 Ruggedized Low Noise	
Cable Length	4 ft	1.3 m	
Water Fow Rate (at 50 psi)	1.2 gal/min	1.2 gal/min	

CE [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® 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
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: DBJ	Engineer: BSH	Sales: DPC	Approved: WSH	Spec Number:
Date: 4/25/02	Date: 4/26/02	Date: 4/26/02	Date: 4/26/02	5668

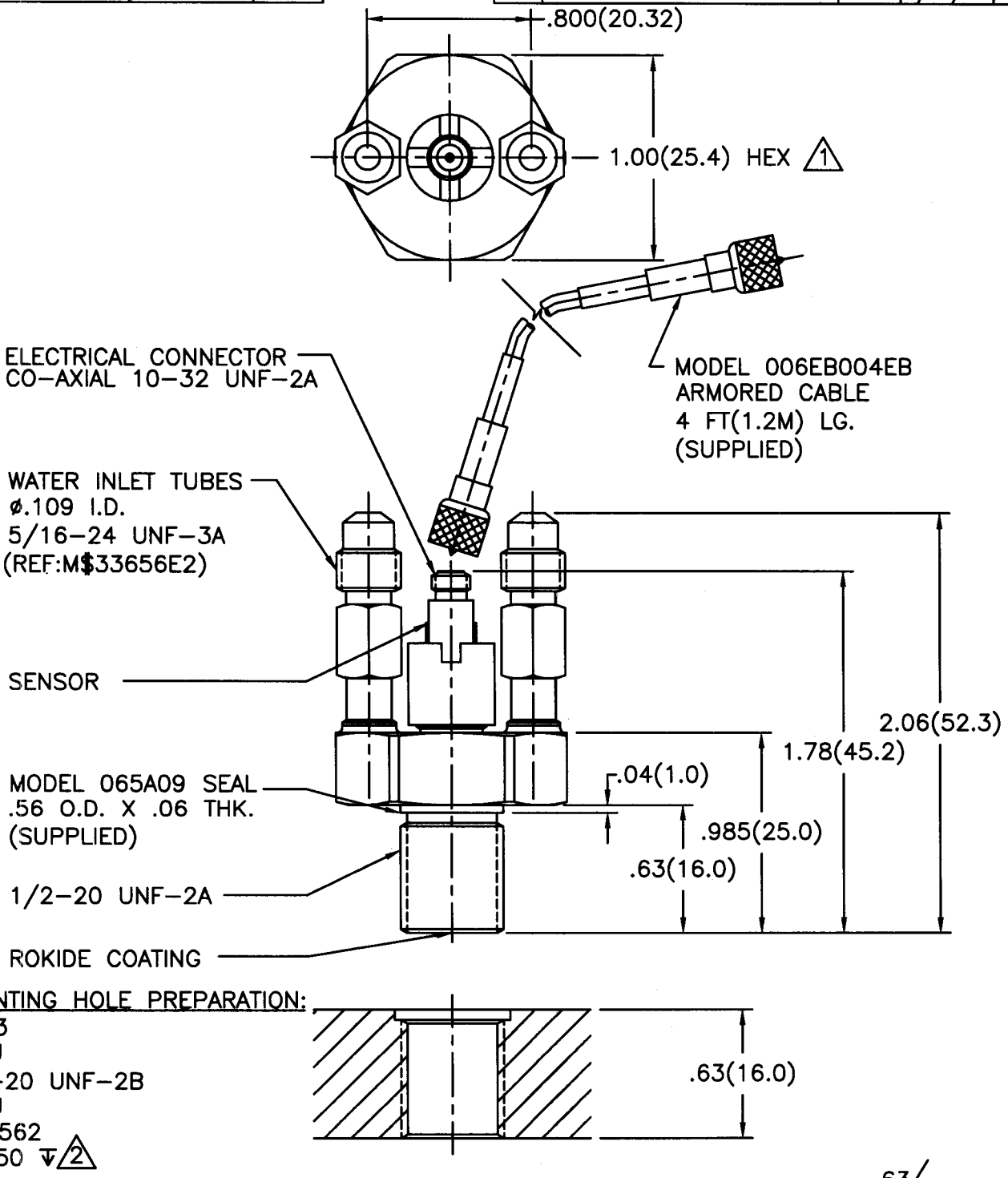
PCB PIEZOTRONICS
PRESSURE DIVISION
3425 Walden Avenue, Depew, NY 14043

Phone: 716-684-0001
Fax: 716-686-9129
E-Mail: pressure@pcb.com

124-1210-90

APPLICATION		
NEXT ASS'Y	USED ON	VAR

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



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 XXX ±.010	DECIMALS X ±0.8 XX ±0.25
ANGLES ±2 DEGREES	ANGLES ±2 DEGREES
FILLETS AND RADII .003 - .005	FILLETS AND RADII [0.07 - 0.13]
DD011 REV. C 01/21/03	

DRAWN	GB	7/14/04	MFG	KLG	7/14/04
CHK'D	DM	7/14/04	ENGR	BVH	7/14/04
APP'D	RF	7/16/04	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.	DWG. NO.
52681	124-1210-90
SCALE: 1.33X	SHEET 1 OF 1