



**Model 130F22**

**ICP® Electret Array Microphone**

**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

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.

## **OPERATING GUIDE FOR 130 SERIES MICROPHONES**

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**Figure 1**

### **1.0 Introduction**

PCB<sup>®</sup> 130 series ICP<sup>®</sup> array microphones provide an extremely cost-effective method for large channel count sound pressure measurements. Multiple array microphones with their excellent phase characteristics can be combined with the appropriate software to perform measurements that are not possible with a single microphone. Typical applications include sound pressure mapping, beamforming, acoustic mode analysis, near-field acoustic holography, or sound intensity measurements. To ensure the best performance from your 130 series microphone follow the installation and operating procedures in this guide. If you have additional questions concerning the microphone system or applications, call a factory Application Engineer at 716-684-0001, or your nearest PCB<sup>®</sup> Field Application Engineer.

### **2.0 Product Description**

PCB<sup>®</sup>'s 130 series ICP<sup>®</sup> Array are integrated systems that include a built-in preamplifier. Models 130F20, 130F21, and 130F22 are all 1/4-inch microphones that provide a 45 mV/Pa output over an extended 120dB dynamic range. They are ideal for use at frequencies from 20 Hz to 10 kHz ( $\pm 2$ dB) or 20 kHz ( $\pm 5$ dB). All models are of rugged, stainless steel construction .

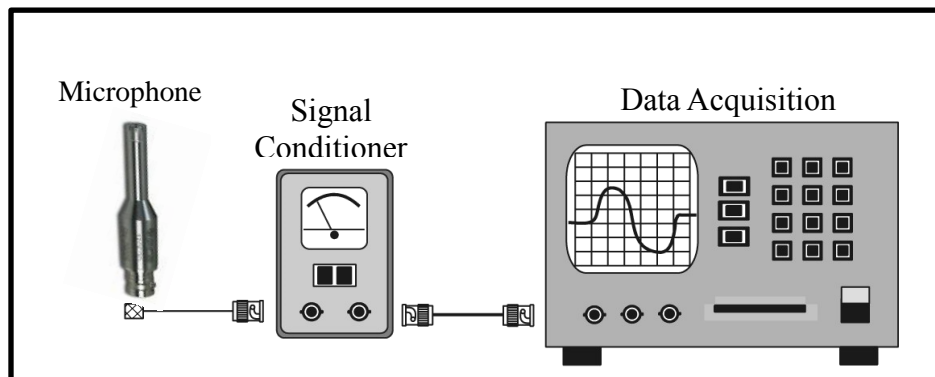
These microphones all have the same performance specifications but are fitted with different electrical connectors to make them suitable for differing applications. Model 130F20 features a BNC connector while Model 130F21 uses a 10-32 coaxial jack connector. Model 130F22 terminates in a SMB connector. These models are shown in Figure 1.

The 130A23 and 130A24 are designed for high amplitude applications with an upper dynamic range of 150 dB. Model 130A23 terminates in a SMB electrical connector. The 130A24 is an enhanced, rugged, water and dust resistant design, and terminates in a BNC electrical connector. Model 130A24 has a lower sensitivity (10 mV/Pa) than the 130A23 (14 mV/Pa), but otherwise the performance specifications are the same.

All 130 Series array microphones include TEDS capable digital memory and communication electronics compliant with IEEE 1451.4. These microphones are easy to operate and interface with many PCB® ICP® constant current signal conditioners and other data acquisition and recording instruments available on the market today. In a complete microphone system, low-impedance cables couple the microphone and signal conditioner to customer supplied read-out instruments. The use of low impedance cables enables signals to be driven long distances with negligible signal loss.

### 3.0 Powering

All ICP® powered microphones require constant-current excitation for proper operation. For this reason, use only PCB constant-current signal conditioners or other approved constant-current sources. The signal conditioner provides an AC-coupled output signal that is compatible with most standard readout devices. Signal conditioners consist of a regulated 2-20mA, 18-30 VDC source. They are available in single or multi channel, battery or line powered configurations. Battery powered devices offer versatility for portable low noise measurements, whereas line powered units provide the capability for continuous monitoring. A typical system schematic is shown in Figure 2.

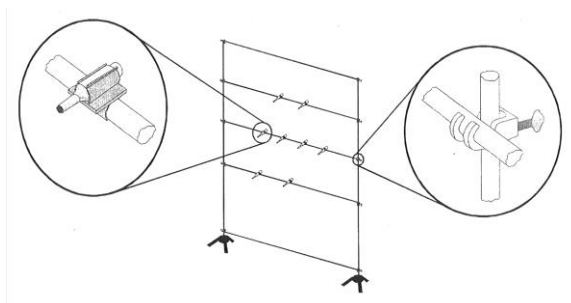


**Figure 2**

Signal conditioners have meters or LEDs, which enable users to monitor the bias voltage output signal, check microphone operation, and detect cable faults. Typically yellow denotes an open circuit; green indicates normal operation and red indicates a short circuit. Many FFT analyzers, data acquisition modules, and data collectors have the proper constant-current excitation built-in for direct use with ICP® microphones. Before using this feature, care should be taken to assure the proper supply voltage and constant current excitation are provided. Check the enclosed specification sheet to make sure the supply voltage and current are within acceptable limits for your particular microphone.

## 4.0 Installation

There are many ways to mount the microphone, from simply placing the microphone in a clip to using a two-dimensional array stand. A diagram of an array configuration is provided in Figure 3. For installation of this type, remove the microphone from its package, connect the appropriate cable between the signal conditioner and the microphone, and connect a second cable between the signal conditioner and the data acquisition device. Cabling may consist of standard low-impedance coax cables. Desired electrical connectors would be dependent on the 130 series microphone used and the input of the signal conditioner and read-out instrument. PCB® offers these cables in a variety of standard or customer specified lengths.



**Figure 3**

The 130A24 microphone features a removable grid cap and replaceable protective cover. This allows the 130A24 to withstand harsh environments while extending the lifespan of critical sensitive components. If the water and dust resistant cover is damaged, having a removable grid cap allows the user to replace this protective cover quickly and easily.

To replace a grid cap, first unthread the grid cap from the housing. Next, peel off the existing cover from the end of the housing. Sharp edged tools can be used to aid in cover removal, but it is important to keep the tool at a shallow angle. DO NOT make contact with the microphone's delicate diaphragm (right hand side of Figure 4). To ensure a proper seal, gently wipe the top of the microphone housing to remove any moisture or debris. Do not use solvent when removing debris from the housing because solvents have the potential to damage the microphone. Apply the replacement water resistant patch to the end of the housing (left hand side of Figure 4) while keeping it centered. Finally, assemble the grid cap back onto the housing. Additional 079A46 five-pack replacement water resistant pads can be ordered separately.



**Figure 4**

## 5.0 Calibration

All microphones are supplied with calibration documentation showing the free field frequency response and the conditions under which the calibration was performed. Calibrations are performed with reference microphones traceable to national laboratories specializing in acoustic measurements (NIST, PTB, or DFM). PCB is ISO 10012-1 and ISO 9001-2008 certified. Calibration methods used by PCB for acoustic pressure have been audited for proficiency and accredited for compliance with ISO/IEC 17025:2005; ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3. Sample calibration certificates are provided in Figure 5, Figure 6, and Figure 7 for the 130F series, 130A23, and 130A24, respectively.



## ~ Calibration Certificate ~

Model Number: 130F20

Serial Number: 43998

Description: ICP® Microphone

Manufacturer: PCB

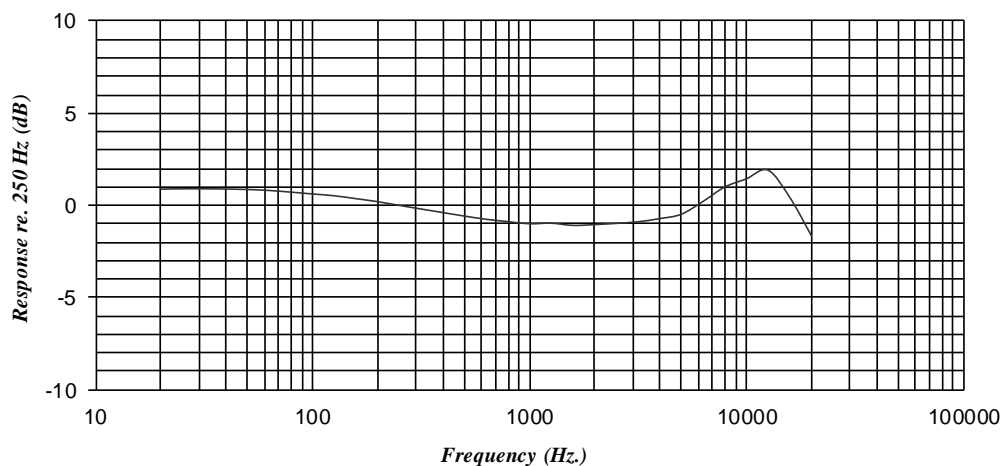
### Calibration Data

Sensitivity: 44.2 mV/Pa  
-27.1 dB re 1V/Pa

Reference Freq.: 250 Hz  
Output Bias: 9.8 VDC

Temperature: 73 °F 23 °C Relative Humidity: 60 %

### Response Plot



### Condition of Unit

As Found: n/a  
As Left: New Unit, In Tolerance

### Notes

1. Frequency response determined by IEC 61094-5: Methods for pressure calibration of working standard microphones by comparison.
2. Calibration of reference equipment is traceable to one or more of the following National Labs: NIST, PTB or DFM.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1 and ANSI/NCSL Z540.3.
4. Due to state-of-the-art limitations, 4:1 calibration ratios are not possible on pressure measurement standards, microphones and acoustic calibrators. Calibration ratios for these types of devices are limited to 1:1.
5. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
6. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc
7. Calibrated per ACS-21.

Technician: Isaac Miller

Date: May 16, 2016



Headquarters: 3425 Walden Avenue, Depew, NY 14043

Calibration performed at: 10869 Highway 903, Halifax, NC 27839

Figure 5

## ~ Calibration Certificate ~

Model Number: 130A23

Serial Number: 45002

Description: ICP® Microphone

Manufacturer: PCB

Method <sup>1</sup>: Back-to-Back Reference

### Calibration Data

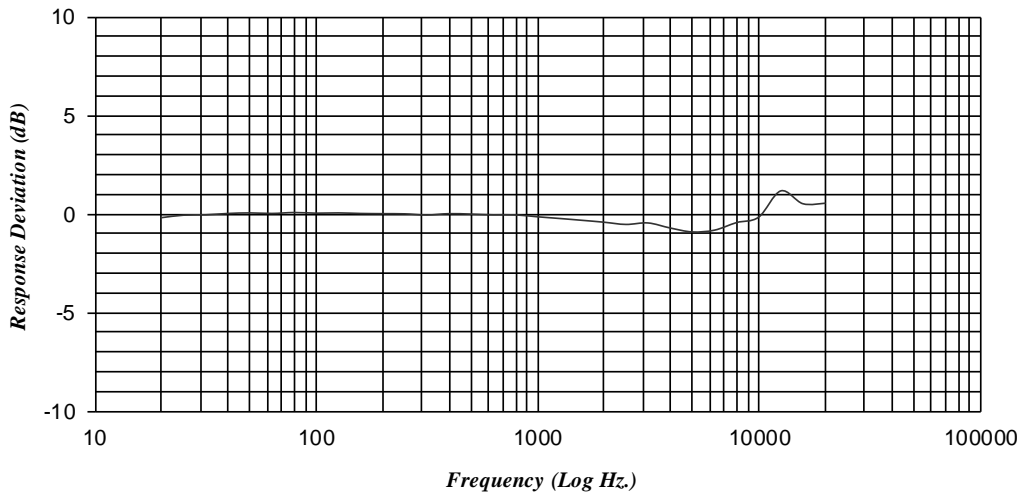
Sensitivity: 12.2 mV/Pa  
-38.3 dB re 1V/Pa

Reference Freq.: 250 Hz.  
Output Bias: 11.8 VDC

Temperature: 72 °F 22 °C

Relative Humidity: 44 %

### Response Plot



### Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

### Notes

1. This method involves comparing the test unit with a reference microphone in a GRAS 51AB calibrator.
2. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1 and ANSI/NCSL Z540.3.
4. Due to state-of-the-art limitations, 4:1 calibration ratios are not possible on pressure measurement standards, microphones and acoustic calibrators. Calibration ratios for these types of devices are limited to 1:1.
5. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
6. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc
7. Calibrated per ACS-21.

Technician: Scott Skibniewski

Date: June 10, 2016



Headquarters: 3425 Walden Avenue, Depew, NY 14043

Calibration performed at: 10869 Highway 903, Halifax, NC 27839

Figure 6

## ~ Calibration Certificate ~

Model Number: 130A24

Serial Number: 41270

Description: ICP® Microphone

Manufacturer: PCB

Method <sup>1</sup>: Back-to-Back Reference

### Calibration Data

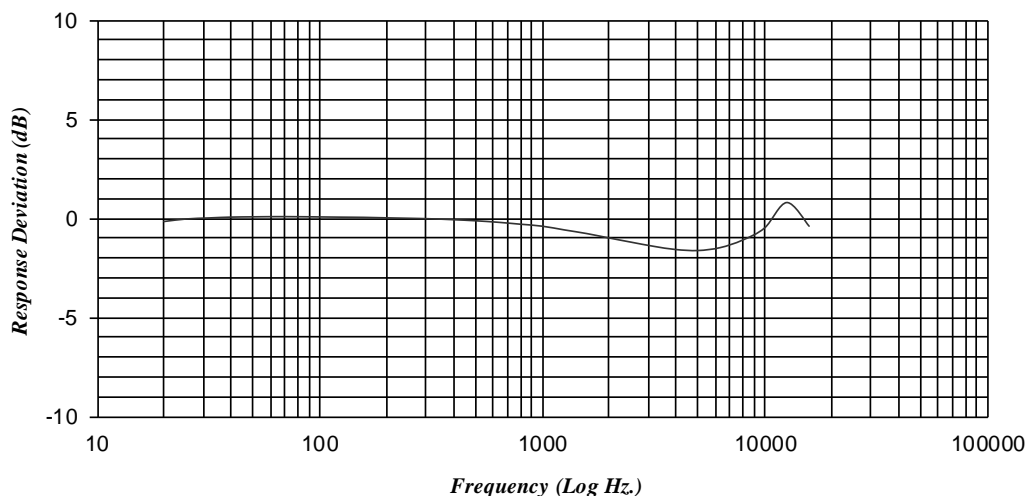
Sensitivity: 10.4 mV/Pa  
-39.7 dB re 1V/Pa

Reference Freq.: 250 Hz  
Output Bias: 11.8 VDC

Temperature: 71 °F 22 °C

Relative Humidity: 39 %

### Response Plot



### Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

### Notes

1. This method involves comparing the test unit with a reference microphone in a GRAS 51AB calibrator.
2. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1 and ANSI/NC SL Z540.3.
4. Due to state-of-the-art limitations, 4:1 calibration ratios are not possible on pressure measurement standards, microphones and acoustic calibrators. Calibration ratios for these types of devices are limited to 1:1.
5. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
6. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc
7. Calibrated per ACS-21.

Technician: William M. Urbanek

Date: April 13, 2015



3425 Walden Avenue  
Depew, New York 14043

Figure 7

All 130 series array microphones are designed for use in a free field environment. A free field environment is one without reflections. Anechoic rooms and outdoor spaces without structures are good examples of a free field environment. The free field response is the voltage response with respect to the pressure when exposed to a plane progressive sound wave. A free field microphone has a flat frequency response with respect to any source whose primary direction is collinear with the axis of the microphone.

Calibration of free field microphone occurs at a zero degree angle of incidence. This means that the frequency response reported on the calibration certificate is valid when the microphone is directed straight at the sound source. If the microphone is directed at an angle with respect to the source the response may vary depending on the angle and the frequency of operation.

After completing the system set-up, turn on the the signal conditioner and allow 1 to 2 minutes for the system to stabilize. If the system doesn't appear to be functioning correctly check all system connections and try to isolate and individually check functionality of all system components, or consider replacing system components one at a time. If the system still does not operate properly, consult a PCB Application Engineer.

Under normal conditions, microphones offer a very stable response. However, the microphone output may be affected by harsh environments, such as moisture, dirt, mechanical shock, or other unusual conditions. This may manifest itself in a number of ways, ranging from a loss in frequency range to failure of the built-in microelectronic circuits. To assure sensors characteristics are known PCB® recommends that a recalibration cycle be established for each microphone. Customers should determine a calibration cycle best suited for their needs as the cycle is based upon a variety of factors, such as frequency of use, exposure to harsh environments, accuracy requirements, trend information obtained from previous calibration records, contractual regulations, and risk associated with incorrect readings. PCB® recommends 12 to 24 month calibration intervals but as stated, this interval is at the discretion of the customer and is based on customer needs. It is also best practice to perform verification both before and after each test. PCB's CAL 250 acoustic calibrator (sold separately) is a handheld calibration instrument ideal for field or quick sensor operational evaluation purposes.

## **6.0 Service**

See the supplemental sheet for information on our service, repair and return policies, procedures and instructions. If an unexpected problem arises, call our 24-Hour SensorLine<sup>SM</sup> (716-684-0001) to discuss your dynamic instrumentation needs with a PCB® Application Engineer.

## **7.0 Warranty**

PCB's 130 Series Microphones are covered by a limited warranty against defective material and workmanship. Visit [http://www.pcb.com/terms\\_conditions](http://www.pcb.com/terms_conditions) for a complete statement of our warranty.



3425 Walden Avenue, Depew, NY 14043-2495

E-Mail: [info@pcb.com](mailto:info@pcb.com)

Website: [www.pcb.com](http://www.pcb.com)

24-hour SensorLine<sup>SM</sup>: 716-684-0001

Fax: 716-684-0987

Toll-free: 800-828-8840

ISO 9001 CERTIFIED • AS9100 CERTIFIED

In the interest of constant product improvement, specifications are subject to change without notice.

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SensorLine<sup>SM</sup> is a service mark of PCB Group, Inc.

Manual Number: 64548

Manual Revision: NR

ECO# 45478

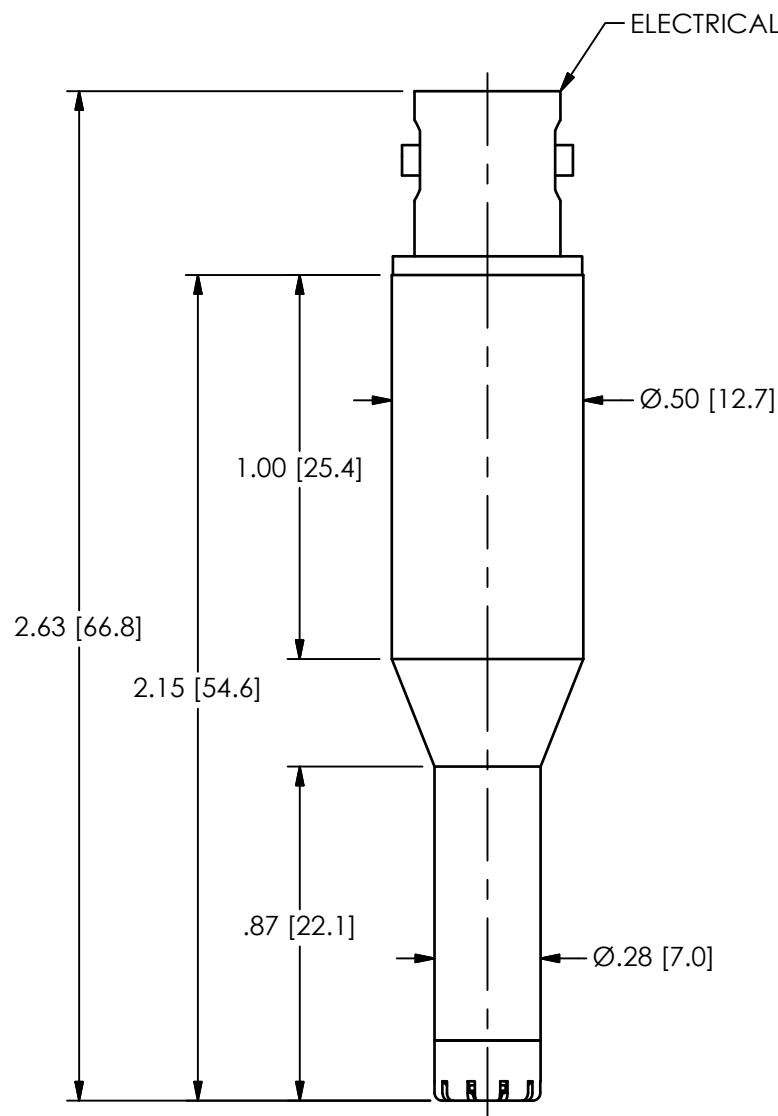
Printed in the U.S.A.

Model Number 130F22		ICP® ELECTRET ARRAY MICROPHONE		Revision: NR ECN #: 45478	
<b>Performance</b> Nominal Microphone Diameter Frequency Response Characteristic(at 0° incidence) Frequency Response(± 2 dB) Frequency Response(± 3 dB) Frequency Response(± 4 dB) Phase Match(100 Hz to 3 kHz) Phase Match(50 Hz to 5 kHz) Phase Match(5 kHz to 10 kHz) Sensitivity Sensitivity(+/-3)( @ 250 Hz) Inherent Noise(Linear) Inherent Noise(A Weighted) Inherent Noise(A Weighted) Dynamic Range(3% Distortion Limit) TEDS Compliant		<b>ENGLISH</b> 1/4" Free-Field 20 to 10,000 Hz 10 to 16,000 Hz 10 to 20,000 Hz ± 3 ° ± 5 ° ± 10 ° 45 mV/Pa -26.9 dB re 1 V/Pa 29 dB re 20 µPa <26 dB(A) re 20 µPa 24 dB(A) re 20 µPa >122 dB re 20 µPa Yes		<b>SI</b> 1/4" Free-Field 20 to 10,000 Hz 10 to 16,000 Hz 10 to 20,000 Hz ± 3 ° ± 5 ° ± 10 ° 45 mV/Pa -26.9 dB re 1 V/Pa 29 dB re 20 µPa <26 dB(A) re 20 µPa 24 dB(A) re 20 µPa >122 dB re 20 µPa Yes	
<b>Environmental</b> Temperature Range(Operating) Temperature Effect on Output(-10 to +50 °C)		+14 to +122 °F 0.7 dB		-10 to +50 °C 0.7 dB	
<b>Electrical</b> Excitation Voltage Constant Current Excitation Output Bias Voltage Output Impedance		18 to 30 VDC 2 to 20 mA 5.5 to 14 VDC <150 Ohm		18 to 30 VDC 2 to 20 mA 5.5 to 14 VDC <150 Ohm	
<b>Physical</b> Housing Material Electrical Connector(Output) Size (Diameter x Length)(overall) Weight		Stainless Steel SMB coaxial socket 0.28 in x 2.32 in 0.30 oz		Stainless Steel SMB coaxial socket 7.0 mm x 59.0 mm 8.5 gm	
 [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.	
				<b>NOTES:</b> [1]Typical. [2]TEDS Capable Digital Communication, compliant with IEEE 1451.4 [3]See PCB Declaration of Conformance PS023 for details.	
				Entered: LK    Engineer: TP    Sales: MV    Approved: MT    Spec Number:	
				Date: 6/21/2016    Date: 6/21/2016    Date: 6/21/2016    Date: 6/21/2016    63462	
				 3425 Walden Avenue, Depew, NY 14043 Phone: 716-684-0001 Fax: 716-684-0987 E-Mail: info@pcb.com	

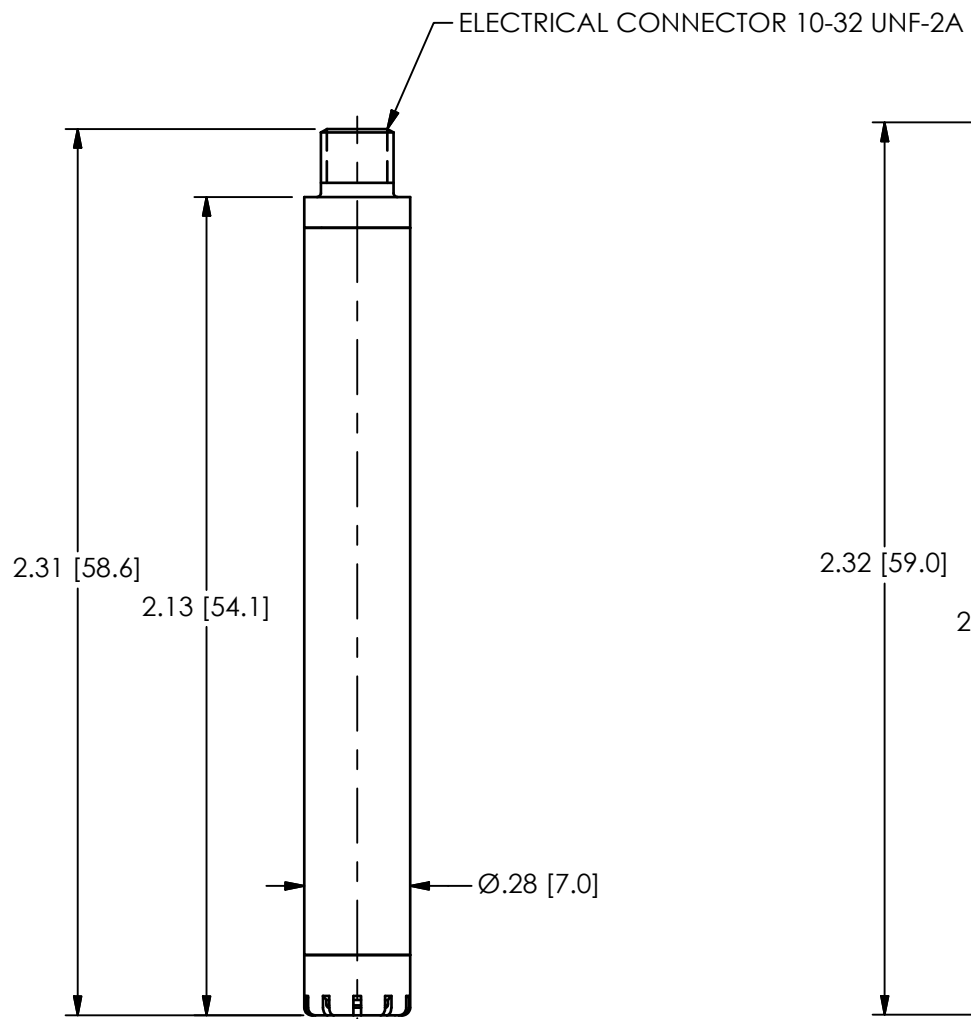
63459

PCB Piezotronics Inc. claims proprietary rights in the information disclosed hereon. Neither it nor any reproduction thereof will be disclosed to others without the written consent of PCB Piezotronics Inc.

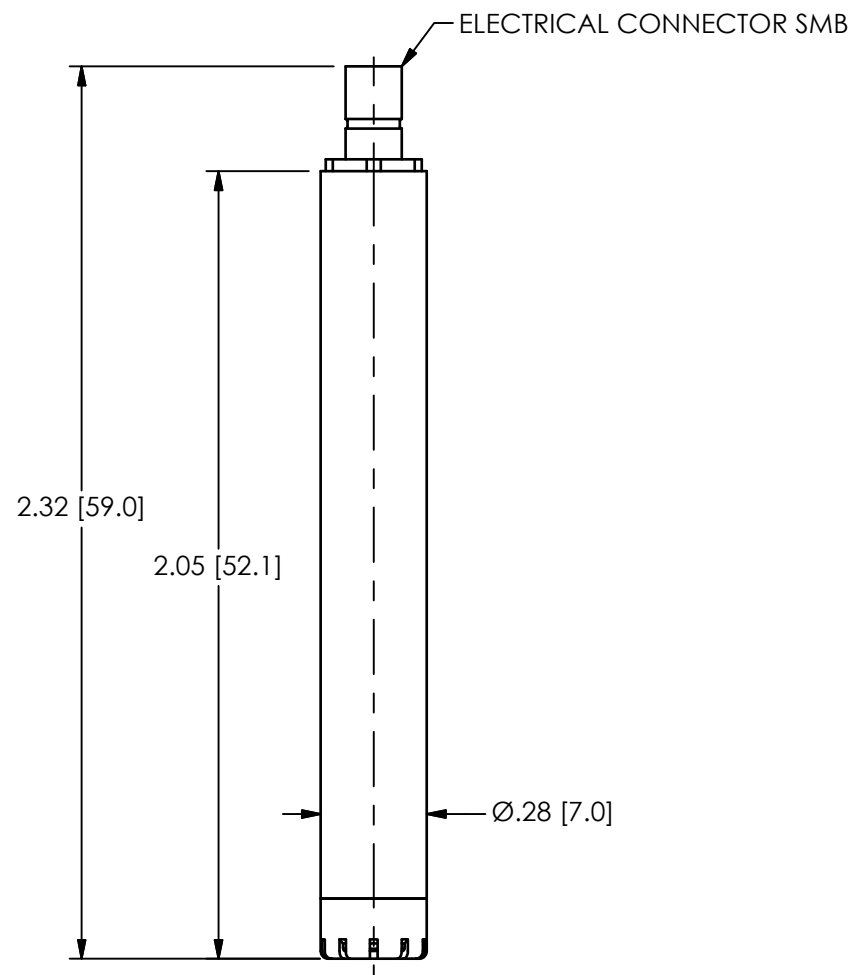
REVISIONS		
REV	DESCRIPTION	DIN
NR	RELEASED TO DRAFTING	45478




# MODEL 130F20



MODEL 130F21



MODEL 130F22

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN		CHECKED		ENGINEER		<div> <b>PCB PIEZOTRONICS™</b></div> <div>3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 E-MAIL: sales@pcb.com</div>	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [ IN BRACKETS ]	KRM	6/15/16	ECB	6/15/16	NJL	6/15/16		
DECIMALS XX ±.03 XXX ±.010	DECIMALS X ± 0.8 XX ± 0.25	TITLE  OUTLINE DRAWING MODEL 130F SERIES ICP MICROPHONE						CODE IDENT. NO. 52681	DWG. NO.  63459
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES							SCALE: 2X	SHEET 1 OF 1
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13								