



## **Model 137B32**

**Quartz, free-field, ICP® blast pressure pencil probe, front sensor is 250 psi, 20 mV/psi, rear sensor is a placebo, 4-pin connector**

### **Installation and Operating Manual**

**For assistance with the operation of this product,  
contact the PCB Piezotronics, Inc.**

**Toll-free: 716-684-0001  
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)**



# OPERATION MANUAL FOR FREE FIELD BLAST PRESSURE PROBE Models 137B21X, B22X, B23X, B24X

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## 1.0 INTRODUCTION

The Series 137B2XX Free Field Blast ICP® Pressure Probe is designed for measuring free field blast and shock tunnel pressure time profiles.

Designed with an ICP® built-in source follower amplifier, the 137B2XX Series offers sensitivities of 1, 20, 10 and 100 mV/psi with full-scale ranges from 0 to 50, 250, 500 or 5000 psi. The 137B2XX Series is constructed with a stable quartz piezoelectric element in an Invar housing

## 2.0 INSTALLATION

In field blast measurements, mount the Series 137B2XX pressure probe in an axial direction to the blast source. The probes should be elevated high enough off of the ground such that ground does not interfere with the measured pressure. See photo 1.

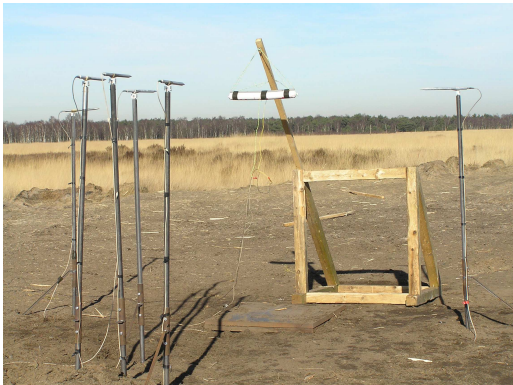


Photo 1

The sensing surface should be aligned in a vertical plane with respect to the ground as shown in photo 2. Avoiding direct exposure of the diaphragm to sunlight is good practice so that changing temperatures throughout a test day do not change the sensitivity of the sensor. In any case care must be taken such that the sensor's diaphragm is not oriented down to avoid ground reflections.

In some cases, where flash temperatures such as those generated by blasts and shock fronts are present, it may be necessary to thermally insulate the diaphragm to minimize signals generated by these effects.



Photo 2

Common black vinyl electrical tape has been found to be an effective thermal insulating material in many cases. One layer may be used across the end of diaphragm and adaptor. See photo 3.



Photo 3

A silicone rubber coating approximately 0.010 inch (0.25 mm) thick has also been proven effective in many applications. General Electric RTV type 106 is recommended (PCB Model 065A67). Apply the rubber coating to the surface of the diaphragm and allow it to cure in accordance with the manufacturer's instructions.

## 3.0 OPERATION

Using suitable cable, connect the sensor to one of PCB's Series 480, 481, 482, 483, or 484 signal conditioners or equivalent power supply. If using a PCB line power unit, the equipment will supply the 137B2XX with an adjustable 2 to 20 mA constant current at +22 to +30 VDC through a current-regulating circuit. If using a battery-operated unit, the constant current is 2 mA. See Guide G-0001 for powering and signal utilization information pertinent to all ICP® instrumentation.

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Switch power on and observe reading of bias monitoring voltmeter on front panel of signal conditioner.

If indicator is in green section of indicator panel, the IC amplifier is producing proper bias (8 to 14 VDC), the cable connections are normal, and the system is ready to operate.

If the pointer moves into the red area of the fault monitor meter, output is zero and a short is indicated. The short could be located in amplifier cable connectors or power unit.

If the pointer moves into the yellow area of the fault monitor meter, an open circuit is indicated with full power supply voltage.

An open circuit could be the result of a faulty amplifier, an open cable or open connectors. Check to be sure connectors are properly mated. Some PCB power units feature fault LEDs in place of a fault meter. Instead of a pointer, the fault LED will light when an open or short circuit condition is present.

Allow the sensor to thermally stabilize for about one minute. A signal drift may occur when the cable is connected to the readout instrument. This drift occurs during charging of the coupling capacitor in the power unit. The signal will stabilize in several minutes. Proceed with measurements.

Most line-powered signal conditioners manufactured by PCB have an adjustable current feature allowing a choice of input currents from 2 to 20 mA. In general, for the lowest noise (best resolution), choose the lower current ranges.

In order to maintain a high frequency response of the system when driving long cables (to hundreds or thousands of feet), use a higher current, up to 20 mA maximum. Use of low-capacitance cable (i.e. RG 62/U) and impedance-matching variable resistors are suggested to improve long cable performance characteristics. See Guide G-0001 for a discussion on cable considerations.

## 3.1 POLARITY

The 137B2XX Series produces a positive-going output voltage for increasing pressure output.

## 4.0 LOW-FREQUENCY RESPONSE

Consult Section 7.0 in General Guide G-0001 for detailed explanation of low-frequency characteristics of ICP® instrumentation.

## 5.0 CALIBRATION

Do not try to calibrate the Series 137B2XX statically. The Series 137B2XX is calibrated dynamically by PCB using a hydraulic pulse technique.

For best accuracy, use the calibration certificate supplied. Factory recalibration is available for a nominal charge.

## 6.0 MAINTENANCE

Although ICP® sensors have low-output impedance and are not usually affected by moisture, in extremely damp environments it may be well to protect cable connections with shrink tubing.

It is well to observe the following precautions in using the sensor:

1. Do not exceed specified maximum range.
2. Do not subject sensor to temperatures exceeding temperature shown on specification sheet.
3. Do not apply voltage to sensor without current-limiting diodes or other current protection.
4. Do not apply more than 20 mA of current to the sensor.

Field repair of the piezoelectric element or amplifier of the Series 137B2XX is not practicable. Thus, should a sensor in this series require servicing, refer to the warranty sheet.

**CAUTIONARY NOTE:** If sensors are left outside overnight, they should be coated with silicone oil and covered. The protective silicone oil or grease coating should also be applied when the sensors are operated in a humid or rainy environment.

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| Model Number<br>137B32                                                              |                 | ICP® PRESSURE SENSOR                                                                                                                                                                                                                      |           |                                                                                                                                                                                                                                                                                                                                | Revision: B<br>ECN #: 55416 |
|-------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Performance</b>                                                                  |                 | <b>ENGLISH</b>                                                                                                                                                                                                                            | <b>SI</b> | <b>OPTIONAL VERSIONS</b><br>Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.                                                                                                                                       |                             |
| Measurement Range(for ±5V output)                                                   | 250 psi         | 1,724 kPa                                                                                                                                                                                                                                 |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Useful Overrange(for ± 10V output)                                                  | 500 psi         | 3,447 kPa                                                                                                                                                                                                                                 | [1]       |                                                                                                                                                                                                                                                                                                                                |                             |
| Sensitivity(± 15 %)                                                                 | 20 mV/psi       | 2.90 mV/kPa                                                                                                                                                                                                                               |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Sensitivity                                                                         | 0 mV/psi        | 0 mV/kPa                                                                                                                                                                                                                                  | [2]       |                                                                                                                                                                                                                                                                                                                                |                             |
| Maximum Pressure                                                                    | 5 kpsi          | 34,474 kPa                                                                                                                                                                                                                                |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Resolution                                                                          | 0.7 mpsi        | 0.005 kPa                                                                                                                                                                                                                                 | [3]       |                                                                                                                                                                                                                                                                                                                                |                             |
| Resonant Frequency                                                                  | ≥ 400 kHz       | ≥ 400 kHz                                                                                                                                                                                                                                 |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Rise Time(Incident)                                                                 | ≤ 6.5 µ sec     | ≤ 6.5 µ sec                                                                                                                                                                                                                               |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Non-Linearity                                                                       | ≤ 1.0 % FS      | ≤ 1.0 % FS                                                                                                                                                                                                                                | [4]       |                                                                                                                                                                                                                                                                                                                                |                             |
| <b>Environmental</b>                                                                |                 |                                                                                                                                                                                                                                           |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Temperature Range(Operating)                                                        | -100 to +275 °F | -73 to +135 °C                                                                                                                                                                                                                            |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Temperature Coefficient of Sensitivity                                              | ≤ 0.05 %/°F     | ≤ 0.090 %/°C                                                                                                                                                                                                                              |           |                                                                                                                                                                                                                                                                                                                                |                             |
| <b>Electrical</b>                                                                   |                 |                                                                                                                                                                                                                                           |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Discharge Time Constant(at room temp)                                               | ≥ 0.2 sec       | ≥ 0.2 sec                                                                                                                                                                                                                                 |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Excitation Voltage                                                                  | 20 to 30 VDC    | 20 to 30 VDC                                                                                                                                                                                                                              |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Constant Current Excitation                                                         | 2 to 20 mA      | 2 to 20 mA                                                                                                                                                                                                                                |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Output Impedance                                                                    | ≤ 200 Ohm       | ≤ 200 Ohm                                                                                                                                                                                                                                 |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Output Bias Voltage                                                                 | 8 to 14 VDC     | 8 to 14 VDC                                                                                                                                                                                                                               |           |                                                                                                                                                                                                                                                                                                                                |                             |
| <b>Physical</b>                                                                     |                 |                                                                                                                                                                                                                                           |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Sensing Geometry                                                                    | Compression     | Compression                                                                                                                                                                                                                               |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Sensing Element                                                                     | Quartz          | Quartz                                                                                                                                                                                                                                    |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Housing Material                                                                    | Aluminum        | Aluminum                                                                                                                                                                                                                                  |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Diaphragm                                                                           | Invar           | Invar                                                                                                                                                                                                                                     |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Sealing                                                                             | Epoxy           | Epoxy                                                                                                                                                                                                                                     |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Electrical Connector                                                                | 4-Pin           | 4-Pin                                                                                                                                                                                                                                     |           |                                                                                                                                                                                                                                                                                                                                |                             |
| Weight                                                                              | 16.1 oz         | 456 gm                                                                                                                                                                                                                                    | [3]       |                                                                                                                                                                                                                                                                                                                                |                             |
|                                                                                     |                 |                                                                                                                                                                                                                                           |           | <b>NOTES:</b><br>[1]For +10 volt output, minimum 26 VDC supply voltage required. Negative 10 volt output may be limited by output bias.<br>[2]Rear element - see drawing #65310 for details.<br>[3]Typical.<br>[4]Zero-based, least-squares, straight line method.<br>[5]See PCB Declaration of Conformance PS023 for details. |                             |
|                                                                                     |                 |                                                                                                                                                                                                                                           |           | <b>OPTIONAL ACCESSORIES:</b><br>Model PCS-6AD Calibration of dynamic pressure sensors at 100% and 10% of sensor range for active element, including single point null verification on placebo element.                                                                                                                         |                             |
|  |                 | Entered: ND                                                                                                                                                                                                                               |           | Engineer: RPF                                                                                                                                                                                                                                                                                                                  | Sales: MV                   |
|                                                                                     |                 | Date: 12/12/2024                                                                                                                                                                                                                          |           | Date: 12/12/2024                                                                                                                                                                                                                                                                                                               | Date: 12/12/2024            |
|                                                                                     |                 |                                                                                                                                                                                                                                           |           | Approved: RPF                                                                                                                                                                                                                                                                                                                  | Spec Number:                |
|                                                                                     |                 |                                                                                                                                                                                                                                           |           | Date: 12/12/2024                                                                                                                                                                                                                                                                                                               | 67327                       |
|                                                                                     |                 |  <b>Phone: 716-684-0001</b><br><b>Fax: 716-684-0987</b><br><b>E-Mail: info@pcb.com</b><br>AN AMPHENOL COMPANY<br>3425 Walden Avenue, Depew, NY 14043 |           |                                                                                                                                                                                                                                                                                                                                |                             |

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.  
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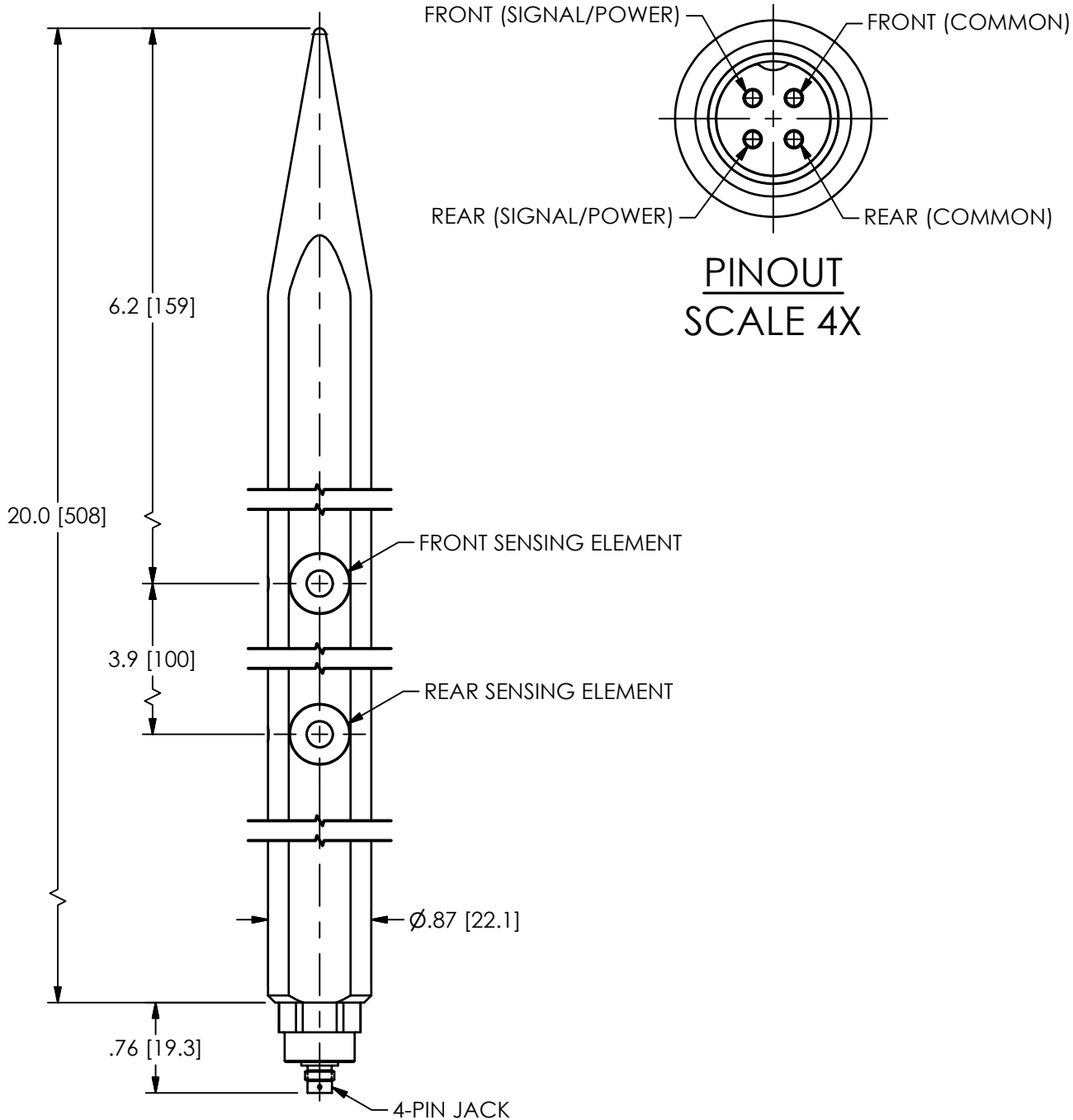
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## REVISIONS

| REV | DESCRIPTION   | DIN   |
|-----|---------------|-------|
| A   | UPDATED TITLE | 46873 |

65310



## UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:

## DIMENSIONS IN INCHES

DECIMALS XX  $\pm .03$   
XXX  $\pm .010$

ANGLES  $\pm 2$  DEGREES

FILLETS AND RADII  
.003 - .005

DIMENSIONS IN MILLIMETERS  
[IN BRACKETS]

DECIMALS X  $\pm 0.8$   
XX  $\pm 0.25$

ANGLES  $\pm 2$  DEGREES

FILLETS AND RADII  
0.07 - 0.13

## DRAWN

JDM 6/6/17

## CHECKED

JDM 6/6/17

## ENGINEER

DRK 6/6/17

## TITLE

OUTLINE DRAWING  
MODEL 137BXX  
2- SENSOR FREE FIELD BLAST PROBE

**PCB PIEZOTRONICS™**

3425 WALDEN AVE. DEPEW, NY 14043  
(716) 684-0001 E-MAIL: sales@pcb.com

CODE  
IDENT. NO.  
52681

## DWG. NO.

65310

SCALE: .75X

SHEET 1 OF 1

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