



**Model 377B26**

**PROBE MICROPHONE ICP®**

**Installation and Operating Manual**

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

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**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](http://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](http://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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## MODEL 377B26 PROBE MICROPHONE OPERATING GUIDE

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### **1.0 General Description**

The PCB<sup>®</sup> Model 377B26 Probe Microphone (see Figure 1 at right) is a compact, rugged unit for sound pressure measurement in small enclosures, harsh environments, and close proximity to sound sources. The high acoustic input impedance of the probe tip minimizes the influence on the acoustic field, while the 160 mm stainless steel probe tube can withstand temperatures of up to 800° C. The Probe Microphone is internally-compensated to equalize the static pressure at the probe tip with the internal microphone pressure.



**Figure 1: 377B26 Probe Microphone**

The probe is constructed with a detachable stainless steel probe tip, which guides the acoustical signal to a microphone inside the probe housing. The probe can be used with both stainless steel probe tips and flexible tube tips of different lengths. After being measured, the acoustical pressure wave is passed on to an impedance-matched wave guide, which eliminates internal reflections. This results in a smooth frequency response from 2 Hz to 20 kHz. The internal microphone is connected to a low noise preamplifier with high dynamic range.

The Probe Microphone consists of probe tips, a 1/4” microphone, a preamplifier, and an impedance matching tube. The microphone has a BNC connector termination for connection to ICP<sup>®</sup> signal conditioning devices.

The sound pressure at the probe tip is transmitted through the probe tip tube to the microphone and impedance matching tube inside the Probe Microphone. The microphone measures the pressure fluctuations on the microphone diaphragm, and the preamplifier converts the high impedance microphone output signal to a low impedance signal suitable for connection to a standard signal analyzer or other measurement equipment. The impedance matching tube reduces reflections and ensures a smooth frequency response of the probe microphone.

The impedance matching tube ends with a small opening inside the probe housing, ensuring that the static pressure at the probe tip is transmitted inside the Probe Microphone. The static pressure is then transmitted to the rear of the microphone to ensure that the static pressure inside the microphone is identical to the static pressure at the probe tip.

The Probe Microphone is ideal for measurements inside small enclosures or very close to a sound source, such as inside a vehicle exhaust system. In this application, the probe tip is inserted into the exhaust system pipe wall through a small 1.3 mm diameter hole.

## 2.0 Operation

The Probe Microphone is supplied with various accessories to calibrate the probe and to adapt the probe for special measurement situations. The carrying case (see Figure 2 below) includes the Probe Microphone unit and stainless steel probe tips of varying lengths. The probe set also includes a flexible probe tip and additional flexible tubing to make custom probe tips of different lengths. The length of the stainless steel probe tips can be reduced for a specific application using the file and pliers included in the set (see [Figure 3](#) on page 3).



Figure 2: Probe Microphone Set

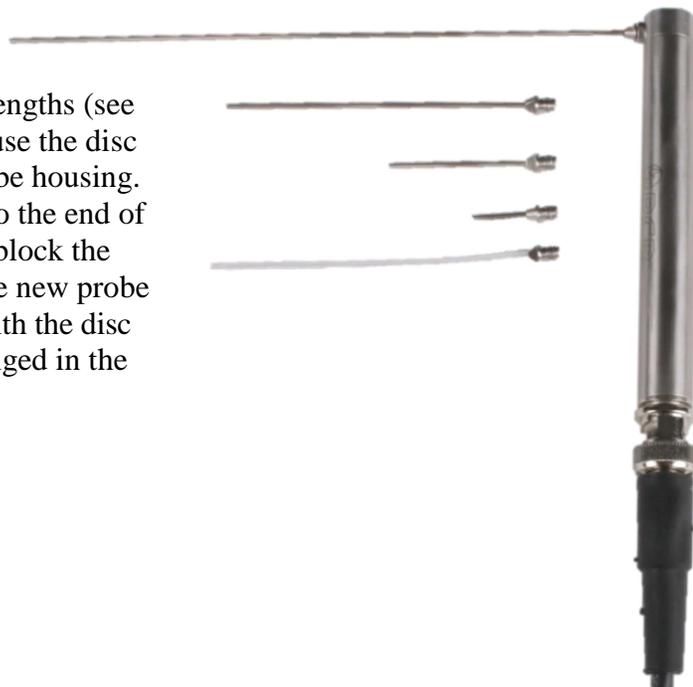


**Figure 3: Probe Microphone Tools**

The probe set includes calibration adaptors for frequency response calibration and level calibration. The two level calibration adaptors fit into a Pistonphone or calibrator intended for 1/2" microphones, and allow precise calibration with both stainless steel probe tips and flexible probe tips. Because the outer diameter of the stainless steel probe tips and the flexible tube are not the same, two different calibration adaptors are provided. The probe set also includes a calibration adaptor for frequency response calibration. This is intended for use with one 1/2" microphone and one 1/4" microphone used as emitting and receiving microphones respectively (these microphones are not included in the probe system). The probe set's aluminum disc acts both as a heat shield and as a tool to loosen and tighten the probe tips in the probe housing. Additionally, a tube of o-ring grease is included for sealing small leaks.

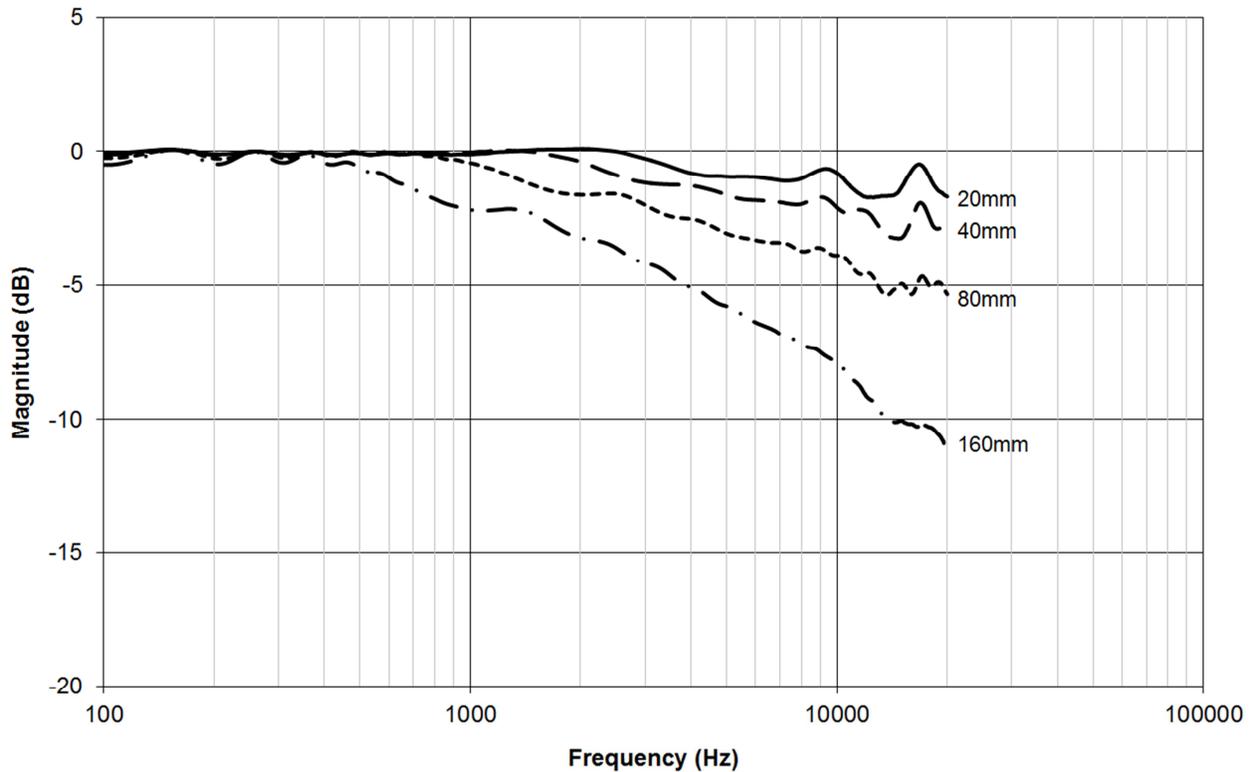
### **3.0 Changing the Probe Tips**

The Probe Microphone includes four (4) stainless steel probe tips of different lengths (see Figure 4 at right). To change probe tips, use the disc tool to remove the probe tip from the probe housing. Apply a very thin layer of o-ring grease to the end of the new probe tip (be very careful not to block the probe tip hole with the grease). Mount the new probe tip on the probe housing, and tighten it with the disc tool. The flexible tube probe tips are changed in the same way.



**Figure 4: Probe Tips**

The frequency response of the Probe Microphone depends on the probe tip length and diameter. Due to the damping of the pressure wave in the thin tubes, a long tube will reduce the transmitted signal at higher frequency. Figure 5 below shows the signal reductions as a function of frequency caused by different lengths of stainless steel probes. To obtain the pressure response for a specific probe tube length, the response should be corrected with the appropriate value, as shown in Figure 5. The values are provided in [Table 1](#) on page 5. For lengths other than those shown in the table, interpolate between the stated values.

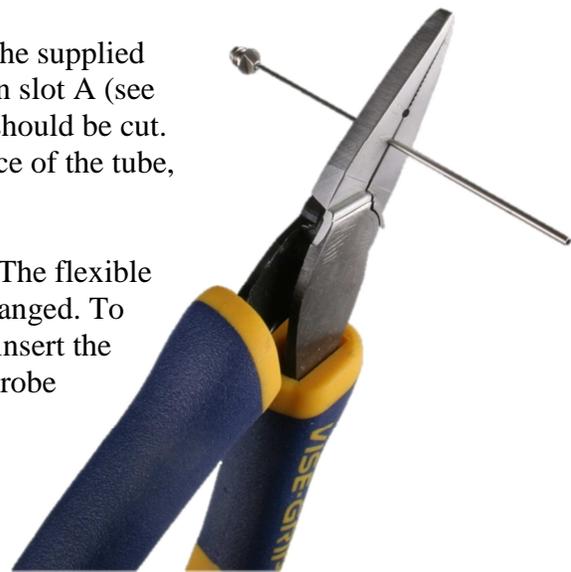


**Figure 5: Typical Frequency Response for Different Probe Tip Lengths**

#### 4.0 Other Probe Tip Lengths

The stainless steel tubes can be cut to length using the supplied pliers and file. Insert the probe tube into the pliers in slot A (see Figure 6 at right), near the position where the tube should be cut. Use the file to file a groove around the circumference of the tube, and gently break off the tube.

The flexible tube can be cut with a pair of scissors. The flexible tube in the probe tip thread can be removed or exchanged. To remove the flexible tube from the probe tip thread, insert the flexible tube into the pliers in slot B. Unscrew the probe tip thread by turning it in a clockwise direction. To mount a new flexible tube in the probe tip thread, insert the flexible tube into the pliers in slot B and screw the probe tip thread onto the flexible tube by turning it in a counter-clockwise direction.



**Figure 6: Probe tip in lower diameter slot of pliers**

## 5.0 Correction Values for Different Probe Tip Lengths

**Table 1 Correction Values**

<i>Frequency (Hz)</i>	<i>20mm</i>	<i>40mm</i>	<i>80mm</i>	<i>160mm</i>
2.0	0.63	0.63	0.63	0.63
2.5	0.63	0.63	0.63	0.63
3.2	0.63	0.63	0.63	0.63
4.0	0.63	0.63	0.63	0.63
5.0	0.63	0.63	0.63	0.63
6.3	0.63	0.63	0.63	0.63
8.0	0.63	0.63	0.63	0.63
10	0.63	0.63	0.63	0.63
13	0.63	0.63	0.63	0.63
16	0.63	0.63	0.63	0.63
20	0.59	0.59	0.59	0.59
25	0.54	0.54	0.54	0.54
32	0.45	0.45	0.45	0.45
40	0.36	0.36	0.36	0.36
50	0.27	0.27	0.27	0.27
63	0.18	0.18	0.18	0.18
80	0.14	0.14	0.14	0.14
100	0.09	0.09	0.09	0.09
125	0.05	0.05	0.05	0.05
160	0.00	0.00	0.00	0.00
225	0.00	0.00	0.00	0.00
250	0.00	0.00	0.00	0.00
315	0.00	0.00	0.00	-0.20
400	0.00	0.00	0.00	-0.40
500	0.00	0.00	-0.10	-0.60
630	0.00	0.00	-0.20	-1.00
800	0.00	-0.10	-0.30	-1.40
1000	0.00	-0.20	-0.50	-1.80
1250	-0.20	-0.30	-0.70	-2.20
1600	-0.26	-0.40	-0.90	-2.60
2000	-0.32	-0.50	-1.10	-3.00
2500	-0.44	-0.80	-1.50	-3.40
3150	-0.68	-1.10	-1.90	-4.00
4000	-0.80	-1.40	-2.30	-4.80
5000	-0.92	-1.70	-2.90	-5.60
6300	-1.16	-2.00	-3.50	-6.60
8000	-1.16	-2.30	-4.10	-7.60
10000	-1.16	-2.60	-4.70	-8.60
12500	-1.42	-2.90	-5.30	-9.60
16000	-1.64	-3.20	-5.90	-10.60
20000	-1.86	-3.50	-6.50	-11.60

## 6.0 High Temperature Shielding

For very high temperature applications, only a stainless steel probe tip should be used. To protect from heat conduction through the probe tip, mount the disc tool on the probe tip between the hot end of the probe tip and the probe body. If the probe tip remains below the rated temperature for its length, there will be no significant increase in the temperature of the probe body. The operating temperature of the probe system is limited only by the length of the probe tip chosen for a particular application.

## 7.0 Level Calibration

To calibrate the Probe Microphone with a Pistonphone such as the PCB<sup>®</sup> Model CAL250, insert the appropriate 1/2" calibration adaptor into the calibrator or Pistonphone. The probe set comes with two 1/2" calibration adaptors, one for the stainless steel probe tips and one for the flexible tube probe tips. Insert the probe tip into the calibration adaptor and turn on the handheld calibrator. For the Model CAL250, the sound pressure at the probe tip will be 114 dB re 20 µPa. The CAL250 automatically compensates for changes in the barometric pressure.

## 8.0 Frequency Response Calibration

The frequency response can be performed either as a free-field calibration using a suitable 1/4" microphone in an anechoic chamber, or as a pressure calibration using the frequency calibration adaptor included with the Probe Microphone. To use the adaptor, an additional emitting microphone and receiving microphone are required. These are not included with the Probe Microphone.

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Manual Number: 55700  
Manual Revision: NR  
ECN 42045



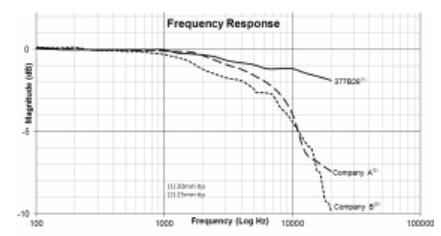
Printed in the U.S.A.

	ENGLISH	SI	
<b>Performance</b>			
Open Circuit Sensitivity (at 250 Hz)	2.15 mV/Pa	2.15 mV/Pa	[5]
Open Circuit Sensitivity (+/-2 dB) (at 250 Hz)	-53.35 dB re 1 V/Pa	-53.35 dB re 1 V/Pa	[5]
Frequency Range (+2.2/-4.9 dB)	2 to 20000 Hz	2 to 20000 Hz	[6]
Lower Limiting Frequency (-3 dB)	0.25 to 3.0 Hz	0.25 to 3.0 Hz	
Dynamic Range (3% Distortion Limit)	>164 dB re 20 µPa	>164 dB re 20 µPa	
Inherent Noise	<45 dB(A) re 20 µPa	<45 dB(A) re 20 µPa	
<b>Environmental</b>			
Temperature Range (Operating)	-40 to +158 °F	-40 to +70 °C	[2]
Temperature Range (160mm Probe Tip)	-40 to +1472 °F	-40 to +800 °C	[3][4]
Temperature Range (20mm Probe Tip)	-40 to +752 °F	-40 to +400 °C	[4]
Temperature Range (40mm Probe Tip)	-40 to +1472 °F	-40 to +800 °C	[3][4]
Temperature Range (80mm Probe Tip)	-40 to +1472 °F	-40 to +800 °C	[3][4]
<b>Electrical</b>			
Polarization Voltage	0 V	0 V	[1]
Excitation Voltage	20 to 32 VDC	20 to 32 VDC	
Constant Current Excitation	2 to 20 mA	2 to 20 mA	
Output Impedance	<50 Ohm	<50 Ohm	
<b>Physical</b>			
Housing Material	Stainless Steel	Stainless Steel	
Probe Material	Stainless Steel	Stainless Steel	
Electrical Connector	BNC Jack	BNC Jack	
Size (Diameter) (with grid)	0.5 in	12.7 mm	
Size (Length)	4.4 in	111 mm	
Weight	1.9 oz	55 gm	[7]

**Optional Versions** (Optional versions have identical specifications and accessories as listed for standard model except where noted below. More than one option maybe used.)

- Notes**
- [1] Prepolarized
  - [2] Probe microphone body.
  - [3] With heat sink.
  - [4] At probe tip end
  - [5] Individually calibrated with 20mm probe tip.
  - [6] Individually calibrated with 20mm probe tip (20 Hz to 20 kHz).
  - [7] Typical.
  - [8] See PCB Declaration of Conformance PS076 for details.

- Supplied Accessories**
- 012A10 Extension cable, black coaxial (RG58/U), 10-ft, BNC plug to BNC plug (1)
  - 100-11129-30 FILE (1)
  - 100-11509-90 GREASE (1)
  - 51606-01 HEAT SINK/DISC TOOL (1)
  - 51607-01 CALIBRATION ADAPTOR FOR METAL PROBE (1)
  - 51607-02 CALIBRATION ADAPTOR FOR FLEXABLE PROBE (1)
  - 53434-01 20mm PROBE TIP (1)
  - 53434-02 40mm PROBE TIP (1)
  - 53434-03 80mm PROBE TIP (1)
  - 53434-04 160mm PROBE TIP (1)
  - 54073-01 CLEANING TUBE (1)
  - 55103-01 PLIERS (1)
  - 55454-01 FLEXIBLE TUBING (1)
  - 55455-01 80mm FLEXIBLE PROBE TIP (1)
  - 56508-01 CALIBRATION COUPLER (1)
  - ACS-42 Calibration of microphone with preamplifier (1)



Entered: AP	Engineer: MJN	Sales: MV	Approved: MT	Spec Number:
Date: 11/27/2013	Date: 11/26/2013	Date: 11/26/2013	Date: 11/26/2013	<b>54896</b>

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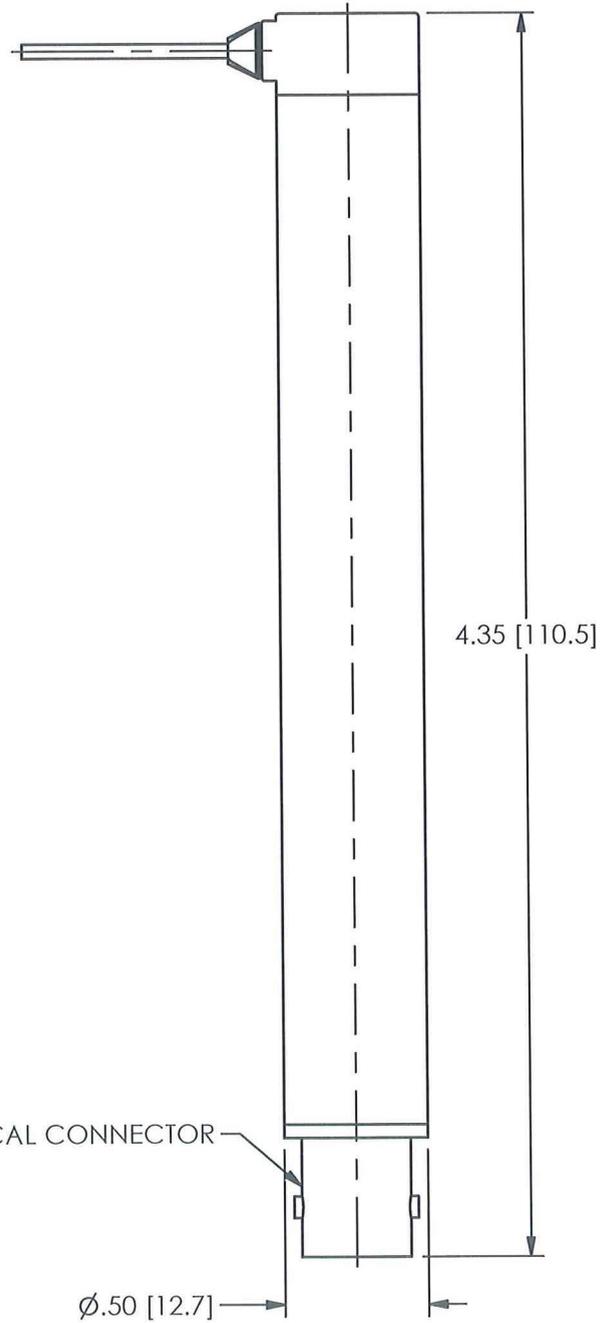
REVISIONS

REV	DESCRIPTION	DIN
NR	RELEASED TO DRAFTING	42045

54895

B

B



ELECTRICAL CONNECTOR  
BNC

Ø.50 [12.7]

4.35 [110.5]

A

A

1.) SHOWN WITH 20MM TIP INSTALLED

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:

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

DRAWN		CHECKED		ENGINEER	
JDM	11/21/13	<i>gm</i>	<i>v/wh</i>	MJN	11/21/13

TITLE  
 OUTLINE DRAWING  
 MODEL 377B26  
 ICP PROBE MICROPHONE

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SCALE: 1.5X	SHEET 1 OF 1

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jmorawski 11:02 11/21/2013