



Model 113B27

High frequency ICP® pressure sensor, 100 psi, 50 mV/psi, 0.218" dia. diaphragm, accel. comp.

Installation and Operating Manual

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

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24-hour SensorLine: 716-684-0001
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OPERATION MANUAL FOR QUARTZ PRESSURE SENSORS SERIES 102 SERIES 113

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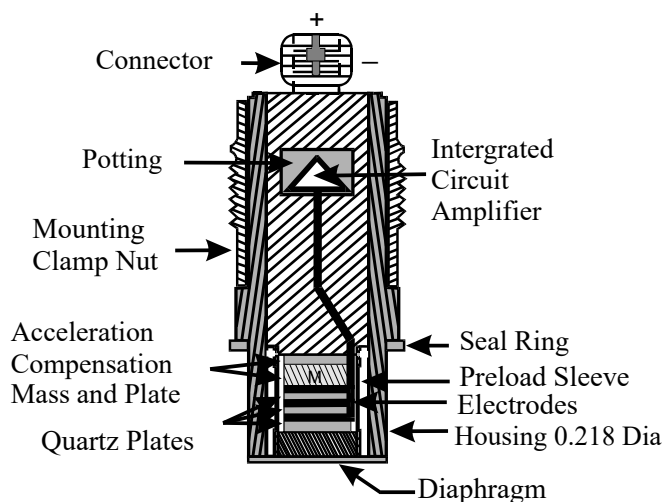
1.0 INTRODUCTION

This series of miniature dynamic pressure sensors is specifically designed for shock tube and blast wave measurements and for other applications requiring very high frequency, near non-resonant response.

The term used to describe the transient response of this model series is "Frequency Tailoring" and it encompasses several mechanical and electrical design features coupled with stringent in-process fabrication/test procedures with heavy emphasis on the shock tube as a tool.

2.0 DESCRIPTION

Although this series consists of sensors with three basic mechanical configurations and six different sensitivities, each model is basically similar in internal design.



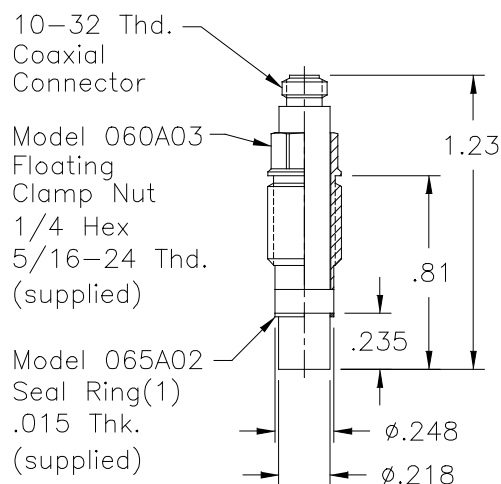
Typical ICP® Probe Style Sensor

Each utilizes the acceleration-compensated Series 113 quartz piezoelectric element coupled to a source follower type miniature electronics. (See "General Guide to ICP® Instrumentation," G-0001, for a detailed description of the ICP® concept.)

The figure above shows the components of the basic ICP® probe, i.e. the piezoelectric element and the ICP® source follower amplifier. These components are joined together as an inseparable sealed assembly at the factory. Disassembly should not be attempted in the field.

Series 113B2x are in a probe configuration and are installed with a hollow clamp nut with 5/16-24 or M7x0.75 external threads. The housing of these models is at electrical ground potential.

Series 113B3x are similar to the B2x Series with an additional feature; all Invar construction. The all Invar sensors are designed to have minimal susceptibility to thermal transient events and are specifically suited for high-temperature shock and blast measurements.



Series 113: Probe Style Sensor

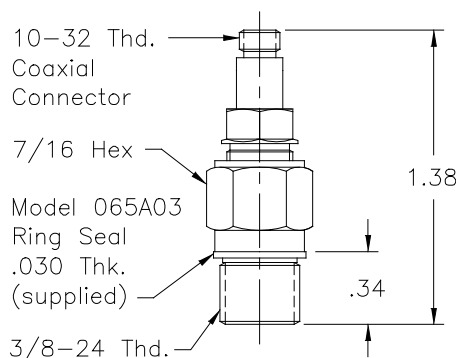
Series 102 consist of the basic 113 Series probe, as in the above mentioned series, mounted in a 3/8-24 or M10 x 1.0 threaded mounting adaptor. The probe is installed at the factory in an "off ground" configuration, i.e. the probe body is insulated from the external mounting adaptor body.

The Model 102A12 utilizes the same inner probe design as the above two designs but in a 3/8-24 or

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M10x 1.0 threaded adaptor with floating seal to allow adjustment of diaphragm mounting depth where it is necessary to adapt to various wall thicknesses. These models are supplied only as low-pressure (250 psi and 100 psi) sensors and are also "off ground".



Series 102: Thread Mount Design, Ground-Isolated Sensor

3.0 INSTALLATION

This manual contains outline and installation information for your specific model.

Prepare mounting ports in accordance with instructions given in specific installation drawings, paying particular attention to sealing surfaces. These surfaces must be smooth and free from chatter marks, nicks and other irregularities which could preclude a pressure tight seal.

To fully realize the high-frequency response capabilities of this sensor series, flush mounting of the diaphragm must be used.

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.

Common black vinyl electrical tape has been found to be an effective insulating material in many cases. One or more layers may be used across the end of diaphragm and adaptor.

A silicone rubber coating approximately .010" thick has also been proven effective in many applications. General Electric RTV type 106 is recommended. Apply the rubber coating to the surface of the diaphragm and allow it to cure in accordance with the manufacturer's instructions. (If you have ordered the CA option, ablative coated models, further protection will not be necessary.)

Although ICP® sensors have low-output impedance and in general are not affected by moisture, in extreme environments it is good practice to protect cable connections with shrink tubing.

It is not necessary to use low-noise cable with this sensor series. In fact, an optional Model 070B09 Solder Connector Adaptor allows the use of ordinary two-wire cable if desired.

4.0 OPERATION

It is only necessary to supply the sensor with a 2 to 20 mA constant current at +20 to +30 VDC through a current-regulating diode or equivalent circuit. (See guide G-0001 for powering and signal utilization information pertaining to all ICP® instrumentation).

Most of the signal conditioners manufactured by PCB have an adjustable current feature allowing a choice of input currents from 2 to 20 mA. In general, for lowest noise (best resolution), choose the lower current ranges. For driving long cables (to several thousand feet), use higher current, up to 20 mA maximum.

To operate system using a PCB signal conditioner:

1. Switch power on.
2. Wait several minutes for the IC amplifier to turn on and stabilize.
3. Proceed with measurements.

5.0 POLARITY

The sensors in this series produce a positive-going output voltage for increasing pressure input.

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6.0 LOW-FREQUENCY RESPONSE

The low-frequency response of an ICP® system is determined by:

1. The discharge T.C. of the sensor
2. If AC-coupled at power unit, the coupling time constant.

Consult Section 7.0 in guide G-0001 detailed explanation of low-frequency characteristics of ICP® instruments.

7.0 HIGH-FREQUENCY RESPONSE

Frequency tailoring and the very high-natural frequency of the sensor give an extremely wide usable frequency range (beyond 100 kHz). Exceptionally fast response time (1 µsec) and clean, virtually non-resonant response to rapid step functions are also features of these sensors. As mentioned previously, the diaphragm must be flush-mounted to fully realize the high-frequency response capabilities of this series.

8.0 CALIBRATION

Piezoelectric sensors are dynamic devices, but static calibration means can be employed if discharge time constants are sufficiently long. Generally, static methods are not employed below several hundred seconds time constant.

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To employ static means, direct couple the sensor to the DVM readout using a T-Connector from the sensor jack or use the Model 484B06 or 482C24 in the calibrate mode. Apply pressure with dead weight tester and take readings quickly. Release pressure after each calibration point.

For the shorter time constant, rapid step functions of pressure are generated by a pneumatic pressure pulse calibrator or dead weight tester and readout is by recorder or storage oscilloscope.

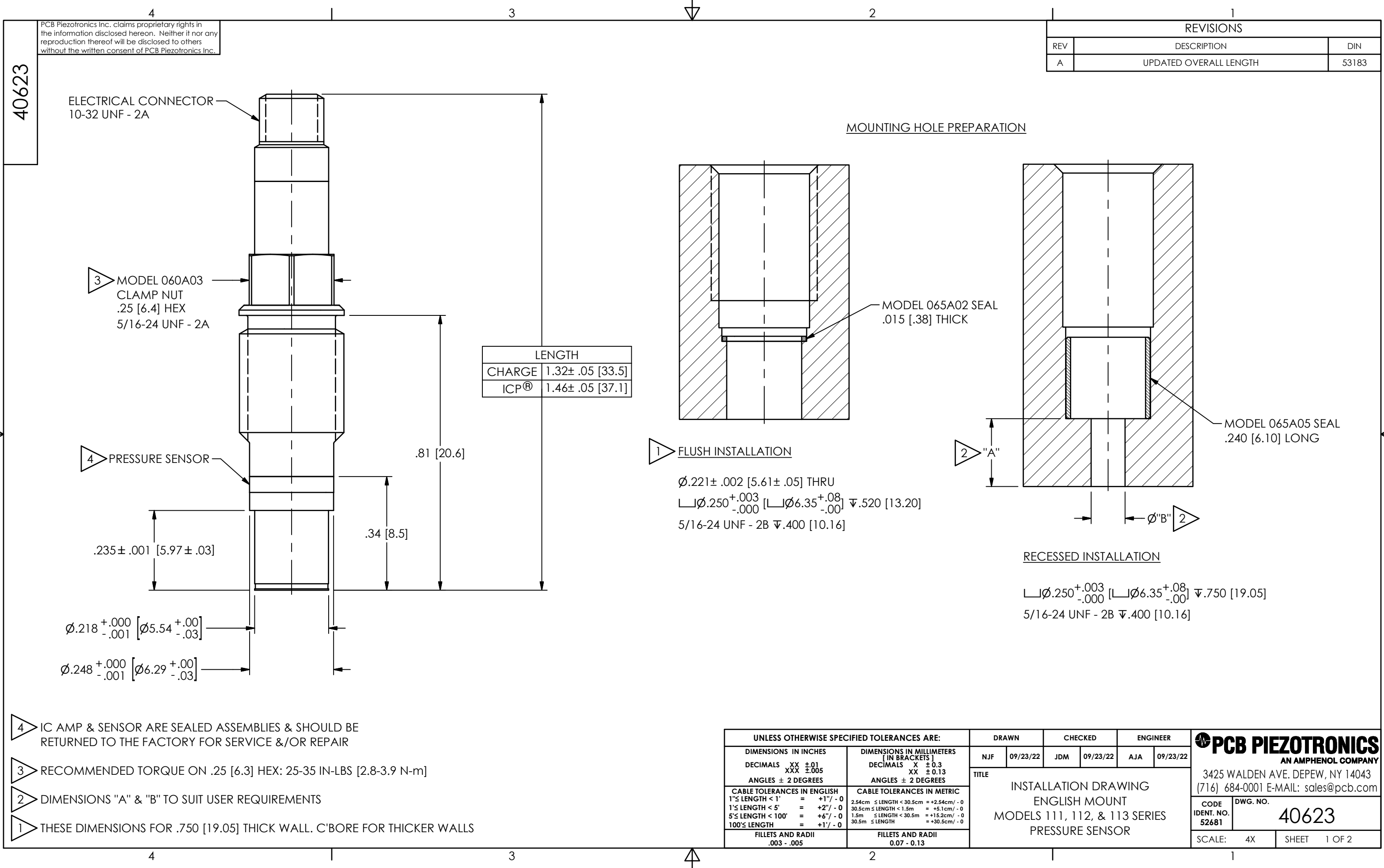
PCB offers a complete calibration service. Consult factory for details.

Drawing Number: 21075

Revision: D

ECN Number: 53304

Model Number 113B27		ICP® PRESSURE SENSOR			Revision: F ECN #: 54949
Performance		ENGLISH	SI		OPTIONAL VERSIONS
Measurement Range(for ±5V output)		100 psi	689.4 kPa		Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.
Useful Overrange(for ± 10V output)		200 psi	1378.8 kPa	[1]	
Sensitivity(± 15 %)		50 mV/psi	7.25 mV/kPa		CA - Ablative Coating [5]
Maximum Pressure		1 kpsi	6,895 kPa		
Resolution		1 mpsi	0.007 kPa	[2]	E - Emralon coating [6] Coating Emralon Emralon Electrical Isolation 10 ⁸ Ohm 10 ⁸ Ohm
Resonant Frequency		≥ 500 kHz	≥ 500 kHz		
Rise Time		≤ 1.0 μ sec	≤ 1.0 μ sec		Supplied Accessory: Model 065A08 Isolation ring 0.250"OD x 0.218" ID x 0.027" thk anodized aluminum (3) Supplied Accessory: Model 065A22 Isolation Seal, .250" OD x .218" ID x .015", Torlon or Vespel (3) [6][5]
Low Frequency Response(- 5 %)		0.5 Hz	0.5 Hz		
Non-Linearity		≤ 1.0 % FS	≤ 1.0 % FS	[3]	J - Ground Isolated [6] Electrical Isolation(50 V) 10 ⁸ Ohm 10 ⁸ Ohm
Environmental					
Acceleration Sensitivity		0.002 psi/g	0.0014 kPa/(m/s ²)	[2]	N - Negative Output Polarity [6]
Temperature Range(Operating)		-100 to +275 °F	-73 to +135 °C		
Temperature Coefficient of Sensitivity		≤ 0.03 %/°F	≤ 0.054 %/°C		S - Stainless Steel Diaphragm [6][7] Diaphragm 316L Stainless Steel 316L Stainless Steel
Maximum Flash Temperature		3,000 °F	1,649 °C		
Maximum Vibration		2,000 g pk	19,600 m/s ² pk		W - Water Resistant Cable [6][7] Supplied Accessory: Model 060A03 Clamp nut, 5/16-24-2A thd, 1/4" hex, stainless steel (1)
Maximum Shock		20,000 g pk	196,000 m/s ² pk		
Electrical					WM - Water Resistant Cable [6][7] Supplied Accessory: Model 060A05 Clamp nut M7 x 0.75-6g thd (1)
Output Polarity(Positive Pressure)		Positive	Positive		
Discharge Time Constant(at room temp)		≥ 1.0 sec	≥ 1.0 sec		NOTES: [1]For +10 volt output, minimum 24 VDC supply voltage required. Negative 10 volt output may be limited by output bias. [2]Typical. [3]Zero-based, least-squares, straight line method. [4]See PCB Declaration of Conformance PS023 for details. [5]Used with optional mounting adaptor. [6]For sensor mounted in thread adaptor, see adaptor installation drawing for supplied accessories and pressure limitations. [7]Clamp nut installed prior to cable attachment
Excitation Voltage		20 to 30 VDC	20 to 30 VDC		
Constant Current Excitation		2 to 20 mA	2 to 20 mA		SUPPLIED ACCESSORIES: Model 060A03 Clamp nut, 5/16-24-2A thd, 1/4" hex, stainless steel (1) Model 060A05 Clamp nut M7 x 0.75-6g thd (1) Model 065A02 Seal ring, sensor flush mount, 0.248" OD x 0.219" ID x 0.015" thk, brass (3) Model 065A05 Seal sleeve sensor recess mount 0.248" OD x 0.221" ID x 0.240" thk 17-7 (1) Model PCS-1AZ Sensitivity calibration at 100% and 10% of sensor range
Output Impedance		< 100 Ohm	< 100 Ohm		
Output Bias Voltage		8 to 14 VDC	8 to 14 VDC		Entered: ND Engineer: AJA Sales: RWM Approved: RPF Spec Number: Date: 06/26/2024 Date: 06/26/2024 Date: 06/26/2024 Date: 06/26/2024 40651
Physical					
Sensing Geometry		Compression	Compression		CE UK CA [4]
Sensing Element		Quartz	Quartz		
Housing Material		17-4 Stainless Steel	17-4 Stainless Steel		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 Piezotronics, Inc.
Diaphragm		Invar	Invar		
Sealing		Welded Hermetic	Welded Hermetic		PCB PIEZOTRONICS AN AMPHENOL COMPANY Phone: 716-684-0001 Fax: 716-684-0987 E-Mail: info@pcb.com
Electrical Connector		10-32 Coaxial Jack	10-32 Coaxial Jack		
Weight(with clamp nut)		0.16 oz	4.5 gm		3425 Walden Avenue, Depew, NY 14043



REVISIONS		
REV	DESCRIPTION	DIN
A	UPDATED OVERALL LENGTH	53183

LENGTH	
CHARGE	1.32± .05 [33.5]
ICP®	1.46± .05 [37.1]

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN		CHECKED		ENGINEER		 PCB PIEZOTRONICS AN AMPHENOL COMPANY 3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 E-MAIL: sales@pcb.com	
DIMENSIONS IN INCHES		NJF		JDM		AJA			
DECIMALS XX ±.01 XXX ±.005		09/23/22		09/23/22		09/23/22			
ANGLES ± 2 DEGREES		TITLE							
CABLE TOLERANCES IN ENGLISH		INSTALLATION DRAWING							
1"≤ LENGTH < 1' = +1"/ - 0		ENGLISH MOUNT							
1'≤ LENGTH < 5' = +2"/ - 0		MODELS 111, 112, & 113 SERIES							
5'≤ LENGTH < 100' = +6"/ - 0		PRESSURE SENSOR							
100'≤ LENGTH = +1' / - 0									
FILLETS AND RADII .003 - .005									

