



Model 106B51
ICP® Pressure Sensor
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



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
Repair inquiries: rma@pcb.com

For a complete list of distributors, global offices and sales representatives, visit our website, 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	0	0	0	0	0	0
PCB板	X	0	0	0	0	0
电气连接器	0	0	0	0	0	0
压电晶体	X	0	0	0	0	0
环氧	0	0	0	0	0	0
铁氟龙	0	0	0	0	0	0
电子	0	0	0	0	0	0
厚膜基板	0	0	X	0	0	0
电线	0	0	0	0	0	0
电缆	X	0	0	0	0	0
塑料	0	0	0	0	0	0
焊接	X	0	0	0	0	0
铜合金/黄铜	X	0	0	0	0	0
本表格依据 SJ/T 11364 的规定编制。						
0：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.

OPERATION MANUAL FOR HIGH INTENSITY MICROPHONES MODELS 106B, 106B10, 106B50

1.0 INTRODUCTION

The Series 106B microphones feature high-sensitivity, acceleration-compensated quartz pressure elements coupled to built-in integrated circuit impedance converting amplifiers.

These very sensitive sensors are designed to measure pressure perturbations in air or in fluids in severe environments. They can also be used to measure very small pressure disturbances on a much higher static head, with certain precautions.

2.0 DESCRIPTION

The quartz elements in the 106B Series utilize a special cut in quartz to produce a proportionately higher output voltage than the standard X-cut compression crystals normally used.

A built-in seismic mass acting on another quartz crystal effectively cancels the spurious signal produced by the mass of the diaphragm and end piece acting upon the very sensitive crystals in the presence of axial vibration inputs.

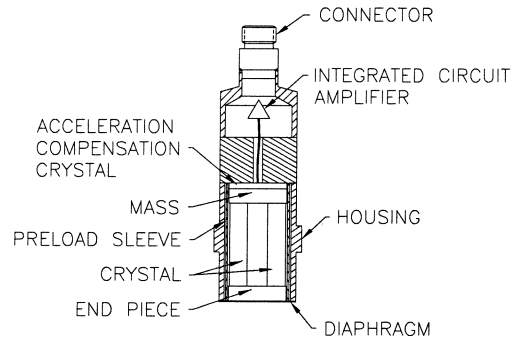
This design produces an extremely high level output signal with good resolution, relatively free from unwanted vibration effects.

As with all quartz sensors, the high rigidity results in negligible diaphragm motion producing excellent linearity from the threshold pressure to full-scale pressure. The high rigidity of quartz also results in sensors with high natural frequency, giving a very wide useful frequency range.

Although the same basic quartz element is used in both models, the sensitivity of the 106B50 is twice that of the 106B, the result of a larger diaphragm area in the B50.

The Model 106B10 consists of the Model 106B element in a customized package specifically designed for paper mill headbox measurements. The built-in electronics consist of a low-noise MOSFET input source follower with unity gain. A single wire feeds constant current power to the source of the FET and also carries the dynamic signal, superimposed on the +3 to +5 bias.

See "Guide to ICP[®] Instrumentation, G-0001B" for a more complete treatment of the "Integrated Circuit Piezoelectric" (ICP[®]) concept.



Cross Section: Series 106B Microphone Element

3.0 POLARITY

Both models produce a positive-going output signal with increasing pressure at the diaphragm. Since the bias voltage of the low-noise electronics is rather low compared to other ICP[®] instruments, the output voltage capability is nonsymmetrical, i.e. the units can produce positive-going voltages to 12 or 13 volts with a +18 V battery supply, but the linear negative-going output voltage is limited to approximately 2.5 volts.

This is not a disadvantage because +2.5 volts provide an adequate output signal for most microphone applications and the higher positive-going voltage affords an ability to measure much higher positive-going pulses if desirable.

4.0 POWER UNITS

In general, it is advisable to use battery-powered signal conditioners (such as the 480C02) to power the Series 106 microphones because of their inherently low noise.

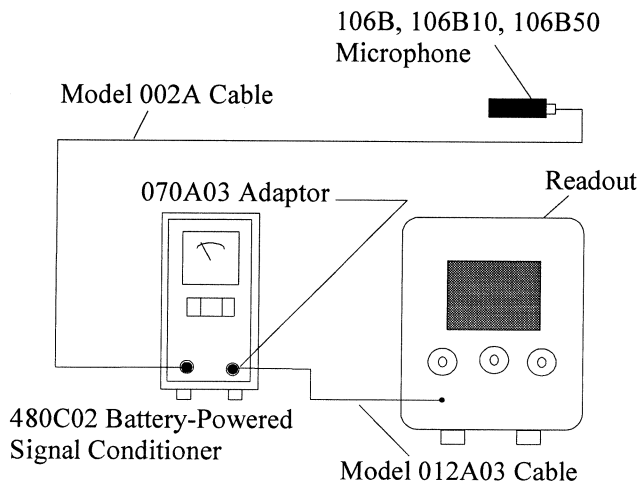
If line powering is desirable, consult the factory for help in selecting the best signal conditioner for the application.

OPERATION MANUAL FOR HIGH INTENSITY MICROPHONES MODELS 106B, 106B10, 106B50

These sensors must only be powered through constant-current diodes or other equivalent current-limiting circuitry, (2 to 20 mA) as contained in all PCB signal conditioners.

CAUTION: Never apply power directly to the center pin of the connector without the current-limiting protection (2 mA maximum), as to do so will destroy the built-in amplifier.

Connect the microphones to the power unit as shown in the figure below.



Typical Power Connection

The 106B, 106B10, and 106B50 differ from the standard ICP[®] sensors in that the low noise, built-in amplifiers have a +3 to +5 V bias or turn-on voltage instead of the usual +11 V bias. Consequently, the bias monitor voltmeter located on the front panel of most PCB signal conditioners will indicate approximately 20% full scale under normal operating conditions, rather than the mid-scale reading associated with normal operation for other ICP[®] instruments.

A full-scale reading on the bias monitor meter indicates an open circuit between the signal conditioner and sensor.

A zero reading indicates a short circuit in cable, connections, or sensor.

5.0 INSTALLATION

Consult the applicable installation drawing at the front of this manual for details on the preparation of mounting ports. For best high-frequency response, flush mounting of the diaphragm is desirable.

The standard type of mounting arrangement for these microphones is by use of the hollow clamp nut supplied (refer to installation drawing), but other methods of mounting the units are acceptable.

Non-metallic mounting adaptors for off-ground installations are available. Consult factory with your specific installation problem.

6.0 CALIBRATION

The 106B, 106B10, and 106B50 are calibrated by dynamic means over the full range by subjecting the unit to a series of calibrated pneumatic pressure steps. In addition, the units are given a 124 dB sound pressure level calibration at 250 Hz with a pistonphone. An electrostatic calibration is used to verify the sensor's frequency response.

Recalibration service is offered by PCB. Consult the factory for details.

7.0 MEASURING SMALL PRESSURE FLUCTUATIONS ON A HIGH STATIC HEAD

It is possible to measure small dynamic pressure variations superimposed upon a high static (pneumatic or hydraulic) head, but care must be exercised during application and removal of the static pressure to avoid destroying the input MOSFET amplifier.

The important point is to apply and release the static head slowly to allow the resistor across the quartz crystal to bleed off the charge and avoid a voltage build-up that can punch through the gate structure of the MOSFET, rendering it inoperative. (Approximately 100 V maximum rating.)

**OPERATION MANUAL FOR
HIGH INTENSITY MICROPHONES
MODELS 106B, 106B10, 106B50**

For the high sensitivity 106B50 (500 mV/psi), keep the rate of pressure application and removal below 200 psi/sec and do not exceed the maximum pressure rating of the unit. Remember that this rate must not be exceeded during removal of the static head as well as during application.

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For the lower sensitivity 106B and 106B10, do not exceed a pressure application or removal rate of 300 psi/sec.

After the high static head is applied, allow time for all coupling capacitors in the readout circuit to fully charge (signified by an end to the apparent "drift" of the output signal), then proceed with the measurement.

8.0 MAINTENANCE

The sealed construction of the 106B Series precludes field maintenance and repair.

Should the time constant degrade or should an abnormality appear in the normal bias voltage, bake the unit in a +250 °F oven for 1 to 2 hours, then retest.

If this does not remove the problem, or should other problems occur, contact the factory for assistance in tracing the problem or for instructions on returning the unit for repair or replacement.

9.0 PRECAUTIONS

1. Do not apply voltage to the units without a current-limiting device (20 mA maximum) in the line, such as is incorporated in all PCB signal conditioners. To do so will destroy the built-in amplifier.
2. Do not subject these sensors to temperatures exceeding 250 °F.
3. Use caution when applying and releasing high static pressures (as outlined in Section 7.0 of this guide) to avoid destroying built-in amplifier.
4. Do not exceed maximum pressure rating.

	<u>ENGLISH</u>	<u>SI</u>	
Performance			
Measurement Range(for ±5V output)	5 psi	35 kPa	
Useful Overrange	10 psi	69 kPa	[1]
Sensitivity(± 15 %)	1000 mV/psi	145 mV/kPa	
Maximum Pressure(step)	100 psi	690 kPa	
Maximum Pressure(static)	500 psi	3448 kPa	
Resolution	0.05m psi	.00034 kPa	
Resonant Frequency	≥ 40 kHz	≥ 40 kHz	
Rise Time	≤ 12 μ sec	≤ 12 μ sec	
Low Frequency Response(-5 %)	0.5 Hz	0.5 Hz	
Non-Linearity	≤ 1 % FS	≤ 1 % FS	[2]
Environmental			
Acceleration Sensitivity	≤ 0.002 psi/g	≤ 0.0014 kPa/(m/s ²)	
Temperature Range(Operating)	-65 to +250 °F	-54 to +121 °C	
Temperature Range(Operating)	-65 to +250 °F	-54 to +121 °C	
Temperature Coefficient of Sensitivity	≤ 0.03 %/°F	≤ 0.054 %/°C	
Maximum Flash Temperature	3000 °F	1649 °C	
Maximum Vibration	500 g pk	4903 m/s ² pk	
Maximum Shock	1000 g pk	9807 m/s ² pk	
Electrical			
Output Polarity(Positive Pressure)	Positive	Positive	
Discharge Time Constant(at room temp)	≥ 1 sec	≥ 1 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 Ohm	≤ 100 Ohm	
Output Bias Voltage	8 to 14 VDC	8 to 14 VDC	
Physical			
Sensing Element	Quartz	Quartz	
Housing Material	17-4 Stainless Steel	17-4 Stainless Steel	
Diaphragm	316L Stainless Steel	316L Stainless Steel	
Sealing	Welded Hermetic	Welded Hermetic	
Electrical Connector	10-32 Coaxial Jack	10-32 Coaxial Jack	
Weight	1.13 oz	32 gm	

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.		
E - Emralon coating		
Coating	Emralon	Emralon
Electrical Isolation	10 ⁸ Ohm	10 ⁸ Ohm
J - Ground Isolated		
N - Negative Output Polarity		
W - Water Resistant Cable		
Supplied Accessory : Model 060A11 Acetal clamp nut 3/4-16-2A thd 3/4" hex (1)		
WM - Water Resistant Cable		
Supplied Accessory : Model 060A13 Metric Acetal clamp nut M20 x 1.5-6g thd 20 mm hex (1)		

NOTES:
 [1]For +10 volt output, minimum 24 VDC supply voltage required. Negative 10 volt output may be limited by output bias.
 [2]Zero-based, least-squares, straight line method.
 [3]See PCB Declaration of Conformance PS023 for details.

SUPPLIED ACCESSORIES:
 Model 060A11 Acetal clamp nut 3/4-16-2A thd 3/4" hex
 Model 060A13 Metric Acetal clamp nut M20 x 1.5-6g thd 20 mm hex (1)
 Model 065A36 Seal, .687" OD x .625" ID x .060", Derlin (3)

Entered: LK	Engineer: BAM	Sales: MFG	Approved: RPF	Spec Number:
Date: 4/7/2016	Date: 4/7/2016	Date: 4/7/2016	Date: 4/7/2016	23894



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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Phone: 716-684-0001
 Fax: 716-684-0987
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1

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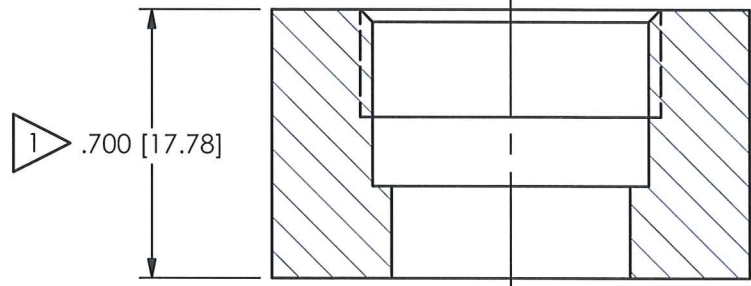
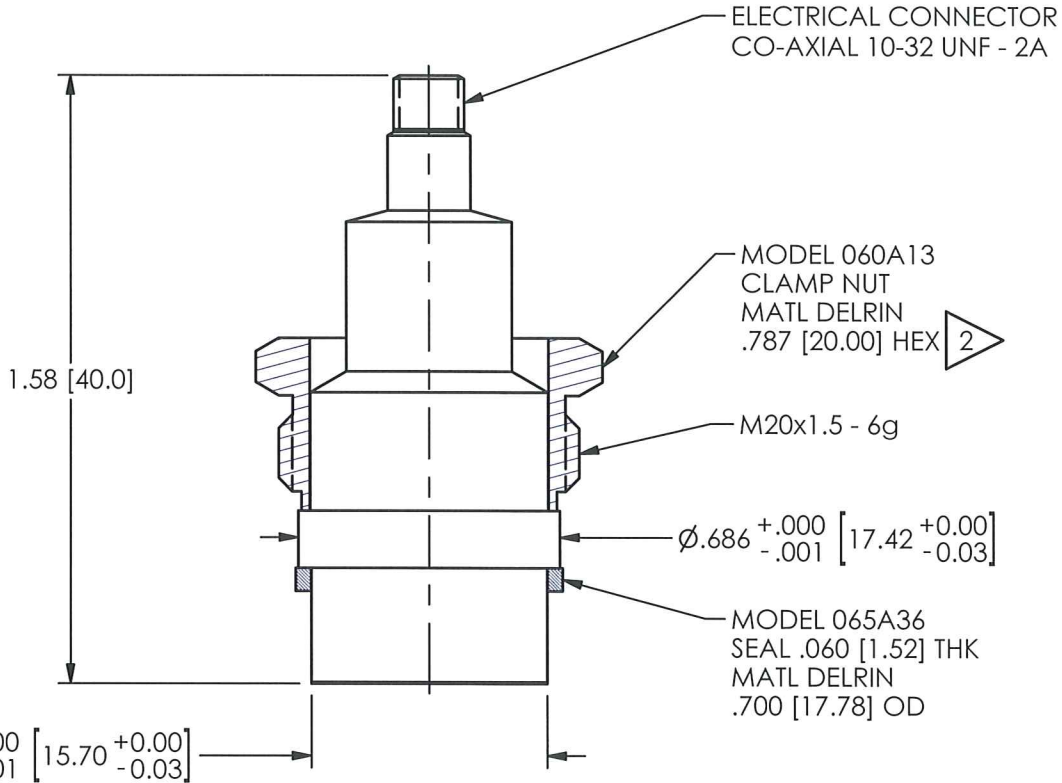
REVISIONS

REV	DESCRIPTION	DIN
A	CHANGED TITLE	36394

27455

B

B



MOUNTING HOLE PREPERATION:

$\phi .625$ [15.88] THRU
 $\square \phi .718$ [18.24] $\nabla .460$ [11.68]
M20x1.5 - 6H $\nabla .28$ [7.1]

A

A

∇ 2 RECOMENDED MOUNTING TORQUE ON HEX 3-5 lbs · ft [0.415-0.0691 kg/m].

∇ 1 DIMENSIONS SHOWN FOR .700 [17.78] THICK WALL. COUNTERBORE THICKER WALLS.

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN	CHECKED	ENGINEER	 3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 E-MAIL: sales@pcb.com
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]	SMB	7/21/11	JDK	
DECIMALS XX ±.01 XXX ±.005	DECIMALS X ± 0.3 XX ± 0.13	TITLE			CODE IDENT. NO. 52681
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES	INSTALLATION DRAWING OFF GROUND PRESSURE SENSOR			DWG. NO. 27455
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13	SCALE: 2X			SHEET 1 OF 1

2

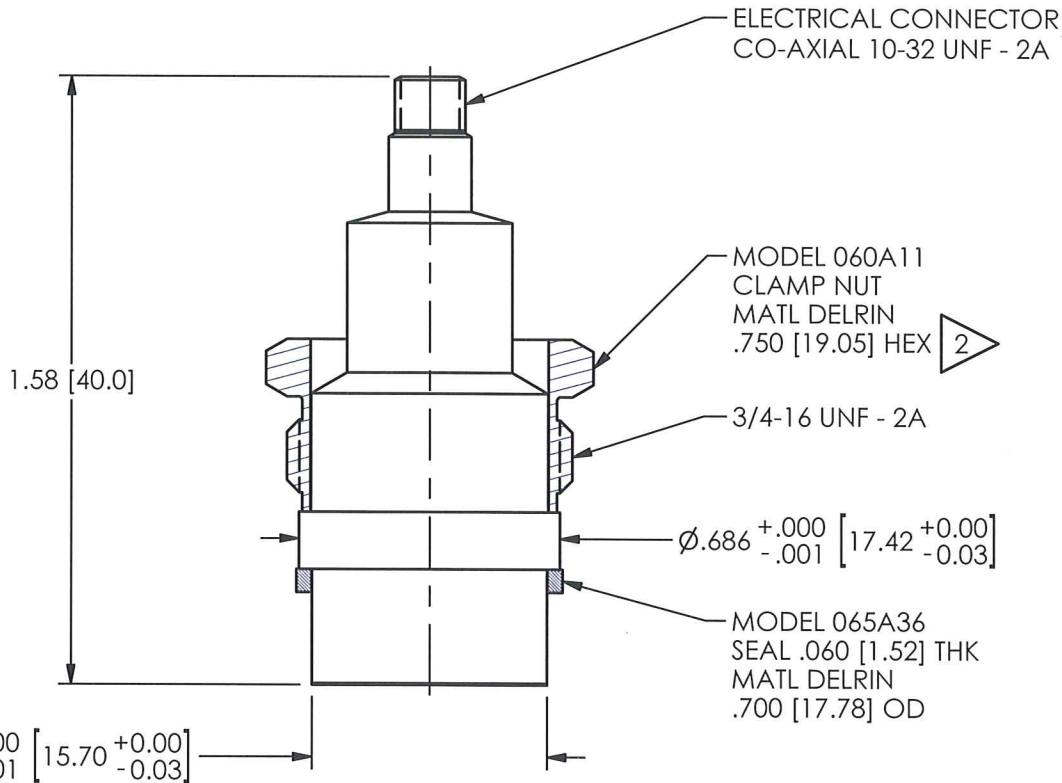
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REVISIONS

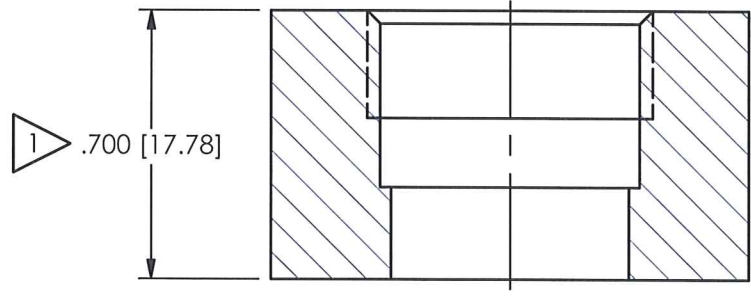
REV	DESCRIPTION	DIN
A	CHANGED TITLE	36394

23892



$\phi .618^{+.000}_{-.001}$ [15.70 $^{+0.00}_{-0.03}$]

$\phi .686^{+.000}_{-.001}$ [17.42 $^{+0.00}_{-0.03}$]



MOUNTING HOLE PREPERATION:

$\phi .625$ [15.88] THRU
 $\sqcap \phi .703$ [17.86] $\nabla .460$ [11.68]
 3/4-16 UNF - 2B $\nabla .28$ [7.1]

- 2** RECOMENDED MOUNTING TORQUE ON HEX 3-5 lbs · ft [0.415-0.0691 kg/m].
- 1** DIMENSIONS SHOWN FOR .700 [17.78] THICK WALL. COUNTERBORE THICKER WALLS.

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN	CHECKED	ENGINEER	 PCB PIEZOTRONICS ^{INC} 3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 E-MAIL: sales@pcb.com
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]	SMB	7/21/11	JDK	
DECIMALS XX ±.01 XXX ±.005	DECIMALS X ±.3 XX ±.13	TITLE			CODE IDENT. NO. 52681
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES	INSTALLATION DRAWING OFF GROUND PRESSURE SENSOR			DWG. NO. 23892
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13				SCALE: 2X