PCB PIEZOTRONICS
AN AMPHENOL COMPANY

Model 102B04

High frequency ICP® pressure sensor, 1000 psi, 5 mV/psi, 3/8-24 mtg thd, accel. comp., ground isolated

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
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E-mail: info@pcb.com
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OPERATION MANUAL FOR
QUARTZ PRESSURE SENSORS
SERIES 102
SERIES 113

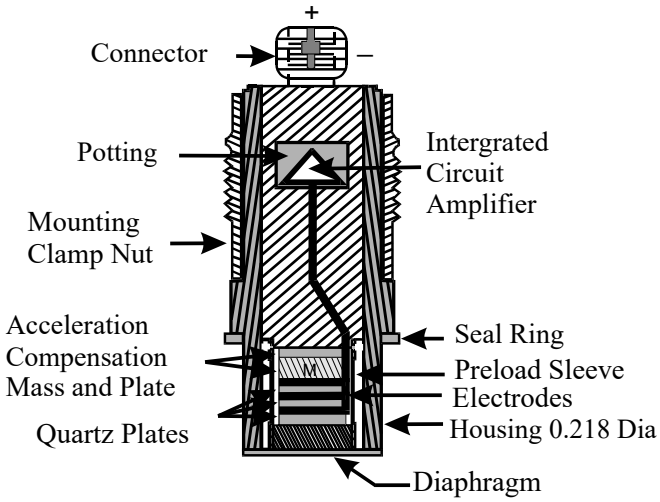
1.0 INTRODUCTION

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.



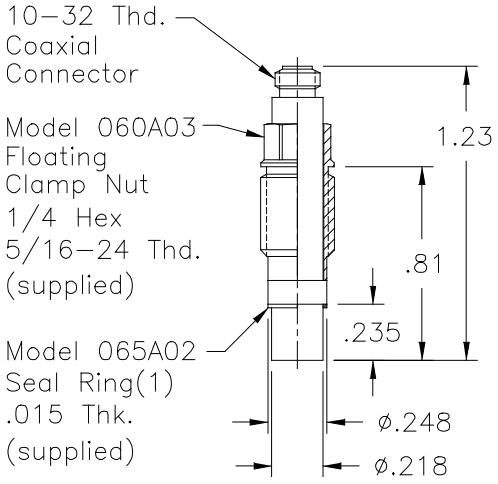
Typical ICP® Probe Style Sensor

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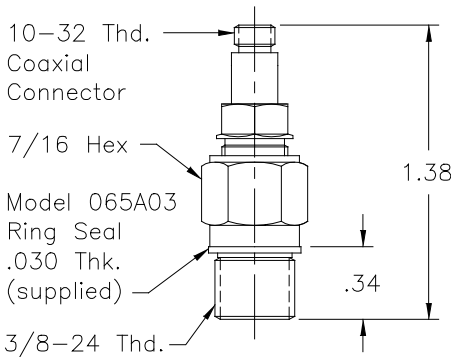
M10x 1.0 threaded adaptor with floating seal to allow adjustment of diaphragm mounting depth where it is necessary to adapt to various wall thicknesses. These models are supplied only as low-pressure (250 psi and 100 psi) sensors and are also "off ground".



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-0001for 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.

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.

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Model Number 102B04	ICP® PRESSURE SENSOR	Revision: E ECN #: 54949

Performance	ENGLISH	SI	
Measurement Range(for ±5V output)	1,000 psi	6,900 kPa	
Useful Overrange(for ± 10V output)	2,000 psi	13,790 kPa	[1]
Sensitivity(± 10 %)	5.0 mV/psi	0.7 mV/kPa	
Maximum Pressure	10,000 psi	69,000 kPa	
Resolution	0.02 psi	0.14 kPa	[2]
Resonant Frequency	≥ 500 kHz	≥ 500 kHz	
Rise Time(Reflected)	≤ 1.0 µ sec	≤ 1.0 µ sec	
Low Frequency Response(- 5 %)	0.005 Hz	0.005 Hz	
Non-Linearity	≤ 1.0 % FS	≤ 1.0 % FS	[3]
Environmental			
Acceleration Sensitivity	0.002 psi/g	0.0014 kPa/(m/s²)	[2]
Temperature Range(Operating)	-100 to +275 °F	-73 to +135 °C	
Temperature Coefficient of Sensitivity	≤ 0.03 %/°F	≤ 0.054 %/°C	
Maximum Flash Temperature	3,000 °F	1,650 °C	
Maximum Vibration	2,000 g pk	19,600 m/s² pk	
Maximum Shock	20,000 g pk	196,000 m/s² pk	
Electrical			
Output Polarity(Positive Pressure)	Positive	Positive	
Discharge Time Constant(at room temp)	≥ 100 sec	≥ 100 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	
Electrical Isolation	10^8 Ohm	10^8 Ohm	
Physical			
Sensing Geometry	Compression	Compression	
Sensing Element	Quartz	Quartz	
Housing Material	Stainless Steel	Stainless Steel	
Diaphragm	Invar	Invar	
Sealing	Welded Hermetic	Welded Hermetic	
Electrical Connector	10-32 Coaxial Jack	10-32 Coaxial Jack	
Weight	0.41 oz	11.6 gm	

CE

UK CA [4]

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.

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.

CA - Ablative Coating

M - Metric Mount
Supplied Accessory: Model 065A40 Seal ring 0.435" OD x 0.397" ID x 0.030" thk brass (3) replaces Model 065A03

N - Negative Output Polarity

S - Stainless Steel Diaphragm

Diaphragm	316L Stainless Steel	316L Stainless Steel

W - Water Resistant Cable

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.

SUPPLIED ACCESSORIES:

Model 065A03 Seal ring 0.435" OD x 0.377" ID x 0.030" thk brass (3)
Model PCS-1AZ Sensitivity calibration at 100% and 10% of sensor range

Entered: ND	Engineer: AJA	Sales: RWM	Approved: RPF	Spec Number:
Date: 06/25/2024	Date: 06/25/2024	Date: 06/25/2024	Date: 06/25/2024	40730

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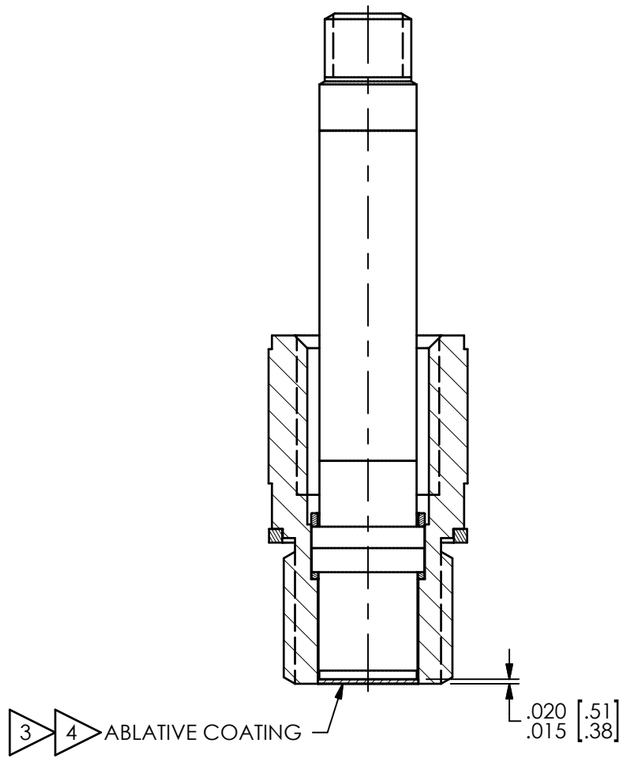
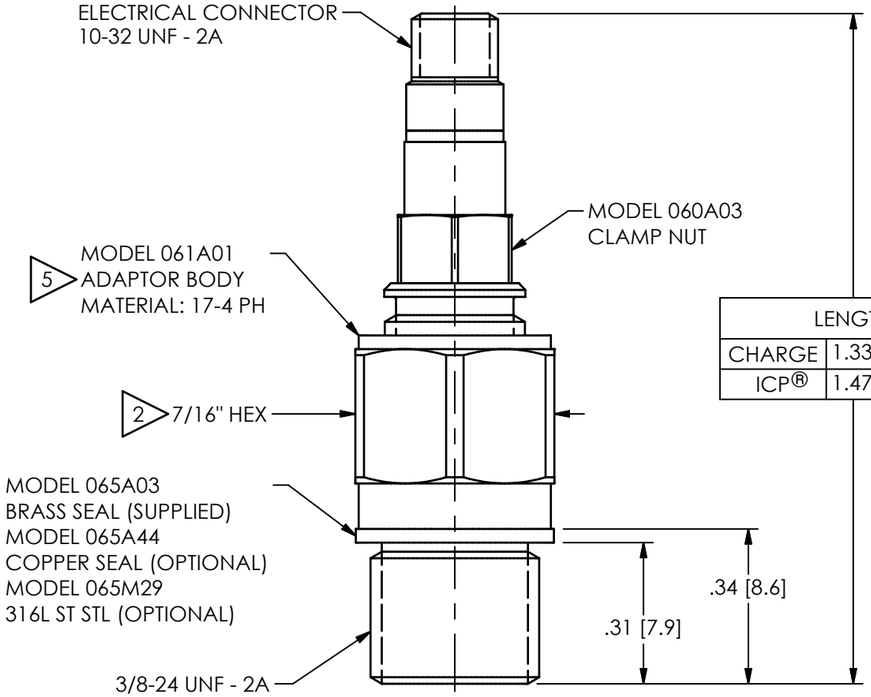
REVISIONS		
REV	DESCRIPTION	DIN
G	UPDATED NOTES	54569

6450

ABLATIVE INSTALLATION



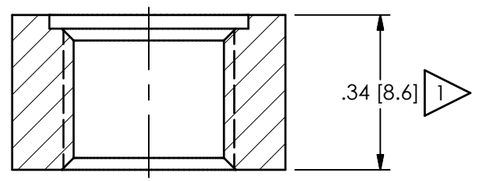


LENGTH	
CHARGE	1.33± .05 [33.8]
ICP®	1.47± .05 [37.3]

MOUNTING HOLE PREPARATION:

3/8-24 UNF - 2B THRU

⌴Ø.437± .001 [11.10± .03] ↧.030 [.76]



5 ADAPTOR MAY BE PURCHASED SEPARATELY: 061A01 (17-4PH) OR 061A09 (316L)

4 BLACK VINYL ELECTRICIANS TAPE HAS BEEN FOUND TO BE AN EFFECTIVE ABLATIVE MATERIAL, AS IS DC-4 SILICON GREASE

3 "CA" OPTION ONLY

2 MOUNTING TORQUE ON 7/16" HEX: 5-8 FT-LBS [6.78-10.85 Nm]

1 ABOVE INSTALLATION SHOWN FOR WALL THICKNESS OF .34 [8.6]. ⌴ THICKER WALLS Ø.75 [19.1] TO CLEAR 7/16" HEX AND ALLOW FOR SOCKET WRENCH

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:	
DIMENSIONS IN INCHES DECIMALS XX ±.01 XXX ±.005 ANGLES ± 2 DEGREES	DIMENSIONS IN MILLIMETERS [IN BRACKETS] DECIMALS X ± 0.3 XX ± 0.13 ANGLES ± 2 DEGREES
CABLE TOLERANCES IN ENGLISH 1"≤ LENGTH < 1' = +1"/ - 0 1'≤ LENGTH < 5' = +2"/ - 0 5'≤ LENGTH < 100' = +6"/ - 0 100'≤ LENGTH = +1'/ - 0	CABLE TOLERANCES IN METRIC 2.54cm ≤ LENGTH < 30.5cm = +2.54cm/ - 0 30.5cm ≤ LENGTH < 1.5m = +5.1cm/ - 0 1.5m ≤ LENGTH < 30.5m = +15.2cm/ - 0 30.5m ≤ LENGTH = +30.5cm/ - 0
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13

DRAWN		CHECKED		ENGINEER	
NJF	02/02/24	JDM	02/02/24	MJB	02/02/24

TITLE

INSTALLATION DRAWING
MODELS 101A, 102A, 102B,
102M, 061A01, & 061A09
PRESSURE SENSOR

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CODE IDENT. NO.	SHEET	DWG. NO.
52681	B	6450
SCALE: 3X		SHEET 1 OF 1