



**Model 401B04**  
**ICP® Source Follower**  
**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](mailto:info@pcb.com)**  
**Web: [www.pcb.com](http://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](mailto:info@pcb.com)  
Repair inquiries: [rma@pcb.com](mailto:rma@pcb.com)

For a complete list of distributors, global offices and sales representatives, visit our website, [www.pcb.com](http://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.

## 401B04 ICP<sup>®</sup> Sensor Simulator

### 1. INTRODUCTION AND DESCRIPTION

The Model 401B04 is a unity gain, non-inverting, impedance-converting voltage amplifier with the same characteristics as the built-in ICP<sup>®</sup> amplifiers provided in most PCB pressure sensors, force sensors, and accelerometers. This model consists of MOSFET circuitry packaged in a convenient Pomona box with BNC connectors. When used in conjunction with a signal generator or oscillator, it can be used in place of an ICP sensor to calibrate ICP<sup>®</sup> sensor signal conditioners, do system verifications and gain adjustments, or check frequency response of systems with long input cables. (The Model 401B04 simulates the circuit of an ICP<sup>®</sup> sensor while the signal generator takes the place of the sensor's crystals.)

### 2. INSTALLATION AND OPERATION

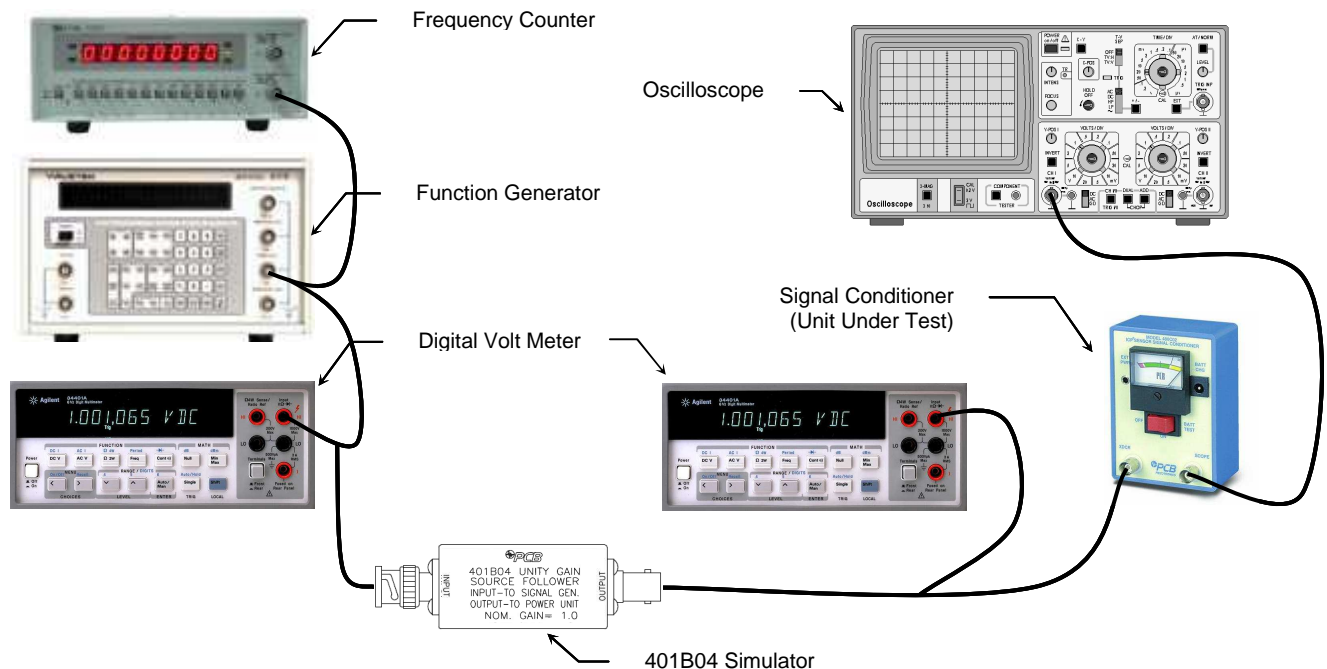
**CAUTION:** Connect the output only to an ICP<sup>®</sup> type, current-limited signal conditioner.

**WARNING:** Excessive current may damage this model. Measure the ICP<sup>®</sup> sensor signal conditioner current prior to connecting the 401B04. The ICP<sup>®</sup> excitation current should be  $\leq 20$  mA.

#### 2.1 CALIBRATION OF ICP<sup>®</sup> SENSOR SIGNAL CONDITIONERS

Refer to the acceptance test procedure for your particular PCB signal conditioner, dual mode charge amplifier, or digital peak meter model. (Acceptance test procedures are available for most PCB electronic products. Consult factory for details.)

Connect a signal generator or oscillator to the input jack of the 401B04, after observing the caution and warning above. Connect the output jack of the 401B04 to the ICP<sup>®</sup> sensor signal conditioner being tested. (Various cables and adaptors are available from PCB as needed.) Switch on the signal conditioner and note the output bias voltage on the meter as you would for any ICP<sup>®</sup> sensor. The meter should read mid scale, indicating that the 401B04 is operational. Follow the acceptance test procedure for your particular PCB model. The exact gain factor (near unity) of the 401B04 is noted on the calibration certificate supplied with the unit. The nominal value of Gain = 1.0 is on the housing of the unit.



## **2.2 MEASUREMENT SYSTEM CHECKOUT AND/OR GAIN ADJUST**

The Model 401B04 is inserted in place of the ICP<sup>®</sup> sensor in your measurement system. Connect the input of the 401B04 to a signal generator and the output to the ICP<sup>®</sup> sensor signal conditioner. Also connect any additional amplifiers or recording devices that will be used in the test, as shown in the figure above. After switching on all equipment and allowing sufficient warm-up time, apply a known signal through the system with the signal generator and adjust gains, ranges, zeroes, etc., as needed.

## **2.3 CALIBRATION OF LONG LINES**

Model 401B04 can be used, in conjunction with an oscillator or step function generator, to simulate an ICP<sup>®</sup> sensor driving a long input cable between the sensor and the ICP sensor signal conditioner. Refer to PCB "General Guide to ICP<sup>®</sup> Instrumentation" for more details on the procedure.

## **3. FREQUENCY RESPONSE CONSIDERATIONS**

When used with a signal generator for system checkouts or testing of long lines, low frequency response of the 401B04 is DC.

High frequency response of the Model 401B04, when driving short cables with small (~1V) signals, is 1 megahertz. Refer to PCB "General Guide to ICP<sup>®</sup> Instrumentation." if long cables are to be driven. Also, consult the factory if less than 2 mA constant current will be used to power the 401B04.



## **4. MEASUREMENT AND REPAIR**

The miniature size precludes most maintenance. If used in a very humid or dirty environment, signal degradation, usually in the form of reduced output or loss of low frequency response, may occur. If the connectors become dirty, clean with Freon TF<sup>®</sup>, Genesolv, or other suitable solvent that leaves no residue.

Manual Number: 40858

Manual Revision: A

ECN Number: 38393

Model Number 401B04	ICP® SOURCE FOLLOWER			Revision: F ECN #: 52519
<b>Performance</b> Gain(+ 0 to -2 %) Output Range Low Frequency Response High Frequency Response(2.0 mA) High Frequency Response(4 mA) High Frequency Response(20 mA) Non-Linearity <b>Environmental</b> Temperature Range(Operating) <b>Electrical</b> Excitation Voltage Constant Current Excitation Output Impedance Output Bias Voltage Output Current Broadband Electrical Noise(10 to 100,000 kHz) Spectral Noise(1 Hz) Spectral Noise(10 Hz) Spectral Noise(100 Hz) Spectral Noise(1 kHz) Spectral Noise(10 kHz) Insulation Resistance(Minimum) <b>Physical</b> Housing Material Electrical Connector(Input) Electrical Connector(Output) Size (Length x Width x Height) Weight	<b>ENGLISH</b> 1 ± 5 V 0 Hz 110 kHz 220 kHz 1,000 kHz ≤ 2 % FS +30 to +150 °F + 18 to 30 VDC 2 to 20 mA < 100 Ohm + 7 to 14 VDC 1 to 19 mA 12 µV rms 4 µV/√Hz 1 µV/√Hz 0.3 µV/√Hz 0.1 µV/√Hz 0.05 µV/√Hz 10 <sup>9</sup> Ohm Aluminum BNC Plug BNC Jack 2.2 in x 1.1 x 0.9 2.50 oz	<b>SI</b> 1 ± 5 V 0 Hz 110 kHz 220 kHz 1,000 kHz ≤ 2 % FS -1.1 to +65.5 °C + 18 to 30 VDC 2 to 20 mA < 100 Ohm + 7 to 14 VDC 1 to 19 mA 12 µV rms 4 µV/√Hz 1 µV/√Hz 0.3 µV/√Hz 0.1 µV/√Hz 0.05 µV/√Hz 10 <sup>9</sup> Ohm Aluminum BNC Plug BNC Jack 55.9 mm x 27.9 x 22.9 70.9 gm	[1] [1] [1] [2] [3] [4] [4] [4] [4] [4] [4]	<b>OPTIONAL VERSIONS</b> Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.
<b>NOTES:</b> [1]Above stated frequency, the amplifier becomes slew rate limited. [2]Voltage < 20 VDC reduces input range to ±3V. [3]Excitation current supplied minus 1 mA nominal current consumption. [4]Typical, tested with 1000 pF capacitance at input. [5]See PCB Declaration of Conformance PS024 for details. A low impedance connection from case to earth ground is required to maintain CE compliance.				
				
Entered: TP	Engineer: CPH	Sales: AH	Approved: JWH	Spec Number:
Date: 01/27/2022	Date: 01/27/2022	Date: 01/27/2022	Date: 01/27/2022	40857
 <b>PCB PIEZOTRONICS</b> AN AMPHENOL COMPANY Phone: 716-684-0001 Fax: 716-684-0987 E-Mail: info@pcb.com 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. ICP® is a registered trademark of PCB Piezotronics, Inc.				

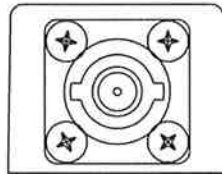
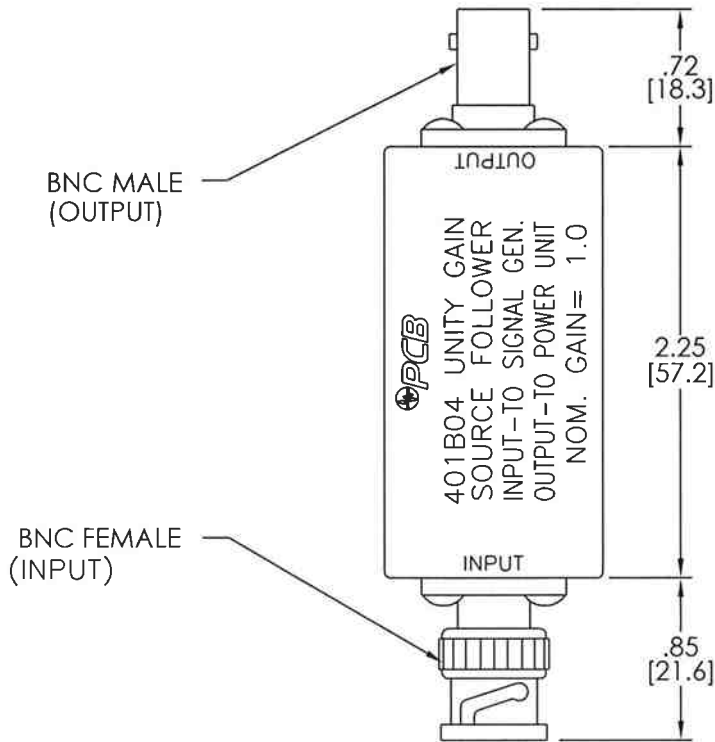
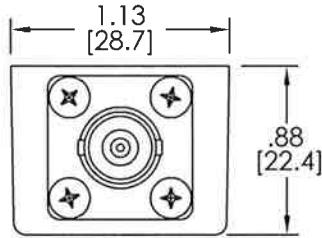


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REVISIONS

REV	DESCRIPTION	ECN	APP'D
NR	RELEASED TO DRAFTING		
A	UPDATE BILL OF MATERIALS	29967	

40854



UNLESS SPECIFIED TOLERANCES

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	FILLETS AND RADII
.003 - .005	[0.07 - 0.13]

DD011 REV. D 01/17/08

DRAWN	MCG	01/28/09	MFG	CPH	01/28/09
CHK'D	EB	1/28/09	ENGR	PH	01/28/09
APP'D	EB	01/28/09	SALES	JJM	01/28/09

TITLE  
**OUTLINE DRAWING  
 MODEL 401B04  
 UNITY GAIN SOURCE FOLLOWER**

**PCB PIEZOTRONICS™**  
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CODE IDENT. NO. 52681	DWG. NO. <b>40854</b>
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SCALE: FULL SHEET 1 OF 1