



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
Web: www.pcb.com



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. 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. 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:

PCB Piezotronics, Inc.
3425 Walden Ave.
Depew, NY 14043 USA
Toll-free: (800) 828-8840
24-hour SensorLineSM: (716) 684-0001
Website: www.pcb.com
E-mail: info@pcb.com

401B04 ICP[®] 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[®] 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[®] 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[®] sensor while the signal generator takes the place of the sensor's crystals.)

2. INSTALLATION AND OPERATION

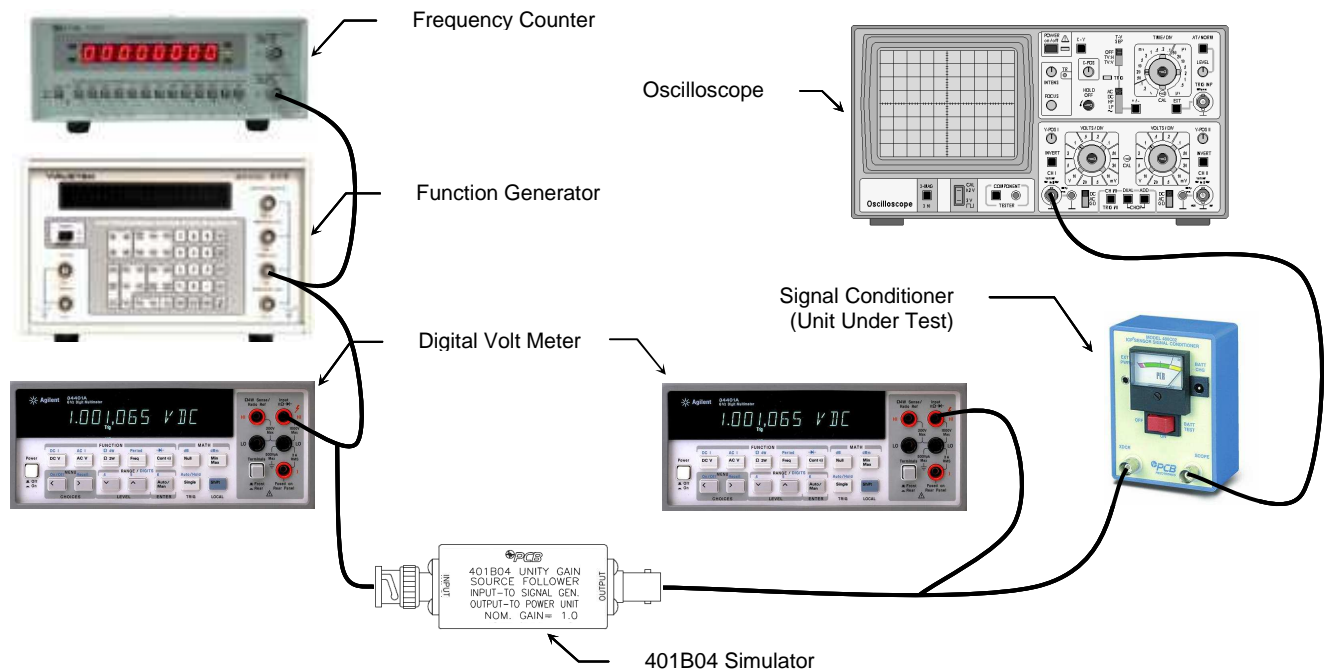
CAUTION: Connect the output only to an ICP[®] type, current-limited signal conditioner.

WARNING: Excessive current may damage this model. Measure the ICP[®] sensor signal conditioner current prior to connecting the 401B04. The ICP[®] excitation current should be ≤ 20 mA.

2.1 CALIBRATION OF ICP[®] 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[®] 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[®] 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[®] sensor in your measurement system. Connect the input of the 401B04 to a signal generator and the output to the ICP[®] 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[®] sensor driving a long input cable between the sensor and the ICP sensor signal conditioner. Refer to PCB "General Guide to ICP[®] 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[®] 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[®], Genesolv, or other suitable solvent that leaves no residue.

Manual Number: 40858

Manual Revision: A

ECN Number: 38393

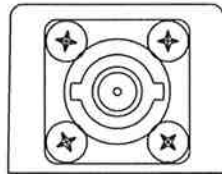
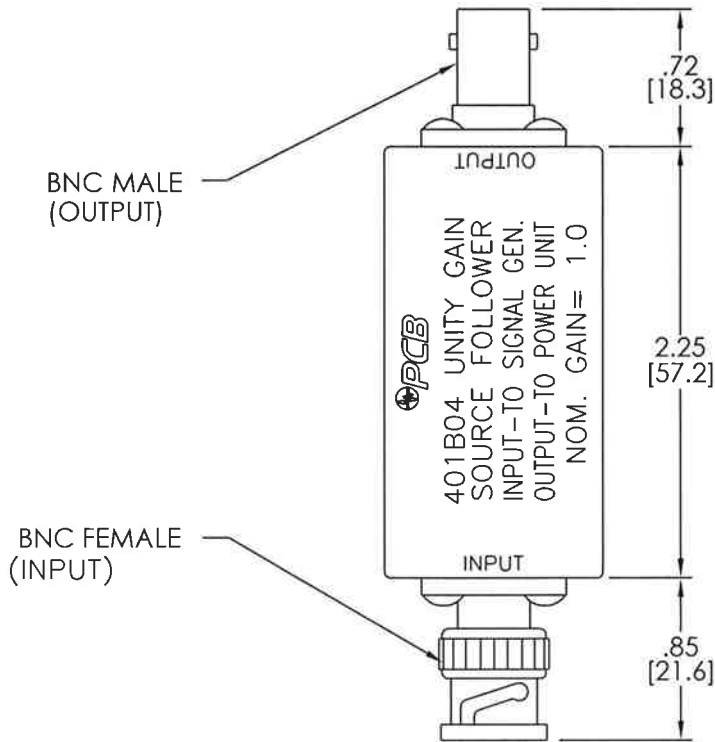
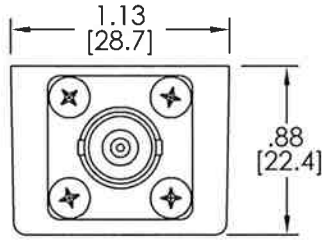
Model Number	ICP® SOURCE FOLLOWER			Revision: A
401B04				ECN #: 30009
Performance	ENGLISH	SI		OPTIONAL VERSIONS
Input Range	± 5 V	± 5 V		Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.
Gain(+0 to -2 %)	1.00	1.00		
Output Range	± 5 V	± 5 V		
Low Frequency Response	0 Hz	0 Hz		
High Frequency Response(2.0 mA)	110 kHz	110 kHz	[3]	
High Frequency Response(4 mA)	220 kHz	220 kHz	[3]	
High Frequency Response(20 mA)	1000 kHz	1000 kHz	[3]	
Non-Linearity	≤ 2 % FS	≤ 2 % FS		
Environmental				
Temperature Range(Operating)	+30 to +150 °F	0 to +50 °C		
Electrical				
Excitation Voltage	+18 to 30 VDC	+18 to 30 VDC		
Constant Current Excitation	2 to 20 mA	2 to 20 mA		
Output Current	1 to 19 mA	1 to 19 mA	[1]	
Output Impedance	<100 ohm	<100 ohm		
Output Bias Voltage	+7 to 14 VDC	+7 to 14 VDC		
Broadband Electrical Noise(1 to 100,000 Hz)	12 µV rms	12 µV rms	[2]	
Spectral Noise(1 Hz)	4 µg/√Hz	4 µg/√Hz	[2]	
Spectral Noise(1 Hz)	1 µg/√Hz	1 µg/√Hz	[2]	
Spectral Noise(10 Hz)	0.3 µg/√Hz	0.3 µg/√Hz	[2]	
Spectral Noise(100 kHz)	0.1 µg/√Hz	0.1 µg/√Hz	[2]	
Spectral Noise(1 kHz)	0.05 µg/√Hz	0.05 µg/√Hz	[2]	
Insulation Resistance(Minimum)	10 ⁹ ohm	10 ⁹ ohm		
Physical				
Housing Material	Aluminum	Aluminum		
Electrical Connector(Input)	BNC Plug	BNC Plug		
Electrical Connector(Output)	BNC Jack	BNC Jack		
Size (Length x Width x Height)	2.2 in x 1.1 x 0.9	55.9 mm x 27.9 x 22.9		
Weight	2.50 oz	70.9 gm		
 [4]				Entered: <i>BLS</i>
				Engineer: <i>PH</i>
<i>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.</i>				Sales: <i>ADM</i>
				Approved: <i>EB</i>
				Spec Number:
<i>ICP® is a registered trademark of PCB Group, Inc.</i>				Date: <i>1-29-09</i>
				Date: <i>1-26-09</i>
PCB PIEZOTRONICS ELECTRONICS DIVISION 3425 Walden Avenue, Depew, NY 14043				Date: <i>1-26-09</i>
				Date: <i>1-27-09</i>
Phone: 716-684-0001 Fax: 716-684-0987 E-Mail: electronics@pcb.com				40857

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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**

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CODE IDENT. NO. 52681
 DWG. NO. **40854**

SCALE: FULL SHEET 1 OF 1