



Model 699A02
Handheld Vibration Shaker
Installation and Operating Manual

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

Toll-free: 800-959-4464
24-hour SensorLine: 716-684-0001
Fax: 716-684-3823
E-mail: imi@pcb.com
Web: www.imi-sensors.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
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Introduction

The Model 699A02 Hand Held Shaker is a small, handy, completely self-contained vibration reference source. It is intended for rapid checking of vibration measurement, monitoring and recording systems using piezoelectric accelerometers, as well as other types of vibration transducer having a maximum of 250 grams. See Figure 1.

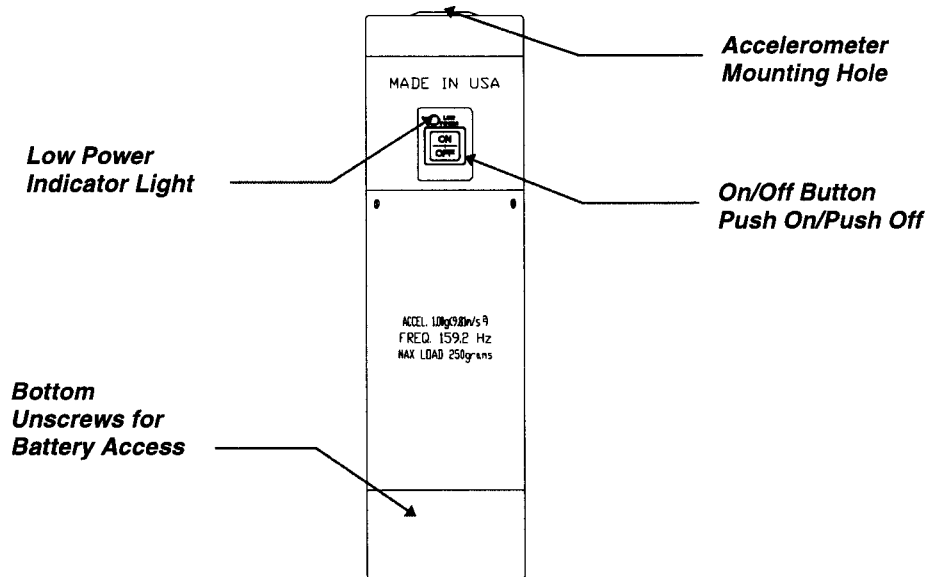


Figure 1: Model 699A02 Hand Held Shaker

Description

The Model 699A02 permits accurate adjustment of measuring instrumentation to indicate a standard acceleration level of 1 g RMS or 1 g peak, adjusting the system for correct measurement. The reference signal may also be used for velocity and displacement, at 10 mms⁻¹ RMS or 10 mms⁻¹ peak and 10 μm RMS or 10 μm peak-to-peak, respectively. To change between RMS and peak, depress the corresponding side of the rocker switch in the options cavity of the shaker. For example, to choose RMS, depress the left side of the rocker switch (see Figure 4).

A system adjustment using the Model 699A02 also provides a quick check of the correct function of the complete measurement system.

A sectional view of the shaker's vibration head is shown in Figure 2. The shaker consists of an electromagnetic exciter, driven by an oscillator at a frequency of 159.2 Hz ($1\ 000\ \text{rads}^{-1}$). A small ICP® accelerometer provides a servo feedback to maintain a constant vibration level of 1 g. This enables accelerometers with masses of up to 250 grams to be adjusted without their mass influencing the reference level.

Use of the shaker is straight-forward. The accelerometer is attached to the shaker using the supplied 1/4-28 stud. Alternatively, the shaker is supplied with adaptor mounting studs for 10-32 and M6 x 1.0 mounting threads.

NOTE: When the sensor mass is lighter than 75 grams, screw in adaptor mass between the sensor and the shaker head. The unit will not operate if mass of sensor system is less than 75 grams.

Connect the accelerometer to the vibration level indicating instrument and activate the shaker by pushing the ON/OFF button on the side of the shaker. See Figure 1.

The indicating instrument may now be adjusted to read the relevant reference value. Following the system adjustment, the shaker is switched off by pressing the ON/OFF button a second time. To prolong the useful life of the batteries, the Model 699A02 automatically switches off after 90 seconds. With new batteries, 80 sensitivity checks with maximum load are possible. To change between auto shutoff and continuous run, depress the corresponding side of the rocker switch in the options cavity of the shaker. For example to choose auto shutoff, depress the left side of the rocker switch (see Figure 4).

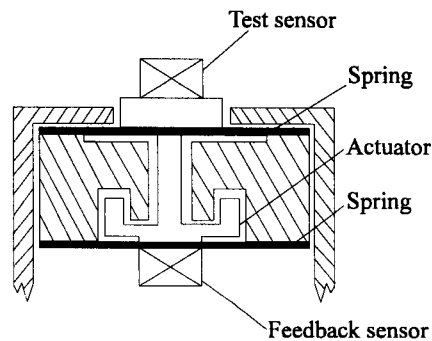


Figure 2: Shaker's Vibration Head — Cross Section

Operation

When the ON/OFF button is pushed the first time, the Model 699A02 Hand Held Shaker is activated. Power is ramped up to the actuator to provide a smooth, gradual turn-on. This action prevents shock-induced overloads to the test sensor. A special sensor within the unit constantly measures the g level and adjusts to maintain 1 g. The frequency is 159.2 Hz. Since a relatively stiff suspension is used, any sensor up to 250 grams can be verified without affecting accuracy. Model 699A02 is powered by four (4) "AA" batteries in a pack, Model 073A15. Alkaline batteries are recommended for a longer service life. Since the Model 699A02 is a precision instrument and is used to check the sensitivity of sensors, it should be verified prior to use with a reference standard. The unit has several unique features of interest:

- ❑ **Continuous Use Option Switch.** In this mode, once the shaker is turned on, it does not shut off until the ON/OFF button is depressed a second time. The default position of this switch is AUTO; the unit turns off automatically after a preset time.
- ❑ **Peak/RMS Selection.** If a 100 mV/g sensor is on the shaker table, and the unit is in peak mode, then the output is 100 mV. If the switch is set to RMS, then the output is 141 mV. See Figure 3.

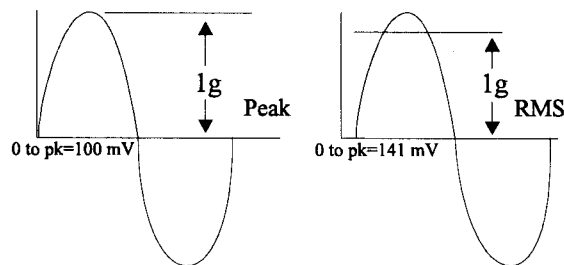


Figure 3: Peak vs RMS Selection with 100 mV/g Accelerometer

- ❑ **External Power Supply.** An optional Model 073A16 DC Power Supply is available for powering the Model 699A02 Shaker. It operates off of 85 to 265 VAC, 47 to 63 Hz input. When this power supply is plugged into the shaker, the internal batteries are automatically disconnected.
- ❑ **Calibration Check Points.** Calibration of the internal feedback circuit can be verified via test points (located in the options access pocket). See Figure 4. The

measured value in volts AC should agree with the calibration certificate. This is useful for quick field check of unit integrity, such as that which might be needed if the shaker is dropped and a reference standard is not immediately available. This test is not a guarantee of shaker function. If the data does not agree with expected values, the shaker should be checked with a calibration standard before continued use.

- ❑ **Low Power Indicator.** A low power indicator light is located above the ON/OFF switch. See Figure 1. This light glows when the available power is marginally adequate to drive the shaker (with the mass on the shaker). This indicator does not signify erroneous data. If the Model 699A02 cannot obtain 1 g at 159.2 Hz, then the unit shuts off. The low power indicator signifies an imminent inability to drive the mass on the shaker — the test sensor is too heavy, the batteries are low on power or the external power supply is inadequate.

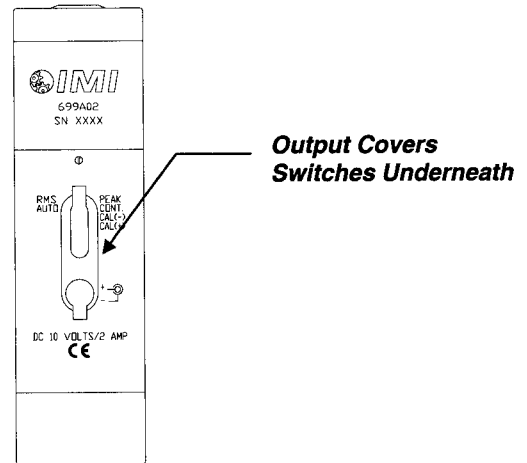


Figure 4: Hand Held Shaker Calibration Check Points

Maintenance - Repair

This unit is fully **CE** compliant. Aside from battery replacement, no maintenance is required for this unit. It is suggested that if trouble occurs, contact the factory for assistance. Because of the nature of IMI instrumentation, field repair is typically not recommended and voids the warranty. If factory service is required, return the instrument to IMI. A free quotation will be provided prior to servicing.

IMI, a division of PCB Piezotronics, Inc., is an ISO 9001 certified company that has embraced its company mission of **TOTAL CUSTOMER SATISFACTION**. This is a guarantee that means if at any time you are not satisfied with any of our products or service, we will correct the problem. Please contact us for high-quality equipment and unmatched customer support. If you have any questions or concerns on the use of any IMI product or the aforementioned policies, call the IMI Vibration Group at 716-684-0003.

ESD Sensitivity Warning 1

The power supply/signal conditioner should not be opened by anyone other than qualified service personnel. This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury.

Warning 2

This equipment is designed with user safety in mind; however, the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by PCB Piezotronics, Inc.

Caution 1

Cables can kill your equipment. High voltage electrostatic discharge (ESD) can damage electrical devices. Similar to a capacitor, a cable can hold a charge caused by triboelectric transfer, such as that which occurs in the following:

- *Laying on and moving across a rug,*
- *Any movement through air,*
- *The action of rolling out a cable, and/or*
- *Contact with a non-grounded person.*

The PCB solution for product safety:

1. *Connect the cables only with the AC power off.*
2. *Temporarily "short" the end of the cable before attaching it to any signal input or output.*

Caution 2



ESD considerations should be made prior to performing any internal adjustments on the equipment. Any piece of electronic equipment is vulnerable to ESD when opened for adjustments. Internal adjustments should therefore be done **ONLY** at an ESD-safe work area. Many products have ESD protection, but the level of protection may be exceeded by extremely high voltage.

Warranty

IMI instrumentation is warranted against defective material and workmanship for 1 year unless otherwise expressly specified. Damage to instruments caused by incorrect power or misapplication, is not covered by warranty. *If there are any questions regarding power, intended application, or general usage, please consult with your local sales contact or distributor.* Batteries and other expendable hardware items are not covered by warranty.

Service

Because of the sophisticated nature of IMI instrumentation, field repair is typically **NOT** recommended and may void any warranty. If factory service is required, return the instrumentation according to the "Return Procedure" stated below. *A repair and/or replacement quotation will be provided prior to servicing at no charge.* Before returning the unit, please consult a factory IMI applications engineer concerning the situation as certain problems can often be corrected with simple on-site procedures.

Return Procedure

To expedite returned instrumentation, contact a factory IMI applications engineer for a RETURN MATERIAL AUTHORIZATION (RMA) NUMBER. Please have information available such as model and serial number. Also, to insure efficient service, *provide a written description of the symptoms and problems with the equipment to a local sales representative or distributor, or contact IMI if none are located in your area.*

Customers outside the U.S. should consult their local IMI distributor for information on returning equipment. For exceptions, please contact the International Sales department at IMI to request shipping instructions and an RMA. For assistance, please call (716) 684-0003, or fax us at (716) 684-3823. You may also receive assistance via e-mail at imi@pcb.com or visit our web site at www.pcb.com.

Customer Service

IMI, a division of PCB Piezotronics, guarantees **Total Customer Satisfaction**. If, at any time, for any reason, you are not completely satisfied with any IMI product, IMI will repair, replace, or exchange it at no charge. You may also choose, within the warranty period, to have your purchase price refunded.





IMI offers to all customers, at no charge, 24-hour phone support. This service makes product or application support available to our customers, day or night, seven days a week. When unforeseen problems or emergency situations arise, call the **IMI Hot Line at (716) 684-0003**, and an application specialist will assist you.



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ICP® is a registered trademark of PCB Piezotronics, Inc., which uniquely identifies PCB sensors that incorporate built-in microelectronics.

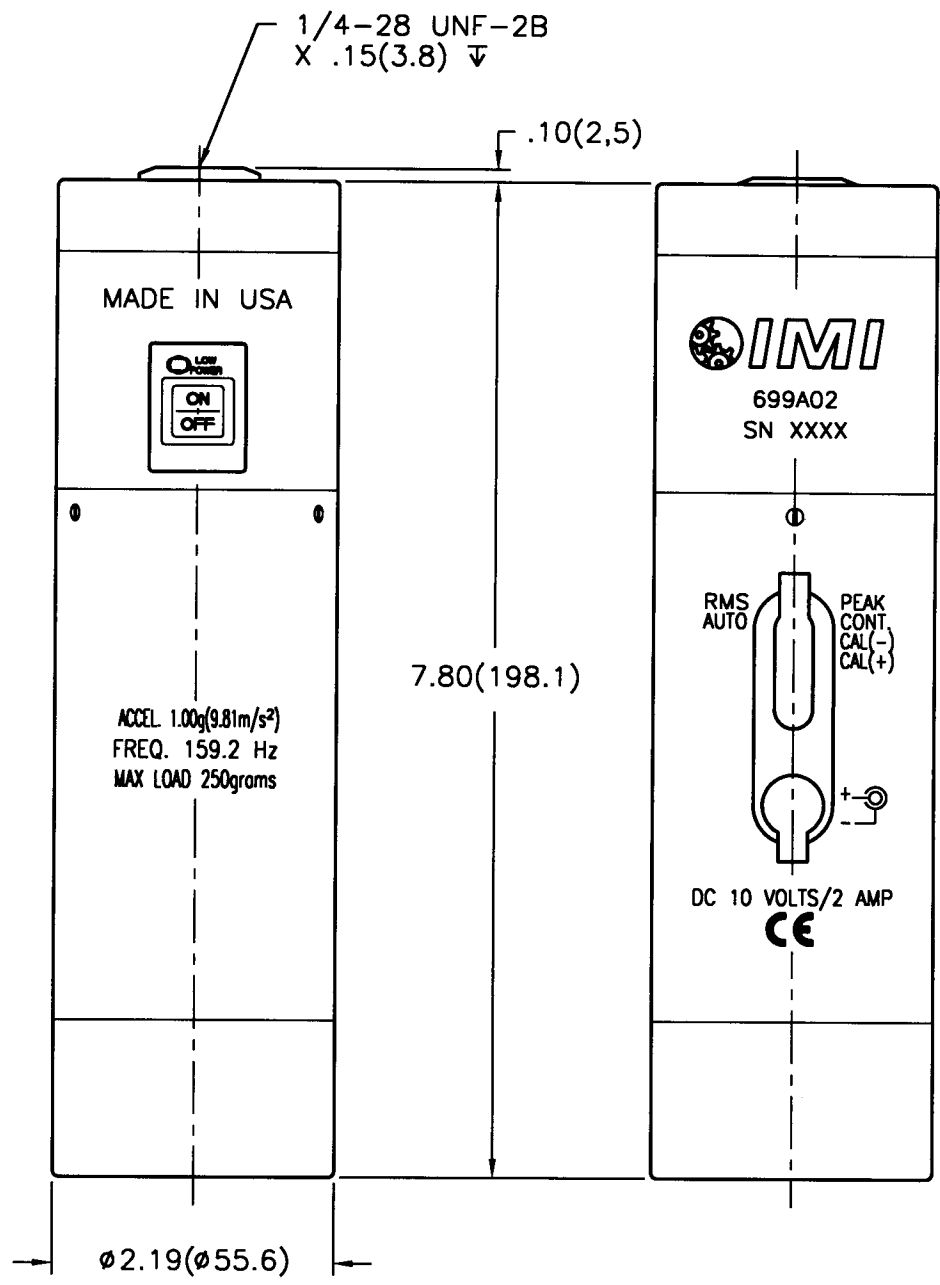
Model Number 699A02	HANDHELD VIBRATION SHAKER			Revision D ECN #: 33831										
Performance Operating Frequency (±1 %) Acceleration Output (±3 %) Velocity Output Displacement Output Transverse Output Distortion (0 to 250 grams load) Maximum Load Automatic Switch Off Time Calibration Cycles (250 gram load)	ENGLISH 159.2 Hz 1 g rms 0.39 in/sec rms 0.39 mil rms ≤3 % ≤7 % 8.8 oz 1.0 to 2.5 minutes 90 cycles	SI 159.2 Hz 9.81 m/s ² rms 9.81 mm/s rms 9.81 mil rms ≤3 % ≤7 % 250 gm 1.0 to 2.5 minutes 90 cycles		Optional Versions (Optional versions have identical specifications and accessories as listed for standard model except where noted below. More than one option maybe used.)										
Environmental Temperature Range (Operating)	15 to 130 °F	-10 to 55 °C		Notes [1] Typical. [2] Alkaline type recommended for longest service life. [3] Approximate values, based on automatic switch off time and dependent on type of batteries. [4] Unit supplied set to rms; see manual for peak selection. [5] Calculated values for reference only. [6] Typical max for range [7] For sensors weighing <75 grams add model 080A136 mass [8] Unit supplied set to auto shut off; see manual for continuous use selection. [9] Test sensor should be hand tightened (without tools). [10] Transducer to shaker table. [11] See PCB Declaration of Conformance PS022 for details.										
Electrical Ramp-Up time Power Required (Standard) Power Required (Alternate) Internal Battery (Quantity) Internal Battery (Type) DC Power (±5 %) DC Power Battery Life (250 gram load)	≤3 sec Internal Battery DC power 4 AA to 10 VDC to 2.4 amps 2.3 hours	≤3 sec Internal Battery DC power 4 AA to 10 VDC to 2.4 amps 2.3 hours	[1] [2] [3]	Supplied Accessories 073A15 Battery Pack (1) 081A40 Mounting Stud (1) M081A19 Mounting stud, 1/4-28 to M6 x 1, SS with shoulder (1)										
Physical Size (Diameter x Height) Weight (with batteries) Mounting Thread Mounting Torque (Maximum)	2.2 in x 7.8 in 31 oz 1/4-28 Female to 10 in-lb	56 mm x 200 mm 900 gm No Metric Equivalent to 10 in-lb	[1] [9][10] [10]											
														
<i>All specifications are at room temperature unless otherwise specified.</i>														
In the interest of constant product improvement, we reserve the right to change specifications without notice.														
ICP® is a registered trademark of PCB group, Inc.														
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Entered: LLH	Engineer: EGY	Sales: LLH		Spec Number:										
Date: 08/30/2010	Date: 08/25/2010	Date: 08/30/2010		9563										
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APPLICATION		
NEXT ASS'Y	USED ON	VAR

REVISIONS				
REV	DESCRIPTION	ECN	DATE	APP'D
A	REMOVED PCB LOGO	9637	10/6/98	DM10/98



UNLESS SPECIFIED TOLERANCES		DRAWN				MFG		PCB PIEZOTRONICS™	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS (IN PARENTHESIS)	CHK'D	DATE	ENGR	DATE	3425 WALDEN AVE. DEPEW, NY 14043			
DECIMALS XX ± .01	DECIMALS XX ± 0.3	APP'D	DATE	SALES	DATE	(716) 684-0001 EMAIL: SALES@PCB.COM			
XXX ± .005	XXX ± 0.13	TITLE				CODE IDENT. NO.	DWG. NO.		
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES	OUTLINE DRAWING				52681	8792		
FILLETS AND RADII .003 - .005	FILLETS AND RADII (0.07 - 0.13)	MODEL 699A02				SCALE: 1.5X			
DD011 REV. B 03/13/98		HAND HELD CALIBRATOR				SHEET 1 OF 1			