CAL250

Precision Acoustic Calibrator
Technical Reference Manual

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Larson Davis
CAL250
Technical Reference Manual

I250.01 Rev F

Copyright

Disclaimer

The following paragraph does not apply in any state or country where such statements are not agreeable with local law:

Even though PCB Piezotronics, Inc. has reviewed its documentation, PCB Piezotronics Inc. makes no warranty or representation, either expressed or implied, with respect to this instrument and documentation, its quality, performance, merchantability, or fitness for a particular purpose. This documentation is subject to change without notice, and should not be construed as a commitment or representation by PCB Piezotronics, Inc.

This publication may contain inaccuracies or typographical errors. PCB Piezotronics, Inc. will periodically update the material for inclusion in new editions. Changes and improvements to the information described in this manual may be made at any time.

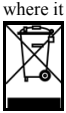
Recycling

PCB Piezotronics, Inc. is an environmentally friendly organization and encourages our customers to be environmentally conscious. When this product reaches its end of life, please recycle the product through a local recycling center or return the product to:

PCB Piezotronics, Inc.
Attn: Recycling Coordinator

1681 West 820 North

Provo, Utah, USA 84601-1341
where it will be accepted for disposal



CHAPTER

1 Introduction

The Larson Davis Model CAL250 is a battery operated precision microphone calibrator used for the calibration of sound level meters and other sound measurement equipment. The CAL250 delivers a full 114.0 dB level output signal @ 251.2 Hz. It has been designed for field or laboratory use and its accuracy has been calibrated to a reference traceable to the National Institute of Standards and Technology (NIST).

About This Manual

This manual has two chapters and one appendix covering the following topics:

- *Chapter 1 - Introduction:* Orients the user to the contents of this user manual and the features, functions and measurement capabilities of the CAL250.
- *Chapter 2 - Using the CAL250:* Describes the setup and operation of the CAL250.

- *Appendix A - Technical Specifications:* Presents the technical specifications of the CAL250.

Features of the CAL250

- Automatic compensation sensors provide accurate calibrations in extreme environments
- An effective volume of > 100 cm^3 (6 in^3) ensures an accurate calibration, even if the microphone and microphone adapter are not fully seated
- An accurate tone is measured even with a weakened battery
- Special adaptors make possible the use of $^1/_8$, $^1/_4$, $^3/_8$ and $^1/_2$ inch microphones, as well as 1 inch microphones without an adaptor

CAL250 Accessories

The CAL250 includes the following accessories:

- ADP019: Adapter for 1/2" microphone
- CCS003: Storage case
- 9 V alkaline battery

Optional Accessories

The following optional accessories are available:

- ADP020: 3/8” adaptor
- ADP021: 1/4” adapter
- ADP023: 1/8” adaptor

CHAPTER

2 Using the CAL250 Calibrator

Installing the Battery

The CAL250 will run for approximately 100 hours on one 9 volt battery. This will give you nearly 4200 calibrations.

The CAL250 uses a 9 volt battery and it is recommended that you use an alkaline battery to extend the running time of your calibrator.

Refer to FIGURE 2-1 and follow the steps below to install the battery:

A. The end cap of the bottom of the calibrator functions as the battery door.

B. Unscrew the cap by hand, in a counterclockwise direction until battery is exposed.

FIGURE 2-1 Remove Battery Cap

C. Pull the battery out of the compartment and undo the battery from the clip

D. Snap a new battery onto the clip and place the battery back into the compartment.

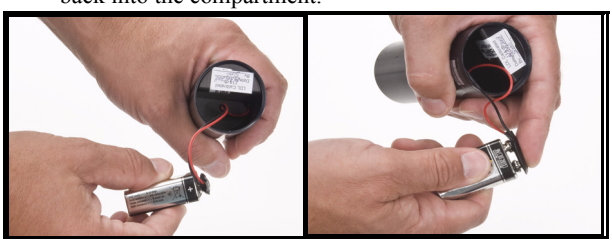


FIGURE 2-2 Replace Battery

E. Replace the battery cap and tighten using only finger/ hand strength

FIGURE 2-3 Replace Battery Cap

Microphone Calibration

The CAL250 provides a nominal tone of 250 Hz at 114 dB. If the device being calibrated has only A-weighting, it should be calibrated to read 105.4 dB.

Perform the Calibration

To calibrate the microphone, follow the steps below:

Step 1 Insert the proper microphone adapter fully into the calibrator. Make sure it fits snugly.

Step 2 Insert the microphone fully into the adapter. Make sure it fits snugly.

Step 3 With the microphone connected to the instrument being calibrated, press the CAL250's ON button. With a fresh battery, the calibrator will issue a tone for more than 60 seconds before automatically shutting off (see note below).

Step 4 Make a reading. If the reading is not within tolerance, refer to the instrument's manual for instructions on how to adjust the instrument.

Step 5 Check the ambient noise level to insure that the calibration was not influenced by noise from external sources. The CAL250 needs to be on the microphone but with the CAL250 signal off. External noise levels lower than 89 dB SPL will influence the calibration by less than 0.015 dB.

As the battery becomes weaker, the calibration tone will not deteriorate, but the operating time will decrease until the time is too short to accomplish an adequate calibration.

NOTE: Each time the ON button is pressed, the CAL250 calibrator will run approximately 60 seconds on a fresh battery. In order for the calibrator to turn off do not press the ON button again. Wait until the calibrator times out. It is not an ON/OFF button

When making a sequence of measurements, a calibration check and an adjustment (if necessary) of the instrument should be

made at the beginning. At the end of the measurement sequence, the calibration should be checked again. The inaccuracy of the measurements will be at least as large as the difference between the level measured for the initial calibration (or calibration check) and the level measured for the final calibration check.

Calibration History

Larson Davis strongly recommends that a history of each calibration adjustment be kept for each piece of equipment. Normally, most modern equipment requires little or no adjustment once the initial calibration is performed. Systematic drifts are possible, and these should be recorded for corrective action.

Most Larson Davis sound level meters keep a history of each calibration change that can be printed before an overall reset. Please refer to the individual instrument manuals for details.

Environmental Precautions

While the CAL250 will perform normally under a wide variety of gradually changing environmental conditions, some precautions should be taken when sudden changes occur:

- The temperature of the CAL250 should be stable. If the temperature changes suddenly, provide a stabilization time of at least 15 minutes. This will ensure that the temperature compensation sensors are at the same temperature as the rest of the unit.

- While humidity will not affect the CAL250, avoid condensing moisture. Also, avoid environments over 90% relative humidity because condensation can easily take place.

- The CAL250 is insensitive to magnetic fields. However, the instrument being tested may not be. Therefore, calibration should not be done near motors, dynamos, high voltage wires, or other sources of electromagnetic fields.

Calibrator Calibration

The American National Standards Institute states, “An acoustical calibrator should be recalibrated at least annually by the instrument manufacturer or an acoustical test laboratory qualified to perform calibration.” (American National Standards Institute. Specifications for Acoustical Calibrators. ANSI S1.40, 1984,

par.t 5.2)

Larson Davis believes the frequency of recalibration depends on the number of calibrators being used and the number of instruments being calibrated. With this in mind, the following guidelines are presented for your consideration:

- For one calibrator and one measurement instrument, the CAL250 should be certified at least yearly.

NOTE: If a systematic drift of several dB occurs, there is no reliable way to verify which instrument is at fault, even though it is more likely to be the measurement instrument.

- For one calibrator and several measurement instruments, one calibration a year is recommended. but if no systematic drift occurs, every two years might be satisfactory.

- For several calibrators and several instruments, one calibration a year is recommended.

NOTE: If the CAL250 is being used to calibrate several instruments, then the history of calibration adjustments can usually pinpoint which instrument is drifting. If all the measurement instruments are drifting in the same direction by an amount you consider significant, the CAL250 should be recertified. If several instruments and several calibrators are in use, then the history of calibration adjustments would precisely pinpoint any problem pieces of equipment. Furthermore, it is probably satisfactory to recalibrate only one of the calibrators

each year.

APPENDIX

A Technical Specifications

The specifications contained in this chapter are subject to change without notice. Please refer to calibration and test results for data on a specific unit.

Standards Met:

- ANSI S1.40-2006, Specifications and Verification Procedures for Sound Calibrators, Class 1
- IEC 60942-2003, Class 1, Sound Calibrators
- IEC 61010-1:2001, Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1, General Requirements
- IEC 61326-1:2005 Electrical equipment for measurement, control, and laboratory use - EMC requirements

Technical Specifications

Calibration sound pressure level (factory specification)	114.0 dB ± 0.1 dB SPL re: 20μPa @ 101.3 kPa, 23 ºC and 50 % RH
Calibration sound pressure level after one year	114.0 ± 0.2 dB under same conditions as above
Equivalent free-field level	0.0 dB for 1/2” microphones
Frequency	251.2 Hz ± 2 Hz
Harmonic distortion	< 2 %
Stability after pressing On	± 0.1 dB after 2 seconds
Minimum stabilizing time after the microphone and the calibrator are coupled together	10 seconds
Static pressure range	65 kPa to 108 kPa, SPL variation will be < ± 0.3 dB
Temperature range	SPL variation < ± 0.4 dB Frequency variation < ± 2 Hz over the range -10 ºC to 50 ºC

Table A- 1 CAL250 Specifications

Humidity range	SPL variation < ± 0.4 dB over the range 10 % to 90 % relative humidity (non-condensing) Frequency variation < ± 2 % over the range 10 % to 90 % relative humidity (non-condensing)
Storage temperature	-40 ºC to 60 ºC
Storage humidity	0 % to 90 % relative humidity (non-condensing)
Effective volume of calibrator and microphone	> 100 cm^3 (6.1 $in.^3$)
Dimensions	Length 124 mm (4.9 in.) Diameter 44.5 mm (1.75 in.)
Weight	249 gm. (8.8 oz.)
Battery	9 V NEDA 1604A or IEC 6LR61. With sufficient battery voltage, calibrator will run (after releasing ON button) for 1 to 1.5 minutes before automatic shutdown. With insufficient battery voltage, calibrator will not remain ON after release of button
Battery Voltage Operating Range	6.7 Volts to 10 Volts

Table A- 1 CAL250 Specifications

Traceability	Utilize a precision condenser microphone (WS2P) in conjunction with other traceable measuring instruments to establish traceability of the output level and frequency of the Model CAL250
CE	CE-mark indicates compliance with EMC directive. Note: The reference orientation for testing the effects of radio-frequency fields is with the radio-frequency field incident on the calibrator side (with the On button) and the electric field vector parallel to the axis of the microphone. This is also the orientation of maximum susceptibility and emissions

Table A- 1 CAL250 Specifications

For use with the following microphone types:

Size according to IEC 61094-4:1995

1” WS1P, WS1F and WS1D without any adaptor

1/2” WS2P, WS2F and WS2D with ADP019 adaptor (supplied)

1/4” WS3P, WS3F and WS3D with ADP021 adaptor (optional)

Size according to IEC 61094-1:2000

1” LS1P without any adaptor

1/2” LS2P with ADP019 adaptor (supplied)

Other Microphones

1/8” with ADP023 adaptor (optional)

PCB PIEZOTRONICS

Declaration of Conformity

Application of Council Directives: 2004/108/EC EMC Directive

Standards to which Conformity is Declared:

CE	CE - mark indicates compliance with EMC directive 2004/108/EC.
Harmonised Standards	IEC 61326-1:2005 Electrical equipment for measurement, control, and laboratory use - EMC requirements. IEC 61326-2-3:2006 Part 2-3: Particular requirements – Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning.
Product Specific standards	IEC 60942:2003 Sound Calibrators. ANSI S1.40-2006 Specifications and Verification Proceedures for Sound Calibrators.
Emissions Test Standards	CISPR 11: edit 4.1 2004: Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement. Class B, Group 1.
Immunity Test Standards	IEC 61000-4-2:2001 Electrostatic discharge (ESD) immunity. ±4 kV contact discharges and ±8 kV air discharges.
	IEC 61000-4-3:2006 Radiated, radio-frequency, electromagnetic field immunity. 80 MHz to 1 GHz at 10 V/m
	IEC 61000-4-8:2001 Power frequency magnetic field immunity. 80 A/m. 50/60 Hz.
Notes: The above are guaranteed only when using accessories listed in the CAL250 product manual.	

Manufacturer's Name: PCB Piezotronics, Inc.
Manufacturer's Address: 3425 Walden Ave.
Depew, NY, 14043, USA

Type of Equipment: **CAL250 - Acoustic Calibrator**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

David M. Carroll
(Signature)
David M. Carroll
(Full name)
V.P. Manufacturing
(Title)
Date: 19 June, 2008

ICP® (Integrated Circuit Piezoelectric) is a registered trademark of PCB Piezotronics, Inc.

- ISO 9001 Certified -

PCB Piezotronics, Inc.
Phone: 716-684-0001 FAX: 716-684-0987

PS080 REV. A 06/18/08 1 of 1

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Total Customer Satisfaction Guaranteed
3425 Walden Avenue, Depew NY USA 14043
Phone: 716-926-8243 Toll Free: 888-258-3222
LarsonDavis.com FAX: 716-926-8215