Larson Davis

CAL200

Technical Reference Manual

I200.1 Rev F

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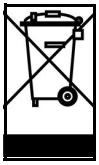

CHAPTER

1 Introduction

The Larson Davis CAL200 Sound Level Calibrator is a battery operated precision microphone calibrator used for the calibration of sound level meters and other sound measurement equipment. It can provide an output level of either 94.0 or 114.0 dB (switch-selectable) at a frequency of 1 kHz. It has been designed for both field and laboratory use and the accuracy has been calibrated to a reference traceable to the National Institute of Standards and Technology.

About This Manual

This manual has 2 chapters and 1 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 CAL200.
- *Chapter 2 - Using the CAL200:* Describes the setup and operation of the CAL200.
- *Appendix A - Technical Specifications:* Presents the technical specifications of the CAL200.

Features

The Larson Davis CAL200 Sound Level Calibrator has the following features:

- Precision sound level calibrator
- Dual output levels: 94.0 dB and 114.0 dB (user selectable)
- Output frequency 1 kHz
- Internal batteries for portable operation
- Opening for use with 1/2” microphones
- Adaptor ADP031 available for use with 3/8” microphones
- Adaptor ADP024 available for use with 1/4” microphones
- Adaptor ADP075 available for use with 1/8” microphones

CHAPTER

2 Using the CAL200 Calibrator

Installing the Battery

The CAL200 uses a 9 volt battery and it is recommended that you use an alkaline battery to extend the running time of your calibrator. The CAL200 will run for approximately 100 hours on one 9 volt battery when using the 114 dB output level. This will give you nearly 4200 calibrations.

Follow the steps below to install the battery:

Step 1 Slide the battery door on the lower section of the back panel up to remove it

Step 2 Gently pull the battery connector clip sufficiently outside the interior to permit it to be snapped onto the battery terminals

Step 3 Tuck the battery, with the battery connector clip attached, into the battery compartment

Step 4 Slide the battery door back into place, pressing until the tab snaps the door securely shut

Microphone Calibration

The CAL200 provides a nominal tone of 1 kHz, which requires no weighting corrections when used with sound level meters utilizing A, B, C or Z (Flat) frequency weighting.

Select the Output Level

The output level is user-selected to be 94.0 or 114.0 dB using the slide selector on the side of the CAL200. Slide the switch to lower position for 114.0 dB or to the upper position for 94.0 dB, as indicated by the label on the lower left of the front panel.

CAL200 Used to Calibrate an Instrument with a ½" Free-Field Microphone

The CAL200 provides a nominal pressure level of 94 dB or 114 dB. The exact levels are printed on the Larson Davis calibration sheet that came with the calibrator. When using a free-field microphone, the pressure level at the microphone diaphragm will be slightly different. Thus, a free field correction of -0.12 dB should be applied to either of these levels. Pressure and random incidence microphone do not require a correction of this type. If the calibrator and instrument are near room temperature (23° C) and near sea level (101.3 kPa) then no other corrections need to be made. If the calibration sheet for the CAL200 indicates 113.98 dB for its level when set to 114 dB then set the Cal Level in the instrument to 113.86 dB and 1 kHz.

When the microphone and instrument are at a temperature other than near room temperature or static pressures not near sea level, then corrections will need to be added for the ambient temperature and the prevailing static pressure. Check the calibration data shipped from Larson Davis with the CAL200 to get these corrections. The corrections can be added to the level obtained in the previous paragraph to get the actual level of the CAL200. The microphone's sensitivity varies with static pressure. If the instrument is calibrated in one environment and moved to another, then the sensitivity will change (after stabilization) depending on the change of temperature and pressure. The coefficient of static pressure is typically -0.013 dB/kPa for PCB ½" free-field microphones. If the system is calibrated at 85 kPa, for instance, then it will be 0.21dB less sensitive at sea level. The sensitivity of the microphone varies slightly with temperature also. The coefficient of temperature is typically -0.009 dB/°C for PCB ½" free-field microphones. If the system is calibrated at 18 °C then it will be 0.05 dB less sensitive at 23 °C.

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 CAL200'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 CAL200 needs to be on the microphone but with the CAL200 signal off. External noise levels lower than 89 dB SPL for the 114 dB level calibration, and 69 dB SPL for the 94 dB calibration level 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 CAL200 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 CAL200 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 CAL200 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 CAL200, avoid condensing moisture. Also, avoid environments over 90% relative humidity because condensation can easily take place.
- The CAL200 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, 2006, par. 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 CAL200 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 CAL200 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 CAL200 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 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, Class1
- 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	94.0 dB and 114.0 dB ± 0.2 dB SPL re: 20µPa @ 101.3 kPa, 23 ºC and 50 % RH (114.0 dB is the principal sound pressure level)
Level Stability Long-Term	± 0.2 dB under same conditions as above
Equivalent free-field level	-0.12 dB for 1/2” free-field microphones
Frequency	1 kHz ± 1%
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
Humidity range	SPL variation < ± 0.3 dB over the range 10 % to 90 % relative humidity (non-condensing) Frequency variation < ± 2 Hz 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	4.15 cm^3 (0.253 $in.^3$)
Dimensions	Length 106.1 mm (4.18 in.) Width 63.4 mm (2.5 in.) Thickness 25.9 mm (1.02 in.)
Weight	156 gm. (5.5 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
Traceability	Utilize a 1/2” precision condenser microphone (WS2P) in conjunction with other traceable measuring instruments to establish traceability of the output level and frequency of the Model CAL200
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 incident on the calibrator face 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 CAL200 Specifications

Microphone Types

According to IEC 61094-4:1995

1/2” WS2P, WS2F and WS2D microphones; no adaptor required.

1/4” WS3P, WS3F and WS3D microphones with ADP024 adaptor.

According to IEC 61094-1:2000

1/2” LS2P

Other Microphones

3/8” with ADP031 adaptor

4180 Microphone

The CAL200 level correction is +0.26 dB

CE Mark Declaration of Conformity

PCB PIEZOTRONICS INC.

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 CAL200 product manual.	

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

Type of Equipment: **CAL200 - 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

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FIGURE A-1 Declaration of Conformity