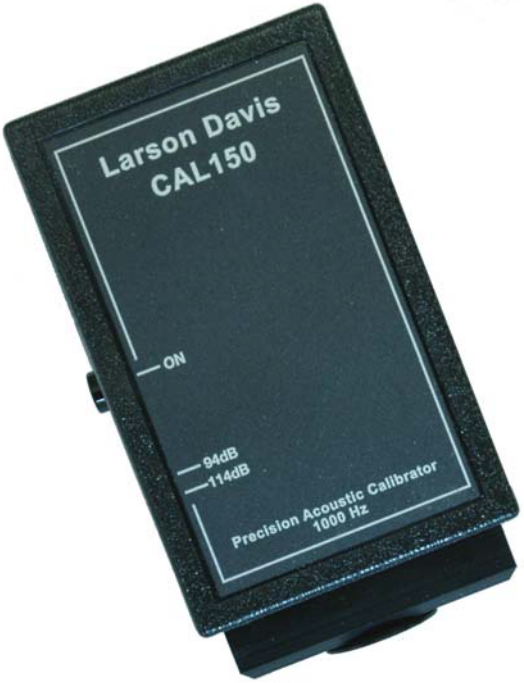
CAL150

Precision Acoustic Calibrator

Manual



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Larson Davis

CAL150

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I150.01 Rev F

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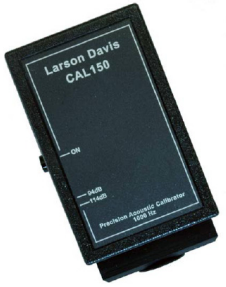
CHAPTER

1 Introduction

This chapter describes the features and accessories of the Larson Davis CAL150 Sound Level Calibrator.

Features

The Larson Davis CAL150 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.



The Larson Davis CAL150 Sound Level Calibrator has the following features:

- Class 2 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

Accessories

- Adaptor ADP031 included for use with 3/8” microphones
- Adaptor ADP024 available for use with 1/4” microphone

CHAPTER

2 Using the CAL150

This chapter describes the setup and operation of the CAL150.

Installing the Battery

The CAL150 uses a nine-volt battery and it is recommended that you use an alkaline battery to extend the running time of your calibrator. The CAL150 will run for approximately 100 hours on one nine-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 CAL150 provides a nominal tone of 1 kHz, which requires no weighting filter corrections when used with sound level meters utilizing A, B, C or Z (Flat) frequency weighting.

Selecting 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 CAL150. 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.

Calibrating with ½" Free-Field Microphone Corrections

The CAL150 provides a nominal pressure level of 94 dB or 114 dB. The exact levels are printed on the Larson Davis calibration sheet that comes 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 CAL150 indicates 113.98 dB for its level when set up 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 CAL150 to get these corrections. The corrections can be added to get the actual level of the CAL150.

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 0.21 dB 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.

To calibrate the microphone, follow these steps:

Step 1 Place the instrument so that you can perform the calibration vertically, as shown in Figure 2-1.

WARNING! *Do not remove the microphone grid cap during calibration as this may damage the microphone.*

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

Step 3 Insert the microphone fully into the adapter. Make sure it fits snugly.

The preferred method for calibrating with the CAL150 is to mount the preamplifier in a fixed, vertical position.

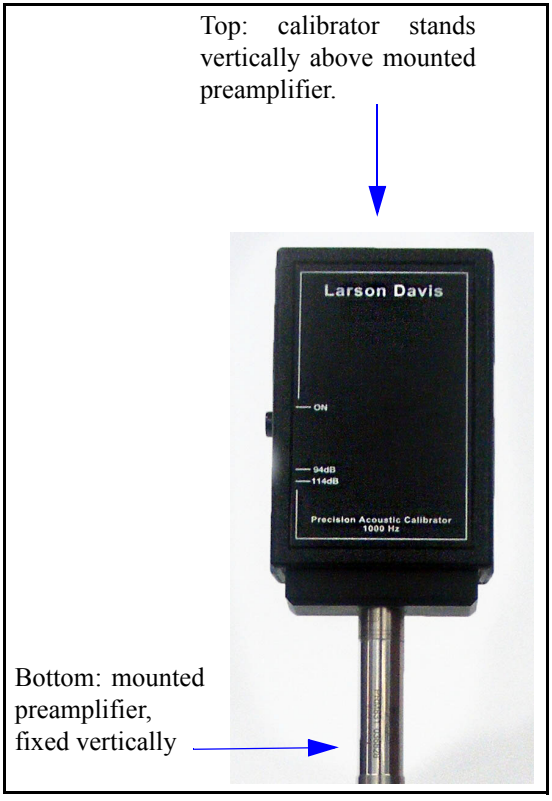


FIGURE 2-1 Vertical Positioning

Step 4 With the microphone connected to the instrument being calibrated, press the CAL150'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 5 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 6 Check the ambient noise level to insure that the calibration was not influenced by noise from external sources. The CAL150 needs to be on the microphone but with the CAL150 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.

Each time the ON button is pressed, the CAL150 will run approximately 60 seconds on a fresh battery. Do not press the ON button again to turn it off. 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 respective instrument manuals for details.

Environmental Precautions

While the CAL150 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 CAL150 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 CAL150, avoid condensing moisture. Also, avoid environments over 90% relative humidity because condensation can easily take place.
- The CAL150 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 CAL150 should be certified at least yearly.

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.

If the CAL150 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 CAL150 should be re-certified.

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, Class 2
- IEC 60942-2017, Class 2, 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)	94.0 dB and 114.0 dB ±0.3 dB SPL re: 20µPa @ 101.3 kPa, 23 ºC and 50 % RH (114.0 dB is the principal sound pressure level)
Calibration sound pressure level after one year	114.0 dB ± 0.3 dB under same conditions as above
Equivalent free-field level	93.88 dB and 113.88 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 calibrator are coupled together	10 seconds
Static pressure range	65 kPa to 108 kPa, SPL variation will be < ± 0.4 dB

Temperature range	SPL variation < ± 0.6 dB Frequency variation < ± 2 Hz over the range of -10 ºC to 50 ºC
Humidity range	SPL variation < ± 0.5 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	4.15cm^3 (0.253 in.^{3}) with LD Model 2559 Microphone
Influence of Load Volume	<0.2 dB
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 CAL150
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 CAL150 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; no adaptor required

Other Microphones

3/8” with ADP031 adaptor

CE Mark Declaration of Conformity

PCB PIEZOTRONICS Inc.

LARSON DAVIS
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EU Declaration of Conformity PS078
In Accordance with ISO/IEC 17050

Manufacturer:	PCB Piezotronics, Inc. 3425 Walden Avenue Depew, New York 14043 USA	**Authorized European Representative:**	PCB Piezotronics Europe GmbH Porschestrasse 20-30 41836 Hückelhoven,Germany

Certifies that type of equipment: CALXXX Acoustic Calibrator

Whose Product Models Include: CAL150, CAL200, and CAL250

This declaration is applicable to all Acoustic Calibrators of the above series which have the CE mark on their data sheets and where those data sheets refer to this Declaration of Conformity. The data sheets for all model numbers referenced above which include the CE mark on such data sheets and refer to this Declaration of Conformity are hereby incorporated by reference into this Declaration.

Conform to the following EU Directive(s) when installed per product documentation:	2014/30/EU 2014/35/EU 2011/65/EU	EMC Directive Low Voltage Directive RoHS Directive

Standards to which Conformity is Declared:

Harmonized Standards	EN 61326-1:2013 EN 61326-2-3:2013 EN 61010-1:2010 EN 50581:2012	Electrical Equipment for Measurement, Control and Laboratory Use- EMC Electrical Equipment for Measurement, Control and Laboratory Use- EMC Safety Standard Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
Product Specific Standards	EN/IEC 60942:2017	Sound Calibrators
Emissions Test Standards	EN 55011:2009 +A1:2010	Industrial, scientific and medical(ISM) radio frequency equipment Electromagnetic disturbance characteristics- Limits and methods of Measurement Class B
Immunity Test Standards (Non-OJEU)	EN 61000-4-2:2001 EN 61000-4-3:2006 EN 61000-4-8:2001	Electrostatic Discharge (ESD) immunity Radiated, radio-frequency, electromagnetic field immunity Power frequency magnetic field immunity. 80 A/m. 50/60 Hz
Test Reports	EMC and Safety Reports	D1244.0009, D1244.0021, D1244.0017

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

Place: Provo, UT **Date:** 12/13/17

Signature: Carrie Termin

Name: Carrie Termin

Title: Regulatory Affairs and Product Certification Specialist

- ISO 9001 Certified PCB Piezotronics, Inc. Phone: 716-684-0001 FAX: 716-684-0987

PS078 Rev. G 12/13/2017

FIGURE A-1 CE Mark Declaration of Conformity