

Larson Davis

CAL291

Technical Reference Manual



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Introduction

The Larson Davis Model CAL291 Residual Intensity Calibrator satisfies the residual intensity test device specifications of both IEC 1043:1993 and ANSI S1.9-1996.

About This Manual

This manual has 3 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 CAL291. It also includes instructions on unpacking the CAL291.
- *Chapter 2 - Description:* Provides a physical description of the CAL291.
- *Chapter 3 - Operation:* Describes the setup and operation of the CAL291.
- *Appendix A- Specifications:* presents the technical specifications of the CAL291.

Features

The Larson Davis Model CAL291 Residual Intensity Calibrator has the following features:

- Applies the same signal with zero phase difference to a pair of 1/2” or 1/4” microphones
- Can be driven by external signal generators such as the following:
 - Larson Davis Model SRC20 Signal Source
 - Analog or digital signal generator modules available for the Larson Davis Models 2800, 2900, 3000+ and 3200 portable real-time analyzers.
- Built-in amplifier provides sound pressure levels to 122 dB

Applications

- Generation of signals for verification of the amplitude/phase accuracy of multi-channel acoustic measurement systems
- Amplitude/Phase Normalization: The digital filters of the Larson Davis analyzers provide both amplitude and phase, permitting the measurement of the complex transfer function between two measurement channels, including microphones, in the 1/3 octave frequency bands. By using the CAL291 to excite both microphones simultaneously, the amplitude and phase differences between the two measurement channels can be determined as a function of frequency. From this information, a correction function can be generated within the analyzer to correct for any amplitude and phase errors which may have existed between channels prior to the normalization.

Unpacking and Inspection

Your CAL291 has been shipped in protective packaging. Please verify the package contains the items listed below and retain the shipping container for safe shipment at a future date. Report any damages or shortage immediately to Larson Davis, Inc. at 801-375-0177.

If you have not already done so, please record your instrument's serial number (located on the bottom of the instrument) and the purchase date. You may be asked to give this information in future communications with Larson Davis.

Accessories

The CAL291 is delivered with the following *standard* accessories:

- PSA004 100 - 240 VAC to 12 Vdc 2.5A Switching AC Power Adaptor
- Two ADP038 1/2" to 1/4" microphone adaptors
- User Manual (Larson Davis part number I291.01)
- Calibration Certificate

Description

The physical description of the CAL291 is presented in this chapter. Operational information is presented in Chapter 3 “Operation” on page 3-1

General Description

The CAL291 has a flat shape factor for optimal use on a table or desktop. In use, the sound intensity probe of the intensity measurement system to be evaluated is laid flat on the table with the two microphones inserted into the microphone ports of the CAL 291 as shown in Figure 2-1.



FIGURE 2-1 CAL291, General View

Microphone Ports

The microphone ports are on two opposite faces of an aluminum block mounted on one end of the CAL291, as shown in Figure 2-2.



FIGURE 2-2 Aluminum Block with Microphone Ports

End Plate

The power switch, electrical input connector, DC power connector and fuse are located on the end plate, as shown in Figure 2-3.

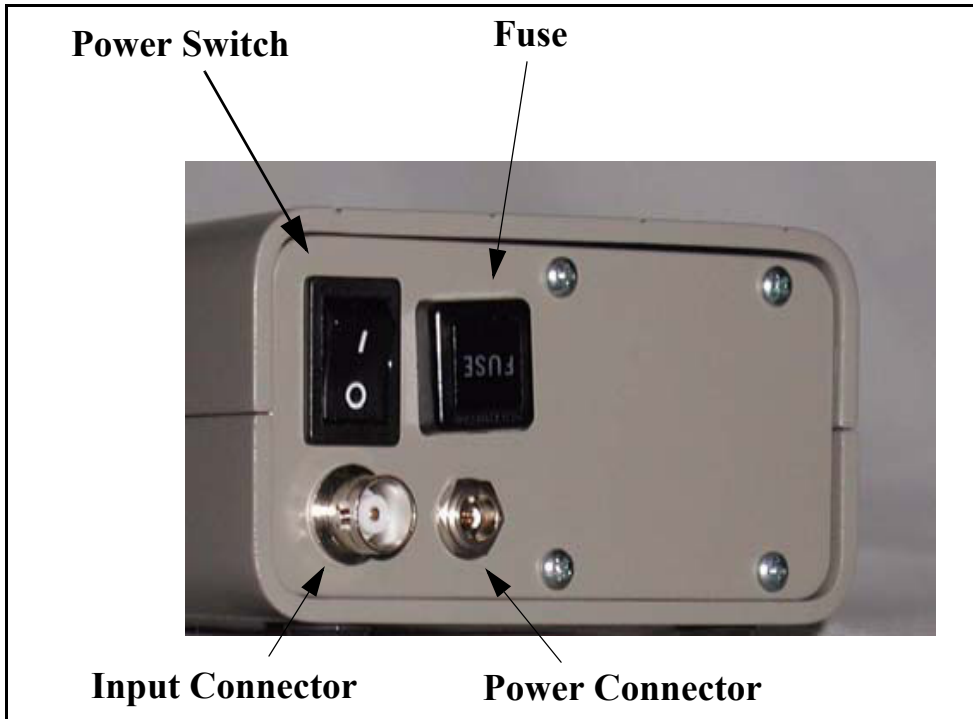


FIGURE 2-3 CAL291 End Plate

Connectors

Input

BNC Female

Power

2.5 X 5.5 mm coaxial connector, center positive

Operation

This chapter presents a detailed description of the operation of the CAL291.

Powering the CAL291

An LED in the center of the top surface of the CAL291 is illuminated when the CAL291 power is On.

The CAL291 is powered by the Larson Davis PSA004, which is supplied as a standard accessory. Connect to the AC power cable to main power and the DC output to the power connector on the end plate of the CAL291. Press the upper portion of the power switch (I) to switch on the CAL291 and press the lower portion (O) to switch it off.

Input Signal

The CAL291 was designed to work optimally with the analog and digital signal generators available with the Larson Davis Models 2800, 2900, 3000+ and 3200 portable real-time Analyzers.

Connect the output from the external signal generator capable of generating pink noise to the BNC input on the end plate of the CAL291.

Microphone Placement

In most cases this CAL291 will be used with a dual channel sound intensity probe, although it can also be used with two separate microphones mounted on the microphone preamplifiers.

- If using a sound intensity probe, separate the two microphones as described in the operating manual for the probe, remove the space, and spread the microphones far enough apart that they can be placed over the microphone port block. Do not remove the microphone grid caps. Slide them firmly into the two ports as shown in Figure 3-1.



**FIGURE 3-1 Microphone In Place Inside
Microphone Ports of CAL291**

- If using separate microphones, insert each firmly into the microphone ports. It may be necessary to place support beneath the preamplifiers so that they are aligned parallel to the center line of the microphone port openings.

Pressure\Residual Intensity Measurement

The CAL291 can be used to determine the pressure-residual intensity index of either the sound intensity probe or the complete sound intensity measurement system.

With the probe microphones inserted into the microphone ports as described in “Microphone Placement” on page 3-1, excite the CAL291 with pink noise at a low voltage level using the signal generator.

Table 3-1 shows the recommended maximum input voltage level to the CAL291 for several different frequency bands, and the corresponding sound pressure levels which would be produced at the microphone diaphragms.

To maintain the total harmonic distortion less than 1%, the sound pressure level at the microphones should be kept within the range of 25 dB- 121 dB (1 kHz). Adjust the signal generator output to obtain a sound pressure level at the microphones within this range and the amplitude level difference between the two microphones will be < 0.1 dB (@ 1kHz). The phase angle between the acoustic signals will be zero.

Frequency (Hz)	Output SPL (dB re. 20 μ Pa)	Maximum Input Voltage (dB μ V)
250	≥ 124	128
630	≥ 122	127
1000	≥ 121	128
1600	≥ 121	127
2000	≥ 118	128
2500	≥ 119	121
6300	≥ 112	113

Table 3-1 Output Level and Maximum Input Voltage

The signals applied to the microphones will no be as required for the measurement of the pressure-residual intensity index.

ANSI S1.9-1997 and IEC1043:1993 call for the measurement of the pressure-residual intensity index in 1/3 octave bands (1/1 octave bands for the instrument providing only 1/1 octave analysis). The user is directed to refer to the

appropriate standards for further details on performing these measurements as specified.

Amplitude/Phase Normalization

For sound intensity measurements, it is essential to have the best possible amplitude and phase match between measurement channels in order to meet the minimum pressure-residual intensity index cause stipulated by the standards. Both the ANSI and IEC standards include provisions for phase compensation in the measurement system.

Because a residual intensity testing device is being used as the acoustic source for both microphones, we know that they are exposed to equal amplitude signals with zero phase difference between them (within the limits of the device). Thus, any variation of the magnitude of the transfer function between channels from unity (0 dB) and of the phase from zero is the result of errors in the measurement system which includes the microphones, intensity probe electronics and the analyzer.

Some instruments, such as the Larson Davis Models 2900B, 3000+ and 3200 can not only measure the complex transfer function between channels in the 1/3 octave frequency bands, but they can also use the measured transfer function to generate a correction function to correct for some of the errors and decrease the pressure-residual intensity index of the system. For further details on the implementation of this normalization technique, see the operators manual for the instrument being used.

A

Technical Specifications

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

Standards

Meets the residual intensity test device specifications as presented in IEC 1043:1993 “Instruments for the measurement of sound intensity” and ANSI S1.9-1996 “Instruments for measurement of sound intensity”.

Input

Input Connector
BNC with impedance of $1M\Omega$

Acoustical Output

- Sound Pressure Level (1% harmonic distortion): 25 - 115 dB @ 1kHz
- SPL difference between channels: < 0.1 dB 1 kHz
- Maximum pressure-intensity index: > 27 dB
- Output Level and Maximum Input Voltage for < 1% distortion: as specified in Table A-1 on page A-2

Frequency (Hz)	Output SPL (dB re. 20 μ Pa)	Maximum Input Voltage (dB μ V)
250	≥ 124	128
630	≥ 122	127
1000	≥ 121	128
1600	≥ 121	127
2000	≥ 118	128
2500	≥ 119	121
6300	≥ 112	113

Table A-1 Output Level and Maximum Input Voltage

Mechanical Characteristics

Length

25.6 cm (10.3 in)

Width

10.0 cm (4.0 in)

Height

5.3 cm (1.1 in)

Weight

1.0 kg (2.2 lb)

Power

D.C. Power: 9 -16 Vdc, 400 mA provided by PSA004 DC Power Supply (included) 90 - 240 VAC @ 50- 60 Hz

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