Sound Intensity Calibrator Type 51AB Serial No. : 82893

Introduction

The Sound Intensity Calibrator is a two port calibration coupler for phase and level calibration of sound intensity microphone pairs. The Sound Intensity Calibrator is connected to an external electrical generator producing either white, pink noise or sine waves.

The Sound Intensity Calibrator consist of a sound source which supplies a well defined sound pressure field simultaneously to the diaphragms of two measurement microphones. This can be ½ inch microphones or, by using two adapters, 1/4 inch microphones. The microphones are inserted into the holes in the ends of the Sound Intensity Calibrator. The external generator is connected to the BNC connector on the side of the Sound Intensity Calibrator. For a sound pressure level inside the coupler with the microphones inserted of approximately 102 dB (re. 2'10-5Pa) the generator should supply approximately 600mV rms. The electrical input to the Sound Intensity Calibrator should never exceed 1V rms.

The Sound Intensity Calibrator can be used in two modes, either as a P-I index calibrator or as an intensity/particle velocity calibrator. In the P-I index mode the two microphones are subjected to exactly the same sound field so that the difference in phase response between the two microphones can be determined. In the intensity/particle velocity calibration mode the sound pressure signal supplied to one of the microphones in the Sound Intensity Calibrator is phase shifted relative to the signal to the other microphone. This phase shift is established by introducing an acoustic resistor in the coupler between the two microphones.

P-I index Measurement Procedure

To determine the phase-match of an intensity probe, the P-I index is measured with an intensity analyzer. Before measuring the P-I index of the sound intensity microphone pair it should be checked that the phase match of the two channels of the sound intensity analyzer is sufficient. This can be done by electrically measuring the P-I index of the sound intensity analyzer alone. Connect the same signal to the two inputs of the intensity analyzer and measure the levels in pressure mode and intensity mode. The intensity analyzer should be set to measure the intensity corresponding to a 25 mm microphone spacing. The pressure mode result should be measured in dB re. 2'10-5Pa and the intensity result in dB re. 10-12 W/m2. The P-I index of the sound intensity analyzer is then the difference, in dB, of these two dB values. For frequencies above 300 Hz, this should be at least 29 dB.

When it has been assured that the P-I index of the sound intensity analyzer is large enough, the intensity probe, consisting of sound intensity microphone pair and preamplifiers can be checked with the 51AB Sound Intensity Calibrator. Mount the intensity microphones on the preamplifiers and connect the output of the preamplifiers to the sound intensity analyzer. Insert the microphones into the holes in the ends of the Sound Intensity Calibrator, making sure that they are pushed all the way in. Connect a white noise, pink noise or sine generator to the BNC input on the Sound Intensity Calibrator. The P-I index of the probe can now be determined by measuring the levels in the mean pressure mode and intensity mode. The intensity analyzer should be set to measure the intensity corresponding to a 25mm microphone spacing.

The pressure mode result should be measured in dB re. 2'10-5Pa and the intensity result in dB re. 10-12 W/m2. The P-I index of the sound intensity probe is then the difference, in dB, of these two dB values. Note that in order to determine the P-I index accurately, long averaging times are necessary. For example to determine a P-I index of 20 dB at 50 Hz, with a bandwidth of 1/3 octave, the averaging time should be at least 4 min.

Intensity and Velocity calibration

The calculation procedures for sound intensity and particle velocity can be checked with the Sound Intensity Calibrator in the intensity/particle velocity calibration mode. For this, an acoustic resistor must be introduced into the calibration chamber. The four screws in the black end of the Sound Intensity Calibrator are removed. The acoustic resistor Part "C" is mounted between the black coupler part and the other part and the Sound Intensity Cali-brator is assembled again. Mount the one intensity microphone in the Sound Intensity Calibrator hole in the end with the connector (channel A) and the other microphone in the hole in the black end of the Sound Intensity Calibrator. Adjust the sound pressure level in the coupler as measured with microphone channel A to 94 dB re. 2'10-5Pa by adjusting the output level from the generator. For any other sound pressure level subtract the difference value in dB given below from the sound pressure level to obtain the intensity level for a 25mm spacer. For a 50mm spacer add 3.0dB to the difference value. For a 12mm spacer subtract 3.0dB from the difference value. The calculated intensity levels and particle velocity levels should then be as indicated below, in the calibration data section for the Sound Intensity Calibrator.

Calibration Data for 51AB Serial No. : 82893

For a Sound Pressure Level of 94 dB re. $2*10^{-5}$Pa (= 1.0Pa) the calibrator will give :

Intensity level :	at 250 Hz	91.1 dB. re. 10^{-12}W/m^2	2.9 dB difference value
	at 1kHz	92.1 dB. re. 10^{-12}W/m^2	1.9 dB difference value
Velocity level :	at 250 Hz	93.5 dB. re. 10^{-12}W/m^2	0.5 dB difference value
	at 1kHz	89.8 dB. re. 10^{-12}W/m^2	4.2 dB difference value

These calibration values are valid for a spacing of 25 mm between the microphones and an equivalent microphone volume of 35 mm^3, at 23°c and 1013 hPa.

Date : 06/05/2008 Operator : HM

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