

# **Instruction Manual**

## **Sound-intensity Calibrator Type 51AB**



**G.R.A.S.**  
**Sound & Vibration**

## **Sound-intensity Calibrator Type 51AB**

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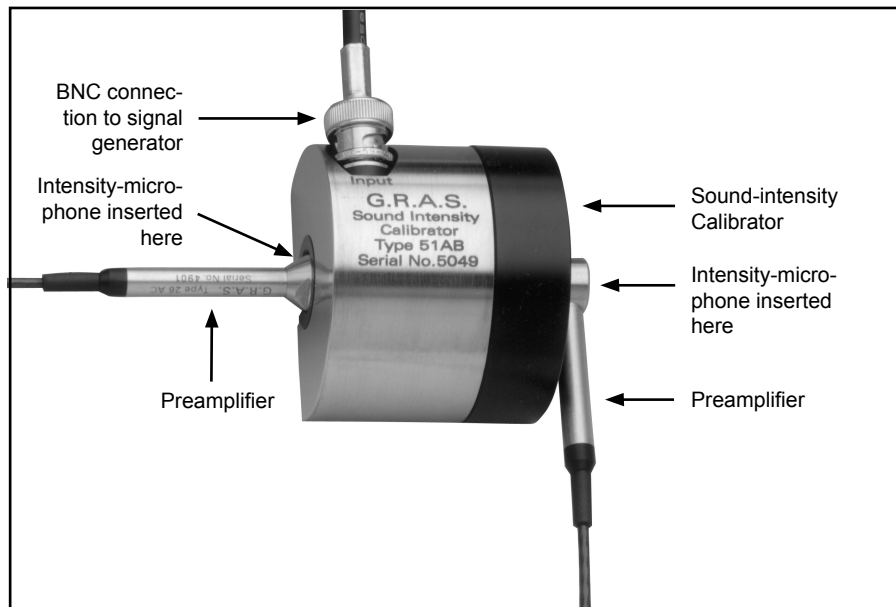
# 1 Introduction

The Sound-intensity Calibrator Type 51AB is a two-port calibration coupler for phase and level calibration of sound intensity microphone pairs. It can be connected to an external electrical signal generator producing any of the following signals:

- white noise
- pink noise
- sine waves.

## 1.1 Description

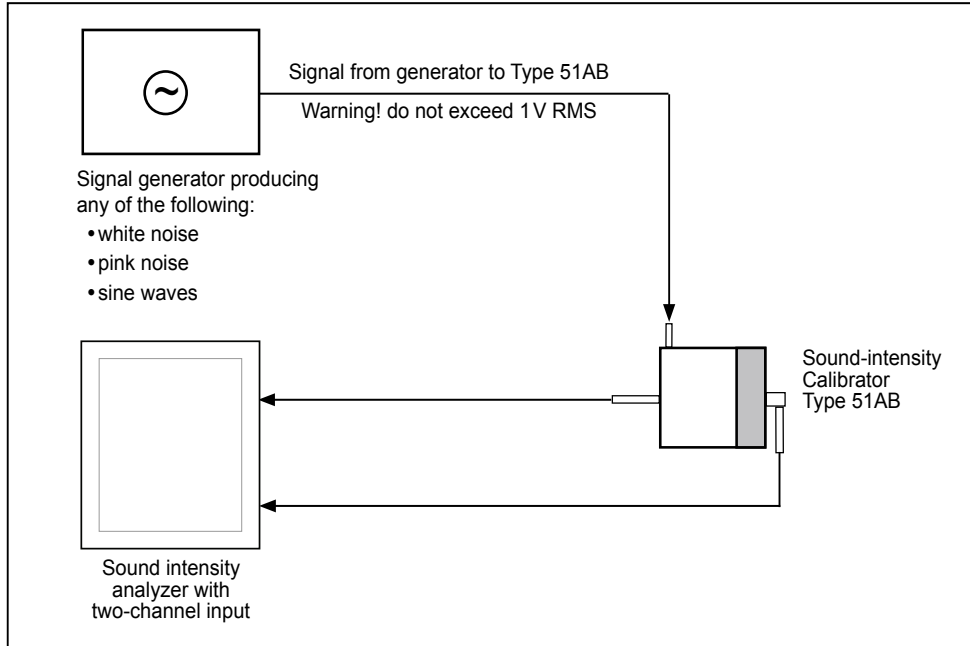
The Sound Intensity Calibrator consists of a sound source which supplies a well-defined sound pressure field simultaneously to the diaphragms of two measurement microphones. These can be either  $\frac{1}{2}$ " microphones or, by using two adapters,  $\frac{1}{4}$ " microphones. The microphones are inserted into the ports at the ends of the Sound Intensity Calibrator (see Fig. 1.1).



*Fig. 1.1 Showing setup for testing a pair of intensity microphones*

The external generator is connected to the BNC connector on the side of the Type 51AB. For a sound pressure level inside the coupler with the microphones inserted of approximately 110 dB (re. 20  $\mu$ Pa) the generator should supply approximately 300 mV RMS.

**Important!** The electrical input to the Sound Intensity Calibrator should never exceed 1 V RMS. Fig. 1.2 shows a setup with a signal generator and a sound-intensity analyzer.



*Fig. 1.2 Type 51AB setup with signal generator and sound-intensity analyzer*

## 1.2 Modes of Use

The Sound Intensity Calibrator can be used in either of the following two modes:

### **P-I Index Calibrator (residual intensity)**

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 them can be determined.

This is treated in section 2.2.

### **Intensity/Particle-velocity Calibrator**

In the intensity/particle-velocity calibration mode, the sound pressure signal applied to one of the microphones in the Sound Intensity Calibrator is phase shifted relative to the signal applied to the other microphone. This phase shift is established by introducing the supplied Acoustic Resistor GU0023 between the two microphones in the coupler.

This is treated in section 2.3.

## 2 P-I index Measurement Procedure

To determine the phase-match of an intensity probe, the P-I index is measured using an intensity analyzer. Before measuring the P-I index of the sound intensity microphone pair, the phase match of the two channels of the sound intensity analyzer should be checked. This can be done electrically by measuring the P-I index of the sound intensity analyzer alone; see below.

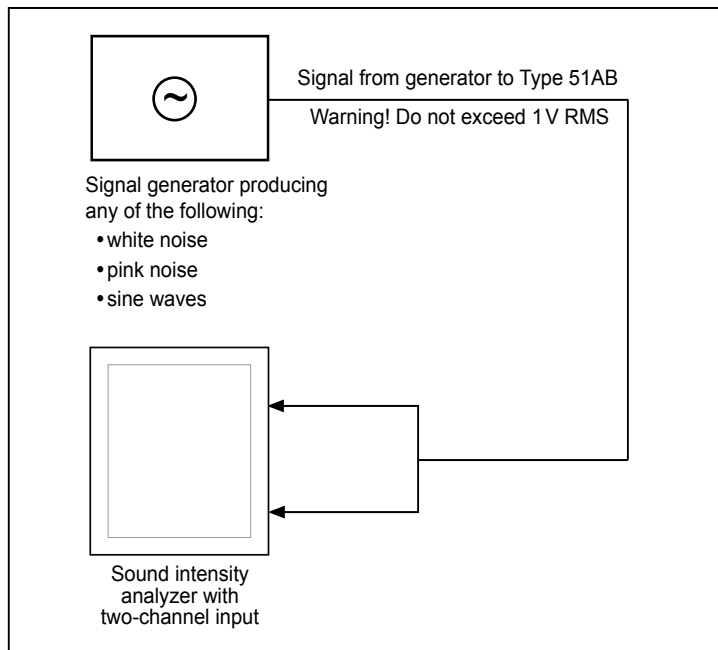
### 2.1 P-I index of Intensity Analyzer Alone

Proceed as follows (refer to Fig. 2.1):

1. Set the the intensity analyzer to measure intensity corresponding to a 25-mm microphone spacing.
2. Apply the same signal\* to the two inputs of the intensity analyzer, and measure the levels in pressure mode and intensity mode.
3. Set the analyzer to mean pressure mode, and measure the result in [dB re. 20  $\mu$ Pa].
4. Set the analyzer to intensity mode, and measure the result in [dB re. 10–12 W/m<sup>2</sup>].

You can now determine the P-I index of the sound intensity analyzer as the difference [dB] of these two results.

For frequencies above 300 Hz, this should be at least 29 dB.



*Fig. 2.1 Setup with signal generator and sound-intensity analyzer alone*

\* The signal that will be used for measuring the P-I index of the intensity probe

## 2.2 P-I index of Intensity Probe

After ensuring that the P-I index of the sound-intensity analyzer alone is large enough (see section 2.1), the intensity probe, consisting of sound intensity microphone pair and preamplifiers can be checked with the Sound-intensity Calibrator Type 51AB.

Proceed as follows (refer to Fig. 2.2):

1. Mount the intensity microphones onto their preamplifiers.
2. Connect the preamplifier outputs to the sound-intensity analyzer\*.
3. Insert the microphones into the ports at the ends of the Sound-intensity Calibrator, making sure to push them all the way in.
4. Set the the intensity analyzer to measure intensity corresponding to a 25-mm microphone spacing.
5. Apply a signal\*\* to the BNC input of the Sound-intensity Calibrator.  
**Important!** Signal must not exceed 1 V RMS).
6. Set the analyzer to mean pressure mode, and measure the result [dB re. 20  $\mu$ Pa].
7. Set the analyzer to intensity mode, and measure the result [dB re.  $10^{-12}$  W/m<sup>2</sup>].

You can now determine the P-I index of the intensity probe as the difference [dB] of these two results. For frequencies above 300 Hz, this should be at least 20 dB.

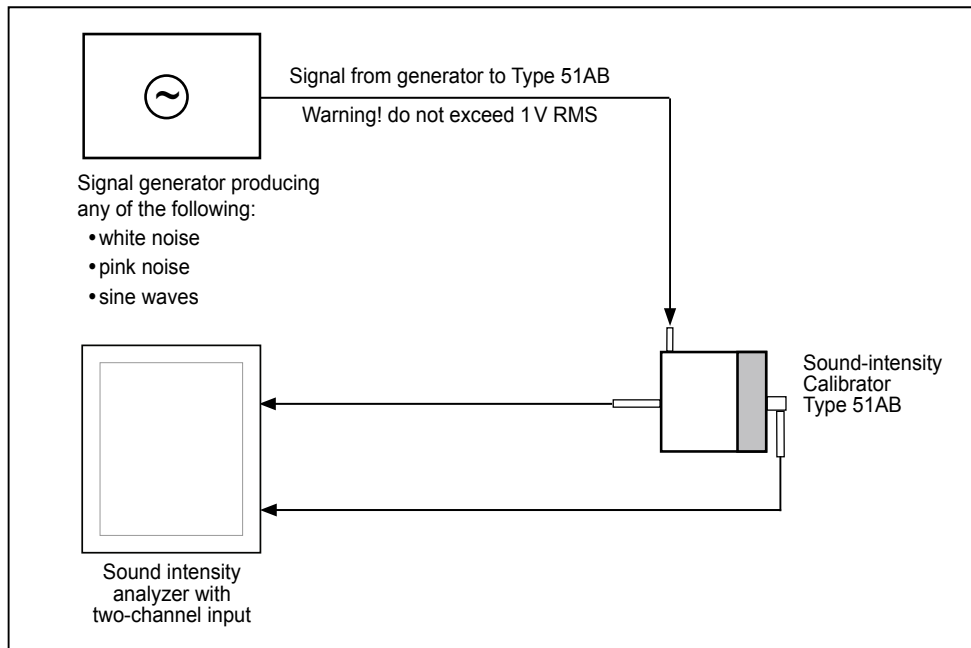


Fig. 2.2 Type 51AB setup with signal generator and sound-intensity analyzer

\* Via a preamplifier power module (e.g. the GRAS 2-channel Power Module Type 12AA) if the sound-intensity analyzer does not provide power for preamplifiers.

\*\* White-noise, pink-noise or a sine wave.

## 2.3 Calibration of Sound Intensity and Particle Velocity

You can check the calibration of sound intensity and particle velocity using the Sound Intensity Calibrator Type 51AB in the intensity / particle velocity mode.

Proceed as follows (refer to Fig. 2.3):

1. Insert Acoustic Resistor GU0023 into the calibration chamber.
  - a. Remove the four Allen screws located in the black part of the Sound Intensity Calibrator (Allen key supplied).
  - b. Mount the acoustic resistor between the black coupler and the other part of the sound intensity calibrator.
  - c. Remount the four screws.
2. Mount one intensity microphone into test port A (channel A) and the other intensity microphone into test port B (channel B).
3. Adjust the generator's sound pressure level until the microphone of Channel A produces 94 dB re. 20  $\mu$ Pa.
4. To determine the intensity level for the 25-mm spacing for any sound pressure level, subtract the difference [dB] (given in the Calibration Chart for the sound intensity calibrator) from the sound pressure level.

For a 50-mm spacer, *add* 3.00 dB to the difference [dB].

For a 12-mm spacer, *subtract* 3.00 dB from the difference [dB].

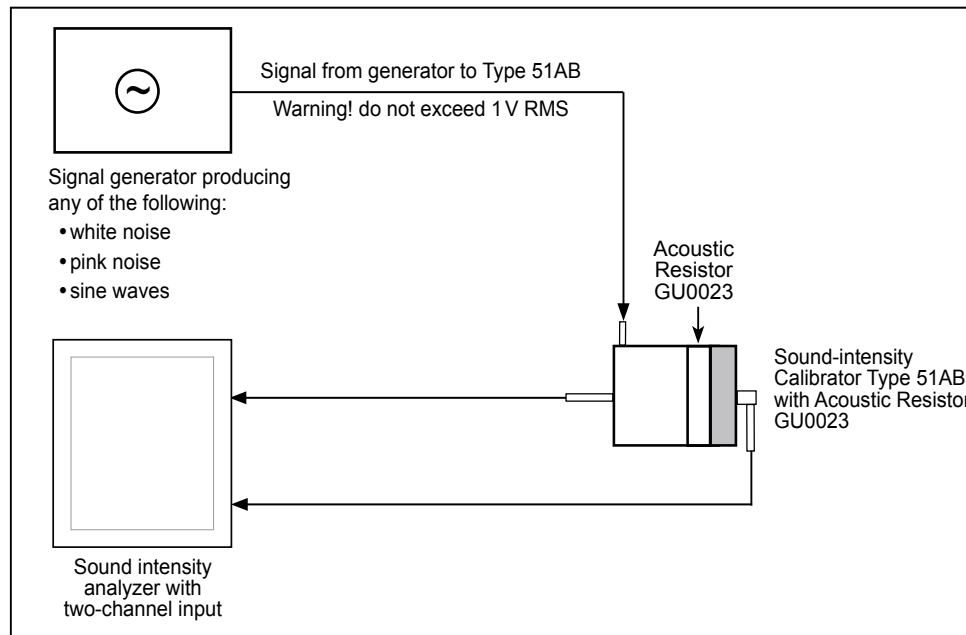


Fig. 2.3 Setup with Acoustic Resistor GU0023 inserted in Type 51AB

### Calibration Data for 51AB Serial No. 82893

For a Sound Pressure Level of 94 dB re. 20  $\mu$ Pa (= 1 Pa), the calibrator will give:

Intensity Level:	at 250 Hz	91.1 dB re $10^{-12}$ W/m <sup>2</sup>	2.9 dB difference
	at 1 kHz	92.1 dB re $10^{-12}$ W/m <sup>2</sup>	1.9 dB difference
Velocity Level:	at 250 Hz	91.1 dB re $10^{-12}$ W/m <sup>2</sup>	0.5 dB difference
	at 1 kHz	89.8 dB re $10^{-12}$ W/m <sup>2</sup>	4.2 dB difference

The calibration values are valid for a spacing of 25 m between the microphones and an equivalent microphone volume of 35 mm<sup>3</sup> at 23 °C and 1013 hPa.



### 3 Specifications

**Standards:**

IEC standard 1043 Electroacoustics - Instruments for the measurements of sound intensity  
- Measurement with pairs of pressure sensing microphones

**Input connector:**

BNC socket

**Maximum input signal:**

1 V RMS

**Frequency range:**

50 Hz - 6.3 kHz

**Pressure-intensity index:**

> 27 dB

(for 25 mm nominal microphone spacing)

**Sound-pressure-level difference between channels:**

< 0.1 dB

**Operating temperature range:**

+ 5 °C to + 40 °C

**Dimensions:**

Height: 42.2 mm

Width: 50.3 mm

Depth: 60.0 mm

**Weight:**

515 gm (1.3 lbs)

### 4 Accessories

**Included:**

GU0048: Adapter for 1/4" microphones

GU0023: Acoustic Resistor

AA0033: BNC , 1 m, 50 Ω

YY0008: 3-mm Allen key, ball-headed

EM0011: Calibration chart

**Optional:**

Manufactured to conform with:

CE marking directive:  
93/68/EEC



WEEE directive:  
2002/96/EC

