What is the difference between a pistonphone and a sound calibrator?

Pistonphones and sound calibrators are instruments designed for sensitivity checking and calibration of measurement microphones. In order to do that, these instruments can produce a reference signal at a specific level and frequency. Even though both instruments share the same goal, there are some key differences in the use, working principles and applications, that need to be considered.

A Pistonphones is a precision sound source for accurate and reliable calibration of measurement microphones. It produces a reference signal using the mechanical movement of two reciprocated pistons actuated by a precision-machined cam disc with a sinusoidal profile (Figure 39).

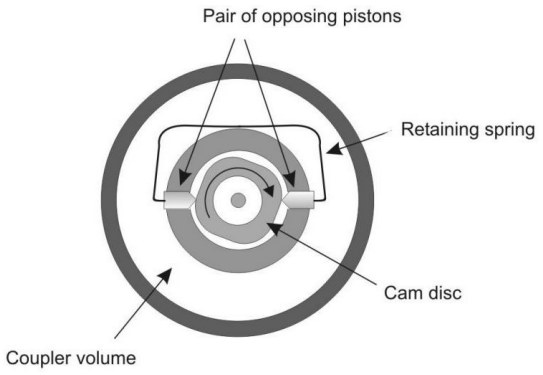

Figure 1. Principle of opertation of the Pistonphone.

Pistonphones have calibration couplers (Figure 40) with a very well defined volume. The pistonphone is calibrated so it produces a certain reference signal (i.e. 114dB @ 250 Hz) with a specific type of measurement microphone at specific environmental conditions (temperature, static pressure and humidity). At these reference conditions, the pistonphone can have a calibration accuracy of +/- 0.09 dB.

Figure 2. Left: Pistonphone with 1" and ½" calibration couplers. Right: ½" microphone set inserted in pistonphone´s calibration coupler.

When a microphone with different dimensions is inserted in the calibration coupler, the volume of the coupler will change compared to the original reference volume. When this happens, the sound pressure level inside the calibration coupler will change due to the air volume modification. Therefore, it will be necessary to apply corrections to the measured results to compensate for the internal volume change and being able to perform an accurate calibration.

The same happens when the environmental conditions differ from the refence conditions. The measured results can be corrected for the deviations in static pressure, temperature and humidity from the reference conditions.

The pistonphone is an expensive and extremely accurate piece of equipment usually reserved for laboratory use. The pistonphone has to be operated by an expert who knows how to apply the volume and environmental corrections in order to take advantage of its calibration accuracy.

Sound calibrators, on the other hand, are less expensive and less accurate, but easier to operate compared to pistonphones. The principle of operation is also completely different, reliying on the use of an internal sinus generator circuit, amplifier and loudspeaker.

This simple design allows this instrument to be able to produce 1 or more different tones at different levels, so the calibration can be performed with different calibration signals. As an example, GRAS 42AG has two calibration frequencies (250 Hz and 1000 Hz) and two levels (94 dB and 114 dB).

Figure 3. GRAS 42AG Sound Calibrator.

Another great advantage of the sound calibrator is that it uses an internal microphone that measures the sound pressure level in the calibration chamber. This data is used by a feed-back and control circuit to correct for any deviations from the stablished sound pressure level due to changes in the internal volume, static pressure, temperature or humidity. This means that the operator won´t need to apply any manual compensations after calibration to get an accurate result, making sound calibrators very easy to use.

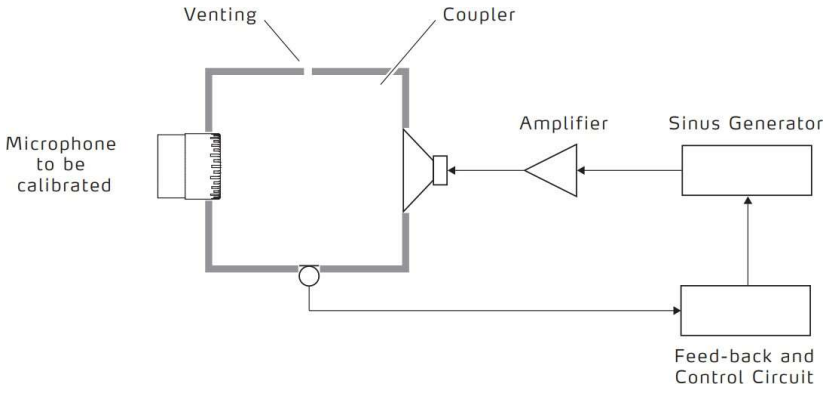

Figure 4. Simplified block diagram illustrating typical sound calibrator´s principles of operation

Sound calibrators are less accurate than pistonphones. A typical calibration accuracy for a sound calibrator is +/- 0.2 dB. They are also less expensive and ligther in weight compared to a pistonphone, which makes them the ideal field sensitivity calibration instrument.