Calibration is an essential step in every precision noise measurement. It establishes the relationship between the sound pressure acting on a microphone and the resulting electrical output of the microphone. There are basically two properties of a measurement microphone requiring calibration, these are: level calibration and a frequency-response calibration.

Level calibration determines the absolute sensitivity of the measurement microphone. Various methods can be used, e.g. reciprocity, comparison, pistonphone or calibrator.

a) Reciprocity is normally considered the most accurate of methods but is elaborate and expensive.

b) Comparison is where the sensitivity of the microphone under test is compared with the known sensitivity of a reference microphone. It is simple and can be done with commonly-available equipment and requires minor investment.

c) A pistonphone, with a precision barometer for applying static pressure corrections, is a robust and highly reliable method of level calibration at 250Hz.

- At 250Hz, the frequency response of most microphones is flat and will give a more accurate result.

d) A calibrator is a convenient way of calibrating a microphone at 1000Hz but does not have the same precision as a pistonphone. Neither does it require static-pressure corrections.

- At 1000Hz, weighting filters have 0dB attenuation and will therefore not affect the calibration. In these cases it might be an advantage to use a 1000Hz calibration tone.
A frequency-response calibration describes the response of the microphone over a range of frequencies. Frequency-response measurements can be presented in various ways, i.e. pressure response, free-field response and diffuse-field response.

Generally, pressure response is determined by using an electrostatic actuator which simulates purely an oscillating pressure exerted on the microphone’s diaphragm. Free-field and diffuse-field responses can then be arrived at by adding predetermined correction values to the measured actuator (pressure) response of the microphone.

Electrostatic actuators require no special acoustic laboratory facilities since background noise is not too critical a factor.

An electrostatic actuator consists of an electrically conductive rigid plate mounted close to, and parallel with, the microphone’s diaphragm. When an oscillating voltage is applied between the microphone’s housing and the electrostatic actuator, an oscillating force will be exerted on the diaphragm. This oscillating force simulates an oscillating sound pressure, thus making it possible to determine the response of the microphone to pressure alone. This means that the frequency response of microphones can be measured under normal circumstances, not requiring special sound insulated test chambers, as long as the background noise levels are reasonable low.

The pistonphone works on the principle of a pair of similar opposing, reciprocating pistons actuated by a precision-machined cam disc with a sinusoidal profile. The profile of the cam disc is such that the pistons follow a sinusoidal movement at a frequency equal to four times the speed of rotation. This results in a corresponding sinusoidal variation in the effective volume of the closed coupler and, consequently, an acoustic signal within it.

The mechanical structure of the pistonphone makes this generated acoustic pressure signal very reliable and stable. By careful control of the atmospheric pressure conditions and the calibration temperature, the calibration far exceeds the requirements for class LS calibrators. Absolute calibration accuracy has been determined to be within ±0.05dB at reference conditions for the pistonphone.
Type 42AA
Pistonphone

Precision sound source for calibrating microphones, sound level meters and other sound measuring equipment. Battery operated and produces a constant nominal sound pressure level of 114 dB re. 20 µPa (equivalent to 10 Pa) at 250 Hz, or 105.4 dBA re. 20 µPa. Each Type 42AA is within 0.1 dB of the nominal value and is delivered with an individual calibration chart and a barometer for Class 1 static pressure corrections. For Class 0 static pressure corrections, a precision barometer is required.

Type 42AA can be used both for field checks of complete measurement systems as well as for laboratory calibrations of measurement microphones. It complies with the requirements of IEC 942 (1988) Class 1 and is PTB approved.

Included accessories:

RA0049
Adapter for 1/4” microphones.

RA0069
Adapter for 1/8” microphones.

Available accessories:

RA0023
Coupler for 1” microphones.

RA0024
Two-port calibration coupler.

RA0025
Octopus coupler for 1/4” microphones.

RA0072
Octopus Coupler for 1/2” microphones.

RA0090
94 dB Adapter.

Type 42AC
High-pressure Pistonphone

Precision sound source for calibrating microphones, sound level meters and other sound measuring equipment at high levels. Battery operated and produces a constant nominal sound pressure level of 134 dB re. 20 µPa (equivalent to 100 Pa) at 250 Hz, or 125.4 dBA re. 20 µPa. Each Type 42AC is within 0.1 dB of the nominal value and is delivered with an individual calibration chart and a barometer for Class 1 static pressure corrections. For Class 0 static pressure corrections, a precision barometer is required.

The Type 42AC can be used both for field checks of complete measurement systems as well as for laboratory calibrations of measurement microphones. It complies with the requirements of IEC 942 (1988) Class 1.

An adapter (GR0398) is included for use with hydrophone couplers.

Included accessories:

RA0049
Adapter for 1/4” microphones.

RA0069
Adapter for 1/8” microphones.

Available accessories:

RA0023
Coupler for 1” microphones.

RA0042
Two-port high-pressure calibration coupler.

RA0025
Octopus coupler for 1/4” microphones.

RA0072
Octopus Coupler for 1/2” microphones.
Type 42AP
Intelligent Pistonphone

Battery-operated, precision sound source for calibrating microphones, sound level meters and other sound measuring equipment. Has built-in precision barometer and thermometer. Via its display and RS-232 interface, the user can read the actual corrected sound pressure level, as well as the calibration temperature and ambient static pressure. It produces a constant nominal sound pressure level of 114 dB re. 20 µPa (equivalent to 10 Pa) at either 250Hz or 251.2Hz (true centre frequency of a 250Hz, 1/3-octave band filter). The actual sound pressure level, corrected for static ambient pressure, is shown on its display which can also show the A-weighted sound pressure level after correcting it for using an A-weighting filter.

The display can be switched to show any of the following:

- Actual corrected sound pressure level in decibels.
- Actual corrected sound pressure level in decibels if measured with an A-weighting filter.
- Static air pressure in hPa.
- Calibration temperature in °C.
- Calibration temperature in °F.
- The Pistonphone frequency can be programmed, via its RS-232 interface, to be either 250Hz or 251.2Hz.

- Type 42AP is an extremely stable laboratory standard sound source which can also be used for field calibrations - it retains its high accuracy even under hostile environmental conditions. It complies with all the requirements of IEC Standard 60942 (2003) LS.
- An individual calibration chart is delivered with each Pistonphone.

Included accessories:

RA0023
Coupler for 1" microphones.

RA0049
Adapter for 1/4" microphones.

RA0069
Adapter for 1/8" microphones.

AA0050
RS-232 interface cable.

Available accessories:

RA0024
Two-port calibration coupler.

RA0025
Octopus coupler for 1/4" microphones.

RA0072
Octopus Coupler for 1/2" microphones.

RA0090
94 dB Adapter.

<table>
<thead>
<tr>
<th>Specifications</th>
<th>42AA</th>
<th>42AC</th>
<th>42AP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound pressure level</td>
<td>114 dB</td>
<td>134 dB</td>
<td>114 dB</td>
</tr>
<tr>
<td>(re. 20µPa) ±0.08 dB</td>
<td>(re. 20µPa) ±0.08 dB</td>
<td>(re. 20µPa) ±0.05 dB</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>250 Hz</td>
<td>250 Hz</td>
<td>250 Hz</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-10 °C to +55 °C</td>
<td>-10 °C to +55 °C</td>
<td>-10 °C to +55 °C</td>
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<td>Batteries</td>
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<td>4 x AA alkaline (IEC LR 6)</td>
<td>4 x AA alkaline (IEC LR 6)</td>
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<tr>
<td>External power</td>
<td>-</td>
<td>-</td>
<td>6V DC 125mA</td>
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<tr>
<td>Weight (with batteries)</td>
<td>325 g</td>
<td>325 g</td>
<td>437 g</td>
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</table>
Type 42AB
Sound Calibrator

Pocket-sized, battery operated calibrator for microphones, sound level meters and other sound measuring equipment. Produces a constant nominal sound pressure level of 114 dB re. 20 µPa (equivalent to 10 Pa) at 1kHz. Easy to use and requires no corrections for ambient pressure changes or microphone equivalent volume. Includes adapters for calibrating 1”, 1/2” and 1/4” microphones. The Type 42AB complies with the requirements of IEC 942 (1988) Class 1.

Type 14AA
Electrostatic Actuator Amplifier

High-voltage, high-gain amplifier and voltage supply for driving electrostatic actuators. The high-voltage output can also be used to drive standard microphones as sound sources. The Type 14AA can drive an electrostatic actuator with a 300 V peak-to-peak signal superimposed on 800 V DC. Its wide frequency range makes it possible to determine the pressure frequency response of condenser microphones from 200Hz to 200kHz (note: care should be taken below 200Hz because of the influence of pressure equalisation in the rear volume of the microphone). The Type 14AA can be connected directly to an external signal generator or the generator output of any standard signal analyzer.

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Type 42AB</th>
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<tbody>
<tr>
<td>Sound pressure level</td>
<td>114 dB (re. 20 µPa) ± 0.2 dB</td>
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<tr>
<td>Frequency</td>
<td>1 kHz</td>
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<td>Temperature range</td>
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<td>Batteries</td>
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<td>Accuracy</td>
<td>IEC 942 (1988) Class 1</td>
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<td>Weight</td>
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<tr>
<th>Specifications</th>
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<tr>
<td>Input signal (max)</td>
<td>3 V peak-to-peak</td>
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<tr>
<td>Gain</td>
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<tr>
<td>Output signal (max)</td>
<td>300 V peak-to-peak</td>
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<td>Actuator Polarisation Voltage</td>
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<tr>
<td>Frequency response</td>
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<tr>
<td>Output impedance</td>
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<td>Power supply</td>
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<td>Weight</td>
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</table>
RA0014
1/2" Electrostatic Actuator

An electrostatic actuator for testing the frequency response of standard 1/2", 1/4" and 1/8" microphones. Adapters are included for testing 1/4" and 1/8" microphones. The RA0014 can be connected directly to the Actuator Supply Type 14AA.

RA0015
1" Electrostatic Actuator

An electrostatic actuator for testing the frequency response of standard 1" microphones. The RA0015 can be connected directly to the Actuator Supply Type 14AA.

AL0010
Calibration Stand

Provides a convenient platform for testing condenser microphones. It has a fixture for holding a 1/2" pre-amplifier (e.g. Type 26AK) securely in place as well as recesses and a column for safely parking electro-static actuators (i.e. RA0014 and RA0015) and microphone protection grids when not in use. It can be set-up for both 1/2" and 1" microphones. The AL0010 is a useful addition to a set up (which includes an Electrostatic Actuator Amplifier Type 14AA) for routinely calibrating condenser microphones.