

# Operating manual

Acoustic calibrator

## HD2022



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# 1 INTRODUCTION

The HD2022 sound level calibrator is a portable, battery operated sound source, suitable for sound level meters (portable and laboratory) and acoustic stations.

It allows calibrating 1/2" (1/4" with **HD2020AD4** adapter) microphones with mechanical dimensions compliant with IEC 61094-1 ("Measurement microphones. Part 1: Specifications for laboratory standard microphones") and IEC 61094-4 ("Measurement microphones. Part 4: Specifications for working standard microphones").

The generated sound pressure level is equal to 114 dB at 1000 Hz frequency.

A LED signals the low battery condition.

## **Advantages of the HD2022 calibrator:**

- The 1000 Hz frequency allows calibrating sound level meters with any frequency weighting (LIN, A, B, ...), without applying any correction factor.
- The generated sound pressure level is independent of atmospheric pressure: you don't need to adjust the value according to static pressure over a wide range of values.
- The calibrator can be conveniently used both in laboratory and in the field. The 114 dB sound level allows performing calibrations even in high background noise environments.
- Its simplicity of use allows even unskilled staff to use it.

## 2 DESCRIPTION



1. **ON-OFF** key: turns on and off the instrument.
2. LED indicating the calibrator status.
3. Calibrator cavity for 1/2" microphones.
4. **LOW BATT** LED: indicates that the battery is low and needs to be replaced.
5. Battery lid.

### 3 CALIBRATION PROCEDURE

The HD2022 can calibrate standard 1/2" (and 1/4" with HD2020AD4 adapter) microphones compliant with IEC 61094-1 and IEC61094-2.

To calibrate the microphone, insert it deep into the cavity. The O-ring will offer some resistance.

The calibrator can be held in vertical position or placed on a flat surface.

While measuring, you should move neither the microphone nor the calibrator; make sure that the worktable doesn't transmit vibrations.

A small misalignment of the microphone and calibrator axes is allowed.

- Switch on the calibrator by pressing the ON/OFF key.
- Calibrate the sound level meter as per the procedure shown in the instrument manual.
- Apply the correction to the pressure level depending on the type of microphone (see the following paragraph).
- Once calibration is complete, switch off the sound level meter and the calibrator and remove the microphone from the cavity.

The HD2022 calibrator allows calibrating any sound level meter provided that it is equipped with a laboratory or working standard 1/2" microphone compliant with IEC 61094-1 and IEC 61094-4 standards.

#### 3.1 CORRECTION DEPENDING ON THE TYPE OF MICROPHONE

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The calibrator generates a 114 dB sound pressure level referred to 20  $\mu$ Pa. Working standard 1/2" microphones for sound level meters are manufactured to achieve flat frequency response in free or diffuse field, i.e. in a field of progressive plane waves propagating in the same direction as the microphone axis and in a field of sound waves coming from every direction, respectively. These propagation conditions are different from those in the calibrator cavity.

In free field, reflections due to the microphone alter the sound level by increasing the actual high-frequency capsule sensitivity. Microphones optimized for free field measurements exploit this phenomenon to achieve flat frequency response even at very high frequencies. In these microphones, the sound level increase at 1 kHz corresponds to approximately 0.05 dB  $\div$  0.20 dB. Therefore, when you calibrate a free field microphone, you must take into account for this difference by setting in the sound level meter a sound level 0.1 dB or 0.2 dB lower than the calibrator nominal one.

Microphones optimized for diffuse field measurements don't require corrections when calibrated in a closed cavity at 1 kHz instead.

## 4 BATTERY

The calibrator is provided with a 9 V alkaline battery that can be replaced by the user. The battery charge is constantly monitored.

### 4.1 LOW BATTERY INDICATION

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If the battery is charged, the LOW BATT LED is off.

If the battery charge is insufficient to ensure the normal operation of the instrument, the LOW BATT LED lights up.

### 4.2 BATTERY REPLACEMENT

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To replace the 9 V battery:

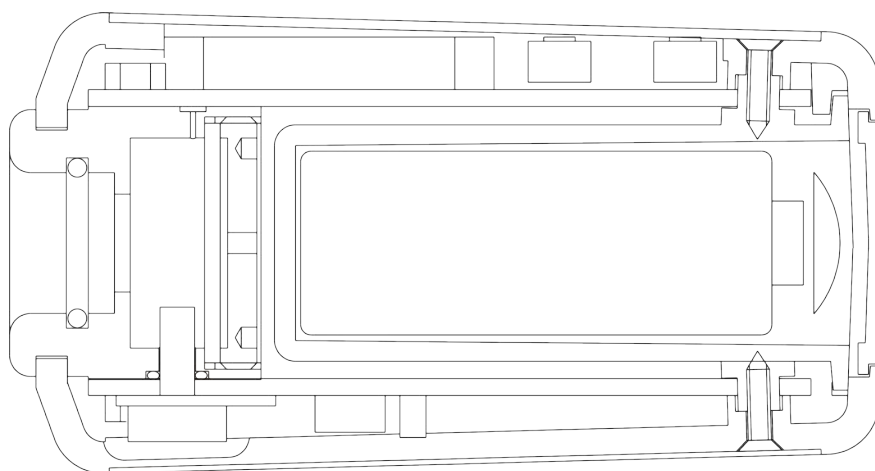
- Switch off the instrument.
- Open the lid at the bottom of the instrument.
- Replace the battery.
- Close the lid.

### 4.3 CAUTIONS ON USING THE BATTERY

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- Remove the battery if the instrument is not to be used for an extended period.
- If the battery is low, replace it as soon as possible.
- Make sure that there is no liquid leakage from the battery.
- Use good quality sealed batteries (alkaline if possible).

## 5 CONSTRUCTION AND FUNCTIONING



**Calibrator mechanical construction (section)**

The figure schematizes the HD2022 calibrator structure (in section). The battery compartment is on the right side of the case. The printed circuits with the electronics are over and under the battery compartment. The electro-acoustic transduction system is on the left and it consists of a wide cavity with a piezoceramic generator and a feedback sensor. The system emits the signal through the 1/2" microphone cavity. An outer capillary hole balances the chamber static pressure protecting microphones from overpressure due to their insertion.

The electronics consist mainly of an oscillator combining high stability and low distortion, as well as an RMS converter, the automatic gain control (AGC), the driver for the ceramic resonator and the electronics for conditioning the signal from the feedback sensor.

The RMS level of the signal provided by the sensor is compared with the factory set reference level; the difference adjusts the width, through the automatic gain control, of the signal generated by the oscillator and thus the acoustic signal generated by the piezoelectric transducer.

The signal provided by the sensor has minimal changes with the ambient temperature and the static pressure; the frequency of the signal provided by the oscillator is also stable in relation to ambient parameters.

## 6 TECHNICAL SPECIFICATIONS

The HD2022 calibrator complies with **IEC 60942-2003 Class 2** and **ANSI S1.40-1984**.

<b>Coupling cavity</b>	For standard ½" (12.7 ± 0.03 mm) microphones according to IEC 61094-1 and IEC 61094-4
<b>Optional adapter</b>	HD2020AD4 for ¼" microphones
<b>Frequency</b>	1000 Hz
<b>Frequency tolerance</b>	2% in the range 0...+40 °C and 10...90%RH
<b>Sound pressure level</b>	114.0 dB ± 0.3 dB at 1 kHz (referred to 101.3 kPa, 23 °C ± 3 °C and 65%RH)
<b>Reference conditions</b>	23 °C, 50%RH, 101.3 kPa, microphone capsule with 10 mm <sup>3</sup> equivalent volume
<b>Stabilization time</b>	10 s
<b>Total distortion</b>	< 1%
<b>Ambient condition influence</b> <b>Temperature and humidity influence</b> <b>Static pressure influence</b>	< 0.3 dB in the range 0...40 °C and 10...90%RH < 0.1 dB in the range 65...108 kPa
<b>Stability levels</b> <b>Short-term stability</b> <b>Stability after 1 year with normal use</b>	±0.05 dB ±0.15 dB
<b>Operating conditions</b>	0...+40 °C / ≤ 90%RH
<b>Storage temperature</b>	-25...+70 °C
<b>Microphone equivalent volume</b>	From 5 to 250 mm <sup>3</sup>
<b>Power supply</b>	9 V alkaline battery IEC type 6LR61 9 V rechargeable batteries can also be used
<b>Battery autonomy</b>	48 hours of continuous use with good quality alkaline batteries
<b>Case material</b>	ABS
<b>Dimensions</b>	53 x 43 x 83 mm
<b>Weight</b>	160 g
<b>Protection degree</b>	IP 64
<b>Effects of electromagnetic fields</b>	< 0.3 dB



## 7 INSTRUMENT STORAGE

Instrument storage conditions:

- Temperature: -25...+55 °C.
- Humidity: less than 90 %RH no condensation.
- In storage, avoid places where:
  - humidity is high;
  - the instrument is exposed to direct sun radiation;
  - the instrument is exposed to a high temperature source;
  - high vibration levels are present;
  - the instrument may be exposed to vapor, salt and/or corrosive gas.

The housing of the instrument is in ABS plastic material: do not use solvents not compatible for cleaning.

## 8 SAFETY INSTRUCTIONS

### General safety instructions

The instrument has been manufactured and tested in accordance with the safety standard EN61010-1:2010 "Safety requirements for electrical equipment for measurement, control and laboratory use" and has left the factory in perfect safety technical conditions.

The instrument proper operation and operating safety can be ensured only if all standard safety measures as well as the specific measures described in this manual are followed.

The instrument proper operation and operating safety can be ensured only in the climatic conditions specified in this manual.

Do not use the instruments in places where there are:

- Rapid ambient temperature variations that may cause condensation.
- Corrosive or flammable gases.
- Direct vibrations or shocks to the instrument.
- High-intensity electromagnetic fields, static electricity.

If the instrument is moved from a cold environment to a hot one or vice versa, the formation of condensation might cause problems to its operation. In this case you need to wait for the instrument temperature to reach ambient temperature before operation.

### User obligations

The instrument operator shall follow the directives and regulations below that refer to the treatment of dangerous materials:

- EEC directives on workplace safety.
- National law regulations on workplace safety.
- Accident prevention regulations.

## 9 ORDERING CODES

**HD2022** Acoustic calibrator. Supplied with: 9 V alkaline battery and instruction manual.

**HD2020AD4** Microphone adapter for 1/4" capsules.

**DELTA OHM metrology laboratories LAT N° 124 are ISO/IEC 17025 accredited by ACCREDIA for Temperature, Humidity, Pressure, Photometry / Radiometry, Acoustics and Air Velocity. They can supply calibration certificates for the accredited quantities.**

## NOTES

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## WARRANTY

The manufacturer is required to respond to the "factory warranty" only in those cases provided by Legislative Decree 6 September 2005 - n. 206. Each instrument is sold after rigorous inspections; if any manufacturing defect is found, it is necessary to contact the distributor where the instrument was purchased from. During the warranty period (24 months from the date of invoice) any manufacturing defects found will be repaired free of charge. Misuse, wear, neglect, lack or inefficient maintenance as well as theft and damage during transport are excluded. Warranty does not apply if changes, tampering or unauthorized repairs are made on the product. Solutions, probes, electrodes and microphones are not guaranteed as the improper use, even for a few minutes, may cause irreparable damages.

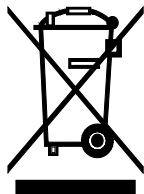
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales of Goods" apply.

## TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.

We reserves the right to change technical specifications and dimensions to fit the product requirements without prior notice.

## DISPOSAL INFORMATION



Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.

# CE RoHS

