

# OPERATING MANUAL

## HD2020

Acoustic calibrator



EN  
V2.0



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## 1 Introduction

The **HD2020** 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 levels are equal to 94 dB and 114 dB, selectable via the keypad, at 1000 Hz frequency.

If the microphone is missing or has not been properly inserted into the calibrator cavity, the sound level indication will blink on the display.

To preserve battery life, the device is equipped with an auto-off feature: if the device is left on with the cavity open, it will automatically turn off after 30 seconds. With the cavity closed and the microphone inserted, the device will turn off 5 minutes after being turned on if no buttons are pressed during that time.

The calibrator display shows the generated sound pressure level, the battery charge status, and the current date and time.

The internal clock allows setting the number of years and months for which the calibration is valid, starting from the calibration date: once the set time period has elapsed, a blinking small triangle on the display will remind to perform a new calibration.

### Advantages of the 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 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.
- The display helps the user set up the calibrator, alerts when calibration is due, and allows monitoring the battery charge level.

## 2 Technical specifications

The calibrator complies with **IEC 60942-2003 Class 1** and **ANSI S1.40-1984**.

|                                                                                                |                                                                                         |
|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Coupling cavity                                                                                | For standard ½" (12.7 ± 0.03 mm) microphones according to IEC 61094-1 and IEC 61094-4   |
| Optional adapter                                                                               | HD2020AD4 for ¼" microphones                                                            |
| Frequency                                                                                      | 1000 Hz                                                                                 |
| Frequency tolerance                                                                            | 1% in the range -10...+50 °C and 10...90%RH                                             |
| Sound pressure level                                                                           | 94.0 and 114.0 dB ± 0.2 dB @ 1 kHz<br>(referred to 101.3 kPa, 23 °C ± 3 °C and 65%RH)   |
| Reference conditions                                                                           | 20 °C, 50%RH, 101.3 kPa, microphone capsule with 10 mm <sup>3</sup> equivalent volume   |
| Stabilization time                                                                             | 10 s                                                                                    |
| Total distortion                                                                               | < 1%                                                                                    |
| Ambient condition influence<br>Temperature and humidity influence<br>Static pressure influence | < 0.3 dB in the range -10...+50 °C and 10...90%RH<br>< 0.1 dB in the range 65...108 kPa |
| Stability levels<br>Short-term stability<br>Stability after 1 year with normal use             | ±0.03 dB<br>±0.1 dB                                                                     |
| Operating conditions                                                                           | -10...+50 °C / ≤ 90%RH                                                                  |
| Storage temperature                                                                            | -25...+70 °C                                                                            |
| Microphone equivalent volume                                                                   | From 5 to 250 mm <sup>3</sup>                                                           |
| Power supply                                                                                   | 9 V alkaline battery IEC type 6LR61<br>9 V rechargeable batteries can also be used      |
| Battery autonomy                                                                               | 48 hours of continuous use with good quality alkaline batteries                         |
| Auto-off                                                                                       | 5 minutes, it cannot be disabled                                                        |
| Display                                                                                        | 3½-digit LCD with battery symbol                                                        |
| Clock/calendar                                                                                 | Internal with 3V lithium backup battery                                                 |
| Case material                                                                                  | ABS                                                                                     |
| Dimensions                                                                                     | 53 x 43 x 83 mm                                                                         |
| Weight                                                                                         | 160 g                                                                                   |
| Protection degree                                                                              | IP 64                                                                                   |
| Effects of electromagnetic fields                                                              | < 0.3 dB                                                                                |

### 3 Description



1. **ON/OFF** key: turns on and off the calibrator.  
**Note:** the display turns on about three seconds after the key is pressed, which is the time the instrument needs to perform a functional self-test.
2. **SETUP** key: allows entering the menu and scrolling through its items; to exit the menu, press the key repeatedly until the sound level indication reappears, or hold down the key for at least 2 seconds.
3. Display. When turned on, all segments light up for a few moments, then the display changes to the standard view showing the sound pressure level (94 or 114 dB).
4. Calibrator cavity for 1/2" microphones.
5. ∨ (down arrow) key: in standard view, selects the sound pressure levels 94 and 114 dB alternately. Within the menu, decreases the current value.
6. ∧ (up arrow) key: in standard view, selects the sound pressure levels 94 and 114 dB alternately. Within the menu, increases the current value.
7. Battery lid.

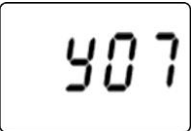
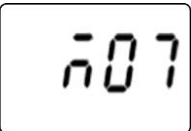
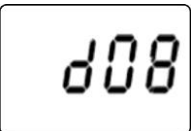
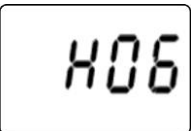
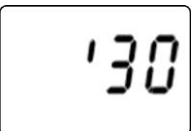
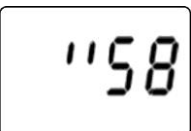
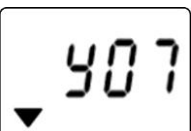
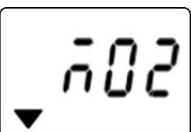
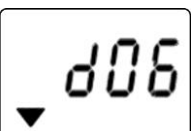
## 4 Setting of date/time and calibration validity period

The menu allows setting the instrument date and time, viewing the calibration date, and setting the calibration validity period as a time interval in years and months from the calibration date.

Press **SETUP** to enter the menu. Use the arrow keys  $\wedge$   $\vee$  to increase or decrease the value of a parameter, if necessary, and press **SETUP** to confirm the parameter and move on to the next one.

To exit the menu, press **SETUP** repeatedly until the sound level indication reappears, or hold down the key for at least 2 seconds.

The sequence of the parameters is as follows:

|                                                                                                                                 |                                                                                     |                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <b>Current date/time</b>                                                                                                        |    | Current year                                                                                       |
|                                                                                                                                 |    | Current month                                                                                      |
|                                                                                                                                 |   | Current day                                                                                        |
|                                                                                                                                 |  | Current hour                                                                                       |
|                                                                                                                                 |  | Current minutes                                                                                    |
|                                                                                                                                 |  | Current seconds<br><i>Pressing the <math>\wedge</math> <math>\vee</math> keys resets the value</i> |
| <b>Calibration date</b><br>Identified by the first small triangle lighting up in the lower left corner.<br>It cannot be edited. |  | Year of calibration                                                                                |
|                                                                                                                                 |  | Month of calibration                                                                               |
|                                                                                                                                 |  | Calibration day                                                                                    |

|                                                                                                              |                                                                                   |                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Calibration validity</b><br>Identified by the second small triangle lighting up in the lower left corner. |  | Years of validity of calibration                                                                                            |
|                                                                                                              |  | Months of validity of calibration<br><i>The number of months is added to the number of years set on the previous screen</i> |

Once the set calibration validity period has elapsed from the calibration date, the small triangle at the bottom will blink to remind you that the calibrator needs to be recalibrated.

## 5 Calibration procedure

Standard 1/2" (and 1/4" with HD2020AD4 adapter) microphones compliant with IEC 61094-1 and IEC61094-2 can be calibrated.

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.

Do not move the microphone or the calibrator during the measurement; make sure that the worktable does not transmit vibrations.

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

Before proceeding with calibration, check the ambient noise level. After inserting the microphone into the cavity, with the sound level meter and the calibrator off, turn on the sound level meter and detect the unweighted ambient sound pressure level. If the measured level is below 78 dB, both the calibrator sound levels can be used (94 and 114 dB); if the measured level is between 78 and 98 dB, only the 114 dB level can be used; if the measured level is above 98 dB, the calibration is not possible.

- Switch on the calibrator by pressing the ON/OFF key.
- Use the arrow keys to select the desired sound level: 94 or 114 dB.
- Make sure that the measurement value is not blinking on the display: this means that the microphone is not inserted correctly.
- 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 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.

### 5.1 Correction depending on the type of microphone

The calibrator generates a 94 or 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...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, instead, do not require corrections when calibrated in a closed cavity at 1 kHz.

## 6 Battery

The calibrator is provided with a 9 V alkaline battery that can be replaced by the user, and a 3 V lithium backup battery, which can only be replaced at an authorized service center, that keeps the clock and calendar operating even when the main battery is missing.

The 9 V battery charge is constantly monitored.

### 6.1 Low battery indication

If the battery is charged, the battery symbol is off.

If the battery level is low, the symbol blinks: replace the battery as soon as possible.

If the battery charge is insufficient to ensure the normal operation of the instrument, the symbol is constantly on and the calibrator turns off within about 10 seconds.

### 6.2 Battery replacement

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.

**Note:** date, time, and calibration validity period remain in memory even if the 9 V battery is removed, provided that the internal backup battery is charged. The average life of the backup battery depends on whether or not the 9 V main battery is present: if the main battery is present, the average life of the internal battery is approximately 5 years.

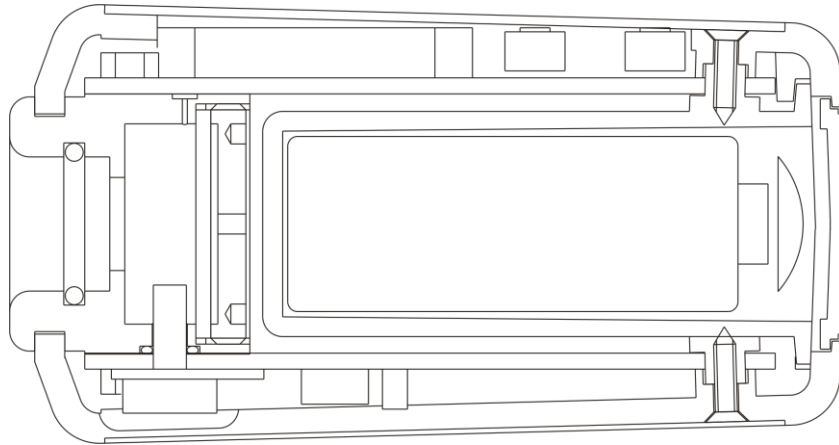
### 6.3 Cautions on using the battery

- 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.
- If the battery leaks, replace it immediately.
- Use good quality sealed batteries (alkaline if possible).

### 6.4 Battery disposal

- Dispose of the dead battery in the dedicated bins or deliver it to authorized collection centers. Follow the relevant regulation.
- Do not dispose as household waste.
- Do not throw the battery into fire.

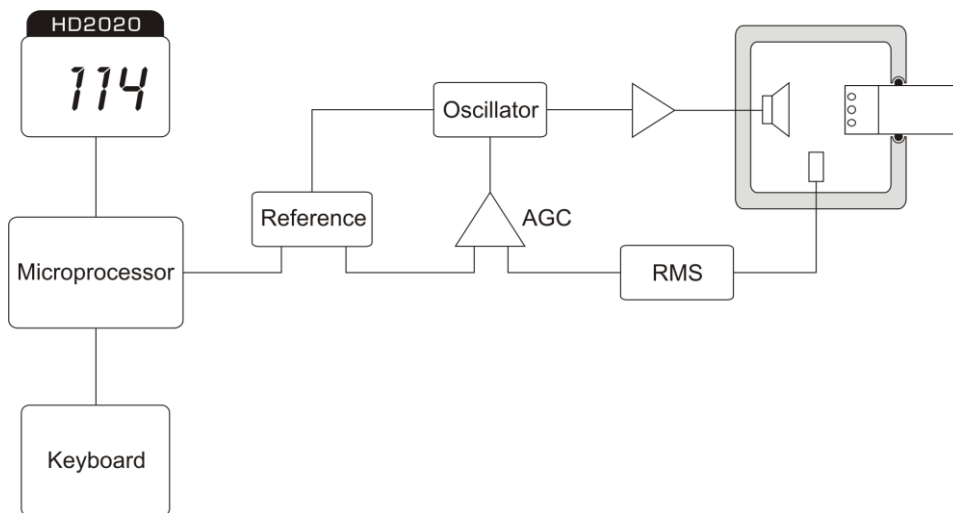
## 7 Construction and operation



**Calibrator mechanical construction (section)**

The figure schematizes the 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 top part is reserved for the display and keyboard. 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.



**Electronics block diagram**

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.

## 8 Maintenance

Do not use aggressive cleaning agents or incompatible with the materials indicated in the technical specifications. For cleaning, use a soft dry cloth or slightly dampened with clean water.

## 9 Safety instructions

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

Do not use the instruments in places where there are:

- Corrosive or flammable gases.
- Direct vibrations or shocks to the instrument.
- High-intensity electromagnetic fields, static electricity.

### User obligations

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

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

## 10 Ordering codes

The calibrator is supplied with a 9 V alkaline battery and ISO 17025 calibration certificate according to IEC 60942.

**The 1/4" microphone adapter must be ordered separately.**

### Accessories

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

## Notes

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## 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.

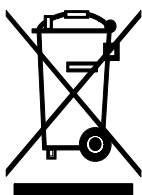
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales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



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