



HD 2010UC INTEGRATING SOUND LEVEL METER

HD2010UC is an integrating portable sound level meter performing statistical analysis. The instrument has been designed combining maximum low cost and simplicity of use. Attention has been paid to the possibility of adjusting the instrument and adding options at any time to the HD2010UC so to extend its applications. The user can upgrade the firmware directly by means of the Noise Studio programme supplied with the instrument.

Technical regulations:

- **Class 1 or 2 sound level meter according to IEC 61672-1 dated 2002 (Certificate of Compliance I.N.R.I.M. n. 07-0124-02)**, IEC 60651 and IEC 60804.

Applications:

- Assessment of the environmental noise level,
- Optional "advanced data logging",
- Optional capture and analysis of sound events,
- Statistical analysis with the calculation of 3 percentile level and optional full statistical analysis,
- Noise monitoring ("Advanced data logger" required)
- Identification of impulsive noises,
- Measurements in workplaces,
- Selection of personal protective equipments (SNR and HML methods),
- Production quality control,
- Measurement of machine noise.

Sound level meter class 1 or 2 Kits

- **HD2010UC kit1 and kit2:** consists of HD2010UC sound level meter class 1 (class 2 for HD2010UC kit2), HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2), windscreen, 5m extension cable and serial RS232 or USB connection cable. Noise Studio PC software. Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804.
- **HD2010UC kit1/E and kit2/E:** version for outdoor measurements, it consists of HD2010UC sound level meter class 1 (class 2 for HD2010UC kit2), HD WME weatherproof microphone unit for outdoor use, HD2010PNE2W heated preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2) and serial RS232 or USB

connection cable. Noise Studio PC software. Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804.

- **HD2010UC kit1/IE e kit2/IE:** version for indoor and outdoor measurements, it consists of HD2010UC class 1 sound level meter (class 2 for HD2010UC kit2), HD WME weatherproof microphone unit for outdoor use, HD2010PNE2W heated preamplifier, HD2010PNE2 preamplifier, UC52/1 microphone for free fields (UC52 for HD2010UC kit2), HD SAV windscreen, 5m extension cable and serial RS232 or USB connection cable. Noise Studio PC software. Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804.

Accessories

Option HD2010.00 "Memory module": 4MB expansion memory. It needs Option "Advanced Data Logger".

Option HD2010.02 "Advanced Data Logger": automatic recording of time sound profiles, complete statistical analysis, capture of noise events using trigger level function, simultaneous data logging of profiles, reports and events. "Navigator" program to recall from memory and analyze stored data.

HD9101: class 1 calibrator according to IEC60942:1988. Features:

- Cavity for 1/2" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD9102: class 2 calibrator according to IEC60942:1988. Features:

- Cavity for 1/2" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.R.I.M. n.90-003-01 Certificate of Conformity. Features:

- LCD Display,
- Static pressure compensation from 65 kPa to 108 kPa,
- Cavity for 1/2" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD2110/RS: serial RS232 cable for connection to a PC or to HD40.1 printer.

HD2110/USB: serial USB cable for connection to a PC

SWD10: stabilized mains power supply with Vin=100÷230Vac Vout=12Vdc/1000mA voltage.

CPA/10: 10m extension cable.

VTRAP: tripod, 1550mm maximum height.

HD2110/SA: support to fix preamplifier to tripod.

HD40.1: portable serial thermal printer with 57mm paper tape equipped with SWD10 stabilizer mains.



HD WME

HD2010MC: module for data logging and data download to MMC or SD type memory cards, 1GB SD card included.

S.C ACCREDIA calibration Certification according to IEC 60942 for single frequency Calibrator.

Software for Windows® 98/XP/Vista/Win7 (32-64bit) operating systems

Noise Studio: Programme for Windows® 98, XP, Vista and Win7 (32-64bit) supplied with the sound level meter kit. Instrument configuration, download and graphic display of the stored data. This programme supports some sound analysis application modules which can be enabled by licence with the hardware key. The programme includes demo versions of the modules.

CH20: Hardware key for PC working with Windows® operating system. It enables the software modules of Noise Studio when introduced into the USB port.

NS1: "Workers' Protection" module in Noise Studio programme. Noise analysis in working environment according to UNI 9432/2011 and ISO 9612/2011 standard.

NS2A: "Acoustic pollution" module in Noise Studio programme. Acoustic climate analysis and road, railway, airport noise evaluation. Option **HD2010.02 "Advanced Data Logger"** compulsory.

NS4: "Monitor" module in Noise Studio programme. Real time PC data acquisition. Synchronized audio recording. Monitor and remote control programming. Connection by modem.

With HD2010UC sound level meter it is possible to measure the sound level by programming 3 parameters with the possibility of freely selecting the frequency weightings and the time constants. It is possible to measure parameters such as Leq, SEL and maximum and minimum sound levels with integration times from 1 second to 99 hours. If an undesired sound event produces an over-load indication, or simply alters the result of integration, it is always possible to exclude it by using the versatile Back-Erase function.

The measured sound levels can be recorded in the large non-volatile memory in order to be transferred to a PC using the supplied Noise Studio programme.

As a **statistical analyzer** the HD2010UC samples the sound signal 8 times per second with A-frequency weighting and FAST constant, and it analyzes it statistically in 0.5 dB classes. It is possible to display up to 3 percentile levels between L_1 and L_{99} . By using "Advanced Data Logger" it is possible to choose whether sampling L_{Fp} , L_{eq} or L_{pk} with A, C or Z weightings (only C and Z for L_{pk}).

For further analysis, the LINE un-weighted output allows recording the sound sample either on tape or directly on a PC equipped with a data acquisition card.

The high speed of the USB interface combined with the flexibility of the RS232 interface allows quick data transfers from the sound level meter to the PC mass storage, but can also control a modem or printer. For example, in case of lengthy recordings, you can activate the "Monitor" function. This function allows to send the displayed data to a PC via the RS232 serial interface, to be directly stored on the PC mass storage.

The sound level meter can be completely controlled by a PC through the multi-standard serial interface (RS232 and USB) by using a special communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.

The calibration can be performed either by using the acoustic calibrator or the built-in reference generator. The electric calibration uses a special preamplifier and checks the sensitivity of the measuring channel, microphone included. A protected area in the non-volatile memory, reserved to factory calibrations, is used as a reference for the user's calibrations, so to allow keeping instrument drifts under control and to prevent the instrument from losing of calibrations.

The control of the complete sound level meter functionality can be made directly by the user, on site, thanks to a diagnostic programme.

The HD2010UC sound level meter can perform all the measurements according to the law with respect to workers' protection from exposure to noise 50.ISO 9612/2011. The selection of the personal protective equipment can be carried out through comparison of the A and C weighted equivalent levels that can be measured simultaneously (SNR method).

The class 1 HD2010UC sound level meter with the "Advanced Data Logger" option is suitable for performing **noise monitoring** and acoustic mapping and, also assessments of the acoustic climate with **capture and analysis of sound events function**. When measuring traffic noise near airports, railways and roads, the sound level meter can be used as a multi-parameter sound recorder, combining statistical analyzer features. Remote electrical calibrations and diagnostic tests can be executed by using its remote control capabilities.

Inputs and outputs

DC outputs corresponds to the A-weighted sound level with FAST time constant, updated 8 times per second (\emptyset 2.5mm jack).

Un-weighted LINE output (\emptyset 3.5mm jack).

RS232C standard serial port according to EIA/TIA574. Baud Rate from 300 to 115200 bauds.

USB 1.1 serial port.

9 \pm 12Vdc External power supply (\emptyset 5.5mm jack).

Options and accessories:

HD2110/MC reader (it needs "Advanced Data Logger" Option)

It allows interfacing SD memory cards to the sound level meter.

This device is connected to the sound level meter by means of a serial interface which supplies the necessary power supply as well. Further to the remarkable recording capacity, the interface allows to quickly download data stored in the internal memory of the sound level meter. It is possible to connect cards having up to 2GB capacity. 1GB card is supplied.

Option "Advanced Data Logger" Cod. HD2010.02

It displays and records the A-weighted **sound level profile** with FAST time constant, sampled 8 times per second. It stores the profiles of 3 programmable parameters, sampled twice per second. It is possible to store 3 programmable parameters at intervals from 1 second up to 1 hour for sound level monitoring. By this recording mode it is possible to store 3 parameters by intervals of 1 minute for over 80 days by using the supplied memory (4MB expandable to 8MB). "Advanced Data Logger" option transforms the HD 2010UC sound level meter into a sound level recorder suitable for recording the profile of 4 parameters for over 23 hours. Impulsive events can be easily identified thanks to the possibility of analysing simultaneously sound level profiles with FAST, SLOW and IMPULSE time constants.

During noise assessment in airport, railways or roads environments, the sound level meter can be used as multi parameters **sound events recorder**, or the possibility for recording simultaneously the profile with FAST time constant level and sound exposure level.

- **Statistical analysis** is available in graphic form both as probability distribution and as cumulative distribution.
- Trigger for the **capture of sound events** with threshold level and filter length.
- Record of the **measuring reports** with intervals from 1 s to 1 hour with a dedicated set of parameters which includes the complete statistic analysis.
- Record of the event parameters with the possibility of setting the maximum temporal resolution for the record of events and a lower resolution for the ground recording.
- Possibility of storing **markers**.
- **Timer** for programming **delayed start** of capture.

Software:

Noise Studio

The Noise Studio software allows interfacing HD2010UC to the PC in a simple and intuitive way. Main functions are:

- Transfer of stored data from the sound level meter to the PC memory.
- Visualization of the captured data under graphic and tabular form.
- Export to Excel and PDF format.
- Printing of graphs and data tables.
- Control of acquisition from a PC.
- Sound level meter setup management.
- Sound level meter firmware update.

It results easier drafting documents regarding the sound level meter's relief due to the handy function which allows to copy graphs or visualized tables from other applications and to create PDF files.

Moreover Noise Studio is a post processing software able to perform different kind of analyses, studied for specific applications assembled in software modules to be enabled with licence. Demo versions of the software modules are provided.

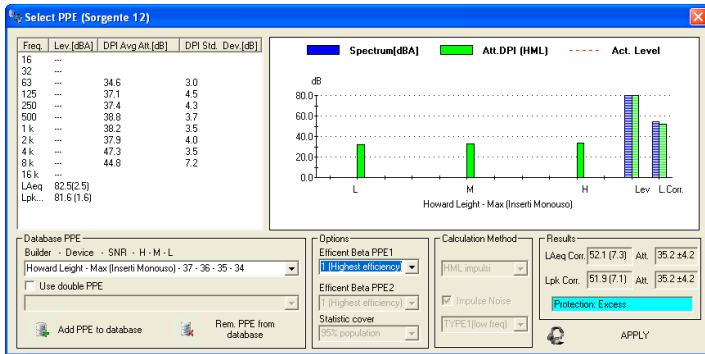
Noise Studio NS1: 'Worker protection' module (to be activated by license)

This application module analyzes noise in the workplace according to, the European directive 2003/10/EC, UNI 9432:2011 and ISO 9612/2011. Data sound level measurement in work environment is organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers the program allows to evaluate the effectiveness of protective equipment by the methods SNR and OBM. According to UNI 9432/2011, the program also calculates the index of impulsiveness of a machine.

Noise Studio NS2A: 'Acoustic Pollution' module (to be activated by license)

This application module analyzes sound level profiles detected both in indoor and outdoor environments for assessment of the noise climate, of noise in airports and transport infrastructures according to 2002/49/CE Directive.

The analysis of the noise climate is made on a daily, weekly and annual basis with resolutions up to 1 minute.



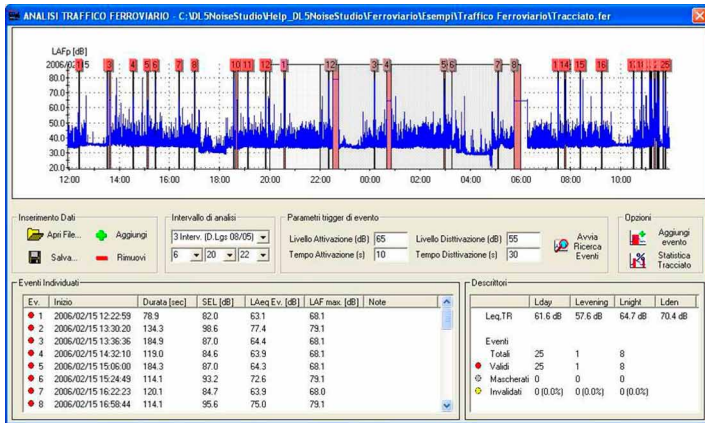
Noise studio: "workers' protection" module NS1: analysis of the effectiveness of PPE

The profiles of noises detected in the external environment are analyzed in order to search for disturbing sources characterized by a sequence of events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1/8 of a second and with automated search and analysis of sound events. **This module needs Option "Advanced Data Logger"**.

Noise Studio NS4: 'Monitor' module (to be activated by license)

This software module allows to control the sound level meter with PC in remote location. The main functions are:

- Real time display of acquired data, in graphical and tabular form.
- Possibility of connection via modem with the sound level meter.
- Acquisition of sound level data directly into the mass memory of the PC (monitor)



Noise studio: "railway traffic" module included in NS2A: analysis of 24 hours with automatic search of transit

function).

- Management of diagnostic and calibration functions.
- Automatic acquisition and monitoring programme.
- Possibility of logging synchronized audio along with the sound level meter measures, by using the easy trigger function.

Ordering Codes for the new kits and accessories

HD2010UC kit 1 and kit 2: it includes class 1 sound level meter HD2010UC (class 2 for HD2010UC kit2), HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 microphone for HD2010UC kit2), windscreen, 5m extension cable and RS232 serial (HD2110/RS) or USB (HD2110/USB) connection cable. Noise Studio PC program). Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804.

HD2010UC kit 1/E and kit 2/E: version for outdoor measurements, it includes HD2010UC class 1 sound level meter (class 2 for HD2010UC kit2), weatherproof microphone unit for outdoor use HD WME equipped with bird spike, wind screen and rain screen, HD2010PNE2W heated preamplifier with 5m connection cable (other lengths upon request), UC52/1 microphone for free field (UC52 for HD2010UC kit2) and serial RS232 or USB connection cable. The kit also includes: Noise Studio software and RS232 (HD2110/RS) or USB (HD2110/USB) cable for connection to PC. Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804.

HD2010UC kit 1/IE and kit 2/IE: version for indoor and outdoor measurements, it includes HD2010UC class 1 sound level meter (class 2 for HD2010UC kit2), weatherproof microphone unit for outdoor use HD WME equipped with bird spike, wind screen and rain screen, HD2010PNE2W heated preamplifier with 5m connection cable (other lengths upon request), HD2010PNE2 preamplifier, HD SAV wind screen, CPA/5 5m extension cable and UC52/1 microphone for free field (UC52 for HD2010UC kit2). The kit also includes: Noise Studio software and RS232 (HD2110/RS) or USB (HD2110/USB) cable for connection to PC. Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804.

Option HD2010.00 "Memory module": 4MB expansion memory. **It can be installed**

on the HD2010UC with option "Advanced Data Logger".

Option HD2010.02 "Advanced Data Logger": automatic recording of time sound profiles, complete statistical analysis, capture of noise events using trigger level function, simultaneous data logging of profiles, reports and events. "Navigator" program to recall from memory and analyze stored data.

HD9101: Class 1 calibrator according to IEC90942:1988. Features:

- Cavity for 1/2" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (Replaced by ACCREDIA Certification if **option S.C** purchased).

HD2020: Class 1 calibrator according to IEC60942:2003 equipped with I.N.R.I.M. n.90-003-01 Certificate of Conformity. Features:

- Backlit LCD,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1/2" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (Replaced by ACCREDIA Certification if **option S.C** purchased).

HD9102: Class 2 calibrator according to IEC90942:1988. Features:

- Cavity for 1/2" microphones according to IEC 61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (Replaced by ACCREDIA Certification if **option S.C** purchased).

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply Vin=100÷230Vac / Vout=12Vdc/1000mA.

CPA/10: 10m extension cable for HD2010PNE2 preamplifier.

VTRAP: Tripod, 1550 mm maximum height.

VTRAP.H4: Tripod with 4 m maximum height.

HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable thermal serial printer with 57mm paper rolls equipped with SWD10 power supply.

BAT40: Replacement battery pack for HD40.1.

RCT: 4 rolls of thermal paper, 57width and 32mm diameter.

HD2010MC: module for data logging and data download to MMC or SD type memory cards, 1GB SD card included.

Ordering codes for spare parts and other accessories

HD2010UC.U1: Upgrade from HD2010UC with "Data Logger" or "Advanced Data Logger" option to **HD2010UC/A**. Includes:

- DSP with octave bands spectral analysis
- ISO 9001 calibration report for sound level meter and filters
- **Calibration certification of the sound level meter according to IEC651 and IEC804 and the octave filter bank according to IEC61260 is included.**

HD WME/PNEUC1 outdoor microphone unit for type 1 HD2010UC and HD2010UC/A. Includes:

- Outdoor protection HD WME
- **Heated preamplifier HD2010PNE2W with 5 m cable**
- **Electret condenser microphone UC52/1, 1/2" diameter**

HD WME/PNEUC2 outdoor microphone unit for type 2 HD2010UC and HD2010UC/A. Includes:

- Outdoor protection HD WME
- **Heated preamplifier HD2010PNE2W with 5 m cable**
- **Electret condenser microphone UC52, 1/2" diameter**

HD WME/PNE2 microphone preamplifier with outdoor protection. Includes:

- **Outdoor protection HD WME with:**
- Windshield HD SAV3
- Anti-bird spikes HD WME1
- Rain protection HD WME2
- Stainless steel support HD WME3
- **Heated preamplifier HD2010PNE2W with 5 m cable**

HD WME outdoor protection with windscreen, rain shield and anti-bird spikes. Includes:

- Windshield HD SAV3
- Anti-bird spikes HD WME1
- Rain protection HD WME2
- Stainless steel support HD WME3

HD SAV: Windscreen for 1/2" microphones.

- HD SAV3:** Windscreen for HD WME and HD WME950 weather protection.
HD WME1: Bird spike for HD WME weather protection.
HD WME2: Rain shield for HD WME microphone unit.
HD WME3: Stainless steel housing for the preamplifier of HD WME weather protection, with holder for rain shield HD WME2.
HD2010PNE2: Microphone preamplifier for pre-polarized UC52 microphones. Equipped with CTC device for electrical calibration.
HD2010PNE2W: Microphone preamplifier to be housed in outdoor protection WME950 HD and HD WME. The preamplifier is heated, provided with standard connection for pre-polarized UC52 microphones and provided with CTC device for electrical calibration. Ending with a connection 5m cable (10mt length upon request).
UC52/1: Class 1 pre-polarized microphone for free field.
UC52: Class 2 pre-polarized microphone for free field.
CPA/5: Microphone 5m extension cable.
S.C ACCREDIA calibration Certification according to IEC 60942 for single frequency Calibrator.



TECHNICAL SPECIFICATIONS

Standards	Class 1 or 2 X group according to IEC 61672:2002 and class 1 or 2 according to IEC 60651:2001 and IEC 60804:2000 type 1 or 2 according to ANSI S1.4-1983 and S1.43-1997
½" Microphone	UC52 condenser type, pre-polarized, for free field.
Dynamic range	30 dBA ÷ 143 dB Peak
Linear Field	80 dB
Acoustic Parameters	Spl, L _{eq} , L _{eq} l, SEL, L _{EP,d} , L _{max} , L _{min} , L _{pk} , Dose, L _n
Frequency Weights	simultaneous A, C, Z (only C and Z for L _{pk})
Temporal Weights	simultaneous FAST, SLOW, IMPULSE
Integration	from 1s to 99 hours with erasing function (Back-Erase)
Statistical Analysis (Option HD2010.02: "Advanced Data Logger")	It displays up to 3 percentile levels, from L ₁ to L ₉₉ Probability distribution and percentile level calculation from L ₁ to L ₉₉ ✓Parameter: L _{Fp} , L _{eq} , L _{pk} weighted A, C o Z (solo C o Z per L _{pk}) ✓Sampling frequency: 8 samples/second ✓Classification: Classes of 0.5 dB
Combined data logging (Option HD2010.02: "Advanced Data Logger")	profiles, reports, events ✓Record of measuring reports with programmable intervals from 1 s to 1 hour with a customizable set of 5 parameters, complete statistical analysis and frequency spectra
Analysis of Events (Option HD2010.02: "Advanced Data Logger")	✓Calculation of 5 freely-programmable event parameters ✓Calculation of statistical levels from L ₁ to L ₉₉ ✓Event identification trigger with programmable threshold and duration filter ✓Manual trigger
Profile Data Logging (Option HD2010.02: "Advanced Data Logger")	1 profile with programmable sampling from 1/8 s to 1 hour and 3 profiles with 2 samples/second
Display	Graphic backlit LCD display 128x64 ✓3 parameters in numeric format ✓Profile L _{AFp} with 8 samples/second (Option HD2010.02: "Advanced Data Logger") ✓Graph of sound level probability distribution (Option HD2010.02: "Advanced Data Logger") ✓Graph of percentile levels from L ₁ to L ₉₉ (Option HD2010.02: "Advanced Data Logger")
Memory	✓Internal, memory equal to 4 MB (if HD2010.02 installed 1 profile for 23 hours or over 80 recording days of 3 parameters per minute). Expandable to 8 MB with option HD2010.00 "Memory module". ✓External, via the HD2110MC memory card interface, using MMC or SD cards up to 2 GB.
Input/Output	✓RS232 serial and USB interfaces ✓AC output (LINE) ✓DC output
PC Programs	Noise Studio (supplied with the instrument): PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key. ✓ NS1 "Worker protection" module. Analysis of noise in the workplace in accordance with the UNI 9432/2011 and ISO 9612/2011. ✓ NS2A "Acoustic pollution" module. Analysis of environmental noise. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. Requires option HD2010.02: "Advanced Data Logger" . ✓ NS4 "Monitor" module. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem. The program allows programming of measurements and calibrations with timer and audio recording with programmable event triggers.
Operating conditions	✓Working temperature -10÷50°C, 25÷90%RH (without condensation), 65÷108kPa. Protection degree: IP64
Power Supply	✓4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimension and weight	✓445x100x50 mm equipped with preamplifier, 740 g (with batteries).



HD 2010UC/A INTEGRATING SOUND LEVEL METER - FREQUENCY ANALYZER

HD2010UC/A is a portable integrating sound level meter, with data logging function, suitable for performing statistical and spectral analyses. The instrument has been designed by combining maximum flexibility and simplicity. Attention has been paid to the possibility of adjusting the instrument so to comply with the changes in the rules about noise and to the necessity of comply with the current and future requests of the users. It is possible to add options to the HD2010UC/A so to extend its applications; the user can update the firmware directly by means of the Noise Studio programme supplied with the instrument.

Technical regulations:

- Class 1 or 2 sound level meter according to IEC 61672-1, 2002 (Certificate of Compliance I.N.R.I.M. No. 07-0124-02), IEC 60651 and IEC 60804.
- Class 1 octave and third octave filters according to IEC 61260.

Applications:

- Assessment of the environmental noise level,
- Noise monitoring, capture and analysis of sound events,
- Octave and optional third octave band spectrum analysis from 25 Hz to 12.5 kHz,
- Statistical analysis with the calculation of 3 percentile levels and, full statistical analysis,
- Identification of impulsive noise,
- Measurements in workplaces,
- Selection of personal protective equipment (SNR, HML, and OBM methods),
- Sound insulation and reclamation,
- Production quality control,
- Measurement of machine noise,
- Optional architectural and building acoustics measurements.

Sound level meter class 1 or 2 Kit

HD2010UC/A kit1 and kit2: consists of HD2010UC/A class 1 sound level meter (class 2 for HD2010UC/A kit2), HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2), windscreens, 5m extension cable and serial RS232 or USB connection cable. Noise Studio PC programme. Supplied

with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804. ACCREDIA Certification of filters according to IEC 61260.

HD2010UC/A kit1/E and kit2/E: version for outdoor measurements, it consists of HD2010UC/A class 1 sound level meter (class 2 for l'HD2010UC/A kit2), HD WME weatherproof microphone unit for outdoor use, HD2010PNE2W heated preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2) and serial RS232 or USB connection cable. Noise Studio PC programme. Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804. ACCREDIA Certification of filters according to IEC 61260.

HD2010UC/A kit1/IE e kit2/IE: version for indoor and outdoor measurements, it consists of HD2010UC/A class 1 sound level meter (class 2 for l'HD2010UC/A kit2), HD WME weatherproof microphone unit for outdoor use, HD2010PNE2W heated preamplifier, HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2) and serial RS232 or USB connection cable. Noise Studio PC programme. Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804. ACCREDIA Certification of filters according to IEC 61260.

Accessories

Option HD2010.00 "Memory module": 4MB expansion memory.

Option HD2010.01: "Third Octave": spectral analysis in third octave bands from 25Hz to 12.5KHz, class 1 according to IEC 61260. **ACCREDIA calibration Certification according to IEC 61260 included.**

Option HD2010.04: "Reverberation Time": reverberation time measurement by source interruption and integration of impulse response method.

HD9101: class 1 calibrator according to IEC60942:1988. Features:

- Cavity for 1/2" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD9102: class 2 calibrator according to IEC60942:1988. Features:

- Cavity for 1/2" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.R.I.M. n.90-003-01 Certificate of Conformity. Features:

- LCD Display,
- Static pressure compensation from 65 kPa to 108 kPa,
- Cavity for 1/2" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD2110/RS: serial RS232 cable for connection to a PC or to HD40.1 printer.



HD WME

HD2110/USB: serial USB cable for connection to a PC
SWD10: stabilized mains power supply with $V_{in}=100-230Vac$ $V_{out}=12Vdc/1000mA$ voltage.
CPA/10: 10m extension cable.
VTRAP: tripod, 1550mm maximum height.
VTRAP.H4: Tripod with 4 m maximum height.
HD2110/SA: support to fix preamplifier to tripod.
HD40.1: portable serial thermal printer with 57mm paper tape equipped with SWD10 stabilizer mains.
HD2010MC: module for data logging and data download to MMC or SD type memory cards, 1GB SD card included.
S.C ACCREDIA calibration Certification according to IEC 60942 for single frequency Calibrator.

Software for Windows® 98/XP/Vista/Win7 (32-64bit) operating systems

Noise Studio: Programme for Windows® 98, XP, Vista and Win7 (32-64bit) supplied with the sound level meter kit. Instrument configuration, download and graphic display of the stored data. This programme supports some sound analysis application modules which can be enabled by licence with the hardware key. The programme includes demo versions of the modules.

CH20: Hardware key for PC working with Windows® operating system. It enables the software modules of Noise Studio when introduced into the USB port.

NS1: "Workers' Protection" module of Noise Studio programme. Noise analysis in working environment according to UNI 9432/2011 and ISO 9612/2011.

NS2A: Noise Studio "**Acoustic Pollution**" module activation. Acoustic climate analysis based on daily, weekly, annual analysis (According to 2002/49/CE Directive) ; evaluation of road, railway and airport traffic noise. **Some of the functions need option "Third octave"**.

NS3: Noise Studio "**Acoustic Insulation**" module activation. Architectural and building acoustic according to ISO354, ISO140 and ISO717 series standards. **For some calculations sound level meter options HD2010.01 "Third Octaves" and HD2010.04 "Reverberation Time" are required.**

NS4: "Monitor" module in Noise Studio programme. Real time PC data acquisition. Synchronized audio recording. Monitor and remote control programming. Connection by modem.

NS5: Noise Studio "**Environmental Noise**" module. Analysis of acoustic pollution and environmental noise sources. The software performs statistical and spectral analyses; automatically identifies noisy events and the pulse and tonal components of the noise sources. The analyses are performed in compliance with the national (D.L. 194/2005 and D.M. 16/03/1998) and EU legislation regarding the acoustic pollution

Noise Studio packages:

NSA: "Environmental" modules package including:

- NS2A: "Acoustic Pollution"
- NS4: "Monitor"
- NS5: "Environmental Noise"

NSLA: "Work & Environment" modules package including:

- NS1: "Workers Protection"
- NS5: "Environmental Noise"

NSAE: "Environmental & Building" modules package including:

- NS2A: "Acoustic Pollution"
- NS3: "Acoustic Insulation"
- NS5: "Environmental Noise"

NSS: Noise Studio software complete package including:

- NS1: "Workers Protection"
- NS2A: "Acoustic Pollution"
- NS3: "Acoustic Insulation"
- NS4: "Monitor"
- NS5: "Environmental Noise"

By using the HD2010UC/A, you can log the time profile of 4 simultaneous parameters freely selecting temporal or frequency weightings. The possibility of displaying, storing and even printing the multi-parameter analysis of the sound level allows the sound level meter to work as a sound level logger capable of storing for more than 23 hours. For sound level monitoring, you can store 3 programmable parameters and the average spectrum at intervals of 1 second to 1 hour. In this recording mode, you can store the sound level (3 parameters + spectra) at intervals of 1 minute for over 23 days using the supplied memory (4 MB expandable to 8 MB).

An advanced acquisition mode allows storing report sequences with dedicated parameters, average spectra and full statistical analysis, as well as sound level profiles. Moreover, a versatile trigger function can identify the sound events and record their analysis with 5 dedicated parameters, average spectrum and statistical analysis.

The spectrum analysis is carried out simultaneously with the profile logging in real time by octave bands and optionally by third octave bands. The sound level meter calculates the sound signal spectrum twice a second and it integrates it linearly for up to 99 hours. The average spectrum is displayed together with an A, C or Z -weighted wideband level.

Additional functions as advanced sound analyser are available in the basic version:

- **Statistical analysis** in graphic form both as probability distribution and as cumulative distribution

- Trigger functions for **sound events capture** with threshold level and event duration filter
- **Record of measuring reports** with programmable intervals from 1 s to 1 hour with a customizable set of 5 parameters, complete statistical analysis and frequency spectra
- Acquisition of noise events with the possibility to set the maximum temporal resolution for event recording and a lower resolution for background recording.
- Possibility to record up to **9 different markers**
- **Timer for programming delayed start** of acquisition

As a statistical analyzer, the HD2010UC/A samples the sound signal 8 times per second with A-weighting and FAST constant and it analyzes it statistically in 0.5 dB classes. Up to 4 percentile levels, selectable between L_1 and L_{99} , can be programmed. The "Advanced Analyzer" can be used to choose the sampling of the following: L_{Fp} , L_{eq} and L_{pk} with A, C and Z -weightings (only C and Z for L_{pk}).

For further analyses, the LINE unweighted output allows recording the sound sample either on tape or directly on a PC equipped with a data acquisition card.

Recordings can be located in memory and visualized on the graphic display using the "Replay" function, which reproduces the time trend of the sound track. The high-speed USB interface, combined with the flexible RS232 interface, allows quick data transfers from the sound level meter to the PC mass storage, as well as controlling a modem or printer. For example, should the supplied memory not be enough, this is the case of lengthy recordings, you can activate the "Monitor" function. This function allows sending the displayed data to a PC via the serial interface, to be directly stored on the PC mass storage.

The sound level meter can be completely controlled by a PC through the multi-standard serial interface (RS232 and USB) by using a special communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.

The calibration can be performed either by using the acoustic calibrator or the built-in reference generator. The electric calibration uses a special preamplifier and checks the sensitivity of the measuring channel, microphone included. A protected area in the non-volatile memory, reserved to factory calibrations, is used as a reference for the user's calibrations, so to allow keeping instrument drifts under control and to prevent the instrument from losing of calibrations.

The control of the complete sound level meter functionality can be made directly by the user, on site, thanks to a diagnostic programme.

HD2010UC/A sound level meter can perform all the measurements required to evaluate **workers' noise exposure**. The selection of the personal protective equipment can be carried out through octave band spectrum analysis (OBM method) or comparison of the A and C-weighted equivalent levels that can be measured simultaneously (SNR method). If an undesired sound event produces an overload indication, or simply alters the result of integration, its contribution can be excluded using the versatile Back-Erase function.

HD2010UC/A sound level meter is suitable for **noise monitoring** and acoustic mapping. Using the "Advanced Analyzer", it can also perform analysis of the acoustic climate with capture and analysis of sound events. When measuring traffic noise near airports, railways and roads, the sound level meter can be used as a multi-parameter sound recorder, combining the statistical and spectrum analyzer features. Remote electrical calibrations and diagnostic tests can be executed using its remote control capabilities.

HD2010UC/A sound level meter with the "Third Octave" and "Reverberation Time" options can perform all measurements prescribed by the regulations on **room acoustics evaluation**. The sound level meter powerful DSP calculates 32 spectra/second, and it can measure reverberation times both using the sound source interruption and impulsive response integration. The analysis is carried out simultaneously by both octave and third octave bands.

Inputs and outputs

DC output corresponding to the A-weighted sound level with FAST time constant, updated 8 times/s (\emptyset 2.5 mm jack). This output is not available for all models.

LINE unweighted output (\emptyset 3.5 mm jack).

Standard RS232C serial port complying with EIA/TIA574. Baud Rate 300 to 115200 baud.

USB 1.1 serial port.

External power supply 9-12Vdc (\emptyset 5.5 mm jack).

Options and accessories:

HD2110/MC reader

It allows interfacing SD memory cards to the sound level meter.

This device is connected to the sound level meter by means of a serial interface which supplies the necessary power supply as well. Further to the remarkable recording capacity, the interface allows to quickly download data stored in the internal memory of the sound level meter. It is possible to connect cards having up to 2GB capacity. 1GB card is supplied.

Option "Third Octave" cod. HD2010.02

Third octave band spectrum analyzer class 1 according to IEC 61260.

Using the "Third Octave" option you can analyze the spectrum of a sound source in real time from 25 Hz to 12.5 kHz. The audibility of the different spectrum components can be evaluated thanks to the equal loudness curves calculation of Noise Studio, the program supplied with the instrument.

Option "Reverberation Time" cod. HD2010.04

Reverberation time measurement using the sound source interruption technique and the impulsive source method.

The reverberation time measurement is made simultaneously by wideband, octave band from 125 Hz to 8 kHz and, optionally, third octave band from 100 Hz to 10 kHz. Sampling interval $1/32$ s.

Automatic calculation of reverberation times EDT, T10, T20 and T30 for all bands

Software:

Noise Studio

The Noise Studio software allows interfacing HD2010UC to the PC in a simple and intuitive way. Main functions are:

Transfer of stored data from the sound level meter to the PC memory.

Visualization of the captured data under graphic and tabular form.

Export to Excel and PDF format.

Printing of graphs and data tables.

Control of acquisition from a PC.

Sound level meter setup management.

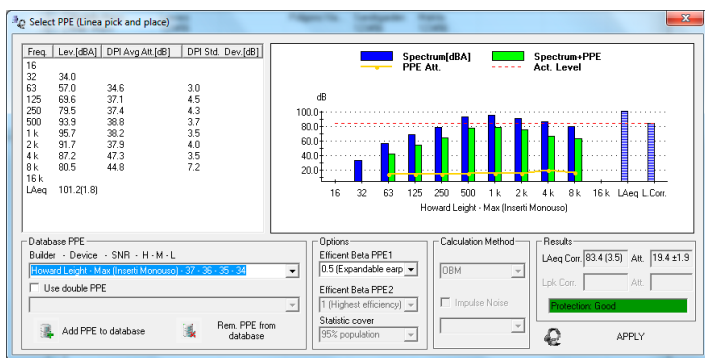
Sound level meter firmware update.

It results easier drafting documents regarding the sound level meter's relief due to the handy function which allows to copy graphs or visualized tables to other applications and to create PDF files.

Moreover Noise Studio is a post processing software able to perform different kind of analyses, developed for specific applications assembled in software modules to be enabled with licence. Demo versions of the software modules are provided.

Noise Studio: NS1 'Worker protection' module (to be activated by license)

This application module analyzes noise in the workplace according to the European directive 2003/10/EC and UNI 9432/2011. Data sound level measurement in work environment is organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers the software allows to evaluate the effectiveness of protective equipment by the methods SNR HML and OBM. According to UNI 9432/2011 and ISO 9612/2011, the software also calculates the index of impulsiveness of a machine.



Noise studio: "workers' protection" module NS1: analysis of the effectiveness of PPE

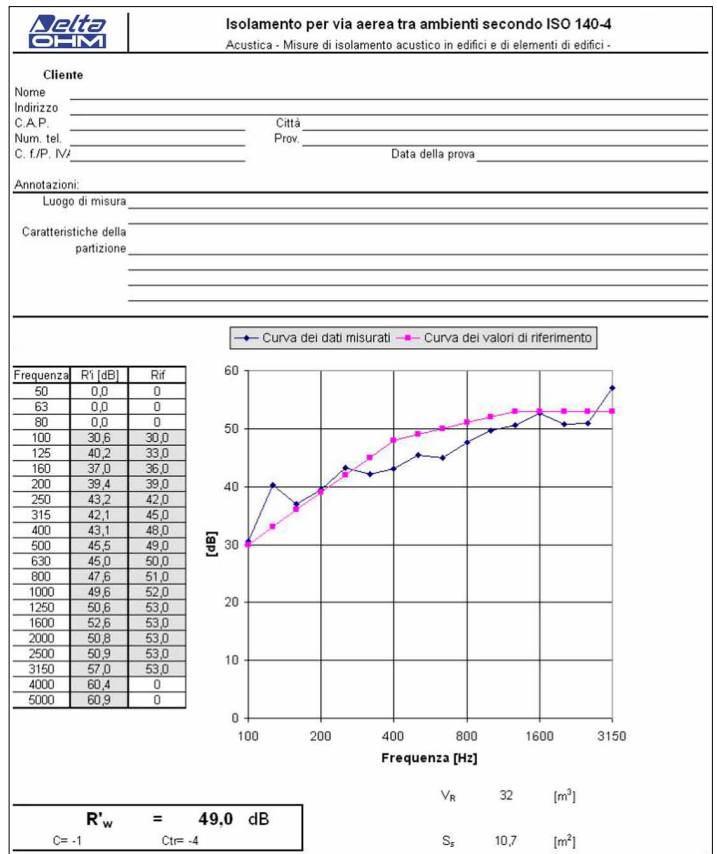
Noise Studio: NS2A 'Acoustic Pollution' module (to be activated by license)

This application module analyzes sound level profiles detected both in indoor and outdoor environments for assessment of the noise climate, of noise in airports and transport infrastructures.

The analysis of the noise climate is made on a daily, weekly and annual basis with resolutions up to 1 minute according to 2002/49/CE Directive.

The profiles of noises detected in the external environment are analyzed in order to search for disturbing sources characterized by a sequence of events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1/8 of a second and with automated search and analysis of sound events.

Some of the functions need Option 1 "Third octaves".



Noise studio "acoustic insulation" module NS3: filling iso report.

Noise Studio: NS3 'Acoustic Insulation' module (to be activated by license)

This module performs calculations of building acoustics for the assessment of passive acoustic requirements of buildings, according to ISO standard.

The measures necessary for the analysis of a building are grouped in a project to simplify their storage and research. Also, technical reports, comments, graphics, photos, etc. which remain part of the work can be added to the same measures and, if necessary, may be found easily.

An updateable database, divided by walls and floors, contains the main characteristics of sound-insulating structures. The data contained in the database can be compared graphically with in situ measures.

With the program you can calculate:

- Average reverberation time (ISO 3382)
 - Reverberation time decay editing
 - Acoustic classification according to UNI 11367/2010
 - Machinery noise: continuous and discontinuous systems
 - Area of equivalent absorption coefficient of sound absorption (ISO 354)
 - Airborne sound insulation: indices R , R' and D_{nT} (ISO 140/III and IV)
 - Insulation of facades and facade elements: indices $D_{2m,nT}$ and R_0 (ISO 140 / V)
 - Impact noise insulation: indices L_{nT} , DL , $The N$ and L'_{nT} (ISO 140/VI, VII and VIII)
- Most of the calculation require "third octave" and "reverberation time" options installed on the sound level meter.**

Noise Studio: NS4 'Monitor' module (to be activated by license)

This software module allows to control the sound level meter with PC in remote location. The main functions are:

- Real time display of acquired data, in graphical and tabular form.
- Possibility of connection via modem with the sound level meter.
- Acquisition of sound level data directly into the mass memory of the PC (monitor function).
- Management of diagnostic and calibration functions.
- Automatic acquisition and monitoring programme.
- Possibility of logging synchronized audio along with the sound level meter measures, by using the easy trigger function.

Ordering codes for the new kits and accessories

HD2010UC/A kit1 and kit2: Includes HD2010UC/A class 1 Sound Level Meter (class 2 for kit HD2010UC/A kit 2), carrying case, HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 for kit HD2010UC/A kit2), windscreens HD SAV, 5m extension cable CPA/5, Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface). Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804. ACCREDIA Certification of filters according to IEC 61260.

HD2010UC/A kit1/E and kit2/E: Version for outdoor measurements, includes class 1 Sound Level Meter HD2010UC/A (class 2 for HD2010UC/A kit2), carrying case, HD WME weather protection complete with bird spike, windscreen and rain shield, heated preamplifier HD2010PNE2W with 5m connection cable (other lengths on request), UC52/1 microphone for free field (UC52 microphone for HD2010UC/A kit2), RS232 serial (HD2110/RS) or USB (HD2110/USB) connection cable. Noise Studio PC software. Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804. ACCREDIA Certification of filters according to IEC 61260.

HD2010UC/A kit1/IE and kit2/IE: Version for indoor and outdoor measurements, includes class 1 Sound Level Meter HD2010UC/A (class 2 for HD2010UC/A kit2), carrying case, HD WME weather protection with bird spike, wind screen and rain shield, heated preamplifier HD2010PNE2W with 5m extension cable (other lengths on request), wind screen HD SAV, preamplifier HD2010PNE2, UC52/1 microphone for free field (UC52 microphone for HD2010UC kit2), 5m extension cable CPA/5, and RS232 serial (HD2110/RS) or USB (HD2110/USB) connection cable. Noise Studio PC programme. Supplied with ACCREDIA calibration Certification, according to IEC 60651 and IEC 60804.

Option HD2010.00 "Memory module": 4MB expansion memory

Option HD2010.01: "Third Octave": spectral analysis in third octave bands from 25Hz to 12.5KHz, class 1 according to IEC 61260. ACCREDIA calibration Certification according to IEC 61260 included.

Option HD2010.04: "Reverberation Time": reverberation time measurement by source interruption and integration of pulse response method.

HD9101: Class 1 calibrator according to IEC90942:1988. Features:

- Cavity for 1/2" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by ACCREDIA Certification if option S.C purchased).

HD2020: Class 2 calibrator according to IEC60942:2003 equipped with I.N.R.I.M. n.90-003-01 Certificate of Conformity. Features:

- Backlit LCD,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1/2" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by ACCREDIA Certification if option S.C purchased).

HD9102: Class 2 calibrator according to IEC90942:1988. Features:

- Cavity for 1/2" microphones according to IEC 61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by ACCREDIA Certification if option S.C purchased).

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply Vin=100±230Vac / Vout=12Vdc/1000mA.

CPA/10: 10m extension cable for HD2010PNE2 preamplifier.

VTRAP: Tripod, 1550 mm maximum height.

VTRAP.H4: Tripod with 4 m maximum height.

HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable thermal serial printer with 57mm paper rolls equipped with SWD10 power supply.

BAT40: Replacement battery pack for HD40.1.

RCT: 4 rolls of thermal paper, 57 width and 32mm diameter.

HD2010MC: SD memory card interface. This device includes a 1GB SD card.

S.C ACCREDIA calibration Certification according to IEC 60942 for single frequency Calibrator.

Ordering codes for spare parts and other accessories

HD WME/PNEUC1 outdoor microphone unit for type 1 HD2010UC and HD2010UC/A.

Includes:

- Outdoor protection HD WME
- Heated preamplifier HD2010PNE2W with 5 m cable
- Electret condenser microphone UC52/1, 1/2" diameter

HD WME/PNEUC2 outdoor microphone unit for type 2 HD2010UC and HD2010UC/A.

Includes:

- Outdoor protection HD WME
- Heated preamplifier HD2010PNE2W with 5 m cable
- Electret condenser microphone UC52, 1/2" diameter

HD WME/PNE2 microphone preamplifier with outdoor protection. Includes:

- Outdoor protection HD WME with:
 - Windshield HD SAV3
 - Anti-bird spikes HD WME1
 - Rain protection HD WME2
 - Stainless steel support HD WME3
- Heated preamplifier HD2010PNE2W with 5 m cable

HD WME outdoor protection with windscreen, rain shield and anti-bird spikes.

Includes:

- Windshield HD SAV3
- Anti-bird spikes HD WME1
- Rain protection HD WME2
- Stainless steel support HD WME3

HD SAV: Windscreen for 1/2" microphones.

HD SAV3: Windscreen for HD WME and HD WME950 weather protections.

HD WME1: Bird spike for HD WME weather protection.

HD WME2: Rain shield for HD WME microphone unit.

HD WME3: Stainless steel housing for the preamplifier of HD WME weather protection, with holder for rain shield HD WME2.

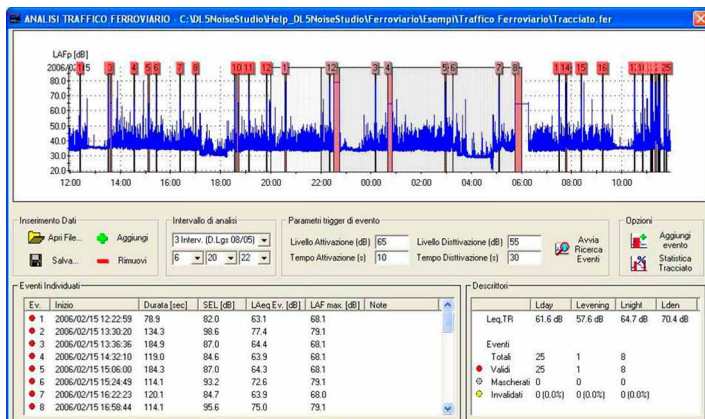
HD2010PNE2: Microphone preamplifier for pre-polarized UC52 microphones. Equipped with CTC device for electrical calibration.

HD2010PNE2W: Microphone preamplifier to be housed in outdoor protection WME950 HD and HD WME. The preamplifier is heated, provided with standard connection for pre-polarized UC52 microphones and provided with CTC device for electrical calibration. Ending with a connection 5m cable (10mt length upon request).

UC52/1: Class 1 pre-polarized 1/2" microphone for free field.

UC52: Class 2 pre-polarized 1/2" microphone for free field.

CPA/5: 5m extension cable for preamplifier HD2010PNE2.



Noise studio: "railway traffic" module include in NS2A: analysis of 24 hours with automatic search of transit



Acoustics - Vibrations

TECHNICAL SPECIFICATIONS

Standards	Class 1 or 2 group X according to IEC 61672:2002, and class 1 or 2 according to IEC 60651:2001 and IEC 60804:2000 Class 1 according to IEC 61260:1995 Type 1 or 2 according to ANSI S1.4-1983 and S1.43-1997 Class 1-D, order 3, Extended range according to ANSI S1.11-1986
½ inch Microphone	UC52 condenser type, pre-polarized, for free field
Dynamic Range	30 dBA ÷ 143 dB Peak
Linear Field	80 dB
Acoustic Parameters	Spl, L_{eq} , L_{eq} , SEL, $L_{EP,d}$, L_{max} , L_{min} , L_{pk} , Dose, L_n
Frequency Weighting	Simultaneous A, C, Z (only C and Z for L_{pk})
Temporal Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function
Spectrum Analysis	Parallel filters in real time complying with class 1 specifications according to IEC61260 ✓ Octave bands from 32 Hz to 8 kHz ✓ Third octave bands from 25 Hz to 12.5 kHz ("Third Octave" option) Average spectrum (AVR) mode
Statistical Analysis	It displays up to 3 percentile levels, between L_1 and L_{99} Probability distribution and percentile level calculation from L_1 to L_{99} ✓ Parameter: L_{Fp} , L_{eq} , L_{pk} A, C or Z -weighted (only C or Z for L_{pk}) ✓ Sampling frequency: 8 samples/second Classification: Classes of 0.5 dB
Combined data logging	profiles, reports, events ✓ Record of measuring reports with programmable intervals from 1 s to 1 hour with a customizable set of 5 parameters, complete statistical analysis and frequency spectra
Analysis of Events	Calculation of 5 freely-programmable event parameters Average spectrum calculation by octave and third octave bands Calculation of statistical levels from L_1 to L_{99} Event identification trigger with programmable threshold and duration filter External and manual trigger
Reverberation Time (option "Reverberation Time")	Reverberation time measurement using sound source interruption or impulse response integration
Profile Data Logging	1 profile with programmable sampling from 1/6 s to 1 hour and 3 profiles with 2 samples/second
Spectrum Data Logging	Programmable sampling from 1 second to 1 hour (AVR mode)
Display	Graphic backlit LCD display 128x64 ✓ 3 parameters in numeric format ✓ Profile L_{AFp} with 8 samples/second ✓ Octave band spectrum from 32 Hz to 8 kHz ✓ Third octave band spectrum from 25 Hz to 12.5 kHz (option "Third Octave") ✓ Graph of sound level probability distribution ✓ Graph of percentile levels from L_1 to L_{99}
Memory	Internal, equal to 4 MB (4 profiles for 23 hours or over 23 recording days of 3 parameters + spectra per minute) expandable to 8 MB External, via the HD2110MC memory card interface, using MMC or SD cards up to 2 GB
Input/Output	✓ RS232 serial and USB interfaces ✓ AC output (LINE) ✓ DC output
PC Programs	Noise Studio (supplied with the instrument): PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key. ✓ NS1 "Worker protection" module. Analysis of noise in the workplace in accordance with UNI 9432/2011 and ISO 9612/2011. ✓ NS2A "Acoustic pollution" module. Analysis of environmental noise. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. Some of the functions need option "Third octaves". ✓ NS3 "Acoustic Insulation" module. Evaluation of airborne sound insulation, impact noise and sound absorption; buildings insulation classification (UNI 11367). It needs option "Third octaves" and option "Reverberation time". Calculation according to ISO140, ISO717 and ISO354. ✓ "Monitor" module. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem.
Operating conditions	✓ Working temperature -10÷50°C, 25÷90%RH (not condensing), 65÷108kPa. Protection degree: IP64
Power	✓ 4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimension and weight	✓ 445x100x50 mm equipped with preamplifier, 740 g (with batteries)



HD2010 kit 1/E: Version for outdoor measurements. It consists of HD2010 Sound Level Meter, HD WME weather protection, free field microphone unit MK223, windscreen, heated preamplifier HD2010PNW, RS232 serial or USB connection cable. Noise Studio PC Program.

HD2010 kit 1/IE: Version for indoor and outdoor measurements. It includes HD2010 Sound Level Meter, HD WME weather protection, free field microphone unit MK223, windscreen HDSAV, heated preamplifier HD2010PNW, preamplifier HD2010PN, 5m extension cable CPA/5 and RS232 serial or USB connection cable. Noise Studio PC Program.

Accessories

Option 0 "Memory Expansion": Additional 4 MB memory expansion.

Option 1 "Third Octave": Third octave band spectrum analysis in real time from 16 Hz to 20 kHz. Includes calibration report according to ISO 9001.

Option 4 "Reverberation Time": Measurement using sound source interruption or impulse response integration. **It requires option 1 "Third octaves".**

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis.

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. **For new instruments only.**

MK231: Class 1 microphone for diffuse field type WS2D according to IEC 61094-4:1995.

MK223: Class 1 Microphone for free field, type WS2F, according to IEC 61094-4:1995. Coated membrane for outdoor use.

HD9101: Class 1 calibrator according to IEC90942:1988. Specifications:

- Cavity for 1" and 1/2" microphones according to IEC61094
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.RI.M. certificate of conformity n.90-003-01. Specifications:

- LCD display,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1" and 1/2" microphones according to IEC61094,
- 1000Hz frequency,
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001.

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply Vin=100-230Vac / Vout=12Vdc/1000mA.

CPA/10: 10m extension cable.

HD 2010 INTEGRATING SOUND LEVEL METER - PORTABLE ANALYZER

The HD2010 is a precision integrating portable sound level meter, with data logging functions, performing both spectrum and statistical analysis. The instrument has been designed combining maximum flexibility and simplicity. Attention has been paid to the possibility of adjusting the instrument to regulatory modifications and to the necessity of meeting its users' needs of today and tomorrow. The HD2010 can be integrated with other options to extend its application scope at any time; the firmware can be directly updated by the user by means of the Noise Studio program (supplied with the instrument).

Technical regulations:

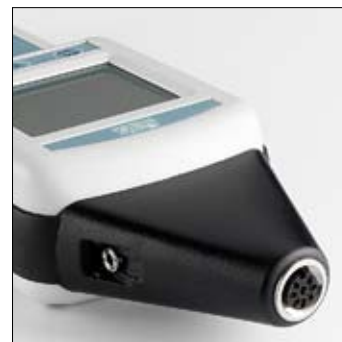
- Class 1 sound level meter according to IEC 61672-1, 2002 (Certificate of Compliance I.E.N. No. 37035-01C), IEC 60651 and IEC 60804.
- Class 1 octave and third octave filters according to IEC 61260
- Microphone complying with IEC 61094-4.

Applications:

- Assessment of the environmental noise level,
- Noise monitoring and optional capture and analysis of sound events,
- Octave and optional third octave band spectrum analysis from 16 Hz to 20 kHz,
- Statistical analysis with calculation of 3 percentile levels and optional full statistical analysis,
- Identification of impulsive noise
- Measurements in workplaces
- Selection of personal protective equipment (SNR, HML, and OBM methods),
- Sound insulation and reclamation,
- Production quality control,
- Measurement of machine noise,
- Optional architectural acoustics and building measurements.

Sound level meter Kits

HD2010 kit 1: consists of HD2010 Sound Level Meter, HD2010PN preamplifier, MK221 microphone for free field, windscreen, 5m extension cable and RS232 serial or USB connection cable. Noise Studio PC Program.



HD WME

VTRAP: Tripod, 1550 mm maximum height.

HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.

HD2010/MC: SD memory card interface complete with 1GB SD card

Software for Windows®/98/ME/2000/XP/Vista operating systems

Noise Studio: Software for Windows® ME/2000/XP and Vista operating systems supplied in the sound level meter kit. Configuration of the instrument, downloading and graphical display of stored data. This programme supports some sound analysis application modules which can be enabled by licence with the hardware key. The program contains demo versions of the modules.

CH20: Hardware key for PC with Windows® operating systems. Inserted into a USB port enables PCs to use software modules of the program Noise Studio.

NS1: Activation of module "Worker protection" of the Noise Studio program. Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008.

NS2: Activation of module "Noise pollution" of the Noise Studio Program. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. **Some program functions require option 1 "Third octaves".**

NS3: Activation of the module "Acoustic Insulation" of the Noise Studio program. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to DPCM of 5/12/1997. **Requires option 4 "Reverberation time".**

NS4: Activation of the module "Monitor" of the Noise Studio program. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem.

Noise Studio Suite: Noise Studio Program complete with following application modules:

- "Worker Protection"
- "Noise Pollution"
- "Acoustic Insulation"
- "Monitor"

Using the HD2010 you can log the time profile of 4 simultaneous parameters freely selecting temporal or frequency weightings. The possibility of displaying, storing and even printing the multi-parameter analysis of the sound level allows the sound level meter to work as a sound level logger capable of storing for more than 23 hours. For sound level monitoring, you can store 3 programmable parameters and the average spectrum at intervals of 1 second to 1 hour. In this recording mode, you can store the sound level (3 parameters + spectra) at intervals of 1 minute for over 23 days using the supplied memory (4 MB expandable to 8 MB).

An advanced logging mode ("Advanced Analyzer" option) allows storing report sequences with dedicated parameters, average spectra and full statistical analysis, as well as sound level profiles. Moreover, a versatile trigger function can identify the sound events and record their analysis with 5 dedicated parameters, average spectrum and statistical analysis.

The spectrum analysis is carried out in real time, simultaneous with profile acquisition, by octave bands and optionally by third octave bands. The sound level meter calculates the sound signal spectrum twice a second and it integrates it linearly for up to 99 hours. The average spectrum is displayed together with an A, C or Z-weighted wideband level.

As a statistical analyzer, the HD2010 samples the sound signal 8 times per second with A-weighting and FAST constant, and it analyzes it statistically in 0.5 dB classes. Up to 4 percentile levels, selectable between L_1 and L_{99} , can be programmed. The "Advanced Analyzer" option can be used to choose if you want to sample L_{Fp} , L_{eq} and L_{pk} with A, C and Z weightings (only C and Z for L_{pk}).

For further analysis, the LINE unweighted output allows recording the sound sample either on tape or directly on a PC equipped with a data acquisition card.

Recordings can be located in memory and viewed on the graphic display using the "Replay" function, which reproduces the time trend of the sound track. The high-speed USB interface combined with the flexible RS232 interface allows quick data transfers from the sound level meter to the PC mass storage, as well as controlling a modem or printer. For example, should the supplied memory not be enough, this is the case of lengthy recordings, you can activate the "Monitor" function. This function allows sending the displayed data to a PC via the serial interface, to be directly stored on the PC memory.

The sound level meter can be completely controlled by a PC through the multi-standard serial interface (RS232 and USB) by using a special communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.

The calibration can be made either using an acoustic calibrator (class 1 according to IEC 60942) or the built-in reference generator. The electrical calibration employs a special preamplifier and it checks the sensitivity of the measuring channel, microphone included. A protected area in the non-volatile memory, reserved for

factory calibration, is used as a reference in the user's calibrations, and it allows keeping instrument drifts under control and preventing the instrument from "going out of calibration".

The control of the complete sound level meter functionality can be made directly by the user, on site, thanks to a diagnostic programme.

The HD2010 sound level meter can perform the measurements required to evaluate workers' noise exposure (Legislative Decree 10.04.06 No. 195). The selection of the personal protective equipment can be carried out through octave band spectrum analysis (OBM method) or comparison of the A and C weighted levels that can be measured simultaneously (SNR method). If an undesired sound event produces an overload indication or simply alters the result of the integration, its contribution can be excluded using the versatile Back-Erase function.

The HD2010 sound level meter is suitable for sound level monitoring and acoustic mapping. Using the "Advanced Analyzer" option, it can also perform analysis of the acoustic climate with capture and analysis of sound events. When measuring traffic noise near airports, railways and roads, the sound level meter can be used as a multi-parameter sound recorder, combining the statistical and spectrum analyzer features. Remote electrical calibrations and diagnostic tests can be executed using its remote control capabilities.

The HD2010 sound level meter with the "Third Octave" option meets the technical requirements of art. 2 of the Decree of 16 March 1998.

Impulsive events can be easily identified thanks to the possibility of analyzing the profile of the A-weighted level with FAST, SLOW, and IMPULSE constants. All measuring parameters can be stored for subsequent analysis. The identification of tonal components using the HD2010 has its limitations: the source can be identified only if dominant in the acoustic climate being examined. Moreover, the sound level meter cannot identify the tonal components at the standard third octave band crossing point. The audibility of the tonal component, to be compared with that of the remaining spectrum areas, can also be evaluated using the Noise Studio program supplied with the instrument, thanks to the calculation of the equal loudness curves.

The HD2010 sound level meter, with the "Third Octave" and "Reverberation Time" options, can perform all measurements prescribed by the regulations on room acoustics evaluation (D.P.C.M. of 5/12/1997). The sound level meter powerful DSP calculates 32 spectra/second, and it can measure reverberation times both using the sound source interruption and the impulsive source integration technique. The analysis is carried out simultaneously both by octave and third octave bands.

Inputs and outputs

DC output corresponding to the A-weighted sound level with FAST constant time, updated 8 times/s (\varnothing 2.5 mm jack).

LINE unweighted output (\varnothing 3.5 mm jack).

Standard RS232C serial port complying with EIA/TIA574. Baud Rate 300 to 115200 baud.

USB 1.1 serial port.

External power supply 9÷12Vdc (\varnothing 5.5 mm jack).

Italian Laws

- Workplace noise: D.L.81/2008, European Standard UNI 9432/2008 and European Directive 2003/10/CE.
- Noise pollution: Law 447 of 26/10/95, D.P.C.M. of 1/3/91, Decree of 16/03/98, D.L. 194 dated 19/08/2005 and European Directive 2002/49/CE.
- Airport noise: Decree of 31.10.97.
- Entertainment noise: D.P.C.M. 215 of 16.04.99.
- Machine noise emissions: D. Lgs. 262 of 4/9/2002 and European Directive 2005/88/CE.
- Room acoustics evaluation: D.P.C.M. of 05.12.97.

Options and accessories:

HD2110/MC reader

It allows interfacing SD memory cards with the sound level meter.

This device is connected to the sound level meter through the serial interface that also gives the required power supply.

In addition to the remarkable recording capacity, the interface allows quickly downloading the data stored in the sound level meter internal memory. Cards up to 2 GB can be connected. Includes a 1GB SD card.

Option 1 "Third Octave"

Class 1 octave and third octave band spectrum analyzer according to IEC 61260. Using the "Third Octave" option you can analyze the spectrum of a sound source from 16 Hz to 20 kHz in real time. The audibility of the different spectrum components can be evaluated thanks to the calculation of equal loudness curves using the Noise Studio program supplied with the instrument.

Option 4 "Reverberation Time" (it requires the "Third Octave" option)

Reverberation time measurement using the sound source interruption technique and the impulsive source method.

The reverberation time measurement is made simultaneously by wideband, octave band from 125 Hz to 8 kHz and, optionally, by third octave band from 100 Hz to 10 kHz. Sampling interval 1/32 s.

Automatic calculation of reverberation times EDT, T10, T20 and analysis of the decay profile with the possibility to calculate the reverberation time in an interval of your choice.

Option 5 "Advanced Analyzer"

This option completes the sound level analyzer functions with the following:

- Statistical analysis available graphically, both as probability distribution and cumulative distribution.
- Trigger function to capture sound events with programmable threshold and duration filter.
- Recording of reports at intervals of 1s to 1 hour, with a dedicated set of parameters that includes average spectra and full statistical analysis.
- Recording of event parameters with the possibility of setting the maximum time resolution for event recording and a lower resolution for background noise recording.
- Possibility of storing markers.
- Timer for a delayed start of the acquisition.

Software:

Noise Studio

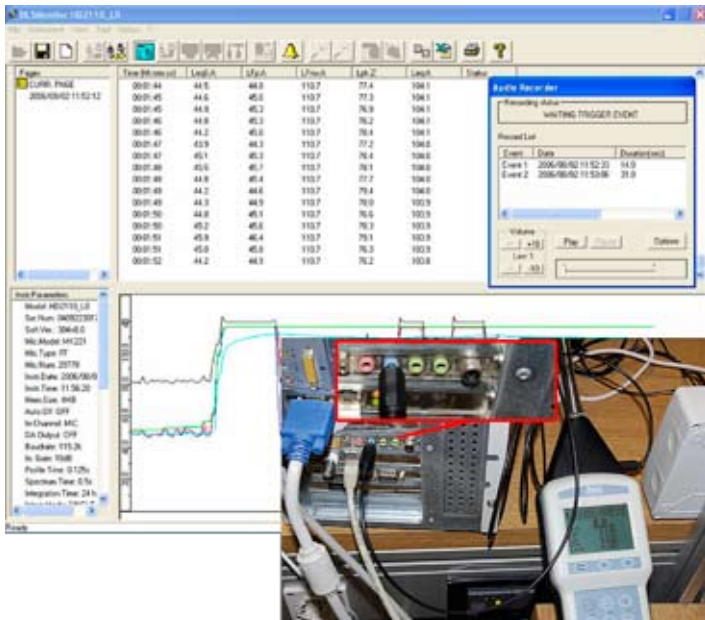
The Noise Studio program allows easily interfacing the sound level meter with the PC. Its main functions are:

- Data transfer from the sound level meter to the PC's memory.
- Display of the logged data as a table or a graph.
- Export to Excel
- Comparison of third octave band spectra with equal loudness curves.
- Logging control through PC (with the "Data Logger" option).
- Sound level meter setup.
- Sound level meter firmware upgrade

Writing reports is easier, thanks to a convenient function that allows copying the graphs or tables to other applications and the ability to create PDF files. Noise Studio is a program of post-processing that can perform different types of analysis designed for specific applications and grouped into modules with licensed software. Demo versions of the software modules are included.

Noise Studio: 'Worker protection' module

This application module analyzes noise in the workplace according to the DL 81/2008, the European directive 2003/10/EC and the UNI 9432:2008. Data sound level measurements in work environment are organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers the program allows to evaluate the effectiveness of protective equipment by the methods SNR and OBM. According to UNI 9432 of 2008, the program also calculates the index of impulsiveness of a machine.



Noise studio: "monitor" module: acquisition on pc with synchronized audio recording

Noise Studio: 'Acoustic Pollution' module

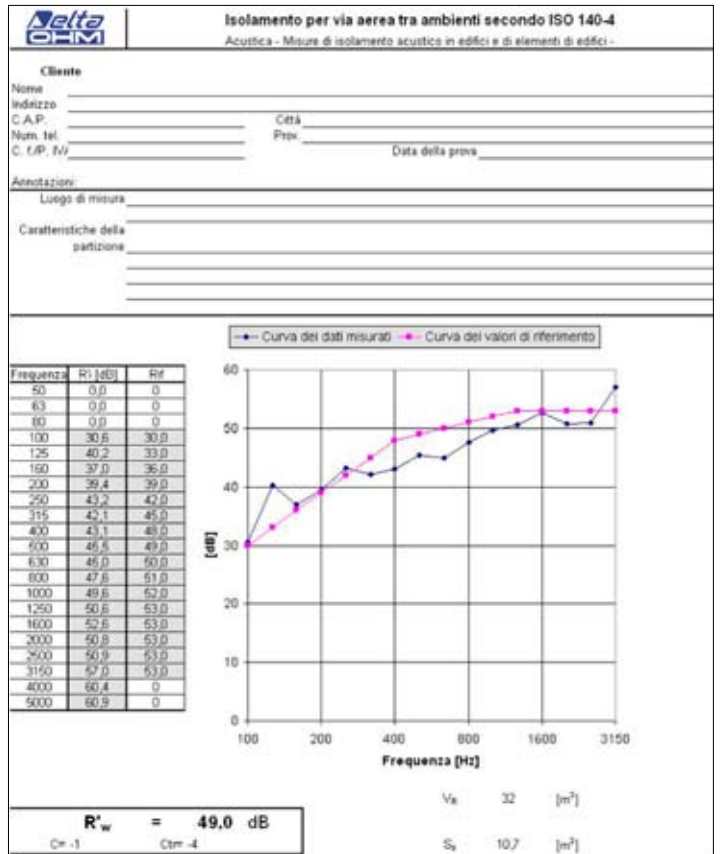
This application module analyzes sound level profiles detected in indoor and outdoor environment for the assessment of the noise climate, the noise of industrial sites, ports, airports and transport infrastructure, and noise generally understood as a disturbance of human activity. The analysis of the noise climate is made on a daily, weekly and annual basis with resolutions up to 1 minute, according to DL 194, 19/08/2005.

The profiles of noise detected in the external environment are analyzed to search for disturbing sources characterized by a sequence of events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1/8 of a second and with automatic search and analysis of sound events, according to the Ministerial Decree D.L. 194, 19/08/2005 of 16/03/1998. For the evaluation of the disturbance caused to the population from any source of noise even domestic, according to DM of 16/03/1998, the measured noise profiles are analyzed in search of impulsive or tonal components.

For some functions you need option 1: "Third octaves".

Noise Studio: 'Acoustic Insulation' module

This module performs calculations of building acoustics for the assessment of passive acoustic requirements of buildings, according to ISO standard, and according to the DPCM of 5/12/1997. The measures necessary for the analysis of a building are grouped in a project to simplify their storage and research. You can also add to the measures themselves, a technical report, comments, graphics, photos, etc. that remain part of the work and, if necessary, may be found easily. An updateable database, divided by walls and floors, contains the principal characteristics of sound-insulating structures. The data contained in the database can be compared



Noise studio "acoustic insulation" module: filling iso report.

graphically with measures in place.

With the program you can calculate:

- Average reverberation time (ISO 3382)
- Area of equivalent absorption coefficient of sound absorption (ISO 354)
- Isolation by air: indices R, R' and DNT (ISO 140/III and IV)
- Insulation of facades and facade elements: indices D_{2M,NT} and R_B (ISO 140 / V)
- Isolation of noise impact: indices L_n, D_n, The N and L' _{nr} (ISO 140/VI, VII and VIII)
- Global Indices (ISO 717-1 and 717-2)
- The program requires option 1 "Third octave" and for the calculation of some indices also the option 'Reverberation time'

Acoustics - Vibrations

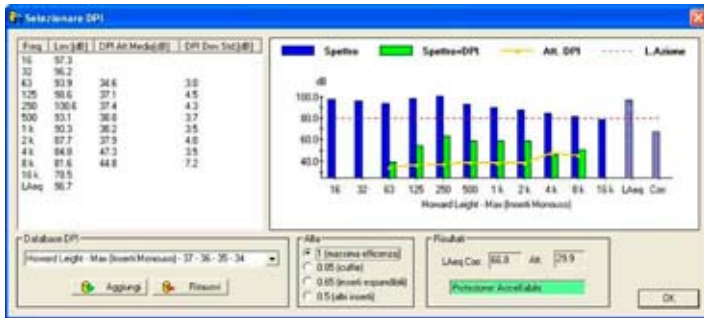
Noise Studio: 'Monitor' module

- This software module allows to control the sound level meter with PC in remote location. The main functions are:
- Real time display of acquired data, in graphical and tabular form.
- Possibility of connection via modem with the sound level meter.
- Acquisition of data sound level data directly into the mass memory of the PC (monitor function).
- Management of calibration and diagnostic functions.
- Automatic acquisition and monitoring program.
- Possibility of synchronized audio recording with the sound level measures, using a versatile trigger function

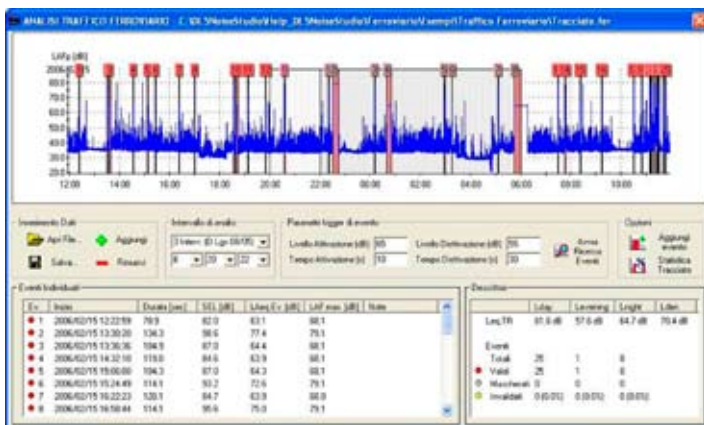
Purchasing codes for kit and accessories

HD2010 kit 1: consists of HD2010 Sound Level Meter, carrying case, HD2010PN preamplifier, MK221 microphone, CPA/5 5m extension cable, HD SAV windscreen, Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

HD2010 kit1/E: Version for outdoor measurements. It consists of: HD2010 Sound



Noise studio: "workers' protection" module: analysis of the effectiveness of ipd



Noise studio: "railway traffic" module: analysis of 24 hours with automatic search of transit

Level Meter, carrying case, HD WME weather protection with bird spike, wind screen and rain shield. HD SAV windscreen, heated preamplifier HD2010PNW with 5m extension cable (other lengths available on request), MK223 microphone, Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

HD2010 kit1/IE: Version for indoor and outdoor measurements. It consists of HD2010 Sound Level Meter, carrying case, HD WME weather protection with bird spike, wind screen and rain shield, heated preamplifier HD2010PNW with 5m extension cable CPA/5, preamplifier HD2010PN, HD SAV windscreen, free field microphone unit MK223, Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

Option 0 "Memory Expansion": Additional 4 MB memory expansion.

Option 1 "Third Octave": Real-time third octave band spectrum analysis from 16 Hz and 20 kHz.

Option 4 "Reverberation Time": Reverberation time measurement using the sound source interruption technique and the impulsive source method. **It requires the "Third Octave" option and, for instruments manufactured before 2007, also the "Data logger" option.**

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis. **It requires the "Data Logger" option for instruments manufactured before 2007.**

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. **Only for new instruments.**

HD9101: Class 1 calibrator according to IEC90942:1988. Characteristics:

- Cavity for 1" and 1/2" microphones according to IEC61094
- 1000Hz Frequency
- Sound level 94dB/114dB

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined to Option 7 "SIT Calibration").

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.R.I.M. certificate of conformity n.90-003-01. Characteristics:

- LCD display
- Static pressure compensation from 65kPa to 108kPa
- Cavity for 1" and 1/2" microphones according to IEC61094
- Frequency 1000Hz
- Sound level 94dB/114dB

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined to Option 7 "SIT Calibration").

MK231: Class 1 Microphone for diffuse field, type WS2D, according to IEC 61094-4:1995.

MK223: Class 1 Microphone for free field, type WS2F, according to IEC 61094-4:1995. Coated membrane for outdoor use.

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply with $V_{in}=100\div 230Vac$ / $V_{out}=12Vdc/1000mA$.

CPA/10: 10m extension cable for HD2010PN preamplifier.

VTRAP: Tripod, 1550 mm maximum height.

HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.

BAT40: Spare battery pack for HD40.1

RCT: 4 rolls of thermal paper, 57 width and 32mm diameter.

HD2010/MC: SD memory card interface complete with 1GB SD card

Codes for spare parts and other accessories

Option 2 "Data logger": Storage of 4 sound level profiles, continuously and at intervals. It includes memory expansion from of 2 MB. **This option is included in the new instruments.**

HD WME/PNWK: HD WME weather protection equipped with:

- HD WME consisting of preamplifier housing WME3 HD, bird spikes WME1, HD SAV wind screen SAV3 and rain shield HD WME2.
- Heated preamplifier HD2010PNW with 5m connection cable (other lengths upon request),
- MK223 microphone for free field type WS2F according to IEC 61094-4:1995 with coated membrane for outdoors use.

HD WME/PN

: HD WME weather protection equipped with:

- HD WME consisting of preamplifier housing WME3 HD, bird spikes WME1, HD SAV wind screen SAV3 and rain shield HD WME2.
- Heated preamplifier HD2010PNW with 5m connection cable (other lengths upon request),

HD WME: Weather protection equipped with:

- Stainless steel housing for HD WME3 preamplifier with rain shield HD WME2 support,
- HD WME1 bird spike,
- HD SAV3 wind-screen,
- HD WME2 rain shield.

HD SAV: Windscreen for 1/2" microphone.

HD SAV2: Windscreen with bird spike for HD WME950 microphone unit.

HD SAVP: Rain shield for HD WME950 microphone unit.

HD SAV3: Windscreen for HD WME and HD WME950 weather protections.

HD WME1: Bird spike for HD WME microphone unit.

HD WME2: Rain shield for HD WME microphone unit.

HD WME3: Stainless steel housing for the preamplifier of the outdoor microphone unit HD WME with holder for rain protection HD WME2.

HD2010PN: Microphone preamplifier for 1/2" microphones. Provided with CTC device for electrical calibration.

HD2010PNW: Microphone preamplifier for HDWME950N and HDWME weather protections. Heated and provided with CTC device for electrical calibration. Ending with 5m connection cable (other lengths upon request).

MK221: Class 1 microphone for free field, type WS2F, according to IEC 61094-4:1995

CPA/5: 5m extension cable for HD2010PN preamplifier.

HD2101/USB: USB serial cable for PC connection. **For sound level meters with serial Mini-Din connector.**

HD2110CSNM: RS232 serial cable for PC connection. **For sound level meters with serial Mini-Din connector.**

TECHNICAL SPECIFICATIONS

Standards	Class 1 group X according to IEC 61672:2002 and class 1 according to IEC 60651:2001 and IEC 60804:2000 Class 0 according to IEC 61260:1995 Type 1 or 2 according to ANSI S1.4-1983 and S1.43-1997 Class 1-D, order 3, Extended range according to ANSI S1.11-1986
½ inch Microphones	MK221 condenser microphone pre-polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4. MK223 condenser microphone with coated membrane, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 (combined with the HDWME950 weatherproof unit). MK231 condenser microphone, polarized (200V), for diffuse field, high stability, type WS2D according to IEC 61094-4.
Dynamic range	21 dBA ÷ 143 dB Peak
Linear Field	80 dB (110 dB for the HD2010RE version)
Acoustic Parameters	Spl, L _{eq} , SEL, L _{EP,d} , L _{max} , L _{min} , L _{pk} , Dose, L _n
Frequency Weighting	Simultaneous A, C, Z (only C and Z for L _{pk})
Temporal Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function
Spectrum Analysis	Parallel filters in real time complying with class 1 specifications according to IEC61260 ✓ Octave bands from 16 Hz to 16 kHz ✓ Third octave bands from 16 Hz to 20 kHz (option 1 "Third Octave") Average spectrum (AVR) mode
Statistical Analysis	It displays up to 3 percentile levels for, L ₁ to L ₉₉ Probability distribution and percentile level calculation from L ₁ to L ₉₉ (option 5 "Advanced Analyzer") ✓ Parameter: A, C or Z weighted, L _{EP} , L _{eq} , L _{pk} (only C or Z for L _{pk}) ✓ Sampling frequency: 8 samples/second ✓ Classification: Classes of 0.5 dB
Analysis of Events	Option 5 "Advanced Analyzer" ✓ Calculation of 5 freely programmable event parameters ✓ Average spectrum calculation by octave and third octave bands ✓ Calculation of statistical levels from L ₁ to L ₉₉ ✓ Event identification trigger with programmable threshold and duration filter ✓ External and manual trigger.
Reverberation Time (optional)	The reverberation time measurement option requires the "Third Octave" option Reverberation time measurement using sound source interruption or impulse response integration
Profile Data Logging	1 profile with programmable sampling from 1/8 s to 1 hour and 3 profiles with 2 samples/second
Spectrum Data Logging	Programmable sampling from 1 second to 1 hour (AVR mode)
Display	Backlit graphic display 128x64 ✓ 3 parameters in numeric format ✓ Profile L _{AFD} with 8 samples/second Octave band spectrum from 16 Hz to 16 kHz ✓ "Third Octave" option ✓ Third octave band spectrum from 16 Hz to 20 kHz "Advanced Analyzer" option ✓ Graph probability distribution of sound level ✓ Graph of percentile levels from L ₁ to L ₉₉
Memory	Internal, equal to 4 MB (4 profiles for 23 hours or over 23 days recording 3 parameters + spectra per minute). Expandable to 8 MB External, via the HD2110MC memory card interface, using MMC or SD cards up to 2 GB
Input/Output	✓ RS232 serial and USB interfaces ✓ AC output (LINE) ✓ DC output
PC Programs	✓ Noise Studio (supplied with the instrument): PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key. ✓ "Worker protection" module. Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008. ✓ "Acoustic pollution" module. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. Some program functions require option 1 "Third octaves". ✓ "Acoustic Insulation" module. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to DPCM of 5/12/1997. Requires option 4 "Reverberation time". ✓ "Monitor" module. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem. The program allows programming of measurements and calibrations with timer and audio recording with programmable event triggers.
Operating conditions	Working temperature -10÷50°C, 25÷90%RH (without condensation), 65÷108kPa. Protection degree: IP6
Power	4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimensions and weight	445x100x50 mm equipped with preamplifier, 740 g (with batteries)



HD 2110 INTEGRATING SOUND LEVEL METER - PORTABLE ANALYZER

The HD2110 is a precision integrating portable sound level meter, with data logging functions, performing both spectrum and statistical analysis. The instrument has been designed in order to offer high-performance analysis of acoustic phenomena, with particular regard to Italian legislation on environmental noise. Attention has been paid to the possibility of adjusting the instrument to regulatory modifications and to the necessity of meeting its users' needs of today and tomorrow. The HD2110 can be integrated with other options to extend its application scope at any time; the firmware can be updated directly by the user by means of the Noise Studio program supplied with the instrument.

Technical regulations:

- Class 1 sound level meter according to IEC 61672-1, 2002 (Certificate of Compliance I.E.N. No. 37035-01C), IEC 60651 and IEC 60804.
- Class 0 octave and third octave filters according to IEC 61260
- Microphone in compliance with IEC 61094-4

Applications:

- Noise monitoring with sound event capture and analysis function,
- Real-time octave and third octave band spectrum analysis from 16 Hz to 20 kHz,
- Statistical analysis with calculation of all percentile levels from L_1 to L_{99} ,
- **Environmental noise measurement according to the decree of 16/03/1998,**
- **Identification of tonal components even at the standard third octave band crossing point,**
- **Estimate of the audibility of spectral components through comparison with equal loudness curves in real time**
- Measurement in workplaces,
- Selection of personal protective equipment (SNR, HML, and OBM methods),
- Sound insulation and reclamation,
- Production quality control,
- Measurement of machine noise,
- Optional architectural acoustics and building measurements.

Sound level meter kit

HD2110 kit 1: consists of HD2110 Sound Level Meter, HD2110P preamplifier, MK221 microphone for free field, windscreen, 5m extension cable and RS232 serial or USB connection cable. Noise Studio PC program.

HD2110 kit 1/E: Version for outdoor measurements. It consists of HD2110 Sound Level Meter, HD WME weatherproof microphone unit, heated preamplifier HD2110PW, MK223 microphone cartridge for free field, 5m extension cable and RS232 serial or USB connection cable. Noise Studio PC program.

HD2110 kit 1/IE: Version for indoor and outdoor measurements. It consists of HD2110 Sound Level Meter, HD WME weatherproof microphone unit, HD2110PW heated preamplifier, preamplifier HD2110P, MK223 microphone cartridge for free field, windscreen HD SAV, 5m extension cable CPA/5 and RS232 serial or USB connection cable. Noise Studio PC program.

Accessories

Option 4 "Reverberation Time": Measurement by sound source interruption or impulse response integration.

Option 6 "FFT": $1/32$ s Short Leq profile, narrow band spectrum analysis (FFT).

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. **For new instruments only.**

MK231: Class 1 microphone for diffuse field, type WS2D according to IEC 61094-4:1995.

MK223: Class 1 microphone for free field, type WS2F according to IEC 61094-4:1995. Protected membrane for outdoor use.

HD9101: Class 1 calibrator according to IEC90942:1988. Characteristics:

- Cavity for 1" and $1/2$ " microphones according to IEC61094,
- Frequency 1000Hz,
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.R.I.M. certificate of conformity n.90-003-01. Characteristics:

- LCD display,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1" and $1/2$ " microphones according to IEC61094,
- 1000Hz frequency,
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001.

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.



HD SAV2

SWD10: Stabilized mains power supply $V_{in}=100\div 230V_{ac}$ / $V_{out}=12V_{dc}/1000mA$.

CPA/10: 10m extension cable.

VTRAP: Tripod, 1550 mm maximum height.

HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.

HD2010/MC: SD memory card interface complete with 1GB SD card

For Windows® /98/ME/2000/XP/Vista operating systems

Noise Studio: Software for Windows® 95/ME/2000/XP and Vista operating systems supplied in the sound level meter kit. Configuration of the instrument, downloading and graphical display of stored data. This programme supports some sound analysis application modules which can be enabled by licence with the hardware key. The program contains demo versions of the modules.

CH20: Hardware key for PC with Windows® operating systems. Inserted into a USB port enables PCs to use software modules of the program Noise Studio.

NS1: Activation of module "Worker protection" of the Noise Studio program. Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008.

NS2: Activation of module "Noise pollution" of the Noise Studio Program. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. **Some program functions require option 1 "Third octaves"**.

NS3: Activation of the module "Acoustic Insulation" of the Noise Studio program. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to DPCM of 5/12/1997. Requires option 4 "Reverberation time".

NS4: Activation of the module "Monitor" of the Noise Studio program. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem.

Noise Studio Suite: Noise Studio Program equipped with the following application modules:

- "Worker Protection"
- "Noise Pollution"
- "Acoustic Insulation"
- "Monitor".

Using the HD2110 sound level meter you can log the time profile of 6 simultaneous parameters choosing freely temporal or frequency weightings. The possibility of displaying, storing and even printing the multi-parameter sound level analysis allows the sound level meter to log sound level and store for more than 46 hours. For sound level monitoring, you can store 5 programmable parameters and the average spectrum at intervals of 1 second to 1 hour, both by octave and third octave bands. Thanks to its high dynamic range, long integrations can be carried out with a minimum possibility of under- or over-range indications. The measurement dynamic range exceeds 110 dB and it is limited downwards only by the instrument intrinsic noise. For example, if you set the measuring upper limit at 140 dB, you can carry out measurements at the typical sound levels of a quiet office, with high accuracy and without overload indications, peak levels up to 143 dB.

The sound level meter can also log report sequences with dedicated parameters, at programmable intervals of 1 second to 1 hour, average spectra and full statistical analysis, in addition to sound level profiles. Moreover, a versatile trigger function can identify sound events and record their analysis with 5 dedicated parameters, average spectrum and statistical analysis.

The spectrum analysis is carried out simultaneous with the logging of the 6 profiles in real time, both by octave and third octave bands. The spectrum of sound signal is calculated twice a second and integrated linearly for up to 99 hours. Alternatively, the instrument can perform multi-spectrum analyses, even maximum or minimum, both with linear and exponential weighting. Spectra are displayed together with an A, C or Z -weighted wideband level. The third octave band spectrum analysis can be carried out, in addition to standard bands from 16 Hz to 20 kHz, also with bands shifted downwards by $1/6^{\text{th}}$ octave, from 14 Hz to 18 kHz. This feature is useful for finding tonal components hidden at the standard band crossing point. While the third octave band spectrum is displayed, you can enable the calculation of equal loudness curves in real time, for quickly estimating the audibility of spectral components.

As a statistical analyzer, the HD2110 samples the sound signal 8 times per second with A-frequency weighting and FAST constant, and it analyses it in 0.5 dB classes. You can program 4 percentile levels from L_1 to L_{99} and choose to sample L_{Fp} , L_{eq} or L_{pk} with A, C and Z-weightings (only C and Z for L_{pk}).

The Digital Audio interface allows recording the sound sample on tape, for further analysis. Recording in digital format guarantees the best accuracy. Audio tracks recorded with other instruments can also be analyzed using the Line input. For further analysis, the LINE unweighted output allows recording the sound sample either on tape or directly on a PC equipped with a data acquisition card.

Recordings can be located in memory and viewed on the graphic display using the "Replay" function, which reproduces the time trend of the sound track. The high-

speed USB interface, combined with the flexible RS232 interface, allows quick data transfers from the sound level meter to the PC mass memory, as well as controlling a modem or printer. For example, should the supplied memory not be enough, this is the case for lengthy recordings, you can activate the "Monitor" function. This function allows sending the displayed data to a PC via the serial interface and storing them directly on the PC mass memory.

The HD2110 can be completely controlled by a PC through the multi-standard serial interface (RS232 and USB) by using a special communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.

The calibration can be performed either by using the provided acoustic calibrator (type 1 according to IEC 60942) or the built-in reference generator. The electric calibration uses a special preamplifier and checks the sensitivity of the measuring channel, microphone included. A protected area in the non-volatile memory, reserved to factory calibrations, is used as a reference for the user's calibrations, so to allow keeping instrument drifts under control and to prevent the instrument from losing of calibrations.

The control of the complete sound level meter functionality can be made directly by the user, on site, thanks to a diagnostic programme.

Most of the damages occurred to the instrument, microphone included, can be promptly identified thanks to a complete analysis program that includes the frequency response measurement of the whole measuring chain: microphone, preamplifier and sound level meter. The regular execution of diagnostic programs allows making reliable sound measurements, avoiding any repetition due to a malfunction later discovered.

The HD2110 sound level meter can perform the measurements required to evaluate workers' noise exposure (Legislative Decree 81/2008). The personal protective equipment can be selected through octave band spectrum analysis (OBM method) and a comparison of the A and C-weighted equivalent levels that can be measured simultaneously (SNR method). If an undesired sound event produces an overload indication, or simply alters the result of integration, its contribution can be excluded using the versatile Back-Erase function.

The HD2110 sound level meter is suitable for sound level monitoring, acoustic mapping and the assessment of the acoustic climate with capture and analysis of sound events. When measuring traffic noise near airports, railways and roads, the sound level meter can be used as a multi-parameter sound recorder, combining statistical and spectrum analyzer features. Remote electrical calibrations and diagnostic tests can be executed using its remote control capabilities.

The HD2110 can also perform the measurements required to evaluate environmental noise (Decree of 16 March 1998, GU No.76 of 1 April 1998). Impulsive events can be easily identified thanks to the possibility of analysing the profile of the A-weighted level with FAST, SLOW, and IMPULSE constants. All measuring parameters can be stored for subsequent analysis. The identification of tonal components is also easy and certain as it allows displaying and recording the minimum spectrum with any wideband weightings (Z, C or A) both by third octave bands with standard nominal frequencies 16 Hz to 20 kHz, and with central frequencies shifted on the former crossing point 14Hz to 18 kHz. The audibility of the tonal component can be evaluated in the field thanks to the real-time calculation of equal loudness curves. The audibility of the tonal component, to be compared with that of the remaining spectrum, can also be evaluated using the Noise Studio program supplied with the instrument, thanks to the calculation of the equal loudness curves.

The HD2110 sound level meter with the "Reverberation Time" option can perform any measurement prescribed by the regulations on the room acoustics evaluation (D.P.C.M. of 5/12/1997). The sound level meter powerful DSP calculates 32 spectra/second, and it can measure reverberation times both using the sound source interruption method and the integration of impulse response technique. The analysis is carried out simultaneously by both octave and third octave bands.

Inputs and outputs

Digital audio input/output (IEC 60958:1999 type II) with RCA connector (S/PDIF).

LINE unweighted input/output (\varnothing 3.5 mm jack).

TRIGGER input/output (\varnothing 3.5 mm jack).

Standard RS232C serial port in compliance with EIA/TIA574. Baud Rate 300 to 115200 baud.

USB 1.1 serial port.

External power supply $9\div 12V_{dc}$ (\varnothing 5.5 mm jack).

Italian Laws

- Noise in workplaces: D. Lgs 81/2008, UNI 9432/2008 and European Directive 2003/10/CE.
- Noise pollution: Law 447 of 26/10/95, D.P.C.M. of 1/3/91, Decree of 16/03/98, Decree No. 194 of 19/08/2005 and European Directive 2002/49/CE.
- Airport noise: Decree of 31.10.97.
- Noise in dancing entertainment locals: D.P.C.M. 215 dated 16/4/99.
- Noise emission from machines D. Lgs 262 of 4/9/2002 and European Directive 2005/88/CE.
- Evaluation of passive requirements of buildings: D.P.C.M. of 05.12.97.

Options and accessories:

HD2110MC reader

It allows interfacing SD and MMC memory cards with the sound level meter. This device is connected to the sound level meter through the serial interface that also gives the required power supply. In addition to its remarkable storing capacity, the interface allows quickly downloading the data stored in the sound level meter internal memory. Cards with a maximum capacity of 2 GB can be connected. Includes a 1GB SD card.

Option 4 "Reverberation Time"

The measure of reverberation time is performed by using the sound source interruption and the impulsive source method.

The measure of reverberation time is performed simultaneously by wideband, octave band from 125 Hz to 8 kHz, and third octave band from 100 Hz to 10 kHz. Sampling interval $\frac{1}{32}$ s.

Automatic calculation of reverberation times EDT, T10, T20 and T30 by all bands, and decay profile analysis with the possibility of calculating the reverberation time over a chosen interval.

Option 5 "Advanced Analyzer"

(included in new sound level meters only)

This option combines the sound level analyzer functions with the following:

- Statistical analysis available graphically, both as probability distribution and cumulative distribution.
- Trigger for noise event capture with level threshold and duration filter.
- Recording of measurement reports at intervals of 1s to 1 hour, with a dedicated set of parameters that includes average spectra and full statistical analysis.
- Recording of event parameters with the possibility of setting the maximum time resolution for event recording and a lower resolution for background noise recording.
- Possibility of storing markers.
- Timer for a delayed start of the capture.

Option 6 "FFT"

(only for HD2110 sound level meters with "Advanced Analyzer" option)

This option adds:

- Leq profile at $\frac{1}{32}$ s intervals.
- Narrow band spectrum analysis (FFT) over the whole audio range with variable resolutions according to the frequency from 1.5Hz to 100Hz.

Software:

Noise Studio

The Noise Studio programme allows interfacing HD2110 to the PC in a simple and intuitive way. Main functions are:

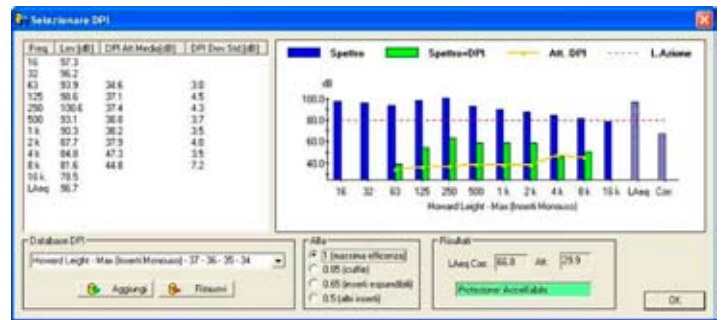
- Transfer of stored data from the sound level meter to the PC memory.
- Display of captured data under graphic and tabular form.
- Export to Excel and PDF format.
- Printing of graphs and data tables.
- Comparison of spectra for third octave bands with noise contours.
- Logging control by a PC.
- Sound level meter setup management.
- Sound level meter firmware update.

It results easier drafting documents regarding the sound level meter's relief due to the handy function which allows to copy graphs or visualized tables from other applications and to create PDF files.

Moreover Noise Studio is a post processing programme able to perform different kind of analyses, studied for specific applications assembled in software modules to be enabled with licence. Demo versions of the software modules are provided.

Noise Studio: 'Worker protection' module (to be activated by license)

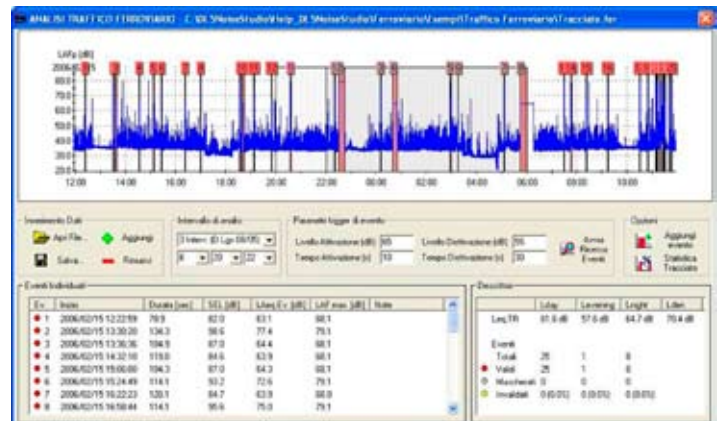
This application module analyzes noise in the workplace according to the DL 81/2008, the European directive 2003/10/EC and the UNI 9432:2008. Data sound level measurement in work environment is organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers the program allows to evaluate the effectiveness of protective equipment by the methods SNR and OBM. According to UNI 9432 of 2008, the program also calculates the index of impulsiveness of a machine.



Noise studio: "workers' protection" module: analysis of the effectiveness of ipd

Noise Studio: 'Acoustic Pollution' module (to be activated by license)

This application module analyzes sound level profiles detected in indoor and outdoor environment for the assessment of the noise climate, the noise of industrial sites, ports, airports and transport infrastructure, and noise generally understood as a disturbance of human activity. The analysis of the noise climate is made on a daily, weekly and annual basis with resolutions up to 1 minute, according to DL 194, 19/08/2005. The profiles of noise detected in the external environment are analyzed to search for disturbing sources characterized by a sequence of events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1/8 of a second and with automatic search and analysis of sound events, according to the Ministerial Decree D.L. 194, 19/08/2005 of 16/03/1998. For the evaluation of the disturbance caused to the population from any source of noise even domestic, according to DM of 16/03/1998, the measured noise profiles are analyzed in search of impulsive or tonal components.



Noise studio: "railway traffic" module: analysis of 24 hours with automatic search of transit

Noise Studio: 'Acoustic Insulation' module (to be activated by license)

according to the DPCM of 5/12/1997.

The measures necessary for the analysis of a building are grouped in a project to simplify their storage and research. You can also add to the measures themselves, a technical report, comments, graphics, photos, etc... which remain part of the work and, if necessary, can be found easily.

An updateable database, divided by walls and floors, contains the principal characteristics of sound-insulating structures. The data contained in the database can be compared graphically with measures in place.

With this program you can calculate:

Average reverberation time (ISO 3382)

Area of equivalent absorption coefficient of sound absorption (ISO 354)

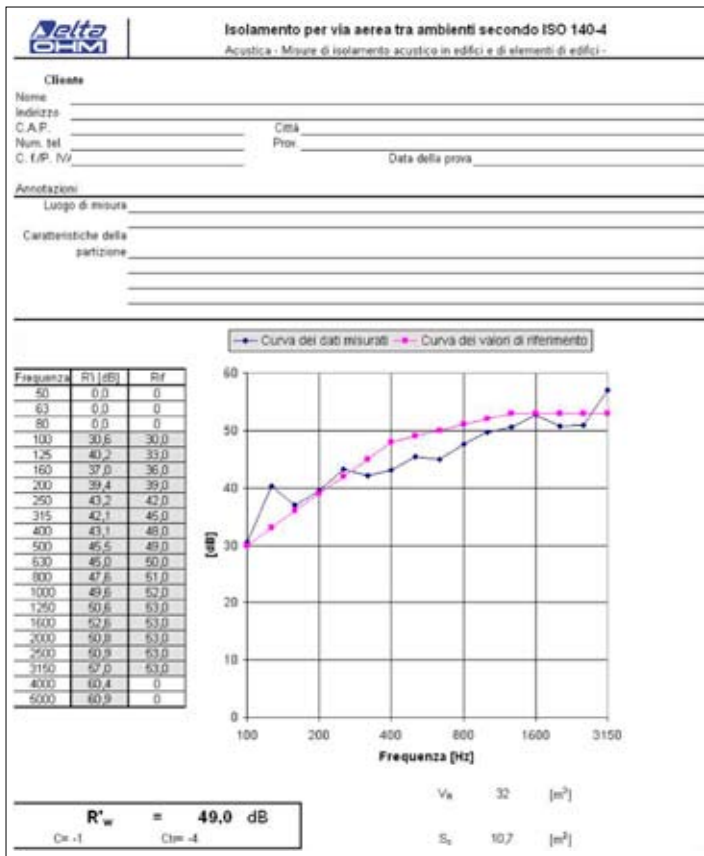
Isolation by air: indices R , R' and D_{nT} (ISO 140/III and IV)

Insulation of facades and facade elements: indices $D_{m,nT}$ and R_{0} (ISO 140 / V)

Isolation of noise impact: indices L_{nT} , DL , $The N$ and $L_{nT}^{2m,nT}$ (ISO 140/VI, VII and VIII)

Global Indices (ISO 717-1 and 717-2)

For the calculation of some indices, option 4 'Reverberation time' is required.

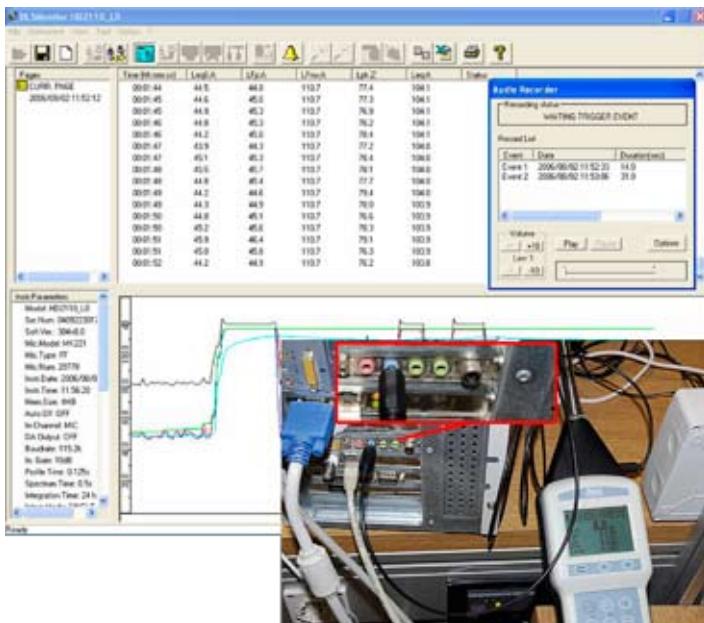


Noise studio "acoustic insulation" module: filling iso report.

Noise Studio: 'Monitor' module (to be activated by license)

This software module allows to control the sound level meter with PC in remote location. The main functions are:

- Real time display of acquired data, in graphical and tabular form.
- Possibility of connection via modem with the sound level meter.
- Acquisition of data sound level data directly into the mass memory of the PC (monitor function).
- Management of calibration and diagnostic functions.
- Automatic acquisition and monitoring program.
- Possibility of synchronized audio recording with the sound level measures, using a versatile trigger function.



Noise studio: "monitor" module: acquisition om pc with synchronized audio recording

Kit and accessories purchasing codes

HD2110 kit 1: consists of HD2110 Sound Level Meter, carrying case, HD2110P preamplifier, MK221 microphone, 5m extension cable CPA/5, HD SAV windscreen, Noise Studio software and RS232 serial (HD2110RS) or USB connection (HD2110/USB) cable.

HD2110 kit1/E: Version for outdoor measurements. It consists of HD2110 Sound Level Meter, carrying case, HD WME weather equipped with bird spike protection, wind screen and rain shield, HD2110PW heated preamplifier with 5m extension cable (other lengths available upon request) and MK223 microphone. The kit includes also Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

HD2110 kit1/IE: Version for indoor and outdoor measurements. It consists of HD2110 Sound Level Meter, carrying case, HD WME weather equipped with bird spike protection, wind screen and rain shield, HD2110PW heated preamplifier with 5m extension cable (other lengths available upon request), HD2110P preamplifier, 5m extension cable CPA/5, HD SAV wind screen and MK223 microphone. The kit includes also Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

Option 4 "Reverberation Time": Reverberation time measurement by source interruption and the impulsive source method.

Option 6 "FFT": Short Leq profiles at 1/32 s, narrow band spectrum analysis (FFT). It requires the "Advanced Analyzer" option.

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. For new instruments only.

HD9101: Class 1 calibrator according to IEC90942:1988. Characteristics:

- Cavity for 1" and 1/2" microphones according to IEC61094,
- Frequency 1000Hz,
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.RI.M. certificate of conformity n.90-003-01. Characteristics:

- LCD display,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1" and 1/2" microphones according to IEC61094,
- 1000Hz frequency,
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate when combined to Option 7 "SIT Calibration").

MK231: Class 1 microphone for diffuse field, type WS2D according to IEC 61094-4:1995.

MK223: Class 1 microphone for free field, type WS2F according to IEC 61094-4:1995. Protected membrane for outdoor use.

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply Vin=100÷230Vac / Vout=12Vdc/1000mA.

CPA/10: 10m extension cable for HD2110P preamplifier.

CPA/20: 20m extension cable for HD2110P preamplifier.

CPA/50: 50m extension cable for HD2110P preamplifier.

VTRAP: Tripod, 1550 mm maximum height.

HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.

BAT40: Spare battery pack for HD40.1

RCT: rolls of thermal paper, 57 width and 32mm diameter.

HD2010/MC: SD memory card interface including 1GB SD card

Codes of spare parts and other accessories

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis. This option is included in new instruments.

HD WME/PMK: HD WME weather protection complete with bird spike, windscreen and rain shield, HD2010PW heated preamplifier with CPA/5 5m extension cable, HDSAV windscreen, MK223 free field microphone unit.

HD WME/P: HD WME weather protection complete with bird spike, windscreen and rain shield, HD2010PW heated preamplifier with CPA/5 5m extension cable (other lengths upon request).

HD WME: Weather protection, equipped with:

- Stainless steel housing for the preamplifier WME3 HD with holder for rain protection HD WME2,
- WME1 HD bird spike,
- HD SAV3 wind-screen,
- HD WME2 rain-shield.

HD SAV: Windscreen for 1/2" microphone.

HD SAV2: Windscreen with bird spike for HD WME950 microphone unit.

HD SAVP: Rain shield for HD WME950 microphone unit.

HD SAV3: Windscreen for HD WME microphone unit.

HD WME1: Bird spike for HD WME microphone unit.

HD WME2: Rain shield for HD WME microphone unit.

HD WME3: Stainless steel housing for the preamplifier of the outdoor microphone unit HD WME with holder for rain protection HD WME2.

HD2010P: Microphone preamplifier for 1/2" microphones. Provided with CTC device for electrical calibration.

HD2010PW: Heated microphone preamplifier for HDWME950N unit for 1/2" microphones for HD2010. It is heated and provided with CTC device for electrical

calibration. Ending with 5m connection cable (other lengths upon request).

HD2110PW: Heated microphone preamplifier to be housed in outdoor protection WME950 HD and HD WME. The preamplifier for ½”microphones is heated and provide with CTC device for electrical calibration; it ends with a 5m connection cable (other lengths on request). The HD2110PW is also equipped with a driver for extension cable up to 100m length.

CPA/5: 5m extension cable for HD2010PN and HD2110P preamplifiers.

HD2101/USB: USB serial cable for PC connection. **For sound level meters with serial Mini-Din connector.**

HD2110CSNM: RS232 serial cable for PC connection. **For sound level meters with serial Mini-Din connector.**

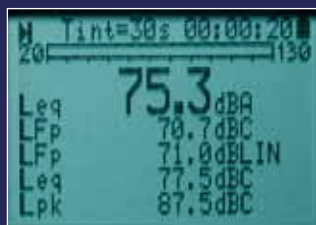
TECHNICAL SPECIFICATIONS

Standards	Class 1 group X according to IEC 61672:2002 and class 1 according to IEC 60651:2001 and IEC 60804:2000 Class 0 according to IEC 61260:1995 Type 1 according to ANSI S1.4-1983 and S1.43-1997 Class 1-D, order 3, Extended range according to ANSI S1.11-1986
½ inch Microphones	✓ MK221 condenser microphone, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 ✓ MK223 condenser microphone with coated membrane, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 (combined with the HDWME950 weatherproof microphone unit) ✓ MK231 condenser microphone, polarized (200V), for diffuse field, high stability, type WS2D according to IEC 61094-4
Dynamic range	23 dBA ÷ 143 dB Peak
Linear range	110 dB
Acoustic Parameters	Spl, L_{eq} , SEL, $L_{EP,d}$, L_{max} , L_{min} , L_{pk} , Dose, L_n
Frequency Weighting	Simultaneous A, C, Z (only C and Z for L_{pk})
Temporal Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function
Spectrum Analysis	Parallel filters in real time complying with IEC61260 class 0 specifications. ✓ Octave bands from 16 Hz to 16 kHz ✓ Third octave bands from 16 Hz to 20 kHz ✓ Third octave bands from 14 Hz to 18 kHz ✓ Optional FFT from 7 Hz to 22 kHz with variable resolutions from 1.5 Hz to 100 Hz Average spectrum (AVR) mode, multi-spectrum analysis (MLT), maximum spectrum (MAX), and minimum spectrum (MIN)
Audibility	Real-time comparison of third octave band spectrum with equal loudness curves according to ISO 266:2003
Statistical Analysis	Probability distribution and percentile level calculation from L_1 to L_{99} ✓ Parameter: L_{Fp} , L_{eq} , L_{pk} , A, C or Z weighted (only C or Z for L_{pk}) ✓ Sampling frequency: 8 samples/second ✓ Classification: 0.5 dB classes
Event Analysis	✓ Calculation of 5 freely programmable event parameters ✓ Calculation of octave and third octave band average spectra ✓ Calculation of statistical levels from L_1 to L_{99} ✓ Event identification trigger with programmable threshold and duration filter ✓ External and manual trigger
Reverberation Time (opt.)	Reverberation time measurement by sound source interruption and impulse response integrated
Profile Data Logging	1 profile with programmable sampling from 1/8 s to 1 hour and 5 profiles with 2 samples/second
Spectrum Data Logging	Programmable sampling from 0.5s to 1 hour (MLT, MAX, or MIN modes)
Display	Backlit graphic display 128x64 ✓ 5 numerical parameters ✓ Profile of a selectable parameter with sampling time from 1/8 s to 1 hour ✓ Octave band spectrum from 16 Hz to 16 kHz ✓ Third octave band spectrum from 16 Hz to 20 kHz or 14 Hz to 18 kHz ✓ Graph of sound level probability distribution ✓ Graph of percentile levels from L_1 to L_{99} ✓ Optional narrow band spectrum analysis (FFT) from 7Hz to 22 kHz
Memory	Internal, equal to 8 MB (1 profile for 72 hours or over 46 recording days of 5 parameters + spectra per minute) External, via the HD2110MC memory card interface, using MMC or SD cards up to 2 GB
Input/Output	✓ RS232 serial and USB interfaces ✓ AC input and output (LINE) ✓ S/PDIF digital audio input and output ✓ External event identification trigger
PC Programs	✓ Noise Studio (supplied with the instrument): PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key. ✓ “ Worker protection ” module. Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008. ✓ “ Acoustic pollution ” module. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. Some program functions require option 1 “Third octaves”. ✓ “ Acoustic Insulation ” module. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to DPCM of 5/12/1997. Requires option 4 “Reverberation time”. ✓ “ Monitor ” module. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem. The program allows programming of measurements and calibrations with timer and audio recording with programmable event triggers.
Operating conditions	Working temperature -10÷50°C, 25±90%RH (without condensation), 65±108kPa. Protection degree: IP64
Power supply	4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimensions and weight	445x100x50 mm equipped with preamplifier, 740 g (with batteries)

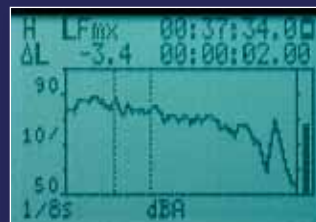


HD2110L

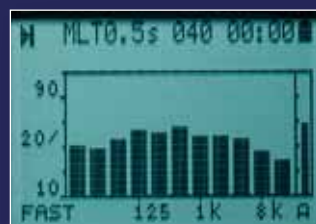
Integrating Sound Level Meter
Analyser



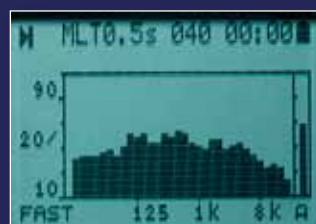
▶ Basic screen



▶ Time profile



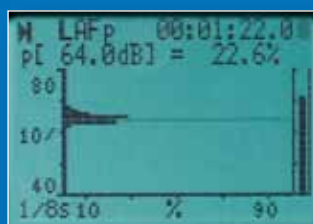
▶ Octave band spectrum



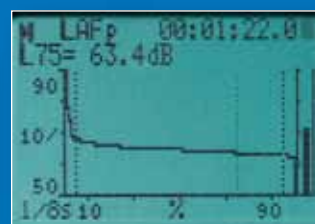
▶ Third octave band spectrum, optional



▶ Narrow band spectrum analysis (FFT option)



▶ Statistical analysis: probability distribution of sound levels



▶ Statistical analysis: percentile levels

HD 2110L

Integrating Sound Level Meter - Portable Analyzer

The HD2110L is a precision integrating portable sound level meter, with data logging functions, performing both spectrum and statistical analysis. The instrument has been designed in order to offer high-performance analysis of acoustic phenomena. Attention has been paid to the possibility of adjusting the instrument to regulatory modifications and to the necessity of meeting its users' needs of today and tomorrow. The HD2110L can be integrated with other options to extend its application scope at any time; the firmware can be updated directly by the user by means of the Noise Studio program supplied with the instrument.

Technical regulations:

- ✓ Class 1 sound level meter according to IEC 61672-1, 2002 (Certificate of Compliance I.E.N. No. 37035-01C), IEC 60651 and IEC 60804.
- ✓ Class 1 octave and third octave filters according to IEC 61260
- ✓ Microphone in compliance with IEC 61094-4

Specifications:

- ✓ Real-time octave and third octave band spectrum analysis from 16 Hz to 20 kHz,
- ✓ Real-time third octave band with two filters bank: from 16 Hz to 20 kHz and from 14Hz to 18kHz (opt. HD2110.O1)
- ✓ Narrow-band spectral analysis (FFT) with variable resolution from 1.5Hz to 100Hz and capture of the Leq profile at intervals of 1/32s (opt. HD2110.O6).
- ✓ Statistical analysis with calculation of the probability distribution in classes from 1.5dB and of all the percentiles from L_1 to L_{99} .
- ✓ Estimate of the audibility of spectral components through comparison with equal loudness curves in real time
- ✓ Simultaneous storage of multi-parameter profiles, reports and records at programmable intervals associated with sound events identified automatically or manually,
- ✓ Measure of the reverberation time by using the method of the interrupted source and with the method of the integration of the response to impulse (opt. HD2110.O4)

Applications:

- ✓ Noise monitoring with sound event capture and analysis function,
- ✓ **Identification of tonal components even at the standard third octave band.**
- ✓ **Estimate of the audibility of spectral components through comparison with equal loudness curves in real time.**
- ✓ Measurement in workplaces and selection of the individual protection devices (methods SNR, HML and OBM),
- ✓ Sound insulation and reclamation,
- ✓ Production quality control and measurement of machine noise,
- ✓ Architectural acoustic and building measures.

Inputs and outputs

- ✓ Unweighted LINE Input/Output (jack Ø 3.5mm).
- ✓ Output DC LAFp 1/8s
- ✓ TRIGGER Input/Output (jack Ø 3.5mm).
- ✓ RS232C standard serial port in compliance with EIA/TIA574. Baud Rate from 300 to 115200 bauds.
- ✓ USB 1.1 serial port.
- ✓ 9÷12Vdc external power supply unit (jack Ø 5.5mm).

Software for I98/XP/Vista/7 Windows® operating systems

CH20: Hardware key for PC working with Windows® operating systems. When inserted into a USB port, it enables the PC to use software modules of

the Noise Studio programme.

Noise Studio: Software for Windows® 98, XP, Vista, 7 versions supplied with the sound level meter kit. Configuration of the instrument, download and graphical display of stored data are available. This programme supports some sound analysis application forms which can be enabled by licence with the hardware key. The programme contains demo versions of the modules.

- This Noise Studio programme allows connecting the HD2110L to a PC in a very easy and intuitive way. Its main functions are:
 - Transfer of data from the sound level meter to PC memory.
 - Display in a graphical or tabular form of the data acquired.
 - Export to Excel and PDF formats.
 - Printing of charts and data tables.
 - Comparison of spectra for third octave bands with the noise.
 - Control of data acquisition from the PC.
 - Setup management of the sound level meter.
 - Firmware upgrade of the sound level meter.

Issuing the documentation for sound level meters is easy thanks to a convenient feature that allows other applications to copy graphs or tables displayed, and the ability to create PDF files.

NS1 - "Workers Protection" module: Noise analysis in the work environment in accordance with ISO 9612.

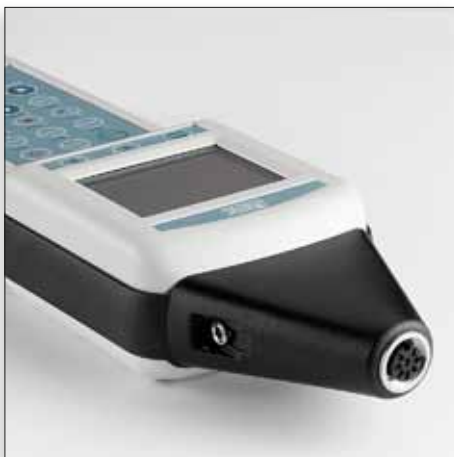
The data for sound level measurements made in the work environment are organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers, the program allows to assess the effectiveness of protective equipment by the methods SNR and OBM.

NS2A - "Noise Pollution" module: analysis of the noise climate and evaluation of road, rail and airport noise.

The application module analyzes sound level profiles detected in internal and external environment for the assessment of climate noise, noise industrial sites, ports, airports and transport infrastructure.

The analysis of the noise climate is done on a daily, weekly and annual basis with a maximum resolution of 1 minute.

The noise profiles detected in the external environment are scanned for sources characterized by a sequence of disturbing events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1 / 8 of a second auto-search and analysis of sound events.



NS3 - "Sound Insulation" module: evaluation of passive acoustic requirements of buildings in accordance with ISO requirements. **It requires option HD2110.04 "Reverberation Time"**.

The measures necessary to make the acoustic classification of a building are grouped in a project to simplify their storage and research. You can add measures to a technical report, comments, graphics, photos, etc. that may be useful to document the work.

An updatable database, divided into walls and ceilings, contains the sound-insulating characteristics of the main structures. The data contained in the database can be compared graphically with the measurements.

The program can calculate:

- Average reverberation time (ISO 3382)
- Area of absorption and equivalent sound absorption coefficient (ISO 354)
- Insulation by air: indexes R , R' and D_{nT} (ISO 140/3, 4 and 14 and ISO 717-1)
- Insulation of facades and façade elements: indexes $D_{2m,nT}$ and R_b (ISO 140/5 and ISO 717-1)
- Insulation of Impact noise: indexes L_n , DL , L'_n and L'_{nT} (ISO 140/6, 7, 8 and 14 and ISO 717-2)

NS4 - "Monitor" module: real time acquisition on a PC; synchronized audio recording; remote monitoring and acquisition programming.

The software module allows you to control the sound level meter with PC in remote location. Main functions are:

- Real time display of acquired data in graphical and tabular form.
- Possibility to connect via modem with the sound level meter.
- Acquisition of the sound level meter data directly into the mass memory of the PC (monitor function).
- Calibration and diagnostic functions management.
- Acquisition programming and automatic monitoring.
- Possibility to record audio in sync with the phonometric measures, by using the versatile trigger function.

NS5 - "Environmental Noise" module: analysis of noise and environmental noise sources resulting as disturbance to human activities.

The noise profiles detected in indoor or outdoor environments are analyzed with an automated search for tonal or impulsive components.

Options

Option HD2110.01 "Third Octave": spectral analysis for third octave bands. Spectral analysis for third octave bands in class 1 according to IEC 61260 from 16Hz to 20kHz. Alternative filter bank with octave band centre frequencies shifted by half from 14Hz to 18kHz for the identification of tonal components at the intersection of standard bands.

Audibility of spectral components is evaluated in real time by comparing the spectrum with the noise contours calculated using ISO 226:2003.

Option HD2110.04 "Reverberation Time": measurement of reverberation time is interrupted by the sound source with a pulsed source method according to ISO 3382.

Measurement of reverberation time for octave bands from 125 Hz to 8 kHz and, in combination to HD2110.01 option for third octave band from 100 Hz to 10 kHz with a sampling interval of 1/32 s.

Automatic calculation of reverberation times EDT, T10, T20 and T30 for all bands and analysis of the decay profile with the ability to calculate the reverberation time in an interval of your choice.

Option HD2110.06 "FFT": narrow band spectral analysis (FFT).

This option adds:

- Leq Profile at intervals of 1/32 s.
- Narrow band spectral analysis (FFT) from 7 Hz to 22 kHz with variable resolutions depending on the frequency from 1.5Hz up to 100Hz.

Ordering codes for instruments and accessories

HD2110L.K1: it includes the HD2110L sound level meter, user's manual, briefcase, HD2110P preamplifier, microphone MC21 for outdoor use, 5m extension cable CPA/5, HD SAV windproof shield, Noise Studio software and RS232 (HD2110/RS) or USB (HD2110/USB) serial cable for connection to a PC. **ACCREDIA Calibration Certificate is supplied.**

HD2110 L.K1/E: version for measuring outdoors. It includes: HD2110L sound level meter, user's manual, briefcase, HDWME protection microphone for outdoor use equipped with protection against birds, windproof and rain-resistant shield, heated preamplifier HD2110PW with 5m connection cable (other lengths on request) and microphone MC21 for outdoor use. This kit also includes the Noise Studio software and the RS232 (HD2110/RS) or USB (HD2110/USB) serial cable for connection to a PC. **ACCREDIA Calibration Certificate is supplied.**

HD2110 L.K1/IE: version for measuring both outdoors and indoors. It includes: HD2110L sound level meter, user's manual, briefcase, HDWME protection

microphone for outdoor use equipped with protection against birds, windproof and rain-resistant shield, heated preamplifier HD2110PW with 5m connection cable (other lengths on request), HD2110P preamplifier, CPA/5 5m extension cable, HD SAV windproof and microphone MC23 for outdoor use and protective membrane. This kit also includes the Noise Studio software and the RS232 (HD2110/RS) or USB (HD2110/USB) serial cable for connection to a PC. **ACCREDIA Calibration Certificate is supplied.**

HD2110.01: option "Third Octave" - spectral analysis for third octave bands with double filter bench from 16Hz to 20kHz and from 14Hz to 18 kHz. Calibration Certificate included.

HD2110.04: option "Reverberation Time" - the measurement of reverberation time is interrupted by the sound source with a pulsed source method according to ISO 3382.

HD2110.06: option "FFT" - narrow band spectral analysis (FFT) from 7 Hz to 22 kHz with resolution from 1.5Hz to 100Hz.

HD2020: sound level calibrator from 1000Hz 94dB/114dB class 1 according to IEC60942:2003. **ACCREDIA Calibration Certificate is supplied.**

HD2010MC: SD memory card interface. This device includes a 1GB SD card. It allows SD memory cards to interface to the sound level meter. It can be connected to the sound level meter through the serial interface which also provides the necessary power. In addition to the large storage capacity, the fast interface allows the download of data stored in the internal memory of the sound level meter. It is possible to connect a maximum capacity of 2GB.

HD2110P: microphone preamplifier with standard connection for 1/2" microphones. It is equipped with the CTC device for the electrical calibration and with a driver for extension cable up to 100m.

HD2110PW: heated microphone preamplifier for the outdoor HD WME device with standard connection for 1/2" microphones. It is equipped with the CTC device for the electrical calibration and with a driver for extension cable up to 100m. It ends with a connection cable 5 m (other lengths on request).

MC21: Class 1 microphone for free field type WS2F according to IEC 61094-4:1995.

MC22: Class 1 microphone for diffuse field type WS2D according to IEC 61094-4:1995.

MC23: Class 1 microphone for free field type WS2F according to IEC 61094-4:1995. Protected membrane for outdoor use.

HD WME/PMK: microphone unit for outdoor use equipped with protection against birds, windproof and rain resistant shield, heated preamplifier HD2110PW 5m connection cable (other lengths on request) and MC23 microphone.

HD WME/P: microphone unit for outdoor use equipped with protection against birds, windproof and rain resistant shield, heated preamplifier HD2110PW 5m connection cable (other lengths on request).

HD WME: microphone unit for outdoor use equipped with protection against birds, windproof and rain resistant shield.

HD SAV: windproof shield for 1/2" microphone.

HD SAV3: windproof shield for the microphone protection HD WME for outdoor use.

HD WME1: protection against birds for the microphone unit HD WME for outdoor use.

HD WME2: rain resistant protection for the microphone unit HD WME for outdoor use.

HD WME3: stainless steel support for the preamplifier of the microphone unit HD WME for outdoor use.

CPA/5: 5m extension cable for the HD2110P preamplifier.

CPA/10: 10m extension cable for the HD2110P preamplifier.

CPA/20: 20m extension cable for the HD2110P preamplifier.

CPA/50: 50m extension cable for the HD2110P preamplifier.

HD2110/RS: serial RS232 cable for the connection to a PC or to the portable printer HD40.1.

HD2110/USB: serial USB cable for the connection to a PC.

SWD10: stabilized power supply voltage $V_{in}=100\div 230Vac$ / $V_{out}=12Vdc/1000mA$.

VTRAP: tripod max. height 1550mm.

HD2110/SA: Support to fix the tripod to the preamplifier.

HD40.1: Portable serial thermal printer equipped with power supply SWD10.

Features

Acquisition

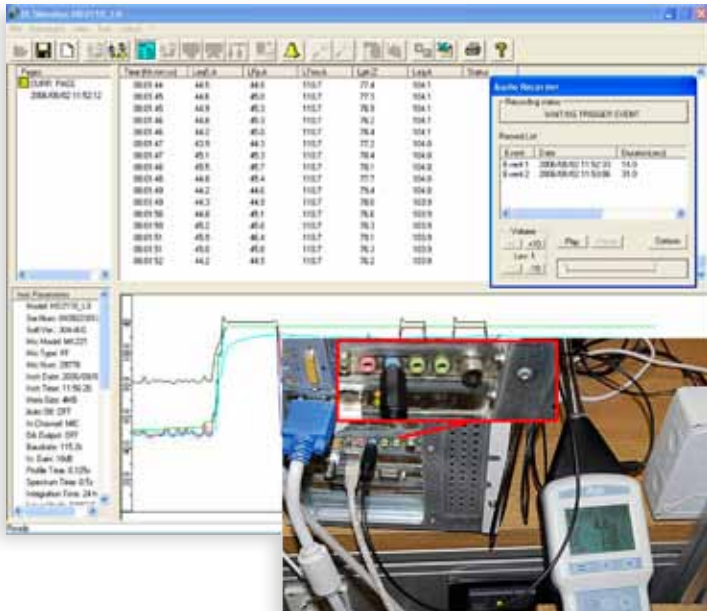
- Possibility to acquire the timing profile of 6 simultaneous measurement parameters by freely choosing the time or frequency weightings.
- Possibility to store multiple parameters of the sound level with a capacity of more than 46 hours. Recordings can be searched in the memory and displayed on a graph with the function "Replay" which reproduces the time course of the sound track.
- In addition to sound level profiles, it is possible to capture sequences of relations at programmable intervals from 1 second to 1 hour, with dedicated parameters, average spectra and full statistical analysis. A versatile trigger function is able to identify sound events and record their analysis with 5 dedicated parameters, average spectrum and statistical analysis.

Dynamic

- The measurements are made with a dynamic that exceeds 110dB and is bounded below only by the intrinsic noise of the instrument. For example, by setting the upper limit of the measures to 140dB, it is possible to perform measurements at noise levels typical of a quiet office with the capacity of measuring accurately peak levels up to 143dB, without indication of overloading.
- With high dynamic range it is possible to make long integrations without worrying about events that may lead to overload or subfield information.

Spectral Analysis

- Simultaneously to the acquisition of six profiles, spectral analysis is performed in real time, both for octave and third octave bands (**option HD2110.O1**).
- The spectrum of the sound signal is calculated 2 times per second and integrated in a linear up to 99 hours.
- It is possible to do multi-spectral analysis, including maximum or minimum, which is linearly exponentially weighted.
- For a proper evaluation of audibility, the spectral analysis can be weighted A or C or unweighted (Z).
- The spectra are displayed along with a A, C or Z-weighted wideband level. The spectral analysis for third octave bands (**HD2110.O1 option**) can be performed, in addition to standard bands from 16 Hz to 20 kHz, with bands shifted down by one-sixth octave, 14 Hz to 18 kHz, for finding their tonal components hidden among standard adjacent bands.
- While displaying the spectrum for third octave bands (**HD2110.O1 option**), it is possible to activate in real time the calculation function of noise contours for a rapid and accurate analysis of audibility of the different components of the spectrum.



NS4 "Monitor": PC logging with synchronized audio recording.

Statistical Analysis

- As a statistical analyzer, the HD2110L samples the sound level 8 times per second and analyzes it in 0.5dB classes.
- It is possible to choose whether sampling LpF, Leq or Lpk with A, C or Z weightings (only C and Z per Lpk).
- Calculation and graphical display of the probability distribution and the percentile levels L_1 and L_{99} .

Analogical Input/Output

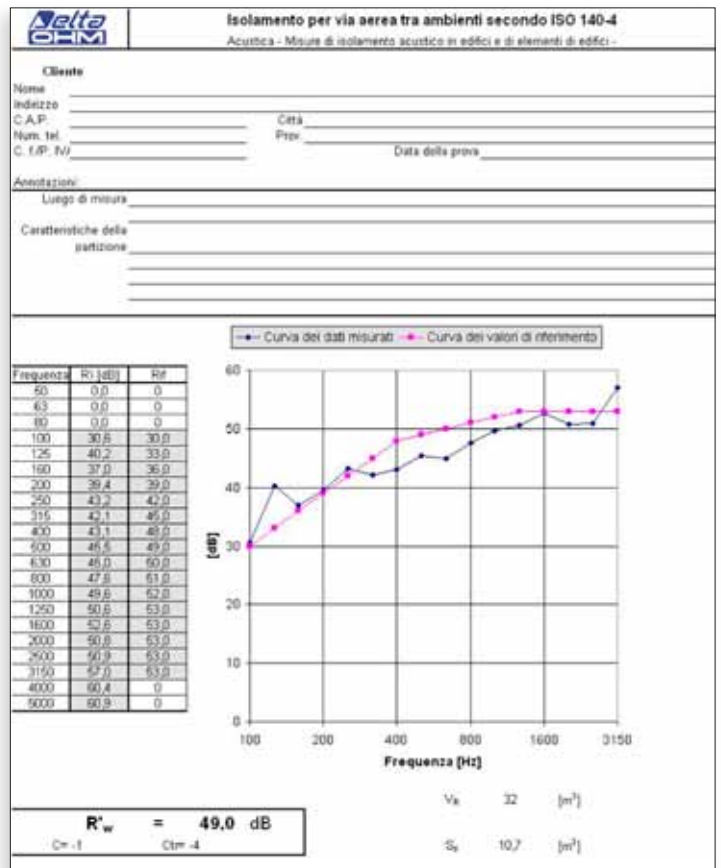
- For further analysis, the unweighted LINE output allows to record the samples on a tape or directly on a PC with a capture card.
- It is also possible to analyze the audio track recorded with other instruments, by using the LINE input.
- Output DC LAFp 1/8s.

Calibration

- The calibration can be performed with an acoustic calibrator (class 1 according to IEC 60942) or with the built-in reference generator.
- The electrical calibration uses a special preamplifier which tests the sensitivity of the measuring channel, including the microphone.
- The factory calibration, kept in a protected storage area, is used as a reference for the calibration by the user, so to allow the control of drifting and prevent any "out of calibration".

Diagnostic

- The verification of the full functionality of the sound level meter can be made directly by the customer on the field.
- Thanks to a diagnostic program, most of the damages to the instrument, as well as to the microphone, can be easily detected. The diagnostic analysis includes the measurement of the frequency response of the entire measuring chain consisting of a microphone, preamp and sound level meter.
- The periodic execution of diagnostics programs allows performing the sound level measurements with confidence and avoiding any risk of malfunction, discovered late.

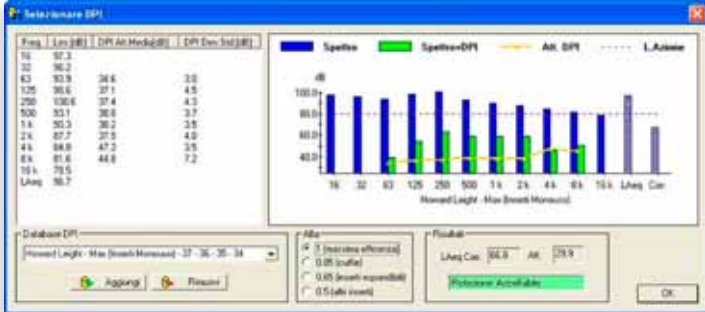


NS3 "Acoustic Insulation": ISO report writing.



Connection to a PC

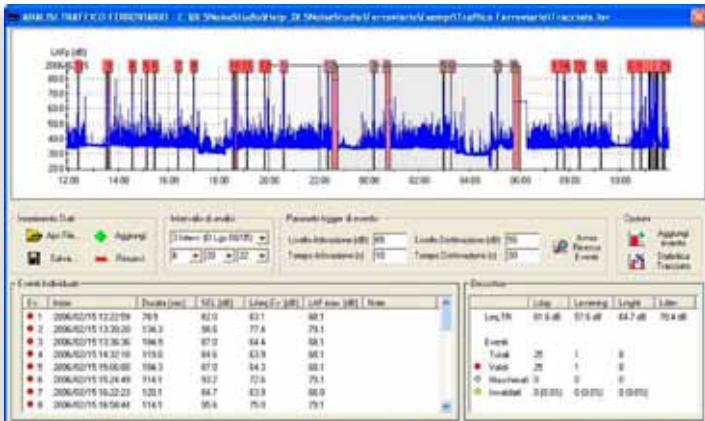
- USB and RS232 interfaces allow quick data transfers from the sound level meter to the mass storage of a PC. In the case of extended recordings where the memory is not sufficient, it is also possible to activate the “Monitor” function which transmits through the serial interface (streaming) the data displayed, by recording them directly on to a PC memory.
- The HD2110L can be completely controlled by a PC via the multi-standard serial interface by using the dedicated communication protocol.
- Via the RS232 interface it is possible to connect the sound level meter to a modem.
- Electrical calibrations and diagnostic tests can be carried out remotely, by using the remote control.



NS1 “Worker protection”: analysis of PPE efficacy

Reverberation time

- The sound level meter HD2110L, with the “Reverberation Time” option (HD2110.O4), can measure the reverberation time by using the method of the stopped source and the method of the integrated impulse response according to ISO 3382.



NS2A “Acoustic Pollution”: 24-hour analysis with automatic search of the transit of trains.

- The powerful DSP calculates the sound level meter 32 spectra per second simultaneously for octave and third octave (in conjunction HD2110.O1 option), allowing measurements of the reverberation time from 0.375s in accordance with ISO 3382.

Application

Noise Pollution

- You can monitor the sound level, noise mapping and assessments of the noise climate with capture and analysis of sound events.
- In the assessment of noise near airports, rail or road noise, the sound level meter can be used as a recorder of sound events to more parameters, combining the characteristics of spectrum analyzer and statistical.
- The identification of impulsive events is easy, with the ability to analyze the profile of the layer with constant weighting and FAST, SLOW and IMPULSE. All parameters of measurement can be stored for further analysis.
- The identification of tonal components is easier and free of uncertainties by viewing and recording the spectra of the minimum estimated with any weighted broadband (Z, C or A) and for third octave bands both with centre frequencies from standard 16 Hz to 20 kHz and with centre frequencies that move on the intersection of the first from 14 Hz to 18 kHz (HD2110.O1 option).

- The audibility of the tonal component, compared with that of the remaining portions of the spectrum, can be evaluated both on the field, thanks to real-time calculation of noise contours (HD2110.O1 option), and with the Noise Studio PC software supplied with the instrument.

Workers protection

- The sound level meter HD2110L is able to perform all the steps required on the protection of workers from the risk of exposure to noise.
- The selection of personal protective equipment can be made with both the octave band spectral analysis (OBM method) and by comparing the weighted equivalent levels and measurable A and C-measured simultaneously (SNR method).
- In case that an undesired sound event produces an overload, or simply alters the result of integration, the contribution can be excluded using the deletion function of unwanted data.
- The calculation of the equivalent time constant IMPULSE (LAeq) allows the assessment of impulsivity sources.



Technical features

Standards	Class 1 group X according to IEC 61672:2002 and class 1 according to IEC 60651:2001 and IEC 60804:2000; Class 0 according to IEC 61260:1995 Type 1 according to ANSI S1, 4-1983 and S1.43-1997 Class 1-D, order 3, Extended range according to ANSI S1.11-1986
½ inch Microphones	<ul style="list-style-type: none"> ✓ MC21 condenser microphone, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 ✓ MC23 condenser microphone with coated membrane, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 (combined with the HDWME950 weatherproof microphone unit) ✓ MC22 condenser microphone, polarized (200V), for diffuse field, high stability, type WS2D according to IEC 61094-4
Dynamic Range	23 dBA ÷ 143 dB Peak
Linear Field	110 dB
Acoustic Parameters	Spl, L_{eq} , L_{Treq} , SEL, $L_{EP,d}$, L_{max} , L_{min} , L_{pk} , Dose, L_n
Frequency Weighting	Simultaneous A, C, Z (only C and Z for L_{pk})
Temporal Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function Parallel filters in real time in compliance with IEC61260 class 0 specifications <ul style="list-style-type: none"> ✓ Octave bands from 16 Hz to 16 kHz
Spectrum Analysis	<ul style="list-style-type: none"> ✓ Double bank third octave filters with central frequencies from 16 Hz to 20 kHz and from 14 Hz to 18kHz ("HD2110.01" option) ✓ FFT from 7 Hz to 22 kHz with variable solutions from 1.5 Hz to 100 Hz (option HD2110.06) Average spectrum (AVR) mode, multispectral mode (MLT), maximum spectrum mode (MAX) and minimum spectrum mode (MIN).
Audibility	Real time comparison of spectrum for third octave bands with the noise contours according to ISO 266:2003 (option HD2110.01).
Statistical Analysis	Calculation of the probability distribution and the percentile levels from L_1 to L_{99} <ul style="list-style-type: none"> ✓ Parameter: L_{Fp}, L_{Tq}, L_{pk}, A, C or Z -weighted (only C or Z for L_{pk}) ✓ Sampling frequency: 8 samples/second ✓ Classification: Classes from 0.5 dB
Analysis of Events	Calculation of 5 freely-programmable event parameters Average spectrum calculation by octave and third octave bands Calculation of statistical levels from L_1 to L_{99} Event identification trigger with programmable threshold and duration filter External and manual trigger
Reverberation Time	Reverberation time measurement by using sound source interruption or impulse response integration (option HD2110.04).
Profile Data Logging	1 profile with programmable sampling from 1/8s to 1 hour and 3 profiles with 2 samples/second
Spectrum Data Logging	Programmable sampling from 0.5s to 1 hour (MLT, MAX or MIN mode)
Display	Graphic display 128x64 <ul style="list-style-type: none"> ✓ 5 parameters in numeric format ✓ Profile parameter to be chosen with sampling from 1/8 second to 1 hour ✓ Octave band spectrum from 16 Hz to 16 kHz ✓ Third octave band spectrum from 16 Hz to 20 kHz or from 14 Hz to 18 kHz (option HD2110.01) ✓ Graph of the probability distribution of the sound level classes from 0.5dB, 1dB or 2dB ✓ Graph of percentile levels from L_1 to L_{99} ✓ Narrow band spectral analysis (FFT) from 7 Hz to 22 kHz
Memory	Internal, equal to 8 MB (1 profiles for 72 hours or over 46 days by recoding 5 parameters + spectra per minute) External, via the HD2110MC memory card interface, by using SD cards up to 2 GB
Input/Output	<ul style="list-style-type: none"> ✓ RS232 and USB serial interfaces ✓ AC output (LINE) ✓ External trigger for identification of events ✓ DC output
PC Programs	Noise Studio (supplied with the instrument): PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key. <ul style="list-style-type: none"> ✓ "Worker protection" module. Analysis of noise in workplaces. ✓ "Acoustic pollution" module. climate analysis acoustic noise caused by traffic and transport infrastructure such as railways and airports. ✓ "Acoustic Insulation" module. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings (It requires the option "Reverberation time"). ✓ "Monitor" module to capture real-time mass memory in the PC remotely via a modem connected to the sound level meter. The program allows you to program measures and calibrations with timer and record audio with programmable trigger event ✓ "Environmental Noise": Analysis of noise and environmental noise sources with automatic identification of tonal and impulsive sources.
Operating conditions	Working temperature -10÷50°C, 25÷90%RH (not condensing), 65÷108kPa. Protection degree: IP64
Power supply	✓ 4 alkaline type AA or rechargeable NiMH batteries or external 9÷12Vdc 300mA
Dimension and weight	✓ 445x100x50 mm equipped with preamplifier, 740 g (with batteries)

Manufacture of portable and bench top scientific instruments - Current loop and voltage output transmitters and regulators
 Temperature - Humidity, Dew point - Pressure - CO₂ - Air speed - Light - Optical Radiation - Acoustics - Vibration - pH - Conductivity - Dissolved Oxygen
 Turbidity - Elements for weather stations - Thermal Microclimate



LAT N° 124 Signatory of EA, IAF and ILAC Mutual Recognition Agreements
 Temperature - Humidity - Pressure - Air speed - Photometry/Radiometry - Acoustics



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Automatic shutdown of the instrument in measuring can be disabled by moving the jumper in the battery compartment. In order to ensure the accuracy of the instrument over time, it is advised by the calibration trimmer multi-turn "CAL" in the probe, after connecting the microphone to the calibrator HD 9102.

TECHNICAL SPECIFICATIONS

- Measuring range: 30 dB (A)...130 dB (A)
- Frequency response: weighted A
- Time constants: S = slow (1 s) and F = Fast (125 ms)
- Resolution: 0.1 dB - Precision: class 2
- Display: 12 mm LCD with indication of operating mode and low battery
- Power supply: 9 V batteries
- Autonomy: (continuous duty) 15 hours with zinc-carbon battery, 30 hours with alkaline battery
- Working temperature: -5...+50°C
- Storage temperature: -20...+70°C
- Dimensions instrument: 80 x 160 x 40 mm
- Weight: 350 gr.



HD 8701 SOUND LEVEL METER

The sound level meter **HD 8701** is a portable instrument, easy and quick to use, suitable for measuring industrial and civil noise levels.

The noise levels can be read easily in dB (A) on the large liquid crystal display which also shows all the information concerning the mode of operation of the instrument. One second after switching on and with a resolution of 0.1 dB, the digital reading gives the continuously updated value of the RMS sound pressure level, with a type A frequency weighting. The single range from 30 to 130 dB further simplifies the use of the instrument, as the user does not have to change scale. With the keyboard the following operations are possible:

- selecting the response time constant S/F
- displaying the maximum value recorded "MAX" and zeroing it "RESET MAX"
- freezing the indication on the display "HOLD".

DIRECTIONS OF USE

When pressing ON/OFF key the instrument switches on; by pressing it again, the instrument switches off.

S/F key allows to select selecting the time constant: Slow (1 second) - Fast (125 milliseconds) are displayed with "S" or "F". HOLD key allows holding the indication on display. By pressing HOLD again, you go back to the normal operation (continuous updating of reading). The frozen state is indicated on the display with "HOLD".

By hold the MAX key, you display the maximum value considered (for periods not exceeding one minute) automatically by the instrument, by the switching on or since pressing the RESET MAX. The display also indicates if the battery is low. The instrument switches off automatically if it is in the measure, after about 3 minutes from ignition. In MAX and HOLD disables automatic shutdown of the instrument.





ACOUSTIC CALIBRATOR

1. **ON-OFF** key: turns on and off the instrument. When you turn the instrument on, the display will switch on about three seconds later.
2. **SETUP** key: allows you to enter and scroll menu. To exit, press it repeatedly until you go back to the standard screen.
3. **Display**. When you turn the instrument on, it shows all segments on, and then the sound pressure level (94 or 114dB) will appear in standard view.
4. Calibrator cavity for conventional 1/2 inch microphones.
5. **▼** key: in standard mode, it selects 94dB and 114dB pressure levels alternately. In menu mode, it decreases the current value.
6. **▲** key: in standard mode, it selects 94dB and 114dB pressure levels alternately. In menu mode, it increases the current value.
7. Battery lid.

Advantages of the HD 2020 calibrator are:

- The 1000Hz frequency allows calibrating sound level meters with any weighting (LIN, A, B, ...), without applying any correction factor.
- The calibration 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 HD 2020 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 the use even by unskilled personnel.
- The presence of the LCD helps you through the steps of setting the calibrator, signal the end of the span and allows you to check the status of the battery.

DESCRIPTION KEYBOARD AND DISPLAY

The keyboard instrument consists of 4 buttons.

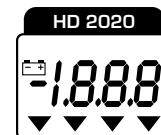
The following describes in detail the functions performed by each.



ON-OFF key

Press the ON/OFF key to turn the instrument on and off.

When instrument is on, all display segments are shown for a few seconds,



...an auto-test including the level of battery charge starts and brings the instrument to the standard working condition.



HD 2020 ACOUSTIC CALIBRATOR

The HD 2020 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" 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 calibration pressure levels of 94dB and 114dB can be selected by the keypad. The 1000 Hz frequency cannot be changed.

If the microphone is absent or not inserted correctly into the calibrator cavity, the sound level will blink on the display.

To conserve battery life, the instrument is provided with an automatic power off function: if you leave the instrument on with open cavity, it switches off automatically after 30 seconds. If the cavity is closed and the microphone is inserted, the instrument switches off 5 minutes after turning on, provided that you don't press any key.

The calibrator display shows calibration pressure level, battery life, current date and time.



Nota: between the instant when you press the ON / OFF button and switching the display pass about three seconds: this time it is necessary to perform the initial self-test.

Auto-off feature (Auto-Power Off)

The instrument has the auto-off feature (Auto-Power Off) that turns the meter off after 5 minutes if, in this interval, the microphone is inserted into the cavity of the calibrator and press any button.

If the cavity is open, indicating the noise level in the display: in these conditions the instrument will turn off automatically after 30 seconds

Auto-off feature cannot be excluded.



SETUP key

The SETUP key allows entering and viewing the menu. To exit, press the SETUP key until you go back to the standard screen, or keep it pressed for more than 2 seconds.

The menu shows:

- Current date and time in the format year, month, day, hour, minute, second.
- Current date and time in the format year, month, day of the last calibration.
- The interval between the calibration date and the expiry date in years and months.

The user can set each of these items by selecting the SETUP button and modifying it with the arrow keys (▲ ▼). To confirm the setting, press the SETUP.

From the standard display, press SETUP to see the current year:

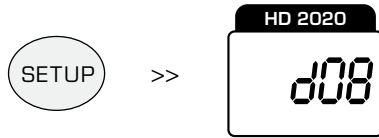


Use the arrows to increase / decrease the value. With the SETUP button is confirmed and changes to current month:



(validity months - second triangle)

Use the arrows to increase / decrease the value. With the SETUP button is confirmed and passed to the current day:



Use the arrows to increase / decrease the value. With the SETUP button is confirmed and the current time passes.



Use the arrows to increase / decrease the value. With the SETUP button is confirmed and passed to the current minutes.



Use the arrows to increase / decrease the value. With the SETUP button is confirmed and passed to the second current.



Each time you press the arrow keys, the seconds value to zero. With the SETUP button you confirm and move to the menu section on the calibration with the lighting of the first triangle to the left and display of calibration (the parameter is not user editable).



(calibration year - first triangle)

With the SETUP button switches per month span (the parameter is not user editable).



(calibration month - first triangle)

With the SETUP button switches per day span (the parameter is not user editable).



(calibration day - first triangle)

With the SETUP button switch setting the date of calibration with the lighting of the second triangle to the left and display the number of years of calibration. You can type the number of years and months between the date of calibration, entered by the laboratory conducting the formal point and the expiry date.

After the interval set, the triangle is flashing to indicate that it is necessary to re-start point of the calibrator.



(validity years - second triangle)

Use the arrows to increase / decrease the value. With the SETUP button you confirm and pass the number of months of validity.



Use the arrows to increase / decrease the value. With the SETUP button you confirm and back to the default mode of operation.



s arrow key

Under standard conditions, select either the sound pressure levels of 94dB and 114dB. In the menu increases the current value.



t arrow key

Under standard conditions, select either the sound pressure levels of 94dB and 114dB. In the menu decrements the current value.

CALIBRATION PROCEDURE

The HD 2020 can calibrate standard ½" 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 calibration can be effected by holding the HD2020 upright as well as by leaning the instruments on a worktable.

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.

- Before beginning to calibrate, you should make sure that the ambient noise level doesn't affect the calibration. After inserting the microphone into the cavity, with the sound level meter and the calibrator off, switch on the sound level meter and detect the unweighted ambient sound pressure level. If the measured level is below 78 dB, you can use both calibration sound levels (94 dB and 114 dB); if the level is between 78 dB and 98 dB you can use the 114 dB level only, while a sound level above 98 dB means that calibration is not possible.
- Press the ON/OFF key to switch the instrument on.
- Use the arrow keys to select the sound level: 94 dB or 114 dB.
- If the value displayed on the display stops flashing within a few seconds, this indicates improper placement of the microphone.
- Proceed with the calibration of sound level meter, following the procedure indicated on the instrument manual.
- Apply the correction to the pressure level generated in the type of microphone (see the following chapter).
- At the end, turn the sound level meter and calibrator off and remove the microphone from the cavity.

With the HD 2020 calibrator can calibrate any type of SLM is provided with a microphone or laboratory sample of work from ½" in conformity with the standards described in IEC 61094-01 and IEC 61094-4.

Corrections for the type of microphone

The HD2020 calibrator generates a sound pressure level equal to 94 dB (or 114 dB) reported in 20µPa. The normal working microphones ½", used on sound level meters are engineered to have a flat frequency response in terms of free field or diffuse field is respectively in a field of progressive plane waves with propagation direction coincides with the axis of microphone and in a field of sound waves from all directions. These propagation conditions are different from those experienced in the cavity of the sound calibrator. Free field reflections caused by the presence of the microphone alter the sound level by increasing the effective sensitivity of the capsule at high frequencies. The microphones are optimized for free-field measurements exploit this phenomenon to obtain a flat frequency response up to very high frequencies. In these microphones increase in noise level at 1 kHz is approximately 0.05 dB ÷ 0.20 dB. When you calibrate a microphone for free field should therefore reflect this difference in sound level meter by setting a noise level less than 0.1 dB and 0.2 dB compared to the nominal calibrator. The microphones are optimized for diffuse field measurements do not need instead of corrections when calibrated cavity closed at 1 kHz.

REPORTING FOR LOW BATTERY AND BATTERY REPLACEMENT

The calibrator HD 2020 is equipped with two batteries: a user-replaceable 9V alkaline battery and lithium. This serves to keep the clock and calendar function even if the external battery: its replacement should be done at an authorized by Delta Ohm.

The charge level of the 9V battery is continuously monitored:

- If the battery is fully charged, its symbol is off;
- If the battery is partially charged, its symbol blinks: please replace the battery as soon as possible;
- If the charge is insufficient to ensure normal operation of the instrument, the symbol remains constantly lit. When the battery is discharged, the calibrator is turned off within approximately 10 seconds.

To replace the 9V battery, turn off the power and open the door at the bottom of the instrument. Replace the battery. Close the door. The date, time interval expires calibration will be saved if the battery is fully charged. The average duration of the battery depends on the presence or absence of the external, if the external battery is present; the average life of battery is approximately 5 years.

Warning on use of batteries

- If the battery is low, replace it as soon as possible.
- Make sure that there is no loss of liquid.
- Use good quality sealed batteries (alkaline if possible).

CONSTRUCTION AND OPERATION

Mechanical construction

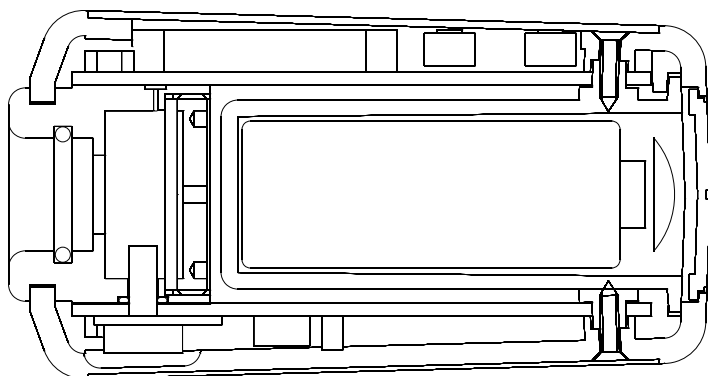


Fig. 3 Mechanical construction of the calibrator (section).

In Fig 3 is the schematic structure of the calibrator HD 2020 (in section). On the right side of the container is the battery compartment. Above and below the battery compartment are printed circuit boards and electronics. The upper one is reserved for the display and keyboard. At left is the electro-acoustic transduction system consists of a large volume cavity with piezoceramic generator and sensor feedback. The system emits a signal through the microphone located $\frac{1}{2}$ ". A capillary hole outward balances the static pressure chamber protects the microphones from excessive pressure caused by the advertiser.

Electronic control

In Fig 4 shows the block diagram of the calibrator.

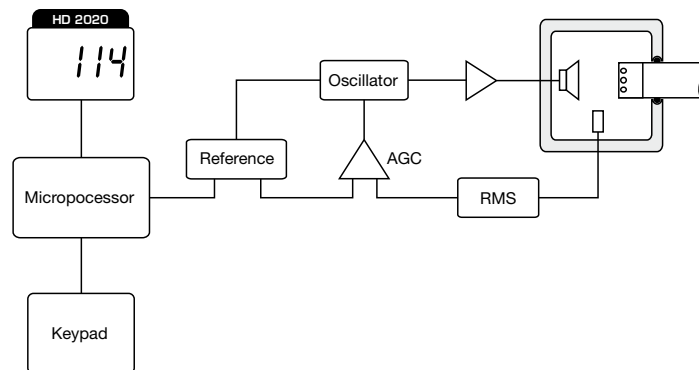


Fig 4 Block diagram of electronics.

The main part of electronics is an oscillator with high stability and low distortion plus an RMS converter, the automatic gain control (AGC), the driver for the ceramic resonator and electronics packaging of the signal provided by sensor feedback. The RMS level of the signal provided by the sensor is compared with the reference level set at the factory, the difference corrected by the automatic gain control, the amplitude of the signal generated by the oscillator and then the acoustic signal generated by the piezoelectric transducer. The signal from the sensor has minimal variation with temperature and static pressure, the frequency of the signal provided by the oscillator is stable in relation to environmental parameters.

INSTRUMENT STORAGE

Storage conditions of the instrument:

- Temperature: -25 ... +55 ° C.
- Humidity: less than 90% RH non-condensing.
- Do not store where:
 - The humidity is high.
 - The instrument is exposed to direct sun radiation.
 - The instrument is exposed to a source of high temperature.
 - There are strong vibrations.
 - There is pressure, salt and / or corrosive gas.

The instrument body is ABS plastic: do not use incompatible solvents for clearing.

NOTES ON THE OPERATION AND OPERATIONAL SAFETY

Authorized use

Observe the specifications given in chapter "SPECIFICATIONS". It only authorizes the use and operation in accordance with the instructions in this operating manual. Any other use is considered unauthorized.

General Safety Instructions

This instrument was manufactured and tested according to EN 61010-1 safety standards relating to electronic measuring instruments and left the factory in perfect condition safety techniques. The smooth functioning and operational safety of the instrument can only be guaranteed if you look all normal security measures as well as those specifications described in this manual. The smooth functioning and operational safety of the instrument can be guaranteed only under conditions specified in "Technical Specifications".

Do not use or store the instrument in the manner and / or where are present:

- Rapid changes in temperature that may cause condensation.
- Corrosive or flammable.
- Direct vibration or shock to the instrument.
- High intensity electromagnetic fields, static electricity.

If the instrument is transported from a cold to a warm place, condensation may cause it to function. In this case we expect that the temperature of the instrument to reach room temperature before putting it back on.

User requirements

The user of the instrument must ensure that compliance with the following rules and guidelines concerning the treatment of hazardous materials:

- EC directives on occupational safety
- National laws and safety at work
- Accident prevention regulations

TECHNICAL SPECIFICATIONS

The calibrator HD 2020 falls in the characteristics of **class 1** according to IEC 60942-2003 and meets the requirements of the ANSI S1.40-1984.

Coupling cavity:	for standard 1/2" microphones (12.7 ±0.03 mm) according to IEC 61094-1 and IEC 61094-4
Frequency:	1000 Hz
Frequency tolerance:	1% in the range -10...+50°C and 10%...90%RH
Sound pressure level:	94.0 dB and 114.0 dB ±0.2 dB at 1 kHz (referred to 101.3 kPa, 23°C ±3°C and 65%R.H.)
Reference conditions:	20°C, 50% RH, 101.3kPa, 10 mm ³ cartridge volume
Stabilization time:	10s
Total distortion:	<1%
Ambient condition influence	
- Temperature and humidity influence:	< 0.3 dB in the range ± 10°C...50°C and 10%...90%RH
- Static pressure influence:	< 0.1 dB in the range 65 kPa ... 108 kPa
Stability levels	
- Short-term stability:	±0.03 dB
- Stability after 1 year, normal use:	±0.1 dB
Operating conditions	
- Working temperature:	-10 ... +50°C
- Relative humidity:	≤90% R.H.
Storage temperature:	-25 ... +70°C
Microphone equivalent volume:	5 to 250 mm ³
Power supply:	9V alkaline battery IEC type 6LR61. 9V rechargeable batteries are also allowed.
9V battery autonomy:	48-hour continuous functioning with good quality alkaline batteries.
Automatic power off:	5 minutes – it cannot be disabled
Watch/date-indicator:	internal with 3V lithium buffer battery
Case material:	ABS
Dimensions:	53x43x83mm
Weight:	160g.
IP Protection degree	IP64
Effects of electromagnetic fields:	< 0.3 dB

PURCHASING CODES

HD2020: The kit consists of: HD2020 calibrator, 1 9V alkaline battery, instruction manual and report of calibration.



HD 9101 AND HD 9102 SOUND LEVEL METERS CALIBRATORS

APPLICATION FIELD

The generator noise level 9101/HD 9102 is a portable, battery-powered sound source, suitable for calibration of sound level meters (portable and laboratory) and acoustic measuring stations. And it's possible to calibrate directly microphones 1 / 2 "of mechanical dimensions conform to the requirements of 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")

ADVANTAGES OF CALIBRATORS HD 9101 / HD 9102 ARE:

- With the frequency of the sound signal at 1000Hz can perform calibration of sound level meters with any frequency weighting (LIN, A, B, ...), without introducing correction factors.
- The sound pressure level generated is independent of atmospheric pressure is therefore not necessary to correct the value function of atmospheric pressure.
- The calibrator 9101/HD 9102 can be conveniently used in both laboratory and field.
- Ease of use allows the use even by unskilled personnel.

TECHNICAL SPECIFICATIONS

The calibrator **HD9101** satisfies **Class 1 specifications** according to the standard **IEC 60942-1988** and **complies with the requirements of the standard ANSI S1.40-1984**. The calibrator **HD9102** satisfies **Class 2 specifications** according to the standard **IEC 60942-1988** and **complies with the requirements of the standard ANSI S1.40-1984**.

- Diameter of microphones that may be calibrated:
 - 23.77 ± 0.05 mm 1"
 - 12.7 ± 0.03 mm 1/2" (with 1/2" adapter mod. 9101040) standard according to IEC 61094-1 and IEC 61094-4
- Stabilization time: 60 sec
- Frequency HD 9101: 1000Hz ± 2%
- Frequency HD 9102: 1000Hz ± 4%
- Sound pressure level HD 9101: 94db/114dB ± 0.3dB
- Sound pressure level HD 9102: 94db/114dB ± 0.5dB (ref.101.3kPa, 23°C ± 3°C and 65% RH)
- Total distortion: < 0.5%
- Static pressure influence (Ref. to 101.3kPa): ± 0.1 dB between 90 kPa and 108kPa ± 0.3 dB between 65 kPa and 108kPa
- Temperature influence: ± 0.05 dB between 5°C and 35°C ± 0.2 dB between -10°C and 50°C
- Relative humidity influence (ref. to 50%R.H.) ± 0.1dB between 10% RH and 90% RH Free from condensation
- Stability (one year, standard use): ± 0.1 dB
- Working temperature: -10°C ÷ +50°C
- Storage temperature: -25°C ÷ +55°C
- Relative humidity: < 90% RH
- Equivalent volume of the calibration room (+23°C): 10 cm³
- Power supply: 9V alkaline battery IEC type 6F22
- Battery life: about 15 hours with an alkaline battery
- Housing made of: NORYL NE110 resin
- Dimensions: 60x140 mm, H=46 mm
- Weight: 400 gr.

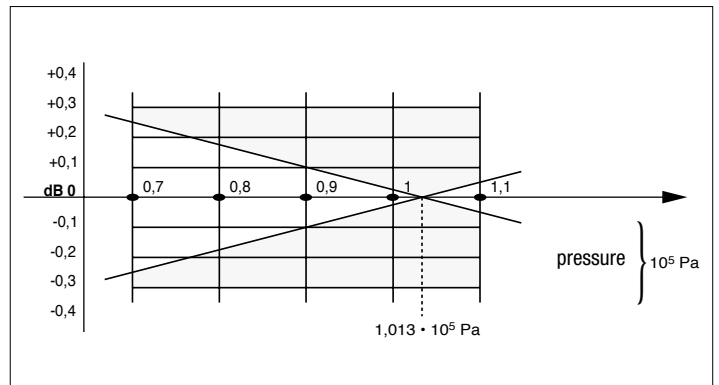
PURCHASING CODES

HD9101: class 1 calibrator according to IEC609442:1988. Frequency 1000 Hz, sound level 94dB/114dB.

HD9102: class 2 calibrator according to IEC609442:1988. Frequency 1000 Hz, sound level 94dB/114dB.

ACCESSORIES:

- Adapter for 1/2" model 9101040
- 9V alkaline battery IEC 6LF22
- Instructions manual



Dependence of sound level on atmospheric pressure





HD 2030 FOUR CHANNEL VIBRATION ANALYZER

HD2030 is a portable vibration analyzer performing spectral and statistical analysis on four channels simultaneously. The instrument measures all parameters required by current regulations concerning workers protection from vibration related risks and is able to measure vibrations transmitted to both hand-arm and whole body.

Main features

HD2030 has been designed combining maximum flexibility and easy of use with the possibility to update the instrument according to the evolution of regulations concerning vibrations. The user can directly update the instrument firmware by means of the program Noise & Vibration Studio supplied with the instrument.

The HD2030 satisfies the specifications of standards **ISO 8041:2005**, **ISO 5349-1:2001** (hand-arm vibrations) and **ISO 2631-1, 2 and 4 1997** (whole-body vibrations). Octave and third octave filters satisfy class 1 specifications of IEC 61260 standard.

The HD2030 vibration analyzer detects accelerations on four axes through two accelerometers with integrated amplifying electronics (IEPE or equivalent type). Three axes are grouped in the right input, where it is possible to connect three accelerometers or a tri-axial one; the fourth axis is associated to left input. Accelerometers with integrated electronics allow using standard cables to achieve low impedance and low noise connections between the accelerometer and the instrument, simplifying its use and decreasing the probability to get wrong or altered measurements, because of interferences or electromagnetic disturbances.

The HD2030 analyzes accelerometer signals and makes calculations simultaneously on four axes. The instrument calculates, in parallel for all the measurement channels, weighted acceleration values and octave or third octave spectra; acceleration, velocity or displacement values can be shown for each frequency band. Frequency weightings can be freely chosen according to the specific application. Together with values of instantaneous and mean acceleration, the analyzer calculates in addition peak levels, vibration dose (VDV), crest factors and performs statistical analysis.

As statistical analyzer HD2030 calculates the probability distribution of a measurement parameter in 1dB classes. Both the probability distribution graph and the percentile levels from L1 up to L99 are available. The measurement of acceleration on four axes allows, as an example, to measure vibration transmitted to the driver body through the vehicle seat isolating driver movements or to evaluate, during design and production verification, the damping effective-

ness of seat suspension and absorbing material in general. In building analysis it is possible to correlate the signal of the hammer used to excite the structure with the signal received by a high sensitivity tri-axial accelerometer.

A flexible data logger function stores multiple profiles and spectra either into the internal 8MB memory or into a memory card (SD up to 2GB). When needed, it's possible to add to profiles the logging of accelerometer signals, directly recording the digital samples. Analysing stored data, it's useful to examine accelerometer signals in order to verify the absence of artefacts like, for example, those generated by DC-shift. Each recording can be documented including a vocal comment. Besides HD2030 can be used like an audio recorder, another possibility to document the measurements.

The "Navigator" program available in the analyzer, allows to examine logged measurements and to hear vocal comments.

For a quick instrument setting the HD2030 can store up to nine setups, customized by the user according to specific applications. The desired setup can be easily identified through the associated title.

Calibration can be performed using either accelerometer calibration data or using a vibration generator. The last 120 performed calibrations are written in a register file and logged in a reserved and protected area of the instrument permanent memory. The interface program Noise & Vibration Studio, included with the instrument, adds automatically the calibration file to the measurements when downloading data into the PC memory.

HD2030 can be completely controlled by a PC, through the RS232 and USB serial interfaces, using a special communication protocol.

Software

The interface program Noise & Vibration Studio is provided with the instrument and allows to download and visualize data logged in the instrument and to manage setups, sensor configurations and calibration register file.

Instrument settings can be customized by the user and stored with a title in a setup file for later use. In order to easily perform different kind of measurements it is possible to upload up to nine instrument settings, selected from the setup file.

Sensor configurations can be set either manually, filling in the accelerometer data table, or automatically, using the CD provided with the accelerometers supplied by Delta Ohm.

The HD2030 stores calibration information in a reserved area of internal memory. The calibration register file is downloaded to PC memory together with logged data and stored in the same folder.

Several optional analysis modules can be activated by means of license. The program can be automatically updated through the web and includes demonstrative versions of all modules.

- NS1 Application module "Workers' Protection":
- Analysis of workers' exposure to noise and vibration, both hand-arm and whole-body, in accordance with Decree Law n.81/2008 9432/2008 and UNI.
- Evaluation of hearing protectors with the methods and OBM SNR according to UNI EN 458.
- Evaluation of measurement uncertainties in accordance with UNI 9432/2008.
- Calculation of the impulsiveness of noise sources according to the requirements of UNI 9432/2008.

Applications

The HD2030 analyzer executes all measurements required by the European regulations concerning workers protection from mechanical vibration exposition at the workplace (2002/44/EC). The choice to perform hand-arm (HA) or whole body (WB or BV) measurements modifies



Input details



Output details



the frequency range of spectral analysis. For hand-arm measurements the range goes from 3.15Hz up to 3.15kHz (from 4Hz to 2kHz for octave band spectrum), while for whole body measurements the range of central frequencies is shifted downward from 0.32Hz up to 315Hz (from 0.5Hz to 250Hz for octave band spectrum).

The HD2030 is suitable for the evaluation of workers exposure to vibrations and to assess the risk of injury in the following cases:

- vibrations transmitted to hand-arm system through vibrating tools or items subject to vibrations or impacts, vibrations transmitted to whole body system through the seat of transport vehicles, vibrations transmitted to whole body system by vibrating floors or seats at the workplace,
- vibrations transmitted to whole body system by buildings with vibrations or impacts.

The HD2030 is a vibration analyzer suitable for the following applications:

- Vibration spectral analysis by octave or third octave bands,
- Statistic analysis with percentile calculation from L1 to L99,
- Evaluation of vibration attenuation of anti-vibration gloves, seats and materials, Structural verification of buildings.

Technical standards

HD2030 vibration analyzer conforms to the following standards:

- ISO 8041:2005** "Human response to vibration – Measuring instrumentation"
- ISO 5349-1:2001** "Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – General requirements"
- ISO 5349-2:2001** "Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Practical guidance for measurement at the workplace"
- ISO 2631-1:1997** "Mechanical vibration and shock – Evaluation of human exposure to whole body vibration – General requirements"
- ISO 2631-2:1989** "Evaluation of human exposure to whole body vibration – Continuous and shock-induced vibrations in buildings (1 to 80 Hz)"
- IEC 61260:1995** "Electroacoustics – Octave band and fractional-octave band filters"

Accelerometer models

- HD356A02:** tri-axial accelerometer for the measurement of vibrations transmitted to the hand-arm system; sensitivity of 10mV/g and maximum acceleration equal to 500g. This sensor is mainly used for hand-arm measurements.
- HD356B21:** miniature tri-axial accelerometer for the measurement of vibrations transmitted to the hand-arm system; sensitivity of 10mV/g and maximum acceleration equal to 500g. This sensor is mainly used for hand-arm measurements.
- HD356B41:** tri-axial accelerometer inserted in a rubber pad for the measurement of the vibrations transmitted to the whole body. 3m connection cable to the HD2030 analyser included. Sensitivity 100mV/g and maximum acceleration 10g.
- HD356A22:** tri-axial accelerometer for general application with sensitivity of 100mV/g and maximum acceleration equal to 50g.
- HD352C34:** mono-axial accelerometer for general application with nominal sensitivity of 100mV/g and maximum acceleration equal to 50g.
- HD356B20:** miniature tri-axial accelerometer for the measurement of vibrations transmitted to the hand-arm system at high shock level. Sensitivity of 1mV/g and maximum acceleration equal to 5000g.

Accessories

In order to measure vibrations transmitted to the hand-arm system, it's necessary to use adapters coupling the accelerometer to the tool handle. The available accessories are:

- HD2030AC1:** cubic shaped mounting block to be fastened to the handle with a cable tie or a metal clamp as near as possible to the hand position. This adapter is suitable for measurements on light tools, where the weight of the measurement chain has to be minimized. Material: light alloy.
- HD2030AC2:** adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles. The measurement must be repeated positioning the accelerometer on both hand sides. Material: light alloy.
- HD2030AC3:** adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles and for accelerometers with integrated screw. The measurement must be repeated positioning the accelerometer on both hand sides. Material: stainless steel
- HD2030AC4:** adapter to be held between the hand and the handle. The accelerometer is placed in central position, between the middle and the ring fingers or between the index and the middle fingers. This adapter is suitable for anatomical handles, not necessarily cylindrical and of small dimensions. Material: light alloy.
- HD2030AC5:** Support for measurement on floors and vibrating surfaces in general. An air bubble level is included and the height of two out of the three feet can be adjusted as needed. The support has a cavity on the lower face, where a high sensitivity tri-axial accelerometer, suitable for measurements in buildings, can be fastened. On the upper face there is a tapped hole (10-32 UNF) for accelerometer mounting. In order to use three mono-axial accelerometers instead of a tri-axial one, a cubic adapter is included to be mounted on the upper face. Material: stainless steel, weight 1.9kg.

The following accessories, needed to keep the accelerometers in contact with various surfaces, are available on request:

- Adhesive metal plate for accelerometer mounting with magnet
- Permanent magnet for accelerometer mounting on metal surfaces
- Adhesive mounting base (glue or wax)
- Insulated mounting base
- Screws with various threading

The following accessories are included with the HD2030 analyzer:

- Wax
- Silicon grease
- USB cable for PC connection
- 1GB SD memory card
- CD with the interface program for PC with Windows operating system "Nose & Vibration Studio" and the HD2030 user manual

Each accelerometer comes with the following accessories:

- Mounting screw
- 2m connecting cable to the HD2030 analyzer (other lengths on request)
- CD with calibration and configuration data and accelerometer manual

Technical specifications of HD2030

- **Technical standards:**
ISO 8041:2005
ISO 5349-1:2001 (hand transmitted vibration)
ISO 2631-1,2,4 1997 (whole body vibration)
IEC 61260:1995 class 1 (octave and third octave filters)
- **Measurement modes:**
Hand-transmitted vibrations
Whole-body vibrations
Building vibrations
- **Measurement parameters:**
RMS, VDV, MTVV, Peak, Max, Min
- **Frequency weightings:**
Fz, Fc, Wh for hand-transmitted vibrations
Fz, Fa, Wb, Wc, Wd, We, Wj, Wk for whole body vibrations
Fz, Fm, Wm for building vibrations
- **Octave or third octave band spectral analysis:**
The range of central frequencies depends on the chosen application according to the following table

Application	Central frequency range	
	Octave Band	Third Octave Band
	[Hz]	[Hz]
Hand-Arm	4 ÷ 2000	3.15 ÷ 3150
Whole-Body	0.5 ÷ 250	0.315 ÷ 315
Building-Vibration	0.5 ÷ 250	0.315 ÷ 315

- **Statistic Analysis** The selected measurement parameter is analyzed in 1dB classes. Both the probability and the percentile graphs can be shown.
- **Measurement range** 0.1m/s² ÷ 7000 m/s² with Dytran accelerometer 3023A2 for hand-arm measurements
- **Linearity range** three ranges of 80dB overlapped by 70dB
- **Digital converter** Four analog to digital converters with a resolution of 25 bits at 8k samples per second
- **Inherent noise level** Less than 30mm/s² with Dytran accelerometer 3023A2 for hand-arm measurements and Wh filter
- **Display** Graphic backlit display 128x64 pixels Screens:
VLM1: Three parameters for each measurement axis
VLM2: Three parameters of acceleration vector calculated from the three right channel input axes
VLM3: Three global parameters for each measurement axis
VLM4: Three global parameters of acceleration vector calculated from the three right channel input axes
PROFILE: Graphic profile of one parameter for each measurement axis with integration time programmable from 1s to 1 hour
SPECTRUM: Octave or third octave spectrum for each measurement axis with calculation of one wideband filter. The graph can show the spectrum of acceleration, velocity or displacement.
STATISTICS: the statistical distribution of the parameter chosen in PROFILE
PERCENTILES: Percentile level graph of the parameter chosen in PROFILE.
- **Memory** 8MB Internal FLASH type memory and connector for memory card SD type up to 2GB.
- **Interface** Serial RS232 and USB type
- **nput/Output** LINE output for the four measurement channels: 2Vpp F.S.
TRGIN electrically isolated input: instrument trigger used by external devices
TRGOUT 3V logic output: trigger output used by external devices
- **Power supply** Four alkaline batteries AA 1.5V type with 10 hour lifetime-
The instrument can use rechargeable batteries Ni-MH type. The HD2030 does not perform the function of charger.

- **Ambient parameters** Storage: -25°C ÷ 70°C relative humidity less than 90% without condensation
Operating: -10°C ÷ 50°C relative humidity less than 90% without condensation
- **Weight and Dimensions** 95mm X 240mm X 50mm, weight 680gr.

Technical specifications of accelerometers:

Model HD356A02

- **Type:** Tri-axial accelerometer with integrated electronics (LIVM™). This sensor is used for hand-arm measures.
- **Sensitivity:** 10mV/g
- **Measuring range:** 500g pk
- **Frequency Range** (±5%): 1Hz ÷ 5000Hz
- **Resonant frequency:** >25kHz
- **Linearity:** 1% F.S.
- **Transverse sensitivity:** 5% max
- **Overload Limit (Shock):** 7000g pk
- **Working temperature:** -50°C ÷ 120°C
- **Temperature drift:** 0.1%/°C
- **Bias voltage:** 8V ÷ 12V
- **Mechanical specifications:** Weight: 10,5gr
Dimensions: (Height x Length x Width) 14.0mm x 20.3mm x 14.0mm
Mounting Thread: 10-32 female (10-32 UNF to 10-32 UNF, 10-32 UNF to M6 screws included)
Connector: ¼-28 4-Pin side type
Housing Material: Titanium alloy
Isolation: case grounded

Model HD356B21

- **Type:** Miniature tri-axial accelerometer with integrated electronics (LIVM™). This sensor is used for hand-arm measurements.
- **Sensitivity:** 10mV/g
- **Measuring range:** 500g pk
- **Frequency Range** (±5%): 2Hz ÷ 10000Hz (y or z axis)
- **Frequency Range** (±5%): 2Hz ÷ 7000Hz (x axis)
- **Resonant frequency:** >55kHz
- **Linearity:** 1% F.S.
- **Transverse sensitivity:** 5% max
- **Overload Limit (Shock):** 10000g pk
- **Working temperature:** -50°C ÷ 120°C
- **Temperature drift:** <0.17%/°C
- **Bias voltage:** 7V ÷ 11V
- **Mechanical specifications:** Weight: 4gr
Dimensions: (Height x Length x Width) 10.2mm x 15.5mm x 10.2mm
Mounting Thread: 5-40 female (5-40 UNF to 5-40 UNF, 10-32 UNF to 5-40 UNF and 5-40 UNF to M3 screws included)
Connector: 8-36 4-Pin side type
Housing Material: Titanium alloy
Insulation: case grounded

Model HD356B41

- **Type:** Low profile tri-axial accelerometer with integrated electronics (LIVM™) put in a rubber pad. This sensor is used for measures of whole body vibration through the seat.
- **Sensitivity:** 100mV/g
- **Measuring range:** 10g pk
- **Frequency response** (±5%): 0.5Hz ÷ 1000Hz
- **Resonant frequency:** >27kHz
- **Linearity:** 1% F.S.
- **Transverse sensitivity:** 5% max
- **Overload Limit (Shock):** 2000g pk
- **Working temperature:** -10°C ÷ 50°C
- **Temperature drift:** <0.17%/°C
- **Bias voltage:** 2.8V ÷ 4.5V
- **Mechanical specifications:** Weight: 272gr
Dimensions: (diameter x thickness) 200mm x 12mm
Cable: 3m integrated cable with 4 pin LEMO connector (supplied)
Material: hard rubber with accelerometer and integrated cable replaceable
Connector: ¼-28 4-Pin side type
Mounting Thread: threaded screw hole 10-32 UNF
Insulation: accelerometer case grounded

Model HD356A22

- **Type:** mono-axial accelerometer with integrated electronics (LIVM™). This sensor is used for general applications.
- **Sensitivity:** 100mV/g
- **Measuring range:** 50g pk
- **Frequency Range** (±5%): 0.5Hz ÷ 4000Hz
- **Resonant frequency:** >25kHz
- **Linearity:** 1% F.S.
- **Transverse sensitivity:** 5% max
- **Overload Limit (Shock):** 5000g pk

- **Working temperature:** -54°C ÷ 77°C
- **Temperature drift:** 0.1%/°C
- **Bias voltage:** 8V ÷ 12V
- **Mechanical specifications** Weight: 5.4gr
Dimensions: (Height x Length x Width) 11.4mm x 16.7mm x 11.4mm
Mounting Thread: 5-40 female (5-40 UNF to 5-40 UNF, 10-32 UNF to 5-40 UNF and 5-40 UNF to M3 screws included)
Connector: 8-36 4-Pin side type
Material: Titanium
Isolation: case grounded

Model HD352C34

- **Type:** mono-axial accelerometer with integrated electronics (LIVM™). This sensor is used for general applications.
- **Sensitivity:** 100mV/g
- **Measuring range:** 50g pk
- **Frequency Range** (±5%): 0.5Hz ÷ 100000Hz
- **Resonant frequency:** >50kHz
- **Linearity:** 1% F.S.
- **Transverse sensitivity:** 5% max
- **Overload Limit (Shock):** 5000g pk
- **Working temperature:** -54°C ÷ 93°C
- **Temperature drift:** 0.1%/°C
- **Bias voltage:** 7V ÷ 12V
- **Mechanical specifications** Weight: 6gr
Dimensions: (Hex x Height) 11.2mm x 22.4mm
Mounting Thread: 10-32 female (10-32 UNF to 10-32 UNF, 10-32 UNF to M6 screws included)
Connector: top mounted 10-32 coaxial jack
Material: Titanium
Isolation: case grounded

Model HD356B20

- **Type:** miniature tri-axial accelerometer with integrated electronics (LIVM™). It is mainly used for hand-arm and shock measurements.
- **Sensitivity:** 1.0mV/g
- **Measuring range:** 5000g pk
- **Frequency Range** (±5%): 2Hz ÷ 10000Hz (y or z axis)
- **Frequency Range** (±5%): 2Hz ÷ 7000Hz (x axis)
- **Resonant frequency:** >55kHz
- **Linearity:** 1% F.S.
- **Transverse sensitivity:** 5% max
- **Overload Limit (Shock):** 7000g
- **Working temperature:** -50°C ÷ 120°C
- **Temperature drift:** <0.1%/°C
- **Bias voltage:** 7V ÷ 11V
- **Mechanical specifications** Weight: 4gr
Dimensions: (Height x Length x Width) 10.2mm x 15.5mm x 10.2mm
Mounting Thread: 5-40 female (5-40 UNF to 5-40 UNF, 10-32 UNF to 5-40 UNF and 5-40 UNF to M3 screws included)
Connector: 8-36 4-Pin side type
Material: titanium alloy
Isolation: case grounded

Purchasing codes for kits and accessories

HD2030 kit 1: it consists of: four channel analyzer HD2030, carrying case, program "Noise & Vibration Studio", USB serial cable (CP22) and 1GB SD memory card (HD2030MC). **Accelerometers, connection cables and accessories have to be specified at the time of placing the order.**

HD2030 kit "HA & WB": it includes,

- HD2030 kit 1 consisting of:
- HD2030: 4 channels vibration analyser with ISO 9001 reports of calibration,
- HD2030MC: 1GB SD memory card,
- CP22: USB serial cable,
- silicone grease (HD6188) and wax bonding (HD6273)
- user manual and case;
- HD356B41: tri-axial accelerometer in a rubber pad with connection cable to HD2030 analyser;
- HD356A02: Miniature tri-axial accelerometer with 081B02 and M081B05 screws and connection cable to HD2030 analyser (HD2030CAB3-3M);
- Reports of calibrations for accelerometers HD356B41 and HD356A02;
- "Noise Studio" interfacing programme for PC.

HD2030 kit "Acoustic & Vibrations": Including

- HD2010UC/A kit 1 consisting of:
- HD2010UC/A: type 1 analyzer sound level meter IEC 61672 with spectral analysis octave bands from 32Hz to 8kHz, data logging with 4MB memory, backlit display;
- UC52/1C: pre-polarized and removable ½" condenser microphone,
- HD2010PNE2: removable microphone preamplifier and 5m extension cable (CPA/5),
- HD SAV: Windscreen for ½" microphones,
- HD2110USB: serial USB cable for PC connection (as an alternative COM-type serial

- RS232 cable is supplied),
- HD2020: type 1 acoustic calibrator IEC 60942,
- user manual and case;
- HD2030 kit "HA & WB" consisting of:
- HD2030: 4 channels vibration analyser with ISO 9001 reports of calibration,
- HD356B41: tri-axial accelerometer in a rubber pad with connection cable to HD2030 analyser;
- HD356A02: Miniature tri-axial accelerometer with 081B02 and M081B05 screws and connection cable to HD2030 analyser (HD2030CAB3-3M);
- HD2030MC: 1GB SD memory card,
- CP22: USB serial cable,
- "Noise Studio" interfacing programme for PC with user licence (CH20) for application modul NS1 "Workers protection",
- silicone grease (HD6188), wax bonding (HD6273) and glue (080A90)
- user manual and case;
- ISO 9001 Reports of calibration for:
- HD2010UC/A sound level meter,
- HD2020 acoustic calibrator,
- accelerometers HD356B41 and HD356A02,
- HD2030 4 channels vibration analyser.

HD2030AC1: cubic shaped mounting block to be fastened to the handle, by means of a cable tie or a metal clamp, as near as possible to the hand position. This adapter is suitable for measurements on light tools, where the weight of the measurement chain has to be minimized. Material: light alloy. It includes:

- Hexagon socket head cap screw 10-32 UNF
- 4mm hex key
- 10 cable ties (length x width) 200mm x 4.5mm
- 1 metal clamp with 9mm width

HD2030AC2: adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles. The measurement must be repeated positioning the accelerometer on both hand sides. Material: light alloy. Includes:

- Hexagon socket head cap screw 10-32 UNF
- 4mm hex key
- 10 cable ties (length x width) 200mm x 4.5mm
- 2 flat velcro straps, 24.5mm size

HD2030AC3: adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles and for accelerometers with integrated screw with 10-32 UNF-2A threading. The measurement must be repeated positioning the accelerometer on both hand sides. Material: stainless steel. Includes:

- 10 cable ties (length x width) 200mm x 4.5mm
- 2 flat velcro straps, 24.5mm size

HD2030AC4: adapter to be held between the hand and the handle. The accelerometer is placed in central position, between the middle and the ring fingers or between the index and the middle fingers. This adapter is suitable for anatomical handles, not necessarily cylindrical and of small dimensions. Material: light alloy. Includes:

- Hexagon socket head cap screw 10-32 UNF
- 4mm hex key
- 10 cable ties (length x width) 200mm x 4.5mm
- 2 flat velcro straps, 24.5mm size

HD2030AC5: Support for measurement on floors and vibrating surfaces in general. An air bubble level is included and the height of two out of the three feet can be adjusted as needed. The support has a cavity on the lower face, where a high sensitivity tri-axial accelerometer, suitable for measurements in buildings, can be fastened. On the upper face there is a tapped hole (10-32 UNF) for accelerometer mounting. In order to use three mono-axial accelerometers instead of a tri-axial one, a cubic adapter is included to be mounted on the upper face. Material: stainless steel, weight 1.9kg. Includes:

- Stainless steel base with air bubble level and three feet. There are a tapped hole on the upper face (10-32 UNF) and a cavity with tapped hole (M4) on the lower face.
- Cubic adapter to be mounted on the upper face using two M4 screws (included). The cube has threaded holes (10-32 UNF) on three orthogonal faces.
- 3mm hex key

HD356B21: miniature tri-axial accelerometer for the measurement of hand transmitted vibrations. Sensitivity 10mV/g, range $\pm 500g$. Mounting screws included.

HD356B41: tri-axial accelerometer contained within a rubber pad for the measurement of whole body transmitted vibrations. Analyzer 1.5m connecting cable included. Sensitivity 100mV/g, range $\pm 50g$.

HD356B20: tri-axial accelerometer for the measurement of hand transmitted vibrations at high shock levels. Sensitivity 1mV/g, range $\pm 5000g$. Mounting screws included.

HD352C34: mono-axial accelerometer for general purpose. Sensitivity 100mV/g, range $\pm 50g$. Mounting screws included.

HD356A22: high sensitivity tri-axial accelerometer. Sensitivity 100V/g, range $\pm 50g$. Mounting screws included.

HD2110/CSNM: serial cable connection to PC COM interface.

CP22: serial cable for connection to a PC with USB interface.

HD2030CAB1-3M: low noise coaxial cable for connection of mono-axial accelerometers (mini-coax SMA 10-32 connector) to the HD2030 analyzer (4 pin push-pull circular connector). 3m Long (other lengths upon request). Equipped with connectors.

HD2030CAB3-3M: coaxial cable for connection of tri-axial accelerometers (4 pin SMA connector) to the HD2030 analyzer (4 pin push-pull circular connector). 3m Long (other lengths upon request). Equipped with connectors.

HD2030CAB13: coaxial cable for connection of three mono-axial accelerometers to the HD2030 analyzer. 400mm Long, BNC connectors.

HD2030CAB1B-5M: coaxial cable for connection of mono-axial accelerometers to the HD2030CAB13 cable. 5m Long (other lengths upon request). Equipped with connectors.

HD2030CAB1B-10M: coaxial cable for connection of mono-axial accelerometers to the HD2030CAB13 cable. 10m Long (other lengths upon request). Equipped with connectors.

HD2030CAB1B-3M: coaxial cable for connection of mono-axial accelerometers HD2030CAB13 analyzer. 3m Long. Equipped with connectors.

HD2030CAB.BNC-xxM: coaxial cable, extension for HD2030CAB1B-3M cable. 30m maximum length.

HD2030MC: 1GB SD memory card.

HD2030AM: headset with microphone.

SWD10: Stabilized mains power supply $V_{in}=100\div 230Vac / V_{out}=12Vdc/1000mA$.

CH20: hardware key for PC with Windows® operating systems. When inserted into a PC USB port enables execution of software modules.

NS1: "Workers Protection" Module. Analysis of noise and vibration in the workplace in accordance with Decree 81/2008

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.

BAT-40: Replacement battery pack for HD40.1

RCT: 4 rolls of thermal paper, 57width and 32mm diameter.

VTRAP: tripod.

Available accessories for the accelerometers are:

HD6188: Silicone grease repellent to water and electrically insulating.

HD6273: Pan with wax bonding

080A90: Glue for quick fixing.

081B05: screw with double thread 10-32 UNF, included in accelerometers HD356A02 and HD356C34.

081A90: screw with double thread 5-40 UNC and 10-32 UNF, included in accelerometers HD356B21, HD356A22 and HD356B20.

M081B05: screw with double thread 10-32 UNF and M6x0,75, included in accelerometers HD336A02 and HD352C34.

M081A27: screw with double thread 5-40 UNC and M3x0,5", included in accelerometers HD356B21, HD356A22 and HD356B20.

081A27: screw with double thread 5-40 UNC, included in accelerometers HD356B21, HD356A22 and HD356B20.

HD6239: tip for accelerometer.

HD6286: metal disk to be applied by adhesive; for magnetic bases HD6284 and HD6196.

HD6284: magnetic base with 10-32 UNF threaded hole; for any accelerometer.

HD6194: magnetic base with 10-32 UNF screw integrated; for accelerometers HD356A02, HD356C34 and HD356B41 (by removing the rubber pad).

HD6226: base with 10-32 UNF threaded hole for mounting by adhesive; for any accelerometer.

HD6245: isolated base with integrated 10-32 UNF screw for mounting by adhesive, for accelerometers HD356A02, HD356C34 and HD356B41 (by removing the rubber pad).

HD6220: isolated base with integrated 10-32 UNF screw and threaded 10-32 UNF hole for mounting the accelerometer; for any accelerometer.





HD 2070

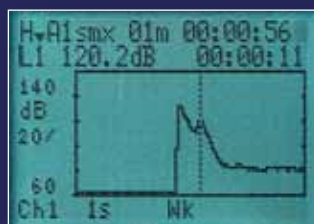
▶ Three channel vibration analyzer



▶ Base screen: single axis measurements



▶ Base screen: vector measurements



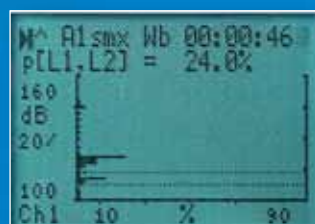
▶ Time profile



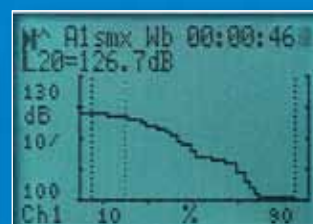
▶ Octave band spectrum (option)



▶ Third octave spectrum (option)



▶ Statistic analysis: probability distribution (option)



▶ Statistic analysis: graph of percentile levels (option)



Three channel vibration analyzer

HD2070 is a portable vibration analyzer performing spectral and statistical analysis on three channels simultaneously. The instrument measures all parameters required by current regulations concerning workers protection from vibration related risks and is able to measure vibrations transmitted to both hand-arm and whole body. It has been designed combining simplicity of use with maximum flexibility and the possibility of updating the instrument according to the evolution of the regulations relating to vibration measurement. The firmware can be updated directly by the user by means of the Noise Studio program supplied with the instrument.



Technical standards

HD2070 vibration analyzer conforms to the following standards:

- **ISO 8041:2005** "Human response to vibration – Measuring instrumentation"
- **ISO 5349-1:2001** "Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – General requirements"
- **ISO 5349-2:2001** "Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Practical guidance for measurement at the workplace"
- **ISO 2631-1:1997** "Mechanical vibration and shock – Evaluation of human exposure to whole body vibration – General requirements"
- **ISO 2631-2:1989** "Evaluation of human exposure to whole body vibration – Continuous and shock-induced vibrations in buildings (1 to 80 Hz)"
- **IEC 61260:1995** "Electro-acoustics – Octave band and fractional-octave band filters" (option HD2070.O1)

Main features

- Octave and third octave filters, available as option (**HD2070.O1**), satisfy class 1 specifications of IEC 61260 standard.
- The HD2070 detects accelerations on three axes with integrated amplifying electronics (IEPE or equivalent type); it is possible to connect three single-axes or one tri-axial accelerometer to the instrument. Accelerometers with integrate electronics allow to achieve low impedance and low noise connections between the accelerometer and the instrument, decreasing the probability to get wrong or altered measurements because of interferences or electromagnetic disturbances.
- The HD2070 analyzes the signals coming from the accelerometer and makes calculations simultaneously on three axes; it calculates the weighted acceleration values as well as the octave or third octave spectra (**with option HD2070.O1**). Acceleration, velocity or displacement values can be shown for each frequency band. Frequency weightings can be freely chosen according to the specific application.
- Together with values of instantaneous and mean acceleration, the analyzer calculates in addition peak levels, vibration dose (VDV), crest factors and performs statistical analysis (**option HD2070.O2**).
- As statistical analyzer, the HD2070 calculates, with option **HD2070.O2**, the probability distribution of a measurement parameter in 1dB classes. Both the probability distribution and the percentile levels from L_1 to L_{99} are available as graphs.
- A versatile data logging function stores multiple profiles and spectra using either the internal memory of 8MB or memory card (MMC or SD cards up to 2GB). Each record can be documented with a voice comment. In addition, the HD2070 can be used as an audio recorder, as a further opportunity to document the measures.
- With the **option HD2070.O3** you can add to the profiles also the signals provided by accelerometers, recording the digital samples directly. When the stored data are analyzed, it is useful to examine the accelerometer signals to verify the absence of artefacts such as, for example, those associated with the phenomenon of DC-shift.
- The "Navigator" program available in the analyzer allows to examine logged measurements and to hear vocal comments.
- For a quick setup of the instrument it is possible to store up to nine setup, user-customized according to specific applications. The desired setup is easily identified by the associated title.
- The calibration can be performed using either the calibration data of the accelerometers with a vibration generator. The last 120 calibrations performed are recorded in a file and stored in a protected and reserved area of the permanent memory of the instrument. The program interface Noise Studio automatically adds the file supplied with the calibration measurements during the downloading of data into the PC memory.
- HD2070 can be completely controlled by a PC, via RS232 and USB serial interfaces, using a special communication protocol.

Applications

The HD2070 analyzer is able to perform all the measures required by the **European regulations 2002/44/EC** concerning workers protection from mechanical vibration at the work place. The choice of **hand-arm measurements (HA) or whole body (WB and BV)** changes the frequency range of the spectral analysis available with the option HD2070.O1. For hand-arm measures the range extends from 3.15Hz up to 3.15kHz (from 4Hz to 2kHz for octave band spectrum), while for whole body measures the range of central frequencies is shifted towards low frequencies, from 0.5Hz up to 315Hz (from 0.5Hz to 250Hz for octave band spectrum).

The HD2070 is suitable for the evaluation of worker exposure to vibration and the risk of injury in the following cases:

- vibrations transmitted to the hand-arm system by vibrating tools or objects subject to vibration or impact,
- whole-body vibration transmitted through the driver's seat of vehicles,
- whole-body vibration in workstations,
- Whole-body vibration of buildings subject to vibration or impact.

Technical specifications

Technical standards

- ISO 8041:2005
- ISO 5349-1:2001 (hand-arm transmitted vibrations)
- ISO 2631-1,2,4 and 5 1997 (whole body vibration)
- IEC 61260 :1995 class 1 (**option HD2070.O1**)

Measurement mode:

- **HA:** Vibrations transmitted to the hand-arm system
- **WB:** Vibrations transmitted to the whole body
- **BV:** Vibrations in buildings.

Measurement parameters

RMS, VDV, MTVV, Peak, Max, Min

Frequency weightings

- Fz, Fc and Wh for measurements on the hand-arm system
- Fz, Fa, Wb, Wc, Wd, We, Wj, Wk for whole-body measurements
- Fz, Fm and Wm for the measurement of vibrations transmitted by buildings

Spectrum analysis by octave or third octave bands (option HD2070.O1)

The range depends on the choice of the central frequencies as reported in the table below:

Application	Range of central frequencies	
	Octave bands	Third octave bands
	[Hz]	
Hand-Arm	4 ÷ 2000	3.15 ÷ 3150
Whole-Body	0.5 ÷ 250	0.5 ÷ 315
Building-Vibration	0.5 ÷ 250	0.5 ÷ 315

Statistical Analysis (option HD2070.O2)

It is performed on a parameter measuring range in 1dB classes. It is possible to see the probability distribution and graph of percentile levels.

Measurement range

0.1 m/s² ÷ 7000 m/s² with accelerometer HDD – 3023A2 for hand-arm measures

Linear range

Three measuring ranges from 80 dB to 70 dB superimposed

Digital converter

Four analog to digital converters with a resolution of 25 bits to 8k samples per second.

Levels of intrinsic noise

Less than 30mm/s² with accelerometer HDD – 356A02 for hand-arm measures and Wh filter.

Display

128x64 pixel large graphic backlit display

Screens:

- **VLM1:** Three measurement parameters to be chosen for all channels.
- **VLM2:** Three parameters of the acceleration vector calculated on the tri-axial input channels.
- **VLM3:** Three global parameters to be chosen, for all channels.
- **VLM4:** Three global parameters to of the acceleration vector calculated on the tri-axial input channels.
- **PROFILE:** graphic profile of a parameter of integration interval programmable from 1s up to 1 hour, calculated simultaneously for all channels.
- **SPECTRUM:** Band spectrum octave or third octave filter with restatement of a high-bandwidth choice, calculated for all channels simultaneously. It is possible to view the acceleration, velocity and displacement (**with option HD2070.O1**).
- **STATISTICS:** Probability distribution of the parameter chosen for the PROFILE screen (**with option HD2070.O2**).
- **PERCENTILES:** Graph of percentile levels relative to the parameter chosen for the PROFILE screen (**with option HD2070.O2**).

Storage

Internal 8MB FLASH type memory card and connector for type MMC or SD cards up to 2GB

Interface

Serial type RS232 and USB

Input/Output

LINE type output for each channel: 2Vpp f.s.

TRGIN input electrically isolated: used as trigger by external devices

TRGOUT output: 3V logic used as a trigger output for external devices

Power supply

Four AA 1.5V alkaline batteries with autonomy of 10 hours.

The instrument can use four rechargeable NiMH batteries. **The instrument does not act as a charger.**

Environmental Parameters

Storage range: -25°C to 70°C, relative humidity less than 90% non-condensing.

Operating range: -10°C to 50°C, relative humidity below 90% without condensation.

Dimensions and weight

95mm x 240mm x 50mm, weight 680g

Accelerometers

HD2070 can be connected to tri-axial accelerometer-type and mono-axial with integrated electronics (IEPE type or equivalent) and sensitivity 1mV/g up to 1 V/g. The accelerometers are powered with a DC bias voltage of 25V and a current of up to 2mA. The accelerometer models shown in table are available on request:

Model	Axes	Application	Sensitivity [mV/g]	Range [±gpk]	Weight [gr]
HDD – 3200B5T	1	HA - Shock	1	5000	6
HDP – 352C34	1	General	100	50	5.8
HDD – 3056B2	1	General	100	50	10
HDP – 356B20 (*)	3	HA – Shock	1	5000	4
HDP – 356A02 (*)	3	HA	10	500	10.5
HDP – 356B21	3	HA	10	500	4
HDP – 356A22	3	WB - General	100	50	5.4
HDP – 356B41 (*)	3	WB + seat	100	10	272
HDP – 356B18	3	Buildings	1000	5	25
HDD – 3233A	3	Buildings	1000	5	28

(*) Usually in stock



Input details



Output details

Technical characteristics of mono-axial accelerometers:

	HDD 3200B5T	HDD 3019A1	HDP 352C34	HDD 3056B2
Axes	1	1	1	1
Sensitivity [mV/g]	1	10	100	100
Range [±gpk]	5000	500	50	50
Frequency response [±5%]	0.5Hz ÷ 20kHz	1Hz ÷ 10kHz	0.5Hz ÷ 10kHz	1Hz ÷ 10kHz
Resonance frequency [kHz]	130	50	50	32
Linearity [%F.S.]	±1	±2	±1	±2
Transverse sensitivity [%max]	3	5	5	5
Maximum Shock [gpk]	50000	3000	5000	2000
Operating temperature [°C]	-51 ÷ +121	-51 ÷ +149	-54 ÷ +93	-51 ÷ +121
Weight [g]	6	8	5.8	10
Dimensions	3/8" x 16.3mm	3/8" x 18.5mm	7/16" x 22.4mm	1/2" x 23.1mm
Mounting	Integrated screw 10-32	Integrated screw 10-32	Threaded hole 10-32	Threaded hole 10-32
Isolation	> 10MΩ	> 10MΩ	-	> 10MΩ
Connector	Top 10-32	Top 10-32	Top 10-32	Top 10-32
Material	Stainless steel	Stainless steel	Titanium	Titanium

Technical characteristics of the tri-axial accelerometers:

	HDP 356B20	HDP 356A02	HDP 356B21
Sensitivity [mV/g]	1	10	10
Range [±gpk]	5000	500	500
Frequency response [±5%]	(Z-Y) 2Hz ÷ 10kHz (X) 2Hz ÷ 7kHz	1Hz ÷ 5kHz	(Z-Y) 2Hz ÷ 10kHz (X) 2Hz ÷ 7kHz
Resonance frequency [kHz]	55	25	55
Linearity [%F.S.]	±2.5	±2	±1
Transverse sensitivity [%max]	5	5	5
Maximum shock [gpk]	7000	7000	10000
Operating temperature [°C]	-54 ÷ +121	-54 ÷ +121	-54 ÷ +121
Weight [g]	4	10.5	4
Dimensions	10.2 x 10.2 x 10.2 mm	14 x 14 x 20.3 mm	10.2 x 10.2 x 10.2 mm
Mounting	Threaded hole 5-40	Threaded hole 10-32	Threaded hole 5-40
Isolation	-	-	-
Connector	Lateral 8-36 4 pin	Lateral 1/4-28 4 pin	Lateral 8-36 4 pin
Material	Titanium	Titanium	Titanium

	HDP 356A22	HDP 356B41	HDP 356B18	HDD 3233A
Sensitivity [mV/g]	100	100	1000	1000
Range [±gpk]	50	10	5	5
Frequency response [±5%]	0.5Hz ÷ 4kHz	0.5Hz ÷ 1kHz	0.5Hz ÷ 3kHz	0.4Hz ÷ 3kHz
Resonance response [kHz]	25	27	20	20
Linearity [%F.S.]	±1	±1	±1	±1
Transverse sensitivity [%max]	5	5	5	5
Maximum Shock [gpk]	5000	2000	5000	5000
Operating temperature [°C]	-54 ÷ +77	-10 ÷ +50	-29 ÷ +77	-51 ÷ +121
Weight [g]	5.4	272 (with seat pad)	25	28
Dimensions	11.4 x 11.4 x 11.4 mm	∅ 200mm x 12 mm	20.3 x 20.3 x 26.1 mm	33 x 25 x 13 mm
Monting	Threaded hole 5-40	Accelerometer with 10-32 threaded hole inserted into a rubber pad for the seat.	Threaded hole 10-32	Hole for 8-32 screw or M4.

Isolation	-	-	-	Provided with insulating spacer
Connector	Lateral 8-36 4 pin	Lateral 1/4-28 4 pin	Lateral 1/4-28 4 pin	Lateral 1/4-28 4 pin
Material	Titanium	Titanium	Anodized aluminium	Titanium steel

Accessories for accelerometers

In order to make measurements of vibration transmitted to the hand-arm system, you must use the accessories that allow you to pair the accelerometer to the handle of the tool. The accessories available are:

- **HD2030AC1:** Cube-shaped support to be fixed to the handle with a plastic or metal strap, positioned close to that occupied by the hand. Suitable for measurements on lightweight tools where you need to keep the weight measurement system. Material: Light alloy.
- **HD2030AC2:** Adapter to be held between the hand and the handle. The accelerometer is placed in a lateral position, the left or right hand. Suitable for large cylindrical handles. The measurement should be repeated by placing the accelerometer on both sides of the hand. Material: Light alloy.
- **HD2030AC3:** Adapter to be held between the hand and the handle. The accelerometer is placed in a lateral position, the left or right hand. Adapted to handle large cylindrical and accelerometers with integrated screw. The measurement should be repeated by placing the accelerometer on both sides of the hand. Material: stainless steel.
- **HD2030AC4:** Adapter to be held between the hand and the handle. The accelerometer is placed in a central position between the middle finger and ring finger or between the index and middle fingers. Suitable for handles with anatomical shape and small size. Material: Light alloy.
- **HD2030AC5:** Support for measurements on surfaces and floors vibrating in general. Fitted with bubble level and three supporting legs, two of which are adjustable in height. The media has, on the lower face, a quarry site for the assembly of a tri-axial accelerometer with high sensitivity for measuring vibrations in buildings. The upper surface has 10-32 UNF threaded hole for mounting an accelerometer. If you want to use mono-axial accelerometers, three, comes a cube adapter fixed on the top surface of the substrate. Material: steel, weight 1.9kg.

For mounting the accelerometers on different surfaces are available on request screws, bases for bonding, isolated bases, magnets and stickers discs. The HD2070 comes along with the following accessories:

- Wax
- Grease
- Adhesive for quick mounting
- Connection cable to the USB port of a PC
- 2GB SD Memory card
- CD-ROM containing the PC interface program "Noise Studio" and the user manual

For each accelerometer combined with a kit with HD 2070 are also provided the following accessories:

- Fixing screws (if required by the accelerometer)
- 2m connection cable for HD2070 (other lengths on request, on payment)
- CD ROM containing the manual and the configuration data of the accelerometer

Software for Windows © 98/XP/Vista/7

The program interface Noise Studio is supplied to the instrument and allows downloading and displaying the data stored in the instrument, to manage the setup, configurations of sensors and calibration files.

Instrument settings can be customized by the user and stored with a title in a setup file for future use. In order to easily perform various types of measures, in up to nine different settings, selectable from the setup file, can be loaded into the instrument.

Sensor configurations can be set either manually, by filling out the table of the characteristics of each accelerometer, or automatically, using the CD-ROM provided by the accelerometers Delta OHM.

The HD2070 stores the calibration information in a reserved area of memory. The calibration of the log file is transferred to PC memory with the data and stored in the same folder.

Several optional analysis functions can be activated by means of license. The program can be updated automatically via the web and includes demo versions of all modules.

CH20: Hardware key for PCs with Windows® operating systems. Inserted into a USB port, enables the use of PC software program modules Noise Studio.

NS1 – Software module “Worker protection”:

- Analysis of workers exposure to noise and vibration on the hand-arm system and whole body, in accordance with Decree Law n.81/2008 and standards UNI 9432 and ISO 9
- Evaluation of protective equipment including impulsive noise with SNR and OBM methods according to UNI EN 458,
- Evaluation of measurement uncertainties in compliance with ISO 9612
- Calculation of the index of impulsiveness of the noise sources.

Ordering codes and accessories

Vibration analyzer kit

HD2070.K1 Vibration analyzer Kit, includes:

- **HD2070** Vibration analyzer, silicon grease for **HD6188** accelerometers, wax bonding **HD6273**, adhesive for quick mounting **080A90**, 2GB SD memory card, serial cable **CP22** for USB ports, user manual and carrying case.
- **Noise Studio** PC program for Windows® operating systems,
- **Calibration report** according to ISO8041 of the HD2070 analyzer.

HD2070.HA-WB Kit Vibration analyzer Kit, It includes:

- **HD2070** Vibration analyzer, **HD6188** silicon grease for accelerometers, **HD6273** wax bonding, **080A90** adhesive for quick mounting, 2GB SD memory card, **CP22** serial cable for USB ports, user manual and carrying case.
- **10mV/g triaxial accelerometer** to measure the vibration transmitted to the hand-arm system, **HD2030CAB3-3M** 3m connection cable to the analyzer, mounting screws, manufacturer calibration documents and ISO8041 calibration report of the vibration meter-accelerometer measuring chain with Wh filter accelerometer for all axes,
- **100mV/g triaxial accelerometer** integrated into a rubber pad for the measurement of whole body vibration through the seat and back, **HD2030CAB3-3M** with 3m connection cable to the analyzer, the manufacturer’s calibration chart and ISO8041 calibration report for the vibration meter-accelerometer measuring chain with filters Wd, Wd, Wk, respectively, for axes X, Y and Z,
- **HD2030.124 set** with 3 adapters for mounting the accelerometer on the handle of tools.
- **Noise Studio program** for PC with Windows® operating systems,
- **Calibration report** according to ISO8041 of analyzer HD2070.

HD2070.SL Kit “Safety in the workplace” “for the measurement of noise and vibration in the workplace, including:

- **HD2010UC/A** integrating sound level meter and spectrum analyzer for

any work environment, includes: windshield HD SAV, CPA/5 5m extension cable for the preamplifier, HD2110USB serial cable for USB ports, manual and carrying case

- **HD2070** Vibration analyzer, silicon grease for **HD6188** accelerometers, wax for bonding **HD6273**, adhesive for quick mounting **080A90**, 2GB SD memory card, serial cable **CP22** for USB ports, user manual and carrying case.
- **10mV/g triaxial accelerometer** to measure the vibration transmitted to the hand-arm system, 3m connection cable to the analyzer **HD2030CAB3-3M**, mounting screws, manufacturer calibration documents and ISO8041 calibration report of the vibration meter-accelerometer measuring chain with Wh filter accelerometer for all axes,
- **100mV/g triaxial accelerometer** integrated into a rubber pad for the measurement of whole body vibration through the seat and back, with 3m connection cable to the analyzer **HD2030CAB3-3M**, the manufacturer’s calibration chart and ISO8041 calibration report for the vibration meter-accelerometer measuring chain with filters Wd, Wd, Wk, respectively, for axes X, Y and Z,
- **HD2030.124 set** with 3 adapters for mounting the accelerometer on the handle of tools,
- **Noise Studio program** for PCs with Windows® operating systems and software module “Worker protection” (**NS1**), **CH20 dongle** and licensing,
- **Calibration report** according to ISO8041 of the vibration analyzer HD2070,
- **Calibration report** according to IEC651 and IEC804 of the sound level meter HD2010UC/A.

HD2070.RV Kit “Noise and Vibrations” for the measurement of noise and vibrations, includes:

- **HD2110L** integrating sound level meter and spectrum analyzer (**option HD2110.O1** “Third octaves”), HD SAV wind shield, CPA/5 5m extension cable for the preamplifier, HD2110USB serial cable for USB ports, user manual and carrying case.
- **HD2070** Vibration analyzer, **HD6188** silicon grease for accelerometers, **HD6273** wax bonding, **080A90** adhesive for quick mounting, 1GB SD memory card, **CP22** serial cable for USB ports, user manual and carrying case.
- **10mV/g triaxial accelerometer** to measure the vibration transmitted to the hand-arm system, **HD2030CAB3-3M** 3m connection cable to the analyzer, mounting screws, manufacturer calibration documents and ISO8041 calibration report of the vibration meter-accelerometer measuring chain with Wh filter accelerometer for all axes,
- **100mV/g triaxial accelerometer** integrated into a rubber pad for the measurement of whole body vibration through the seat and back, **HD2030CAB3-3M** with 3m connection cable to the analyzer, the manufacturer’s calibration chart and ISO8041 calibration report for the vibration meter-accelerometer measuring chain with filters Wd, Wd, Wk, respectively, for axes X, Y and Z,
- **HD2030.124 set** with 3 adapters for mounting the accelerometer on the handle of tools,
- **Noise Studio program** for PCs with Windows® operating systems and software module “Worker protection” (**NS1**), **CH20 key** and licensing,
- **Calibration report** according to ISO8041 of the vibration analyzer HD2070,
- **Calibration report** according to IEC651 and IEC804 of the sound level meter HD2110L.

Options for HD2070 analyzer

HD2070.O1 - option “Spectrum Analysis”: spectrum measurement of the acceleration in octave bands from 0.5Hz to 2kHz and third octaves from 0.5Hz to 3.15kHz, class 1 according to IEC 61260. Includes calibration report according to IEC 61260 standard.

HD2070.O2 – option “Statistical Analysis”: graph of the probability distribution of acceleration and calculation of percentile levels from L_1 to L_{99} in 1dB classes.

HD2070.O3 – option “Digital recorder”: digital storage of accelerometer signals to memory card

Options for the sound level meter HD2010UC/A

HD2010.O0 – option “Memory module”: 4MB additional memory bank.

HD2010.O1 – option “Third octaves”: spectral analysis in third octave bands from 25Hz to 12.5kHz according to IEC 61260 class 1. Includes certificate of calibration according to IEC 61260.

HD2010.O4 – option “Reverberation time”: measurement of reverberation time by source interruption and integration of the impulse response.



Optional headset

Options for the sound level meter HD2110L

HD2010.04 – option “Reverberation time”: measurement of reverberation time by source interruption and integration of the impulse response.

HD2010.06 – option “FFT”: 1/32s Short Leq profile and FFT spectral analysis on the entire audio field with resolution ranging from 1.5 Hz to 100 Hz.

Sound level meter CALIBRATORS

HD2020: Class 1 sound level calibrator according to IEC60942: 2003 with LCD display, suitable for ½” standard microphones. Calibration frequency 1000Hz, 94dB and 114dB levels. I.N.R.I.M approved.

Accelerometers

(*) Available from stock, the other codes are upon request.

HDD - 3200B5T: mono-axial accelerometer to measure vibrations transmitted to the hand-arm system in the presence of high shock levels. Sensitivity 1mV/g, range ±5000g. Integrated 10-32 mounting screw. Uses HD2030CAB1-xM cables for the connection to the analyzer.

HDD - 3019A1: mono-axial accelerometer to measure vibrations transmitted to the hand-arm system. Sensitivity 10mV/g, range ±500g. Integrated 10-32 Mounting screw. Uses HD2030CAB1-xM cables for the connection to the analyzer.

HDP - 352C34: mono-axial accelerometer to measure overall vibration. Sensitivity 100mV/g, range ±50g. 10-23 and M6 mounting screws included. Uses HD2030CAB1-xM cables for the connection to the analyzer.

HDD - 3056B2: mono-axial accelerometer to measure overall vibration. Sensitivity 100mV/g, range ±50g. 10-32 mounting screw included. Uses HD2030CAB1-xM cables for the connection to the analyzer.

HDP - 356B20: miniature tri-axial accelerometer for the measurement of (*) vibrations transmitted to the hand-arm system in the presence of high shock levels. Sensitivity 1mV/g, range ±5000g. Mounting screws 5-40, 10-23 and M3 included. Uses HD2030CAB3S-xM cables for the connection to the analyzer.

HDP - 356A02: tri-axial accelerometer for measuring vibrations transmitted to the hand-arm system. Sensitivity 10mV/g, range ±500g. 10-23 and M6 mounting screws included. Uses HD2030CAB3-xM cables for the connection to the analyzer.

HDP - 356B21: miniature tri-axial accelerometer for measuring vibrations transmitted to the hand-arm system. Sensitivity 10mV/g, range ±500g. Mounting screws 5-40, 10-23 and M3 included. Uses HD2030CAB3S-xM cables for the connection to the analyzer.

HDP - 356A22: miniature tri-axial accelerometer for overall vibration measures. Sensitivity 100mV/g, range ± 50g. Mounting Screws 5-40, 10-23 and M3 included. Uses cables HD2030CAB3S-xM for the connection to the analyzer.

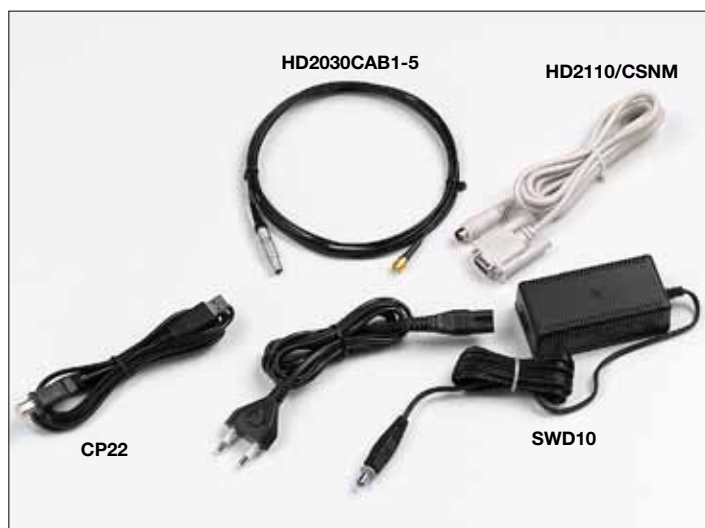
HDP - 356B41: tri-axial accelerometer, sensitivity 100mV/g, range ±50g, (*) integrated in a rubber pad for the measurement of whole body vibration through the seat and back. HD2030CAB3 1.5m connection cable to the analyzer included. The accelerometer, removable from the rubber pad and with a 10-32 threaded passing hole, is used for overall vibration measures.

HDP - 356B18: high sensitivity tri-axial accelerometer for vibration measurements in buildings. Sensitivity 1V/g, range ±5g. 10-23 and M6 mounting screws included. Uses HD2030CAB3-xM cables for the connection to the analyzer.

HDD - 3233A: high sensitivity tri-axial accelerometer for vibration measurements in buildings. Sensitivity 1V/g, range ±5g. M4x20 mounting screw and washer included. Uses HD2030CAB3-xM cables for the connection to the analyzer.



Optional tripod



Accessories



Accessories

Mounting adapters for accelerometers

HD2030AC1: Cube for mounting accelerometers on handles with plastic or metal cable ties in place as close as possible to the hand. Suitable for measurement of small tools where the weight of the measuring system must be minimized. Material: Light alloy. It includes:

- 10-32 UNF hexagon socket head cap screw
- 4mm hex wrench
- 10 plastic cable ties width 4.5mm length 200mm
- 1 metal band width 9mm

HD2030AC2: Adapter to be held between the hand and the handle. The accelerometer is placed in a lateral position to the left or the right side of the hand. Suitable for large cylindrical handles. The measurement should be repeated by placing the accelerometer on both sides of the hand. Material: light alloy. It includes:

- 10-32 UNF hexagon socket head cap screw
- 4mm hex wrench
- 10 plastic cable ties width 4.5mm length 200mm
- 2 straps fabric strips width 24.5mm

HD2030AC3: Adapter to be held between the hand and the handle. The accelerometer is placed in a lateral position to the left or the right side of the hand. Suitable for large cylindrical handles and **accelerometers with integrated screw**. The measurement should be repeated by placing the accelerometer on both sides of the hand. Material: stainless steel. It includes:

- 10 plastic cable ties width 4.5mm length 200mm
- 2 straps fabric strips width 24.5mm

HD2030AC4: Adapter to be held between the hand and the handle. The accelerometer is placed in a central position between the middle finger and ring finger or between the index and middle fingers. Suitable for handles with anatomical shape and small size. Material: light alloy. It includes:

- 10-32 UNF hexagon socket head cap screw
- 4mm hex wrench
- 10 plastic cable ties width 4.5mm length 200mm
- 2 straps fabric strips width 24.5mm

HD2030AC5: Support for measurements on vibrating surfaces and floors in general. Fitted with bubble level and three supporting studs, two of which are adjustable in height. The support has on its lower face a cavity for mounting a tri-axial accelerometer with high sensitivity for measurements in buildings. The upper surface has a 10-32 UNF threaded hole for mounting an accelerometer. If you want to use three mono-axial accelerometers, a cube adapter to be fixed on the top surface is provided. Material: stainless steel, weight 1.9kg. It includes:

- Stainless steel support with three supporting studs and bubble level. 10-32 UNF threaded hole on the upper surface and a M4 threaded cavity on the lower surface.
- Cube adapter to be mounted on the upper face by two screws. The cube has 10-32 UNF threaded holes on three orthogonal faces.
- 3mm hex wrench

Cables for the connection of the accelerometers to the analyzer HD2070

HD2030CAB1-3M: low noise coaxial cable for connection of mono-axial accelerometers, coaxial connector 10-32. 3m long (other lengths on request).

HD2030CAB3-3M: cable for connecting the tri-axial accelerometers, 1/4-28 to 4-pin connector. 3m long (other lengths on request).

HD2030CAB3S-3M: cable for the connection of tri-axial accelerometers, 8-36 to 4-pin connector. 3m long (other lengths on request).

HD2030CAB13: cable for the connection of three mono-axial accelerometers to the tri-axial input of the analyzer. Length 40cm with 3 BNC connectors for connecting the accelerometer cables.

HD2030CAB1B-5M: coaxial cable for connection of mono-axial accelerometers to the cable HD2030CAB13, length 5 meters (other lengths on request).

HD2030CAB.BNC-xxM: coaxial extension cable for connecting mono-axial accelerometers to the HD2030CAB13 cable. BNC connectors and maximum length 50m.

Fixing accessories for accelerometers

HD6188: silicone grease, repellent to water and electrically insulating.

HD6273: wax bonding

HDV.540: screw with double 5-40 UNC thread.

HDV.5401032: screw with double 5-40 UNC and 10-32 UNF thread.

HDV.540M3: screw with double 5-40 UNC and M3 thread.

HDV.1032: screw with double 10-32 UNF thread.

HDV.1032M3: screw with double 10-32 UNF and M3 thread.

HDV.1032M5: screw with double 10-32 UNF and M5 thread.

HDV.1032M6: screw with double 10-32 UNF and M6 thread.

HD6239: tip for accelerometer.

HD6286: metal disc, to be applied by adhesive. Used for coupling the accelerometer by magnet on non-metallic surfaces.

HD6284: isolated magnetic base.

HD6226: base with 10-32 UNF threaded hole for mounting by adhesive.

HD6245: isolated base with integrated 10-32 UNF screw for mounting by adhesive.

HD6220: isolated base with integrated 10-32 UNF-2 mounting screw and 10-32 UNF-2A threaded hole.

Accessories

HD2110/CSNM: serial cable for connection to PC COM interface.

CP22: serial cable for connection to PC USB interface.

HD2030MC: 1GB SD memory card

HD2030AM: headset

SWD10: stabilized mains power supply 100-240Vac/12Vdc-1A.

VTRAP: tripod

HD40.1: Portable thermal printer, 24 columns with RS232 interface. Paper width 57mm. Powered by four 1.2 V NiMH rechargeable batteries. Connection to the analyzer HD2070 using the HD2110/CSNM cable (not included). Includes: SWD10 stabilized power supply voltage Vac/12Vdc-1A 100-240, 5 rolls of thermal paper, user's manual.



Accessories



Accessories

Manufacture of portable and bench top scientific instruments
Current loop and voltage output transmitters and regulators
Temperature - Humidity, Dew point - Pressure - CO₂
Air speed - Light - Optical Radiation - Acoustics - Vibration
pH - Conductivity - Dissolved Oxygen - Turbidity
Elements for weather stations - Thermal Microclimate



LAT N° 124 Signatory of EA, IAF and ILAC Mutual Recognition Agreements
Temperature - Humidity - Pressure - Air speed
Photometry/Radiometry - Acoustics

CE CONFORMITY

- **Safety:** EN61000-4-2, EN61010-1 Level 3
- **Electrostatic discharge:** EN61000-4-2 Level 3
- **Electric fast transients:** EN61000-4-4 Level 3, EN61000-4-5 Level 3
- **Voltage variations:** EN61000-4-11
- **Electromagnetic interference susceptibility:** IEC1000-4-3
- **Electromagnetic interference emission:** EN55022 class B



HD WME

- ▶ [GB] Microphone outdoor protection



Applications

- Stationary and mobile noise control
- Long-term outdoor measurements

Features

- Microphone protection from wind and rain
- Stainless birdspikes
- Heated preamplifier
- Frequency response according to IEC 61672:2002-5 (and IEC 60651:2001-10) and ANSI S1.4:1983 class 1, both for airport and environmental noise
- Compatible with standard ½" microphone sound calibrator

Description

The HD WME microphone unit is suitable for long lasting outdoor monitoring, even in a fixed unattended location. The unit is adequately protected from rain and wind and the heated preamplifier together with the protective membrane coating of the microphone capsule provide stability of acoustic parameters over time and allow you to make measurements over a wide range of environmental conditions.

The Delta Ohm sound level meter preamplifier matched with the outdoor microphone unit is equipped with a circuit for electrical calibration of the preamplifier - microphone chain, a technique that uses a charge distribution.

The frequency response of the unit in open field meets the specifications of class 1 according to IEC 61672 (and IEC60651) and was certified by I.N.R.I.M. (Certificate of conformity No. 10-0126-02 of 04.29.2010). **The microphone unit HD WME must always be positioned vertically** to allow the anti-rain to perform its function and can be used both to detect the noise from the air and the ground. The Delta Ohm sound level meters perform spectral corrections to the measures to ensure tolerances in accordance with the IEC61672 class 1 in every situation.

The microphone unit **HD WME** has an optimized frequency response for "free field". Since the microphone is installed in a vertical position, the frequency response is flat for the sound waves coming from above, such as those of aircraft overflights. To correct the frequency response HD WME microphone unit for the presence of the windscreen, the appropriate parameter of the sound level meter has to be set as follows:

Menu >> Calibration >> Screen Correction >> WME.

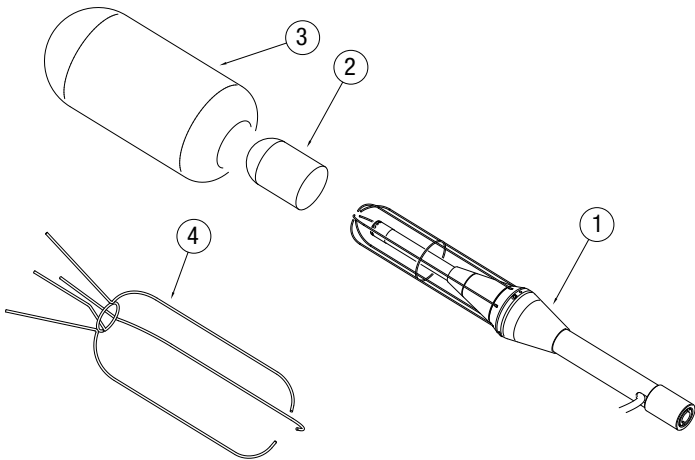
The frequency response of the microphone to noise coming from the surrounding ground is very different from that for "free field". By setting the parameter:

Menu >> Calibration >> Microphone Response >> RI

The sound level meter applies the necessary spectral correction for measurements of noise coming from the ground in accordance with specifications of class 1 according to IEC 61672 (and IEC 60651) and ANSI standards. When calibration is complete, refit the protections according to the explanations under Assembly.

The easiness of disassembly and reassembly of the unit allows to perform periodic testing of the electro-acoustic characteristics the same way as a standard measurement microphone, using a standard calibrator for ½" microphone.

The unit consists of a central body and the following parts:



- HD SAV3: windscreen (3)
- HD WME1: birdspike (4)
- HD WME2: rainshield (2)
- HD WME3: stainless steel holder (1)
- Microphone capsule with optimized frequency response for "free field":
 - MK223: ½" condenser microphone, polarization voltage 200V, with protected membrane
 - MK250B: ½" condenser microphone, prepolarized, with protected membrane
 - UC52: ½" condenser microphone, prepolarized
- Microphone preamplifier:

- HD 2110PW: heated preamplifier for 200V polarized microphones, with CTC calibrator and differential driver for cable lengths up to 100 meters. For HD2110 sound level meters.
- HD 2110PEW: heated preamplifier for prepolarized microphones, with CTC calibrator and differential driver for cable lengths up to 100m. For HD2110 sound level meters.
- HD 2010PNW: heated preamplifier for 200V polarized microphones, with CTC calibrator and driver for cable lengths up to 10 meters. For HD2010 sound level meters.
- HD 2010PNEW: heated microphone for prepolarized microphones, with CTC calibrator and driver for cable lengths up to 10m. For HD2010 sound level meters.
- HD 2010PNE2W: heated preamplifier for UC52 microphone, with CTC calibrator and driver for cable lengths up to 10m. For HD2010UC and HD2010UC/A sound level meters.

Connection cable 5m (other lengths available on request).

Calibration

To perform the calibration, the ½" standard microphone must be made available by removing the wind and rain protections (see Section Disassembly). Before performing the electrical or acoustical tests you need to disable the spectral corrections of the sound level meter by setting the following parameters:

- Menu >> Calibration >> Microphone Response >> FF
- Menu >> Calibration >> Screen Correcton >> OFF

For electrical testing, you can connect a generator of electrical signals to the preamplifier unit HD WME via a capacitive adapter (K65-MK221 for MK223 and MK250B microphones or K65-UC52 for microphone UC52) which replaces the microphone and can be supplied by Delta Ohm on request from the calibration laboratory. It is also possible to use other models of capacitive adapters provided that the equivalent capacitance of the device is between 15 pF and 33 pF.

The frequency response of microphones and MK223 MK250B, provided with a special isolated grid, is detectable by the electrostatic actuator method (IEC 61094 Part 6). The electrical signal applied to the grid should have the following characteristics:

- Polarization level 400V.
- Actuator gain of 0.5 mV/V, corresponding to 0.01 Pa/V.

The sensitivity is such that applying a signal of 10 Vrms, you get a level corresponding to approximately 74 dB.

To the frequency response obtained by the electrostatic actuator, you should add the corrections reported in the following table to get the "free field" response of the microphone unit HD WME.

Frequency [Hz]	"free field" response correction with electrostatic actuator [dB]	
	MK223 - MK250B	
1k	0.0	
2k	0.1	
4k	1.0	
8k	2.7	
12.5k	5.1	
16k	7.4	

The frequency response of all the microphones can be detected by pressure coupling with a multi-frequency acoustic calibrator, such as the B & K4226. In this case, the microphones and MK223 MK250B require the suitable ring (code MK021) to be mounted on the capsule in place of the protection grid.

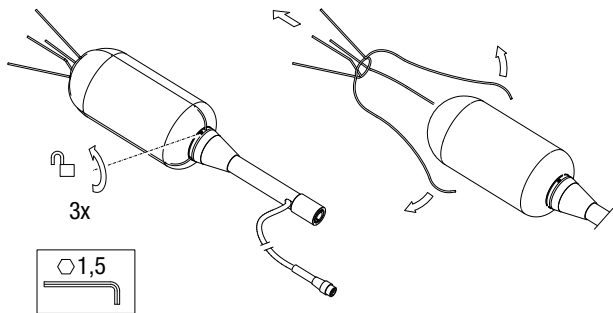
The following table shows the corrections to be applied to the frequency response obtained with the multi-frequency calibrator B & K 4226 in "Pressure" mode, with manual control of frequency, to obtain the answer in "free field" of the microphone unit HD WME.

Frequency [Hz]	"free field" response corrections with B&K 4226 [dB]	
	MK223 - MK250B with MK021 ring	UC52
500	0.0	-0.2
1k	0.0	0.4
2k	0.1	-0.8
4k	1.1	-0.4
8k	2.9	1.9
12.5k	5.4	4.5
16k	6.9	2.5

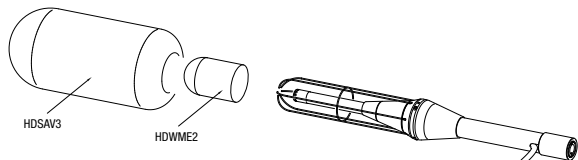
Disassembly

To completely disassemble the unit, a 1.5mm male hex key and a 14mm wrench are needed. To separate all components of the unit, proceed as follows; to extract the group-preamplifier microphone capsule to calibrate, start from step 3:

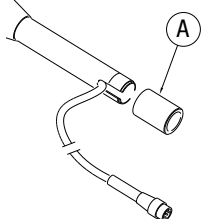
1. Remove the bird spike by loosening the three hex head screws at the base of the windscreen: alla base dello schermo antivento.



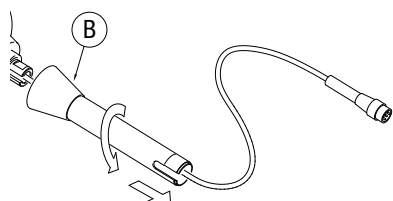
2. Pull up the windscreen HDSAV3 and rain protection HDWME2.



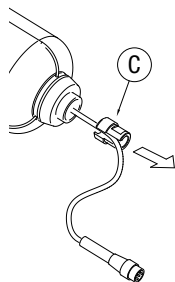
3. Unscrew the terminal placed at the lower end of the stem (A).



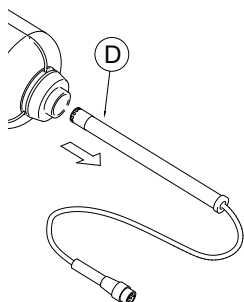
4. Unscrew the stem (B) and disconnect the cable connected to the preamplifier.



5. Unscrew the lock nut of the preamplifier (C) using, if necessary, a 14mm wrench. Be careful not to twist the preamplifier cable.



6. Remove the preamplifier (D) by pulling slowly down. At this point the microphone is accessible and you can proceed with calibration.



For details on calibration, see the manual attached to the sound level meter

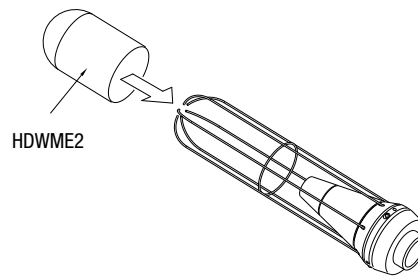
7. For assembly of the protection, proceed as specified in the following paragraph

Assembly

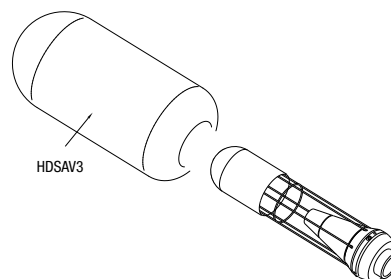
To assemble the unit, a 1.5mm male hex key and a 14mm wrench are needed.

To assemble the protection completely, start from Step 1. If you need only to assemble the preamplifier with the microphone after calibration, from Step 4.

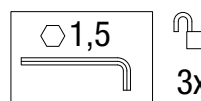
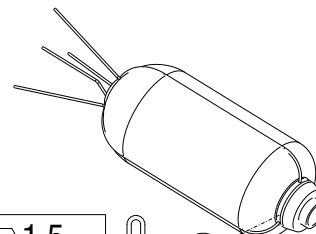
1. Fit the rain shield HDWME2 on the metal grid support.



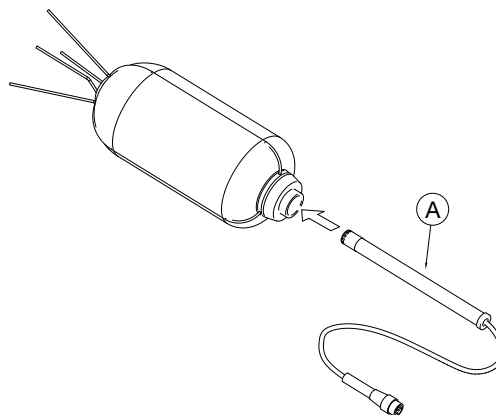
2. Insert the wind screen HDSAV3.



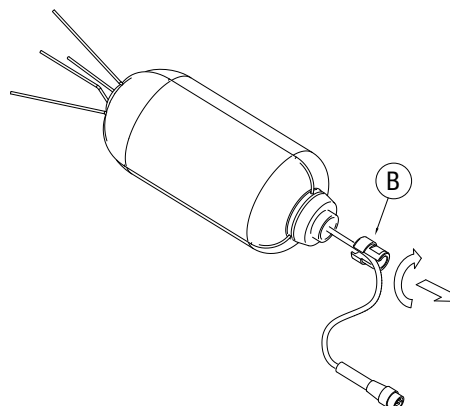
3. Apply the bird spikes and secure it using the three hex head screws located on the support at the base of the windscreen.



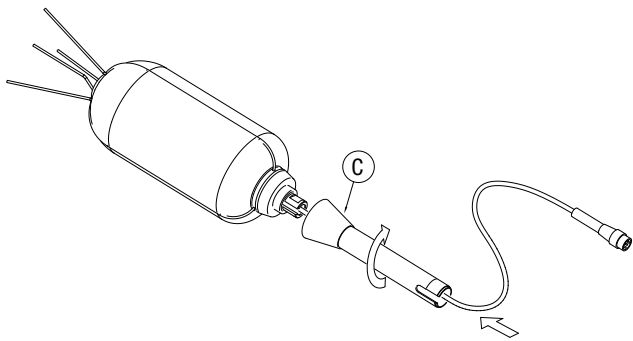
4. Insert the preamplifier (A) into the support pushing slowly upward until its limit position.



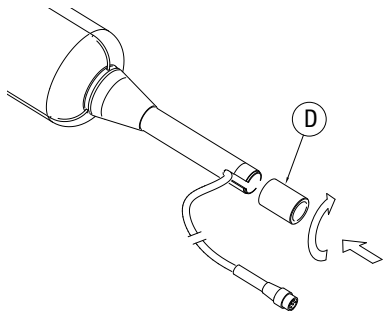
5. Screw the gland (B) using, if necessary, a 14mm wrench. Be careful not to twist the preamplifier cable.



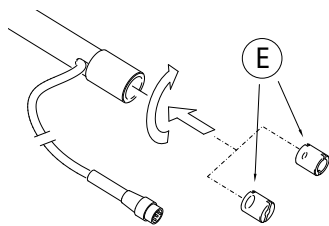
6. Insert the cable connected to the preamplifier through the stem (C) and screw the stem to the support.



7. Screw the terminal placed at the lower end of the stem (D) releasing the cable laterally.



8. To secure protection for outdoor use you can use the threaded end (D) or you can apply the fitting (E) on a tripod. The terminal (E) has two threads, 1/2" and 1/4".



Maintenance

To avoid permanent alteration of the frequency response and consequently a degradation of specifics so as to exit the class 1 tolerance limits, is necessary to prevent accumulation of dust and dirt particles on the microphone membrane. The microphone capsules MK250B and MK223 must be periodically cleaned. **This operation is usually performed during the periodic calibration** and can be performed at Delta Ohm or at an accredited laboratory for calibration of measurement microphones. **It is recommended to calibrate the unit annually.**

The removal of the protective grid of the microphone must be performed by qualified personnel.

The dirt on the membrane can be cleaned with a soft cloth by working very carefully so as not to damage it. Avoid using the unit in the presence of vapours containing oils, conductive or corrosive substances. Condensation on the membrane should be avoided because it significantly modifies the acoustic response, causes corrosion and contributes substantially to the formation of residues that are difficult to remove.

When the unit is used to make measurements, the sound level meter power and the preamplifier heating prevent condensation on the membrane. For this reason, when the unit is not used, it should be stored in a dry place.

Ordering codes

HD WME: Outdoor microphone protection for HD2110, HD2010, HD2010UC and HD2010UC/A.

Includes:

- Stainless steel preamplifier support HD WME3
- Windshield HD SAV3
- Rainshield HD WME2
- Birdspikes HD WME1

HD2110PW: Heated preamplifier for 200V polarized microphone MK223 with 5m cable. Compatible with HD2110 sound level meters.

HD2110PEW: Heated preamplifier for pre-polarized microphone MK250B with 5m cable. Compatible with HD2110 sound level meters.

HD2110PNW: Heated preamplifier for 200V polarized microphone MK223 with 5m cable Compatible with HD2010 sound level meters.

HD2110PNEW: Heated preamplifier for pre-polarized microphone MK250B with 5m cable. Compatible with HD2010 sound level meters.

HD2110PNE2W: Heated preamplifier for pre-polarized microphone UC52 with 5m cable. Compatible with sound level meters HD2010UC and HD2010UC/A.

MK223: 1/2" 200V polarized condenser microphone with coated corrosion protected membrane. Compatible with HD2110PW and HD2010PNW preamplifier.

MK250B: 1/2" pre-polarized condenser microphone with coated corrosion protected membrane.

Compatible with HD2110PEW and HD2010PNEW preamplifier.

UC52: 1/2" pre-polarized condenser microphone. Compatible with HD2010PNE2W preamplifier.

Example of a complete microphone unit:

- HD WME/PEW** Outdoor microphone unit for HD2110. Includes:
 Stainless steel preamplifier support HD WME3
 Windscreen HD SAV3
 Rainshield HD WME2
 Birdspikes HD WME1
 Heated preamplifier with 5m cable HD2110PEW
 1/2" pre-polarized condenser with coated corrosion protected membrane MK250B

Accessories

HD WME1: Birdspikes for outdoor protection HD WME.

HD WME2: Rainshield for outdoor protection HD WME.

HD WME3: Housing in stainless steel for the preamplifier and support for rainshield of outdoor protection HD WME.

HD SAV3: Windscreen for outdoor protection HD WME.

Specifications

Microphone MK223

Type	1/2" standard condenser
Polarization voltage	200V
Frequency response	3.5Hz – 20 kHz
Sensitivity	50 mV/Pa
Maximum sound pressure level(3% THD at 1kHz)	146 dB

Microphone MK250B

Type	1/2" standard condenser
Polarization voltage	0V
Frequency response	3.5Hz – 20 kHz
Sensitivity	50 mV/Pa
Maximum sound pressure level (3% THD at 1kHz)	146 dB

Microphone UC52

Type	1/2" standard condenser
Polarization voltage	0V
Frequency response	20Hz – 20 kHz
Sensitivity	20 mV/Pa
Maximum sound pressure level (3% THD at 1kHz)	146 dB

Preamplifier

Power supply	± 6V
Power consumption	5 mA
Heater	35 mA @ 6V
Output impedance	50 Ω

Operating conditions

Temperature	-25 ... +70 °C
Relative humidity	< 100% without condensation

Mechanics

Dimensions (∅ x L) complete with birdspikes	90 x 470 mm
Weight	600 g
Thread for type MK microphone capsules	11.7 mm 60 UNS
Thread for type UC52 microphone capsules	M11.6 x 0.4
Thread for the support of the unit	M18 x 1, 1/2 W, 1/4 W
Cable lengths	5m (other lengths available on request)
Connector	DIN 8-pole



Manufacture of portable and bench top instruments

Current and voltage loop transmitters

Temperature - Humidity - Pressure

Air speed - Light - Acoustics - Air Quality - CO - CO₂

pH - Conductivity - Dissolved Oxygen - Turbidity

Elements for weather stations - Thermal Microclimate



SIT CENTRE N°124

Temperature - Humidity - Pressure - Air speed

Photometry/Radiometry - Acoustics

CE CONFORMITY

- **Safety:** EN61000-4-2, EN61010-1 Level 3
- **Electrostatic discharge:** EN61000-4-2 Level 3
- **Electric fast transients:** EN61000-4-4 livello 3, EN61000-4-5 Level 3
- **Voltage variations:** EN61000-4-11
- **Electromagnetic interference susceptibility:** IEC1000-4-3
- **Electromagnetic interference emission:** EN55022 class B





HD 2040

- ▶ Tapping Machine

HD 2050

- ▶ Dodecahedron Loudspeaker

HD 2050.20

- ▶ Digital power amplifier

HD 2050.30

- ▶ Directional Sound Source for façade insulations

HD 2050.40

- ▶ Subwoofer



HD 2040

Tapping Machine

The tapping machine **HD 2040** is a noise generator to measure normalized impact sound insulation of floors according to ISO 140-6, ISO 140-7, ISO 140-8, ASTM E492 and E1007.

It has 5 in line hammers operated by means of a camshaft engine controlled by an electronic system. The falling speed of the hammers and the frequency of impacts are constantly monitored to ensure compliance with the legislation. LED indicators on the front panel indicate the correct operation of each hammer.

The hammers are made of hardened stainless steel and are non-deformable over time.

It is equipped with height-adjustable feet with rubber base. On the back cover it is fitted with a **distance spacer** to verify the height of fall. The distance spacer enters into place with a slight pressure, pull to drive it out. The feet can be rotated under the base to reduce the size of the package and facilitate the transportation of the machine.

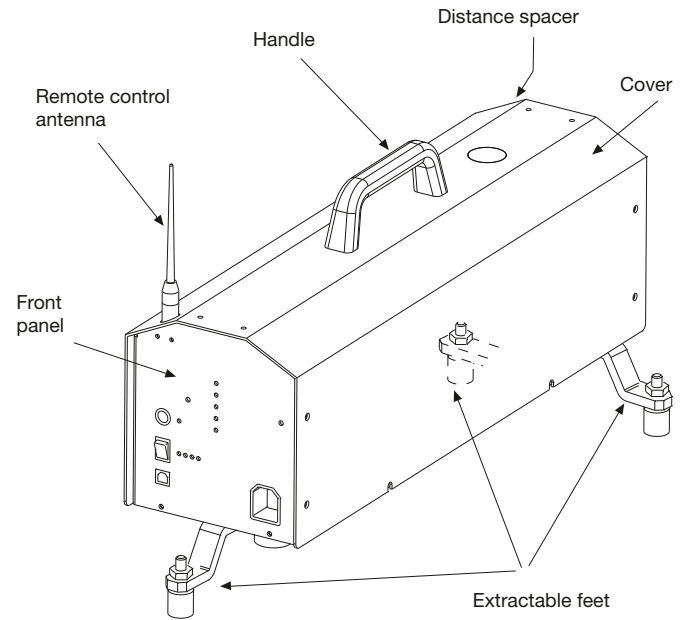
The starting and stopping of the machine is via a button on the front panel or remotely via the supplied remote control. The antenna is screwed to the connector on the top of the machine, unscrew it to store the machine in its case.

100 ... 240Vac mains supply or rechargeable lithium ion battery housed inside the machine. The charger is built-in and the battery recharges automatically when the machine is connected to the mains.

The aluminium construction reduces the weight of the machine and makes it easily transportable.

A bubble level on the cover of the machine allows you to position it perfectly in the horizontal plane.

Description



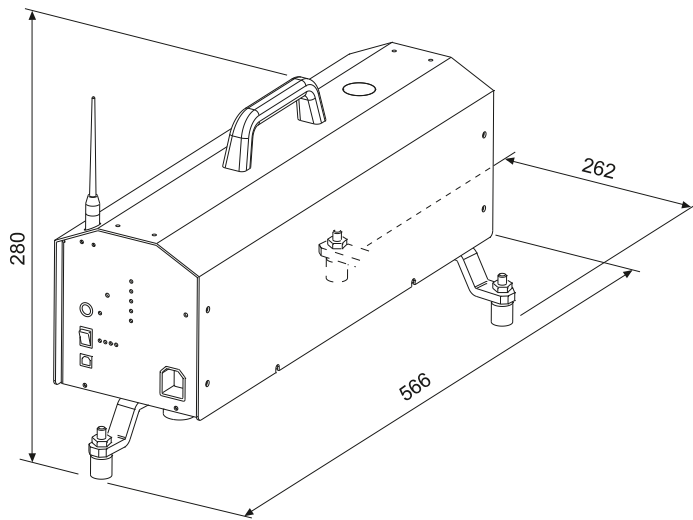
Technical specifications:

Number of hammers	5 in-line
Hammer weight	500 ± 12g each
Fall height	40 mm
Tapping frequency	100 ± 20ms
Average tapping frequency	100 mm ± 5ms
Interval between the impact and the lifting of the hammer	< 80ms
Distance between the hammers	100 ± 3mm
Hammer tip	Diameter 30 ± 0,2mm, spherical impact surface with 500 ± 100mm curvature radius
Falling direction	Perpendicular to the impact surface within ± 0.5 °
Feet	3 adjustable in height, rubber base
Service serial output	USB with type B connector
Remote control	By remote control (frequency 869,525 MHz, power 6 mW) or PC serial interface
Power supply	100...240Vac, 50÷60Hz Rechargeable Battery Pack Li-Ion, 7.2 V nominal voltage, nominal capacity 2900 mAh
Power absorption	< 30 W
Battery autonomy	80 min approx. of continuous working
Operating temperature and humidity	-10...+50 °C, 0 ... 90% RH, no condensation
Dimensions (L x W x H)	520 x 162 x 280 mm cover with handle and feet in transport position 566 x 262 x 280 mm cover with handle and feet in working position (Remote control antenna excluded)
Weight	11 kg complete machine with battery pack and radio control 5,4 kg the carrying case for transportation
Machine structure	Anodized and painted aluminium

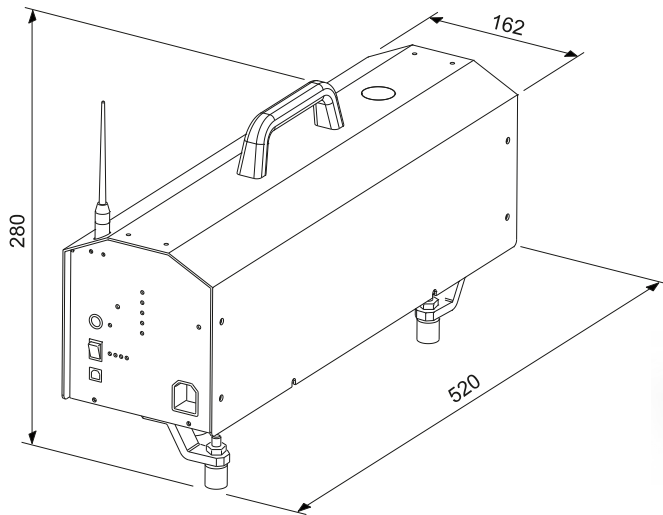


Dimensions (mm)

With feet in transport position



With feet in working position



Ordering codes

HD2040: Machine for the production of footfall noise in accordance with ISO 140-6 and 140-7, 140-8, ASTM E492 and E1007. Complete with rechargeable lithium ion battery, built-in battery charger, remote control, instruction manual. **Optional carrying case.**

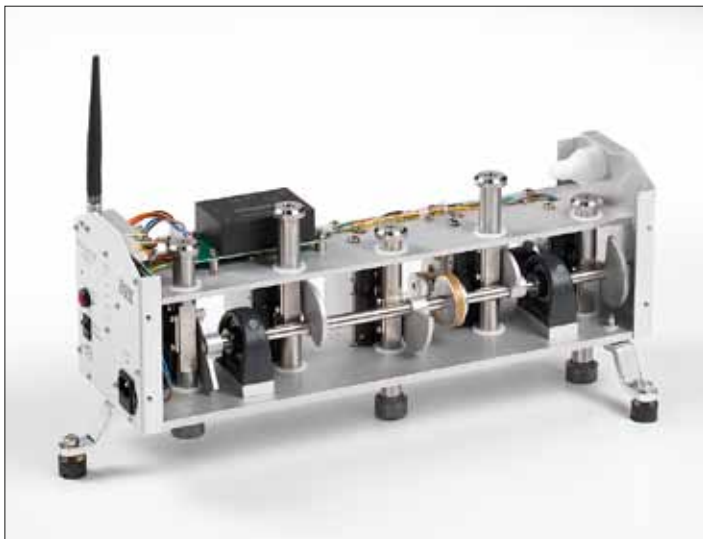
Accessories

HD2040-R: Additional remote control. Frequency 869.525 MHz Power 6 mW.

HD2040-A: Additional remote control antenna.

HD2040-V: Transportation carrying case for the machine.

HD2040-B: Additional rechargeable lithium ion battery pack. 7.2 V nominal voltage, nominal capacity 2900 mAh.



HD 2050

Dodecahedron Loudspeaker for building acoustics

To test buildings acoustic insulation, it's necessary to use sound sources that meet the demands of specific technical ISO standards. Delta Ohm has developed a system for the measurement of passive acoustic performances of buildings that integrates the most advanced features required for this type of equipment.

The need for high noise excitation levels, necessary to deal with increasing insulation values of modern buildings, has been made co-exist with portability and versatility among the best on the market today. **HD 2050** is a sound source composed of 12 speakers arranged in a dodecahedral chassis, capable of radiating high power sound energy in all directions with a directionality in accordance with ISO3382.

The sound source can be integrated with the digital amplification system **HD 2050.20**, which offers high power as well as providing an equalizer that adapts the system's response to any more specific measurement needs.

Features:

- According to ISO 140-3, ISO 3382, UNI 11367 (D.p.c.m. 5/12/97).
- Customizable user setup with user defined equalization when used with **HD 2050.20** power amplifier.

High Power Level

With **122.8 dB** (LIN) re 1pW sound power level, the HD 2050 can also be used for sound insulation measures where the signal/noise ratio in the receiving room becomes critical. The linear frequency range from **80 Hz** to **10 kHz** (1/3 oct) can easily cover the requirements of technical standards for the measurement of acoustic insulation of buildings. In addition the spectrum extension over canonical range 100 Hz ÷ 3150 Hz makes the system HD 2050 a perfect tool also for room acoustics measurements. The optional subwoofer HD 2050.40 further improves power and response extension at lower frequency to cover specific applications in large volume rooms.

Versatility of use with digital amplification

Power amplifier HD 2050.20 incorporates a parametric equalizer that allows to change the emission spectrum of HD 2050. With this device, specific measurement needs can be easily satisfied, such as the need to concentrate more sound power in specific areas of the acoustic frequency spectrum. The software supplied with the power amplifier, allows to customize the frequency response and then store it, in order to be loaded and activated in the dodecahedron-amplifier system when needed.

Lightness and portability

With a weight of only 9 kg and an outer diameter of 38.5 cm, the HD 2050 is one of the lightest dodecahedron speakers on the market. HD 2050.20 digital amplifier provides an output of more than 1000 W @ 12 ohm, and comes with an extremely rugged and light-weight flight case. The HD 2050 system is designed for in situ portability: the dodecahedron has a robust and ergonomic T shaped carrying handle.

Accessories

The system can be supplied with all the accessories useful for transport and correct positioning: extendable tripod with foldable wheels **HD2050.1** (minimum height **1300mm** maximum height **2500mm**), flight-case **D2050-V** moreover, to obtain the best performance, the dodecahedron is to be coupled to the amplifier **HD2050.20** with remote control **HD2050.20R**, and with subwoofer **HD2050.40** To extend the response up to 20Hz.

- Automatic shut-off of ventilation fan (HD 2050.20 digital amplifier).
- Wireless remote control for digital amplifier HD 2050.20.

Applications:

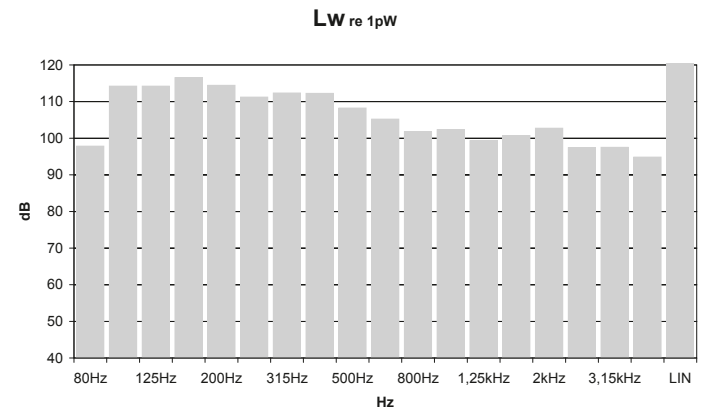
- Sound insulation
- Sound absorption
- Reverberation time measurements
- Architectural acoustics
- Impulse response

Technical specifications:

Reference Standards	ISO 140-3: 2006 ISO 3382: 2001
Nominal impedance	12 + 12 ohm
Power	Peak 540 + 540 W Nom. 180 + 180 W
Loudspeakers	12 x 5"
Operating frequency range	80 Hz ÷ 16 kHz (1/3 oct. bands)
Connectors	Neutrik® NL4FC speakON
Sound Power Level	122 dB re 1pW (10 ⁻¹² W)
Dimensions	Diameter 38.5 cm
Weight	9 kg
Handling	T shaped handle Flight-case padded with wheels and carrying handles

Note: Neutrik® is a registered trademark of Neutrik AG.

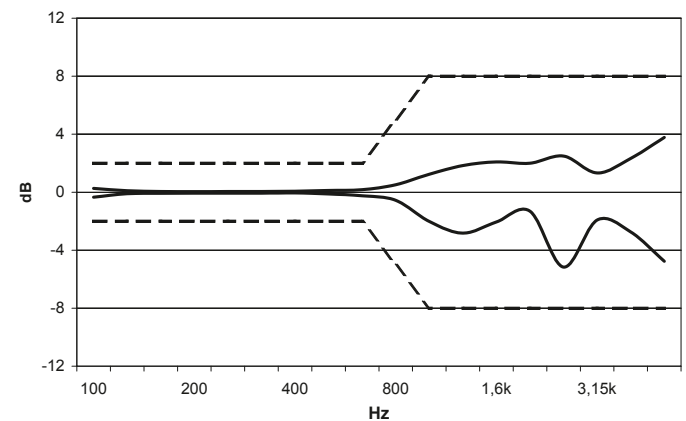
Typical Sound Power Level spectrum



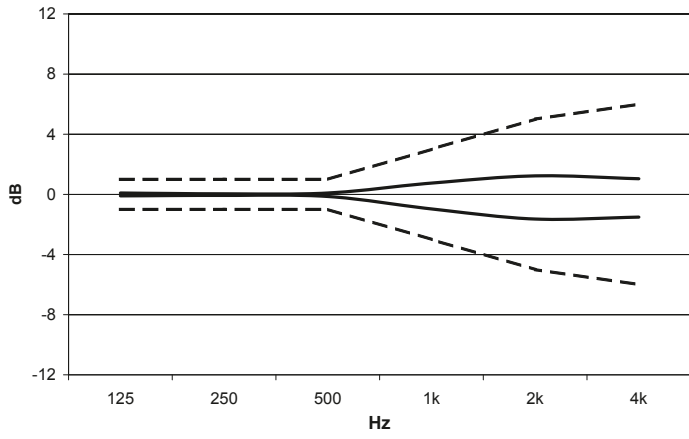
Directivity:

HD 2050 meets the requirements of ISO 140-3 and ISO 3382. The diagrams of directional response measured in the horizontal plane in octave bands, show the ideally isotropic behaviour of HD 2050. Below 1000 Hz the speaker has no significant directionality.

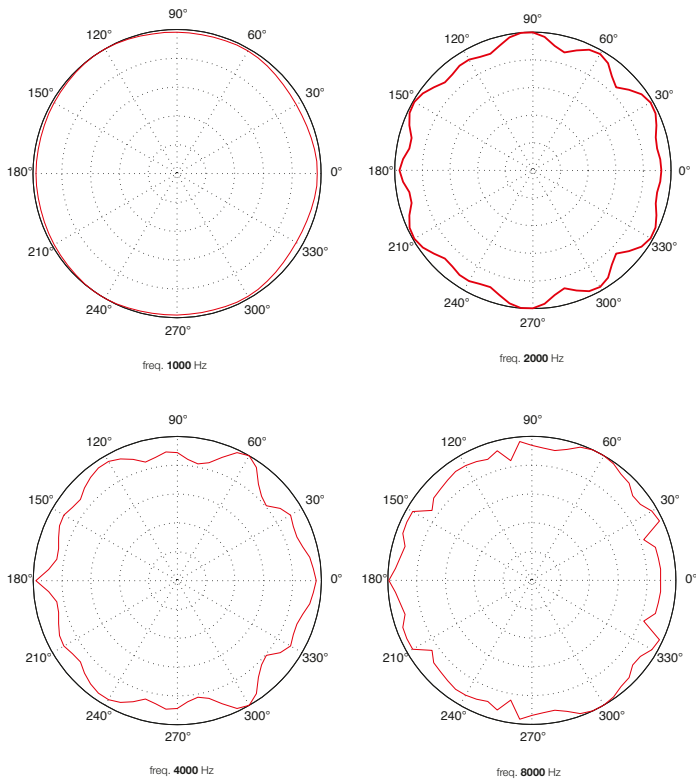
Directivity ISO 140



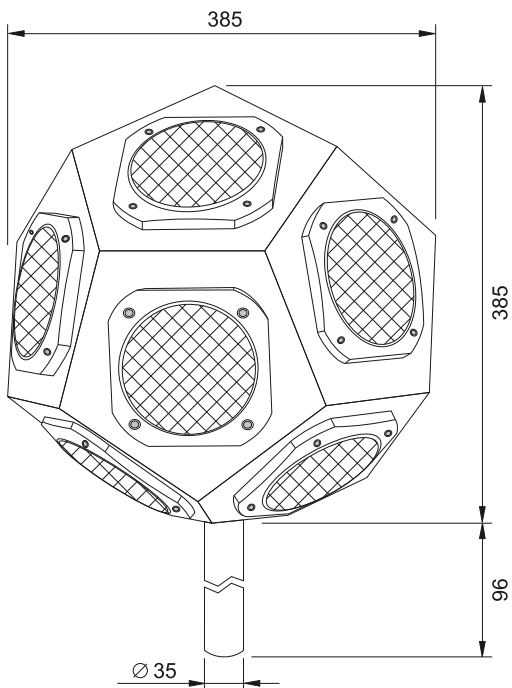
Directivity ISO 3382



Polar diagrams: 10 dB / div. – sectors 30°



Dimensions (mm)



HD2050

HD2050.1

Input



Ordering codes

HD2050: Dodecahedral loudspeaker according to ISO 140-3 and ISO 3382 standards.

Accessories

HD2050.1: Stand for dodecahedron HD 2050, with steering wheels, extensible and foldable. Minimum height **1300mm**, maximum height **2050mm**, Damping of the extensible rod.

HD2050.1.5: Signal cable, length 5 m.

HD2050.1.L: L-shaped signal cable.

HD2050V: Semi-rigid carrying case for **HD 2050** dodecahedron.

HD2050.20: Digital power amplifier with integrated parametric equaliser. Complete with flightcase, power cord **HD2050.2**, connection cable **HD2050.20.1** and remote control with **HD2050.20R**.

HD2050.20R: Wireless remote control Kit to control the internal noise generator of **HD 2050.20**. Composed of receiver, transmitter with activation switch. Range of use up to 100 m.

HD2050B: Kit for battery power supply. 4 batteries 100 VA – 700 W. 15 minutes autonomy at maximum power.

HD 2050.20

Digital power amplifier

HD 2050.20 is a high-power digital amplifier; it includes a white and pink noise generator with wireless remote control. Thanks to the auxiliary input it's possible to drive it with an external generator to apply, for example, sine sweep signals.

In order not to influence the measured levels, a controller can automatically turn off the cooling fan when taking measurements in a quiet environment or when measuring reverberation times with interrupted source technique; in such a case the fan is turned automatically off when you stop the generator's emission.

With Podware, the parametric equalizer's control software, it is possible, even in real time, to activate and manage the following functions: mute, gain, 8-band parametric equalizer and two shelving filters, two HP and LP filters, delay. The user setups can be stored in the amplifier's HD2050.20 memory.

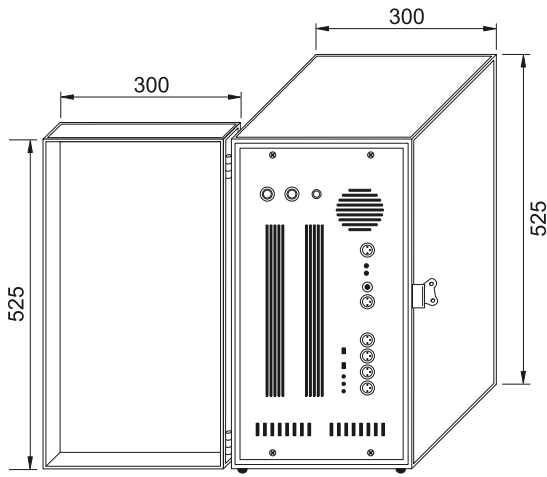


Technical specifications:

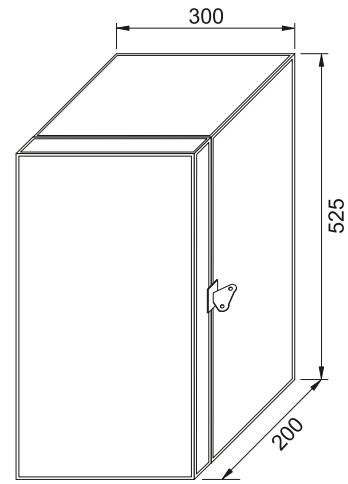
Reference Standards	EN 55103-1 (Emissions), EN 55103-2 (Immunity) EN 6065, class 1 (Safety)
Type	Digital, class D
Maximum power	1200 W @ 12 ohm
Continuous power	2 x 530 W RMS
External generator input	With level control
Power requirements	230 Vac ($\pm 10\%$), 50-60 Hz
Frequency response	20 Hz \div 20 kHz
THD	< 0.1% @ 1 kHz
Noise generator	white/pink with level control Output connector: Neutrik® XLR
Connectors	Input: Neutrik® Combo Output: Neutrik® NL4FC speakON AC Power: Neutrik® powerCON
Level limiter	Control on the maximum power accepted by HD 2050 loudspeaker
State indicators	Mute, Active, Power ON
Protections	Short circuit, thermal, ultrasonic and RF, clip limiter, DC Fault PS shutdown
Dimensions with flight-case	30 x 52.5 x 20 cm
Weight	4.8 kg without flight-case 11.8 kg with flight-case

Note: Neutrik® is a registered trademark of Neutrik AG.

Dimensions (mm)



Amplifier with opened flight case



Amplifier with closed flight case



HD2050.1.5



HD2050.1.2



HD2050.20.1



HD2050.20.2

HD2050.1.L

HD2050.20

Ordering codes

HD2050.20: Digital power amplifier with integrated parametric equaliser. Includes: Flight-case, power cord **HD2050.2**, and remote control kit **HD2050.20R**

Accessories

HD2050.1.5: Signal cable, length 5 m.

HD2050.20R: Wireless remote control Kit to control the internal noise generator of **HD2050.20**. Composed of receiver, transmitter with on/off switch. Range of use up to 100 m.

HD2050B: Kit for battery power supply. 4 batteries 100 VA – 700 W. 15 minutes autonomy at maximum power.

HD 2050.30

Directional Sound Source for façade insulations

The façade passive loudspeaker **HD 2050.30** is the ideal tool to create a uniform sound field in front of a building.

HD 2050.30 provides not only the high output emission in a frequency range extended from 65 Hz to 20 kHz, which is necessary to minimize background noise contribution, but also a uniform sound distribution, especially at higher frequencies, which is guaranteed by the particular construction of the high frequencies driver. With this solution, phenomena of sound concentration due to the directionality of the normal transducers when used near the wall, are greatly reduced especially on the high range; measurement accuracy is therefore improved.

Features:

- **High Power Level**

With a 129 dB spl, **HD 2050.30** loudspeaker allows to perform measurements on high insulated façade even in the presence of high background noise.

- **Versatility**

HD 2050.30 directional loudspeaker can be easily positioned in the typical situations found during façade testing. A specific support is available for 45 positioning both on land and on stand; with the latter system the user gains valuable meters in front of the façade, where space is often little. The weight of 18 kg is the right compromise between power emission and portability.

- Excellent diffusion of acoustic field at high frequency.
- Wireless remote control with HD 2050.20 digital power amplifier.

Applications:

- Façade sound insulation
- Sound absorption

Accessories

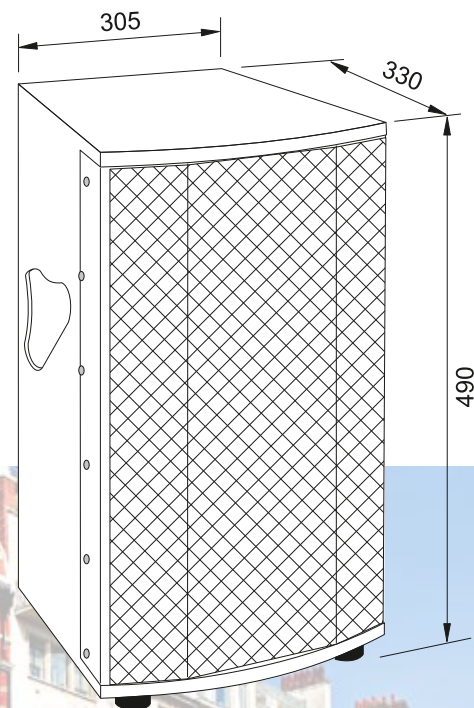
The system can be supplied with all the accessories useful for transport and correct positioning: extendable tripod with foldable wheels **HD2050.1** (minimum height 1300mm maximum height 2500mm), case **HD2050.30.1**.

Technical specifications:

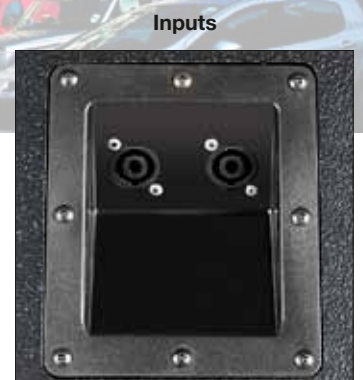
RMS Power	300 W
Nominal impedance	8 ohm
Loudspeakers	Low frequency 1 x 10" (neodimium magnet) High frequency 1 x 1" (Mylar®)
Emission	129 dB spl peak @ 1 m
Frequency range	70 Hz ÷ 20 kHz
Connectors	2x Neutrik® NL4 speakON
Dimensions	305 x 409 x 330 cm
Weight	13,5 kg
Carriage	Protective bag with shoulder straps and handle
Finishing	Geal-coat anti-scratch
Amplifier	To be combined with HD 2050.20 digital power amplifier
Holder	Adjustable to 45° with hole for mounting on standard tripod HD 2050.1

Note: Mylar® is a registered trademark of Dupont Teijin Films. Neutrik® is a registered trademark of Neutrik AG.

Dimensions (mm)

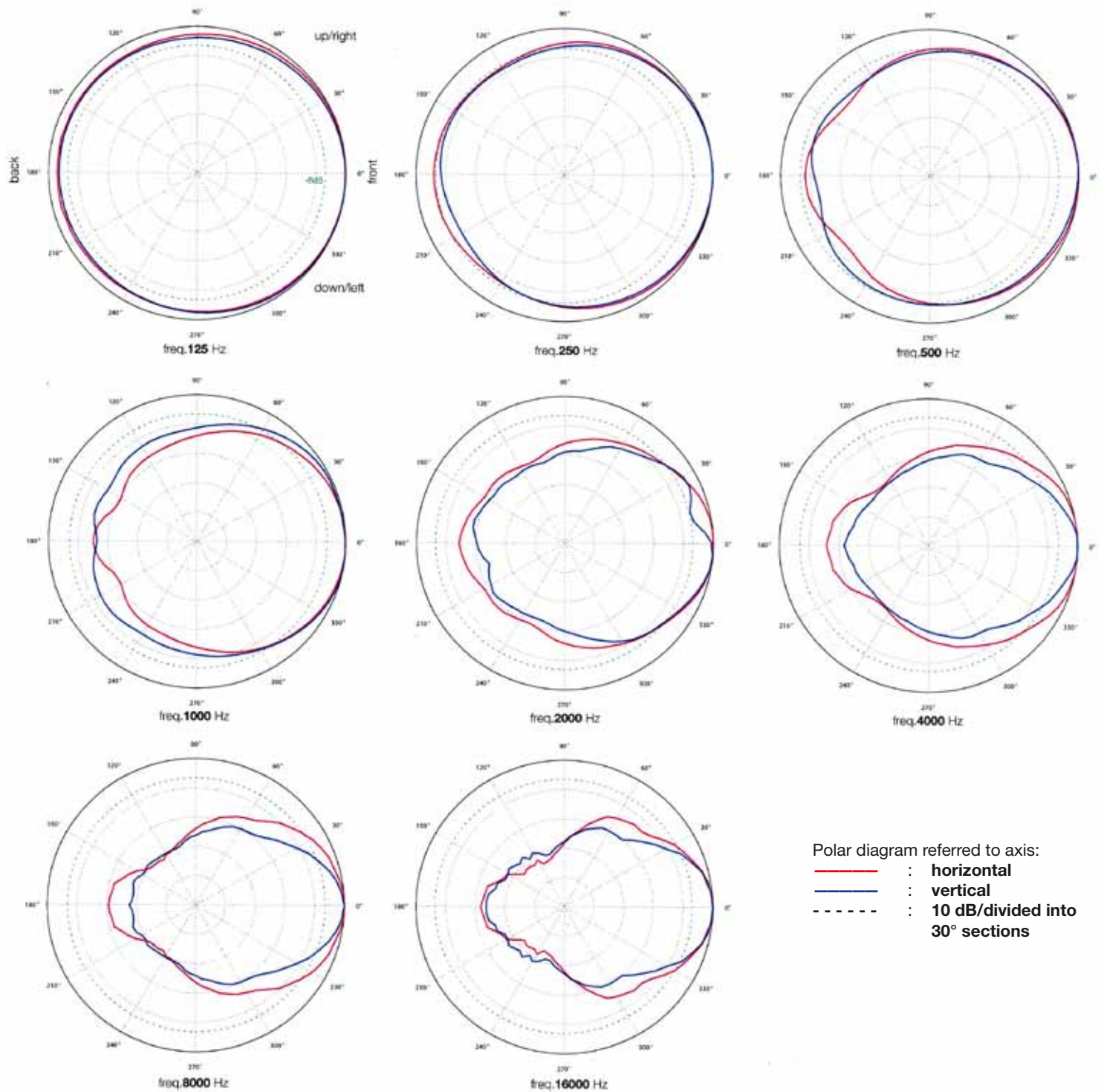


HD2050.30



Directivity:

Polar diagrams by frequency referred to emission axis.



Ordering Codes

HD2050.30: Directional façade loudspeaker, (signal cable HD2050.1.5 excluded).

Accessories

hd2050.30.1: Protective bag with shoulder straps and handle.

HD2050.30.2: 45° holder for the case of façade loudspeaker HD 2050.30. Used to direct the case to 45° or to hoist HD 2050.1 on the tripod.

HD2050.1: Stand for HD 2050 dodecahedron, with steering wheels, extensible and retractile. Minimum height 1300mm, maximum height 2050mm, Damping of the extensible rod.

HD2050.1.5: Signal cable, length 5 m.

HD2050.20: Digital power amplifier with integrated parametric equaliser. Includes: Flight-case, power cord HD2050.2, and remote control kit HD2050.20R.

HD 2050.40

Subwoofer

HD 2050.40 passive subwoofer, is designed to work in conjunction with HD 2050 dodecahedron. The system composed of HD 2050.40 subwoofer, HD2050 dodecahedron and HD 2050.20 digital power amplifier allows to meet measurement requirements in the highest acoustic insulation situations.

Acoustic testing laboratories, high performance acoustic materials manufacturers, acoustic engineers with specific measurement needs or in general where it is needed a lot of sound energy at low and high frequency, they will find in this system a complete and effective tool.

Features:

• High performance materials Sound Insulation

A 130 dB SPL in the frequency range **45 Hz to 120 Hz** allows the subwoofer HD 2050.40, combined with HD 2050 dodecahedron and HD 2050.20 digital power amplifier, to excite rooms in order to measure extremely high insulations at lower frequencies. HD 2050.40 is the correct solution for laboratories with measurement requirements up to date with the development of high-performance insulating materials in construction and shipbuilding fields.

• Large rooms architectural acoustics

HD 2050.40 subwoofer integrates HD 2050 dodecahedron in applications where reverberation time measurement of high-volume environments is needed. In such environments, often the sound power and frequency extension characteristics of dodecahedron loudspeaker, are not sufficient to recreate a good diffuse sound field or even high sound pressure levels on the walls of large rooms. The measures in these sound field conditions can be unreliable, or heavily dependent on the need for a very low background noise. In these cases, HD 2050.40 is the correct solution.

Applications:

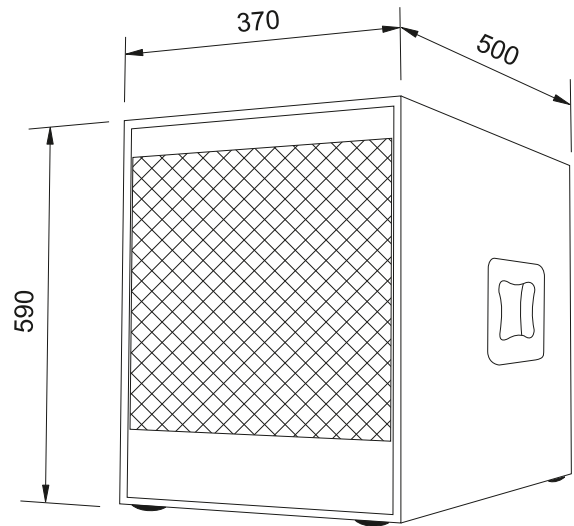
- High level sound insulation
- Sound absorption
- Large rooms reverberation time measurements

Technical specifications:

RMS Power	500 W
Nominal impedance	4 ohm
Loudspeaker	LF 1 x 12" (neodimium magnet)
Emission	130 dB spl peak @ 1 m
Frequency range	45 Hz ÷ 120 Hz
Connectors	2x Neutrik® NL4 speakON
Dimensions	500 x 500 x 370mm
Weight	22 kg
Finishing	Geal-coat anti-scratch
Amplifier	To be combined with HD 2050.20 digital power amplifier

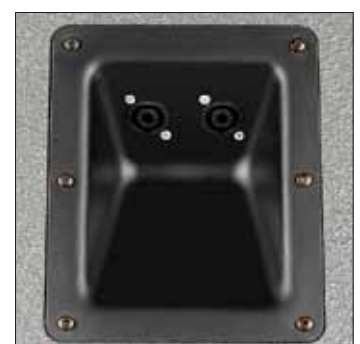
Note: Neutrik® is a registered trademark of Neutrik AG.

Dimensions (mm)



HD2050.40

Input



Ordering codes

HD2050.40: Subwoofer.

Accessories

HD2050.40.1: Extensible stand for HD 2050 dodecahedron mounting on subwoofer. HD2050.40 Height min. 1370mm, max. 1970mm (subwoofer + stand + wheels).

HD2050.1.5: Signal cable, length 5m.

HD2050.1.2: Signal cable, length 2m.

Order codes for a complete system for building acoustics

HD2040: Machine for the production of footfall noise in accordance with ISO 140-6, ISO 140-7, ISO 140-8, ASTM E492 and E1007. Complete with rechargeable lithium-ion battery HD 2040-B, built-in battery charger, remote control HD 2040-R, Antenna HD 2040-A, Instruction Manual. **Optional carrying case.**

HD2040-V: Carrying case for the machine HD 2040.

HD2050: Dodecahedron in accordance with ISO 140-3 and ISO 3382. Complete with signal cable HD 2050.1 and cable HD2050.1.L.

HD2050V: Case for dodecahedron HD 2050.

HD2050.1: Stand for dodecahedron HD 2050, with wheels, extendable and foldable. Minimum height 1300 mm, maximum height 2050 mm. With rod damping system.

HD2050.1.S: Carrying bag for stand HD 2050.1 and telescopic rod HD 2050.40.1.

HD2050.20: Digital Amplifier with integrated parametric equalizer. Complete with flight case, power cord HD 2050.2, and remote control kit HD 2050.20R.

HD2050B: Kit for battery power 4 x 100 VA - 700 W. Autonomy 15 minutes at max. power.

HD2050.20R: remote control kit for the control of the internal generator of HD 2050.20. Composed of receiver and transmitter with activation switch. Range of use up to 100 m.

HD2050.30: Façade loudspeaker (signal cable HD 2050.1.5 not included).

HD2050.30.1: Protective case for the Façade loudspeaker HD 2050.30.

HD2050.30.2: 45° holder for the case of façade loudspeaker HD 2050.30. Used to direct the case to 45° or to hoist HD 2050.1 on the tripod.

HD2050.40: Subwoofer complete with transport wheels. (The needed signal cable HD 2050.1 for connection to the dodecahedron HD 2050 is not included)

HD2050.40.1: Telescopic pole to mount the dodecahedron on subwoofer HD 2050.40. Minimum height 1370 mm, maximum height 1970 mm (subwoofer + pole + wheels).

HD2050.1.5: Signal cable, length 5 m.

HD2050.1.2: Signal cable, length 2 m.

HD2050.20.2: Mains power cable for amplifier HD 2050.20.

HD2050.20.1: Connection cable for generator- amplifier HD 2050.20.

HD2050.1.L: L-shaped signal switch for dodecahedron.



Manufacture of portable and bench top scientific instruments
Current loop and voltage output transmitters and regulators
Temperature - Humidity, Dew point - Pressure - CO₂
Air speed - Light - Optical Radiation - Acoustics - Vibration
pH - Conductivity - Dissolved Oxygen - Turbidity
Elements for weather stations - Thermal Microclimate



LAT N° 124 Signatory of EA, IAF and ILAC Mutual Recognition Agreements
Temperature - Humidity - Pressure - Air speed
Photometry/Radiometry - Acoustics

CE CONFORMITY

- **Safety:** EN61000-4-2, EN61010-1 Level 3
- **Electrostatic discharge:** EN61000-4-2 Level 3
- **Electric fast transients:** EN61000-4-4 Level 3, EN61000-4-5 Level 3
- **Voltage variations:** EN61000-4-11
- **Electromagnetic interference susceptibility:** IEC1000-4-3
- **Electromagnetic interference emission:** EN55022 class B

