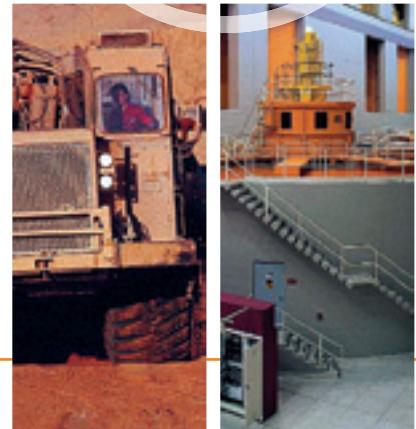




Acoustics and Vibration



Acoustics

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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. HD2010UC is equipped with a backlit graphic display.*

Technical regulations:

- Class 1 or 2 sound level meter according to IEC 61672-1 dated 2002 (Type Approval Certificate I.N.RI.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" option required)
- Identification of impulsive noises,
- Measurements in workplaces,
- Selection of personal protective equipment (SNR and HML methods),
- Production quality control,
- Measurement of machine noise, sound power measurements.

With HD2010UC sound level meter it is possible to measure the sound pressure 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 L_{eq}, SEL, maximum and minimum sound levels with integration times from 1 second to 99 hours. If an undesired sound event produces an overload 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 software package.

As a **statistical analyzer** (option HD2010.02 "advanced data-logger" compulsory) the HD2010UC samples the sound signal 8 times per second with A-frequency weighting and FAST time constant, and analyzes it statistically in 0.5 dB classes. It is possible to display up to 3 percentile levels between L₁ and L₉₉. 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 fast 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 long term measurements, it's possible to 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 (class 1 or class 2 according to the sound level meter version) 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 measurements according to the law with respect to workers' protection from exposure to noise (D.Lgs.n.81/2008, UNI 9432/2011, ISO 9612/2011). The selection of the personal protective equipment (PPE) can be carried out through comparison of the A and C weighted equivalent sound pressure levels that can be measured simultaneously (SNR method).



HD WME

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 in the proximity of 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 output: A-weighted sound level with FAST time constant, updated 8 times per second (\varnothing 2.5mm jack).
Un-weighted LINE output (\varnothing 3.5mm jack).
RS232C standard serial port according to EIA/TIA574. Baud Rate from 300 to 115200 bauds.
USB 1.1 serial port.
9÷12Vdc External power supply (\varnothing 5.5mm jack).

Options and accessories:

HD2010MC card reader (“Advanced Data Logger” option required)

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 with up to 2GB capacity. 2GB memory card is supplied.

Option HD2010.02 “Advanced Data Logger”

It displays and records the A-weighted **sound pressure 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 with option HD2010.00). “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 SEL.

This option integrates the sound level analyser functions, with the following additional features

- **Statistical analysis** available in graphic form both as probability distribution and as cumulative distribution.
- **Capture of sound events** with trigger activated using a threshold level and filter length.
- **REPORTS** function which allows to log 5 additional overall parameters with logging interval from 1 s to 1 hour and complete statistical analysis.
- Record of the event parameters with the possibility of setting the maximum time resolution for the record of events and a lower resolution for the ground recording.
- Possibility to store **markers**.
- **Timer for delayed start of acquisition.**

Option HD 2010.0R “Heated preamplifier”:

replacement of the standard preamplifier HD2010PNE2 with the heated version HD2010PNE2W. The heated preamplifier can be combined with the outdoor microphone protection HDWME and is equipped with CTC device for electrical calibration and 5m integrated extension cable (10m on request).

Post-processing software:

Noise Studio

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

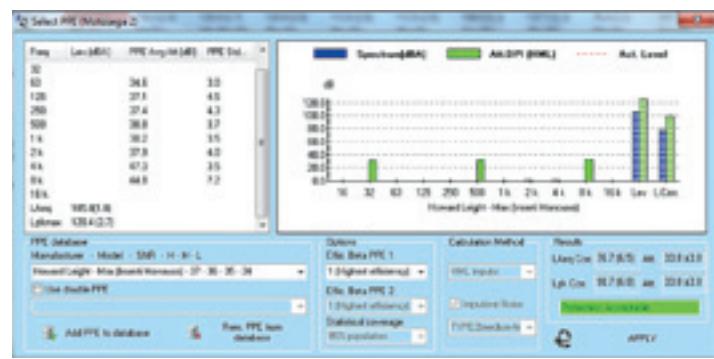
Transfer of stored data from the sound level meter to the PC memory.
Visualization of the acquired data in a graphic and tabular form.
Export to Excel and PDF format.
Printing of graphs and data tables.
Control of acquisition from a PC.
Sound level meter configuration via PC. User configurations management and storage.
Sound level meter firmware update.

It results easier to create reports starting from the sound level meter's measurements due to the handy function which allows to copy and paste graphs or tables to other applications and to create PDF files.

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

Noise Studio NS1: ‘Workers protection’ module (to be activated by license)

This application module analyses noise and vibrations in the workplace according to the European directives 2003/10/EC, 2002/44/EC, UNI 9432/2011 and ISO 9612/2011. Sound level measurements and vibration measurements in workplaces are organized in a project where they can be handled and analysed according to standards requirements. The company information, the list of workers and the noise or vibration sources are organized in a database. In addition to calculating the noise exposure of workers the program allows to evaluate the effectiveness of personal protective equipment (PPE) using the SNR, HML and OBM methods (the method applied depends on the presence or not of octave band spectrum on the sound level meter performances). According to UNI 9432/2011, the program also calculates the impulsiveness index of a noise source. The software creates complete reports both for individual worker and synthetic including the company exposition summary. Reports can be exported or printed directly.



Noise Studio: NS1 “Workers Protection” module; PPE effectiveness analysis.

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

This application module analyzes sound level profiles for the assessment of the noise climate, airports noise, road traffic noise and railway noise according to 2002/49/CE Directive.

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

Noise profiles detected outdoor, are analyzed in order to search for annoying 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 detection and analysis of sound events. **This module works on time histories acquired with option “Advanced Data Logger” installed on the sound level meter.**

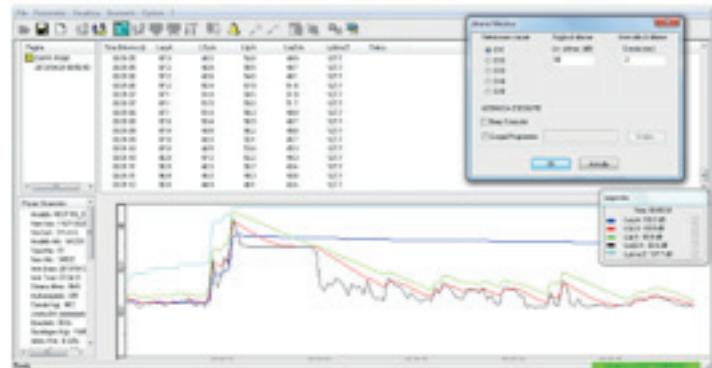


Noise Studio: NS2A “Acoustic Pollution” module; railway traffic noise, 24h analysis with automatic identification of train transits.

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 features are:

- Real time display of acquired data, in graphical and tabular form.
- Possibility to remotely connect to the sound level meter via modem.
- 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 to log synchronized audio along with the sound level meter measurements, by using the easy trigger function.



Noise Studio: NS4 "Monitor" module; PC based noise acquisition with synchronized audio recording (for later playback).

ORDERING CODES

HD2010UC kit 1 and kit 2: it includes class 1 sound level meter HD2010UC (class 2 for HD2010UC kit2), HD2010PNE2 preamplifier, UC52/1 free field prepolarized microphone (UC52 microphone for HD2010UC kit2), windscreens, USB (HD2110USB) connection cable (alternatively on request RS232C connection cable). Noise Studio PC software, carrying case and paper instruction manual. Supplied with ACCREDIA individual calibration Certification, according to IEC 61672.

Accessories and options

Option HD2010.00 "Memory module": 4MB expansion memory. **HD2010.02 "Advanced Data Logger" option required.**

Option HD2010.02 "Advanced Data Logger": automatic logging of time history noise 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, view and analyze stored data.

Option HD 2010.OR "Heated preamplifier": replacement of the standard preamplifier HD2010PNE2 with the heated version HD2010PNE2W. The heated preamplifier can be combined with the outdoor microphone protection HDWME and is equipped with CTC device for electrical calibration and 5m integrated extension cable (10m on request).

HD2020: Class 1 sound calibrator according to IEC60942:2003 (I.N.R.I.M. n.90-003-01 Type approval Certificate). Features:

- Static pressure compensation from 65kPa to 108kPa,
- Cavity for ½" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB noise levels.

The calibrator is provided with ACCREDIA individual calibration Certification.

HD9101: Class 1 sound calibrator according to IEC60942:1988. Features:

- Cavity for ½" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound levels.

The calibrator is provided with ACCREDIA individual calibration Certification.

HD9102: Class 2 sound calibrator according to IEC 942:1988. Features:

- Cavity for ½" microphones according to IEC 61094,
- 1000Hz frequency,
- 94dB/114dB sound levels.

The calibrator is provided with ACCREDIA individual calibration Certification.

HD2010PNE2: Preamplifier for UC52/1 and UC52 microphones, equipped with CTC device for electrical calibration and driver for cable up to 10 m

HD2010PNE2W: Heated preamplifier for UC52/1 and UC52 microphones, with 5m integrated extension cable (10m on request). The preamplifier can be combined with the microphone outdoor protection HD WME and is equipped with CTC device for electrical calibration

HD2110RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110USB: serial USB cable for PC connection.

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

CPA/5: 5m microphone extension cable.

CPA/10: 10m microphone extension cable.

VTRAP: Tripod, 1550 mm maximum height.

VTRAP.H4: Tripod with 4 m maximum height. Max. load 10 kg

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, 2GB SD card included.

HDWME: Outdoor microphone protection with windscreen, rain shield and birds spike. Can be combined with the HD2010PNE2W preamplifier. Includes: windscreen HDSAV3, birds spike HDWME1, rain shield HDWME2, stainless steel support HDWME3

Software for Windows® operating systems

Noise Studio: Programme for Windows® (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. When plugged into the USB port, according to licence purchased, it enables the following Noise Studio software modules:

NS1: Noise Studio "Workers' Protection" module activation. Noise and vibration analysis in the workplaces according to UNI 9432/2011, ISO 9612/2011 and 2003/10/CE and 2002/44/CE European directives.

NS2A: Noise Studio "Acoustic Pollution" module activation. Acoustic climate analysis and evaluation of road, railway and airport traffic noise (According to 2002/49/CE Directive). **Requires HD2010.02 "Advanced data logger" option**

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

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:

- octave bands spectral analysis
- ACCREDIA calibration Certification of the sound level meter and the octave filter bank.

HDSAV: Windscreen for ½" microphones.

HDSAV3: Windscreen for HD WME microphone weather protection.

HDWME1: Bird spike for HD WME microphone weather protection.

HDWME2: Rain shield for HD WME microphone weather protection.

HDWME3: Stainless steel housing for the preamplifier of HDWME microphone weather protection, including holder for rain shield HDWME2.

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

UC52: Class 2 free field pre-polarized microphone.



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 free field, pre-polarized, condenser type .
Dynamic range	30 dBA ÷ 143 dB Peak
Linearity range	80 dB
Acoustic Parameters	Spl, L _{eq} , L _{eqL} , SEL, L _{EP,d} , L _{max} , L _{min} , L _{pk} , Dose, L _n
Frequency Weightings	simultaneous A, C, Z (only C and Z for L _{pk})
Time Weightings	simultaneous FAST, SLOW, IMPULSE
Integration	from 1s to 99 hours with erasing function (Back-Erase)
Statistical Analysis	<p>It displays up to 3 percentile levels, from L₁ to L₉₉ Probability distribution and percentile level calculation from L₁ to L₉₉ (HD2010.02 "Advanced Data Logger" option required)</p> <ul style="list-style-type: none"> ✓ Parameter: L_{Fp}, L_{eq}, L_{pk} weighted A, C or Z (only C or Z for L_{pk}) ✓ Sampling frequency: 8 samples/second ✓ Classification: Classes of 0.5 dB
Analysis of Events (Option HD2010.02: "Advanced Data Logger")	<ul style="list-style-type: none"> ✓ Calculation of 5 freely-programmable event parameters ✓ Calculation of statistical levels from L₁ to L₉₉ ✓ Event identification trigger with programmable threshold and duration filter ✓ Manual trigger
Profile Data Logging (Option HD2010.02: "Advanced Data Logger")	Parallel profiles, reports, events acquisition 1 profile with sampling 1/8 s + 3 customizable parameters profiles with 2 samples/second + 5 customizable parameters profiles with 1 s to 1 hour sampling period (Reports mode) ,
Display	Graphic LCD backlit display 128x64 <ul style="list-style-type: none"> ✓ 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 L₁ to L₉₉ (Option HD2010.02: "Advanced Data Logger")
Memory	<ul style="list-style-type: none"> ✓ 4 MB internal, memory for more than 500 records . If HD2010.02 option 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 HD2010MC memory card interface, using SD memory cards up to 2 GB.
Input/Output	<ul style="list-style-type: none"> ✓ RS232 serial and USB interfaces ✓ AC output (LINE) ✓ DC output
PC Programs	Noise Studio (provided 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"> ✓ NS1 "Workers protection" module. Analysis of noise and vibrations in the workplace according to 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 roads, railways and airports according to European Directive on environmental noise. Requires option HD2010.02: "Advanced Data Logger". ✓ NS4 "Monitor" module. PC based real time acquisition. Synchronized audio recording. Remote monitoring and data capture. Remote connection also via Modem. The program allows programming of measurements and calibrations with timer and performs events audio recording with programmable triggers levels.
Operating conditions	<ul style="list-style-type: none"> ✓ Working temperature -10÷50°C, 25÷90%RH (without condensation), 65÷108kPa. Protection degree: IP64
Power Supply	<ul style="list-style-type: none"> ✓ 4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimension and weight	<ul style="list-style-type: none"> ✓ 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 multiparametric data logging capability. It is suitable for statistical and spectral analyses, the instrument has been designed by combining maximum flexibility, cost effectiveness and usability. Attention has been paid to the possibility to update the instrument in order to comply with the standards evolution concerning acoustics. In order to adapt to the current and future users needs, 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 software supplied with the instrument.

Technical regulations:

- Class 1 or 2 sound level meter according to IEC 61672-1-2002 (Type Approval Certificate 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 bands 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.

By using the HD2010UC/A, you can log the time profile of 4 simultaneous parameters freely selecting time or frequency weightings. The possibility to display, store and even print 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 can integrate 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 HD2010UC/A samples the sound signal 8 times per second with A-weighting and FAST time constant and analyzes it statistically in 0.5 dB classes. Up to 4 percentile levels, selectable between L₁ and L₉₉, can be programmed. It can be decided to sample the following: L_{Fp}, L_{eq} and L_{pk} with A, C and Z -weightings (only C and Z for L_{pk}).

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 multi-spectra
- Acquisition of **noise events** with the possibility to set the maximum temporal resolution for event recording and a lower resolution for background recording.



HD WME

- Possibility to record up to 9 different markers
- Timer for programming delayed start of acquisition

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 a printer. For example, should the supplied memory not be enough, this can be the case of long term monitoring campaign, 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 **environmental noise, noise monitoring** and acoustic mapping. Using the "Advanced datalogger", 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 **building 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 impulse 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 (\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).

Options and accessories:

HD2010MC 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 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. 2GB card is supplied.

Option "Third Octave" cod. HD2010.01

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. The third octave analysis can be also in "multi-spectrum" mode with 1s minimum logging time period, thanks to the REPORT data-logging mode.

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 octave bands from 125 Hz to 8 kHz and, optionally, third octave bands from 100 Hz to 10 kHz. Sampling interval $1/32$ s.

Automatic calculation of reverberation times EDT, T10, T20 and T30 for all bands. Additional post processing of RT decays can be performed via NS3 Noise Studio software module available as an option.

Option "Heated preamplifier" cod. HD 2010.0R

Replacement of the standard preamplifier HD2010PNE2 with the heated version HD2010PNE2W. The heated preamplifier can be combined with the outdoor microphone protection HDWME and is equipped with CTC device for electrical calibration and 5m integrated extension cable (10m on request).

Software:

Noise Studio

The Noise Studio software allows interfacing HD2010UC/A 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.
- Isophonic curves superposition over third octave charts
- Control of acquisition from a PC.
- Sound level meter setup management.
- Sound level meter firmware update.

It results easy to create documents regarding the sound level meter's measurements 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 noise and vibration analyses. Different software modules are available for specific applications; they can be enabled by purchasing the proper 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 and vibrations in the workplace according to the European Directive **2003/10/EC**, and technical standards **ISO9612/2011** 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: NS1 "Workers Protection" module; PPE effectiveness analysis.

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

This application module analyzes noise level profiles for the assessment of noise produced by industrial plants, construction sites, airports, roads, railways and transport infrastructures.

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

The noises profiles are analyzed in order to search for disturbing sources characterized by a sequence of events such as railways and airports (SEL calculations). The analysis is performed on a daily basis with a resolution of 1/8 s and with automated search and analysis of sound events.

Some of the functions require option HD2010.01 "Third octaves".



ORDERING CODES

HD2010UC/A kit1 and kit2: it includes HD2010UC/A class 1 sound level meter (class 2 for HD2010UC/A kit2), HD2010PNE2 preamplifier, UC52/1 free field microphone (UC52 for HD2010UC kit2), windscreens and serial RS232 or USB connection cable. Noise Studio PC programme. Supplied with individual ACCREDIA calibration Certification, according to IEC 61672. ACCREDIA Certification of CPB filters according to IEC 61260.

Options and 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.

Option HD 2010.OR "Heated preamplifier":

replacement of the standard preamplifier HD2010PNE2 with the heated version HD2010PNE2W. The heated preamplifier can be combined with the outdoor microphone protection HDWME and is equipped with CTC device for electrical calibration and 5m integrated extension cable (10m on request).

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

- Static pressure compensation from 65kPa to 108kPa,
- Cavity for ½" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB noise levels.

The calibrator is provided with ACCREDIA individual calibration Certification.

HD9101: Class 1 sound calibrator according to IEC60942:1988. Features:

- Cavity for ½" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound levels.

The calibrator is provided with ACCREDIA individual calibration Certification.

HD9102: Class 2 sound calibrator according to IEC 942:1988. Features:

- Cavity for ½" microphones according to IEC 61094,
- 1000Hz frequency,
- 94dB/114dB sound levels.

The calibrator is provided with ACCREDIA individual calibration Certification.

HD2010PNE2: Preamplifier for UC52/1 and UC52 microphones, equipped with CTC device for electrical calibration and driver for cable up to 10 m

HD2010PNE2W: Heated preamplifier for UC52/1 and UC52 microphones, with 5m integrated extension cable (10m on request). The preamplifier can be combined with the microphone outdoor protection HDWME and is equipped with CTC device for electrical calibration

HD2110RS: serial RS232 cable for connection to a PC or to HD40.1 printer.

HD2110USB: serial USB cable for connection to a PC

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

CPA/5: 5m microphone extension cable.

CPA/10: 10m microphone extension cable.

VTRAP: tripod, 1550mm maximum height.

VTRAP.H4: Tripod with 4 m maximum height. Max. load 10 kg

HD2110/SA: support to fix preamplifier to tripod.

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

BAT40: spare battery pack for HD40.1 printer

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, 2GB SD card included.

HDWME: Outdoor microphone protection with windscreens, rain shield and birds spike. Can be combined with the HD2010PNE2W preamplifier. Includes: windscreen HDSAV3, birds spike HDWME1, rain shield HDWME2, stainless steel support HDWME3

Software for Windows® operating systems

Noise Studio: software for Windows® (32-64bit) supplied with the sound level meter kit. It allows sound level meter configuration, download, export and graphic display of stored data. This software supports acoustic and vibration post processing application modules, which can be enabled by licence with protection hardware key. Noise Studio includes demo versions of the application modules.

CH20: Hardware key for PC working with Windows® operating system. When plugged into the USB port, according to licence purchased, it enables the following Noise Studio software modules:

NS1: Noise Studio "**Workers' Protection**" module activation . Noise and vibration analysis in the workplaces according to UNI 9432/2011, ISO 9612/2011 and 2003/10/CE and 2002/44/CE European directives.

NS2A: Noise Studio "**Acoustic Pollution**" module activation. Acoustic climate analysis and evaluation of road, railway and airport traffic noise (according to 2002/49/CE Directive). **Some of the functions require HD2010.01 "Third Octaves" option**

NS3: Noise Studio "**Acoustic Insulation**" module activation. Architectural and building acoustic according to ISO354, ISO140 and ISO717 series standards and UNI11367/10. **For some calculations sound level meter options HD2010.01 "Third Octaves" and HD2010.04 "Reverberation Time" are required.**

NS4: Noise Studio "**Monitor**" module activation. 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 national (D.M. 16/03/1998) and EU legislation regarding noise pollution.

Noise Studio combined packages:

NSA: "Environment" modules package including:

NS2A: "Acoustic Pollution"

NS5: "Environmental Noise"

NSLA: "Work & Environment" modules package including:

NS1: "Workers Protection"

NS2A: "Acoustic Pollution"

NS5: "Environmental Noise"

NSE: "Environment & 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"

Ordering codes for spare parts and other accessories

HD SAV: Windscreen for ½" microphones.

HDSAV3: Windscreen for HDWME weather protections.

HDWME1: Bird spike for HDWME weather protection.

HDWME2: Rain shield for HDWME microphone unit.

HDWME3: Stainless steel housing for the preamplifier of HDWME weather protection, with holder for rain shield HDWME2.

UC52/1: Class 1 free field pre-polarized ½" microphone .

UC52: Class 2 free field pre-polarized ½" microphone.



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
Linearity range	80 dB
Acoustic Parameters	Spl, L _{eq} , L _{eqL} , SEL, L _{EP,d} , L _{max} , L _{min} , L _{pk} , Dose, L _n
Frequency Weightings	Simultaneous A, C, Z (only C and Z for L _{pk})
Time Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function
Spectrum Analysis	Parallel CPB 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 – Multi-spectrum in "REPORT" 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	Parallel profiles, reports, events acquisition ✓ 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 HD2010.04)	Reverberation time measurement using sound source interruption or impulse response integration Reverberation time calculation in 1/3 octave requires option HD2010.01 "Third Octave"
Profile Data Logging	1 profile with sampling 1/8 s and 3 profiles with 2 samples/second, 5 parameters profiles in "Report" mode with minimum sampling interval 1s.
Spectrum Data Logging	Programmable sampling from 1 second to 1 hour (AVR mode). Multi-spectrum data logging in "Report" mode with minimum sampling interval 1s.
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 HD2010MC 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 "Workers protection" module. Analysis of noise in the workplace in accordance with ISO 9612/2011 and UNI 9432/2011. ✓ 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). Some of the calculation require option "Third octaves" and option "Reverberation time" installed in the sound level meter. Calculation according to ISO140, ISO717 and ISO354. ✓ NS4 "Monitor" module. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem. ✓ NS5 "Environmental Noise" module: environmental noise analysis. Noise sources identification with threshold conditions. Tonality and impulsiveness evaluation. Some of the functions require "Third octave" option.
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)



HD 2110L

INTEGRATING SOUND LEVEL METER - PORTABLE ANALYZER

The HD2110L is a precision integrating portable sound level meter, with multiparametric data logging capability, providing both spectral and statistical analysis. The instrument has been designed in order to offer high-performance analysis of acoustic phenomena, with particular regard to legislation on environmental noise. Attention has been paid to the possibility to update the instrument in order to comply with the technical standards evolution. The HD2110L can be integrated with additional options to extend its application range when required; the firmware can be updated directly by the user by means of the Noise Studio program provided with the instrument.

Technical regulations:

- Class 1 sound level meter according to IEC 61672-1, 2002 (Type Approval Certificate 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

Features

- real time spectral analysis in **octave** bands from 16Hz up to 16KHz
- real time spectral analysis in **third octave** bands with a double bank of filters: from 16Hz up to 20KHz and alternatively from 14Hz up to 18KHz (**option HD2110.01**)
- narrow band **FFT** real time spectral analysis from 7Hz up to 22KHz with variable resolutions from 1.5Hz a 100Hz. Short Leq profile acquisition with 1/32s period (**option HD2110.06**)
- **statistical analysis** with probability distribution calculation in 0.5dB classes; calculation of all percentiles from L₁ to L₉₉.
- parallel storage of all **multi-parametric time profiles, reports** at programmable intervals and reports associated to specific **noise events** (automatically or manually identified).
- **reverberation time** measurement with *steady noise interruption* or with *back integration of impulse response* (**option HD2110.04**)

Applications:

- **Noise monitoring** with sound event capture and analysis function,
- **Environmental noise measurement**,
- Assessment of **noise tones** even if they are at a frequency located between two standard third octave band filters (with shifted bands filters),
- Assessment of **audibility of spectral components** through real time comparison with equal loudness curves (ISO226)
- Evaluation of **noise exposition** in workplaces, and selection of **personal protective equipment** (SNR, HML and OBM methods),
- **Sound insulation** and reclamation
- Production quality control,
- Measurement of machine noise, **sound power** measurements (sound pressure method)
- **Architectural acoustics** and **building acoustics** measurements.

Inputs and outputs

- LINE unweighted input/output (Ø 3.5 mm jack).
- DC output: A-weighted sound level with FAST time constant, updated 8 times per second
- TRIGGER input/output (Ø 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÷12Vdc (Ø 5.5 mm jack).

Functionality description

Acquisition

- Possibility to log time profiles of 6 simultaneous parameters freely selecting time or frequency weightings.
- Possibility to store the multi-parameter sound level analysis for more than 46 hours. Different time recordings can be recalled from internal memory and displayed and replayed using "Replay" function.
- In addition to sound level profiles, it's possible also to log at programmable intervals of 1s to 1h, report sequences with dedicated parameters, average spectra and full statistical analysis. A versatile trigger function allows to identify sound events and store results with 5 dedicated parameters, average spectra and statistical analysis.



HD WME

Dynamic capacity

- The measurement dynamic range exceeds 110 dB and it is limited in the lower range only by the instrument intrinsic noise. For example, by setting the full scale at 140 dB, it's possible, without modifying the gain setting, to carry out noise measurements in a quiet office with high accuracy and without overload indications at peak levels up to 143 dB.
- Thanks to its high dynamic range, long integrations can be carried out with a minimum possibility of under- or over-range indications.

Spectral Analysis

- Real time spectral analysis is carried out in parallel with the logging of 6 time profiles, both by octave and third octave bands (**option HD2110.01**).
- The spectrum of sound signal is calculated twice a second and integrated linearly for up to 99 hours.
- It's possible to perform multi-spectrum CPB analyses, even maximum or minimum, both with linear or exponential time constants (Fast or Slow).
- Spectra are displayed together with an A, C or Z -weighted overall levels. Lin, A or C weightings are available for spectrum ponderation.
- The third octave band spectral analysis (**option HD2110.01**) can be carried out, in addition to standardized bands 16Hz - 20kHz, also with bands shifted downwards by $\frac{1}{6}$ th octave, from 14Hz to 18kHz. This feature is useful to evaluate tones having a frequency close to filters crossing frequency (two third octave filters).
- While the third octave band spectrum (**option HD2110.01**) is displayed, it's possible to superimpose in real time the equal loudness curves (ISO226), for a fast estimation of spectral components audibility.

Statistical analysis

- As a statistical analyzer, the HD2110L samples the sound signal 8 times per second and analyses it in 0.5 dB classes.
- 4 percentiles values can be directly displayed on the screen. Additional percentiles can be calculated as reports.
- Calculation and direct display of probability distribution and cumulative distribution from L_1 to L_{99}
- You can program to sample L_{Fp} , L_{eq} or L_{pk} with A, C and Z-weightings (only C and Z for L_{pk}).

Analog Input/Output

- 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.
- Audio tracks recorded with other instruments can also be analyzed using the Line input.
- DC output: L_{AFp} 1/8s

Calibration

- The calibration can be performed either by using an 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.

Diagnostics

- 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 possible damages occurred to the instrument, microphone included, can be promptly identified thanks to a complete diagnostic 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.

PC connection

- The RS232 and USB interfaces, allow quick data transfers from the sound level meter to the PC memory. For example, should the internal memory not be enough, in case of long term recordings, it's possible to activate the "Monitor" function that allows sending the displayed data to a PC via the serial interface and storing them directly on the PC mass memory.
- The HD2110L can be completely controlled by a PC through the multi-standard serial interface (RS232 and USB) by using a dedicated communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.
- Remote electrical calibrations and diagnostic tests can be executed using its remote control capabilities.

Reverberation time

- The HD2110L sound level meter with the "Reverberation Time" (**option HD2110.04**) can measure the T60 both using the sound source interruption method or the *impulse response integration* technique.
- The sound level meter's powerful DSP calculates 32 spectra/second allowing T60 calculations from 0.375s (according to ISO 3382), and it carries out simultaneously both octave and optional (**option HD2110.01**) third octave bands analysis.

Applications

Environmental noise

- It's possible to perform sound level monitoring, acoustic mapping and the assessment of the acoustic climate with capture and analysis of sound events.
- When measuring airports, railways and roads noise, the sound level meter can work as a multi-parameter sound level recorder, combining statistical and spectrum analyzer features.
- Impulsive events can be easily identified thanks to the ability to analyse the A-weighted profiles with FAST, SLOW, and IMPULSE time constants. All measurement parameters can be stored for later analysis.
- The identification of tonal noises is also easy as it is possible to display and record the minimum spectrum with any wideband weightings (Z, C or A) both by third octave bands (**option HD2110.01**) with standard nominal frequencies (16Hz - 20kHz), and with shifted by $\frac{1}{6}$ th oct. central frequencies (14Hz to 18kHz).
- The tonal component audibility can be evaluated in the field thanks to the real-time calculation of equal loudness curves (ISO 226) directly on the SLM's display or using the Noise Studio software supplied.

Workers protection

- The HD2110L sound level meter can perform the measurements required to evaluate workers' noise exposure (European Directive 2003/10/CE). PPE can be selected through octave band spectral analysis (OBM method) or comparing the A and C-weighted equivalent levels measured simultaneously (SNR method).
- If an undesired sound event causes an overload indication, or simply alters the integration result, its contribution can be excluded using the Back-Erase function.
- Sources impulsivity can be evaluated using the IMPULSE time constant (L_{Aeq} descriptor compared to L_{Aeq})

Software for Windows® operating systems:

CH20: Hardware key for PC with Windows® operating systems. Plugged into a USB port enables PCs to use Noise Studio's software modules.

Noise Studio

The Noise Studio programme, supplied in the sound level meter kit, allows interfacing HD2110L to PC in a simple and intuitive way. It supports the *application modules* to be enabled with licence on the protection dongle. The software includes demo versions of the application modules. Main functions are:

- Transfer of stored data from the sound level meter to PC memory.
- Display of data in graphic and tabular format.
- Export to Excel and PDF format.
- Printing of graphs and data tables.
- Comparison of third octave bands spectra with ISO 226 noise contours.
- PC based data logging.
- Sound level meter user setup management.
- Sound level meter firmware update.

It results easier creating reports from sound level meter's measurements, thanks to the copy and paste function which allows to copy graphs or tables to external applications and to create PDF files.

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

This application module analyses noise and vibrations in the workplace according to the European directives 2003/10/EC, 2002/44/EC, UNI 9432/2011 and ISO 9612/2011. Sound level measurements and vibration measurements in workplaces are organized in a project where they can be handled and analysed according to standards requirements. The company information, the list of workers and the noise or vibration sources are organized in a database. In addition to calculating the noise exposure of workers the program allows to evaluate the effectiveness of personal protective equipment's (PPE) using the SNR, HML and OBM methods (the method applied depends on the presence or not of octave band spectrum on the sound level meter performances). According to UNI 9432/2011, the program also calculates the impulsiveness index of a noise source. The software creates complete reports both for individual worker and synthetic including the company exposition summary. Reports can be exported or printed directly.

Characteristics of sound-insulating structures. The data contained in the database can be graphically and numerically compared with on-site measures.

It's possible to calculate:

- Average reverberation time (ISO 3382)
- Reverberation time decays editing
- Acoustic classification according to UNI 11367/2010
- Service equipments 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 140/3, 4, 14 and ISO717-1)
- Insulation of facades and facade elements: indices $D_{2m,nT}$ and R_0 (ISO 140/5 and ISO717-1)
- Impact noise insulation: indices L_n , DL , L'_n and L'_{nT} (ISO 140/6, 7 and 8 and ISO717-2)

Most of the calculation require "third octave" and "reverberation time" options installed on the sound level meter.



Noise Studio: NS1 "Workers Protection" module; PPE effectiveness analysis.

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

This application module analyzes sound level profiles for the assessment of the noise climate, airports noise, road traffic noise and railway noise according to 2002/49/CE Directive.

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

Noise profiles detected outdoor, are analyzed in order to search for annoying 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 detection and analysis of sound events.

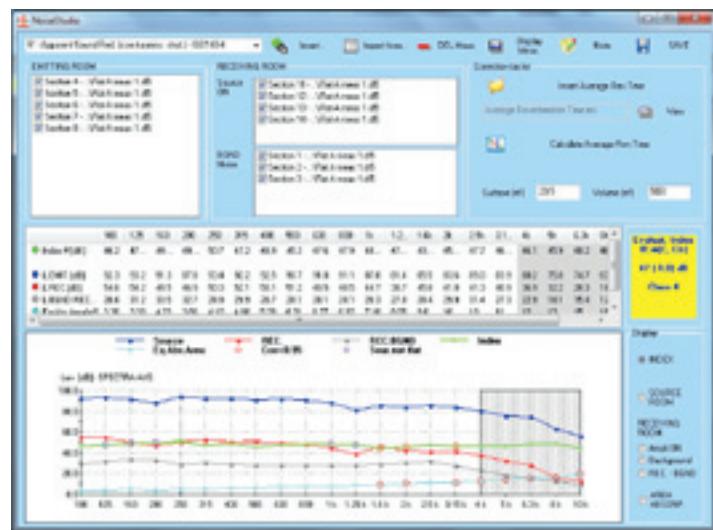


Noise Studio: NS2A "Acoustic Pollution" module; railway traffic noise, 24h analysis with automatic identification of train transits.

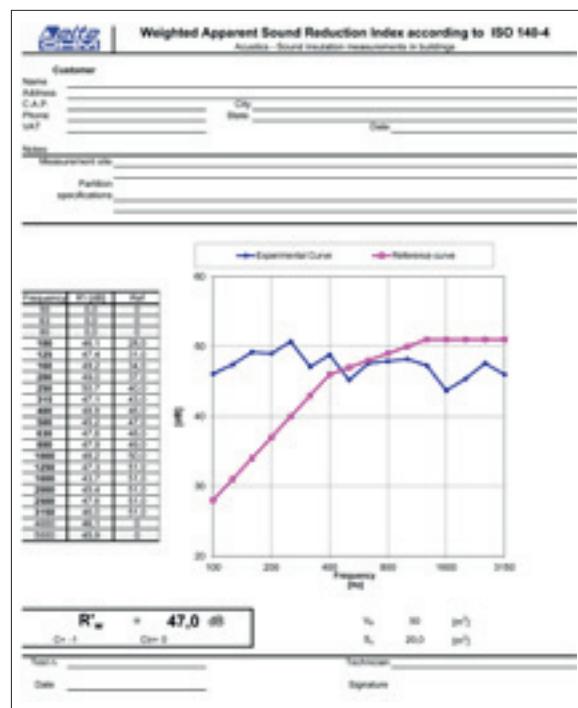
Noise Studio: NS3 'Acoustic Insulation' module (to be activated by license)

This module performs building acoustics calculations for the assessment of acoustic performances of buildings, according to ISO standard. The measurements necessary for the analysis of a building are grouped in a project to simplify their storage and search. 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 upgradable database, divided by walls and floors, contains the main charac-



Noise Studio: NS3 "Acoustic Insulation" module; calculation of *airborne sound insulation* and *impact noise* descriptors.

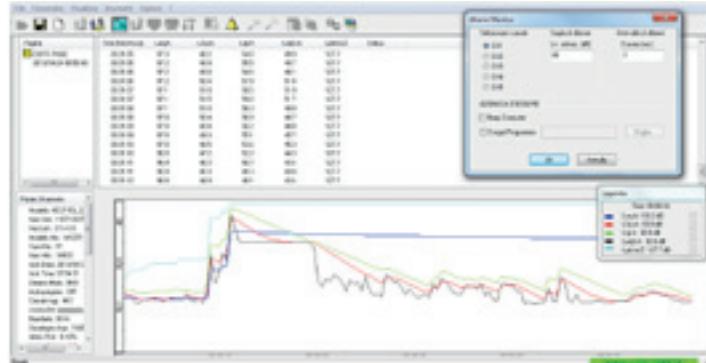


Noise Studio: NS3 "Acoustic Insulation" module; ISO717 report.

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:

- PC based 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 to log synchronized audio records along with the sound level measurements, using a trigger function.

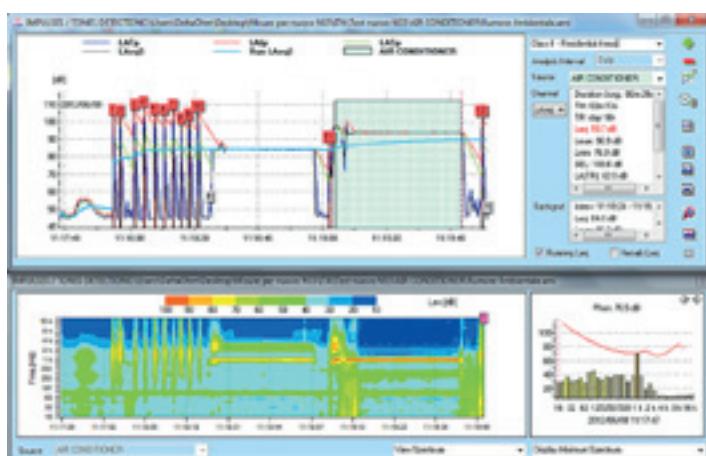


Noise Studio: NS4 "Monitor" module; PC based noise acquisition with synchronized audio recording (for later playback).

Noise Studio: NS5 "Environmental noise" module (to be activated by license)

Detailed analysis of acoustic pollution and environmental noise sources. The software performs statistical and spectral analyses; manually and automatically identifies, by means of the trigger function, single and combined sources. Partial sources levels can be calculated and compared to background noise. Masking and automatic search for pulse and tonal components. Automatic report and comparison with the limits, both absolute and differential.

Some of the functions require option HD2110.01 "Third octaves".



Noise Studio: NS5 "Environmental Noise" module; sound sources analysis with tonality and impulsiveness evaluation.

Options:

Option HD2110.01 "Third Octave": Third octave band spectrum analyzer according to class 1, IEC 61260 from 16Hz to 20KHz. Additional $\frac{1}{3}$ octave filters with shifted central frequencies from 14Hz to 18KHz.

The audibility of the different spectrum components can be evaluated thanks to the equal loudness curves (ISO 226:2003) displayed on the SLM's screen. Spectral analysis can be performed in multi-spectrum as well.

Option HD2110.04 "Reverberation Time": reverberation time **measurement both with steady** source interruption and with impulsive **noise back integration** method (**Shroeder's**) according to ISO 3382.

Reverberation time measurement performed in octave bands from 125 Hz to 8 kHz, and third octave bands (**option HD2110.01**) from 100 Hz to 10 kHz with sampling interval $\frac{1}{32}$ s.

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

Option HD2110.06 "FFT": constant bandwidth FFT analysis.

This option adds:

- Leq profile at $\frac{1}{32}$ s intervals.
- Narrow band spectrum analysis (FFT) from 7Hz up to 22KHz with spectral resolution from 1.5Hz to 100Hz.

HD2110.0P "Polarized microphone": replacement of the standard MC21E pre-polarized microphone and HD2110PEL preamplifier with the MC21P or MC22P microphone polarized at 200V and HD2110PL preamplifier.

HD2110.0R "Heated preamplifier": replacement of the standard preamplifier HD2110PEL with the heated version HD2110PEWL. The heated preamplifier is combinable with the microphone outdoor protection HDWME and is equipped with CTC device for electrical calibration and 5m integrated extension cable (other lengths 10, 20, 50 mt on request). **This option is available only in conjunction with MC21E or standard pre-polarized microphones. It's not compatible with option HD2110.OP**

Ordering codes and accessories

HD2110L.kit 1: includes, HD2110L sound level meter, MC21E pre-polarized $\frac{1}{2}$ " condenser microphone (alternatively MC21P or MC22P microphone polarized at 200 V) and HDSAV windscreen, HD2110PEL preamplifier (HD2110PL in combination with the microphone polarized at 200 V MC21P or MC22P), HD2110USB cable (alternatively, on request, HD2110RS serial cable for RS232 connection), Noise Studio software and carrying case, individual ACCREDIA calibration certificate, according to IEC 61672, of the chain consisting of sound level meter, preamplifier and microphone. ACCREDIA calibration certificate, according to IEC 61260, of the octave filters bank.

HD2110.01 "Third octave": spectral analysis with double bank of third octave from 16 Hz to 20 kHz and from 14 Hz to 18 kHz according to IEC61260. Evaluation of audibility of the spectral components by real-time comparison with the isophonic curves ISO 226:2003. ACCREDIA Calibration certificate according to IEC61260 of the bank from 20 Hz to 20 KHz included.

HD2110.04 "Reverberation time": reverberation time measurement by source interruption and integration of impulse response method.

HD2110.06 "FFT": $\frac{1}{32}$ s Short Leq profile and FFT spectral analysis over the entire audio range with variable resolution from 1.5 Hz to 100 Hz.

HD2110.OP "Polarized microphone": replacement of the standard MC21E pre-polarized microphone and HD2110PEL preamplifier with the MC21P or MC22P microphone polarized at 200V and HD2110PL preamplifier.

HD2110.OR "Heated preamplifier": replacement of the standard preamplifier HD2110PEL with the heated version HD2110PEWL. The heated preamplifier is combinable with the microphone outdoor protection HDWME and is equipped with CTC device for electrical calibration and 5m integrated extension cable (other lengths on request). **This option is available only in conjunction with MC21E or standard pre-polarized microphones. It's not compatible with option HD2110.OP.**



HD2020 Sound level calibrator class 1 IEC 60942:2003 with LCD display. Frequency 1000 Hz, levels 94 dB and 114 dB. **ACCREDIA individual calibration certificate included.**

HD9101: Sound level calibrator class 1 IEC 942:1988. Frequency 1000 Hz, levels 94 dB and 114 dB. **ACCREDIA individual calibration certificate included**

HD2010MC Module for data logging and data download to MMC or SD type memory cards, 2 GB SD card included.

HD2110PEL: Microphone preamplifier for MC21E pre-polarized microphones, equipped with CTC device for electrical calibration and driver for cable up to 100 m.

HD2110PL: Microphone preamplifier for MC21P and MC22P microphones polarized at 200V, equipped with CTC device for electrical calibration and driver for cable up to 100 m.

HD2110PEWL: Heated preamplifier for pre-polarized MC21E microphones, with 5m integrated extension cable (10, 20, 50 mt lengths on request). The pre-amplifier is combinable with the microphone outdoor protection HDWME and is equipped with CTC device for electrical calibration and driver for cable up to 100 m.

MC21E: $\frac{1}{2}$ " high stability pre-polarized condenser microphone, suitable for free field measurements. Compliant with IEC61094-4 WS2F type. Combinable with HD2110PEL and HD2110PEWL preamplifiers.

MC21P: $\frac{1}{2}$ " high stability condenser microphone polarized at 200 V, suitable for free field measurements. Compliant with IEC61094-4 WS2F type. Combinable only with HD2110PL preamplifier.

MC22E: $\frac{1}{2}$ " high stability pre-polarized condenser microphone, suitable for diffuse field measurements. Compliant with IEC61094-4 WS2D type. Combinable with HD2110PEL preamplifiers.

MC22P: $\frac{1}{2}$ " high stability condenser microphone polarized at 200 V, suitable for diffuse field measurements. Compliant with IEC61094-4 WS2D type. Combinable only with HD2110PL preamplifier.

HDWME: Outdoor protection with windscreen, rain shield and birds spike.

Combinable with the HD2110PEWL preamplifier. Includes: windscreen HDSAV3, birds spike HDWME1, rain shield HDWME2, stainless steel support HDWME3

HDSAV: Windscreen for $\frac{1}{2}$ " microphone.

HDSAV3: Windscreen for HDWME microphone unit.

HDWME1: Bird spike for HDWME microphone unit.

HDWME2: Rain shield for HDWME microphone unit.

HDWME3: Stainless steel housing for the preamplifier of the outdoor microphone unit HDWME.

CPA/5: 5m extension cable.

CPA/10: 10m extension cable.

CPA/20: 20m extension cable.

CPA/50: 50m extension cable.

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

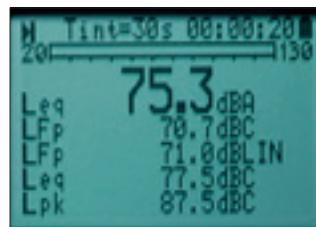
HD2110 USB: serial USB cable for PC connection.

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

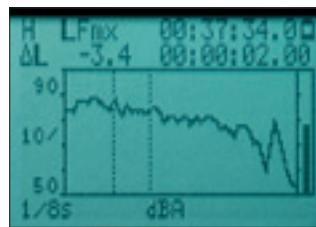
VTRAP: Tripod, 1550 mm maximum height.

VTRAP.H4: Tripod with 4 m maximum height. Max. load 10 kg.

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



SLM screen



Profile screen

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

CH20: Hardware key for PC working with Windows® operating system. When plugged into the USB port, according to licence purchased, it enables the following Noise Studio software modules:

NS1: Noise Studio "Workers' Protection" module activation . Noise and vibration analysis in the workplaces according to UNI 9432/2011, ISO 9612/2011; 2003/10/CE and 2002/44/CE European directives.

NS2A: Noise Studio "Acoustic Pollution" module activation. Acoustic climate analysis and evaluation of road, railway and airport traffic noise (according to 2002/49/CE Directive). Some of the functions require HD2110.01 "Third Octaves" option.

NS3: Noise Studio "Acoustic Insulation" module activation. Architectural and building acoustic according to ISO354, ISO140 and ISO717 series standards and UNI11367/10. For some calculations sound level meter options HD2110.01 "Third Octaves" and HD2110.04 "Reverberation Time" are required.

NS4: Noise Studio "Monitor" module activation. 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, impulsive and tonal components of the noise sources. Some of the functions require HD2110.01 "Third Octaves" option

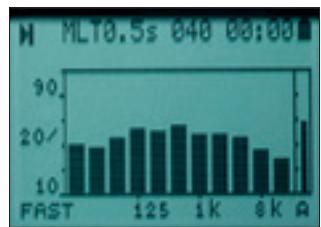
Noise Studio combined packages:

NSA "Environment" modules package including: NS2A "Acoustic Pollution", NS5 "Environmental Noise"

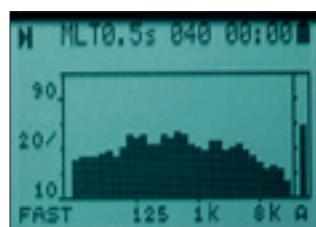
NSLA "Work & Environment" modules package including: NS1 "Workers Protection", NS2A "Acoustic Pollution", NS5 "Environmental Noise"

NSAE "Environment & Building" modules package including: NS2A "Acoustic Pollution", NS3 "Acoustic Insulation", NS5 "Environmental Noise"

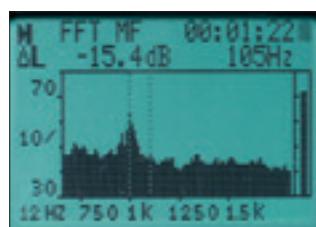
NSS Noise Studio software **Complete Package** including: NS1 "Workers Protection", NS2A "Acoustic Pollution", NS3 "Acoustic Insulation", NS4 "Monitor", NS5 "Environmental Noise"



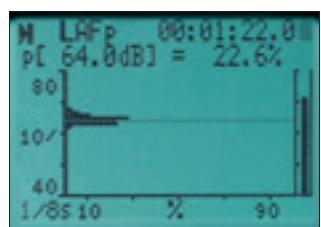
Octave bands spectrum



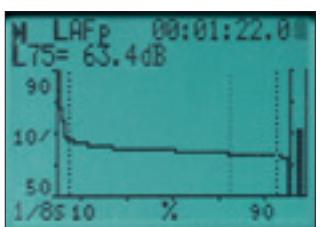
Third octave bands spectrum (option HD2110.01)



FFT narrow band spectrum (option HD2110.06)



Statistical analysis: probability distribution graph



Statistical analysis: percentile levels graph

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 1 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	✓ MC21E: ½" pre-polarized (0V) free field condenser microphone. Frequency range 3.15Hz-20KHz. Compliant with IEC61094-4 WS2F type. Compatible with HD2110PEL and HD2110PEWL preamplifiers. ✓ MC21P: ½", polarized (200V) free field condenser microphone. Frequency range 3.5Hz-20KHz. Compliant with IEC61094-4 WS2F type. Compatible only with HD2110PL preamplifier. ✓ MC22E: ½" pre-polarized (0V) diffuse field condenser microphone. Frequency range 3.15Hz-12.5KHz. Compliant with IEC61094-4 WS2D type. Compatible with HD2110PEL preamplifiers. ✓ MC22P: ½", polarized (200V) diffuse field condenser microphone. Frequency range 3.5Hz-12.5KHz. Compliant with IEC61094-4 WS2D type. Compatible only with HD2110PL preamplifier.
Dynamic range	23 dBA ± 143 dB Peak
Linearity range	110 dB
Acoustic Parameters	Spl, L _{eq} , L _{1eq} 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 real time filters complying with IEC61260 class 1 specifications. ✓ 1/1 octave bands from 16 Hz to 16 kHz ✓ 1/3 octave bands double digital filters (option HD2110.01) from 16 Hz to 20 kHz and from 14 Hz to 18 kHz (shifted center frequency) ✓ FFT from 7 Hz to 22 kHz with variable resolutions from 1.5 Hz to 100 Hz (option HD2110.06) Modes: average spectrum (AVR), multi-spectrum (MLT), maximum (MAX), and minimum (MIN). Time averaging: Linear, Exponential (Fast or Slow) Spectral analysis can be A or C weighted or unweighted (LIN)
Audibility	Real-time comparison of 1/3 octave spectrum (option HD2110.01) with equal loudness curves (ISO 226:2003)
Statistical Analysis	Probability distribution and percentile level calculation from L ₁ to L ₉₉ ✓ Parameters: 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 (option HD2110.01) 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	Reverberation time measurement (option HD2110.04) using sound source interruption or back integration of impulse response
Profile Data Logging	1 user defined parameter profile with programmable sampling from 1/8 s to 1 hour, 5 profiles at 2 samples/sec, 5 additional user defined parameters from 1s to 1h (Report mode).
Spectrum Data Logging	Programmable sampling from 0.5s to 1 hour (MLT, MAX, or MIN modes) and parallel additional multi-spectrum sampling from 1s to 1h (Report mode)
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 (option HD2110.01) ✓ Graph of probability distribution in 0.5dB, 1dB or 2dB classes ✓ Graph of percentile levels from L ₁ to L ₉₉ ✓ Narrow band spectrum analysis (FFT) from 7Hz to 22 kHz (option HD2110.06)
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 HD2010MC memory card interface, using MMC or SD cards up to 2 GB
Input/Output	✓ RS232 serial and USB interfaces ✓ AC input and output (LINE) ✓ External event identification trigger ✓ DC output (Fast time constant)
PC Programs	Noise Studio (supplied with the instrument): PC interface for data download, setup and instrument management. Licensed software modules to be enabled by hardware key. ✓ NS1 "Workers protection" module. Analysis of noise and vibrations in the workplaces according to ISO 9612/2011, UNI 9432/2011 and European Directives 2003/10/CE and 2002/44/CE. ✓ 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). Some of the calculation require option "Third octaves" and option "Reverberation time" installed in the sound level meter. Calculation according to ISO140, ISO717 and ISO354. ✓ NS5 "Environmental Noise" module: environmental noise analysis. Noise sources identification with threshold conditions. Tonality and impulsiveness evaluation. Some of the calculations require option "third octaves". ✓ NS4 "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 (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 (including batteries)



HD 8701 SOUND LEVEL METER

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

The noise levels can be easily read in dB (A) on the large LCD 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.

Through the keyboard the following operations are possible:

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

MODES OF OPERATION

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.

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 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 $\frac{1}{2}$ " 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.



The clock/calendar allows you to set the number of years and months of validity of the calibration from the date of adjusting: at the expiration time, an appropriate symbol flashes on the display.

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 $\frac{1}{2}$ 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.

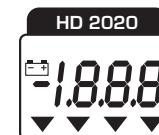
The following describes in detail the functions performed by each.



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.



Note: 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

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

The 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:

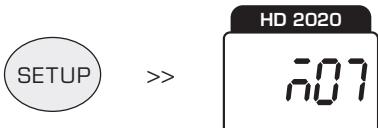
- Current date and time in the format year, month, day, hour, minute, second.
- Current date and time in the format year, month, day of the last calibration.
- The interval between the calibration date and the expiry date in years and months.

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:



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).



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



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



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.



(Years of validity - second triangle)



(Months of validity - second triangle)

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



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



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 $\frac{1}{2}$ " 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 $\frac{1}{2}$ " 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 20 μ Pa. The normal working microphones $\frac{1}{2}$ ", 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 \pm 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

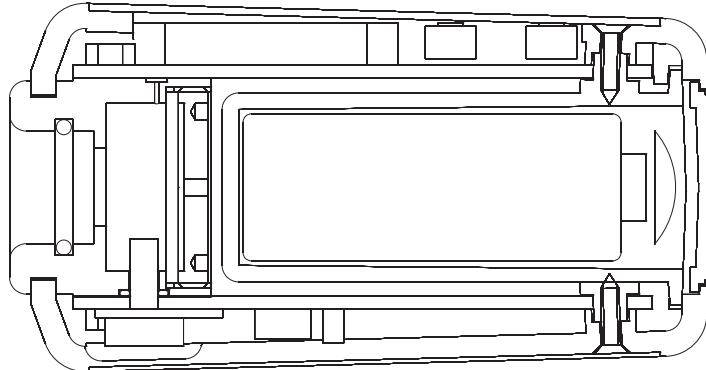


Fig. 3 Mechanical construction of the calibrator (section).

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.

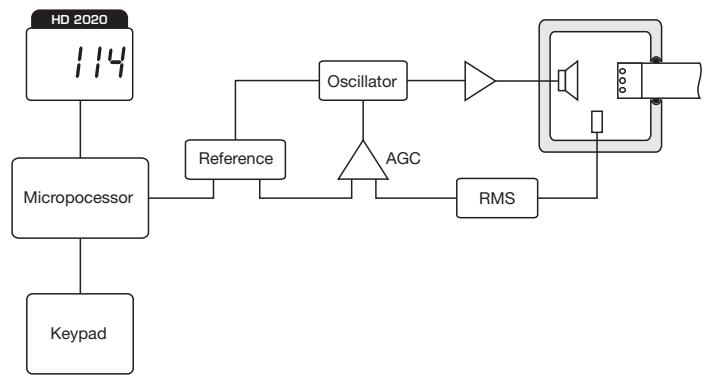


Fig 4 Block diagram of electronics.

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: $-25 \dots +55^{\circ}\text{C}$.
- 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 $-10\dots+50^{\circ}\text{C}$ 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, $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ 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 $-10^{\circ}\text{C}\dots50^{\circ}\text{C}$ 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 ... $+50^{\circ}\text{C}$
- Relative humidity:	$\leq 90\%$ R.H.
Storage temperature:	-25 ... $+70^{\circ}\text{C}$
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
Display	3½ LCD, battery symbol
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

ORDERING CODES

HD2020: The kit consists of: HD2020 calibrator, 1x 9V alkaline battery, instruction manual. ACCREDIA individual calibration certification included.



HD 9101 AND HD 9102 SOUND LEVEL METERS CALIBRATORS

APPLICATION FIELD

The generator noise level HD9101, HD9102 is a portable, battery-powered sound source, suitable for calibration of sound level meters (portable and laboratory) and acoustic measuring stations. And 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 HD9101, HD9102 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 ½" (with ½" adapter mod. 9101040) standard according to IEC 61094-1 and IEC 61094-4
 - Stabilization time: 60 sec
 - Frequency HD 9101: 1000Hz $\pm 2\%$
 - Frequency HD 9102: 1000Hz $\pm 4\%$
 - Sound pressure level HD 9101: 94dB/114dB ± 0.3 dB
 - Sound pressure level HD 9102: 94dB/114dB ± 0.5 dB (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.) ± 0.1 dB between 10% RH and 90% RH Free from condensation
 - Stability (one year, standard use): ± 0.1 dB
 - Working temperature: -10°C \div +50°C
 - Storage temperature: -25°C \div +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.

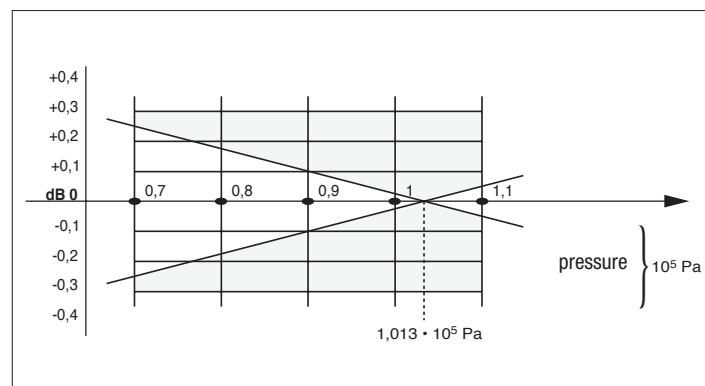
ORDERING CODES

HD9101: class 1 calibrator according to IEC60942:1988. Frequency 1000 Hz, sound level 94dB/114dB. ACCREDIA individual calibration certification included.

HD9102: class 2 calibrator according to IEC60942:1988 Frequency 1000 Hz, sound level 94dB/114dB. ACCREDIA individual calibration certification included.

ACCESSORIES:

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



Dependence of sound level on atmospheric pressure





HD WME MICROPHONE OUTDOOR PROTECTION

Applications

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

Features

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

Description

The HDWME microphone unit is suitable for long term outdoor monitoring, even in a fixed unattended location. The unit is adequately protected from rain and wind and the heated preamplifier provides stability of acoustic parameters over time and allows 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 free field frequency response, 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 HDWME must always be positioned vertically** to allow the anti-rain to perform its function and can be used both to detect the noise at 0° and 90° directions.

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 **HDWME** provides 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 HDWME frequency response for the presence of the windscreen, the proper 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:

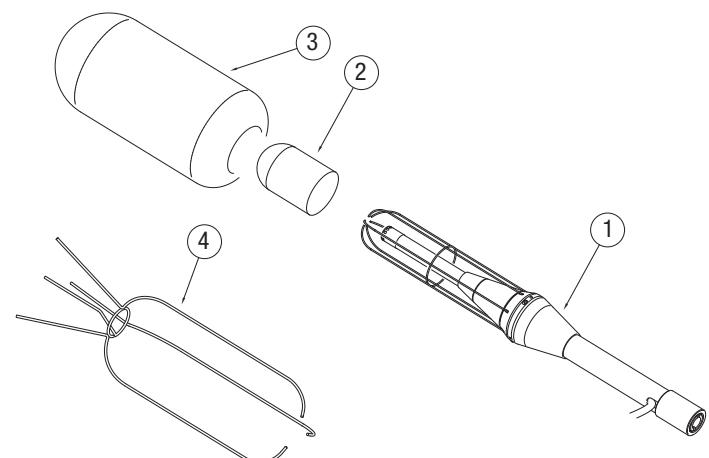
Menu >> Calibration >> Microphone Response >> RI

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.

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.

When calibration is complete, refit the protections according to the explanations under Assembly.

The unit consists of a central body and the following parts:



- HDSAV3: windscreen (3)
- HDWME1: birdspike (4)
- HDWME2: rainshield (2)
- HDWME3: stainless steel holder (1)

Microphone capsule:

- UC52: ½" free field type 2 condenser microphone, prepolarized (0V) for HD2010UC and HD2010UC/A class 2
- UC52/1: ½" free field type 1 condenser microphone, prepolarized (0V) for HD2010UC and HD2010UC/A class 1
- MC21E: ½" free field type 1 condenser microphone, prepolarized (0V) for HD2110L

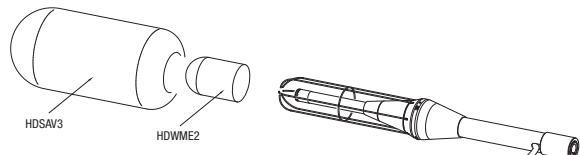
Microphone preamplifier:

- **HD2010PNE2W:** heated preamplifier for pre-polarized microphones UC52 and UC52/1 with integrated extension cable L=5mt (10mt on request). For HD2010UC and HD2010UC/A sound level meters.
- **HD2110PEWL:** heated preamplifier for pre-polarized microphones MC21E with integrated extension cable L=5mt (10, 20, 50mt on request). For HD2110L sound level meters.

Calibration

To perform the calibration, the $\frac{1}{2}$ " 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

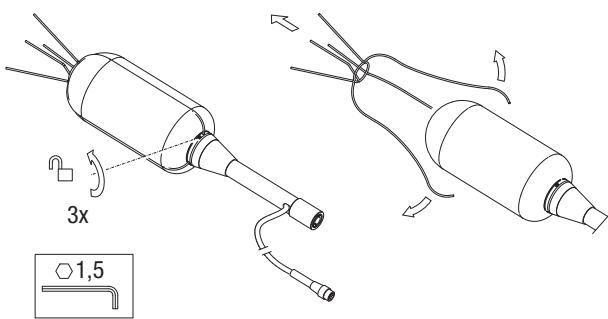


For electrical testing, you can connect a generator of electrical signals to the preamplifier unit HDWME via a capacitive adapter which replaces the microphone and can be supplied by Delta Ohm on request from the calibration laboratory. For additional details and specifications of *capacitive adapter*, please see the document "Periodic calibration according to IEC61672-3 of Delta Ohm sound level meters" available on HYPERLINK "<http://www.deltaohm.com>" website (Home >> Support >> Documentation).

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:

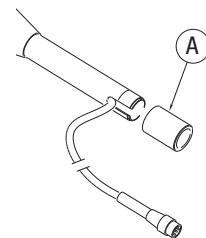
1. Remove the bird spike by loosening the three hex head screws at the base of the windscreens:



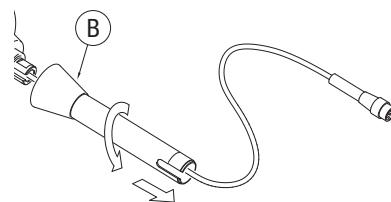
2. Pull up the windscreen HDSAV3 and rain protection HDWME2.



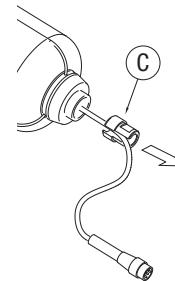
3. Unscrew the terminal placed at the lower end of the stem (A).



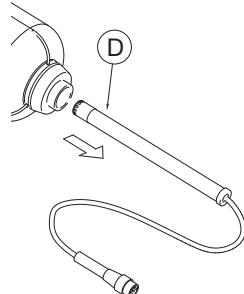
4. Unscrew the stem (B) and disconnect the cable connected to the preamplifier.



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

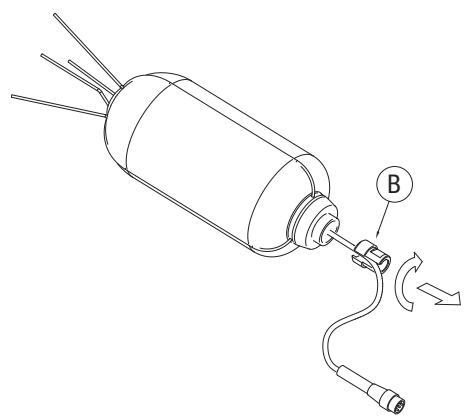
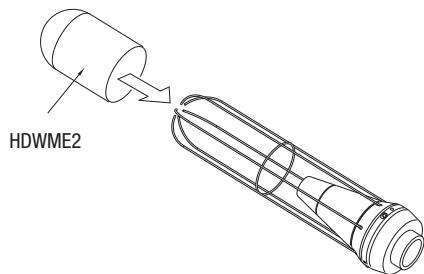
7. For assembly of the protection, proceed as specified in the following paragraph.

Assembly

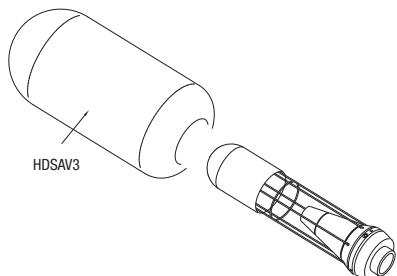
To assemble the unit, a 1.5mm male hex key and a 14mm wrench are needed.

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.

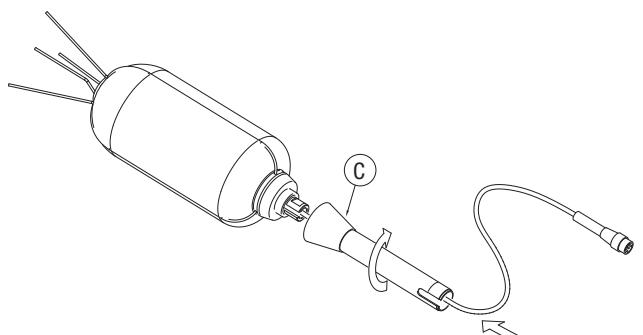
1. Fit the rain shield HDWME2 on the metal grid support.



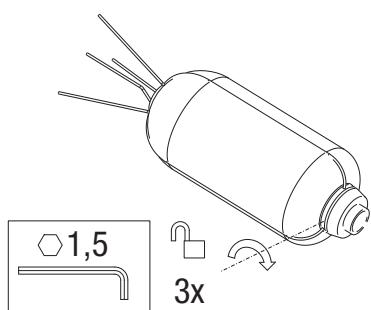
2. Insert the wind screen HDSAV3.



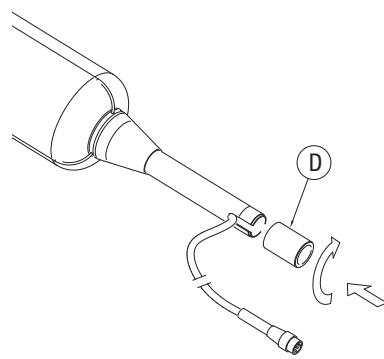
6. Insert the cable connected to the preamplifier through the stem (C) and screw the stem to the support.



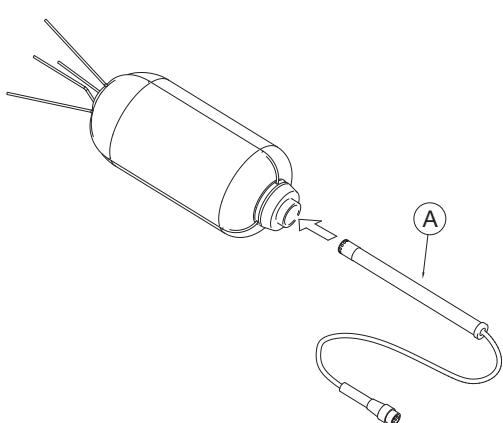
3. Apply the bird spikes and secure it using the three hex head screws located on the support at the base of the windscreen.



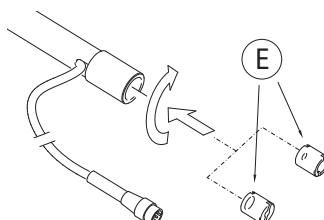
7. Screw the terminal placed at the lower end of the stem (D) releasing the cable laterally.



4. Insert the preamplifier (A) into the support pushing slowly upward until its limit position.



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, $\frac{1}{2}$ "and $\frac{1}{4}$ ".



5. Screw the gland (B) using, if necessary, a 14mm wrench. Be careful not to twist the preamplifier cable.

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 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 yearly.**

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 vapors 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 hard 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

HDWME: Outdoor microphone protection for HD2110L, HD2010UC and HD2010UC/A. (for older models contact your local distributor)

Includes:

- Stainless steel preamplifier support HDWME3
- Windshield HDSAV3
- Rain shield HDWME2
- Anti bird-spikes HDWME1

HD2010PNE2W: heated preamplifier for pre-polarized microphones UC52 and UC52/1 with integrated extension cable L=5mt (10mt on request) For HD2010UC and HD2010UC/A sound level meters.

HD2110PEWL: heated preamplifier for pre-polarized microphones MC21E with integrated extension cable L=5mt (10, 20, 50mt on request). For HD2110L sound level meters.

UC52: ½" free field type 2 condenser microphone, prepolarized (0V) for HD2010UC and HD2010UC/A class 2

UC52/1: ½" free field type 1 condenser microphone, prepolarized (0V) for HD2010UC and HD2010UC/A class 1

MC21E: ½" free field type 1 condenser microphone, prepolarized (0V) for HD2110L

Standard preamplifier can be replaced by *heated* version that can work in conjunction with HDWME outdoor protection:

HD2010.OR option "Heated preamplifier": replacement of the standard preamplifier HD2010PNE2 with the heated version HD2010PNE2W. The heated preamplifier is combinable with the microphone outdoor protection HDWME and is equipped with CTC device for electrical calibration and 5m integrated extension cable (10m on request). For HD2010UC and HD2010UC/A sound level meters.

HD2110.OR option "Heated preamplifier": replacement of the standard preamplifier HD2110PEL with the heated version HD2110PEWL. The heated preamplifier is combinable with the microphone outdoor protection HDWME and is equipped with CTC device for electrical calibration and 5m integrated extension cable (other lengths on request). **This option is available only in conjunction with MC21E or standard pre-polarized microphones. It's not compatible with option HD2110.OP.** For HD2110L sound level meters.

Example of a complete microphone unit:

Outdoor microphone unit for HD2110L. Includes:

- Stainless steel preamplifier support HDWME3
- Windscreen HDSAV3
- Rainshield HDWME2
- Anti-bird spikes HDWME1
- Heated preamplifier with 5m cable HD2110PEWL
- ½" pre-polarized condenser microphone MC21E

Accessories

HDWME1: Anti-bird spikes for outdoor protection HDWME.

HDWME2: Rain shield for outdoor protection HDWME.

HDWME3: stainless steel housing for the preamplifier and support for rain shield of outdoor protection HDWME.

HDSAV3: Windscreen for outdoor protection HDWME.

Specifications

Microphone MC21E

Type	½" standard condenser
Class	1
Polarization voltage	0V
Frequency response	3.15Hz – 20 kHz
Sensitivity	50 mV/Pa
Maximum sound pressure level (3% THD at 1kHz)	146 dB

Microphone UC52/1

Type	½" standard condenser
Class	1
Polarization voltage	0V
Frequency response	20Hz – 16 kHz
Sensitivity	22.5 mV/Pa
Maximum sound pressure level (3% THD at 1kHz)	146 dB

Microphone UC52

Type	½" standard condenser
Class	2
Polarization voltage	0V
Frequency response	22.5Hz – 10 kHz
Sensitivity	22.5 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

Mechanical

Dimensions (Ø x L)	
complete with Anti-bird spikes	90 x 470 mm
Weight	600 g
Thread for type MC21E microphone	11.7 mm 60 UNS
Thread for type UC52 microphone	M11.6 x 0.4
Thread for the support of the unit	M18 x 1, ½ W, ¼ W
Cable lengths	5m (other lengths available on request)
Connector	DIN 8-pole

HD 2040
HD 2050
HD 2050.20
HD 2050.30
HD 2050.40



HD2040 TAPPING MACHINE, HD2050 OMNIDIRECTIONAL SOUND SOURCE, HD2050.20 POWER AMPLIFIER, HD2050.30 DIRECTIONAL LOUDSPEAKER FOR FAÇADE SOUND INSULATION, HD2050.40 PASSIVE SUBWOOFER

HD2040: Tapping Machine

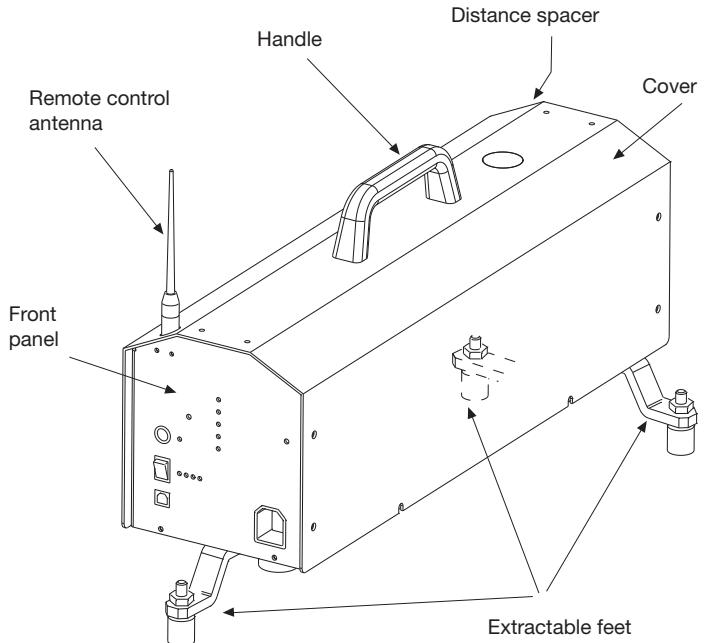
The tapping machine **HD2040** is a normalized impact noise generator for the measurement of sound insulation of floors according to ISO 140-6, ISO 140-7, ISO 140-8, ASTM E492 and E1007. It has 5 hammers in line driven by a motor controlled by an electronic system, by means of camshaft. The rate of fall of the hammer and the frequency of the impacts are constantly monitored to ensure compliance with the legislation. **LED indicators on the front panel indicate the proper functioning and impact speed of each hammer, detected by an optical sensor.** The hammers are made of stainless steel, hardened and dimensionally stable over time. The unit is equipped with support feet with height-adjustable rubber base. On the back cover is available a housing for a detachable spacer which can be used to assist the user to set exact 40mm vertical falling height from the floor. The spacer can be positioned in the housing with a light pressure; pull to remove it. A spirit level on the top cover allows to set the machine in a perfectly horizontal position. The feet will be turned below the base to reduce the size of the packing and easy transport of the machine. The starting and stopping of the machine is via a front panel button or remotely using the supplied remote control. The antenna is screwed to the connector on the top of the unit and it has to be unscrewed to store the unit in its case. Mains power supply 100 ... 240 VAC or rechargeable lithium-ion battery housed inside the unit. The charger is built in; the battery recharges automatically when the machine is connected to the mains supply. The aluminium frame reduces the weight of the machine and makes it easily transportable. The inside of the lid of the machine is treated with sound absorbing material.

Technical Specifications

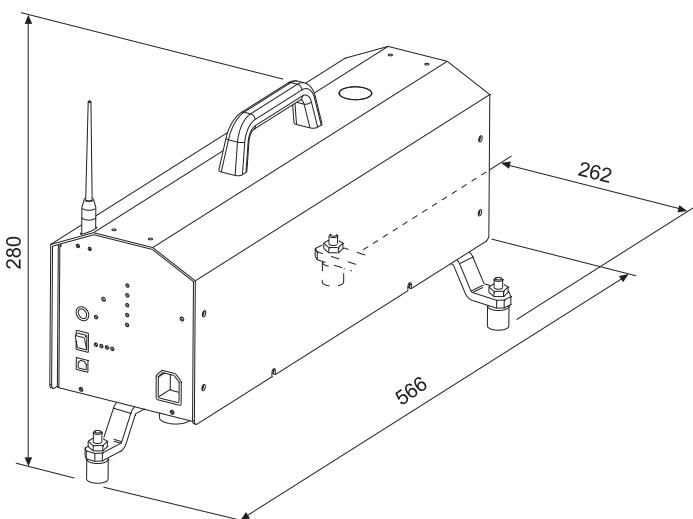
Number of hammers	5 in line
Weight of the hammers	500 ± 12g each
Fall height	40 mm
Tapping interval	100 ± 20 ms
Average tapping interval	100 ± 5 ms
Interval between the impact and the lifting of the hammer	< 80 ms
Distance among the hammers	100 ± 3 mm
Head of the hammers	Diameter 30 ± 0.2 mm, spherical impact surface with radius of curvature 500 ± 100 mm
Fall direction	Perpendicular to impact surface within ± 0.5°
Support feet	3 height-adjustable feet with rubber pads.
Service serial output	USB with type B connector
Remote control	By remote control (frequency 869.525 MHz, power 6 mW)
Power supply	100...240Vac, 50-60Hz Lithium Ion rechargeable battery, rated voltage 7.2V, rated capacity 2900 mAh
Power consumption	< 30 W
Battery autonomy	About 80 min of continuous operation
Working Temperature and Humidity	-10...+50 °C, 0 ... 90 %RH no condensation
Weight	11 kg machine with battery pack and remote control 5.4 Kg carrying case.
Dimensions (L x W x H)	520 x 162 x 280 mm with cover with handle and retracted feet 566 x 262 x 280 mm with cover with handle and extended feet (excluding the antenna for the remote control)
Structure of the machine	Anodized and painted aluminum



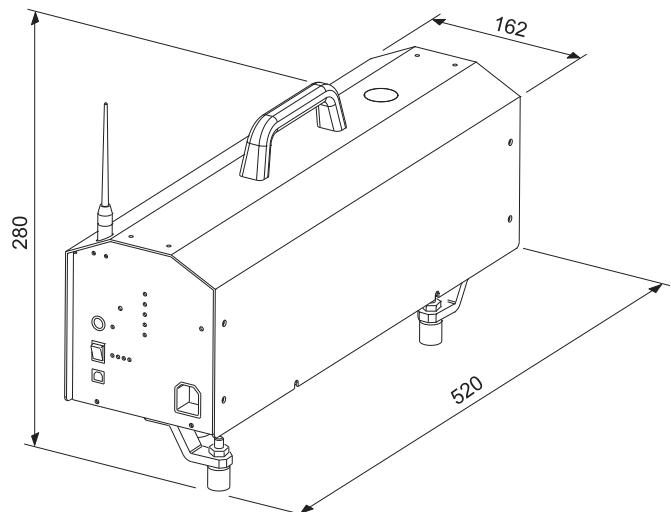
Description



Dimensions (mm)
With extended feet



With retracted feet



ORDERING CODES

HD2040: Machine for the generation of impact noise in accordance with ISO 140-6, ISO 140-7, ISO 140-8, ASTM E492 and E1007. Complete with rechargeable lithium ion battery,built-in battery charger, remote control, 13 mm wrench, instruction manual. **Optional carrying case.**

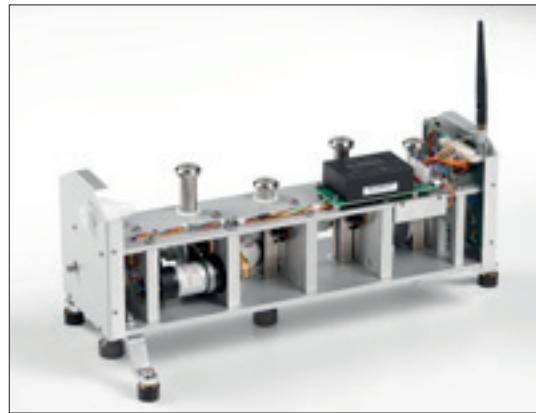
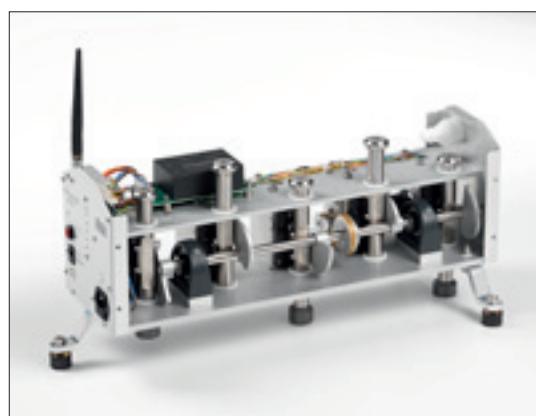
Accessories

HD2040-R: Additional remote control. Frequency 869.525 MHz Power 6 mW.

HD2040-A: Additional antenna for the remote control.

HD2040-V: Carrying case.

HD2040-B: Spare rechargeable lithium-ion battery pack. Nominal voltage 7.2 V. Rated capacity 2900 mAh.



HD2050 - Dodecahedron Loudspeaker

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.

HD2050 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 **HD2050.20**, 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 **HD2050.20** power amplifier.
- **High Power Level**

With more than **120 dB** (LIN) re 1pW sound power level, the HD2050 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 HD2050 a perfect tool also for room acoustics measurements. The optional subwoofer HD2050.40 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 HD2050.20 incorporates a parametric equalizer that allows to change the emission spectrum of HD2050. With this tool, 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 HD2050 is one of the lightest dodecahedron speakers on the market. HD2050.20 digital amplifier provides an output of more than 1000 W @ 12 ohm, and comes with an extremely rugged and lightweight flight case. The HD2050 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 in situ positioning: extendable tripod with steering wheels **HD2050.1** (minimum height 1300 mm, maximum height 2050 mm), wireless remote control, flight case for loudspeaker **HD2050-V**. For best performances, HD2050 should be driven with **HD2050.20** power amplifier (including wireless remote control **HD2050.20R**) and **HD2050.40** subwoofer to extend the frequency response down to 20Hz.

Applications:

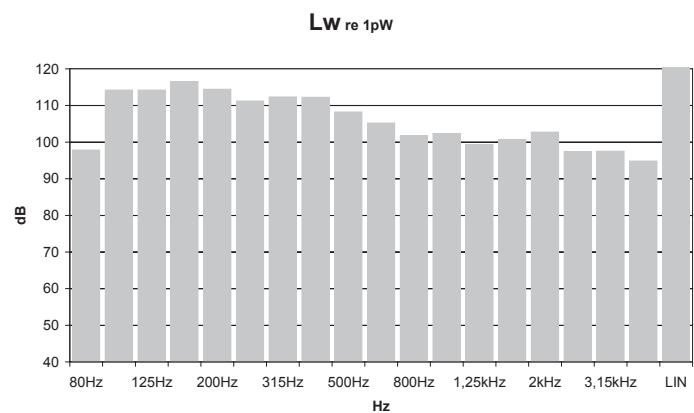
- Sound insulation
- Sound absorption
- Reverberation time measurements
- Architectural acoustics
- Impulse response of rooms

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	120 dB re 1pW (10^{-12} W) or better
Dimensions	Diameter 38.5 cm
Weight	9 kg
Handling	T shaped handle Flight-case

Note: Neutrik® is a registered trademark of Neutrik AG.

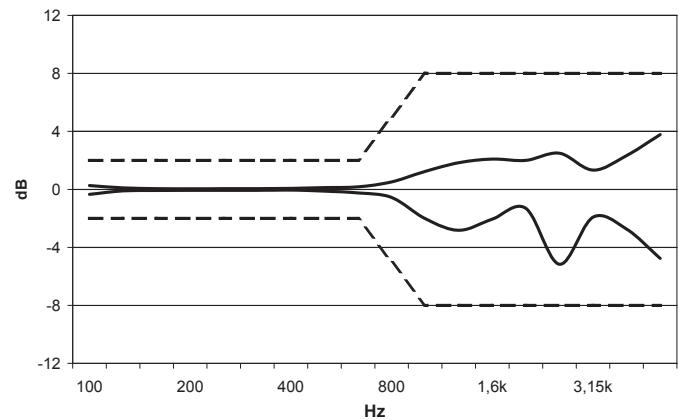
Typical Sound Power Level spectrum



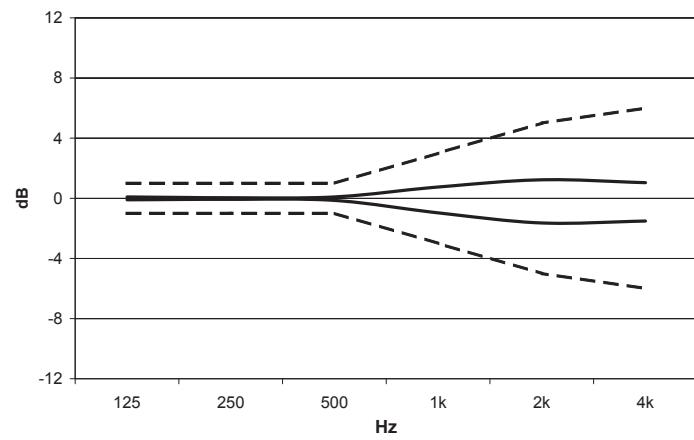
Directivity:

HD2050 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 HD2050. Below 1000 Hz the speaker has no significant directivity.

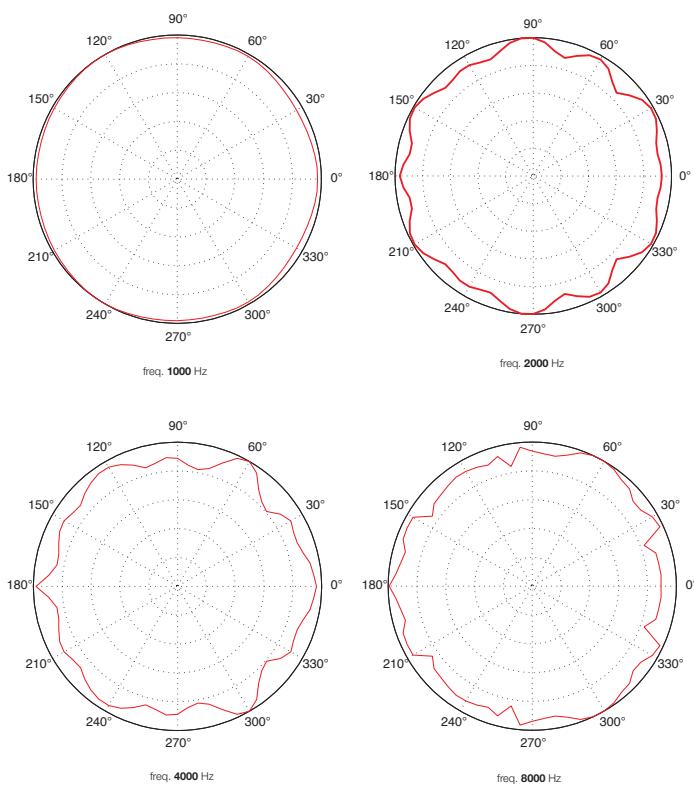
Directivity ISO 140



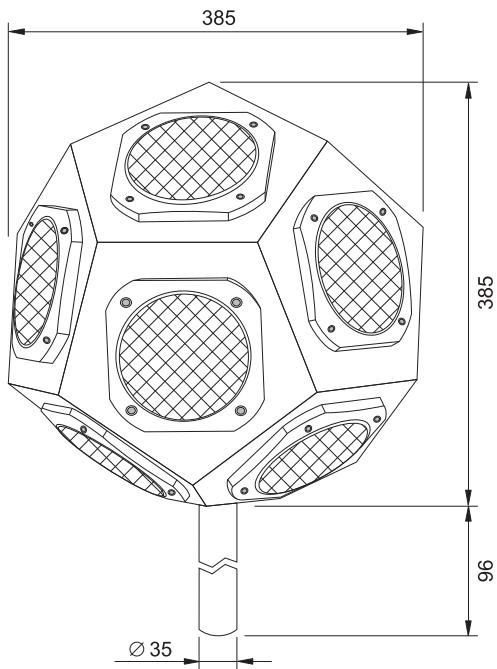
Directivity ISO 3382



Polar diagrams: 10 dB / div. – sectors 30°



DIMENSIONS (mm)



ORDERING CODES

HD2050: Dodecahedral loudspeaker according to ISO 140-3 and ISO 3382 standards.
Including signal cable HD2050.1.5, cable HD2050.1.L. User manual. Carrying case.

Accessories

HD2050.1: Stand for dodecahedron HD2050, 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.

HD2050.1.L: Signal cable adapter.

HD2050V: Carrying case for HD2050 dodecahedron.

HD2050.20: Digital power amplifier with integrated parametric equaliser. Includes flight case, Podware software, power supply cable HD2050.2, integrated wireless remote control HD2050.20R, user manual.

HD2050.20R: Wireless remote control Kit to control the internal noise generator of HD2050.20. Composed of receiver, transmitter with activation switch. Range of use up to 100 m.



HD2050.20 - Digital power amplifier

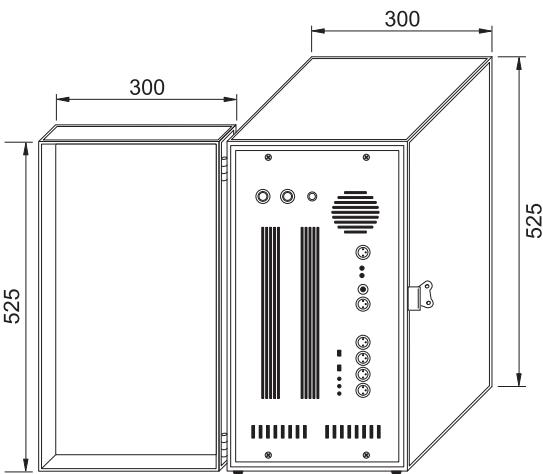
HD2050.20 is a high-power digital amplifier; it includes a white and pink noise generator with wireless remote control. Thanks to the auxiliary input it's possible to drive it with an external generator to apply, for example, sine sweep signals. In order not to influence the measured levels, a controller 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:

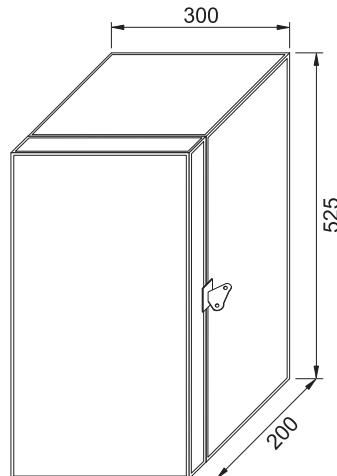
Reference Standards	EN 55103-1 (Emissions), EN 55103-2 (Immunity) EN 6065, class 1 (Safety)
Type	Digital, class D
Maximum power	1200 W @ 12 ohm
Continuous power	2 x 530 W RMS
External generator input	With level control
Power requirements	230 Vac ($\pm 10\%$), 50-60 Hz
Frequency response	20 Hz \div 20 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
RMS Level limiter	Control on the maximum power accepted by HD 2050 loudspeaker
Status 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

ORDERING CODES

HD2050.20: Digital power amplifier with integrated parametric equaliser. Includes flight case, Podware software, power supply cable HD2050.2, integrated wireless remote control HD2050.20R, user manual.

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.



HD2050.1.5



HD2050.1.2



HD2050.1.L

HD2050.20.2





Software Podware: user defined frequency response equalization

HD2050.30 - Directional Sound Source for façade insulations

The façade passive directional loudspeaker **HD 2050.30** is the ideal tool to create a uniform sound field in front of a building.

HD2050.30 provides not only the high output emission in a frequency range extended from 70 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 the land and on the stand; with the latter system user can gain valuable meters in front of the façade, where often space is little. The weight of 13.5 kg is the right compromise between power emission and portability.

- Excellent diffusion of acoustic field at high frequency.
- Wireless remote control with HD2050.20 digital power amplifier.

Applications:

- Façade sound insulation
- Sound absorption

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	30.5 x 49 x 33.3 cm
Weight	13.5 kg
Carriage	Protective bag
Finishing	Geal-coat anti-scratch
Amplifier	To be combined with HD2050.20 digital power amplifier
Holder	Adjustable to 45° with hole for mounting on standard tripod HD2050.1

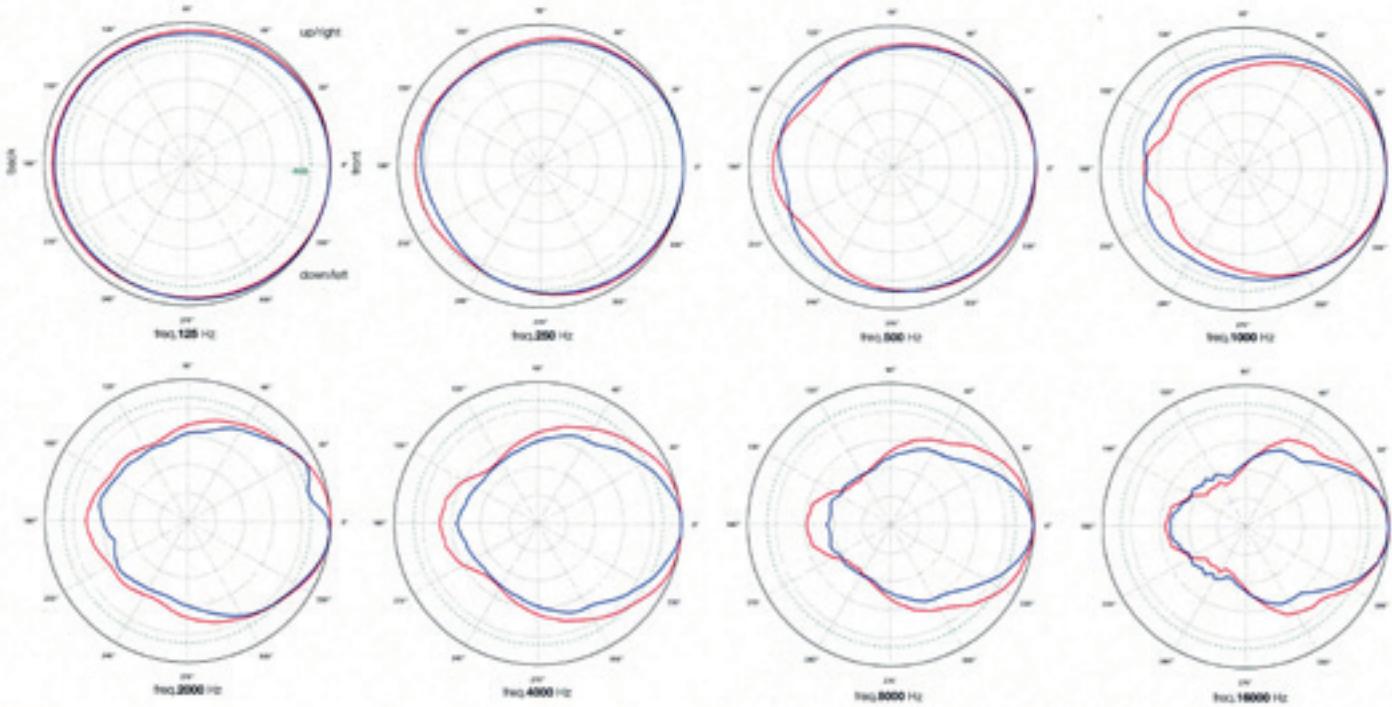
Note: Mylar® is a registered trademark of Dupont Teijin Films. Neutrik® is a registered trademark of Neutrik AG.

Input



Directivity:

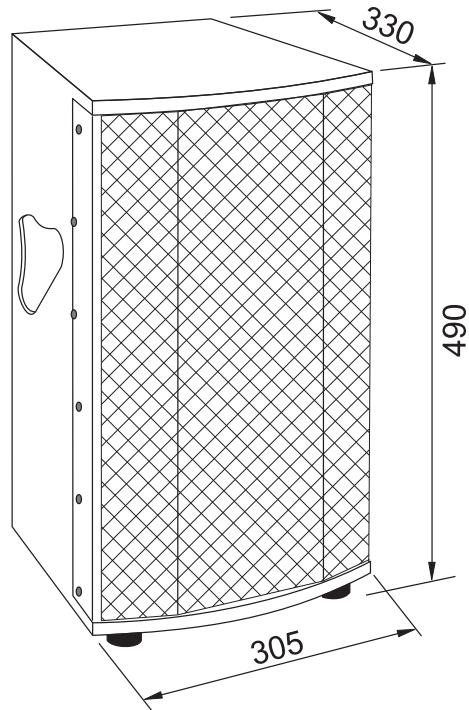
Polar diagrams by frequency referred to emission axis.



Polar diagram referred to axis:

- : horizontal
- : vertical
- - - : 10 dB/divided into 30° sections

Dimensions (mm)



ORDERING CODES

HD2050.30: Directional façade loudspeaker, user manual (Signal cable HD2050.1.5 not included).

Accessories

HD2050.30.1: Protective bag for HD2050.30 loudspeaker.

HD2050.30.2: 45° adjustable holder. It allows to direct the loudspeaker to 45° and to hoist it on the HD2050.1 stand.

HD2050.1: Stand for HD2050 dodecahedron, with steering wheels, extensible and retractile. Minimum height 1300 mm, maximum height 2050 mm 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, Podware software, power supply cable HD2050.2, integrated wireless remote control HD2050.20R, user manual.

HD2050.40 - Subwoofer

HD2050.40 passive subwoofer, is designed to work in conjunction with HD2050 dodecahedron. The system composed of HD2050.40 subwoofer, HD2050 dodecahedron and HD2050.20 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 HD2050.40, combined with HD2050 dodecahedron and HD2050.20 digital power amplifier, to excite rooms in order to measure extremely high insulations at lower frequencies. HD2050.40 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

HD2050.40 subwoofer integrates HD2050 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, HD2050.40 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	590 x 500 x 370 mm
Weight	22 kg
Finishing	Geal-coat anti-scratch
Amplifier	To be combined with HD2050.20 digital power amplifier

Note: Neutrik® is a registered trademark of Neutrik AG.

ORDERING CODES

HD2050.40: Subwoofer supplied with steering wheels, instruction manual. (for the connection to the HD2050 dodecahedron it is necessary the signal cable HD2050.1.2 not included).

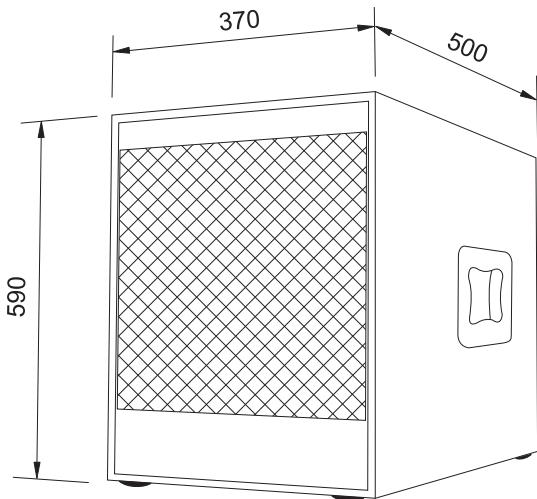
Accessories

HD2050.40.1: Extensible stand for HD2050.40 subwoofer. Minimum height 1370 mm, maximum height 1970 mm (subwoofer + stand + wheels).

HD2050.1.5: Signal cable, length 5 m.

HD2050.1.2: Signal cable, length 2 m.

Dimensions (mm)



Ordering codes for complete building acoustics system

HD2040: Machine for the generation of impact noise in accordance with ISO 140-6 and 140-7, ASTM E492 and E1007. Complete with rechargeable lithium ion battery, built-in battery charger, remote control, 13 mm wrench, instruction manual. **Optional carrying case.**

HD2040-V: Carrying case for tapping machine.

HD2050: Dodecahedral loudspeaker according to ISO 140-3 and ISO 3382 standards. Including signal cable HD2050.1.5, cable HD2050.1.L. User manual. Carrying case.

HD2050.1: Stand for dodecahedron HD2050, with steering wheels, extensible and retractile. Minimum height 1300mm, maximum height 2050mm. Damping of the extensible rod. Supplied with protective bag.

HD2050.20: Digital power amplifier with integrated parametric equaliser. Includes flight case, Podware software, power supply cable HD2050.2, integrated wireless remote control HD2050.20R, user manual.

HD2050.30: Directional façade loudspeaker, user manual (signal cable HD2050.1.5 not included).

HD2050.30.1: Protective bag for HD2050.30 loudspeaker.

HD2050.30.2: 45° adjustable holder. It allows to direct the loudspeaker to 45° and to hoist it on the HD2050.1 stand.

HD2050.40: Subwoofer supplied with steering wheels, instruction manual. (for the connection to the HD2050 dodecahedron it is necessary the signal cable HD2050.1.2 not included)

HD2050.40.1: Extensible stand for HD2050.40 subwoofer. Minimum height 1370 mm, maximum height 1970 mm (subwoofer + stand + wheels).

HD2050.1.2: Signal cable, length 2 m.



HD2050.40

Input





HD 2030 FOUR CHANNELS VIBRATION METER-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 ease 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 Studio supplied with the instrument.

The HD2030 satisfies the specifications of standards ISO 8041:2005, ISO 5349-1 and 2:2001 (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 effectiveness 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 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 Studio** is provided with the instrument and allows to download and display 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.

CH20: Hardware key for PC working with Windows® operating system. When plugged into the USB port, according to licence purchased, it enables the Noise Studio software 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 and UNI9432/2011, European Directive 2003/10/CE and 2002/44/CE.
- Evaluation of hearing protectors with the methods OBM and SNR according to UNI EN 458.
- Evaluation of measurement uncertainties in accordance with UNI 9612.
- 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 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 0.315Hz 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)"
- ISO 2631-4:2001** "Evaluation of human exposure to whole body vibration – Guidelines for the evaluation of the effects of vibration and rotational motion on passenger and crew comfort in fixed-guideway transport systems"
- ISO 2631-5:2004** "Evaluation of human exposure to whole body vibration – Method for evaluation of vibration containing multiple shocks"
- IEC 61260:1995** "Electroacoustics – Octave band and fractional-octave band filters"

Accelerometer models

It's possible to connect integrated electronics type (IEPE or equivalent) accelerometers both mono-axial and tri-axial. Accelerometers are directly power supplied with a 25V tension and a 2mA current.

The following models are available:

Model	Axes	Application	Sensitivity [mV/g]	Range [\pm gpk]	Weight [gr]
HDP-352C34	1	General purpose	100	50	5.8
HDP-356B20	3	Ha - Shock	1	5000	4
HDD-3023A2	3	Ha	10	500	4
HDP-356A02	3	Ha	10	500	10.5
HDP-356B21	3	Ha	10	500	4
HDP-356A22	3	WB - General purp.	100	50	5.4
HDP-356B41	3	WB - Seat	100	10	272
HDD-3143D1	3	General purpose	100	50	14
HDP-356B18	3	Building vibration	1000	5	25

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 provided with the HD2030 analyzer:

- Wax for quick fastening
- Silicon grease
- USB cable for PC connection
- 2GB SD memory card
- CD containing "Noise Studio" PC software (Windows compatible), user manual and carrying case

Each accelerometer comes with the following accessories:

- Mounting screw (if provided accelerometer requires it)
- 2m length connection cable for HD2030 analyzer input (other lengths on request)
- Manufacturer calibration chart of the sensor and ISO9001 calibration report
- CD with user manual and configuration data of accelerometer

Technical specifications

Measurement modes:

Hand-transmitted vibrations
Whole-body vibrations
Building vibrations

Measurement parameters:

RMS, VDV, MTV, 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	
	1/1 Octave Band [Hz]	1/3 Octave Band [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 accelerometer HDP356A02 (Ha measurement), 0.0007 m/s² ÷ 7m/s² with HDP356B18 (BV measurement).
- **Linearity range** three ranges of 80dB overlapped by 70dB
- **Digital converter** Four A/D converters with a resolution of 25 bits at 8k samples per second
- **Inherent noise level** Less than 30mm/s² with accelerometer HDP356A02 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 vector acceleration calculated from the channels of tri-axial input
VLM3: Three global parameters for each measurement axis
VLM4: Three global parameters of vector acceleration calculated from the channels of tri-axial input
PROFILE: Graphic profile of one parameter for each measurement axis with integration time programmable from 1s to 1 hour
SPECTRUM: 1/1 or 1/3 octave spectrum for each measurement (contemporaneously) 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 screen
PERCENTILES: Percentile level graph of the parameter chosen in PROFILE

Datalogging

Time history: Multi Profile recording with **single integration** allows to log with sampling periods from 1s to 1h:

- 3 instantaneous or integrated parameters of the VLM_1 screen calculated on Ch1, Ch2, Ch3 and Ch4 channels (a total of 12 parameters)
- 3 vector parameters of the VLM_2 screen (vector values from Ch1, Ch2, Ch3)
- Multi-spectra (from 1s) on Ch1, Ch2, Ch3 and Ch4 (4 multi-spectra), in 1/1 or 1/3 octave bands.
- Raw acceleration signals on Ch1, Ch2, Ch3 and Ch4 (4 signals at 8KHz each)
- Statistical analysis in 1dB classes with 1 second sampling frequency (only in multiple integration mode). Graph of levels probability distribution; graph of percentile levels from L₁ to L₉₉
- Voice comments recording

Global values: in parallel to time histories data logging, are logged:

- 3 overall integrated VLM_1 parameters for Ch1, Ch2, Ch3 and Ch4
- 3 overall vector parameters of the VLM_2 screen (vector values from Ch1, Ch2, Ch3)
- Integrated spectra on Ch1, Ch2, Ch3 and Ch4 (4 spectra), in 1/1 or 1/3 octave bands
- Graph of levels probability distribution; graph of the percentile levels from L₁ to L₉₉
- **Memory** 8MB Internal FLASH memory and memory card SD type up to 2GB (SD card supplied).
- **Interface** Serial RS232 and USB type
- **Input/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 battery charger.**
- **Environmental 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
- **Dimensions and weight:** 95mm X 240mm X 50mm, weight 680gr.

Technical specifications of accelerometers:

	HDP-352C34	HDP-356B20	HDP-356A02	HDP-356B21
Axes	1	3	3	3
Sensitivity [mV/g]	100	1	10	10
Range [±gpk]	50	5000	500	500
Frequency response [±5%]	0.5Hz ÷ 10KHz	(Z-Y) 2Hz ÷ 10KHz (X) 2Hz ÷ 7KHz	1Hz ÷ 5KHz	(Z-Y) 2Hz ÷ 10KHz (X) 2Hz ÷ 7KHz
Resonance frequency [KHz]	50	55	25	55
Linearity [%F.S.]	±1	±2.5	±2	±1
Transverse sensitivity [%max]	5	5	5	5
Max shock [gpk]	5000	7000	7000	10000
Operating temperature [°C]	-54 ÷ +93	-54 ÷ +121	-54 ÷ +121	-54 ÷ +121
Weight [g]	5.8	4	10.5	4
Dimensions	7/16" x 22.4 mm	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 screw hole 10-32	threaded screw hole 5-40	threaded screw hole 10-32	threaded screw hole 5-40
Insulation	-	-	-	-
Connector	top mounted 10-32	Side 8-36 4 pin	Side 1/4 -28 4 pin	Side 8-36 4 pin
Material	Titanium	Titanium	Titanium	Titanium

Technical specifications of accelerometers:

	HDP-356A22	HDP-356B41	HDD-3143D1	HDP-356B18
Axes	3	3	3	3
Sensitivity [mV/g]	100	100	100	1000
Range [±gpk]	50	10	50	5
Frequency response [±5%]	0.5Hz ÷ 4KHz	0.5Hz ÷ 1KHz	0.5Hz ÷ 3KHz	0.5Hz ÷ 3KHz
Resonance frequency [KHz]	25	27	25	20
Linearity [%F.S.]	±1	±1	±1	±1
Transverse sensitivity [%max]	5	5	5	5
Max shock [gpk]	5000	2000	1500	5000
Operating temperature [°C]	-54 ÷ +77	-10 ÷ +50	-50 ÷ +85	-29 ÷ +77
Weight [g]	5.4	272 (with seat pad)	14	25
Dimensions	11.4 x 11.4 x 11.4 mm	Ø 200mm x 12 mm	20.8 x 20.8 x 8.6 mm	20.3 x 20.3 x 26.1 mm
Mounting	threaded screw hole 5-40	Accelerometer with threaded screw hole 10-32 mounted in a rubber seat pad	Through hole for 6-32 UNC screw or M3	threaded screw hole 10-32
Insulation	-	-	-	-
Connector	Side 8-36 4 pin	Side 1/4 -28 4 pin	Side 1/4 -28 4 pin	Side 1/4 -28 4 pin
Material	Titanium	Titanium	Titanium	Anodized aluminium

ORDERING CODES FOR KITS AND ACCESSORIES

Vibration analyzer kits

HD2030 kit 1 including: HD2030 4-axis vibration analyser, 1/1 and 1/3 octave filters, statistical analysis, digital recording of the accelerometer signals, silicon grease, wax tray for gluing, glue for quick mounting, 2 GB SD memory card, CP22 USB serial connection cable, "Noise Studio" software, user manual and carrying case, calibration reports for analyser and filters according to ISO8041 and IEC 61260. **Accelerometers, connection cables and accessories must be specified at the time of order.**

HD2030 kit "HA & WB": it includes,

- HD2030 kit 1 consisting of:
- HD2030: 4 channels vibration analyser with ISO 9001 calibration report
- HD2030MC: 2GB SD memory card,
- CP22: USB serial cable,
- silicon grease (HD6188), wax (HD6273) and glue (080A90)
- user manual and carrying case;
- HDP356B41: tri-axial accelerometer in a rubber pad with connection cable to HD2030 analyser;
- HDP356A02: miniature tri-axial accelerometer with 10-32 UNF and M6 screws and connection cable to HD2030 analyser (HD2030.CAB3-3M);
- Calibration reports for accelerometers;
- HD2030.124 accelerometer mounting adapters composed of HD2030.AC1, HD2030.AC2 and HD2030.AC4
- "Noise Studio" software for PC.

Accelerometer mounting adapters

HD2030AC1: cube-shaped adapter for accelerometers mounting. The adapter has to be fastened with plastic cable-tie or metallic clamp close to the handle holding hand. Suitable for anatomical handles and small size tools, where the weight and dimensions of the measurement chain must be minimized. Material: **light alloy**. *Includes:*

- 10-32 UNF cylindrical head with hex socket screw with 4 mm hex key
- 5-40 UNC cylindrical head with hex socket screw with 4 mm hex key
- 10 cable-ties, width 4.5 mm, length 200 mm
- 1 metallic clamp, width 9 mm

HD2030AC2: adapter for accelerometers mounting between the hand and the handle, is pushed against the handle by the hand itself. Because the accelerometer is placed in a lateral position, the measurement must be repeated placing the accelerometer both on the right and left side of the hand. Suitable for large cylindrical handles. Material: **light alloy**. *Includes:*

- 10-32 UNF cylindrical head with hex socket screw with 4 mm hex key
- 5-40 UNC cylindrical head with hex socket screw with 4 mm hex key
- 10 cable-ties, width 4.5 mm, length 200 mm
- 2 velcro straps, width 25 mm, length 300 mm (HD2030FV)

HD2030AC3: adapter for accelerometers mounting. The adapter, inserted between the hand and the handle, is pushed against the handle by the hand itself. Because the accelerometer is placed in a lateral position, the measurement must be repeated placing the accelerometer both on the right and left side of the hand. Suitable for large cylindrical handles. Provided with 10-32 UNF fixing hole for the mounting of the accelerometer. Material: **inox**. *Includes:*

- 10 cable-ties, width 4.5 mm, length 200 mm
- 2 velcro straps, width 25 mm, length 300 mm (HD2030FV)

HD2030AC4: The adapter, inserted between the hand and the handle, is pushed against the handle by the hand itself. The accelerometer is placed in central position between the middle-finger and the ring-finger or between the forefinger and the middle-finger. Suitable for anatomical handles even if not cylindrical or with small dimensions. Material: **light alloy**. *Includes:*

- 10-32 UNF cylindrical head with hex socket screw with 4 mm hex key
- 5-40 UNC cylindrical head with hex socket screw with 4 mm hex key
- 10 cable-ties, width 4.5 mm, length 200 mm
- 2 velcro straps, width 25 mm, length 300 mm

HD2030AC5: Support for mono and tri-axial accelerometers for the measurement of vibrations on floors or vibrating surfaces in general. Provided with levelling device and three feet, two of them with adjustable height. The support has a cavity on the bottom side with a M4 threaded hole; on the top side a 10-32 UNF threaded hole for accelerometer mounting. A cubic adapter is provided to fix on the top side three mono-axial accelerometers. Material: **nickel-plated steel**, weight 1.9 kg. *Includes:*

- Steel support with three feet and spirit level. Has a 10-32 UNF threaded hole on the top side and a cavity on the bottom side with a M4 threaded hole.
- Cubic adapter to be mounted on the support top side with two M4 screws (included). The cube is provided with 10-32 UNF threaded holes on three orthogonal faces.
- 3 mm hex key.

HD2030.124: adapters kit for the measurement of the vibrations transmitted to the hand-arm system. *Includes:*

- HD2030AC1: cube-shaped adapter for anatomical handles and small size tools. Has to be fastened to the handle with plastic cable-tie or metallic clamp (included).
- HD2030AC2: adapter for cylindrical handles. It is placed laterally with respect to the hand.
- HD2030AC4: general purpose adapter. The accelerometer is placed between the forefinger and the middle-finger or between the middle-finger and the ring-finger.

HD2030.1234: adapters kit for the measurement of the vibrations transmitted to the hand-arm system. *Includes:*

- HD2030AC1: cube-shaped adapter for anatomical handles and small size tools. Has to

be fastened to the handle with plastic cable-tie or metallic clamp (included).

- HD2030AC2: adapter for cylindrical handles. It is placed laterally with respect to the hand.
- HD2030AC3: adapter for cylindrical handles provided with threaded hole for accelerometers with 10-32 UNF screw. It is placed laterally with respect to the hand.
- HD2030AC4: general purpose adapter. The accelerometer is placed between the forefinger and the middle-finger or between the middle-finger and the ring-finger.

Accelerometers

HD352C34: General purpose ICP mono-axial accelerometer. Sensitivity 100 mV/g. Range ± 50 g pk. Weight 5.8 g. Includes: 10-32 UNF copper-beryllium alloy mounting screw (081B05), M6 copper-beryllium alloy mounting screw, (M081B05), Calibration certificate (ACS-1)

HD356B20: Miniature ICP tri-axial accelerometer for hand-arm vibrations at high shock levels. Sensitivity 1 mV/g. Range ± 5000 g pk. Weight 4 g, Includes: 5-40 UNC copper-beryllium alloy mounting screw (081A27), 10-32 UNF copper-beryllium alloy mounting screw (081A90), M3 copper-beryllium alloy mounting screw (M081A27). Calibration certificate (ACS-1T)

HD356A02: ICP tri-axial accelerometer for the measurement of the vibrations transmitted to the hand-arm system. Sensitivity 10 mV/g. Range ± 500 g pk. Weight 10.5 g. Includes: 10-32 UNF copper-beryllium alloy mounting screw (081B05), M6 copper-beryllium alloy mounting screw (M081B05), Calibration certificate (ACS-1T)

HD356B21: Miniature ICP tri-axial accelerometer for hand-arm vibrations. Sensitivity 10 mV/g. Range ± 500 g pk. Weight 4 g. Includes: 5-40 UNC copper-beryllium alloy mounting screw (081A27), 10-32 UNF copper-beryllium alloy mounting screw (081A90), M3 copper-beryllium alloy mounting screw (M081A27), calibration certificate (ACS-1T).

HD356A22: General purpose miniature ICP tri-axial accelerometer. Sensitivity 100 mV/g. Range ± 50 g pk. Weight 5.4 g. Includes: 5-40 UNC copper-beryllium alloy mounting screw (081A27), 10-32 UNF copper-beryllium alloy mounting screw (081A90), M3 copper-beryllium alloy mounting screw (M081A27), Calibration certificate (ACS-1T).

HDD3143D1: General purpose tri-axial accelerometer. Sensitivity 100 mV/g. Range ± 50 g pk. Weight 14 g. Includes: 6-32 UNC mounting screw, Mounting adapter with M3 screw for fixing to the floor support HD2030AC5

HD356B41: General purpose ICP tri-axial accelerometer inserted in a rubber pad for whole body vibrations transmitted through seats and backs. Sensitivity 100 mV/g. Range ± 10 g pk. Weight 272 g. Includes: HD2030.CAB3-3M, 3 m connection cable. Calibration certificate (ACS-1T).

HD356B18: High sensitivity ICP tri-axial accelerometer for buildings vibrations. Sensitivity 1 V/g. Range ± 5 g pk. Weight 25 g. Includes: 10-32 UNF copper-beryllium alloy mounting screw (081B05), M6 copper-beryllium alloy mounting screw (M081B05), calibration certificate (ACS-1T)

Vibration calibrator

HD2060: Portable vibration calibrator with frequency 15.915 Hz and levels 1 m/s² and 0.1 g, and frequency 159.155 Hz and levels 10 m/s² and 1 g. LCD display. Includes: HD2060.20 support with UNF 10-32 screw for mounting tri-axial accelerometers, HD6245.1 insulated base with integrated UNF 10-32 screw for adhesive mounting, BAT-40: 1.2 V x 4 NiMH rechargeable battery pack, SWD10 stabilized mains power supply 100-240 Vac / 12 Vdc - 1A, carrying case, calibration report

HD6245.1: adhesive base with integrated 10-32 UNF screw. It can be used with accelerometers without mounting screw.

HD2060.20: support for the lateral mounting of tri-axial accelerometers with 10-32 UNF mounting screw

Cables for mono-axial accelerometers

HD2030.CAB1-3M: low noise coaxial cable for connection of mono-axial accelerometers. L=3m (other lengths upon request). Can be used with HD352C34

HD2030.CAB1-5M: low noise coaxial cable for connection of mono-axial accelerometers. L=5m (other lengths upon request). Can be used with HD352C34

HD2030.CAB1-10M: low noise coaxial cable for connection of mono-axial accelerometers. L=10m (other lengths upon request). Can be used with HD352C34

HD2030.CAB13: coaxial cable for connection of three mono-axial accelerometers to the HD2030 analyzer. L=40cm, BNC connectors. The accelerometers are connected to the HD2030.CAB13 cable through HD2030.CAB1B-3M cables

HD2030.CAB1B-3M: coaxial cable for connection of mono-axial accelerometers to the HD2030.CAB13 cable. L=3m (other lengths upon request). Equipped with connectors. Can be used with HD352C34



HD2030.CAB.BNC-xxM: Coaxial extension cable for the connection of mono-axial accelerometers to the HD2030.CAB13 cable. **Maximum length 200 m**, both ends terminated with BNC female connectors.

Cables for tri-axial accelerometers

HD2030.CAB3-3M: Cable for tri-axial accelerometers connection to the right input of the analyzer. **L=3 m** and connectors. It can be used with HDP356A02, HDD3143D1 and HDP356B18 accelerometers.

HD2030.CAB3-5M: Cable for tri-axial accelerometers connection to the right input of the analyzer. **L=5 m** and connectors. It can be used with HDP356A02, HDD3143D1 and HDP356B18 accelerometers.

HD2030.CAB3-10M: Cable for tri-axial accelerometers connection to the right input of the analyzer. **L=10 m** and connectors. It can be used with HDP356A02, HDD3143D1 and HDP356B18 accelerometers.

Cables for miniature tri-axial accelerometers

HD2030.CAB3S-3M: Cable for miniature tri-axial accelerometers connection to the right input of the analyzer. **L=3 m** and connectors. It can be used with HD356B20, HD356B21 and HD356A22 accelerometers.

HD2030.CAB3S-5M: Cable for miniature tri-axial accelerometers connection to the right input of the analyzer. **L=5 m** and connectors. It can be used with HD356B20, HD356B21 and HD356A22 accelerometers.

HD2030.CAB3S-10M: Cable for miniature tri-axial accelerometers connection to the right input of the analyzer. **L=10 m** and connectors. It can be used with HD356B20, HD356B21 and HD356A22 accelerometers.

Software

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 2003-10-CE and 2002-44-CE

Accessories

HD2110CSNM: serial cable connection to PC COM interface.

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

HD2030MC: 2GB SD memory card.

HD2030AM: headset with microphone.

SWD10: Stabilized mains power supply Vin=100-240Vac / Vout=12Vdc/1000mA.

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply. Required interface cable HD2110CSNM (not supplied).

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

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.

HD6196: Magnetic base with integrated 10-32 UNF screw. It can be used with the HD356A02, HD356C34 and HD356B41 (removing the rubber pad) accelerometers.

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

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

080A90: glue for quick fixing.

081B05: screw with double thread 10-32 UNF.

081A90: screw with double thread 5-40 UNC and 10-32 UNF.

M081B05: screw with double thread 10-32 UNF and M6x0,75.

M081A27: screw with double thread 5-40 UNC and M3x0,5".

081A27: screw with double thread 5-40 UNC.

HD2060.20: support for the lateral mounting of tri-axial accelerometers with 10-32 UNF mounting screw

HD6245: Insulated base with integrated 10-32 UNF screw and threaded hole 10-32 UNF. It can be used with the HD356A02, HD356C34 and HD356B41 (removing the rubber pad) accelerometers.

HD6245.1: adhesive base with integrated 10-32 UNF screw. It can be used with accelerometers without mounting screw.



HD2070 THREE CHANNELS VIBRATION METER-ANALYZER

HD2070 is a portable vibration analyzer performing optional 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.

Main features

- HD2070 has been designed combining maximum flexibility and ease 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 Studio supplied with the instrument.
- The HD2070 vibration analyzer detects accelerations on three axes through accelerometers with integrated amplifying electronics (IEPE or equivalent). On the input it is possible to connect three accelerometers or a tri-axial one. IEPE accelerometers 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 HD2070 analyses accelerometer signals and makes calculations simultaneously on three axes. The instrument calculates, in parallel for all the measurement channels, weighted acceleration values and **1/1 or 1/3 octave spectra** (option **HD2070.01 "spectral analysis"**) ; 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 **HD2070.02 "statistical analysis"**).
- As statistical analyzer HD2070 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.
- A flexible data logger function stores multiple profiles and spectra (option HD2070.01) 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 **raw digital samples** (option **HD2070.03 "Digital Recorder"**). Analysing

stored data, it's useful to examine raw 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 HD2070 can be used like an audio recorder, another possibility to add comments to the measurements.

- The "Navigator" program available in the analyzer, allows to examine logged measurements and listen to vocal comments.
- For a quick instrument setting the HD2070 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 calibrator as HD2060. 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 Studio, provided with the instrument, adds automatically the calibration file to the measurements when downloading data into the PC memory.
- HD2070 can be completely controlled by a PC, through the RS232 and USB serial interfaces, using a special communication protocol.

Applications

The HD2070 analyzer executes all measurements required by the European regulations concerning workers protection from mechanical **vibration exposition at the workplace** (2002/44/EC).

- 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
- **Vibration spectral analysis by octave or third octave bands** (option HD2070.01 "Spectral Analysis") on all channels
- **Statistical analysis** with percentile calculation from L₁ to L₉₉ (option HD2070.02 "Statistical Analysis") on all channels
- General signal analysis of exported **raw digital samples** (option HD2070.03 "Digital Recorder") on all channels (to export data in wav format NS1 module is required)

Specifications

technical standard

- 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)"
- ISO 2631-4:2001 "Evaluation of human exposure to whole body vibration - Guidelines for the evaluation of the effects of vibration and rotational motion on passenger and crew comfort in fixed-guideway transport systems"
- ISO 2631-5:2004 "Evaluation of human exposure to whole body vibration - Method for evaluation of vibration containing multiple shocks"
- IEC 61260:1995 "Electroacoustics - Octave band and fractional-octave band filters"

Measurement modes:

- **H_a**: Hand-transmitted vibrations
- **W_b**: Whole-body vibrations
- **B_V**: Building vibrations

Measurement parameters:

- RMS, VDV, MTV, Peak, Max, Min

Frequency weightings:

- F_z, F_c, W_h for hand-transmitted vibrations
- F_z, F_a, W_b, W_c, W_d, W_e, W_j, W_k for whole body vibrations
- F_z, F_m, W_m for building vibrations

Spectral analysis 1/1 and 1/3 octave bands (option HD2070.01):

Real time, parallel on all input channels. The choice to perform hand-arm (HA) or whole body (WB or BV) measurements modifies 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 0.315Hz up to 315Hz (from 0.5Hz to 250Hz for octave band spectrum).

Application	Central frequency range	
	1/1 Octave Band [Hz]	1/3 Octave Band [Hz]
Hand-Arm	4 ÷ 2000	3.15 ÷ 3150
Whole-Body	0.5 ÷ 250	0.315 ÷ 315
Building-Vibration	0.5 ÷ 250	0.315 ÷ 315

Statistical Analysis (option HD2070.02): The selected measurement parameter is analyzed in 1dB classes. Both the probability and the percentile graphs can be shown.

Measurement range $0.1\text{m/s}^2 \div 7000 \text{ m/s}^2$ with accelerometer HDP356A02 (Ha measurement), $0.0007 \text{ m/s}^2 \div 7\text{m/s}^2$ with HDP356B18 (BV measurement).

Linearity range three ranges of 80dB overlapped by 70dB

Digital converter Three A/D converters with a resolution of 25 bits at 8k samples per second

Inherent noise level Less than 30mm/s^2 with accelerometer HDP356A02 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 vector acceleration calculated from the channels of tri-axial input
- **VLM3:** Three global parameters for each measurement axis
- **VLM4:** Three global parameters of vector acceleration calculated from the channels of tri-axial input
- **PROFILE:** Graphic profile of one parameter for each measurement axis with integration time programmable from 1s to 1 hour
- **SPECTRUM** (option HD2070.01): 1/1 or 1/3 octave spectrum for each measurement (contemporaneously) axis with calculation of one wideband filter. The graph can show the spectrum of acceleration, velocity or displacement.
- **STATISTICS** (option HD2070.02): the statistical distribution of the parameter chosen in PROFILE screen
- **PERCENTILES** (option HD2070.02): Percentile level graph of the parameter chosen in PROFILE

Datalogging

Time history: Multi Profile recording with **single integration** allows to log with sampling periods from 1s to 1h:

- 3 instantaneous or integrated parameters of the VLM_1 screen calculated on Ch1, Ch2 and Ch3 channels (a total of 9 parameters)
- 3 vector parameters of the VLM_2 screen (vector values from Ch1, Ch2, Ch3)
- Multi-spectra (from 1s) on Ch1, Ch2 and Ch3 (3 multi-spectra), in 1/1 or 1/3 octave bands (option HD2070.01).
- Raw acceleration signals (option HD2070.03) on Ch1, Ch2 and Ch3 (3 signals at 8KHz each)
- Statistical analysis (option HD2070.02) in 1dB classes with 1 second sampling frequency (only in multiple integration mode). Graph of levels probability distribution; graph of percentile levels from L₁ to L₉₉
- Voice comments recording

Global values: in parallel to time histories data logging, are logged:

- 3 overall integrated VLM_1 parameters for Ch1, Ch2 and Ch3
- 3 overall vector parameters of the VLM_2 screen (vector values from Ch1, Ch2, Ch3)
- Integrated spectra (option HD2070.01) on Ch1, Ch2 and Ch3 (3 spectra), in 1/1 or 1/3 octave bands
- Graph of levels probability distribution (option HD2070.02); graph of the percentile levels from L₁ to L₉₉

Memory

8MB Internal FLASH memory and connector for memory card SD type up to 2GB (SD card supplied).

Interface

Serial RS232 and USB type

Input/Output

LINE output for the three 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 HD2070 does not perform the function of battery charger.**

Environmental 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

Dimensions and weight:

95mm X 240mm X 50mm, weight 680gr.

Available Accelerometer models

It's possible to connect integrated electronics type (IEPE or equivalent) accelerometers both mono-axial and tri-axial. Accelerometers are directly power supplied with a 25V tension and a 2mA current.

The following models are available

Model	Axes	Application	Sensitivity[mV/g]	Range[±gpk]	Weight [gr]
HDP-352C34	1	General purpose	100	50	5.8
HDP-356B20	3	Ha - Shock	1	5000	4
HDD-3023A2	3	Ha	10	500	4
HDP-356A02	3	Ha	10	500	10.5
HDP-356B21	3	Ha	10	500	4
HDP-356A22	3	WB – General purp.	100	50	5.4
HDP-356B41	3	WB - Seat	100	10	272
HDD-3143D1	3	General purpose	100	50	14
HDP-356B18	3	Building vibration	1000	5	25

Technical specifications of accelerometers:

	HDP-352C34	HDP-356B20	HDP-356A02	HDP-356B21
Axes	1	3	3	3
Sensitivity [mV/g]	100	1	10	10
Range [±gpk]	50	5000	500	500
Frequency response [±5%]	0.5Hz ÷ 10KHz	(Z-Y) 2Hz ÷ 10KHz (X) 2Hz ÷ 7KHz	1Hz ÷ 5KHz	(Z-Y) 2Hz ÷ 10KHz (X) 2Hz ÷ 7KHz
Resonance frequency [KHz]	50	55	25	55
Linearity [%F.S.]	±1	±2.5	±2	±1
Transverse sensitivity [%max]	5	5	5	5
Max shock [gpk]	5000	7000	7000	10000
Operating temperature [°C]	-54 ÷ +93	-54 ÷ +121	-54 ÷ +121	-54 ÷ +121
Weight [g]	5.8	4	10.5	4
Dimensions	7/16" x 22.4 mm	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 screw hole 10-32	threaded screw hole 5-40	threaded screw hole 10-32	threaded screw hole 5-40
Insulation	-	-	-	-
Connector	top mounted 10-32	Side 8-36 4 pin	Side 1/4 -28 4 pin	Side 8-36 4 pin
Material	Titanium	Titanium	Titanium	Titanium

Technical specifications of accelerometers:

	HDP-356A22	HDP-356B41	HDD-3143D1	HDP-356B18
Axes	3	3	3	3
Sensitivity [mV/g]	100	100	100	1000
Range [±gpk]	50	10	50	5
Frequency response [±5%]	0.5Hz ÷ 4KHz	0.5Hz ÷ 1KHz	0.5Hz ÷ 3KHz	0.5Hz ÷ 3KHz
Resonance frequency [KHz]	25	27	25	20
Linearity [%F.S.]	±1	±1	±1	±1
Transverse sensitivity [%max]	5	5	5	5
Max shock [gpk]	5000	2000	1500	5000
Operating temperature [°C]	-54 ÷ +77	-10 ÷ +50	-50 ÷ +85	-29 ÷ +77
Weight [g]	5.4	272 (with seat pad)	14	25
Dimensions	11.4 x 11.4 x 11.4 mm	Ø 200mm x 12 mm	20.8 x 20.8 x 8.6 mm	20.3 x 20.3 x 26.1 mm
Mounting	threaded screw hole 5-40	Accelerometer with threaded screw hole 10-32 mounted in a rubber seat pad	Through hole for 6-32 UNC screw or M3	threaded screw hole 10-32
Insulation	-	-	-	-
Connector	Side 8-36 4 pin	Side 1/4 -28 4 pin	Side 1/4 -28 4 pin	Side 1/4 -28 4 pin
Material	Titanium	Titanium	Titanium	Anodized aluminium

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 provided with the HD2070 analyser:

- Wax for quick fastening
- Silicon grease
- USB cable for PC connection
- 2GB SD memory card
- CD containing "Noise Studio" PC software (Windows compatible), user manual and carrying case

Each accelerometer comes with the following accessories:

- Mounting screw (if provided accelerometer requires it)
- Manufacturer calibration chart of the sensor and ISO9001 calibration report
- CD with user manual and configuration data of accelerometer



Input details



Output details

Software

The interface program **Noise Studio** is provided with the instrument and allows to download and display 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.

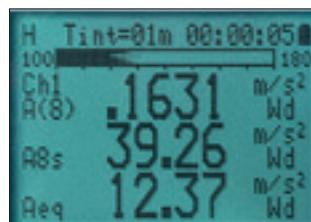
Sensor configurations can be set either manually, filling in the accelerometer data table, or automatically, using the CD provided with the accelerometers supplied by Delta Ohm. The HD2070 stores calibration information in a reserved area of internal memory. The calibration register file is downloaded 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.

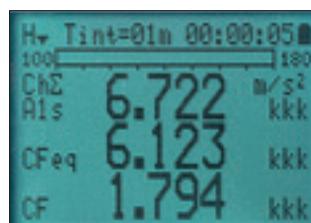
CH20: Hardware key for PC working with Windows® operating system. When plugged into the USB port, according to licence purchased, it enables the Noise Studio software modules.

NS1 Application module "Workers' Protection":

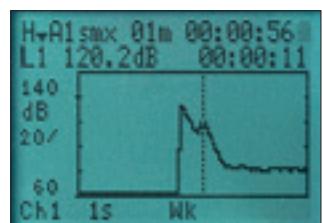
- Analysis of workers' exposure to noise and vibration, both hand-arm and whole-body, in accordance with Decree Law n.81/2008 and UNI9432/2011, European Directive 2003/10/CE and 2002/44/CE.
- Evaluation of hearing protectors with the methods OBM and SNR according to UNI EN 458.
- Evaluation of measurement uncertainties in accordance with UNI 9612.
- Calculation of the impulsiveness of noise sources according to the requirements of UNI 9432/2008.



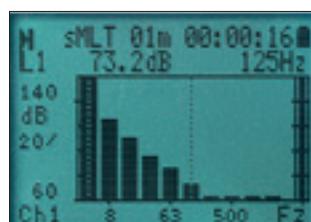
Base screen:
single axis measurements



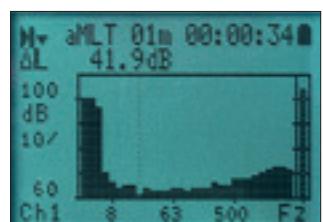
Base screen:
vector measurements



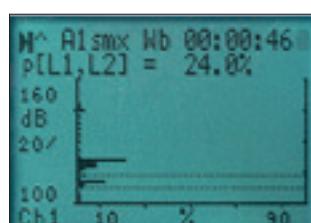
Time profile



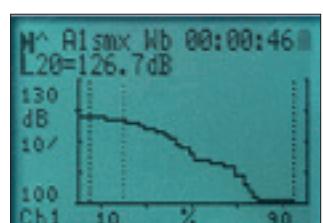
Octave band spectrum
(option HD2070.01)



Third octave spectrum
(option HD2070.01)



Statistic analysis:
probability distribution
(option HD2070.02)



Statistic analysis:
graph of percentile levels
(option HD2070.02)

ORDERING CODES FOR KITS AND ACCESSORIES

HD2070.K1 including:

- **HD2070** 3 channels vibration analyser, **HD6188** silicon grease, **HD6273** wax tray for gluing, **080A90** glue for quick mounting, **HD2030MC** 2 GB SD memory card, **CP22** USB serial connection cable, "Noise Studio" software, user manual and carrying case, **calibration report** for analyser according to ISO8041. **Accelerometers, connection cables and accessories must be specified at the time of order.**

HD2070.HA-WB kit including:

- **HD2070**: 3 channels vibration analyser, **HD6188** silicon grease, **HD6273** wax tray for gluing, **080A90** glue for quick mounting, **HD2030MC** 2 GB SD memory card, **CP22** USB serial connection cable, "Noise Studio" software, user manual and carrying case
- **HDP356A02**: 10mV/g Hand-Arm **tri-axial accelerometer** and connection cable to HD2070 analyser (HD2030.CAB3-3M), manufacturer calibration chart and **ISO8041 calibration report** for analyser-accelerometers chain with Wh filters, mounting screws,;
- **HDP356B41**: 100mV/g whole-body **tri-axial accelerometer** in a rubber pad including HD2030.CAB3-3M connection cable to HD2070 analyser, manufacturer calibration chart and **ISO8041 calibration report** for analyser-accelerometers chain with Wd, Wk filters;
- **ISO 8041 Calibration report** as vibration analyzer;
- **HD2030.124** set of three accelerometer mounting adapters composed of HD2030AC1, HD2030AC2 and HD2030AC4
- "Noise Studio" software for PC.

Firmware Options for HD2070 analyzer

HD2070.01 "Spectral analysis": measurement of the acceleration spectrum in 1/1 octave bands from 0.5 Hz to 2 kHz and 1/3 octave bands from 0.5 Hz to 3.15 kHz class 1 according to IEC 61260. Calibration report according to IEC 61260.



Optional tripod

HD2070.02 "Statistical analysis": probability distribution graph and percentile levels graph from L₁ to L₉₉ in 1 dB classes

HD2070.03 "Digital recorder": digital storage of accelerometer raw signals (on all channels) in the memory card.

Software

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

NS1 Application module "**Workers' Protection**": Analysis of noise and vibrations exposure in the workplace according to UNI9432, ISO9612, 2003-10-CE, 2002-44-CE

Accelerometers

HDP352C34: General purpose ICP mono-axial accelerometer. Sensitivity 100 mV/g. Range ±50 g pk. Weight 5.8 g. Includes: 10-32 UNF copper-beryllium alloy mounting screw (081B05), M6 copper-beryllium alloy mounting screw, (M081B05), Calibration certificate (ACS-1)

HDP356B20: Miniature ICP tri-axial accelerometer for hand-arm vibrations at high shock levels. Sensitivity 1 mV/g. Range ±5000 g pk. Weight 4 g, Includes: 5-40 UNC copper-beryllium alloy mounting screw (081A27), 10-32 UNF copper-beryllium alloy mounting screw (081A90), M3 copper-beryllium alloy mounting screw (M081A27). Calibration certificate (ACS-1T)

HDP356A02: ICP tri-axial accelerometer for the measurement of the vibrations transmitted to the hand-arm system.

Sensitivity 10 mV/g. Range ±500 g pk. Weight 10.5 g. Includes: 10-32 UNF copper-beryllium alloy mounting screw (081B05), M6 copper-beryllium alloy mounting screw (M081B05), Calibration certificate (ACS-1T)

HDP356B21: Miniature ICP tri-axial accelerometer for hand-arm vibrations. Sensitivity 10 mV/g. Range ±500 g pk. Weight 4 g. Includes: 5-40 UNC copper-beryllium alloy mounting screw (081A27), 10-32 UNF copper-beryllium alloy mounting screw (081A90), M3 copper-beryllium alloy mounting screw (M081A27), calibration certificate (ACS-1T).

HDP356A22: General purpose miniature ICP tri-axial accelerometer. Sensitivity 100 mV/g. Range ±50 g pk. Weight 5.4 g. Includes: 5-40 UNC copper-beryllium alloy mounting screw (081A27), 10-32 UNF copper-beryllium alloy mounting screw (081A90), M3 copper-beryllium alloy mounting screw (M081A27), Calibration certificate (ACS-1T).

HDD3143D1: General purpose tri-axial accelerometer. Sensitivity 100 mV/g. Range ±50 g pk. Weight 14 g. Includes: 6-32 UNC mounting screw, Mounting adapter with M3 screw for fixing to the floor support HD2030AC5

HDP356B41: General purpose ICP tri-axial accelerometer inserted in a rubber pad for whole body vibrations transmitted through seats and backs. Sensitivity 100 mV/g. Range ±10 g pk. Weight 272 g. Includes: HD2030.CAB3-3M, 3 m connection cable. Calibration certificate (ACS-1T).

HDP356B18: High sensitivity ICP tri-axial accelerometer for buildings vibrations. Sensitivity 1 V/g. Range ±5 g pk. Weight 25 g. Includes: 10-32 UNF copper-beryllium alloy mounting screw (081B05), M6 copper-beryllium alloy mounting screw (M081B05), calibration certificate (ACS-1T)



Optional headset

Vibration calibrator

HD2060: Portable vibration calibrator with frequency 15.915 Hz and levels 1 m/s² and 0.1 g, and frequency 159.155 Hz and levels 10 m/s² and 1 g. LCD display. Includes: HD2060.20 support with UNF 10-32 screw for mounting tri-axial accelerometers, HD6245.1 insulated base with integrated UNF 10-32 screw for adhesive mounting, BAT-40: 1.2 V x 4 NiMH rechargeable battery pack, SWD10 stabilized mains power supply 100-240 Vac / 12 Vdc – 1A, carrying case, calibration report

HD6245.1: adhesive base with integrated 10-32 UNF screw

HD2060.20: support for the lateral mounting of tri-axial accelerometers with 10-32 UNF mounting screw

Mounting adapters for accelerometers

HD2030AC1: cube-shaped adapter for accelerometers mounting. The adapter has to be fastened with plastic cable-tie or metallic clamp close to the handle holding hand. Suitable for anatomical handles and small size tools, where the weight and dimensions of the measurement chain must be minimized. Material: **light alloy**. *Includes:*

- 10-32 UNF cylindrical head with hex socket screw with 4 mm hex key
- 5-40 UNC cylindrical head with hex socket screw with 4 mm hex key
- 10 cable-ties, width 4.5 mm, length 200 mm
- 1 metallic clamp, width 9 mm

HD2030AC2: adapter for accelerometers mounting between the hand and the handle, is pushed against the handle by the hand itself. Because the accelerometer is placed in a lateral position, the measurement must be repeated placing the accelerometer both on the right and left side of the hand. Suitable for large cylindrical handles. Material: **light alloy**. *Includes:*

- 10-32 UNF cylindrical head with hex socket screw with 4 mm hex key
- 5-40 UNC cylindrical head with hex socket screw with 4 mm hex key
- 10 cable-ties, width 4.5 mm, length 200 mm
- 2 velcro straps, width 25 mm, length 300 mm

HD2030AC3: adapter for accelerometers mounting. The adapter, inserted between the hand and the handle, is pushed against the handle by the hand itself. Because the accelerometer is placed in a lateral position, the measurement must be repeated placing the accelerometer both on the right and left side of the hand. Suitable for large cylindrical handles. Provided with 10-32 UNF fixing hole for the mounting of the accelerometer. Material: **inox**. *Includes:*

• 10 cable-ties, width 4.5 mm, length 200 mm

- 2 velcro straps, width 25 mm, length 300 mm

HD2030AC4: The adapter, inserted between the hand and the handle, is pushed against the handle by the hand itself. The accelerometer is placed in central position between the middle-finger and the ring-finger or between the forefinger and the middle-finger. Suitable for anatomical handles even if not cylindrical or with small dimensions. Material: **light alloy**. *Includes:*

- 10-32 UNF cylindrical head with hex socket screw with 4 mm hex key
- 5-40 UNC cylindrical head with hex socket screw with 4 mm hex key
- 10 cable-ties, width 4.5 mm, length 200 mm
- 2 velcro straps, width 25 mm, length 300 mm

HD2030AC5: Support for mono and tri-axial accelerometers for the measurement of vibrations on floors or vibrating surfaces in general. Provided with levelling device and three feet, two of them with adjustable height. The support has a cavity on the bottom side with a M4 threaded hole; on the top side a 10-32 UNF threaded hole for accelerometer mounting. A cubic adapter is provided to fix on the top side three mono-axial accelerometers. Material: **nickel-plated steel**, weight 1.9 kg. *Includes:*

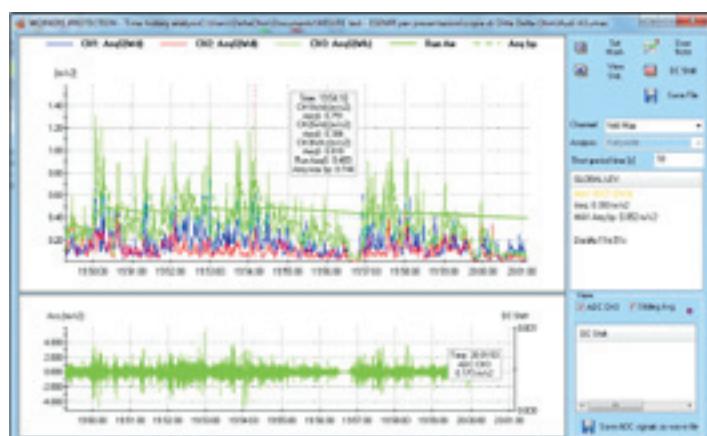
- Steel support with three feet and spirit level. Has a 10-32 UNF threaded hole on the top side and a cavity on the bottom side with a M4 threaded hole.
- Cubic adapter to be mounted on the support top side with two M4 screws (included). The cube is provided with 10-32 UNF threaded holes on three orthogonal faces.
- 3 mm hex key.

HD2030.124: adapters kit for the measurement of the vibrations transmitted to the hand-arm system. *Includes:*

- HD2030AC1: cube-shaped adapter for anatomical handles and small size tools. Has to be fastened to the handle with plastic cable-tie or metallic clamp (included).
- HD2030AC2: adapter for cylindrical handles. It is placed laterally with respect to the hand.
- HD2030AC4: general purpose adapter. The accelerometer is placed between the forefinger and the middle-finger or between the middle-finger and the ring-finger.

HD2030.1234: adapters kit for the measurement of the vibrations transmitted to the hand-arm system. *Includes:*

- HD2030AC1: cube-shaped adapter for anatomical handles and small size tools. Has to be fastened to the handle with plastic cable-tie or metallic clamp (included).
- HD2030AC2: adapter for cylindrical handles. It is placed laterally with respect to the hand.
- HD2030AC3: adapter for cylindrical handles provided with threaded hole for accelerometers with 10-32 UNF screw. It is placed laterally with respect to the hand.
- HD2030AC4: general purpose adapter. The accelerometer is placed between the forefinger and the middle-finger or between the middle-finger and the ring-finger.



NS1 "Workers Protection" vibration module: vibration exposition evaluation, X, Y, Z axes time histories analysis. **Vibration signal DC shift analysis.**



Cables for mono-axial accelerometers

HD2030.CAB1-3M: low noise coaxial cable for connection of mono-axial accelerometers.

L=3m (other lengths upon request). Can be used with HDP352C34

HD2030.CAB1-5M: low noise coaxial cable for connection of mono-axial accelerometers.

L=5m (other lengths upon request). Can be used with HDP352C34

HD2030.CAB1-10M: low noise coaxial cable for connection of mono-axial accelerometers.

L=10m (other lengths upon request). Can be used with HDP352C34

HD2030.CAB13: coaxial cable for connection of three mono-axial accelerometers to the HD2070 analyzer. L=40cm, BNC connectors. The accelerometers are connected to the HD2030.CAB13 cable through HD2030.CAB1B-3M cables

HD2030.CAB1B-3M: coaxial cable for connection of mono-axial accelerometers to the HD2030.CAB13 cable. **L=3m** (other lengths upon request). Equipped with connectors. Can be used with HDP352C34

HD2030.CAB.BNC-xxM: Coaxial extension cable for the connection of mono-axial accelerometers to the HD2030.CAB13 cable. **Maximum length 200 m**, both ends terminated with BNC female connectors.

Cables for tri-axial accelerometers

HD2030.CAB3-3M: Cable for tri-axial accelerometers connection to the right input of the analyzer. **L=3 m** and connectors. It can be used with HDP356A02 , HDD3143D1 and HDP356B18 accelerometers.

HD2030.CAB3-5M: Cable for tri-axial accelerometers connection to the right input of the analyzer. **L=5 m** and connectors. It can be used with HDP356A02 , HDD3143D1 and HDP356B18 accelerometers.

HD2030.CAB3-10M: Cable for tri-axial accelerometers connection to the right input of the analyzer. **L=10 m** and connectors. It can be used with HDP356A02 , HDD3143D1 and HDP356B18 accelerometers.

Cables for miniature tri-axial accelerometers

HD2030.CAB3S-3M: Cable for miniature tri-axial accelerometers connection to the right input of the analyzer. **L=3 m** and connectors. It can be used with HDP356B20, HDP356B21 and HDP356A22 accelerometers.

HD2030.CAB3S-5M: Cable for miniature tri-axial accelerometers connection to the right input of the analyzer. **L=5 m** and connectors. It can be used with HDP356B20, HDP356B21 and HDP356A22 accelerometers.

HD2030.CAB3S-10M: Cable for miniature tri-axial accelerometers connection to the right input of the analyzer. **L=10 m** and connectors. It can be used with HDP356B20, HDP356B21 and HDP356A22 accelerometers.

Accessories for accelerometers mounting:

HD6188: Silicone grease repellent to water and electrically insulating.

HD6273: Pan with wax bonding

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.

HD6196: Magnetic base with integrated 10-32 UNF screw. It can be used with the HDP356A02, HDP356C34 and HDP356B41 (removing the rubber pad) accelerometers.

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

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

080A90: glue for quick fixing.

081B05: screw with double thread 10-32 UNF.

081A90: screw with double thread 5-40 UNC and 10-32 UNF.

M081B05: screw with double thread 10-32 UNF and M6x0,75.

M081A27: screw with double thread 5-40 UNC and M3x0,5".

081A27: screw with double thread 5-40 UNC.

HD2060.20: support for the lateral mounting of tri-axial accelerometers with 10-32 UNF mounting screw

HD6245: Insulated base with integrated 10-32 UNF screw and threaded hole 10-32 UNF. It can be used with the HDP356A02, HDP356C34 and HDP356B41 (removing the rubber pad) accelerometers.

HD6245.1: adhesive base with integrated 10-32 UNF screw. It can be used with accelerometers without mounting screw.

Accessories

HD2110CSNM: serial cable connection to PC COM interface.

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

HD2030MC: 2GB SD memory card.

HD2030AM: headset with microphone.

SWD10: Stabilized mains power supply Vin=100÷240Vac / Vout=12Vdc/1000mA.

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply. Required interface cable HD2110CSNM (not supplied).

BAT-40: Replacement battery pack for HD40.1

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

VTRAP: tripod.





HD2060

PORTABLE MULTI-FREQUENCY AND MULTI-LEVEL CALIBRATOR FOR VIBRATION TRANSDUCERS

The calibrator HD2060 generates mechanical vibration amplitude controlled with precision and frequency stabilized by a quartz. Coupling a transducer to the vibrating base of the calibrator it is possible to check its sensitivity to acceleration, velocity or displacement. The presence of a rechargeable internal battery, the weight and the small dimensions as well as the low sensitivity to environmental parameters make it easy to use the calibrator in the field. The calibrator is equipped with a feedback system capable of accurately maintaining the amplitude level set, regardless of the load associated with the mass of the transducer (within the limits stated in the technical specifications).

The mechanical vibrations generated by the calibrator are very stable over the time, with a typical drift of 1% per year. In order to maintain the accuracy, we recommend the annual calibration at DELTA OHM metrological laboratories. The calibrator notifies the user about the need to make the periodic check by displaying alternately the signs "cal" and "exp" on the display.

The backlit display provides a clear indication of acceleration, frequency and the reaching of the set level. In case of exceeding the maximum permissible load or in case of low battery, the calibrator alerts the user by displaying an error message and the operation of the vibrating base is turned off. The automatic stop of the vibration after the set time and the automatic shutdown function prevent the discharge of the battery.

The calibrator is equipped with screws and accessories for mounting the transducers, with external power supply for charging the battery and with calibration report.

Applications:

- In-the-field calibration of acceleration, velocity and displacement transducers.
- Calibration of acceleration sensors used for the measurement of vibrations transmitted to men in the workplace, according to the standard ISO 8041:2005.
- Calibration of acceleration sensors used to evaluate buildings vibration.

Main specifications:

- Two frequencies of emission: 15,915 Hz at 1 m/s² and 0,1 g
159,155 Hz at 10 m/s² and 1 g
- Low distortion accelerations, independent from the mass of the transducer
- Absence of dispersed magnetic field
- Backlit display with the indication of the acceleration level stabilization
- Internal rechargeable battery which allows 2 hours of continuous operation at 15,915 Hz and 7 hours of continuous operation at 159.155 Hz.

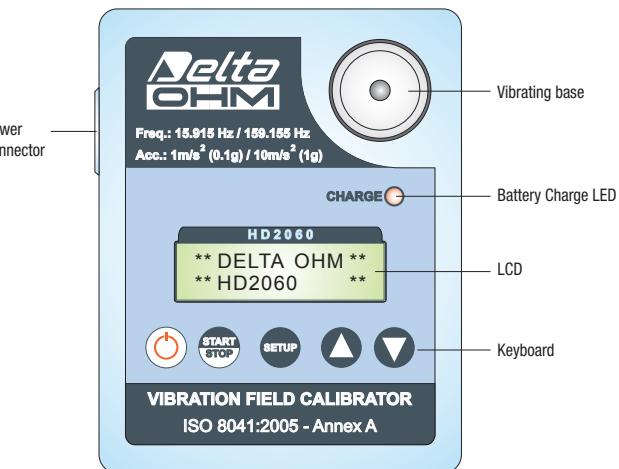


Fig. 1: Description

SPECIFICATIONS

Maximum load of the vibrating base	Traction force: 10 N Pressure: 30 N Transverse: 2 N
Mass of the transducer	Maximum 150 g at 15,915 Hz Maximum 30 g at 159,155 Hz
Emission frequency tolerance	± 0,1%
Emission amplitude tolerance	± 3%
Distortion	Less than 3% at 15,915 Hz Less than 0,5% at 159,155 Hz
Duration of individual emission	Settable from 120 sec to 10 min . Automatic turn OFF
Transverse acceleration	Less than 10% at 15,915 Hz Less than 20% at 159,155 Hz
Mounting of the transducer	Threaded hole UNF 10-32 at 90° ±1°
Working temperature/RH	0...+40 °C / 0...85 %UR not condensing
Stabilization time	Less than 30 s
Display	Backlit with indication of: Frequency generated Acceleration generated Stabilization of the vibration Remaining battery charge Calibration deadline
Power supply	Rechargeable NiMH battery pack 1.2V x 4, capacity 1600 mA/h (BAT-40) Stabilized power supply voltage 100-240 Vac / 12 Vdc 1 A (SWD10)
Autonomy with full charged battery	2 hours of continuous use at 15,915 Hz 7 hours of continuous use at 159,155 Hz
Battery charging time	4 hours at 12 Vdc 1 A
Auto power off	After an inactive period of time equal to 3 times the time of solicitation set
Dimensions	115 x 93 x 63 mm
Weight	930 g including battery

TRASDUCER MOUNTING

The calibrator HD2060 presents a flat circular steel fixing base (see Figure 1), resistant to abrasions, with a threaded hole in the center UNF 10-32 for the mounting of the transducers. The fixing base can freely rotate on its housing so as to avoid damage to the calibrator when mounting the sensors and applying the tightening. To fix the accelerometer using a screw it's sufficient a 1-2 Nm tightening force, compatible with a manual operation. For maximum measurements repeatability, the use of a torque wrench is recommended.

Maximum applicable forces to the fixing base are: 30 N pressure force, 10 N traction force and 2 N transverse force (see picture 2). **Applying a load which exceeds specified limits can permanently damage the HD2060 calibrator.**

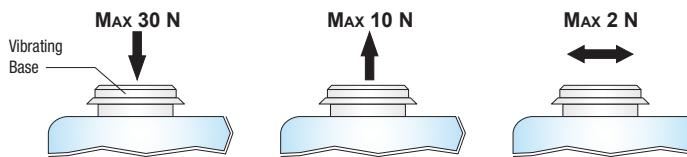


Fig. 2: maximum load limits for vibrating base

As an alternative to screw mounting, it's possible to fix the sensor onto vibrating base using double-sided tape, wax or quick glue; for this can be used the supplied insulated base HD6245.1 (see picture n.3) to be mounted between vibrating base and transducer. To avoid an excessive pressure on the vibrating base, we recommend to glue the transducer on the HD6245.1 adapter before screwing it to the vibrating base.

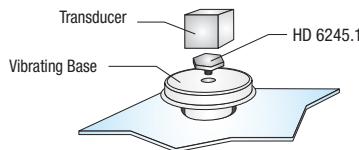


Fig. 3: Adhesive Mounting

To calibrate axes orthogonal to the mounting axis on triaxial accelerometers, is supplied the adapter HD2060.20, complete with UNF 10-32 dual threading screw to fix the adapter to the mounting base and screw with UNF 10-32 threading to fix the sensor to the adapter (see picture n 4).

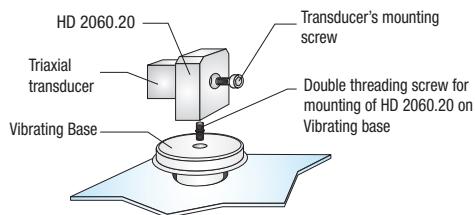


Fig. 4: Use of adapter HD 2060.20

If you use the HD2060.20 adapter to calibrate at 16 Hz perpendicular axis of a triaxial accelerometer having a mass greater than 30 g, it is necessary to balance the load using a counterweight equal to that of the transducer to be mounted, as shown in figure 5.

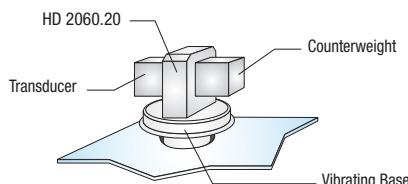


Fig. 5: Use of counterweights

Calibrator must be placed on a flat horizontal surface, possibly free from external vibrations. In order to check that transmitted vibration level from supporting surface is negligible it is sufficient, after transducer has been fixed to the mounting base, to verify that acceleration on the measurement chain with calibrator turned OFF is below 1/5 of calibration level. For example, if a calibration has to be made at 15,915 Hz with 1 m/s² amplitude level, acceleration on the measurement chain when calibrator is OFF should be less than 0,2 m/s².

During calibration solicitation it's necessary to avoid unbalances on the base, taking care of transducer's connection cable positioning, in order to minimize the transverse load. Transducer should be mounted so that the load is centered on the base.

BATTERY CHARGE

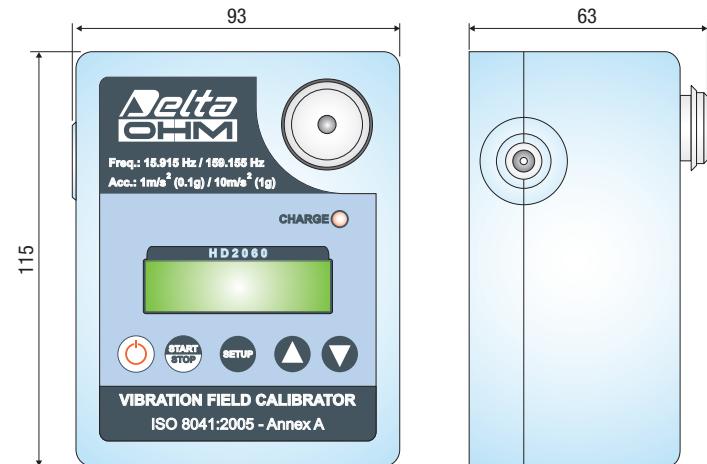
The battery symbol on the display continuously provides the charge battery status. As the battery discharges, the symbol "empties". When the charge is insufficient for correct device operation, the symbol starts blinking and it will be not possible to activate the emission of the vibrating base.

In order to charge the batteries, connect the SWD10 power supply to the input plug positioned on the calibrator's side. During battery charge, the "CHARGE" red LED is ON. The LED will turn OFF when the charge is completed. The time necessary for a full charge is about 4 hours.

Power supply has a dual function: supplies the device and charges the NiMH battery. When power supply is plugged in, the battery symbol on the display, is substituted by the symbol of a plug.

In order to preserve over time the battery capacity, it is recommended to make a complete charge cycle at least one time every two months.

DIMENSIONS (mm)



ORDERING CODES

HD2060: Portable calibrator for acceleration, velocity and displacement transducers. Double emission frequency 15,915 Hz (amplitudes 1 m/s² and 0.1 g) and 159,155 Hz (amplitudes 10 m/s² and 1 g). Backlit LCD display. Power supply with internal rechargeable battery or external 12Vdc power supply. Includes: support (**HD2060.20**) for triaxial accelerometers mounting, rechargeable internal battery (**BAT-40**), power supply (**SWD10**), carrying case and calibration report, **HD6245.1** insulated base for adhesive mounting.

Accessories

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

BAT-40: Rechargeable NiMH battery pack 1,2 V x 4 .

HD6245.1: Base with integrated UNF 10-32 screw. To be used for adhesive mounting

HD2060.20: Support for the lateral mounting of tri-axial accelerometers with 10-32 UNF mounting screw





ACCREDIA N° 124 Laboratory - acoustics measurements





Laboratory LAT N° 124

DELTA OHM s.r.l.
Via G. Marconi, 5
35030 CASELLE DI SELVAZZANO (PD) - ITALIA

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E-mail: info@deltaohm.com
URL http://www.deltaohm.com

Permanent Laboratory

ACCREDITATION TABLE

Quantity	Instruments to be calibrated	Measuring range	Frequency range	Uncertainty (*)	Note
Acoustic pressure Level (1)	Pistonphones:	124 dB	250 Hz	0,10 dB	
	Acoustic calibrators	from 90 dB to 114 dB	250 Hz and 1000 Hz	0,11 dB	
	Multifrequency Calibrators	from 94 to 114 dB	31,5 Hz	0,15 dB	
			from 63 Hz to 2 kHz	0,11 dB	
			4 kHz	0,12 dB	
			8 kHz	0,16 dB	
			12,5 kHz, 16 kHz	0,25 dB	
	Sound level meters	from 94 to 124 dB	250, 1000Hz	0,20 dB	②
		from 25 to 140 dB	from 31,5 Hz to 16 kHz	from 0,40 to 0,80 dB	
	Sound level meters				③
	Indication at the calibration check frequency	from 94 dB to 114 dB	250 Hz o 1000 Hz	0,20 dB	
	Acoustical signal tests of a frequency weighting	from 94 dB to 114 dB	from 31,5 Hz to 4 kHz	0,39 dB	
			8 kHz	0,69 dB	
			12,5 kHz and 16 kHz	0,15 dB	
	Electrical signal tests of frequency weightings	from 25 dB to 140 dB	from 31,5 Hz to 16 kHz	0,15 dB	
	Frequency and time weightings at 1kHz	from 94 dB to 114 dB	1 kHz	0,15 dB	
	Level linearity on the reference level range	from 25 dB to 140 dB	8 kHz	0,12 dB	
	Level linearity including the level range control	94 dB	1 kHz	0,12 dB	
Acoustic pressure sensitivity (2)	Toneburst response	from 25 dB to 140 dB	4 kHz	0,19 dB	
	Peak C sound level	from 110 to 140 dB	500 Hz and 8 kHz	0,17 dB	
	Overload indication	from 110 to 140 dB	4 kHz	0,20 dB	
	Octave band filters		31,5<fc<16000	from 0,10 to 0,80 dB	①
	Fractional octave band filters		20<fc<20000	from 0,10 to 0,80 dB	①

(*) The uncertainty is expressed on a confidence level of about 95% and is obtained by multiplying the standard uncertainty by the coverage factor k specified.

① Uncertainty depends on the frequency

② Sound level meters that conform only to the standards CEI EN 60651 and CEI EN 60804

③ Sound level meters that conform to the standard CEI EN 61672-3

