OPERATING MANUAL

HD2050

Omnidirectional sound source

HD2050.20

Power amplifier/noise generator

HD2050.30

Facade directional loudspeaker

EN

V2.0

senseca

Contents

1 Introduction

The system is composed of HD2050 dodecahedron loudspeaker, HD2050.20 digital power amplifier and related accessories; it allows to perform building and architectural acoustics measurements:

- Acoustic insulation
- Buildings acoustics
- Acoustic absorption
- Reverberation time
- Room acoustics (RASTI, STI, Clarity, Definition descriptors etc.)
- Pulse response

HD2050 is a sound source able to emit sound energy in the room in a isotropic way with very high very high sound power levels. The sound source is designed to offer maximum performances with special attention to international standards in the field of architectural and building acoustics.

It complies with EN ISO 140-3:2006 and EN ISO 3382:2001 standards as concerns directivity.

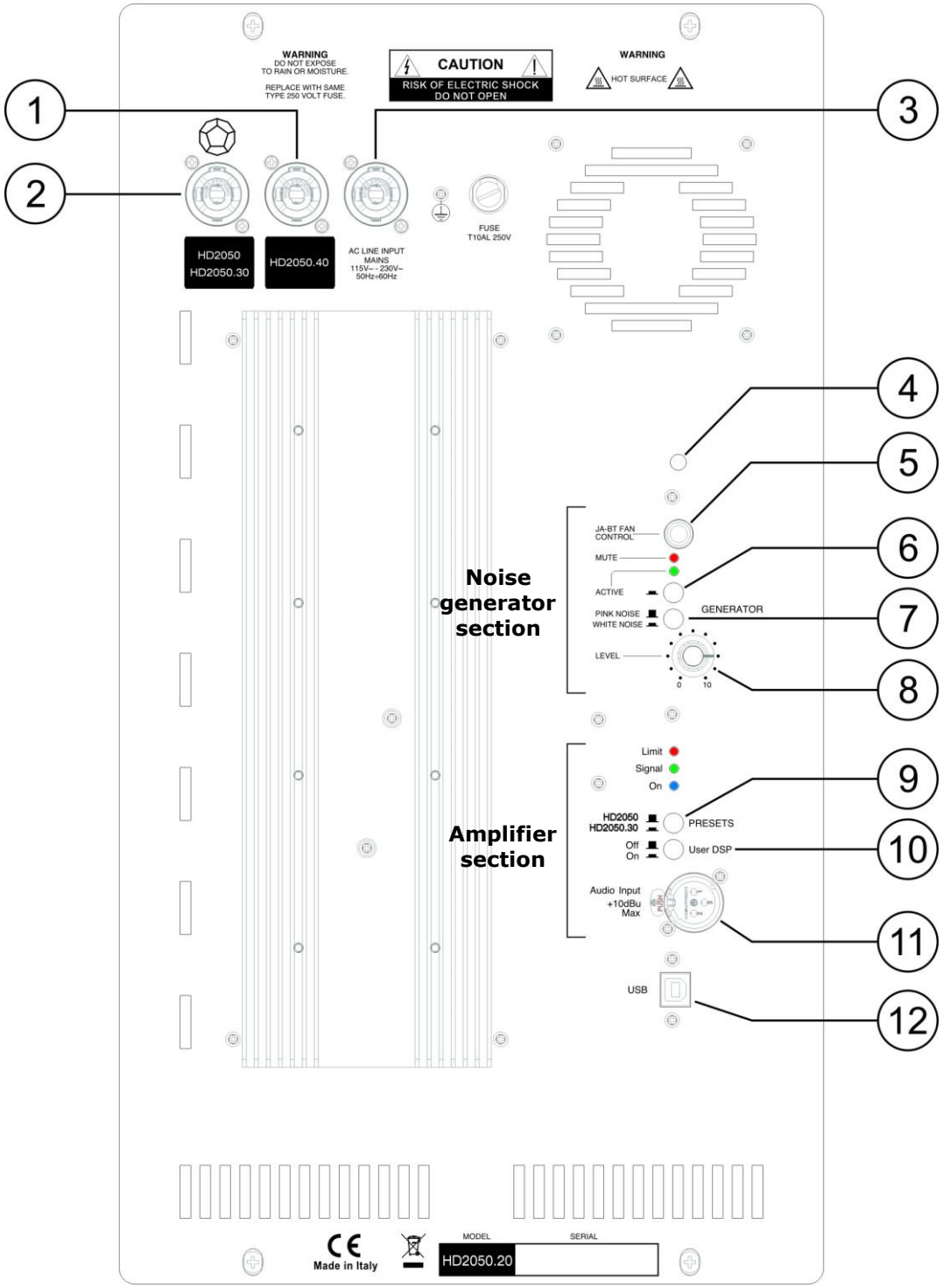
HD2050 features a wide extension frequency response and provides an emission sound power level of more than 122dB re 1pW. Twelve coaxial loudspeakers arranged on the dodecahedron faces, provide a high acoustic performance. The twelve faces cabinet is multilayer wood made and has a light weight allowing an optimal *on site* portability. The double components plastic coating VFI-2513 gives the case a high hardness, so to conform ASTM (American Society for Testing Materials) standards. A further opaque geal-coat finish makes the cabinet surface scratch and waterproof resistant.

The HD2050.20 is a digital signal amplifier designed to operate with HD2050 and HD2050.30 sources. The amplifier incorporates a white/pink noise generator and an auxiliary input to receive signals from other external devices.

Using Podware software (downloadable from the website) you can modify the EQ curve stored in the amplifier's DSP in order to tailor the frequency response of the system to specific measurement needs.

It's also possible to connect the HD2050.30 façade loudspeaker or the HD2050.40 sub-woofer (matched to the source HD2050) to HD2050.20 amplifier.

2 HD2050.20 amplifier description



1. Connection to HD2050 dodecahedron or HD2050.30 facade loudspeaker.
2. Connection to HD2050.40 subwoofer.
3. Power supply.
4. Remote control antenna connector.
5. Battery power kit cooling fan control.
6. Manual signal activation button.
7. White/pink noise selection button.
8. Level control (0=MIN).
9. HD2050 or HD2050.30 selection button.
10. User DSP selection button.
11. Amplifier input connector.
12. USB connector.

3 Connections

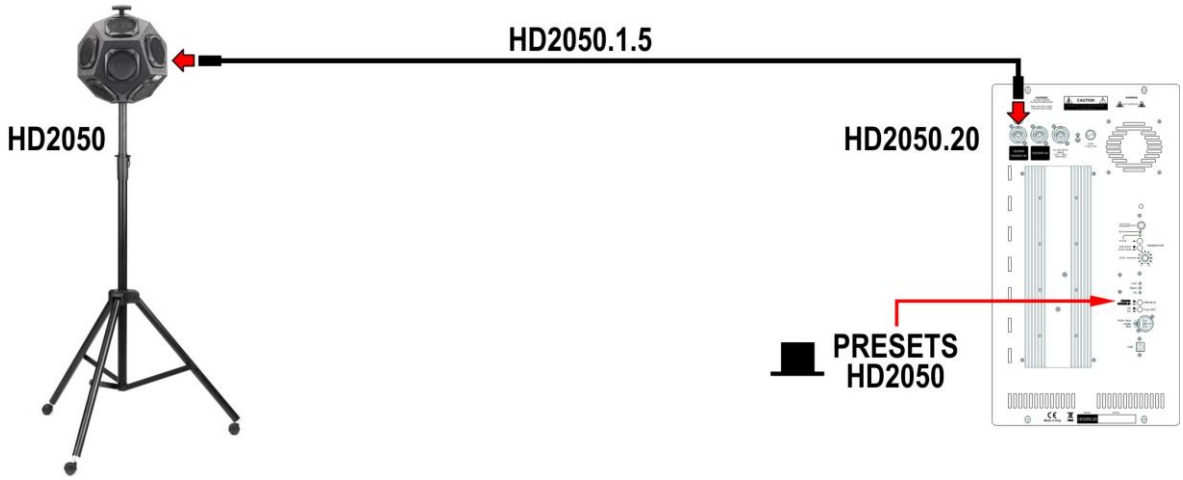
Before making any connections make sure that the "LEVEL" potentiometer is set to minimum by turning the knob all the way counterclockwise (position 0).

If user needs a custom equalization, set the "User DSP" button to On (button up). To create and load in the DSP a custom equalization refer to the section on page 13.

3.1 HD2050 dodecahedron + HD2050.20 amplifier

Use the PRESETS button to select HD2050 (button up).

Connect the Neutrik SPEAKON signal cable to the dodecahedron and to the amplifier connector labelled HD2050/HD2050.30.



3.2 HD2050.30 facade loudspeaker + HD2050.20 power amplifier

Use the PRESETS button to select HD2050.30 (button down).

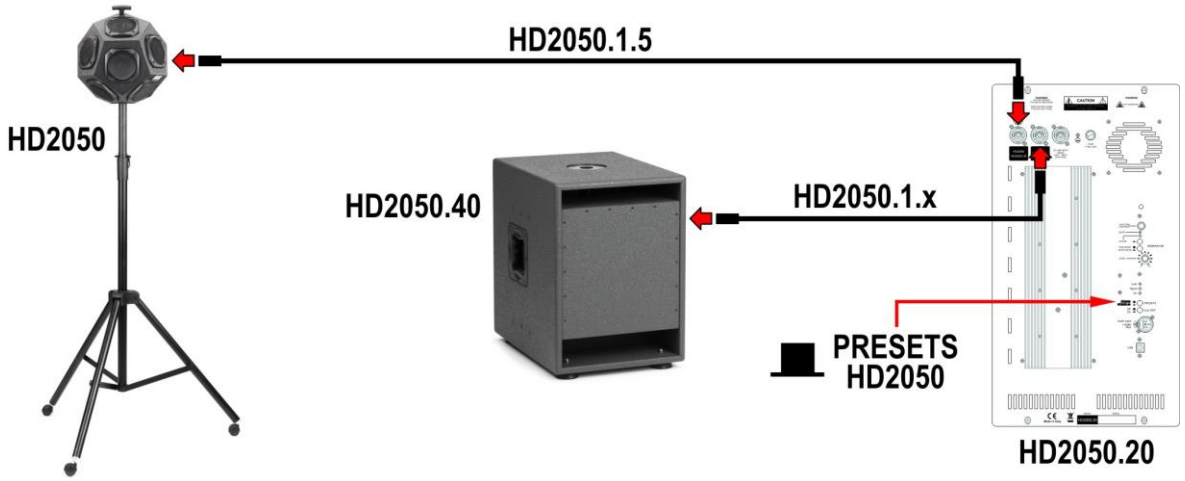
Connect the Neutrik SPEAKON signal cable to the loudspeaker and to the amplifier connector labelled HD2050/HD2050.30.

3.3 HD2050 dodecahedron + HD2050.40 subwoofer + HD2050.20 amplifier

Use the PRESETS button to select HD2050 (button up).

Connect the Neutrik SPEAKON 5 m signal cable to the dodecahedron and to the amplifier connector labelled HD2050/HD2050.30.

Connect the Neutrik SPEAKON 2 or 5 m signal cable to one of the two subwoofer connectors and to the amplifier connector labelled HD2050.40.

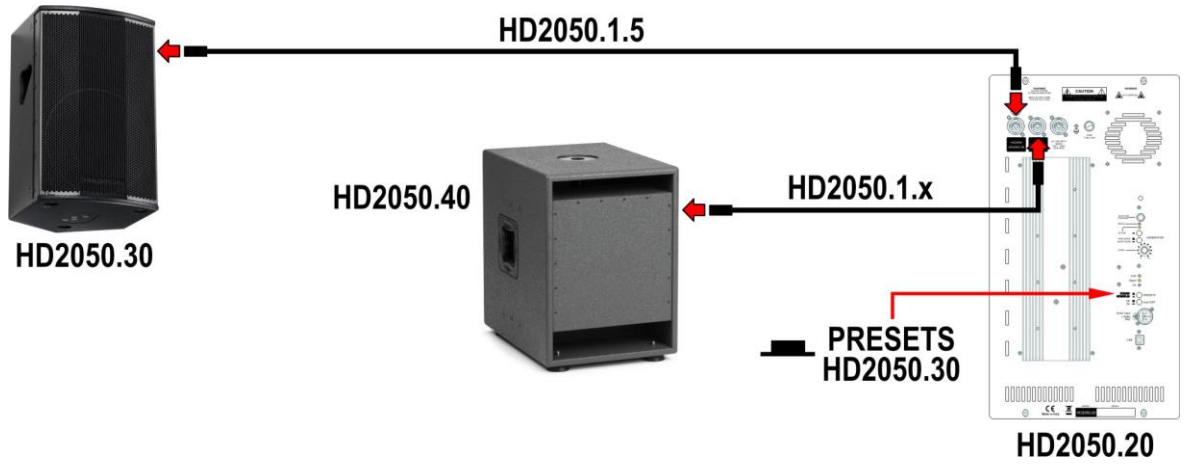


3.4 HD2050.30 facade loudspeaker + HD2050.40 subwoofer + HD2050.20 amplifier

Use the PRESETS button to select HD2050.30 (button down).

Connect the Neutrik SPEAKON 5 m signal cable to the loudspeaker and to the amplifier connector labelled HD2050/HD2050.30.

Connect the Neutrik SPEAKON 2 or 5 m signal cable to one of the two subwoofer connectors and to the amplifier connector labelled HD2050.40.

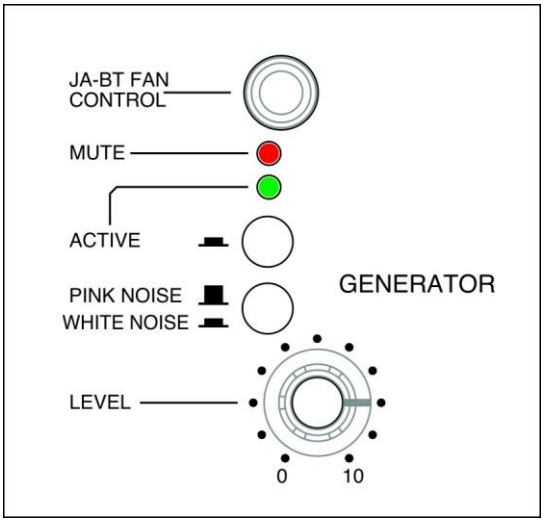


3.5 Power supply

Connect the power cord to the mains socket and to the AC LINE INPUT of the amplifier.

The amplifier-side power cord connector (Neutrik POWERCON) also acts as power switch. To switch on, plug in the POWERCON connector and rotate it about 45° clockwise.

3.6 Noise Generator



The noise generator has two buttons: one is used to activate the noise generator (ACTIVE); the other one is used to select the type of noise, between white noise and pink noise, sent to amplifier.

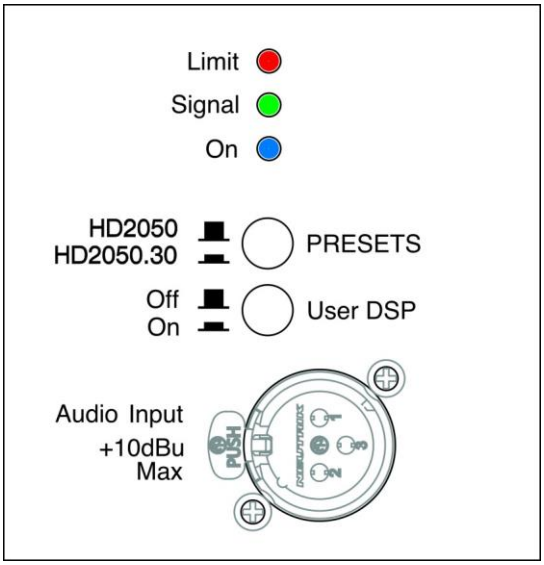
The green led "active" indicates that the generator status is ON.

By the external transmitter of the embedded remote control kit, the "mute" is activated, interrupting immediately the generated noise. When the "mute" is activated, the cooling fan of the amplifier power section will be turned off for some seconds; in this way it is avoided that the noise generated by the fan could influence the acoustic measurement, if the background noise level is considerably low.

If the optional battery power kit (kit with inverter for battery power supply of apparatus when mains power supply is not available) is used, it is possible to use the JA-BT FAN CONTROL connector to drive the power off of cooling fan installed in the battery power kit.

The noise generator emission level is manually adjusted using the "LEVEL" potentiometer. In this way it is possible to send the requested signal level to amplifier input. When the potentiometer is rotated to the maximum clockwise (indication 10), the generator output level is equal to the maximum level allowed by HD2050.20 amplifier input.

3.7 Power amplifier and DSP (Digital Signal Processor)



HD2050.20 power amplifier uses a Digital Signal Processor with two different "presets", selectable via the button on the amplifier front panel.

Select HD2050 or HD2050.30 depending on the source used.

The preset settings allow optimum operation of the amplification system with the use of the dodecahedral source HD2050 or HD2050.30 facade loudspeaker.

The two presets cannot be modified by the user and are loaded as factory default when the system is delivered to customers. They include correct frequency cuts and optimal setup (limiter) of input signal amplitude in order to obtain the maximum system performance without the risk to damage electronic components.

The two "presets" are very different each other and are studied to be used with specific loudspeakers models. For a correct loudspeaker response and mostly in order to avoid any damage, it is compulsory to use the correct preset for each loudspeaker connected to the system.

A second button named "User DSP" allows to activate and load on the system a correction curve to equalize the acoustic response of the loudspeaker. The correction curve works "over" the selected preset. The equalization curve "User DSP" can be created and modified by the user, through the PodWare PC software supplied with the system. After equalization creation and modification, the curve can be loaded on the amplifier DSP through the USB connection. The user defined equalizations can be stored on the PC memory (file with *.dse extension) and when used are loaded on amplifier's DSP.

When the "User DSP" button is set to On, it will be activated the last equalization curve present in the PC connected. If the button is set to Off, the "User DSP" is disabled and the response curve will be the "presets" currently active.

The three led on the front panel have the following functions:

1. **On**: amplifier power on status.
2. **Signal**: signal present on the amplifier input (whether it comes from the internal noise generator and from an external device).
3. **Limit**: signal limiter active.

The limiter is set to drive the different loudspeakers at their maximum performances avoiding possible damage. When external signals are used, it is possible to increase the level until the limiter acts occasionally; it is not recommended to go above this threshold in order to avoid distortion of the signal.

3.8 Remote control kit

The integrated HD2050.20R remote control kit allows to remotely control the internal noise generator of HD2050.20. The kit consists of a portable transmitter and an integrated receiver that can be activated at a distance up to 100 m. The transmitter is supplied by batteries and is activated manually with a button.

The receiver has an external antenna to be screwed on the specific connector on the front panel of HD2050.20 amplifier.

4 Sources and supports

4.1 HD2050.1 stand

Tripod with adjustable height and foldable. Extremely stable and light weight, it is supplied with integrated wheels allowing to translate the dodecahedron on the floor with no need to dismount it.

HD2050.1 stand has a security system to slowdown the pole when extended in order to avoid possible damage to dodecahedron. It also has a lock system.

4.2 HD2050.40 subwoofer

The HD2050.40 passive subwoofer is designed to work in conjunction with the HD2050 dodecahedron. The system consists of the sub HD2050.40, the dodecahedron HD2050 and the HD2050.20 digital power amplifier, allowing to fulfill advanced requirements in applications as sound insulation and architectural acoustics measurements.

Acoustic testing laboratories, manufacturers of materials with high insulation properties, acoustic consultants with specific measurement needs, or in general where it is needed a big amount of acoustic energy at low and high frequency, they will find this system a complete and effective solution.

The HD2050.40 is a band-pass type; the sound radiation is not direct but through a couple of resonant cavities, one front and one rear. In this way the reproduction of the low frequencies has the maximum efficiency, without interfering with the other components of the system. Thanks to the particular configuration, the speaker membrane undergoes far less movement than in reflex systems, significantly reducing distortion even at maximum drive power.

4.3 HD2050.30 facade loudspeaker

The HD2050.30 facade loudspeaker is the ideal tool to generate a uniform sound field on the front of a building

It provides not only a high sound power emission (into the range 70Hz-20KHz), needed in case of high background noise, but also a uniform sound distribution especially at high frequencies, guaranteed by the particular construction of the driver. Thanks to this solution are substantially reduced the phenomena of sound concentration, especially on the high range, due to the directionality of standard transducers when used close to the wall and it is therefore improved the measurements accuracy. The HD2050.30 loudspeaker can be easily positioned in all typical situations of facades sound insulation tests. HD2050.30.2 support is designed to position the loudspeaker at 45° both on the ground and on the tripod, with the latter system gaining valuable meters in front of the façade. The weight of 13.5Kg represents the best compromise between performance in sound emission and portability.

HD2050.30.2 support for 45° orientation

This accessory is designed to position the loudspeaker at 45° orientation with respect to the building facade as requested by the standards. A special housing makes it possible to install the support on the HD2050.1 tripod. This allows to lift the facade loudspeaker from the ground up to about 200 cm (maximum extension of the tripod). The support allows to rotate the loudspeaker freely in the horizontal plane.

The HD2050.30 loudspeaker must be fixed to the HD2050.30.2 support using the screws by hand as shown in the figure below.

Loudspeaker positioned at 45° by means of support HD2050.30.2

Loudspeaker installed on the tripod using HD2050.30.2 support

Mounting the loud-speaker on the support

The support has two screws with knob for each side (see figure above). The screw with the larger size is coupled to a female thread in the rear panel of the case. The coupling hole is positioned under the compartment for electrical connectors. The same type of connection is also present in the upper part of the case.

The two screws with smaller knob, instead are used to disassemble the aluminum support in case of transport.

Once the loudspeaker is assembled with the support, it can be positioned on the floor or installed on the stand (figure on the left).

NB: When the loudspeaker is installed on the stand, make sure that it is properly positioned with the legs extended; an incorrect positioning of the stand and the loudspeaker may damage the instrument itself as well as cause personal injury to user.

When the tripod is used with the pole to its maximum extension make sure that the floor is sufficiently flat to ensure the stability of the system.

The HD2050.30.2 aluminum support disassembled is divided in three parts as shown in the figure below.

HD2050.30.1 support disassembled

The 2050.30 loudspeaker has 2 Speakon NL4 connectors on the back. Only pins 1+/1- of each connector are connected.

5 Connectors for remote management

The USB connector on the front panel of HD2050.20 amplifier enables to connect the system to a PC.

The connection allows to remotely control the amplifier DSP (Digital Signal Processor) to modify some parameters or customize the frequency response of the system using the parametric equalizer.

To modify the DSP settings it is necessary to install and use PodWare PC software. To use PodWare software it is necessary to install the USB driver supplied in the software package (for installation instructions please refer to software installation manual).

To remotely manage HD2050.20 amplifier from a PC the supplied software must be installed on a PC running Windows operating system. The system also works on Apple computers running Windows in emulation or Leopard with Boot Camp. The software requires DotNETV2SP1 Framework available in the software package.

Once the software is installed, connect the USB cable to PC and HD2050.20 amplifier, and run PodWare software.

To connect to the amplifier go to menu "Networks >> Add networks", and select the USB port detected by the system. Then click the red triangle icon that, upon connection, will turn to green. The software provides an online help with detailed explanations of all the operations possible with the system.

6 Using PODWARE software

HD2050.20 digital amplifier has an internal DSP which can be programmed using PodWare software. Connecting the amplifier to a PC via the USB cable it's possible, in real time, to perform the following operations: activate the mute, gain, 8-band parametric equalizer + two shelving filters, HP and LP filters, delay. The created setups can be uploaded in the amplifier simply retrieving them from PC.

The system's response equalization function is particularly important in measures of both building and architectural acoustics. The ISO 10140-5:2010 standard (measurement of sound insulation of building elements - Requirements for test facilities and equipment) requires that the noise spectrum generated by the sound source in the emitting room is good enough to obtain an adequate signal to noise ratio in the receiving room. Moreover, the noise generated in the room from 100 Hz bandwidth, must be such that there is a difference < 6 dB between adjacent bands of 1/3 octave so providing a sufficiently flat spectrum in the emitting room.

Since real rooms have different absorption characteristics, even if are used sound sources having a free field emission spectrum sufficiently smooth, it may be necessary to equalize the response of the system directly on the field to meet the requirements of the mentioned above international standard. The PodWare software enables a quick adjustment of the system response.

System requirements:

To use the software, at least a 450 MHz Pentium processor and 128 MB RAM are required. It is required the presence in the system of Microsoft® .NET Framework 1.1 or .NET Framework 2.0. If .NET Framework is not installed in the system, it is possible to download it from Microsoft website.

6.1 Create a user configuration and load into the DSP

In order to store into the DSP a user configuration of the response curve, is not necessary that the "user DSP" button on the amplifier is set to On. It's necessary that the button is set to On to activate the stored curve.

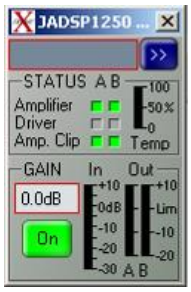
To install PodWare software and USB driver, refer to the software manual.

To use the PodWare software, connect the USB cable to PC and HD2050.20 amplifier. Turn on the amplifier and start PodWare software.

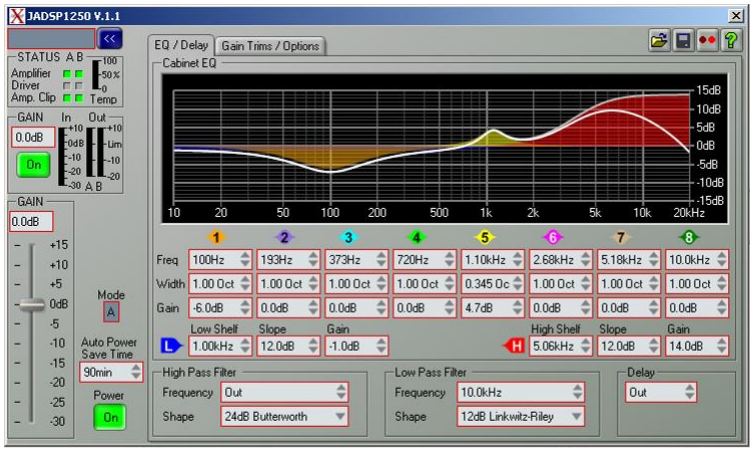
Verify the communication port number in the menu >> Network >> ComPort. When the driver is installed, the system assign a COM port. In order to check which port is assigned by the system, go in Device manager in the PC control panel; under "Ports (COM and LPT)" should appear for example **USB BvNet Port (COM6)**. The indicated COM6 port is the one to be used. The number of the COM port may vary according to PC configuration and the number of COM ports available on the system.

Click on >> Network >> Go online

Under "Devices" appears a line with the name of DSP (JADSP1250). Double click on the line to enable the connection with the DSP



It will appear a control windows with partial vision. Click the icon  to activate the full view.



The full control window allows to access the equalization, mute, filtering an delay functions.

Equalization functions include 8 band-pass filters, represented with different colors; central frequency, bandwidth and gain can be modified.

Under the band-pass filter section are available two additional "shelf" filters; low shelf, high shelf, slope and gain can be modified by the user.

Under the "shelf" filters section, two filters are available: **high-pass** and **low-pass**; cut frequency and shape can be modified.

As soon as necessary adjustments have been applied to the system it is possible to save the configuration and recall it when needed.

To save the equalization created go on menu >> File >> Save as, select a folder and save settings with a name (extension *.dse).

To recall the equalization curve go on menu >> File >> Open. A warning message reminds you that, once recalled the EQ curve, this will replace the one currently installed into the amplifier DSP.

To activate the user equalization curve just created, in the HD2050.20 amplifier front panel, set the "User DSP" button to On. The amplifier is ready to operate with the new EQ curve.

7 Technical specifications

HD2050 - Dodecahedron	
Standards:	UNI EN ISO 140-3: 2006 UNI EN ISO 3382: 2001
Nominal Impedance	12+12 ohm
Power	Peak 540 + 540 W Nom. 180+180 W
Loudspeakers	12 x 5"
Frequency Range	80Hz-16KHz (1/3 octave bands)
Connectors	Neutrik® NL4FC speakON
Sound Power Level	122 dB re 1 pW (10^{-12} W)
Dimensions	∅ 385 mm
Weight	9 kg
Finishing	VFI-2513 and anti-scratch gelcoat

HD2050.20 – Power amplifier	
Standards	EN 55103-1 (Emission), EN 55103-2 (immunity), EN 6065, Class I (safety)
Type	Digital, D class
Max Power	1200 W @12 ohm
Continuous Power	2x530 W RMS
Input for external generator	With level control
Supply	230 Vac (±10%), 50-60 Hz
Frequency response	20 Hz-20 kHz
THD	<0.1% @ 1 kHz
Noise Generator	Internal 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 of maximum power handled by HD2050
Status indicators	Mute, Active, Power ON
Protections	Short circuit, thermal, ultrasonic e RF, clip limiter, DC Fault PS shutdown
Dimensions with Flight case	300 x 525 x 200 mm
Weight	9.5 Kg with flight case
Remote control	Controls the HD2050.20 internal generator. Composed of internal receiver and external transmitter with activation button. Range up to 100 m.

HD2050.40 - Subwoofer	
RMS power	500 W
Nominal impedance	4 ohm
Loudspeaker	LF 1 x 12” (neodymium magnet)
Emission	130 dB spl Peak @ 1 m
Frequency Range	45 Hz-120 Hz
Connectors	2 x Neutrik® NL4 speakON
Dimensions	500 x 500 x 370 mm
Weight	22 kg
Finishing	Anti-scratch gelcoat

HD2050.30 – Facade loudspeaker	
RMS power	300 W
Nominal impedance	8 ohm
Loudspeaker	Low frequency 1 x 10” (neodymium magnet) High frequency 1 x 1” (mylar)
Emission	129 dB spl Peak @ 1 m
Frequency range	70 Hz-20 kHz
Connectors	2 x Neutrik® NL4 speakON
Dimensions	305 x 490 x 330 mm
Weight	13.5 kg
Finishing	Anti-scratch geal-coat

8 HD2050 directivity (ISO 140 – ISO 3382)

The UNI EN ISO 140-3:2006, paragraph C1.3, requires that: "to check directional radiation of loudspeaker according to UNI EN ISO 140-3:2006 should be measured the sound pressure levels around the source in a free field. The source must be supplied with a signal and noise measurements must be performed in 1/3 octave bands."

This standard requires then to "measure the level difference between the energetic average value for a 360 ° arc (L360) and the mean values obtained by gently scanning all the 30 ° arcs (L30)."

The directivity indices are therefore:

$$DI_i = L_{360} - L_{30,i}$$

It can be considered that the radiation is omnidirectional if DI values are within ± 2 dB in the 100 Hz-630 Hz frequency range. In the 630 Hz-1 kHz frequency range, limits increase linearly from ±2 dB to ±8 dB. For frequencies from 1 kHz to 5 kHz limits are ±8 dB. During test were performed measurements with a rotation step equal to 5 °. For the source progressive rotation it has been used a rotating plate automatically controlled via a PC.

The test consists in measuring the impulse response (IR) with MLS technique for each angular position of the source, then this impulse response is processed so as to obtain the spectrum in 1/3 octave bands of the anechoic portion (excluding the sound reflection due to surfaces of the test room by an appropriate rectangular time window); directivity index is calculated with the procedure of moving average energy over 6 consecutive angular positions, as required by this ISO standard.

The signal processing was performed by narrow band frequency analysis with 2048 discrete frequencies, logarithmically spaced, starting from the appropriately windowed impulse response via rectangular window. Both the source and the microphone where placed at a height of 2.6 m from the floor and a distance source - microphone of 3 m.

Below directivity charts of the source detected with the method indicated above.

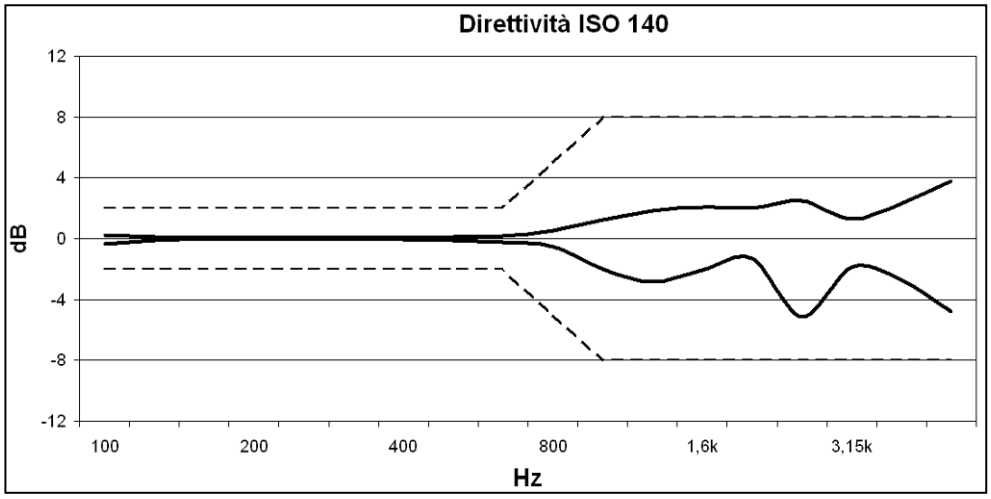


Fig. 8.1 – Directivity chart calculated according to ISO 140

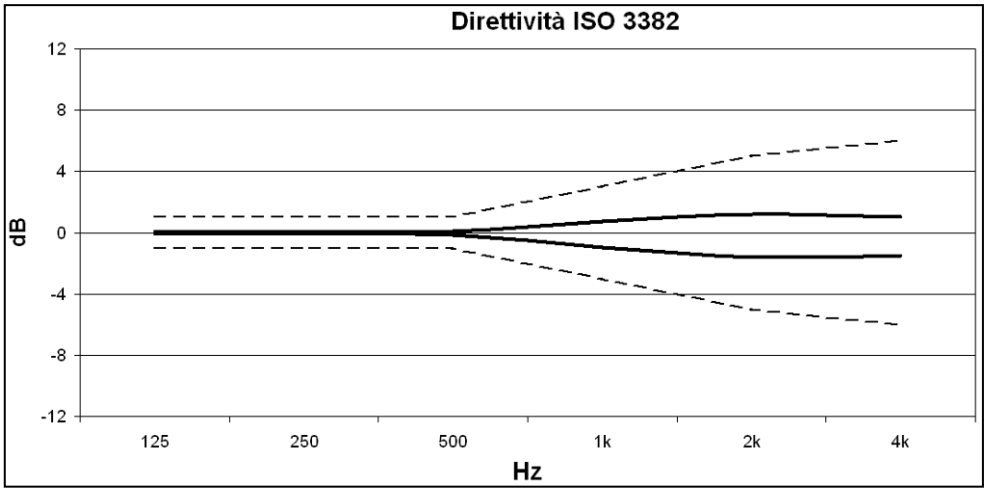


Fig. 8.2 – Directivity chart calculated according to ISO 3382

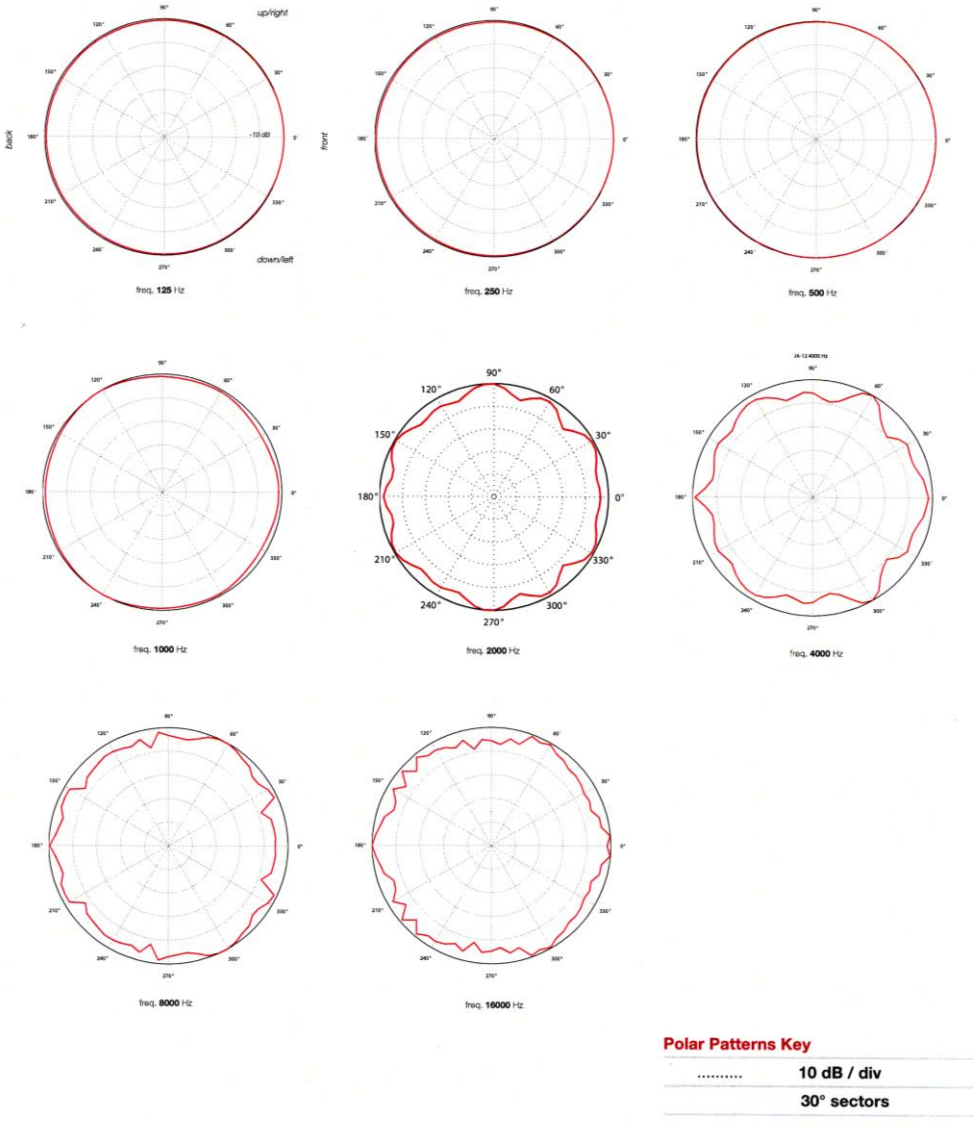


Fig. 8.3 – Directivity polar plots for 1/1 octave bands. 30° sectors. Display 10dB/div.

8.1 HD2050.30 sound power level

HD2050 sound power level has been calculated following instructions contained in ISO 3744 standard. Starting from sound pressure level measurements in 1/3 octave bands, made over a reflecting surface and in a free field, the Lw (re 1 pW) sound power level is obtained.

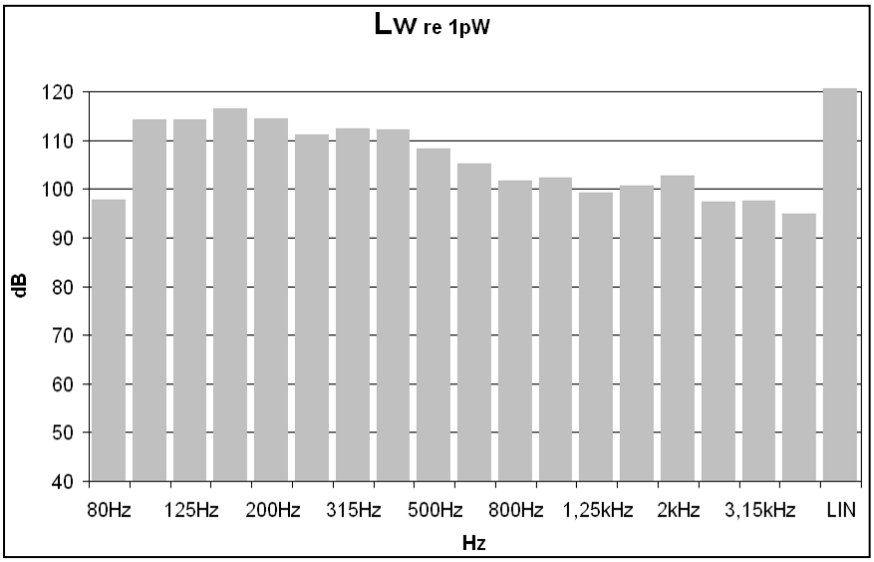


Fig. 8.1.1– Lw Sound power level chart in 1/3 octave bands and overall LINEAR level.

8.2 HD2050.30 directivity

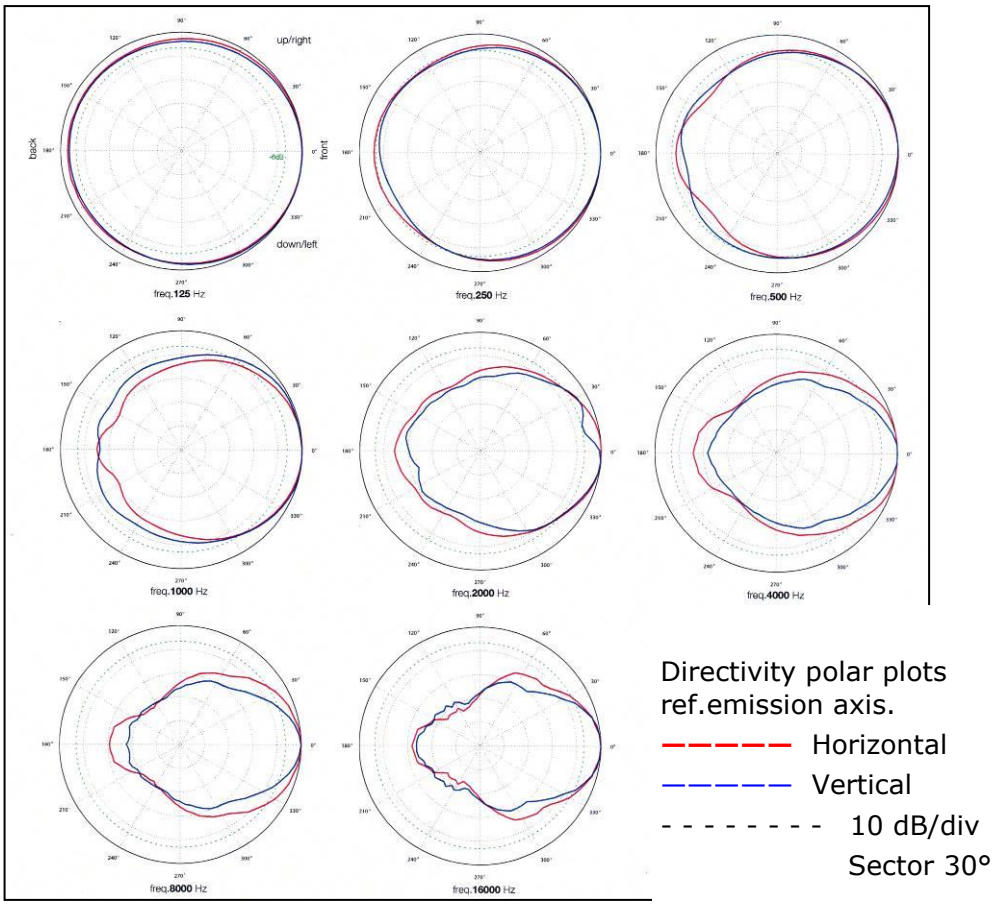


Fig. 8.2.1 – Directivity polar plots for 1/1 octave bands. 30° sectors. Display 10dB/div.

9 Accessories ordering codes

HD2050 dodecahedron is supplied with HD2050.1.5 5 m signal cable for connection to the HD2050.20 amplifier and aluminum carrying case for transportation.

HD2050.20 amplifier is supplied with power supply cable, USB cable, HD2050.20R remote control kit, aluminum carrying case for transportation and Podware software downloadable from the website.

HD2050.30 facade loudspeaker and HD2050.40 subwoofer do not include the signal cable for connection to the amplifier. Order the cable separately.

Signal cables

HD2050.1.2 Signal cable, length 2 m.

HD2050.1.5 Signal cable, length 5 m.

Supports

HD2050.1 Stand with wheels. Retractable and extendible: min height 1300 mm, max height 2050 mm. Damped rod.

HD2050.40.1 Extendable stand to mount the HD2050 dodecahedron on the HD2050.40 subwoofer min height 1370 mm, max height 1970 mm (subwoofer + stand + wheels).

HD2050.30.2 45° support for HD2050.30 facade loudspeaker. It allows to orientate the loudspeaker at 45° both on the horizontal and on the vertical plane and to mount it on the top of HD2050.1 stand.

Other accessories

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

Spare parts

HD2050.20R Remote control kit consisting of receiver and transmitter with activation button. Transmission range 100 m.

NOTES

NOTES

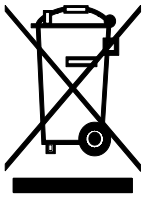
WARRANTY

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

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.
We reserve the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



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

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

CE RoHS

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