



VANITY²⁰³ HD

User Manual

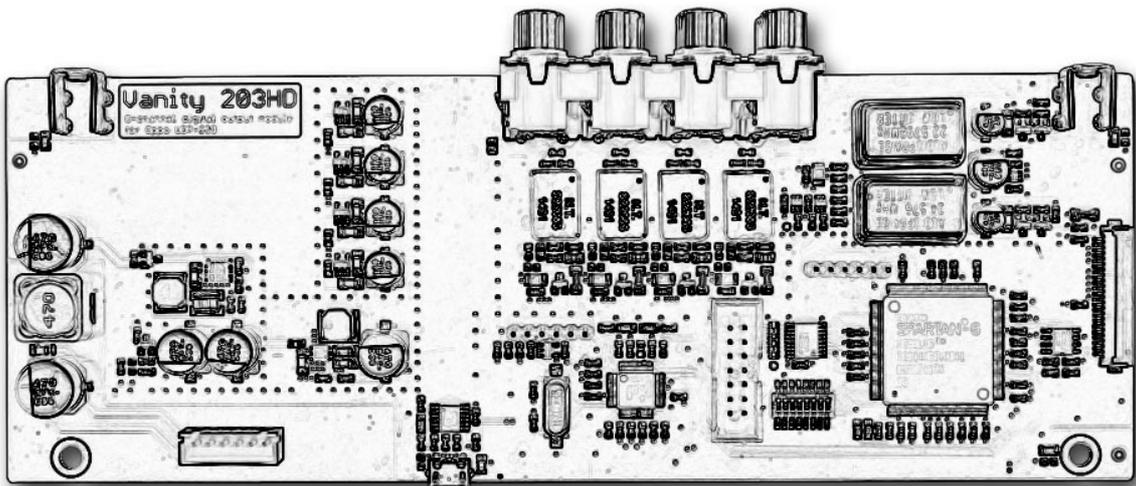


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Introduction

The Vanity²⁰³HD module employs advanced multi channel audio signal processing for digital DSD playback with several parameters configurable by the user. To unlock the full potential of the product, the OPPO UDP-203 player has to be setup properly as well.

Digital Audio Outputs

The 8 channel digital output of the Vanity²⁰³HD module is provided on the 4 red RCA connectors, each carrying 2 channels within a standard S/PDIF signal. The white connectors are connected internally to ground for AES/EBU output modification.



OPPO UDP-203 with Vanity²⁰³HD installed

The arrangement of digital output connectors is similar to the original channel mapping of analogue outputs. Channels transmitted in each S/PDIF output are denoted by labels placed under and above the connector.

The first connector from the left carries both front channels, the second carries the surround channels, the third carries the center and subwoofer channels and finally the fourth contains the surround-back channels.

Installation

The Vanity²⁰³HD module has been designed as a direct replacement of the original board with analog outputs. Therefore the installation procedure is very easy and doesn't require any special skills or tools. The installation is fully reversible and should only take several minutes.

Tools

You will need a screwdriver (Philips type) of suitable size. Precision pliers can be handy as well.



Procedure

Let's start with the OPPO UDP-203 player. Don't forget to unplug the power cable and leave the player for a while to allow the capacitors in the power supply to discharge!

Remove 2 screws on both sides of the player.



Then proceed with 12 screws on the back panel.

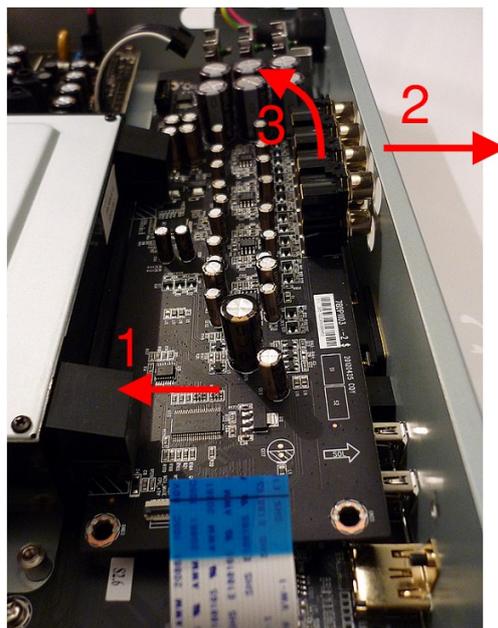


Remove the top cover. Carefully disconnect the data flat foil cable from the analog board. Release the connector lock first and pull the cable out. Then disconnect also the power cable from the analog board. When both cables are disconnected, remove 2 screws holding down the analog board.



Disconnect analogue output board

Now the analog board can be removed. Shift the board slightly towards the front side of the player in order to release the RCA connector block from the back panel (1). Then tilt the board with the RCA block upwards while you gently pull the back panel away from the RCA connector (2+3). Then lift the board out of the player.



Remove analogue output board

Insert the Vanity²⁰³HD module just in reverse order of the analog board removal. Put back the 2 screws holding the board down, but don't tighten them all the way yet. Leave them a bit loose, so that the board can be precisely positioned along the back panel. Attach the RCA connector block of the Vanity²⁰³HD module to the back panel with the 3 screws and tighten them well.

Check position of the Vanity²⁰³HD module in the back panel and tighten the 2 screws on the module. Carefully reconnect the data and power connector (same as the disconnection, performed in reverse). Precisely align the flat data cable within the connector and secure the connector lock.



Fit all the remaining back panel screws.

Congratulations! You have completed the installation of the Vanity²⁰³HD module. If you have already configured the on-board DIP switches you can finish the player assembly. Otherwise you can leave the top cover off for a moment until you finish the module configuration.

Features

SACD to PCM conversion

For SACD discs and DSD files playback, the Vanity²⁰³HD board offers high quality DSD to PCM conversion, superior to the player's internal one. The user has control over several conversion parameters such as output PCM sample rate, bit depth and conversion filter characteristics.

The DSD to PCM conversion algorithm implemented in the Vanity²⁰³HD module sets 0dB SACD level equivalent to -3dB(FS) PCM level. This approach preserves maximum quality, provides sufficient headroom for clipping-less signal peaks and over-modulation, and still does not unnecessarily reduce playback volume in comparison to PCM playback.

The player offers two SACD output modes, PCM and DSD. High quality DSD to PCM conversion is performed by the Vanity HD module only when the SACD output mode is set to DSD. Please refer to the UDP-203 User Manual, section Audio Output Setup.

When a HDMI connection is established with a down-stream device not compatible with DSD, the player automatically switches into PCM mode despite the menu setting. The DSD to PCM conversion is handled internally by the player in order to provide properly down-mixed audio signal for the HDMI connection. This can be resolved by powering down the down-stream HDMI device or disabling the HDMI audio in the player's menu. If in doubt whether the actual playback mode is DSD or PCM the user can verify the actual mode with on-board LED indicators.

Volume control

For system configurations, where the OPPO player is used as a digital pre-amplifier, the Vanity²⁰³HD now features high resolution digital volume control. The user can use player's internal volume control function which was originally performed by the internal DAC chip. The Vanity²⁰³HD works in the same way, just adjust the volume of digital audio signal. In order to use this functionality the volume control option in the player's Audio Processing menu must be set to "Variable".

When the volume is set to 100 – full volume – or when the output volume in the player’s menu is set to “Fixed”, the volume control is bypassed and the signal path is bit accurate.

DSD and PCM Level Matching

As mentioned above, the DSD to PCM conversion produces overall signal level 3dB lower compared to PCM playback. This is usually not an issue, but thanks to the precision volume control function the output levels of DSD and PCM playback can be matched by attenuating PCM signal by 3dB. A side effect is that this may help to create sufficient headroom for inter-sample peaking with PCM material and DACs that don’t provide such headroom by design.

DoP v1 output mode

With the Vanity²⁰³HD it is possible to output SACDs and DSD files in so called DoP format. This allows the user to send raw DSD material directly to a DoP compatible DAC. More details can be found here:

http://dsd-guide.com/sites/default/files/white-papers/DoP_openStandard_1v1.pdf

DSD 4.0 Down-Mix

To achieve the best performance during digital SACD playback, it is essential to avoid the DSD to PCM conversion performed by the player. For this reason, the widely used 4.0 speaker configuration is covered by the dedicated down-mix algorithm implemented in the Vanity HD module. The algorithm preserves the overall signal level balance between channels and it can be described as follows.

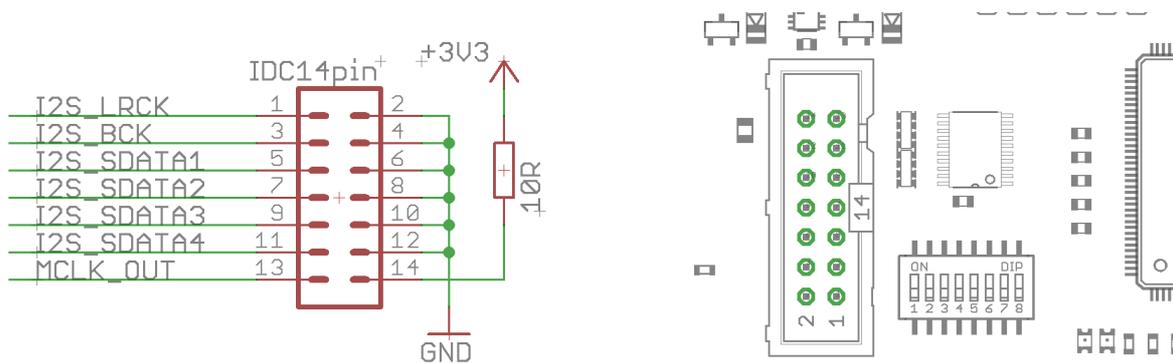
$$\begin{aligned} FL_{mix} &= 0.5 FL + 0.25 C + 0.25 SW \\ FR_{mix} &= 0.5 FR + 0.25 C + 0.25 SW \\ SL_{mix} &= 0.5 SL \\ SR_{mix} &= 0.5 SR \end{aligned}$$

In order to fit the mixed Center and Sub-Woofer channels into the front channels, the overall signal level is shifted by –6dB. No additional signal normalization or scaling is applied. Since the down-mix processing is carried out with full precision, there is no adverse effect on sound quality such as

reduced dynamics or worse noise figures. Multi-channel SACD priority and 5.1 speaker configuration should be set in the player's menu before using the 4.0 down-mix function.

I₂S Output

For added flexibility the Vanity²⁰³HD features an on-board header with 8 channel I₂S output, master-clock signal, ground and 3V3 power signals. The pin assignment is shown in the schematics below.



I₂S output connector pinout in schematics and layout

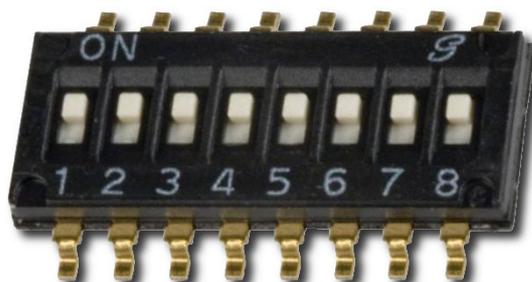
The master-clock signal is either 22.5792MHz or 24.576MHz depending on the base sample rate. The audio channel assignment across the SDATA signals is the same as the channels order at the main S/PDIF outputs. SDATA1 contains both front channels, SDATA2 carries the surround channels, SDATA3 carries the center and subwoofer channels and finally the SDATA4 contains the surround-back channels.

The I₂S output has standard 3V3 LVCMOS signaling levels. If the downstream DAC accepts different signaling type or levels (e.g. I₂S over HDMI or I₂S over UTP/STP Ethernet) the user has to provide a suitable conversion circuit.

Setup

For digital SACD playback, the user can set the output sample rate, bit depth, conversion filter characteristics, enable the I₂S output, dedicated 4.0 DSD down-mix function, DSD and PCM level matching or DoP v1 output format using the player's menu or the on-board switches. These can be carefully operated by tweezers or a toothpick.

DIP Switches



- Switch 1 – output sample rate 88.2 kHz or 176.4 kHz (ON)
- Switch 2 – output bit depth 16 bit or 24 bit (ON)
- Switch 3 – I₂S output enabled (ON) or disabled
- Switch 4 – PCM and DSD level matching enabled (ON) or disabled
- Switch 5 – DoP v1 output mode enabled (ON) or disabled
- Switch 6 and 7 – compatibility setting of the S/PDIF output
- Switch 8 – onboard 4.0 DSD down-mix enabled (ON) or disabled

Switch 1 selects the output sample rate between 88.2 kHz and 176.4kHz. With Switch 1 set to the ON position, the output sample rate is set to 176.4 kHz. In OFF position the sample rate is 88.2kHz.

Switch 2 sets the output bit depth to 16 or 24 bits. The 16 bit option can be useful for owners of so called non-oversampling (NOS) DACs or older devices designed to accept a 16 bit word length. In all other cases the 24 bit option – Switch 2 in ON position – should be used.

Switch 3 enables or disables the on-board I₂S output. When the output is not used the switch should be in OFF position.

Switch 4 enables or disables the PCM and DSD level matching. When enabled, both PCM and converted DSD audio will have maximum level set to -3dBFS.

Switch 5 enables or disables the DoP v1 output format for DSD playback. If the downstream DAC is compatible with the DoP format, enabling this function will allow raw DSD data to be sent to the DAC untouched.

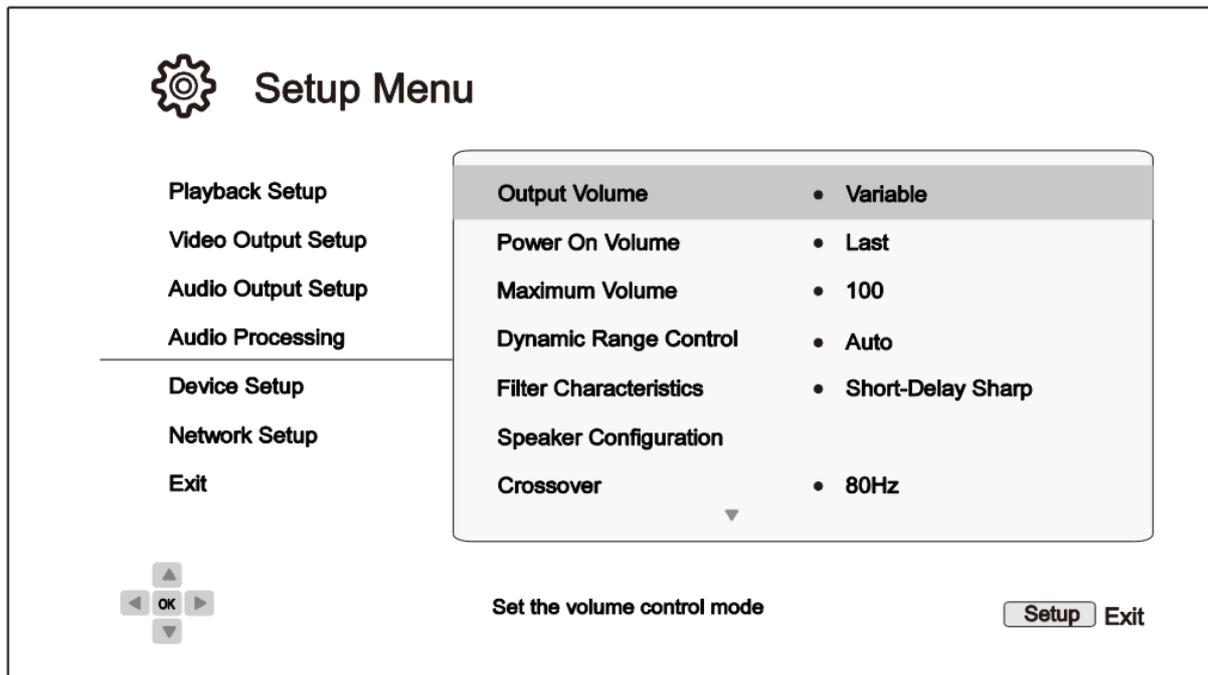
Switches 6 and 7 enable the user to modify the structure and certain synchronization elements of the S/PDIF protocol, which can have an impact on sound (so-called data jitter). Four setting configurations are available in total, as some S/PDIF receivers may not work with some of the available settings. The setting combinations have to be tested by trial and error. With both switches in the OFF position, the output is set to a standard format compatible with all receivers.

Switch 8 enables or disables the dedicated DSD 4.0 down-mix function. This function should be used only for 4.0 speaker configuration.

Player's menu

Some functions and settings of the Vanity²⁰³HD can be controlled directly from the player's menu. The volume control function covers the entire range of the AK4458 DAC chip and can be conveniently adjusted in the menu or with the remote control. Please see the feature description above for details.

The filter characteristics setting in the Setup Menu now controls the DSD to PCM conversion filter of the Vanity²⁰³HD board instead of the AK4458 upsampling filter.



OPPO UDP-203 Setup Menu

The filters differ in their steepness and the amount of attenuation of the ultrasonic noise. There are four filter characteristics in total. All four can be used when the output sampling rate is set to 176.4kHz and only two with 88.2kHz.

- Sharp Roll-off: Sharp filter for 88.2kHz, cut-off frequency approx. 20kHz.
- Short-Delay Sharp (default): Slow filter for 88.kHz, cut-off frequency approx. 25kHz.
- Slow Roll-off: Sharp filter for 176.4kHz, cut-off frequency approx. 44kHz.
- Short-Delay Slow: Slow filter for 176.4kHz, cut-off frequency approx. 55kHz.
- Super Slow – setting not used. Do not select.

The best sounding filter set should be evaluated in each specific audio chain configuration. With a very linear audio system with enough analogue path bandwidth the slow filter for 176.4kHz would be preferred as it maintains the highest level of DSD bandwidth, but with the highest amount of ultrasonic noise.

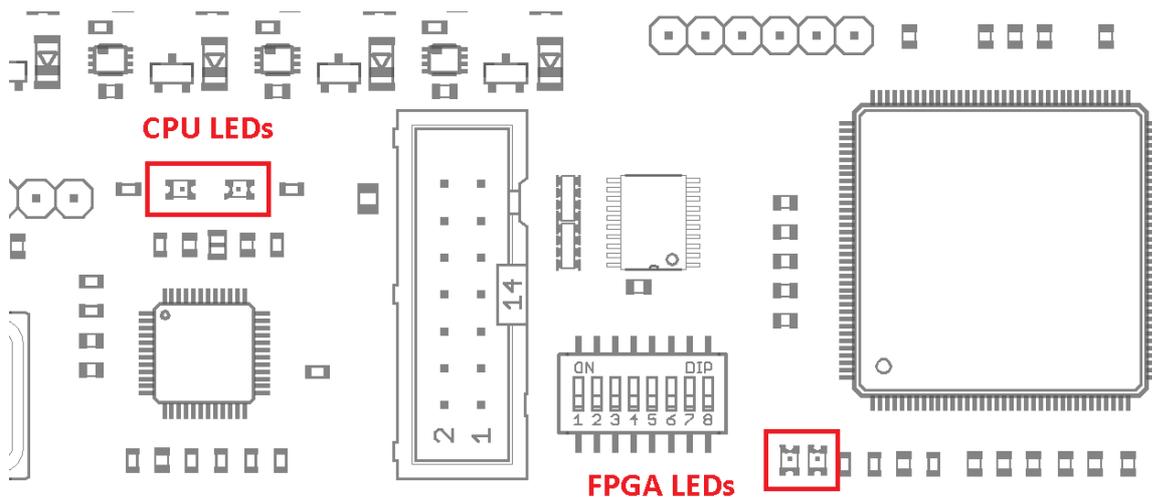
In most situations, the best performance of the Vanity²⁰³HD is obtained with the following switch settings: S1–S2 ON, S6–S7 OFF. The setting of other switches depend on functionality needed for a particular speakers or signal transmission setup.

Apart from the volume control functionality, which includes the DSD and PCM level matching, the Vanity²⁰³HD module does not alter the audio data during PCM playback (CD, DVD, BD media). Data is sent to the outputs directly only via a small re-clocking buffer. All signal processing tasks, such as down-mix, speaker distance adjustments, etc. are provided by the player. Please refer to the UDP-203 User Manual, section Audio Processing.

LED Indicators

To easily distinguish between the DSD and PCM mode, there are 2 LEDs present on the Vanity²⁰³HD module, indicating the current mode. These are located next to the FPGA chip as shown in the board diagrams below.

When the module is in the PCM mode, the green LED is steadily ON. The red LED indicates DSD mode. There are also two LEDs next to the processor chip (the CPU). Alternating flashing of these LEDs indicates communication of the CPU with the player and the FPGA chip. Synchronous flashing indicates adjustments of the local oscillators' frequency.

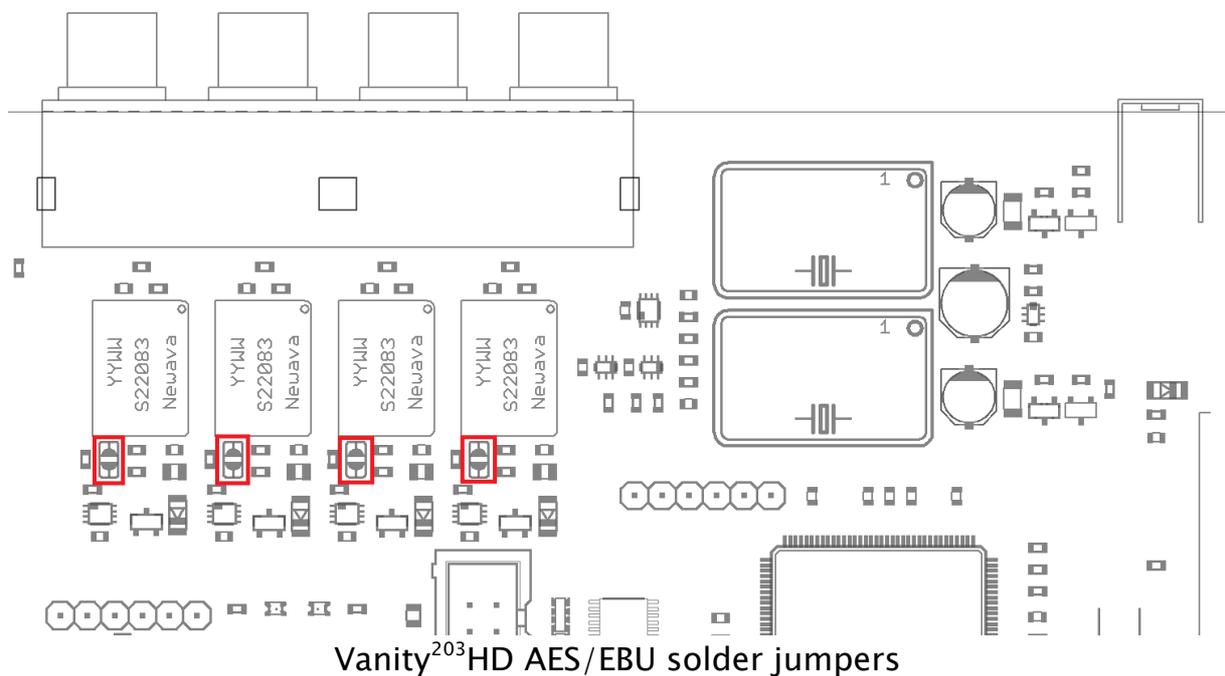


Vanity²⁰³HD LED locations

Adjustments of the local oscillators are usually more frequent in a short period after player start-up, due to the temperature stabilization of all clock related components.

AES/EBU Output Modification

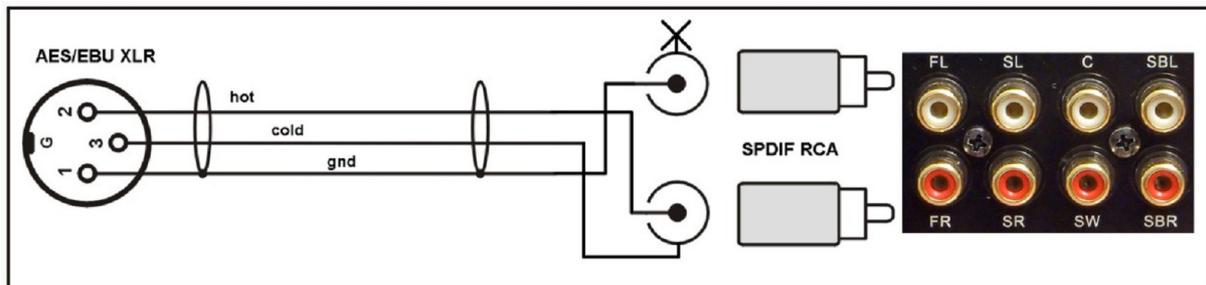
For interfacing the Vanity²⁰³HD board with AES/EBU compatible downstream devices it is possible to modify the output stage to increase the signal level and match the output impedance to 110Ω.



The modification only requires to short four solder jumpers as indicated in the diagram above. There are no component changes needed.

The AES/EBU output requires balanced signaling (hot, cold and ground). The hot and cold connections are provided by default on the bottom RCA connector. The ground connection is available on the center pin of the upper RCA connector.

Usually the AES/EBU signaling uses XLR connectors, but on some professional equipment the digital signals are connected via Cannon (D-Sub) connectors. Either way the user has to provide a custom made cable to make connection between the two RCAs and XLR or D-Sub. A typical connection with XLR connector would look like shown below.



Vanity²⁰³HD AES/EBU connection

Should you need any information beyond this settings guide, don't hesitate to contact us.

customerservice@jvbdigital.com

customerservice@jvbdigital.nl

<http://www.jvbdigital.nl/jvb.asp?cur=1&level=home&page=contactus>

Disclaimer

JVB Digital and its partners accept no responsibility for damage to the player, voiding your warranty or personal injury. Always unplug the power cable before removing the top cover. Follow the electrostatic discharge precautions when manipulating with electronic boards and components.

Specifications

8 channel S/PDIF Output

- protocol: S/PDIF (IEC958 / EIAJ CP1201)
- type: 75Ω re-clocked transformer isolated RCA coaxial
- format: linear PCM stereo
- supported sampling rates: 44.1/48/88.2/96/ 176.4/192kHz
- supported bit depths: 16 / 24bit
- optional modification to differential AES/EBU compatible levels

8 channel I2S Output

- on board IDC header
- dedicated master-clock output
- can be enabled / disabled

S/PDIF Re-clocking

- 2x custom low jitter on-board VCXO
- digitally controlled frequency tuning, $f_c \ll 1\text{Hz}$
- ultra low-noise power regulators for VCXO and TX circuits

High Quality DSD to PCM Conversion

- custom developed Zero Alias Linear Phase Filter
- 37bit arithmetic / 47bit accumulator
- output sample rates: 88.2kHz / 176.4kHz
- 4 selectable DSD to LPCM filter characteristics via player's menu
- full precision 4.0 DSD down-mix option
- optional DoP v1 output encoding of raw DSD

Full Precision Volume Control

- less than 0.001dB gain error
- bit accurate volume bypass at 0dBFS
- TPDF dithering
- PCM and DSD level matching, outputs PCM and DSD at the same levels

User Configurable Functionality

- DSD to LPCM output sampling rate: 88.2kHz / 176.4kHz
- output bit depth settings: 16 / 24bit
- I2S output enable / disable
- dedicated DSD 4.0 down-mix enable / disable
- DoP v1 output encoding enable / disable
- 4 user selectable DSD to LPCM filter characteristics #1/#2/#3/#4
- data jitter reduction: OFF/stage 1-3