dac8 Stereo

Highest performance, streaming-enabled stereo D/A converter

Owner's Manual

Contents

Specifications 3
Mechanical drawings 5
Back panel overview 6
Package contents 6
Setting up 7
USB 7
Drivers 7
Analog Connections 9
Main outputs 9
Driving power amplifiers directly 10
Volume operation 10
Interfacing with legacy devices with single-ended inputs only 10
Headphone output 11
Controls 12
Rotary control 12
Remote control 12
User interface and menu system 13
Main screen, left 13
Main screen, right 14
Main menu 14
Volume submenu 15
Inputs submenu 15
Outputs submenu 16
System submenu 16
Displays submenu 17
Filters submenu 17
Status submenu 21
Advanced submenu 21
Using dac8 Stereo streaming capabilities 22
Converting non-streaming unit into a streaming one 23
Mains voltage selection 24
Troubleshooting 24
Issue 1: USB input not recognized 24
Issue 2: Dropouts during AES/EBU playback 25
Service and warranty 25
Manual revisions 26

Specifications

Digital connections

- Inputs
    - USB (asynchronous, UAC2.0 compliant), up to 384 kHz / 32-bit PCM, DSD256 or DoP128
    - 2x Optical (Toslink)
    - 2x Coaxial (SPDIF)
    - AES/EBU (SPDIF voltage level compatible)
    - Ethernet (through Raspberry Pi)
    - Wi-Fi (through Raspberry Pi)

Analog connections

- Main outputs (back side)
    - 2x XLR balanced, 2 connectors per channel
    - 4.2V RMS full-scale
    - output impedance: 50 Ohms
- Headphone output (front side)
    - 6.3 mm (1/4") TRS connector
    - Output level: 4.2 V RMS full-scale
    - 120 mA linear output current
    - Output impedance <100 mOhm

Analog performance

- 0.00003 % / -130 dB full-scale THD (Total Harmonic Distortion) or better
- 0.0001 % / 120 dB full-scale SINAD or better
- 131 dB dynamic range
- 0.00022 % / -113 dB THD+N @ 100 mW into 32 Ohms headphone output

Additional features

- Designed to directly interface to amplifiers
- Per-channel volume
- Choice between 7 PCM reconstruction FIR filters
- Configurable auto on / auto off

- Configurable display timer for auto dim/off
- Remote control learning
- Adjustable 2nd and 3rd order THD compensation
- Trigger output
    - 5 V voltage level
    - short-circuit proof with 15 mA maximum current
    - pulse or continuous
- Full control with either rotary or remote control

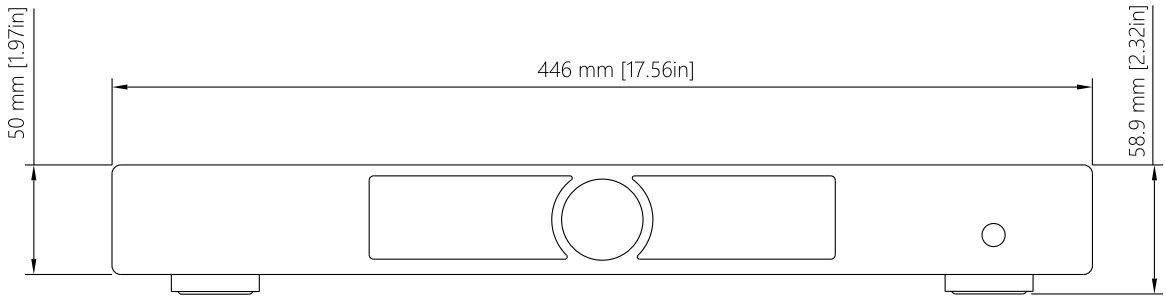
Dimensions

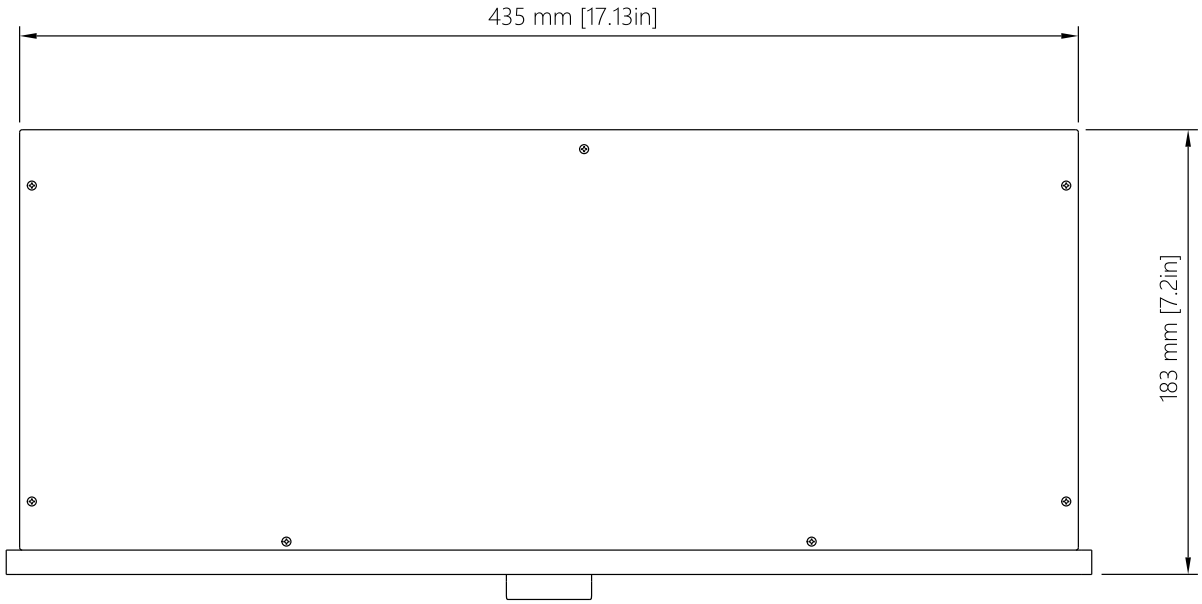
- 446 x 183 x 50 mm, (17.56 x 7.2 x 1.97 in), excluding removable feet
- Weight: 4.5 kg (10 lbs)

Power

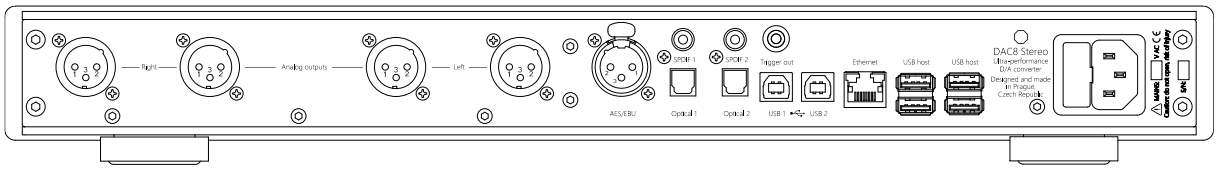
- Mains voltage: 120 V AC or 230 V AC, according to the mains voltage of the country from which the order was placed, unless requested otherwise
- Power rating: 15 W

Mechanical drawings





Back panel overview



Package contents

- dac8 Stereo (silver or black depending on your choice, 120 V or 230 V version depending on the country of order)

Additionally, for the streaming version:

- Wi-Fi USB adapter with antenna
- USB interconnect
- blank 16 GB microSDHC memory card (inserted in the Raspberry Pi's slot)

Optional accessories:

- Apple Remote (optional accessory)

In an effort to reduce electronic waste, we've decided not to include the standard disposable USB and power cables in the package. We understand that audio enthusiasts often already own their preferred cables.

Setting up

USB

The dac8 Stereo is compliant with USB Audio Class 2 (UAC2), a widely used digital audio interface standard that enables asynchronous operation. This feature allows the DAC to control data flow according to its own high-precision oscillator, bypassing any requirements for the precision of the clock in the source device or cables.

Drivers

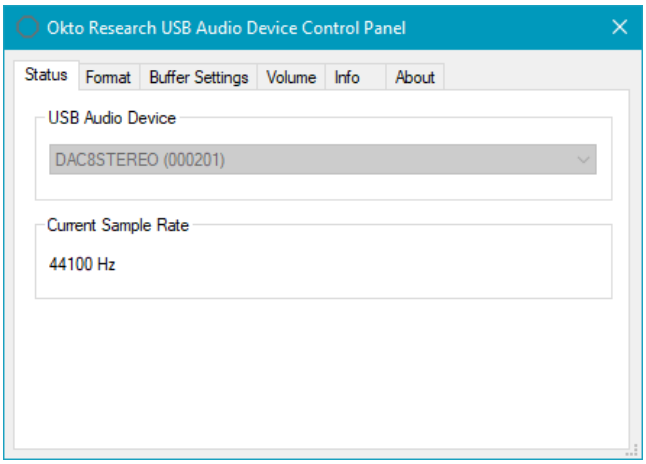
The UAC2 standard also enables operation with Mac OS and Linux without the need for installing additional drivers. The dac8 Stereo will be recognized as a 2-channel playback device and a 2-channel recording device. The only action required by the user is to select the dac8 Stereo in your operating system's audio control panel.

This also applies to Windows 10 and newer; however, we strongly recommend installing the Okto Research ASIO driver to bypass the Windows sound mixer and enable exclusive access to the device for bit-perfect, low-latency operation. The driver can be downloaded from the following link:

https://oktoresearch.com/assets/OktoResearchUsbDriver.zip

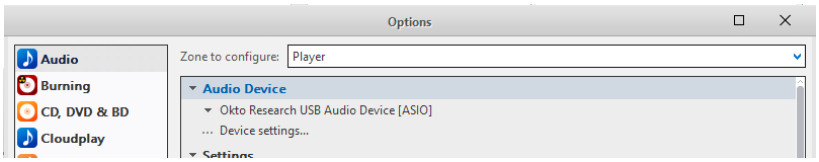
To install it, extract the executable file from the archive, run it and go through the steps.

After a successful installation, the Okto Research icon will appear in your system tray. If the unit is connected to the computer, it will be recognized by the driver, as shown in the following image.

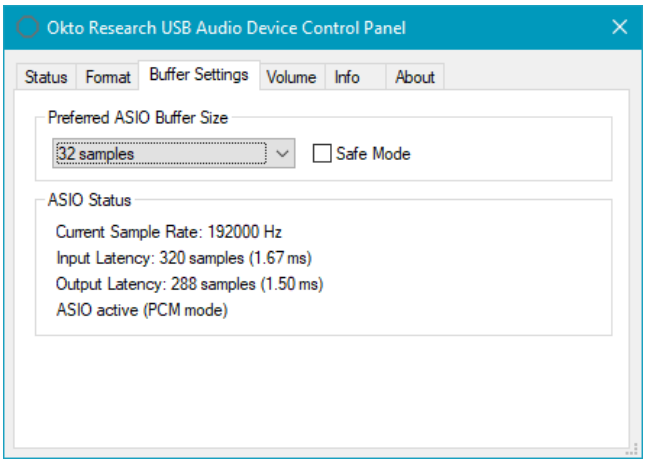


Please note: this driver will only work with units running firmware 1.2 and newer. Units with older firmware have different USB identifiers and will not be recognized. Please contact us to receive an ASIO driver compatible with older firmware versions.

Once the installation is complete, the "Okto Research USB device" will become available in any ASIO-capable playback software. The following image shows the output device setting in JRiver:



To reduce latency, navigate to the USB driver's control panel, select the "Buffer Settings" tab, and change the buffer size in the dropdown menu. The dac8 Stereo is tested to work with 1.5 ms output latency for playback and 1.67 ms for recording; however, the host computer must be able to provide data in a timely manner to avoid buffer underruns and dropouts during playback.



Warning: The USB input of the dac8 Stereo may not work correctly when connected to a USB hub or a legacy USB 1.0 port. Be sure to use a USB 2.0 (or newer) port when connecting the unit.

Analog Connections

Main outputs

The main analog outputs provide 2 channels that represent signals from the selected digital input, converted to the analog domain with extremely high precision. The back plate of the dac8 Stereo features two output XLR connectors per channel. They are connected together internally, allowing for simultaneous connection of two devices, such as a power amplifier for main speakers and an active subwoofer, or a pair of active speakers located in different rooms.

The main outputs are not muted when the headphone jack is plugged in. The reason for this is that the operational amplifiers driving the main outputs are also responsible for driving the headphone amplifier.

Driving power amplifiers directly

Low output impedance allows the unit to directly drive inputs of power amplifiers without the need for a pre-amplifier. In such a setup, the full-scale output voltage of the DAC, which is 4.2 V RMS in the case of the dac8, and the input sensitivity (voltage required for full power) of the power amplifier should ideally match to optimally utilize the dynamic range of the devices. Below are two examples of how the dynamic range can be negatively impacted if there is a significant difference between the two values:

Scenario 1: Consider a power amplifier with 1 V RMS input sensitivity. The limitation might occur in the power amplifier if the dac8 Stereo volume is set to -12 dB or higher. Consequently, the upper 12 dB of the dac8 Stereo's output would remain unused. By lowering the output voltage of the dac8 Stereo to 1 V, its noise floor could be reduced by 12 dB, preserving the dynamic range.

Scenario 2: Consider a power amplifier with 8 V RMS input sensitivity. In this case, the dac8 Stereo wouldn't be able to utilize the full power of the amplifier, resulting in a loss of 6 dB in attainable sound pressure level. Elevating the dac8 Stereo 's output voltage to 8 V RMS would enable it to harness the full power of the amplifier, optimizing the dynamic range of the setup.

The custom output voltage is available as an optional feature at an additional cost. This value, determined by a significant number of small surface-mount resistors, cannot be adjusted by users. The selectable range lies between 1 V RMS and 10 V RMS.

The outputs are protected against long-term short circuit for the default or lower output voltage. However, we advise against stressing the outputs with a long-term short circuit.

Volume operation

The volume control consists of a master volume (displayed on the right screen) and per-channel volume, accessible in Menu > Volume. The resulting value for each channel can be calculated by adding the two values. To bypass the volume control completely, simply set all the values to 0 dB.

Interfacing with legacy devices with single-ended inputs only

We highly recommend using balanced cabling between analog audio components whenever possible. The main reason is that, due to the different reference, ground is not a part of the balanced signal path. This makes equalizing currents created by ground loops

and electromagnetic interference, which would otherwise be injected into the signal, harmless.

If you need to interface the dac8 with a legacy pre-amplifier or a power amplifier that has single-ended inputs only, there are three methods to do so:

1) A solid-state conversion circuit, for example the Neurochrome Universal Buffer
2) Audio transformers like Lundahl LL1584-3FXPHM
3) A special adapter cable with floating pin 3, like "Benchmark XLRF to RCA cable for analog audio with pin 3 floating". The cable does not perform actual signal conversion; instead, it only uses one half of the balanced output from the dac8 without shorting the other half to ground. This method will result in a loss of performance, but it is recommended as a cost-effective way to connect subwoofers.

Warning: We strongly discourage the use of balanced-to-unbalanced cables and converters. Doing so will result in significantly decreased analog performance due to the short they present to the output of the dac8 Stereo's analog stage, potentially overloading it and risking damage after long-term use with high signal levels. Warranty does not apply to units with analog circuitry damaged by using XLR to RCA cables and converters.

Headphone output

The headphone analog output, available on the front panel via a 6.3 mm (1/4") TRS connector, provides a 4.2 V RMS full-scale voltage level, up to 120 mA linear current, and less than 100 mOhm output impedance.

It is suitable for a majority of headphones and earphones, ranging from 16 Ohm IEMs to large 600 Ohm open-back headphones. As mentioned in a previous chapter, plugging in the headphone jack does not mute the main outputs.

Controls

The dac8 Stereo can be operated using either an integrated push-on switch rotary control or an IR remote. Thanks to the 'Learn Remote' menu function, it can pair with any IR remote with a minimum of seven buttons. For the best user experience, we recommend using the Apple Remote or a similar substitute.

Rotary control

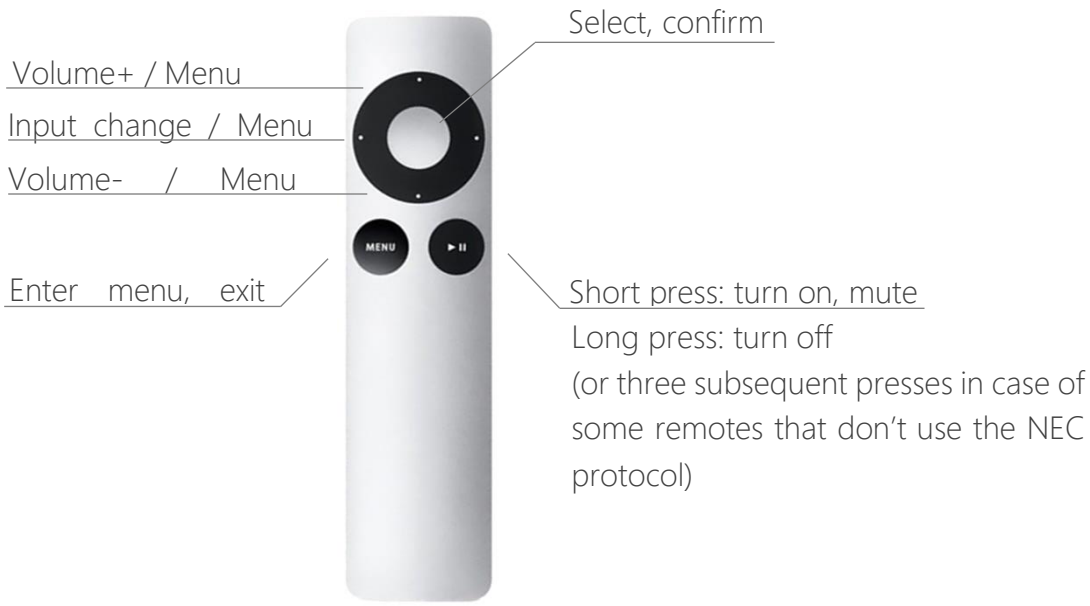
		Device state			
		Off	Main screen	Menu	Menu, selected
Input	Left/right turn	-	Volume control	Navigation	Modify
	Push	Turn on	Enter menu	Select	Confirm
	Long push	Turn on	Turn off	Back	Confirm

The navigation direction is intentionally different for the left and right screens with respect to the movement direction of the cursor.

Remote control

The dac8 Stereo can be paired with any remote that has a minimum of seven buttons. For a detailed description of the pairing process, please refer to the “System submenu” section.

The image below illustrates button functionality as demonstrated with the Apple Remote



User interface and menu system

Warning: All changes made in the device menu will be saved at the moment the device is turned off using the central control knob or infrared remote control. The changes will not be saved if the device is turned off by disconnecting from the power supply. This is to protect the flash memory from unnecessary writes, which increases its lifespan.

Main screen, left

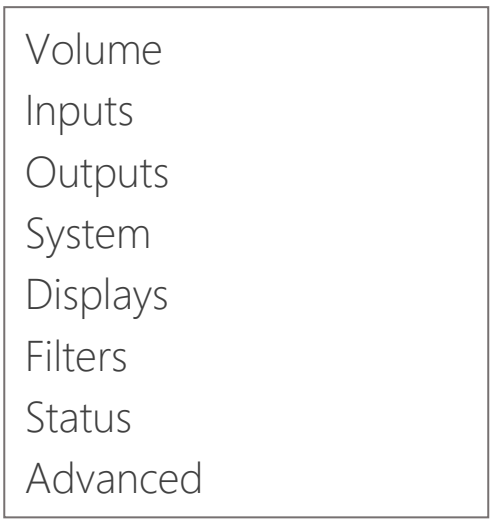
- Play / pause icon: indicates incoming data
- Input mode indicator: shows selected input
- Audio data information: displays sample rate, bit depth and data format (relevant to the current input)

Main screen, right

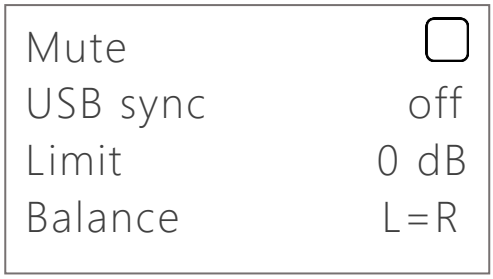
- Master volume: controls volume of all analog outputs. The displayed value is in dB, relative to the nominal full-scale output.
    - range: 0 to -99 dB (default: -50 dB)
- Mute icon: appears when mute is enabled
- Min / max indicator: only appears if the volume reaches upper limit (set in the Menu > Volume > Lim) or minimum value (-99 dB)

Main menu

The main menu will appear on the left screen upon pressing the knob, or by pressing the Menu button on the remote control.

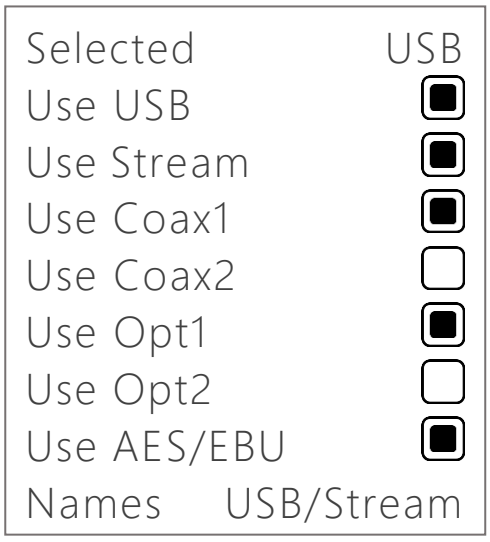


Volume submenu



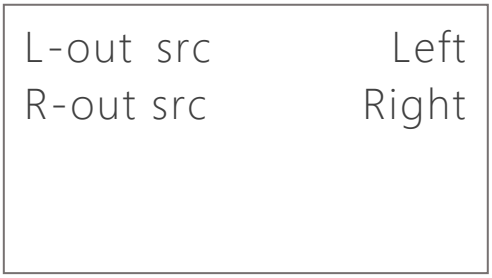
- Mute: mutes all the analog outputs (default: off)
- USB sync: allows the USB driver of the host device to control master volume of the dac8 Stereo (default: off)
- Limit: sets the maximum allowed volume
    - 0 to -50 dB (default: 0 dB)
- Balance: adds additional attenuation relative to the master volume to control volume balance between the left and right channel (default: L = R)

Inputs submenu



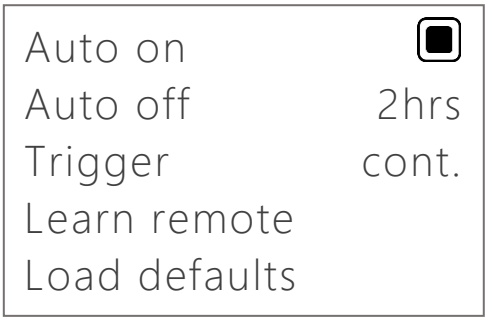
- Selected: shows active (selected) input
- Use USB1 / USB2 / Coax1 / Coax2 / Opt1 / Opt2 / AES/EBU: Allows or disallows the respective input to be selected
- Names: changes displayed name of the two USB inputs
    - USB / Stream
    - USB1 / USB2 (default)

Outputs submenu



- L-out src: selects signal source for the left output
  - Left (default)
  - Right
- R-out src: selects signal source for the right output
  - Left
  - Right (default)

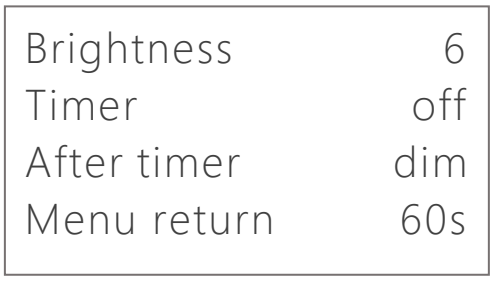
System submenu



- Trigger: sets trigger output as continuous or 10 ms pulse during turn on and off
  - cont. (default)
  - pulse
- Auto ON: turns on the unit when incoming signal of non-zero value is detected
- Auto OFF: turns off the unit after a time period without input signal
  - never
  - 10 min
  - 30 min
  - 2 hrs (default)

- Learn remote: pairs the unit with any IR remote. After activating the function, you will be asked to press 7 buttons in a sequence: Up, Down, Left, Right, Enter, Menu and On/Off/Mute. To cancel the procedure, simply press and hold the rotary control.
- Load defaults: loads factory defaults

Displays submenu

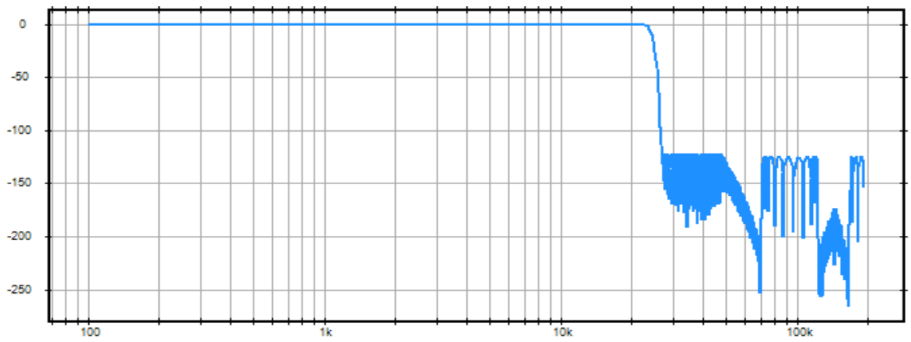


- Brightness: sets the display brightness in 6 steps (default: 6)
- Timer: sets a timer to dim or turn off the displays
    - off (default)
    - 10 s
    - 60 s
    - 5 min
- After timer: sets display action after the selected timer value expires
    - off
    - dim (default)
- Menu return: sets the time for an automatic return from the menu to the main screen
    - off (default)
    - 10 s
    - 60 s
    - 5 min

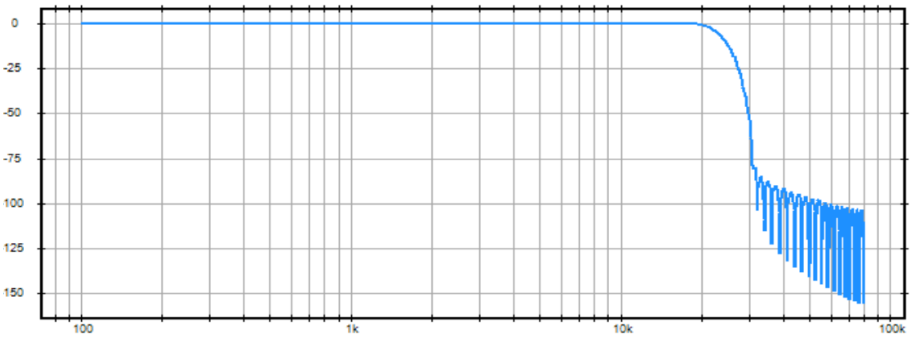
Filters submenu

PCM filter	FRMP
DSD filter	auto

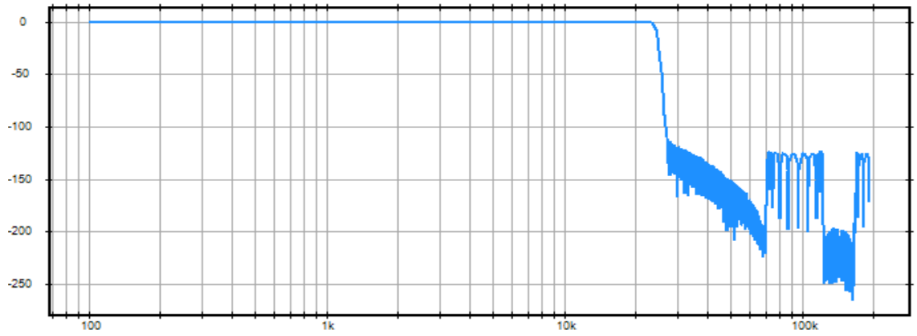
- PCM filter: selects FIR filter type for interpolation of PCM-encoded signal
  - FRLP (fast roll-off, linear phase):



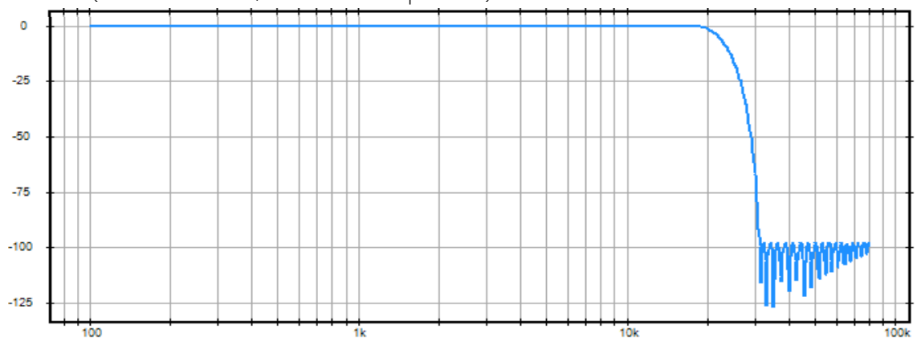
  - SRLP (slow roll-off, linear phase):



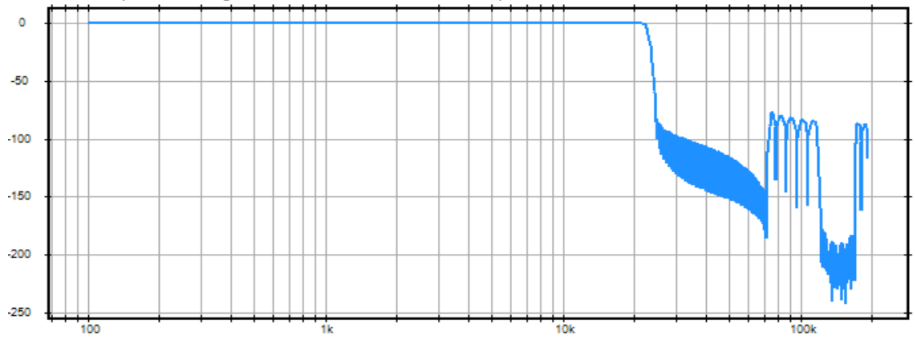
- FRMP (fast roll-off, minimum phase) (default):



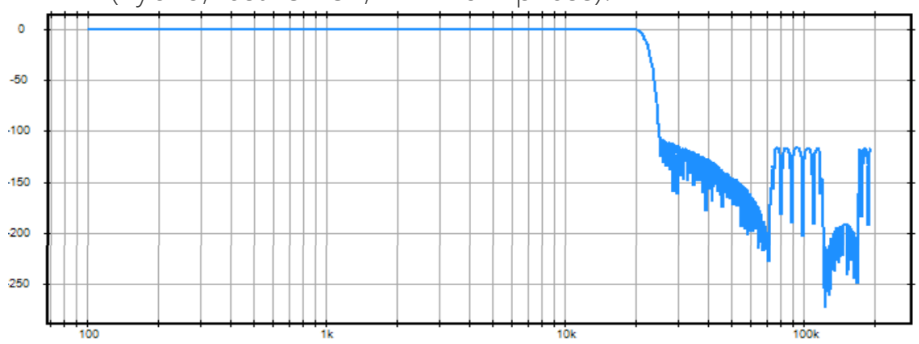
- SRMP (slow roll-off, minimum phase):



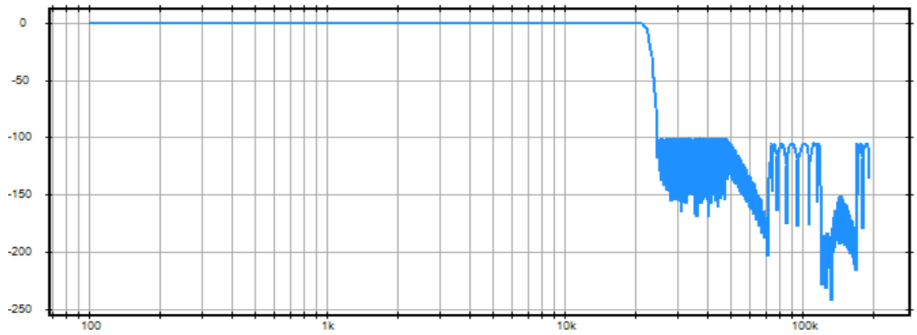
- AFRLP (apodizing, fast roll-off, linear phase):



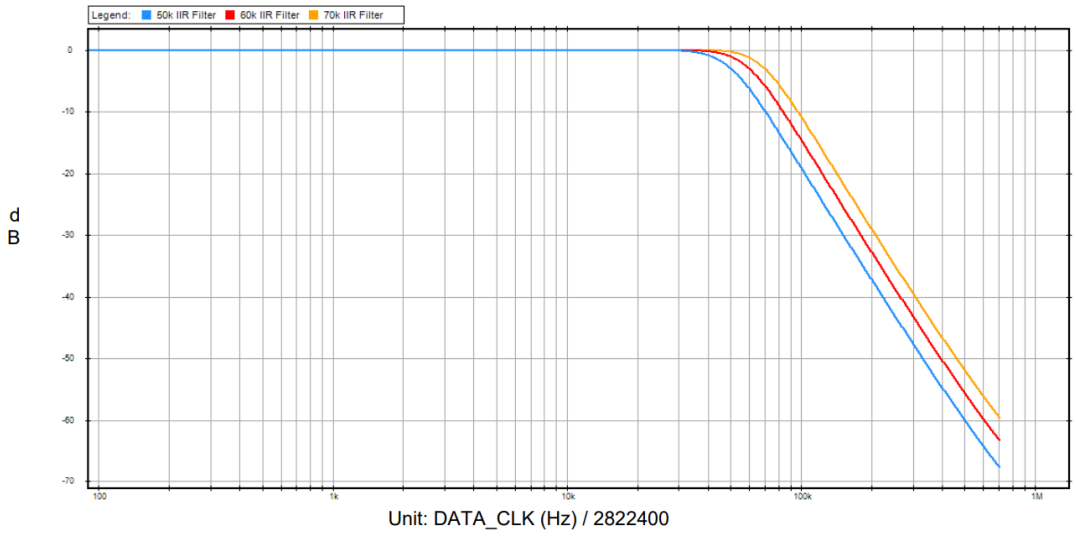
- HFRMP (hybrid, fast roll-off, minimum phase):



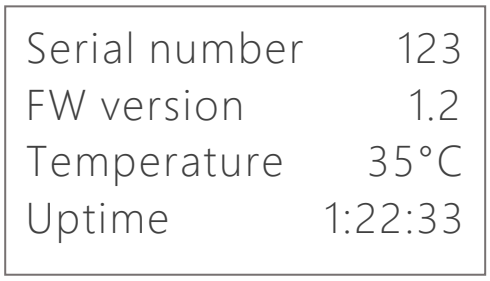
- BW (brickwall):



- DSD filter - sets the cut-off frequency of the low-pass filter for DSD playback
  - auto (default)
  - 50 kHz
  - 60 kHz
  - 70 kHz



Status submenu



- Serial number: shows the serial number that is burned in the OTP (one-time-programmable) memory
- FW version: shows the current version of the device firmware
- Temperature: reading of the temperature on the DAC module
- Uptime: shows the elapsed time since the unit was powered on

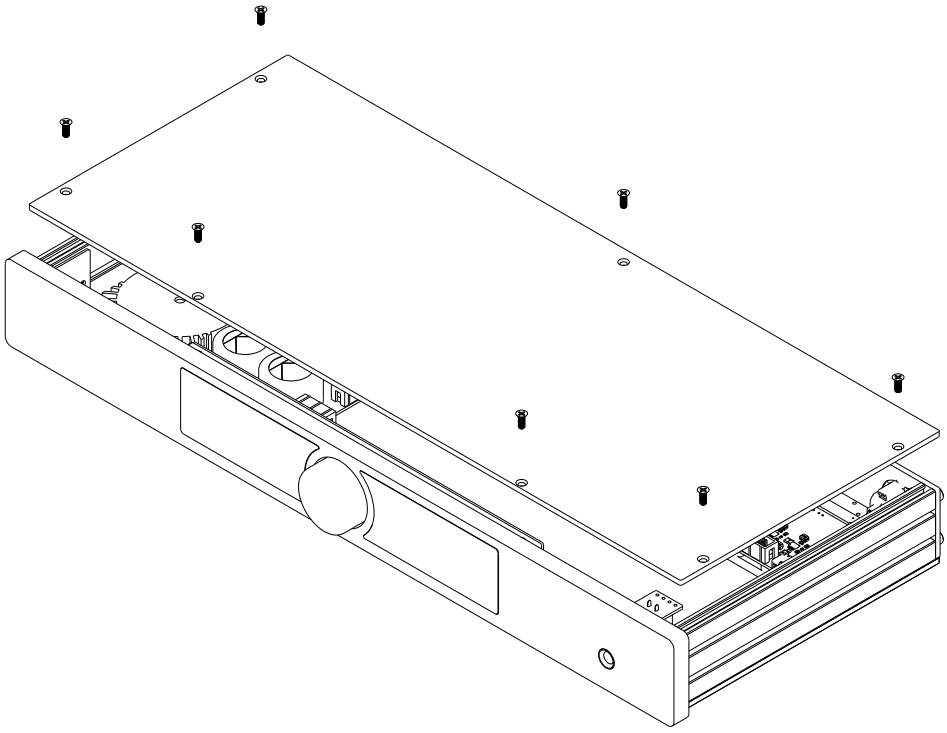
Advanced submenu

- DPLL BW AES: controls bandwidth of the de-jittering mechanism for AES/EBU inputs. Increasing the value will allow for operation with more jittery signal sources at a cost of slightly reduced jitter suppression
    - range: 0 to 15 (default: 8)
- THD h2: introduces a 2nd order nonlinearity to the DAC's transfer curve, potentially neutralizing second harmonic distortion generated by the DAC chip or subsequent analog circuitry. This setting is intended for technically proficient users with access to a high-end audio analyzer.
    - range: -99 to 99 (default: 0)
- THD h3: same as the previous setting, but for 3rd order harmonic distortion
    - range: -99 to 99 (default: 0)

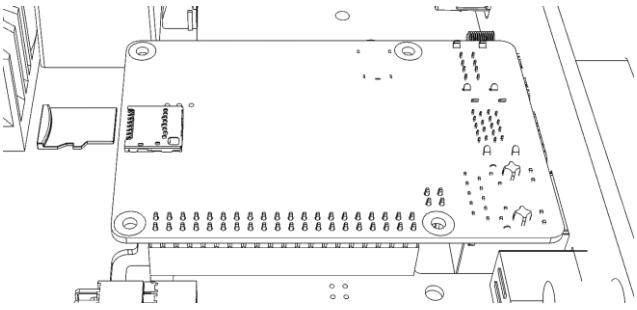
Using the streaming capabilities

If ordered with the streaming option, the dac8 Stereo will come with a built-in Raspberry Pi with a blank memory card, allowing the user to install an audio streaming software of their choice. Please follow these steps to ensure a flawless installation.

1) Make sure the dac8 Stereo is unplugged from mains and remove the top cover:



2) Remove the MicroSD card from the Raspberry Pi's slot and put it into your computer



3) Pick a streaming distribution of your choice and follow their recommended steps to flash it onto the memory card
4) Put the MicroSD card back into the Raspberry Pi slot
5) Mount the top cover back in place
6) Plug-in the Wi-Fi adapter and USB interconnect and plug the unit back into mains

Even if you don't intend to use Wi-Fi, we suggest to keep the adapter in place. Disconnecting it would make the Raspberry use its on-board Wi-Fi radio, which might create audible interference.

Converting a non-streaming unit into a streaming one

The dac8 Stereo is compatible solely with the Raspberry Pi 4 Model B. Any RAM size is sufficient for running streaming audio software, including the legacy 1GB version. However, we recommend checking the compatibility of your intended software with your Raspberry Pi version. Below are the steps for retrofitting the Raspberry Pi into the dac8 Stereo:

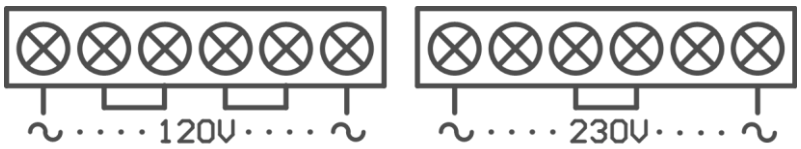
1. Unplug the dac8 Stereo from the mains power source.
2. Remove the top cover by unscrewing the seven Phillips screws.
3. Push the press-fit plastic cover inward to remove it.
4. Unscrew the two M2.5 hex screws located in the mounting posts.
5. Insert the Raspberry Pi's connectors into the cutouts in the dac8 Stereo's back panel, then gently press its 40-pin header into the corresponding header on the dac8 Stereo's input board.
6. Secure the Raspberry Pi by replacing the two screws into the mounting posts and tightening them lightly.
7. Install a Wi-Fi adapter before plugging in the unit to prevent the Raspberry Pi from using its onboard radio.
8. Connect a USB cable between any of the Raspberry Pi's USB ports and the USB2 port of the dac8 Stereo's digital input board.
9. Insert an SD card with your preferred audio streaming software into the Raspberry Pi's card slot.
10. Replace the top cover before plugging the unit back into the mains power source.
11. Follow the configuration steps as outlined in the streaming software's documentation.
12. Optional: Navigate to Menu > Inputs and change the value of entry 'Names' to USB/Stream to change the input names to reflect the new usage.

Mains voltage selection

Because the analog circuits of the unit are powered by a linear power supply, the mains voltage selection requires selection of different transformer primary windings.

Each dac8 Stereo leaves our factory with the input voltage set according to the mains voltage of the country from which the order was placed, unless specified otherwise. If you wish to alter this selection at a later time, please adhere to the following steps. For your reference, this diagram is also imprinted on the power supply module PCB.

1. Unplug the dac8 Stereo from the mains power source.
2. Unscrew the 7 screws in the top lid and remove it
3. Reconfigure wire jumpers on the input terminal block of the power supply module accordingly:



Troubleshooting

This section is designed to help you identify and resolve potential issues that may arise during the use of your dac8 Stereo. If you are unable to resolve an issue following these steps, or if the problem is not listed here, please contact us for further assistance.

Issue 1: USB input not recognized

Recommended action: Perform a power cycle on the unit by unplugging it from mains and then plugging it back in after a 5-second pause.

Issue 2: Dropouts during AES/EBU playback

Recommended action: Navigate to Menu > Advanced > DPLL BW AES and increase the value until the dropouts disappear.

Issue 3: Volume control is stuck and cannot be changed

Recommended action: Navigate to Menu > Volume > USB sync and make sure it is not activated. Please refer to chapter "Volume submenu" to learn more about this setting.

Service and warranty

We are committed to providing technical support and spare parts to both original and second-hand owners.

The dac8 Stereo is designed for maximum reliability, with each unit undergoing extensive testing before shipment. In the unlikely event of spontaneous malfunction, the product is covered by a 2-year warranty. Please note, however, that any damage resulting from abusive operation is not covered under this warranty.

To ensure your satisfaction, we offer a 30-day return policy. If you wish to return the unit, please note that the customer is responsible for the cost of shipping it back to us. The refunded amount will not include the cost of the original shipping from us to the customer. The returned product and its accessories must be complete, clean, and free of scratches or other damage.

Upon receipt of the product, the customer is required to carefully inspect the package for any damage. If any damage is found, it is necessary to have the delivery person document the damage and write a report. This report, along with photographs of the damage, should be emailed to us as soon as possible. Please note that if these steps are not followed, any transportation damage will not be covered by the warranty. The address for returns is as follows:

Okto Research s.r.o.
Jana Masaryka 257/26
12000 Prague
Czech Republic
info@oktoresearch.com
www.oktoresearch.com

Manual revisions

Rev. 1.2	Large number of changes accompanying the release of the v1.2 firmware
Rev. 1.1	Small changes, extended XLR-to-RCA disclaimer, mailing address update
Rev. 1.0	Initial release