

dac8 PRO

A versatile, high-performance 8-channel D/A converter

Owner's Manual



Contents

Specifications	3
Mechanical drawings	5
Back panel overview	6
Package contents	6
Digital connections	7
USB	7
Drivers	7
AES/EBU inputs	9
Signal integrity	9
SPDIF compatibility	10
AES/EBU output	10
Analog Connections	10
Main outputs	10
Driving power amplifiers directly	10
Volume operation	11
Interfacing with legacy devices with single-ended inputs only	11
Headphone output	12
Input modes	13
Pure USB	13
USB / AES	13
Pure AES	14
Controls	15
Rotary control	15
Remote control	15
User interface and menu system	16
Main screen, left	16
Main screen, right	17
Main menu	17
Volume submenu	18
Routing submenu	18
System submenu	19
Displays submenu	20
Filters submenu	20
Status submenu	23
Advanced submenu	24
Mains voltage selection	24
Troubleshooting	25
Issue 1: USB input not recognized	25
Issue 2: Dropouts during AES/EBU playback	25
Service and warranty	26
Manual revisions	27

Specifications

Digital inputs / outputs:

- USB
 - 8 output and 8 input channels
 - asynchronous, UAC 2.0 compliant
 - playback data formats
 - PCM, up to 192kHz / 32-bit
 - native DSD, 64x / 128x
 - DSD over PCM (DoP), 64x
 - recording data format
 - PCM, up to 192kHz / 32-bit
- AES/EBU
 - 4 AES/EBU inputs (SPDIF compatible)
 - up to 192 kHz / 24-bit
 - resampling-free (i.e. requiring a single signal source)
 - unique USB/AES input mode ensures a bit-perfect data flow from AES/EBU to USB, allowing for a real-time signal processing or simultaneous recording & playback with no resampling applied
 - 1 AES/EBU output
 - fixed to playback channels 1 and 2 (of USB or AES/EBU, depending on the selected input)

Analog outputs:

- Main outputs (back side)
 - 8 x Neutrik gold-plated XLR connector
 - output level: 4.2 V RMS differential full-scale
 - output impedance: 200 Ohm (differential) or 100 Ohm (SE)
 - capable of directly driving power amplifiers
- Headphone output (front side)
 - 6.3 mm (1/4") TRS connector
 - Output level: 4.2 V RMS full-scale
 - 120 mA linear output current
 - fixed to output channels 1 and 2
 - output impedance <100 mOhm

Analog performance

- 0.000032 % / -130 dB THD (Total Harmonic Distortion) full-scale, 1kHz
- 0.00011 % / -119 dB THD+N (Total Harmonic Distortion + Noise) or 119 dB SINAD (full-scale, 1kHz)
- 125 dB of dynamic range
- 0.000224 % / -113 dB THD+N @ 100 mW into 32 Ohm headphone output

Menu functions

- Individual volume for each of the 8 output channels (relative to the master volume)
- Routing matrix (any input channel to a specific output channel)
- Upper volume limit
- Remote control learning
- Choice between 7 PCM reconstruction FIR filters
- Configurable display timer to dim or turn off the displays
- Configurable Auto on / Auto off with non-zero audio data detection
- Adjustable 2nd and 3rd order THD compensation

Other features

- Trigger output
 - 5 V voltage level (works with most 12 V trigger inputs)
 - short-circuit proof with 15 mA maximum current
 - pulse or continuous
- Full control with either rotary or remote control
- Rack-mountable with optional 2U, 19" rack mounting brackets

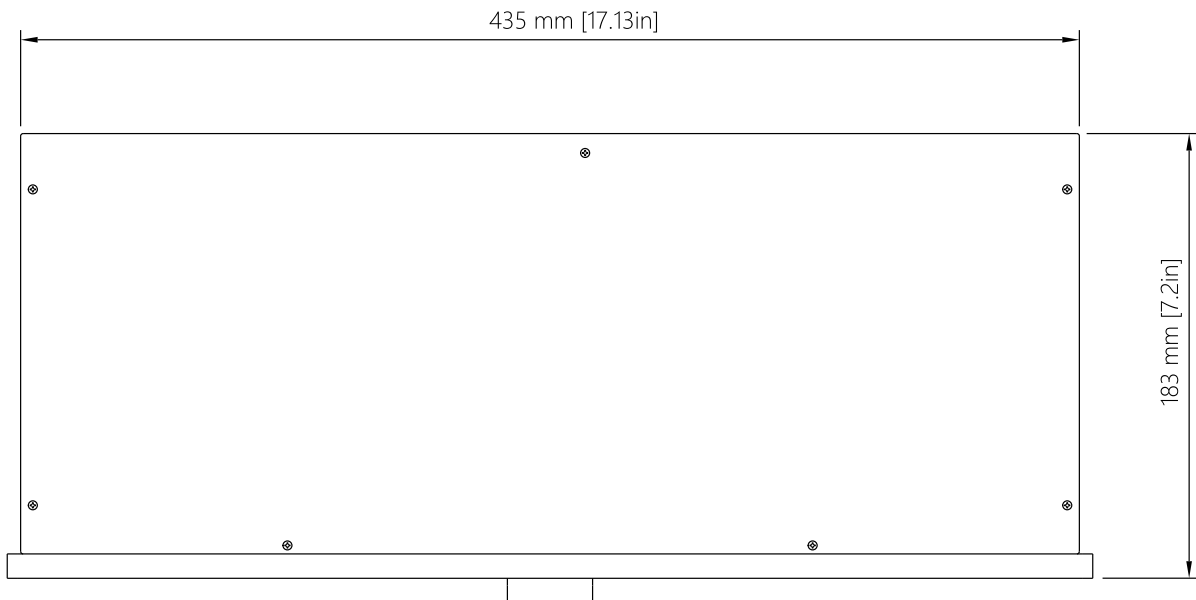
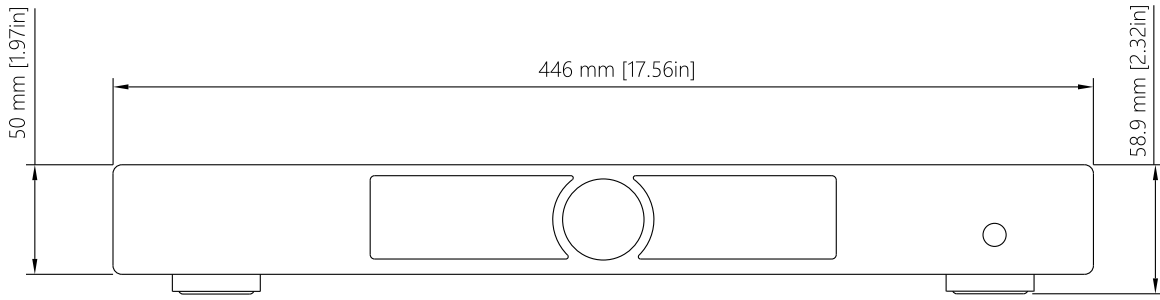
Dimensions

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

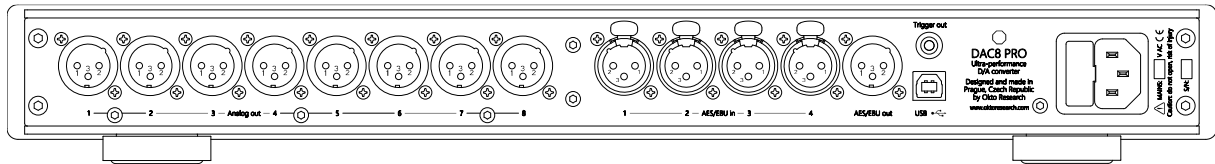
Power

- 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
- Standard 3-pin IEC 60320 power connector
- Power rating: 15 W
- Fuse: F400mA

Mechanical drawings



Back panel overview



Package contents

- dac8 PRO (silver or black depending on your choice, 120 V or 230 V according to the mains voltage of the country from which the order was placed, unless requested otherwise)
- rack mounting brackets (optional)

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.

Digital connections

USB

The dac8 PRO 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 PRO will be recognized as an 8-channel playback device and an 8-channel recording device. The only action required by the user is to select the dac8 PRO in your operating system's audio control panel.

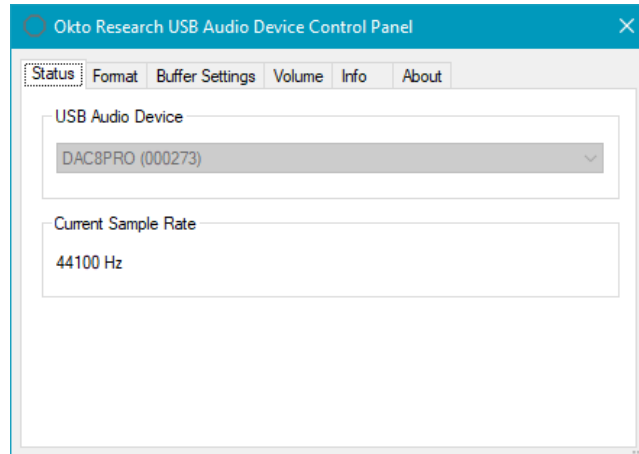
This also applies to Windows 10 and newer; however, we strongly recommend installing the Okto Research ASIO driver to bypass the Windows sound mixer and enable exclusive access to the device for bit-perfect, low-latency operation. The driver can be downloaded from the following link:

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

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

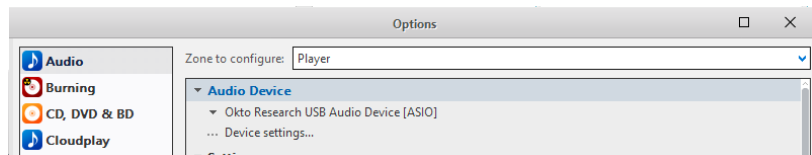


After a successful installation, the Okto Research icon will appear in your system tray. If the unit is connected to the computer, it will be recognized by the driver, as shown in the following image.

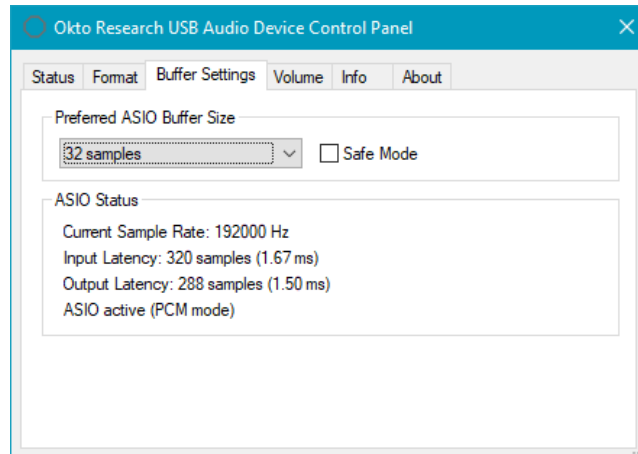


Please note: this driver will only work with units running firmware 1.5 and newer. Units with older firmware have different USB identifiers and will not be recognized. Please contact us to receive an ASIO driver compatible with older firmware versions.

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 PRO 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 PRO 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.

AES/EBU inputs

The dac8 PRO offers four AES/EBU inputs that are free of resampling. This allows for bit-perfect playback, as well as recording at the USB host side. However, it also requires the inputs to be mutually synchronized and carry signals with matching sample rates.

Due to the device's design, there is a specific order in which individual AES/EBU inputs must be connected. If only one input is used, it must be the first input; if two are used, they must be inputs 1 and 2. There are no further requirements for inputs 3 and 4.

Signal integrity

AES/EBU (as well as SPDIF and TOSLINK) is a synchronous connection, meaning that the signal source device also serves as a clock source. Moreover, the clock signal is encoded into a single bitstream with audio data using biphasic mark code. This places the responsibility of reconstructing the clock signal on the receiving device, and in the case of a D/A converter, deviations can lead to undesirable noise or spurious signals at the output. Although the dac8 PRO employs the highly effective Sabre jitter elimination algorithm, it is recommended to ensure the best signal integrity possible. One important and commonly overlooked factor is cable impedance. The source and termination impedance for AES/EBU is 110 Ohms, and while reception will likely work with a line cable, using a dedicated cable with 110 Ohm impedance is highly recommended.

SPDIF compatibility

The AES/EBU inputs of the dac8 PRO will also accept a signal with the SPDIF voltage level of 0.5V peak-to-peak. The termination impedance requirements differ between the two standards, and while the SPDIF signal will generally be received correctly, it is recommended to either employ an impedance-matching transformer or use a 75 Ohm RCA – XLR cable and solder a 240 Ohm resistor to the XLR connector on the receiving side, effectively decreasing the termination impedance from 110 Ohms to 75 Ohms.

AES/EBU output

The AES/EBU output is always active, transmitting channels 1 and 2 of the audio data currently being played by the dac8 PRO, with the master volume applied. The per-channel volume value is not taken into account.

Analog Connections

Main outputs

The main analog outputs provide 8 channels that represent 8 signals from the selected digital input, converted to the analog domain with extremely high precision.

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 PRO volume is set to -12 dB or higher. Consequently, the upper 12 dB of the dac8 PRO's output would remain unused. By lowering the output voltage of the dac8 PRO 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 PRO 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 PRO'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 XLR 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 PRO'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.

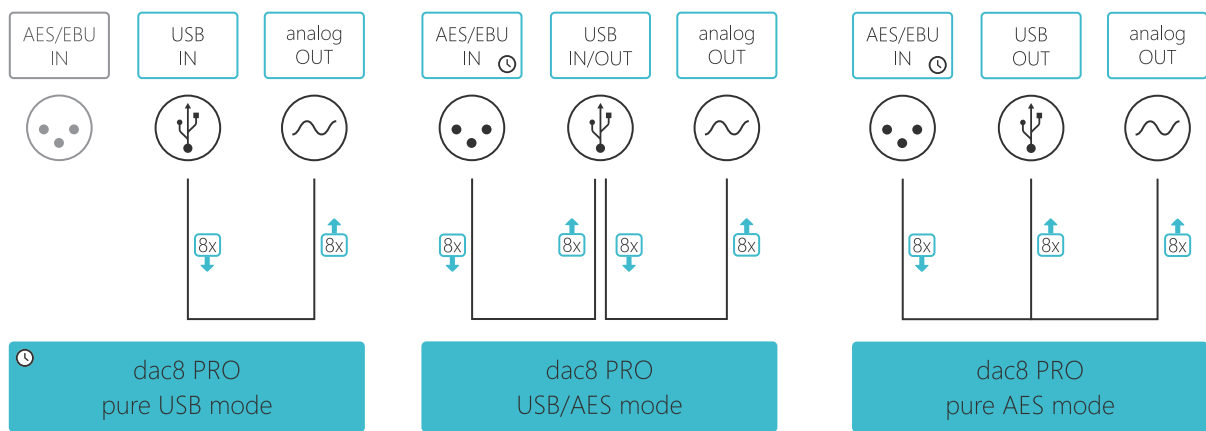
Headphone output

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.

Input modes

The dac8 PRO supports two digital interfaces: USB Audio Class 2 and AES/EBU. There are three available input modes: Pure USB for USB playback, Pure AES for AES/EBU playback, and a combined mode called USB/AES. The USB/AES mode takes advantage of the bi-directional operation of USB Audio Class 2, allowing for simultaneous playback from USB and recording from AES/EBU. The diagram below illustrates the data flow in each mode, with the clock symbol signifying the source of the clock signal in each scenario.



Pure USB

The Pure USB input mode allows 8-channel playback from the USB host using the dac8 PRO's internal low phase noise oscillator as the clock source. This means that the dac8 PRO is in control of the playback speed by providing feedback to the host.

USB / AES

USB/AES is a unique mode of operation that utilizes the clock recovered from the 1st AES/EBU input as feedback for the USB host to set the pace of the playback. This ensures that the data retrieved by the AES/EBU inputs are transmitted in a bit-perfect manner to the USB host through the eight USB input channels to be either recorded or processed and then sent back to the dac8 PRO through 8 playback channels.

Because the UAC2 audio device is unable to change the USB host current sampling frequency, the dac8 PRO will display a warning message, "fs mismatch," if the received

AES/EBU signal's sampling frequency does not correspond to the USB host driver's current frequency. User may be required to take action to ensure that the two sample rates match.

Pure AES

Pure AES mode enables playback from the eight digital audio channels available on the four AES/EBU input connectors. It utilizes the clock recovered from the first AES/EBU input for processing the received digital audio data, and the dac8 PRO's internal low-phase noise oscillators for the actual D/A conversion. The dac8 PRO's jitter eliminator is active in Pure AES mode, ensuring the highest possible jitter rejection and performance.

A USB connection is not required for operation. However, if the sample rate of the signal coming in through the AES/EBU inputs matches the USB driver's sample rate, recording from the AES/EBU inputs will also be available, similar to the USB/AES mode. Since this is not the primary purpose of this input mode, an error message will not be displayed if the sample rate condition is not met.

Controls

The dac8 PRO 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

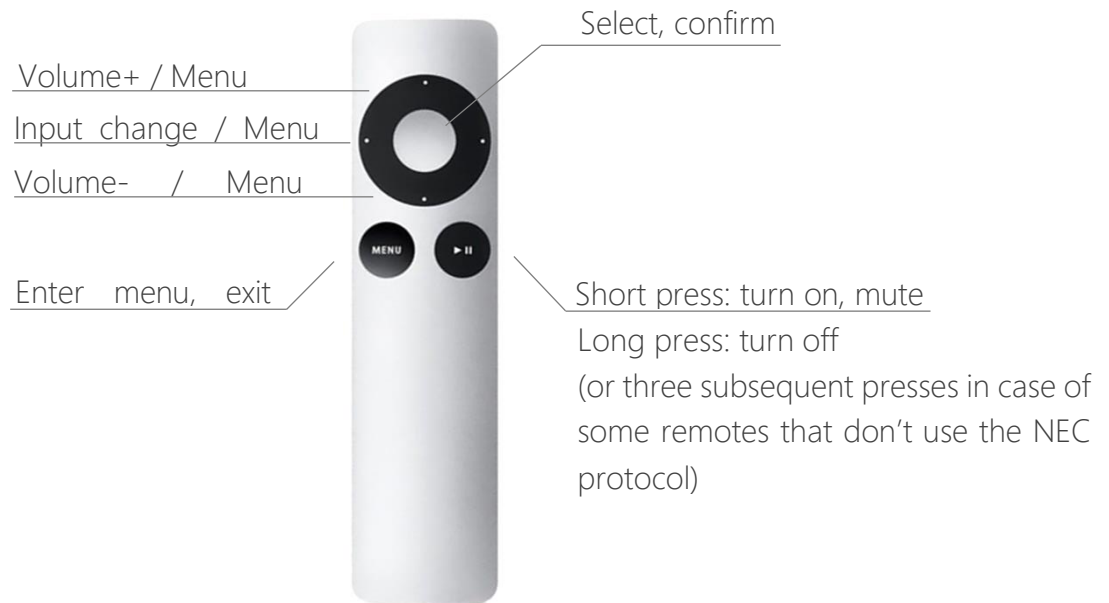
		<i>Device state</i>			
		Off	Main screen	Menu	Menu, selected
<i>Input</i>	Left/right turn	-	Volume control	Navigation	Modify
	Push	Turn on	Enter menu	Select	Confirm
	Long push	Turn on	Turn off	Back	Confirm

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 PRO 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.

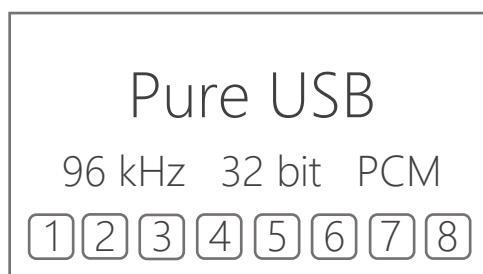
The image below illustrates button functionality as demonstrated with the Apple Remote



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



- Input mode indicator: displays the selected input mode
- Audio data information: displays sample rate, bit depth and data format (relevant to the input mode)

- Per-channel playback indicator: displays the presence of digital data on the input of each of the 8 channels

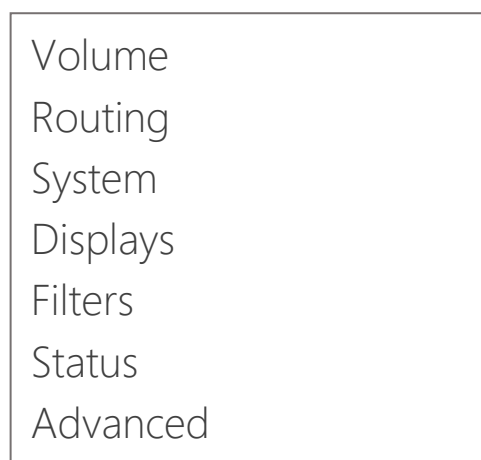
Main screen, right



- Master volume: controls volume of all analog outputs as well as AES/EBU digital output. 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	<input type="checkbox"/>
Limit	0 dB
CH1 volume	0 dB
...	
CH8 volume	0 dB

- Mute: mutes all the analog outputs (default: off)
- Limit: sets the maximum allowed volume level
 - range: 0 to -50 dB (default: 0 dB)
- CH1 to CH8 volume: per-channel volume for individual channels
 - range: 0 to -50 dB (default: 0 dB)

Routing submenu

Out1 source:	CH1
Out2 source:	CH2
...	
Out8 source:	CH8

- Out 1-to-8 source selects the source channel for the respective analog output

System submenu

Input	Pure USB
Auto ON	<input type="checkbox"/>
Auto OFF	2hrs
Trigger	cont.
Learn remote	
Load defaults	

- Input: selects signal input. Please refer to chapter "Input modes" for details
 - Pure USB (default)
 - USB/AES
 - Pure AES
- 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

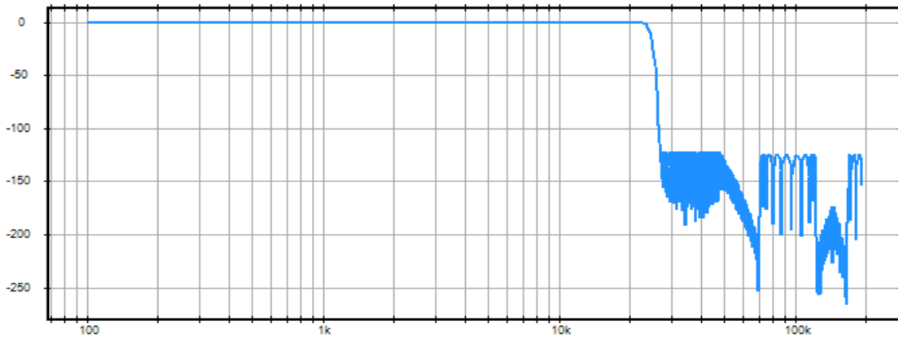
Brightness	6
Timer	off
After timer	dim
Menu return	60s

- 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

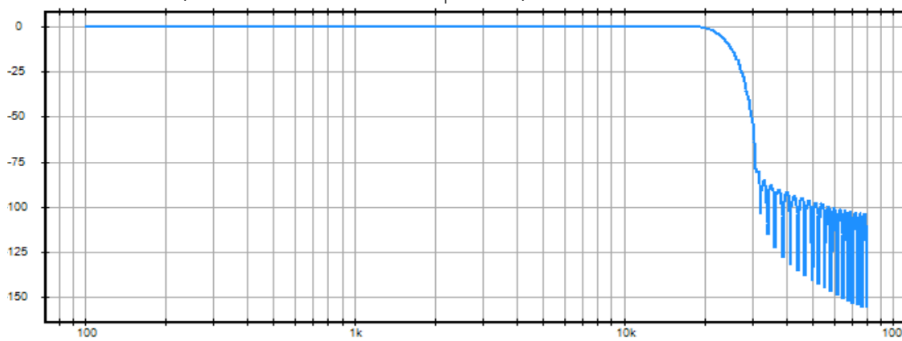
Filters submenu

PCM filter	FRMP
DSD filter	auto

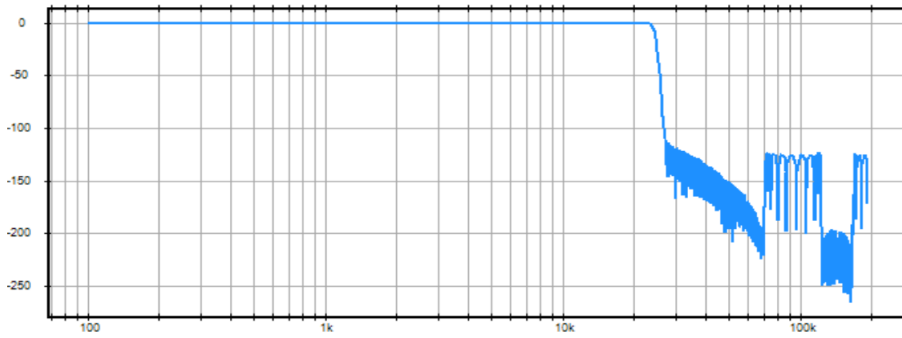
- PCM filter: selects FIR filter type for interpolation of PCM-encoded signal
 - FRLP (fast roll-off, linear phase):



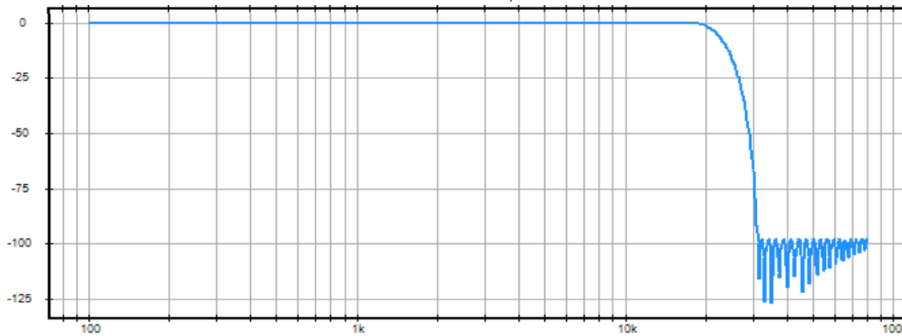
- SRLP (slow roll-off, linear phase):



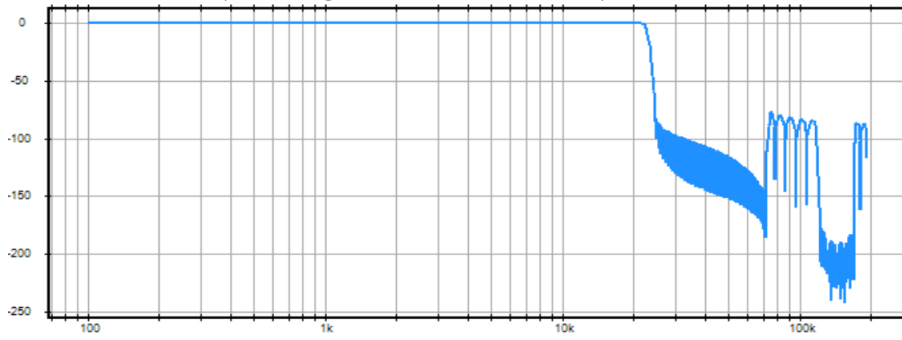
- FRMP (fast roll-off, minimum phase) (default):



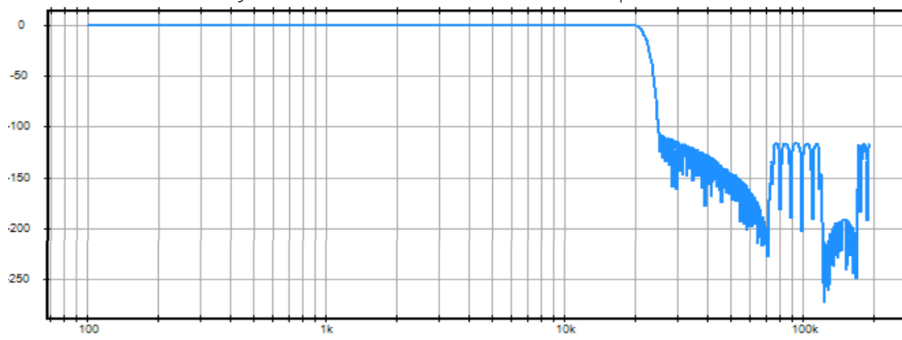
- SRMP (slow roll-off, minimum phase):



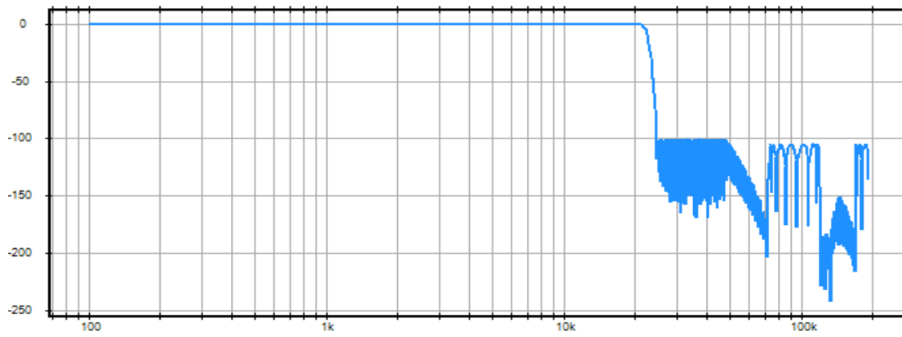
- AFRLP (apodizing, fast roll-off, linear phase):



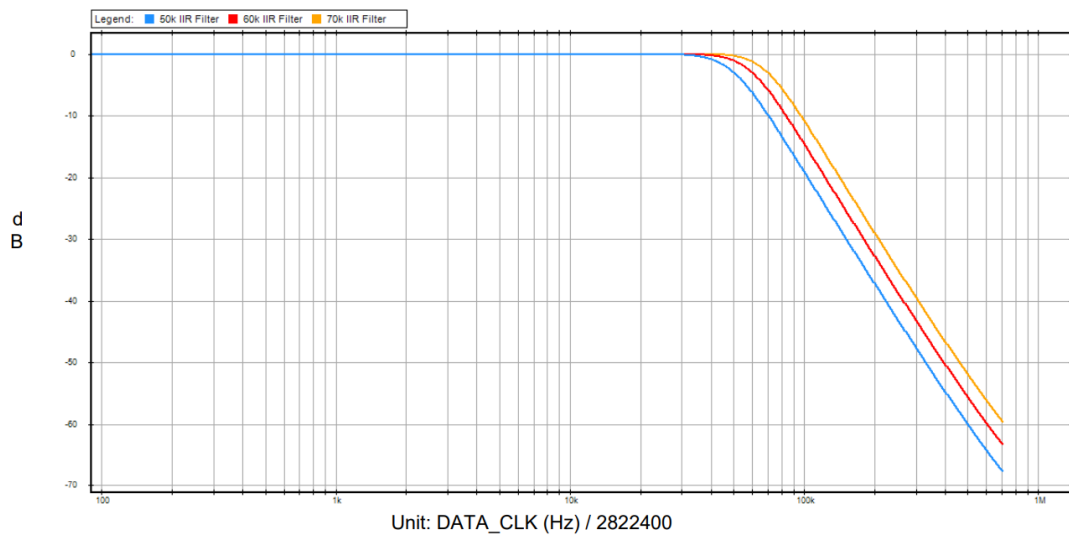
- HFRMP (hybrid, fast roll-off, minimum phase):



- 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	123
FW version	1.5
Temperature	35°C
Uptime	1:22:33

- 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	8
THD h2	0
THD h3	0

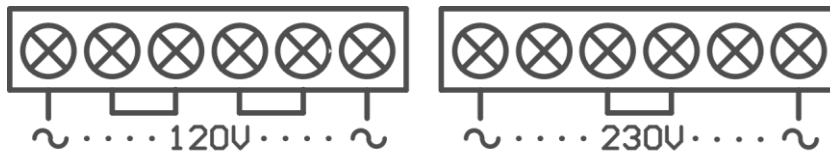
- DPLL BW AES: controls bandwidth of the de-jittering mechanism for AES/EBU inputs. Increasing the value will allow for operation with more jittery signal sources at a cost of slightly reduced jitter suppression
 - range: 0 to 15 (default: 8)
- THD h2: introduces a 2nd order nonlinearity to the DAC's 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)

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 PRO 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 PRO. 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.

Service and warranty

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

The dac8 PRO 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. 1.3	Large number of changes accompanying the release of the v1.5 firmware
Rev. 1.2	Small changes, extended XLR-to-RCA disclaimer, mailing address update
Rev. 1.1	Improved drawings
Rev. 1.0	Initial release

