

CanEVER Audio

ZeroUno DAC-HPA

Digital Preamplifier & Headphone Amp



Introduction

The **ZeroUno DAC-HPA** represents a top-quality DAC based on the well accepted **ZeroUno DAC** - a strong headphone amplifier running in pure Class A and a remote controlled preamplifier, able to drive any power amp or powered speaker – all in one box.

The building blocks of the **ZeroUno DAC-HPA** are based on a set of high-performance power supplies, giving each part of the machine a rock solid base to perform at top level. Looking at the boards inside the **ZeroUno DAC**, one can identify almost 70% of their space covered by the circuits for the individual power supplies. For more details about the design of the power supplies for the **CanEVER Audio** product line, please refer to the detailed technical descriptions of the **ZeroUno DAC** or the **LaScala PowerAmp**.

Special care inside the **ZeroUno DAC-HPA** has been taken to achieve short signal paths with a minimum amount of high-grade components. You will especially experience this in the headphone amplifier since there are no coupling capacitors used in the signal path, and all circuits are free of feedback loops.



Input Connections: 1xUSB, 1x SPDIF via RCA, 1x AES/EBU via XLR and 1x SPDIF via OPTIC
 Output Connection: 2x Pairs of unbalanced RCA-Connectors: 1x Direct DAC Output and 1x Preamp Output,
 (optional: Preamp Output XLR / balanced)

Quick Overview:

The **CanEVER Audio ZeroUno DAC-HPA** is a:

- top quality DAC based on the circuit of the **ZeroUno DAC**
- headphone amplifier with connections for unbalanced AND balanced connections
- digital preamplifier including remote control with functions for:
 volume, balance, absolute phase, input & mute

The analog output stage is based on a discrete topology without operational amplifiers and runs in pure Class A mode.

There are two pairs of RCA output connectors:

One pair of outputs gives access to the analog signal directly at the D/A stage.

The other pair outputs the amplified signal of the preamp stage.

The output stage is designed as a current source with low output impedance able to drive power amps or powered speakers directly, if needed.

The headphone amplifier inside the **ZeroUnoDAC-HPA** is a dual mono design with a super-linear driver, delivering power of 2,5 Wrms even into 30 Ohm per channel in pure Class A.

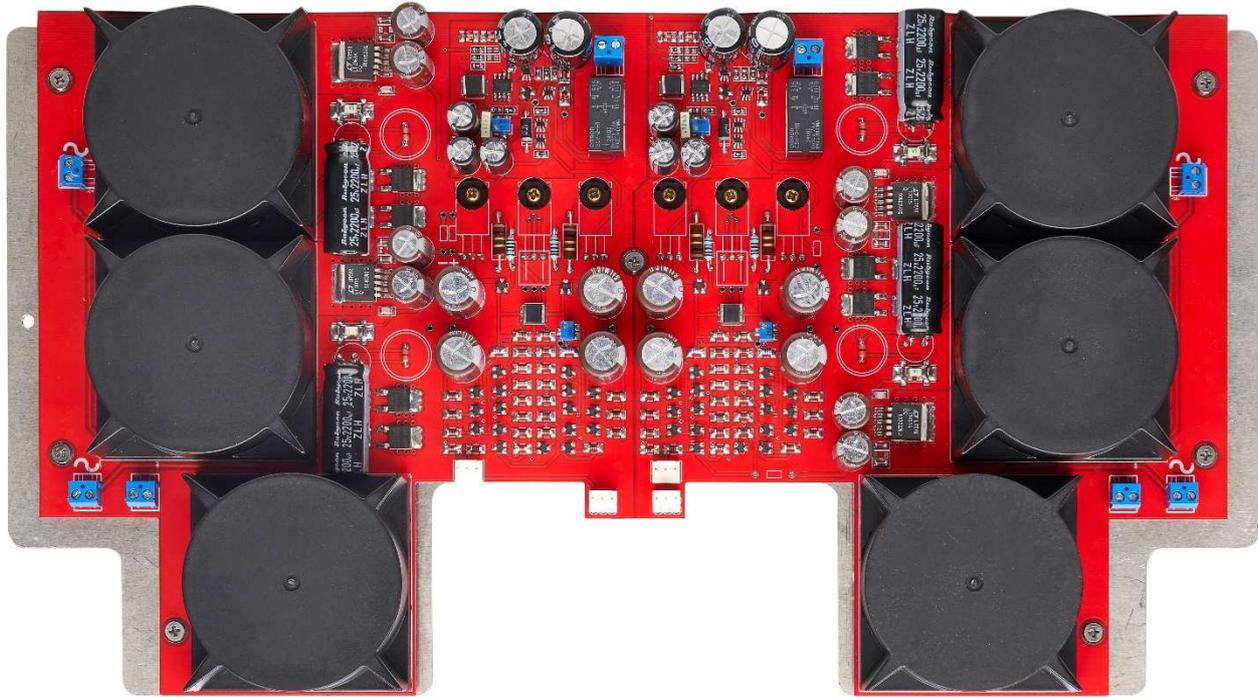
The complete signal path inside the **ZeroUno DAC-HPA** consists of a very limited number of components.

In the amplifier stage there are no:

- capacitors
- integrated circuits
- feedback loops

Detailed Description

The *ZeroUno DAC-HPA*'s DAC board is based on the same topology as the *ZeroUno DAC*. The differences between the *ZeroUno DAC-HPA* and the *ZeroUno DAC* is the analog output stage. The amplifier inside of the *ZeroUno DAC-HPA* is based on the same concept as the *CanEVER Audio LaScala PowerAmp*. It is designed as a small dual mono power amp running in pure Class A mode, which delivers an output power of 2,5 Wrms per channel. The amp can drive both, any headphone in the range 30ohm – 600ohm and as well as power amplifiers or powered speakers.

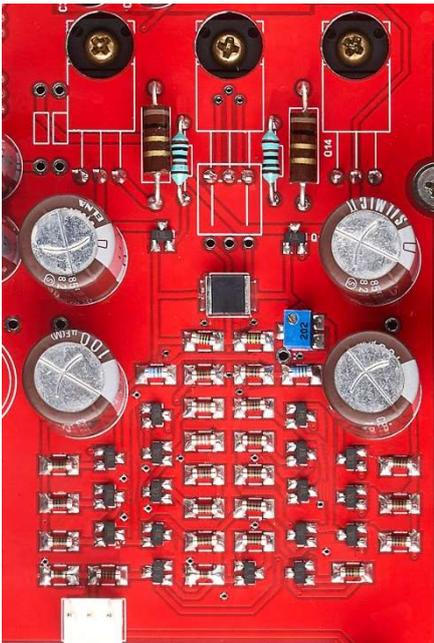


All the design ideas that made the *ZeroUno DAC* a well respected DAC, at the top level of performance in the market, are present inside the *ZeroUno DAC-HPA*, as well. The heart of the DAC board is an ESS Sabre³² ES9018S chip, with its eight differential DACs used in a quad-sum configuration. The digital and analog filtering are a special design of *CanEVER Audio* and incorporate a dedicated output transformer topology inside the D/A interface.

The layout of the main board inside the *ZeroUno DAC-HPA* is the same as the *ZeroUno DAC* to keep the “no noise” performances from the original circuit.

The use of several different ground planes shields the unit from electric noise coming from outside and isolates the individual modules inside the *ZeroUno DAC-HPA* like “islands interconnected by bridges”.

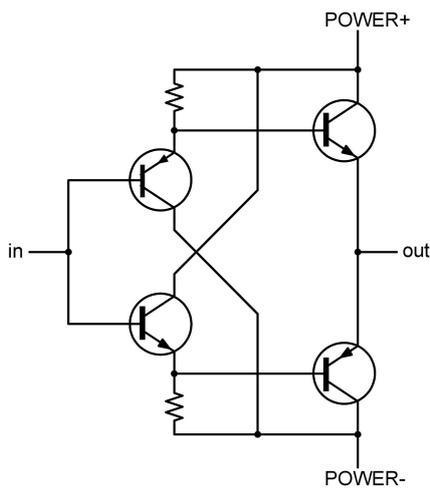
All digital inputs of the *ZeroUno DAC-HPA* are the same as the *ZeroUno DAC*. The new USB receiver board incorporates full MQA functionality. The USB board is powered in “battery mode” and comes with a galvanic isolation from the connected computer or streamer. These additions avoid any injection of noise by the external digital sources.



The design philosophy of the output stage for the **ZeroUno DAC-HPA** is very similar to the **CanEVER Audio LaScala PowerAmp**. The output stage is a Class A Single-ended Push Pull circuit with a high current audio line amplifier – capable of driving even low impedance headphones or in general, any heavy load as a power amplifier.

The topology is N-NFB (No Negative Feedback) to reach the maximum “naturalness” of the sound reproduced. The topology is classic with a complementary JFET input stage followed by a transistor acting as a driver and a transistor acting as power device. Special care has been taken to avoid the distortions created in a N-NFB solution using a JFET/transistors topology.

In the picture on the left, one channel is shown with the power transistors soldered at the backside of the mainboard.



A lot of effort was spent to setup a super-linear circuit that overcomes the non-linearity problems of the above described circuit. The concept is based on the crossing of the driving signals, so that distortions will be naturally cancelled when summed at the push-pull driver in the output stage.

In this manner, the non-linearity of the JFETs and BJTs are absorbed by a reverse non-linearity mode. This technique is not new and implemented with success in very low noise application requiring high linearity.

In a classic push-pull configuration only even harmonics are cancelled leaving only the odd ones present. With the crossed-driver topology (aka “reverse non-linearity mode”) and the selection of the components within a tolerance of 0.1%, the odd harmonics are “cancelled”, as well. Finally, this leads to a “super linear” topology.

Using a feedback network, reduced distortions could be reached as well. But, while “feedback” seems to be simple and inexpensive to implement, it comes with a price. Implementing “feedback” reduces the “natural sound.”

Extended listening tests have proven that feedback loops tend to create certain “patterns” inside the reproduced music, which do not sound pleasant to the ears (better: the brain) of the listeners.

For this reason the feedback in the topology of the **ZeroUno DAC-HPA** is avoided.

Implementing the crossed drivers of the super linear topology, the stability and the linearity of the amp implemented inside the **ZeroUno DAC-HPA** are astonishing even. Deleting the feedback loops and capacitors from the signal path let the sound become more “real” and relaxing.

The drawback of this kind of implementation, is the need for carefully selected JFET and BJT in pairs combined with high quality power supplies of laboratory standard.



The selection process starts from groups of 1000 BJT and FET, ending up at only 20 to 30 transistors suitable for the amplifier.

All the solid state devices are specific for audio use and not simple “industrial” components.

The power supply is completely dual-mono, with separated transformers for different power rails. In total six toroidal transformers are used to power the unit.

The picture to the left shows the power supply of one channel, only.



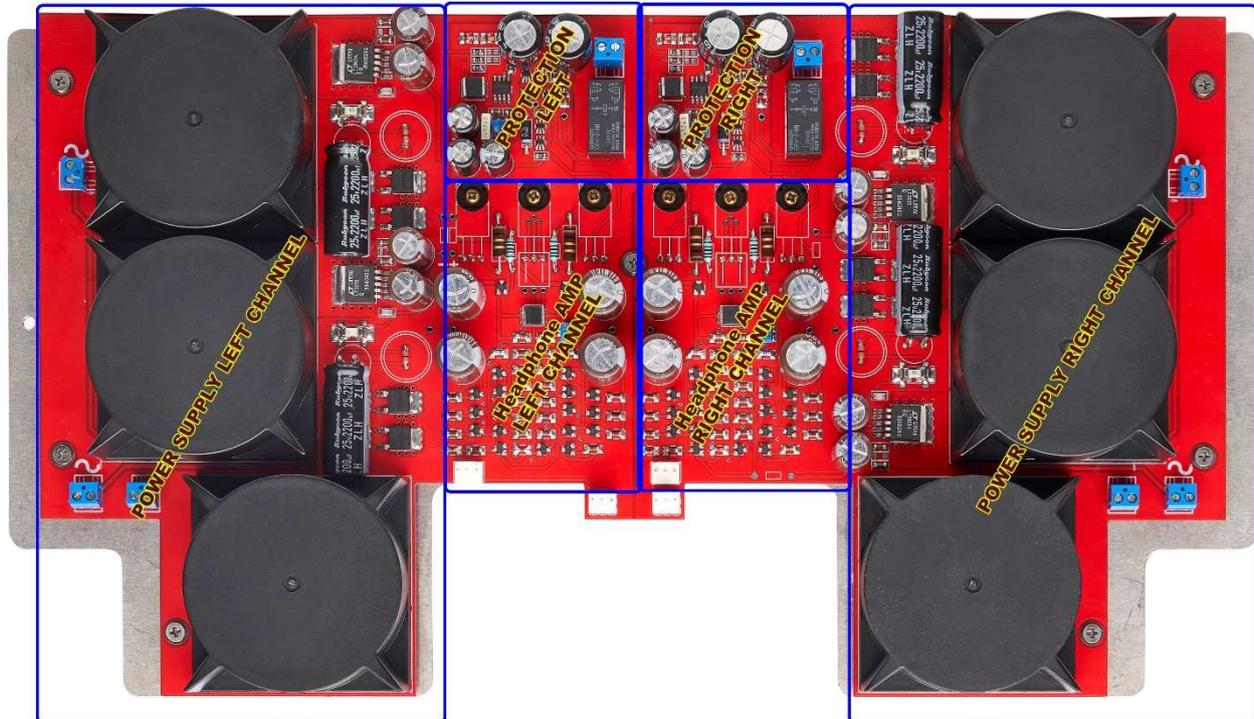
The output is protected against any DC current that might flow at the output in case of a fault. A double contact relay opens and protects the circuit, if needed.

The circuit is also active when the **ZeroUno DAC-HPA** is powered on or off to protect the attached headphone from the transient noise of the power supply.

This circuit is *not* part of the signal path!

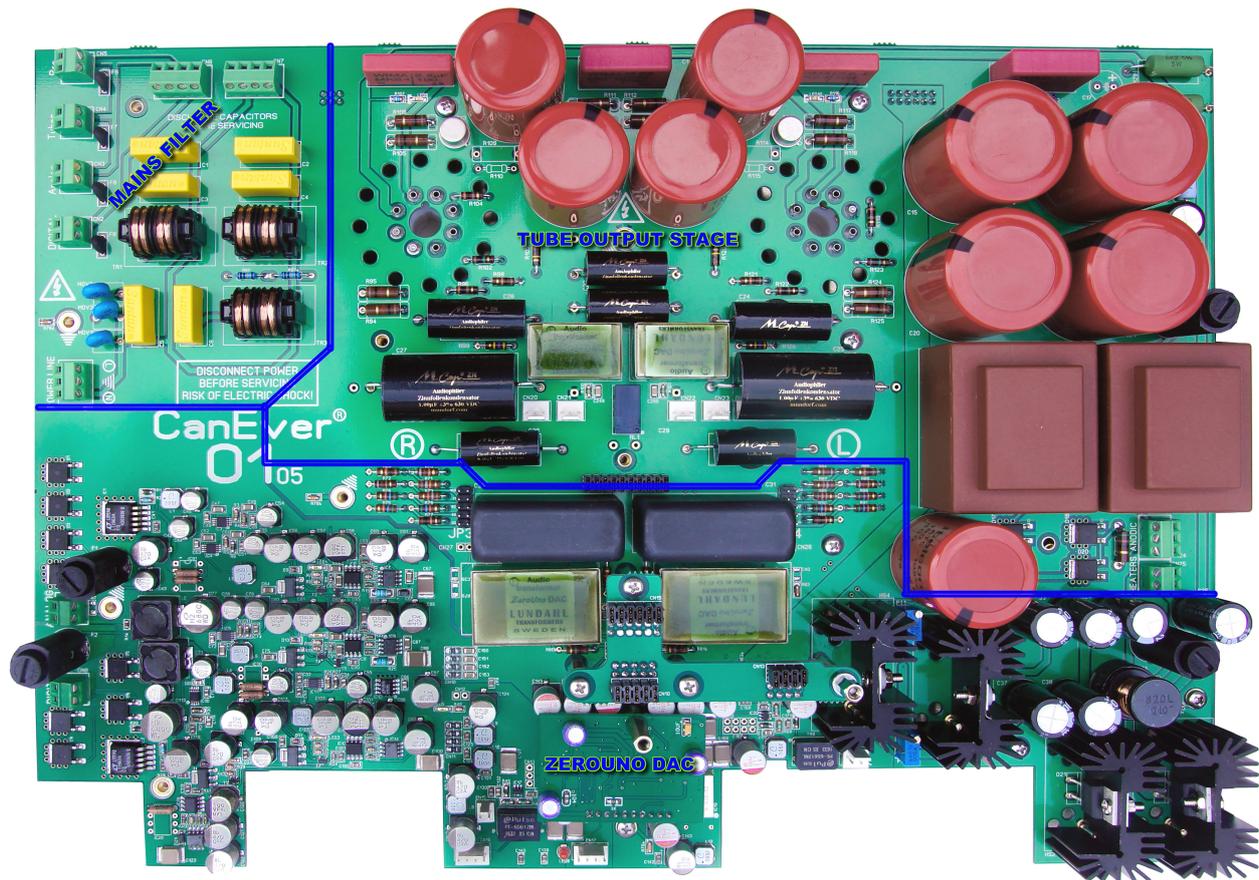
When implementing an audio circuit without feedback loops, the realization of some areas inside the product have to be treated with special care:

- the layout of the printed circuit boards
- the topology
- the grounding



The final implementation of the headphone amp and the analog output stage of the **CanEVER Audio ZeroUno DAC-HPA** is the result of many prototypes and associated listening sessions. It incorporates years of experience in the design of amplifiers of any kind, whether tube or transistor based, push-pull or single ended etc.

Inside the cabinet of the **ZeroUno DAC-HPA** there are two boards stacked above each other. First, there is the main DAC board, which is the one of the **ZeroUno DAC** minus the components necessary for the tube output stage, including the heating system for the tubes itself. Also, there is the amplifier board that includes the discrete Class A analog output stage. In between both boards is a massive sheet of aluminum. The aluminum plate acts as a heat sink for the four transistors of the Class A headphone amp and shields the analog amp from the digital noise radiated by the DAC board, below.



Finally: How does it sound?

Pure Class A amplification with a super-linear driver, no capacitors or integrated circuits in the signal path and no negative-feedback with ability to drive loads even below 30ohms. It really comes close to his “brother” the **CanEVER Audio ZeroUno DAC**.

Art Dudley wrote about the **ZeroUno DAC** in his STEREOPHILE review:

“ But while more flexible choices abound, and while cheaper choices are also thick on the ground, I've heard no other digital product that succeeds quite so well as the ZeroUno at letting music sound like music! Strongly recommended.”

Technical data

- The circuit of the **ZeroUno DAC-HPA** is based on the ESS SABRE³² ES9018S DAC chip plus a proprietary hybrid filter design and encapsulation against external noises.
- For optimum performance the SABRE chip runs on a proprietary implementation of special developed firmware
- One motherboard is based on a four-layer PCB with extra thick copper traces to achieve ultra-short signal paths with minimal wiring to avoid electromagnetic induction of noise and to insure perfect grounding
- Discrete power supplies built for the digital and the analogue sections using six toroidal transformers - the last generation of ultra-low noise rectifier diodes and high quality – low noise regulators
- Audio-grade resistors and capacitors
- Comprehensive noise regulation for all digital circuits
- Jitter free operation by patented high performance algorithm
- Integrated 32 bits volume control with a residual noise below -130dB for the best performances even at very low output levels
- On board output level setup to match different sensitivity levels of the direct connects power amplifies
- Voltage-compensated, ultra-low phase noise and low jitter crystal oscillators (clock) acts as master clock
- Two separated clocks for sampling families of 44.1, 88.2, 176.4, 352.8 kHz and 48, 96, 192, 384 kHz
- DAC output stage with the shortest possible signal path based on custom made amorphous audio transformers produced by Lundahl, with first order discrete analogue filter for the best THD and digital noise suppression
- True Class A discrete built analog output stage with zero negative global feedback
- Separately powered USB chip by a “quasi battery power supply” to avoid any distortion induced by the connected computer (no connection to the +5V powerline of the USB cable)
- USB input based on XMOS xCore audio chip with bit perfect transfer for 16bit, 24bit or 32bit data in PCM format up to 384 kHz, including support for native DSD/DoP and MQA.
- 4 Digital-Inputs: 1x USB 2.0; 1x true S/PDIF 75 Ohm BNC or true AES/EBU 110Ohm XLR; 1x S/PDIF RCA; 1x S/PDIF optical
- USB input compatible with following audio formats via PC and MAC:
 - PCM: 44.1; 48; 88.2; 96; 176.4; 192; 352.8 and 384 kHz up to 32 bits
 - DSD (DoP): 2.822 MHz / DSD64, 3.072 MHz, 5.644 MHz / DSD128
 - MQA all formats
- SPDIF inputs (AES/EBU, BNC, RCA) compatible with PCM signals from 44.1, 48, 88.2, 96, 176.4 and 192 kHz, up to 24 bits. The optical input accepts music files with a resolution up to 24/96 kHz
- LCD Display with variable brightness and letter size for better reading from listening position
- Infrared remote control with direct function keys for volume, balance, absolute polarity, mute and input channel
- No drivers required for LINUX or MAC OSX
USB Audio 2.0 driver available for Windows XP/Vista/7/8/10
- Gain = 26dB (x20);
- Zout < 1 ohm;
- Vo max = ±17V (24dBu)
- Pre-gain between 0dB to +24dB in step of 1dB
- Pout = 2.5Wrms onto 30ohm
- Headphone load within 30 to 600 ohm
- Power amplifier input impedance ≥ 600ohm
- Distortion with 1KHz, 1Vrms, into 30ohm load: 2nd harmonic below -102db; 3rd harmonic below -100dB
4th harmonic below -125dB; 5th harmonic below -120dB

The Specifications in this document are subject to change without notice.

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