

ZeroUno DAC & ZeroUno PLUS by CanEVER Audio

unite

the digital & analog World of High End Audio

"We are putting the band back together!" (Jake Blues)



Even very critical listeners accept computer audio as a music source. A real landmark in the evolution of computer audio has been the introduction of the *asynchronous transfer mode*, using the USB interface of standard personal computers. Drivers based on this technology transfer digital music files from a computer to a DAC independently from the - mostly very inaccurately working - internal clock of the computer. All necessary timing now can be handled by much more precise oscillators inside the connected DAC.

Although the market today is flooded by a huge number of DACs ranging from prices of a few hundred Dollars to 10 or 20 k€ or even more, the statement within numerous marketing brochures, that the customer now (finally) gets the perfect sound forever, is unfortunately (still) not true! It has not been true in 1982, when the CD was introduced with fanfares of marketing and it is still not true today - sorry!

Not only is the number of DACs offered today not easy to overlook by the interested customer. The sound of those DACs can be very different as well – independent from the individual price point. Even very expensive DACs sometimes offer on one hand a very detailed, but on the other hand a *crispy* sound full of details mainly in the mid to high frequencies, which impress the listener in the first run, but make their brain become tired after listening for some time.

Experienced listeners, who grew up with vinyl sound, often complain about the sometimes *harsh* and *cold* sound of DACs. For those, who are interested in all the great features of computer audio, it is not an easy task to find a DAC, which offers a sound, similar to those analogue sound patterns, they are used to.

Based on this market situation CanEVER Audio - together with a group of experienced listeners - developed their family of DAC's. The design goal was to create DAC's, which are able to present all the details of the recorded music, but never make the brain of the user *nervous*. Instead of this, the ZeroUno DAC & ZeroUno PLUS should simply play *music* to enjoy and relax even after many hours of constant listening.

As the ZeroUno DAC comes as a digital preamp / DAC, the ZeroUno PLUS in addition features a high quality analog preamp with two separate analog inputs inside the same elegant cabinet.

As one can see from the photos below, both products are designed around a tube output stage.

All the main functions as volume, balance, mute as well as phase and inputs can be operated by an elegant remote control coming as standard with each unit.



So let us share some of the details in the design of those DAC's, which make them a little bit different. Following we will explain the fundamental building blocks of a good working DAC taking the design principals of the ZeroUno DAC and the ZeroUno PLUS as an example. We will cover in detail the main board, the power supply, the DAC stage, the tube output stage etc.

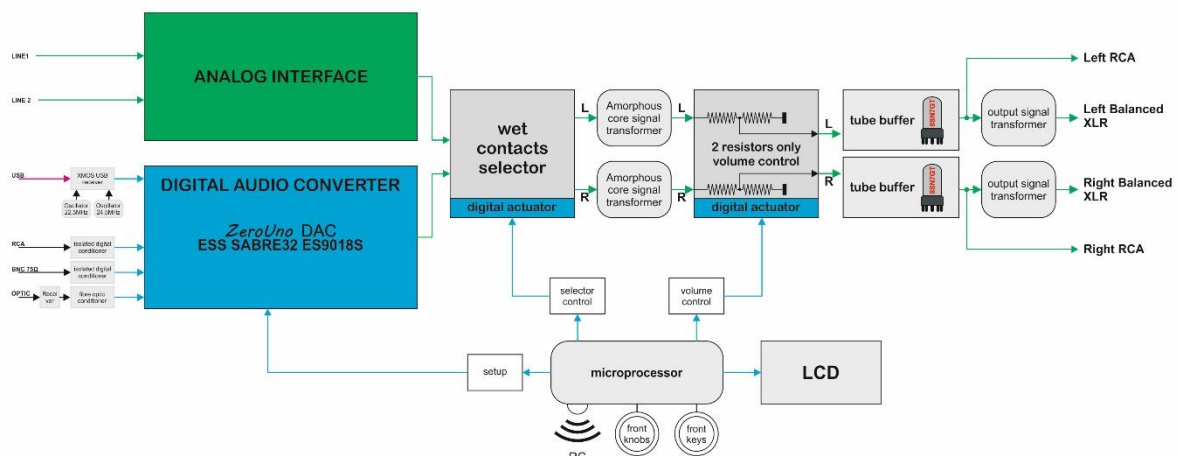


Fig.1: Block Diagram of the ZeroUno PLUS

The Mother Board

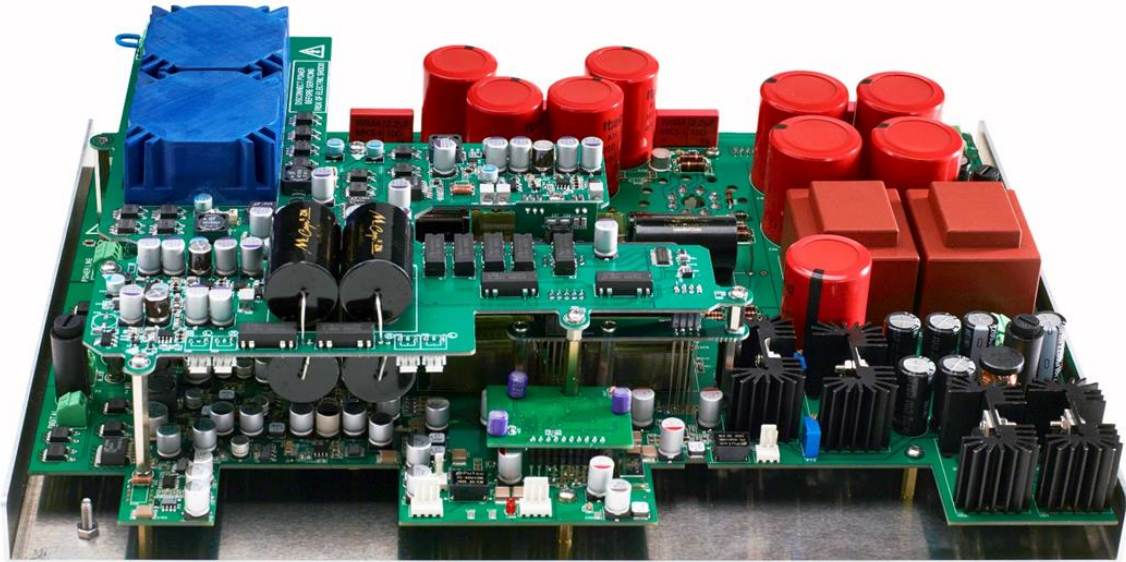


Fig.2: The Main board of the ZeroUno Plus stacked with the analog preamp board

In many audio products, one can see a number of individual printed circuit boards connected by numerous cables. The higher the frequencies of the operated signals in the circuit are the higher is the potential of negative influence on the signal quality by electromagnetic induction, e.g. into connecting cables. In a unit like DAC, which operates with digital input signals up to 12.288 MHz and analog input signals of very low level with a useful bandwidth of at least 50 kHz, the electromagnetic induction can become a nightmare for the engineer. The same is valid for the correct grounding of all the separate modules of the circuit to reduce any kind of hum to a minimum.

To avoid such problems, e.g. the whole circuit of the DACs from *CanEVER Audio* consist of two four-layer PCBs with extra thick copper traces. One PCB is dedicated to the analog inputs only while the other one processes the digital interface and the output stage. The separate PCB for handling the analog input signals avoids electromagnetic induction of noise and insures perfect grounding. The tube output stage and its power supply is located on the main PCB. Both PCBs use very short signal paths with minimal wiring. In both PCBs extra layers are reserved for the analog ground planes, digital ground separation and for the power lines of each stage for the best separation of the signals.

The Power Supplies

The power supplies inside the *ZeroUno DAC* and the *ZeroUno PLUS* cover about 70% in number of components and board space.

The digital part of the circuit consists of 13 separate ultra-low noise power supplies fed by two toroidal transformers followed by a pre-filtering stage plus 13 discrete analog power supplies designed around four AD797 operational amplifiers.

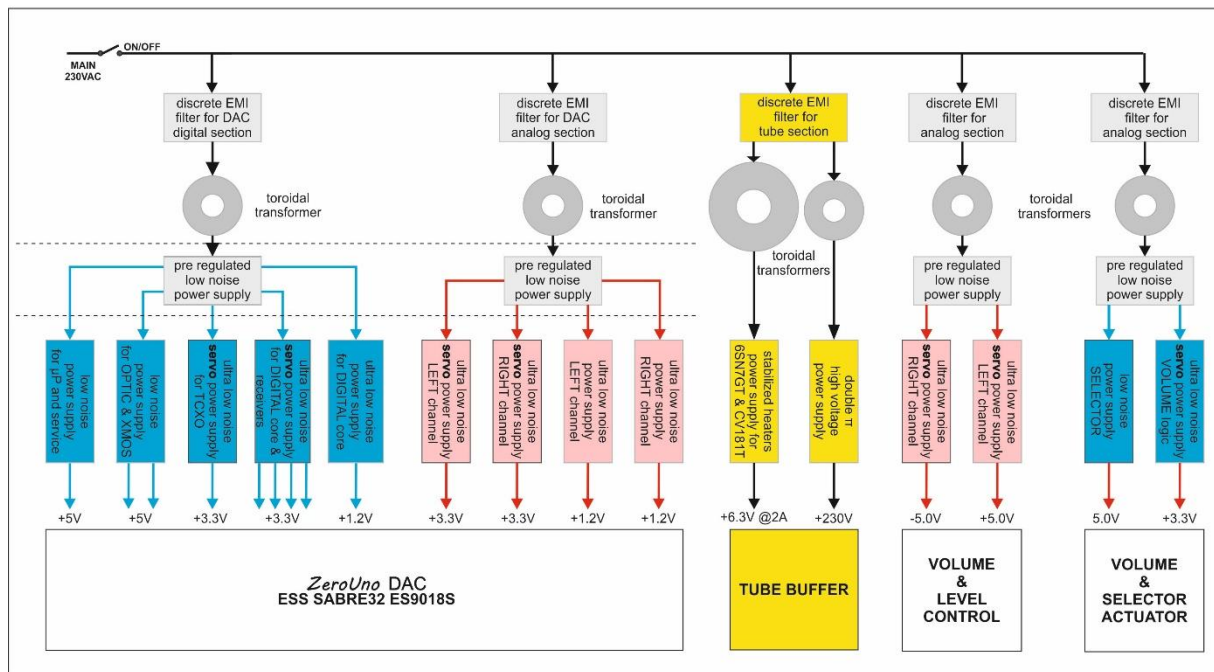


Fig.3: Block Diagram of Power Supplies used inside the ZeroUno PLUS

The analog part of the circuit inside the *ZeroUno PLUS* is based upon three independent power supplies. It is designed with the same philosophy in mind as the digital circuit. Two dedicated toroidal transformers (one for the analog stage and one for the digital volume actuator), followed by three pre-filtering stages, the left analog channel, the right analog channel and the digital volume actuator, plus two ultra-low noise discrete analog power supplies designed around three AD797 to power the analog circuits.

All analog and digital paths are separated and powered independent to avoid any interference or cross talk.

The DAC Stage

The *ZeroUno DAC* and the *ZeroUno PLUS* use exactly the same main board. The chip used in the DAC section is the ESS Technology SABRE³² *ES9018s*. This chip incorporates in total eight individual DACs in dual differential coupling. But the *ES9018s* is not only a DAC! It is one of the most advanced industrial digital chips available today, working with 32 bits math, including 8 pairs of DACs with selectable resolution, IIR filter, FIR filter, de-emphasis filter, notch filter, 8 channels 32 bit volume control, patented jitter reduction algorithm and an 8 channel SPDIF multiplexer.

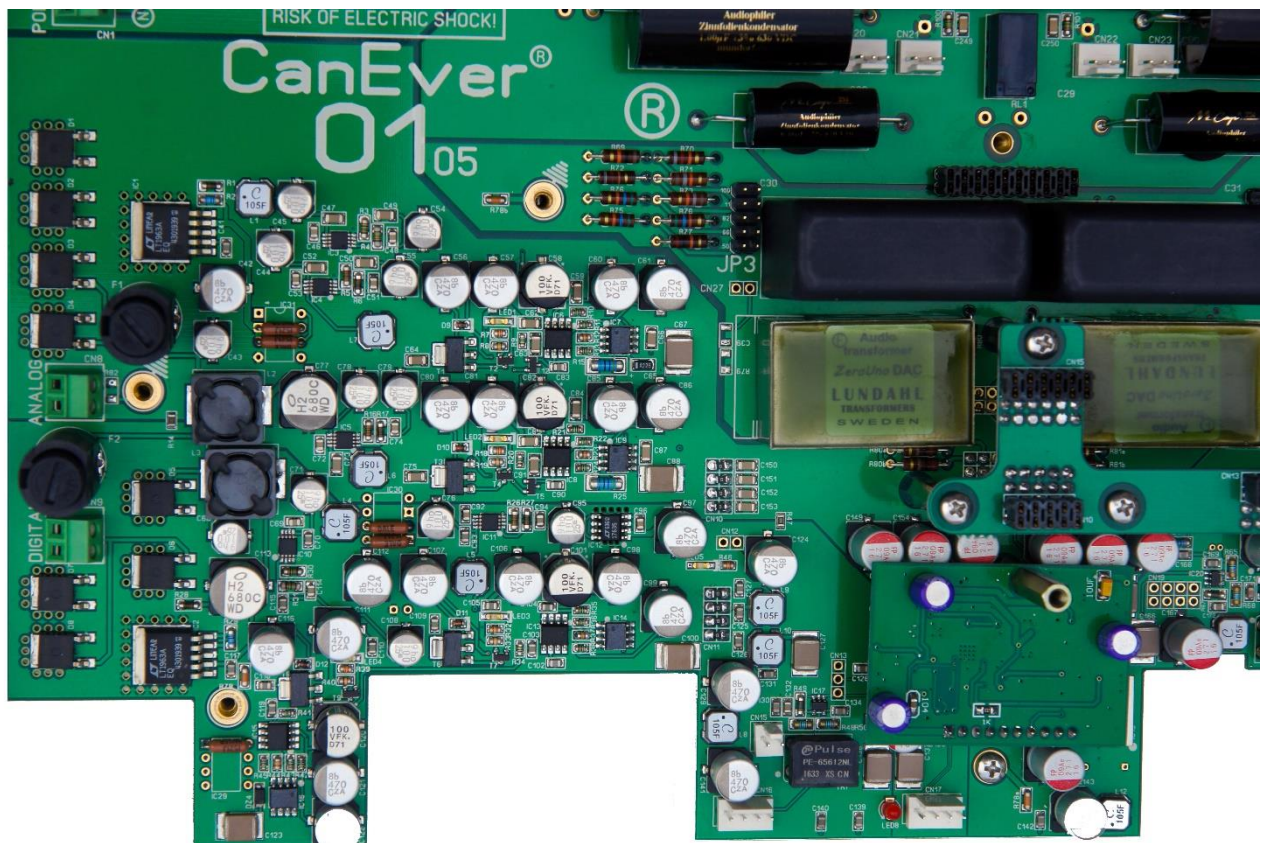


Fig.4: The DAC Stage including Interstage Transformers and USB Receiver Board

Although the *ES9018s* is a very powerful component, it comes from the factory documented for a standard configuration only. This leads to a situation, in which many DACs, using this chip, make use only of the “default” standard configuration. The result often is a sound reproduction, which does not show the real performance level of the *ES9018s*.

To make full use of the complete *ES9018s* feature set, it needs sophisticated engineering skills. A special and complex firmware has been developed by *CanEVER Audio* to let the *ES9018s* run at its full potential. The core implementation is a two channel DAC based on four paralleled pairs of differential DACs. Based on the patented internal jitter reduction module of the *ES9018s* a very low level of jitter is achieved.

Another interesting result of the special firmware is the smooth and natural sound without any loss of the rhythm e.g. using the human voice and unamplified natural instruments as the test benchmark. The special internal configuration of the *ES9018s* chip used for the *ZeroUno DAC* and the *ZeroUno PLUS* eliminates artefacts in the digital domain, which usually affect the quality of sound. Those kind of distortions are more or less part of digital audio gear since the

introduction of the CD in the early '80's and the DACs of *CanEVER Audio* are developed mainly to avoid them.

The Interstage Transformers

The signal transfer from the DAC stage to the analog output stage inside the *ZeroUno DAC* and the *ZeroUno PLUS* is again handled in a very elegant way.

The analog signals directly flow through a pair of high performance amorphous core step up interstage transformers. This results in a minimum number of components in the signal path, which is as clean and short as possible: no capacitors, no resistors and no active components ... only a single transformer for each channel!

The interstage transformers are produced by *Lundahl* due to *CanEVER Audio* specifications. Their coils are wound around an amorphous core resulting in high sensitivity. There is no loss of any detail of the signals even at very low levels. The very special winding of the transformers guaranty a perfect transmission even of very low frequencies. Furthermore, the transformers perform linear across the audio band and even more important, within the human audio bandwidth.

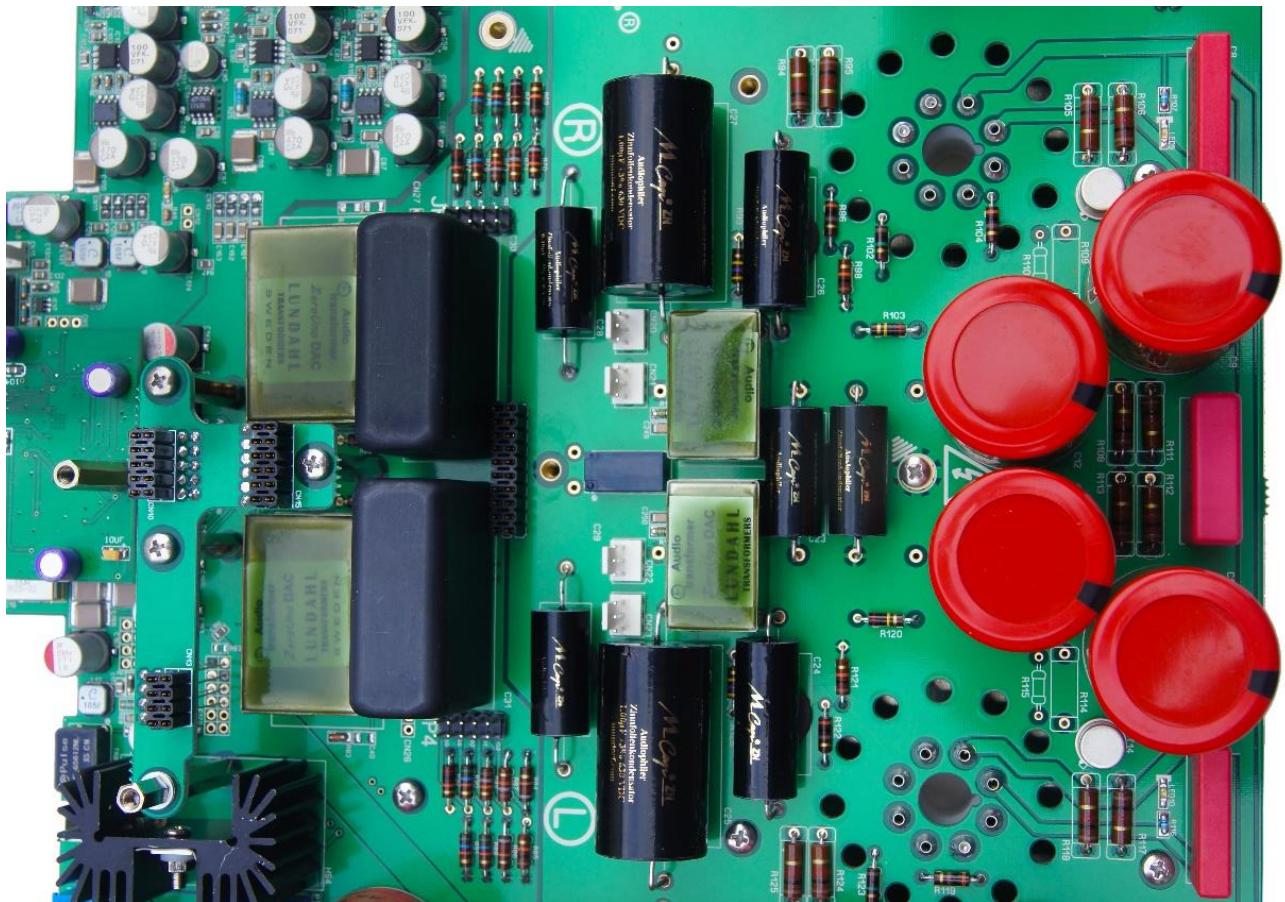


Fig.5: Analog Output Stage including the Interstage Transformers on the left side and the Transformers for the balanced Outputs in the Center of the Board.

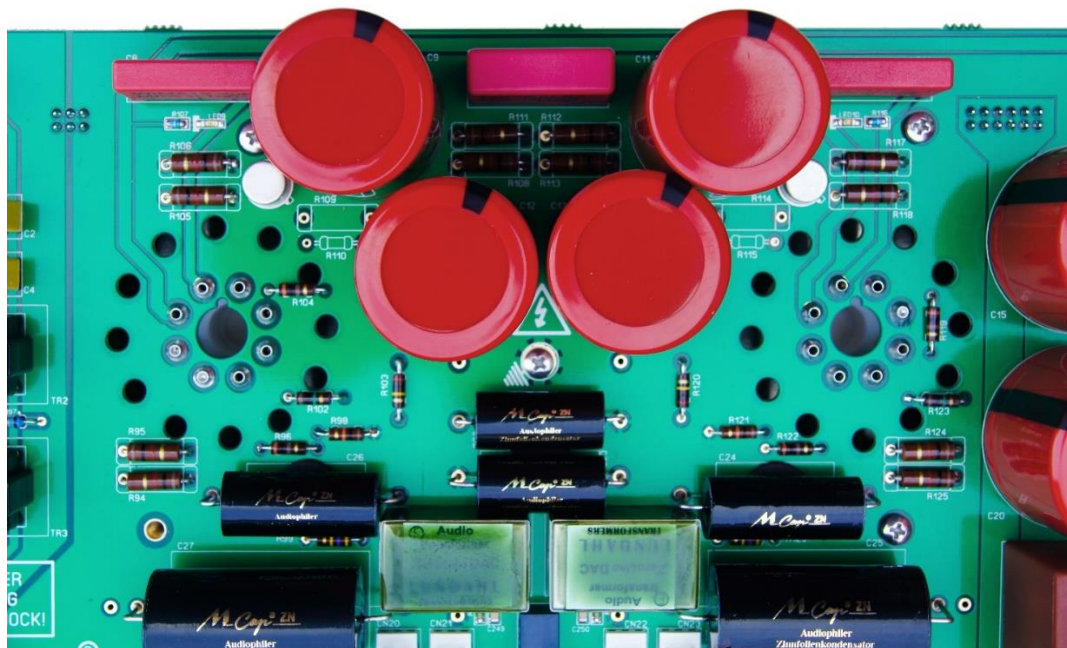
The Tube Output Stage

The audio performance of any audio component, whether it is digital or analog, is very much related to the topology and quality of the analog output stage. The analog output stage of the *ZeroUno DAC* and the *ZeroUno PLUS* are built around a full Class A cascade buffer with zero feedback.

The topology of this tube stage is different from standard circuits. Here the two triodes of one 6SN7GT are connected in a way to cancel the residual ripples from the rectifier stage of the power supply. Using this topology the power supply does not need a huge capacitors to filter those ripples. The value of the filter capacitors can be small, because the main filtering is done by the two triodes inside the 6SN7GT.

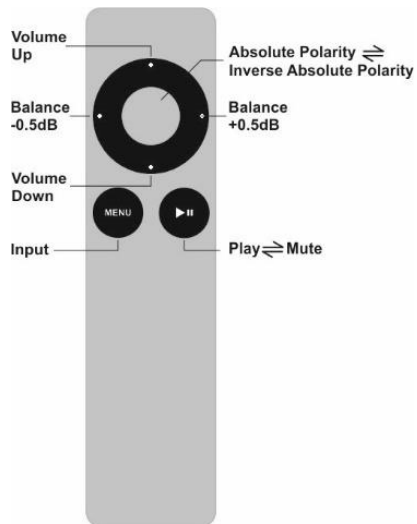
Described in a more technical way: The design philosophy of the tube output stage works as a single ended stage for the audio signal, but as a “push-pull like stage” for the power supply as the auto cancelling capability of a push-pull circuit regarding the ripples from the power supply is well known.

The final signal of the tube output stage leads to one pair of single ended RCA connectors and a pair of balanced XLR connectors. To balance the output signal a pair of high quality transformers produced by *Lundahl* due to *CanEVER Audio* specifications are in use. Both pairs of output connectors can be used in parallel for bi-amping or to add an active subwoofer to the audio chain.



The Remote Control

The remote control gives access to the most important functions of the *ZeroUno DAC* and the *ZeroUno PLUS* from a distance.



Different from most other DAC's on the market, the RC offers in addition to the function "*volume up/down*" buttons for "*balance left/right*" level adjustments! A "*phase*" button for changing the absolute polarity of the music signal and a "*mute*" button for reducing the volume complete the functions on the RC. To switch between the different input channels, the user has to push the "MENU" button.

All those options assist the customer to adjust the sound in a very comfortable way right from the listening position.

Conclusion

Although the ZeroUno DAC and the ZeroUno PLUS are offering high performance technical data, it is impossible to judge their value based on these data only. The result of the management of the input signals is a natural, warm, not harsh and a very dynamic sound, which is not polished to exhibit the last possible details, but to *let the music play*.....

Looking at directly heated triode based tube amps (e.g. 300B, 2A3 or 211 and 845) or tube amps in general one can make similar observations. From a pure engineering point of view, there is no reason to prefer a tube amplifier over a transistor based amplifier. Most of the technical measurements are even voting against a tube amp. However, if we do not leave it up to the instruments alone to qualify such an amp and instead we use our ears to listen and feel our emotions, the picture in many cases can change a lot!

Have fun with the *ZeroUno DAC* and the *ZeroUno PLUS*!



More Infos: www.canever.eu or visit us in Hall 3 / Booth K08