試聽心得
EQUIPMENT REVIEW

Lincoln Cheng

Trinity DAC

The Super DAC from Germany using cutting edge digital technologies

Trinity DAC Specification:
- Size：440W x 300D x 50H（mm）
- Weight：8kg

Although the red book CD standard was released 30 years ago, even for today, when I purchase or audition a high-end CD playback system, I always have two questions in my head: Have we ever heard the best of the CD playback technology? How much details are left unexplored in the CDs that we are already familiar with? Since I owned the Sony's flagship CD player CDP-R10, then Accuphase DP-100 + DC-101, Metronome Kalista + C2 Signature, Weiss Jason + Medea, Estoeric P-01 + D-01, Wadia 971 + 922 + 931, dCS Scarlatti and Vivaldi, and most recently Metronome Kalista Ultimate SE + Nausicaa Signature, I realised that 16bit/44.1kHz CD playback still keeps surprising me as the digital playback technologies remain advancing. New systems often turn my favourite CDs into something unfamiliar to me, when I discover the details that I have never heard before. This often leads me to believe that after so many years of development, CD playback still has a lot of head room for improvement. Accurately playing back the musics in CD is proven challenging even with technologies nowadays.

Taking a risk despite knowing the dangers involved

Among the partners of Audiotechnique, Audio Exotics is probably one of the most 'exotic'. They are a dealer of 20 Hi-Fi brands from Europe, America and Japan. These brands have one thing in common - they are not major manufacturers with a lot of reputations. Some of them are even unknown to many audiophiles. But they produce equipments which are truly high-end in terms of build and sound quality. Apparently, their prices do reflect their performance and quality, which, at the same time, makes them less affordable than those mainstream products. As a dealer, the good news is that there is less pressure in making a lot of sales given that these manufacturers don't mass produce given their limited scale. However, the bad news is that it's somewhat challenging to promote these products to audiophiles if these products are not truly outstanding. The chief of Audio Exotics, Chris, has very unique views on Hi Fi equipments and their market positions. He is apparently very risk taking when selecting products from manufacturers that are less known to audiophiles but he appears to be very confident in his picks. There have been many "victims" who couldn't resist the temptation after listening to these products. I was one of the them - I was to have a brief test on Tripoint Audio ground box at home but I ended up buying two of them (and they are more expensive signature editions!) after I realised how much performance gain it brings about in my home system. Recently, Chris presented me another "challenger" - a black DAC which has a height of 50mm only.

Astonishing Performance

This DAC is designed and made by Trinity Electronic Design. Trinity DAC is simply the model name. Trinity is probably almost unknown to a majority of audiophiles. In fact, the first time I saw Trinity DAC was in the Munich Audio Show 4 to 5 years ago. At that moment, Trinity DAC looked very different from now - there were 3 triangular components. One of which was the main DAC and the other two were power supplies for the left and right channels. The price tag freaked me out - the maker were asking for 60,000 Euros! Despite the outstanding audio performance, its stratospheric price has been keeping this DAC from getting more popular. In 2012, its designer, Dietmar Bräuer, left GTE and found Trinity Electronic Design. The first two products Trinity Electronic Design were however two analog devices - phono amplifier and pre-amplifier. Shortly after releasing these two products, Trinity DAC went live.

Catch me if you can

After years of hard work, Bräuer developed Trinity DAC which integrates the original three component form into one piece. “Trinity” has a meaning of “three in one” but I often like to call it “Triad”. The official website said all the three products (i.e., phono, pre-amp and DAC) that Trinity offered at the moment share the same chassis - 440mm(W) x 330mm(D) x 50mm (H) - supported by three pieces of feet with diameter of 32mm and height of 15mm. These feet are made of stainless steel with balls made of different materials. There are eight backlighted buttons and one LED indicator in the front panel. On the rear side, there are twelve identical holes that allow different input and output plugs to be installed. It appears to me that design as such makes it easier for Bräuer to reuse the chassis in different products with ease. Although the exterior configuration of Trinity DAC looks simple, the net retail price is as high as HK$320,000. While this is not as pricey as the three piece predecessor, I can hardly say it’s affordable by normal consumers. Having said that, Audio Exotics is very confident with this product. Before even marketing this product, there were two high-end audiophiles who have already replaced their existing multi-piece DAC with Trinity DAC after listening to it. Chris asked me if I’m courageous enough to check it out (at the risk of replacing my own DAC after listening to it). I said, “Catch me if you can!”

High quality build

Although I tend to believe that Bräuer designed chassis to make it reusable across products out of cost reason, I realised that cost is not his concern at all when I received the DAC in a luxurious heavy duty Italian made carrying case. When I opened the chassis, I figured the aluminium alloy undercover was as thick of 5mm. What’s more impressive is that the entire chassis was machined by CNC in one piece and dyed in black at the anodising stage. The finish quality is consistent with my expectation on a high end German made equipment. All the interior parts and circuit boards were firmly hanging upside down. Aside from two massive switching power supplies on both sides, there was a densely populated circuit board responsible for digital stage in the centre. The analog stage of the left and the right channels are powered by a large scale LIANOTEC + DAC chipsets in a double deck configuration. The most eye catching part is probably the two enormous VCOCXO clocks. They are responsible for generating pulses at multiples of 44.1kHz and 48kHz up to 512 times - i.e., 22.5792MHz and 24.576HHz, respectively. According to Bräuer, these clocks are very precise and their jitters are extremely low. The user can even adjust the clock to compensate the ageing effect for the next 20 years. There are four digital inputs that support up to 24bit/192kHz sampling rate - Toslink optical fibre, SPDIF coaxial, AES/EBU, USB 2.0. The eight buttons in front panel enable the user to power on,

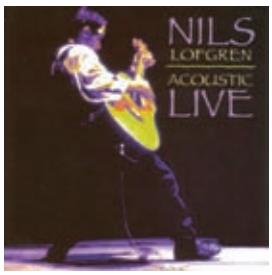
switch between four digital sources, enable LIANOTEC and select between two digital filters. The back panel has four digital inputs, two clock outputs, analog outputs and banana plug typed ground terminal.

Serious Audition

Aside from great build quality and materials, Bräuer developed a analog upsampling technology called LIANOTEC (Linear Analog Oversampling Technology) and owned its patent. I believe Trinity DAC sounds so great because of LIANOTEC and the super precision clocks. I'll let Paul Leung get into the technical details about LIANOTEC. Here I'd like to describe my exciting audition experience with Trinity DAC in a bit more detail. The venue of the audition is the audition room of Audiotechnique. To prepare for such a serious listening experience, we decided to use dCS Vivaldi as source, Dan D'Agostino Momentum pre-amplifier and power amplifiers and Dynaudio Platinum Evidence speakers. All cables used are Nordost Odin. We spent 100+ hours running in the DAC before the audition sessions. Given that Trinity DAC supports only PCM sources, my choice of music were mainly on CDs. Paul will share with us his experience of hi-res file playback on this DAC.

Superb Performance

I clearly remember the first song that I heard with this DAC was a song called "How can I miss you" in the infamous audiophile album "Snow.Wolf.Lake", which I have listened to for uncountable times. With the guitar introduction followed by Jacky Cheung's singing, I was deeply astonished. There is so much detail I have never heard before. It just sounds so differently than before. I can virtually "see" the guitarist's fingering such as picking and strumming right in front of me. The subtle details such as string vibrations, resonance of the sound board, harmonics have never been so clear and effortless. Jacky Cheung's voice is so transparent and definite. I can even hear how he inhales, exhales and changes postures when singing! The contrast between the voice and the musical instruments and openness of the sound stage are more impressive than what I have listened before. The emotion of his interpretation has never been so dense and so musical too.



Following "Snow.Wolf.Lake", I immediately thought of another album of my most favourite - "We Get Requests". Ray Brown's double bass has a strong sense of rhythm, texture, elasticity and depth in "You Look Good To Me". Oscar Peterson's piano sounds flowing without bound. Ed Thigpen's jazz drum is powerful, shiny and open. Trinity DAC has made the whole musical "picture" incredibly moving.

When playing with Trinity DAC, the live performance of Nils Lofgren, one of my favourite American guitarists, has become more lively and passionate. Every note was played in a lot of clarity and power. This allows me to appreciate Lofgren's great technique even more.

Leo Fung, a renowned audio critics, came by Audiotechnique when I auditioned this DAC. I asked him to tell me what he thinks. He said:

Good news and bad news

I learned that Paul Leung has gone down into a lot of details about this DAC with Bräuer. I found myself benefit from learning about those details. It's surprising to me that there is still so much head room for Red Book CD format.

Speaking of "addiction", thank to Lincoln who asked me, "Sit down and listen" and I was deeply addicted to Trinity's sound.

The first piece was a symphony. First things that stroke me is how analog it sounds. This is the first time I can feel it in the CD format! The realism is better than what I heard before. I can almost "see" the sound stage and positions of the instruments and singers. The dynamics and the resolution are unprecedented.

The second piece was "Wish me blissful" sung by Tsai Chin. The sound images are real as if they were touchable. Trinity seems to have very accurate phasing. Unparalleled fidelity has also added a lot of emotions into the music. The analog feel has also significantly made the music a lot more charming. What's impressive is that the acoustic performance does not compromise the musicality at all. This is something the other DACs that I have listened before simply could not achieve.

The above is the good news. The bad news is "to buy or not to buy". This DAC is not cheap. But if I use this for mastering CD, how good would that be?

Leo

After Thought

After I have spent two weeks with Trinity DAC, I believe Bräuer's LIANOTEC is truly a breakthrough. It is a game changer which really brings Trinity DAC to the next level. While its acoustic performance is superior, its musicality is also unparalleled. For somebody who has a big collection of CDs, Trinity DAC is definitely one of the best choices available.

One more time I thought I could get out of Chris' "trap" but I was wrong again - Trinity DAC has now become part of my home setup!

Trinity DAC

Addictive sounding DAC in a super slim chassis

試聽心得
EQUIPMENT REVIEW

Paul Leung

A few weeks ago Lincoln rang me up with an exciting voice, "You know what? I know you have been looking for a good DAC that sounds as good as dCS Vivaldi but doesn't cost as much money and space as it does. I have a solution for you now!" Lincoln was absolutely right. If I really have to get a Vivaldi, not only do I have to worry about the price tag of the equipments and the cables required, but also the rack space to accommodate them. In Hong Kong, this means that I need a bigger apartment with stratospheric price!

"Really? Does such a solution even exists?", I asked Lincoln in a skeptical way.

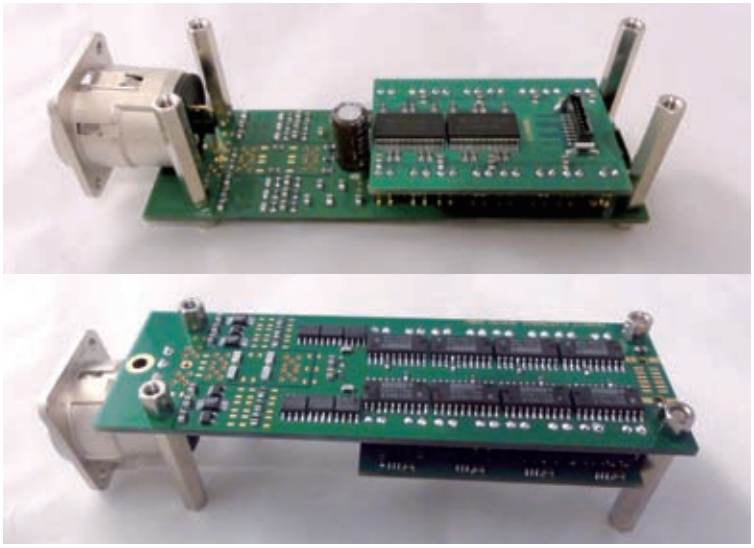
"Have I ever disappointed you? Just come by tomorrow and I'll show you", Lincoln with a lot of confidence.

On the next day I visited the Audiotechnique audition room. My attention was drawn to a black device with a slim metallic chassis. While it was connected to dCS Vivaldi Transport as source, it served as a DAC with integrated up-sampler and superb precision clock. At first I was really doubtful about its sound because of its size. It looks way too slim and light, and it does not even come with an independent power supply. How could the sound of such a small device be comparable with the whole stack of dCS Vivaldi?

This is indeed a bad example of misjudging the performance of an audio equipment based on how it looks! I was deadly wrong. I should have listened to it first. In fact, Trinity DAC is undoubtedly one of the best sounding analog/digital converters I have ever heard. Its extraordinary fidelity, spectral balance and spatial presentation were amongst the most impressive. Not surprisingly, Trinity DAC is not quite affordable by average consumers. It makes use of 'secret sauce' that allows all the high performance components to be accommodated in such a slim chassis. Apparently, one must not forget that an integrated DAC does not require as many cables as a multi-component system, meaning that significant expenses on cables will be saved as well. This could well offset the cost of the device which makes it a preferred alternative to systems at similar price level.

Through incredibly long email chains with the designer, Dietmar Bräuer, I got some

understanding about the 'secret sauce' of Trinity DAC. Unlike a majority of the same kind on the street, it does not emphasise the use of high performance DAC chipset, advanced DSP technologies or FPGA-based filters etc.. Instead the designer focuses on the circuit design based on his 30 years of electronic design experience, high precision master clock, and the 'secret sauce' - LIANOTEC.



△ LIANOTEC / DAC

Linear Analog Oversampling Technology

Let's begin with LIANOTEC, which stands for "Linear Analog Oversampling Technology". As it reads, it is a technology that up-samples PCM signals. While the conventional converter performs interpolations between two consecutive samples in digital domain, Trinity employs a very innovative approach to interpolates signals in analog domain using patented architecture of multiple DACs. This approach yields extremely linear performance, which could hardly be achievable using conventional approach. LIANOTEC is based on a patented technology. After reading the associated document provided by Bräuer, I have to admit that LIANOTEC is indeed a very simple, clean and effective way to perform up-sampling, filtering and interpolation, which have long been the key focuses of modern DAC designers. LIANOTEC is patented in both Europe and the USA.

Conventional up-sampling is performed in digital domain. Basically, through real time signal processing, extra samples are inserted between two consecutive samples to virtually increase the sampling rate. When sampling rate increases, the frequency band of the images or aliases will also increase. For the basics of images/aliases, refer to my 'File As Source' column in AudioTechnique #374. As a result of the shift of images to higher frequency band, the digital filter that serves to attenuate these images can operate in a higher frequency range, thus reducing the impact of the filter to the quality of sound in the audible range. However, the number of 'artificial' samples that could be inserted between two consecutive native samples depends on the computing power of the DSP that does the job. Typically speaking, modern DAC chipset allows at most 8x up-sampling.

To upsample the audio signal beyond 8x, Bräuer has come up with 'upsampling in analog domain'. The principle is that, in each channel, eight PCM1704 DAC chipsets were connected in parallel. While it is not novel to have multiple DAC chipsets connected in parallel to reduce high frequency noises or errors, a phase shifting control circuit is inserted into the signal path to each of these chipsets. The control circuit is responsible for interleaving the signals by 1/8 of the word clock. As a result, 8 additional interpolation points between two original samples were yielded, which means that the sampling rate is virtually multiplied by 8. If the sampling rate of the signal is 192kHz, the sampling frequency after 8x upsampling becomes 1.536MHz. The aliases generated from the new sampling frequency will be far higher than the upper limit of bandwidth in the downstream audio components. In this case, a low pass filter will not be necessary. Without a filter, there will not be any issue brought about by phase distortion or ringing caused by a filter. And this is exactly why Bräuer has every right to claim that LIANOTEC enables Trinity DAC to have perfect impulse response.

Super Precision Clocks

There are two built-in VCOCXO clocks in Trinity. One generates pulses at 22.57792MHz and the other does at 24.576MHz. They are correspondent to digital sources sampled at multiples of 44.1kHz and 48kHz respectively. VCOCXO stands for Voltage Controlled Oven Controlled Xrystal Oscillator. The accuracy of the oscillator is up to 1 part per billion (ppb) and the jitter is as low as 28 femto seconds (fs). This can only be achievable via stable temperature maintained by sealed oven. If you have little idea how long 28 femto seconds is, you can use the period of light wave as reference, which is about 2 femto seconds.

Speaking of jitter, Bräuer told me that the ultimate purpose of keeping the Trinity DAC so compact is to minimise the length of signal paths between electronic components. He believes that an accurate master clock is not the only way to keep the jitter low. A well designed integrated circuit is also necessary. He even believes that DAC

implemented in separate enclosures will be more vulnerable to external interferences. Jitters will be further increased by the use of cables (e.g., clock cables) that connect components together. These cables will be suffered from deviation in impedance, interference from atmosphere and poor connection points.

The devil is in the details

If one just looks at the exterior of Trinity DAC, it's difficult to fully appreciate the craftsmanship of the maker who relentlessly pursues the ultimate audio performance. If you take a look at the interior, you probably don't realise that the 16 pieces of PCM1704 DAC chips were actually hand picked by the maker, with the use of precision measurement devices, to ensure both channels are paired consistently.

Each Trinity DAC comes with four sets (3 pieces in each set) of balls to support the feet. These balls are made of difference materials. Two of them are made of high-tech ceramic (Black - Silicon nitride & White - Aluminium) and the other two are made of plastic (White - Polytetrafluorethylene (PTFE) & Green - Polypropylene (PP)). I literally tried all of them and found that the black balls make the bass richer and more agile; the green balls make more lively high frequencies and more crispy bass;

the white ceramic ones produce warmer and thicker sound; the white metallic ones have similar effects as the black ones.

Aside from the resonance characteristics of these feet materials, Bräuer also pointed out that he purposely positioned the circuit boards in such a way that vibrations will take the longest possible path to the electronic components, so that the mechanical energy get dissipated when travelling through the path. The 50mm CNC machined aluminium alloy chassis also significantly damps vibrations.

It's often the details that change the game. Bräuer knows it well. When implementing the circuit board, he picked the best available parts. For example, the small feedback resistors near the round capacitor are 0.01% metal film precision resistor with 0.1ppm/°C, which costs €20 each!

The sound is just charming

Apart from listening to Trinity DAC in Audiotechnique, I'm fortunate enough to have chance to bring it home to audition it with my system. With such a significantly different combination (of sources, speakers and amplifiers), I experienced more deeply the characteristics of this DAC.

Trinity DAC supports PCM up to 24bit/192kHz. It does not play any DSD or SACD source. This sounds like that it loses edge when comparing with other products in the competitive DAC market today. However, Bräuer told me that the architecture of Trinity DAC is specifically tailored for PCM playback. He chose to go all the way to get the best out of PCM rather than compromising the architecture to support both formats.

In the front panel, apart from the power switch, four source select buttons and two filter buttons, there is a round LED indicator. When playing source with 88.2kHz, 96kHz or lower, the indicator will be red. When playing HiRes source (i.e., 176.4kHz or 192kHz), the indicator will turn green.

At the centre of the front panel, there is a "Pure LIANOTEC" switch. Basically, this switch allows the user to force the DAC not to use digital filter. When playing 176.4kHz/192kHz source, "Pure LIANOTEC" will simply ignore the state of the DF1 and DF2 buttons so no filter will be applied. Upsampling will also be disabled. When "Pure LIANOTEC" is not on and the sampling rate is below 176.4kHz, either DF1 or DF2 will come into effect.

I used my reference SACD/CD player, Esoteric K-01

(using SPDIF), Aurender from TV Logic (using USB and SPDIF separately) and MacBook (using USB) as reference sources. The tone sounds almost the same in all the cases. But when I compared the sound quality of CD playback in K-01, CD-ripped file playback in Aurender and file playback in MacBook, the former two are more vivid and detailed than MacBook, which is not surprising at all. I was quite impressed by the amount of details that Trinity DAC is capable of revealing. It sounds more transparent than most of the high-end DAC I listened to. The timbre is lively and natural. There is very little coloration, which makes it ideal for playing almost all kinds of musics- voices, chamber musics, symphonies and percussions. I played one of my favourite songs from Lily Chen, which I have listened for hundreds of times. I usually found the vinyl version is more superior to the CD version as the sound in the latter more edgy and dry. Now that when I use Trinity DAC to play the CD version, the music sounds analogue to an extent that I have rarely experienced in a digital system before!

I also played one of my favourite Chinese percussion piece “Deep in the night”. The details that Trinity DAC delivers “depicts” clearly the texture of the drum skins. Believe it or not, I can almost tell the sizes and weights of these drums.

I played a 24bit/192kHz FLAC file of Beethoven’s String Quartet Op.74 from 2L to evaluate the quality of HiRes playback. The green light was on, which means that all the filters are disabled. I have to say that was really the best part of the whole listening experience. The string sound produced by Trinity DAC was so real, airy and natural. Perhaps it’s one of the best, especially in terms of tone balance, texture and 3D imaging. When the bow is drawn through the strings of cello, I can clearly hear a lot of subtle details of the friction sound between the bow hair and the strings and the microscopic variations of the applied force. Frankly speaking, even if I further describe the sound of Trinity DAC using a few hundred words, I’m not sure if I can truly describe how amazing the music this masterpiece can deliver. Or should I simply put that the sound quality of Trinity DAC is in par with that of some very good high-end vinyl systems that I have heard!

Conclusion

Aside from its addictive sound, the small footprint of Trinity DAC is certainly its advantage, especially for audiophiles who have limited real estates (like those in Hong Kong) to accommodate their equipments. The performance of this DAC realises Dietmar Bräuer’s relentless pursuit of purity and simplicity in hi-fi audio design. No complicated DSP is required. The upsampling technique in both the analog and digital domains addresses some of the most haunting issues in digital audio design.

If you ask me if Trinity DAC could resolve the problem I aforementioned, the answer is undoubtedly yes. If I didn’t have to prepare for the tax seasons, I would have made Trinity part of my home system after listening to it.