



## DESIGN PHILOSOPHY

*We had a Dream...*

The from-ground-up new architecture is the result of multiple prototype generations over the last two years where the experience of digital and analog algorithms and circuit designs from Andreas Koch's and Bert Gerlach's expertise refined over many decades has been combined and perfected to create a truly no-compromise, flexible and programmable product platform that can deliver ultimate performance and can grow for many years as technology keeps evolving.

### **EXPANDABILITY**

Playback Designs products are known for their expandable architecture. For instance, the MPS-5 SACD player received 20 free software and one hardware upgrade over its lifetime of ten years. The Dream Series have been architected with the same philosophy in mind: software upgrades for performance improvements and also new features can be installed by the end user at no cost.

However, with the increasingly fast paced developments of high resolution audio via downloads and internet streaming, it is inevitable that hardware upgrades will become necessary. For this, all Dream Series products are equipped with a high speed fiber optical interface. It uses a proprietary protocol designed by Playback Designs that natively supports all PCM and DSD formats.

New external accessory boxes can then be added to existing products to expand their capabilities with new features. For instance, new streaming protocols (Tidal, Roon etc.) and encoding formats (MQA and others) are created every year. Some become successful, some disappear again. But with this modular approach of external hardware boxes, Playback Designs can quickly adapt and introduce new features to existing product lines, so they do not become obsolete for a long time.

This is the most important reason why Playback Designs products keep a high resale value.



## **SEPARATION**

It is well known that the core D/A circuitry and its associated analog output stage are one of the most sensitive links in the digital playback chain. They are susceptible to various influences from clocked circuits (such as processors, displays etc.), power supplies and external sources that are connected to it via galvanic (copper) cables. Only the slightest modulation of the digital sample clock will result in jitter and can contribute to what audiophiles often describe as “digital sound”. Often these subtle disturbances, especially related to clock jitter, are very hard or even impossible to measure. Only experience and tedious listening tests with prototype circuits can help the designer in optimizing the general architecture and detailed circuit design. This is exactly what the Playback Designs team did over the last few years after accumulating valuable experience over the last 30+ years.

As with any critical part in any product design, it needs to be well shielded from any harmful influences and embedded in an environment that lets it perform at its best. In order to control negative cross talk and inter modulation effects between the stereo output channels the new Dream Series MPD-8 DAC is designed with two completely separate circuits for each channel. The core D/A and associated analog output circuitry is completely separate and on a separate printed circuit board for each channel.

This separation alone helps much already, but a further significant optimization can be achieved by adding a separate power supply to each channel. We went even further and designed each power supply with two separate and parallel circuits so that the small digital parts in the core D/A can be powered from a separate source than the analog part. This may sound like design overkill (and maybe it is), but the benefits in sonic performance are very significant - we were able to clearly measure and hear them.

A DAC product wouldn't be complete without a digital front end, digital inputs and a front panel display. These are all purely digital circuits that can have a significant negative impact on the DAC's overall performance if not carefully laid out and integrated into the product.

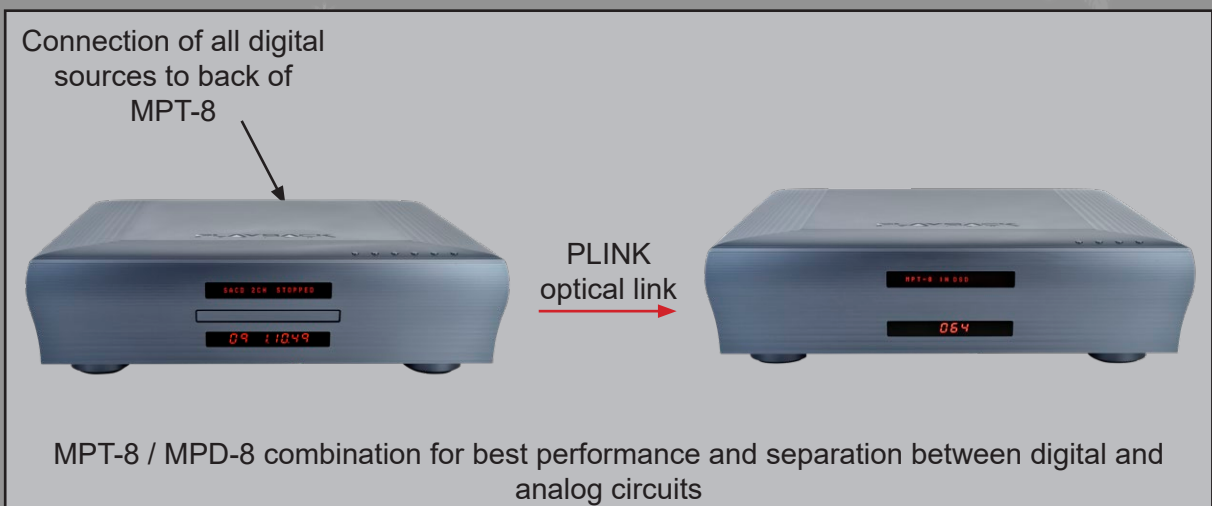
It was already our experience in earlier products from Playback Designs that it is best to



physically isolate all digital circuitry and power it by a separate power supply. We took this same proven philosophy for the Dream Series and drove it even further by powering the display with its own separate supply. Front panel displays are a significant source of power consumption and therefore should be isolated even further.

In addition we make extensive use of mechanical shielding between power supplies, analog and digital circuits. The three dual power supplies in the MPD-8 DAC are housed in a solid metal cage that shields any electric fields from the sensitive analog circuits. The same applies to the two dual power supplies in the MPS-8.

While the Dream DAC MPD-8 has its own digital inputs and digital signal processing built-in, it can also be combined with the MPT-8 transport that offers the same digital inputs, plus an array of other digital sources, such as CD/SACD drive, music server, streamer and network bridge. The link between MPD-8 and MPT-8 is via a fiber optical cable that natively supports all digital formats and sample rates. This is a proprietary technology by Playback Designs that is a vital element in the separation between digital sources and the DAC. By connecting all your digital sources to the MPT-8 and then connecting the MPT-8 with a single fiber optical cable to the MPD-8 we achieve the most significant separation between analog and digital.





### **AUDIO SAMPLE CLOCK AND DISPLAY**

It may not appear empirical to group these two subjects into the same paragraph, but unfortunately, they are very much related, and in a negative way. Most available displays are driven by internal processors or refreshing circuits with simple built in clock generators that run freely at frequencies that are not related or coupled to any audio sample rate.

It is also well known that two independent clock generators within the same product that are not coupled or synchronized in any way, will “beat against each other” and create inter modulation distortion. This doesn’t matter so much for the display clock, but for the audio sample clock it does very much.

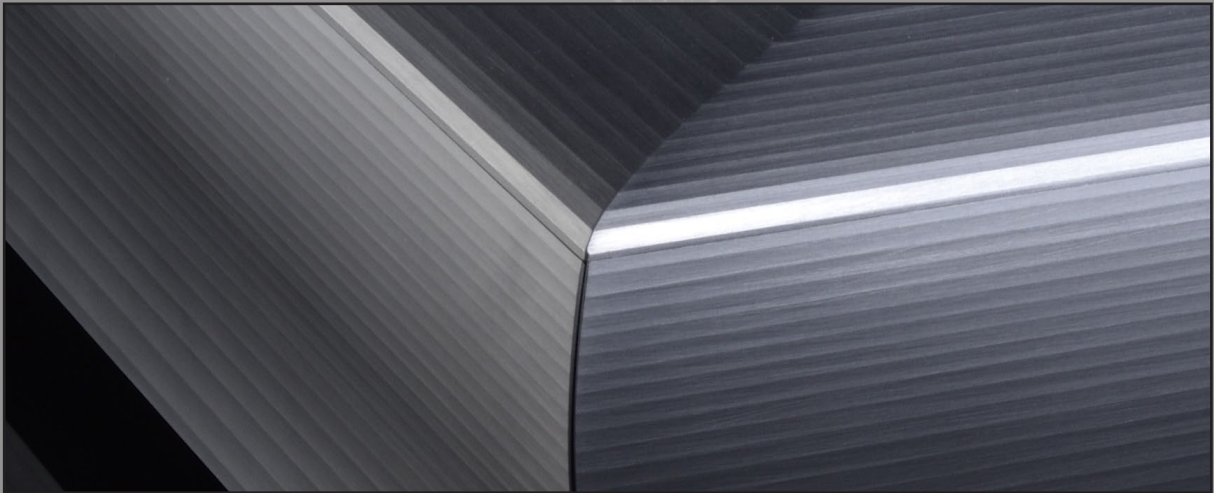
Therefore, it is Playback Designs’ strict design rule to only use one single clock generator in the most critical element, the DAC. But this limits the choice of front panel displays drastically. Where most competing products show off fancy graphic color displays, all Playback Designs products use somewhat simpler displays that can be driven with an external clock that we can then synchronize with the audio sample rate. This eliminates a significant performance issue right at the source.

The MPD-8 and MPS-8 products use a single clock source to drive every circuit from control processor, to signal processor, to digital input, to display.

The MPT-8 is designed to allow multiple clock generators: drive, server, streamer, network bridge etc. but then re-clocks all digital signals through Playback Designs’ proprietary high precision clock generator before sending the signal out to the DAC via its fiber optical interface. This prevents any inter modulation effects from reaching the DAC.

For the audio sample clock Playback Designs uses a proprietary generator designed to eliminate any correlated jitter that can negatively impact the sonic performance. This is one of the most critical technologies in a DAC and Playback Designs is constantly innovating new algorithms on the same basic concept that was started already 20 years ago.

Special attention was given to the analog circuitry for the clock generator by refining it with the



lowest noise linear regulators available in the market today. The result is the cleanest clock generator we have ever designed and its performance cannot easily be matched with any competitor's design.

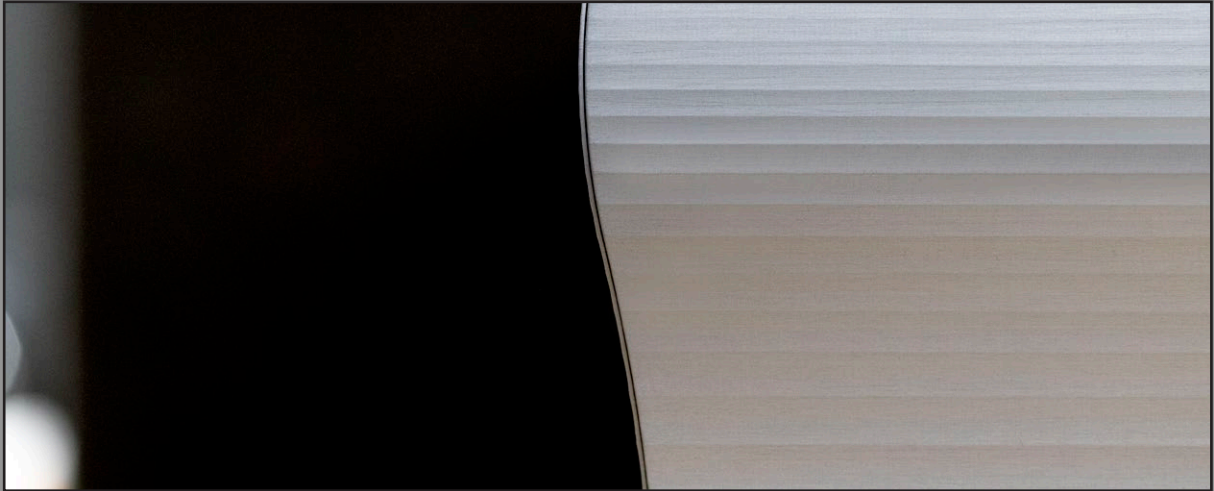
### ***DIGITAL INPUT PROCESSING AND D/A CONVERSION***

The Dream Series DACs incorporate the same basic digital signal processing algorithms that made Playback Designs' earlier products famous and well liked all over the world already. New frequency and time based filters are working in concert to optimize performance during transients in the music signal - and the music signal is generally full of such transient signals. This helps bring out performance of redbook CD's that is normally hidden when using conventional DAC chips and algorithms. On top of that an apodizing filter is used which can remedy some of the side-effects caused by the A/D converter used in the studio during production. A recently launched music format makes similar claims about this feature, but Playback Designs has implemented this filter already in 2010 and has constantly been improving it since then.

All PCM inputs are upsampled through this series of algorithms to a very high sample rate from where they are converted to DSD at an even higher sample rate. All DSD inputs are also upsampled to this intermediate sample rate.

What follows then is a proprietary digital process that further upsamples the signal to around 50MHz. At that point the sample rate is so high that a conversion to analog becomes quite trivial. The significant advantage of this is not only a drastic simplification of the analog part of the DAC, but also the prevention of any non-linear distortions that are common with most other DAC structures.

While the core DAC is built with discrete components (i.e. no off-the-shelf chip sets), just like all previous products by Playback Designs, the DAC of the Dream Series is built with a much more elaborate architecture and layout, more precise and powerful components, and with strict separation between sensitive circuits and anything that could impact its performance negatively.



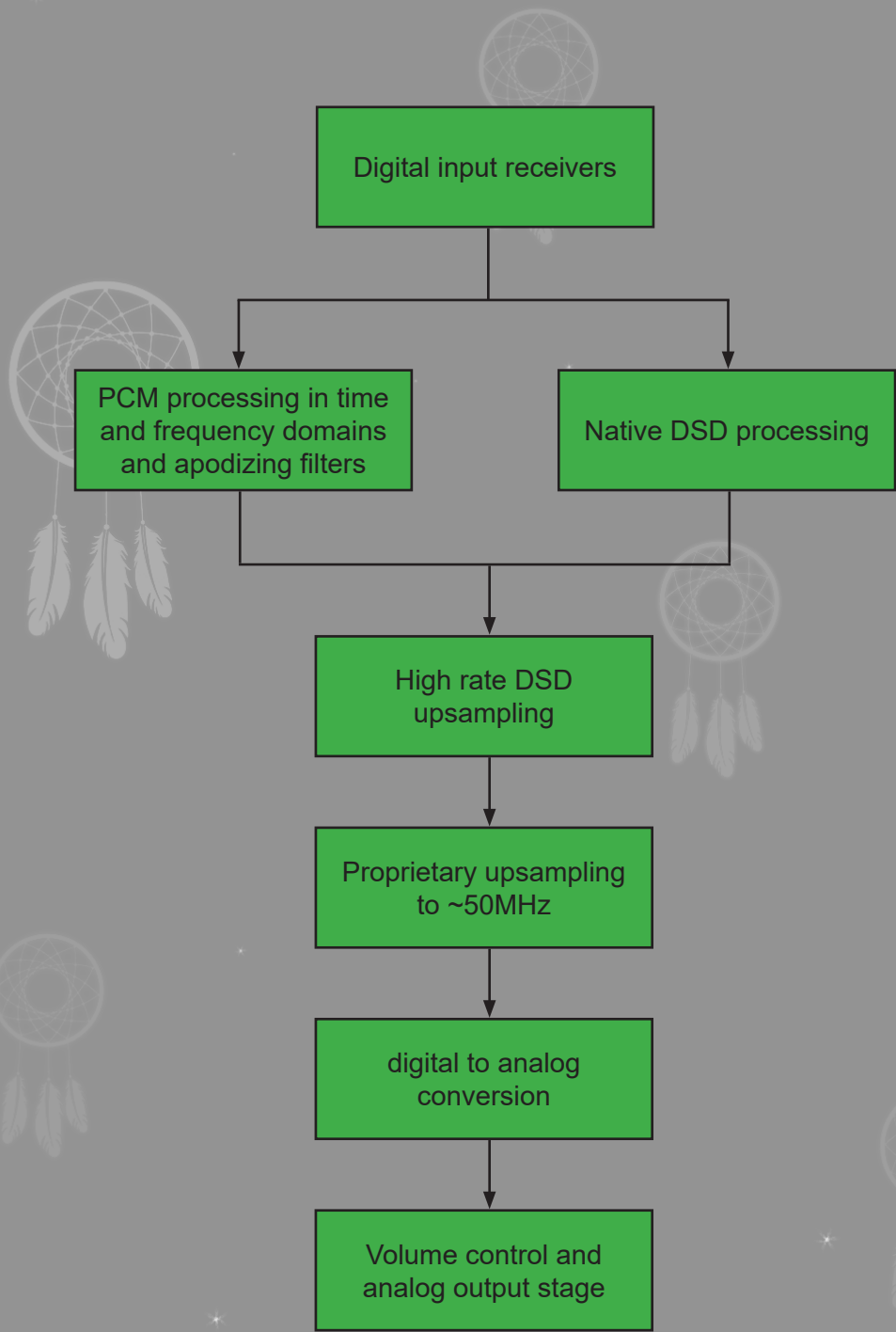
### ***VOLUME CONTROL AND ANALOG OUTPUT STAGE***

The analog output stage of the DAC is designed with the finest components of 0.1% metal film resistors and film capacitors combined with lowest noise precision impedance converters. This from-ground-up new design features a true double differential structure which means, that one channel of audio is actually built out of four fully differential digital signals that are driven by a FPGA dedicated to the analog section only! The data transfer to this FPGA from the digital board is also differential without any galvanic ground connections.

Again, the concept of maximum separation and isolation is applied to the analog section of the DAC to achieve maximum performance.

In the past, Playback Designs DACs had no volume control. The Dream Series now incorporates a very high quality analog volume control which has been developed and refined over many years. Even the volume control is laid out differentially. This way, the output of the Dream Series DAC can be adjusted to any level from zero to an amazing level of almost 25 volts peak in fine steps without compromising noise and distortion performance.

A critical part in any analog circuit is its power supply. So we gave it our special attention too and applied the same principles again of separation by designing it with ten (!) of the lowest noise linear regulators for each channel. No expense was spared to achieve the highest performance the most transient friendly power for the analog output stage.



Simplified block diagram of Dream Series DAC to illustrate the discrete architecture with its various proprietary processing steps all designed by Playback Designs



### ***POWER SUPPLY***

All power supplies used in the Dream Series products are linear and a new from ground-up development. One power supply is actually two-in-one as it has two parallel circuits to help further separating individual power domains. Each supply has its own transformer that is custom built for Playback Designs with integrated Mu-metal shielding.