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This Issue

Balanced Lies

Boy would I like to find the individual who started all this false controversy about something incorrectly termed 'true balancing'.

The entire reason balanced line technology exists is to cancel noise picked up on long interconnects. There are two ways to do this: One way is to use an input transformer. A transformer is insensitive to common-mode signals (signals that are the same in amplitude and phase on both wires of the input), and passes signals that are differential-mode, (in this case, equal in amplitude, but opposite in phase). The second way is with an active circuit called a Differential Amplifier. This type of input buffer does just what its name implies; it amplifies only the Differences in the signals between the two input wires.

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Customer Feedback

The following is an excellent article written by Mr. Jeff Switzer, a Bryston customer, on the workings of our BP-25DA.

One way to understand the BP-25DA is to follow the flow of a signal from when it gets to the BP-25DA in digital form to when it leaves to drive an amplifier. This article describes both what is important in providing an output signal of the greatest fidelity and how Bryston succeeds in this effort.

The digital signal first arrives at the BP-25DA via an RCA connector in standard SPDIF form. This is the normal digital output from a CD player. There are two SPDIF inputs which are selected by a front panel switch. This digital signal contains data at over 1 million bits per second which requires a bandwidth of 5 to 10 million hertz (cycles per second). At these high frequencies it is very important to maintain the quality of the signal by having the correct termination at the SPDIF inputs. Bryston provides this termination in the best manner using high quality devices call impedance matching transformers. These devices provide the best possible interface to the line under all sorts of signal conditions.

Lesser quality terminations will degrade the signal which will cause increased jitter, for example. Once the digital signal is received in the BP-25DA it goes to a digital interface circuit. In the BP-25DA this function is provide by a Cirrus Logic CS8420. This circuit cleans-up the signal to remove the inaccuracies which were added by the transfer from the signal source (say a CD player) to the BP-25DA. One of the key functions of this circuit is a reduction in digital jitter which was part of the signal which it arrived at the BP-25DA. Jitter is a variation in the timing of the digital signal. Left uncorrected is causes very serious degradation in the ultimate audio output. We'll see several places where jitter can arise in a DAC processor and how this jitter is either eliminated or better yet, not allowed to arise.

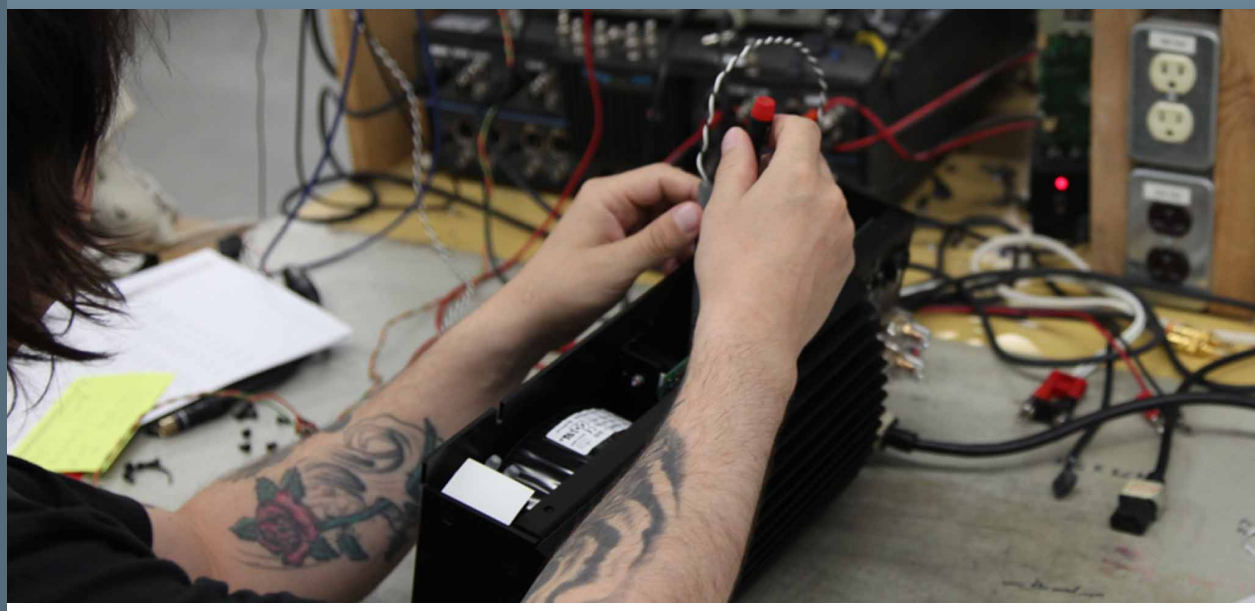
The signal next goes to the up sampling circuit. This function is provided within the same Cirrus Logic CS8420 described in the previous paragraph. This circuit converts the digital signal from one sample rate and bit depth to another. This process is called up sampling. In the BP-25DA the sample rate is increased from the 44.1k samples per second sample rate and 16 bits of depth (the CD standard) to 96.0k samples per second and 24 bits. The new samples are created by a complex mathematical process which develops a new set of data from the existing samples. The added 8 bits are filled with place holder information. This up sampling process provides a digital signal for later conversion to analog by the actual DAC chip. The up sampling process doesn't add any new data to that which came off the CD but it puts the data in a form which can better be used by the DAC as described below.

Since input transformers generally are bulky, expensive, and prone to distortion, Bryston has determined the best approach for home audio is a, fully discrete Differential Amplifier input buffer, which can be arranged to have some gain, and actually reduces the main amplifier's distortion as a result.

It is important to note that a Differential Amplifier takes two input signals, multiplies the differences between them, and subtractive cancels the common elements between them. This effectively eliminates any noise picked up on balanced-line interconnects, because the induced noise is always present in common-mode on the two halves of the signal.

What has been called 'true balancing' is actually a corruption of this simple concept: It involves keeping the signal in two separate polarities all the way through the signal chain, to the amplifier's output. This of course completely avoids the mechanism for eliminating the induced noise on the long interconnects! It not only costs more, it doesn't do what it's supposed to do.

Bryston manufactures amplifiers with differential outputs, (like a 'true balanced' amplifier), in the 14B SST and the 7B SST, but we also utilize a fully discrete Differential Am-



Many people report improved sound from DAC processors which include this up sampling process. This may be due to the better processing of the up sampled signal by the DAC chip. This device was designed for these higher sample rates and bit depths and performs better when they are supplied. There may also be a noise shaping process where noise from the audible spectrum is not being eliminated but it is being shifted up to frequencies above audible limits. An added advantage of this up sampling process is that a total new clock signal is applied which causes a significant reduction in jitter. Up sampling can be made to a variety of new sample rates. Bryston has found that while higher sample rates can be used, such as 192 kHz or even 384 kHz, there are penalties in noise, jitter sensitivity and distortion which outweigh any added benefits from these higher rates vs. 96 kHz

The DAC integrated circuit (chip) provides the conversion of the digital signal to the analog domain. The chip used in the BP-25DA is the Crystal CS43122. Due to the requirements of the conversion process, this chip and every other DAC chip, applies a digital filter to the signal before the conversion to analog and an analog filter after the conversion process. Due to the previous up sampling process these filters have their effects far above the audio range. Without up sampling, the filters would affect frequencies of 20 kHz or perhaps even lower with associated level and phase changes.

The CS43122 is a hybrid multi-bit delta-sigma DAC. This is a rather tongue-twisting description which essentially means that it is an advanced generation chip which uses several methods to optimize the conversion process. This DAC uses a process similar to the previous up sampling process where it oversamples 8x times. This again allows for filters which are out of the audible range. The output of this process is a sensitive analog signal. The timing of this process is very closely controlled by a low jitter clock.

In the implementation of the DAC we see some of the real benefits of Bryston expertise. The DAC chip requires a very clean digital power supply if it is to function at its optimum. Noise on the digital supply may cause added jitter, noise and distortion. Incorrect board routing of the digital power supply or ground may introduce digital noise into the analog circuits.

This digital power supply is provided from a separate closely regulated and filtered source. The DAC also requires a high quality analog power source. The analog signal is at its lowest magnitude in and coming out of the DAC so any added noise or distortion will be greatly amplified by later stages. Again a separate, heavily regulated and filtered power supply with carefully routed grounds is provided. This sort of care with the power supplies is one of the reasons for the superior sound of BP-25DA. Here is an example of a potential problem: if a digital trace, signal or power, is routed a layer above or below an analog trace it can induce noise via capacitive coupling. Careful trace routing eliminates these problems and provides the extra dB's of noise and distortion reduction which separate good from great equipment.

The quality of power in an audiophile class piece of equipment is a key to wonderful performance. The BP-25DA uses an external enclosure for the power trans-

plifier input buffer to derive the balanced input. Anything else would be misrepresenting the true purpose of balanced circuits.

Recent Movies

Here are some recent movies recorded utilizing Bryston amplifiers and PMC monitoring systems:

The Passion Of The Christ

Moose Port

Mystic River

Big Fish

Finding Nemo

Hidalgo

The list just keeps on getting more and more impressive as the years go by…

former and the initial stages of filtering and regulation. This separating of the power transformer from the main electronics reduces the level of induced power line noise, especially 60 Hz and its multiples from the supply. A steel enclosure then helps to make sure that external capacitive, magnetic and EMF noise doesn't enter sensitive circuits. Additional filtering and regulation then occurs within the BP-25DA.

Once the sensitive analog signal leaves the DAC it is buffered and increased in strength by operational amplifiers (Opamps). These are constructed from discrete devices (transistors, resistors and capacitors) instead of integrated circuits. The use of discrete devices allows the design of a circuit which exactly matches the needs of the DAC and other circuits as implemented in the BP-25DA. Use of integrated circuits always involves comprises since they are designed as general purpose devices. The discrete devices allow Bryston to design and manufacture circuits which exactly meet requirements. Discrete devices allow more powerful outputs from op amps since heat from the output driver transistors is separated from other devices. In an integrated circuit op amp this heat can affect the rest of the circuitry since it is all on one chip. Discrete devices also allow specific matching of important characteristics such as input and output impedances based on the specific in-circuit requirements. Discrete op amps can also be designed to more closely match their power source which again leads to reduced distortion and noise. The discrete devices can be tested very closely to match tolerances and matched against each other when matching is important to obtaining a desired result. Circuits can and are designed to require closely matched devices for optimum performance. Integrated circuits have large numbers of components on one chip and it is not practical to do more than high-level sorting of device characteristics. Bryston does sorting and grading with its DAC chips but can do a much finer level with the discrete devices, which leads to better sound quality.

The signal now leaves the DAC board in the BP-25DA and introduced in to the remainder of the analog circuitry in the BP-25DA including the laser trimmed ALPS volume control and further high-quality discrete op amps. Touches as small as custom made, gold-plated output jacks, leave no missed opportunities of optimum quality.

Jeff Switzer

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