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Bel Canto VBS1 Virtual Battery Supply Technology

Offering low noise, high current and isolation from the AC Line supply, the battery is often seen as an absolute reference power source for sensitive audio circuitry. Bel Canto re-defines this ideal power source with our Virtual Battery Supply (VBS) technology. Combining low noise switching technology, multiple stages of isolation, filtration and regulation, the VBS1 provides a highly stable, isolated and low noise base for our precision digital and analog audio circuitry. The VBS1 with internal VB board is designed to provide this ideal power source for all signal sources and control electronics in the Bel Canto e.One line. You can use it to drive up to three front end products (CD2, DAC3 and PRe3, for example).

Background

The VBS1 began as a thought experiment, what if we could re-create the advantages of a battery power supply without any of the disadvantages?

- 1) Define the key elements that make a battery a superior power source
- 2) Determine what technologies to use to deliver these key elements
- 3) Improve upon battery performance
- 4) Package it to best effect and in the most versatile manner
- 5) Design any auxiliary supplies to power specific circuitry
- 6) Confirm the results through comprehensive testing
- 7) Listen to the results
- 8) Iterate as needed

Having gone through these steps we arrived at a final design. The result transcended our original expectations. The VBS1 provides an un-paralleled foundation for building the ultimate audio playback system.

Technical Approach

Our first VBS was based on a traditional 50/60 Hz transformer and linear regulation scheme with abundant local LC filtration and energy storage. Our experiments proved that while providing excellent overall performance it still did not approximate the noise levels that a quality battery could provide. It also suffered from the typical inefficiencies of a linear regulation scheme, especially when required to operate over the AC power line voltage variations, interference and noise encountered in real world operation. We

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decided to explore alternative technologies that gave us higher inherent efficiency and more control over the specific performance of the power supply.

Switching - Supplies

The Switch Mode Power Supply (SMPS) provides great levels of efficiency, over 90%, great control over specific operating parameters of the supply design and potentially greater levels of isolation and lower audio band noise. Their weakness is in the high frequency noise generated. This weakness was addressed in the design of the VBS1 and it became obvious that it is much more effective to filter high frequency noise than to attempt filtration of low frequency noise.

Later prototypes approached the problem by using a quality SMPS to generate 12Volts DC from the incoming AC line voltage. We included extensive input filtration, low noise rectification and high energy storage prior to the SMPS. This is followed by a massive bank of LC filtration using compound inductors, parallel electrolytic capacitors and final stage polypropylene capacitors to insure hundreds of amperes of peak current capability and low noise across a wide frequency spectrum. There is nearly ½ of a FARAD of total capacitance (500,000 microfarads) and over 100 Joules of energy storage in the VBS1.

Spectrum analysis of this design from the low audio frequencies to well beyond the audio frequency band revealed a noise floor within a few decibels of the spectrum analyzer noise floor. This represented a 10X to 100X reduction of the noise floor of the traditional linear approach. This reduction in noise was particularly evident in the lower region of the audio frequency band, the critical midrange where the ear is most sensitive. Indeed in the low frequencies the VBS1 provides an even lower noise floor than a lead-acid battery!

Isolation/Filtration

Perhaps the only area where a battery is, potentially, superior is isolation from power line noise. However, this isolation is not a given. The only time that a battery is 'totally' isolated is if it is not being charged, even then there is likely to be some kind of charger circuitry in the supply that is connected to the wall outlet, and its isolation may be quite poor. Also when a battery is NOT being charged it is in discharge mode and the voltage, noise and regulation is constantly changing as it discharges. In the VBS1 we have several advantages that we apply to insure a VERY high degree of isolation.

LC filtration provides over 100 dB of isolation starting below 100 Hz, and on top of this the very small power transformer in the SMPS happens to provide several advantages over the traditional line frequency transformer, much less copper and much less

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parasitic capacitance, both of these factors provide better performance and better isolation for the transformer, especially at low frequencies.

We have confirmed this isolation by performing listening tests with the VBS1 where you literally UNPLUG the VBS1 from the wall and listen for any change in the audio performance-there is no change-nor is there much, if any, sensitivity to the specific type of power cord used to drive the VBS1, providing further proof of the quality of isolation from AC power born noise. The VBS1 is acting like a local low noise power station for your front end electronics-rendering many power filters, regenerators and such unnecessary or even counter productive.

Internal VB board

The 12VDC provided by the VBS1 supply needs to be further acted upon to deliver the needed supply voltages for the internal digital and analog sections of the e.One equipment. This necessitated further technology development. We designed the new VB board that converts the ultra-isolated, ultra-low noise 12V supplied by the VBS1 to the needed voltages for the digital and critical analog power stages of the e.One equipment. Our approach uses a tiny SMPS to optimally generate the voltage for the digital sections an SMPS transformer isolated, ultra-low noise symmetrical supply for the critical analog audio section. The noise floor of the analog power supply now is close to that of the audio circuitry that it is driving! With our new VB board the VBS1 is complete.

A New (Greener) World

The sum total of the VBS1 is an obvious increase in resolution from all audio sources. What was most surprising was the great increase in how NATURAL the images and sounds are within the larger, deeper soundstage when the VBS is used to power the front end electronics. With the VBS1 you have the best of both worlds as the increase in resolution and detail are accompanied with an even more naturally beautiful sound quality. As if this weren't enough, the system efficiency is higher, with the Dac3V with the VBS using only 7 watts of power instead of 12 watts for the Dac3 and its traditional linear supply.

Superior Audio performance, lower power usage, isolation from the power line and less power cords!

Not to be missed...