



SHUNYATA RESEARCH

Power Distribution: Concepts, Measurement & Custom Parts

For more than 15 years, Shunyata Research has demonstrated a profound ability to translate its intellectual properties into the material foundation for state-of-the-art products. Shunyata Research designer Caelin Gabriel's development of patented science and use of objective measurement has led to an entire series of custom-engineered parts that provide the foundation for products that demonstrate measurable advances in power-system performance. These innovations are the reason Shunyata Research has remained at the forefront of a fiercely competitive industry for almost two decades.

Following are the unique concepts, measurements and custom-designed parts that define Shunyata Research's successful, outside the box approach to power-distribution in the recording, film and medical industries.





DTCD™ (Dynamic Transient Current Delivery)



CCI™ (Component-to-Component Interference)

DTCD™ Analysis is a proprietary measurement technique developed to measure instantaneous current flow through very low impedance electrical conductors and contacts. It is used to optimize the design of electrical parts and materials ensuring optimal instantaneous current delivery. DTCD™ Analysis gives Shunyata Research a clear competitive advantage in the design and development of high performance power conditioners and power cabling products.

DTCD™ test results indicate that designing electrical delivery systems around the base concepts of minimized AC impedance, high-quality contact integrity and maximum conductivity will deliver optimum performance and electrical reliability across all entertainment and professional sound or recording systems.

Traditional power conditioners are designed to block noise coming from outside the home but do not address the noise that is generated by the electronic component's themselves. In fact, many conditioners reflect noise back into other components that are connected to the same power conditioner. CCI™ is one of the most significant, but overlooked aspects to power system performance. Shunyata Research has developed several noise reduction technologies to control CCI™ interference without using heavy transformers, coils or large capacitors. Shunyata Research avoids the inconsistent and reactive performance that is prevalent with common one-box power filters and conditioners. Shunyata Research's CCI filters measurably reduce inter-component interference and reactance with a corresponding performance improvement in high-end audio, video systems.

DISTRIBUTED POWER CONDITIONING

Shunyata Research pioneered the concept of *Distributed Power Conditioning* to solve the problems associated with power line noise at all critical points within audio and video systems. Home entertainment systems can be very complex involving many components located in multiple locations. These systems may use several dedicated power lines making it impossible to effectively reduce power line noise with a single-box power conditioner solution. Shunyata Research solves this problem by intercepting noise at multiple locations in the entertainment system using a variety of methods.

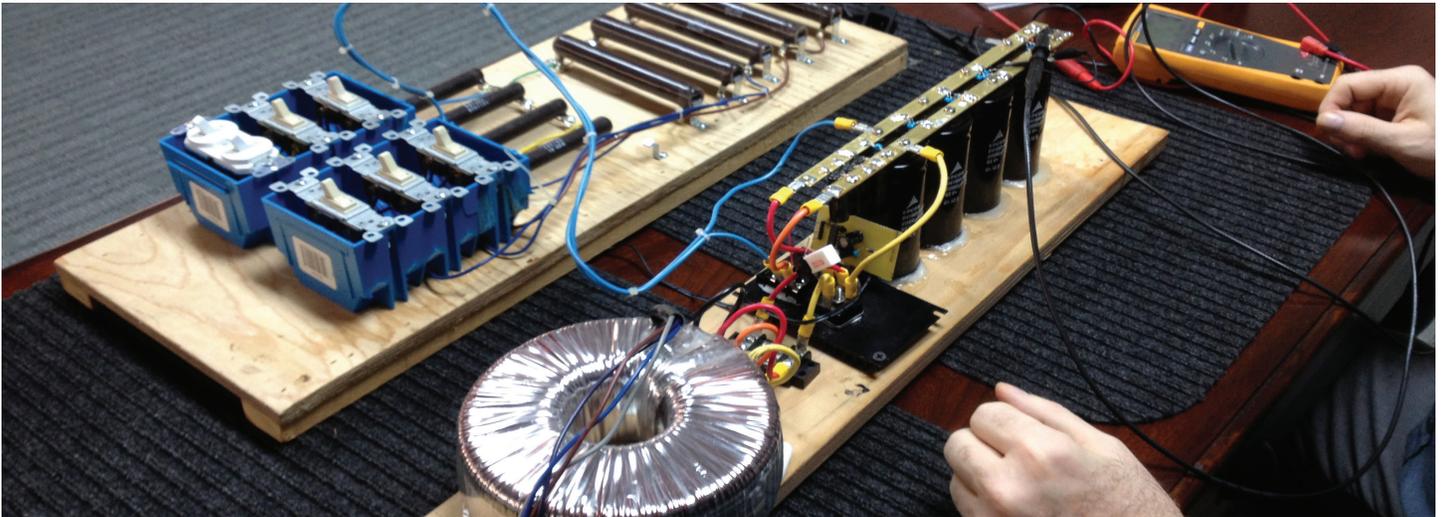
Power Distributors: Shunyata power distributors supply power to multiple components while intercepting incoming power line RFI and EMI. They also address problematic CCI™ (*component-to-component interference*) with patented and proprietary noise reduction technologies. DTCD™ Measurement Analysis has enabled Shunyata Research to develop multiple noise reduction technologies that do not compromise instantaneous current delivery.

NR Power Cables: Shunyata Research has developed several "noise reduction" power cables that measurably reduce power supply generated noise. The noise is intercepted by the power cord at the component power supply and dissipates interference before it has the opportunity to propagate throughout the power system.

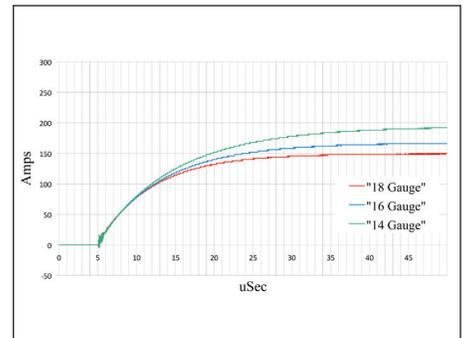
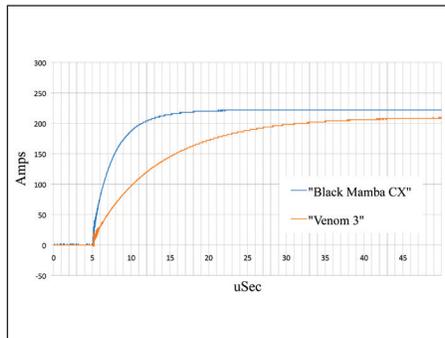
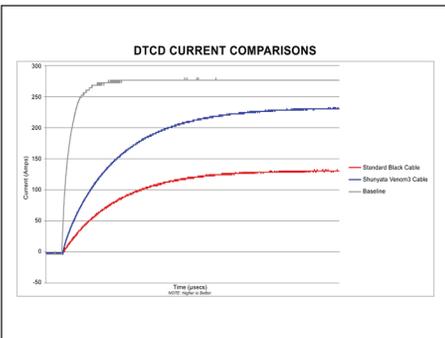
Remote Solutions: Shunyata Research also produces single and dual outlet devices that reduce noise. These unique products provide surge protection and noise reduction for mono-block amplifiers, video projectors and other components that may be remotely located from the main system. The best example of these solutions is the affordable VENOM DEFENDER which plugs directly into the AC duplex, eliminating the need for a conventional power conditioner and the associated power cabling.



SHUNYATA RESEARCH: OBJECTIVE SCIENCE AND MEASUREMENT



To achieve optimum noise-reduction without the loss of instantaneous current – or interference with electronic power supplies, Shunyata Research used objective measurement to guide in the design and manufacturing of its own parts and materials. Following are some of the compelling CCI™ (*Component-to-Component Interference*) and DTCD™ (*Dynamic Transient Current Delivery*) measurements that formed the design template for Shunyata Research’s massive library of custom-engineered parts and technologies.

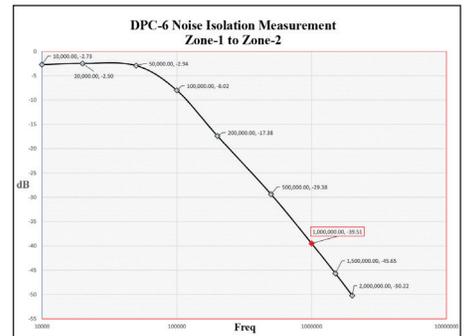
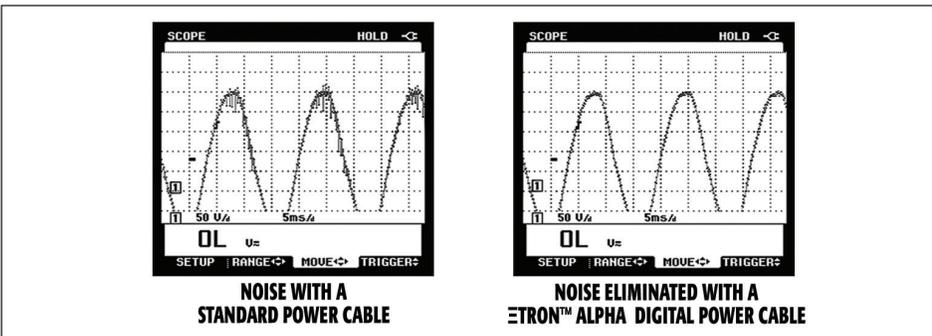


DTCD™ Measurements

This shows a definitive and measurably significant increase in available DTCD™ using the superior parts and materials of a custom-designed VENOM 3 power cord compared to a standard black power cord.

This graph demonstrates the profound effect that a purposefully crafted wire geometry can have on DTCD™ versus a conventional wire geometry in a more standardized design.

This graph clearly shows that the available wire gauge within a power cord will affect DTCD™ (*instantaneous current*).



CCI™ Measurements

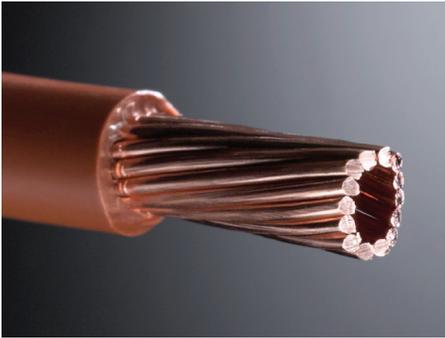
The above graphs are screen shots of intense power line noise measured with a Fluke Power Analyzer. The first measurement at left shows noise levels with a standard black power cord – followed by the graph on the right of the same noise, but using Shunyata’s least expensive Noise-Reduction power cord.

The above graph shows the profound effect of Shunyata’s noise isolation technologies in one of its passive power-distributors.

SHUNYATA RESEARCH'S CUSTOM MANUFACTURED PARTS AND MATERIALS

Following are descriptions and photo's of the parts, materials and technologies that set Shunyata Research products apart from all others in terms of their design concept and performance. These technologies and parts were developed using calibrated measurements and the tenets of objective science cultivated during fifteen years of intensive research by Shunyata designer Caelin Gabriel. Few companies can combine the vision, understanding and investment necessary to create such a complete library of purpose-built parts and materials.

METALS AND CONDUCTORS



VTX™ Conductors

Shunyata Research's exclusive VTX™ conductors are made in the shape of virtual tubes. The core of the conductor is completely hollow minimizing skin effects and random eddy currents. They are produced using OFE Alloy-101.



OFE ALLOY 101 Copper

Shunyata Research uses only the highest purity of copper available for the production of its wire products. **OFE Alloy 101** or **C10100** is the highest grade of copper with a *minimum* 99.99% purity and a conductivity rating of 101% IACS. OFE stands for *oxygen-free electrolytic* and supersedes the term OFHC (*oxygen-free high conductivity*). C10100 is the *only* grade of copper that comes with a written certification of purity.

Certified by ASTM F68 C10100

Caelin Gabriel's development of **patented science**
and use of **objective measurement** has lead to an entire series of
custom-engineered parts...

CCC - COMPUTER CONTROLLED CRYOGENICS



Shunyata Research operates its own onsite *Cryogenics International* computer-controlled cryogenic plant. Liquid nitrogen is used to reduce the temperature of the contents to -320 degrees Fahrenheit. The computer monitors and lowers the temperature by a single degree at a time to prevent thermal shock.

We use this process to improve the performance of wire, conductors, connectors and terminals that are used in our power products and signal cabling.

See online for more information.

www.shunyata.com

NOISE REDUCTION TECHNOLOGY



CCI™ Filter

CCI™ filters have the unique ability to reduce component generated power line noise without reducing DTCD™ (*dynamic transient current delivery*) or interfering with normal power supply operation. These unique filter elements prevent one component's power line noise from contaminating the adjacent electronic components.

Shunyata Research's CCI™ filter modules consist of proprietary multi-stage filters that reduce power supply generated noise without the use of heavy transformers, coils or large capacitors.



ZrCa™ Noise Reduction Compound

ZrCa-2000™ compound is a proprietary formulation of *ferroelectric* substances that absorb and dissipate high-frequency power line noise in the megahertz and gigahertz frequency ranges when placed in proximity to the power conductors or power supplies. The ZrCa-2000™ materials are crystalline materials that act on the *electric field* in a manner similar to the manner in which ferrite (*ferrous metals*) acts on the *magnetic field*. They both absorb high frequency noise. However, the ZrCa-2000™ compounds do so without the negative sonic side-effects commonly associated with the use of ferrite in an audio system.

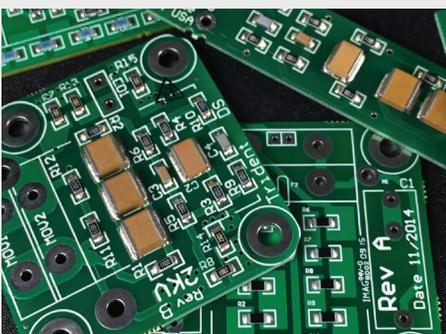
~ Patents US 8,658,892 and US 6,242,689 ~



NIC™ Noise Reduction

NIC™ (*Noise Isolation Chamber*) is a proprietary Shunyata Research technology that reduces high frequency power line noise. It employs a *ferroelectric* substance that actually absorbs high frequency noise in the Megahertz to Gigahertz range. Shunyata Research power distributors with NICs™ reduce noise without any of the *reactive negatives* associated with conventional power conditioners.

~ Patent US 8,658,892 ~



MPDA™ Module

The MPDA™ (*Multi-Phase Differential Array*) is a Shunyata Research designed filter array that significantly reduces power-line noise without impacting DTCD™. The MPDA™ is made with multiple, miniature *surface-mount* filter elements each designed to target very specific bands of power line noise without the negative side-effects associated with *pi* and *T* filters that are commonly used in conventional power conditioners.



SDC Coil

The *Shunyata Digital Coil* is a unique component designed to reduce high frequency power line noise without the negative effects of *common* transformers or coils. It is a *dual, interleaved, hand-wound air-core design* that is produced with Shunyata Research's 12-gauge **OFE Alloy-101** conductors.

When combined with the MPDA™ or CCI™ filters it is capable of reducing power line noise by an impressive 40db @ 1Mhz.

CONNECTORS & TERMINALS



ZPP-DS Distribution Buss

ZPP-DS is Shunyata Research's exclusive power buss made entirely of solid **OFE Alloy 101 copper**. The ZPP-DS unifies the internal wiring, outlet contacts and power distribution buss into a single-point of electrical contact. This improves contact integrity and DTCD™ performance by eliminating many of the terminal connections and the daisy-chained wiring found in other products.



Trivial Terminals

Ring terminals, spades, bolts and washers that are used to connect internal wiring, terminals and switches are good examples of parts that are considered "*trivial miscellaneous parts*" by some engineers. Shunyata Research actually designs and makes a wide variety of these small parts using superior metals and platings for each specific application.

Attention to even the smallest details is what distinguishes Shunyata Research's design approach!



SR-Z1 Outlets

SR-Z1 Outlets are built by Hubbell to Shunyata Research's exacting specifications. Oversized housing for improved cooling. High purity copper-brass alloy instead of commonly used bronze-tin alloy. Triple wipe contacts for better electrical continuity.

All SR-Z1 outlets are treated on-site with our *Cryogenics International Computer Controlled Cryogenics facility*.



C20 Inlet

Many audiophile grade power conditioners actually use a common computer grade C14 power inlet. These inexpensive inlet connectors have very small electrical contacts and notoriously feeble grip. Worse, they are only rated at less than 15 amps of current which falls far short of what is required for many high power components.

Even our entry level VENOM PS8 power distributor is fitted with a HUBBELL IEC C20 inlet. It has massive electrical contacts with continuous current rating of 20 amps and a grip strength that is light years beyond the common computer grade inlet.

Additionally, this rugged inlet gets treated in Shunyata Research's *Cryogenics International Computer Controlled Cryogenics facility*.



CopperCONN™ Connectors

The electrical contacts in virtually all *audiophile grade* AC connectors are made from brass or bronze. Some audiophile grade connectors may get a *plating* of nickel, silver, gold or rhodium that is only a few *millionths of an inch thick*. However the base metal is thousands of times thicker and carries the majority of the current. Shunyata Research CopperCONN™ AC Connectors are constructed using *solid, high purity, OFE Alloy-101 copper* contacts that provide greater conductivity.

The CopperCONN™ Connectors are designed with superior grip strength and contact integrity. This contributes to a measurable improvement in DTCD™ (*Dynamic Transient Current Delivery*) and a correspondingly obvious difference in audible performance.



CopperCONN™ Outlets

The electrical contacts in commercial grade outlets and virtually all *audiophile grade* outlets are made from brass or bronze. Some audiophile grade outlets may get a plating of nickel, silver, gold or rhodium that is only a few *millionths of an inch thick*. However the base metal is thousands of times thicker and carries the majority of the current. Shunyata Research CopperCONN™ outlets are constructed using *solid, high purity, OFE copper* contacts that provide far greater conductivity.

The CopperCONN™ outlets are designed with superior grip strength and contact integrity. This contributes to a measurable improvement in DTCD™ and a correspondingly obvious difference in audible performance.

POWER PROTECTION



GEMINI Module

The GEMINI Module provides a massive 40,000 amps of surge protection, spike protection and noise reduction in a single compact module. The noise reduction circuitry is similar in design to the MPDA™ and CCI™ noise reduction modules. It also includes a LED status indicator and circuitry that monitors its operation. The module was designed to be field replaceable with only two terminal connections.



Hydraulic Electromagnetic Breaker

Common power strips and conditioners use fuses or thermal breakers for over current protection because they are inexpensive. When under heavy load, these devices cause voltage drops, increased contact impedance, thermal noise, excessive heat generation and current limiting effects.

Shunyata Research power distributors use a far more advanced solution called *hydraulic electromagnetic* breakers. They operate right up to their maximum current rating without the current limiting and heat limitations caused by fuses and thermal breakers.



Shunyata Isolation Footer

Power distributors react very similar to amplifiers in their sensitivity to vibration. After researching many methods to dissipate floor borne vibration, Designer Caelin Gabriel developed the Shunyata Isolation Footer that possesses excellent vibration dampening characteristics. Shunyata also produces several optional SSF *stainless steel feet* for our power conditioners.



Chassis Dampening

Shunyata Research recognizes that vibration control is important to the overall performance of our products. Our power distributor chassis' are made with heavy gauge steel or aluminum not plastic or thin wall sheet metal. We have developed our own accelerometer test instrument that detects extremely low levels of vibration. We use it in the development of vibration absorbing materials such as energy absorbing footers, AC outlet gaskets and chassis dampeners that measurably reduce resonant vibration within the power distributor.

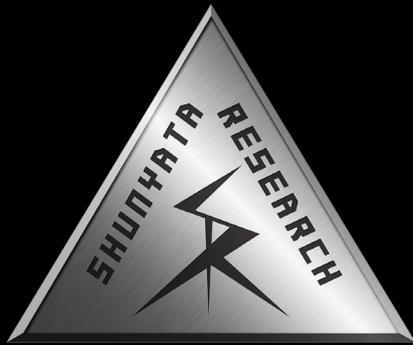


SSF - Stainless Steel Feet

Shunyata has designed several performance-added options of SSF *stainless steel feet* for our power conditioners.

The SSF-38 for VENOM power conditioners and the SSF-50 for HYDRA TRITON, TYPHON and DPC-6.

VIBRATION MANAGEMENT



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