Unity Audio

Owner's Manual

Cerous
Professional Application
Reference Monitor
[PARM]

Introduction

Welcome to the world of the *UNITY AUDIO* Cerous Professional Application Reference Monitor. The Cerous **PARM** System was the culmination of over 5 years of dedicated research into the areas of Psychoacoustics, the study of how the human hearing mechanism interprets sound, and the Physics of Wave Propagation by Transducer. Listening biases can be argued and debated, but the Cerous **PARM** System is, without question, the most technologically advanced loudspeaker system on the market today. Employed are design principles never before realized in loudspeaker technology.

1] The worlds first fully Derivative Passive Crossover, which places no components in the signal path

2] The world's first all Ceramic Composite Cone drive unit loudspeaker

Combined, these elements yield a system that is flat in both electrical and acoustic phase, with the purest signal path ever incorporated in a production loudspeaker.

3] The *UNITY AUDIO* Phase Locked Woofer System enabling the design of a woofer system that, until its creation, had been labeled "a physical impossibility".

The creation of the passive BALANCED CLASS A CROSSOVER (currently used in all products) alone required a Cray supercomputer solving NODAL WINGS totaling 27 variables! The next advancement - The world's first fully derivative passive crossover- added even more to the equation.

Equally radical is the construction techniques employed to bring the Cerous **PARM** System to market. Each system is hand fabricated of composites of *FOUNTAINHEAD* and wood using propitiatory adhesive technologies and aeronautic cyanoacrylates (SuperGlues).

We feel, however, that the most radical area of the Cerous **PARM** System is HOW IT SOUNDS! We hope you take as much pride in ownership of this revolutionary system as we do in its production.

On behalf of all the people of *UNITY AUDIO* we offer you "ALL OUR BEST".

Robert L. Grost
President

ELECTRONIC CROSSOVER:

The electronic crossover is the electrical heart of the **PARM** System.
In simplistic terms it is to divide the signal from the preamplifier into two separate signals. The:

high pass] all frequencies sent to the Satellites
low pass] all frequencies below 65 Hz (infinitely variable)

and send these signals to dedicated amplifiers to power the satellites and woofers. The sonic transparency of the **PARM**, however, revealed that placing *ANY* device in the signal path running to the satellites would cause an unacceptable sonic degradation. The satellites, therefore, run full range and passively fall off in frequency below 65 Hz. The subwoofers are added at 18 db/octave below 65 Hz by the fully balanced **PARM** Electronic crossover. All signals entering the Unity **PARM** crossover in the Balanced configuration will stay balanced throughout the entire signal path never being converted to single ended configurations for signal filtering and processing.

The configuration of the crossover is a buffered 3rd order passive low pass stage followed by a gain stage with available 10 db of gain [to match levels between two separate amplifier input sensitivities] and level control. The bass volume control is found on the front of the crossover. The high pass circuit is a direct pass through element.

Hooking Up The Electronic Crossover

Connect the output of the preamplifier to the jacks marked inputs being careful to make sure individual channels are maintained. Traditionally if long interconnects are needed they are placed between the preamp and crossover. This makes sense because you only need *ONE* set of interconnects here versus *TWO* sets from the output of the crossover. If, however, you are driving your system via a *PASSIVE* preamp or directly from a *CD* player then the run of interconnects from the source to the crossover should be kept to minimum length.

Connect the low and high pass output to the dedicated amplifiers. The *UNITY AUDIO* crossover will sound best after running for over 24 hours and should only be turned off if no use is anticipated for an extended period of time. Utilizing *PURE* high bias *CLASS A* topology requires long warm up times to reach optimum temperature stability. Power to the unit can be maintained while plugging in and removing interconnects with no loss of stability.

The output of the high pass amplifier should connect to the satellites while the low pass amplifier will connect the woofers.

Amplification Needs:

The most requested information on proper system set up is the proper mating of the Cerous **PARM** System to amplification. It is here that individual taste will come in to play. The ultimate design goal of the Unity Audio Cerous **PARM** is a system that will totally reflect the other components of the system, while adding no sonic character of its own. What this means is that if you have tube electronics, your system will *REFLECT THEIR SONIC CHARACTER*. If you use solid state, *the SONIC CHARACTER WILL SHIFT*. This can allow you to produce "tube sound", if that is your preference, without the problems associated with most tube amps - bass.

Many people have stated that you should only use identical amplifiers when bi-amping. This is like saying that you can only build a dynamic speaker system *using ALL THE SAME DRIVER!* The significant advantage to bi-amping is the ability to tailor the system for each piece to function in *THEIR OPTIMAL MANNER*. Tubes are tremendous voltage gain devices, yet, when asked to provide current fall far short of linear in nature. Analyzing frequency spectrums we see that tube amplifiers deliver 75% of their current *BELOW 130Hz*! For this reason many people choose to use tubes on the satellites and solid state on the woofers. With this configuration tube amplifiers of 50 watt or greater output will drive the system comfortably. Power requirements for the woofers are power, power and more power [we recommend a minimum of 100 watts]. We also recommend solid state on the bass. Each subwoofer is virtually unlimited in dynamic capability and will sound better with the more power they receive. Each woofer cube is 3.5 ohms and with a good 100 watt [8 ohms] solid state amplifier will play 115 db *ALL DAY LONG*. If higher output is needed add more power. Each woofer cube will handle 1800 watts! *REMEMBER* - there are some great sounding amps out there [both tube AND solid state]. Let the *SOUND* tell you which one is best for you and keep an open mind. For further technical assistance on amplification needs see the section on Cerous **PARM** technology.

Speaker Placement

We believe that the Unity Audio Cerous **PARM** System is the easiest "esoteric" system in the world to set up and position properly. Room boundaries, such as floors, walls, and ceilings all reflect sound and affect bass "loading". The first reflective surface the sound encounters is the most significant with each subsequent reflection having less effect on the sound than the one that preceded it. This is especially true in the region of bass. For this reason we design the first reflection *into each speaker*! The rear woofer of the satellite will encounter reflections off the pedestal of the speaker, while the subwoofers will encounter the floor and top baffle. With this as an integral part of the design we know *exactly* how the first boundary will *AFFECT OUR SOUND*. These boundary reflections were added into the design parameters. In essence *UNITY AUDIO* loudspeakers carry their own room around with them!

With placement of the subwoofer 8" out from the front wall [wall to rear of cabinet] we now know what our *SECOND REFLECTION IS*! This reflection is also part of the design and *WILL NOT CHANGE FROM ROOM TO ROOM.*

We can see that with the two most significant reflections as an integral part of the design the room interface problems are greatly reduced. The only boundary that could now effect the bass is the side wall. Placing our subwoofers farther away from our side walls than 2x our distance from the front wall [2 feet] will virtually eliminate their effect on bass performance. In addition, we recommend placing the subwoofers five feet apart and between the two satellites.

The same design advantages used in the subwoofers are incorporated into the satellites to aid in their room placement. With our first reflection set by the pedestal of the speaker, we can see that the front wall will also be the second reflection for our satellite. Placement 46 " out from the front wall will give us the second reflection, and will begin to cause phase cancellation at-- -- 65 Hz! This distance from the front wall will cause the satellite's bass response to drop 12 db/octave starting at 65 Hz. For distances farther than 46" out from the front wall the slope rate will remain linear. If the satellites are placed closer to the wall than 46" some mid-bass reinforcement will occur. If this situation occurs please consult your Unity Audio dealer or Unity Audio directly to answer any questions you may have on system alternatives.

Begin listening with the satellites placed 9 feet apart [center to center] and toed in slightly toward the listener. Start with the volume of the subwoofers turned all the way down and slowly increase the volume until a smooth transition is achieved. After a rough level match is accomplished turn the subwoofers down in volume [approx. -3db] relative to the satellites. If the system is "fat" sounding with too much mid bass [frequencies between 130 and 350 Hz] increase the spread of the satellites farther apart from each other *IN SMALL INCREMENTS*! *GO SLOW*. The mid bass will thin out until the proper balance is reached. Conversely, if the system lacks mid-bass the satellites should be moved closer together. *AGAIN GO SLOWLY*.

When the proper tonal harmonic neutrality is reached [the most frequent spread is 9 feet center to center] final adjustments involve proper aim or "toe in". Select a piece of music that contains a strong center image, such as a singer, with good surrounding instruments. Being careful to maintain their room position turn the speakers so they aim straight ahead pointing directly out into the room. Start the music. *SLOWLY* aim the speakers more directly at your listening position only moving them a few degrees at a time. The center image will lock into focus and the other instruments will maintain a wide image spread. Continuing to toe in the speakers will compress the sound stage while not improving the focus of the center image. *TAKE YOUR TIME*. Settle on the best presentation with solid center focus and wide soundstaging. You will find the more lively the room the more directly the satellites will point straight out into the room. When proper positioning of the satellites is achieved you may now *SLOWLY* bring up the volume of the subwoofers until proper volume is achieved. Treating the spread of the

subwoofers as you did the satellites will also affect the mid-bass in much the same way. If too much mid-bass is present, move the subwoofers wider apart in 1 foot [total] increments until the system is properly tuned. You now have a properly functioning Cerous **PARM** System.

TECHNICAL INFORMATION

The Subwoofers:

Each Unity Audio Cerous **PARM** Subwoofer contains two 12" woofers utilizing Cerous Composite Ceramic Cones (C_4), rubber surrounds, cast frames, 3" voice coils and HUGE vented magnet structures. Each woofer can handle bursts of 1800 watts and sustained clean power of 400 watts for extended intervals. These woofers fire in direct motional opposition to each other [when one is moving down the other will be moving up] so the cabinet "sees" no change in the center of gravity. This aids to greatly reduce cabinet vibration and motion.

The cabinet is constructed of laminations of solid Fountainhead, with no sections less than 1" thick. The greatest mass is concentrated at the cabinet center of gravity, which is also the center of the cabinet. The center of each woofer cabinet is a solid laminate of Fountainhead 14" *THICK*! Cabinet construction is of space age cyanoacrylates that bond at a molecular level. These adhesives are superior to other bonding agents because they do not form an Impedance gap between the two pieces to be bonded. In simpler terms, the two pieces will behave as if they were one piece molded together as one, instead of two separate panels that are "touching" in one place. This is a key element of the **PARM** cabinet structure, in that the entire cabinet behaves as *one structural element.*

The last key to structural resonance control would reside in the ability to eliminate the large air masses that occupied standard subwoofer systems. In acoustic structures resonance's occur through two forms of excitation - vibration and transmission. Vibrations transmitted directly from the driver to the cabinet can be controlled by cabinet rigidity and mass, but, energy carried by the air mass that occupies the cabinet are extremely random and hard to control. Focusing on this problem and treating this air mass as a *ENERGY* transmission medium [*ENERGY* can not be created or destroyed] it proved a monumental task to dissipate this energy in any practical fashion. Through extensive computer modeling and mathematical analysis, a cabinet design was formulated that *DID NOT VARY WITH INTERNAL VOLUME*!!! Therefore, the medium by which resonance is carried throughout a loudspeaker cabinet could be effectively eliminated. With no air mass inside to "carry" the sound around no resonance's could be transmitted from one area of the cabinet to another. For this reason each Unity Audio Cerous **PARM** Subwoofer contains minimal damping materials inside to absorb "sound". Small pieces of foam are employed to couple the woofer baskets to the cabinet sides for damping of *VIBRATIONAL* resonance's.

The result is a subwoofer system that is -3 db down at 23 Hz [real world] with an efficiency of over 94 db 1 watt/ 1 meter with virtually no internal volume! These subwoofers employ NO equalization or frequency contouring. The "**IMPOSSIBLE**" subwoofer is now a reality. Each Cerous **PARM** subwoofer weighs 127 pounds each.

The Satellites:

The satellites share the same structural qualities as the Unity Audio Cerous **PARM** Subwoofers. Vibrational resonance's, however, are handled quite differently. Vibrations at high frequencies were found to be an extremely important aspect of inner detailing capabilities. If you look at a tweeter it must start and stop thousands of times a second and any vibration of the cabinet will cause a loss and smearing of information. The greatest cause of vibration to the tweeter is from the midrange transmitting vibrations to the cabinet. Bracing alone proved to be ineffective as a cure to this problem.

Unity Audio took a radical approach to this problem. An identical driver [another midrange] is mounted to the rear of the cabinet and operated in parallel with the main midrange. The position and mounting of this driver were fine tuned to transmit an opposite vibration into the rear cabinet wall forming a vibrational null spot located in the exact spot the tweeter is located. This is one reason why the high frequency performance of the Cerous **PARM** is so dynamic and uncolored. This also leads the Cerous **PARM** to be brutal to ANY shortcomings found in equipment or sources that precedes it [especially those of digital artifacts].

The most radical feature of the Cerous **PARM** loudspeaker cabinet is the engineering address to how a loudspeaker cabinet dissipates energy. Research has shown that the "contradiction" exists that the "deadest cabinets" see the most improvement from the resonance control devices such as Combak dots and other control devices. This, on the surface, is a contradiction, but after analyzation, we see that it makes great sense. If we realize the *true* reason that our cabinet exists, we can see why this relationship occurs.

The enclosure exists to dissipate the rear wave that is emmitted from the back side of the cone. If a cabinet is totally rigid and "dead" then, by definition, it is not capable of vibrating to dissipate energy. With this in mind, we must realize that the only way this cabinet can absorb and dissipate the rear wave is through the materials (damping materials) stuffed inside the box. This creates real problems.

An anechoic chambers is a large structure made to absorb all the sound from a loudspeaker so it may be tested with no reflected sound from the environment. A anechoic chamber designed to work properly to only 50 Hz must be the size of a football stadium and filled with absorbative material. If we realize that a dynamic driver (such as a midrange or woofer) puts out as much "sound" from the back of the cone as from the front of the cone we can begin to see the contradiction. If we need a structure like an anechoic chamber to absorb the front firing energy, then why do we feel we can absorb the rear wave with a shoe box and some foam? Clearly, we cannot.

The Cerous **PARM** enclosures are the first ever designed to fuction as the real reason for an enclosure, that of an energy sink. The enclosure must draw the rear wave away from the back of the driver and dissipate this energy, or it will be reflected by the enclosure and "come back out" through the driver cone. The Cerous **PARM** enclosure functions in precisely this way. The ribbed sides of the satellite enclosure act as vibrational "dampers", each a different width and, therefore, each operating over different frequency spectrums. These side panel "sinks" function like heat sinks on power amplifiers, serving to vibrate and dissipate the energy from within the enclosure.

A cabinet that serves to preserve the integrity of the signal generated by the drive units would only be well served by the best of drive units. For this reason you will never find a paper cone driver in any Unity Audio design. All drive units employed in the Cerous **PARM** employ the world's first all ceramic cone drivers - Cerous Composite Ceramic Cones (C_4). For a detailed explanation of the advancements of these designs ask your Unity Audio Dealer for the white paper dedicated to the technology behind this breakthrough cone technology. For the first time dynamic drivers, utilizing C_4 cones, are capable of behaving as pistons throughout their entire operating range, delivering a uniform flat frquency *and phase response* with virtually no unwanted resonances. With the cabinet technology and C_4 drivers employed in the Cerous **PARM** we now come to the final, and possibly the most important, piece of the puzzle.
The passive crossover...

The Passive Crossover:

Unity Audio has been a pioneer in the technology of loudspeaker crossover design for many years. Unity Audio's radical Balanced Class A Crossover technology was the first to address time constants (the time delay element of a circuit) in both the positive *and negative* signal paths. From this research has come an even greater departure from traditional crossover theory - *The Unity Audio Passive Derivative Crossover*.

This crossover technology allows, for the first time, that the functional employment of all crossover functions can be carried out *outside of the signal path*! The best sounding passive device (capacitor, inductor) is nothing at all in the signal path.

The *Unity Audio Derivative Passive Crossover* functions identically (electronically) to a normal crossover. The key element of the Derivative Crossover is that during the frequency band deviding of the signal

The PARM