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**“...this was the closest I'd been to realistic concert hall bass in my personal audio system.”**

## Review at a Glance

<b>Sound</b>	Loud, clean and taut bass -- "can deliver 20Hz bass at levels in excess of 100dB"; external crossover is very transparent.
<b>Features</b>	Servo-controlled 15" driver; built-in 400W amplifier; external active crossover/controller with phase adjustment; can be purchased with internal crossover too.
<b>Use</b>	Three low-pass adjustments -- 50Hz, 80Hz and 120Hz -- as well as phase should make it easy to get good results with different speakers in different rooms.
<b>Value</b>	A lot of technology for \$1500; can truly boast significant bang-for-the-buck!

By

Frank Alles

**“STRIKING...  
VISCERAL... PALPABLE.”**

There aren't many components that can access the audio reviewer's inner-child with greater vigor and rapidity than a big *baaaad* subwoofer. I am very proud of myself for resisting the urge (most of the time!) to crank the gain of the Servo-15 to unduly exaggerated and punishing levels -- such levels proved to be more punishing for other household members than for myself. Although my listening room is set up in a finished basement, it is my understanding that some extraneous rattles and buzzes were happening up on the main floor and made my poor wife feel somewhat ill at ease. In fact, on at least one occasion I heard her make a hasty retreat from the epicenter at Rancho de Paco (our humble abode) shortly after the tremors began...

The Servo-15, as its name implies, contains a BIG 15" servo-controlled bass driver. How BIG is it? Well, I'll tell you -- it makes the 10" woofers in my InnerSound Eros speakers look like midrange drivers! Actually the Kevlar-fiber composite cone measures about 15", while its massive die-cast aluminum frame measures 16" to 17 3/4", making it appear more like an 18" woofer. The cabinet itself is a sealed enclosure, measuring a modest 20"H x 18"W x 23"D and weighing in at about 80 pounds. A pop-off black fabric grille with the Paradigm logo adorns the front baffle of the front-firing driver. Four large black plastic feet couple the subwoofer to one's flooring and make the woofer easy to slide around the room (I wonder if the Vibrapod people know about this!).

The enclosure is made from medium-density fiberboard (MDF). It is internally braced and



extremely rigid. The front and rear baffles use self-locking joints and there are two full-perimeter vertical braces that are implemented in what Paradigm calls a "Cascade" design. One brace connects the top and bottom to the two sides, and the other brace connects the front and rear baffles. The standard finish is black-ash laminate, which ain't real wood, but is unobtrusive and quite durable. Optional light-cherry or rosenut wood veneers are available at extra cost.

**“The X-30 crossover/controller unit was particularly transparent and did not seem to colour, cloud, or distort the presentation in any perceptible manner.”**

A 400-watt power amplifier is built into a removable panel mounted to the back of the enclosure and has a single RCA input with a level control. There is a female IEC receptacle for use with detachable power cords, but for some reason the third prong (ground) is not used. My guess is that this is done to circumvent potential ground-loop problems.

The amplifier has servo circuits that work in conjunction with an accelerometer that is bonded to the voice coil under the woofer's dust cap. The result is a closed-loop system that compares the output of the accelerometer to the input signal, and then corrects any incongruity in the driver's motion. Furthermore, the amp has protective circuitry that guards against excessive clipping and limits the maximum cone excursion in the event of a gross overload. Reportedly, the Servo-15 is capable of nearly 115dB output at 40Hz -- without factoring in room gain. Yikes!

**“I was VERY impressed with the neutrality of the X-30 crossover... the usual signal degradation that occurs whenever an audio signal is passed through active circuitry was virtually non-detectable ... the soundstage was expansive, the dynamics were unbridled and the frequency balance was virtually unaltered.”**

The most user-friendly part of the package is an active crossover module, dubbed the X-30, that is included in the price of \$1500. The X-30 is also sold separately for \$159, for use with other subwoofer systems. This diminutive device, measures only 1.85"H x 7.25"W x 5"D and uses a 24-volt wall-wart power supply that plugs into its rear panel. Also included is a decent-quality 23-foot umbilical that links it to the Servo-15, so you can locate the controller wherever it's convenient, normally near your preamplifier.

The X-30 employs high-quality active circuitry. The high-pass section topology is third-order active Sallen-Key, implementing a Butterworth transfer function.

Butterworth is claimed to give the best compromise between attenuation rate and group delay. The X-30 uses 1% metal-film resistors and 5% metal/polyester-film capacitors. The low-pass section also uses a third-order, 18dB/octave slope, and it has two mono RCA subwoofer outputs that can be run independently or together.

**“...power and precision that was as undeniable as it was satisfying.”**

Please note that the X-30 is a line-level device, made to work in conjunction with a stereo preamplifier's main outputs. It will also work with receivers or integrated amplifiers that have variable preamp line outputs -- *not tape outputs*. In the case where you have an integrated amp or a receiver that lacks a variable preamp line output, you will need to order the Servo-15 with the X-20 crossover/controller, which is equipped with amplifier/speaker level inputs as well as a line-level input. This is a good choice if you are presently using a receiver, but plan to upgrade to separates in the future. With either crossover, the price is the same. The drawback to the X-20 is that the high-pass section allows for only one crossover point, fixed at 125Hz. With the X-30 you can select one of three fixed crossover frequencies: 50Hz, 80Hz, or 120Hz. Both the X-20 and the X-30 have variable pot-controlled low-pass sections that let you roll the subwoofer off at any frequency between 35Hz and 160Hz.

**“The low notes on “Gnomus,” as reproduced by the Servo-15, were visceral and palpable. And I did get a sense of the dimensions of concert hall, which made the performance all the more convincing.”**

The other front panel controls are a 0-to-180-degree phase control and a volume control. I found the variable phase control to be a particularly useful feature. When the subwoofer is not located in the same plane as the main speakers, as will be the case in many installations, time-delay errors will occur and result in cancellations and suck-outs of other bass

frequencies. Indeed, I found that with the subwoofer and the main speakers operating in the same *electrical* polarity but in different physical planes (the 0-degree position) I did in fact experience attenuation at other midbass frequencies. In fact, not only did this *acoustically* out-of-phase configuration result in nonlinearities in the bass, but I thought I detected a mild dynamic compression of midrange frequencies as well. With the driver of the Servo-15 located about 20 inches behind the Eros' woofers, I found that I needed to rotate the phase control to around the 150-degree mark to get the most linear bass performance. This way, in effect, the woofers work in unison from an acoustic perspective. The detailed instructions that come with the crossover walk its user through the simple process of dialing-in this very useful feature (as well as the other control functions).

The good news is that upon inserting the X-30 in my system, I was elated to find that, contrary to my preconceptions, the usual signal degradation that occurs whenever an audio signal is passed through active circuitry was virtually non-detectable. That is to say that the soundstage was expansive, the dynamics were unbridled, and the frequency balance was virtually unaltered. It was perhaps a hint brighter-sounding with the X-30 -- but if it was, it had to be considered a subtle hint. In fact, I found the X-30 to be so transparent, even when played through the very revealing InnerSound Eros speakers, that I dare say if Paradigm were to offer switchable input selection and a master volume control on this crossover it would obviate the need for a separate line stage preamp in many instances.

### Setup

My analog source was a Townshend Audio Rock Mk III 'table with a modified Rega RB-300 tonearm. The cartridge was a Transfiguration low-output moving-coil, which fed a customized AHT/P phono stage. Wireworld Equinox III interconnects linked the phono preamp to an AHT tube line-stage preamp. Digital duties were assumed by a Parasound C/BD-2000 transport, which fed crispy digits to the Parasound D/AC-2000 Ultra processor via the Harmonic Technology Cyber-Link Silver coaxial digital cable.

The signal from the AHT line stage was delivered to the InnerSound crossover/bass amp by way of Wireworld Equinox III interconnects. From there, Monarchy's SM-70 power amps (used as bridged monoblocks) fed the electrostatic panels of the InnerSound Eros speakers. The InnerSound bass amp drove the woofer sections.

I first introduced the Servo-15 to my system through the X-30 active crossover and fed from a second pair of outputs on the AHT preamp. The low-pass section was dialed to about the 40Hz mark, while the high-pass section was bypassed allowing the Eros' woofers to roll off naturally. This configuration worked very well for me and had the advantage of not running the signal to the main speakers through X-30 crossover's active circuitry. On balance, I'd say that the midbass was slightly leaner this way, but had greater palpability and detail.

Next I tried using the high-pass section of the X-30 to run the main speakers. I got very good results using both the 50Hz and the 80Hz settings. With the 50Hz cutoff, my results were surprisingly similar to the bypassed configuration described above. I was VERY impressed with the neutrality of the X-30 crossover. It was very hard to tell it was in the system.

**“a most impressive package... solid construction... with high quality parts... The X-30 crossover/controller unit was particularly transparent and did not seem to color, cloud, or distort the presentation in any perceptible manner.”**

Using the 80Hz cutoff point, which is the one I suspect many audiophiles will opt for, also yielded commendable performance. The midbass was a tad fuller and had slightly more impact, but it lost a tiny bit of dexterity. This was evident on Erykah Badu's "Certainly" from Erykah Badu Live [Kedar UD-53109] as a mild obfuscation of the incisive electric-bass licks of Hubert Eaves IV. The Eros, with their transmission-line woofers, are more nimble in the lower octaves than many speakers, so I suspect that with quite a few good speaker systems, no loss of finesse would be evident with the Servo-15 used at the 80Hz mark. As it was, I found that with many recordings I was willing to trade the slight reduction in agility for this somewhat fuller and punchier presentation. Truth be told, I think that the 80Hz crossover point provided the best overall bass performance -- not necessarily the truest to the source, but the most FUN!

Using the active high-pass section of the X-30 does entail an extra set of interconnect cables; but then, only one set of outputs is used on the preamplifier or source. With either the 50Hz or 80Hz positions I was able to get away with placing the subwoofer near the room corner to the right of the main speakers. This is because low bass below 100Hz is non-directional and will not upset the stereo imaging. Corner placement of the sub results in the most reinforcement of low-bass frequencies, so this worked out well for me.

**“Paradigm has garnered very high marks on my personal tally sheet for the R&D that made this relatively affordable and impressive product reality.”**

Going to the higher 120Hz crossover point would likely necessitate that the Servo-15 be placed close to the midpoint between the main speakers to preserve the imaging integrity. Above 100Hz most humans can discern and thus locate the source of the sound. The other way to circumvent this (arguably the better way) would be to use two subwoofers, with one on each side. If your subs lack a phase control, you'd need to locate them in the same plane as the main speakers, and in close proximity, to avoid those cancellations I discussed earlier.

### Good vibrations

My listening tests confirmed that the Servo-15 subwoofer is a very solid performer. In most cases it will seem more "solid" than the dwelling in which it is used. Because this woofer can deliver 20Hz bass at levels in excess of 100dB, it is also capable of rattling windows, paneling, doors, and other objects that would not normally be affected by your main speakers. But after you batten down the hatches, you'll be in for quite a thrilling voyage.

When a good subwoofer is properly set up, on most recorded material, you should scarcely be aware of its presence, and I found this to be the case with the Servo-15. On most of my recordings with strong midbass content (bass between 40Hz and 80Hz) the Servo-15 didn't make much of a difference. In fact, depending on how its controls were set, in some instances there appeared to be less apparent bass. However, digging

into my collection of bass-rife CDs, I was able to produce a few recordings where the difference was both impressive and dramatic.

First I went to US 3's Hand On The Torch [Blue Note CDP 0777 7 80883 2 5] because track 6, "Cruisin'," has a room-swallowing undertow that literally shakes the walls in my listening room -- causing one wall in particular to buzz judiciously if the woofer in question can produce the low-bass beat with the proper amount of gusto. I believe that the beat is centered just above 25Hz, and it's fairly constant throughout the song. This one really impresses unsuspecting visitors. I'm happy to report that the feisty Paradigm Servo-15 did not disappoint. I had to go into the adjacent room to get the full effect, and I must report that my wall was shakin' to a most satisfying degree.

Next up was the title track from Béla Fleck's *Flight of the Cosmic Hippo* [Warner Bros. 9 26562-2]. On this cut I try to recall the scene from Disney's *Fantasia* that features hippo-ballerinas in tutus doing pirouettes with some caped swashbuckling alligators. At any rate, I have to say that both the agility and quantity of those quavering synthesizer notes presented me with the most lifelike illusion of the aforementioned allusion that I've ever had the pleasure to experience. OK, "Dance of the Hours" it wasn't, but it worked for me.

On Madonna's "The Power Of Good-Bye" from *Ray Of Light* [Warner Bros. 9 46847-2], the power of good-bass was striking. The low sustained synthesizer notes locked to the room with power and precision that was as undeniable as it was satisfying.

But the one area where I truly came to appreciate the virtues of the powerful pedigree was with full-scale symphonic works and pieces involving large organs -- pipe-organs, to be more specific. Seeking out one of my all-time favorites from Mussorgsky's *Pictures At An Exhibition* [Dorian DOR-90117], I braced for impact. This recording features Jean Guillou, playing the Great Organ of the Tonhalle, Zurich and was recorded in July of 1988. The low notes on "Gnomus," as reproduced by the Servo-15, were visceral and palpable. And I did get



a sense of the dimensions of concert hall, which made the performance all the more convincing.

Bass drum was another instrument that was particularly well served. For example, the gratuitous blasts punctuating the finale of Copland's "Hoe Down," *from Rodeo--Aaron Copland: The Music of America* [Telarc CD-80339], seemed to reach a bit deeper when played via the Paradigm puppy. It added more solidity and weight to the instrument, but without the smear or overhang typical of lesser designs. For me, this was the closest I'd been to realistic concert hall bass in my personal audio system.

In comparison to my AudioPro B 250 subwoofer, the Servo-15 could play louder without any distress; and because the B 250 lacked a phase control, the bass spectrum sounded more linear and correct through the Servo-15.

I also listened to a pair of Bob Carver's Sunfire True Subwoofers (not the Signature) at the home of a fellow reviewer. These were mated to a pair of Quad 63 ESL speakers. As I recall that listening session, the True Subwoofers produced copious quantities of low room-shaking bass. However the dexterity did appear to suffer, because the midbass of the Quads seemed noticeably more articulate sans subs. In the same system, the Gradient subwoofers offered greater finesse and detail when paired with the Quads, but could not match the Sunfires' ultimate extension and power.

## Conclusion

The Paradigm Reference Servo-15 subwoofer is surely a most impressive package. It combines solid construction with high-quality parts and comes with a serviceable, built-in 400-watt amp. The X-30 crossover/controller unit was particularly transparent and did not seem to color, cloud, or distort the presentation in any perceptible manner. It allowed me the facility and flexibility to maximize the performance of the Servo-15 and to integrate it successfully into my audio system. I was able to achieve a seamless blend with the InnerSound Eros speakers, which possess a respectable and adroit bottom end in their own right.

Any audiophile who has experimented with adding a subwoofer to his own system can attest to the fact that this is an accomplishment that cannot be taken lightly. Paradigm has garnered very high marks on my personal tally sheet for the R&D that made this relatively affordable and impressive product a reality.

# SERVO-15

