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Compact Speakers

Avantgarde Solo

This speaker is a dynamite choice for home theater, especially for all of you who want your system to play impressively loud, but don't have rooms with enough space to accommodate the large speaker enclosures usually needed to furnish truly loud sound. The Solo marks an interesting departure for Avantgarde, and involves a lot of fresh thinking and innovative engineering.

Avantgarde has a proud heritage of making speaker systems that can play very loud and very clean. All their systems to date have been front horn loaded over most of the spectrum, which gives them very high efficiency, high power handling capability with low distortion (because both sides of the diaphragm are loaded), and hence very clear, clean sound up to very loud levels. But all these Avantgarde systems have been large in size, with full size straight axis (non-folded) front horns. They're great if you have a large room and want to set up just two speakers for stereo. But if you want to set up five to seven speakers all around you for home theater, things could get a bit crowded, especially if your room is merely ordinary in size.

Enter the diminutive Avantgarde Solo. Its size is utterly astounding for a horn loaded speaker system, merely 18 inches in

diameter by 17 inches deep. And within this volume the Solo also contains a 250 watt power amp to drive the whole speaker system. Visually reminiscent of a portable outdoor speaker in a round plastic case (as put out years ago by Electro Voice and others), the Solo conveys that same portable, put-me-anywhere message. And you can easily put it just about anywhere. Because it has its own built-in front horn loading, and its own controlled directivity, you can put it anywhere in a room and it will do fine (in a corner, against a wall, facing down from the ceiling, free standing, etc.). Thanks to its compact size, it will fit just about everywhere, so you can optimize its placement to give you the very best surround sound experience (see IAR issues 68-70 for discussion of how to optimize surround sound systems). The only caveat is that your mounting will have to support the Solo well; this cute little baby is built like the proverbial brick, and weighs in at 84 pounds (special mounting brackets and stand are available from Avantgarde).

Even more surprising than the Solo's diminutive size is its great sound, and also the span of its frequency range. The upper mid-range and treble is covered by a single driver, the same H1 compression horn tweeter de-

veloped for the recent 2.0 update of Avantgarde's large UNO speaker system. Avantgarde's tweeters all do an excellent job covering music's upper frequencies, and this H1 tweeter is based upon the design of Avantgarde's very best tweeter, the H3 used in their most expensive large system, the TRIO. Testimony to the seriousness of this tweeter is that its magnet assembly alone weighs 6.8 pounds. This tweeter can cover the wide spectral span of 800 Hz to 20,000 Hz. This means that all of music overtones and transient articulation comes coherently and with a single voice from a single driver in the UNO. Furthermore, thanks to this tweeter's high power handling capability, it can be crossed over with a single pole (6dB per octave) slope, which gives the Solo ideal transient response and also allows its two drivers to be phase coherent with each other (see IAR Journal 1-2 and later issues for further discussion).

Covering the entire range from 800 Hz to 20,000 Hz from this one tweeter driver also means that this wide spectral span is radiated by a single point source, instead of from two different driver sources as in many conventional speaker systems (this wide range is usually handled by separate midrange and tweeter cone and/or dome drivers). This single point source radiation improves stereo (and surround) imaging, and also provides better temporal coherence and better harmonic coherence for all music.

The Solo then takes this point source concept, with all its sonic advantages, a step further. The tweeter is coaxial with the woofer. So the entire musical spectrum comes from a single point source in the Solo. This means that the Solo's sonic advantages in ste-

reo (and surround) imaging, and in temporal and harmonic coherence, obtain over the whole musical spectrum. The 6 db per octave crossover between these two coaxial drivers then further enhances this coherence, by being transient perfect and phase coherent.

In most other coaxial drivers, the woofer cone forms part of the horn for the tweeter, or at least sits in the radiated field of the tweeter. This can introduce problems of modulation distortion (for example, the woofer cone moving at low frequencies can

modulate the acoustic pressure waves of the tweeter that are radiated at the woofer cone). Lipshitz and Vanderkooy have written an excellent paper, available through the AES, which with great imaginative flair examines several kinds of modulation distortion in coaxial drivers.

The Solo's coaxial design cleverly avoids these modulation distortion traps, and thus sounds cleaner and clearer than other coaxial designs. The Solo's tweeter does not use the moving woofer cone as horn, but instead has its own rigid molded horn.

Furthermore, this tweeter horn, with its controlled radiation directivity, insures that the acoustic output of the tweeter does not even encounter the woofer cone. Finally, this molded tweeter horn also acts as a phase plug for the 12 inch woofer, extending its usable response at its upper end, so that it too can be rolled off at merely 6 dB per octave, thus completing both sides of the Solo's transient perfect, phase coherent crossover.

We now come to the most radical aspect of the Solo's engineered design. The *raison d'être* for the Solo is compact size, which restricts the woofer horn to being only 18 inches in diameter. But this small a horn can bestow its horn benefits, augmenting the



woofer's acoustic output and acoustically matching it to the room air impedance, only for the lower midrange. Within the warmth region, and certainly for all the bass regions, this small a horn ceases to provide these acoustic benefits, so the Solo's woofer becomes a direct radiator, without front horn loading. This would mean less net acoustic output, hence a lowered amplitude response, for these bass and warmth frequencies.

But the Solo claims frequency response down to 30 Hz. How does the Solo's design provide this? Since the power amp is included within each Solo speaker, this power amp's frequency response can easily be tailored to complement that of the speaker drivers, in order to provide net overall system response that is flat. In this case, the signal fed to the woofer must be boosted, at frequencies below where the small horn no longer provides its benefits. This in turn means that the woofer driver will undergo very large excursions for music's lower frequencies, even more than woofers in normal systems, since its power input is boosted by the tailored power amp at low frequencies. To insure that the woofer driver could take these large excursions, and still deliver high fidelity sound without distortion, the Avantgarde engineers bit the bullet and designed a very heavy duty, expensive woofer. Though the woofer driver is only 12 inches in diameter, it employs a massive 8 inch diameter magnet structure weighing 19.1 pounds, and uses a 4 inch voice coil (such a large voice coil, pioneered by JBL, maintains better control of the cone during stressful large excursions, and also allows louder volume, because its larger radiating circumference can dissipate more heat).

Because the signal to the Solo's woofer from the built in power amp has a custom tailored frequency response, the woofer cone does not have to be made heavy in order to provide a low frequency resonance in an enclosure. So instead the woofer's cone can be made very light. In combination with the very strong magnet, this light cone gives the Solo's woofer driver very high efficiency. This in turn means that the built in power

amp can easily drive the woofer to very loud levels, and still have plenty of dynamic headroom to provide realistic crest factors for your listening enjoyment. The Solo's driver complement is rated as having a high 97 dB sensitivity, and its power amp delivers 250 watts, so naturally the Solo can accurately play the peak crests of very loud transients without flinching.

Music's instantaneous transient peaks have a very high crest factor when heard live, but most conventional speaker systems compress these peak crests, thus robbing their reproduction of the dynamic impact and vividness that you hear from live music. Speakers with front horn loading are noted for preserving this dynamic impact and vividness, thereby bringing you closer to the sound of live music in this aspect. The larger Avantgarde horn systems have this quality, and the diminutive Solo preserves this heritage. That's a remarkable engineering achievement in such a small package.

Reproducing dynamic crest factor accurately is very important also for home theater sound. Sound effects are rich in very high transients. If these transients are reproduced accurately, they add to the impressive thrill of the soundtrack, and they enrich the sheer believability of the whole home theater experience. As we discussed in IAR issues 68-70, the most important factor in home theater is the believability of the surround sound field. If the surround sound is believable to your ear/brain, then you will be transported out of your room and into the venue of the film. You will be there, not here. Indeed, the audio of your home theater system is even more important than the video. No matter how good your video is, it is still merely a two dimensional screen that is only in front of you; it does not surround you and does not define your environment. But a good surround audio system does define your environment, all around you. It alone has the power to make you suspend disbelief.

Other speakers that compress dynamic peaks fail to deliver the realism that can define an environment and make you believe. Furthermore, under the stress that

makes them compress dynamics, these other speakers also make extraneous noises and distortions. These spurious noises and distortion detract from the realism of the sounds of the film soundtrack. They also further detract, from the believability of your being transported to another venue, because your ear/brain localizes these spurious straining noises and distortions as coming from your speakers in your listening room, not from the surrounding environment field of the other venue recorded in the film soundtrack. So your ear/brain, hearing these repeated straining noises and distortions localized within your listening room, will constantly be reminding your subconscious that you are still trapped within your listening room, and it will not believe that you have been magically transported to the surrounding environment of the film venue. These straining noises and distortions keep pulling you back into your listening room, so you never really believe.

The Avantgarde Solo, by reproducing these high peak dynamics accurately, provides a more realistic and thus more convincing surround sound field to transport you to that other venue in the film. And, because the Solo reproduces these dynamic transients without strain or coloration, it does not emit spurious sounds that would detract from the alternative venue illusion and pull you back into your listening room.

The Solo is also free of the colorations that most front loaded horn systems have. We are very sensitive to horn coloration, and indeed we hear a slight bit of it in the low end of the midrange from Avantgarde's large TRIO and DUO systems, and in the high end of the midrange from the UNO. But the Solo covers the midrange in a different manner, and we don't hear this coloration.

The Solo's built in power amp affords opportunity for further signal manipulation, giving you the user considerable flexibility. The bass contour is user adjustable, to optimize it for corner placement of the speaker vs. wall or free standing placement. The treble contour can also be adjusted, to suit

listener preference, to compensate for overly dead room acoustics, or to allow placement behind a projection screen. An input volume control allows you to match system sensitivity to a subwoofer, or to be optimum for the output level from your preamp or surround processor.

There is also a built in user adjustment for choosing rolloff frequency for the woofer at its low bass end. You can use this merely as a subsonic filter to lessen excess woofer excursion from infrasonic energy, thereby reducing modulation distortion of its lower midrange musical output (see IAR issue 8 for discussion). Or you can exploit this adjustment to use it as an electronic crossover, for mating the Solo with a subwoofer. This could give you even better bass than the diminutive Solo is capable of, while giving you even cleaner lower midrange with even less modulation distortion, since even the excursions for normal musical low bass would be offloaded from the Solo's woofer (remember that these excursions are larger than usual, thanks to the necessary equalizing boost of bass frequencies by the Solo's power amp). This adjustment can be varied anywhere between 25 Hz and 70 Hz, or can be switched off entirely (thus allowing even subsonics to drive the Solo's woofer).

The Avantgarde Solo gives you an amazingly complete system, of extraordinary capability, in an amazingly compact and convenient package. Considering that you get such an impressive speaker, plus a power amp, plus an electronic crossover, the Solo's price of \$3485 each is excellent value. They equal or surpass the sonic capabilities (including dynamics) of most huge tower speakers, using conventional direct radiating cone drivers, that sell for \$20,000 or more for just one pair (and also require you to buy an expensive monster power amp to drive them). Put five of these compact Avantgarde Solos in your home theater, and you will have mind blowing sonics, for less than the price of a mere pair of those huge tower speakers.