

## TAD REFERENCE ONE LOUDSPEAKER (TAS 218)

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Most audiophiles don't know this, but in 1975 Pioneer Electronics created a kind of "skunk works" to develop highly advanced, cutting-edge loudspeaker technologies for the professional audio market. This division, called Technical Audio Devices (TAD), operated much like a completely independent research laboratory. The combination of solid funding, contributions from some of audio's brightest thinkers, and a mandate to create products that broke new ground resulted in several patents, Audio Engineering Society papers, and some remarkable inventions. This division's very name speaks volumes about their charter; no flowery language or marketing spin, just the words "technical," "audio," and "devices."

One of the innovations that arose from this development effort was driver diaphragms made from beryllium. Beryllium is the hot buzzword today—and for good reason. It is extremely light and stiff, making it the ideal material for driver diaphragms. Rockport, Magico, and Focal are among the ultra-high-end loudspeaker companies now using beryllium tweeters. But 35 years before this renaissance in beryllium, TAD developed proprietary processes for working this notoriously difficult metal into the specialized shapes of loudspeaker cones and domes. In fact, the techniques they employ today remain unique.

In 2000, TAD decided to create a division that would bring to the consumer market some of the technologies the company had developed for the professional audio world. They hired the talented loudspeaker designer Andrew Jones, who had spent much of his career at KEF working with legends of British loudspeaker design including Raymond Cooke, Laurie Fincham, and Peter Baxandal. Jones' first product for TAD was the Model One, an audacious ground-up design whose massive cabinet was built from horizontally stacked birch ply. This construction was revived a few years later by Magico in the Mini, scaled down in size by an order of magnitude. The Model One was a sonic success (our Anthony H. Cordesman bought a pair), but the enclosure turned out to be just too difficult and expensive to manufacture.

The Model One was notable not only for its heroic enclosure, but for its concentric midrange/tweeter, both made from beryllium. Many of the best loudspeaker companies design stiff cabinets, but a concentric midrange/tweeter driver is quite rare. In a concentric driver, a tweeter is mounted at the center of the midrange cone. One advantage is perfect coherence between the drivers no matter what the listening position in relation to the loudspeaker. Jones had long worked with concentric drivers, specifically KEF's Uni-Q concept. But TAD was no stranger to concentric designs. When Jones did a patent search while researching prior art in preparation for filing his own patent application for a concentric driver, guess who owned the late-1970s patents on concentric technology? That's right—Pioneer and TAD.

## Reference One Overview

This background brings us to the subject of this review, the TAD Reference One. The direct descendent of the Model One, this new loudspeaker is based on the same fundamental principles of a stiff cabinet along with a concentric beryllium midrange/tweeter.

The first thing you notice about the Reference One is its rounded, graceful shapes. Within the bullet-shaped enclosure is a second bullet-shaped structure that is an extension of the front baffle. The lack of flat surfaces and parallel lines not only softens the Reference One's appearance, it also contributes a technical function in reducing diffraction. The main enclosure is veneered in gorgeous pommele sapele wood buffed to a high sheen. The

matte black baffle forms a beautiful contrast with the natural wood...

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The driver complement features dual 10" forward-firing woofers and a 6.5" beryllium cone midrange. Within the midrange cone's center is a 1-3/8" beryllium-domed tweeter. The midrange cone acts as a waveguide for the tweeter, and the concentric configuration confers many technical advantages. A large horizontal port runs across the bottom of the baffle. A flat aluminum plate, mounted at the curved enclosure's apex, holds two pairs of binding posts for bi-wiring. The plate also serves as a heat sink for the crossover. The enclosure itself is mounted on an aluminum base that provides support as well as threads for screwing in the three short spikes. I found that the spikes were not quite long enough to penetrate my thick carpet and pad—TAD should include a choice of spike length.

The Reference One's sensitivity is 90dB and the loudspeaker has a 4.1-ohm minimum impedance, suggesting that it's not too difficult to drive. At 330 pounds out of the crate, each Reference One is heavy, but not unmanageable.

## Listening

Setting up the Reference One was quite simple and fast—about 90 minutes from crates in the garage to final placement. The speakers seemed remarkably unfussy about location, but that could have been an illusion owing to designer Andrew Jones' vast experience in setting up his creation. I was surprised by the amount of toe-in Jones selected; the axes crossed in front of the listening position rather than at the listening seat or behind it.

If you want an example of just how low in distortion and coloration, and high in resolution, speed, transparency, and dynamics the best of today's loudspeakers have become, look no further than the TAD Reference One. This is one clean, quick, uncolored, and dynamic loudspeaker that exemplifies the advances in loudspeaker technology over the past ten years.

The Reference One's most salient characteristic is a pristine purity and clarity, starting in the midrange and extending to the top octave. There is simply no trace of grain, hash, or grit overlaying timbres. There is also no hint of micro-tonal colorations, resonances, or frequency response anomalies through the mids and treble. The entire midrange and treble region is forefront in the presentation, giving the Reference One a lively and vivid character. Upbeat music, such as big band or Latin jazz, is particularly well served by the Reference One's incisive presentation and visceral immediacy. The Reference One could get away with this somewhat assertive rendering because of the complete absence of glare, grain, or hardness of timbre, freedom from tonal coloration, ability to maintain clarity at any listening level, and sheer sense of openness, air, transparency, and top-octave extension. This presentation is consistent with TAD's roots in professional monitors, loudspeakers that are designed to reveal to the recording engineer exactly what the microphone feed or mastertape sounds like. If you want a soft, forgiving, and romantic sound, look elsewhere.

But if you want a transducer that presents every last bit of musical detail in your favorite recordings, you'll be hard-pressed to find a more resolving loudspeaker than the Reference One. The presentation through the Reference One is dense with musical information—the inner detail of instrumental timbres, the fine micro-dynamic structure of woodwinds for example, and subtle inflections of dynamics and timing that create a sense of contemporaneous music-making. No part of the music escapes the Reference One's microscope. It is interesting to hear how every increase in the source resolution, from CD to SACD to 176.4kHz/24-bit files to 45rpm LP, is laid bare and seemingly heightened by the Reference One.

A large part of the Reference One's sense of life and realism comes from this loudspeaker's stunning portrayal of transient detail; the Reference One reproduces the leading edges of transients with a speed and articulation that approach that of live music. Take an LP like *Friday Night in San Francisco*, virtuoso live acoustic guitar performance by Al DiMeola, John McLaughlin, and Paco de Lucia. On many loudspeakers, the multiple ultra-fast guitar lines can smear slightly, causing the music to congeal into one big sound rather than resolving into three individual instruments. Needless to say, this phenomenon reduces the music's coherence and expression. Through the Reference One, I had a greater impression of three distinct musical lines combining into a meaningful whole. In addition, the Reference One's mighty resolving power conveyed a wealth of subtleties in fingering, dynamics, and expression. The TADs vividly brought this recording to life. Some listeners might find the Reference One a bit too vivid on this LP, however. Al DiMeola's guitar, the brightest of the three, could get a bit etched and fatiguing. A guitar recording with a softer tonal balance, the stunningly natural LP *Misterio* from Strunz & Farah recorded by Kavi Alexander on the Water Lily Acoustics label, was absolutely transcendental through the Reference One. The TAD beautifully conveyed the delicate and intricate musical lines of the two guitars, revealing subtleties in the performance that fostered a deep connection with the musical expression. Similarly, comparing the CD and new SACD of Stevie Ray Vaughn's *Couldn't Stand the Weather*, I found the Reference One really benefited from the reduced glare and smoother treble of the terrific Mobile Fidelity remastering.

I loved the Reference One's big, powerful, and dynamic bottom end. The region below 100Hz had a wonderful warmth, weight, power, and richness, yet with no sacrifice in articulation or pitch definition. The midbass was a bit leaner than that of the Rockport Altair or Focal Stella Utopia EM, but with tremendous precision and pitch definition. This combination served orchestral music and rock equally well; basses and timpani were rendered with equal parts sonorous richness and tremendous dynamics, and bass guitar and kick drum formed a solid foundation for rock, blues, and some jazz. Moreover, despite the bottom-end impact, the bass was extremely articulate and "fast," the Reference One conveying a wealth of subtlety in pitch and fine dynamics. I could clearly hear the intricacies of virtuoso acoustic bass performances, from Ray Brown on the Bill Evans LP *Quintessence* (45rpm Analog Productions reissue) to Stanley Clarke on *The Rite of Strings*. The Reference One's bass power extended all the way down to the mid-20Hz region, but didn't quite reach into pipe organ territory (Track 9 of Rutter's *Requiem* on Reference Recordings, for example), at least in my room. This last point is moot for most listeners; very few recordings have information below 25Hz. The bottom line is that the Reference One has extremely satisfying bass reproduction, both in its visceral power that appeals to the body and in its articulation that appeals to the intellect.

The Reference One has a world-class sense of openness and transparency, engendering a strong impression of the loudspeakers disappearing. Vocals seem to hang in space, perfectly focused exactly between, and slightly in front of, the loudspeakers. The overall perspective is slightly forward and immediate rather than laid-back or reticent—no broad midrange dip here.

## Conclusion

The TAD Reference One is among a handful of the world's great loudspeakers, epitomizing low coloration, tremendous micro- and macro-dynamic agility, low distortion, high resolution, and a stunning sense of transparency. The overall presentation is lively, incisive, immediate, and highly detailed, qualities that contribute to the Reference One's ability to replace the playback hardware with a feeling of contemporaneous music-making.

There might be some listeners who find the Reference One too resolving, detailed, or "technical" sounding. There's no question that this is an unforgiving

loudspeaker that provides an unvarnished view of your playback electronics and the recording chain—for good or for ill. It's therefore important to match the Reference One with very clean sources and electronics. For listeners who like a dash of lush romanticism that rounds dynamics and softens timbres at the expense of resolution, transparency, and timbral realism, the Reference One probably isn't for you.

The TAD Reference One is clearly a world-class loudspeaker in every respect, from the innovative design through the beautiful execution. If you want to hear all the music locked away in your library with as little editorial interpretation as possible, and with the maximum conveyance of musical information the TAD Reference One is hard to top.

## Technical Description

Andrew Jones was charged with developing the next generation driver technology, and had at his disposal TAD's rich history, technology, and unique manufacturing capability. The concentric driver he developed is unlike any other in the world. In addition to a beryllium-dome 1-3/8" tweeter, the Reference One's 6.5" midrange diaphragm is also made from beryllium. Except for TAD's tweeter, all true beryllium tweeters today are made by stamping a dome in beryllium foil under high temperature, a process that precludes complex shapes. TAD had developed, in the 1970s, a vapor-deposition process for creating beryllium diaphragms in any shape or size. In addition, vapor-deposited beryllium has a different—and reportedly superior—grain structure compared with rolled beryllium foil which is stamped into domes. Vapor-deposited beryllium is stiffer than rolled beryllium, but is unbendable and will shatter under pressure. TAD is the only company in the world making vapor-deposited beryllium driver diaphragms. Vapor deposition also allows TAD to make the large midrange cone, which would be impossible with stamping techniques. The entire concentric driver is made by TAD in Japan, including casting the baskets, building the magnet assemblies, and creating the spider and suspension. Incidentally, Andrew Jones mentioned to me that in his 27 years as a loudspeaker designer, he has never used an off-the-shelf driver in any of his products; all the drivers have been designed from scratch for specific applications.

The concentric driver is a true point-source, with no nodal cancellation that results when the midrange and tweeter are physically separated on the baffle. The midrange and tweeter outputs sum perfectly regardless of the listening distance, listening height, or listening axis. In addition, the midrange cone acts as a waveguide for the tweeter, controlling the tweeter's dispersion so that at the lower end of the tweeter's frequency range, the tweeter's dispersion more closely matches the midrange driver's dispersion. These qualities allow the crossover to be simpler and less intrusive.

The Reference One's dual 10" woofers are made from scratch in TAD's Japanese factory. The factory makes every element of the driver, from the baskets to the spiders. The woofer features a unique magnet geometry that linearizes the magnetic-field strength in the gap. When this magnet is coupled with a very short voice coil, the result is a more linear drive throughout the diaphragm's entire excursion. Dual spiders help to stabilize the diaphragm at high excursions. The diaphragm itself is a tri-laminate construction of an acrylimide core sandwiched between two layers of aramid fibers. The voice coil has whopping 100mm (nearly 4") diameter.

The enclosure is made from 16 layers of 3mm MDF augmented with layered plywood. A spine at the enclosure's rear apex is 6" thick. This apex has been machined to a flat outer surface to hold the 1" aluminum plate that supports the crossover on the inside and binding posts on the outside. There are actually two separate baffles—the inner structure that is part of the main cabinet, and the outer part that is painted black. They are bolted together, and the woofer mounting bolts pass through both baffles. The total thickness is nearly three inches. Inside the enclosure birch ply braces stiffen the cabinet walls. Cabinet resonances have been tuned to be above the woofer's passband so that they are less likely to be excited. In addition, the concentric driver is mechanically decoupled from the enclosure. A slight tilt back of the baffle provides some degree of time alignment between the woofers and the concentric driver. The cabinet is made in TAD's Chinese factory. The crossovers are asymmetrical and feature non-classic shapes. Because of the coincident driver, the crossover has no effect on the radiation pattern or the way the drivers' outputs sum acoustically.

## SPECS & PRICING

- Type:** three-way floorstanding loudspeaker in a vented cabinet
- Driver complement:** two 10" woofers, one 6.5"/1.375" concentric midrange/tweeter
- Frequency response:** 21hz–100khz -10db (-3db point is 27hz)
- Crossover frequencies:** 250hz and 2khz
- Sensitivity:** 90db (2.83v at 1m)
- Maximum SPL:** 115db
- Nominal impedance:** 4 ohms (4.1 ohms minimum)
- Dimensions:** 21.75" x 51" x 27"
- Weight:** 330 lbs. each, net
- Price:** \$78,000 per pair

### Associated Components

bAlabo bC-1 Mk-ii preamplifier and bp-1 Mk-ii amplifier, Constellation Altair preamplifier and hercules power amplifiers; Meridian 808.3 and Meridian Sooloos system (ethernet connected), dCS puccini/u-Clock, and berkeley Audio design Alpha dAC, custom fanless and driveless pC server with lynx AeS16 card; iMac server with berkeley Alpha uSb interface; basis inspiration turntable with basis vector 4 tonearm, Air tight pC-1 Supreme cartridge; Aesthetix rhea Signature phonostage; Shunyata v-ray v2 and Audience ar6tS power conditioners; Shunyata Cxseries AC cords; transparent xl reference interconnects; transparent xlreference loudspeaker cables; Shunyata Anaconda interconnects and loudspeaker cables; billy bags equipment racks, ASC 16" full round tube traps