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Fujitsu Ten Eclipse TD712z

Robert Deutsch

LOUDSPEAKER



Fujitsu Ten Eclipse TD712z loudspeakers

DESCRIPTION Single-driver loudspeaker with dedicated stand. Drive-unit: 4.7" (120mm) glass-fiber-cone. Magnet insulation: EIAJ Grade 1. Frequency response: 40Hz–20kHz, –10dB. Impedance: 6 ohms. Sensitivity: 83.5dB/V/m. Power handling: Rated 35W/Maximum 70W.

DIMENSIONS 11.3" (290mm) W by 14.3" (365mm) H by 14.7" (375mm) D. Height on stand: 38.5–38.9" (987–997mm).

Weights: speaker, 26.5 lbs (13.3kg); stand, 28.7 lbs (13kg).

FINISH Silver.

SERIAL NUMBERS OF UNITS REVIEWED ZD700090, ZD700066.

PRICE \$7000/pair, including stands.

Approximate number of dealers: 5.

MANUFACTURER Fujitsu Ten Limited, 2-28 Goshō-Dōri 1-Chōme, Hyōgo-Ku, Kobe 652-8510, Japan. US distributor: Mickey Tachibana. Tel: (415) 244-8341. Web: www.eclipse-td.com.

All right, it's time for a pop quiz in Loudspeaker Design 101. Answer the following, and justify your answer.

What is the ideal number of drivers in a loudspeaker system?

- a) two
- b) three
- c) four or more
- d) none of the above

You have your answer? Good. Next question:

What is the best type of crossover in a loudspeaker system?

- a) first order (6dB/octave)
- b) second order (12dB)
- c) third order (18dB)
- d) fourth order (24dB) or higher
- e) none of the above

Got that one, too? Well, if you've noticed what kind of speaker is being reviewed here, you've probably figured out that the answers to these questions are d) and e): "none of the above." The ideal number of drivers in a system is one, and the ideal crossover is none—that is, if that single driver is able to reproduce the entire frequency range without neglecting or emphasizing any part of the range, has sufficiently low distortion through-

out the range, can play loud enough to produce satisfying sound levels, and has no other anomalies, such as a highly restricted or uneven radiation pattern.

Alas, these are major qualifications, and most loudspeaker designers have decided that there are simply too many difficulties and compromises in producing a single-driver speaker. So most speakers on the market use multiple drivers and a variety of crossover configurations, and arguments continue about which crossover design is best.

However, some brave souls are devoted to the design and manufacture of full-range, single-driver speakers,¹ the most notable of these being Lowther, which has a fan in our own Art Dudley. Lowther is primarily a manufacturer of drive-units, with other companies using their drivers in complete speaker systems (usually horn-loaded enclosures). Lowther's highly efficient drivers feature a "whizzer cone" that provides a kind of mechanical crossover for high frequencies, and some of them have an equalizer phase plug.

Fujitsu Ten is a relatively new entrant in the world of single-driver speaker systems, and I must admit that these speakers at first flew under my audiophile radar. I first encountered the Fujitsu Ten Eclipse TD712z at the 2006 Consumer Electronics Show (actually, at the concurrent T.H.E. Show), and was most impressed with the sound (see <http://blog.stereophile.com/ces2006/>). I was interested in reviewing the speaker, but at the time it was available from only two dealers in the US, not the five required by Stereophile's editorial policy. However, a few weeks later I received an e-mail from Mickey Tachibana, North American representative for Fujitsu Ten Eclipse, stating that the line had been picked up by three more dealers. The review was on, and in due course I received a pair of TD712z's—the same pair that had been demoed in Las Vegas.

1 Coaxial and triaxial drivers don't count. These still have a separate woofer and tweeter, or woofer, midrange, and tweeter; they're just mounted in a different way.

Description and Design

As a glance at the photo accompanying this review shows—saving me a thousand words of description—the TD712z looks nothing like your typical box loudspeaker. A single 4.7" driver with a glass-fiber cone is mounted in an egg-shaped enclosure of artificial marble, with a rear-facing port 1.5" in diameter. The speaker comes with a matching sand-filled stand; the interface between speaker and stand has a bolt in the front that permits adjustment of the vertical angle. The stand has four adjustable feet, but, contrary to common audiophile practice, the feet don't end in spikes but in flat bottoms. Speaker and stand have the kind of automotive finish you might expect from Mercedes or Lexus, and the look is sleek and streamlined; the TD712z could be used as part of the set decoration in a movie set some time in the future. In fact, it won Japan's Good Design Award in 2005.

The eggshell construction is designed to distribute mechanical stresses, and its lack of parallel walls functions to minimize any distinct "cabinet sound." However, this is

MEASUREMENTS

The Eclipse TD712z's voltage sensitivity was to specification but significantly lower than average, at an estimated 83.5dB(B)/2.83V/m. However, its impedance remains above 6 ohms at almost all frequencies (fig.1), and rises in value above the midrange, this due, I assume, to the effect of the single drive-unit's voice-coil inductance. This speaker will be easy to drive, even by low-powered tube amplifiers

The traces in fig.1 feature a couple of small discontinuities in the upper midrange, but the loudspeaker's beautifully finished, egg-shaped enclosure was effectively free from vibrational resonances. All that an accelerometer revealed was a very slight degree of movement at 130Hz (fig.2), and nothing at all above the graph's -30dB noise floor at higher frequencies. However, the nearfield response of the rear-facing

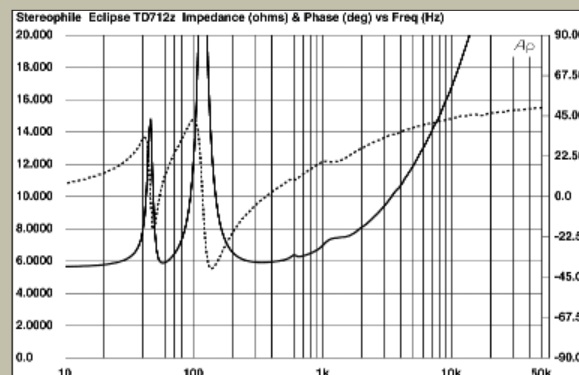


Fig.1 Eclipse TD712z, electrical impedance (solid) and phase (dashed). (2 ohms/vertical div.)

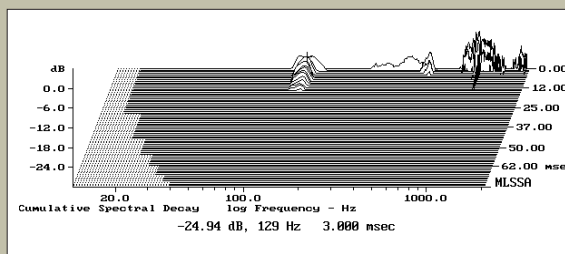


Fig.2 Eclipse TD712z, cumulative spectral-decay plot calculated from the output of an accelerometer fastened to the top center of the cabinet (MLS driving voltage to speaker, 7.55V; measurement bandwidth, 2kHz).

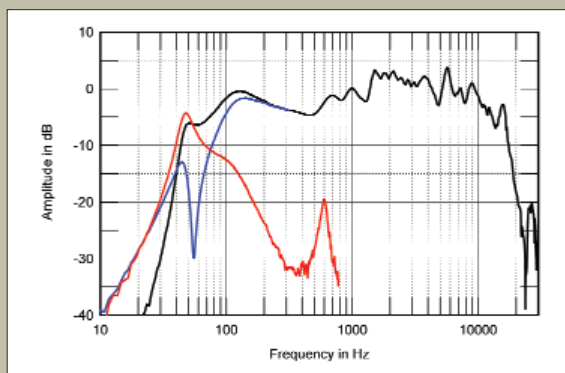


Fig.3 Eclipse TD712z, anechoic response on drive-unit axis at 50°, averaged across 30° horizontal window and corrected for microphone response, with the nearfield responses of the single drive-unit (blue trace) and the port (red) plotted below 300Hz and 900Hz, respectively, and the complex sum of the nearfield responses plotted below 300Hz (black).

only one of the notable aspects of the TD712z's mechanical design. The driver is not actually attached to the baffle but to five mechanical stays directly attached to the pedestal and extending outward to the edge of the unit, thus creating a floating structure in which driver and enclosure are mechanically separated. Of course, there has to be something that stops the driver from flopping around when the cone is going back and forth to produce sound; in the TD712z it's a 7.3-lb iron weight called the Grand Anchor. According to Fujitsu Ten, this allows the driver's diaphragm to exhibit ideal piston action. The TD712z differs from the less expensive model 512 in that its stays are made of zinc diffusion, which has three times the specific gravity of the aluminum used in the 512 and thus provides better damping. The vibrational mass of the TD712z driver is 10% lower than the 512's, and there is a 20% increase in magnet flux density. These differences are reflected in the specifications: a frequency response of 40Hz–17kHz and a sensitivity of 81.5dB for the 512, and 40Hz–20kHz and 83.5dB,

respectively, for the TD712z. A sensitivity of 83.5dB is still below average for an audiophile speaker, but it compares favorably with the 82.5dB of the famed BBC LS3/5a.

The TD712z is the brainchild of Fujitsu Ten engineer Hiroshi Kowaki, who drew on the speaker-design theories of Hiroyuki Yoshii of the Time Domain Corporation. (See www.fujitsu-ten.co.jp/english/company/researchdev/gihou/en_pdf/18/18-3.pdf.) In a phone conversation, Kowaki told me the story of how the design of the TD712z and other Eclipse TD speakers came about.

Kowaki was trained as an electrical engineer and has a strong background in digital signal processing (DSP). His initial thinking was that he could develop the perfect loudspeaker by measuring the impulse response of a speaker and designing a Finite Impulse Response (FIR) inverse filter that canceled out the irregularities in the impulse response. He pursued this approach for some time, but eventually concluded that it couldn't be made to work: the "corrected" speaker measured

quite well but just didn't sound right.

Kowaki abandoned the DSP-based approach and turned his attention to developing speakers that would produce excellent impulse response through the reduction of mechanical resonances in the driver and enclosure. The stated aim of Fujitsu Ten's Eclipse TD line of speakers is to produce "Authentic Waveform Reproduction," which depends critically on the timing of different components of the waveform. According to Kowaki, the measure that relates most directly to this capability is the impulse response, and he feels that focusing on getting the frequency response to be more linear may actually impair the impulse response. He suggests that while multiple-driver systems may have some advantages for achieving linearity of frequency response, a single-driver system, which by definition eliminates the potential waveform-distorting effects of crossovers, has the greatest potential for accurate waveform reproduction. The TD712z is the top model from Fujitsu Ten to embody this approach.

reflex port (fig.3, red trace) features a fairly low-level resonance at 700Hz, this the frequency of one of the discontinuities in the impedance traces. It is possible that because the port faces away from the listener, this, in combination with the low level of the mode, will minimize its audibility

The saddle centered on 55Hz in the impedance-magnitude trace indicates that this is the port's tuning frequency, which is confirmed by the fact that this is also the frequency of the minimum-motion notch of the drive-unit's nearfield response (fig.3, blue trace). However, the port's output peaks a little lower in frequency, meaning that it doesn't quite fully reinforce the drive-unit's output below the system resonance. As a consequence, the sum of the drive-unit and port outputs, taking into account acoustic phase and the distance between the two radiators (fig.3, black trace below 300Hz), shelves down a little before the usual 24dB/octave reflex rollout. As Robert Deutsch

found, this speaker's balance is somewhat light in weight

Higher in frequency, the upper-midrange and treble regions are shelved up by a couple of dB, which will make the speaker very revealing of recorded detail (as RD mentions in his auditioning notes) but perhaps a little unforgiving of problems with source and amplification components (which RD didn't find to be the case). Though the treble region is flat overall, there is a succession of small peaks and dips of approximately equal amplitude. As might be expected from a speaker with a single drive-unit, the frequency response rolls off quickly above 10kHz. RD does comment that the lack of top-octave extension actually better balances the TD712z's limited low-frequency output than would be the case with a conventional design

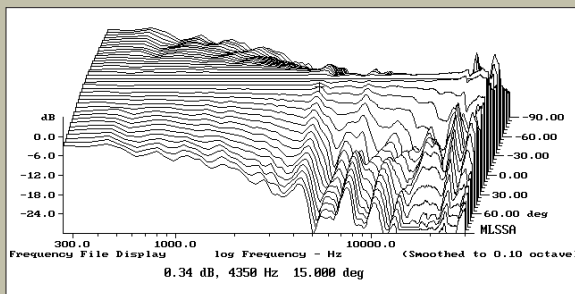


Fig.4 Eclipse TD712z, lateral response family at 50°, normalized to response on tweeter axis, from back to front: differences in response 90–5° off axis, reference response, differences in response 5–90° off axis.

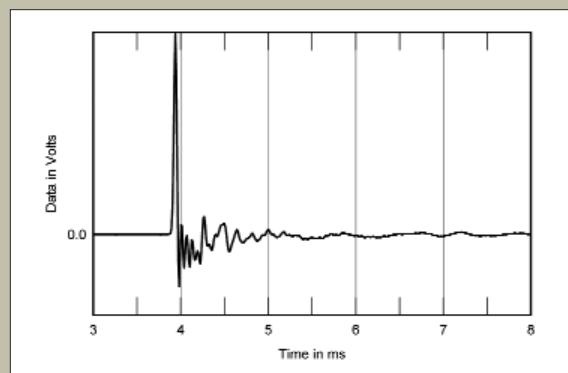
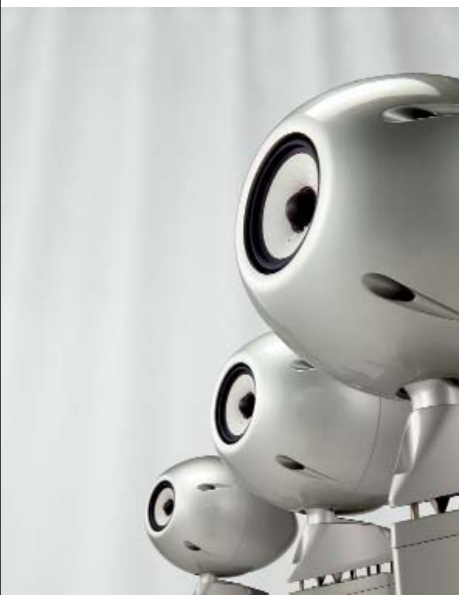


Fig.5 Eclipse TD712z, impulse response on drive-unit axis at 50° (5ms time window, 30kHz bandwidth).

Setup

Setting up the Eclipse TD712z was surprisingly easy. The speaker enclosure fits precisely on the stand, secured by three bolts, and there's a template supplied to help set the angular adjustment bolt. I set this at level (0°), which seemed to work well, the sound achieving its best focus at my normal listening position—so I didn't fiddle with it. The feet are simple to adjust, and the lack of spikes means that the speaker can be moved around quite easily to find the right position. In my room, those positions were pretty much the same as for other speakers I've had there, the Eclipses forming a more or less equilateral triangle with my listening position and aimed at me (not straight ahead). I like to use a laser pointer to aim speakers, making sure that the left and right cabinets are pointed at my left and right ear, respectively—but the TD712z's curved surfaces didn't permit consistent positioning of the laser pointer. I had to eyeball the alignment, closing each eye to judge whether the speaker was pointed right at



Full-range sound from just one drive-unit.

me. The Eclipses didn't seem overly sensitive to positioning.

I used three amplifiers with the Eclipses: the Audiopax Model 88 and PrimaLuna

ProLogue Seven monoblock tube amplifiers, and the PS Audio GCC-100 digital integrated amplifier. The TD712z was highly revealing of amplifier differences—the character of each of these amps was immediately apparent on switchover. In different ways, all three amplifiers were good matches, but my overall favorite was the PrimaLuna, which had much (not all) of the sweetness of the Audiopax, but with better bass and a more authoritative sound. The combination of the TD712z's relatively low sensitivity and the PrimaLunas' extra power might have been a factor here. My comments about the Eclipse's sound refer to this combination.

Sound

I'll get the negatives out of the way first: The Eclipse TD712z wouldn't play very loud and didn't go very low. And that was it.

As I played a variety of CDs and LPs, the system with the Eclipses had a clarity, transparency, resolution, timbral accuracy, and specificity of imaging that were simply breathtaking. The speaker did particularly

The speaker's horizontal radiation pattern is shown in fig.4, plotted at 5° intervals, each trace normalized to the on-axis response. (The TD712z's symmetrical cabinet design means that the vertical pattern was basically identical.) The dispersion is superbly even below 4.35kHz, but there is a sharp discontinuity at that frequency, with a rapid rolloff to the speaker's sides. Usually, this kind of behavior would give a speaker a rather lifeless quality in the listening room, but the shelved-up treble output might well compensate for this, at least up to 10kHz

The Eclipse TD712z's impulse response (fig.5) is typical of a design with a single drive-unit, with a sharp up/down spike of energy, though this is followed by some low-level ringing; this is probably associated with the small peaks

seen in the frequency response's treble region. The step response (fig.6) has an excellent, time-coincident, right-triangle shape, though again, some lower-frequency ripples are evident. As a result, some ridges of delayed energy can be seen in the cumulative spectral-decay plot (fig.7), the most prominent lying at 1.2kHz (the frequency of the response step seen in fig.3) and 5.7kHz

Considering its unusual design, the Eclipse TD712z measured much better than I was expecting. As RD notes, this is not a speaker that will go very loud or very deep, and tonally it is not all that neutral. However, it does offer other benefits, particularly in its time-coincident presentation and freedom from cabinet resonances. And it looks stunning!

—John Atkinson

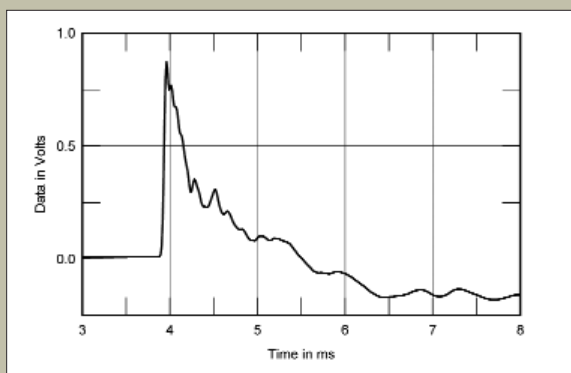


Fig.6 Eclipse TD712z, step response on drive-unit axis at 50° (5ms time window, 30kHz bandwidth).

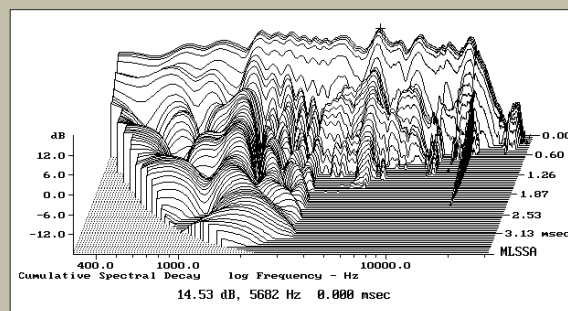


Fig.7 Eclipse TD712z, cumulative spectral-decay plot at 50° (0.15ms risetime).

well with voices, which had a human flesh-and-blood quality, an effect that I suspect was due to the absence of the mechanical resonances present with other speakers. We normally accept these resonances as inevitable and so must mentally tune them out. The difference with the TD712z was that these resonances simply weren't there—there was nothing to tune out. That wasn't literally true, of course—no mechanical device can be entirely free of resonances—but the TD712z's were at an exceedingly low level, and masked by the distortions of other aspects of the recording/playback process as well as by the music itself. This lack of resonant signature or coloration and this sense of transparency to the source brought to mind Quad electrostatic speakers—such as the original ESL-57, a pair of which I used to own.

Two of the words I've here used to characterize the TD712z are transparency and resolution. By transparency I mean the ability of a speaker or other audio component to impose on the music as little character of its own as possible, so that we get an unimpeded sense of what's on the recording, and—assuming that the recording engineers did their job right—a sense of the sounds made by the musicians in the studio or wherever the recording was made. At best, this is a kind of sonic time travel, and the TD712z did this in a way that I have not heard bettered by any other speaker. Live recordings were particularly convincing. Listening to "Lamento di Federico," from Cilea's *L'Arlesiana*, on Mario Lanza's 1958 Royal Albert Hall concert (CD, Live from London, RCA 61884-2), brought tears to my eyes from the sheer beauty of the sound (and from thinking of the all-too-premature death of this gifted artist). My Avantgarde Uno speakers are better at seeming to bring performers into the listening room (the they-are-here effect), but the Eclipses were superior at transporting me to the recording site (the I-am-there effect).

Allied to the notion of transparency is that of resolution: the ability to differentiate sonic differences rather than gloss over them. Here, too, the TD712z was in the highest class, matching the ultra-high-resolution Avantgarde Uno. Some readers may recall my mentioning what appears to be an edit point or other recording artifact at 1:35 of track 10, "All the Things You Are," on Sylvia McNair's *Sure Thing: The Jerome Kern Songbook* (CD, Philips 442 129-2). With some speakers and systems this is notice-

able only if you deliberately listen for it; McNair's voice just seems to get momentarily fuzzy at that point. With the TD712z, it was clearly a sort of echo of the voice, as if McNair is singing an overdubbed duet with herself for part of the phrase "that lights the star." I think it's interesting—and not surprising—that the list of testimonials for Eclipse speakers (the 512; the TD712z is too new) includes a number of highly respected recording engineers, including Simon Rhodes of Abbey Road, Mike Ross-Trevor of Sony Music, Klaus Hiemann of Emile Berliner Studios, and composer and record producer Brian Eno. These folks want to hear exactly what's on the records they make.

Speakers that are highly revealing of faults in recordings are normally thought to be "unforgiving," making all but the most pristine recordings sound unlistenable. Paradoxically, the TD712z proved to be nothing of the sort. Although faults in the recording were certainly audible through these speakers, they also communicated more of the music on the recording. It's analogous to considering noise in relation to signal. The noise (audible artifacts) may be higher, but the signal (musical detail) is correspondingly higher still, so that the ratio of signal to noise remains higher than with a speaker that glosses over the subtleties of both music and recording artifacts. At no point in my auditioning of the TD712z did I feel that I had to restrict myself to listening only to the most technically perfect recordings. On the contrary: I got the greatest enjoyment from listening to recordings that I knew were far less than perfect. Through the TD712z, I had the sense that I was hearing more of what my recordings "really" sounded like.

The TD712z's precision of imaging and soundstage definition were virtually in classes by themselves. With the right recording, instruments and voices were placed precisely in space, with no change in position when the music went high or low. This must be one of the effects of having a single driver reproduce all frequencies; there was no shifting of the image when the reproduction of a given instrument was transferred from being, say, tweeter-dominated to midrange-dominated. In a multiple-driver system, a physical offsetting of drivers and selective delay of a range of frequencies through a crossover are supposed to solve this problem, but with the single-driver TD712z there is no problem to solve.

When I listened to the difficult "Depth of Image" tracks on *Best of Chesky Jazz and More Audiophile Tests/Vol.2* (Chesky JD 68), the clickers recorded at distances of 60', 70', and 80'—which through most speakers sound the same as the one recorded at 50'—were clearly distinguishable from each other through the Eclipses.

What about those limitations in loudness and bass extension? Well, while perceived loudness depends on the actual sound-pressure level, it's also a psychological function, related in a complex manner to the dynamic rise and fall of the music, the presence or absence of distractions, the time of day, the person's liking for the music, and individual preferences for how loud reproduced music should be. (Some people routinely listen at levels that make your ears bleed, whereas others never turn the volume up past the background listening level.)

I think it's fair to say that if you like your music reproduced at the level of a live rock concert or a symphony orchestra going full tilt, the TD712z is not the speaker for you. Its 4.7" driver is an amazing device, but it has its limits. That said, I was able to play the speakers in my 14' by 16' room at levels that were quite satisfactory with still some level to spare—I could turn up the preamp's volume control another notch or two (though no more than that) without the speakers sounding strained. What helped to mitigate the effect of the TD712z's maximum loudness limit was the speaker's resolution and its ability to communicate the music's ebb and flow (ie, microdynamics). I could say that while some speakers must be played loud to be at their best in the realistic reproduction of music, the TD712z was able to achieve a subjectively similar effect at what was objectively a lower sound level.

The TD712z's claimed low-frequency response limit is 40Hz, but this is at -10dB (presumably an anechoic measurement), not the more common -6dB. That's still a lot to ask of a 4.7" driver, especially one that must reproduce the rest of the audioband as well. But, surprisingly, with the standard level set at 80dB using the RadioShack SPL meter (C weighting, fast; Stereophile Test CD 2), the bass in my room actually held out to the 40Hz range, helped by a room mode at 50Hz. So, at least at this level (I didn't want to push it higher than 80dB with test tones), the Eclipse's bass was more extended than one might expect, given the size of its driver and enclosure. In normal listening, the bass was very smooth and

even, apparently rolling off in a gradual way that suggested greater bass extension than was in fact produced. String bass was particularly clean, with enough of the fundamental not to sound too threadbare and an absence of transient overhang. The bass drum in the opening of Ramirez's Misa Criolla (Philips 420 955-2) was convincing enough that if I hadn't heard it reproduced by a speaker with greater bass extension and power I might not have thought there was anything missing.

A factor that undoubtedly helped to make the TD712z's bass sound more impressive than it might have been in purely objective terms was the speaker's tonal balance. The treble was smooth, lacking in grain, sufficiently extended to communicate instrumental overtones and transients, but not overextended. A well-known trick of loudspeaker design (pay attention; this could be on the next test) is a careful balancing of the amount of bass and treble. A speaker with highly extended, powerful

bass will sound best if it has correspondingly extended treble, but if the treble is relatively weak then the speaker will sound bass-heavy, and if the speaker has relatively weak bass but extended treble it will sound

are concerned is the latest Quad electrostatic, the ESL-2805. The TD712z's limitations—which it shares with the Quad—are an inability to play very loud (especially in large rooms), and bass response that, while

THE **FUJITSU TEN** ECLIPSE TD712Z IS AN EXTRAORDINARY **LOUDSPEAKER** WHOSE CLARITY, TRANSPARENCY, RESOLUTION, IMAGING, AND TIMBRAL ACCURACY **MATCH** OR EXCEED THOSE OF JUST ABOUT EVERY OTHER SPEAKER I'VE HAD IN MY SYSTEM OR HEARD AT SHOWS.

ASSOCIATED EQUIPMENT

ANALOG SOURCE Linn LP12 (fully updated) turntable, Linn Ittok tone-arm, AudioQuest AQ-7000nsx cartridge.

DIGITAL SOURCES PS Audio Lambda II CD transport, Perpetual Technologies P-1A/ModWright P-3A digital processors with Monolithic Sound P3 power supply, Ayre CX-7e CD player.

PREAMPLIFIER Convergent Audio Technology SL-1 Ultimate.

POWER AMPLIFIERS PrimaLuna ProLogue Seven and Audiopax Model 88 monoblocks; PS Audio GCC-100.

LOUDSPEAKERS Avantgarde Uno.

CABLES Digital: Mystic Reference I2S, Illuminati Orchid AES/EBU. Interconnect: Nordost Quattro Fils. Speaker: Nordost Valhalla. AC: PS Audio xStream Power, TARA Labs Decade.

ACCESSORIES PS Audio P500 AC regenerator, Bright Star Little Rock (atop CD transport), Shakti stone (atop Monolithic Sound P3 power supply), Arcici Suspense Rack, Vistek Aurios 1.2 MIB component supports, PolyCrystal amplifier stands, Furutech RD-2 CD demagnetizer.

—Robert Deutsch

too bright. The TD712z's balance of high and low frequencies was such that they seemed to be in just the right proportion. It was mostly when playing music with a lot of low bass at a high level that the TD712z's bass-response limitations became obvious: the low-bass synthesizer notes on Mickey Hart's Planet Drum (Rykodisc RCD-10206) were simply missing in action. But again, what was there was clean, and the imaging and clarity of the transients were almost enough to make up for what was missing at the low end.

Conclusion

The Fujitsu Ten Eclipse TD712z is an extraordinary loudspeaker whose clarity, transparency, resolution, imaging, and timbral accuracy match or exceed those of just about every other speaker I've had in my system or heard at shows. Offhand, the only speaker I can think of that's in the same league as far as these characteristics

satisfactory for most music, is more limited in extension than what you can get for the price from more "normal" speakers.

My own Avantgarde Unos represent, in a way, the opposite end of the spectrum: They can play extremely loud with very little power, and their twin powered subwoofers provide as much bass as any sane person would want. Another obvious difference is in the level of coloration: the Uno's is low for a horn hybrid, but still much higher than that of the TD712z.

What these two speakers with very different design approaches share is an ability to make music sound alive. I wish I could afford to have—and had the space for—both. As I write this conclusion, the Unos are still in storage in another room of the house, and I haven't listened to them for a couple of months. When I do so again, I'll have to give serious consideration to whether I want to keep the Fujitsu Ten Eclipse TD712z's instead. They're that good. ■

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