

Stax Earspeaker



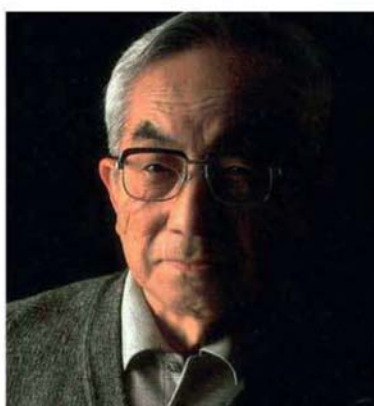
When it comes to private listening, one marque dominates the sector, and has done so for some 70 years. Why, it even delivered an electrostatic driver before Quad!

Ken Kessler on the Stax Earspeaker, a component as iconic for its looks as its sound

Try to name a single hi-fi brand that *owns* a product genre. By that I mean a brand which has such a total command of its sector that it is as omnipotent as the iPod is for portables, or Zippos are amongst cigarette lighters. No single cable, turntable, speaker, amplifier nor CD player manufacturer so thoroughly dominates its category such that it has become a default choice, nor done so for decades. In the entire history of our beloved hobby, I can only think of one product category to which this applies and that is electrostatic headphones.

Or should that be 'earspeakers', the name Stax wisely created exactly 50 years ago and uses to this day, for that is precisely what headphones are: speakers for the ear rather than the room. It was around 1960 that the granddaddy of the genus appeared, the SR-1, a model that would sire the breakout product eight years later, the

RIGHT: Stax founder Naotake Hayashi, who ran the company with his wife Toyoko, and their son, the company president Takeshi Hayashi



BELOW RIGHT: Original catalogue for the design that started it all – the SR-1 Earspeaker, first shown to the world at the 1959 Tokyo Audio Fair

BELOW: The breakout product from 1968 – the SR-3 Earspeaker, pictured here with SRD-5 Energiser

SR-3. From that point onward, Stax has known no opposition. That Stax reigns supreme is not open to debate. It genuinely is the *de facto* high-end headphone.

Yet to understand why this is a rare occasion when being 'Number One in a field of nearly one' is not a back-handed compliment, first you have to decide whether or not headphones *per se* are the best way of listening to music. Then you have to decide whether electrostatic headphones are the best *type* of headphones ever devised.

KING CANS

If you agree with or merely acknowledge both, Stax's achievement becomes all the more impressive, for, along the way, numerous manufacturers have offered their versions of headphones using electrostatic drivers. While some of the challengers, especially the high-end models from Sennheiser, have raised the bar, Stax still reigns supreme.

Purely on a simplistic level, conventional headphones are nothing more than little speakers in enclosures that fit close to the head. They exist for listening in hostile

environments, eg for pilots in noisy aircraft, and to enable one to listen when others are present, without disturbing them. The unintentional benefit, which makes headphones the listening method of choice for truly fastidious audiophiles, even when they don't have to use headphones, is that headphones eliminate the intrusive effects of the listening room on the sound of the system because their 'direct injection' of the sound into the ear bypasses the room entirely.

As I wrote in a review in 1994 of the Lambda Signatures, 'Stax argues that, "...only headphones, which are totally immune to the sonic variations of listening rooms, can serve as a truly universal audio reference standard monitor." You simply cannot fault the thinking, other than to cite the unsociable aspects of headphone use and the somewhat alien nature of hearing sounds inside the head rather than around one's person.'

Theoretically, then, listening to headphones betters listening



STAX electrostatic earspeaker



- 3 FIXED ELECTRODE
- 3 DIAPHRAGM
- 3 FIXED ELECTRODE
- 3 HUMIDITY PROTECTORS
- 3 SHAPING MATERIAL

How Electrostatic Earspeaker Works
 The electrostatic drive system, used in STAX earspeakers, employs a diaphragm coated with electrically conductive material suspended between two fixed electrodes with equal gaps on either side. A polarizing DC voltage is applied to the diaphragm so that when the audio signal is applied to the electrodes the diaphragm will be pushed forth and pulled back due to the repulsion and attraction of electrostatic charges.
 As time has passed, the world's top electrostatic headphones more than hold a half decade ago, and since then have been making constant reference, all of which contribute to the remarkable quality of the SR series earspeakers. The top polymer film used for the diaphragm in these earspeakers is also that of the SR series headphones. The SR series includes 1.5 meters in the SR-30, SR-35, SR-300, SR-350, and 3 meters in other electrostatic earspeakers. This diaphragm, straight-through diaphragm is driven with incredible accuracy by electrostatic forces. Therefore there is no transient distortion, no phase distortion, and no intermodulation distortion produced regardless of how loud or soft the music is, and throughout the entire audio frequency spectrum. This is in direct contrast to the multitude of complex distortions available in the conventional dynamic type of headphones with its need for a rigid and extremely heavy diaphragm and accompanying magnet and voice coil structure. With STAX electrostatics, there are none of the weaknesses and limitations in frequency response that

accompany other methods of reproduction. Pure sound goes directly to the listener's ears, which is why no one fails to be astounded the very first time they listen to music on electrostatic earspeakers. There is quite simply no comparison. And it would be inaccurate to call these ultra-high fidelity music reproduction devices "headphones". "Earspeakers" much better describes their unsurpassing performance.

The SR-30 is the direct descendant of the SR-1, our first born earspeaker. Sound is even more realistic as immediate realism, accuracy of tonal balance, and unbelievable detail, accuracy available with even the most sophisticated loudspeakers. It is rated high among audiophiles, broadcast stations and record industries.

The SR-300 was developed in an effort to reproduce more musical information and detail, resolution is excellent. The small early type ear set design improves low-range response and the entire speaker has been biomechanically engineered with professional applications in mind. In the construction of all the SR series earspeakers we have gone to great lengths to ensure even diaphragm tension and precise electrode gap tolerances. Electrical and insulation characteristics are excellent and materials are carefully chosen for their long-term durability and resistance to physical shock and damage. All units are manufactured under strict quality control.

As its innovative appearance reveals, the Lambda Junior is SR-84 electrostatic earspeaker system consisting of the SR-80 earspeaker and the SRD-4 adaptor is a direct successor of the SR-34. Like the SR-34, the unique open back type enclosure plays an important role in sound reproduction. For the SR-80 we adopted a commonly polarized electrostatic diaphragm to eliminate power supply for polarizing voltage. All you have to do to drive the sound is to connect the SR-80. Therefore, it is to connect the SRD-4 adaptor to your amplifier's speaker terminals. The adaptor switch on the SRD-4 front panel will you readily choose between your loudspeaker system and the SR-80. The compact enclosure with soft velvets and light weighted headband adds more to the real and transparent reproduction of the SR-84.

The SR-34, a combination of the SR-30 electrostatic earspeaker and the SRD-4 adaptor, is the first earspeaker that has received an excellent quality award and rating. For other headphones in this price range could offer such clear, detailed, distortion-free sound as the SR-34. The special electrostatic diaphragm as the SR-30 is employed for the SR-34, so that you can simply connect the SRD-4 adaptor to your amplifier's speaker terminals. The SRD-4 front panel selector allows you to easily switch back and forth between your loudspeakers and the SR-30. The soft velvets along with the biomechanically engineered headband contribute to non-fatiguing listening to music.



to loudspeakers because one of the worst acoustic nightmares of all – the effect of the room on the sound being played back – has been removed entirely from the equation. The downside is that the majority of headphones create the most unnatural sensation in all of hi-fi playback, despite what may be less-distorted sound. They place the sound 'in the head', which is not the way one hears a performance traditionally taking place in front of the listener.

A TRADE-OFF

Leaving aside the in-the-head effect for a moment, every headphone immediately has an advantage over loudspeakers because of the above immunity to the listening environment. But everything in life is a trade-off, and another downside affects headphone reproduction, by virtue of the drivers needing to be small to allow the headset to be wearable: bass is severely compromised. Thus Stax, like all other headphone manufacturers, has to juggle the benefits of the aforementioned, controlled environment provided by the ear-cup and the gap between the driver and the ear, with truncated bass and an in-the-head perspective.

Miniaturising conventional woofers and tweeters involves challenges that face full-scale speakers: low moving mass for determining the quality of the mid and treble, and moving reasonable quantities of air for reproducing bass. The former benefits from downsizing, the latter doesn't. Just about the only good thing one can

posit about designing headphones is that playback level is rarely an issue, because it's simple to make a transducer capable of producing ample SPLs when it is situated mere centimetres from the ear opening.

Electrostatic panels are naturals for headphones because the problems they face in full-range speaker applications do not affect headphones: the aforementioned proximity to the ear immediately relieves the designer from having to produce the sound pressure levels that bedevil all ESL loudspeakers bar the very largest, eg Sound Labs.

Directivity and beaming cease to be an issue because of the driver location, as does bass extension. Most designers would argue, too, that the only real hurdle to overcome is the need for high DC polarizing voltage for the diaphragm, which involves the expenditure of an outboard



ABOVE LEFT: Stax brochure detailing the Earspeaker lineage and 'How The Electrostatic Earspeaker works'

ABOVE RIGHT & BELOW: The SR-Lambda Earspeakers from 1979. This model featured an oblong diaphragm – as opposed to the round one used in previous models – in a bid to better mirror the shape of the outer ear and so give better sound

powered box. But even that has been achieved with great success by Stax, which has produced both affordable models, with today's entry-level system of earspeaker and energiser for under £500, and tiny models: the energiser for the portable model runs off batteries and is the size of an iPod Classic.

ENTER STAX

Stax, founded in 1938 by Naotake Hayashi, produced its first condenser microphone as far back as 1950, and the CP-20 RF modulation-type condenser phono pick-up system two years later. Also in 1952, Stax participated in Japan's first audio fair, the beginning of a presence in specialty audio that establishes Stax as a 'veteran' manufacturer by any definition – certainly one of the oldest specialist brands in that country.

Other audio products followed during the post-war years, when Japan was rebuilding its industries, including the LA-24 tonearm for its condenser phono cartridge, and the CSG-1 high frequency and CSP-500 mid/high frequency electrostatic tweeters in 1954.

While all and sundry rightly respect Quad as the god of all things electrostatic, it is worth noting that Stax thus issued its first commercial electrostatic speakers, albeit tweeters and mids, before Quad's immortal ESL appeared in 1956-7. The principle was established decades before: an electrostatic driver employs a thin, electrically charged diaphragm, a material such as Mylar with a special conductive coating, suspended between two perforated metal

AUDIO MILESTONES



plates that act as electrodes. The audio signal is applied to the electrodes, which produces an electrical field, its polarity determining which of the two plates attracts the diaphragm. The attracted and repelled diaphragm then acts as do most other drivers, forcing air through the perforations, at the frequency determined by the source signal.

Electrostatic headphones require the aforementioned energiser to amplify the signal to move the membrane, often in the order of 100V to 1000V. As this adds bulk and weight, the energiser is usually provided in the form of an external unit. Early on, Stax referred to this as an 'adaptor', while the *lingua franca* of audio changed it, more accurately, to 'energiser'. Safety is a concern with such voltages near the listener's head, but I've yet to hear of an electrostatic headphone killing a user in normal conditions.

Because ESL panels, whether for loudspeakers or headphones, are ultra-light, more so than any other type of driver – MartinLogan's are said to be lighter than air – and thin on the order of micrometers, upper frequencies are extended and fast. While this writer loves a number of speakers with conventional dome tweeters, and others with ribbons, it is apparent that the upper registers of electrostatic tweeters are in a class of their own for speed, clarity and detail. Frequency response measurements well into the ultrasonics are not uncommon.

'The SR-Sigma did the most to banish in-head listening'

Stax's headphones exploited these virtues, and – more crucially – lower midrange distortion thanks to the panels' speed and transparency across the range. But it was another feature of Stax headphones that provided an almost unique quality which dynamic driver phones would achieve only many years later, and to a less unequivocal degree.

TASTE OF FREEDOM

Possibly the first-ever open-backed headphones, predating Sennheiser HD414s by eight years, the SR-1s progeny enjoyed unsealed capsules that were effectively miniaturised ESL speakers, acting as bipolar designs. While hardly having any bearing on sound dispersion in the manner of free-standing speakers, the open-back nature of the Stax headphones gave the impression of sound slightly outside of the head. Even for listeners 40 or more years ago, this taste of freedom from in-the-skull sound added to the Stax's allure. It was a benefit of the sound that Stax would exploit decades later to even greater effect.

While SR-1s are rare and probably did not enjoy the sales that established the brand as the leading purveyor of electrostatic headphones, the SR-3 of 1968, along with

ABOVE: From the SRM Series, which began production in 1993, the SRM-T1W Energiser with SR-Omega Earspeaker on top. To the right is the Lambda Nova Signature Earspeaker while in front is the SR-001 portable and Energiser

ABOVE LEFT: 'Please be cautious!' – with high voltages near the listener's head safety is a concern

BELOW: The SR Sigma from 1977 – these took their feed from an amp's speaker outlets, using some of that signal to power the Energiser

the SRD-5 adaptor, was successful enough to be regarded by most authorities as the 'break-out' model. The timing was impeccable, for the late 1960s were a golden age for headphone listening, prior to the headphone sales-booms inspired by the Walkman in 1979 and later, of course, by the iPod.

It coincided with the market explosion in audio in general, the hunger for headphones being driven primarily by two sectors of the audio community. For those who believed that headphone listening was – as far as absolute purity and neutrality are concerned – the best way to get into the music, Stax electrostatics (and top-quality conventional cans such as Koss Pro 4AAs) were godsend. The second group, which fuelled the growth in audio because it occupied the burgeoning budget sector, consisted of students who wanted to listen in dorm rooms at night and needed to respect others' privacy. By the time the high-end was an established phenomenon, in the early-mid-1970s, Stax was a recognised force, the gold standard for headphone users.

Never standing still, the company continued to refine the technology over dozens of models in the intervening years. Standouts included the SR-Sigma of 1977, which did the most to relieve listeners of the in-the-head experience. This was accomplished by devising what amounted to a pair of angled speaker enclosures strapped to one's head. While nowhere near as uncomfortable as the bulk might suggest, they were absurdly ungainly. The model featured an





oval driver angled at approximately 80 degrees to the ear.

It was intended to create the illusion of sound in front of the listener, rather than just at the sides and in the skull. What improved on this early effort was the SR-Lambda of 1979, which reduced the size by better than half; I still swear by them, as does Stax. It used the Sigma driver in a less bulky, slanted frame, augmented by angled pads, and worked almost as well. And its practicality proved superior.

As importer Nigel Crump informed us, 'Today, the Stax Earspeaker business revolves around the SR-Lambda and its various energiser options, especially the matching SRM-066t matching vacuum tube amplifier. We recently introduced a 30th anniversary version of the SR-Lambda featuring revised cushions and a high purity oxygen free cable. 1000 pieces were made for worldwide production, and all were sold in four months.'

Other notable models included the round-cased Gammas and Omegas, while the company presaged the iPod generation's love for minimalist in-the-ear-designs with the SR-001 of 1995. It even answered the need for a sealed-back electrostatic headphone for studio usage and other loud environments with the 4070 of 2001. But Stax Earspeakers did

not evolve in isolation. The new models also gave birth to a range of energisers, allowing customers to mix and match headphones and adaptors according to budget. For many users, the golden moment came in 1987 with the SRM-T1 valve energiser. During the 1980s, when Stax developed the Professional Series, it worked for German car manufacturer Daimler Benz, who were investigating noise, vibration and harshness in the cars; the Stax headphones became design tools, and the resultant SR-Lambda Pro was the first to feature a driver with a 0.5mm electrode gap and a 'PRO-series' voltage of 580V.

ALL GO PRO

Stax eventually increased the voltages of all of its models to 'PRO' status, supplanting the 230V voltages of the older models entirely in 1992, when the last

'normal bias' Staxes were produced. To prevent accidental connection to the wrong voltage, the company changed the plugs, from 6-pin to 5-pin, so only PRO models could connect to the 580V PRO bias, as energisers came supplied with both outputs.

Stax closed in 1995 but was saved by its loyal engineers, who have restored the brand to its former glory. They wisely decided to concentrate solely on their Earspeakers and related accessories. But for those unaware of



STAX TIMELINE

- 1938 Founding of the company
- 1950 Stax brand starts; high frequency style condenser microphone
- 1952 RF modulation type condenser phono pick-up system CP-20 and CP-30; LA-24 tonearm for CP-20/CP-30 cartridge
- 1954 Electrostatic tweeter: CSG-1 (high frequency); CSP-500 (mid/high frequency)
- 1959 Stax shows the first Earspeaker at the Tokyo Audio Fair
- 1960 Sales begin for SR-1 Earspeaker and SRD-1 Earspeaker Adaptor
- 1964 First full-range electrostatic loudspeaker systems launched, with SRD-5 Adaptor
- 1970 Stax UA-7 integrated tonearm; SRX Earspeaker introduced
- 1971 SR-3 Earspeaker and SRD-7 adaptor
- 1975 SR-5E Earspeaker and SR-X Mk-3 adaptor
- 1976 DA-80, DA-80M A class DC type power amplifier
- 1977 SR-Sigma semi-panoramic Earspeakers
- 1978 Full-range electrostatic loudspeaker systems ELS-8X, ELS-4X
- 1979 SR-Lambda Semi-panoramic Earspeakers
- 1981 SRM-1 PRO Driver Unit for Earspeakers; Full Range Electrostatic loudspeaker system, the ELS-F81
- 1983 Full Range electrostatic loudspeaker system ELS-F83
- 1985 SR-Gamma Pro 'PRO Bias' Earspeaker
- 1987 SR-Sigma PRO Earspeaker; Pure Crystal Ohno Continuous Casting Cable (PC-OCC)
- 1988 Quattro 2 CD Player
- 1989 DAC-X1t 20-bit/8x oversampling D/A converter
- 1993 SRM-T1S valve output stage energiser; SR-Omega Earspeaker
- 1995 SR-001 in-the-ear electrostatic Earspeaker system
- 1995-6 Stax Industries Ltd closes but is reformed by a few engineers as Stax Ltd
- 2001 4070 closed-back Earspeaker
- 2003 SRM-310 solid state driver unit

TOP LEFT: Superior model – the SRX Earspeaker, produced in 1970

LEFT: The ELS-F81 from 1981, a full range electrostatic speaker that worked on the same principals as Stax's Earpiece

its history, it is easy to marginalise Stax by thinking of it only as a manufacturer of headphones.

Reality is quite different: the company produced everything bar a turntable: sophisticated power amps, tonearms and cartridges, cables, CD players and DACs, and – most desirable of all – a handful of full-range electrostatic loudspeakers, including the immortal ELS-F81. But to remember Stax only for the Earspeakers is no back-handed compliment: it's like forgetting about 'I Got Rhythm' and remembering Gershwin only for *Rhapsody In Blue*. ☺