



FLOOR LOUDSPEAKER REVIEWS

Quad ESL loudspeaker

Dick Olsher | Oct 10, 2017 | First Published: Aug 1, 1987

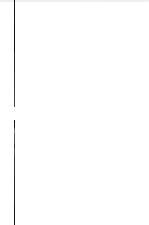


High fidelity took a giant step forward in 1956 with [Peter Walker's](#) introduction of the Quad ESL. Walker's research efforts had been motivated by his firm belief in the superiority of the electrostatic dipole over the box loudspeaker, but actually to take the economic plunge and market such a speaker was surely an act of bravery. After all, those were the pre-stereo, pre-audiophile days of the mid '50s, and the public's tastes and expectations were relatively unsophisticated. The average front end was abominable by today's standards, so that making definitive assessments of loudspeaker quality was a difficult task at best.

At the time, the "hornless" direct-radiator loudspeaker reigned supreme. Rice and Kellogg's moving-coil loudspeaker, which had displaced the competition during the radio boom days of the '30s—primarily because of its ruggedness and low cost—had had 25 years to be perfected. A credulous public was besieged by a variety of loudspeakers whose usual claim to fame was some sort of "innovative" cabinet design housing one or more paper cones. There were infinite baffles, misguided baffles, and a bounty of boomy phase-inversion (bass-reflex) enclosures. And Edgar



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Against this background, what chance for survival did this exotic new kid on the block have? It would seem that the forces of history were stacked against the newborn Quad, which appeared to be destined to play out its life cycle as a "small voice in the wilderness." With hindsight, however, it now appears obvious that the Quad ESLs were at the right place at the right time. The age of stereo and the resultant audio boom were just around the corner; indeed, during the '60s, the reputation of the Quads grew exponentially. Early audiophiles quickly became aware that the conventional box loudspeaker was a very weak link in the sound reproduction chain, and many of them discovered to their amazement the clean, transient-quick, transparent, and focused sound of the Quads.

The rest is history. For over a generation, the Quads were proclaimed a reference standard, being used by countless reviewers, as well as a multitude of audiophiles. Around 60,000 of the original Quads were produced, and most of them are still in active use. In 1984 production of the ESL was finally wound up in order that the company could concentrate their resources on the [Quad ESL-63](#), introduced in 1981. However, as Fred Yando at Quad America (footnote 1) tells me that there are enough spare parts on hand to safely see Quad owners through to the 21st century, it seemed appropriate to assess the Quad classic's sonic worth in a modern setting. Is it still a viable speaker or simply an anachronistic relic? Do you have to be over 50 to enjoy them? Do mods improve the sound? These are some of the questions I will attempt to answer.

Prologue

It is commonly assumed that the electrostatic speaker is a fairly recent high-tech innovation. Nothing could be further from the truth. Its roots are firmly planted in 19th-century scientific invention. For example, in 1881 Professor Amos Dolbear of Tufts University patented a condenser-type telephone receiver and transmitter. I quote from Professor Dolbear's US patent (No. 240,578): "My receiver is based upon the discovery that one terminal of an open circuit will attract and be attracted by a neighboring body when the terminal is charged." The commercial success of radio during the 1920s generated much interest in the electrostatic speaker, although it seems that only two commercial ESLs were produced in any numbers: a German design, and the US Kyle condenser speaker which was incorporated into the Peerless radio of around 1930. ESL designs in those days were handicapped by the lack of suitable materials. Light plastic films and mylar were not available, and inventors such as Colin Kyle had to resort to india-rubber diaphragms, aluminum foils, and mosquito netting for insulation. Needless to say, there were reliability problems, and these early ESLs were quickly driven off the market by the advent of the rugged and more efficient dynamic loudspeaker.

The original Quad is a full-range electrostatic loudspeaker which uses the well-known push-pull grid geometry, but with an important new wrinkle: constant-Q or constant-charge operation. This means that a constant charge is maintained on the diaphragm, usually by using a high-resistivity coating. If this condition is not maintained, it can be shown that the electrostatic forces acting on the diaphragm will be nonlinear, *i.e.*



A Quad ESL is made up of two bass panels and three centrally located "strips." The two outside or midrange strips operate in parallel and roll off above 2-3kHz, while the middle or treble strip reproduces all the frequencies above 600Hz. At serial number 16800, additional high-pass filtering, in the form of an RC network, was added to protect the treble unit from damage due to large low-frequency signals. The bass units are biased at 6kV, and the strips at 1.5kV nominal. Plastic dust covers are used to isolate the grids from dust accumulation and to preserve the life of the high-resistivity diaphragm coating. Expanded-metal grilles are used front and rear to protect the dust covers and drive-units and to prevent curious hands and fingers from getting zapped. Thick felt damping is provided behind the central treble unit, while "burlap" damping material is glued to the inside of the rear grille to control bass panel resonances.

The ESL Sound

It is difficult to conceal one's respect and admiration for the midrange quality of these "antiques" in stock condition. In a cognitive sense, you can readily dissect the Quad's sonic attributes: excellent resolution of low-level detail, transient quickness, and cohesive harmonic textures. But the instant emotional impression is one of naturalness. They don't scream, shout or wave their hands at you with a phony sonic signature. Instead, you're confronted with a clean and harmonically convincing sonic window that captures the heart of the musical experience. The perspective, however, is quite distant, even on closely miked recordings: you're invariably transported to the back of the hall. This is readily explainable on the basis of the Quad's frequency response, which features a broad valley from about 2.5 to 8kHz, or from the upper mids through the lower treble. Another side effect of this response anomaly is an occasional slight honky quality to female voice, no doubt caused by a slight suppression of the upper speech formants.

In matters of dynamic contrasts, say from very soft to loud, the Quads are outstanding. True, they are limited in ultimate SPL to about 95dB at a

excellent dynamic range. The Quads are startling performers indeed, and the "startle index" is quite high through the middle octaves—I'd say about 8 on a scale of 10. What is the "startle index," you ask? Well, it's my slightly tongue-in-cheek attempt to quantify (footnote 2) the physical sensation of involuntary bodily movement associated with a sudden SPL change. (The startle index should not be confused with the wet-spot, or ring-around-the-sofa, syndrome, which is a measure of a speaker's ability to scare you.)

No, you don't have to listen to the Quads in diapers. There are no chest-crushing crescendos. There is no bass punch. There isn't even any deep bass, though with the right amplifier and the modifications described later, the midbass is tight and very well delineated. They're not monster speakers. King Kong is not likely to own a pair, though Godzilla might. After all, he appears to have audiophile instincts. Why else would he periodically destroy the city of Tokyo, if not to vent his frustration with the Japanese audio mass market?

The Quads possess a definite sweet spot, which is to say that the upper octaves are rather beamy—sort of like the way a flashlight concentrates light in the forward direction. The spatial extension of this sweet spot is defined primarily by the dispersion in the vertical plane, which is a mere 15° in the treble. Beamy treble is not a problem unique to the Quads, or to electrostatics in general, but is common to all speakers where the active dimensions of the treble driver are on the order of the radiated wavelengths or larger. For example, the length of the tweeter strips is around 24", which corresponds to the wavelength at 550Hz. At frequencies above 550Hz, therefore, the Quads become increasingly directional in the vertical plane. It becomes necessary then to contain the listening seat to the area of the sweet spot.

The speakers must first be toed in toward the listener and the height of the listening seat adjusted so that the ears are no higher than the top of the panels. The sweet spot is then defined (according to DO, at least!) by an area centered on a line bisecting the speakers, six to eight feet from the plane of the panels and one foot wide on either side of the centerline. The optimum distance from the speakers is somewhat room-dependent and should be selected on the basis of active experimentation in your room. Within the sweet spot, the sound of the Quads is quite cohesive and capable of excellent imaging. Outside of the sweet spot, their imaging ability and tonal balance deteriorate. The Quads are therefore a one-person speaker. That's fine with me; I prefer to do my private listening solo and reserve mingling with the crowds to live performances.

As you can see, I prefer to listen to the Quads rather close-up—almost using them as headphones—but a caveat is in order here: at distances less than about six feet, the speakers don't quite gel, so ultra-nearfield listening is to be avoided. The idea of listening in the nearfield, however, is to maximize the ratio of direct sound to room reverberation, and thereby reduce the sonic signature of the room. Intense, early room reflections are the most significant offenders, capable of defocusing the soundstage and, even more importantly, of modifying instrumental timbres.

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Footnote 1. As of 2010, Quad products were distributed in the US by Mofid Distribution, 1811 W. Bryn Mawr Avenue, Chicago, IL 60660. Tel: (312) 738-5025. Web: www.mofidistribution.com. Their service center in Fairfax, Virginia will service all vintages and versions of the loudspeaker, including the original ESL.

Footnote 2: I've always been amazed at the facility Martin Colloms shows (at least in his writings for *Hi-Fi News & Record Review* in the UK) in nailing down sonic quality to a single percentage point (*eg*, 83% sonic score for a component under review). I can't do that. It is extremely difficult to quantify personal sensations, and is very likely to be of limited usefulness to someone else, considering the variability in individual response to physical stimuli.—**Dick Olsher**



NEXT: Page 2 »

ARTICLE CONTENTS

[Page 1](#)

[Page 2](#)

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COMMENTS

QUAD ESL

Submitted by labarkeer on August 17, 2019 - 12:34pm



I bought my pair in 1976. They are still in use and I've not had anything done to them. Two things puzzle me.

1. Why some people have claimed they lack bass. Since they were favoured by organists (even at the time I bought mine) how can that be?

2. Why are people claiming that most of these speakers are either dead or "barely working" now? All I can assume is that they have been abused. One of the two guys who delivered my speakers said he had blown his. I think he had connected one of QUAD's more powerful amplifiers to it.

I think there might have been a third criticism: lack of loudness. That set me wondering how big the complainer's living room (or listening room) might be. The size of the Albert Hall? When I played LPs I mostly turned the pre-amp loudness control to 6. With CDs it was usually 4. I now have the smallest living room I've ever owned (4.46 metres wide, 7 metres long) and only need as high as 4 for a relatively quiet CD (such as a Paul O'Dette solo). I don't play LPs any more.

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Quad ESL loudspeaker Page 2

It is well known that the direction of a broad-band soundsource is largely determined by interaural cues associated with the earlier-arriving direct sound to the neglect of later-arriving reflections. This is precisely the precedence effect. (Note that the precedence effect does not preclude the perception of two separate but simultaneous auditory events from a pair of loudspeakers if the spectral content of the left and right signals is greatly different.) Experimental evidence supports the notion that the time course of the precedence effect spans two "windows." Following the abrupt onset of a sound, the sensitivity of the ear/brain system to interaural intensity and time differences is greatly degraded over the following 0.5 to 10ms. This means that during this time, the listener cannot distinguish even intense early reflections from the direct sound. Early reflections arriving in this 10ms window fuse with the direct sound and the sum is spectrally dissected by the ear/brain in order to form an impression of timbre or tonal color.

Sizeable reflections arriving during the second window, from about 10 to 50ms, are largely recognized as such by the ear/brain and do not figure prominently in timbre perception. However, because they are still below the threshold where they are recognized as discrete echos, these later reflections are not perceived as separate auditory events; instead, they are localized with the direct sound and used in determining the size or diffuseness of the spatial impression. After about 50ms, the spatial persistence of the auditory system fades and the cycle repeats itself.

With this introduction out of the way, it should be easy to understand the sonic degradation introduced by nearby room surfaces during playback. For example, strong lateral room reflections will fuse with the direct sound and cause the perceived image to shift toward the source of the reflection. This may result in the extension of the soundstage width well beyond the edge of the speakers, but the rub is that the subsequent size of the instruments will appear broader or more diffuse. Timbre accuracy suffers when the room generates early reflections (delayed less than 10ms) from walls, floor, ceiling, or even a coffee table in front of the listening seat.

To prove to yourself that the ear/brain actually works this way, you might want to try this rather interesting and elegant experiment. Record a short passage of a familiar solo instrument on a two-track open-reel tape deck.



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throughout on a gross time scale of several seconds the spectral content of the passage in reverse is identical to that in the forward direction, the reverse presentation sounds strange and unrecognizable! That's because during the "reverse" playback, the ear's 10ms window integrates primarily over the decay part of the musical information. One can conclude from this that correct arrival times for the various frequency components are crucial for the interpretation of timbre, and that extraneous room reflections can influence timbre perception.

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Positioning the Quads in the listening room should follow the rules of thumb applicable to any dipole radiator, and they should be positioned several feet away from the back wall and side walls. In addition to acoustical treatment of the back wall, the side walls should be treated—at least when the Quads are fairly close to them. Generally, you wouldn't think that a figure-eight radiator is likely to create much in the way of lateral wall reflections, but because of the toeing-in requirements, the back-wave can interact strongly with the side walls.

Choice of amplifiers is also important. The Quads work extremely well with the old Quad II tube amps, simply because these amps were designed around the speakers. Any candidate amp must meet strict stability requirements into a significantly reactive load (30–15 ohms in the range 40Hz to 8kHz, falling above 8kHz) and possess a voltage-limited output of no greater than 33 volts (peak), this limit representing the threshold of physical pain for the Quads. More than 33 volts and you will punch holes in the diaphragm. The Radford STA-25, Marantz 8B and, of course, the Jadis JA-30, are all good choices. The nature of the load tends to favor tubed amps, but small class-A solid-state designs like the Krell KSA-50 should also mate well with the Quads.

Quad Mods: from the Simple to the Sublime

As with any other piece of classic gear, the Quads have not escaped audiophile intervention in an effort to improve an already good product to further sonic heights. And considering the amount of time the product has been around, I believe that everything possible has been tried (footnote 3).

The simplest possible mods consist of discarding the cosmetic accouterments—namely, the back and front grilles. Removing the rear grille, together with the burlap padding, trades off bass control against enhanced midrange transparency. (Although with the Koval mod described later, bass control is not a problem and the reduced veiling and midrange congestion are worthwhile benefits.) Removing just the burlap padding and retaining the grille does not work as well. The gain in midrange transparency is not as great, and a standing-wave resonance develops in the response at about 4kHz, where the wavelength corresponds to the spacing between the back grille and the treble panels. Do not remove the thick felt padding behind the central treble unit, as it provides needed acoustic damping and controls what would otherwise be serious ringing in the mids.

Removing the front grille provides an even more dramatic gain in transparency and focus, which must be heard to be believed. It appears that the front grille acts as a diffraction grating or diffuser for the sound, veiling musical textures and reducing clarity. Without the front grille, clarity

removing grilles, for example. There are practical problems, however, inherent in removing the grilles—the least of which is the resultant ugly cosmetics. The dust covers are now exposed and vulnerable to rupture. High-voltage terminals are accessible to prying hands and curious pets. If there are small children or pets around your listening room, I'd think twice about these modifications. In my case, the Quads in my new listening room are quite isolated from such intruders, except from an occasional visit by one of JGH's cats.

The next modification is a lot trickier to implement. It is not one that I've personally tried, but I have it on good authority that it is sonically worthwhile. It involves replacing the dust covers with thinner mylar sheets. Such plastic sheets are readily available at hardware stores, and are commonly sold as paint drop-cloth. The reported improvement is in the same direction as that afforded by the removal of the grilles. Of course, no dust covers are better than even thin ones, so you may be tempted to dispense with them entirely. Don't! You will drastically shorten the life of the diaphragm by doing so.

Finally, the Koval mod (footnote 4). Amazingly, this mod was first advertised for public sale around 1979, and is still available in 1987 from John Koval. You'll need a pair of his mysterious-looking modules (one per channel), for which he asks a modest \$160/pair, post paid, and there is a money-back guarantee in case you're not satisfied. The modules are completely potted-in, with only five wires and six connecting pins protruding from the body. They are to be installed in the bottom of the audio transformers.

The installation is not overly complex, but is time-consuming (figure on a few hours), and requires care and a lot of soldering. Electrically, the mod involves, among other things, allowing the two midrange strips to run fullrange, rather than rolling off above 2–3kHz. The woofer panels are also rebalanced to complement the new and much simpler radiation scheme, which eliminates the overlap and interference between the mid and treble strips. Another benefit is the elimination of capacitors from the signal path—no caps are better than good caps.

As you can see, the Koval mod borders on a redesign of the stock unit. Is all of this effort justified? The answer is a resounding yes! Sonically, the most significant improvement is in the area of tonal balance. The Koval mod eliminates the speaker's broad midrange recession. My measurements show the modified Quads to possess flat response on-axis (within 2dB) from 700Hz clear out to 17kHz. Below 700Hz, the room response is excellent but a bit more jittery (4dB glitches) down to about 55Hz. The change in balance is quite obvious and results in a more lively and spacious character through the mids and treble. It takes some getting used to, especially if you've tailored the rest of your system around the tonal balance of the original Quads. Initially you might think the sound a bit bright or the treble a bit tipped up, but in the final analysis, the Koval mod advances the Quads much closer to reference caliber. The focus of instruments within the soundstage is also tighter, improving imaging specificity. The bass (with both grilles removed), too, is better defined, with

Of course, the Koval mod is not an overall panacea. The dynamic range and deep-bass limitations of the original Quads are still apparent. But the improvements are so significant that I think the Koval mod may be the best-kept secret in audio. It represents great value for money, and, together with the other modifications outlined above, pumps new life into the original Quads.

I have been using my modified Quads for quite a while now, not only as a reference tool, but simply for the sheer enjoyment of it all. It will be a cold day in hell before I retire these babies!

Footnote 3: Art Dudley described renovating and modifying a pair of original Quad ESLs in his July 2007 "[Listening](#)."—**John Atkinson**

Footnote 4: Linear Acoustic Labs, 11521 Cielo Place, Santa Ana, CA 92705 (1987).

Footnote 5: Bass transparency also improves if the Quads are used on rigid 15-inch stands, as recommended by Christopher Breunig in Vol.10 No.1.—

John Atkinson

ARTICLE CONTENTS

[Page 1](#)
[Page 2](#)

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