

AKG Model K-340 Stereo Electrostat/Dynamic Headphone



The new reference standard for "realworld" musical enjoyment from a stereo headphone

AKG Acoustics has broken the sound barrier to realistic reproduction in a headphone. Taking a no-compromise approach, we began with extensive electro-acoustic and psychoacoustic research, and backed it up with AKG's world renowned precision manufacturing capability. Ultimately we were able to combine the best qualities of popular headphone designs with none of their drawbacks. At last you *can* enjoy it all—comfort, light weight and

natural, open sound—sound with more realistic stereo imaging, wider and more accurate frequency response, lower distortion and less listening fatigue than ever thought possible. Once you've heard the new AKG K-340 Electrostat /Dynamic Stereo Headphone, you'll know why it is truly the new reference standard for "real world" musical enjoyment.

PSYCHOACOUSTICS ARE THE KEY TO NATURAL SOUNDING HEADPHONES.

When we hear a sound, we perceive its location essentially by sensing the differences in loudness and in arrival time of the sound at each ear. This information is further enhanced by the human brain's ability to sense a "comb filter" effect, a series of notches or dips in the frequency response of the ear itself that affect all sounds heard. The "comb filter" is so called because a graph of the response looks like a comb. The notches are caused by outer-ear resonance and diffraction effects (interference of direct and reflected sound waves), and partially by resonances within the ear canal itself. The comb-filter effect is a natural phenomenon that gives us specific information about sound-source localization. We are never aware of the "filter" per se, but we can certainly hear a difference when it is altered.

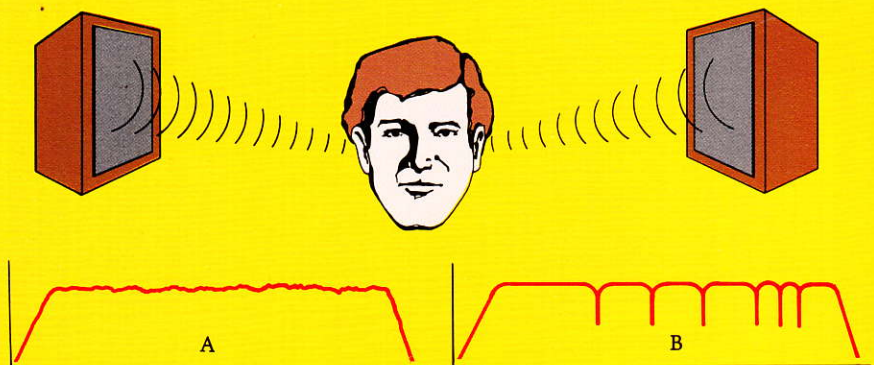
In addition, conventional headphones, whether the headphones are circumaural ("sealed"—cushion around the ears) or supra-aural ("open air"—cushion resting on the ear), suppress or alter the ears' natural resonances so that the comb filter changes or disappears. Suddenly the realism and accurate sound localization that would normally be heard over a good set of loudspeakers is gone. However, if a headphone can retain, or *even simulate*, the comb-filter effect, as does the K-340, it will create acceptably accurate stereo separation and localization (imaging).

Typical sound recording techniques

only aggravate the psychoacoustic problems caused by alteration of the comb filter: nearly all stereo recordings are engineered to create natural separation when played back *through loudspeakers*. That is, they have more than normal separation to account for acoustic mixing in the room during playback. Headphones do not provide acoustic mixing or reverberant fields, so separation tends to be very exaggerated. The combination of altering the comb filter effect and the exaggerated left-to-right separation in recordings makes the headphone listening experience unnatural.



The ideal "flat" frequency response (green line) is not what we actually hear. The anatomy of the ear creates a "comb filter" which produces peaks and dips in the frequency response (red line) which we accept as "normal" hearing.



Loudspeakers yield a reasonably flat frequency response when measured in an anechoic chamber (A). Our ears and brain, influenced by their inherent comb filter (B), perceive the sound as "normal" and "flat".



When "measured," a **sealed headphone** may produce a similar or better frequency response than a high-quality loudspeaker (A). However, when *worn*, its tight seal around the ears exaggerates the bass response, while the location, number, and depth of the comb filter's notches are also severely altered, destroying the impression of "normal," flat sound.



An **open air headphone** may also produce a similarly "measured" flat frequency response as the loudspeaker; however, air escaping around the ears weakens the effective bass response, while the earpads damp the desirable comb filter notches, again restricting perceived "normal" hearing.



The **AKG K-340 headphone**—with its dual sound-chambers, passive diaphragms, and acoustic resistances—maintains accurate bass response and recreates normal comb filter notch location, number, and depth. We perceive the sound to be normal as though coming from loudspeakers or live performances rather than wearing a headphone.

AKG's uniquely engineered design

Tradeoff 1— Sealed or Open Air?

"Sealed" headphones, with earpieces that form an essentially air-tight chamber over the ear, can develop strong bass notes, although usually exaggerated at a particular resonant frequency. The trick here is that unless the cushions fit tightly, bass response will be uneven . . . and the kind of pressure needed to ensure consistent response can get uncomfortable. Moreover, "sealed" headphones create pronounced cavity resonances that mask some of the ear's natural resonances - especially at lower frequencies - and shift others in frequency and amplitude, thus destroying much of the realism of the sound.

"Open air" headphones are usually fitted with open-pore foam earpads that damp out low-frequency resonances and minimize boominess. Since an air-tight seal is unnecessary, the headband can be more loosely fitted for increased comfort. Unfortunately the earpads' damping is wideband, extending beyond the bass, so at high frequencies it suppresses desired ear-canal resonances, modifies or destroys the comb filter, and alters the perceived sound image. Another primary trade-off here is in the bass range, which suffers from decreased level because the transducers are operated "unloaded" resulting in less boominess. Soft transducer diaphragms with wide excursion have been used to overcome the drop in bass, but they have a tendency to break up and introduce distortion at relatively low volume levels.

With either of these conventional designs, sealed or open air, the listener may hear directional effects in the program, but they won't bear an accurate relationship to the original sound source.

AKG's Solution— Use both

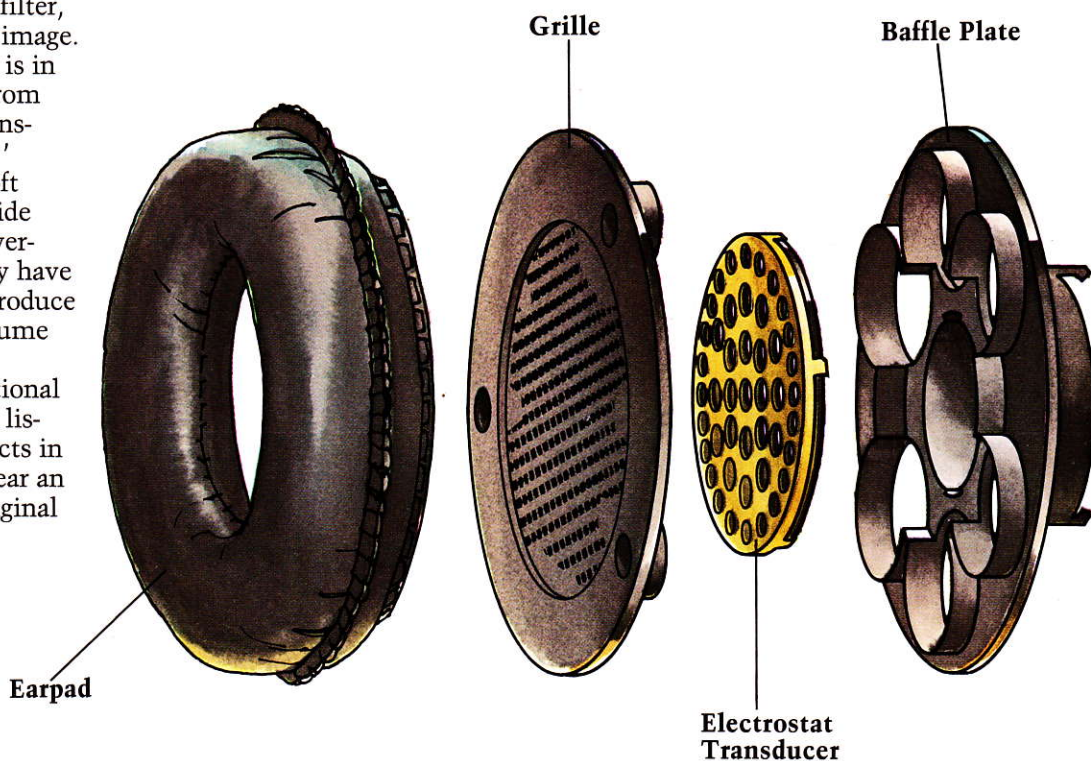
It was a genuine technological challenge, but we were able to combine the best characteristics of sealed and open air designs, with none of their disadvantages, into one headphone—the K-340. The K-340 has large, comfortable circumaural earpads that create a small primary sound chamber around the ear to strengthen low frequencies, the only similarity to conventional sealed headphones. Then we use something in each earpiece that no other headphones, except our Model K-240, have: patented AKG Passive Diaphragms, a secondary sound chamber, and acoustic resistance elements, all of which provide controlled mid- to high-frequency response without degrading psycho-acoustic performance. These innovations make the "free field" listening experience with a K-340 the most realistic ever achieved in a headphone, much better than that of so called "open air" or sealed headphones, and with no sacrifice in bass response.

Tradeoff 2—Transducers ... Condenser or Dynamic?

Headphones using conventional condenser transducers, also called "electrostatics," are capable of superb transient response, but have the disadvantages of weaker bass and the need for expensive, inconvenient external power supplies. Headphones using dynamic transducers typically yield stronger bass and require no external supply, but the moving mass is too great to equal the transient accuracy of condenser types.

AKG's Solution— Use both.

The K-340 is a two-way headphone with unexcelled transient and frequency response. Each earpiece has a fixed-charge electrostat transducer for the mid and high frequencies and a dynamic (moving-coil) transducer for the low frequencies, plus a built-in crossover network. The technique is just like that used successfully for years in two-way high fidelity speaker systems, with one difference; instead of using scaled-down



Design eliminates common tradeoffs

speakers, we manufacture transducers specifically for optimum performance in a headphone.

To make a compact dynamic transducer with powerful, tight bass response, we wind precision voice coils that can be inserted to very close tolerances in the narrow gap of a dense magnetic structure. The stiff diaphragm moves plenty of air without danger of break-up or distortion. The fabrication techniques are based on our experience manufacturing professional dynamic microphones, maximizing efficiency and ensuring consistent performance.

To create the fixed-charge electrostat element a 20-micron thick layer of gold molecules is vacuum deposited onto a strong, flexible mylar substrate. Since this element is permanently charged, it requires no external polarizing voltage; you can connect the K-340 directly to the headphone jack of any receiver or amplifier, or across the speaker output terminals. Sensitivity is high enough for use with low-power amps, yet the 400 ohm load impedance means the K-340 can be used safely

with high-power amplifiers. There are no circuit breakers to cut out, and no extra boxes to plug in.

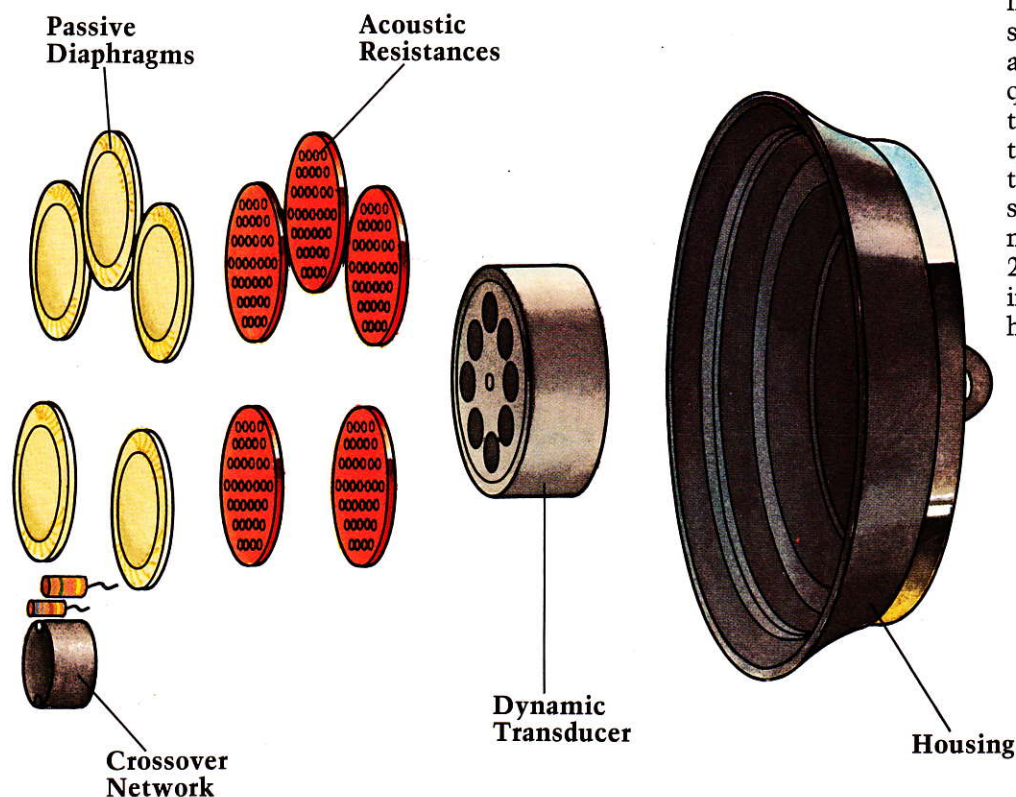
The 4,000 Hz crossover frequency allows one transducer to handle critical vocal and midrange sounds. Despite the small size, the crossovers are assembled from premium components providing the smoothest possible transition between the low- and high-frequency transducers. A miniature impedance-matching transformer easily fits in each earpiece as part of the crossover network.

AKG's two-way electrostat/dynamic design is a dramatic improvement over the sound quality which could be obtained from a single transducer. The full frequency spectrum is reproduced with phenomenal clarity and definition. A drum beat won't affect the cymbals. Vocals are uncolored, and the sound is always transparent and undistorted—even during high-level passages with a large orchestra.

Passive Diaphragms, the key to natural sound reproduction.

The Passive Diaphragms are thin, high compliance membranes that control the "acoustical size" of the headphone for optimum results at all frequencies. Opaque to sound at the lowest frequencies, the Passive Diaphragms seal the primary chamber for extended, linear bass output down to 16 Hz. Just at the point where a resonant peak normally would create boominess, around 200 Hz, the Passive Diaphragms become acoustically transparent. Effectively acting as vents, they "unload" the primary chamber into a secondary sound chamber to increase the coupling volume of air, smoothing the mid-bass response. Because the dual chambers reduce susceptibility to unpredictable bass output in the event of air leaks, the K-340 is designed to exert far less pressure against the sides of the head.

The secondary sound chamber is, itself, ported to the open air environment of the room, so the ear is free to develop *its own natural resonances* throughout the critical midrange. There are no induced cavity resonances, nor any foam to damp the sound, as with "open air" (supra-audal) phones. At extremely high frequencies where headphone coupling to the open air tends to be less effective, acoustic resistances just behind the Passive Diaphragms create a subtle comb-filter, simulating the natural response of the ear out to 25 kHz, re-creating vital localization information not present with other headphones.



With a headphone, comfort is as important as sound quality

The K-340 headphone surpasses even the most elaborate electrostatics in transparency and accuracy. It has deeper and more precisely defined bass than is available from the most expensive loudspeakers, while also being completely free from the effects of room acoustics. Every detail of the sound is clear and natural, and the acoustic image is better localized than with any other headphone available. Listening fatigue is the biggest enemy of headphones — but you can listen to the coloration-free K-340's hour after enjoyable hour.

A headphone's acoustical performance is academic if it is uncomfortable to wear, so every unnecessary ounce of weight was eliminated. The K-340 — despite its dual transducers and crossover networks — weighs about the same as an average open air headphone. Side pressure against the head is very low, and the large ultra-soft urethane-



filled circumaural earpads may be removed for cleaning. The headphones are supported by a wide, soft headband with raised pads which not only permit air to circulate, but also provide flexibility to conform to the exact curvature of any head. Strength is supplied by a dual-bow bail above the headband. The bail terminates in a pair of self-adjusting slide fittings that automatically

position the earpieces at the proper height.

The K-340 comes with a 3 meter (9-3/4 foot) coiled input cable that terminates in a standard 1/4" stereo phone plug. The cable's flat, side-by-side conductors are specially designed to reduce kinking. The input cable is brought directly to the left earpiece, and the headphone bail carries audio to the other earpiece, doing away with distracting "Y" cords under the chin. No detail has been overlooked in the design and every detail is revealed in the music for your enjoyment.

K-340 Technical Data

Transducer Types: Dynamic moving coil low-frequency system; Fixed-charge electrostat high-frequency system

Frequency Range: 16 Hz to 25,000 Hz

Crossover: 4000 Hz, 6 dB/octave

Nominal Impedance: 400 ohms, each channel

Sensitivity: 1.6 Pa/volt*

Normal listening level requirements:

0.63 V (1 mW) for 94 dB SPL (approx. 1 Pa). "IHF Sensitivity" rating. 5.0 V (63 mW) for 112 dB SPL (approx. 8 Pa).

Sound Pressure Level for ≤ 1.0 THD:

104 dB (200 to 2,000 Hz)

Maximum Continuous Input (per chan.):

9 V (200 mW), approx. 117 dB SPL.

Cable: 3 meter (9.8 feet) 4 conductor cable with 3-conductor (stereo) 1/4" phone plug.

Weight: 385 grams (13.5 oz.) less cable.

Contact force: Approx. 3 newtons (10.5 oz.).



*The Pascal (Pa) is now the standard unit for sound pressure level. 1 Pa \approx 10 microbar (μ b) \approx 10 dynes/square cm. \approx 94 dB SPL.

Other fine AKG headphones



Model K-140S Studio "Cardan"

This "open air" stereo headphone is an improved version of the popular Model K-140 (used in many recording studios), in which modifications in the transducer design have resulted in improved high-frequency performance. They also have the comfortable, self-adjusting "Cardan" designed earpiece suspension.



Model K-141 Deluxe "Cardan"

A lightweight, semi-open headphone featuring the resonance-free characteristics of "open-air" designs with freedom from low frequency side-effects caused by varying ear shapes and contact pressure. The K-141 is a good choice where both fidelity and economy are important.



Model K-240 Sextett "Cardan"

The K-240 utilizes the same Passive Diaphragm/acoustic resistance approach as the K-340 for controlled response and "free field" realism. These superb headphones utilize dynamic transducers (moving-coil) to provide excellent fidelity and high output. The "Cardan" design refers to a self-adjusting, universal-gimbal suspension for each earpiece.



Model K-40 "Stereohit"

An economical version of the K-140, the K-40 utilizes supra-aural foam pads for a true "open air" design. AKG large diaphragm transducers provide high quality reproduction, and a pleasant listening experience.



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