

AMP LISTENING TEST-YOU NEED TO KNOW WHAT OUR JUDGES HEARD



# car audio

THE LEADING MONTHLY MOBILE A/V SOURCE

## AND ELECTRONICS

OPTIMAL SEATING FOR 5.1 SURROUND SOUND

# PROJECT A



WHAT'S UP AHEAD WITH **NAV**TRAFFIC?

**PIONEER'S AVIC-N2**

**+ CADILLAC CTS  
ACURA RL**

**KENWOOD ANNIVERSARY  
WIN A COMPLETE SYSTEM!**



**TOP 3 CARS**

**VISIT** [WWW.CARAUDIOMAG.COM](http://WWW.CARAUDIOMAG.COM)



**PRIMEDIA**  
The Authoritative Source

# Electrostatic

TEXT VANCE DICKASON

**A**sk any audiophile what is the best type of speaker he has ever heard and the chance that at least one electrostatic speaker makes it onto the list is good.

Over the years, electrostatic loudspeakers have always been part of high-end audio, and, as I will explain, their complex and exotic construction has kept them out of the "best buy" category. But while the design of an electrostatic speaker is somewhat exotic in comparison to the magnet, voice coil and cone speakers that occupy 95 plus percent of all loudspeakers sold, the theory behind them goes back as far as 1881. In fact, the first electrostatic speakers came into existence in the early 1920s, but the technology of the time made them impractical. I'll give you some more history, but first let's look at what exactly an electrostatic speaker is and how they work.

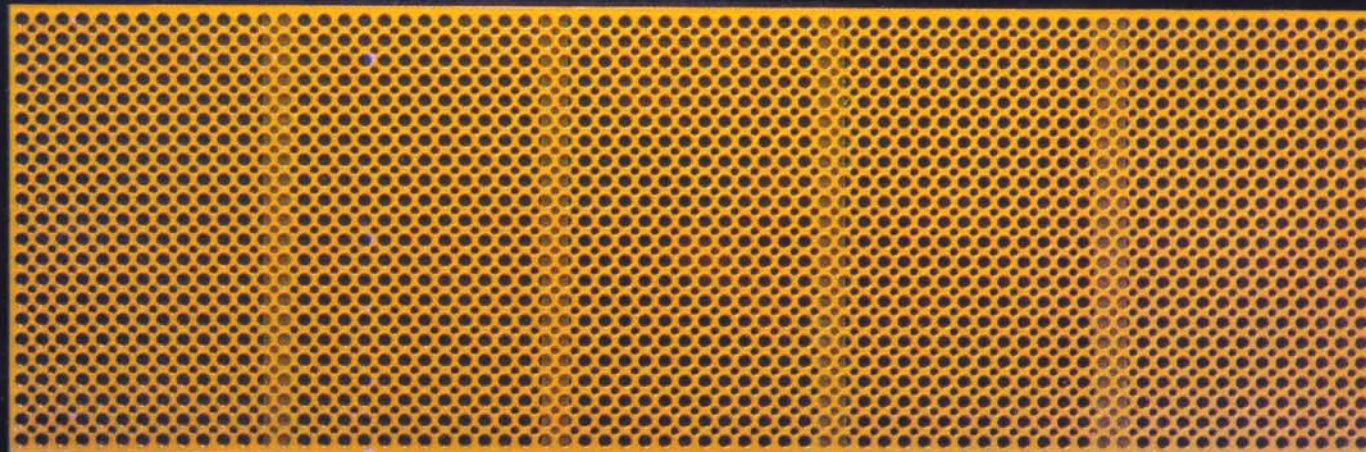
The idea for electrostatic speakers, sometimes referred to as condenser or capacitor speakers, probably occurred as the world transitioned from the early electricity era in the late 1800s to the beginning of the radio electronic era in the early 1900s. The genesis likely came from observing glass plate capacitors of that era that would "sing" when a signal was applied to them. In its simplest form, an electrostatic speaker would consist of one fixed conducting plate placed very close to a movable conducting plate (like a thin piece of Mylar plastic film impregnated with graphite), again rather like a capacitor. Since an audio signal is an alternating current (just like the electricity that comes out of the electrical sockets in the walls of your house), it puts a positive charge on one plate and a negative charge on the other plate. Then it reverses direction, swapping the polarity, which is of course the nature of electrical alternating current cycle (your 60-cycle house AC electricity does this reversal thing 60 times a second).

Each time the plates are charged with a voltage, the movable plate is attracted to the fixed plate and moves enough to push the air, just like the subwoofer cone in your car or home theater. However, in one cycle we get two air pushes as the movable plate is attracted both times it's charged, so if the signal going to our primitive electrostatic speaker is 1,000Hz (reversing 1,000 times per second), then the movable plate pushes the air 2,000 times per second, which is why the basic two-element electrostatic speaker would be called a frequency doubler. This frequency-doubling thing, however, is not cool—if a guy in the band plays middle C on his synthesizer, you don't want to hear a

note one octave above middle C. (By definition, if you double the frequency, it moves one octave up; if you cut the frequency in half, it moves one octave down.)

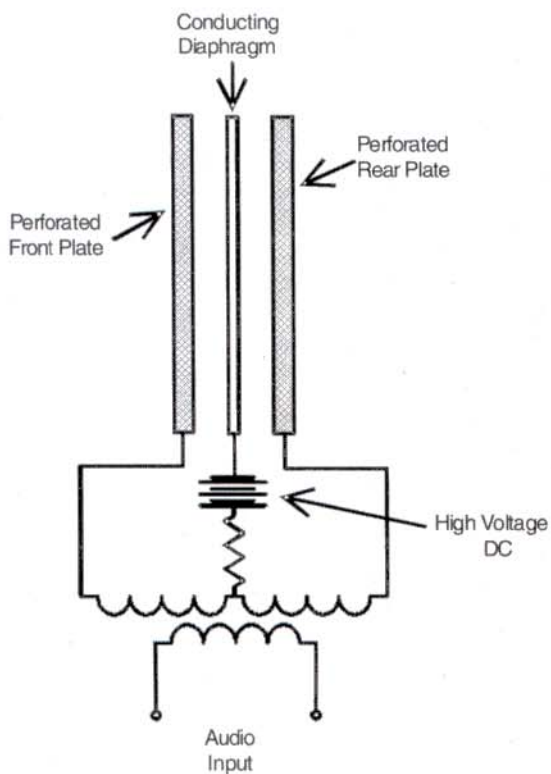
The solution to this frequency-doubling problem was to apply a very high DC (i.e., direct current, like that of a car battery) voltage (e.g., 300V to 2,000V) to the movable plate (i.e., diaphragm). The high-voltage DC charge, also called the polarizing voltage, causes a strong constant attraction from the fixed plate to the movable plate. Now when we put our 1,000Hz signal to the two plates, the movable plate moves more toward the fixed plate and then returns to a zero position on the positive half of the alternating "cycle." On the negative half of the cycle it causes the plate to have less total attraction and moves in the opposite direction, so now the plastic film plate moves in unison with the incoming audio signal and the frequency-doubling problem is history. In reality, the configuration of the plates works a little differently, but the principle is the same. In most electrostatic speakers, you have two fixed and heavily perforated metal plates (like a speaker grille) on either side of the movable diaphragm plate, as shown in the drawing. The polarizing voltage is applied to the movable plate (usually a metallized Mylar diaphragm) and the audio voltage is applied across the two fixed (stator) plates.

So why go to all this trouble? The main advantage of an electrostatic loudspeaker is the very low mass of the diaphragm. Because the diaphragm is so light, the transients are extremely quick and detailed. Compare that to the weight of a speaker cone, the surround, the spider, the voice coil wire and the voice coil former, and that's what all the fuss is about. A lot of famous electrostatic loudspeakers have been well loved by "audiophiles" the world over. The first full-range electrostatic was the Quad ESL, produced in 1957 in England by Peter Walker and David Williamson. At about the same time American engineer Arthur Janzen developed the famous Janzen electrostatic tweeters/midrange drivers. Other examples of electrostatic loudspeakers include speakers by Dayton Wright, KLH, Beveridge, Acoustat and Martin Logan. Of course, these are all very large and very expensive home speakers. But nowadays this technology has taken its place in the mobile environment (again) with Critical Mass' new ESL series. If you have ever had the opportunity to listen to electrostatics, you might want to check out what's offered for your ride. ✖



CRITICAL MASS SP-1C

# TRICS



Martin Logan is one of the premier electrostatic manufacturers for the home. The Summit series is a result of years of research. Check them out at [www.martinlogan.com](http://www.martinlogan.com).

**RIDING THE  
WAVE FROM  
THE PAST INTO  
THE FUTURE**