



## “Tight & Refined Bass”

### e<sup>2</sup> Subwoofer

#### ***All About Moving Air - Overview***

FredericStevenson innovative design created the small box, high power subwoofer category for automobile and modern homes where space is limited. Physics tells us that in order to have high-impact, low frequency bass, a large cabinet was required. The design for a high-pressure, miniature sized subwoofer changed everything. With the Extreme Excursion e<sup>2</sup> Subwoofer, music and film enthusiasts could have real bass in a car or room that could never support a large, bulky, old-school subwoofer.

Needless to say, the e<sup>2</sup> Subwoofer Clarity series is our flagship model. Available in 8 & 10 inches twin drivers, it produces huge bass from a box a fraction of the size of its competitors. When you first see it, you won't believe it's capable of delivering significant bass. And when you first hear it, you'll search the room to see if someone has sneaked in two of them.

#### ***e<sup>2</sup> Technology – Know How***

It seems simple - to have lots of bass, you must move lots of air. The measure of air movement is called "displacement", which is cubic inches. If we want to shake the walls and rattle the windows in a normal sized listening room, as a rule of thumb we need 135 cubic inches of air displacement. Its a matter of raw power, and the air moved by a woofer is the surface area of its cone,  $\pi r^2$  x movement in and out.

For example, a very high quality 15" woofer that can move in and out 1/2" (its "excursion" or "throw") can displace approximately 66 cubic inches of air. That's a lot, but still not quite enough to shake the walls and rattle the windows. According to Dolby Laboratories, for Dolby Digital the air displacement required is at least **265** cubic inches of air movement. Using our above example of a 15" woofer with a 1/2" excursion, to reach 265 cubic inches of displacement would require four 15" drivers! That may not be a problem for a commercial cinema, but it is simply not practical in an automobile or our modern home.



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### ***The solution***

Here's where innovative thinking takes over. In order to get lots of air displacement we need a very large stroke (long throw) woofer, that is why all FredericStevenson subwoofer designs come with "Extreme Excursion" trademark.

**$\pi(4)^2$  (area of piston) x 2.5" (Extreme excursion of woofer) x 2 (two drivers in a box) = 201 cubic inches.**

201 cubic inches of air displacement is about the same as three or four (depending on their excursion) "Classic" 15" drivers operating in a cabinet the size of a small refrigerator. In practice, it's somewhat less because the excursion limiter is set to prevent bottoming.

### ***How The Twin Drivers Move***

Both drivers in the FredericStevenson e<sup>2</sup> Subwoofer are driven by a common electric motor and magnetic structure. One driver is driven by a voice coil, the other by a 100g mass. Both drivers move inward and outward together. The voice coil driven driver is moved by a force,  $j = Bli$ , where B is the magnetic field, l is the length of wire on the voice coil, and i is the current through the coil. The mass driven driver is moved by the force (mass x acceleration) of a 100g weight. The two forces are exactly equal and opposite. The twin drivers contribute equally to the output sound pressure in its chosen operating band.

### ***Summary***

FredericStevenson e<sup>2</sup> Subwoofer do the seemingly impossible – from a tiny cabinet they are able to put out as much bass as an extremely large woofer in a very large cabinet. The secret behind is the custom large excursion drivers. Its in and out movement is approximately five times greater than a conventional woofer. Since it can move back and forth 2inches, it can move lots of air.