Subject: First-order tweeter crossovers
Posted by Wayne Parham on Thu, 15 Apr 2004 12:20:39 GMT
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Any of you guys running first-order tweeter crossovers?I've built several loudspeakers over the years, and many of them have used first-order crossovers. There are some distinct advantages for home use, not the least of which is cost. They generally sound pretty good too, when you don't have banks and banks of loudspeakers to try to keep phased.But I always seem to poof the tweeters. I mean, over about 10 or 20 watts, the tweeters just eventually go "phoop". Not a lot of power, really, and one minute everything sounds great and the next, no tweeter. It just disappears, like a fuse.Seems like cone tweeters and domes work OK with first-order filters. They aren't really designed for all that much power anyway. Midrange and woofer cones are always good with first-order, or even no crossover at all. But compresson drivers don't like these single-cap crossovers very much. And ribbons, you can't even think about first-order. You can actually be using a higher-order crossover and just think about the mere possibility of a first-order and the ribbon will blow. They really don't like 'em.I suppose it's probably fine for small signal SET owners to use single-cap crossovers on compression tweeters, but if you ever connect to something with a little more power, you're in trouble. Too much low frequency energy passes, even with a way-too-high crossover point. So the dynamic range is kinda limited, and I don't like that. I concluded a long time ago that I had to find other solutions.Any of you guys had any luck with more than a handful of watts to your compression tweeters on a first-order filter?

Subject: Re: First-order tweeter crossovers
Posted by Bill Wassilak on Thu, 15 Apr 2004 14:26:07 GMT
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Nope blew them all like you said. You got to remember that every time you 1/2 the freq. the excursion goes up by a factor of 4. From what I learned from other people about compression drivers is, lets say you have a tweeter x-over at 6k at 10 watts rated power, at 3k(-6db) the drivers are only going to be able to handle 5 watts ,@ 1.5K(-12db) 2.5watts, etc., because of the excursion increases. So you can see why it's to easy to shoot diaphram across the room with to much power on first order x-overs.Bill W.

Subject: Re: First-order tweeter crossovers
Posted by GarMan on Thu, 15 Apr 2004 15:12:42 GMT
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Haven't built enough speakers to have real world experience in this area. But wondering, would a tweeter's ability to deal with first order also be depended on its sentitivity compared to the woofer?For example, it pretty common for tweeters to have 10dBs over the woofer. Put an L-Pad

in to match SPL levels, and the tweeter only receives 10% of power. So, while the woofer might be getting 50W to 100W, the tweeter only receives 5W to 10W.Gar.

Subject: Re: First-order tweeter crossovers
Posted by Bill Wassilak on Thu, 15 Apr 2004 17:59:02 GMT
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>>But wondering, would a tweeter's ability to deal with first order also be depended on its sentitivity compared to the woofer? This has nothing to do with it. It's in the construction of the tweeter and materials used, Like Wayne says the cone or dome tweeters seem like they can handle it better, where as you get into compression drivers and ribbons the diaphram materials are so thin it won't take much flexing (from the lower freqs. below the x-over point) they'll rip themselves apart on a first-order.Bill W.

Subject: Re: First-order tweeter crossovers
Posted by akhilesh on Thu, 15 Apr 2004 18:41:43 GMT
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I use a supertweeter with a first order crossover at 14,000 cycles, with low powered tube amps. never had a problem. IF the tweeter is doing less than 3000 HZ, i guess there may be a problem.....I guess if one is doing first order, then cross it over high....go 3 way!-akhilesh

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Subject: Re: First-order tweeter crossovers
Posted by Wayne Parham on Fri, 16 Apr 2004 05:21:27 GMT
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You've got dome tweeters too, which seem to be a bit more forgiving of lower-frequency energies from first-order filters.

Subject: Re: First-order tweeter crossovers
Posted by Wayne Parham on Fri, 16 Apr 2004 05:31:08 GMT
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Well, sure, cutting power by 10x gives you that much more ability to handle input power. But the

sound output ability remains the same, it just shifts the power point where maximum safe output occurs. You're still talking the same max SPL.Consider that a first-order crossover with 10dB padding is -16dB an octave below crossover. The same thing but with a third-order filter is -28dB one octave below. The tweeter with the third-order filter is receiving less energy one octave below crossover (-18dB) than the first-order filter (-6dB), even if the first-order solution is padded 10x (-16dB).It's not that the first-order solution is without merit. It's just that you can't hit the dynamic range peaks with a compression tweeter using a first-order crossover as you can with a higher-order slope.

Subject: Consider both power and excursion.
Posted by Bill Fitzmaurice on Fri, 16 Apr 2004 11:30:21 GMT
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What limits a tweeters ability to run with a 1st order crossover is both power and excursion. The power reduction afforded by a capacitor at 6dB per octave is generally adequate to counter the rising program power input, on average 3dB per octave, as one goes lower in frequency, giving a net reduction of 3dB per octave, assuming a reasonably robust voice-coil. However, since excursion increases by a factor of 4(6dB) per octave as frequency drops for equal power input then even with a net power input reduction of 3dB/octave the excursion demand will rise at 3dB/octave. That being the case I wouldn't consider a 1st order filter unless the corner frequency was set to at least 4 times Fs. On the other hand, you can go to the other extreme as well with a very high order crossover. Neville Thiele has recently shown that with a 5th order high-pass you can run the corner frequency very close to the Fs without any difficulty from either the power or excursion standpoint, and the additonal octave or two of operating range thus afforded can well offer the opportunity to run two-way rather than 3-way. This works very well with a 3rd order low-pass on the woofer as far as integration goes, and offers a parts cost reduction as well compared to a 4th order/4th order arrangement due to the lessened high value inductor count.

Subject: Re: First-order tweeter crossovers
Posted by hurdy_gurdyman on Fri, 16 Apr 2004 12:14:54 GMT
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I'm using a transformer coupled piezo with a first order crossover with my EV LS-12 open baffles. A 1.5uF cap couples the 25 volt line transformer used to the amp. After the transformer is a zobel circuit and a 60 ohm resistor. The piezo has liquid nails covering the cheap plastic horn and a thin coat of Dammar varnish on the diaphram. The whole thing sounds pretty good. I've been listening to this set-up instead of my Heresy's for over a week now and am in no hurry to switch again.Dave :^)

Subject: Re: First-order tweeter crossovers
Posted by Wayne Parham on Fri, 16 Apr 2004 13:21:07 GMT
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That's pretty cool. I often run the piezo's with no crossover at all and I've never had any trouble smoking them. They act like they have a built-in crossover, so adding an additional (first-order) pole works just fine.

Subject: Re: First-order tweeter crossovers
Posted by Bill Wassilak on Fri, 16 Apr 2004 15:19:15 GMT
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I've done the same thing in my floor monitors (no x-overs), the only time I've blown the piezo's is when I did mixing for some jazz or funk bands with horn sections trumpet,sax,etc.Bill W.

Subject: Piezopower
Posted by Bill Fitzmaurice on Fri, 16 Apr 2004 19:24:36 GMT
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If you run multiple piezos in a cab you can wire them for more power or more sensitivity. Wire parallel and you get increased SPL of 6dB/doubling of drivers, but with no increase in power handling. But if you wire in series the SPL remains level while wattage increases by a factor of four for each doubling of drivers, so two 50 watters in series will handle 200 watts, and four would handle 800 watts.

Subject: Re: Piezopower
Posted by Bill Wassilak on Fri, 16 Apr 2004 19:53:25 GMT
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Thanks Bill,That's good to know, I had 2 piezo's wired in parallel thinking that it would double the power handling along with increasing the SPL. Know wonder they blew shoving 150w at them even tho they were rated at 50 watts each.Bill W.

Subject: Think of piezos as capacitors vis a vis power.

Posted by Bill Fitzmaurice on Sat, 17 Apr 2004 13:15:10 GMT
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Piezos place a capacitive load rather than resistive load, so they are voltage limited rather than amperage limited when figuring power capacity. The average piezo is very comfortable with about 25 volts in. When used in multiples wiring them parallel they all see the same voltage input. For example, 40 volts putting 200 watts into your woofers will probably toast a pair of piezos in parallel, both seeing 40 vols input. But if you wire them in series then the voltage is divided between them for 20 volts apiece, keeping them safe.For boxes that I don't plan on putting more than 75 watts or so average program into I use them paired in parallel for high SPL. With four or more I wire them as series/parallel pairs to gain both sensitivity and power capacity. A vertical array of eight piezos gives better than 105dB sensitivity, is able to handle 100 volt signals, and can be built for as little as 16 bucks. That is a serious bang for the buck factor.