

Quiz 7 Solution

1. In the circuit diagram below, identify which speakers are ‘tweeters’ for reproducing high frequencies, and which are ‘woofers’ for reproducing low frequencies. Briefly explain your choices.

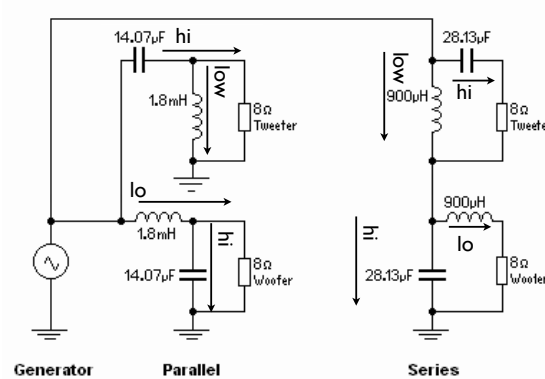


Figure 1: Image from <http://sound.westhost.com/parallel-series.htm>.

Solution: In the upper left, we have an inductor making a shortcut path around the speaker, and a capacitor blocking low frequencies in series. Thus, only high frequencies make it to the speaker, and it must be a tweeter. In the lower left, the situation is reversed: a blocking inductor for high frequencies in series, and a shortcut capacitor in parallel, so that speaker is a woofer. In the upper right, we have a blocking capacitor in series and a shorting inductor again, so as with the upper left this is a tweeter. In the lower right, as with the lower left, we have a blocking inductor and shorting capacitor, so this too is a woofer.

2. Below is a three-way crossover, driving one tweeter, one woofer, and one mid-range speaker. Which speaker is which, and why? (The symbol with one straight and one curved line is a type of capacitor.)

Solution: For the upper speaker, we have a blocking capacitor, so only reasonably high frequencies make it to the speaker. In parallel, we have a capacitor-inductor series combination. This blocks both low and high frequency, and thus lets mid-range signals through, and has the effect of shorting out mid-range signals that made it through the initial capacitor, leaving only the highest frequencies for the speaker, which must therefore be a tweeter.

For the lower speaker, we have series inductors to block high frequencies and a shorting capacitor for high frequencies, making this a woofer.

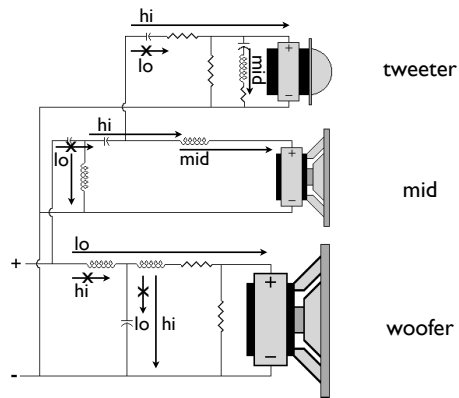


Figure 2: Image from <http://www.rane.com/note134.html>.

The center speaker must be midrange by elimination. There is a series inductor-capacitor combination with this speaker which blocks both low and high frequencies, letting only mid-range through to the speaker. Additionally, there are both shorting inductors and capacitors which have the same effect.