Series, Parallel, and Series-Parallel Speaker Wiring

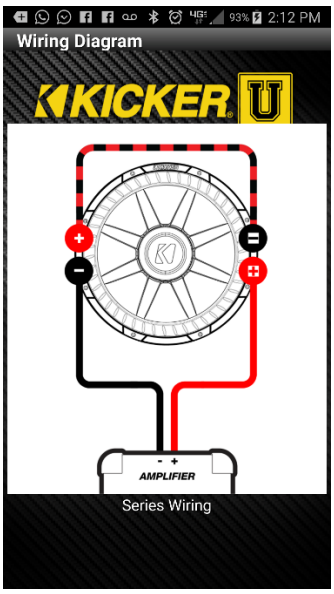
When wiring speakers with multiple voice coils, it is important to understand the process for series and parallel wiring. Depending on what method you use it will present a different load to the amplifier. This process is the same for resistors as well as voice coils in electrical circuits. When wiring speaker voice coils, it is very important to observe the polarity in both series and parallel wiring of speakers.

Series Wiring:

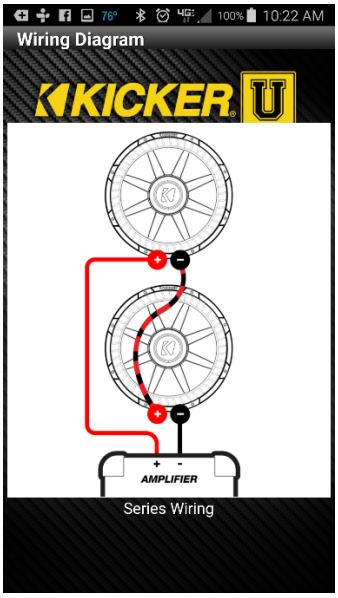
When wiring two or more voice coils in series, you will connect the positive connection of the first voice coil to the positive connection of the amplifier. The negative voice coil connection will attach to the positive connection of the second voice coil. If you are only wiring two voice coils in series, the negative connection on the second voice coil will then connect to the negative connection of the amplifier. If you are using more than two voice coils, you will repeat the process for each additional voice coil by connecting the negative voice coil connections to the positive voice coil connection of the next speaker and so on.

Examples:

One dual coil speaker



two single coil speakers



When you wire voice coils in series, you will simply add the resistance of all the voice coils to know what the impedance will be at the amplifier. The coils do not need to be the same impedance but it will affect how much power each speaker receives from the amplifier. It is never recommended in car audio to mix impedances of speakers connected to the same terminals.

Examples:

Two 4 ohm voice coils wired in series, 4 Ω + 4 Ω = 8 Ω

Two 8 ohm voice coils wired in series, 8 Ω + 8 Ω = 16 Ω

Three 4 ohm voice coils wired in series, 4 Ω + 4 Ω + 4 Ω = 12 Ω

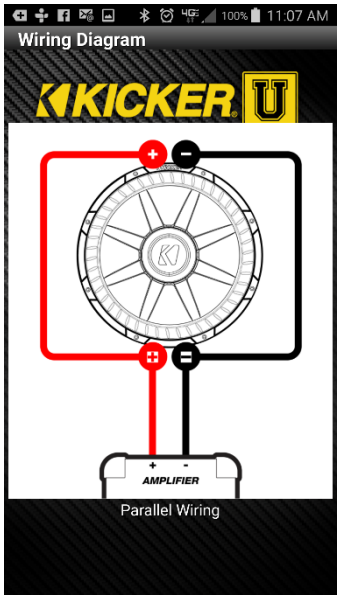
Three 8 ohm voice coils wired in series, 8 Ω + 8 Ω + 8 Ω = 24 Ω

Parallel wiring:

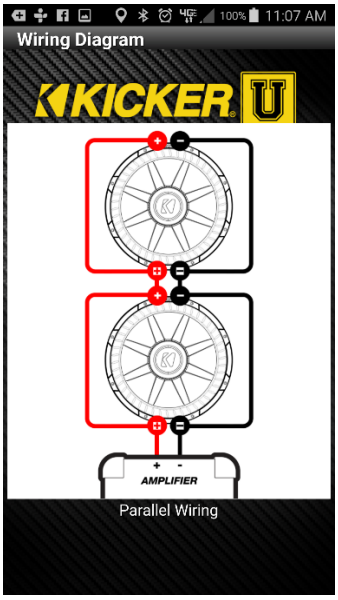
Parallel wiring is very simple. You will simply wire all the positive voice coil connections to the amplifier's positive terminal and wire all of the negative voice coil connections to the negative amplifier terminal.

Example:

One dual voice coil speaker



Two dual voice coil speakers



If all of the coils are the same impedance, it is very easy to calculate final impedance. You will take the impedance of the voice coils and divide by the number of voice coils. This formula only works if all the voice coils are the same impedance.

Examples:

Two 4 Ω voice coils in parallel, 4 Ω ÷ 2 coils = 2 Ω

Two 8 Ω voice coils in parallel, 8 Ω ÷ 2 coils = 4 Ω

Four 4 Ω voice coils in parallel, 4 Ω ÷ 4 coils = 1 Ω

Four 8 Ω voice coils in parallel, 8 Ω ÷ 4 coils = 2 Ω

If your speakers are of different impedances, there is a mathematical formula to determine the total parallel impedance. This method does not work correctly for audio because not all the speakers will get the same power even if the load is correct for the amplifier used.

Formula:

R1 in Parallel with R2, R3, and So On

$$\frac{1}{R_{Total}} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \ldots$$

Where R1, R2, and R3 are individual coil impedances and Rtotal is the final impedance load at the amplifier.

Example:

You have two 4 Ω speakers and an 8 Ω speaker

1/4 Ω + 1/4 Ω + 1/8 Ω = 1/Rtotal

=

.25 + .25 + .125 = 1/Rtotal

=

.625 = 1/Rtotal

= 1.6 Ω

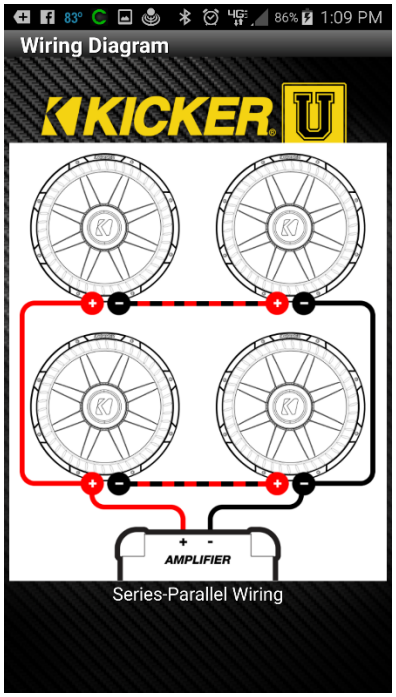
You could use series-parallel to get a 4 Ω final impedance for the amplifier, but the 8 Ω speaker will get double the power of the two 4 Ω speakers. There is no way to balance the power to all three speakers when powered by the same amplifier output.

Series/Parallel Wiring:

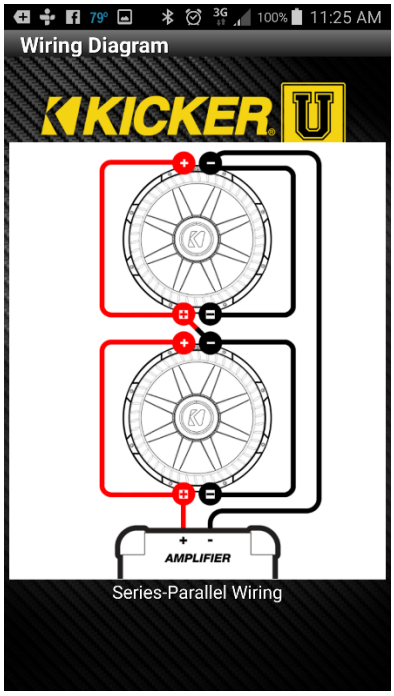
There are many times when you have to use a combination of both series and parallel wiring to get the impedance you desire. This can be a bit harder to calculate. We are going to assume all of the coils are of the same impedance to make this much easier. We are also going to assume we have an even number of voice coils. With single voice coil speakers, you will have to have a minimum of 4 speakers to use this method. If all four speakers have the same impedance, with series-parallel wiring, the final impedance will be the same as the impedance of a single speaker. You will simply series two sets of two speakers and then wire one group of two speakers in parallel with the other group of two speakers. For multiple dual voice coil speakers, you will need to decide which way you will wire the coils on each speaker, either series or parallel. You will take that final impedance of the woofers two coils and use the other method, series or parallel, to calculate the final impedance to the amplifier.

Example:

Four single voice coil speakers



two dual voice coils speakers



Example:

Four single coil 4 Ω speakers or two dual voice coil 4 Ω speakers will calculate exactly the same way with a series-parallel combination.

4 Ω + 4 Ω // 4 Ω + 4 Ω = 4 Ω

=

8 Ω // 8 Ω = 4 Ω