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How to calculate speaker impedance, the easy way

When you connect multiple speakers to an amplifier, you have to make sure that the amp isn't overloaded. As you add more speakers in parallel, the impedance that the amp "sees" gets lower, causing the amp to work harder. By using impedance matching devices such as Audioplex OPT series volume controls, MatchIts, or a speaker selector, we can fool the amp into seeing a safe load. But in order to know how to set your impedance matching device, you need to know the impedance of the connected speakers.

Technically speaking the impedance of loads connected in parallel is the reciprocal of the sum of the reciprocals of the connected loads.

$$\text{Impedance} = \frac{1}{\frac{1}{I_1} + \frac{1}{I_2} + \frac{1}{I_3} + \dots}$$

where I_1 , I_2 , and I_3 are the impedances of individual speakers

The math isn't too bad, but there's a much easier way to figure the impedance to the amp if the loads are eight or four ohms, which is the case for most speakers.

Simply count up how many speakers are on each channel. Count four ohm speakers as two. Then divide eight ohms by this number, and you'll get the impedance of the parallel combination of the speakers.

$$\text{Impedance} = \frac{8 \text{ ohms}}{n}$$

where n is the number of 8 ohm speakers plus twice the number of 4 ohm speakers.

So if you have 4 eight ohm speakers and 2 four ohm speakers on each channel, the count would be 8: 4 for the 4 eight ohm speakers and 4 for the 2 four ohm speakers. Then you divide 8 by 8 and get 1 ohm.

We can further simplify this by making up a table of impedance values for different numbers of speakers. Find the number of 8 ohm speakers in the left column. If there are any 4 or 6 ohm speakers, count them as two. The approximate impedance of the combination of parallel speakers can be read from the right column.

Number of 8 ohm speakers (4 ohm speakers count as 2)	Combined Impedance
1	8.0 ohms
2	4.0 ohms
3	2.7 ohms
4	2.0 ohms
5	1.6 ohms
6	1.3 ohms
7	1.1 ohms
8	1.0 ohms

So what do you do with this number? In order for your amp to work properly, the impedance of connected speakers has to be equal to or greater than the impedance rating of the amp. Most amps can handle a 4 ohm load, some need 8 ohms, and a few will work with 2 ohms or even lower. This rating is usually printed on the back of the amp; if it's not, it's usually safe to assume 8 ohms. You'll need to set your impedance matching device so that the amp will "see" a load equal to or greater than its impedance rating.

In our example, our combined speakers have an impedance of 1 ohm. Suppose we want to connect them to an amp rated at 4 ohms. We need to increase the 1 ohm to at least 4 ohms to keep the amp from overloading. This is exactly what impedance matching devices do. In this case, we can set the impedance matching device to x4, which means that it will multiply the connected load (1 ohm) by 4, yielding 4 ohms. Because this is equal to (or greater than) the amp's rating, the amp should function normally. If the amp needs at least 8 ohms, you'd want to set the impedance matching device to x8. It's OK if the impedance at the amp is greater than its rating; it just won't deliver as much power.