

Matching Amplifiers and Speakers

Some basic specifications & principles

Continuous Power Rating of amplifier

Watts per channel of power delivered into load at specified impedance

Nominal Impedance of speaker

Impedance is basically frequency dependent resistance

Continuous Power Rating of speaker

Amount of power the speaker can safely handle

As speaker impedance drops, output power of the amp increases proportionally

An amp that outputs 100w into 8 ohms outputs 200w into 4 ohms, etc. (more or less) (remember Ohm's Law!)

Some ideas to keep in mind

Over-powered

Run the risk of blowing speaker drivers by physically driving the elements too far in the enclosures

Underpowered

Run the risk of driving power amp too hard to get desired SPL, causing clipping

Clipping causes more THD (total harmonic distortion)

Sends more signal to tweeters

Risk blowing tweeters due to thermal overload

In general, a good rule of thumb is to choose an amp that has a calculated power rating 1.6-2.5 times the power rating of the speaker(s) at the specified impedance. See the section on the following page for specifics.

Parallel vs. Series connections

Resistance in series adds

$$R\text{-total} = R1+R2$$

Resistance in parallel divides

$$R\text{-total} = R1*R2/R1+R2$$

Connecting speakers in parallel decreases the impedance, increasing the output power, and also splits the total power among the connected speakers. For example, two 8 ohm speakers connected in parallel provide a total nominal impedance of 4 ohms. Each of the two speakers then receives half of the amplifier's 4 ohm continuous power rating.

Problems:

- 1) Connecting two 8 ohm speakers in parallel to Amplifier A will provide a total nominal impedance of how many ohms?
- 2) Amplifier A has a continuous power rating of 200 watts into 8 ohms. How much power will it deliver to the load calculated in #1?
- 3) Each speaker will receive how much power from Amplifier A?
- 4) If you have a speaker with a continuous power rating of 150 watts, what is the range of output power for an appropriate amplifier for this speaker (assuming correct impedance matching)?

From the Crown Audio, Inc. website:

How much power can my speakers handle?

You can determine this by looking at the speaker's data sheet. Look for the Nominal Impedance spec. Typically it will be 2, 4, 8 or 16 ohms. Next, look for the loudspeaker specification called Continuous Power Handling or Continuous Power Rating. It might be called IEC rating or Power capacity.

If you can prevent the power amp from clipping (by using a limiter), use a power amp that supplies 2 to 4 times the speakers continuous power rating per channel. This allows 3 to 6 dB of headroom for peaks in the audio signal. Speakers are built to handle those short-term peaks. If you can't keep the power amp from clipping (say, you have no limiter and the system is overdriven or goes into feedback) the amplifier power should equal the speakers continuous power rating. That way the speaker won't be damaged if the amp clips by overdriving its input. In this case there is no headroom for peaks, so you'll have to drive the speaker at less than its full rated power if you want to avoid distortion.

If you are mainly doing light dance music or voice, we recommend that the amplifier power be 1.6 times the Continuous Power rating per channel. If you are doing heavy metal/grunge, try 2.5 times the Continuous Power rating per channel. The amplifier power must be rated for the impedance of the loudspeaker (2, 4, 8 or 16 ohms).

Here's an example. Suppose the impedance of your speaker is 4 ohms, and its Continuous Power Handling is 100 W. If you are playing light dance music, the amplifier's 4-ohm power should be $1.6 \times 100 \text{ W}$ or 160 W continuous per channel. To handle heavy metal/grunge, the amplifier's 4-ohm power should be $2.5 \times 100 \text{ W}$ or 250 W continuous per channel.

If you use much more power, you are likely to damage the speaker by forcing the speaker cone to its limits. If you use much less power, you'll probably turn up the amp until it clips, trying to make the speaker loud enough. Clipping can damage speakers due to overheating. So stay with 1.6 to 2.5 times the speaker's continuous power rating.

<http://www.crownaudio.com/amp_html/amp_info/how_much_power.htm>