



# Series and Parallel Speaker Wiring with Volume Controls

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Multiple speaker connections can be arranged in series and parallel using volume controls, maximizing amplifier power transfer (without danger of speaker or amplifier damage).

When properly installed, each speaker will sound its best. Installations of multiple speakers properly wired in series and parallel *always* sound better than adding impedance matching transformers. Individual and zones of speakers can have volume controls as desired with a few exceptions. For further detailed information on this subject see the Knöll white paper "Speaker Level: Splitting and Control".

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## **For the best series and/or parallel speaker layout determine:**

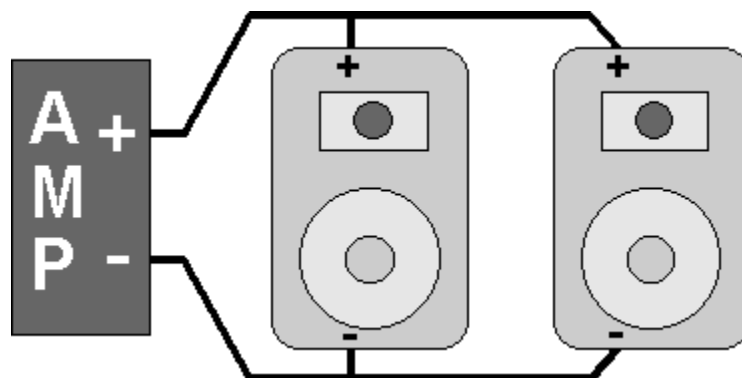
1. The minimum recommended amplifier impedance (in ohms). This is usually printed on the back of the amplifier or is in the owners manual. If not, contact the manufacturer for this information.
  2. How many pairs of speaker will be powered by each stereo amplifier?
  3. The impedance (in ohms or ) of the speakers. This is usually printed on the back of the speaker or in the owners manual. Impedance of conventional speakers can usually (but not always) be checked with an ohmmeter. Readings of 3 - 4.5 ohms usually mean the speakers are 4 ohms; 4.6 - 6 usually mean the speakers are 6 ohms; 6.1 - 9 usually means the speakers are 8 ohms.
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## **Installation Tips:**

1. It is best to wire multiple pairs of speakers so the resulting impedance is equal to or more than the amplifier minimum recommended impedance. Sometimes the number of speakers and amplifiers can be juggled in larger systems to maximize system capabilities.
2. Recommended minimum speaker wire size is 16 gauge low oxygen type. Wire runs longer than 15m (50') need larger 14 gauge or 12 gauge wire.

### Fig. 1 Parallel Speaker Wiring

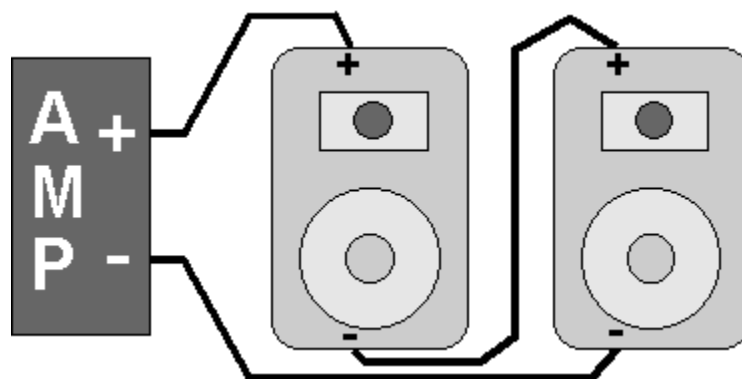
**Note:** Left channel amplifier, speakers and connections shown. The two speakers can be different models and both will sound their best



3. Series wired speakers must all be exactly the same model for best sound quality. Only one stereo volume control can be used for each series "leg". A series "leg" is two or more speakers wired together (see Fig. 2) so the amplifier current flowing through the first speaker also flows through the next and any subsequent speakers in the "leg" before returning to the amplifier. Always connect series "leg" speakers with a single conductor wire from the first speaker's negative or "-" terminal to the next speaker's "+" terminal and so on.

### Fig. 2 Series Speaker Wiring

**Note:** Left channel amplifier, speakers and connections shown. The two speakers must be identical models to sound acceptable. Always avoid using speakers with different woofer sizes when series wiring.



4. It is not advised at this time to wire two or more volume controls together to control the same speaker(s).

In the examples below only the left channel wiring is shown. The right or B channel is always wired and connected identically. The TABLES detail the resulting minimum amplifier impedance when speakers with different impedances are used.

For example, when installing four pairs of speakers as in Fig. 4 with speakers A and B rated 4 and speakers C and D rated 8 the resulting "minimum amplifier impedance" is 5.3

(see Table 4). The amplifier powering these speakers must be capable of 5.3 ohm loads or less (if the amplifier has a 6 ohm or higher rating, expect an early system component failure such as tweeter burn out, that is not normally covered by warranties). Alternatively the speakers could be connected to a Knöll SI1x6 stereo interface to safe guard system reliability and allow three volume controls instead of two.

**Table 1** Resulting Amplifier Load (ohms) with two speakers **PARALLEL** wired

<b>Speaker A (ohms)</b>	<b>4.0</b>	<b>6.0</b>	<b>8.0</b>
Speaker B - 4 ohms	2.0	2.4	2.7
Speaker B - 6 ohms	2.4	3.0	3.4
Speaker B - 8 ohms	2.7	3.4	4.0

**Table 2** Resulting Amplifier Load (ohms) with two speakers **SERIES** wired

<b>Speaker A (ohms)</b>	<b>4.0</b>	<b>6.0</b>	<b>8.0</b>
Speaker B - 4 ohms	8.0	10	12
Speaker B - 6 ohms	10	12	14
Speaker B - 8 ohms	12	14	16

**Table 3** Resulting Amplifier Load (ohms) with three speakers **SERIES** and **PARALLEL** wired

<b>Speaker A &amp; B in series (ohms)</b>	<b>4.0</b>	<b>6.0</b>	<b>8.0</b>
Speaker C - 4 ohms	2.7	3.0	3.2
Speaker C - 6 ohms	3.4	4.0	4.4
Speaker C - 8 ohms	4.0	4.0	5.3

**Table 4** Resulting Amplifier Load (ohms) with four speakers **SERIES** and **PARALLEL** wired

<b>Speaker A &amp; B in series (ohms)</b>	<b>4.0</b>	<b>6.0</b>	<b>8.0</b>
Speaker C & D in series - 4 ohms	4.0	4.8	5.3

Speaker C & D in series - 6 ohms	4.8	6.0	6.8
Speaker C & D in series - 8 ohms	5.3	6.8	8.0

### Example 1

Two pairs of speaker wired in parallel (see Fig 1). If both speakers are 8 ohms the resulting impedance is 4 ohms (the amplifier needs a 4 ohm or less capability). The speakers can be different types. A volume control can be added to each speaker allowing independent control.

### Example 2

Two pairs of speakers in series (see Fig. 2). Note the polarity of the wire connecting the two speakers. Always connect the - (or negative) of the first speaker to the + (or positive) of the next speaker. It is important that both speaker pairs are identical models. A single volume control can be added in the line between the amp and the speakers but only one volume control can be added, so the speakers CANNOT have different volumes.

### Example 3

Three pairs of speakers in series & parallel (see Fig. 3). Note the speaker connecting wire polarity. Both series leg speakers need to be identical models. Two volume controls can be added as only one volume control is allowed per series leg. At full volume, the series leg speakers will be lower volume than the other speakers if they are the same model.

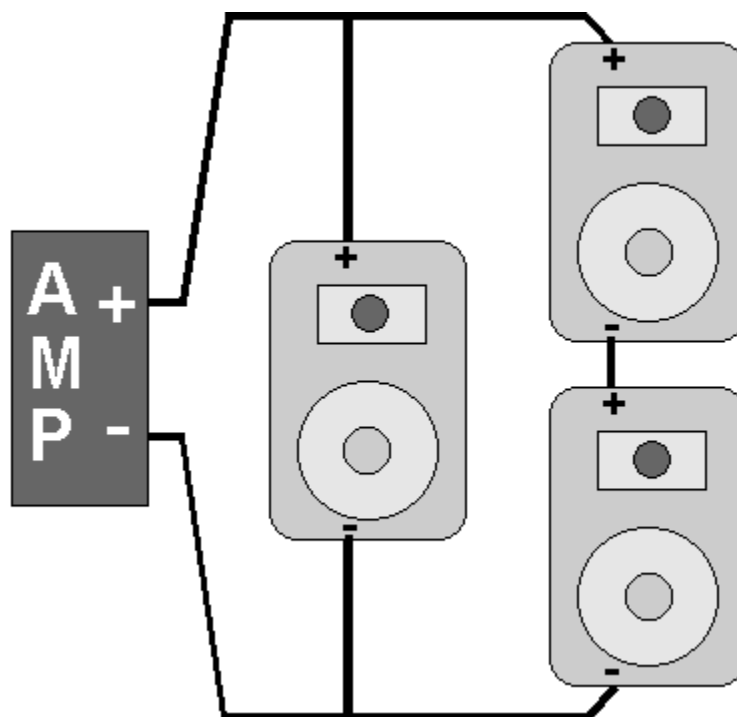


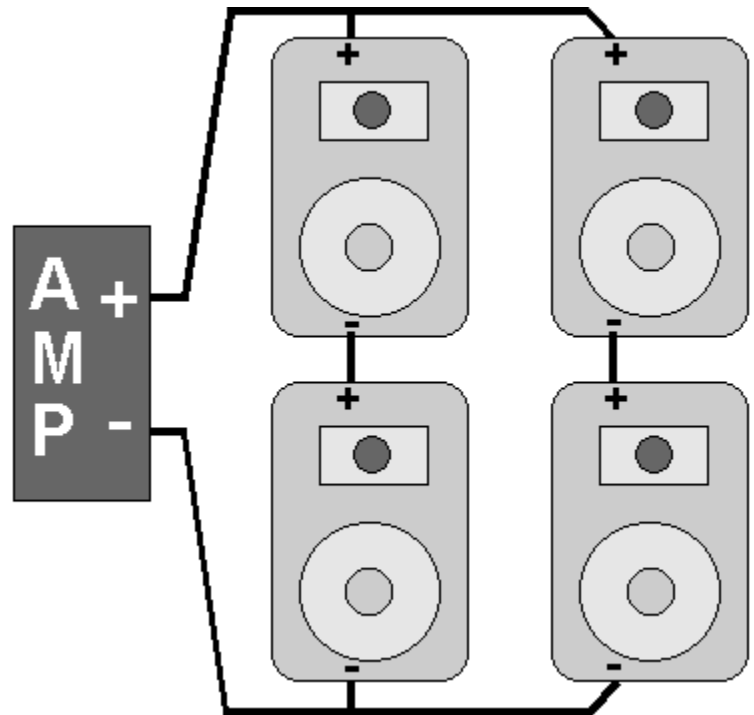
Fig. 3 Series and Parallel Speaker Wiring

## Example 4

Four pairs of speakers in series & parallel (see Fig. 4). Same as example three with two parallel legs of series speakers. Again only two volume controls are allowed, one in each series leg.

**Fig 4:** Series and Parallel Wiring

**Note:** Left channel amplifier, speakers and connections shown. The two "A" speakers need to be the same model. The two "B" speakers need to be the same model. "A" speakers do not have to be the same type as the "B" speakers. Polarity is very important when wiring as the bass could be adversely affected. If all four pairs of speakers are 8 ohm and wired as in fig 4, the resulting amplifier load is 8 ohms.



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