

Connecting speaker signals to line level inputs

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Sometimes it is necessary to connect a device which has only speaker outputs to external amplifier's line level inputs. Because speaker levels are much higher than line level signals, the direct connection does not usually give satisfactory results. That's the reason why I developed this signal level attenuator for connecting speaker signals to line level inputs without signal level problems.

The circuit

The circuit is designed to work with typical HIFI amplifiers where negative speaker connector (black) is connected to amplifier ground. Be careful here because some modern amps have both terminals actively driven. Connecting either one to a common reference could cause the output stage to smoke.

Technical specs

The circuit is suitable to be used with 1..50W audio amplifiers. The circuit is connected to the speaker output of the amplifier and can be used in parallel with the existing speakers.

Suitability for amplifiers: 1..50W

Signal attenuation: 20 dB

Input impedance: 10 kohm

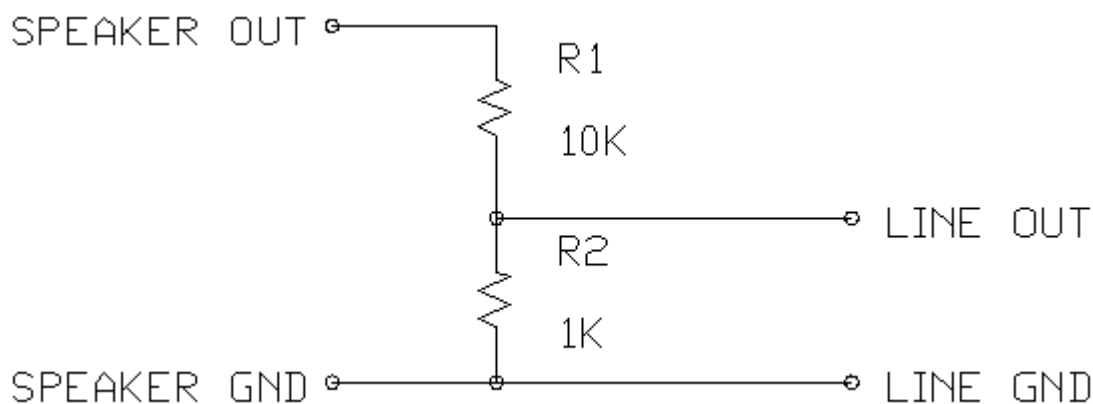
Output impedance: 1 kohm

Frequency response: flat from 20 Hz to 20 kHz

Description of the circuit

Speaker level signals are usually in 3..20V range (amplifiers up to 50W output power). The line level signals should be in 0.3..2V range to be suitable for amplifier's line level input. So attenuation of about 20 dB is needed to bring the signals to right level. This conversion can be done easily using 10:1 voltage divider circuit.

The circuit below is a resistor voltage divider circuit which just does about 10:1 voltage attenuation. Input impedance of the circuit is about 10 kohm, so it does not load the amplifier driving it in any significant way and can be used in parallel with existing speakers without any problems. The output impedance of the circuit is about 1 kohm, which is well suitable for normal line inputs.



Component list:

R1 10 kohm resistor 0.25W

R2 1 kohm resistor 0.25W

The resistor power ratings can be this low because this circuit will only take a very small fraction of the power that the amplifier tries to put out. You can use this circuit as such with an amplifier or you can connect it in parallel with existing speakers as well.

Notes on using the circuit

Remember to check that the circuit is connected in the right way every time you use it. If you mix up speaker out and speaker ground connection, you can end up shorting speaker output to ground, which can damage your amplifier and/or other equipment connected to it. If you want to reduce the risk of damaging anything then put 10 ohm resistor between the circuit and speaker ground connector (this will make sure that short circuit impedance is always at least 10 ohms, though it can introduce sometime hummin problems because of increase grounding impedance).

Remember that this circuit is designed only to be used with normal amplifiers which have common ground for speaker signals. It is not suitable to be used with bridge type output car stereo amplifiers.

If you are planning to use this circuit with amplifier where there are no speakers connected to them some amplifiers might have poorer sound quality if there is nothing connected to speaker output. If you experience this kind of problem, then you can put a 8 ohm resistor (or whatever the speaker impedance that amplifier normally runs is) and use it as a load. Remember to select a resistor which can handle the power that the amplifier outputs. If you want to get around using a lower power resistor, then usually a resistor in 50-300 ohm range gives satisfactory results (instead of nominal 8 ohm). Anyway in most cases you don't need this kind of loading resistors.

Ideas for modifications

Adjustable output level

If you want to adjust the output level then replace R2 with 1 kohm trimmer. This makes it possible to make the output level to be adjustable from 0V to line level.

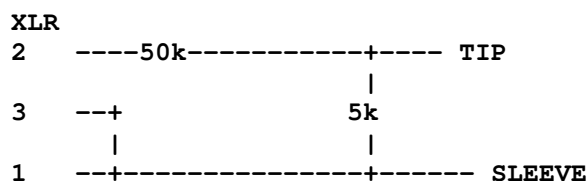
Using the circuit with more powerful amplifiers

If you want to use the circuit safely with more powerful amplifiers than 50W, then you have to modify the circuit to give more attenuation. This can be easily done by changing the value of R1 to 33 kohm (0.25W power rating). This makes the attenuation to be 33:1 (around 30 dB). With this attenuation the circuit is usable to amplifiers up to about 300W. Remember to construct the circuit very carefully if you are going to use it with those high power amplifiers because the voltage on their speaker lines are at dangerous levels at high sound levels.

Other related circuits

Simple resistor attenuator is very useful also in many other applications than just the speaker level to line level converters.

+4 dBm pro level to instrument amplifier input attenuator



HiFi video audio input attenuator

Modern HiFi-VHS VCRs don't typically have automatic level adjustment or manual adjustment of recording levels. The dynamics of the HiFi-VHS video soundtrack is so large that the adjustments are quite often unnecessary. But in some cases some satellite boxes output higher than the specs say signals and if they are connected to HiFi-VHS video the sound can distort in largest signals. To avoid this you can use the following small attenuator in the HiFi VCR audio connections (you need one for left audio channel and one for right channel and you can built the circuit inside SCART EURO-AV connector if your equipments are connected together using them).

