

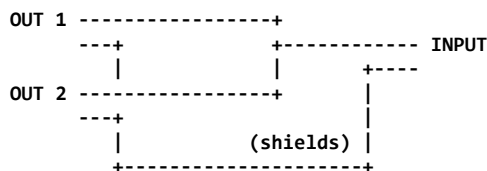
Simple two line output combiner

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Introduction

Sometimes there is need to combine the output of two line level audio sources to be fed to one input. A standard way in professional audio is to use a mixing desk, but on home audio system you might want to look for a simpler and less expensive alternative.

Some people have suggested of combining two audio outputs with an "Y-adapter" which is ment to split one output. Those adapters are just one male connector and two feamle connector directly wired to each other in the followin way:



This kind of circuit is just a correct construction for situation where you have one line level output (connected to circuit input) which you want to split to two inputs (connected to circuit outputs). Hardwiring two inputs in parallel and ot one signal source is perfectly OK in line leve audio.

But if you want to do the opposite this arrangement is not adequate. If you use this kind of "Y-adapter" to combine two line level audio signal you are effectively shorting two equipment output to each other. Audio equipments are not designed for this.

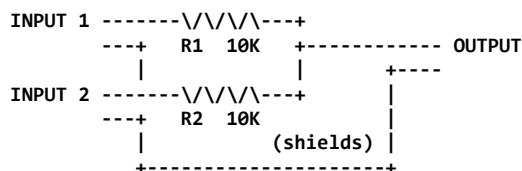
When two outputs are directly wired in parallel, you are effectively fighting with each other. When they are sending out different audio signal, then most of the time one of them is trying to push the output to different voltage than other output. This effectivley causes stress and overload to outputs. In best case you get uneven mix of the signals, lowered output voltage and increased distortion in the sound. In some cases you even risk on damaging the equipments because you are constatly overloading the outputs. The reason for this to happen is that line-level outputs are low-impedance voltage sources and they just aren't going to be very happy if you connect them to each other. Anytime the output differs between the two (as it will almost all the time in stereo) each will be trying to ram current through the other -- more current than they're designed to source, and way more current than they're designed to accept (they're designed to accept practicly nothing).

So "Y-adapter" is NOT the right way mix two audio sources.

Correct approach

A right approach is to make a mixer circuit which combines the audio signals without overloading the outputs. This kind of circuit will safely load the outputs as they are designed to be and provides very nice even mix of the two signals to the output.

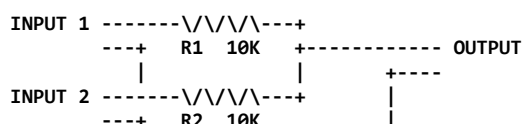
A mixer circuit of this kind does not have to be anything complicated. Two correctly selected resistors will do the job very well. The circuit below shows a circuit which works very well.



This circuit construction provides 10 kohm input impedance and around 5 kohm output impedance. Both of the values are well within what you would expect from an audio equipment.

Building the circuit

To build this circuit you need three RCA connectors and two 10 kohm resistors (R1 and R2). The resistors connect the audio signals (center connector) from inputs together to from one output signal. You can see the wiring details in the figure below:



| (shields) |
+-----+

When you have connected the audio lines together using the resistors, then connect the connector grounds directly together using short piece of wire. Now you have made a nice one channel mixer circuit which can mix together two line level audio signal sources.

Component list

R1 10 kohm resistor (0.25W)
R2 10 kohm resistor (0.25W)
INPUT1 Female RCA connector
INPUT2 Female RCA connector
OUTPUT Male RCA connector

Technical specs

- Attenuation: 6 dB
- Input impedance: 10 kohm
- Output impedance: 5 kohm
- Distortion level: So low that it could not be measured.
- Noise level: Very low (temperature noise of 10 kohm resistor)
- Power source: Passive device, does not need external power source.

Frequently asked questions

What does that attenuation mean ?

The attenuation causes that you need to turn up your stereo equipment volume a little bit up from what you are used to do to get the same volume output.

What does it mean that the output impedance of the circuit is 5 kohms ?

The output impedance of the the audio equipments have effect on two things: loss of output level because of load and loss of high frequencies because if long cables. At 5 kohm that output amplitude loss is neglectable when connected to a typical audio amplifier input (10 kohm impedance or more). The only bad effect of this large outpu impedance is that you might notice some loss of highest fequencies if you use long audio cable more quicly that if the cable were connected directly to your audio source. If you need this circuit directly connected to your audio amplifier audio input, there is no problems. Even something like 1-2 meters of typical audio cable does not cause anythign severe. If you put 10 meters of cable after this circuit, you might notice some loss of highest frequencies though.

How do I use the circuit for stereo signals ?

For mixing you need to build two of those circuits. One for left channels signals and other for right channel.

Can I adjust how loudly each signal source play at output ?

This signal itself does not provide you any possibility to adjust the levels of the signals. If you want individual volume control you have to either have equipments which have output volume controls on their line outputs or you have to build my more complicated [Simple line mixer](#) circuit instead.

Can I mix more than two outputs with this kind of circuit ?

You you can expand this circuit to more channels if you add one resistor and one input connector for each new output. Connect them to the circuit in the same way as the existing inputs. Adding more channels adds the attenuation caused by the circuit. You can go up to around 5 channels if you are not afraid of some extra attenuation and noise (background hiss).

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