

MULTISIM DEMO 4.4: USING AN OPERATIONAL AMPLIFIER IN A SIMPLE AUDIO MIXER

Op amps can be used in a bunch of applications. Let's pretend we're engineers in the 1970's and we need to design an audio mixer board for a famous band (you can insert your favorite 1970's band here). How can we do it?

A mixer is essentially a summing amplifier with variable resistors which can increase or decrease the amount a particular input signal contributes to the overall output signal. A very basic audio mixer built around an operation amplifier is shown in Fig. 4.4.1 below.

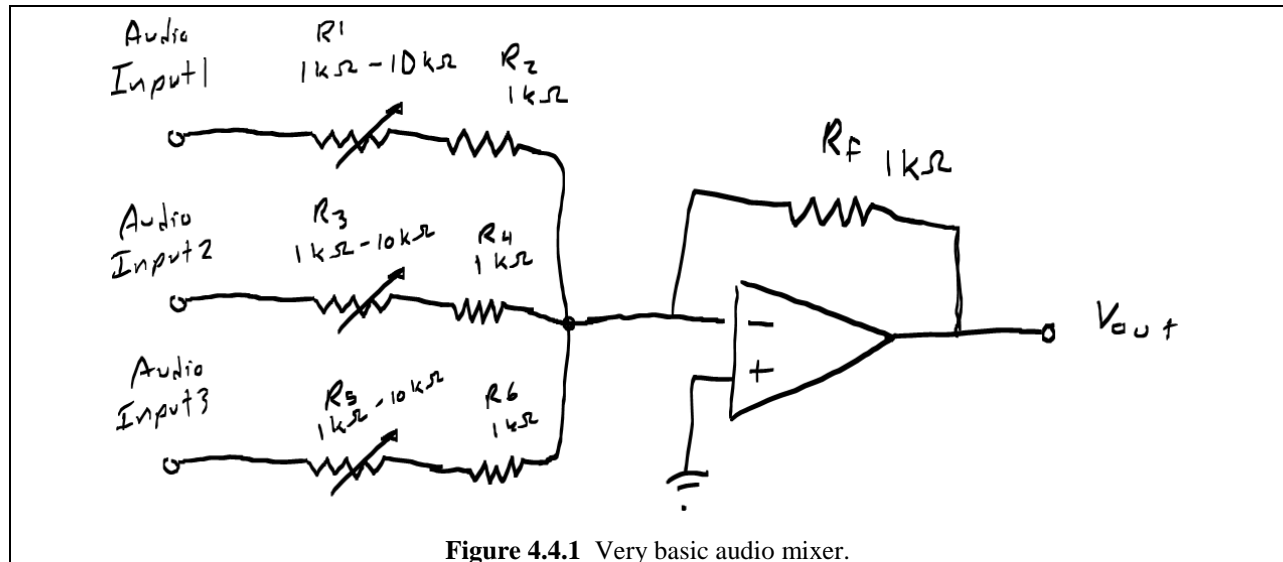


Figure 4.4.1 Very basic audio mixer.

For this simulation we are going to use an actual op amp (no more of that virtual stuff) since Multisim has extensive libraries of actual components to choose from. We'll pick a classic op amp...perhaps one of the most famous IC's ever produced: The 741 op amp. To access this component, go to:

Group: Analog
 FAMILY: OPAMP
 Component: 741

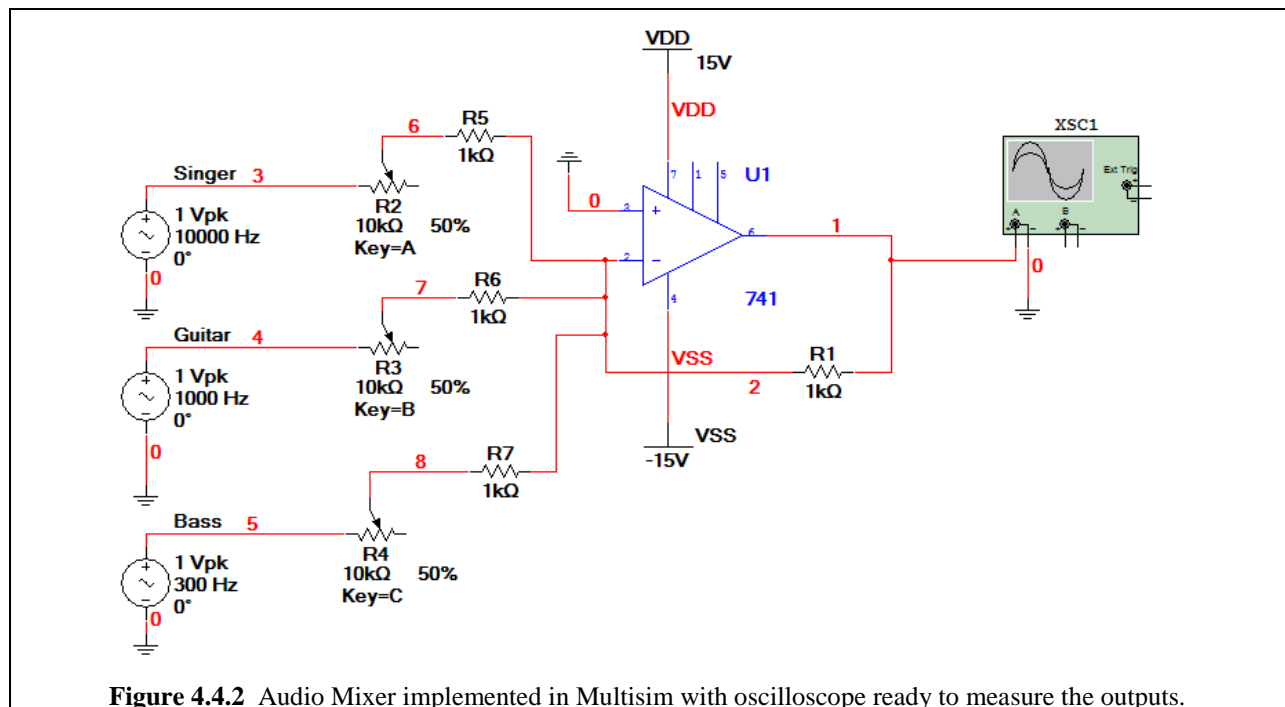
Now you may notice that this op amp has several more pins than the virtual op amps we've used so far. Don't worry about those extra pins. Simply connect the op amp as usual, and leave pins 1 and 5 unconnected. Make sure VDD and VSS are +15V and -15V respectively.

What do the numbers next to each of the 741 op amp's pins mean? They correspond to the pin numbering of the actual 741 op amp IC.

Now we need to add symbolic sources to represent the different instruments. We can use AC_VOLTAGE sources, found under:

Group: Sources
 Family: SIGNAL_VOLTAGE_SOURCES
 Component: AC_VOLTAGE

Now we need to assign a different frequency to each of the three sources so we can distinguish between them when analyzing them in the oscilloscope. To do this, double-click each of the sources and under the Frequency (F) field enter the necessary value. Let's assume that a good representative sine wave frequency for the guitarist is 1 KHz, a good bass representative frequency is 300 Hz, and let's assume the singer often hits the falsetto range around 10 KHz. Also, if you feel like it, you can change the default names of the sources to "Singer" "Guitar" or even get creative and add actual musician's names; it's your preference. Regardless of what you do, your circuit should generally resemble that in Fig. 4.4.2 below when you're all done. Notice that the three potentiometers are all set to an equal value and as a result the three signals are balanced.



So now let's simulate and mess with our creation. Open up the oscilloscope and position it so that you can see the three potentiometers as well as the oscilloscope screen output. Start the Interactive Simulation by pressing F5 or one of the appropriate buttons (which you should have memorized by now.)

First: Turn down the Bass and Singer signals and max out the Guitar: See Fig. 4.4.3.

Second: Turn down the Bass and Guitar signals and max out the Singer: See Fig. 4.4.4.

Third: Turn down the Guitar and Singer signals and max out the Bass: See Fig. 4.4.5.

Four: Turn all of the signals to the same level (balanced): See Fig. 4.4.6

If you'd like, you can mess around with the balance controls for the different instruments, and see what you get. You can also change the values of the resistors, and even add an amplifier to

the output of the mixer in order to boost the output signal. Also remember that while the audio mixer we built here will work, the ones that are actually used in industry are much, much more complicated, but the basic principles still apply.

