

Experiments (/fundanalogcircuit/page/experiments)

Experiment 4—Performing Algebraic Operations (/fundanalogcircuit/page/experiment4)

Experiment 4— Performing Algebraic Operations

+ Overall objective: To perform algebraic operations

Use only sets of 10k Ω , 100k Ω , 300k Ω resistors and 5 op-amps

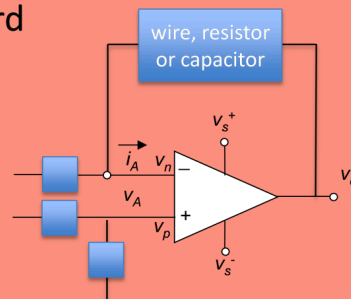
- A. To buffer +15V
- B. To step-down from +15V to -5V
- C. To sum the A and B outputs
- D. To invert the B output
- E. To subtract the D output from the A output (A-D)
- F. To get an output of 3V from the +15V inputs

In this experiment, you first build five circuits (A through E) with guidance. These five circuits give you the ability to generate any voltage between -15 V and +15 V. After building these circuits, you build circuits that generate different voltages (F) without guidance.

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A. To buffer +15V

- Don't yet supply $v_s = 15V$ to the board
- Build the buffer circuit
Position on the upper left
- Connect the supply voltage
- Clip the **red** lead to the output and the **black** lead to ground
- Did you measure an output of 15V?

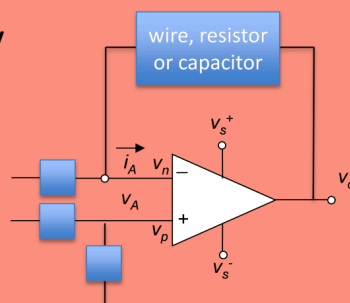


Examine the buffer circuit from earlier in Chapter 3. Compare it with the generic circuit given previously. This will tell you what element to put in each box. Then, perform the steps listed previously. Do not proceed to the next step until you get the correct output. Also record the measured output for test 4.

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B. To step down from +15V

- Disconnect the supply voltage from the board.
- Build the step down circuit from +15V to -5V (gain reduction of 1/3)
Position it below the buffer circuit
- Connect the supply voltage
- and measure the output.
- Did you measure the correct output?

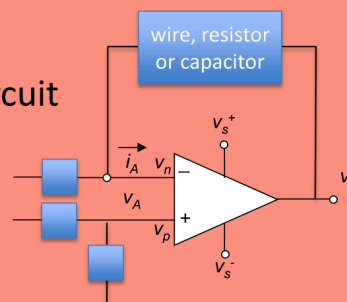


Do not disassemble the buffer circuit you built earlier. Examine the gain and inverting circuit from earlier in Chapter 3 and proceed with the steps listed previously. Do not proceed to the next step until you get the correct output. Also record the measured output for test 4.

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C. To sum the A and B outputs

- Disconnect the supply voltage from the board.
- Build the summing circuit.
Position it to the right of the buffer circuit
- Connect the supply voltage and measure the output.
- Did you measure the correct output?

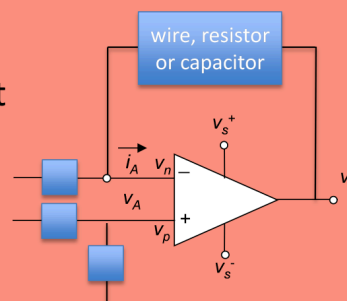


Do not disassemble the circuits you built earlier. Examine the summing (addition) circuit from earlier in Chapter 3 and proceed with the steps listed previously. Do not proceed to the next step until you get the correct output. Also record the measured output for test 4.

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D. To invert the B output

- Disconnect the supply voltage from the board.
- Build the inverting circuit.
Position it below the step down circuit on the left
- Connect the supply voltage and measure the output.
- Did the output invert?



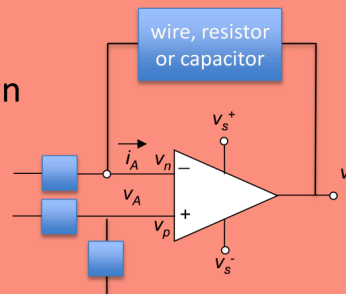
Examine the gain and inverting circuit from earlier in Chapter 3 and proceed with the steps listed previously. Do not proceed to the next step until you get the correct output. Also record the measured output

for test 4.

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E. To subtract the D output from the A output ($A - D$)

- Disconnect the supply voltage from the board.
- Build the subtraction circuit.
Position it to the right of the step down circuit
- Connect the supply voltage and measure the output.
- Did you measure the correct output?



Examine the subtraction circuit from earlier in Chapter 3 and proceed with the steps listed previously. Do not proceed to the next step until you get the correct output. Also record the measured output for test 4.

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F. To get an output of 3V from the +15V input

How would you get the 3V output voltage by cascading two gain circuits using only 10k Ω , 100k Ω , 300k Ω resistances?

At this stage of the experiment, you have experienced the buffering of voltages, the stepping down of voltages, and the addition and subtraction of voltages. The idea is to know how to generate a specific output voltage from a given source. It would serve as the input voltage for a device or for another part of a circuit.

You are now asked to generate 3 V from the +15 V source. There are many ways of accomplishing this. In a design setting, you might have a few bins of resistors, where each bin would have resistors of a specified resistance. Go ahead and perform the previous task. Generate the 3 V, drawing only from bins of 10 KW, 100 KW, and 300 KW resistors. Also try generating output voltages of 1 V and 2 V, doing this in different ways until you feel comfortable with the process.

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