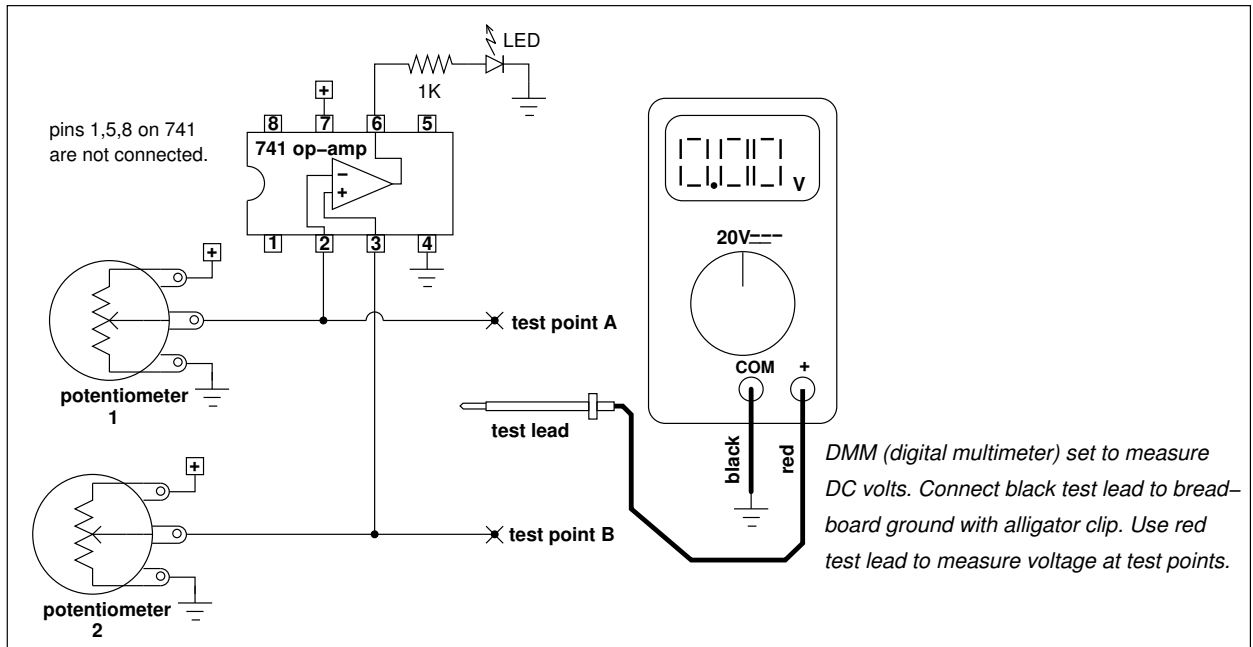


# COMPARATOR TEST CIRCUIT

A comparator is an analog circuit that watches and compares two input voltages. One is called the reference voltage ( $V_{ref}$ ) and the other is the input voltage ( $V_{in}$ ). Depending on how you hook it up, you can make an output signal change state (go from low to high, or go from high to low) based on whether  $V_{in}$  rises above or falls below  $V_{ref}$ .

Comparators are good at "conditioning" analog signals and changing them into digital signals. The output can be directly hooked up directly to any logic input such as on another chip, a BASIC Stamp, a solid state relay etc. you can also hook it up to a transistor (like a TIP122 or TIP127) to control a motor, relay etc. Set up the test circuit below and read the descriptions to get a feel for how it works, and then try out some of the circuits on the sample circuit handout.



Build this circuit on your breadboard to learn about how the comparator works.

The potentiometers (pots) can be any value or size really, but at least 10K or more is best. The pots supply a range of adjustable voltages to the 741 inputs. Measure them with your DMM as described above and below.

In each test example, one pot is used to set the trigger voltage or trip point voltage. Let's call this the reference voltage or  $V_{ref}$  for short. The other pot is used to simulate an input voltage signal. We'll call this  $V_{in}$  for short. In a real circuit the input signal might come a range of sources: light sensor, flex sensor, audio signal etc.

## NON-INVERTING COMPARATOR:

1. In this example POT1 is used to set the reference voltage ( $V_{ref}$ ) and POT2 supplies the input voltage ( $V_{in}$ ).
2. Use the DMM to measure  $V_{ref}$  at TEST POINT A. Turn POT1 to set it. You can set it to whatever you need, but for now let's set it to 3 volts.
3. Now measure  $V_{in}$  at TEST POINT B. Turning POT2 changes the voltage up and down.
4. Whenever  $V_{in}$  is HIGHER than 3 volts ( $V_{ref}$ ) the output is HIGH (LED turns on). Whenever  $V_{in}$  is LOWER than 3 volts ( $V_{ref}$ ) the output is LOW (LED turns off).

## INVERTING COMPARATOR:

1. In this example POT2 sets  $V_{ref}$  and POT1 supplies  $V_{in}$ .
2. Use the DMM to measure  $V_{ref}$  at TEST POINT B. Turn POT2 to set it. Let's use 3 volts again.
3. Now measure  $V_{in}$  at TEST POINT A. Turning POT1 changes the voltage.
4. Whenever  $V_{in}$  is HIGHER than 3 volts ( $V_{ref}$ ) the output is LOW (LED turns off). Whenever  $V_{in}$  is LOWER than 3 volts ( $V_{ref}$ ) the output is HIGH (LED turns on).