

HANDS-ON LAB INSTRUCTION SHEET – MODULE 5

ANALOG IC VOLTAGE COMPARATOR

NOTES:

- 1) To conserve the life of the Multimeter's 9 volt battery, be sure to turn the meter off if not in use for over 5 minutes. Always double check the unit is off when finishing your work, or leaving the classroom.
 - 2) All work is to be done individually and submitted before you leave
 - 3) If you did not finish Hands-on Module 1 or Module 2, be sure to finish it **NOW!** before starting Module 3. If you don't finish by the end of the class, consult instructor.
 - 4) Always keep the Instruction sheets.
 - 5) Enter your Kit # in the upper right corners of ALL RESULTS sheets.
- Keep the 5 volt Voltage Regulator Circuit (7805 with 1 uF capacitor) wired till end of course!**

BILL OF MATERIALS

Radio Shack Electronic Learning Lab Console, AC Adapter (9 volts at 150 mA), Digital Multimeter, Wire Stripper, Miscellaneous Connecting leads and wires (Standard for all labs)

(1) Red LED and (1) Green LED
 (1) TLC272 Dual Integrated Circuit Operational Amplifier
 (2) 10Kohm, ½ Watt Resistors with color code: **brown black orange gold** (10KΩ at 5%)
 (2) 1000 Ohm, ½ Watt Resistors with color code: **brown black red gold** (1KΩ at 5%)

Use of a TLC272 Op-Amp as a “voltage comparator”

In this application two voltages are compared, and the output of the operational amplifier goes fully low or fully high to indicate the result of the comparison. Very little difference in voltage is needed to allow the op-amp to make its decision.

5) TEST to see if your +5 Volt Voltage Regulator Circuit is still working:

5.1) Verify: The **Green LED** goes **ON** when Power switch moved **UP**. (___ YES, ___ NO)

5.2) Verify: The regulated voltage output is close to +5.0 volts. (___ YES, ___ NO)

ALWAYS Turn the Power switch **OFF** while wiring your circuits.

5.3) With power **OFF**... **wire the circuit of Workbook I, page 80** using one of the op amps inside a type **TLC272** dual op-amp integrated circuit (IC):

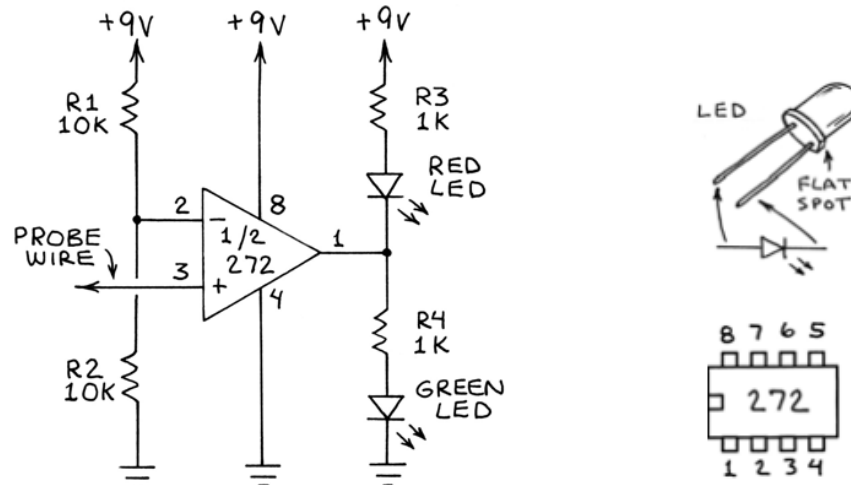


Figure 5.1. Comparator Circuit (Original Circuit Diagram Mims Workbook #1 - Page 80)

5.4a) Wire the circuit of Figure 1 such that the **TLC272** Dual Op-Amp IC is inserted with **pin 1** is in **J15** and **pin 8** in **J16**, the **RED LED** is across **H12** and **J12**, and the **GREEN LED** is across **T12** and the **ground strip**. The resistors should be inserted appropriately to complete the circuit.

Circuit Modifications Required:

5.4b) Instead of +9V use the regulated +5V.

5.4c) Instead of a probe wire going “nowhere”, connect **pin 3** of the **TLC272 IC** to the slider (**Spring #38**) of the **10Kohm** pot.

5.4d) Connect the bottom of the **10Kohm** pot (**Spring #39**) to **ground** and the top (**Spring #37**) to **+5V** so that *the slider can be set for any voltage from zero to +5V*.

5.4e) REDRAW THE MODIFIED CIRCUIT ON THE RESULTS PAGE

5.5) With power **ON**, measure the voltage from **pin 2** of the **TLC272 IC** to ground. Is it close to **2.5 V** as you should expect? (**YES**, **NO**)?

5.6) Measure the pot-slider voltage at **Spring #38** (with respect to ground) as you adjust the pot and observe the LEDs.

5.6a) Range of voltage that yields **GREEN LED ON** _____ to _____ volts

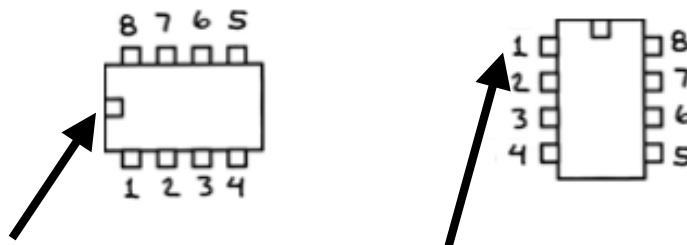
5.6b) Range of voltage that yields **RED LED ON** _____ to _____ volts

You should observe that almost any voltage will fully light one or the other, with essentially no “in-between” range that will give both or neither.

This is instructor **checkpoint 5M**

Demonstrate that circuit works or ask for help - be clear what you are requesting.

Note carefully how the IC pins are numbered - looking down on the IC with pins facing down - the “top view” (we have removed the part number as the pin numbering is the same for all 8-pin ICs:



Normally a notch shows the end on which the “1” pin is located.

Occasionally there is a dot or other indication at pin “1”

If the IC has dot marks on both ends, one of the marks is likely a circular trademark.