

What's the conductivity of Gatorade? – Conductivity Meter Building Instructions

## Materials List

- Basic Stamp Board of Education kit (\$100, available from [parallax.com](http://parallax.com))
- Computer (System requirements: PC - Pentium 133 mhz or higher, 32 megs ram, VGA display; MAC - G3 or higher 64megs ram, Color display)
- Basic Stamp editor software (latest version, free download available from [parallax.com](http://parallax.com))
- (5) 550  $\Omega$  resistors, (1) 20 k $\Omega$  resistor
- (1) 1  $\mu$ F Capacitor
- 22 AWG Wire
- (5) LEDs (any color)
- (1) 555 timer, 8-pin DIP
- (2) 5-inch 4/40 stainless steel screws
- (4) 4/40 nylon nuts
- (1) empty Fisherbrand<sup>®</sup> SureOne<sup>™</sup> pipette tip rack (100 $\mu$ l – 1000 $\mu$ l size)
- (1) 50ml conical tube

## Building Instructions

1. Attach the 555 timer, resistors and capacitors to the corresponding pins on the Board of Education.

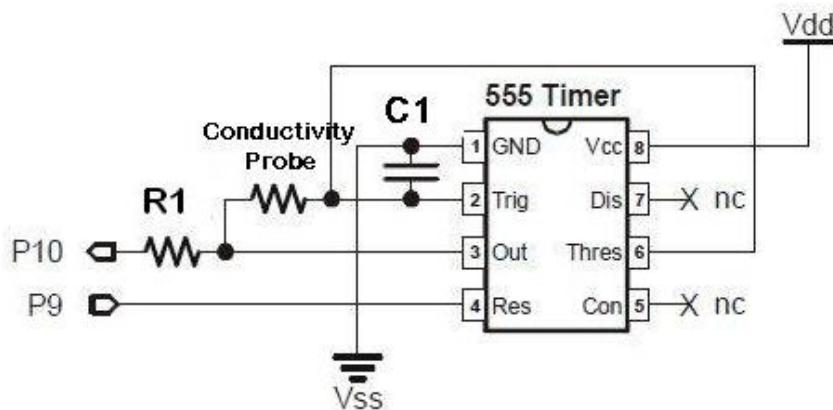


Figure 1. Attachment of the 555 timer to the Board of Education. The conductivity probe is configured as a resistor.

2. Connect the LEDs to the corresponding pins on the Board of Education.

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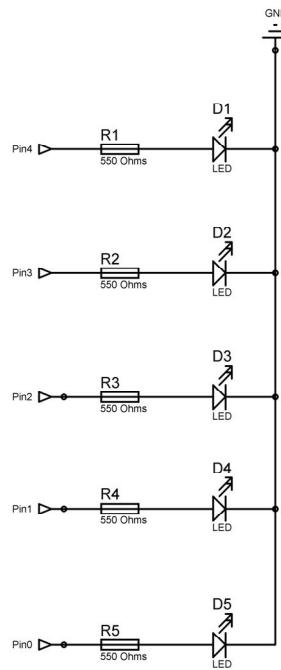


Figure 2. Connection of LEDs to the Board of Education using the 550 ohm resistors.

3. Secure the Board of Education to the pipette tip box (zip ties work well for this).
4. Attach the conductivity probe to the Board of Education. Wrap the ends of the jumper wires around the base of the screw head, and space them approximately 1 inch apart. Connect the conductivity probe to the 555 timer as shown in figure 1.
5. Remove the bottom half of the conical tube. Make two holes in the cap (1 inch apart) and feed the two screws of the conductivity meter through. The conical tube should slightly cover the ends of the screws. Lock the conical tube in place using nuts or tape. The conical tube is used as shield to minimize the effects of the electric field interacting with the walls of the container. The shield helps to ensure reproducible conductivity readings, regardless of the container used for measurement.

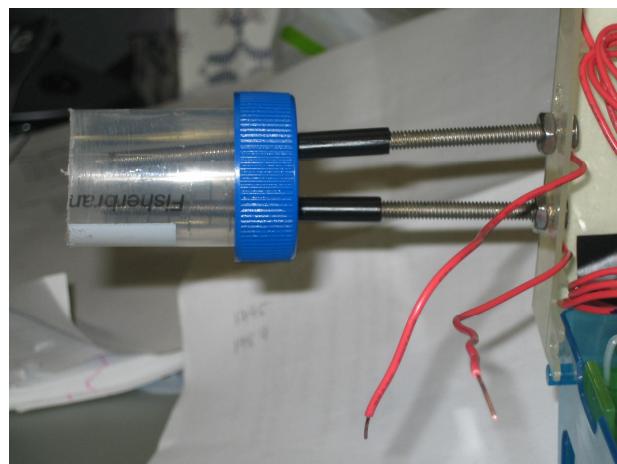


Figure 3. Attachment of conductivity probe and conical tube.

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6. Download the Conductivity Meter program onto the Basic Stamp Module.
7. Close the lid of the pipette tip rack and take conductivity readings.

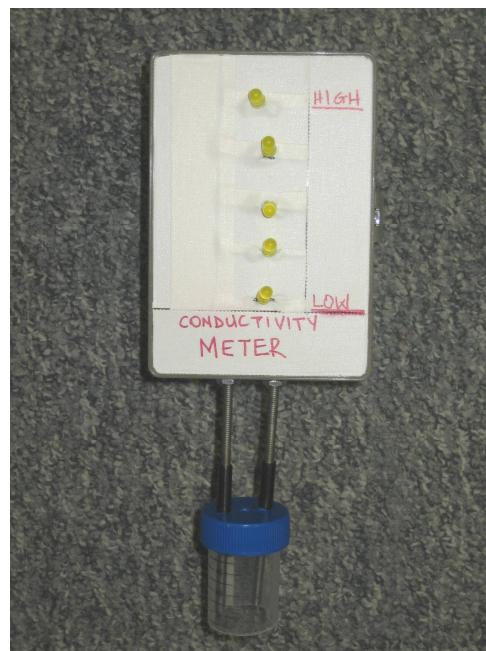
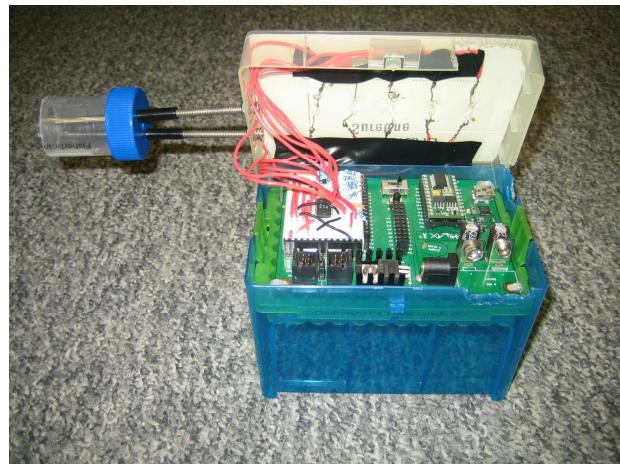


Figure 4. Completed Basic Stamp conductivity meter.

\* Modifications to these instructions may result in improper functioning of the meter. However, it is strongly recommended that the user perform their own calibration of the meter, and verify output readings that are sent from the 555 timer for the various salt concentrations. Also, the depth of immersion of the conductivity probe should be the same during the calibration and actual usage.