



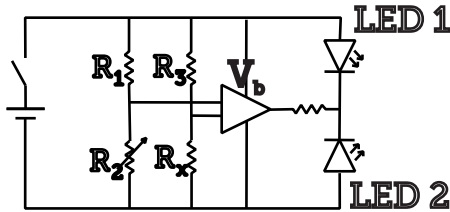
Very Useful Circuits

Sensor

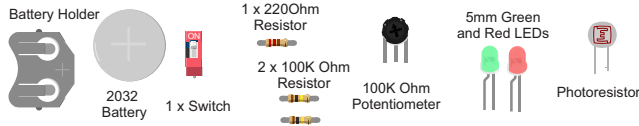
Sense changes in resistance using a Wheatstone Bridge

When $V_b = 0$

$$\frac{R_2}{R_1} = \frac{R_x}{R_3}$$



9 components to solder, instructions inside.



Electronics for Makers of All Ages

Lectrify is designed for makers! Components snap off board and into your creations using standard craft materials including Lego



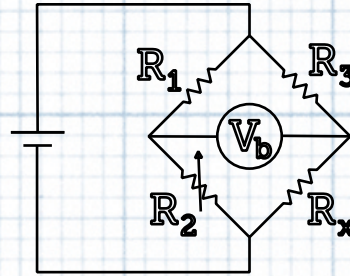
Very Useful Circuits enable you to explore engineering through hands-on building.

Each board provides a discrete learning opportunity in a core concept of electrical engineering.



Designed and made in California, USA

The Sensor Board uses a circuit known as a Wheatstone Bridge. The Wheatstone bridge circuit has been used for over 150 years to identify unknown resistance or measure a change in resistance.



When $V_b = 0$

$$\frac{R_2}{R_1} = \frac{R_x}{R_3}$$

Often, Resistors R_1 and R_3 are known values (often identical), R_x is unknown and R_2 is a form of a variable resistor that can be changed until V_b is zero.

Resistance based sensors are commonly used as low cost means of measuring pressure, temperature, light, humidity, water quality and water quality.

In the Sensor board circuit, R_2 is a potentiometer that is used to balance the circuit. The Sensor also uses a Operational Amplifier (OpAmp) to amplify the change in voltage when the circuit is unbalanced. Because of the sensitivity of the circuit, it is near impossible for V_b to be exactly zero (which would be indicated by both LEDs being off.)

HOW TO USE: Turn R_2 to the point where a fraction of a turn flips between the two lights. In this mode, if LED1 is left on, when the resistance R_x becomes higher than R_2 (i.e. it gets darker), the circuit flips and turns on LED. Conversely, if LED2 is left on and the resistance of R_x becomes lower than R_2 , LED1 will turn on.

Tag your creations



Explore the Very Useful Circuit boards:

[TouchPad](#) - Transistor switch

[NiteLight](#) - Logic with sensor

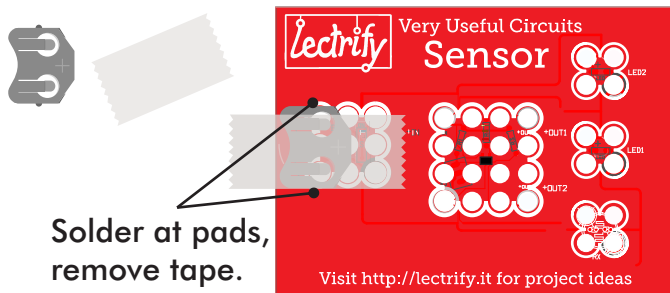
[Blinker](#) - Capacitor discharge

Sensor - Wheatstone Bridge

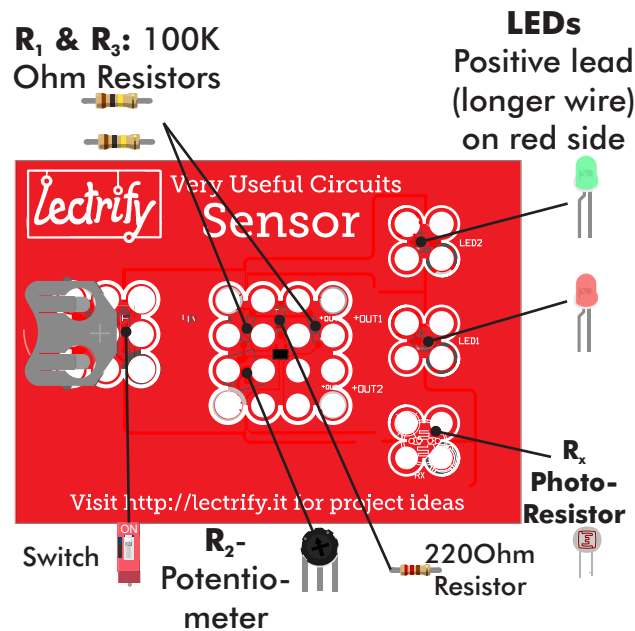
visit <http://lectrify.it/veryuseful>

SOLDERING INSTRUCTIONS

Step 1: Use tape to fasten battery holder to board.



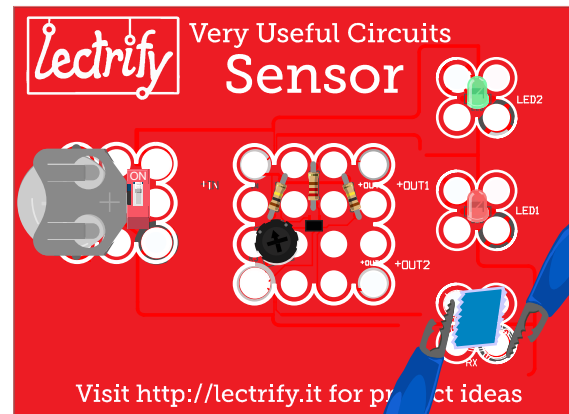
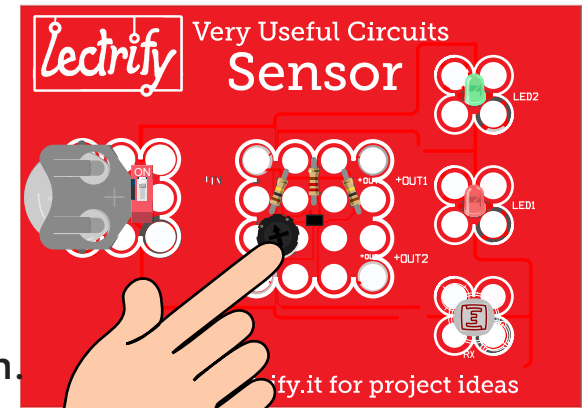
Step 2: Insert components and solder from back of board



Note: Switch, potentiometer and resistors (including photo-resistor) do not have to be inserted in a specific direction in order to work.

Adjust potentiometer to find the point where a fraction of a turn changes the lights.

- If you want to measure an increase in resistance (darker) leave LED1 on.
- If you want to measure a decrease (lighter), leave LED2 on.



If the Photo-resistor is covered with a piece of opaque tape to make the resistance fixed, other objects can be tested for resistance. In the example above, a probe made out of a plastic straw and copper tape can be used to test relative conductivity of various objects.

Visit <http://lectrify.it> for more projects, ideas and help.