

# Energy Baton

## How it Works

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The Energy Baton is a battery-powered circuit tester. It's so sensitive that it can detect an incredibly small amount of electricity traveling across moisture on your skin from one silver ring to the other! It's a completely safe, but totally cool, way to test circuits, learn about electrical conductors, and identify insulators that block electricity.

Electricity is free electrons moving from atom to atom through a material. This flow is called a current. Something that allows a current to move through it freely is called a conductor. Good conductors include most metals such as copper, aluminum, iron, silver, gold, and lead, but there are others like water, mercury, and neon. If a material slows or even stops the current altogether, it offers resistance to the current and is called an insulator. Materials like glass, rubber, plastic, paper, cloth, and wood are very good insulators. However, if the charge is high enough, an insulator won't stop the current. Since your body is mostly water and there are water and minerals on your skin, your body can be a conductor, but a poor one. The weak current travels from one silver ring onto one hand and then across the surface of your skin to the other hand and onto the other silver ring. This complete loop is called a closed circuit and allows the Energy Baton to do its detection thing. Take a hand off a silver ring and you break or open the circuit and the current stops flowing to the Energy Baton. Grab the silver ring once more and you make a complete circuit. That's just what a switch on a wall does or a circuit breaker (or fuse) does in the breaker box on a house. It stops the current.

### What are the parts?

Don't try to take the Energy Baton apart! It's securely glued together and you will have to destroy it to open it. You can see the major parts through the clear body of the tube. The guts of the Baton include a circuit board, two button batteries, an integrated circuit, three light emitting diodes (LED), a piezoelectric transducer, a transistor, and two electrodes.

- The batteries are connected in series (head to toe) to form a small power supply. Each button battery (cell) supplies direct current (DC) electricity. Since the cells are so small, they provide very little current (milliamps), and therefore, very little power (milliwatts). Three volts at low current is a level generally considered safe.
- Inside there is a circuit board with an integrated circuit, or chip. It contains tiny transistors, resistors, diodes, and other electronic parts that produce the noises and the flash pulses.
- The light emitting diodes (LEDs) are like small red, blue, and green lights, except that they have no filament. The lights are produced by brightly glowing junctions on semiconductor chips.
- The piezoelectric transducer functions like a speaker – it's what makes the noise. It consists of a very thin slice of quartz mounted on a brass disk. When electrical pulses are applied to the quartz, it vibrates, and that vibration is what we hear as sound.
- Transistors are electronic switches. In this case, the integrated circuit provides the sound waves, but they're not powerful enough to be heard by the transducer. So, the integrated circuit tells the more powerful transistor to turn on or off, and it controls the transducer.
- Electrodes are simply the electrical conductors. They are the two metallic strips that you touch to complete the circuit.

See more information, see Steve Spangler's website at:

<http://www.stevespanglerscience.com/lab/experiments/human-circuit#sthash.6wxdkEd5.dpuf>