Light-up Makey

MAKEY IS THE MASCOT OF MAKER FAIRE. You can make your own Makey with eyes that light up. To do that, you’ll learn how to make an electronic circuit.

Before you start, you’ll need to gather the tools listed to go with your kit.

GETTING STARTED
Your kit comes with a printed picture of Makey. You can cut Makey out by carefully cutting along the outside borders with your scissors. Don’t cut the spaces between the head, legs,
and arms. (You don’t have to cut Makey out if you prefer not to.)
Use a pencil to lightly mark a spot directly in the center of each of Makey’s eyes. With that same sharpened pencil, carefully punch a small hole about three centimeters in diameter through the center mark in each eye.

**INSERT THE LEDs**

1. From the back of the sheet, push an LED through the hole in each eye—but don’t push it all the way through. Let the ledge at the base of the LED press against the back of the paper, forming a backstop.

2. Bend down the short leads of the LED (the negative ones) so that they point to the center of Makey’s head.

3. Bend the long leads (the positive ones) at a right angle to the short leads so they point toward Makey’s feet.

**ABOUT LEDS:** LED stands for light-emitting diode. When electricity flows through an LED, it forces electrons to move and release light particles called photons. Two wires, called leads (pronounced leeds), extend from the base of the LED. One lead is slightly longer than the other. The long lead is positive; the short one is negative. You can also identify the negative lead by the fact that the base is flatted along that edge.

**BEGIN BUILDING THE CIRCUIT**

1. Turn Makey over and make a few marks on the back to help lay out your circuit.

2. Place the button battery in the center of the big M in Makey’s chest on the reverse side of the paper. Use your pencil to outline the battery.

3. Set the battery aside and draw two parallel lines from the battery circle toward the top of the paper.

4. Cut two strips of copper tape from the roll, remove the backing tape from one strip and place it on the paper so that it overlaps the battery circle and extends far enough to reach the negative lead. Do the same with the other strip of copper tape.

5. Place the negative lead of one LED so that it lies across the top of one strip of copper tape. Trim the lead with your scissors, if necessary, to be sure that it doesn’t touch the other piece of copper tape. Use clear tape to secure the negative lead to the copper tape.

6. Repeat the previous step with the other negative lead.

**ABOUT CIRCUITS:** A circuit is the path that electricity flows along. An electronic circuit must have a power source. In this case, the power comes from your button battery. A complete circuit must be connected end-to-end, from the positive side of the battery to the negative side, with a conductive material. If it’s not, it’s a broken circuit, and it won’t work. For the LED circuit to be complete, the positive side of the battery must be connected to the positive lead, while the negative side of the battery must be connected to the negative lead.
START BUILDING THE SWITCH

A switch allows you to close (complete) or break a circuit—which turns the power on or off. We’re going to make a “momentary switch,” which only completes a circuit when you hold it down. When you let go of the switch, the circuit will be broken, and the electricity will stop flowing.

1. Use the ruler and pencil to measure and mark three one-inch-wide strips on your index card and cut them out.

2. Fold one paper strip back and forth four times to make an accordion fold.

3. Repeat the previous step with the second strip of paper.

4. Use clear tape to attach the accordion folds to the back of Makey on either side of the battery circle you drew earlier.

5. The top of the button battery is marked with a + indicating that it’s the positive side. The bottom side is negative. Make a cylinder of tape with the sticky side out and press it onto one side of the bottom of the button battery.

6. Tape the battery down so the bottom touches both strips of copper tape. Don’t let the clear tape come between the battery and the copper tape.
FINISH THE CIRCUIT AND THE SWITCH

1. Cut two more strips of copper tape. Remove the backing from one and lay it across the top of the accordion strip, then lay it down on the sheet of paper so it reaches far enough to touch the positive lead.

2. Repeat the previous step with the other strip of copper tape and the other accordion strip. Make sure there's enough slack in the strip to allow the accordion to spring up.

3. Trim the length of the third index card strip so it fits exactly across the two accordion strips.

4. Cut a strip of copper tape, remove the backing, and place it all the way across the length of the flat strip.

5. Lay the flat strip across the tops of the two accordion folds to form a bridge with the copper strips on the tops of the accordion folds touching the copper strip on the bridge piece.

6. Use clear tape at the edges to secure the bridge strip to the accordion folds. You've now completed the momentary switch.

7. Finish the circuit by using clear tape to secure the positive (long) lead of each LED across the tops of their respective copper strips.

Turn Makey over so it's lying face up on your work table and press the big M in the middle of its chest. If you have made the circuit correctly, Makey's eyes will light up! The momentary switch will probably have enough play that you can make one eye light up, then the other, and then both eyes, depending on where you press and how much pressure you apply.

TAKE IT FURTHER
You've just built a parallel circuit. This is a circuit where the current divides into two paths to light up each eye before recombining to close the circuit. Can you think of other things to do with the circuit? Another kind is called a series circuit. A series circuit follows just one path through all the LEDs it activates. Can you design a series circuit on your own and make it work? The best way to learn is through trial and error. Experiment!