Learn how to Solder a Jiggybot

Mini-Guide
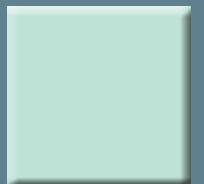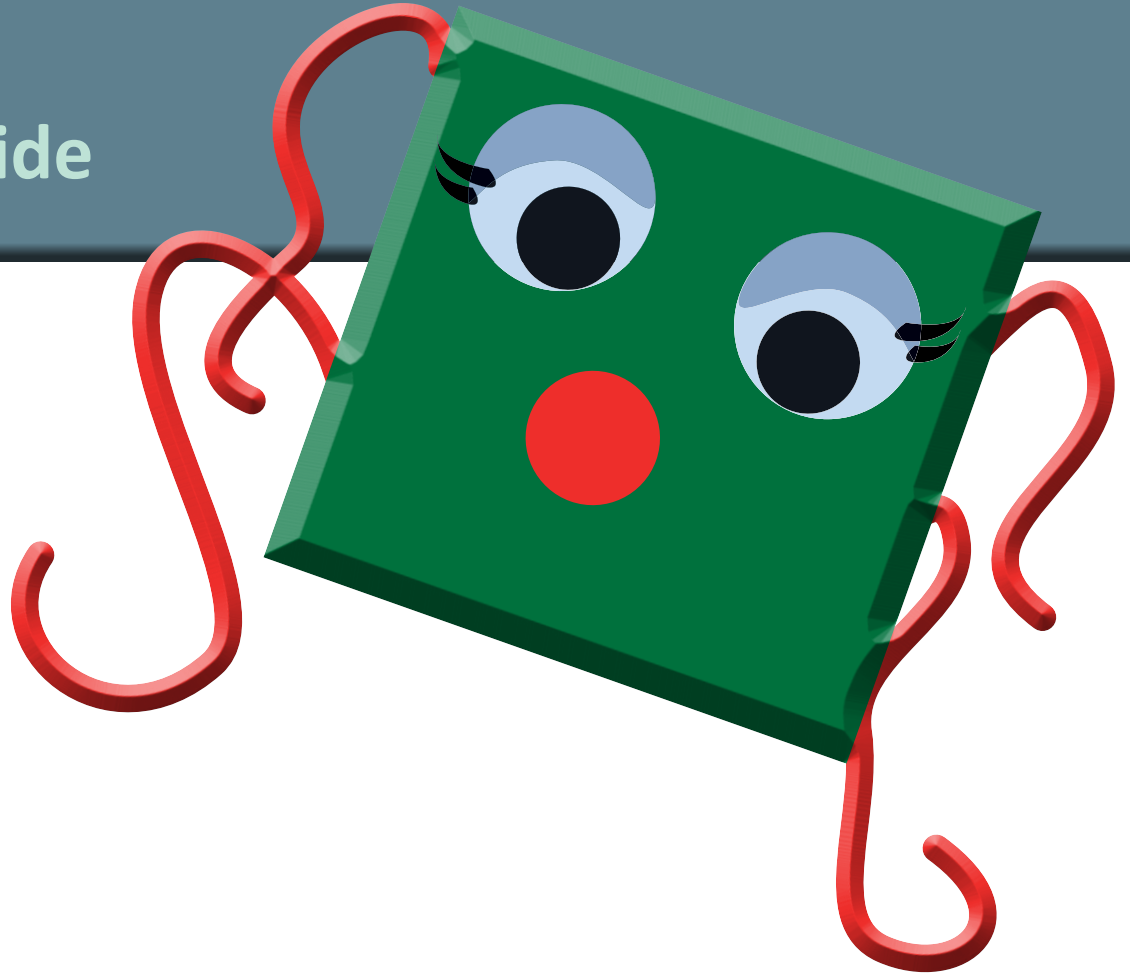
Partner

Learn How to Solder a Jiggy Bot
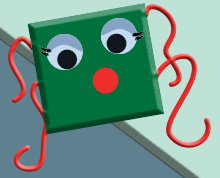
Overview:
In this mini-guide, you will learn how to:
1. Cut and strip wires
2. Solder wires and other components onto circuit boards
3. Build the JiggyBot
4. Troubleshoot Electrical Circuits

SAFETY ALERT: Wear **Safety Glasses**; be aware of the hot temperature of the soldering iron, inform your instructor immediately if burned; DO NOT go ahead of the instructor as they lead you through the assembly; hold your hand over leads when clipping and/or trimming.

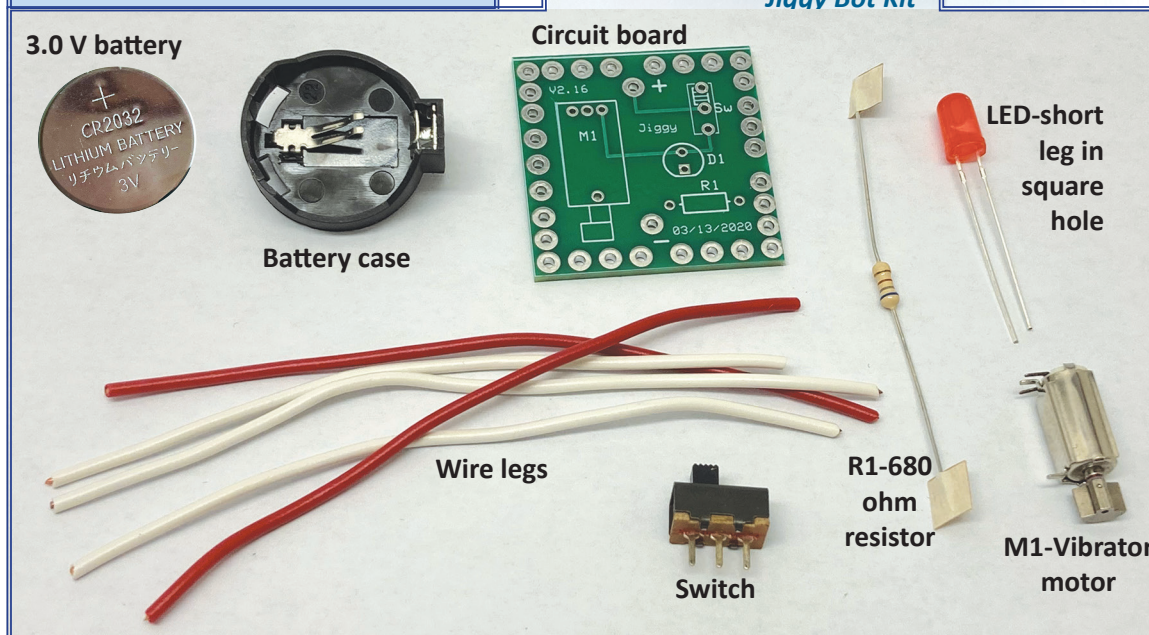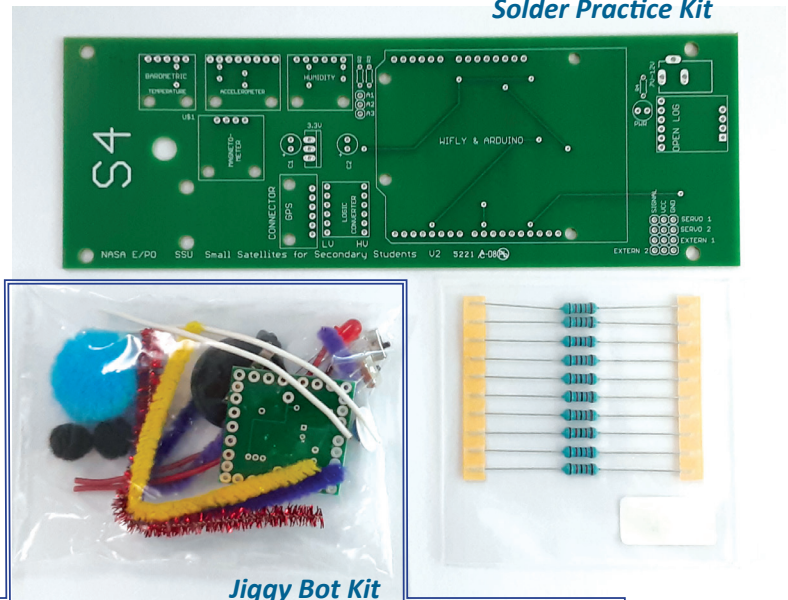### Solder Practice Kit:

1. Green S4 board
2. Resistors

Jiggy Bot Kit:

- Circuit board
- LED
- R1-680 ohm resistor
- Switch
- 3.0 V battery
- Battery case
- M1-Vibrating motor
- Wire legs

Solder Practice Kit

Jiggy Bot Kit

3.0 V battery

Circuit board

LED-short leg in square hole

Battery case

Wire legs

Switch

R1-680 ohm resistor

M1-Vibrator motor

Tools:

Provided:
- Digital Multimeter
- FTDI cable
- Glue
- Helping hands
- Hobby Knife
- Sandpaper,
- Screwdriver
- A soldering iron
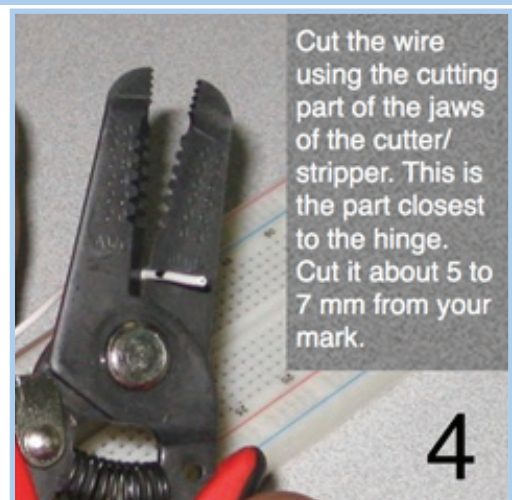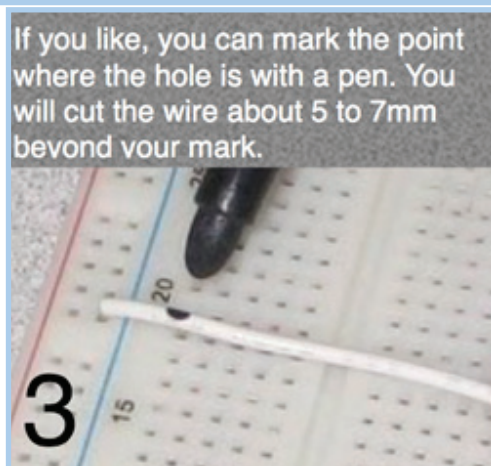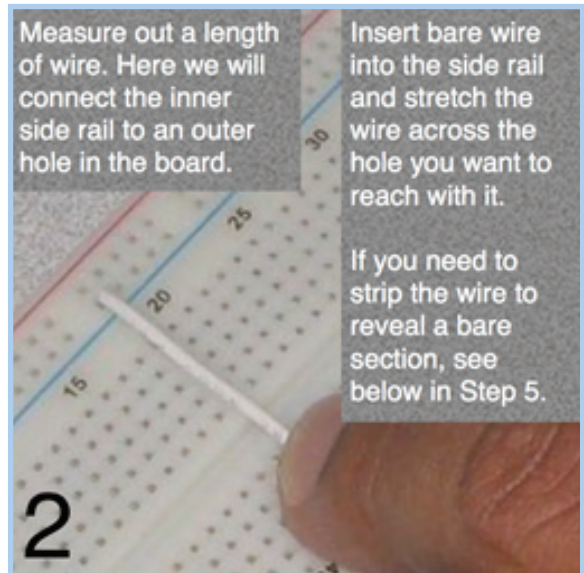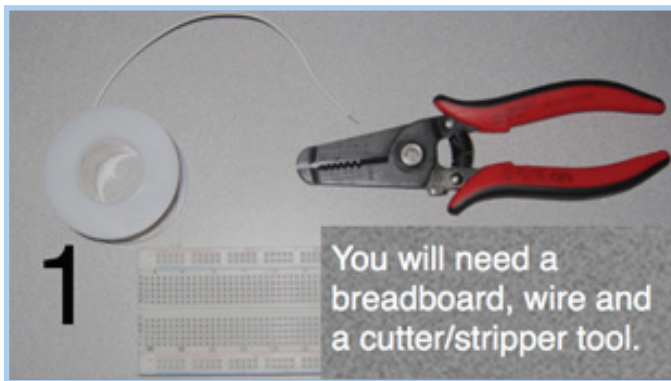- Solder
- Wire cutter/stripper

Also Useful:
- Needle nose pliers
- Safety goggles
- Tape (Scotch, masking or painters)

Hobby Knife

Soldering Iron

Glue   Solder   Screwdriver

Sandpaper

Wire cutter/stripper

FTDI cable

Helping Hand
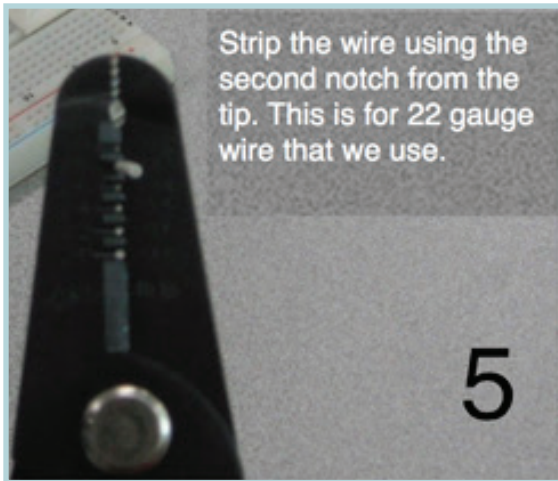
Digital Multimeter.

1. Cutting and Stripping Wires

For this practice session, you will use the green circuit board that says S4 on it (rather than a white plastic breadboard like the one shown in the photos below). Choose any two holes to practice cutting and stripping wire. Cut and strip at least one wire and stick the cut ends through the holes.

Cutting wires to length and stripping their insulation for use on a breadboard or protoboard is a basic skill needed for building test and experimental circuits. These photos show one way to do it.

Measure out a length of wire. Here we will connect the inner side rail to an outer hole in the board.

Insert bare wire into the side rail and stretch the wire across the hole you want to reach with it.

If you need to strip the wire to reveal a bare section, see below in Step 5.

1 You will need a breadboard, wire and a cutter/stripper tool.

2

If you like, you can mark the point where the hole is with a pen. You will cut the wire about 5 to 7mm beyond your mark.

3

Cut the wire using the cutting part of the jaws of the cutter/stripper. This is the part closest to the hinge. Cut it about 5 to 7 mm from your mark.

4

Strip the wire using the second notch from the tip. This is for 22 gauge wire that we use.

5
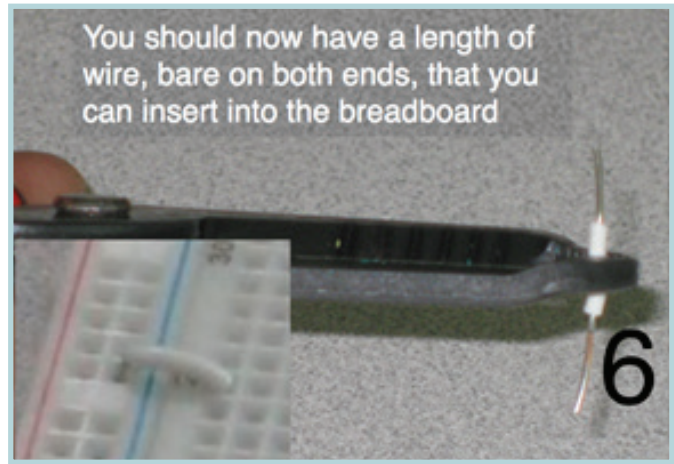
You should now have a length of wire, bare on both ends, that you can insert into the breadboard

6

The following link also has information about stripping wires:
https://learn.sparkfun.com/tutorials/working-with-wire/how-to-strip-a-wire

2. Practice Soldering

Instructions: *Read the directions carefully. Follow the steps in order with your instructor. When you have your component into the proper placement, ask for a check of placement from your instructor before soldering*

General Tips:

• When soldering, remember to always wear safety goggles. Additionally, make sure you've read the user's manual for your soldering iron for specific information related to its use.

• Before you begin, be sure to turn the soldering iron on so that it is hot enough when you wish to begin soldering.

1. Take the soldering wire and unravel about 6-10 inches of it so that you have plenty of slack.
2. Take the soldering iron out of its holder and touch the tip of it on the sponge to be sure it is clean and ready.
3. Hold the soldering iron with one hand up against the side of the lead as close to the board as you can. You will want to hold it at an angle as shown.
4. On the other side of the lead you will hold the tip of the soldering wire. As you do this, you will see the wire starting to melt and it will form a small pyramid shape of solder around your lead. As soon as you see this happen, remove the wire first and then the iron.
5. Place the iron back in its holder and look closely to be sure you've made a good connection.

What to Do:

1. Solder the stripped wire ends of your wire to the green S4 circuit board
2. Take a resistor and stick its legs through any two holes in the S4 board, and solder it.
3. Inspect your solder joints. They should look like this:

Wetting Angle 40 to 70 degrees from horizontal

Smooth, Shiny, Concave Surface

(side view)

(perspective view)

Wire lead

Solder

Soldering Iron
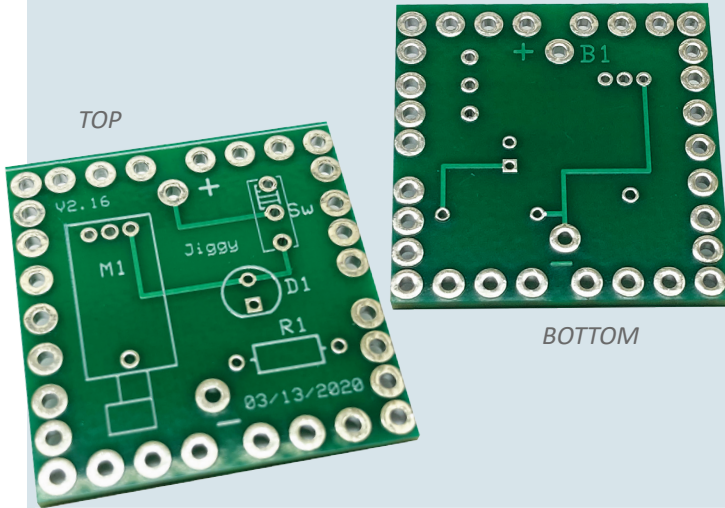
Circuit Board

Electronic Part
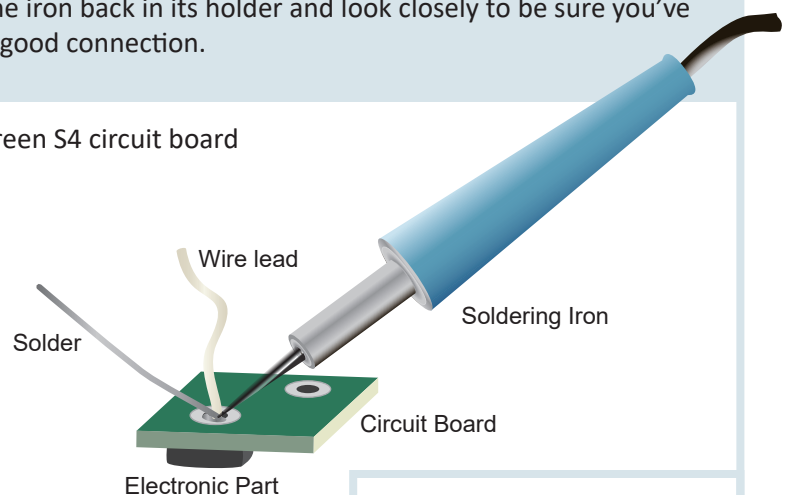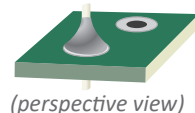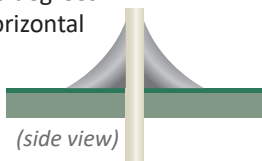
Be sure to touch the soldering iron to the solder and NOT the wire leads.

For more information about good techniques and solving soldering problems, see
https://learn.adafruit.com/adafruit-guide-excellent-soldering/common-problems

1. Observe both the TOP and BOTTOM surfaces of the circuit board. The TOP side has all the printing. The words, figures, and shapes will help guide you to where the components should be soldered.

TOP

BOTTOM

2. Following the steps, place all the parts except for the battery case on the TOP (printed) side of the board. Then turn the board over and solder the pins or wire ends on the BOTTOM side of the board.

3. Solder the 680-ohm resistor onto the circuit board in the space labeled R1. The resistor body sits on the top (printed) side of the board, and the leads go through the holes. Turn the board upside down, and spread the legs out to help hold them in place. Solder leads on the back (not printed) side. Then shorten the leads with wire cutters right above the solder joint.

BOTTOM
(soldered wires)

TOP
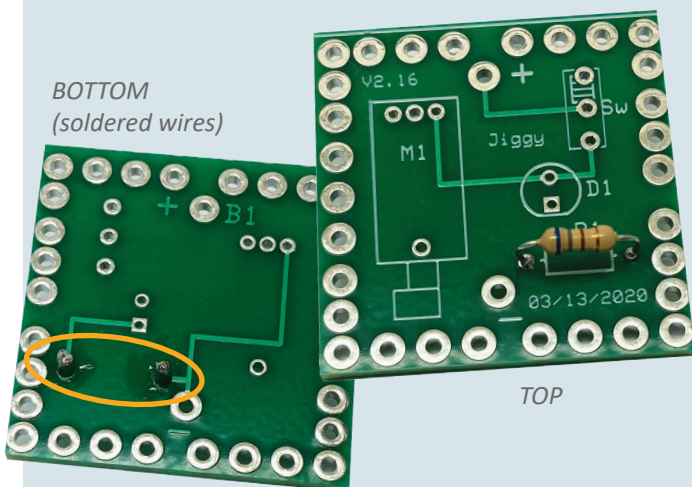
4. Solder Switch: Place the switch so it is on the outside of the circuit board. The switch body goes on the top of the board, and the leads go through the board.

Switch

Circuit Board

Turn the board over to do the soldering. To hold the switch on the board, you can ask your neighbor for help, use the helping hands to hold the board and/or use tape to keep it from falling out when you turn the board over.. Be careful not to use too much solder.
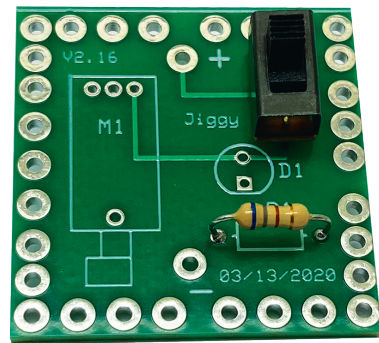
5. Solder the LED onto the top side of the circuit board. The LED sits on the top side of the board, and the legs go through the holes. Make sure to get approval before soldering because…
 a. LEDs have one short and one long lead.
 b. Always insert the short lead into the square hole and the long lead into the round hole.
 c. Line up the flat side of the LED with the shape on the board.

Anode
(Long lead)

Cathode
(Short lead &
flat side or spot)
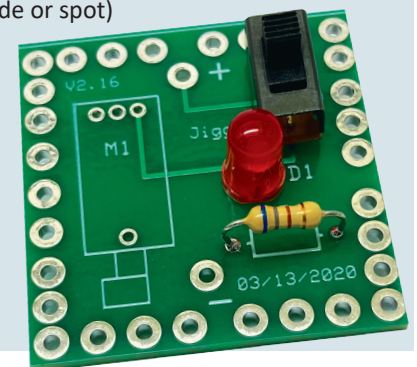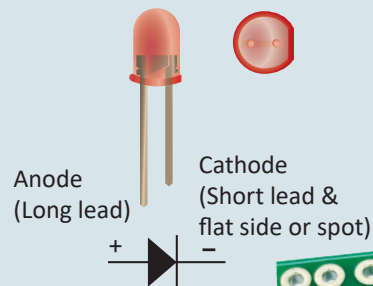
6. Solder Motor:

 a. Find the M1 shape on the board.
 b. Place the motor in the appropriate position on the top of the board and stick the wire leads through the holes.
 c. Turn the board over and solder the leads on the back side.
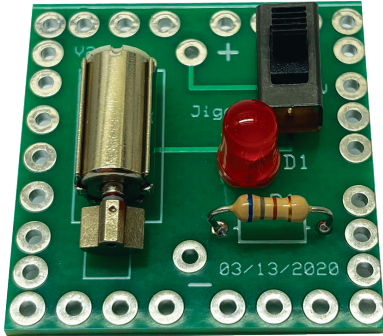
7. Solder Battery case:

 a. Observe the back of the board and trim all leads right above the solder joint.
 b. Put the battery case on the back of the board so that the leads go through the two remaining holes towards the top. Make sure placement is correct. DO NOT put the battery in the case yet. Solder when ready.
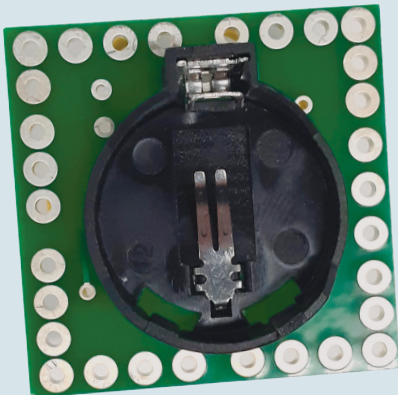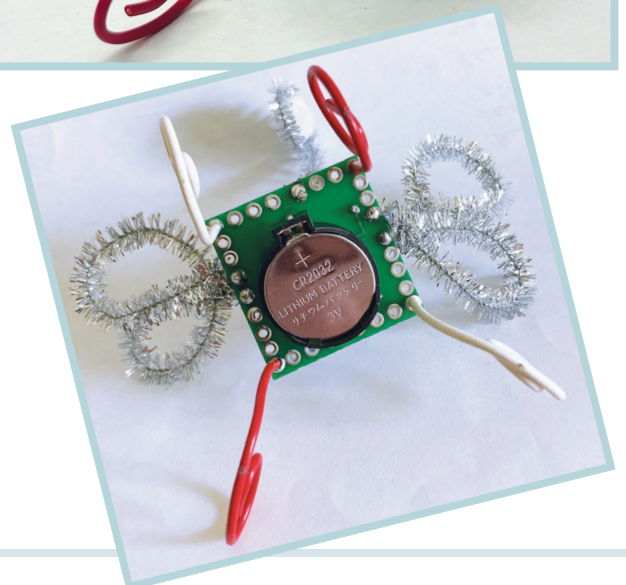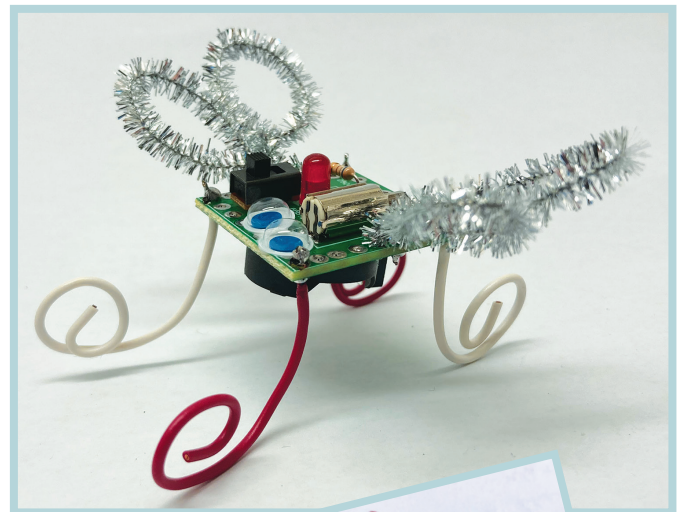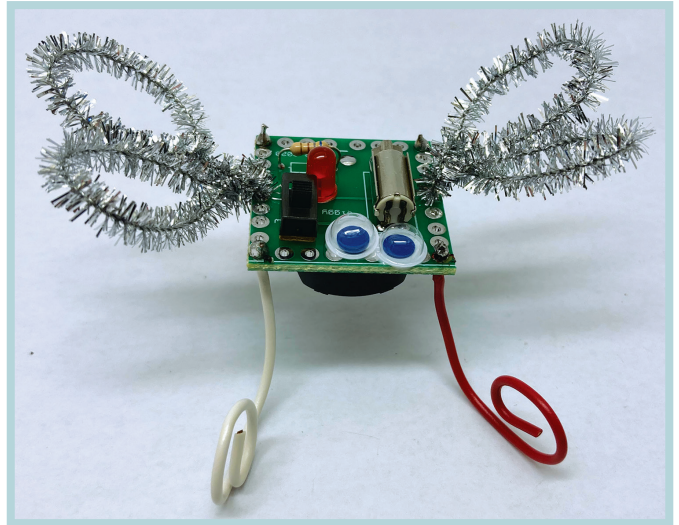

Complete Circuit
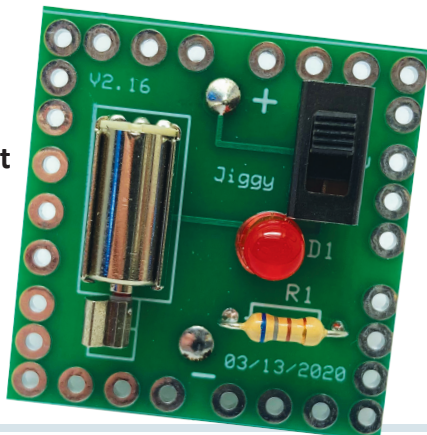
8. Leg Design:
Use your creativity and the four wires to put legs onto the Jiggy Bot. You may use any available holes. This is also a good time to add tails, wings, and googly eyes!

 a. Glue the pipe cleaners and googly eyes.
 b. Then put your battery into the battery case and turn on the switch to watch the Jiggy bot dance!

4. Troubleshooting Electrical Circuits

If your circuit does not work as expected, it is time to troubleshoot! Here are some steps you can take:

A. Check the Power

To test the power in a circuit, you can use a digital multimeter to measure voltage from a battery or other power source. Voltage is a type of electrical force that makes current move through a wire. This force is often provided by a battery. Measured in units of volts, this quantity tells you how much energy each individual electric charge carries throughout a circuit. In your kit you have a CR2032 coin cell battery for the JiggyBot power and in the payload box, there are three AAA batteries.
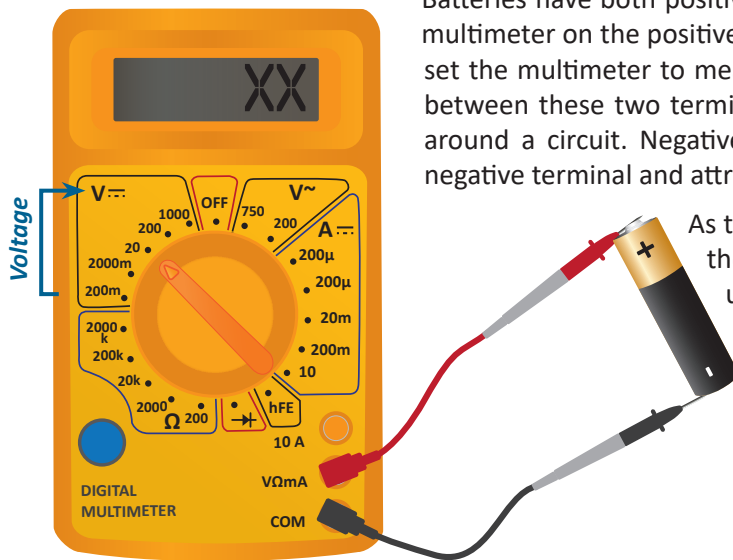
Here is an example of a multimeter measuring the voltage of AA battery..

Batteries have both positive and negative terminals. If you put the red lead of your multimeter on the positive terminal and the black lead on the negative terminal and set the multimeter to measure V⎓ the readout will display the voltage difference between these two terminals. This voltage difference causes the charges to move around a circuit. Negative charges, like electrons, will be pushed away from the negative terminal and attracted to the positive terminal of the battery.

As the electrons travel from atom to atom through the circuit, they carry electrical energy with them. This energy can be used to light LEDs, run motors, turn on/off switches and many other useful tasks.

1. What voltage do you get when you measure one of the AA batteries?

2. Where would you put the leads to measure the voltage from the CR2032 battery? What is its voltage?

3. What happens if you reverse the leads (put the red lead on the negative terminal of the battery and the black lead on the positive terminal of the battery)?

Notes on reading these meters:
- The scales on the voltage dial range from 200m (milli or thousandths) volts to 1000 volts full scale.
- For the most accurate results, set the dial on the meter to a value greater than you expect to measure.
- If you choose a scale that is too low, the meter will display the number 1. If that happens, turn the dial to the next larger scale on the meter.

B. Check for Bad Connections

In order for a circuit to function properly, there must be continuous electrical connections around the entire circuit. Any break in the connectivity will stop the current flow. Breaks in the circuit could be due to bad solder joints or poor connections.

Here is an example of a multimeter measuring the resistance of a resistor.
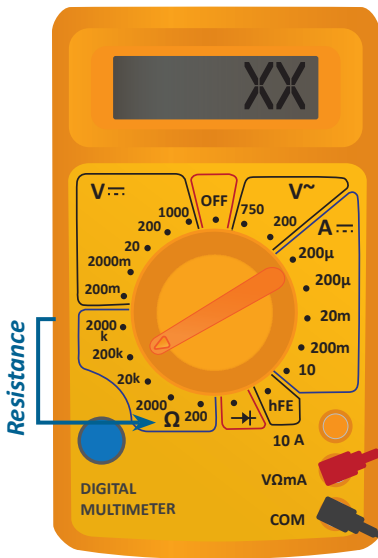
Visually inspect all your solder joints. Do they look like the examples? If not, you might need to add or remove some solder.

If everything looks good, you can measure the connectivity between two different places in a circuit by measuring the resistance between them.

Resistance is measured in ohms, which are abbreviated by using the Greek letter Omega (Ω). Low resistance (no more than a few ohms) means that current will be easily able to flow. Infinite resistance means that there is a broken path somewhere along the circuit. When you measure resistance, it does not matter which color lead (red or black) you use to touch each end of the wire, resistor or circuit path that you are testing.

1. What resistance do you get when you measure one of the resistors that are included in your payload parts box?

2. What resistance do you get when you measure one of the wires?

Notes on reading these meters:

• The scales on the resistance dial range from 200 Ω to 2000k (thousands) Ω full scale. (2000 KΩ = 2MΩ or 2 millions ohms)

• For the most accurate results, set the dial on the meter to a value greater than you expect to measure.

• If you choose a scale that is too low, the meter will display the number 1. If that happens, turn the dial to the next larger scale on the meter. If the number 1 is still displayed on the highest scale, there is a break in the circuit.