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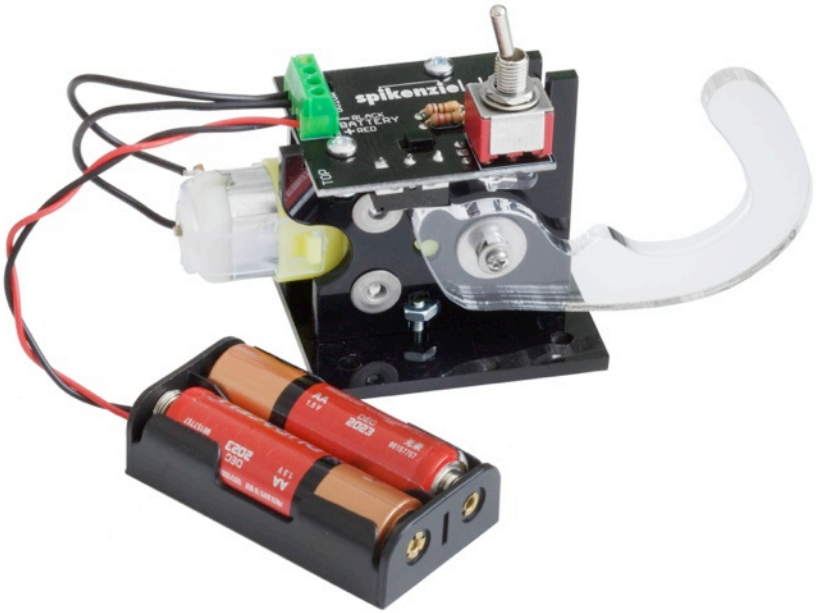
The Useless Machine™

Parts Only - Build Guide

v0001

For the best outcome, follow each step in order.
We recommend reading this guide entirely before you get started.



Tools required:
One phillips screwdriver, and one flat screwdriver, soldering Iron, solder, snips and supplies to build your own Useless Machine.

Laser cut acrylic, electronics, hardware parts


Motor mount - wire side


Motor mount - Arm side


2x #4 weld nuts


4x 4-40 nuts

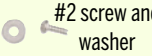

4x 3/8" 4-40 screws

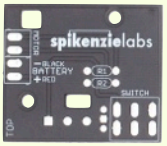

2x #4 washers


2x 1" 4-40 screws


#12 washer


Switch nut and washer


#2 screw and washer



PCB


Battery holder


220 ohm resistor

100 ohm resistor


Switch

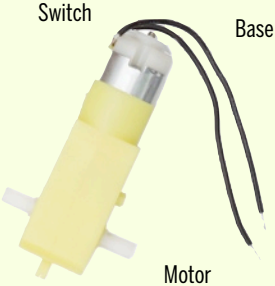

Base washers

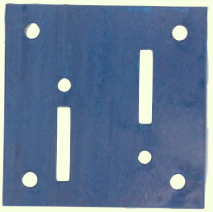

Arm

2 Color LED


Snap switch


Screw terminals


Motor


Base

Some of the steps in the build of this kit require the snipping component legs. If you're building this kit on your own, or with a someone else, we **STRONGLY** recommend whoever is present is wearing safety glasses. When the legs are snipped, the can fly off in unpredictable directions, at a high speed. Also, be sure to follow the safety instructions that came along with your soldering iron. **Wash your hands** after handling solder. Especially before eating. Be safe, and enjoy.

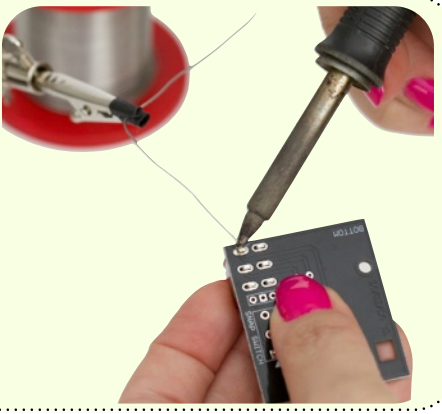
Assembling the PCB

Switch Installation:

Make sure that the switch is being installed on the top side of PCB. There is no orientation to the switch. Refer to these photos.

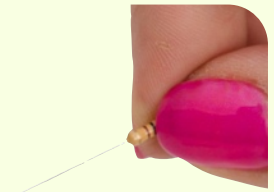
Switch Soldering:

The switch needs to be standing perfectly vertical on the PCB. We use a 'Helping Hands' tool to hold the solder.
This way, your fingers hold the switch, and the other hand is free to solder.
Solder one tab, and see if the switch is 90° to the PCB.



Resistor Preparation:

There are 2 resistors in the kit. One 100 Ohm (brown black brown), gets installed into [R1]. The 220 Ohm (red-red-red) gets installed in [R2].



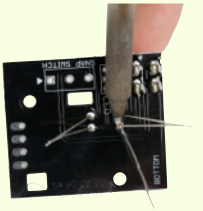
Bend the legs like in the photos here, with the leg as close as possible to the body of the resistor.

Resistor placement and soldering:

1- Place the resistors in place as the photo above.

2- Flare the legs to hold the resistors in place

3- Solder the 4 legs on the bottom side of the PCB.



4- While wearing safety glasses,

Trim the excess.

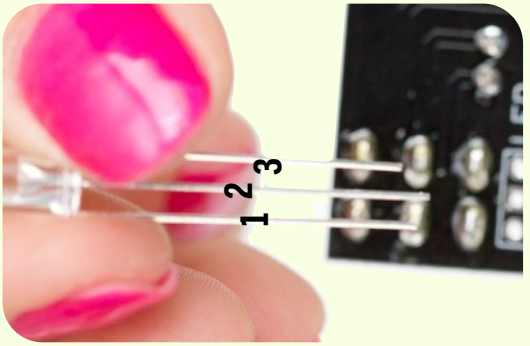
Screw terminal placement and soldering:

2- The holes in the screw terminals need to be aiming away from the switch.

3- Solder all 4 pins.

1- Slide the 2 screw terminals together joining them into one single 4 pin strip.

Aligning and soldering the LED:

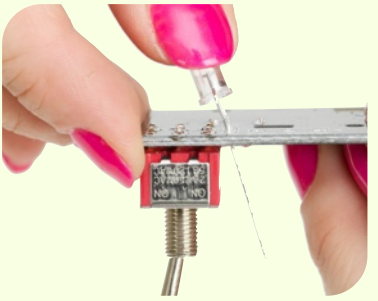


1- Notice the different lengths of the legs on the LED. Leg #2 is the longest. #1 is the second longest, and #3 is the shortest.

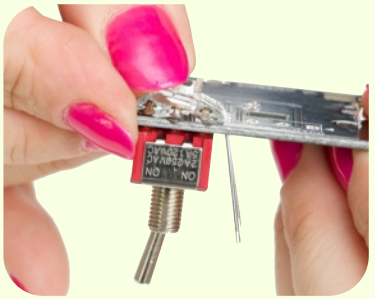
The LED gets installed with leg #1 closest to the edge of the PCB.

Important to note:
The LED gets installed on the bottom side of the PCB.

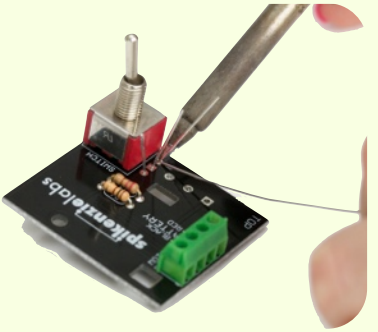
2- Slide the 3 LED legs down through the holes in the PCB.



3- Leaving about .25" of leg bend the LED so that it can bend like the photo in step #4.

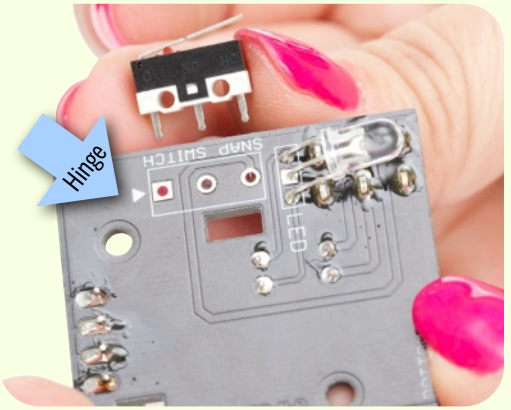


4- Bend the led like in this photo, and hold it in place.



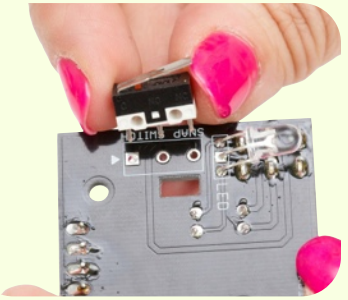
5- Solder the three legs of the LED, and snip the excess.

Placing and installing the snap switch:

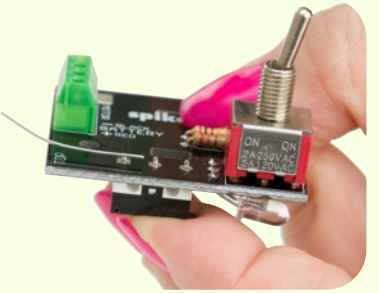


1- The snap switch gets installed on the bottom side of the PCB.

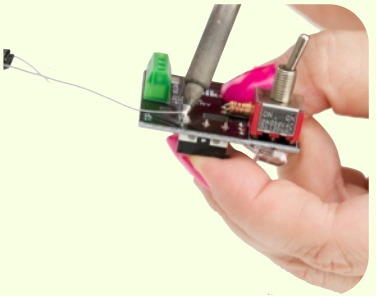
The hinge side of the snap switch goes on the indicated side on the PCB.



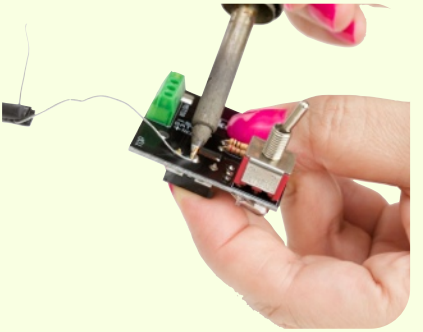
2- Line up the 3 pins with the three holes on the PCB.



3- Press firmly on the snap switch, making sure it is flush with the surface of the PCB.



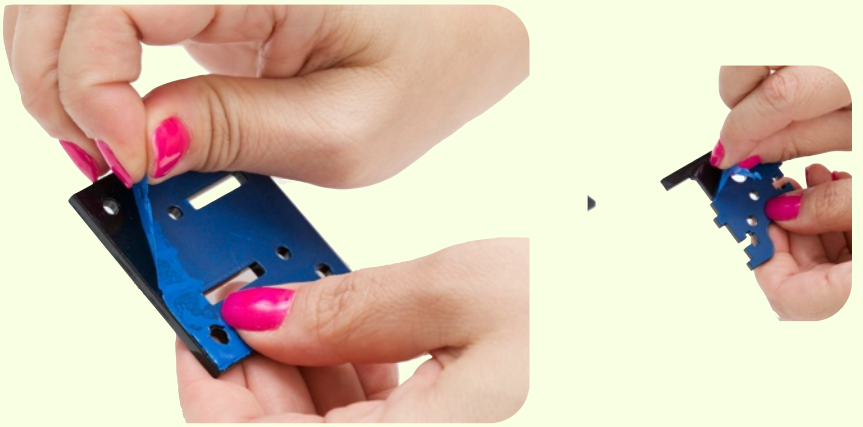
4- Solder one pin, and check to make sure the snap switch is flush with the PCB.



5- Solder the other two pins.

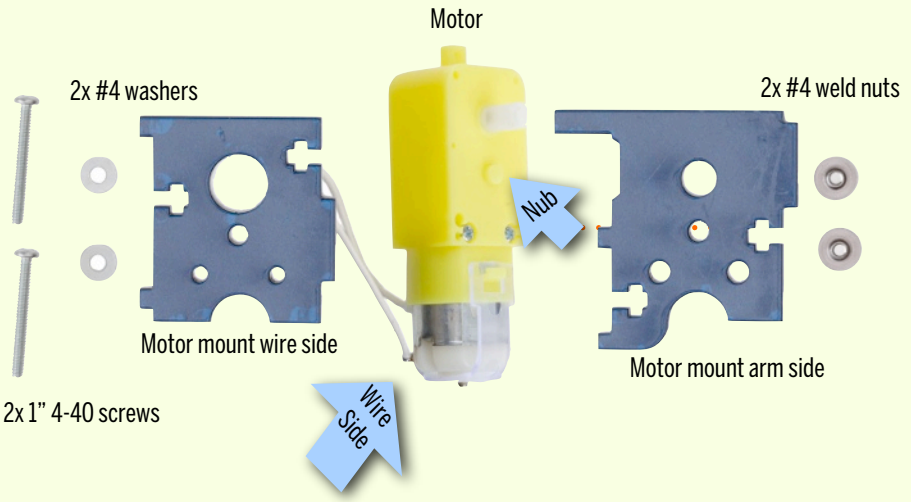
Peel the protective film

All of the acrylic parts have a cling film that protects the pieces during manufacturing and transport. The film or tape may be blue, brown or white. Start at a corner, and remove the film from both sides of each piece.



Ready the motor, motor mount, and fasteners

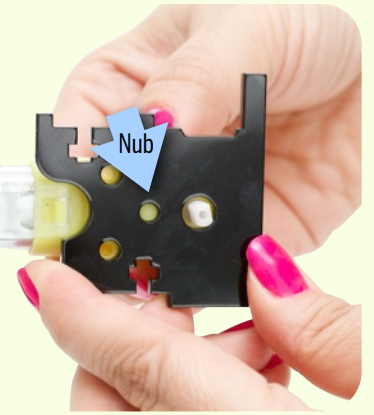
Line up the 2 long screws, 2 small washers, 2 motor mount acrylic pieces, and weld nuts as you see below.

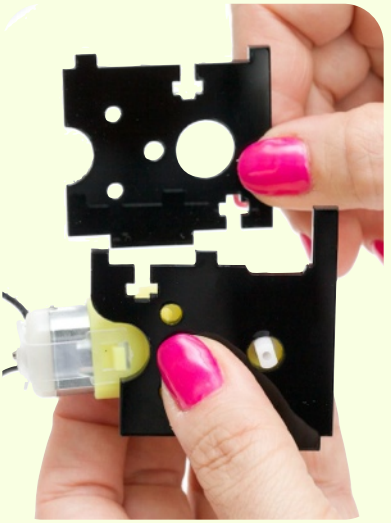


Attaching the motor to the mount

Hold the motor with the wires on the left and away from you. The 'nub' facing you.

Place the arm side motor mount acrylic piece over the motor, making sure that the 'nub' fits in the hole in the mount.

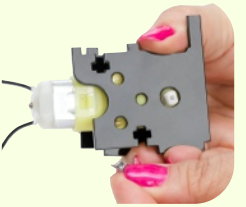




Hold the other motor mount as above. Place against the wire side of the motor

Place the weld nuts into the holes on the arm side of motor mount.

The weld nuts



Hold the weld nuts in place with tape or your fingers. In the next step we will be screwing them in place.

Place a washer on each of the long screws

While holding the weld nuts in place, slide both screws through the washers, motor mount, motor and screw into the weld nut. For the moment, leave the screws loose enough so that the motor mount plastic can wiggle a little.

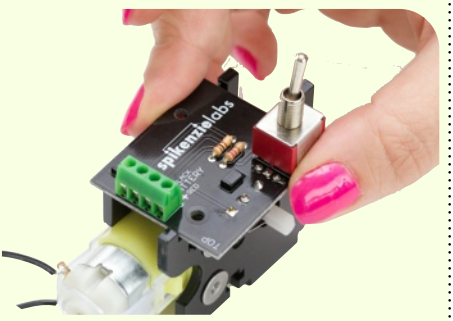
With the screws a little loose, press down against a flat surface, so that the both bottoms of the motor mount are flat.

Keeping the bottoms of the motor mount flat against the surface, tighten both screws. Do not over-tighten, you may crush the motor.

Attaching the PCB assembly

Take the PCB that you've previously assembled.

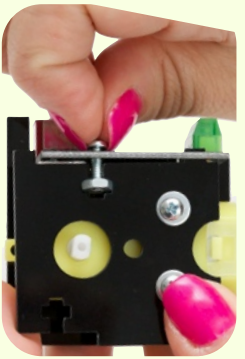
Place the PCB assembly over the motor assembly.
Note how the acrylic tabs fit through the holes in the PCB.



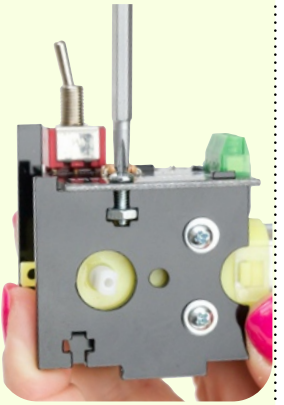
You will be using these nuts and screws to hold secure the PCB to the motor mount.

Slide the nut into the slotted area in the mount, and start sliding the screw through the hole in the PCB.

Using your fingers, tighten the screw. Make sure the nut does not slide out.

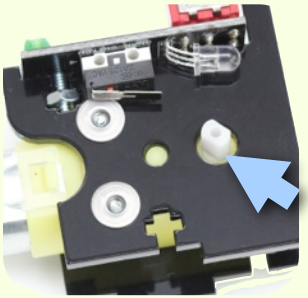


Finish tightening the screw using a screwdriver.

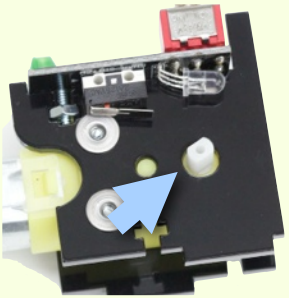


In the same way, slide in the other nut, on the other side, and attach the other screw.

In order to attach the arm, the motor spindle should be in the 12 o'clock position (or close to it). Check yours.



✗ Bad



✗ Bad

✔ **Good**

12 o'clock position

If your motor happens to be in the correct 12 o'clock position, skip to: **Attaching the arm**

Adjusting the motor shaft position

Skip this step if your motor shaft is already in a 12 o'clock position - from the previous step

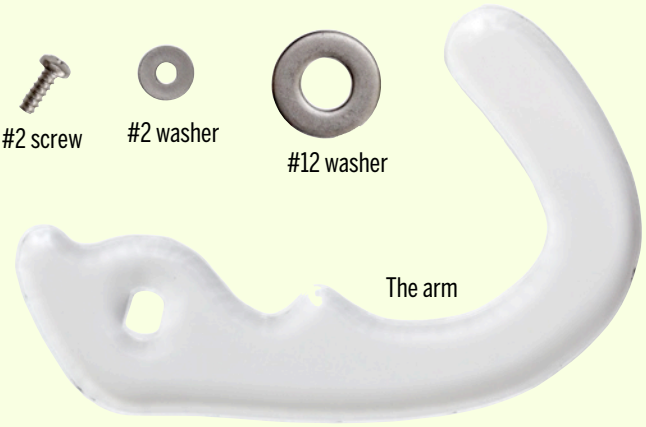
Do not try to twist the motor spindle by hand, or using the arm. We will show you how to use the battery pack to rotate the motor.

Load 2x AA batteries into the battery holder.

Touch the red and black wires to the wires connected to the motor. Pull one of the wires away and check the position of the motor shaft. Repeat until you have the motor shaft at a 12 o'clock position. Really close is good too.
Once done, remove the batteries from the holder and set it aside.

Attaching the arm

Locate these parts:



Place the large washer over the motor spindle.
Note: The washer and arm get attached to the LED / Switch side.

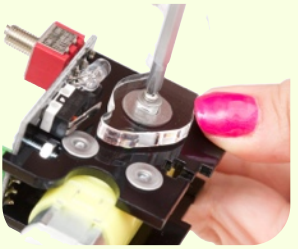
The large washer in place.

Align the arm piece so that the laser cut hole will fit the motor spindle. Press the arm over the spindle until the top of the spindle and the arm plastic are flush. The arm does not get pushed all the way down to the washer. Make sure not to bend the level on the snap switch with the arm, as you are attaching the arm to the motor spindle.

Do not try to move the arm with your hand.
You will break the gears in the motor

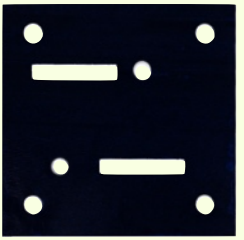
Put the #2 washer on the #2 screw.

Using a screwdriver, screw in the screw and washer to secure the arm.



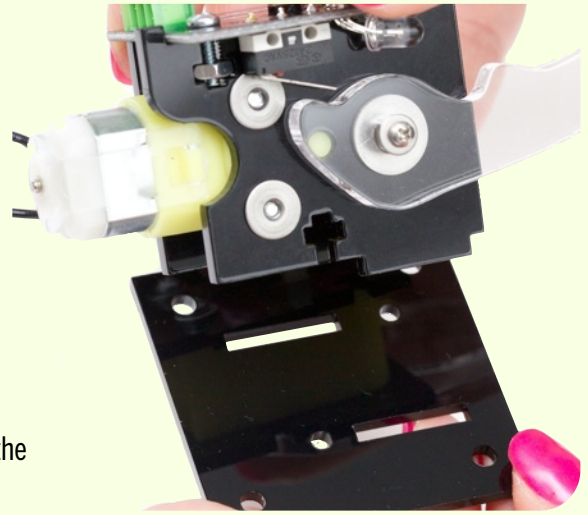
Installing completed motor assembly

Next, we will be attaching the base.



Set up the bottom panel, and the motor assembly in this orientation in front of you.

Note, the arm side of the base has the slot closer to the slot.



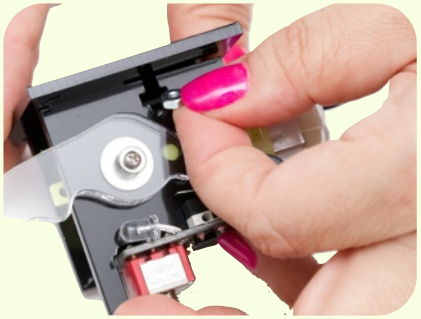
Line up the 2 slots, and place the motor assembly in place.

You will be using these nuts and screws to hold secure the motor mount assembly to the bottom plate.

3/8” 4-40 screws

4-40 nuts

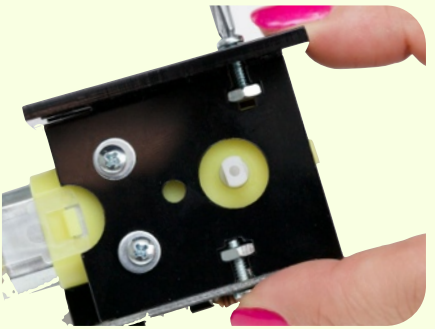
Slide the screw through the base, and side the nut in so it rests in the slot.



Tighten with a screwdriver, do not over tighten.

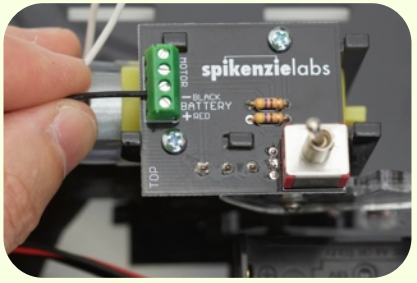
Do the same on the other side of the assembly. Slip the nut in the slot, and slide the screw up from the bottom

Tighten with a screwdriver, do not over tighten.

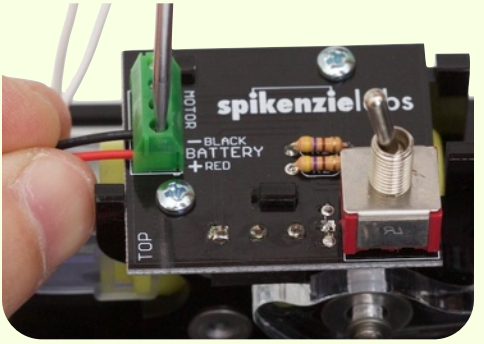


Attaching the wires

To attach the wires, you will need a small flat blade screwdriver. Start by sliding the black wire from the battery pack in to the screw terminal marked **-BLACK** on the PCB.

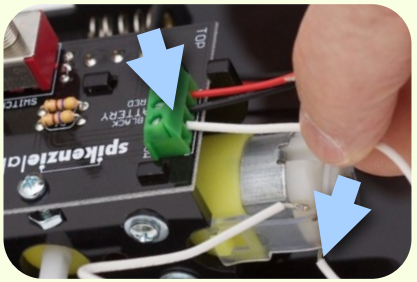


The red wire from the battery pack goes to the **+RED** screw terminal. Screw both in place.

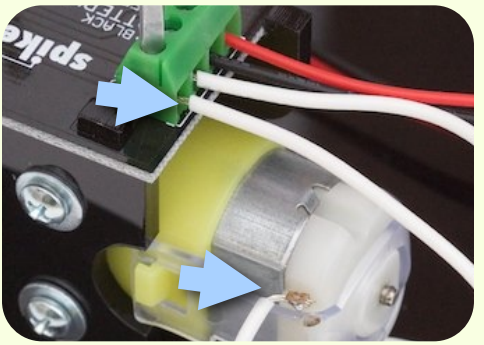


Note: Make sure to tighten the screw terminals onto the bare wire, and not the colored plastic casing. You may have to loosen the screw terminal in order to get the wire in.

The bottom wire coming off the motor goes beside the black wire. Handle these wires carefully, the terminals on the motor are not very robust.
Slide in and screw down the wire.



The top wire from the motor connects to the last screw terminal. Slide it in place, and screw it down.



Motor and wiring testing flowchart

Flip switch - away from arm

↓

Install batteries

↓

Arm should move down (If not already in the down position)

↓

Flip switch - towards arm

↓

Works well? → **No**

↓ **Yes**

Continue to next step

Troubleshooting

No movement at all:

- Check batteries.
- Verify black goes to (-) and red to (+) on the PCB assembly.
- Make sure bare wire is making contact in each of the screw terminals, and not the plastic covering.

Arm moves the wrong way:

- Switch the position of the two wires from the motor going to the screw terminals on the PCB assembly

Arm does not toggle the switch:

- Loosen the 2x 1" screws that go through the motor and mount a little.

After troubleshooting, test with this flowchart once again.

There are four mounting holes on the base to mount the mechanism into the box you create.

We included four 1/8" washers so that if required, the base can be bolted down inside your box .