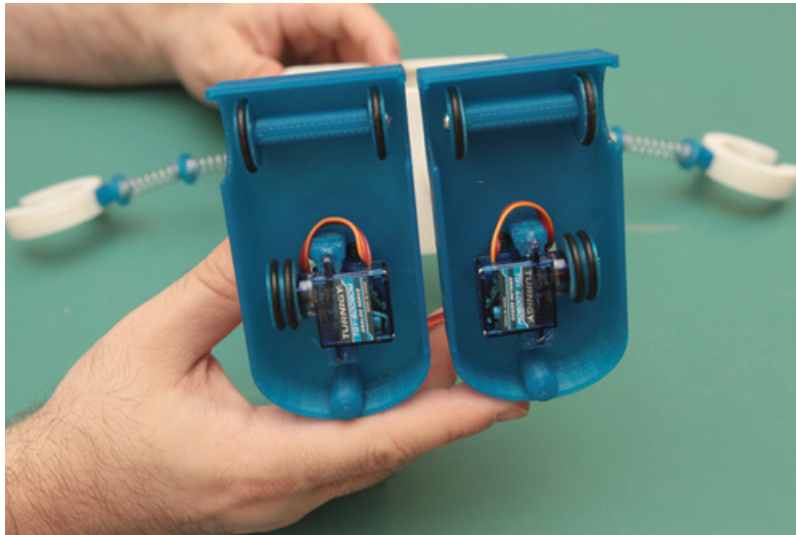


## Modifying Servos for Continuous Rotation

Created by Rick Winscot



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## Guide Contents

|                       |    |
|-----------------------|----|
| Guide Contents        | 2  |
| Overview              | 3  |
| Tools / Materials     | 4  |
| Void the Warranty     | 5  |
| Breaking Bad Barriers | 12 |
| 'The Mod'             | 18 |
| Re-assembly           | 23 |

## Overview

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Continuous rotation servos are awesome: instead of having a "standard servo" 180 degree range, a continuous servo can move all the way around like a wheel. By changing the pulses you can change speed and direction!

If you're familiar with some of the other tutorials out on the Interwebs to modify servos for continuous rotation... you might be wondering what this guide has to offer.

Lots!

### **No Drift**

Many of the mods / hacks I've seen use low precision resistors which will require you to poke around until you find what the servo thinks is center-position. That approach will require you to capture that value and use it as an offset in your software... which makes re-using your servos much more difficult. Using high-precision resistors is the way to go.

### **Grinders Away!**

Cracking off a piece of the potentiometer housing is a quick and easy way to remove the servos rotational limits. It's also a great way to make the servo wobbly and grind it's gears; there is a better way.

### **Variable Speed**

Matched resistors give you sweet and smooth variable speed coming or going.

Before we get started, I have a few words of advice.

First, you will be modifying tiny precision molded parts. One small slip-up can transform the servo you are working on into spare parts. I would recommend buying three or four servos just in case.

Second, this guide will require time, a steady hand, and some patience.

Last, buying continuous rotation servos is always an option!

## Tools / Materials

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### Tools

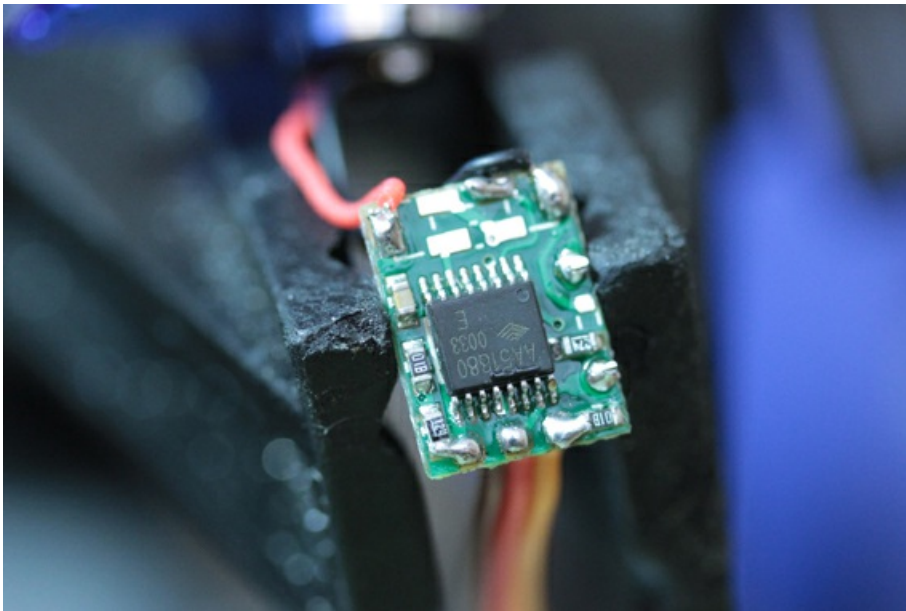
- Soldering iron
- Multimeter
- Wire cutters
- Precision screwdrivers

### Materials

- [A servo! We'll be using "Micro" servos here \(http://adafru.it/169\)](http://adafru.it/169) but any size will do
- [2.2k 0805 resistors \(https://adafru.it/cSA\)](https://adafru.it/cSA) (thick or thin film is fine)

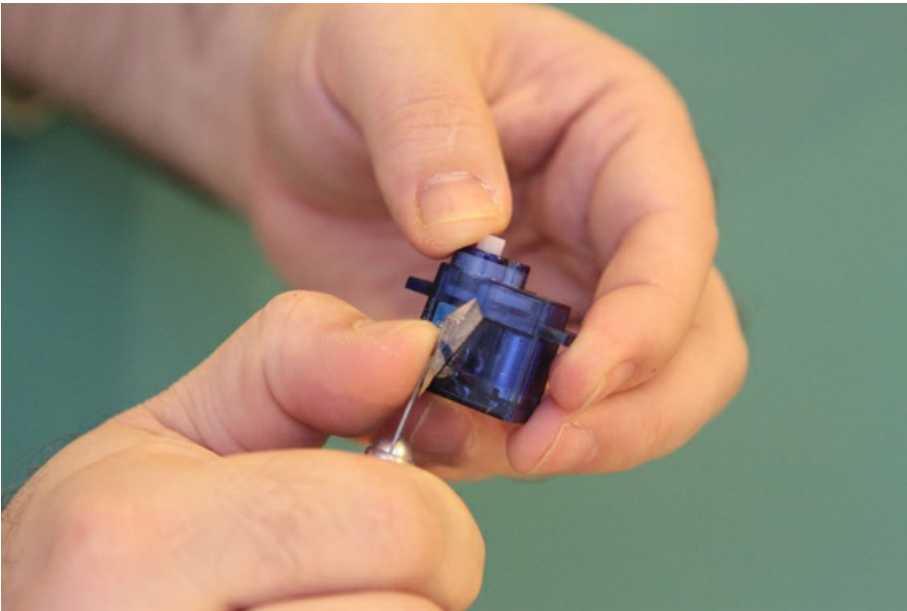
This hack will work with just about any servo... but the ones that have the potentiometer contacts in a row will be the easiest (by far) to mod.

Here is an example of a standard Micro 9g servo driver with the potentiometer leads removed. We will be placing resistors between those three contacts on the bottom.

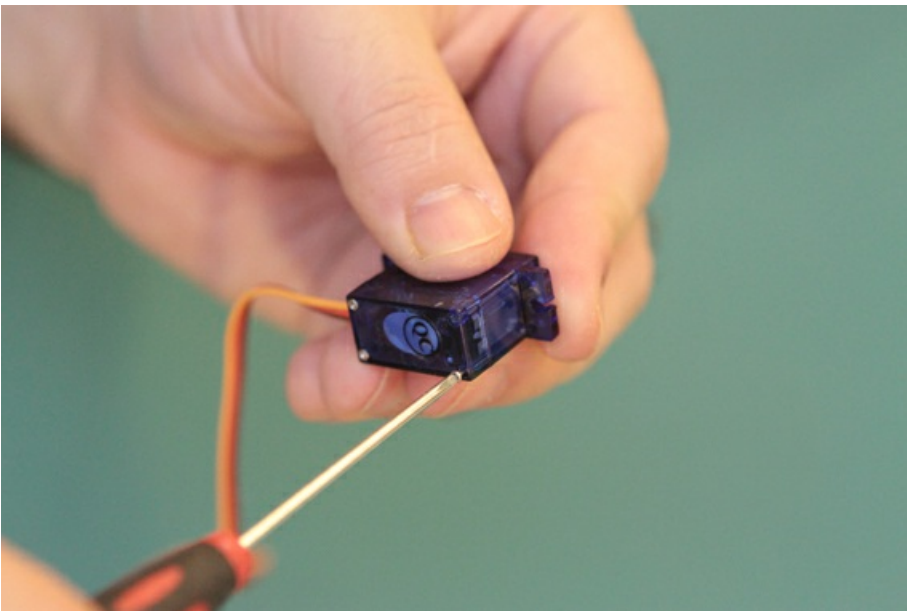


## Void the Warranty

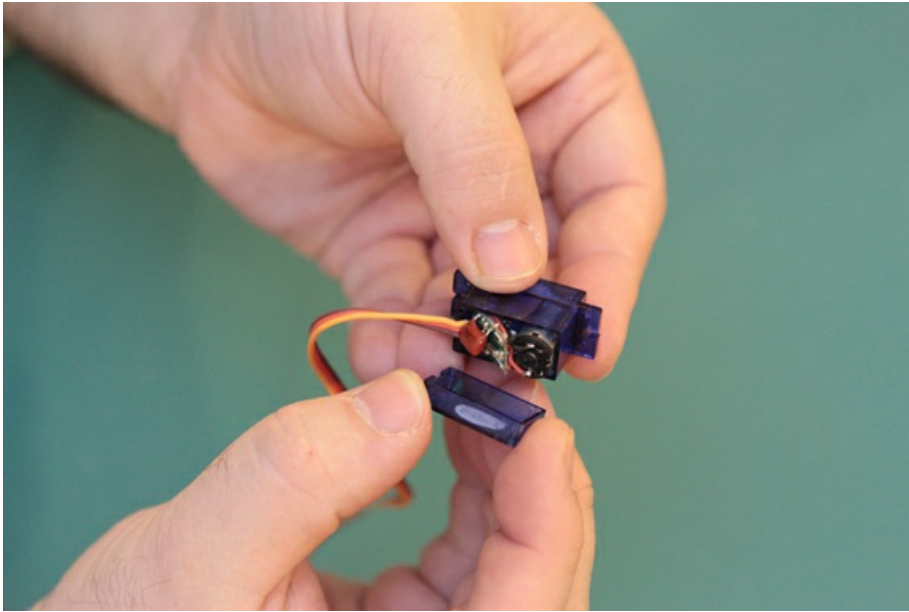
Alrighty then... let's remove any stickers and such that might prevent us from getting to the guts of the servo.



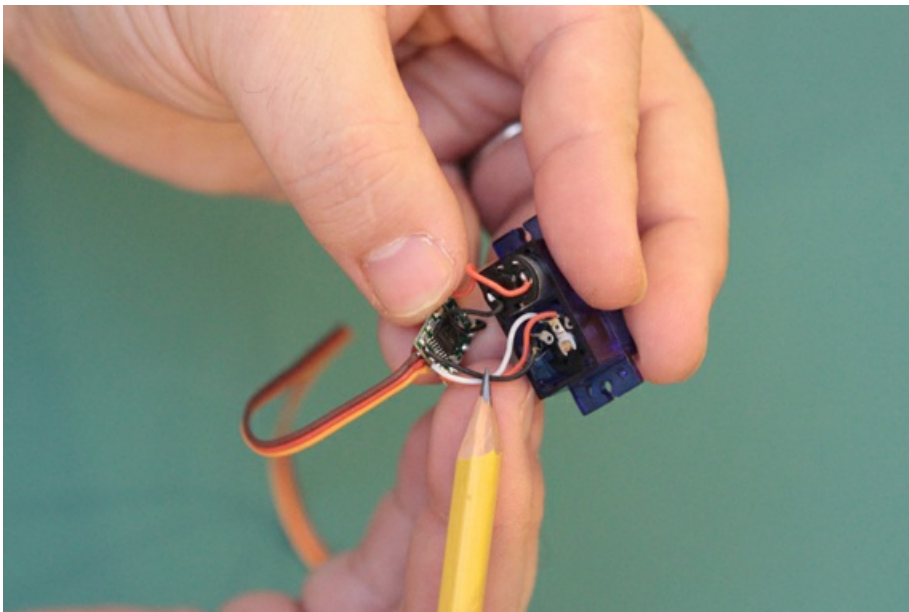
Remove any screws or bands that hold the servo case together.



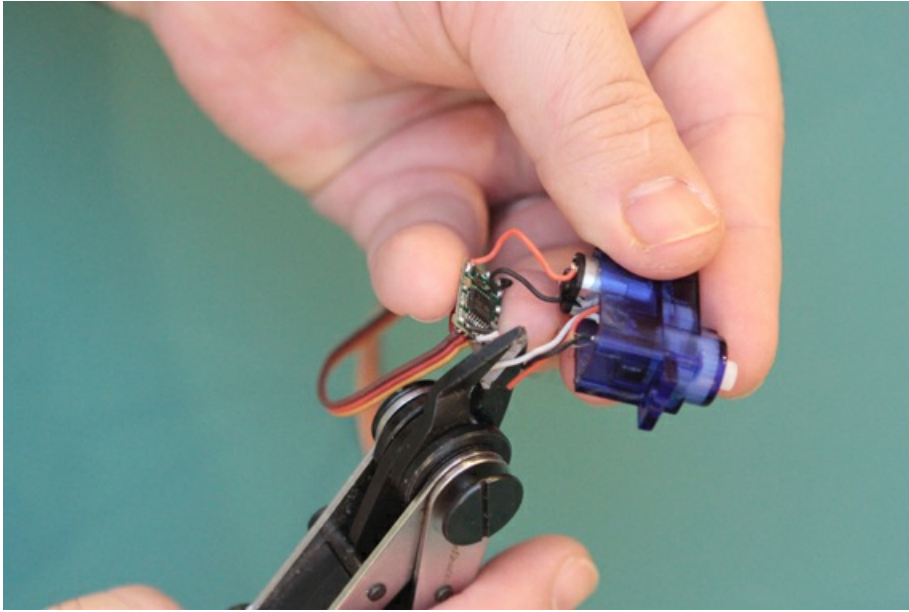
Inside you'll see a tiny circuit board, a motor, and a potentiometer.



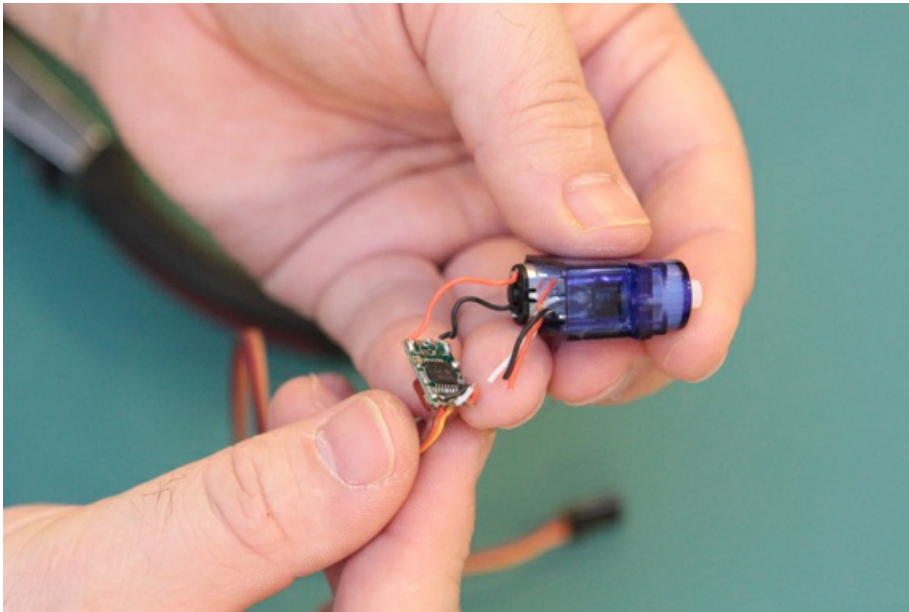
We'll remove these three wires coming from the potentiometer.



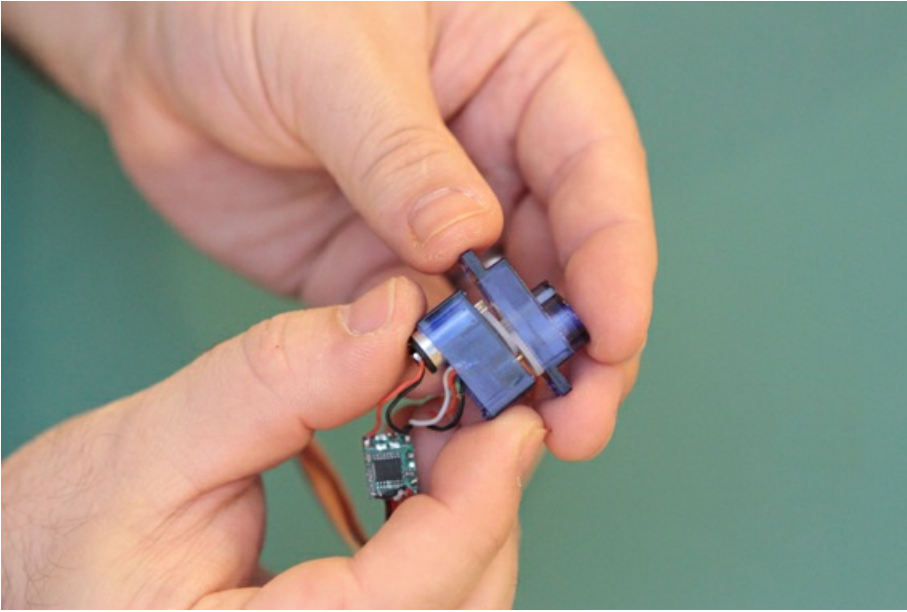
No worries... just cut through them.



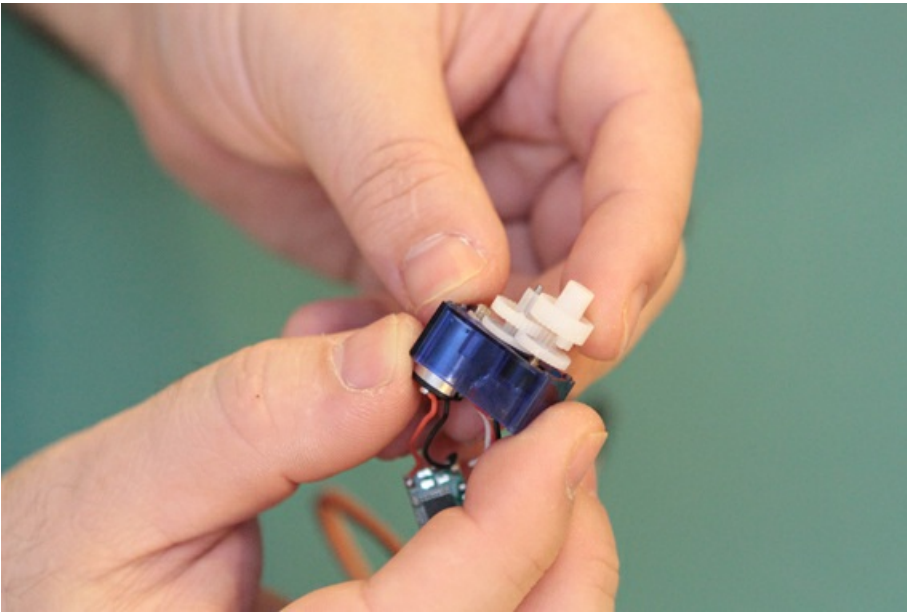
But be careful not to damage the wires coming from the motor.



Depending on your servo, you might have to get at the potentiometer through the top.

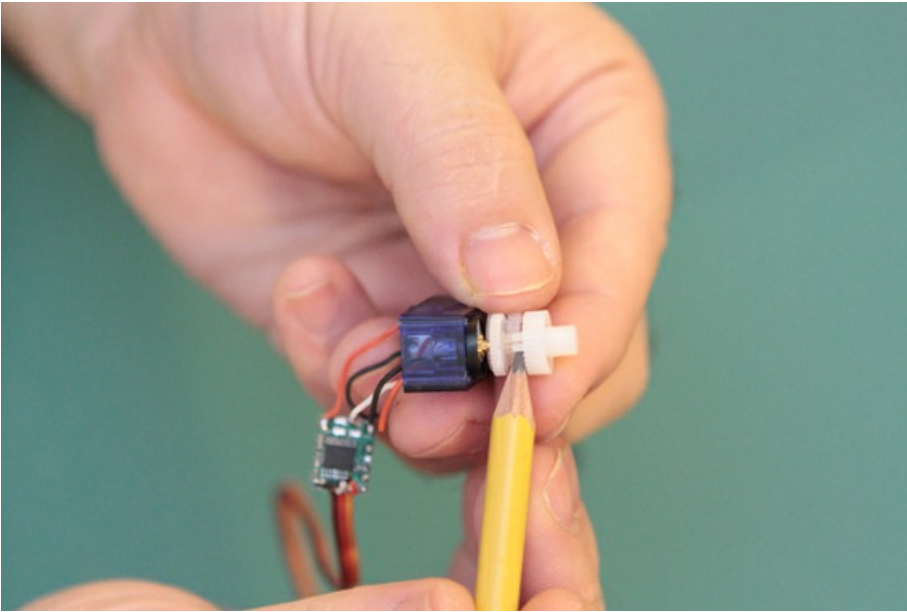


Make a mental note of the gear configuration - you're going to have to put them back in their proper order.

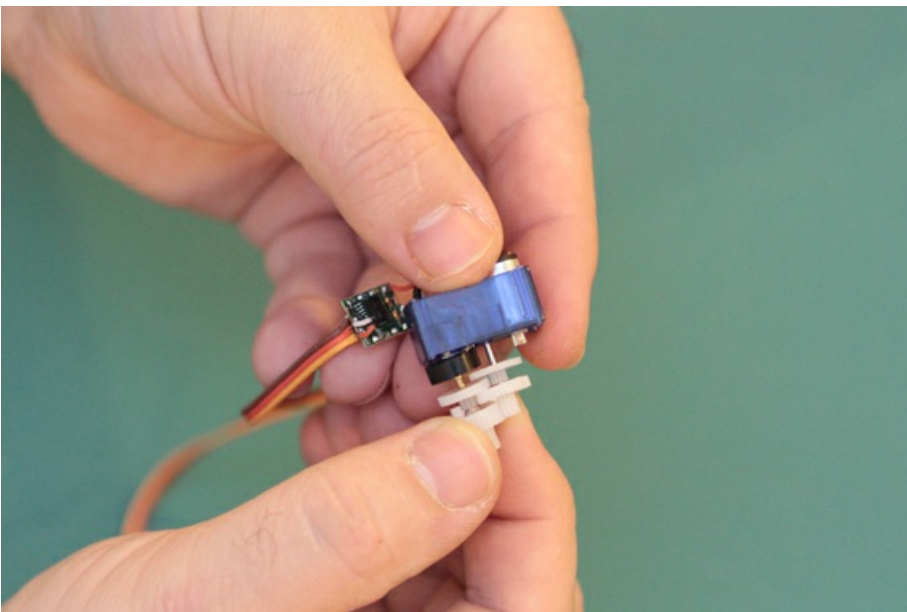


This knob helps limit servo movement - it also will have to go. We'll get to that in a minute.

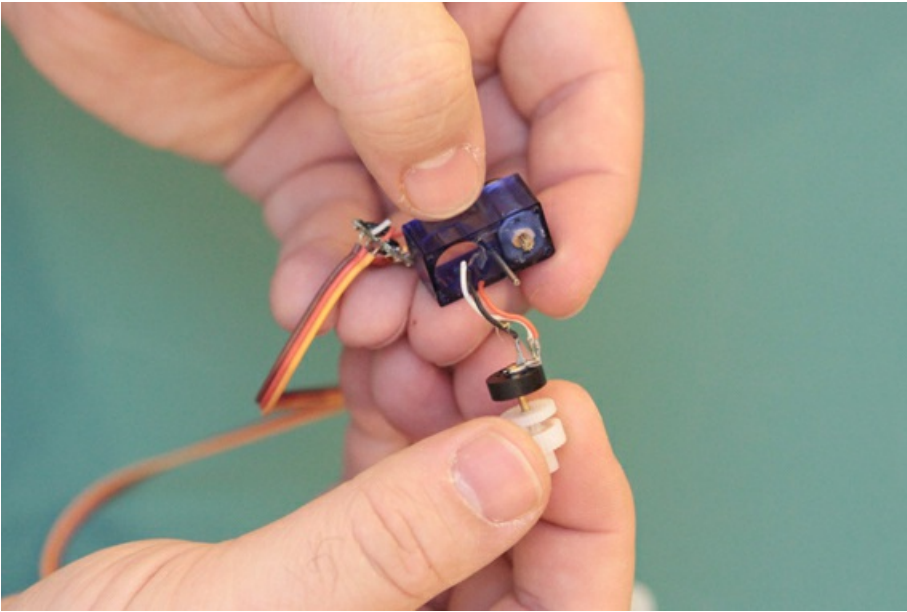




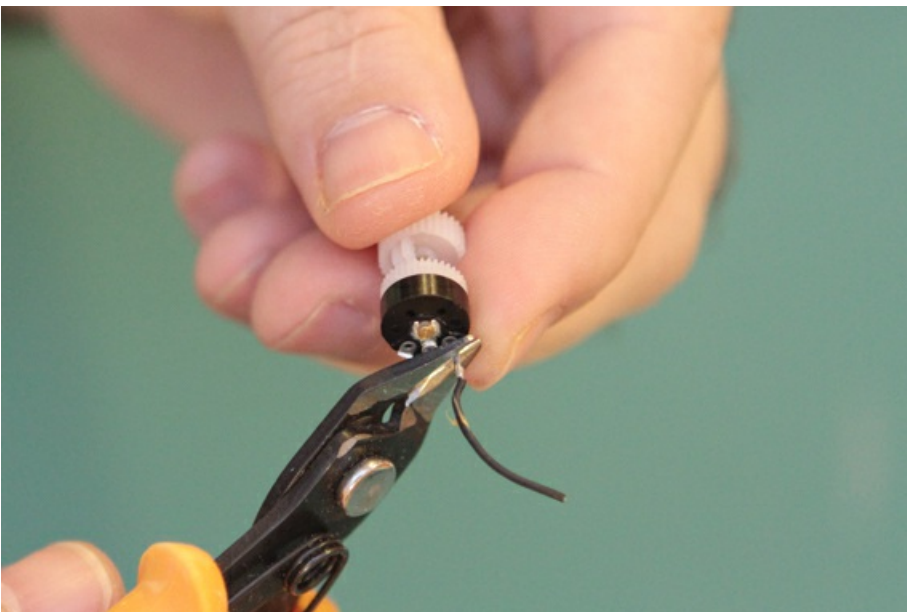
Gently pull out the gears and potentiometer. Minimizing movement of the press-fit gears now will mean a more solid / reliable gear-motor later.



Time to get rid of the wires hanging off the potentiometer.



Clip them as close as you can to the base of the potentiometer. Try not to damage the housing, it's typically made of brittle resin or plastic.

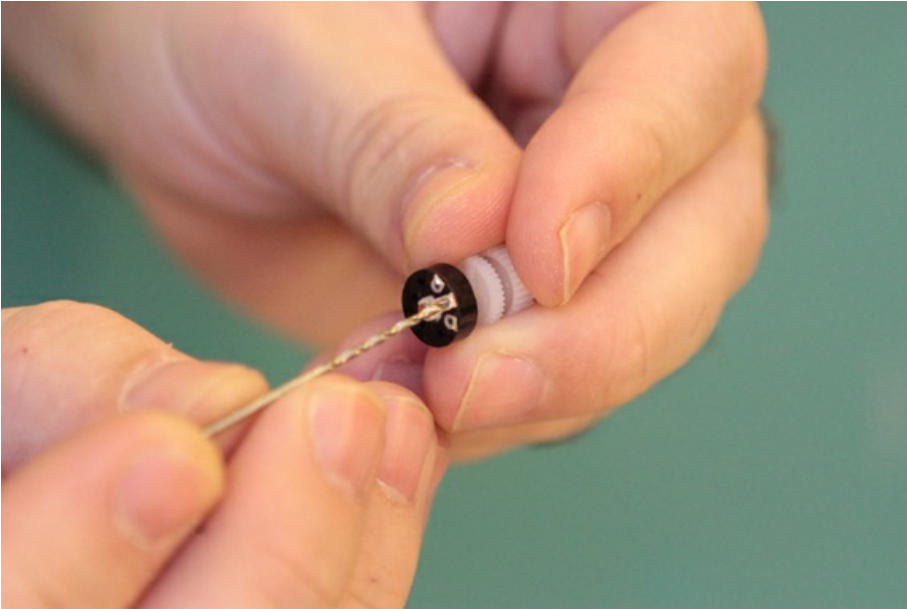


One of these things is not like the other... the guy in the middle is the first key to making a solid gear-motor.

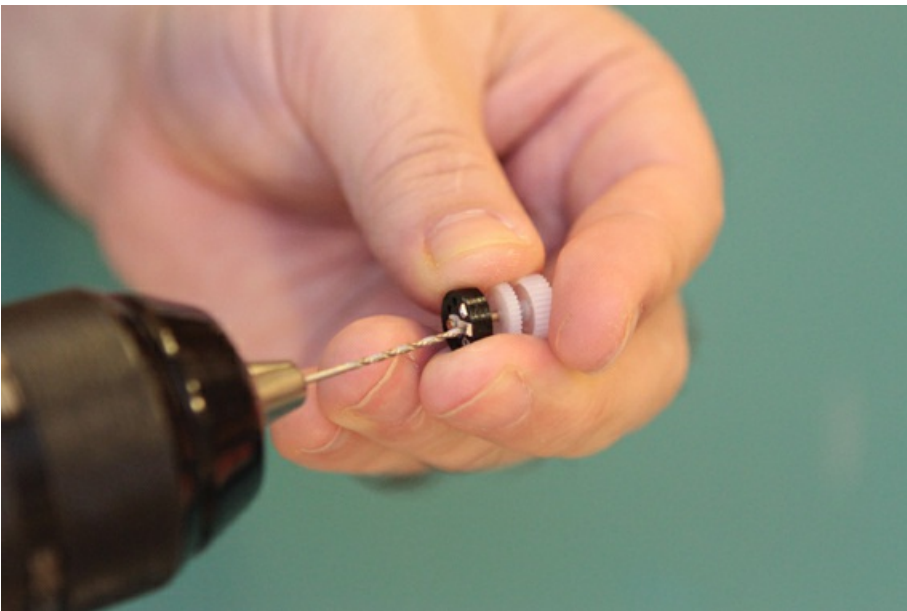


## Breaking Bad Barriers

Use a drill bit that is just slightly bigger than the inner hole of the tiny rivet.



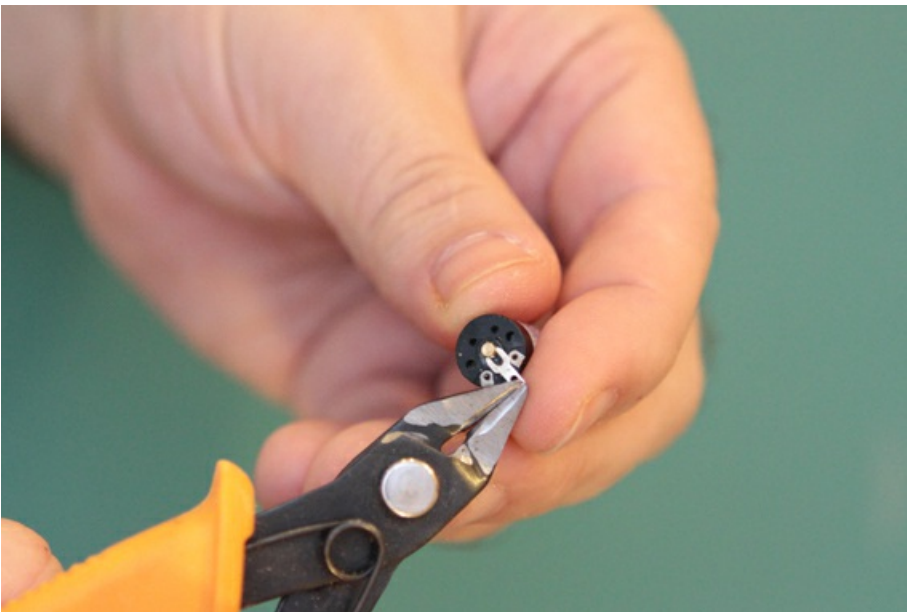
You can drill fast... but don't press hard. Also, try not to get any of the gear grease on this contact.



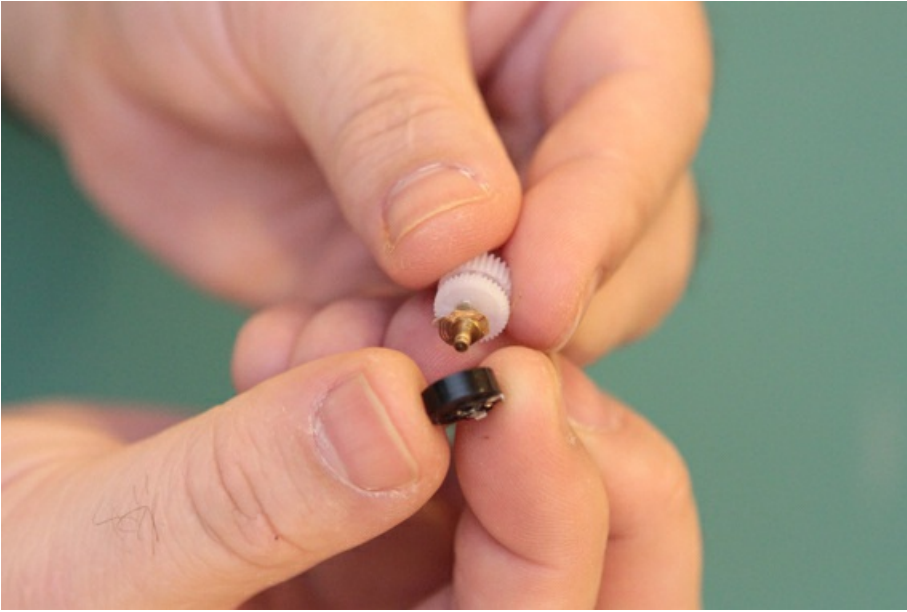
If lady-luck is with you, you'll produce a tiny doughnut; the rim of the rivet. As soon as you see that come off... **STOP DRILLING!**



With the rivet top removed, you can pull the end-stop off and set it aside.



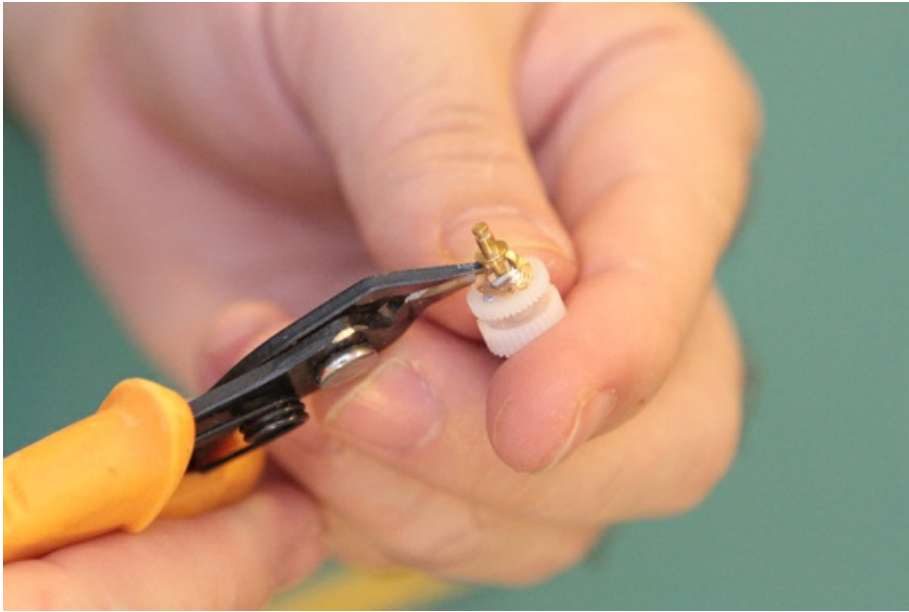
These bits on the shaft makes the potentiometer work... some of it will have to go.



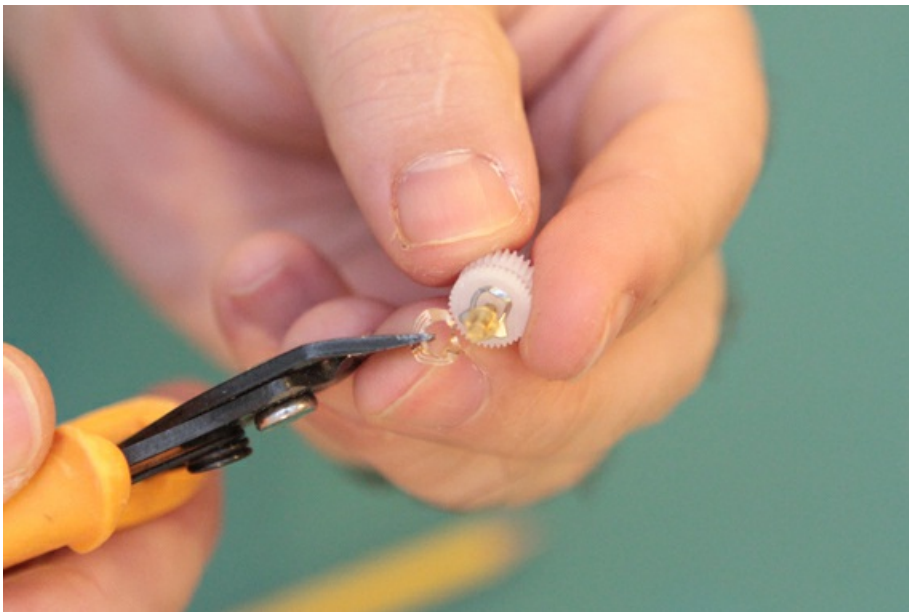
These little bumps in the potentiometer housing also help prevent continuous rotation. Many of the other hacks I've seen just have you break a chunk off... and re-assemble the servo. Compromising the structure of the housing can lead to all kinds of poor outcomes.



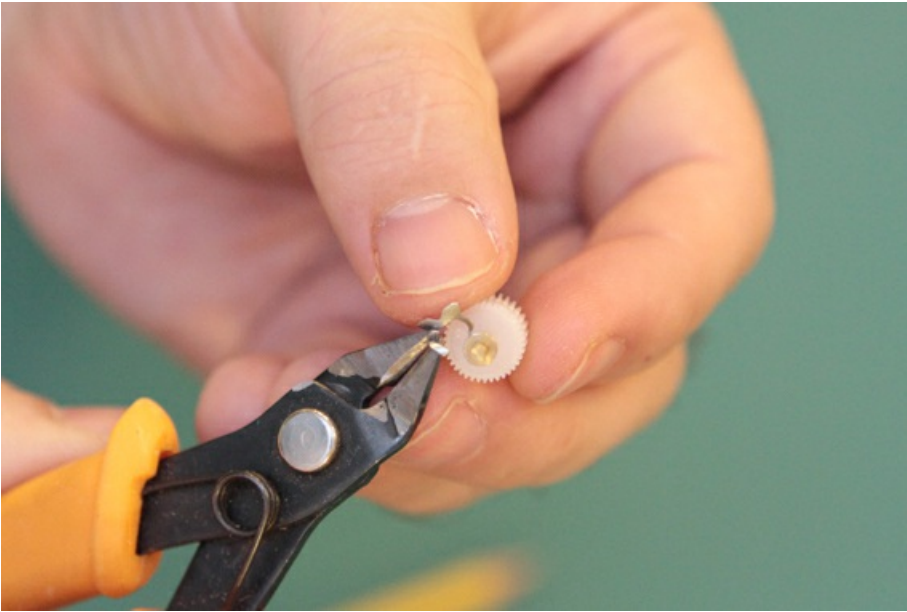
This... is a better way to fly. The foil contact and limiter are pressed into place - give them a little wiggle towards the gears and they should come right off.



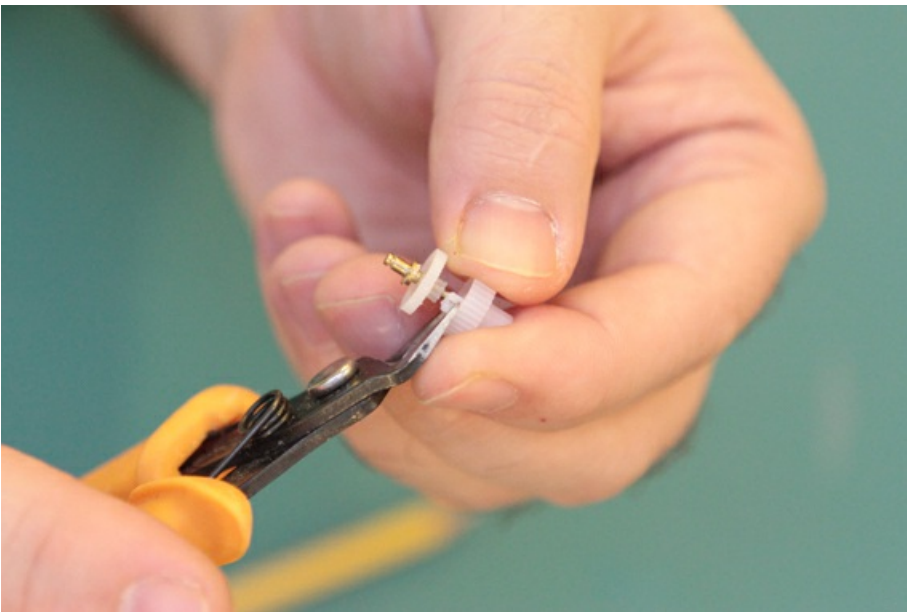
Now that you have a little more room, dig-in and snip them both off without marring the shaft.



The foil contact comes off without a fight... you'll need a good pair of snips to get the limiter off.

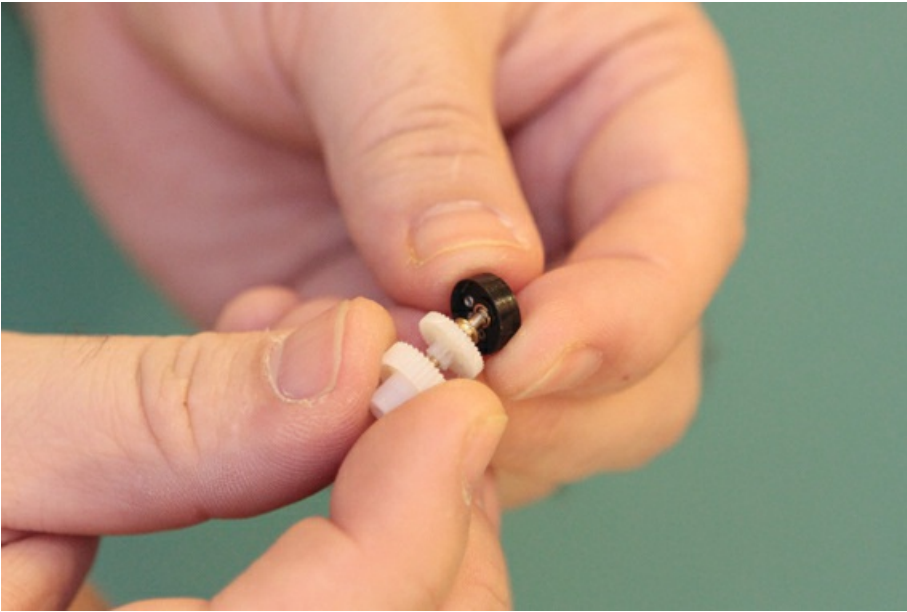


Time to remove those knobs we mentioned earlier.



Put the shaft back on with a smidge of petroleum jelly.





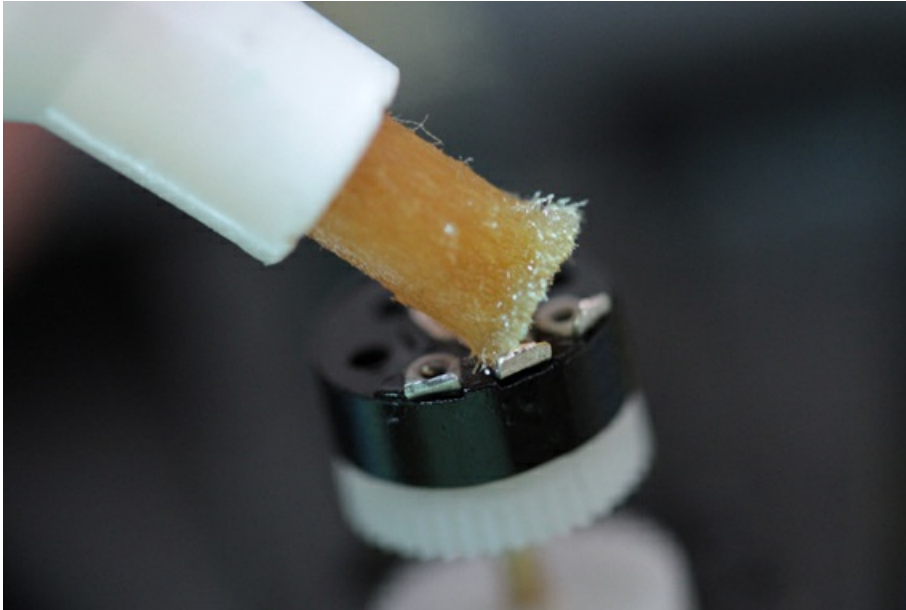
Put the shaft end-stop back into place... and fire-up your soldering iron.



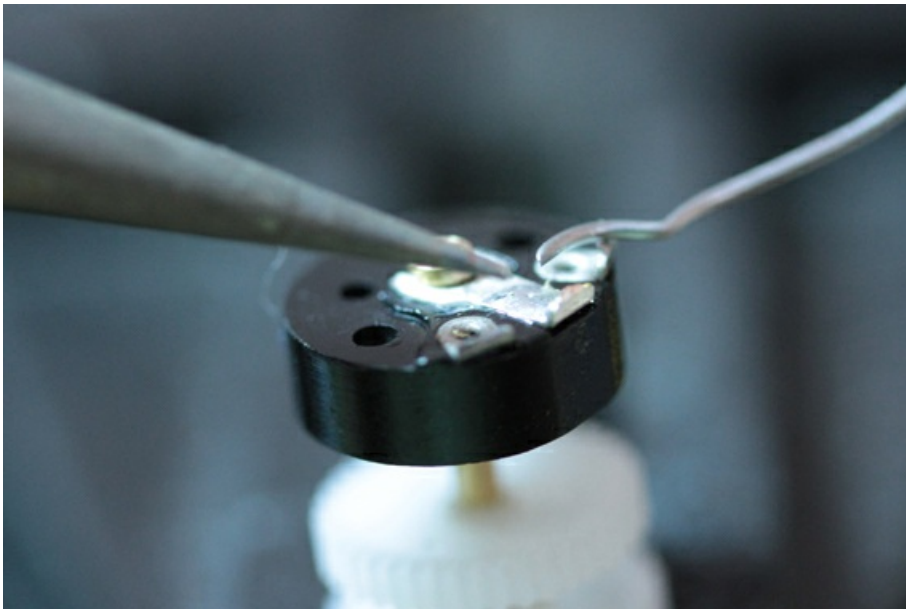
## 'The Mod'

Remember I said to try and not get lubricant on the center contact? This is why... we're going to solder it back into place.

Add a little flux to make the solder flow easily between the contact and the rivet beneath.

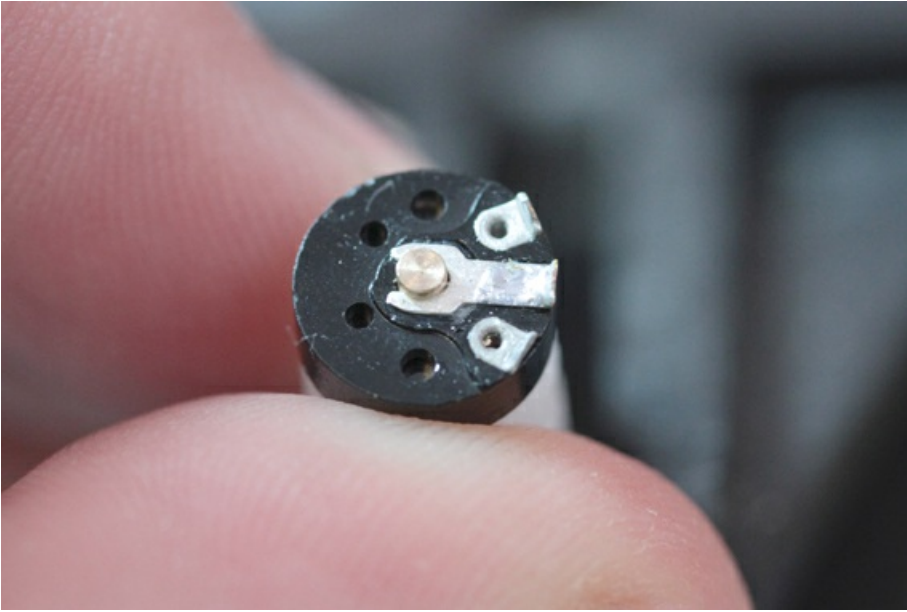


The potentiometer housing is typically heat resistant, but don't linger there too long. Just make sure that a little solder gets down to the rivet and call it good.

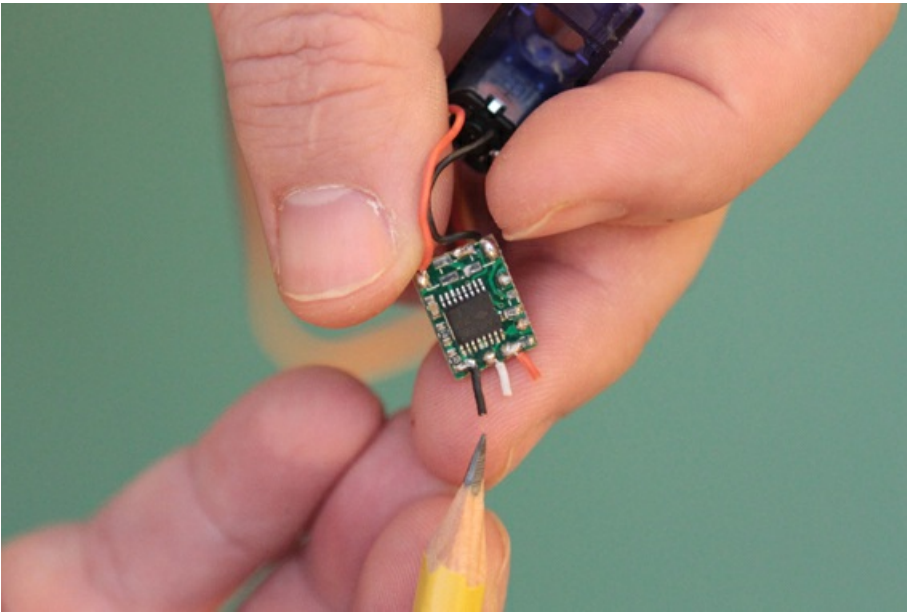


Give the shaft a twirl to make sure that it rotates without binding.

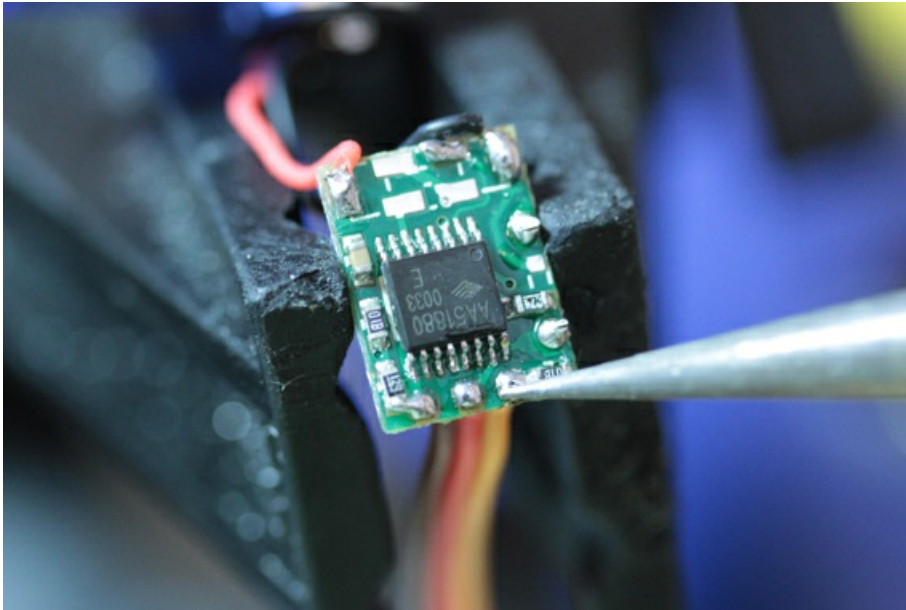
Perfecto!



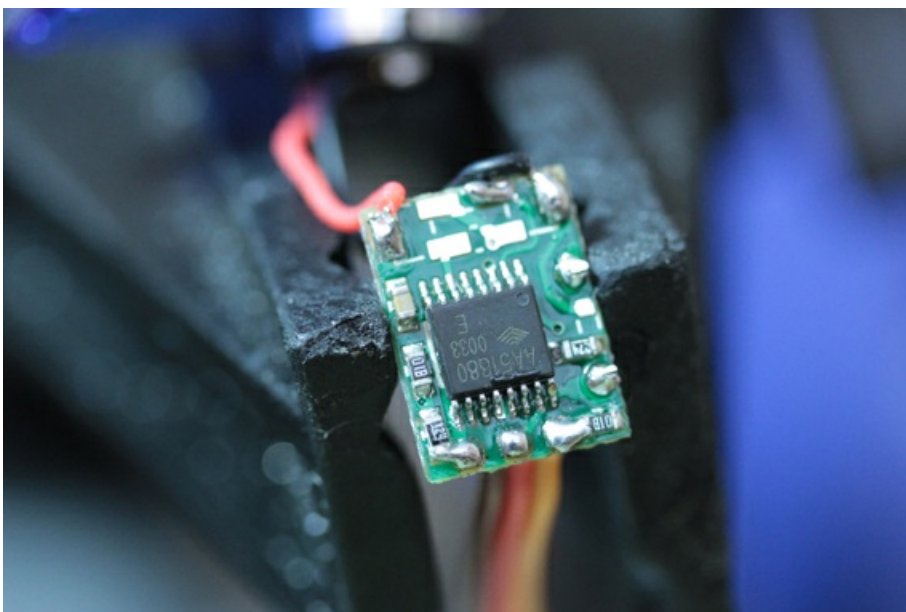
Time to modify the driver.



Touch the wires with a hot soldering iron and brush them away.

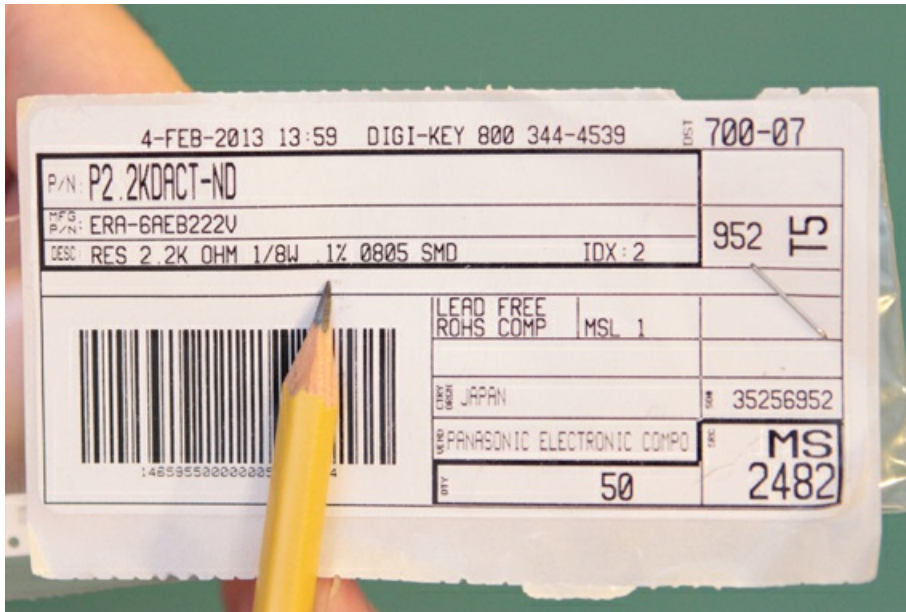


We're going to trick the servo driver into thinking that the potentiometer is always at a center-position with a pair of resistors.



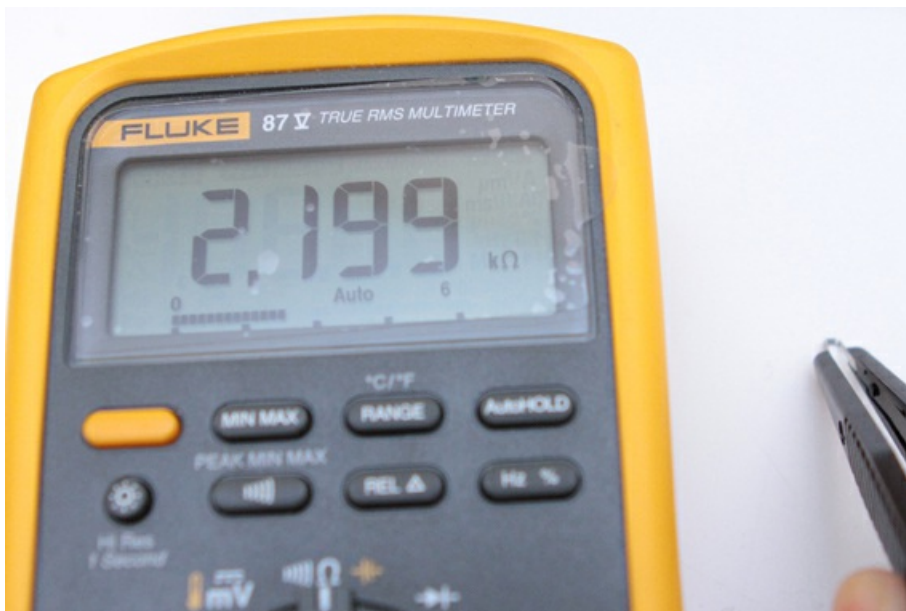
Not just any resistors... we will need some high-precision resistors to make sure that we won't have to tweak software to account for drift.

It's hard to see, but these are .1% resistors. They are a little expensive, but well worth it for what work they will save you in the end.



You should be able to use any two off the tape... but I like to go the extra mile and find a matching pair.

Sure enough, they are what they say on the package!



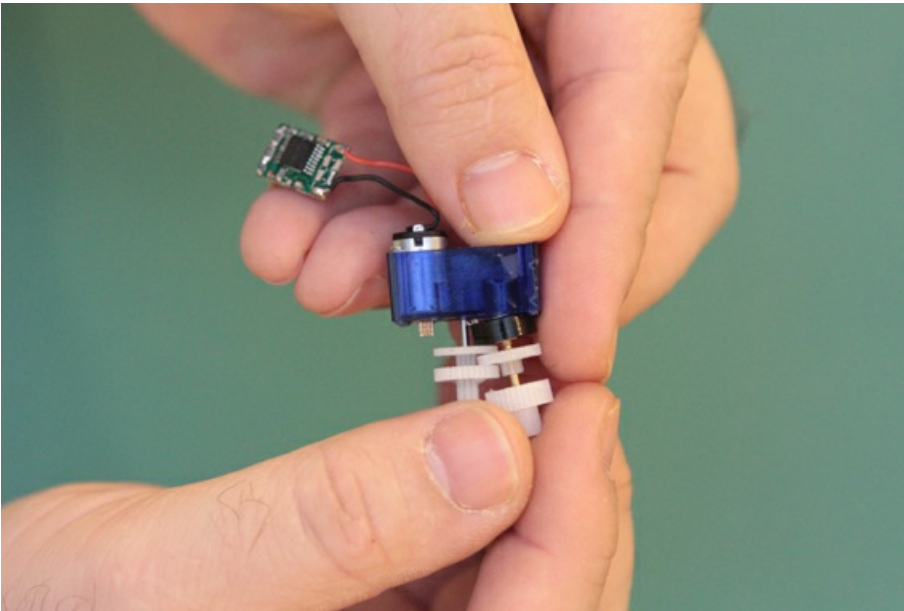
It will take a steady hand to get the 0805 components in place... it doesn't need to be pretty - just functional.

Your trusty flux pen should help solder flow more easily if the tiny connections start to give you attitude.

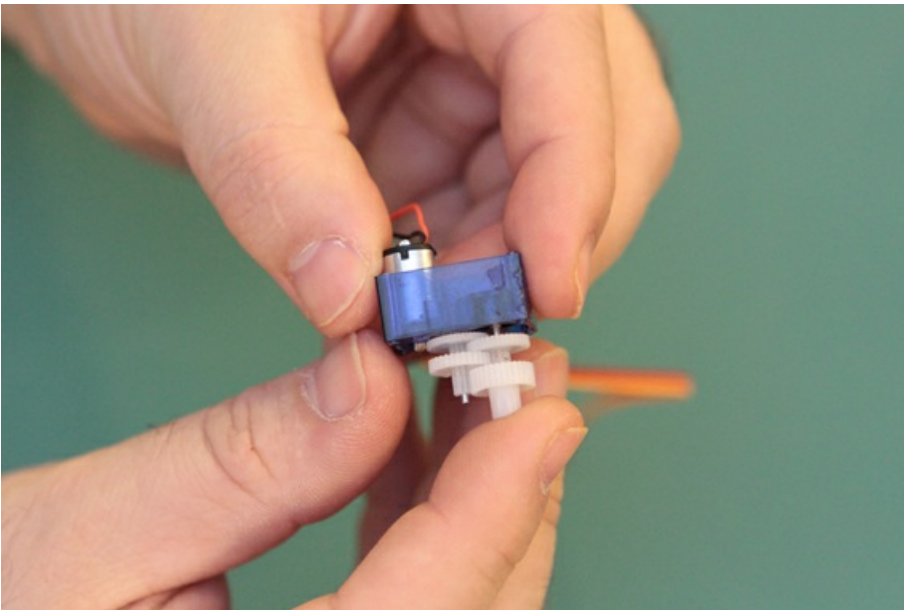


## Re-assembly

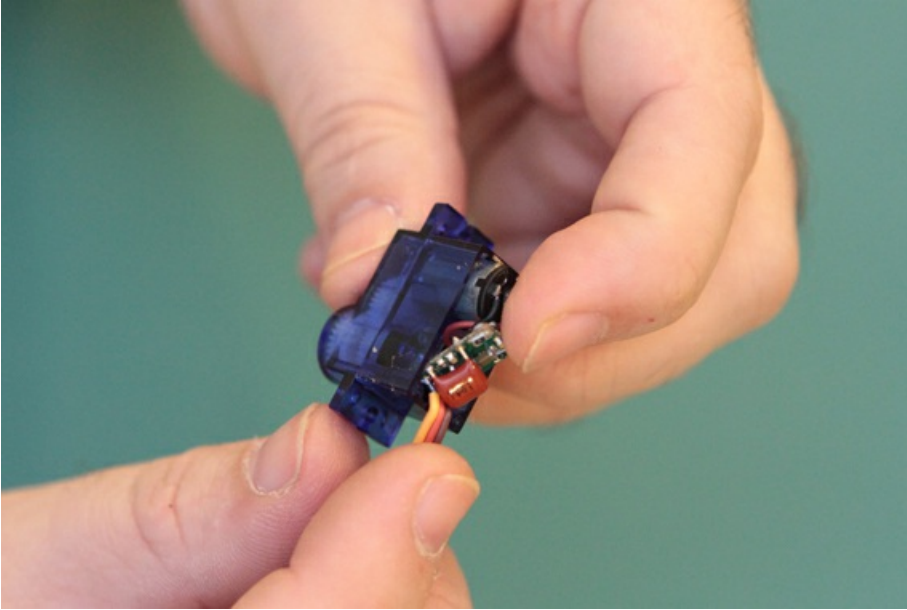
Collect all the bits for the gear cluster and... you do remember what order they go in right?



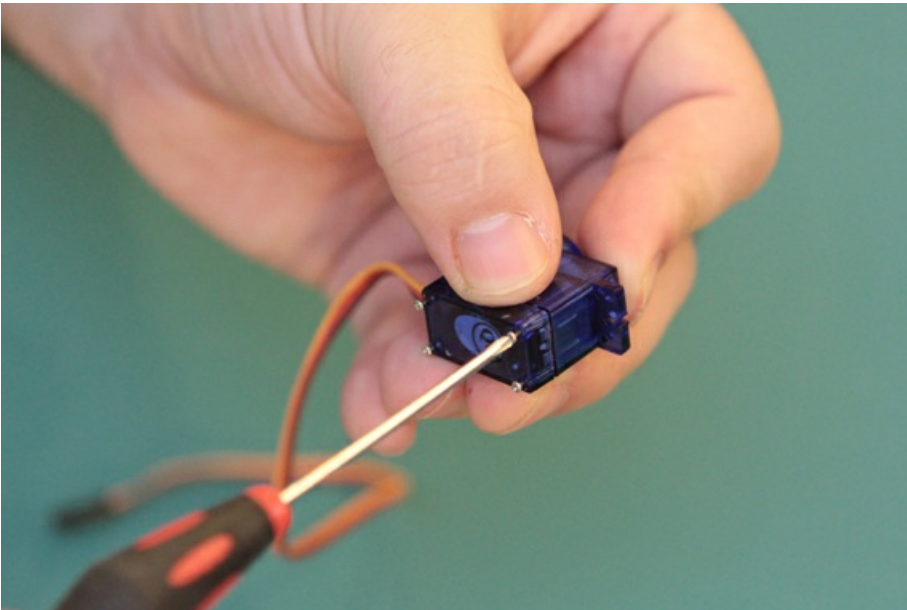
Push the potentiometer back into place carefully. Don't try to rotate the gears at this point, it's highly likely that you will damage them if you do.



Replace the PCB as you found it.



Make sure that the servo wires aren't pinched... and then re-insert the screws.



Now... all you need is a project to put them in!



