

Modification of Servos for Continuous Rotation

If you want to use a Hitec HS-422 servo (don't try this for other models) for continuous wheel motion (360+ degree rotation) you can use the following modification instructions.

You should follow these instructions if you want to make a wheeled mobile robot. It only takes about 5 minutes to modify a servo in this manner.

After modification, servo commands result in constant motor angular velocities rather than positions. For example, a 0 degree command produces a full reverse angular velocity. A 90 degree command (or close to that value) produces a zero angular velocity and a 180 degree command provides a full forward angular velocity. Angles in between will produce velocities that are in between these extreme values.

Note you need a small Phillips head screwdriver to access the screws in the HS 422 servo. The lab instructor can lend you a screwdriver in the lab.

Before modifying the servo you should check first if the servo is functioning with one of the Lab #2 examples.

Step #1

Move the servo disc to the center position (i.e. 90 deg) by hand. This is halfway between the stops at 0 deg and 180 deg. Then remove the screw from the front of the servo.



Note: After the front screw is removed then remove the back screws (see step #8) while holding the front of the case together with the back of the case to prevent the gears from falling out.

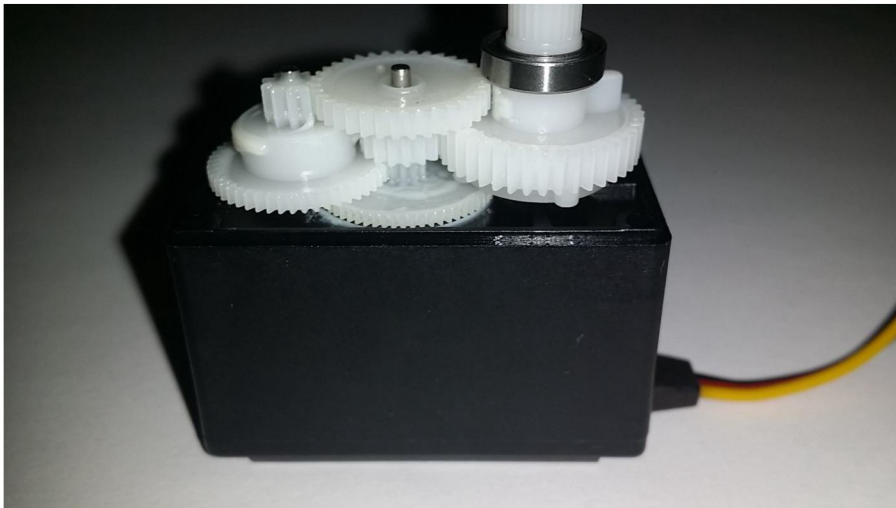
Step #2

Remove the top part of the case from the servo while pressing on the servo shaft. This helps keep the servo gears in place when the top part of the case is removed. Be careful not to take apart / disrupt the gear assembly underneath the cover.



Step #3

The servo gears should look like the following picture after the top part of the case is removed. This picture is supplied so you can reassemble the gears in case they are disassembled by accident. Note the gear notch which is used to restrict motion between 0 deg and 180 deg. This notch needs to be removed for continuous rotation (see next step). Note you should not remove any of the gear lubrication since it's needed for gear operation.



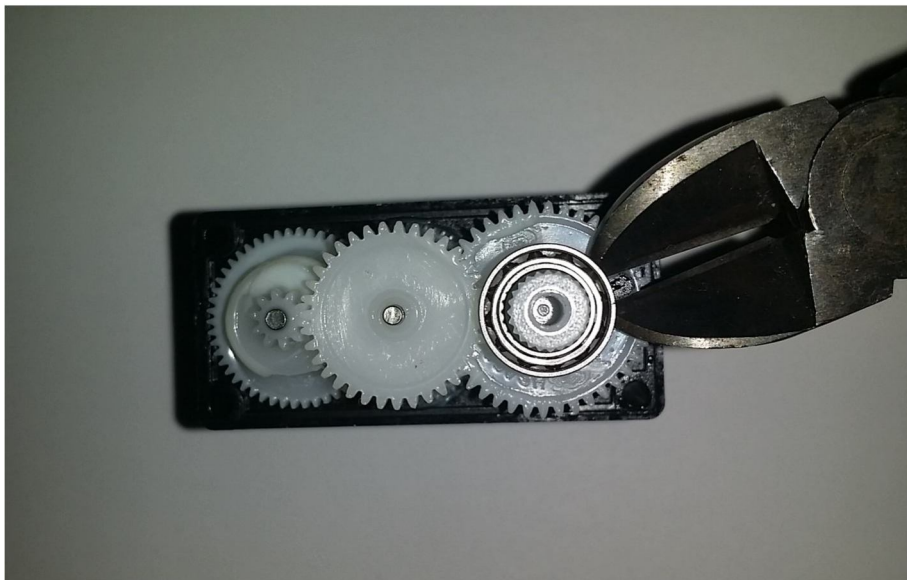
Step #4

The gear notch is highlighted with black marker in the figure below.



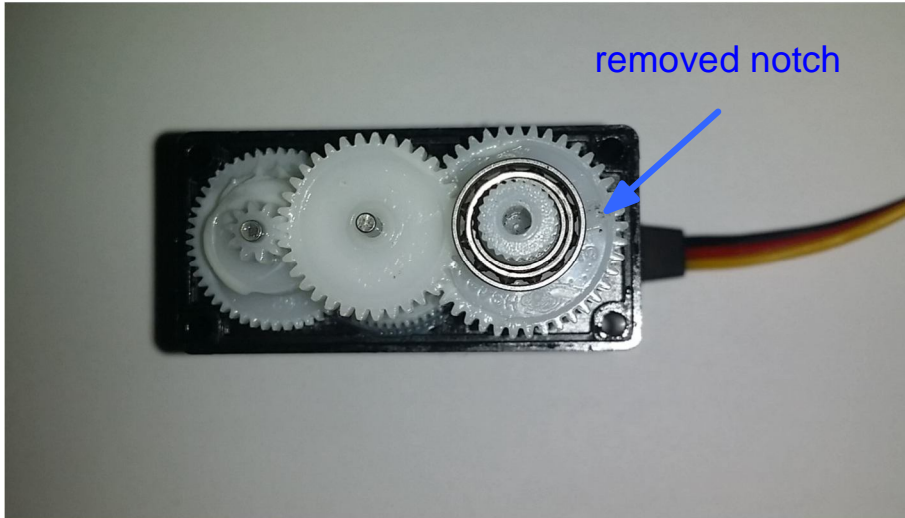
Step #5

Remove the notch using the “mini-cutters” from the lab kit as follows. The cutters should be placed as close to the flat part of the gear as possible and then squeezed hard to cut it off. Close your eyes when doing so (the notch can fly off) or use safety glasses. If the notch is still attached then wiggle the cutters gently until the notch falls off. You can also cut the notch in the vertical direction if it gets stuck.



Step #6

The gears with the notch removed will look like the following figure. If there are any debris or significant raised edges remaining then trim it with the mini-cutters while making sure the gear teeth are not cut by accident.



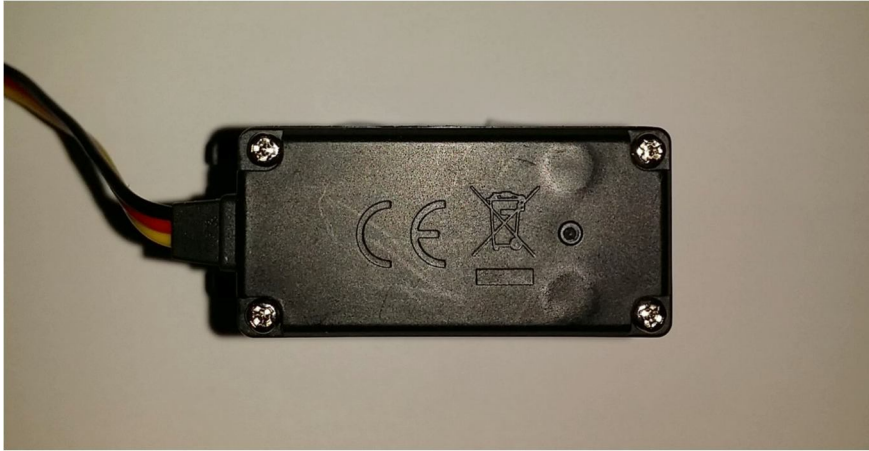
Step #7

Place the top case cover back and screw it back on as follows.



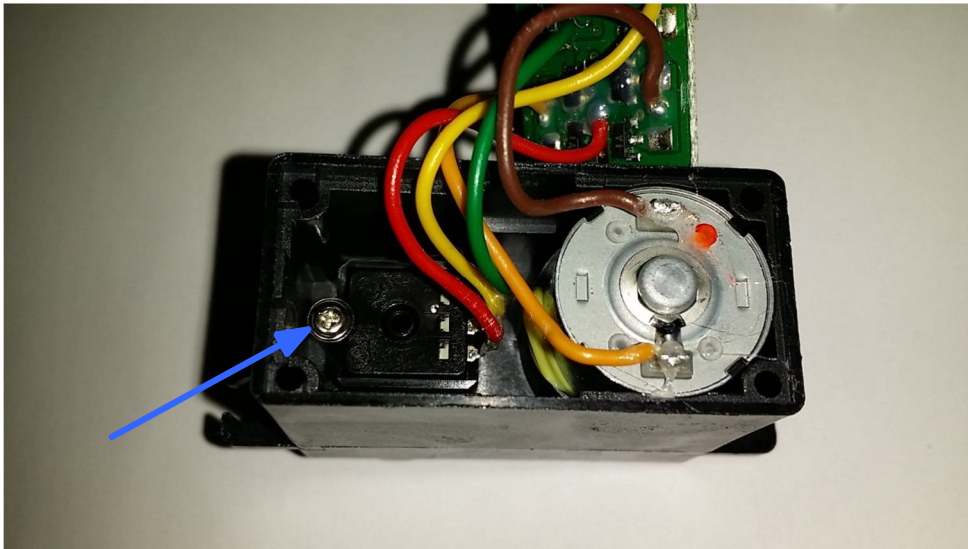
Step #8

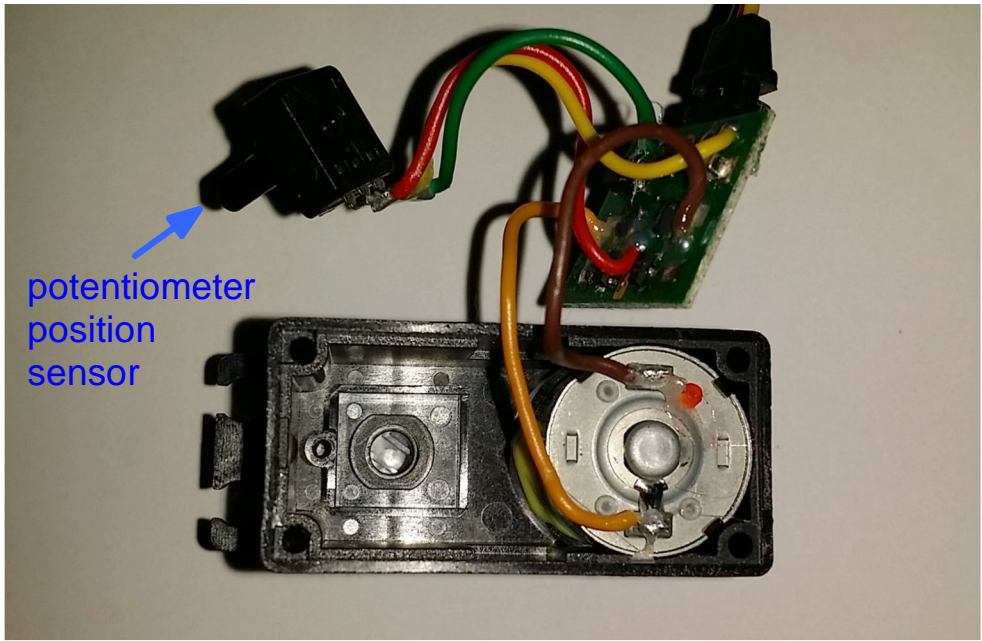
Now remove the screws from the back of the servo.



Step #9

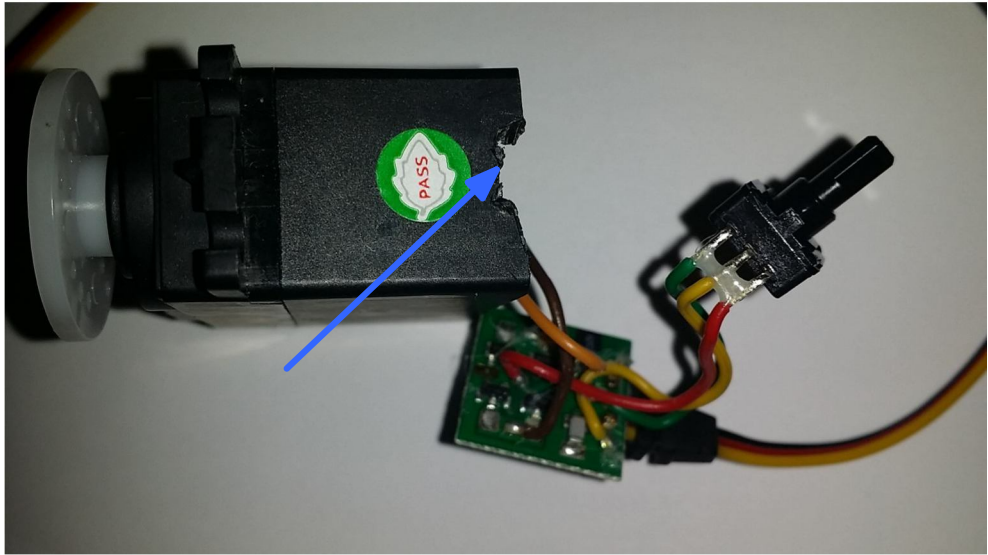
Pull the green circuit board away from the servo as follows (see first figure below) and remove the screw holding the potentiometer (see second figure below).





Step #10

Make a notch in the back of the case with the mini-cutters as follows.



Step #11

Place the potentiometer cables through the notch. Then put the green circuit board back and the case together as follows.

The position of the potentiometer should be adjusted so that the short end points towards the wire connector (see figure below). The potentiometer should then be close to the center position. You can make small further adjustments to obtain zero angular velocity when a 90 deg command is sent to the servo (modify the example from Lab #2 to do this).

After the operation of the servo has been verified, the potentiometer should be glued to the center position. This prevents vibration of the potentiometer affecting the servo motion.

