Chapter 12 – Adding Motors: Steppers and Servos

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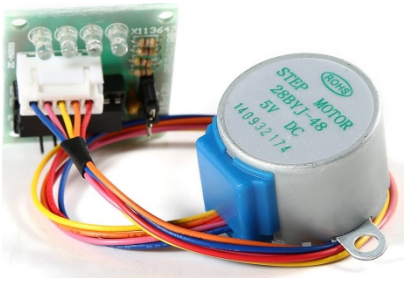
Want to make something rotate on your model railroad? You need a low voltage motor, probably a stepper motor or a servo motor. If you visit AMAZON and do a search on "Arduino Motors", you will get over 1,000 hits. Many of the hits are relevant to applications other than model railroading. The ones that I use are generally classified as "Stepper Motors" and "Servo Motors". So, what's the difference?

- Servos have absolute positioning; if you tell one to go to a specific position, like 0°, it will always do so. Steppers have relative positioning; if you tell one to rotate a certain number of degrees, it will do so, but it cannot remember where any specific position is.
- Servos are generally limited to 180° of travel, sometimes only 90°, whereas steppers have unlimited rotation capability
- Servos generally require a bit less space under the layout.
- Servos require only 1 control pin from an Arduino, plus 5V power and Ground, but only 6 digital pins can generate the "Pulse Width Modulation" ("PWM") required by a servo, pins 3, 5, 6, 9,10 and 11. Steppers require 4 digital pins (any will work) plus a ground pin.
- Servos come with either plastic or metal gears. Steppers that I have found come only with plastic gears.
- Servos with plastic gears (model SG90) are about $3.50 when bought in a 2-pack, and about $1.80 when bought in a 10 pack. Servos with metal gears (model MG90-S) are about $3.50 each when bought in a 2-pack or a 6-pack.
- Steppers require and generally come with a controller board. Servos do not require one.



Stepper Motor

Servo Motor

That's not to say that these are the only types I use for Arduino projects; for the Carousel project I used a Hankscraft 12VDC, 4RPM motor to drive the carousel, but it's current draw was more than I wanted to require of an Arduino, so I powered it through a relay and controlled it through the Arduino. But I found that stepper motors with their plastic gears were prone to stripping, and since I don't use motors often, and only then with limited rotational requirements, (only in the Lumberjack project, at least for now), I have decided to use servo motors.

Although both types of motors usually come with plastic attachment arms (aka: "horns"), I found that I sometimes wanted something different than came with the motor (or I lost the ones that did), and I found that arms from DUBRO fit the stepper motors I use. Their model 675 fit the stepper motor described above (AMAZON ASIN: B0006MZR5A). The servo motor I purchased was fairly inexpensive, and when I emailed tech support for the dimensions of the servo arm, they said they were the only ones who sold arms that fit, but wouldn't tell me how to get replacements, and I was more than a bit discouraged. I think the spline is 4.8mm, 20 teeth, but I am not sure. I may resort to 3D printing my own arms.

I did discover that I could take Evergreen Polystyrene tubing, part number 227 and jam it over the spline, and it was tight enough to hold, but the interior diameter was too large to hold the 1/8" rod on which my lumberjack was attached. I took a short piece of Evergreen 225 tubing and glued it into the Evergreen 227 to reduce the interior diameter. Once I did so, the inside diameter was smaller than the Evergreen rod which I was using with my lumberjack, so I bored into the diorama Evergreen with a #30 bit, and the "press fit" held.

I do want to document an anomaly I discovered when using servo motors in conjunction with the DFPlayerMini MP3 player. In the Lumberjack project, I initially decided to place the motor's "attach" function in the SETUP routine (this function logically associates a specific servo instance to a specific Arduino pin). But I discovered that every time I made a call to the MP3 player, the motor would rotate slightly and quickly, or what I call "jitter". This was unacceptable to me, and I could find no way in my hardware setup to avoid the problem. Eventually I discovered that if I removed the motor's "attach" function from the SETUP routine and placed it in the LOOP, right before I wanted to use the motor, and then used the motor's "detach" function immediately after I was done using the motor, the "jitter" went away. To save you some effort, I did try to power the servo external to the Arduino, but the problem persisted. Only when I decided to turn the motor off and on by using "attach" and "detach" in the LOOP did the problem go away.