An Owl cannot fly without ...

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Flight Feathers

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MEETINGS

FIRST SATURDAY OF THE MONTH AT 11AM

NO MEETINGS JULY/AUGUST

NEXT MEETING:
NOVEMBER 4th

EMERGENCY CALLS FROM OUR FIELD

352-485-5111

2023
WISE OWLS

RON SANDERS
PRESIDENT & TREASURER
~
RICHARD GIBSON
VICE PRESIDENT
~
GILBERT PRIEUS
SECRETARY
~
ART SCHEURER
SAFETY COORDINATOR & FIELD MARSHALL
~
BRET MARTIN
FERNANDO MESA
AMA INTRO PILOT INSTRUCTORS

From the Newsletter Guy:

I was unable to attend the December meeting to photograph activities and did not receive any photo contributions from the membership. The following is a link to a YouTube video showing the Ten Strangest Types of RC airplanes.

https://youtu.be/HJGWuTOOvu8

Below is an article on servos I hope you find informative or even entertaining.

Servos

What are Servos? The word “servo” is derived from the Latin word “servus” or slave. Today we use it as shortened version of the word “servomechanism”. Servo mechanisms are defined by the inclusion of a negative feedback error sensing ability that will correct the action or insure the accuracy of the mechanism's operation. Some examples of servos are the little boxes we use to operate the control surfaces in our model airplanes or the steering in RC vehicles. Cruise controls on our cars are also servos.

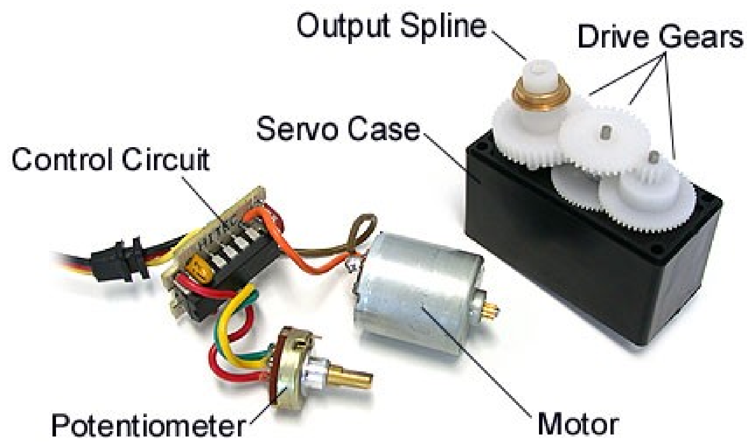
Electronic Speed Controls (ESCs) used in electric RC cars, multi-rotor aircraft, helicopters, and airplanes are a type of servo too. They receive feedback from the coils of the motor to govern the motors speed. The flight controller boards on multi-rotor craft are very complex types of servos. They receive feedback from accelerometers, position sensors and sometimes GPS devices. The volume control on a stereo or the controls of a power window are not servos. Their operation is not automatic. The human operator determines whether these mechanisms are operating in the desired manner or are in the correct position.

The type of servos I'll be talking about in this article are the (mostly) square box mechanical ones that control our RC cars or aircraft. These types come in a variety sizes from nano (very small) to large. Although the type names refer to size, servos for a given size, say micro, generally are within a weight (in grams) range.

Nano – 5g or less
Sub-micro – 5g to 12g
Micro – 12g to 25g
Mini – 25g to 30g
Standard 40g – 60g
Large 70g – 400g

There are also specialty servos that have different shapes for various purposes. Some examples are thin wing, low profile retract, rudder tray, and tail rotor servos. Even though they have different shapes and uses, all of them use the same types of internal components.

The following image shows the components of a dis-assembled servo.



Control arms fit on the spline and are attached to connecting rods going to controls or other things to be moved under remote control. Typically a variety of control arms are included with a servo.

Potentiometer: This part is electrically identical to rotary volume controls found in older stereos. It is simply a long circular resistor with a tap that slides around its surface to provide a voltage that varies in amplitude with the position of the tap. The potentiometer shaft turns to move the tap from one end of the resistor to the other. The shaft is connected to the spline so that the position of the spline and it's connected control horn determines the exact voltage coming out of the potentiometer. The voltage is connected to an input on the control circuit so the control circuit knows the exact position of the control arm.

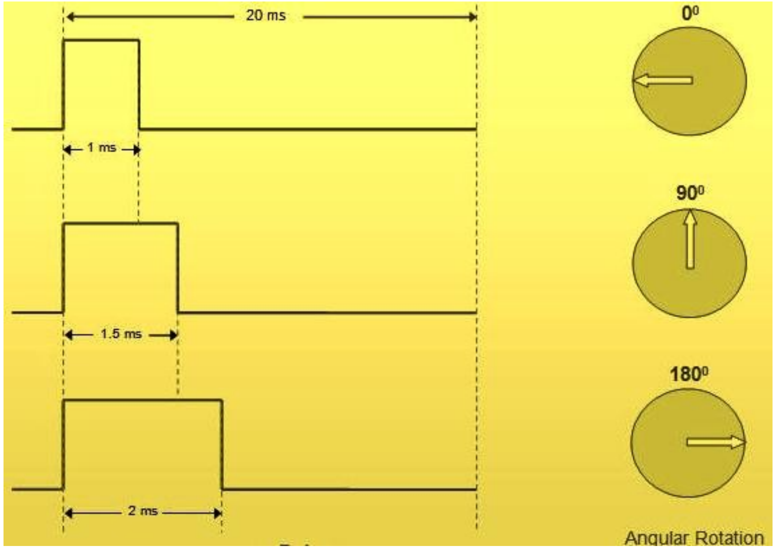
Electric Motor: The shaft is turned by an electric motor via a series of reduction gears (Drive Gears) that allow the motor to have precise control over the position of the shaft-spline-control horn.

Control Circuits: This component takes two inputs, the potentiometer voltage and the control signal from the receiver. If the voltage from the potentiometer and the control signal do not correspond correctly, it will turn the motor, monitoring the voltage from the potentiometer, to ensure that the position of the control arm corresponds precisely with the control signal. If the arm is moved by forces external to the servo the control circuit senses the movement in the potentiometer voltage and controls the motor to resist the movement and maintain the correct position of the control arm.

Control circuits come in two types: **analog** and **digital**. Both types perform the same function with regard to motor control and input sensing. The difference is mainly in performance. In general, digital control circuits respond faster and have more precise control than analog. That means that there is less overshoot (going past the correct position and returning when moving fast) and quicker, more precise operation. You only see the difference between analog and digital in high performance, very aerobatic, or some pattern aircraft.

Control Signal Inputs: The signal from the receiver is a pulse width modulated signal. That means that a pulse is sent to the servo at regular intervals and the width of the pulse signals the position of the servo arm.

The controller circuit decodes the pulse width of the input signal to get a position, compares that position with the current position of the control arm and then drives the motor in the correct direction and with the required power to make the positions match.



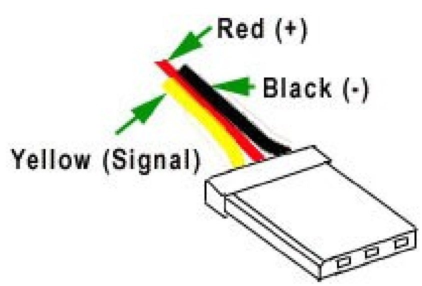
Servo Specifications: Servos can have different specifications for torque and speed. **Torque** is a measure of the turning force on a rotating object. Servo torque is measured in inch-ounces (in-oz). If a servo has an arm one inch in length and can lift or pull 16oz of weight then it is specified as having 16 in-oz of torque.

Servo **speed** is measured seconds-degrees, usually 60 degrees. If a servo can move the arm with no load, 60 degrees in .17 seconds then it's speed is .17 sec/60deg.

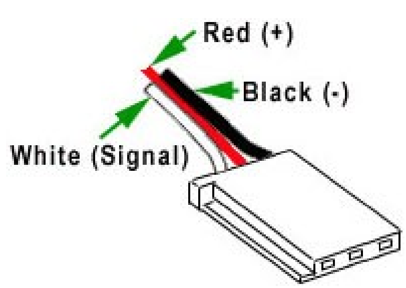
Drive Gears: The reduction gears are made with different materials depending on the application of the servo. The most common material is *nylon*. This material is used in low end servos that have relatively low torque and don't need a lot of strength. Nylon has a tendency to break off gear teeth when subjected to shock or continuous heavy loads. Some stonger servos that get heavy use use *Karbonite* (carbon fiber reinforced?). While this material is stronger than nylon and light weight, it is more brittle and reported to break under shock loads. Another material is commonly known as *polyacetal.* This is a synthetic plastic with excellent characteristics – Light, strong, self-lubricating, and shock resistant. It's also called *Delrin, Polyoxymethylene* (*POM*), and *acetal.* Lastly the strongest material is metal – usually brass but can also be aluminum or titanium. The downside to metal is wear and the slop in the gears, even in new servos.

Servo Connectors: Servo connectors for RC applications come in three different types. The *Hitec "S"* or universal connector can be used with almost all pulse width output receivers. It is also identical to the *Airtronics "Z"* connector. The Futaba J connector has a key in the side to prevent plugging it in reversed. The *JR* connector is the same as *Hitec*. All three connectors have different wiring color codes. The following images show the differences

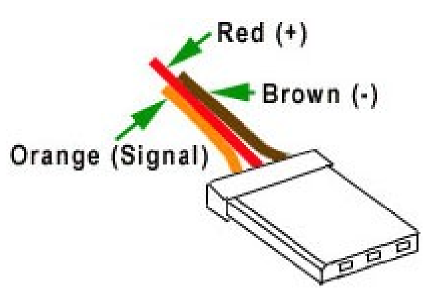
Hitec "S"



Futaba "J"



JR



Splines: Splines are the knurled ends of the potentiometer shaft to which are attached the control arms. It is not recommended that control arms from one manufacturer be used on another manufacturers spline even if it appears to fit. If the teeth don't fit tightly a shock or heavy load will strip the teeth and the arm will slip and fail. Splines vary greatly in the number of teeth, diameter of the shaft and the screw that secures the arm to the shaft even within a single manufacturers product line.

There are lots of other specifications for servos but we've covered the main ones – analog, digital, size, weight, torque, speed, gear material, connectors, and splines.