The Flightline

Volume 41, Issue 2 | Newsletter of the Propstoppers RC Club AMA 1042 | February 2011

President's Message

Well this has been no weather for flying but is a good time to be building. Maybe we should pick a small plane kit as a club project -- a small, but cheap, build up three channel small electric. just to see if we still can build. anyone can put together an ARF. Maybe John Moloko could bring in his small foam plane in to show off the decals. They are very nice and he did a great job on the plane also. This is an outstanding build. What do you all think about a trip to the Helicopter museum on a sat say 12 to 3 we can check out Dave's Work. This would be a club Event. If you have some show + tells please bring them in. Maybe Jeff could bring in his latest helicopter and Mike his smallest.

Remember iindoor flying at Brookhaven rec. center on Feb 19th.

See you at the meeting

Dick Seiwell

Minutes of the Propstoppers Model Airplane Club

The January meeting was cancelled due to snow, so there are no minutes to report.

INSIDE THIS ISSUE

Servos 101

If you fly RC; be it indoor or outdoor, fixed wing or rotary, glider or sport, gas or electric, you will find two things in common on the aircraft: a radio receiver, and servos. While the radio receiver is responsible for delivering the commands from the pilot, the servos are responsible for carrying out the actions commanded by the pilot.

One size does <u>not</u> fit all! When looking at the dizying array of servo sizes, and features available, it helps to know some of the basics.

Due to the wide ranges of applications for servos, there is an overwhelming variety of shapes, sizes, speeds, and prices of servos on the market today. Understanding which servo is the most appropriate for your aircraft is an important part of getting the best performance. Putting a heavy, power-hungry hi-torque servo onto your ultra-light glider makes as little sense as putting a $3 analog servo on the tail of your 700 sized heli – you have to use the right tool for the job.

Despite the wide variety of servos on the RC market, they share a common three wire interface to the receiver.

Agenda for March 8th Meeting At the Middletown Library:

Doors open at 6 pm meeting at 6:30

1. Membership Report
2. Finance Report
3. Show and Tell

Calendar of Events

Club Meetings

Monthly Meetings
Second Tuesday of the month.
Middletown Library
Doors open at 6:00, meeting at 6:30
Next Meeting:

March 8th

Tuesday Breakfast Meeting
Tom Jones Restaurant on Edgemont Avenue in Brookhaven.
9 till 10 am. Just show up.
Flying after at Chester Park 10 am.

Regular Club Flying

At Christian Academy; Electric Only
Monday through Friday 10 am till dusk
Saturday 10 am till dusk
Sunday, after Church; 12 pm till dusk

Indoor Flying

Tinicum School, Friday nights 6:30-9:30
March 4
Brookhaven Boro Gym, Saturday 6 – 10 pm
February 19

Special Club Flying

Saturday mornings 10 am
Thursday evenings in the Summer
Tuesday mornings 10 am weather permitting after breakfast at Chester Park.
Check our Yahoo Group for announcements;
http://groups.yahoo.com/group/propstoppers/

Beginners

Beginners using due caution and respecting club rules may fly GWS Slow Stick or similar models without instructors.

The club also provides the AMA Introductory Pilot Program for beginners without AMA insurance

Propstoppers RC Club of Delaware County, Pennsylvania Club Officers

President Dick Seiwell
(610) 566-2698 reslawns@verizon.net

Vice President Dave Bevan
(610)-566-9152 olddave@icdc.com

Secretary Richard Bartkowski
(610) 566-3950 rbartkowski@comcast.net

Treasurer Pete Oetinger
(610) 627-9564

Membership Chairman Ray Wopatek
(610) 259-4942 raywop@juno.com

Safety Officer Eric Hofberg
(610) 565-0408

Newsletter Editor and webmaster Mike Williams
(302)-475-1249 mike@ddsw.com

Propstoppers Web Site; www.propstoppers.org

Connections

Ground (black or brown wire)

This line provides a reference for the other two lines, and identifies the "0 volt" level. It is connected to the black, or negative, line of the battery.

Power (red or orange wire)

This wire powers the control electronics in the servo, as well as the motor. Traditionally, servos have run at 5-6 Volts. This is starting to change has HV (High Voltage) servos are starting to appear on the market which can run at as much as 7.4 volts. The advantage of the high voltage servos is that they can consume more power, providing increased speed and torque, without increasing the current being carried over the relatively thin servo wire. It also allows you to run your servos directly off of a 2 cell Lipo, eliminating the need for a voltage regulator between your battery and the receiver. Running high voltage servos requires a radio receiver that is capable of handling the higher voltage.

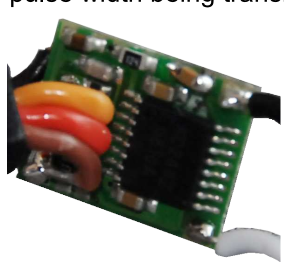
Control (white or orangle wire)

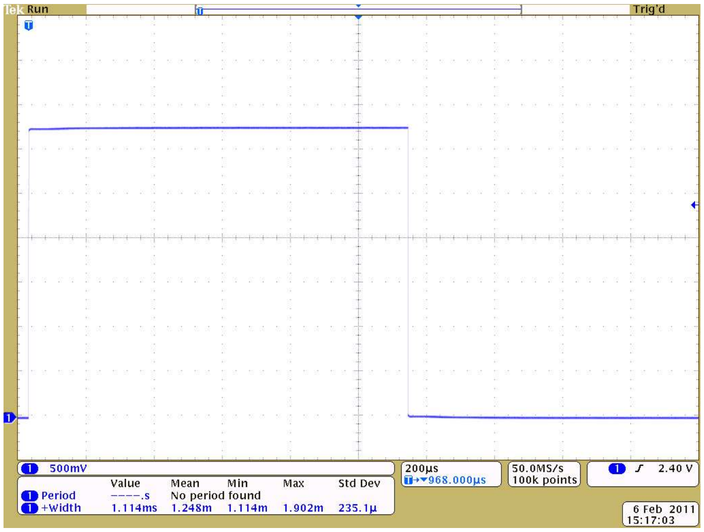
This line carries the signal that tells the servo what position to hold. Receivers communicate with the servo using pulse width modulation where a series of pulses are sent to the servo at regular intervals. The width of the pulse identifies the desired position. Most servos on the market use pulse widths of 1-2 milliseconds, with 1.5 milliseconds being the center position. These pulses are sent to the servo every 22 milliseconds for traditional analog servos, 11 milliseconds for digital servos, or even faster for specialized helicopter tail servos.

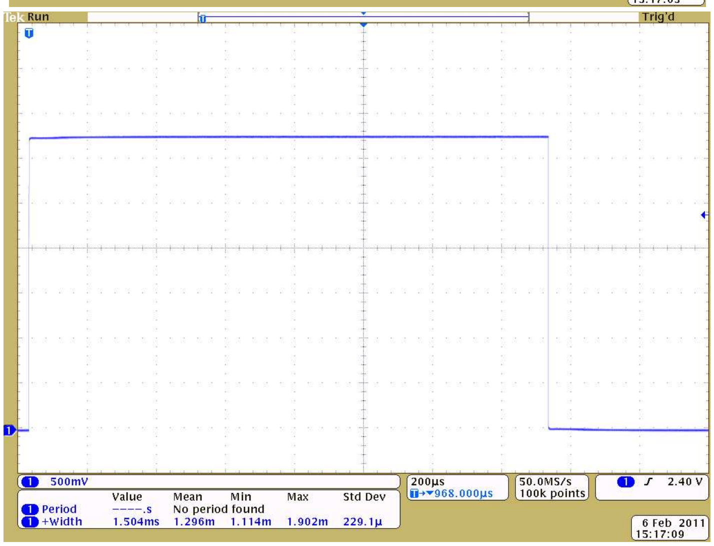
Main Components of a Servo

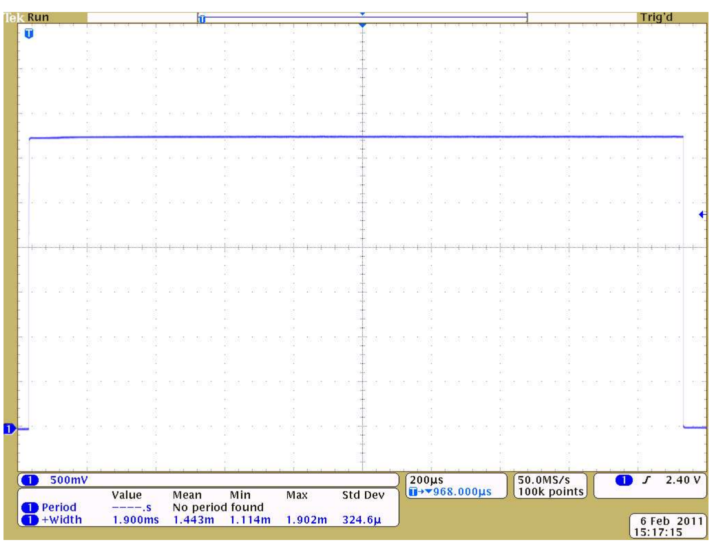
Control Electronics

These are the brains of the servo which interpret the pulse width being transmitted by the receiver, compare it to the position indicated by the position sensor, and command the motor to move to the desired position. The implementation of these electronics will vary depending on whether the servo is analog or digital, the type of position sensor, and the designed purpose of the servo (general purpose, heli tail servo, high torque vs low torque, etc.).









The width of the pulse determines the position of the servo. Here we see the pulse width vary as the radio controls the servo to move from one extreme to another. Note that the center position is at 1.5 ms

Motor

If the drive electronics are the servo's brain, the motor is the muscle. This does the work of moving the servo in one direction or another. Typically this turns at a relatively high RPM and is reduced through the gear train to get increased torque.

Motors fall into three different camps:

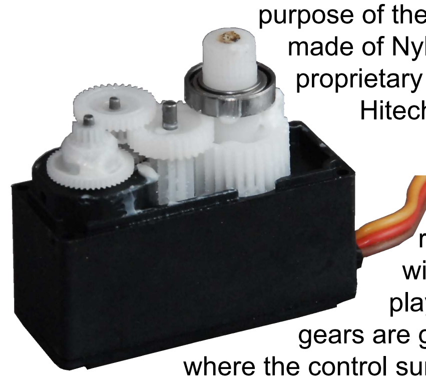
your classic brushed DC motor is in most standard duty servos

Servos that require faster speed have "coreless" brushed motor that works like a traditional brushed motor, but has a lightweight cage instead of the traditional coils of wire wrapped areound a heavy metal core found in the traditional motor DC motor.

The next step up from coreless motors, are brushless motors. These are basically miniaturized versions of the brushless motors that have revolutionzed electric flight for our planes and helis, with many of the same advantages: increased efficiency, speed, torque, and reliability. The downside is that servos with this technology are considerably more expensive than a standard or coreless motor.

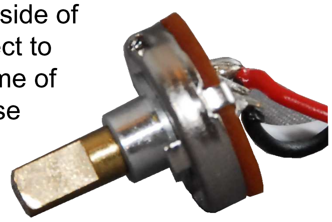
Gears

The gears do the work of translating the rotation of the motor into movement of the servo arm. Depending on the purpose of the servo, they will be made of Nylon, brass, or other, proprietary materials such as Hitech's Karbonite. Nylon gears offer fine control, and tight tolerances resulting in a servo with very little "slop" or play in the gears. Metal gears are good for situations where the control surface connected to the servo will be subjected to high vibrations or other stress. The gears of the servo are often damaged in a crash, and should be carefully inspected before putting the servo back into service. Most reputable servo manufacturers (including Futaba, Hitec, and JR) sell replacement gear sets which can be replaced by the user.



Position Sensor

The position sensor provides feedback to the electronics indicating the position of the servo arm. In the vast majority of the servos on the market, this is a potentiometer ("pot"). The downside of using a pot is that they are subject to mechanical wear over time. Some of the high-end servos will either use an optical encoder (normally used on robots rather than RC servos) or magnetic induction sensors. The magnetic induction sensors are relatively new to the RC market, and time will tell if they offer a significant advantage over pots.



Key Specifications

When choosing servos, the choices available to us can seem overwelming. Consult the manual or plans for your model. They will usually specify the servo requirements, or indicate a specific servo model to use. The basic parameters for a servo are the torque it provides, the speed at which it moves, the physical dimensions, and whether it is an analog or digital servo.

Torque

Measured in ounce inches, or kilogram centimeters, this specifies the force that the servo is capable of applying when moving from one position to another. High torque is important when moving large control surfaces like elevators or long helicopter rotor blades.

Speed

Measured in seconds per 60 degrees, it indicates the time required for an unloaded servo to move 60 degrees. Speed is important when many small adjustments are required in a short period of time. The classic example is a tail servo on a helicopter which is responding the commands from a gyro. They don't require a lot of torque, but they need to be fast. Tail servos with speeds as fast as .06 seconds per 60 degrees are not uncommon.

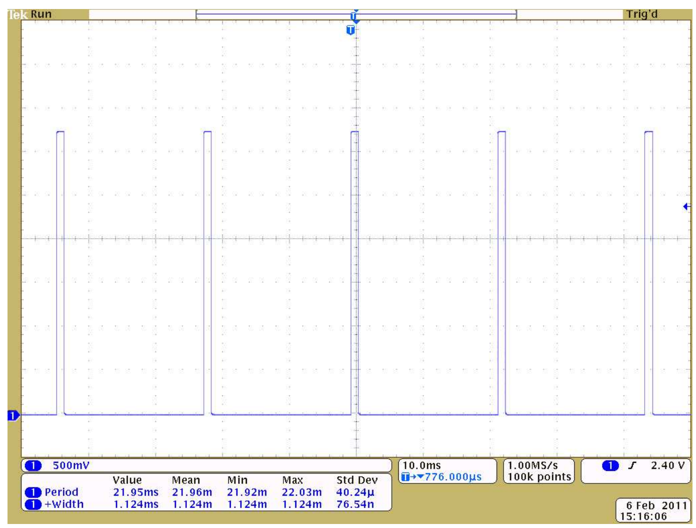
Analog vs. Digital

Analog

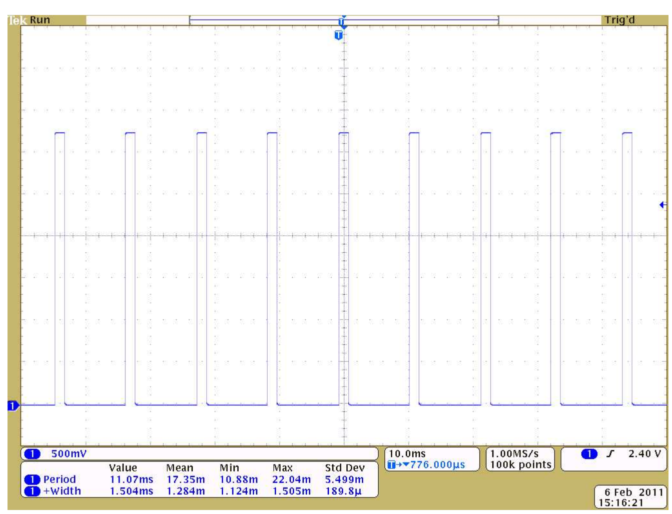
In an analog servo, a pulse is sent to the motor once every 22 milliseconds, or about 50 Hertz. The width of this pulse determines the power sent to the motor, and as a result, the torque applied by the motor.

Digital

While analog servos work well in many applications, one area that they have some shortcoming is when many small movements are desired. Due to the (relatively) long period of time between pulses, and the short pulse width associated with small adjustments, analog servos don't provide a lot of torque when making small adjustments. Some applications, such as helicopters or 3D airplanes require high torque in small increments. This is best handled by digital servos. In a digital servo, the rate at which pulses are sent to the motor is doubled to 100 Hertz. By sending pulses to the motor more often, the torque applied by the motor is greater for small movements. It also allows pulses from the receiver or gyro to be sent at higher rate (every 11 ms instead of 22 ms). Most gyros, and some radios allow you to indicate the rate at which pulses are sent to the servos. IMPORTANT! -- Do not send pulses to an analog servo at a rate above 22 milliseconds. Doing so can damage the motor and/or electronics in the servo. On the other hand, it is perfectly safe to send signals to a digital servo at 22 ms intervals. If you are in doubt as to whether your servo is analog or digital, select the 22 ms or analog setting on the radio or gyro.



The pulses for an analog server occur at 22 ms intervals



The pulses for a digital servo occur at 11 ms intervals

Physical Dimensions

A servo with all the right electrical characteristics, speed and torque is useless unless it fits in your model. Servo manufacturers post the dimensions of each of their servos so that you can insure that it will fit your specific application.

When things go wrong

It would be nice if our servos work 100% of the time. In fact, they are remarkably reliable considering the abuse that we subject them to. However, they do occasionally give us cause for grief. Here are a few of the more common things that can go wrong:

Stripped Gears

Rough landings, bad bumps in the car on the way to the field – it happens to all of us. If the control surface connected to the surface gets too much of a jolt, the result can be stripped gears. Symptoms of stripped gears are servos that bind or have spots where the servo arm can spin freely. Fortunately, most servo manufacturers sell replacement gears, and they are relatively easy to replace.

Frayed/stripped wires

After a while, it is common for the insulation around servo wires to get frayed, exposing the wire beneath. When the signal wire gets shorted against the power or ground line, the servo will move to an extreme position at high speed. This happened to me on a 500 sized helicopter, and the result was an instant crash. When the power and ground lines get shorted, the receiver loses power and you lose control of your model. If the wires are frayed near the connector, it is relatively simple to replace the connector. On the other hand, if the damage is where the wire enters the servo, you are better off sending the servo in to the manufacturer for service.

Loose connectors

A loose connector can end your day rather quickly. Depending on how loose it gets, you can intermittently lose control over your servo, or lose control of your model completely. This is common on models that experience a lot of vibrations, or are subjected to a lot of G forces like a 3D helicopter or aerobatic airplane.

An occasional inspection of your connectors can save you some headache and expense.

There are several techniques that I've seen to prevent this. A line of Shoe Goo or hot-melt glue along the connectors at the receiver can help keep the connector in, but can easily be removed when necessary. Dental floss strung through the wires, and tied behind the receiver is another approach. There are also a number of commercial products available to keep extension connectors together.

Bad Potentiometer

A faulty pot can result in a malfunctioning servo, and a crashed aircraft. The main symptom of a bad pot is that the servo twitches – often around the same position. Unfortunately, it is not something that can be found through visual inspection, and is not a user replaceable part. The best bet is to swap the servo for a unit that is known to be good. If the replacement functions properly, you need to send the servo in for repair.

Burned out electronics

A binding linkage, stuck control surface, driving an analog servo at digital servo speeds, or using a servo that is underpowered for the application can result in a servo with fried control electronics, or a burned out motor. It's easy to tell when you have a burned out servo – it's dead as a doornail. It's not always as easy to tell what caused it to burn out. Make sure that the linkage and control surface move freely, and that the radio or gyro settings are correct prior to replacing the servo to insure you don't burn out the replacement.

For More Information

To get more information about servos, check out the following sources on the web:

http://www.servodatabase.com/ is a listing of servos, and their relevant specifications.

http://www.hitecrcd.com/ Hitec's website

http://www.futaba-rc.com/servos/index.html Futaba's website

http://www.jrradios.com/Products/Servos-Air.aspx JR's website

Mike Williams

Field Trip to the American Helicopter Museum

We are in the process of planning a field trip to the helicopter museum to occur on a Saturday afternoon in March.

Once a date has been determinined, it will be posted on the calendar in Yahoo Groups, as well as on the email list, so keep an eye our for the announcement!

Warm weather isn't too far away. Visions of Brian Williams' electric Raptor and Jef Frazier's T34 remind us of what we have to look forward to.