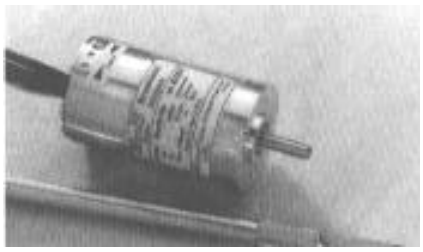
NV 14127-1958 (tel. or fax 1-716-662-5651).



"More Power per Dimension" are the bywords of this company about its new Max15 series of high-performance motors. This gives the modeler great power in a compact, lightweight unit, which features "Plug-n-Play" technology for the serious flier of electric-powered models. These motors have more efficiency than others of equal size, as they don't have the friction and resistive losses associated with brushes and commutators. This gives longer flight time per watt of input power. An aluminum housing for the coil windings provides direct heat dissipation to the outside air for higher peak and continuous power capability. Motor cooling is easily accomplished by airflow over the motor exterior. The Max15 Series uses the best, temperature stable, samarium cobalt magnets currently available. These motors are lubricated with synthetic grease and have double-shielded ball bearings. Since a brushless motor has no mechanical commutator, the motor life is essentially equal to the bearing life, which can approach 50,000 hours in average "sport" service. The user selects the "Fixed Optimum Timing" for the chosen rotation direction. No adjustment is necessary; just set it, and forget it. The Max15 "anti-cog" magnetic design provides a unique combination of low audible noise and minimal mechanical vibration, contributing to long life of the airframe, R/C system, and gearbox. Max15 motors require no maintenance, no break-in, no brush dust to clean up, and no capacitors or diodes to jury-rig in the wiring (meaning higher reliability and ease of use). These motors are American-made and were developed from over 10 years of aerospace and industrial applications of brushless motor technology. Direct only.

ElectroSpeak

by Rob Campbell

USING CURRENT MEASUREMENTS FOR TIMING BRUSH DC MOTORS

from the "**Electric Model Flyer**"

(see previous article for rest of credit)

It took a long time for me to find out how to set the timing on the type of motors we most commonly use to power our electric aircraft. I'm not sure why this is. Maybe I just missed the articles on the subject when they appeared in periodicals. Or maybe I didn't ask the right questions, or the persons I talked to didn't know how or didn't feel it was necessary.

I have read up a bit on DC motors but the actual reason why timing must be advanced with higher armature currents does not jump out at me. I think what is going on here is basically a distortion of the normal stator permanent magnet field by the strong, rotationally oftset, magnetic field being generated by the rotor windings.

When faced with making a reversal in the direction of rotation, I used to find neutral timing and just change the timing so that it was advanced the same amount in the other direction. I suppose this wasn't a bad approach, but there are better ways. If you don't know how to adjust timing or when such adjustments are required, here are some tips.

The best source of information on setting timing, that I am aware of, is Bob Boucher's Electric Motor Handbook.

If you can afford it (*You can't really NOT AFFORD IT! - km*), go to your local hobby shop and BUY THE BOOK. The book contains a lot of good information that I could not possibly pass on here. The method outlined here is not the only method, but it is a universal method of setting electric motor timing for brush motors requiring only a few tools that should keep most of us out of trouble!

The truth is, depending on the circumstances, you may never have a situation where the timing on one of your motors MUST be adjusted. For example, AstroFlight claims their motors are timed at the factory. The most common reason the timing MUST be re-set on a motor is undoubtedly to handle a reversal of rotation - such as is required by installing or removing a standard gear and pinion gearbox. This highlights an advantage of belt and internal-tooth gear drives - it is not necessary to re-time the motor when these are installed or removed because the direction of rotation of the motor does not change.

If you are using an inexpensive can motor it probably does not facilitate brush timing adjustments. You may still be able to adjust the timing with some ingenuity on your part. At the lower currents that these motors operate, timing adjustment is less critical.

To properly time a motor a starting point for the adjustment must be established. This starting point is NEUTRAL TIMING. Adjusting the brush holders so that commutation switching occurs earlier in rotation relative to the permanent magnet field is called

advancing the timing. The opposite, retarding timing, is never desirable. In fact, serious damage to the commutator due to arcing can result in short order when running a motor with retarded timing. Advancing the timing too farwill also cause problems - especially when the motor is run at lower throttle settings.

Fortunately, there is a relatively simple way of setting the timing that should always give good results. The method is contained in Bob Boucher's book and has also appeared in Flying Models courtesy of Larry Sribnick. The following basic steps are required:

1) Determine the expected full-load current for the motor.
2) Establish the current at neutral timing.
3) Calculate the appropriate no-load current.
4) Advance the timing until the no-load current is achieved.

Full-load current is the current draw in Amperes (Amps) with the propeller INSTALLED. No-load current is the current draw AFTER the timing is set with the propeller REMOVED.

Steps 2) and 4) require that you loosen the screws clamping the motor together enough to turn the end bell with the brush holders relative to the field ring (centre section). These steps also require that you have a current meter capable of measuring the anticipated no-load currents. A 10A analog meter is sufficient for most motors. Remember that current changes will be harder to see if you are trying to measure small currents with a higher current meter. For checking the actual full-load current, I recommend using a meter that has a low resistance shunt. Some 50A analogue meters have an internal resistance as low as .001 milliohms which will provide a pretty accurate reading under load. AstroFlight now sells a switchable current/voltage meter with a digital readout that is very convenient for this sort of adjustment.

For these tests, the motor does not need to be run at full voltage, but enough voltage must be used to read a proper no-load current. There is a minimum voltage required to read an accurate no-load current. You should be OK if you hook up the motor to at least one-half of the number of cells the motor is normally used with.

If you don't know where to start, the value of full-load current for step 1) can often be taken from motor data sheets. If you will be using a different propeller than is recommended by the manufacturer, you can guesstimate the current draw. As a guide, sport cobalt motors are designed for good efficiency in the 15 to 30 Amp range. You can always measure the actual static current draw at full throttle after timing the motor and if you were significantly off on your current estimate, another iteration can be made.

Ideally, your anticipated current draw is not too far from the current at best efficiency. I prefer to adjust the timing based on the anticipated current draw in flight which is about 0.8X the static current draw if the correct propeller has been selected.

The current at neutral timing, Step 2), is the minimum current that can be obtained while rotating the end bell with the brushes relative to the field ring. You'll know you have found neutral timing if turning the end-bell either way increases the current. Again, your motor may have been supplied with a data sheet that has this information.

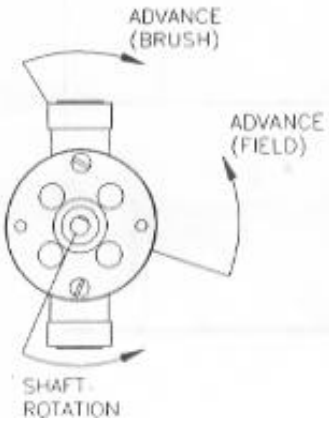
Step 3) is a simple calculation. The no-load current is the current at neutral timing plus one tenth of the full-load current. This is referred to in Bob Boucher's book as the "Divide by Ten Method". For example, an Astro Cobalt-05 with a current at neutral timing of 2.5 Amps that is expected to have a full-load current of 22 Amps works out as follows:

No Load Current = 2.5 + 22/10 Amps

It is simplest just to move the decimal point for the full-load current over one space to the left:

No Load Current = 2.5 + 2.2 = 4.7 Amps

The only hurdles left are to advance the timing until this calculated current is reached with the motor unloaded and then tighten the screws holding the motor together. To advance the timing, turn the end-bell with the brush holders in the direction **OPPOSITE** to the direction of rotation. (It helps to think of it this way - by turning the end-bell opposite to the direction of rotation, you are, in fact, causing commutator switching to occur sooner relative to the field - hence the term advance). Relative to the end-bell, the field ring is being turned in the direction of rotation. The screws securing the motor endbell are very fine on Astro motors - **DO**



Standard Direct Drive (Counterclockwise) Timing Adjustment - Astro 05

(continued on last page)

Motor Timing - cont. from p. 9

NOT OVERTIGHTEN! Advancing the timing will always increase the motor RPM so this provides an additional check.

All of the motor runs should be kept short, as the motor will get quite warm quickly. Happy Motoring.

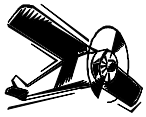
9th Annual D.E.A.F Electric Fly
Sept. 30 & Oct. 1
Dallas R/C Club Field
Contact: Frank Korman (214) 327-8411
Great Contest - Get the Details

August OOPS:

Several of you asked where to get the inexpensive motor, talked about in the Aug. 1995 issue. Please write to Mike Patzig, 4620 Freeman, The Colony, TX 75056 or call him at (214) 625-5935. I apologize for what the post office managed to do to many August issues!!!

1995 Calendar

Aug 26 & 27 Weak Signals QM 40 Silver Cup - Rick Cromer (419) 537-6776
Sep 2 & 3 Midwest R/C IMAA Big Bird Fly-in - Ed Douville (810) 348-2327
Sep 9 & 10 Milan Flyers "Wolverine Classic" Pattern contest - Tom Mitchell (313) 426-3009
Sep 9 & 10 Kitchener, Ont., scale
Sep 10 Michigan Whirlybirds heli contest - Roy Dietz (313) 839-4143
Sep 10 Mag Cat race - Signal Seekers - Barney Polzin (313) 728-3029
Sep 10 Greater Detroit Soaring and Hikeing Sailplane contest - Dave Coven (810) 656-1879
Sep 16 Weak Signals Animal 500 - Jim Warner (419) 856-8783
Sep 17 QM 40 Weak Signals - Karen Yeager (517) 547-4430
Sep 16 & 17 Skymasters float fly - Island Lake - Jerry Schoenbeck (810) 739-1398
Sep 17 Southern R/C cross country Power race - Joe Gibson (519) 326-8569
Sep 24 Flying Tigers IMAC Fall Aerobatics - Dana Test Track - John Borton (419) 241-3865
Sep 23 & 24 Flying Pilgrims IMAA meet - Rich Vukmirovich



The Ampeer
Ken Myers
1911 Bradshaw Ct.
Walled Lake, MI 48390

Next Meeting, Sept. 7, ASAP,