

INSTRUCTION MANUAL

Thank you for purchasing eMULTIGOV from Aerospire LLC. eMULTIGOV maximizes your electric RC helicopter's 3D performance by giving you more power when you need it while keeping the rotor speed constant at other times. eMULTIGOV achieves this by monitoring the helicopter rotor speed and automatically adjusting the input to your motor's electronic speed controller (ESC).

eMULTIGOV has been tested to work with and enhance Align's stock T-Rex 600 helicopter, 600X/XL motor, and Align's BL ESC. If you can install the RPM sensor correctly, eMULTIGOV should work with other electric helicopters and ESCs.



Please read all instructions carefully. Radio-controlled helicopters are not toys. Improper installation or misuse can result in serious injury, physical damage, and/or death. Since Aerospire LLC has no control over the installation or use of this product, no liability may be assumed, nor will liability be accepted for any damage resulting from the use of this product. Under no circumstances shall the buyer be entitled to consequential or incidental damages. By the act of installing this product, the user accepts all resulting liability.

FEATURES

- Push 3D performance to the limits by giving you more power when you need it while keeping the rotor speed constant at other times
- Get consistent flight feel from start to finish; unlike some ESC governors, RPM does not drop as battery voltage drops (as long as battery can provide enough power)
- Replaces and can produce better 3D performance compared with ESC governors. Gives you dynamic governing with low-cost, high current airplane ESCs
- Easy installation and upgrade to stock T-Rex 600
- Eliminates guesswork in setting up target RPM; unlike ESC governors, no optical tachometer/tweaking needed
- Maximum RPM reached during flight viewable after flight
- Fast, dedicated microprocessor controls actual rotor speed – not just motor speed which may differ from rotor speed due to one-way bearings
- Three individual remotely selectable speed and low throttle point settings
- Detachable backlit LCD makes setup fast and easy
- Only one LCD configuration module is needed for any number of eMULTIGOV or MULTIGOV (nitro governor) units
- Built-in adjustable slow startup and throttle failsafe
- Small and light board adds almost no weight to model
- Works with Futaba, JR, and Spektrum receivers
- Software can be upgraded for future enhancements. eMULTIGOV can be sent to Aerospire and converted to nitro helicopter MULTIGOV without any hardware changes
- Designed and developed in the USA

PACKAGE CONTENTS

1	eMULTIGOV RC dynamic electric helicopter governor
1	Detachable LCD configuration module (if purchased)
1	RPM sensor + bracket to bend sensor
2	Servo wire extensions
2	Sensor magnets
1	Double sided tape
1	Jumper for disabling RPM Select function

PRE-INSTALLATION NOTES

- **BEFORE INSTALLING eMULTIGOV, MAKE SURE YOUR HELICOPTER HAS BEEN SUCCESSFULLY TEST FLOWN.**
- The RPM sensor included with eMULTIGOV is made to only work with eMULTIGOV. **DO NOT CONNECT OTHER DEVICES TO THE RPM SENSOR (i.e. dataloggers). CONNECTING OTHER DEVICES TO THE RPM SENSOR WILL RESULT IN PERMANENT DAMAGE AND VOIDS YOUR WARRANTY.**
- Additional electronics increase the rate at which your receiver battery is drained. Use the highest capacity battery that is reasonable for your model. **ALWAYS PERFORM A RECEIVER BATTERY CHECK BEFORE EACH FLIGHT.**
- **BEFORE POWERING eMULTIGOV FOR THE FIRST TIME AFTER INSTALLATION, PLEASE REMOVE YOUR ROTOR BLADES AND PERFORM A PROPER RANGE CHECK.**
- Using eMULTIGOV changes the power consumption rate of your batteries. **SET YOUR FLIGHT TIMER INITIALLY SHORTER TO DETERMINE WHAT YOUR NEW FLIGHT TIME SHOULD BE.**

*** REQUIRED SETTINGS FOR SPEED CONTROLLER ***

eMULTIGOV is meant to work with brushless motor speed controllers which can operate in basic airplane mode. It replaces any existing governor mode function built into a speed controller. **Before installing eMULTIGOV, you must program your speed controller with the following settings:**

- **SPEED CONTROLLER SET TO AIRPLANE MODE**
- **BRAKE DISABLED**
- **GOVERNOR MODE DISABLED IF AVAILABLE**



FAILURE TO PROGRAM YOUR SPEED CONTROLLER PROPERLY MAY CAUSE INCORRECT OPERATION OR DAMAGE. IF YOU DO NOT KNOW HOW TO PROGRAM YOUR SPEED CONTROLLER, DO NOT USE THIS PRODUCT!

Setup for Align T-Rex 600 BL ESC

1. Adjust your radio's throttle channel travel endpoints (ATV) to 100% at low throttle and maxed out at full throttle (140% for Futaba radios or 150% for JR/Spektrum).
2. After adjusting your radio's throttle channel endpoints (ATV), program your ESC according to the following table:

Brake	BRAKE DISABLED
Electronic Timing	MID-TIMING
Battery Protection	MIDDLE VOLTAGE PROTECTION
Aircraft	NORMAL AIRPLANE/GLIDER
Throttle Response Speed	QUICK SPEED

3. Install and program eMULTIGOV.

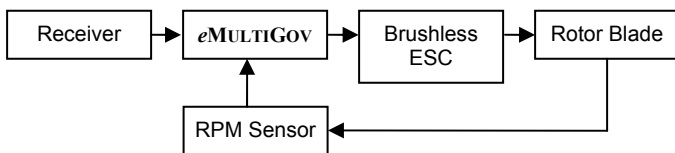
NOTE: If the motor startup speed is too fast with the "NORMAL AIRPLANE/GLIDER" mode, you can try changing to "HELICOPTER (SOFT START)" mode at your own risk. We have had some Align ESC's start smoking with this mode but we were never able to determine the cause. Align ESC's initially had the reputation of overheating even without our product (they might have fixed the problem by now). If it works with the soft start mode initially, it should continue to work.

Example setup for Castle Creations ESC

The following options should be set:

Brake Type	BRAKE DISABLED
Throttle Type	FIXED THROTTLE

INSTALLATION DIAGRAM



As shown the drawing above, eMULTIGOV is installed between your receiver and the electronic speed controller (ESC). It monitors the rotor blade RPM and operates the speed controller as needed.

INSTALLING RPM SENSOR

The RPM sensor needs to be mounted so it can accurately measure rotor blade speed. The sensor reads RPM through a magnet which is typically attached to the helicopter's tail drive gear. The tail drive gear provides an accurate RPM reading since it spins with the blades without any one-way bearing in-between.

- The instructions and pictures below are for a T-Rex 600 electric helicopter. If you are installing on a different helicopter, you will need to make appropriate mounting changes to achieve similar results.
- Only 1 magnet is needed for the sensor. No additional magnet for counterbalancing is needed. An extra magnet is included with eMULTIGOV as a spare part.

Bending the RPM sensor

1. The RPM sensor needs to be bent to face a magnet which is glued onto the tail drive gear. Place the sensor chip approximately 4 mm above the green bracket with the writing on the chip facing away from the bracket. Bend the sensor 90 degrees as shown in figure 2.



Figure 1. Use green bracket to bend sensor 90 degrees



Figure 2. Bent sensor – writing on chip faces up (is on top)

Mounting magnet on tail drive gear

The RPM sensor activates when a magnet is passed over it. The sensor chip is polarity sensitive and will only work when the magnet is mounted in the right direction. You will be determining the correct magnet direction to use and mounting it onto the tail drive gear in this step.

1. Plug the RPM sensor connector onto the eMULTIGOV connector labeled "Sensor" with the ORANGE wire toward the "HEART" light.
2. Connect the eMULTIGOV LCD configuration module.
3. Using the included servo wire extension, connect receiver throttle channel to "RX Throttle". ORANGE wire goes toward the "HEART" light.
4. Turn on your receiver, enter the eMULTIGOV configuration and go to the "Sensor" function.
5. Get an included magnet and move it over the top of the RPM sensor approximately 1-2 mm away, the "Sensor" value should be close-to or at 100 if the magnet is oriented correctly. If this is not the case, flip the magnet over for opposite polarity and/or double check all your connections. **Once you have determined the side of the magnet that should face the sensor, mark it with a pen.**
6. Turn your helicopter upside down and place drops of CA (superglue) onto the tail drive gear. Place the magnet onto the tail drive gear to securely mount it as shown below:

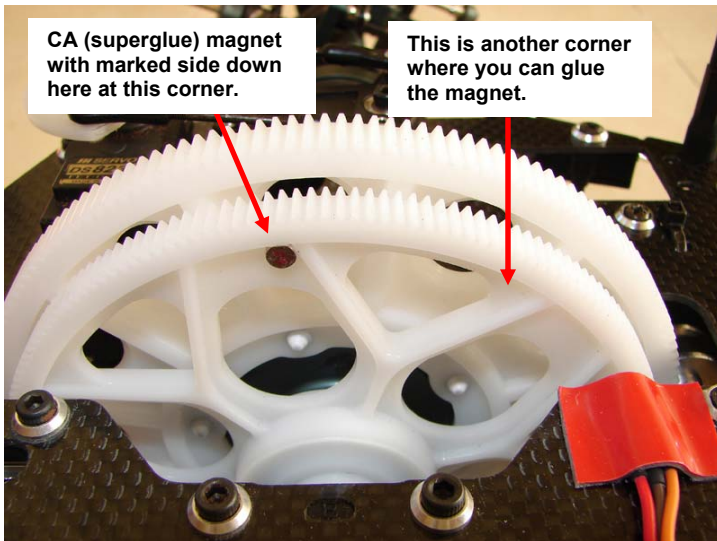


Figure 3. Magnet glued onto tail drive gear

7. After you have glued the magnet, you can add another drop or two of CA on top of the magnet and corners for added strength.

Mounting RPM sensor onto helicopter frame

1. Cut a small piece of included double sided tape and stick sensor approximately 2 mm away from magnet as shown in picture. Make sure the magnet passes over the top of the sensor chip as you turn the rotor head.

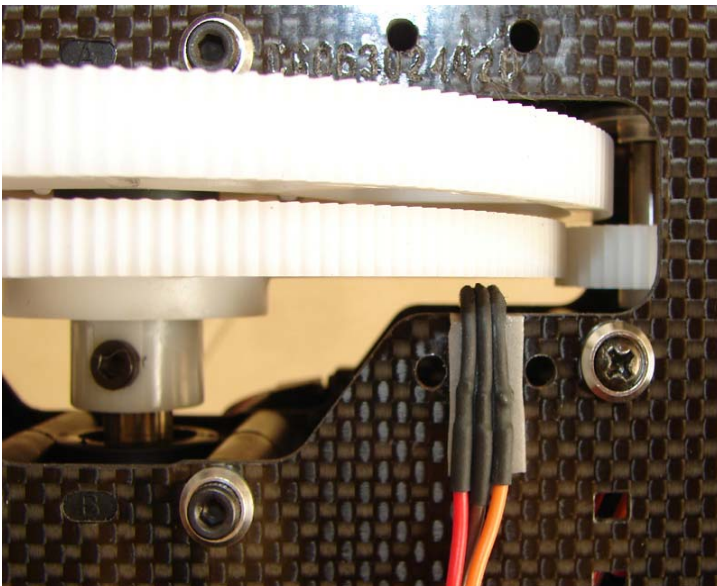


Figure 4. Sensor held with small piece of double sided tape beneath it

2. As you turn the rotor head, make sure the RPM sensor reads the magnet correctly (close-to or at 100) using the LCD configuration's "Sensor" function. Adjust the sensor so it is as close as possible to the magnet without hitting the drive gear in flight.
3. To finish, cut a larger piece of double sided tape and stick over sensor as shown below (figure 5):

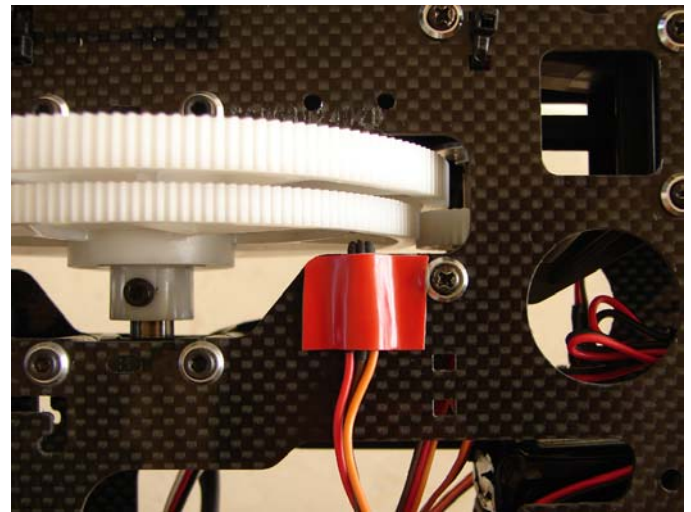


Figure 5. Completed mounting of sensor with double-sided tape

CONNECTING eMULTIGOV TO RECEIVER AND SENSOR

1. Connect the RPM sensor connector to the "Sensor" input. Make sure the orange wire is toward the "HEART" light.
2. Connect your ESC's throttle input wire to the "Servo" input. Make sure the orange (JR)/white (Futaba) wire is toward the "HEART" light.
3. Using the included servo wire extension, connect your receiver's throttle channel output to the "RX Throttle" input. Make sure the orange wire is toward the "HEART" light.
4. **If you want to use the RPM select function to have three different speeds, a free channel on your receiver is required.** Using the included servo wire extension, connect your receiver's output to the "RPM Select" input. Make sure the orange wire is toward the "HEART" light.
5. **If you do not use the RPM select function, you must connect the included jumper on the "RPM Select" input. The jumper forces eMULTIGOV to only use one speed setting. See figure 7.**
6. Securely mount eMULTIGOV on your model using the attached double sided foam tape or Velcro. Place eMULTIGOV away from the motor and speed controller to minimize noise.

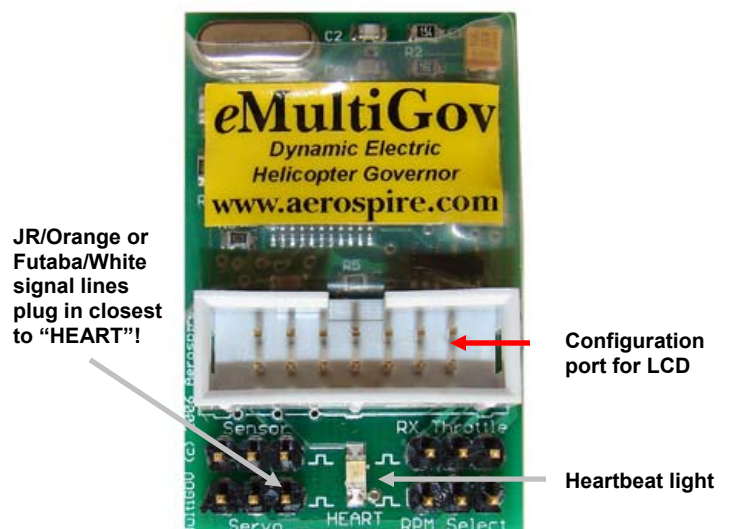
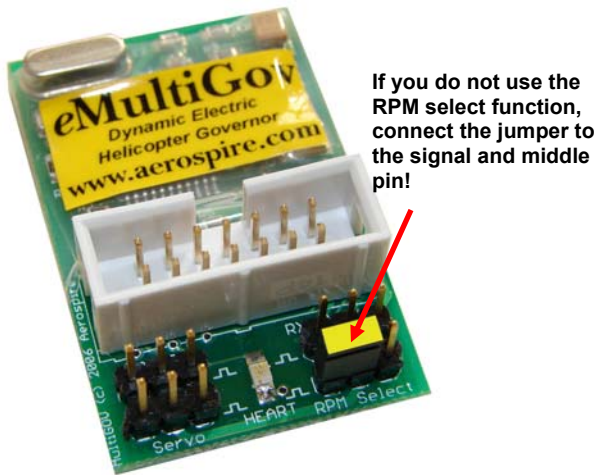


Figure 6. Connecting eMULTIGOV



If you do not use the RPM select function, connect the jumper to the signal and middle pin!

Figure 7. Connecting the jumper to the “RPM Select” input

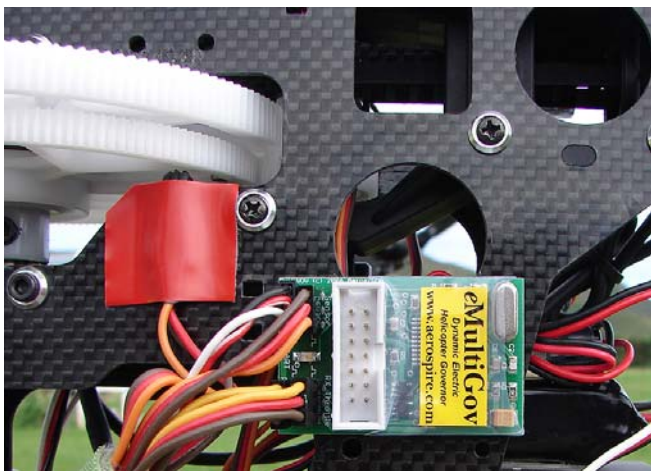


Figure 8. Example mounting locations on T-Rex 600

When eMULTIGOV is not active, your radio's throttle output is passed onto the motor ESC. At any time, if no throttle signal is detected from the receiver within approximately 4 seconds, eMULTIGOV will enter failsafe mode. In failsafe mode, the programmed throttle stop point will be sent to the ESC.

The following are the recommended initial throttle curves that you should set on your helicopter radio. Make sure your full throttle channel travel endpoint (ATV) is maxed out (i.e. high ATV set to 140% for Futaba radios or 150% for JR/Spektrum).

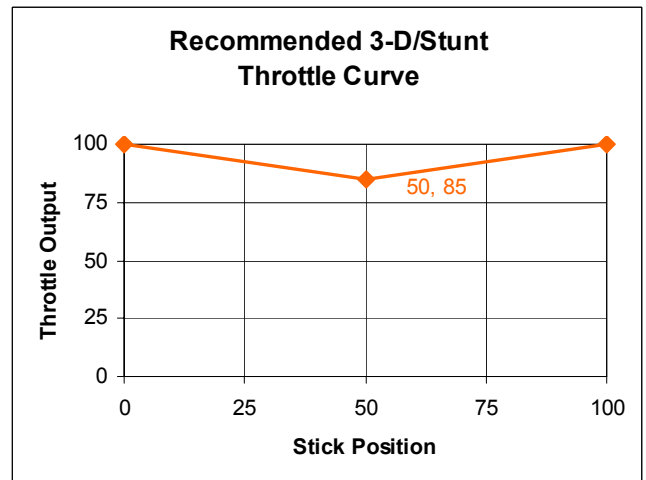
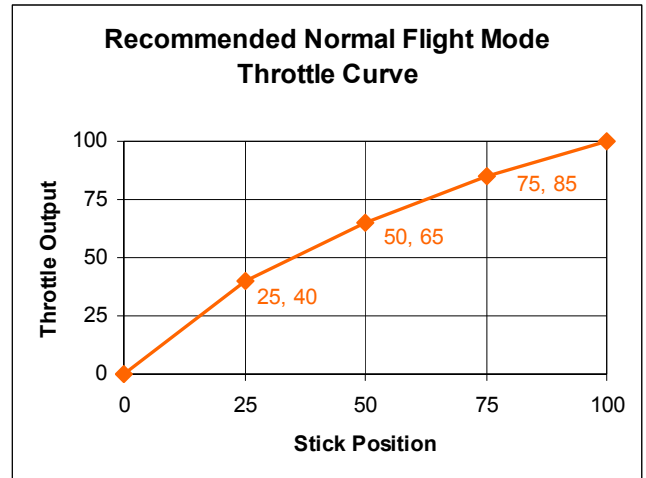


Figure 9. Recommended initial throttle curves

Configuring the RPM select channel

There are three independent speeds that are available when using the RPM select feature. The speed that is currently activated is determined by the receiver output going to the “RPM Select” input.

Speeds 1, 2, and 3 correspond to low stick, half stick, and full stick respectively. This may be opposite depending on your JR/Futaba radio type and the servo reversing function. Please program your flight mode switch to output these three positions on the RPM select channel. This way, you can automatically have three different speeds depending on your flight mode.

To test the RPM select functionality, go to the “Speed” configuration function. As you flip your flight mode switch, you should see the speed setting change. Also verify that no other switch or stick movement changes the speed.

RADIO THROTTLE CURVE CONFIGURATION

eMULTIGOV activates dynamic governing when 1) the throttle channel input is 20% above the set motor stop point and 2) the rotor speed is over 70% of the target speed.

ACCESSING THE CONFIGURATION OPTIONS

After you have installed *eMULTIGOV*, you must configure it before flying. Enter the configuration options and set/verify each function as shown in the configuration chart.

Entering configuration

1. Turn off your model.
2. Plug the LCD configuration cable into *eMULTIGOV*.
3. Turn on your model.
4. Press "NEXT-MENU" for **3 seconds** to enter configuration.

"NEXT-MENU" or "PREV-MENU"
 "NEXT-MENU" and "-VALUE" Enter configuration
 Reset *eMULTIGOV*
 settings to factory
 defaults

"or" = press either button for 3 seconds

"and" = press both buttons at the same time for 3 seconds



Figure 10. Configuration module

CONFIGURATION OPTIONS

Throttle output is always disabled during configuration. Please set the options highlighted in **bold**. As a safety measure, the throttle output will not work until you have done the "**Set Stop, Set High**" procedure.

OPTION	FUNCTION	RANGE	DEFAULT	NOTES
Spd1, Spd2, Spd3	Sets the target rotor speed for the three available settings. To disable governing, set the speed to "OFF" by going below 500 RPM. The lowest governed throttle point is also displayed for each speed.	<ul style="list-style-type: none"> • OFF is below 500 RPM • Top rotor speed is 5000 RPM 	1850, 2050, and 2150	Adjust target speed value by pressing "+VALUE" and "-VALUE"
LowThrotPcnt1, LowThrotPcnt2, LowThrotPcnt3	Sets the lowest governed throttle point for each speed setting. When governing, the ESC throttle will not go below this point. A lower value will control overspeeding better, but too low may reduce 3D performance. With too high a value, you may be higher than the target rotor speed.	5-90 percent	55, 75, and 75	This is % above the motor stop point. Percentage is based on the stop to high throttle range. NOTE: Some speed controllers do not like running at low throttle points. Always check the speed controller temperature after making changes.
Sensor	Tests whether the sensor is working and is close enough to the magnet.	0 to 100	--	Reading must be close-to or at 100 when magnet is over the sensor. Must be 0 when not over sensor.
Set Stop, Set High	Sets the motor stop and high points of the throttle output. When setting, be sure your throttle curve goes from 0 to 100 and that you are not in stunt/3-D flight mode! Also make sure your ESC is programmed properly to match the ATV (travel endpoints) of your throttle channel.	The number represents the throttle channel's pulse width. Should move as you move the throttle stick. The number may decrease or increase depending on your radio settings; either is ok as long as it is consistent.	--	Press "+VALUE" to set each point. Press the button only momentarily to set each point; holding the button down too long will cause a "Bad Endpoints" error. If you change your radio's throttle channel endpoints or the radio itself, you must set this function again!
Gov. Test	Bench-test the throttle stick where the governor would be enabled in flight. Move throttle stick through its range.	<ul style="list-style-type: none"> • OFF where governor would be disabled • ON where governor would be enabled 	--	If you are using multiple speeds tied to your flight mode switch, verify correct operation by doing this test with each flight mode.
Startup Speed	Sets the rotor startup speed when transitioning from governor being disabled to active.	1-50	20	Lower values will increase the startup time (a slower startup). Higher values will make the governor try to reach the target speed faster when it becomes active (faster startup). Startup period expires approximately 5 seconds after being active.

- For T-Rex 600 with 600L/XL motor, BL ESC, stock 170 tooth main gear, 10 tooth pinion: a good 3D target RPM is 2050
- For T-Rex 600 with 600L/XL motor, BL ESC, stock 170 tooth main gear, 11 tooth pinion: a good 3D target RPM is 2150-2300

HEARTBEAT STATUS LIGHT

The "HEART" light indicates *eMULTIGov*'s operational status.

With motor battery power OFF

No blinking	Error ; check the receiver battery and connections. DO NOT PLUG IN MOTOR BATTERY.
Slow blinking (2 sec. apart)	Status OK.
Fast blinking	Error. Configuration needed (throttle output is disabled). DO NOT PLUG IN MOTOR BATTERY.

With motor battery power ON and rotor stopped

No blinking	Error ; check the receiver battery and connections. UNPLUG MOTOR BATTERY IMMEDIATELY.
Slow blinking (2 sec. apart)	Status OK.
Fast blinking	Error. Check configuration and connections. UNPLUG MOTOR BATTERY IMMEDIATELY.

With motor battery power ON and rotor spinning

No blinking	Error ; check the receiver battery and connections. STOP MOTOR AND UNPLUG MOTOR BATTERY IMMEDIATELY.
Slow blinking (2 sec. apart)	Error. Sensor is not capturing rotor RPM; check sensor mounting/magnet.
Fast blinking	Status OK. RPM samples being captured.

PRE-FLIGHT CHECKS

Before attempting to fly your model, please perform the following checks in addition to your normal procedure:

1. Verify your receiver battery is sufficiently charged.
2. Make sure the LCD configuration is not connected.
3. Make sure your speed controller has been programmed according to *eMULTIGov*'s required settings.
4. Verify that sensor and magnet are securely mounted.
5. **Make sure radio's throttle stick is at full stop before plugging in motor battery!**
6. Verify the heartbeat light is slowly blinking before you start the motor.

ADJUSTING "DYNAMIC" POWER VIA THROTTLE CURVE

A great advantage of using *eMULTIGov* is the capability to give you instant additional power during blade pitch changes.

eMULTIGov does this by rapidly calculating changes in your radio's throttle curve and applying some of that change to your ESC. The larger the throttle curve change, the larger the corresponding output to the ESC. Visually, the amount of instant additional power applied to the ESC is reflected by the throttle curve slope.

The recommended default 3D/stunt throttle curve is 100-85-100 as shown in figure 6. If you want to adjust the amount of additional power applied to your motor as you pump your blade pitch, move the 50% point value up or down. Moving the 50% point up (i.e. 100-95-100) will decrease the slope of the throttle curve so there will be less amount of additional power applied as your pitch changes. Moving the 50% point down (i.e. 100-75-100) increases the throttle curve slope so more additional power is applied as pitch changes.

Note that this instant "dynamic" additional power can be positive or negative. This means that as you decrease blade pitch, *eMULTIGov* tells your ESC to reduce power ("negative"). If you increase blade pitch, your ESC is told to increase power ("positive").

To experiment with this dynamic power feature, simply adjust the throttle curve on your radio before flying on a fully charged battery. Making adjustments in-between a flight is not an ideal test since electric battery power decreases with flight time. Generally, the more additional power you set *eMULTIGov* to output, the model may feel stronger but too much will lead to overspeeding on increasing pitch and possible underspeeding during decreasing pitch.

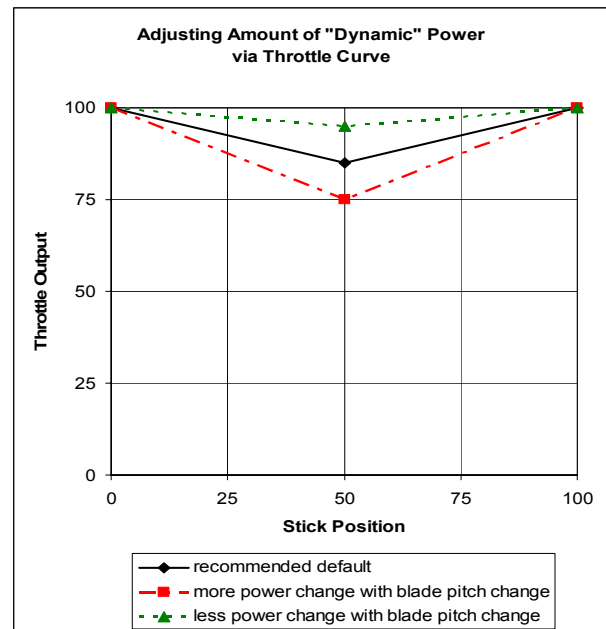


Figure 11. How "dynamic" power changes with various throttle curves

MAXIMUM RPM DURING FLIGHT FEATURE

eMULTIGov stores the maximum rotor RPM since power on. This is helpful to verify that you are reaching your target RPM during hover. To view this value after landing, do the following:

1. After your flight, unplug motor battery but do not power off receiver.
2. Plug in the detachable LCD to *eMULTIGov*.
3. Press the "+VALUE" button on the LCD.
4. The display will show "Max. RPM" with maximum RPM reached.
5. Turn off your receiver when done.



Figure 12. You can view maximum RPM recorded since power on

SPECIFICATIONS

Battery input voltage:	4.2 – 11 volts DC
Radio receiver compatibility:	Futaba, JR/Spektrum, and compatible
Receiver input pulse width:	0.8 ms to 2.2 ms
Current consumption:	Approximately 26 mA
Dimensions	1.75 by 1.125 inches
Weight	0.30 oz

FAQs AND TROUBLESHOOTING

Please visit our web site at www.aerospire.com for the latest frequently asked questions and troubleshooting issues.

90-DAY LIMITED WARRANTY

Aerospire offers a 90-day limited warranty from the date of purchase against defects in materials and workmanship. During the warranty period, Aerospire will repair or replace the defective unit. This warranty does not cover damages due to improper installation, misuse, modification, crashes, or negligence.

When returning an *eMULTIGOV* unit for warranty repair or replacement, please include the following information:

1. Your name, address, phone number, and email address.
2. A detailed description of the problem, including your RC helicopter model, radio control system, receiver, and throttle servo if applicable.
3. A copy of your dated sales receipt (if not purchased direct from Aerospire).

Send your *eMULTIGOV* unit to:

Aerospire LLC
Attn: Warranty Service
PO Box 25925
Honolulu, HI 96825
USA

Note: Aerospire is not liable for lost or damaged shipments.

Web: www.aerospire.com
Email: support@aerospire.com

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