

Aerospire

MULTIGOV PRO

WORLD-CLASS 3D GOVERNOR
PLUS AUTOMATIC MIXTURE CONTROL

Thank you for purchasing **MULTIGOV PRO** from Aerospire. **MULTIGOV PRO** keeps your RC helicopter rotor speed constant by monitoring the helicopter motor speed and automatically adjusting your model's throttle servo. In addition, **MULTIGOV PRO** has built-in support for automatic control of a mixture servo by monitoring the motor's cylinder head temperature. Mixture control is not required for governor operation.



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

- Maximizes your RC helicopter's power and response by providing a constant rotor speed
- Switch between standard or 3D flight modes on the fly
- Optionally set the 3D mode to act as a RPM limiter
- No optical tachometer/calculations/ATV needed for setup
- Three individual remotely selectable speed settings that cover a wide range of rotor speeds and gear ratios
- Intelligent algorithm provides excellent hovering and hardcore 3-D performance
- Built-in support for automatic mixture control (requires temperature sensor and mixture servo hardware)
- Detachable LCD configuration module makes setup fast and easy
- Only one LCD configuration module is needed for any number of **MULTIGOV PRO** units
- Advanced configuration options allow fine-tuning of performance
- Supports adjustable slow startup
- Works with Futaba, JR, Spektrum, and compatible receivers
- Software can be upgraded for future enhancements
- Designed and developed in the USA

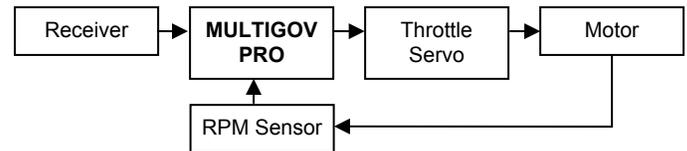
PACKAGE CONTENTS

- | | |
|---|--|
| 1 | MULTIGOV PRO unit |
| 1 | Detachable LCD configuration module (if purchased) |
| 2 | Servo wire extensions |
| 1 | RPM sensor |
| 3 | RPM sensor mounting brackets |
| 2 | RPM sensor magnets |
| 1 | Adhesive heat shrink tubing |
| 1 | Cable tie |

PRE-INSTALLATION REQUIREMENTS

- A throttle servo with at least a .21 sec/60 degrees speed is recommended. Digital servos in the .10 sec-.16 sec are excellent choices. A faster servo gives better performance.
- Any governor's performance will work only as well as your motor's response. It is highly recommended that you fly your model with the governor disabled and make motor needle adjustments for good flying response first.
- Digital servos and additional electronics increase the rate at which your receiver battery is drained. Use the highest capacity receiver battery that is reasonable for your model. **ALWAYS PERFORM A BATTERY CHECK BEFORE EACH FLIGHT.**

INSTALLATION DIAGRAM



As shown the drawing above, **MULTIGOV PRO** is installed between your receiver and the throttle servo. It monitors your motor's RPM and controls the throttle servo as needed.

MULTIGOV PRO CONNECTIONS

There are two connectors on the **MULTIGOV PRO** unit. The white connector is for the detachable LCD module. Below the white connector are pins for the main unit.

All wires plug in ***vertically***. Each column of pins has a label on the board describing its function. Signal wires (JR orange/Futaba white) go into the top pin as labeled by the letter "S" on the case. The positive and negative wires go in below that as labeled by "+" and "-". **Please double check your connections before applying power!**

MULTIGOV PRO CONNECTION TABLE

Name	Used for	Description
Thr	Governor	Connect to receiver throttle channel
Rpm	Governor	RPM select input (optional)
Sen	Governor	Connect to RPM sensor
Sv1	Governor	Connect to throttle servo
Aux	--	Extra power connector (optional)
Sv2	Mixture	Connect to mixture servo (optional)
Tmp	Mixture	Connect to temperature sensor (optional)

BUILDING, TESTING, AND INSTALLING RPM SENSOR

The RPM sensor needs to be constructed so that it can accurately monitor motor speed. The sensor reads RPM through a magnet which is mounted on the motor fan.

- Before you build the sensor, please study the picture of the completed sensor on the bracket.
- The bending direction of the sensor and its mounting on the sensor bracket may differ from our pictures depending on your situation.
- Only 1 magnet is needed for the sensor. If you decide to attach two magnets on the fan for optional balancing, make sure the second magnet is at 0 for the "Sensor" test.
- If you have a Trex 600 Nitro helicopter, please go to our web site for instructions to mount the RPM sensor at http://www.aerospire.com/trex600n_mount.html

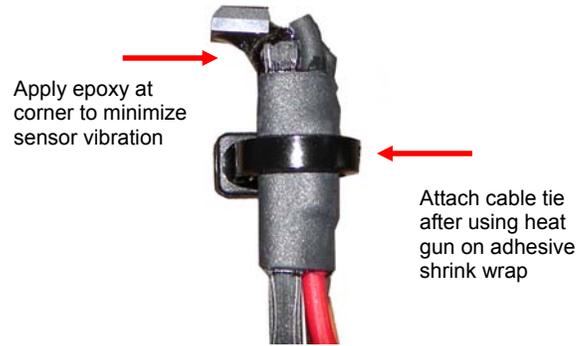
Building the RPM sensor

1. Select the appropriate bracket for your motor. When selecting the bracket, test fit it on your motor first. You can Dremel the bracket for proper fit if necessary.
2. Cut approximately ½ inch of included adhesive heat shrink tubing and slide it over the RPM sensor chip onto the sensor wire. The heat shrink tubing will be used to secure the sensor to the bracket.
3. The RPM sensor needs to be bent to face a magnet which is epoxied on the motor fan. Slide the top of the bracket inside the heat shrink tubing. With the text of the RPM sensor chip facing towards the motor fan, place the RPM sensor over the top of the bracket and carefully bend the sensor 90 degrees. *If you have an existing magnet on your motor fan, perform a sensor test using the LCD configuration to determine which way to bend the sensor.*
4. Using a heat gun, attach sensor to the bracket using included adhesive heat shrink tubing. Let the heat shrink adhesive dry for a few minutes.
5. Attach included cable tie over the heat shrink to ensure secure mounting.
6. Apply epoxy at the 90 degree joint to minimize vibration.



Heat shrink wrap on RPM sensor and bracket

In preparation for bending sensor, place it on bracket and slide heat shrink over sensor. Do not heat until you have bent the sensor.



Completed RPM sensor mounted on bracket

Testing RPM sensor

1. Plug the RPM sensor wire vertically onto the **MULTIGOV PRO** connector labeled "Sen" with the ORANGE wire closest to the word "Sen".
2. Connect the **MULTIGOV PRO** LCD configuration module.
3. Using the included servo wire extension, connect receiver throttle channel to "Thr".
4. Turn on your receiver, enter the **MULTIGOV PRO** configuration and go to the "Sensor Test" function.
5. As you move the magnet over the top of the RPM sensor approximately 1-2 mm away, the "Sensor Test" should be "ON" 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.

Installing RPM sensor on motor

1. Mount bracket on motor using motor bolts. Do not tighten motor bolts yet.
2. Temporarily affix magnet on motor fan using tape. Position magnet or adjust bracket so that the magnet moves exactly over the sensor as you turn the fan.
3. Test to make sure the RPM sensor reads the magnet correctly using the LCD configuration's "Sensor Test" function. The RPM sensor should be approximately 1-2 mm away from the magnet.
4. Once you have determined the correct location of the magnet, drill a hole for the magnet on the fan if necessary and secure with epoxy.
5. Bolt down RPM sensor to motor once magnet is secure and you have tested RPM sensor functionality. Don't forget to use blue Loctite on the motor bolts!
6. **When you mount the motor on the helicopter frame, make sure the helicopter frame/fan shroud does not touch the RPM sensor or bracket. Dremel/trim your frame to fix this if necessary.**



RPM sensor mounted on motor

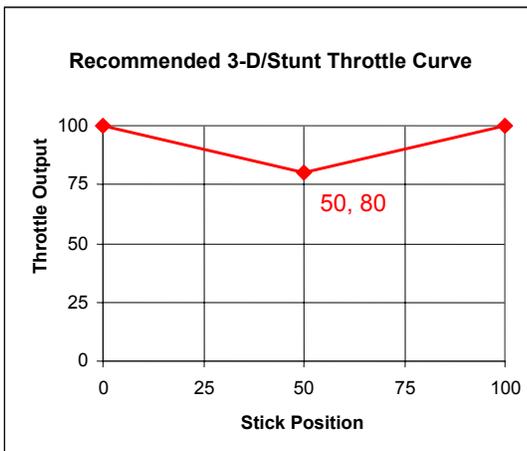
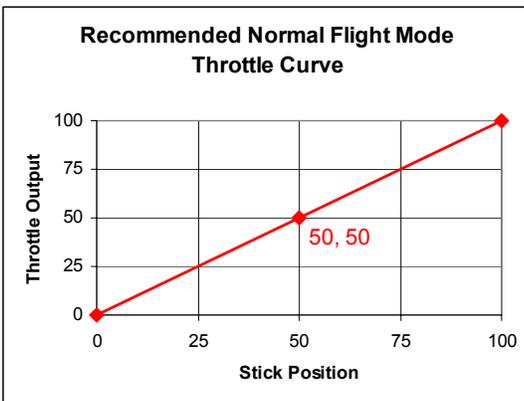
CONNECTING MULTIGOV TO RECEIVER AND SENSOR

1. Connect the RPM sensor to the "Sen" input.
2. Connect your throttle servo to "Sv1".
3. Using the included servo wire extension, connect your receiver's throttle channel output to "Thr".
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" input.

RADIO CONFIGURATION

MULTIGOV PRO activates governing when 1) the throttle channel input is 20% above the set idle point and 2) the rotor speed is over 70% of the target speed.

The following are the recommended throttle curves that should be set on your transmitter. Try to make your throttle channel travel endpoints as close to 100% as possible.



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" 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. Visit the "Support" page on our

website for instructions on how to do this with the most common radios.

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.

OPTIONAL: AUTOMATIC MIXTURE CONTROL

MULTIGOV PRO's automatic mixture control monitors motor cylinder head temperature and adjusts a mixture servo to give:

- Possibly longer flight time
- Possibly more power
- Possibly smoother running motor for hard to tune motors
- A safety measure for motor overheating

On the downside, it requires an additional temperature sensor and mixture control servo hardware.

So is it needed? In our opinion, it all depends on how well you can tune your motor and how it is already running. If your motor is running great, then mixture control isn't needed. If you understand how it works and don't mind the additional hardware, it doesn't hurt to try.

If your goal is to maximize 3D performance, tune your motor as best as you can and fly *without* mixture control first. Since our governor works so well, using mixture control may decrease 3D performance if not properly configured. You can then enable mixture control to see if there is any benefit to having it on.

Setting up Automatic Mixture Control

To use mixture control, you must attach a temperature sensor (sold separately) to the cylinder head using non-conductive thermal epoxy such as Arctic Silver's Arctic Alumina. An example is shown below where the sensor is attached below the glow plug.



If you have an existing CSM CarbSmart sensor, you can use that as **MULTIGOV PRO** uses the same sensor.

The other hardware requirement is installing a servo, carb horn, and linkages (not provided). A mini-sized servo is recommended.

Plug the temperature sensor into the **MULTIGOV PRO's** "Tmp" connector and the mixture servo into "Sv2".

ACCESSING THE CONFIGURATION OPTIONS

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

Entering Governor configuration

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

"NEXT-MENU"

"PREV-MENU"

"NEXT-MENU" and "PREV-MENU"

"NEXT-MENU" and "-VALUE"

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

Enter Governor configuration

Enter Mixture configuration

Enter Advanced configuration

Reset to factory defaults

GOVERNOR CONFIGURATION OPTIONS

Please set/verify the options highlighted in **bold**. As a safety measure, the throttle servo will not operate until you have done the "Set Idle, Set High" procedure.

OPTION	FUNCTION	RANGE	DEFAULT	NOTES
Speed1, Speed2, Speed3	Sets the target rotor speed and governor mode for the three available settings. Governor can be disabled for any Speed# if you set the target RPM below 500. The display will show "OFF".	<ul style="list-style-type: none"> • OFF is below 500 RPM • Top rotor speed is 25,000 motor RPM gear ratio 	1800 STD, 1950 3D, 2050 3D	<p>"STD" = Standard mode for smooth flying "3D" = Aggressive 3D mode for hard aerobatic flight</p> <p>To toggle between STD and 3D modes, press "+VALUE" and "-VALUE" at the same time. This can be done with any Speed#.</p>
GearRatio	Sets the main gear ratio of the model: $\text{Gear Ratio} = \frac{\text{\#main gear teeth}}{\text{\#motor pinion gear teeth}}$	1-30 in 0.001 increments	8.500	This number needs to be set exactly for proper operation.
Sensor Test	Tests whether the sensor is working and is close enough to the magnet.	---- or ON	--	Reading must be "ON" when magnet is over the sensor. Must be "----" when not over sensor.
Set Idle, Set High	Sets the motor idle and high points of the throttle servo. When setting, be sure your transmitter throttle curve goes from 0 to 100 and that you are in normal flight mode!	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 throttle linkage, servo, or transmitter's endpoints, you must set this function again!
Test Idle, Test High	Moves the throttle servo to the points that you have set.	--	--	Servo will move to each point as you cycle with +/- VALUE. When "Test Idle" is displayed, your throttle servo should be at idle. When "Test High" is displayed, your throttle servo should be at full throttle.
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.
LowThrotPcent	Lowest governed throttle point. A lower value controls overspeeding better but motor sound/exhaust smoke may not seem constant as throttle approaches the motor idle point. With too high a value, you may be higher than the target rotor speed.	5-90 percent	30	<p>This is % above the idle point. Percentage is based on the idle to high throttle range.</p> <p>Leave at default setting unless you need adjustment.</p>

AUTOMATIC MIXTURE CONTROL CONFIGURATION OPTIONS

Mixture control is optional and not required for governor operation. By default, it is disabled. Please set/verify the options highlighted in **bold**.

OPTION	FUNCTION	RANGE	DEFAULT	NOTES
AutoMixture	Turns mixture control on or off. Mixture control does not engage unless temperature is above 45°C / 113 °F.	OFF / ON	OFF	To reduce power usage, this should be set to OFF if you aren't using mixture control.
Units	Choose the temperature format you want.	FARENHEIT, CELCIUS	CELCIUS	
Target	Set target temperature.	70-130 °C / 157-266 °F	105 °C	Adjust lower/higher as needed.
Current	Displays current temperature from sensor	--	--	Use to verify that sensor is being read correctly on the bench.
Set Rich, Lean	Set the maximum travel points to be used for mixture control. Use your radio's throttle stick to adjust. Press "+VALUE" momentarily to save. It is recommended to start with a small travel range and increase to your liking. The endpoints do not need to be symmetrical -- for example, you can have more lean travel than rich.	Receiver pulse width displayed in ms	--	With the governor connected, the throttle channel is used to set the mixture servo endpoints. If you need more range, temporarily adjust your throttle channel's travel – <i>make sure you set it back to the original values when done.</i> <i>Do not to allow too lean a setting that can damage your motor!</i>
Test Rich, Center, Lean	After setting your endpoints, press "+VALUE" to cycle through the positions. Center position is fixed at 1.50 ms pulse width.	--	--	During a failsafe condition (sensor breaks or falls off) or if mixture control is disabled, the servo will go to the center position.
MixtureGain	Adjusts the aggressiveness of the control. The higher the gain, the mixture servo is moved more to reach the target temperature.	1-500	85	Start with default and adjust to your liking.

ADVANCED CONFIGURATION OPTIONS

Press NEXT-MENU and PREV-MENU on LCD at the same time to enter advanced configuration options. Advanced configuration options are provided for experienced users and troubleshooting only. **Do not change these settings unless you fully understand what each function does!**

OPTION	FUNCTION	RANGE	DEFAULT	NOTES
MultiMixTemp	Allows multiple target temperatures to be set. When this is ON, you will have three independent target temperatures available for mixture control. This will cycle automatically with the RPM select function just like Speed1, 2, and 3.	OFF / ON	OFF	For any target temperature, you can have the mixture control disabled (servo goes to center) by setting the temperature below 70 °C / 157 °F.
BaseGain	Sets the minimal gain.	10-1000	85	Lowest gain that is used. A higher value may provide better performance. Too high a value can cause motor "hunting"
GainAgres	Sets the gain aggressiveness.	1-10	5	The higher the value, the governor becomes more aggressive.
AdaptAgres	Used for troubleshooting. Do not change.	1-500	10	--
3D-ThCurLmt	Used in "3D" mode only. Limits the throttle servo to your radio's throttle curve at all points in time and acts as a RPM limiter.	OFF / ON	OFF	We don't believe this is the best option since you would need to put your throttle curve at a flat 100% for maximum performance. Leave OFF unless you really want this type of operation.
3D-Agres	Used in "3D" mode only. Adjusts the aggressiveness of the "3D" flight mode.	1-100	25	A higher value can improve performance but too high may cause more overspeeding.
Startup Speed	Sets the rotor startup speed when transitioning from governor being disabled to active.	1-50	10	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.
Feedforward	Sets the amount of throttle channel feedforward.	0-200%	20	Too much feedforward can cause RPM overshoot.

STATUS LIGHT

The light indicates **MULTIGOV PRO**'s operational status.

With motor OFF

No blinking	Error; check the battery and connections. DO NOT start motor.
Slow blinking (2 sec. apart)	Status OK.
Fast blinking	Configuration needed (throttle servo is disabled). If mixture control is turned on, there may be a problem with the temperature sensor. Check error by restarting with LCD. DO NOT start motor.

With motor ON

No blinking	Error; check the battery and connections. SHUT OFF MOTOR IMMEDIATELY.
Slow blinking (2 sec. apart)	RPM sensor is not reading magnet correctly. Shut off motor and check.
Fast blinking	Status OK. RPM samples being captured.

MIXTURE CONTROL MAXIMUM TEMPERATURE FUNCTION

When mixture control is turned on, the maximum temperature is recorded during your flight. To view this, perform the following:

1. Complete your flight but do not turn the helicopter off.
2. Take the helicopter to the bench and plug in the LCD while power is still on.
3. Press the "+VALUE" button on the LCD and the maximum temperature will be shown.

Note that this function records the maximum temperature at any point in time while the motor was running. Since the temperature can go above your target temperature even for a few seconds, do not assume too much from this reading. It is provided just for informative purposes and does not replace a device like a data logger.

PRE-FLIGHT CHECKS

Before you attempt 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. **After turning on your model, verify the throttle servo moves correctly as the radio's throttle stick is moved. If it doesn't, turn your model off and then back on.**
4. *Make sure throttle stick is on idle before starting the motor!*
5. Verify the status light is slowly blinking before you start the motor and quickly blinking after you start the motor.

FAQs AND TROUBLESHOOTING

Please visit our website at <http://www.aerospire.com/support.html> for the latest frequently asked questions and troubleshooting issues.

SPECIFICATIONS

Battery input voltage:	3.6 – 10 volts DC
Radio receiver compatibility:	Futaba, JR, Spektrum, and compatible
Receiver input pulse width:	0.8 ms to 2.2 ms
RPM sensor range:	500 – 25,000 motor RPM
Dimensions	32 mm by 40 mm
Weight	8 grams (unboxed)/14 grams (boxed)

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 a **MULTIGOV PRO** 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 **MULTIGOV PRO** 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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Rev. 6/2008