ACE RC®

ACE RC GOVERNOR FOR MODEL HELICOPTER ZERO α INSTRUCTION MANUAL

Safety Warning
- When using the Zero α for the first time or if the throttle linkage has been changed, be sure to perform the calibration process.
- When starting the engine, always keep the throttle in idle position.
- The failsafe setting and the backup throttle curve are recommended.
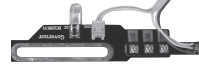
Introduction
The Zero α is a state-of-the-art digital engine speed governor for model helicopters which automatically monitors engine speed and maintains constant RPM by using an active integral control algorithm. It not only works very well in all maneuvers, but also has a very user-friendly interface and easy to setup. The Zero α is designed to govern the engine speed between 10,500 and 21,000 RPM. Like all the PCM radio accessories, this governor will only work while a transmitter signal is received.

Features
- Easy setup and user-friendly interface.
- High-speed CPU and advanced feed forward control algorithm.
- Instant reaction and smooth engagement.
- Precise adjustment and high reliability.
- Bright LED RPM display and explicit indication of "Lock" or "Unlock" condition.
- Variable gain for the adjustment of the control response time.
- Simple wiring, small and light weight.
- Adjustable mounting device, more flexibility in installation.
- Low Power Consumption.

Set contents
Before starting installation, check if the following items are supplied.

Governor x 1	4mm magnet x 2	Nut x 3	Washer x 2	M3 x 16 x 2
Sensor x 1	Screw x 3	Washer x 3	Washer x 2	M4 x 20 x 2

I. Installation :

1.1 The magnet should be mounted on the underside of the fan. Make sure the red point of the magnet faces toward the fan. If the magnet is embed in the wrong direction, the engine RPM will not be detected. If 2 magnets are installed to balance the fan in a 2-stroke setup, make sure that the sensor only responds to one of the magnets.（Please refer to section 3.2.3）. If your fan does not come with magnet holes, you must drill the holes yourself.
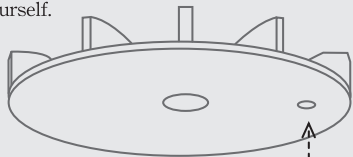

Fig-1

1.2 Mount the sensor bar to the bridge. Then, bolt the bridge to the engine mount (Fig 2). Please use the included washer to protect the bridge. The sensor bar and the bridge are adjustable; make sure the sensor faces the magnet as it passes by. Also make sure that the sensor is about 1-2mm away from the surface of the magnet (Fig 3).
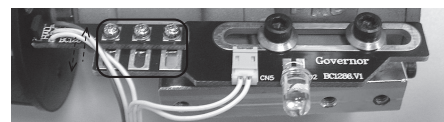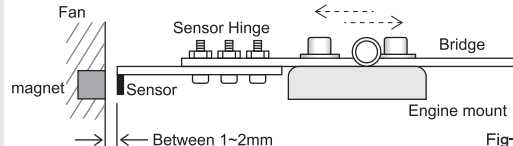

Fig-2

Fan / Sensor Hinge / Bridge / magnet / Sensor / Engine mount / Between 1~2mm
Fig-3

II. Connection :

Throttle channel
Switch channel
Receiver
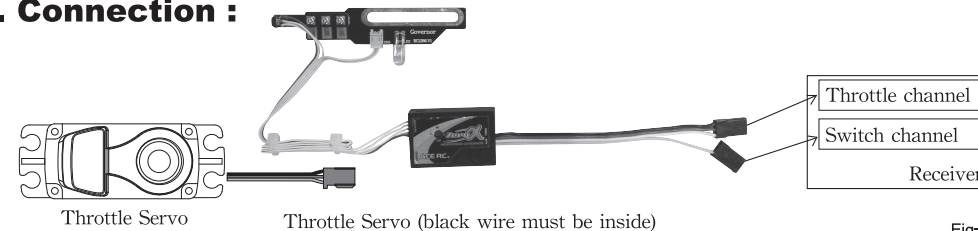Throttle Servo   Throttle Servo (black wire must be inside)
Fig-4

III. Operation mode setting and adjustment :

3.1 General Information :
The Zero α can be operated in two modes: Lock or Unlock Mode. In the Unlock Mode, the Zero α is not engaged and the throttle servo is controlled by the throttle curve directly. In the Lock Mode, the Zero α will be engaged unless the one of the following conditions have not been reached :
- The sensor, the throttle and the AUX channel are not operating correctly OR
- The Zero α has not been calibrated correctly OR
- The throttle is bellow 25% OR
- The AUX ATV is less than +/-10% OR
- The RPM has not been reached to 80% of the target RPM
In addition, make sure the swash→throttle mixes are turned off during calibration and during lock mode.

3.2 Unlock Mode :
3.2.1. Switch position check :
When power is turned on, the LED of the Zero α will flash quickly for 10 seconds. After that, a steady red light indicates that the governor is in Unlock Mode; a flashing red light indicates Lock Mode.
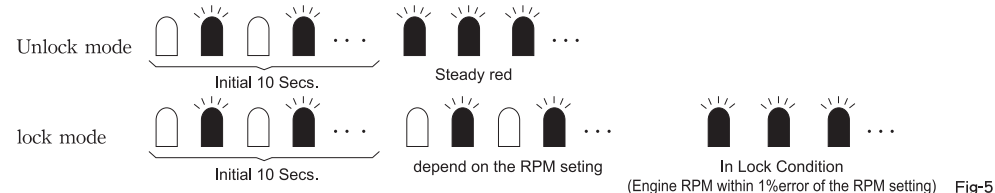

Unlock mode — Initial 10 Secs. — Steady red
lock mode — Initial 10 Secs. — depend on the RPM seting — In Lock Condition (Engine RPM within 1%error of the RPM setting)
Fig-5

3.2.2. Calibration（*Important）:
During calibration, the Zero α measures and stores the limits of the throttle channel. Calibration needs to be done when first installation of the Zero α, when the throttle servo throws are altered or when transferring the Zero α to another machine. The following is the calibration procedure:
- Set the throttle servo operation to full travel
- Be sure the AUX channel ATV is above +/-10%
- Make sure the throttle is at idle and turn on the transmitter and then turn on the receiver.
- Within the first 10 seconds while the LED is quickly flashing, toggle the AUX switch until the LED extinguished.
- Raise the throttle stick to its full position continuously. Do this continuously; do not stop in any middle position.
- After few seconds, the LED will stay on steadily and the throttle servo will move to its high end.
- The setting is done

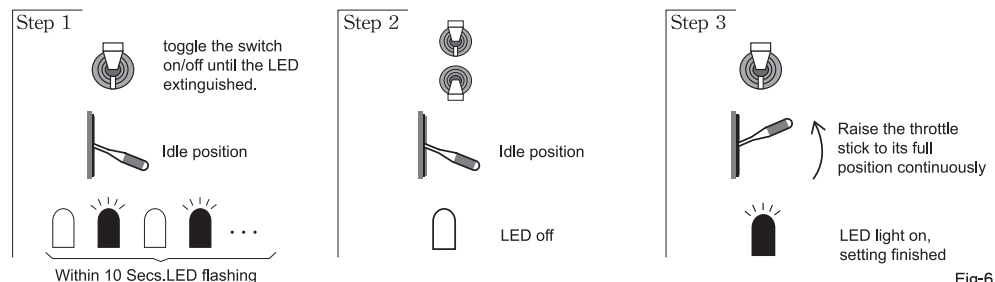Step 1 — toggle the switch on/off until the LED extinguished. / Idle position / Within 10 Secs.LED flashing
Step 2 — Idle position / LED off
Step 3 — Raise the throttle stick to its full position continuously / LED light on, setting finished
Fig-6

3.2.3. Sensor check :

In Unlock Mode, the LED light will extinguish when the sensor detects the magnet. If the LED stays lit, as the magnet passes the sensor, the magnet is not detected. The gap between the senor and the magnet needs to be decreased. To perform this sensor check, the user could simply manually rotate the cooling fan instead of starting up the engine.

3.3 Lock Mode :

3.3.1. Read the setting RPM. :

The setting RPM can be read by two methods. The user can read directly from the LED or the user can convert from the ATV value. In Lock Mode, the LED will start to flash. The setting RPM can be read by counting the flashes. The minimum value is 10,500. Every additional flash indicates 500 RPM more. For example, only one flash means 10,500 RPM. Five flashes indicate 12,500 RPM.

For example :

- For 10,500 ~ 13,000 RPM

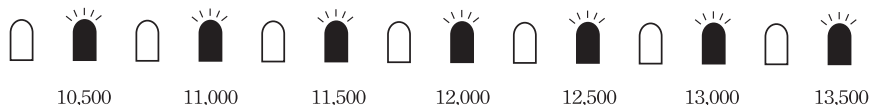| 10,500 | 11,000 | 11,500 | 12,000 | 12,500 | 13,000 | 13,500 |

Fig-7

The other way to confirm the setting RPM value is from the ATV / RPM conversion table. The RPM will vary between different transmitter manufacturers. Three common transmitters are listed. From this table, the exact RPM can be read directly:

ATV	FUTABA PCM 1024Z	FUTABA T14MZ	JR PCM10X
10%	10500	10500	10500
20%	10500	10500	10500
30%	12040	10783	10500
40%	13729	12040	11200
50%	15418	13297	12430
60%	17068	14554	13624
70%	18757	15811	14854
80%	20410	17086	15982
90%	21000	18340	17212
100%	21000	19696	18445
110%	21000	20857	19639
120%	21000	21000	20764
130%	21000	21000	21000
140%	21000	21000	21000
150%	21000	21000	21000

3.3.2. Change the RPM setting :

To change the RPM setting, please use the ATV setting function of the transmitter. By adjusting the ATV value of the switch in Lock Mode, the RPM setting will be increased or decreased. The RPM range is from 10,500 to 21,000. The new RPM setting can be confirmed by the LED flash.

3.3.3. " Lock " condition :

The governor will engage only when the throttle stick is above 25% and when the engine RPM has reached 80% of the target RPM. While engaged, an error within +/-1% RPM will be indicated by a steady red LED light. Once the RPM error exceeds +/-1% range, the LED will start to flash again.

3.3.4. Throttle curve setting :

If the Zeroα fails, it will give control back to the throttle curve. Therefore, it is recommend to setup the backup throttle curve. The simple linear line can be used for normal flight. However, a V curve is needed for idle up mode and the valley must be higher than 25%. The following throttle curves are recommended in case the governor malfunctions.
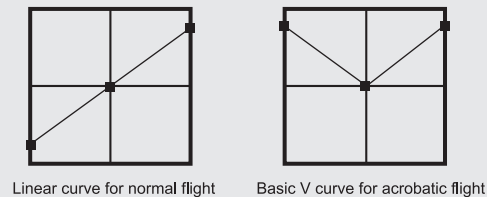
Linear curve for normal flight   Basic V curve for acrobatic flight

Fig-8

3.3.5. Pitch curve setting :

The pitch curve setting is almost the same with or without the governor. The only difference is that the maximum pitch must be calculated to maximize the governor effect. To get the max pitch, fly the helicopter in the lock mode and max throttle. If the LED light steadily illuminates, increase the pitch setting angle until the LED temporarily extinguishes. Reduce the pitch setting a little bit from this point; this will be the max pitch setting for the max engine power output.

3.3.6. Gain Setting :

The governor gain controls the response time. If the user feels that the response is too slow or if the engine overspeeds, a clockwise turn of the gain adjuster will speed up the governor's response. On the other hand, if an unstable or hunting situation is found, a counter-clockwise turn of the gain is necessary to reduce the control response.

3.4 Flight test :

For the first flight after installation of the governor, be sure to start the engine in the Unlock mode. After lift-off under control and without any abnormal conditions, engage the governor into Lock Mode. The flights will be the same with or without the governor. The only difference is that the engine will be locked at the setting RPM in the Lock mode. If there is any abnormal conditions, switch back to Unlock Mode immediately and land the helicopter. Please check all the governor setting procedures (3.2 and 3.3) and do the flight test again. After a successful flight test, the helicopter can take off in either Lock or Unlock Mode. The mode can be switched back and forth between Lock and Unlock during flight. When Lock Mode is engaged, the LED will turn into a steady red from the flashing red after a short period. The steady red light indicates that the governor already maintains the engine RPM within 1% error of the setting RPM. During normal maneuvers, the LED will be steady red. The LED may temporarily flash then turn back to steady red during violent maneuvers. It is normal for the engine to require some time to respond to the control command.

IV. Specifications :

- Control system：Digital advanced control
- Speed pick-up：Direct detection of engine rotation by hall sensor
- Speed stability accuracy：Less than 1%
- Control response：14ms
- Speed control range：10,500~21,000rpm (engine speed)
- Operating voltage range：DC 4.8V~6.0V
- Current drain：40mA (at 4.8V, including sensor)
* Note：Specifications and ratings are subject to change without prior notice.

Spare Parts

Item No.	Description	Q'ty
AQ1705	Governor Sensor	1
AQ1706	Governor Bridge	1
AC1679	Magnet	4

AQ1705
AQ1706   AC1679

Manufactured by

THUNDER TIGER CORPORATION

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