



## CASTLE CREATIONS INC.

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[www.castlecreations.com](http://www.castlecreations.com)

### **Important, please read this in its entirety before downloading and using Castle Link Beta 1.51 and later.**

This is the most significant software update Castle Creations has released for its Phoenix line of brushless sensorless speed controllers. This revision is our effort to create the best helicopter speed control available. In the process of improving helicopter functions we also improved features across all modes of flying, not just helicopter functions. All functions are documented by blue question marks above the settings which you can check in the Castle Creations link anytime you have an ESC plugged into the link.

Please read and print or print and read before using this software version. Print this so you will have a manual and reference for using the brand new Castle Creations Phoenix controller you will have by installing this software.

#### **Error Codes**

We have added persistent error codes that the LED will flash until the ESC is disconnected from the power source. The codes should help explain the conditions that are experienced by the controller in use.

- 1 flash - Startup Failed
- 2 flashes - Low voltage cutoff in soft cutoff mode complete (voltage could not rebound above cutoff voltage)
- 3 flashes - Over current (soft cutoff mode)
- 4 flashes - Low voltage cutoff (hard cutoff mode)
- 5 flashes - Over current (hard cutoff mode)
- 6 flashes - Prop strike detected
- 7 flashes - Excessive radio noise

## **SETTING**

### **Throttle Type**

Throttle Type changes how the ESC responds to the servo signal that is changed when you move the transmitter throttle stick. There are no industry standards, and different transmitters will give different signal for MIN (off) and MAX (full throttle). As a result, Castle must offer the following modes to accommodate the different transmitters in use.

**Auto calibrating** is primarily for gliders;

**Airplane Fixed Endpoint** is for most fixed wing power planes.

**Governor mode(s) (Low and High)** is for collective pitch helicopters when you want a fixed head-speed throughout the collective range.

**Helicopter Fixed Endpoint** is for fixed pitch helicopters and collective pitch helicopters when a manually set throttle and pitch curve is used on the transmitter.



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### SETTING EXPLANATION

- **Airplane: Auto Calibrating:**

(Airplanes). Utilizes your transmitter's full available throttle range. If selected you will need to calibrate the throttle every time after you arm the system. To use follow these steps:

1. Turn your transmitter on with the throttle stick in a middle position. Plug your battery into the controller. You will get the initialization tones.
2. Move the throttle to the bottom position to arm the system.
3. If you wish to have full throttle range before flying, move the throttle stick to the top position (full throttle and motor running) for at least 2 seconds to allow the controller to determine where the top stick position is. Otherwise, to ensure proper throttle range setting be sure to climb out right after launch at full throttle for at least 2 seconds.

- **Airplane: Fixed Endpoints:** (Airplanes).

Uses predetermined fixed endpoints within the controller. To Use:

1. Turn your Tx on with the throttle stick in the middle or top position. You get the initialization tones.
2. Move the throttle to the low position to arm.
3. With fixed throttle, motor start and full throttle points will be determined by the end point settings on your transmitter (in most cases, throttle will start between 10% and 20% throttle, and will reach full throttle at 75% to 85% throttle. You can adjust your throttle endpoints on your Tx to get full stick throttle range (endpoints vary with transmitters). The throttle curve and resolution is the same as auto calibrate.

#### **Helicopter Throttle settings note**

Selecting any helicopter-specific throttle setting also changes voltage 'Cut Off' type to 'Soft Cut Off' and disables all brake functions. However, these setting changes are not reflected in the 'Cut Off' type' or the 'Brake' settings.

#### **Helicopter set up basics**

To get your electric helicopter to fly well and for the new helicopter throttle settings to work properly you need to set your helicopter up correctly. The Heli Throttle types will not compensate for an improper system set up and you may damage your motor, your ESC or your batteries. To make sure your helicopter is set up correctly start with 'Heli: Fixed Endpoint' mode. In 'Heli: Fixed Endpoint' adjust the endpoints on your transmitter until the system will arm with the stick in the bottom position and the red LED comes on solid on the ESC at full throttle (Solid red LED means full throttle on the ESC). This gives you a full throttle range on your transmitter which assures that your throttle percentages will be correct. Now set the heli up to get the head speed you want at about 75% throttle in 'Heli: Fixed Throttle' mode. Gear as needed to get the desired head-speed at 75% throttle on you transmitter. Set up like this your motor will be running within its efficient operating speed with enough headroom that the motor can maintain this speed with hard collective use. Gearing here is the key. Once you get the head-speed you want at about 75% throttle in 'Heli: Fixed Throttle' mode your helicopter will fly well in either 'Heli: Fixed Throttle' or in one of the governor modes. If you decided to use the governor adjust your throttle curve to a straight line that gives



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you the same head-speed as you got at 75% throttle in 'Heli: Fixed Endpoint' mode. Start with Heli: Governor Low' If you cannot get this head-speed in 'Heli: Governor Low' go to 'Heli: Governor High.' If the heli is set up right in 'Heli: Fixed Endpoint' mode it doesn't matter what throttle % gives you your desired head-speed in governor mode.

If you can't gear to get the head-speed you want at about 75% throttle in 'Heli: Fixed Endpoint' by gearing you need a different motor or battery voltage. If you cannot get the head-speed you want at about 75% throttle in "Heli: Fixed Throttle" your helicopter is not set up right and will not work in correctly in 'Heli: Fixed Endpoint' or either 'Governor' Modes

- **Heli: Governor Low:** (Helicopter).

When this throttle mode is selected, the Phoenix will automatically maintain your helicopter's head-speed at an RPM that is determined by the throttle signal. Once you determine the throttle % that gives the head speed you want, your throttle curve should be programmed to be "flat" at that percentage setting (all throttle points set to that throttle %). The following settings must be made in your transmitter's program; typically one three position switch is used to toggle between the settings:

1. Phoenix must see a zero or bottom throttle setting to arm, so set one flight mode or switch to provide that signal.
2. Then set up a second flight mode or switch setting that will be your "throttle up" switch.
3. Determine the necessary throttle % for your desired head-speed. Start with a flat curve in low governor and measure the head-speed. Move the throttle % up or down to reach your desired head-speed. If you cannot get a fast enough head-speed in low gov, then switch to high gov. When you find the throttle % that produces your desired head-speed, set all the throttle points to that % and the Phoenix will maintain that constant head-speed as long as your transmitter is sending that throttle percentage. It is not advisable to change throttle speed with the transmitter while in governor mode, with the obvious exception of on and off.

### **Governor Mode general notes:**

1. When using Heli Governor Mode, allow the Phoenix governor to control the spool up of your heli. Trying to control spool up by gradually increasing the throttle can lead to abrupt power changes. It is best to use a switch for startup that goes from zero throttle directly to your required throttle setting when flipped. The Phoenix governor will take it from there.
2. **When using Governor Mode always set 'Throttle Response' to Low. This does not effect governor response.**
3. Governor Auto Rotation with Bail-Out Mode (Idle/flight mode) You want to keep the ESC from resetting and going to governed spool up by not going to OFF throttle. Set idle 3 to a low flat throttle curve that keeps the motor running slowly. Now drop the throttle curve down slowly until the motor stops running. Bring the throttle % back up a few points until it begins running again. That setting will be your minimum throttle % to keep the ESC from resetting by going to 'Off Throttle.' Your motor will throttle down to your lowest speed setting that will not affect the auto-rotation, while preventing the ESC from resetting and going to governor controlled slow spool up.



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If you need to bail out simple switch to idle 2 to power back up. **Make sure Throttle Response is set to LOW!**

- **Heli: Governor High:** (Helicopter).

Use when Governor Low won't provide the head-speed you want. Set up is the same as Governor low. Generally, governor low is for high Kv motors. Governor High is for low Kv motors. The reason for the two governor settings is to accommodate all motor system.

Note: Selecting any helicopter specific throttle setting also change voltage 'Cut Off' type to 'Soft Cut Off' and disable all brake functions. However, these setting changes are not reflected in the 'Cut Off' type' or the 'Brake' settings.

- **Heli: Fixed Endpoints:** (Helicopter).

This is an entirely new throttle type that allows you to use manual throttle for flight while preventing sudden high-powered motor starts that can harm your gears. Setting up your transmitter for Fixed Throttle is the same as setting up a fuel heli. Use this throttle mode if you prefer mixing your own pitch/throttle curves on your transmitter for collective helicopters, or want a "bail out" option when practicing auto rotations. Once the ESC is armed, if you throttle up quickly to a mid-throttle point (or release the throttle hold/cut button), the heli will smoothly spool up to that throttle level. Once that throttle level is reached, full power and throttle response are now available with changing throttle/pitch levels on the stick. Think of the throttle in terms of a glow/gas engine. Don't return to absolute 0 RPMs, always keep it at an idle unless you want to re-engage the slow spool routine.

Note that the **Throttle Response** setting will still serve to act as to modify the speed of throttle changes when this mode is selected. Start with low throttle response then move this setting up until the heli responds as you like it. Be careful, high throttle response is very fast and powerful and it is easy for powerful setups to strip gears at high settings.

**You will need to program the following flight modes into your TX to operate a collective pitch heli with the various start and flight modes.**

Utilize your idle settings/switch or the throttle hold/cut button for start-up and shut down, then flip into one of the flight modes suggested here:

1. Start-up/shut down (Idle/flight mode) – you'll most likely want to use a linear "airplane" throttle curve from zero to 100% here, to show the ESC a low throttle for arming, and to stop the motor. You can also set your throttle hold/cut button/switch for zero throttle and use it to arm and shut down in either of the flight modes below. Normal Flight Mode (Idle/flight mode)
2. Set your desired head-speed using the throttle % at middle stick and move it up or down to get the head-speed you want. Depending on your motor, you'll need to complete a "V" curve with slightly higher throttle %'s on either side of the middle throttle point to maintain head-speed with changes in pitch. A good test is to spool up the heli on the ground, and tach the head at full negative pitch. Use this reading to adjust the outermost throttle % to get the desired head-speed at full negative and positive pitch.



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3. Governor Auto Rotation with Bail-Out Mode (Idle/flight mode) You want to keep the ESC from resetting and going to controlled spool up by not going to OFF throttle. Set idle 3 to a low flat throttle curve that keeps the motor running slowly. Now drop the throttle curve down slowly until the motor stops running. Bring the throttle % back up a few points until it begins running again. That setting will be your minimum throttle % to keep the ESC from resetting by going to 'Off Throttle.' Your motor will throttle down to your lowest speed setting and will not affect the auto-rotation, while preventing the ESC from resetting and going to controlled slow spool up. If you need to bail out simple switch to idle 2 to power back up. **Make sure Throttle Response is set to LOW!**

### **Spool up Speed** (Scale 1 to 10)

This setting controls how quickly the power is ramped up from zero or low head-speed to the throttle level given from the transmitter This setting will only work if you have selected a heli throttle mode (Governor high or low, or Heli Fixed Endpoint throttle mode). The faster the spool up speed, the faster the head will accelerate to the throttle % in governor and Heli Safe Throttle modes. Once the head-speed is very near that level, spool up function ceases, and the throttle stick or Phoenix Governor is in direct control of throttle changes. Experiment to find the speed you are most comfortable with, as some pilots enjoy a slow spool up and others want a very fast one.

1. **Low:** Very slow spool up
2. **Med:** Medium speed spool up
3. **High:** Fast spool up
4. **Custom:** Fine tune your start up speed

### **Motor Start Power** (scale 1 to 100)

This setting controls how much power is allowed into the motor to get it started for the first few revolutions from a dead stop. Each power system, airplane and heli is different, so it's best to start with a low setting first, and experiment to find which looks best to you from there.

1. **Low:** Very low start up power
2. **Med:** Medium start power
3. **High:** Powerful start up power
4. **Custom:** Fine tune your start up power

### **Throttle Response** (Scale 1 to 10)

This setting controls the allowable rate of change from one throttle level to another. The higher the response, the less dampening there is for changing throttle levels. At low setting there will be some lag between changing throttle setting and achieving the actual change in speed. Higher response levels make the throttle response quicker related to throttle changes. For the Fixed Endpoint mode, this setting is important for "fine tuning" the throttle response time to maintain constant head-speed across pitch



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changes. USE THIS SETTING TO PREVENT STRIPPED GEARS if you will be increasing throttle quickly on an over-powered setup.

1. **Low:** Slow throttle response
2. **Med:** Medium throttle response
3. **High:** Fast throttle response
4. **Custom:** Fine tune your throttle response

### **Governor Gain Scale** (1 to 100)

This setting works the same as the gain on your gyro. Too little, and the governor rpm response can appear mushy, and too much can induce oscillation. Generally the larger the heli, the higher the gain. A Logo 10 size heli might run best on HIGH, and the medium setting is a bit soft. TRex size helis might run best on MEDIUM, and HIGH can induce rapid oscillation.

1. **Low:** Slow governor response
2. **Med:** Medium governor response
3. **High:** Fast governor response
4. **Custom:** Fine tune your governor response