



TOTAL CONTROL

by John Gilmore 📷 Photography by John Reid

One of the more confusing parts of setting up an electric RC helicopter is programming the electronic speed control (ESC). Because an ESC regulates electricity that we can't see, this tends to make it difficult for most of us to understand. Besides not being able to see what's going on inside an ESC, there are additional functions like regulating power to the receiver and even governor functions that an ESC provides. Fortunately, most ESC manufacturers make setting up an ESC very easy once you understand the features and what the choices mean.

9 things you need to know about programming your heli's throttle

It's important to note that just about any ESC will work right out of the package without going through all the programming steps, but it won't work nearly as well as a properly set-up ESC.

LET'S GET STARTED

For this article, I am going to use the Castle Creations Phoenix 35 ESC to demonstrate how I set up an ESC for a helicopter. This unit is probably the most popular ESC used on 450-class helicopters like the Thunder Tiger Mini Titan and Align T-Rex 450. The features we

talk about on the Phoenix 35 will be very similar to most other ESCs you might use, so even if you have another brand you can most likely apply the same principles.

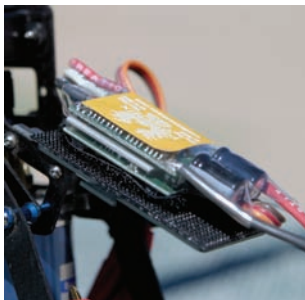
The Castle Creations Phoenix line of ESCs can be programmed as standalone units on the helicopter with just your transmitter and the ESC, or you can purchase a computer USB interface (see sidebar) to plug into a computer and program them through a graphical interface for you geek types out there (like me). For this article we will use the method without a computer.

INITIAL SETUP AND THROTTLE CALIBRATION

Since I feel throttle calibration is the most critical part of setting up any ESC (and the most overlooked and least understood), I



Don't forget to remove the pinion gear or move the motor away from the main gear since you will need to start and stop the motor during the calibration process.



am going to do a walk-through of my method of throttle calibration. Safety first, though. Remove the pinion gear or adjust the motor in its mount so it doesn't contact the main gear. We don't want the blades spinning while we do our setup, but we need to have the motor plugged in so we can hear the programming beeps and can spin the motor up during calibration.

The Phoenix 35 has eight programming features and a throttle calibration. Follow the

steps in the instructions to connect the ESC to your motor and receiver. For the throttle calibration, we will start with the transmitter by making sure the throttle trim tab is in the lowest position. The throttle sub trim is set to zero, and the throttle curve is linear (e.g. 0, 25, 50, 75, 100). Then, go to your travel adjust screen in your radio (some radios will call this endpoint adjustment, or EPA). I used a Spektrum and set the low throttle travel to about 50 percent (I know that's too high, but that's where we will start), and the high throttle travel adjust to about 55 percent. Now with the throttle stick set at 50 percent, plug in the battery to the ESC. Because the ESC is protected against starting the motor above zero stick position, the motor should not start. If it does start, go back through the setup steps and try again because something is not set correctly.

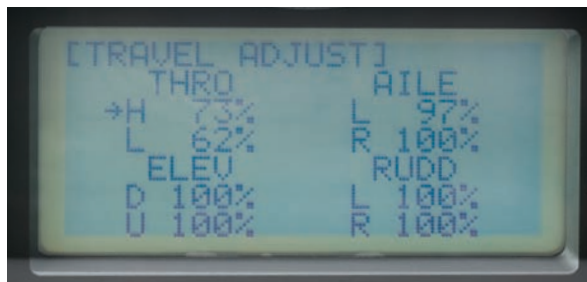
Now move the throttle stick to its lowest position and start increasing the low throttle travel until you hear the ESC initialize with a series of beeps. Every transmitter will give a different number (mine is at 62), so don't be too concerned with the actual number; just add three clicks after you hear the initialization beeps. We do not want the motor turning at the low stick position or it won't arm properly when it is time to fly.

As for the high stick, plug the battery in with the throttle stick at low. You will hear

several beeps that mean the throttle is armed. Now slowly advance the throttle to full stick. The motor will be running at around 50 to 60 percent now (that's why we made sure in the setup that the motor could not engage the main gear). Now slowly increase the high throttle travel adjust until the red light comes on solid on the ESC; this is 100-percent throttle. When you just see the red light come on, increase the travel adjust three or four more clicks and you are finished with throttle calibration. Remember, this calibration is critical to a smooth-flying heli, so take your time to get this right!

ESC FEATURE SETUP

Now the hard part is done and we can set the other eight items. These are easy to do and they all follow the same method of entering programming mode by doing a stick sequence and answering yes or no



Every transmitter is unique, so your travel adjust numbers for throttle are likely to be different than mine. But, your numbers won't be at the default L100 percent and H100 percent.

to whether you want to accept that choice. The instructions are very clear about the mechanics of how to accept or decline setting choices so I won't bore you with the details. Just follow the instructions that came with your ESC to make the choices. We are going to talk a bit about these features and why I pick certain choices over others.

FEATURE 1: CUTOFF VOLTAGES

This feature is designed to save your expensive battery from being destroyed by discharging your battery too low. Typical setting for a LiPo battery is 3 volts per cell, so if you use a standard 3-cell LiPo, 9 volts would be appropriate. If you use LiPo batteries, choice one is auto cell detection, which will adjust the battery cutoff to 3 volts per cell and automatically adjust to the amount of cells you are using. This

works well for me, but there are choices available for absolute voltage settings if you prefer that or use NiMH batteries. This is only for LiPo batteries, so if you use other types of batteries you will need to pick the correct voltage for the type and number of cells you use.

FEATURE 2: CURRENT LIMITING

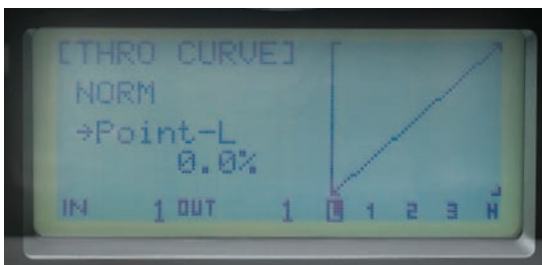
This setting will save your ESC from a meltdown if you have extreme amperage draw. I use a disabled setting for this feature and I assume the risk that if I severely over-amp my ESC I could damage it. My batteries and motors are well within the amperage range of this ESC and I have never experienced a problem with this. I feel that if my ESC shut off in flight I would probably do more damage to my heli in the inevitable crash than the cost of a new ESC, so I leave it disabled.

FEATURE 3: BRAKE TYPE

This is an easy one: never use a brake on a heli. The brake feature will stop the motor quickly when the throttle shuts down and we don't want that.

FEATURE 4: THROTTLE TYPE

There are two good choices here and they are really personal preference. Do not use auto calibrating, but you can choose between fixed throttle that uses the curves in your radio or governor mode that



It's important that the throttle curve is linear to start the calibration process. It can be changed to your normal curve after the calibration is complete.

allows the ESC to auto adjust your throttle setting while flying. Both are good choices but realize the governor mode requires a heli tachometer (and a friend to use it while you're flying) to set up. My personal preference is using my own curves with fixed throttle.

FEATURE 5: ELECTRONIC TIMING ADVANCE

If you use an outrunner motor like the Align Trex450 motors, use low timing. If you use an inrunner motor you could use

standard or advanced timing. If you use higher than low timing you may make a little more power, but you will certainly reduce your flying time (possibly by a large percentage) and you will build up more heat in your motor and battery from the higher current draw. Try low timing and see if the performance is what you need before experimenting with higher timings.

FEATURE 6: LOW-VOLTAGE CUTOFF TYPE

This is important! There are only two choices here: hard cutoff and soft cutoff. If you use hard cutoff and accidentally fly for a bit too long and hit the low voltage cutoff point, your motor will stop—as in stop dead, and your helicopter will fall to the ground. If you're really quick you can re-arm the ESC by going to zero-percent throttle and then hoping you can spool your blades up before hitting the ground. The soft cutoff will pulse the throttle letting you know to land now, but you should be able to save your model if you land quickly. No question here: use soft cutoff.

FEATURE 7: SOFT START

Soft start will slowly spool the blades up to save stress on the gear train of your heli, but the downside is that you will have some delay in throttle response. This is a nice feature for beginners who are just learning to hover, but I don't like the delay for aerobatic flying. I always use fast start and I just have to be very



easy on initial spool up of the blades on the ground. If you do any float flying on water, soft start is a big advantage since it significantly limits the torque effect as the helicopter spools up.

FEATURE 8: PWM SWITCHING RATE

This setting should be the default 13KHz for every heli motor I'm aware of. The other settings are for special low-inductance motors, so just stick with 13KHz here.

CONCLUSION

I can't stress enough the importance of throttle calibration. Many features rely on accurate calibration, as does your radio setup. Your throttle curves assume that the calibration is correct so make sure it's right. Use the explanations of the features above and apply them to whatever ESC you use to have a better flying heli that is easier on your batteries and motor, and might add some valuable flight time to each battery charge. ☺

See the Source Guide for manufacturers' contact information.

Castle Link

Castle Creations manufactures a companion product, Castle Link, for their Phoenix electronic speed controls. With this interface, you can program all the same features that can be set with your transmitter, and a few more. This interface is available at a very low cost and the software (and updates) can be downloaded for free. The interface plugs into a USB port of your computer and has a connector for the throttle cable of your ESC. The Castle Link provides power to the ESC as well as data transfer so you don't even have to connect the ESC to your heli to program it. The Castle Link not only has additional features for your heli (and airplanes as well), but also allows you to save your configurations on your computer and includes the ability to update the ESC to a later version as Castle Creations updates their firmware. If you like to fine-tune your setups, this is great to have.