

# Multi-Rotor Series User Guide

## 1 INTRODUCTION

This manual provides instructions on incorporating your Castle Creations Multi-Rotor ESCs into your aircraft, from wiring and mounting your ESCs to configuring them for your first flight. For more information on the technical aspects of your ESCs, please see the applicable Multi-Rotor Technical Datasheet.

## 2 IMPORTANT WARNINGS

- *Castle Creations is not responsible for your use of this product or for any damage or injuries you may cause or sustain as a result of its usage.*
- *Castle controllers are for use by adults only.*
- *Always remove all propellers when working on a power system with the battery connected.*
- *Please observe all local and federal laws regarding the flying of remote control aircraft.*
- *Never fly over others or near crowds.*
- *An RC vehicle crash or a power system malfunction may result in fire. Never operate RC vehicles in a flammable environment, such as around dry vegetation.*
- *Castle Multi-Rotor ESCs come programmed with default settings optimized for Multi-Rotors using direct drive outrunner motors. Using the Multi-Rotor settings in applications other than Multi-Rotor platforms can be potentially harmful to the ESC.*
- *Low voltage cutoff is DISABLED by default on all Multi-Rotor controllers. You must use an external device to monitor battery voltage or manually enable low voltage cutoff to avoid damage to your batteries.*
- *The “No BEC” versions of Multi-Rotor ESCs require the red wire of the receiver lead to be connected to a 4.5-8.0 V source. The red wire of the receiver lead should remain intact and connected to the flight-controller/receiver power circuit.*
- *Do not drive a motor with Multi-Rotor ESCs powered by a DC power supply without first disabling Active Braking and Idle Brake. Voltage spikes from sudden braking may cause damage to the supply and ESC.*

## 3 INSTALLATION

The first step in using your Multi-Rotor ESCs is properly installing them in your aircraft. Plan the location and wiring routes of all components before you begin soldering. ESCs should be placed in a location with adequate airflow. For optimal efficiency, keep wire connections to the motor and battery as short as possible. Ensure that no wires can enter the plane of the propellers, and avoid running power wires across sensitive control electronics. Note that the following steps can be performed in any order, but this is typically the easiest.

### 3.1 ADD YOUR BATTERY CONNECTOR

Solder a quality power distribution board and/or battery connectors of your choice to the red (+) and black (-) power wires of each Multi-Rotor ESC. ENSURE THAT THE POLARITY IS CORRECT (red wire to battery red wire, black wire to battery black wire). Follow the instructions provided with the power distribution board or battery connectors.

### 3.2 CONNECT THE MOTORS TO YOUR ESCS

Solder connectors to both the ESC and motor wires, or solder the motor wires directly to the motor leads on the ESC. Swap any two connections to reverse the rotation of the motor. The motor direction can also be changed using Castle Link or during the throttle calibration procedure.

### 3.3 CONNECT THE ESCS TO YOUR FLIGHT CONTROLLER

Connect the ESC receiver leads to the corresponding throttle channels on your flight-controller.

*Note on the usage of "No BEC" versions of Multi-Rotor ESCs: The "No BEC" versions of Multi-Rotor ESCs require the red wire of the receiver lead to be connected to a 4.5-8.0 V source. The red wire of the receiver lead should remain intact and connected to the flight-controller/receiver power circuit. Castle recommends powering the flight-controller/receiver power circuit with the BEC version of Multi-Rotor ESCs. However, an external power supply may also be used.*

### 3.4 ATTACH THE ESCS TO YOUR FRAME

Securely fasten the ESCs to the frame of your aircraft. Castle Creations recommends placing a piece of foam at least 1/8" thick under each ESC before securing it to the aircraft. If cable ties are used to secure the ESC, do not cinch the cable tie down directly on the board as this may damage components on the underside of the device.

## 4 FIRST-FLIGHT SETUP

Once all ESCs are connected to power, the flight controller, and their respective motors, they must be configured before flight. The following procedure will calibrate the ESCs to the flight controller's throttle signals and program the direction of motor rotation.

1. Remove propellers from all motors
2. Configure the flight controller to produce a full throttle signal
3. Connect a battery or power supply to the ESC
4. The motor should chime and begin to repeatedly beep indicating the ESC has recognized the full endpoint
5. Reduce the throttle signal to the minimum
6. The motor will chime again. The start endpoint will be set to 5% above the minimum signal.
7. Throttle calibration data has now been saved. Continue to step 8 to program the direction of rotation. Otherwise disconnect power from the ESC.
8. Briefly spin motor in the desired direction of rotation
9. The motor will beep twice when the ESC has detected motor rotation
10. Spin the motor in the same direction to confirm the direction
11. The motor will beep four times confirming the setting
12. Disconnect power from the ESC to exit calibration

*Always perform a range check at full, half, and zero throttle before flying with any new speed controller! Consult your radio transmitter's manual for more information.*

## 5 OPERATION

The Castle Multi-Rotor ESCs will not provide power to the motors when first powered up. The ESCs must receive a throttle signal below the start endpoint to arm. Follow this initialization sequence to arm the power system. Note that different flight controllers have their own initialization procedure, and may automatically arm the ESCs once powered. Always treat a powered aircraft as armed and take all necessary safety precautions.

1. Turn your transmitter on and move the controls to the disarmed position (this varies between flight controllers – consult your flight controller's documentation for more information).
2. Connect the battery to the ESCs.
3. The motors will "chime" to indicate that the ESCs are powered. If you have Auto-LiPo voltage cutoff enabled the motors will emit a sequence of beeps indicating the number of LiPo cells connected.\* The ESCs will remain disarmed and will not operate the motors until they receive a zero throttle signal.
4. When the zero throttle command is received, the Multi-Rotor ESCs will play an arming tone through the motors and light the green LED to indicate that they are armed.
5. Move controls to the armed position and the motors should start (this varies between flight controllers – consult your flight controller's documentation for more information).

The ESC will interpret a throttle signal below the start endpoint as an arming/idle throttle. Once armed, throttle signals between the start and full endpoints will cause the ESC to drive the motor with proportional power, reaching full throttle at the full endpoint.

The Castle Multi-Rotor series is compatible with the standard servo PWM protocol, OneShot, and OneShot125. The controller will automatically detect which protocol the flight control is using, and then internally latch this setting until the next reset. Please see the applicable technical datasheet for detailed communication specifications.

*\*Voltage cutoff is DISABLED by default on the Multi-Rotor ESCs. You must enable the cutoff voltage setting or use an external source to monitor battery voltage to avoid damage to your batteries. If the ESC is in Auto-LiPo mode and does not count the correct number of cells, as indicated by the beeps on power-up, then your cutoff voltage will NOT work. Ensure your battery is fully charged. If the problem persists please contact technical support.*

## 6 PROGRAMMABLE FEATURES

The Castle Multi-Rotor series offers a variety of programmable settings which can be changed by connecting the ESC to a Windows PC via the Castle Link USB adapter. Users can configure ESC settings, save and load settings profiles, and upgrade ESC firmware by simply connecting the Castle Link USB adapter to the receiver wire of an ESC.

### DIRECTION

The Motor Direction setting allows you to reverse the direction of rotation on your motor. The actual direction will be determined by the motor and how the wires are connected.

### ENDPOINTS

The user may configure the ESC's throttle endpoints. These endpoints represent the boundaries of the ESC's input throttle measured in microseconds. If using OneShot125, simply enter the desired pulse width multiplied by 8. The values entered here should closely match those in the flight controller's configurator.

### POWER-ON BEEP

When this setting is enabled and the throttle is at idle, the ESC will beep every twenty seconds to alert the user that power is still connected.

### VOLTAGE CUTOFF TYPE

When enabled, this setting adjusts how the ESC responds when the input voltage drops below the cutoff voltage.

### CUTOFF VOLTAGE

The ESC will enter Low-Voltage Cutoff when the input voltage drops below this value.

### AUTO-LIPO VOLTS/CELL

This setting adjusts the per-cell cutoff voltage when using Auto-LiPo cutoff. The ESC will enter Low-Voltage Cutoff when the average cell voltage drops below this value.

### SPOOL UP SPEED

When enabled, the ESC will smoothly increase power after startup at the selected rate until the applied power matches the throttle signal. After the motor has spooled up, the ESC will respond normally until the throttle returns to idle. The value displayed in Castle Link represents the time required to accelerate to 25% power.

### MOTOR START POWER

This setting adjusts the power applied to the motor during startup.

### ACTIVE BRAKING

When enabled, the ESC will apply regenerative braking to the motor when throttle is reduced. This will cause the motor speed to respond more quickly to decreases in throttle and may affect system efficiency.

### IDLE BRAKE

This setting adjusts the regenerative braking force applied when the throttle is at idle or disconnected.

## 7 OPERATIONAL TONES AND ERROR CODES

In the event of a pullback or shutdown the ESC will produce an error code for trouble shooting. The ESC uses the motor to produce beep codes. The red LED will also blink out the error codes. Refer to the table below for error code meanings. A dot (•) stands for a short beep and a dash (–) stands for a long beep.

Tone	Meaning	Description
•	ESC ready to run motor	ESC beeps motor every 20 seconds to remind user that power is connected to the ESC. This notice may be disabled in Castle Link.
••	Start Fail	ESC was unable to start the motor.
•-	Low Voltage Cutoff	Main battery voltage dropped below the cutoff value (disabled by default).
•••	Propeller Strike/ Motor Anomaly/ Motor Desync Detected	ESC detected a sudden mechanical interruption of the motor's rotation.
••-	Radio Glitch	ESC detected unusual signals or loss of signal on receiver lead.
•-•	Over-Temperature	ESC reached an over-temperature condition when operated under too high a load, operated without proper cooling airflow.

## 8 CONTACT AND WARRANTY INFO

Castle Creations is proud to stand by its products with a world-class technical support department and a one-year warranty on all Multi-Rotor ESCs.

### 8.1 TECHNICAL SUPPORT

You may contact our technical support department via e-mail anytime or by phone. Please visit Castle Creations website for technical support hours.

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

E-mail: [support@castlecreations.com](mailto:support@castlecreations.com)

Phone: (913) 390-6939, option #1.

### 8.2 WARRANTY

All Castle Creations ESCs are warranted for one (1) year\* from date of purchase to be free from manufacturing and component defects. This warranty does not cover damages caused to the controller from abuse. Abuse includes, but is not limited to: exceeding specifications listed in this document, incorrect wiring, over-voltage, overloading, improper motor and/or propeller selection, incorrect controller settings, insufficient batteries, or inadequate connectors.

\*Customer may have additional warranty rights under the laws of certain nations or states.

### 8.3 NON-WARRANTY REPAIRS

Never throw away a damaged Castle product! You may send it to Castle and take advantage of our flat price replacement offer. Please check our website for specific pricing.

If you have any questions, comments, or wish to return your Castle Multi-Rotor ESC for warranty or non-warranty repair or replacement, please visit [www.castlecreations.com/support](http://www.castlecreations.com/support) before contacting us directly.