RAPTOR
390
BLHeli

⚠ **ATTENTION** Thank you for purchasing our brushless electronic speed controller (ESC) . Any Improper operation may cause personal injury damage to the product and related equipments. This high power system for RC model can be dangerous ,we strongly recommend reading the user manual carefully and completely. We will not assume any responsibility for any losses caused by unauthorized modifications to our product. We have the right to change the design, appearance, performance and usage requirements of the product without notice.

01 Main features

- Using C8051F390 MCU ,pipelined 8-bit C8051 core with 50 MHz maximum operating frequency.
- Maximum support to 6S LiPos,small size&lighter in weight.
- ESC maximum speed is limited to 400k eRPM.
- Use BLHeli open-source firmware, can update the firmware or write setup via signal cable; Using "Damped light" mode , it improves the throttle response, when reducing the throttle amount, the Motors slow down rapidly. It strengthens the stability and flexibility of multi-rotors, quite suitable for QAVs.
- There are tuneable parameters that can make the code run well even in the most demanding situations, although default settings will work excellently in normal operating environments.
- Supports regular 1-2ms pulse width input, as well as Oneshot125 (125-250us), Oneshot42 (41.7-83.3us) and Multshot (5-25us). The input signal is automatically detected by the ESC upon power up.
- The twisted-pair of the throttle signal cable effectively reduces the crosstalk caused by signal transmission, and makes flight more stable.
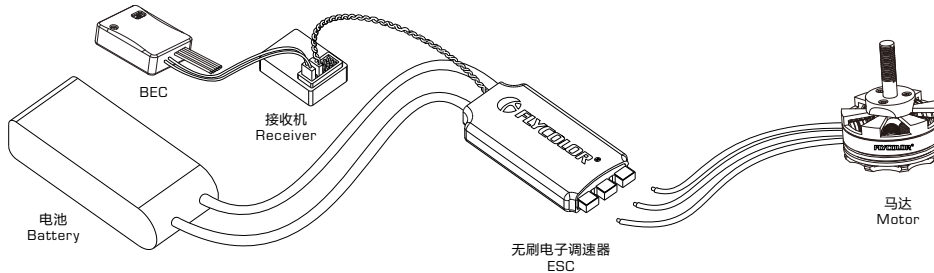
02 Specifications

Model	Manufacture Model	Con. Current	Burst Current(10S)	BEC	LiPo cells	Weight	Size (Excluding heat shrink)
Raptor 390-35A 6S	W-FW035006-B	35A	45A	No	3-6S	9g	33x15x6mm

03 Wiring diagram

*Please ensure all solder joints are insulated with heat shrink where necessary.

BEC

接收机 Receiver

电池 Battery

无刷电子调速器 ESC

马达 Motor

*All pictures are for reference only

04 Programming parameter

Programming parameters below in table that can be accessed from the remote control or configuration software (BLHeliSuite):

Function	1	2	3	4	5	6	7	8	9	10	11	12	13
1 - Closed loop P gain	0.13	0.17	0.25	0.38	0.50	0.75	1.00	1.5	2.0	3.0	4.0	6.0	8.0
2 - Closed loop I gain	0.13	0.17	0.25	0.38	0.50	0.75	1.00	1.5	2.0	3.0	4.0	6.0	8.0
3 - Closed loop mode	HiRange	MidRange	LoRange	Off	/	/	/	/	/	/	/	/	/
4 - Multi gain	0.75	0.88	1.00	1.12	1.25	/	/	/	/	/	/	/	/
5 - Startup power**	0.031	0.047	0.063	0.094	0.125	0.188	0.25	0.38	0.50	0.75	1.00	1.25	1.50
6 - Commutation timing	Low	MediumLow	Medium	MediumHigh	High	/	/	/	/	/	/	/	/
7 - Pwm frequency	High	Low	*DampedLight	/	/	/	/	/	/	/	/	/	/
8 - Pwm dither***	Off	3	7	15	31	/	/	/	/	/	/	/	/
9 - Demag compensation	Off	Low	High	/	/	/	/	/	/	/	/	/	/
10 - Rotation direction	Normal	Reversed	Bidirectional	/	/	/	/	/	/	/	/	/	/
11 - Input pwm polarity	Positive	Negative	/	/	/	/	/	/	/	/	/	/	/

Default values are marked in dark gray.
*:Only enabled for some ESCs. From code rev 14.4, damped light is default on the ESCs that support it. For prior code revisions, high is default.
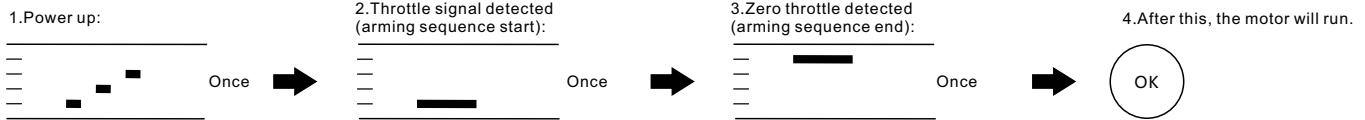**: Default startup power varies by ESC. Generally the default power is lower for larger ESCs.
***:For code revs 14.4 and before, dither range was 7/15/31/63.

1. Closed loop P gain sets the proportional gain for the rpm control loop. This setting controls the gain from speed error to motor power.
2. Closed loop I gain sets the integral gain for the rpm control loop. This setting controls the gain from integrated speed error (summed over time) to motor power.
3. Closed loop mode sets the range of speeds that the control loop can operate on.
   - For the high range, throttle values from 0% to 100% linearly correspond to rpm targets from 0 to 200000 electrical rpm
   - For the middle range, throttle values from 0% to 100% linearly correspond to rpm targets from 0 to 100000 electrical rpm
   - For the low range, throttle values from 0% to 100% linearly correspond to rpm targets from 0 to 50000 electrical rpm
   - When closed loop mode is set to off, the control loop is disabled.
4. Multi gain scales the power applied to the motor for a given input. Note that this is only for PWM input, for PPM input it has no effect. Beware that a low multi gain will also limit the maximum power to the motor.
5. Startup is always done with the direct startup method, which runs the motor using back emf detection from the very start. In this mode power is given by the throttle used, but limited to a maximum level. This maximum level can be controlled with the startup power parameter. Beware that setting startup power too high can cause excessive loading on ESC or motor!
6. Commutation timing can be adjusted in three steps. Low is about 0°, mediumlow 8°, medium 15°, mediumhigh 23° and high 30°. Typically a medium setting will work fine, but if the motor stutters it can be beneficial to change timing.
7. Pwm frequency:
   -High: High pwm frequency is around 20kHz.
   -Low: Low pwm frequency is around 8kHz.
   -Damped light : This mode adds loss to the motor for faster retardation. Damped light mode always uses high pwm frequency. This mode is only supported on some ESCs (where fet switching is sufficiently fast).
8. Pwm dither is a parameter that adds some variation to the motor pwm off cycle length. This can reduce problems (like throttle steps or vibration) in rpm regions where the pwm frequency is equal to harmonics of the motor commutation frequency, and it can reduce the step to full throttle. It is primarily beneficial when running damped light mode. Dither is not applied in closed loop mode.
9. Demag compensation is a feature to protect from motor stalls caused by long winding demagnetization time after commutation. The typical symptom is motor stop or stutter upon quick throttle increase, particularly when running at a low rpm. As described earlier, setting high commutation timing normally helps, but at the cost of efficiency.
   Generally, a higher value of the compensation parameter gives better protection. If demag compensation is set too high, maximum power can be somewhat reduced.
10. The rotation direction setting can be used to reverse motor rotation.
11. The input pwm polarity setting can be used to inverse the throttle behaviour. This is intended to be used with receivers that provide negative pwm. When using PPM input it must be set to positive.
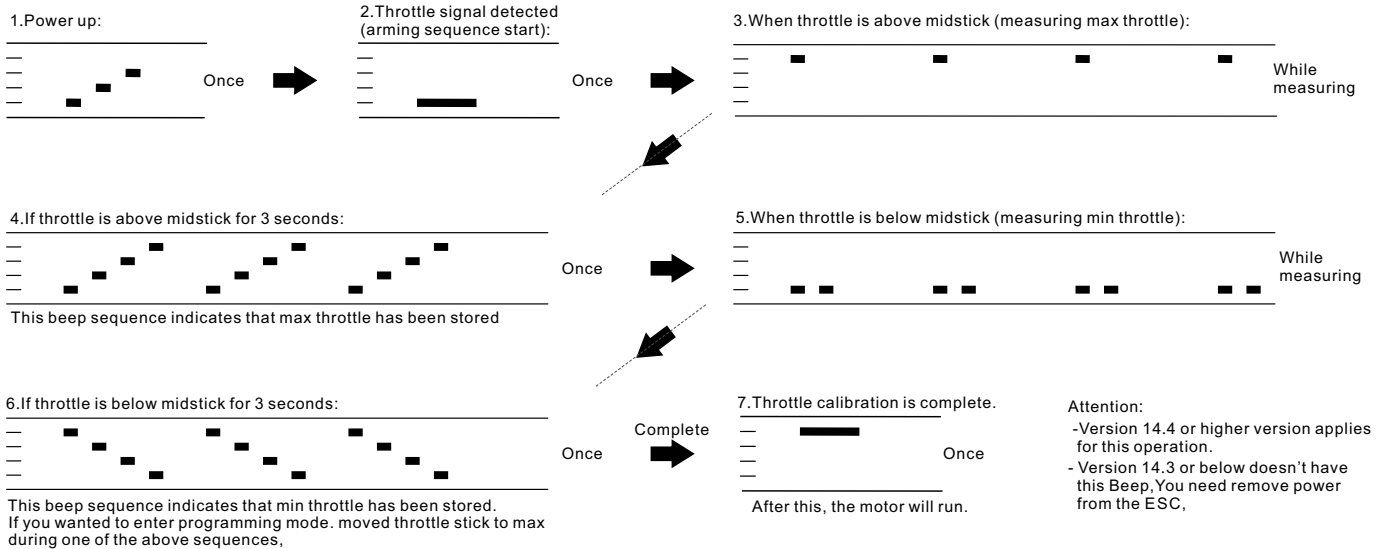
Programming parameters that can only be accessed from configuration software (BLHeliSuite):
- Throttle minimum and maximum values for PPM input (will also be changed by doing a throttle calibration).
- Throttle center value for bidirectional operation with PPM.
- Beep strength, beacon strength and beacon delay.
- Programming by TX. If disabled, the TX can not be used to change parameter values (default is enabled).
- Thermal protection can be enabled or disabled (default is enabled).
  Temperature is above 140℃, motor power is limited to 75%;Above 145℃, motor power is limited to 50%;Above 150℃, motor power is limited to 25%.Above 155℃, motor power is limited to 0%.
- PWM input can be enabled or disabled (default is disabled). If disabled, only 1-2ms PPM and 125-250us OneShot125 are accepted as valid input signals.
- Power limiting for low RPMs can be enabled or disabled (default is enabled). Disabling it can be necessary in order to achieve full power on some low kV motors running on a low supply voltage. However, disabling it increases the risk of toasting motor or ESC.
- Brake on stop can be enabled or disabled (from rev14.5 ,default is disabled),When enabled, brake will be applied when throttle is zero. For nonzero throttle, this setting has no effect.
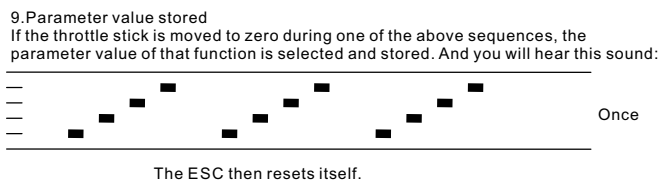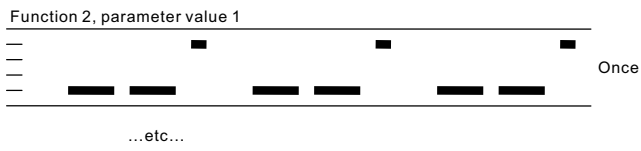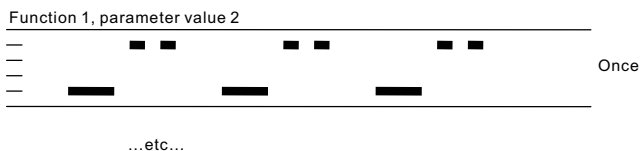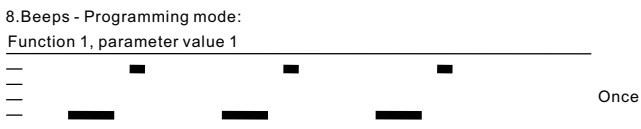
05 Beeps-Normal operation

1.Power up:

Once ➡

2.Throttle signal detected (arming sequence start):

Once ➡

3.Zero throttle detected (arming sequence end):

Once ➡

4.After this, the motor will run.

(OK)

06 Beeps - Throttle calibration

1.Power up:

Once ➡

2.Throttle signal detected (arming sequence start):

Once ➡

3.When throttle is above midstick (measuring max throttle):

While measuring

4.If throttle is above midstick for 3 seconds:

Once ➡

This beep sequence indicates that max throttle has been stored

5.When throttle is below midstick (measuring min throttle):

While measuring

6.If throttle is below midstick for 3 seconds:

Once ➡ Complete

This beep sequence indicates that min throttle has been stored.
If you wanted to enter programming mode. moved throttle stick to max during one of the above sequences,

7.Throttle calibration is complete.

Once

After this, the motor will run.

Attention:
- Version 14.4 or higher version applies for this operation.
- Version 14.3 or below doesn't have this Beep, You need remove power from the ESC,

Programming mode ⬇

7.Full throttle detected:

Once

This beep sequence indicates that programming mode is entered

⬇

8.Beeps - Programming mode:

Function 1, parameter value 1

Once

Function 1, parameter value 2

Once

…etc…

Function 2, parameter value 1

Once

…etc…

9.Parameter value stored
If the throttle stick is moved to zero during one of the above sequences, the parameter value of that function is selected and stored. And you will hear this sound:

Once

The ESC then resets itself.

Example :

Highest tone ⬇ Lowest tone

■ Short beep

▬ Long beep

⚠ CAUTIONS

- If the throttle stick is moved below max (but not to zero), the current parameter will be skipped, and programming will proceed to the next parameter. This way it is possible to access the later parameters without going through all the beeps. It is generally a good idea to go to full throttle again before selecting a parameter, to make sure you have selected the right parameter.
- If the throttle stick is never moved to zero, the ESC will load the defaults and then reset itself after the last parameter value of the last function.
  This is a convenient way of setting all parameters to defaults.
- If power is disconnected during the programming sequence, then no changes are done to the programmed values.
- If you use BLHeliSuite to programming parameters , it will be more convenient

- User need to calibrate the throttle range when starting to use a new ESC or another transmitter.
- When some abnormality occurs in ESC driving the motor or need the motor to reach a higher RPM, user can try to change the timing.
- User also can update the firmware or change the setup via signal cable. Flycolor Programming Adaptor is recommend.
- Please contact Flycolor sales or technical support for more information.

User Manual
Multi-Rotor Brushless ESC

FLYCOLOR ®

www.flycolor.net