

01 Introduction



Thank you for purchasing this HOBBYWING product! Brushless power systems can be very dangerous. Any improper use may cause personal injury and damage to the product and related devices. We strongly recommend reading through this user manual before use. Because we have no control over the use, installation, or maintenance of this product, no liability may be assumed for any damage or losses resulting from the use of the product. We do not assume responsibility for any losses caused by unauthorized modifications to our product.



02 Warnings

- Read through the manuals of all power devices and aircraft and ensure the power configuration is rational before using this unit, as incorrect configuration may cause the ESC to overload and be damaged.
- Ensure all wires and connections must be well insulated before connecting the ESC to related devices, as short circuit will damage your ESC. And ensure all devices are well connected, (please use a soldering iron with enough power to solder all input/output wires and connectors if necessary,) as poor connection may cause your aircraft to lose control or other unpredictable issues such as damage to the device.
- Do not use this unit in the extremely hot weather or continue to use it when it gets really hot (around 105°C/221°F). Because high temperature will cause the ESC to work abnormally or even damage it.
- Users must always disconnect the batteries after use as the current on the ESC is consuming continuously if it's connected to the batteries (even if the ESC is turned off). The battery will completely be discharged and may result in damage to the battery or ESC when it is connected for a long period of time. This will not be covered under warranty.

03 Features

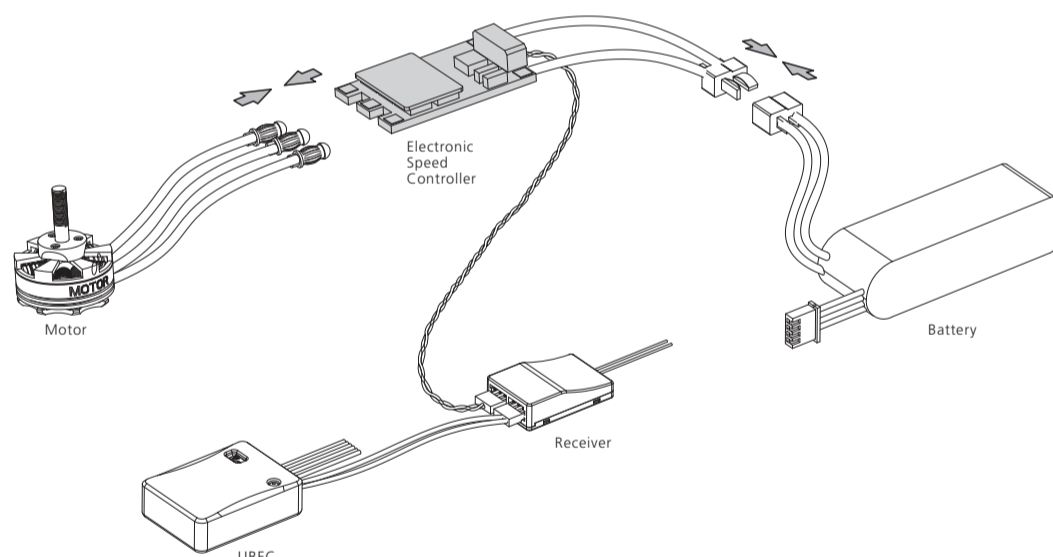
- F396 chip for great performance , 48MHz .
- BLHeli open-source program implemented in the ESC supports all BLHeli functions like ESC programming and firmware upgrade via the throttle control signal cable.
- Small size combined with light weight for easy installation.
- Compatible with "Regular" signal-receiving mode and "OneShot" signal-receiving mode (that is the ESC can receive fixed throttle signals range from 125µs~250µs).
- The twisted-pair design of the throttle signal cable effectively reduces the crosstalk produced in signal transmission and makes flight more stable.
- Compatible with various flight-controllers and supports a signal frequency of up to 500Hz in "Regular" signal-receiving mode.

04 Specifications

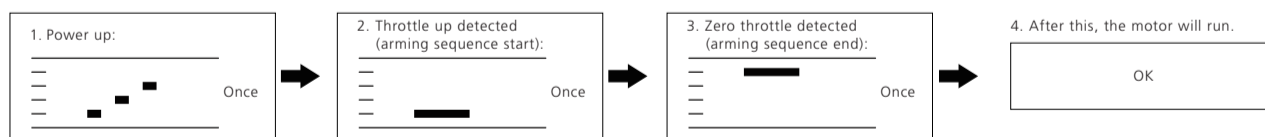
Model	Cont. Current	Peak Current (10sec)	BEC	LiPo	Weight	Size
XRotor micro 20A BLHeli	20A	30A	No	2-4S	6.8g	24.0 x 13.9 x 5.5 mm
XRotor micro 30A BLHeli	30A	40A	No	2-4S	6.8g	24.0 x 13.9 x 5.5 mm
XRotor micro 35A BLHeli	35A	50A	No	3-6S	9.5g	36.5 x 16.7 x 5.5 mm

05 User Guide

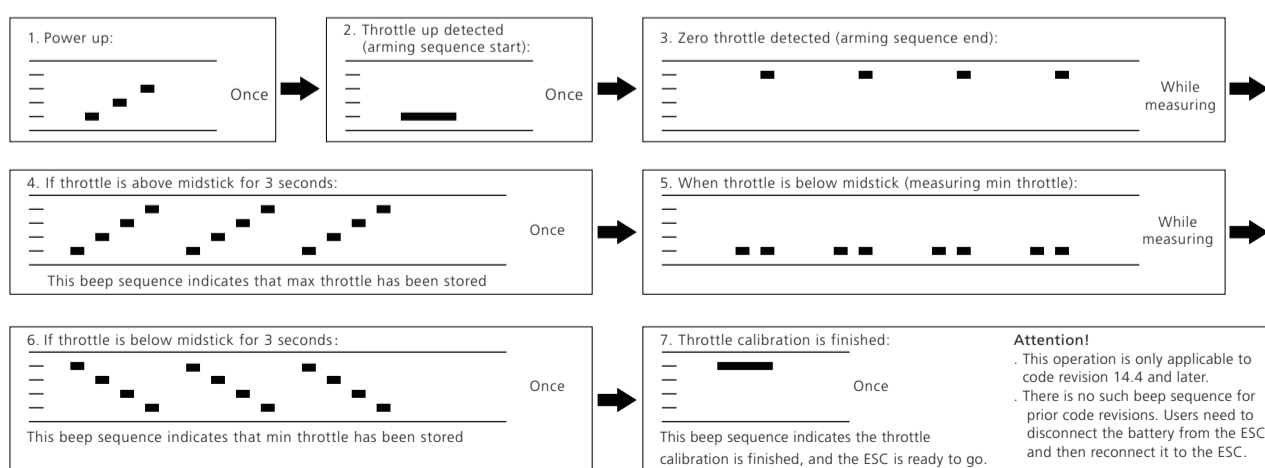
1 Motor Wiring



2 Normal Start-up Process



3 Throttle Range Calibration



This is an extremely powerful brushless motor system. We strongly recommend removing your propellers for your own safety and the safety of those around you before performing calibration and programming functions with this system.

4 ESC Programming

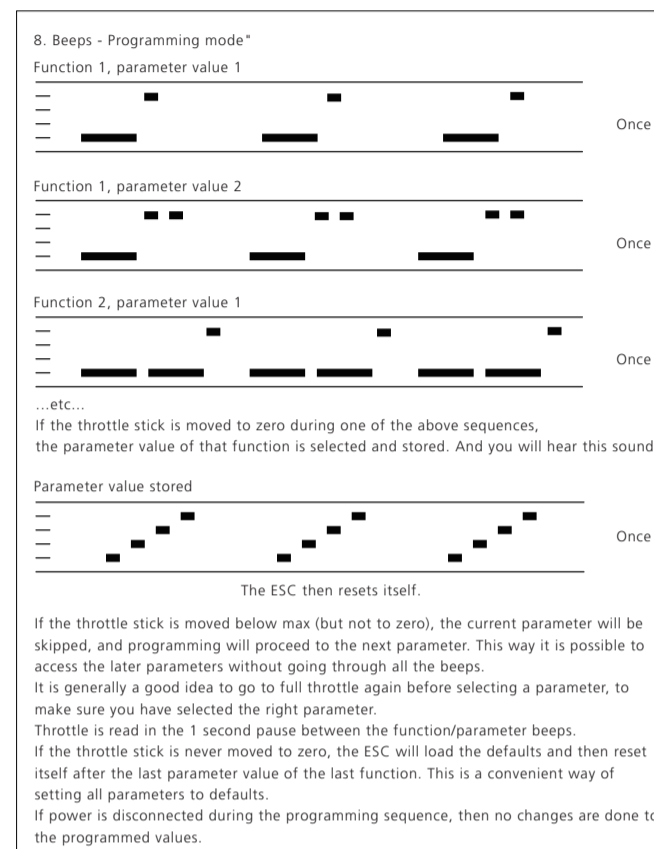
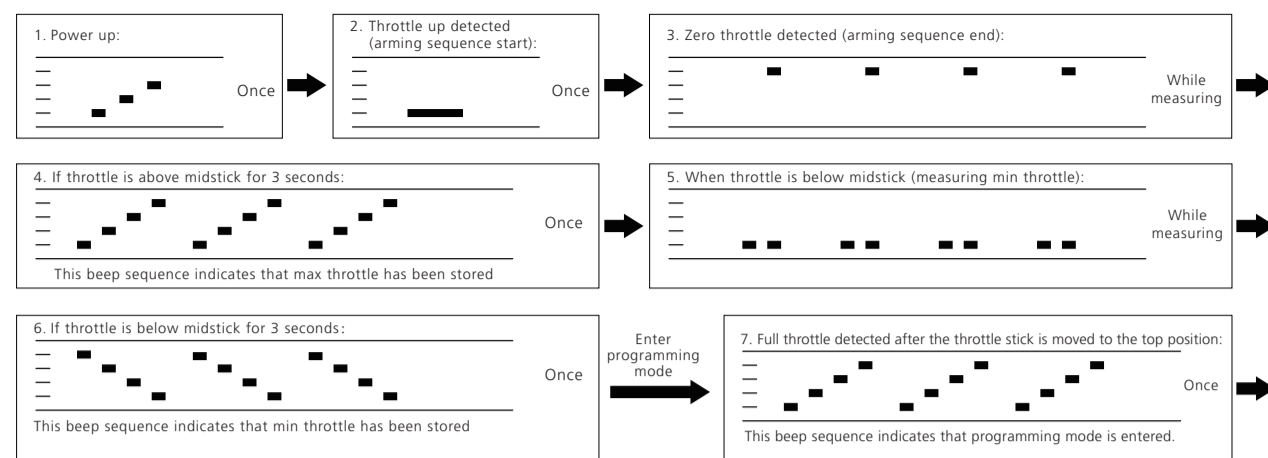
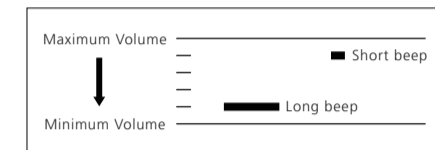


Illustration:



It will be more convenient if users adjust parameters via BLHeli Suite (configuration software).

06 Programmable Items

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	7	15	31	63								
9 Demag compensation	Off	Low	High										
10 Rotation direction	Normal	Reversed	Bidirectional										
11 Input pwm polarity	Positive	Negative											

(Those "gray background and black text" options are the factory default settings.)

*: 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.

If for some reason there is an error in the eeprom/flash write operation (e.g. due to loss of power or low voltage), defaults will be loaded.

- Closed Loop P Gain:** it sets the proportional gain for the rpm control loop. This setting controls the gain from speed error to motor power.
- Closed Loop I Gain:** it sets the integral gain for the rpm control loop. This setting controls the gain from integrated speed error (summed over time) to motor power.
- Closed Loop Mode:** it 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.
- Multi Gain:** it 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.
- Startup Power:** it 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 parameters. Beware that setting startup power too high can cause excessive loading on ESC or motor.
- Commutation Timing:** it can be adjusted in five 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 the timing.
- PWM Frequency** High pwm frequency is around 20kHz, and low pwm frequency is around 8kHz. Pwm damped light mode: it adds loss to the motor for faster retardation and it always uses high pwm frequency. It is only supported on some ESCs where fet switching is sufficiently fast.
- PWM Dither:** it's 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.
- Demag Compensation:** it's a feature to protect from motor stalls caused by long winding demagnetization time after commutation. The typical symptom is motor stop or stutter up 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.
- Rotation Direction:** it can be used to reverse motor rotation.
- Input PWM Polarity:** it can be used to invert the throttle behavior and it's intended to be used with receivers that provide negative pwm (at least some Walkeras do). 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).
- (The motor power will be reduced to 75% when its temperature exceeds 140°C; the power will be reduced to 50% when the temperature is above 145°C; the power will be reduced to 25% when the temperature goes above 150°C; and the power will be reduced to 0% if the temperature exceeds 155°C.)
- PWM input can be enabled and disabled (default is disabled). If disabled, only 1-2ms PPM and 125-250µs OneShot125 are accepted as valid input signals. Set to disabled if using OneShot125 with looptimes below 1100.
- 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.

07 Others

BLHeli official website: <https://github.com/bitdump/BLHeli>

BLHeliSuit download: <https://www.mediafire.com/folder/dx6kfaasyo24i/BLHeliSuite>

This BLHeli ESC Firmware: XRotor 20A (Multi) BLHeli Rev: 14.4