# User Manual
# Multi-Rotor Brushless ESC

¸Swift ¢±ï¿½±¢ °ηk¸

**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.**

## 01 Main features

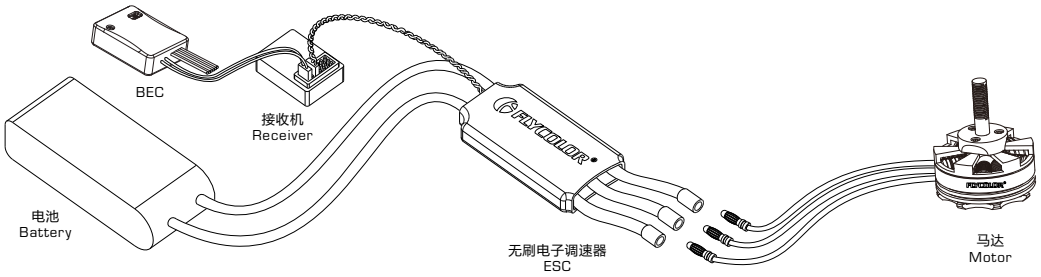
- High performance MCU.
- Mini size, lighter in weight.
- Optimized firmware is specialized for disc motor,excellent compatibility.
- The firmware is specialized for multi-rotor , fast throttle response during flying.
- Strong self-adaptable firmware, 8 timing options.
- Support frequency of throttle signal to 500Hz max , compatible with various kinds of flight control. ( ≥500Hz throttle signal is nonstandard signal )

## 02 Specification

| Model | Con. Current | Burst Current (10S) | BEC | LiPo cells | Weight | Size (Excluding Plugs) | Typical Applications (For reference) |
|---|---|---|---|---|---|---|---|
| Swift -6A | 6A | 8A | 5V/1A | 2-4S | 6.7g | 28x13x5mm | 200-250 Multi-Rotor |
| Swift -10A | 10A | 15A | 5V/1A | 2-4S | 8.6g | 28x15x6mm | 200-280 Multi-Rotor |
| Swift -12A | 12A | 18A | 5V/1A | 2-4S | 9.5g | 28x15x6mm | 200-330 Multi-Rotor |
| Swift -15A | 15A | 20A | 5V/1A | 2-4S | 9.5g | 28x15x6mm | 250-450 Multi-Rotor |
| Swift -20A | 20A | 30A | 5V/1A | 2-4S | 10g | 28x15x6mm | 330-550 Multi-Rotor |
| Swift -30A | 30A | 40A | 5V/1A | 2-4S | 11g | 28x15x6mm | 330-650 Multi-Rotor |
| Swift -40A | 40A | 50A | No | 2-6S | 15g | 40x21x7mm | 450-850 Multi-Rotor |
| Swift -50A | 50A | 60A | No | 2-6S | 16g | 40x21x7mm | 650-1000 Multi-Rotor |

## 03 Wiring diagram

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




*All pictures are for reference only

## 04 Programming parameter value

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

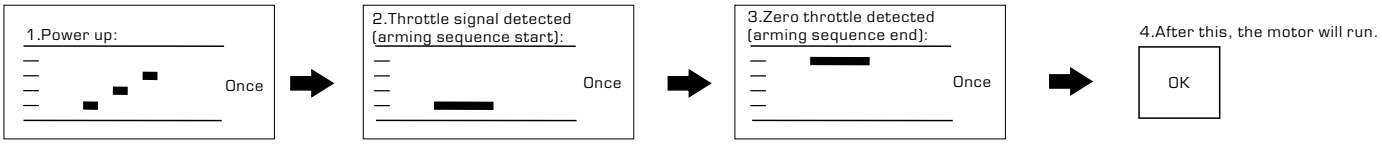
| Function | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 - Closed loop P gain | 0.13 | 0.17 | 0.25 | 0.38 | 0.50 | 0.75 | 1.00 | 1.5 | 2.0 | 3.0 | 4.0 | 6.0 | 8.0 |
| 2 - Closed loop I gain | 0.13 | 0.17 | 0.25 | 0.38 | 0.50 | 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 | 7 | 15 | 31 | 63 | / | / | / | / | / | / | / | / |
| 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

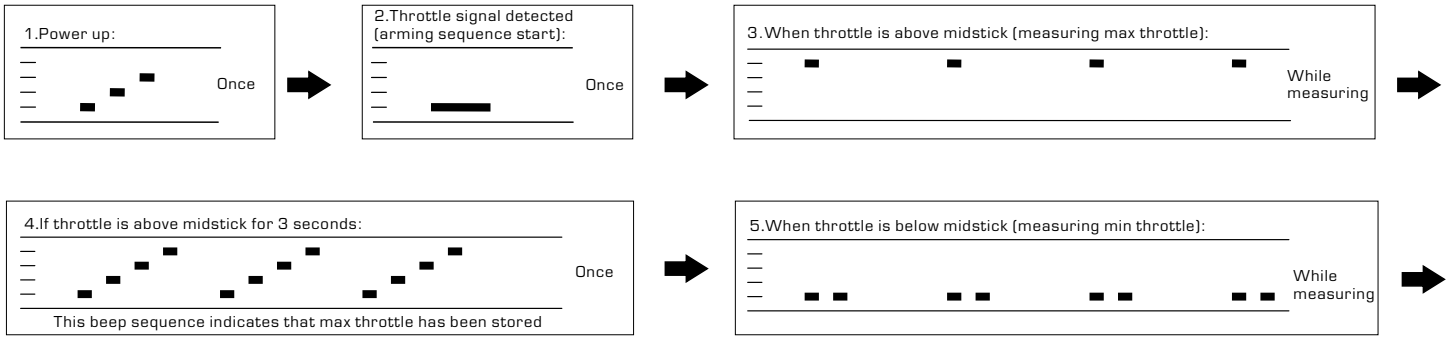
1. Closed loop P gain sets the proportional gain for the rpm control loop. This setting controls the gain from speed error to motor power.
2. Closed loop I gain sets the integral gain for the rpm control loop. This setting controls the gain from integrated speed error (summed over time) to motor power.
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 00, mediumlow 80, medium 150, mediumhigh 230 and high 300. 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.

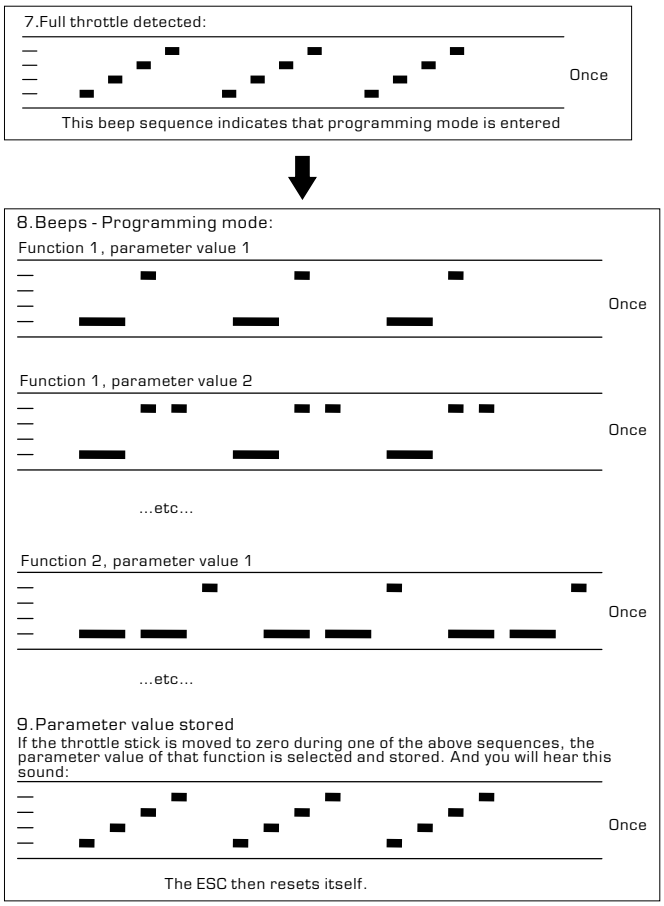
## 05 Beeps-Normal operation

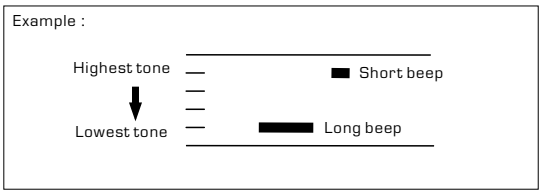



## 06 Beeps - Throttle calibration and entering programming mode




Programming mode





- 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

## 07 Attention

- After the ESC connected to the flight system, it will automatically detect the input throttle signals every time it powered on, and then execute the corresponding signal-receiving mode.
- User need to calibrate the throttle range when starting to use a new ESC or another transmitter.
- BLHeli open-source firmware, 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.
- Please contact Flycolor sales or technical support for more information.