



感谢您购买本产品！本产品功率强大，错误的使用可能导致人身伤害和设备损坏，强烈建议您在设备使用前仔细阅读本说明书并保存，严格遵守规定的操作程序。我们不承担因使用本产品或擅自对产品进行改造所引起的任何责任，包括但不限于对附带损失或间接损失的赔偿责任。我们有权在不通知的情况下变更产品的设计、外观、性能及使用要求。

01 主要特性

- 采用功能强大EFM8BB21F16G MCU，8位C8051核心，工作频率高达50MHz；
- 专用三合一驱动IC，反应速度更快。电调最高支持50万转速。
- 超小尺寸，更适合小型多旋翼。
- BLHeli-S固件，专为多旋翼提升优越的性能，硬件产生的电机PWM可提升平滑的油门响应和降低噪音。
- Damped light 会产生再生制动，使得效率更高，油门从大到小变化时电机减速响应更加迅速，多旋翼稳定性和灵活性得到显著加强。
- 多种参数可设置，使得电调能够在最暴力的配置下运行，即使默认设置也能在正常配置下出色的运行。
- 电调上电自动检测油门信号，支持普通PWM油门模式1-2ms的脉宽输入、Oneshot和Multishot。
- 支持Dshot150、Dshot300和Dshot600。Dshot为数字信号，抗干扰能力强，而且电调不需要校准油门行程。
- 信号线为双绞硅胶线，增加其使用寿命同时更有效降低信号在铜线内传输所产生的干扰，使飞行更稳定。

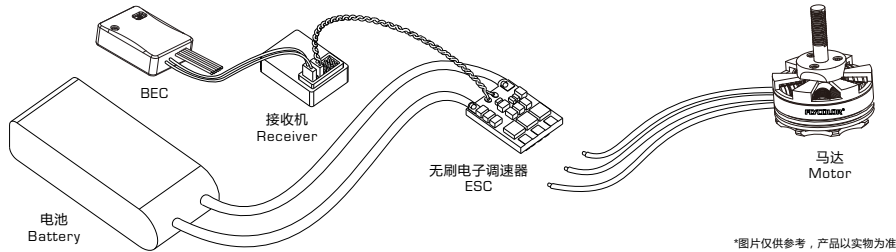
02 产品规格

型号	持续电流	瞬时电流(10S)	BEC	锂电池节数	重量(供参考)	尺寸(供参考)	典型应用(供参考)
Raptor BLS-Mini-15A	15A	20A	No	2-3S	5g	15x11.5x4.2mm	90-150 多旋翼

*Raptor BLS-Mini使用的BLHeli-S固件为**G-H-30**；请联系Flycolor以获取更多信息。

03 连线示意图

*为避免短路和漏电，请确保连接处绝缘良好

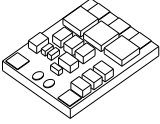


*图片仅供参考，产品以实物为准

04 编程参数值

以下的参数需要通过BLHeliSuite编程

- 1. 启动功率 (Startup power) :**
启动功率可以设置为0.031到1.5的一个值。它是启动过程中允许的最大功率，实际应用的功率取决于油门的输入值。启动功率也会影响双向操作，因为启动功率也是用来限制在反向时一个施加的功率。对于低转速电机，最大功率是有限的，为了便于低反电动势的电压检测，允许的最大功率可以通过启动功率这个参数来设置。
- 2. 进角 (Commutation timing) :**
进角可设置为低/中低/中/中高/高，分别对应0°/7.5°/15°/22.5°/30°进角。通常设置中进角即适用于大部分电机，但如果电机运转不顺畅时，可以尝试改变进角。对于一些高感电机，其换向退磁时间较长，尤其在低速运转的时候，电机会在油门快速增加的情况下停转或者不顺畅。将进角改高点会有助于改善这个现象，因为高进角允许更长的换向退磁时间。
- 3. Demag补偿 (Demag compensation) :**
Demag补偿是防止电机由于换向引起停转的一个功能，典型的现象是在快速增加油门时电机停转或不顺畅，尤其在低转速运行时。如前面所述，设置高进角可以帮助改善，但有可能降低效率。一般情况下，Demag补偿参数的值越高，保护越好。如果补偿值设置得太高，最大功率将有所降低。
- 4. 转向 (Rotation direction) :**
电机转向可以设置为正转/反转/双向。在双向模式下，油门中点为零点，中点以上为正转，中点以下为反转；当选择双向操作时，油门编程被禁用。
- 5. 鸣叫声强度 (Beep strength) :**
设置正常运行下鸣叫声强度。
- 6. 警报音强度 (Beacon strength) :**
设置警报音响起时的强度。如果油门信号在零点位置的时间超过一个设定的时间，电调将开始报警。请注意如果设置一个高的警报强度将会导致电机或电调发热。
- 7. 警报音延迟 (Beacon delay) :**
设置报警音开始之前的延时。



8. 油门编程 (Programming by TX) :

如果禁用，油门行程校准将被禁用

注意：BLHeli-S 只能用遥控器油门进行油门行程校准，不能使用油门来编程。

9. 最小油门，最大油门和中心油门 (Min throttle, max throttle and center throttle) :

设置电调的油门范围；中点油门只用于双向操作；设置值正常的为1000us到2000us的输入信号，对于其他输入信号，该值必须按比例设置。

10. 温度保护 (Thermal protection) :

可以启用或禁用。温度保护阈值可以设置为80°C-140°C（从16.3版本开始），当温度高于阈值时，电机功率降低到75%；当温度高于阈值5°C，电机功率降低到50%；当温度高于阈值10°C时，电机功率降低到25%；当温度高于阈值15°C时，电机功率降低到0%。

11. 低转速功率保护 (Low RPM power protect) :

低转速功率限制可以启用或禁用。

禁用它可以保证低KV电机在低电压运行时实现全功率。然而禁用它将增加同步丢失的风险，伴随着电机或ESC发热的可能性。

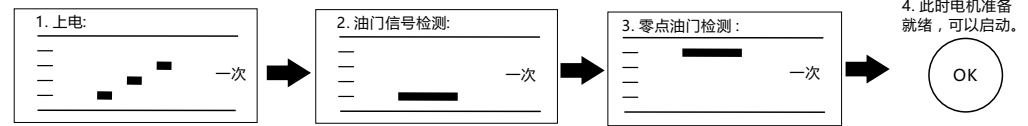
12. 停车制动 (Brake on stop) :

可以启用或禁用。当设置启用时，在通电状态，油门在零点位置电机将会有拖刹，阻止电机转动。如果油门没有零点，此项设置无效。

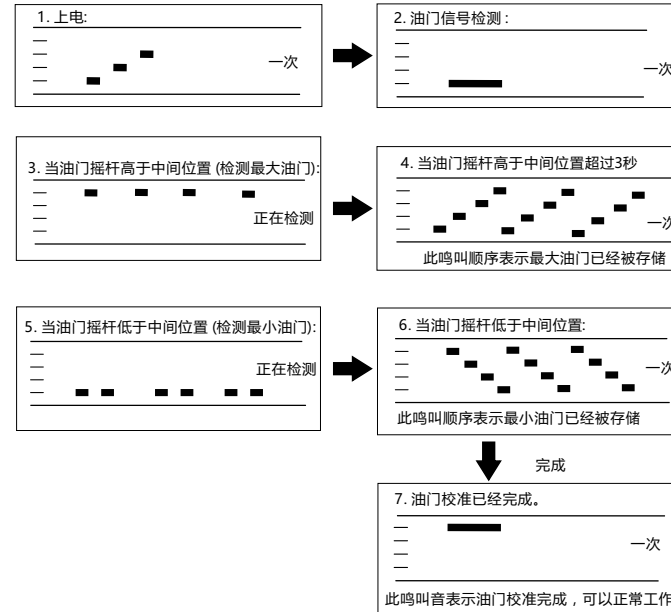
13. LED控制 (LED control) :

对于支持的ESC，可以控制发光二极管。多达4个LED可以打开或关闭。

05 正常工作及提示音

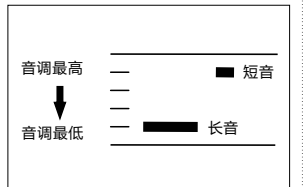


06 油门校准



1. 使用飞控调参软件校准油门将更简便；
2. 当输入信号为Dshot模式时，将不再需要校准油门，请忽略此步骤。

图示举例：



07 注意事项

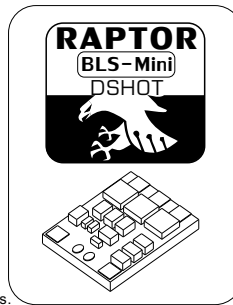
- 电调接入飞行系统后，每次上电会自动检测输入的油门信号，然后执行相应的油门模式；
- 首次使用无刷电调或更换遥控设备后需要进行油门行程校准；Dshot模式时，将不再需要校准油门；
- 使用BLHeli-S开源程序，当电机出现异常或者要求达到更高转速时，可尝试更改进角参数；
- 如需更多信息，请联系飞盈佳乐售后或者技术支持。



Thank you for using our product. 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

- EFM8BB21F16G MCU, pipelined 8-bit C8051 core with 50 MHz maximum operating frequency.
- Dedicated 3in1 driver, faster response. ESC maximum speed is limited to 500k eRPM.
- Ultra small size, more suitable for small multirotor.
- BLHeli-S firmware is designed for superior performance in multirotors, and uses hardware generated motor pwm for smooth throttle response and silent operation.
- Damped light does regenerative braking, causing very fast motor retardation, and inherently also does active freewheeling.
- Supports features to prevent sync loss. 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.
- The code supports regular 1-2ms pulse width PWM input, as well as Oneshot and Multshot. The input signal is automatically detected by the ESC upon power up.
- Supports Dshot150, Dshot300 and Dshot600. Dshot is digital signal, anti-interference ability is stronger, and do not need throttle calibration.
- The silicone twisted-pair of the throttle signal cable increase the service life, and effectively reduces the crosstalk caused by signal transmission, and makes flight more stable.



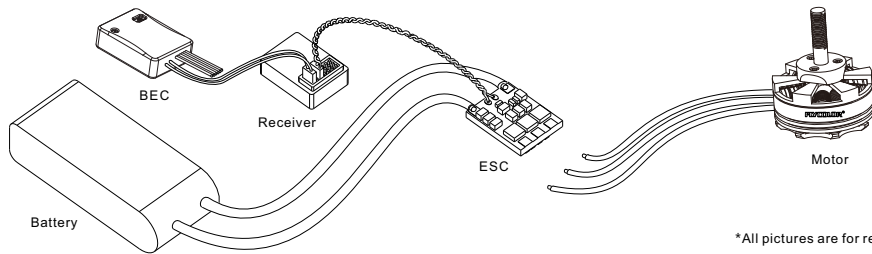
02 Specifications

Model	Con. Current	Burst Current (10S)	BEC	LiPo cells	Weight (For reference)	Size (For reference)	Typical Applications (For reference)
Raptor BLS-Mini-15A	15A	20A	No	2-3S	5g	15x11.5x4.2mm	90-150 Multi

*Raptor BLS-Mini is using the **G-H-30** BLHeli-S firmware; Please contact Flycolor for more information.

03 Wiring diagram

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



*All pictures are for reference only

04 Programming parameter

Programming parameters below can be accessed from the configuration software (BLHeliSuite):

- 1. Startup power:**
Startup power can be set to relative values from 0.031 to 1.5. This is the maximum power that is allowed during startup. Actual applied power depends on throttle input, and can be lower, but the minimum level is a quarter of the maximum level. Startup power also affects bidirectional operation, as the parameter is used to limit the power applied during direction reversal. For low rpms, the maximum power to the motor is limited, in order to facilitate detection of low BEMF voltages. The maximum power allowed can be set via the startup power parameter.
- 2. Commutation timing:**
Commutation timing can be set to low/mediumlow/medium/mediumhigh/high, that correspond to 0°/7.5°/15°/22.5°/30° timing advance. Typically a medium setting will work fine, but if the motor stutters it can be beneficial to change timing. Some motors with high inductance can have a very long commutation demagnetization time. This can result in motor stop or stutter upon quick throttle increase, particularly when running at a low rpm. Setting timing to high will allow more time for demagnetization, and often helps.
- 3. Demag compensation:**
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 mentioned above, 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.
- 4. Direction:**
Rotation direction can be set to fwd/rev/bidirectional fwd/bidirectional rev. In bidirectional mode, center throttle is zero and above is fwd rotation and below is reverse rotation. When bidirectional operation is selected, programming by TX is disabled.
- 5. Beep strength:**
Sets the strength of beeps under normal operation.
- 6. Beacon strength:**
Sets the strength of beeps when beeping beacon beeps. The ESC will start beeping beacon beeps if the throttle signal has been zero for a given time. Note that setting a high beacon strength can cause hot motors or ESCs!

7. Beacon delay:

Beacon delay sets the delay before beacon beeping starts.

8. Programming by TX:

If disabled, throttle calibration is disabled. Please notice that throttle stick can calibrate throttle range only, and can not programming parameter via throttle stick.

9. Min throttle, max throttle and center throttle:

These settings set the throttle range of the ESC. Center throttle is only used for bidirectional operation. The values given for these settings are for a normal 1000us to 2000us input signal, and for the other input signals, the values must be scaled.

10. Thermal protection:

Thermal protection can be enabled or disabled. And the temperature threshold can be programmed between 80°C and 140°C (from rev16.3).

The ESC measures temperature within the MCU and limits motor power if the temperature is too high. Motor power is limited in four steps:

- If the temperature is above threshold, motor power is limited to 75%.
- If the temperature is above threshold 5°C, motor power is limited to 50%.
- If the temperature is above threshold 10°C, motor power is limited to 25%.
- If the temperature is above threshold 15°C, motor power is limited to 0%.

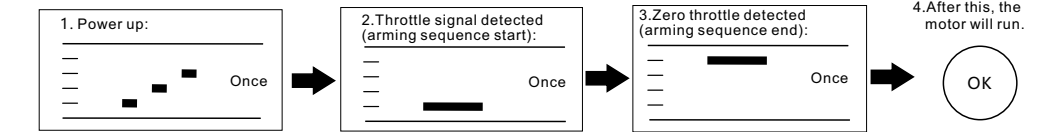
11. Low RPM power protect:

Power limiting for low RPMs can be enabled or disabled. 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 sync loss, with the possibility of toasting motor or ESC.

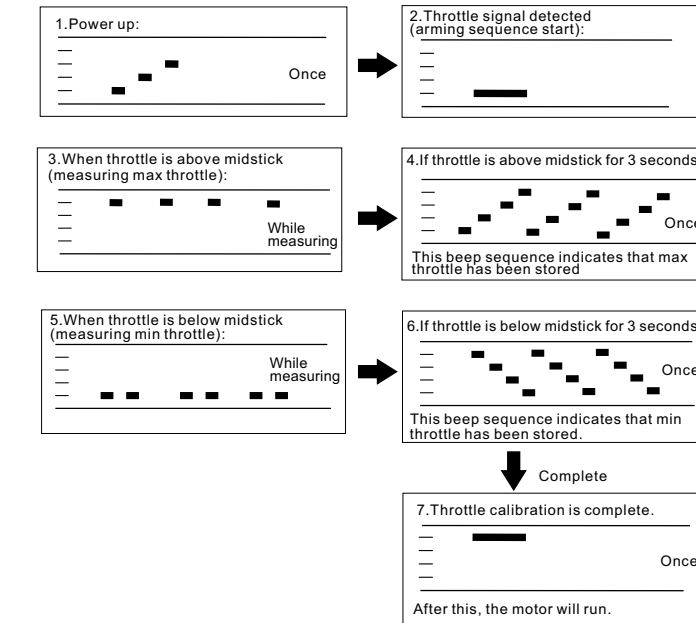
12. Brake on stop:

Brake on stop can be enabled or disabled. When enabled, brake will be applied when throttle is zero. For nonzero throttle, this setting has no effect.

05 Beeps-Normal operation

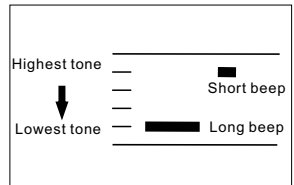


06 Beeps - Throttle calibration



1. Throttle calibration will be more simple if using Flight Controller Configurator.
2. When the input signal is Dshot, throttle calibration is disabled, and the throttle calibration values are ignored.

Example :



07 Others

- 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. When the input signal is Dshot, throttle calibration is disabled
- 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.
- Please contact Flycolor sales or technical support for more information.