

USER MANUAL PLATINUM

Brushless Electronic Speed Controller
Platinum 60A V4



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 damages or losses resulting from the use of the product. We do not assume responsibility for any losses caused by unauthorized modifications to our product. Besides, we have the right to modify our product design, appearance, features and usage requirements without notification.

01 Features

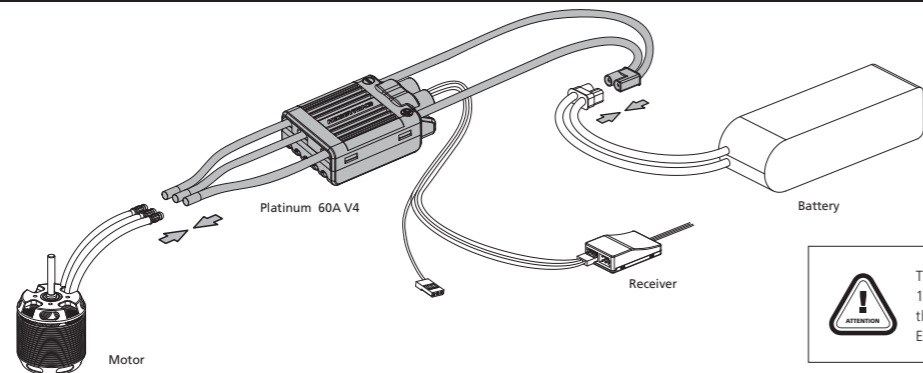
- High performance microprocessor with a running frequency of up to 72MHz for excellent motor speed-governing and super soft start-up.
- Microprocessor powered by independent DC regulator has better anti-interference performance, which greatly reduces the risk of losing control.
- DEO (Driving Efficiency Optimization) Technology adopted greatly improves throttle response & driving efficiency, reduces ESC temperature.
- New switch-mode BEC with adjustable output voltage ranges from 5V to 8V and continuous/peak current of 7A/18A.
- BEC is separated from other circuits of the ESC, it will keep its normal output when the MOSFET board of the ESC is burnt.
- Multiple flight modes: Fixed-wing, Helicopter (Linear Throttle), Helicopter (Elf Governor), Helicopter (Store Governor).
- New governor program with adjustable governor parameter P/I brings excellent speed-governing effect, guarantees the stability of the propeller's revs when the load changes dramatically.
- Data logging records the standardized RPM, minimum voltage and maximum temperature of the flight.
- "Restart in auto rotation" can manually interrupt the auto rotation and quickly restart the motor to avoid crashes caused by incorrect operations.
- Independent output port for RPM (that is: motor speed) signals.
- Separate programming port for ESC programming or parameter setting.
- WIFI module (sold separately) for programming the ESC wirelessly with your smart phone (ios or Android).
- Online data checking, ESC programming, firmware upgrade (Multifunction LCD program box or WIFI Express is needed) supported.
- Multiple protections like start-up protection, ESC thermal protection, capacitor thermal protection, overload protection, throttle signal loss protection, and etc.

02 Specifications

Model	Platinum 60A V4
Application	450-480 Class Heli (Propeller: 325-360mm)
Input Voltage	3-6S LiPo
Cont./Peak Current (10s)	60A/80A
(Switch-mode) BEC	5V-8V Adjustable (Step: 0.1V), 7A/18A Cont./Peak
Separate Programming Port	For connecting LCD Program Box/WIFI Express
Throttle Signal/BEC Output/RPM Signal Transmission Wires)	White Throttle Signal Wire/Red & Black BEC Output Wires/Yellow RPM Signal Transmission Wire
Input/Output Wires	14AWG Input/Output Wires
Weight/Size	49g / 48x30x15.5mm

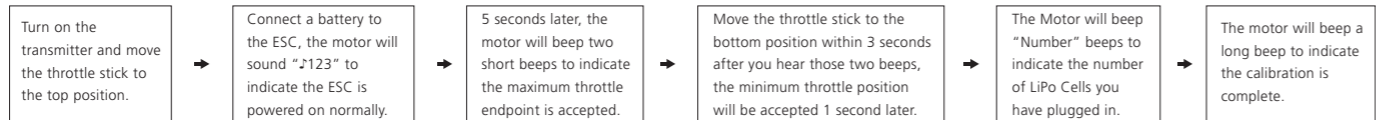
03 Begin to Use the New Brushless ESC

1 Connections



The default throttle range of this ESC is from 1100µs to 1940µs, you need to re-calibrate the throttle range when the first time you use this ESC or after you change the transmitter.

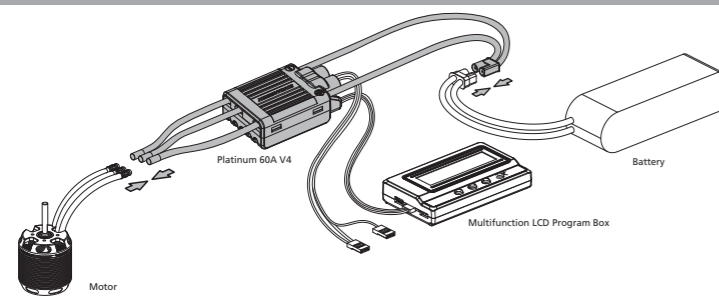
2 ESC/Radio Calibration



During the ESC/Radio calibration, please set the throttle curve to NORMAL and ensure the corresponding throttle amounts to the maximum throttle endpoint and the minimum throttle endpoint on your transmitter are respectively 100% and 0%.

04 ESC Programming

Program Your ESC with a Multifunction LCD Program Box



After adjusting parameters, you need to power your ESC off and then on. Otherwise, those new parameters won't take effect.

Programming

- Connect the LCD program box and a battery to your ESC as shown above.
- Press the "OK" button to connect the program box to your ESC. "The current firmware version" will show up after the program box is successfully connected to your ESC.
- Press the "ITEM" button to browse programmable items, and press the "VALUE" button to change parameter value(s).
- After changing parameter value(s), press the "OK" button to save those new values to your ESC.
- Press the "ITEM" button to browse other programmable items or exit the programming.
- Disconnect the ESC and battery, unplug the programming cable from the ESC and LCD program box.

Program Your ESC with a WIFI Express: For detailed information, please refer to the user manual of WIFI Express.

05 Programmable Items

Programmable Item List of Platinum 60A V4 ESC. (** in the form below indicate factory defaults.)

Item	1	2	3	4
1. Flight Mode	Fixed-wing	Helicopter (Linear Throttle)	* Helicopter (Elf Governor)	Helicopter (Store Governor)
2. LiPo Cells	*Auto Calculation	3-6S		
3. Voltage Cutoff Type	*Soft Cutoff	Hard Cutoff		
4. Cutoff Voltage	Disabled	2.8V-3.8V (Default 3.0V)		
5. BEC Voltage	5V-8V (Default 6V)			
6. Start-up Time	4s-25s (Default 15s)			
7. Governor Parameter P	0-9 (Default 4)			
8. Governor Parameter I	0-9 (Default 5)			
9. Auto Restart Time	0s-90s (Default 25s)			
10. Restart Acceleration Time	1s-3s (Default 1.5s)			
11. Brake Type	*Disabled	Normal	Proportional	Reverse
12. Brake Force	0-100% (Default 0%)			
13. Timing	0°-30° (Default 15°)			
14. Motor Rotation	*CW	CCW		
15. Freewheeling	*Enabled	Disabled		

1. Flight Mode

- 1.1. In "Fixed-wing" mode, the motor will start up when the throttle amount reaches 5% or above. There is no soft start-up, the motor responds to the throttle increase rapidly.
- 1.2. In "Helicopter (Linear Throttle)" mode, the motor will start up when the throttle amount reaches 5% or above. And it will accelerate to the RPM corresponds to the specific throttle amount in the preset start-up time (4-25s).
- 1.3. In "Helicopter (Elf Governor)" mode, the motor will start up when the throttle amount reaches 40% or above. And it will complete the speed standardization and enter the speed-governing operation in the preset start-up time (4-25s). In this mode, the motor will standardize its speed every time it starts up. Due to different discharge rates/capabilities of different batteries, the RPM you standardize each time may be a little different. In consequence, at the same throttle amount, the RPM may be a bit different when using different batteries, but this won't affect the speed-governing effect.
- 1.4. In "Helicopter (Store Governor)" mode, the motor will start up when the throttle amount reaches 40% or above. It will also start up in a very soft way. And it will also complete the speed standardization and enter the speed-governing operation in the preset start-up time. In this mode, the motor will only standardize its speed the first time when it starts up. When performing RPM standardization for the first time, we recommend using a fully-charged battery with good discharge capability. After the RPM standardization, change another battery to fly your aircraft. At the same throttle amount, the RPM should be the same as the RPM of the first flight. For consistent control feel, we recommend using this mode.

About RPM Standardization & Others

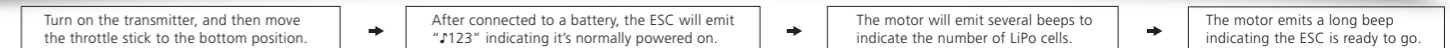
- The motor will enter the soft start-up when user switches the throttle amount from 0 to 40% or above (50% throttle is recommended). The pitch of main blades should be 0 degree during the soft start-up process, the RPM standardization completes when the soft start-up ends, and the ESC makes the motor enter the speed-governing state. In "Helicopter (Store Governor)" mode, if user wants to re-standardize the speed, he needs to set the flight mode to "Helicopter (Elf Governor)" and save this mode first, and then reset the flight mode back to "Helicopter (Store Governor)", then the ESC will re-standardize the motor speed when the motor rotates for the first time after the ESC is powered off and then on again.
 - For ensuring the speed-governing effect, we recommend setting the throttle amount to 85% or below in both speed-governing modes (Helicopter (Elf Governor)&Helicopter (Store Governor), so there will be sufficient compensating room to maintain the consistency of the RPM. We recommend replacing the motor or adjusting the gear ratio if the expected RPM still cannot be reached when the throttle amount exceeds 85%. (Note: You need to re-standardize the RPM after replacing the motor, blades, body frame or adjusting the gear ratio.)
 - In "Heli Store Governor" mode, if you fly your aircraft with another pack that has poor discharge capability after the RPM standardization (with a pack which has good discharge capability), the pack has poor discharge capability will get damaged.
 - In "Helicopter (Store Governor)" mode, different battery packs can bring the same stable RPM only if they have the same cell count. This won't change even when you change the battery pack. However, battery packs with different cell count don't have the same effect. For instance, in "Helicopter (Store Governor)" mode, you can not use a 4S to calibrate the motor RPM and then use a 6S to drive the motor, hoping it can run at the same RPM.
 - User can decide the control feel via adjusting Governor Parameter P/I. In "Helicopter (Store Governor)" mode, connect your ESC to a smart phone or PC, then you can check the throttle vs speed chart.
2. **LiPo Cells:** the ESC will automatically calculate the number of LiPo cells you have plugged in as per the "3.7V/Cell" rule if "Auto Calc" is selected. Or user can set this item manually.
 3. **Voltage Cutoff Type:** the ESC will gradually reduce the output to 50% of the full power in 3 seconds after the voltage cutoff protection is activated, if soft mode is selected. It will immediately cut off all the output when hard mode is selected.
 4. **Cutoff Voltage:** 2.7V-3.7V (custom), 3.3V (default).
 5. **BEC Voltage:** 5-8V (adjustable), 0.1V (step), 6V (default).
 6. **Start-up Time:** 4-25s (adjustable), 1s (step), 15s (default). (Note: It only functions in Heli Elf/Store Governor Mode)
 7. **Governor Parameter P:** Control the ESC maintaining the stability of the current motor speed.
 8. **Governor Parameter I:** Control the dynamic response. To be specific, control the supplement extent when the actual motor speed is below expectation. If you choose a very big value, then the supplement may be too much. If select a very small value, then the supplement may not sufficient.
 9. **Auto Restart Time:** the ESC will cut off its output when the throttle amount is between 25% and 40%. If you increase the throttle amount to above 40% within preset time period (0-90s), the motor will rapidly start up and accelerate to the speed (in the programmed Restart Acceleration Time) corresponds to the specific throttle amount, complete the shutdown and restart up. If you move the throttle stick to over 40% beyond the preset time period, the ESC will enter the soft start-up process. (Note: This function won't effect unless the throttle amount is over 25% and it only effects in "Heli Governor Elf/Store" mode.)
 10. **Restart Acceleration Time:** 1-3s (adjustable), 0.5s (step), 1.5s (default). This item controls the time the motor will cost to restart and accelerate to the full speed. (This function only effects in "Heli Governor Elf/Store" mode)
 11. **Brake Type**
 - 11.1. **Proportional Brake:** when the throttle range on the transmitter is between 20% and 100%, the corresponding ESC throttle output is between 0% and 100%. When the throttle range on the transmitter is between 20% and 0%, the corresponding brake force is between 0 and 100%.
 - 11.2. **Reverse:** after selecting this option, the RPM signal wire will turn into a reverse signal wire (the signal range is in line with the throttle range). After setting a channel on the transmitter, when the reverse signal length is above 20% signal length, the Reverse mode will be activated. The reverse signal length must be below 20% signal length when the ESC is powered on for the first time. When the reverse signal length is below 20% signal length, 0-100% throttle corresponds to "CW"; when the reverse signal length is above 20% signal length, the motor will stop spinning CW (and then spin CCW); at this time, 0-100% throttle corresponds to "CCW". Any signal loss will activate the throttle signal loss protection, no matter it happens to the RPM signal wire or the throttle signal cable during the flight.
 12. **Brake Force:** 0-100% (adjustable), 1% (step), 0 (default). (Note: this function only effects in "Normal Brake" mode.)
 13. **Timing:** 0-30° (adjustable), 1° (step), 15° (default).
 14. **Motor Rotation:** CW/CCW. User can adjust this item via a multifunction LCD program box.
 15. **DEO Freewheeling:** User can decide this function "Enabled" or "Disabled" in "Fixed Wing" mode or in "Heli (Linear Throttle Response)" mode. This item has been preset to "Enabled" and cannot be adjusted in "Heli (Elf Governor/Store Governor)" mode. This function can brings better throttle linearity.

06 Data Checking

The ESC will record the standardized RPM, minimum voltage, and maximum temperatures of the flight but won't save these data, so you need to keep the ESC on if you want to check the information of the flight.



07 Normal Start-up Process



08 Explanations for Warning Tones

1. Input voltage is abnormal: The ESC will measure the input voltage the moment when it's powered on. The motor will keep beeping "BB, BB, BB" (the interval between two BBs is 1 second) when the input voltage is beyond the normal range. The warning tone won't stop until the voltage turns normal.
2. Throttle signal loss protection is activated: The motor will beep "B-, B-, B-" (the interval between two B-s is 2 seconds) when the ESC doesn't detect any throttle signal.
3. Throttle stick is not at the bottom position: The motor will beep "B-B-B-B-" when the throttle stick is not moved to the bottom position.
4. Throttle range is too narrow: The motor will beep "B-B-B-B-B-" when the throttle range you set is too narrow (when designing this ESC, it requires that the entire throttle range you set cannot be less than 50% of the whole throttle range available on the transmitter.) The warning tone indicates the throttle range you set is void and you need to set it again.

09 Explanations for Multiple Protections

1. Start-up Protection: The ESC will monitor the motor speed during the start-up process. When the speed stops increasing or the speed increase is not stable, the ESC will take it as a start-up failure. At that time, if the throttle amount is less than 15%, the ESC will automatically try to restart up; if it is larger than 15%, you need to move the throttle stick to back the bottom position and then restart up the ESC. (Possible causes of this problem: poor connection/disconnection between the ESC and motor wires, propellers are blocked, etc.)
2. ESC Thermal Protection: The ESC will gradually reduce the output but won't cut it off completely when the ESC temperature goes above 110°C. For ensuring the motor can still get some power and won't cause crashes, so the maximum reduction is about 50% of the full power. The ESC will gradually resume its maximum power after the temperature lowers down. In addition, the ESC temperature cannot exceed 70°C when it's powered on. Otherwise, it cannot be started up. (Here we are describing the ESC's reaction in soft cutoff mode, while if in hard cutoff mode; it will immediately cut off the power.)
3. Capacitor Thermal Protection: The ESC will activate this protection when the operating temperature of capacitors goes over 130°C. It protects capacitors in the same way as the ESC thermal protection does to the ESC.
4. Throttle Signal Loss Protection: When the ESC detects loss of signal for over 0.25 second, it will cut off the output immediately to avoid an even greater loss which may be caused by the continuous high-speed rotation of propellers or rotor blades. The ESC will resume the corresponding output after normal signals are received.
5. Overload Protection: The ESC will cut off the power/output or automatically restart itself when the load suddenly increases to a very high value. (Possible cause to sudden load increase is that propellers are blocked.)

PLATINUM

空模无刷电子调速器

使用说明书

Platinum 60A V4 20151203



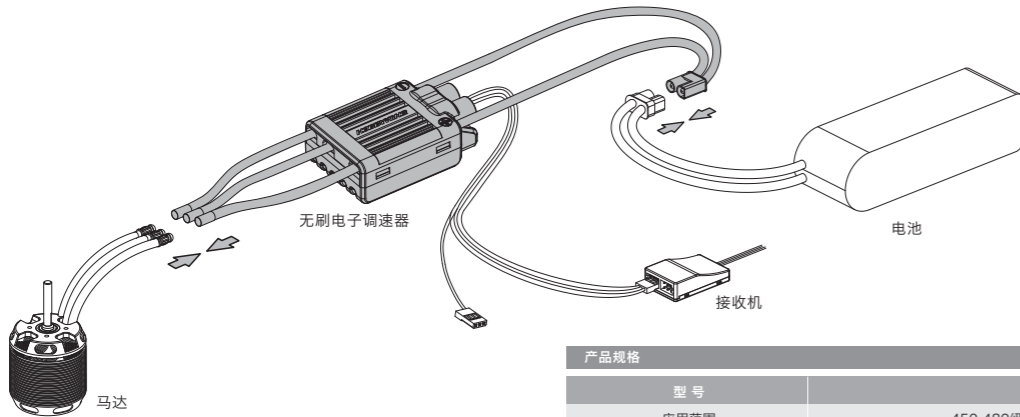
感谢您购买本产品！无刷动力系统功率强大，错误的使用可能导致人身伤害和设备损坏，为此我们强烈建议您在设备使用前仔细阅读本说明书，并严格遵守规定的操作程序。我们不承担因使用本产品或擅自对产品进行改造所引起的任何责任，包括但不限于对附带损失或间接损失的赔偿责任。我们有权在不通知的情况下变更产品设计、外观、性能及使用要求。

01 产品特点

- 使用运行频率高达72MHz的高性能微处理器，具备更优异的定速和缓启动性能。
- 微处理器才用独立的稳压IC供电，具有更好的抗干扰能力，大大降低失控的可能性。
- 采用同步整流驱动效率优化技术（DEO---Driving Efficiency Optimization），油门响应更快，驱动效率更高，电调温度更低。
- 使用新的大功率开关稳压BEC，输出电压在5-8V之间可调，瞬间输出电流提升至18A。
- BEC模块和电调其他电路相互独立，当电调功率板出现烧毁等故障时，最大限度保证BEC正常输出，提供舵机机会；
- 具有“固定翼模式/直升机线性油门模式/直升机精英定速模式/直升机存储定速模式”4种飞行模式。
- 使用新的直升机定速程序，定速感度可调，易于操作，具有优异的定速效果，在负荷急剧变化的情况下，保证大桨转速稳定。
- 具有飞行数据记录功能，可记录当次飞行的最低电压、最高温度数据、标定转速；
- 具有熄火降落保护时间选择功能，在保护时间内可人工中断熄火降落过程并快速重新启动马达，避免因操控失误而坠机。
- 具有转速（RPM）信号输出接口；
- 具备独立参数设定接口，用于连接LCD参数设定盒进行参数设定；
- 支持WIFI无线调参，通过手机端（苹果&安卓）软件可完成所有参数设置（需要wifi模块）；
- 支持在线读取、设定电调参数，查看速度曲线表（存储模式下），升级电调固件（需要LCD参数设定盒或WIFI模块）。
- 具有启动保护、温度保护、电容温度保护、过负荷保护、油门信号丢失保护、输入电压异常保护多重保护功能，有效延长电调使用寿命。

02 使用向导

1 接线示意图

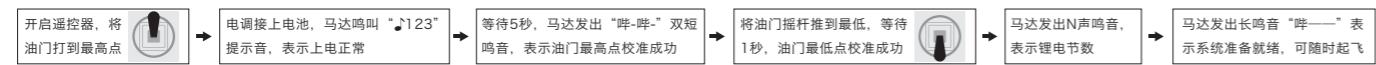


产品规格	
型号	Platinum 60A V4
应用范围	450-480级电动直升机（桨长325-360mm）
输入电压	3-6S LiPo
持续/瞬间（10秒）电流	60A/80A
BEC	开关稳压BEC，输出电压5-8V可调（调整幅度为0.1V每阶）；输出电流持续7A，瞬间18A
独立参数编程接口	用于连接LCD参数设定盒或WIFI模块
油门信号/BEC输出/RPM信号传输线	白色为油门信号线/红黑二色线为BEC输出线/黄色为RPM信号传输线
输入/输出线	输入14AWG，输出14AWG
重量/尺寸	49g / 48x30x15.5mm

2 油门行程校准

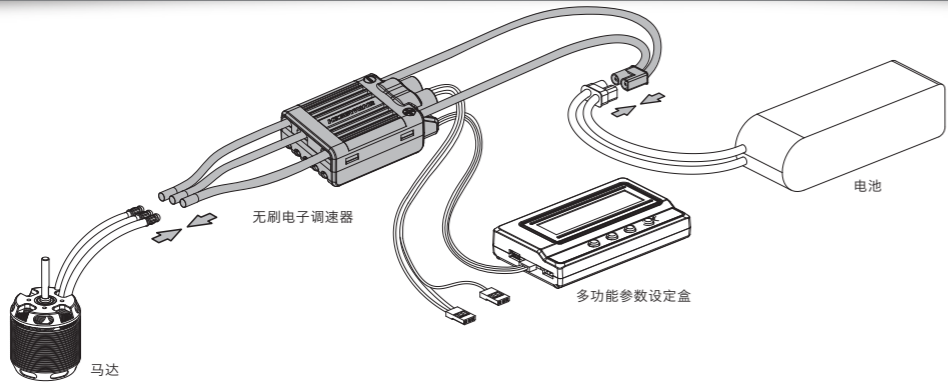
注意：电调的油门行程出厂默认值为1100μs—1940μs,当首次使用电调或者更换其他遥控器使用时，均应重新设定油门行程。

- 油门行程校准接线方法如上图所示。
- 油门行程校准操作方法：

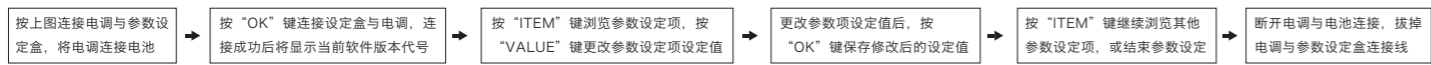


注意：进行油门行程校准时，请将油门曲线设置为normal，并确保遥控器油门最高点对应的油门值为100%，油门最低点对应的油门值为0%。

03 参数设定方法及其连接图示意图



参数设定方法：



Wifi无线调参：请参见无线wifi模块使用说明书。

04 可编程参数项目及其说明

下表中带“*”的为出厂默认参数：

编程项目	参数值	1	2	3	4
1	飞行模式	固定翼模式	直升机线性油门模式	*直升机精英定速模式	直升机存储定速模式
2	锂电节数	*自动计算	3-6节		
3	低压保护模式	*软关断	硬关断		
4	低压保护阈值	关闭	2.8V-3.8V(默认3.0V)		
5	BEC 输出电压	5V-8V (默认6V)			
6	启动时间	4秒-25秒 (默认15秒)			
7	定速参数P	0-9(默认4)			
8	定速参数I	0-9(默认5)			
9	熄火降落保护时间	0秒-90秒 (默认25秒)			
10	熄火降落重启加速时间	1秒-3秒(默认1.5秒)			
11	刹车类型	*无刹车	普通刹车	比例刹车	反转刹车
12	刹车力度	0-100% (默认0%)			
13	进角	0° -30° (默认15°)			
14	电机转向	*正转	反转		
15	DEO开关	*开启	关闭		

可编程参数表（英文对照）

Item	1	2	3	4
1. Flight Mode	Fixed-wing	Heli LineTH	*Heli ElfGov	Heli StoGov
2. LiPo Cells	*Auto Calc.	Customized:3cells-6cells, Step:1cell		
3. Cutoff Type	Soft Cutoff	Hard Cutoff		
4. Cutoff Volt	Disable	Customized:2.8V-3.8V, Step:0.1V	*3.0V	
5. BEC Voltage	Customized:5V-8V, Step:0.1V	*6.0V		
6. Start-up Time	Customized:4s-25s, Step:1s	*15s		
7. Gov Param P	Customized:0-9, Step:1	*4		
8. Gov Param I	Customized:0-9, Step:1	*5		
9. AR time	Customized:0-90s, Step:1s	*25s		
10. Restart Accel.	Customized:1s-3s, Step:0.5s	*1.5s		
11. Brake Type	*Disable	Normal	Proportiona	Reverse
12. Braek Force	Customized:0%-100%, Step:1%	*0%		
13. Timing	Customized:0deg-30deg, Step:1deg	*15deg		
14. Motor Rotate	*CW	CCW		
15. Free-Wheeling	*Enabled	Disable		

1、飞行模式

- 固定翼模式下，油门达到5%启动电机，无缓启动，油门响应迅速；
- 直升机线性模式下，油门达到5%启动电机，有缓启动，马达在设定的缓启动时间内加速至当前油门应有转速；
- 直升机精英定速模式下，油门达到40%启动电机，有缓启动，马达在设定的缓启动时间内完成转速标定进入定速运行状态。该模式下每一次上电启动都会进行转速标定，由于电池放电能力等差异，将导致每一次标定的转速有细微区别，最终将导致在同一个油门值下，使用不同的电池会有转速上的细微差别，但并不影响定速效果。
- 直升机存储定速模式下，油门达到40%启动电机，马达以超柔方式启动，在设定的缓启动时间内完成转速标定进入定速运行状态。该模式下仅第一次上电启动会进行转速标定，第一次转速标定建议使用状态较好的电池，标定完成后，更换不同电池再次飞行，在同一油门值下的转速将与第一次飞行时一致，为保持手感一致性，建议使用该模式。

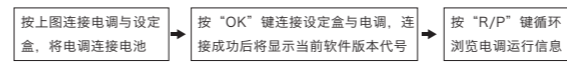
关于转速标定：

- 将油门从0切换至≥40%（建议使用50%油门），马达将进入缓启动阶段，缓启动期间需保持主桨螺距为0°，缓启动结束后转速标定完成，电调进入定速运行状态。直升机存储定速模式下，若需重新标定转速，需首先将飞行模式设置为直升机精英定速模式并保存，然后再次设置为直升机存储定速模式，重新上电后电机首次运转过程中将进行转速标定；
- 为保证定速效果，建议在定速飞行模式下的油门范围不超过90%，确保有足够的补偿空间维持马达转速恒定，若超过90%油门仍未达到理想转速，建议更换马达或更换齿比；（更换马达、齿比、桨、机架后均需重新标定转速）
- 直升机存储定速模式下，使用性能较好的电池完成转速标定后，若使用性能较差的电池飞行，可能对该电池造成损害。
- 在存储定速时，不同的电池包只要里面电芯数一样就能带来稳定的转速，即使是在更换电池时都不会变化。但是不同电芯数的电池包不能得到补偿。比如，在存储定速时，不能用4S电池包的来校准转速，然后用6S电池包以相同转速运行。
- 通过设定PI参数，用户选择自己合适的手感。存储定速模式下，链接手机或者PC可查看油门和速度的对应表。

- 锂电节数：**选择自动计算，将按单节电池3.7V计算电池节数，也可手动设置电池节数；
- 低压保护模式：**软关断，触发低压保护后3秒内输出功率将逐渐降低为总功率的50%；硬关断，立即断开输出；
- 低压保护阈值：**2.7V-3.7V自定义，默认为3.3V；
- BEC输出：**5-8V可调节，调节步长为0.1V，默认为7.4V；
- 启动时间：**4-25秒可调，调节步长为1秒，默认为15秒；（该功能仅在直升机定速（精英/存储）模式下有效）
- 定速感度P：**控制电调维持当前转速的稳定程度；
- 定速感度I：**当转速低于预期值时，电调将进行转速补偿。该参数用于调整补转的程度大小。参数过大将造成补转过度，参数过小将引起补转不足；
- 熄火降落保护时间：**当油门在25%-40%之间时，电调输出关闭，0-90s的范围油门再次高于40%，电机将快速启动加速到当前油门值（加速时间为设定的熄火降落重启加速时间）应有转速，完成熄火重启，如果时间超过设置值，将退出熄火降落，油门再次高于40%将恢复正常缓启动。油门低于25%熄火重启保护设置将不生效。（该功能仅在直升机定速（精英/存储）模式下有效）
- 熄火重启加速时间：**1-3秒可调，步长为0.5秒，默认1.5秒。该参数控制熄火重启时马达从静止加速到全速所需的时间。（该功能仅在直升机定速（精英/存储）模式下有效）
- 刹车类型**
 - 比例刹车：遥控器上的油门行程20% - 100%对应电调油门输出0%-100%，遥控器上的油门行程20%-0%对应刹车力度0-100%。
 - 反转刹车：开启反转刹车功能后，RPM信号传输线将变为反转信号输入线（信号范围和油门行程一致），通过遥控器一个通道设置，反转信号大于20%油门信号时，触发反转标志。初次上电反转信号必须低于20%油门行程，反转信号低于20%油门0-100%对应正转；反转信号高于20%，电机先刹车停转，此时油门0-100%对应反转。运行过程中rpm信号传输线和油门信号线中任意一个信号丢失都会触发油门信号丢失保护。
- 刹车力度：**0-100%可调，步长为1%，默认为0%；（该功能仅在普通刹车模式下有效）
- 进角：**0-30°可调，步长为1°，默认为15°；
- 电机转向：**正转\反转，连接设定盒更改该项参数可改变电机转向；
- 同步整流：**当飞行模式为固定翼\直升机线性模式时，可选择开启\关闭，当飞行模式为直升机定速（精英\存储）模式时，固定为开启，开启同步整流将带来更好的油门线。

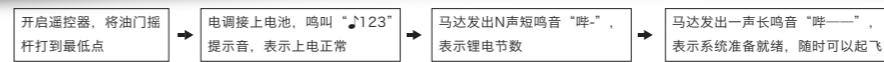
05 电调运行信息查看

电调会记录当次飞行的标定转速、最低电压、最高温度信息，断电后信息将不会保存，查看当次飞行信息需保持电调处于供电状态。



备注：1、标定转速仅在定速存储模式下可查看，且记录不会断电而消失；
2、记录的转速为电气转速，例如电气转速为R，实际大桨转速=R÷电机极对数÷齿比 x 油门百分比。

06 正常开机过程



07 警示音说明

- 输入电压不正常警示音：**电调开机时，会对输入电压进行检测，当输入电压不在正常范围内时，马达会发出“哔哔、哔哔、哔哔”的警示音（每组哔哔声的间隔为1秒），直到电压正常为止；
- 油门信号丢失警示音：**当电调未检测到油门信号时，电调会作如下警示：“哔-、哔-、哔-”（每声之间的间隔为2秒）；
- 油门未归零（油门摇杆未置于最低位置）警示音：**当油门未打到最低时，电调会作如下警示：“哔-哔-哔-哔-”（很急促的单音鸣叫）；
- 油门行程过小警示音：**当所设定油门总行程过窄时（电调设计时，要求油门总行程不得小于三格油门），电调会做警示，表明本次行程设定无效，需重新设定。警示方式为：“哔-哔-哔-哔-”（很急促的单音鸣叫）；

08 其他保护功能说明

- 启动保护：**启动过程中，电调会检测电机转速，当转速出现停止上升或者转速提升不稳定的情况，则判断启动失败，若此时油门小于15%，电调会自动尝试重新启动；若此时油门大于20%，需将油门归零后重新启动。（出现这种情况的原因可能有：电调和马达连线接触不良或有个别出线断开、螺旋桨被其他物体阻挡、减速齿卡死等）
- 温度保护：**当电调工作温度超过110摄氏度时，电调会逐渐降低输出功率进行保护，但不会将输出功率全部关闭，最多只降到全功率的50%，以保证马达仍有动力，避免因动力不足而摔机。温度下降后，电调会逐渐恢复最大动力；上电时电调温度不可超过70度，否则无法启动。（以上为软关断保护方式，若选择硬关断，则直接切断动力）
- 电容温度保护：**当电容工作温度超过130摄氏度时，电调会触发电容温度保护，保护方式与温度保护相同。
- 油门信号丢失保护：**当电调检测到油门遥控信号丢失0.25秒以上即立即关闭输出，以免因螺旋桨继续高速转动而造成更大的损失。信号恢复后，电调也随即恢复相应的功率输出。
- 过负荷保护：**当负载突然变得极大时，电调会切断动力，或自动重启。（出现负载急剧增大的原因通常是螺旋桨旋转）