

USER MANUAL



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 SPECIFICATIONS

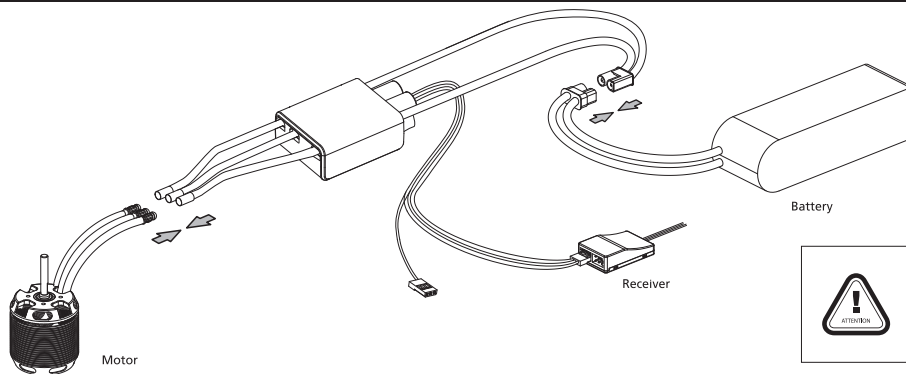
Model	SAB ESC 60A
Input Voltage	3-6S LiPo
Cont./Peak Current (10s)	60A/80A
(Switch-mode) BEC	5V-8V Adjustable (Step: 0.1V), 7A/18A Cont./Peak
Separate Programming Port	For connecting LCD Program Box/WIFI Express
Throttle Signal/BEC Output/ RPM Signal Transmission Wire(s)	White Throttle Signal Wire/Red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

02 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.

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

Turn on the transmitter and move the throttle stick to the top position.



Connect a battery to the ESC, the motor will sound "B123" to indicate the ESC is powered on normally.



5 seconds later, the motor will beep two short beeps to indicate the maximum throttle endpoint is accepted.



Move the throttle stick to the bottom position within 3 seconds after you hear those two beeps, the minimum throttle position will be accepted 1 second later.



The Motor will beep "Number" beeps to indicate the number of LiPo Cells you have plugged in.



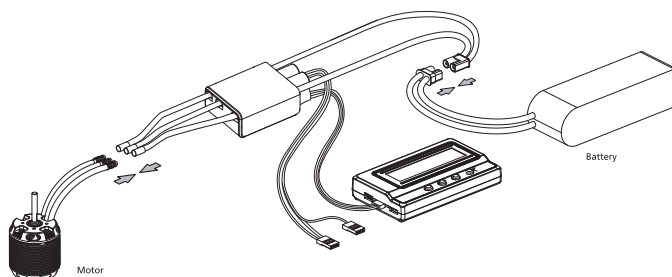
The motor will beep a long beep to indicate the calibration is complete.



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

Item	SAB default setting	Customizable values
1. Flight Mode	Heli StoGov	Heli LineTH - Heli ElfGov
2. LiPo Cells	6cells	3 to 6 cells
3. Cutoff Type	Soft Cutoff	
4. Cutoff Volt	2.8V	Disable
5. BEC Voltage	7.4V	Customized:5V-8V, Step:0.1V
6. Start-up Time	10s	Customized:4s-25s, Step:1s
7. Gov Param P	5	Customized:0-9, Step:1
8. Gov Param I	5	Customized:0-9, Step:1
9. AR time	15s	Customized:0-90s, Step:1s
10. Restart Accel.	1.5s	Customized:1s-3s, Step:0.5s
11. Break Mode	Disable	
12. Braek Force	0%	
13. Timing	15 deg	Customized:0deg-30deg, Step:1deg
14. Motor Rotate	CW	CCW
15. Active FW	Enabled	
16. Start-up Power/Force	5	Customized:1-7, Step:1

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).
5. **BEC Voltage:** 5-8V (adjustable), 0.1V (step).
6. **Start-up Time:** 4-25s (adjustable), 1s (step). (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). 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). (Note: this function only effects in "Normal Brake" mode.)
13. **Timing:** 0-30° (adjustable), 1° (step).
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.
16. **Start-up Power/Force:** User can adjust the start-up force of the motor through this item. It's adjustable from 1 to 7, the higher the value, the bigger the force.

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.

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.

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 "R/P" button to browse all running information relates to the ESC.



1. you can only check the standardized RPM in "Heli Store Governor" mode, the record won't disappear after you turn off the ESC.
2. The recorded revs are electric revs. If the electric RPM is R, the actual rev of the main blades = $R \div \text{Motor Poles} \div 2 \div \text{Gear Ratio} \times \text{Throttle Amount} (\%)$.

07 NORMAL START-UP PROCESS

Turn on the transmitter, and then move the throttle stick to the bottom position.



After connected to a battery, the ESC will emit "123" indicating it's normally powered on.



The motor will emit several beeps to indicate the number of LiPo cells.



The motor emits a long beep indicating the ESC is ready to go.

08 EXPLANATIONS FOR WARNING TONES

Protections	Warning tones	Explanations
Input voltage is abnormal	BB,BB,BB...	The ESC will measure the input voltage the moment when it's powered on.
Throttle signal loss protection is activated	B-,B-,B-,B...	The ESC doesn't detect any throttle signal.
Throttle stick is not at the bottom position	B,B,B,B...	The throttle stick is not moved to the bottom position.

Protections	Warning tones	Explanations
Throttle range is too narrow	BB,BB,BB...	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.
ESC Thermal Protection	BB,BB,BB...	The ESC temperature goes above 110°C.
Low voltage Protection	BBB,BBB,BBB...	The battery voltage is lower than the cut off voltage.

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. **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.
3. **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.)
4. **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.)
5. **Low voltage Protection:** The ESC will gradually reduce the output but won't cut it off completely when the battery voltage is lower than the cut off voltage. 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.