



SUNNYSKY®

Brushless ESC User Manual

Thank you for purchasing the brushless electronic speed controller. We strongly recommend carefully reading this user manual before use for safety reasons. We do not assume any liability for any damages caused by the use of this product or unauthorized modifications to the product, including but not limited to compensation for any consequential or indirect losses. We reserve the right to change product design, appearance, performance, and usage requirements without prior notice.

Safety Precautions

- Always prioritize safety when using this product;
- Be cautious when connecting the motor to the battery and speed controller, as accidental startup can cause injury;
- Before connecting the battery, if you need to perform close-range operations on fixed-wing aircraft or helicopters, do not install the propeller or disconnect the pinion gear;
- Please comply with all local laws and regulations regarding remote-controlled aircraft;
- Do not fly over crowds or in restricted areas;

Main features

- 1.Utilizes a high-performance 32-bit processor with a running frequency of up to 170MHz, providing powerful computational capabilities and faster operation speed.
- 2.Incorporates power output components (MOSFET) manufactured using the latest technology, resulting in low heat generation, high instantaneous current tolerance, and enhanced reliability.
- 3.Self-check function: The speed controller performs self-checking upon power-up, including power supply short circuit detection, motor phase detection, throttle zeroing, and voltage range verification.
- 4.Features dual side vents and a unique heat dissipation channel design, greatly enhancing the heat dissipation performance of the speed controller.
- 5.Offers selection between fixed-wing and helicopter modes.
- 6.Equipped with a helicopter governor function, allowing adjustable governor strength for easy operation.
- 7.The speed controller has an independent programming interface, which can be used with an LCD programming card or Bluetooth module for parameter configuration.
- 8.Supports data telemetry, providing real-time transmission of data such as current, voltage, temperature, RPM, throttle, and speed controller status. This data can be viewed in real time on a mobile app or LCD programming card.
- 9.Supports wireless Bluetooth parameter adjustment, allowing parameter settings, firmware upgrades, and data logging operations via a mobile app (compatible with both iOS and Android).
10. Multiple protections are included: abnormal power voltage protection, startup protection, temperature protection, throttle signal loss protection, overload protection, low voltage protection, and over-current protection.

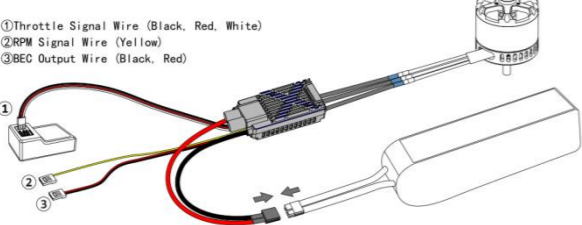
Product specifications

| Model         | Continuous Current (A) | Peak Current (A) | Battery Cells | Weight (approx.) (g) | BEC Output                 | Dimensions (mm) | Programming Method                      |
|---------------|------------------------|------------------|---------------|----------------------|----------------------------|-----------------|---|
| X45A LW       | 45A/60A                | 60A              | 3-6S Lipo     | 45                   | 6V,7.4V,8.4V adjustable/7A | 38*25*15.4      | LCD Programming Card G2 Android&iOS App |
| X65A LW       | 65A/85A                | 85A              | 3-6S Lipo     | 53                   | 6V,7.4V,8.4V adjustable/8A | 34*27*17.7      | LCD Programming Card G2 Android&iOS App |
| X85A LW       | 85A/105A               | 105A             | 3-6S Lipo     | 69                   | 6V,7.4V,8.4V adjustable/8A | 42*32*20.4      | LCD Programming Card G2 Android&iOS App |
| X65A PRO SBEC | 65A/85A                | 85A              | 3-6S Lipo     | 68                   | 6V,7.4V,8.4V adjustable/8A | 51*35*18.6      | LCD Programming Card G2 Android&iOS App |
| X85A PRO SBEC | 85A/105A               | 105A             | 3-6S Lipo     | 82                   | 6V,7.4V,8.4V adjustable/8A | 60.5*36*22      | LCD Programming Card G2 Android&iOS App |

**Note: The dimensions of the speed controller include the approximate size of the heat dissipation fan. X45A, X65A,And X85A do not include a heat dissipation fan.**

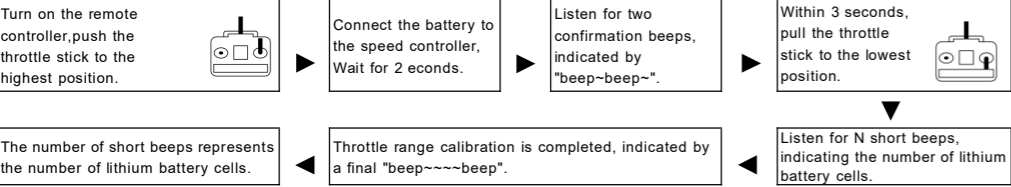
Connection Diagram:

- ①Throttle Signal Wire (Black, Red, White): Insert into the motor throttle channel,where the white wire is used to transmit the throttle signal, while the red and black wires are for voltage output and ground respectively.
- ②RPM Signal Wire (Yellow): Insert into the RPM input channel of the aileronless system.
- ③BEC Output Wire (Black, Red): Insert into the dedicated channel for the receiver battery or any other available channel.



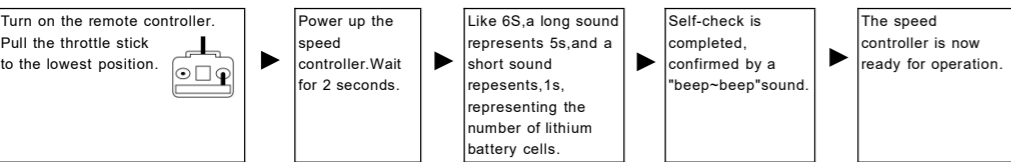
First-time Use of the Speed Controller and Throttle Range Setting

Important Note: When using the speed controller for the first time or when switching to a different remote controller, it is essential to reconfigure the throttle range.



Please follow these steps carefully to ensure proper throttle range calibration.

Normal Startup Procedure for the Speed Controller



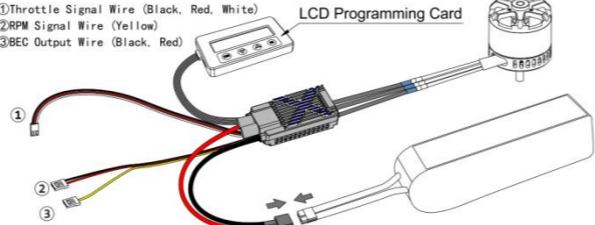
Please ensure that you follow this startup procedure to ensure the proper functioning of the speed controller.

Parameter Setting and Speed Controller Data Viewing Method

This speed controller allows for parameter settings to meet different flight requirements. You can use an LCD programming card or a mobile app to view real-time data from the speed controller, including current, voltage, speed controller temperature, throttle, and status codes.

1. Using the LCD Programming Card for Parameter Setting and Real-time Data Viewing(LCD Programming Card needs to be purchased separately)

B1: Wiring Diagram

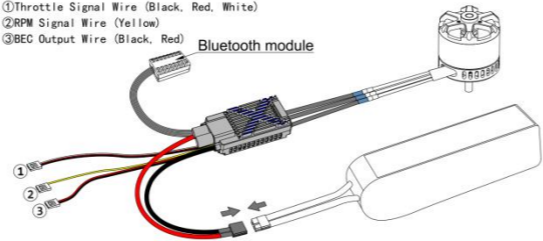


B1: Operation Steps

- 1.Refer to the diagram to correctly connect the speed controller, LCD programming card, and battery. (When connecting the programming card to the speed controller using the programming card connection cable, you can differentiate and negative positions based on the markings. The red wire corresponds to the positive terminal, and the black wire corresponds to the negative terminal.)
2. Once properly connected, the LCD programming card will automatically enter the real-time data interface, where you can view the real-time data from the speed controller. (The displayed real-time data includes voltage, current, throttle, RPM, temperature, etc.)
3. Press the "ITEM" or "OK" button to enter the parameter setting (Pressing "ITEM" cycles through the programming items, pressing "▽" moves down to change the parameter value of a specific programming item, pressing "△" moves up to change the parameter value of a specific programming item, and pressing the "OK" button saves and applies the selected parameter value to the speed controller.)
- 4.After each parameter change, it is necessary to re-power the speed controller for the new settings to take effect.

2.Using the App for Parameter Setting and Real-time Data Viewing (Bluetooth module needs to be purchased separately)

A1: Wiring Diagram



B1: Operation Steps

1. Refer to the diagram to connect the speed controller to the Bluetooth module, and then connect the speed controller to the battery. (The red wire of the Bluetooth module corresponds to the positive terminal, and the black wire corresponds to the negative terminal.)
- 2.Download and install the corresponding mobile app (e.g., SUNNYSKY Mobile App) on your smartphone. Open the app and connect to the Bluetooth module. Once connected, you can proceed with parameter setting and real-time data viewing.
- 3.After each parameter change, it is necessary to re-power the speed controller for the new settings to take effect.

Programmable Parameter Items and Descriptions

| 1.Helicopter Programmable Parameter Items and Corresponding Setting Values Table       |                    |                         |            |           |      |      |      |   |   |    |  |
|--|--------------------|-------------------------|------------|-----------|------|------|------|---|---|----|--|
| Parameter Item   |                    |                         |            |           |      |      |      |   |   |    |  |
| 1.Governor Mode  | *Internal Governor | External Governor       |            |           |      |      |      |   |   |    |  |
| 2.Low Voltage Protection   | Disabled           | 2.7V                    | *3.0V      | 3.2V      | 3.4V | 3.6V | 3.8V |   |   |    |  |
| 3.Timing   | *Auto              | Low                     | Medium     | High      |      |      |      |   |   |    |  |
| 4.BEC Voltage  | 6V                 | 7.4V                    | *8.4V      |           |      |      |      |   |   |    |  |
| 5.Motor Rotation   | *Clockwise (CW)    | Counter-clockwise (CCW) |            |           |      |      |      |   |   |    |  |
| 6.Governor Parameter P   | 1                  | 2                       | 3          | *4        | 5    | 6    | 7    | 8 | 9 | 10 |  |
| 7.Governor Parameter I   | 1                  | 2                       | *3         | 4         | 5    | 6    | 7    | 8 | 9 | 10 |  |
| 8.Acceleration   | Fast               | Normal                  | *Slow      | Very Slow |      |      |      |   |   |    |  |
| 9.Auto Restart Time  | *Disabled          | 90s(Enabled)            |            |           |      |      |      |   |   |    |  |
| 10.Helicopter Type   | Other              | OMP-M4                  | *OMP-M4MAX |           |      |      |      |   |   |    |  |
| 11.Factory Reset   |                    |                         |            | Reset     |      |      |      |   |   |    |  |
| Note: The values marked with * represent the default factory settings for helicopters. |                    |                         |            |           |      |      |      |   |   |    |  |

2.Fixed-wing Programmable Parameter Items and Corresponding Setting Values Table

| 1. Brake Type  | *Normal Brake  | Reverse Brake                                       |       |           |      |      |      |  |  |  |  |
|--|----------------|---|-------|-----------|------|------|------|--|--|--|--|
| 2. Brake Strength  | *0             | 0~100   |       |           |      |      |      |  |  |  |  |
| 3. Timing  | *15°           | 0~30°   |       |           |      |      |      |  |  |  |  |
| 4. Motor Rotation  | *CW(Clockwise) | CCW(Counter-clockwise)                              |       |           |      |      |      |  |  |  |  |
| 5. SR Function   | ON             | *OFF  |       |           |      |      |      |  |  |  |  |
| 6. Battery Cell Count  | *Auto          | 3S, 4S, 6S / 3S, 4S, 6S, 8S / 6S, 8S, 10S, 12S, 14S |       |           |      |      |      |  |  |  |  |
| 7. Low Voltage Protection Threshold  | Disabled       | 2.5V  | *3.0V | 3.2V      | 3.4V | 3.6V | 3.8V |  |  |  |  |
| 8. Low Voltage Protection Mode   | *Reduce Power  | Immediate Shutdown                                  |       |           |      |      |      |  |  |  |  |
| 9. BEC Voltage   | 6.0V           | *7.4V   | 8.4V  |           |      |      |      |  |  |  |  |
| 10.Acceleration  | Fast           | *Normal   | Slow  | Very Slow |      |      |      |  |  |  |  |
| 11.Startup Power   | Low            | *Medium   | High  |           |      |      |      |  |  |  |  |
| 12.Flight Mode   | *Fixed-wing    | Helicopter  |       |           |      |      |      |  |  |  |  |
| 13.Governor Parameter P  | *4             | 1~10  |       |           |      |      |      |  |  |  |  |
| 14.Governor Parameter I  | *3             | 1~10  |       |           |      |      |      |  |  |  |  |
| 15.Motor Pole Count  | *1             | 1~30  |       |           |      |      |      |  |  |  |  |
| Note: The values marked with * represent the default factory settings for fixed-wing aircraft. |                |   |       |           |      |      |      |  |  |  |  |

3.Explanation of Programmable Items for Fixed-wing Aircraft

1、Brake Type

- ①Normal Brake: When this function is enabled, the speed controller will apply the set brake strength to stop the motor after the throttle stick is returned to zero . This is the default setting for brake type.
- ② Reverse Brake: By switching the motor's direction, the motor can be rapidly stopped. To activate this function, connect the 3-pin signal wire to the throttle channel and connect the 1-pin signal wire to any 2-position switch channel on the receiver. Turn on the 2-position switch on the remote controller to enable the reverse function. Toggle the 2-position switch on the remote controller to adjust the motor's direction.

⚠ Warning: This function is only effective below 50% throttle and should only be used when the aircraft is landing on the ground. Otherwise, it may cause damage to the speed controller!

2、Brake Strength

This parameter sets the speed at which the motor stops when the throttle is returned to zero in normal brake mode. A higher value indicates a stronger braking force and a shorter time for the motor to stop. The range is 0% to 100% adjustable (in steps of 1%). The default setting is 0%. (This function is only effective in normal brake mode.)

3、Timing

This parameter adjusts the advance timing of the speed controller driving the motor. The range is 0° to 30° adjustable, with a default setting of 15°.

4、Motor Rotation

This parameter sets the direction of the motor rotation. By default, the motor rotates in the forward direction (CW). If set to reverse (CCW), the motor will rotate in the opposite direction.

5、SR Function

This function improves the efficiency and energy-saving capabilities of the speed controller, resulting in longer flight times. The default setting is OFF.

6、Battery Cell Count

This parameter can be set to automatically calculate the number of battery cells or manually set the cell count. When set to auto, the cell count is calculated based on a single cell voltage of 3.8V. If using LiFe or LiHV batteries and encountering a battery error during the speed controller self-check process, this parameter can be adjusted to correct the detection. The default setting is auto.

7、Low Voltage Protection Threshold

This parameter supports 2.5V/3.0V/3.2V/3.4V/3.6V/3.8V in 6 adjustable levels. The value represents the voltage per cell. For example, if using a 6-cell LiPo battery, the final protection voltage will be the set value multiplied by 6. The default setting is 3.0V.

8、Low Voltage Protection Mode

Reduce Power: When the preset low voltage protection threshold is reached, the speed controller reduces the output power to 70%. This is the default setting.

Immediate Shutdown: When the preset low voltage protection threshold is reached, the speed controller immediately shuts down the output power.

9、BEC Voltage

This parameter sets the voltage output of the built-in BEC (Battery Eliminator Circuit). The options are 6.0V, 7.4V, and 8.4V, with a default setting of 7.4V.

10、Acceleration

This parameter adjusts the acceleration of the motor. The options are Fast, Normal, Slow, and Very Slow. A higher value indicates a smoother acceleration. The default setting is Normal.

11、Startup Power

This parameter adjusts the startup power of the motor. The options are Low, Medium, and High. A higher setting provides more startup power. The default setting is Medium.

12、Flight Mode

Fixed-wing Mode: Suitable for fixed-wing aircraft and multirotor aircraft. In this mode, the motor starts only when the throttle is above 5% (including 5%), and the throttle response is quick.

Helicopter Mode: Suitable for helicopters that require governor mode. In this mode, the motor starts only when the throttle is above 30% (including 30%). The motor starts in an ultra-smooth manner and enters a stable RPM state after a gradual startup. When switching to this mode from other modes, a governor calibration is required for normal operation of the governor function. Once in this mode, repeated governor calibration is not necessary. The default setting is Fixed-wing Mode.

13、Governor Parameter P

This parameter controls the amount of compensation the speed controller applies to maintain the target RPM. A higher value results in greater compensation when the RPM is too low or too high. This parameter should be adjusted in conjunction with the Governor Parameter I. The range is 1 to 10, with a default setting of 4.

14、Governor Parameter I

When the RPM is below or above the set target, the speed controller applies compensation. This parameter adjusts the level of compensation. A higher value can lead to excessive compensation, while a lower value may result in insufficient compensation. The range is 1 to 10, with a default setting of 3.

15、Motor Pole Count

This parameter sets the number of poles in the motor. The range is 1 to 30, with a default setting of 1. For example, if the motor has 5 pole pairs, the value should be set to 10.

Speed Governing Function Explanation and Settings

1.Speed Governing Explanation


By calibrating the RPM (Rotations Per Minute), a motor speed-throttle value curve is established. Then, the throttle value is set to a fixed value on the remote control, which corresponds to the desired RPM output. The speed controller maintains this RPM even when the motor load changes.

2.RPM Calibration Process

- ①Before RPM calibration, perform throttle range calibration (if the speed controller has already been calibrated, this step is not necessary).
- ②Set the main rotor pitch to 0 degrees.
- ③Set the throttle value on the remote control to the lowest position and wait for the speed controller self-check to complete.
- ④Then, slowly increase the throttle to 50%, and the main rotor will start to slowly accelerate (since the main rotor pitch is set to 0 degrees, the helicopter will not lift off). Once the main rotor reaches a stable RPM, reduce the throttle to the lowest position, and the main rotor will gradually decelerate and stop. This completes the RPM calibration.
- ⑤For M4/M4MAX speed controllers, calibration is not required. You can directly select the helicopter type. For other helicopters, select "Other" first, and then proceed with the calibration.

3.How to Calculate 100% Throttle RPM for the Main Rotor

- ①First, check the maximum calibrated RPM using the LCD programming card.


- ②100% throttle RPM for the main rotor = Max RPM ÷ (Number of Motor Poles ÷ 2) ÷ Gear Ratio.

For example, if the motor has 10 poles, 13T motor pinion, and 120T main gear, resulting in a gear ratio of 9.23.

Use the above formula to calculate the 100% throttle RPM for the main rotor.

If you need to maintain a main rotor speed of 2500 RPM during 3D flight, you need to set the throttle value to 2500 ÷ calculated 100% throttle RPM.

Alternatively, you can directly set the number of motor poles and gear ratio on the LCD programming card to obtain the 100% throttle RPM for the main rotor.

Protection Function Explanation

1.Abnormal Input Voltage Protection

When the speed controller is connected to a battery or power supply, it checks the input voltage. If the input voltage is not within the working voltage range of the speed controller, it will enter a protection state and flash the LED lights while emitting an alarm sound.

2.Startup Protection

If the motor fails to start normally within two seconds after applying throttle, the speed controller will shut down the motor. The throttle needs to be reset before the motor can be restarted. Possible reasons for startup failure include loose or disconnected motor connections, obstruction of the propeller by foreign objects, or a jammed gearbox.

3.Temperature Protection

When the working temperature of the electronic speed controller exceeds 110 degrees Celsius, it will automatically reduce the output power to protect itself. However, it will not completely shut off the power output but will reduce it to a maximum of 70% of full power. This ensures that the motor still has some power to prevent a crash.

4.Throttle Signal Loss Protection

If the speed controller detects a loss of throttle signal for one second, it will automatically reduce the output power to the motor. If the throttle signal remains lost for more than two seconds, the speed controller will shut off the motor. If the throttle signal is restored during the power reduction process, the speed controller can immediately resume throttle control. This protection mechanism is designed to prevent sudden loss of control, but it only activates when the throttle signal is genuinely lost for an extended period.

5.Overload Protection

When the load suddenly increases, the speed controller may cut off power or automatically restart. A sharp increase in load is usually caused by a motor stall.

6.Low Voltage Protection

If the working voltage of the speed controller drops below the set protection voltage, it will gradually reduce the output power to protect itself. However, it will not completely shut off the power output but will reduce it to a maximum of 50% of full power. This ensures that there is still enough power for a controlled landing. Once a new battery is connected and the power is restored, the speed controller will return to normal operation.

7.Over-current Protection

If the current exceeds the specified limit during operation, the speed controller will immediately cut off the output power. It will then quickly restore power, but if the current exceeds the limit again, it will permanently cut off power. Normal operation will resume after power is disconnected and reconnected. Over-current protection is usually triggered by overload or motor failure.

8.Disconnection Protection

If the motor and speed controller are not properly connected, the speed controller will detect the disconnection and trigger a protection mechanism. It is important to check the motor and speed controller connections to ensure they are secure and properly soldered.

Alarm Sound Explanation

| Problem                            | Alarm sound  |
|------------------------------------|--|
| 1.Throttle Signal Loss             | "Beep-Beep" (repeated every 2 seconds)                     |
| 2.Temperature Protection           | "Beep Beep-Beep Beep" (repeated every 2 seconds)           |
| 3.Low Voltage Protection           | "Beep Beep Beep-Beep Beep Beep" (repeated every 2 seconds) |
| 4.Throttle Not at Zero on Power-Up | "Beep-Beep" (repeated every 200 milliseconds)              |
| 5.Voltage Out of Supported Range   | "1-2-3-1-2-3" (repeated every 200 milliseconds)            |