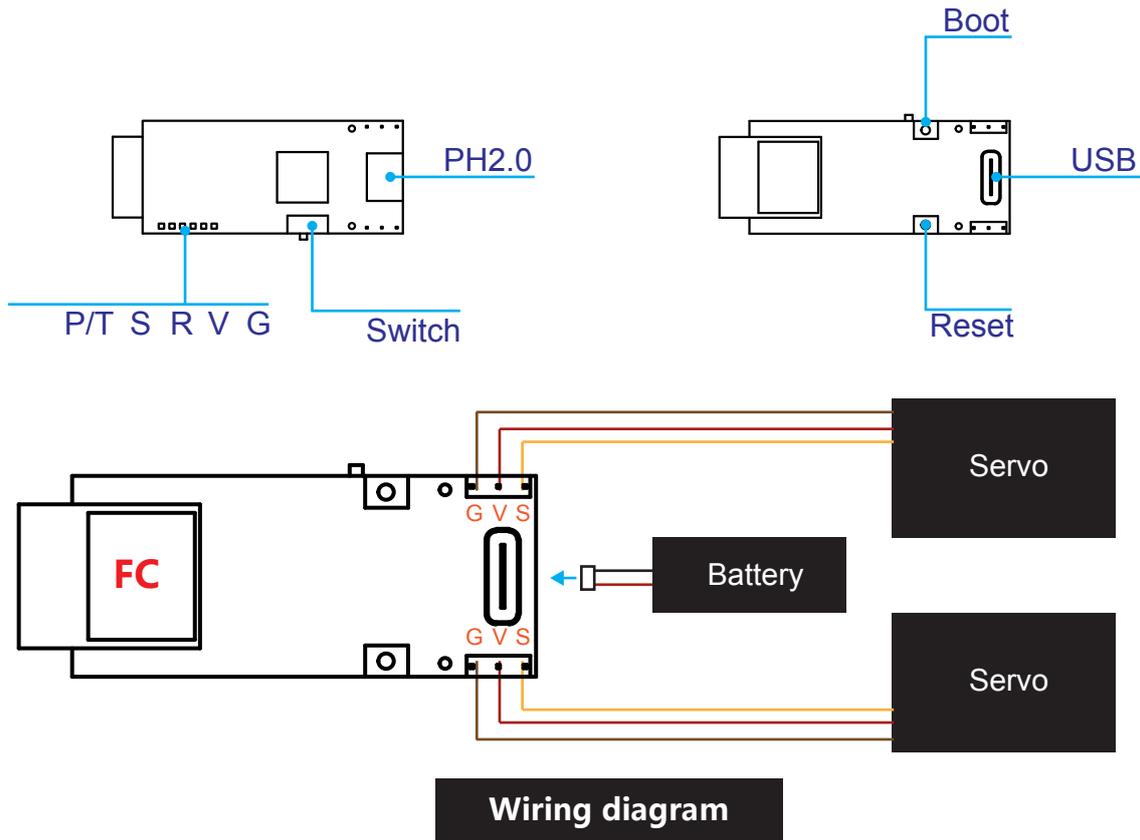# User Manual for CTorque Bionic Butterfly

Wiring diagram

Parameter Introduction

Flight Controller Power Supply: 1S, 300~380mAh, 60C~100C
Flight Controller Communication Protocol: ERLS/PPM/ESPNOW/WiFi
Operation is recommended indoors or in outdoor environments with gentle wind only.

After a battery is connected, the indicator light will flash rapidly continuously for 3 seconds, and the flight controller will enter the communication protocol selection mode. Within these 3 seconds, **single-click** the **BOOT button** to cycle through and switch communication protocols. After switching to the desired communication protocol, **double-click** the BOOT button to confirm and enter this protocol.

- Slow Flash: ERLS Mode
- Fast Flash: PPM
- Long On & Short Off: SBUS
- Short On & Long Off: ESPNOW
- Constant On: WiFi (Difficult to Control for Beginners)

1. Constant Indicator Light: Sufficient Battery Power
2. Flashing Indicator Light: Low Battery Power; the battery needs to be charged.

If the Boot button is not used to select and switch the communication protocol before power-on, the flight controller will automatically load the protocol last selected by the user and enter the working state. When using the flight controller for the first time, the automatically loaded protocol defaults to the WiFi protocol.

Under the ELRS/PPM communication protocols, ensure that the remote control travel range is set to the standard 1000–2000. Otherwise, the butterfly cannot be controlled.

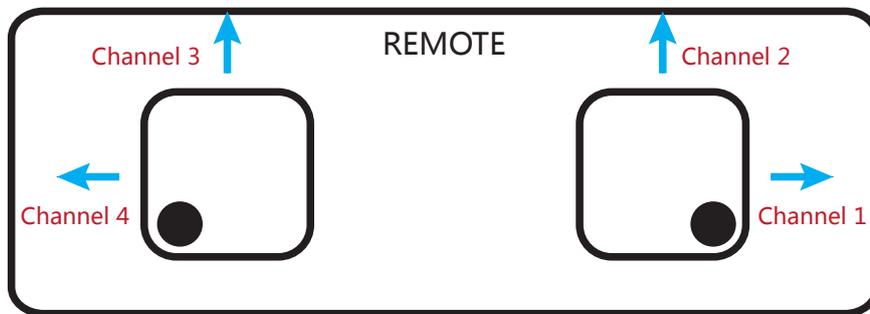Introduction to Remote Control Channel Functions Under ELRS/PPM Protocols

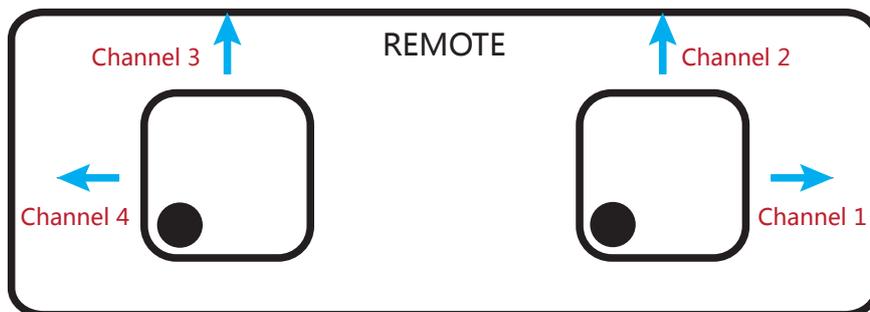Take the American Hand transmitter as an example:
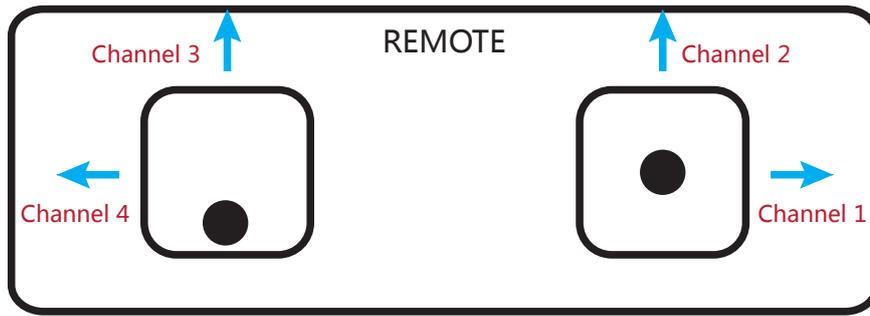
- Channel 3: Throttle
- Channel 2: Ascent/Descent
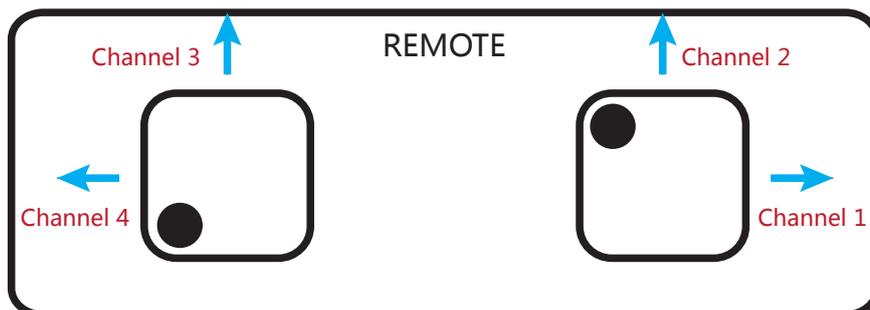- Channel 1: Left/Right Turning

Control Operations:

Channel 3 Down, Channel 4 Left, Channel 1 Right, Channel 2 Down: Unlock (The butterfly must be unlocked first before remote control operation).
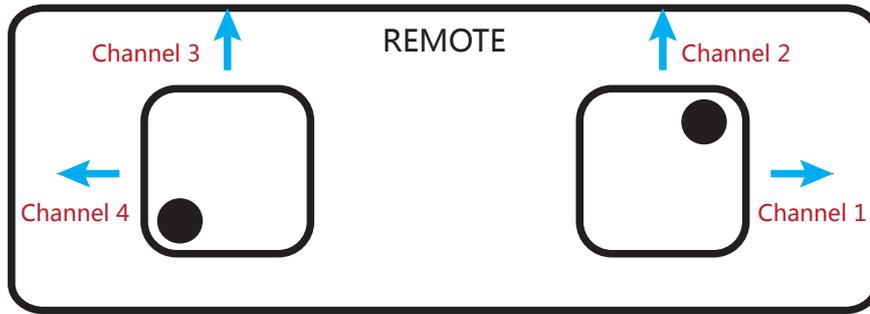

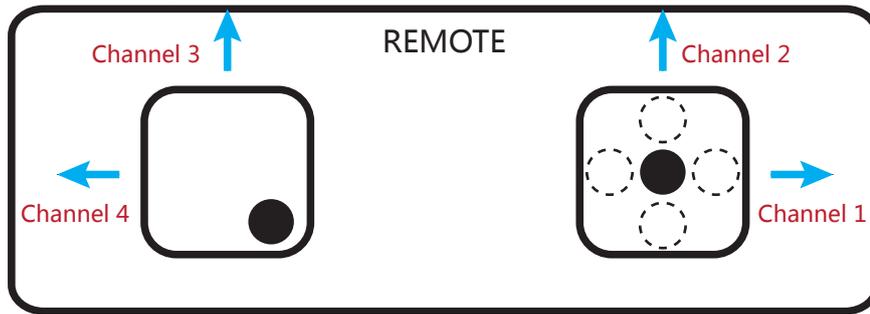Channel 3 Down, Channel 4 Left, Channel 1 Left, Channel 2 Down: Lock.

Channel 3 Down, Channel 4 Left, Channel 1 Left, Channel 2 Up: Gyroscope Off.
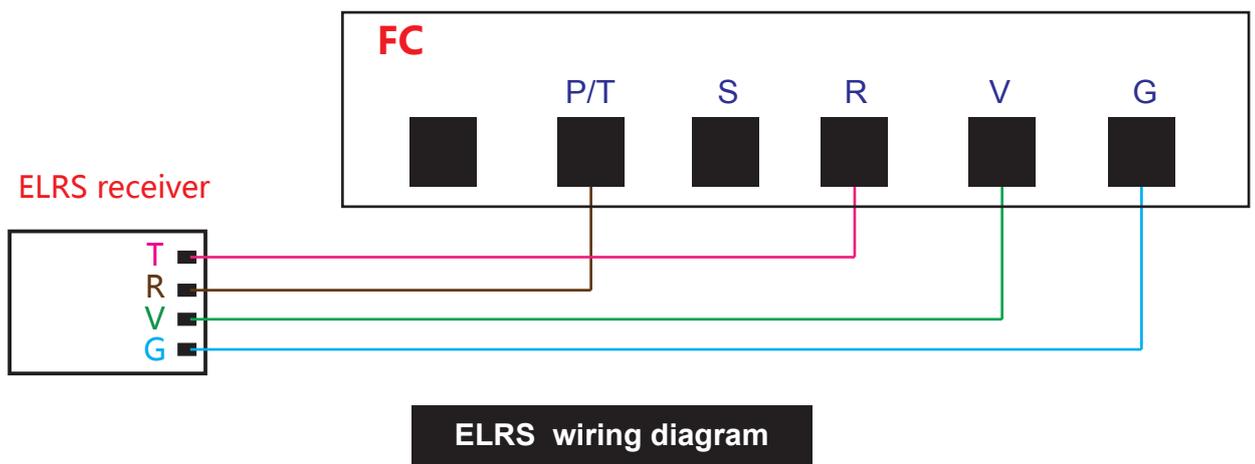
Channel 3 Down, Channel 4 Left, Channel 2 Up, Channel 1 Right: Gyroscope On.

When Channel 3 is Down and Channel 4 is Right: Use Channel 1 and 2 to perform fine-tuning of the servo arm's neutral position.

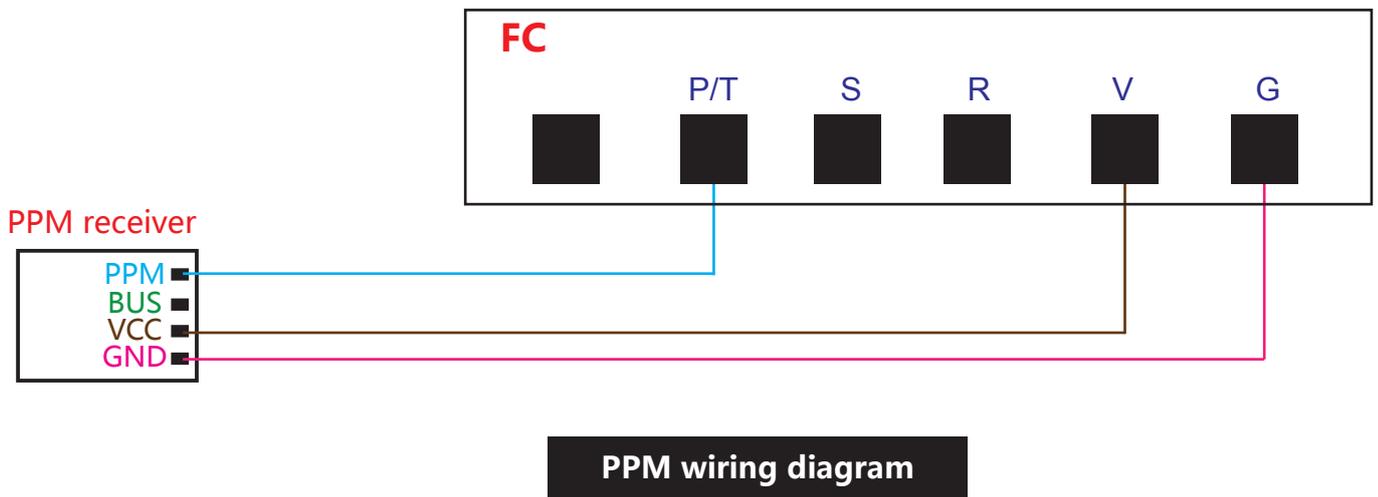## 1. Operation Steps for ELRS Mode

ELRS wiring diagram

(1) Solder the ELRS receiver in accordance with the **wiring diagram**.

(2) Power on the flight controller. Follow the receiver binding tutorial to bind the receiver to the transmitter. Disconnect the battery after binding is completed.

(3) Place the butterfly flat, connect the flight controller to the battery, and **single-click** the BOOT button within 3 seconds to switch the communication protocol.

(4) When the indicator light is in the slow-flashing state, **double-click** the BOOT button to confirm, and the flight controller will enter the ELRS communication protocol.

(5) Unlock the flight controller and turn on the gyroscope; then you can control the butterfly's flight with the transmitter.

(6) Each time the battery is connected, the indicator light will flash slowly three times. This is a reminder that the device pre-boot check and gyroscope calibration process is about to start. During gyroscope calibration, the flight controller (the butterfly) **must be placed flat on the ground**.

(7) **Important Note**: If you are not skilled at launching the butterfly by hand, you can use a vertical rod to support the butterfly's body while ensuring the wings can flap freely. This will make it much easier to control the butterfly's takeoff.

(8) Before the first flight, you need to fine-tune the angle of the servo arm. **Important Note**: The angle of the servo arm has a significant impact on the butterfly's flight performance. Perform fine-tuning in multiple stages until the butterfly can fly stably (refer to the **flight guide** for the optimal angle). After confirming the adjustment is complete, **double-click** the BOOT button to save the current fine-tuning settings.

2. Operation Steps for PPM Mode

PPM wiring diagram

(1) Solder the PPM receiver in accordance with the **wiring diagram**.

(2) Power on the flight controller. Follow the receiver binding tutorial to bind the receiver to the transmitter. Disconnect the battery after binding is completed.

(3) Place the butterfly flat, connect the flight controller to the battery, and **single-click** the BOOT button within 3 seconds to switch the communication protocol.

(4) When the indicator light is in the **fast-flashing** state, **double-click** the BOOT button, and the flight controller will enter the PPM control mode.
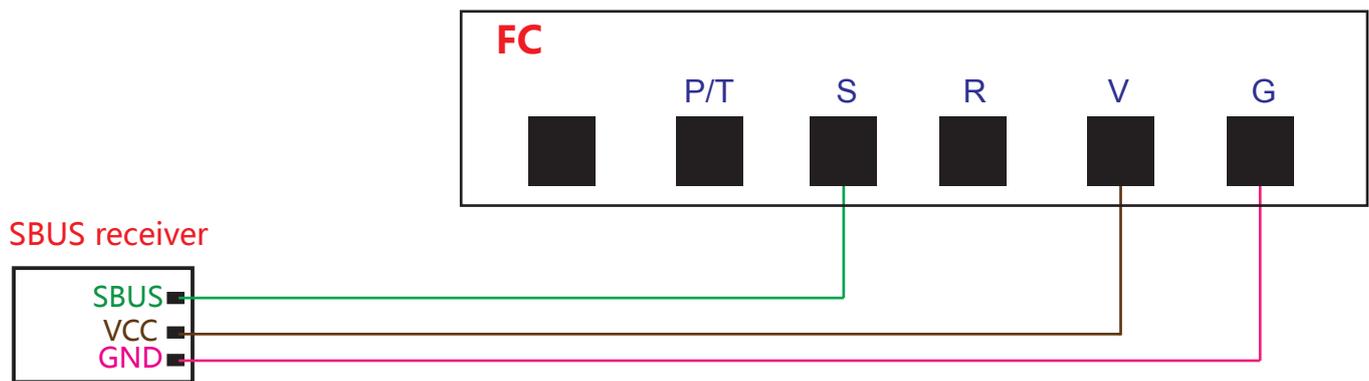
(5) Unlock the flight controller and turn on the gyroscope; then you can control the butterfly's flight with the transmitter.

(6) Each time the battery is connected, the indicator light will flash slowly three times. This is a reminder that the device pre-boot check and gyroscope calibration process is about to start. During gyroscope calibration, the flight controller (the butterfly) **must be placed flat on the ground**.

(7) **Important Note**: If you are not skilled at launching the butterfly by hand, you can use a vertical rod to support the butterfly's body while ensuring the wings can flap freely. This will make it much easier to control the butterfly's takeoff.

(8) Before the first flight, you need to fine-tune the angle of the servo arm. **Important Note**: The angle of the servo arm has a significant impact on the butterfly's flight performance. Perform fine-tuning in multiple stages until the butterfly can fly stably (refer to the **flight guide** for the optimal angle). After confirming the adjustment is complete, double-click the BOOT button to save the current fine-tuning settings.

3. Operation Steps for SBUS Mode

(1) Solder the SBUS receiver in accordance with the **wiring diagram**.

(2) Power on the flight controller. Follow the receiver binding tutorial to bind the receiver to the transmitter. Disconnect the battery after binding is completed.

(3) Place the butterfly flat, connect the flight controller to the battery, and **single-click** the BOOT button within 3 seconds to switch the communication protocol.

(4) When the indicator light is in the **Long On & Short Off** state, **double-click** the BOOT button, and the flight controller will enter the SBUS control mode.

(5) Unlock the flight controller and turn on the gyroscope; then you can control the butterfly's flight with the transmitter.

(6) Each time the battery is connected, the indicator light will flash slowly three times. This is a reminder that the device pre-boot check and gyroscope calibration process is about to start. During gyroscope calibration, the flight controller (the butterfly) **must be placed flat on the ground**.

(7) **Important Note**: If you are not skilled at launching the butterfly by hand, you can use a vertical rod to support the butterfly's body while ensuring the wings can flap freely. This will make it much easier to control the butterfly's takeoff.

(8) Before the first flight, you need to fine-tune the angle of the servo arm. **Important Note**: The angle of the servo arm has a significant impact on the butterfly's flight performance. Perform fine-tuning in multiple stages until the butterfly can fly stably (refer to the **flight guide** for the optimal angle). After confirming the adjustment is complete, double-click the BOOT button to save the current fine-tuning settings.

4. Operation Steps for WiFi Mode

(1) Download the **Edge browser** on your mobile phone.

(2) Connect the flight controller to the battery, and **single-click** the BOOT button within 3 seconds to switch the control mode.

(3) When the indicator light stays **constantly on**, **double-click** the BOOT button, and the flight controller will enter **WiFi** control mode.

(4) Enable WiFi on your mobile phone, search for the WiFi network named "**Kang_Buttflyer**" and connect to it. **WiFi password: 12345678**.

(5) Open the Edge browser and enter the **URL: 192.168.4.1** to access the remote control interface.

(6) Each time the battery is connected, the indicator light will flash slowly three times. This is a reminder that the device pre-boot check and gyroscope calibration process is about to start. During gyroscope calibration, the flight controller (the butterfly) **must be placed flat on the ground**.

(7) **Important Note**: If you are not skilled at launching the butterfly by hand, you can use a vertical rod to support the butterfly's body while ensuring the wings can flap freely. This will make it much easier to control the butterfly's takeoff.

(8) Before the first flight, you need to fine-tune the angle of the servo arm. **Important Note**: The angle of the servo arm has a significant impact on the butterfly's flight performance. Perform fine-tuning in multiple stages until the butterfly can fly stably (refer to the **flight guide** for the optimal angle). After confirming the adjustment is complete, **double-click** the BOOT button to save the current fine-tuning settings.
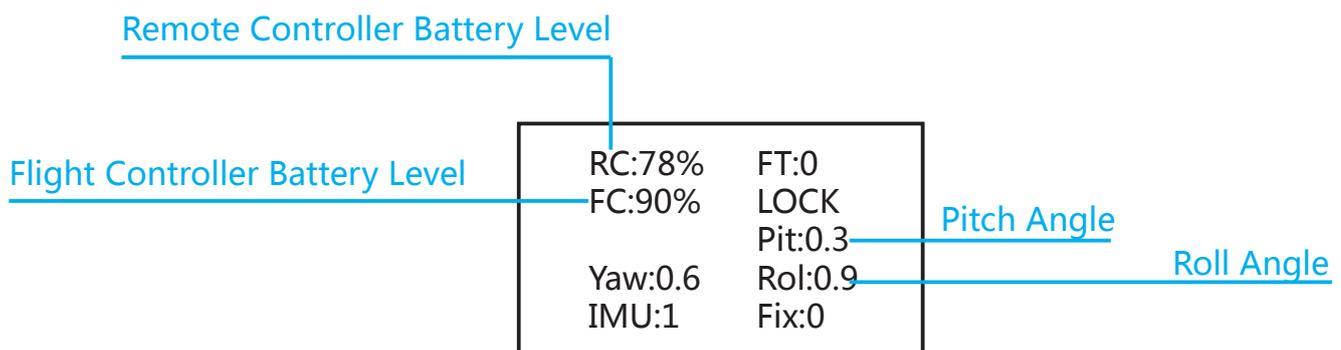
5. ESP-NOW Mode

Installation & Initial Frequency Pairing Instructions
Before use, install the display screen as shown in the diagram.

Initial Frequency Pairing Steps:
(1). Power on the flight controller, and single-click the **BOOT** button within 3 seconds to switch the communication protocol.
(2). When the indicator light is in the **"short on, long off"** state, double-click the **BOOT** button to put the flight controller into the ESPNOW communication protocol mode.
(3). Power off the flight controller.
(4). Turn on the ESPNOW remote controller; the small middle **D4** indicator light will turn on after 2 seconds. **Single-click** the X button within 3 seconds to enable the frequency pairing mode on the remote controller.
(5). Power on the flight controller; it will enter the ESPNOW control mode and automatically pair with the remote controller.
(6). After 3 seconds, the remote controller's display screen will light up, indicating successful frequency pairing.
(7). If pairing fails, repeat the above steps.

Remote Controller Battery Level

Flight Controller Battery Level

```
RC:78%    FT:0
FC:90%    LOCK
          Pit:0.3     Pitch Angle
Yaw:0.6   Rol:0.9     Roll Angle
IMU:1     Fix:0
```

Notes

1. Each time you power on the device, the indicator light will flash slowly three times. This is a prompt that the device is about to enter the pre-boot device detection and gyroscope calibration phase.

Before calibrating the gyroscope, simply place the flight controller (the butterfly) flat on the ground. Within 3 seconds after power-on, be sure to keep the butterfly level. If the gyroscope is not calibrated, the device will fail to fly straight.

2. Normal Operating Modes
(1) Indicator light stays on: Self-stabilization mode. Battery is fully charged.
(2) Indicator light flashes: Self-stabilization mode. Battery is low; please recharge the battery.
(3) Indicator light is off: The device is in acrobatic mode.

3. After adjusting the horizontal angle of the arm, double-click the B button to save the trim results—this eliminates the need to perform trim adjustments before each flight.

4. Self-Stabilization Mode
When Channel 6 is set to the minimum value, the device enters self-stabilization mode. The flight controller's indicator light stays on or flashes, and the bionic butterfly automatically maintains stable attitude and heading.
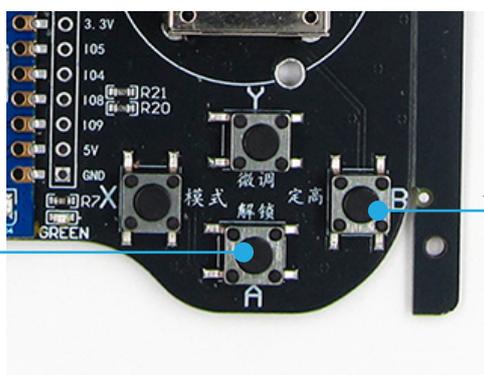
5. Acrobatic Mode
When Channel 6 is set to the maximum value, the device enters acrobatic mode, and the flight controller's indicator light turns off. By manipulating Channel 1 and Channel 2 simultaneously, you can perform four acrobatic maneuvers: 360° forward flip, 360° backward flip, 360° left flip, and 360° right flip.
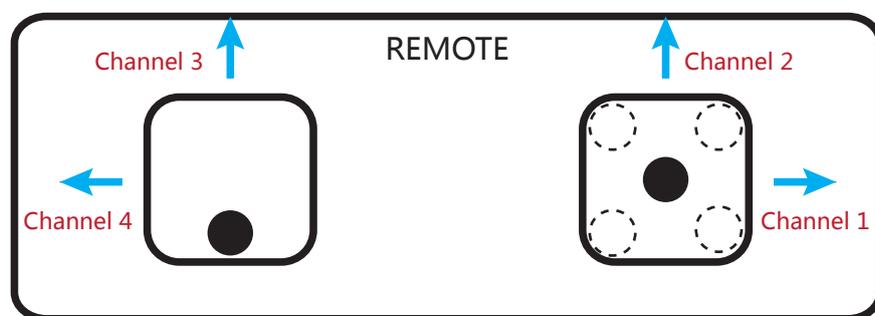
6. LED Strip Control
For remote controllers that support ELRS/PPM/SBUS protocols, use Channel 5 to switch the LED strip modes. For ESPNow remote controllers, press the A button to switch the modes.

Flight Guide — Butterfly Flight Principle and Tuning Methods

Flight Principle

I. Straight Flight
Straight flight is maintained by the **equal lift** generated by the wings on both sides.
The angle between the servo arm and the horizontal line affects the lift force:

● When the servo arm is below the horizontal line, the greater the angle, the stronger the lift.

● Conversely, when the servo arm is above the horizontal line, the greater the angle, the weaker the lift.
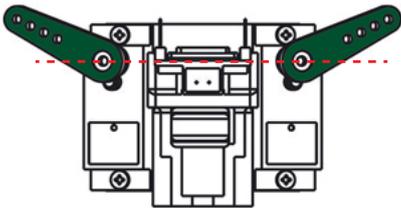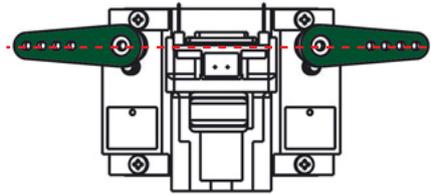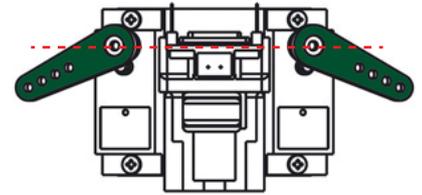

| Figure 1 | Figure 2 | Figure 3 |

Figure 1
Before the butterfly takes off, the servo arm is positioned at an upward angle relative to the horizontal plane. The larger the angle, the more likely the butterfly is to nose-dive.

Figure 2
The servo arm is kept in a horizontal position. Recommended for beginners: adjust to this position before takeoff.

Figure 3
The servo arm forms a downward angle with the horizontal plane. The larger the angle, the more likely the butterfly is to pitch up and flip over.

II. Pitch Control
As shown in **Figure 1**, when the servo arm is at an **upward angle**, the butterfly will generally **dive forward** with fast forward speed and rapid descent.

As shown in Figure 3, when the servo arm is at a **downward angle**, the butterfly will generally **pitch up** with slow forward speed but is prone to loss of control.

III. Turning Control
Turning is achieved by leveraging the **difference in flapping amplitude** of the servos—the side with a larger flapping amplitude generates greater lift, which causes the butterfly to turn.

Uncontrolled Turning to Avoid
The hardness, wear condition and damage level of the wings will affect the working performance of the two sides, leading to uncontrolled turning that interferes with the butterfly's flight control.

IV. Falling-Leaf Glide

Principle: When the butterfly stops flapping its wings, the **positional difference of the servo arms** creates an asymmetric torque, which in turn generates a rolling spin during descent.

As shown in **Figure 5**: the left servo generates less lift while the right servo generates more, causing the butterfly to **spin clockwise**.

As shown in **Figure 6**: the butterfly will **spin counterclockwise** in the air.
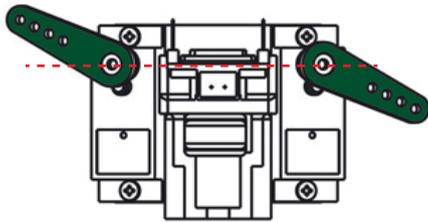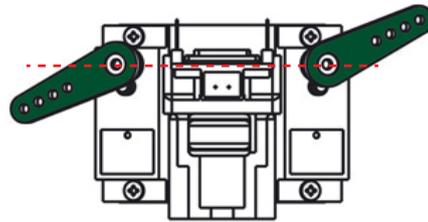
Figure 5

Figure 6

Servo Arm Tuning Methods
(Beginners are strongly recommended to enable the gyroscope before flight)

1. When powering on the flight controller, place the butterfly **flat on the ground** to allow the flight controller to automatically calibrate the gyroscope. Wait until the calibration is complete and the indicator light stays **constantly on** before picking up the butterfly for flight.

2. After the butterfly is powered on, the wings **must be adjusted to the horizontal position shown in Figure 2** before conducting the test flight.

3. If the wings are assembled correctly according to the tutorial, the butterfly should theoretically fly straight under your control with a gentle forward launch, thanks to the gyroscope's advanced algorithm.

Important Note: If you are not skilled at launching the butterfly by hand, you can use a vertical rod to support the butterfly's body while ensuring the wings can flap freely. This will make it much easier to control the butterfly's takeoff.

4. If the butterfly has **insufficient lift**, try fine-tuning the servo position **slightly downward** to increase the wing lift.

5. If the lift is **excessively high**, causing the butterfly to flip backward or fly slowly, try fine-tuning the servo position **slightly upward** to reduce the lift.

6. **The BOOT button serves as the gyroscope calibration button**. If the butterfly tends to **drift off course** during flight, it may be caused by gyroscope data drift. We recommend placing the butterfly flat and pressing the BOOT button once to recalibrate the gyroscope.

If the following issues still persist after trying the above methods:

(1) The butterfly still has insufficient lift when only the throttle is applied for forward flight.

A. Check and ensure the gyroscope is **enabled**.

B. Check for **severe wing asymmetry**: Remove the wings and overlap them to see if there is a significant difference in shape.

C. Check if the wings are **broken or damaged**.

D. Check if the angles of the servo arms are **symmetrical**.

E. Check the neutral position of the servo arms and ensure it does not form an excessively large upward or downward angle (avoid the position shown in **Figure 1**).

(2) The butterfly still **drifts off course** instead of flying straight when only the throttle is applied for forward flight.

A. Try placing the butterfly flat and pressing the BOOT button once to calibrate the gyroscope before each flight.

B. Try launching the butterfly **as horizontally as possible** with a slightly higher initial velocity.

C. If the butterfly drifts to the **left**, try tilting the butterfly 5–15 degrees to the **right** and then press the BOOT button once.
If it drifts to the **right**, try tilting the butterfly 5–15 degrees to the **left** and then press the BOOT button once.

D. If the butterfly drifts to the **left**, you can fine-tune **the left servo arm downward** on the basis of the horizontal position, or fine-tune **the right servo arm upward**. Do the opposite if it drifts to the right.

(3) The butterfly still **flips backward** when only the throttle is applied — Gradually reduce the downward angle of the servo arms and keep them as horizontal as possible.