BETAFPV

Aquila16

FPV Drone

User Manual

Version No.I 2023-10-16

1. Product List

1 x Aquila16 Brushless Quadcopter

Box Contents:
2 x Aquila16 Exclusive Battery|1100mAh
1 x BT2.0 Battery Charger and Voltage Tester
2 x Charging adapter cable
4 x Beta 45mm 3-Blades Prop (Spare Set)
1 x Prop Removal Tool
1 x Special Screw Package (Spare Set)
1 x Phillips screwdriver
1 x 4Pin Adapter Cable
1 x USB Type-C to FC Adapter (Used with 4Pin Adapter Cable to adjust configure quadcopter on BETAFPV Configurator)
1 x User Manual

2. Pre-flight Checks

1. Verify that all components are included, without damage and the quadcopter's frame has no deformation.
2. Verify that propellers and motors are installed correctly and stably.
3. Ensure that propellers do not scratch against frame ducts and motors spin smoothly.
4. Verify batteries (of quadcopter, remote control radio transmitter, and FPV goggles) are fully charged.
5. Be sure pilot is familiar with all flight controls.
6. Always keep a safe distance in all directions around the quadcopter (1 meter or more) when having a test-flight. Operate the quadcopter carefully in open space.
7. Please click the below link and watch the instruction video, you can learn how to install and remove the battery from the quadcopter and how to bind the remote control radio transmitter to the quadcopter.

https://www.youtube.com/watch?v=sVDAzZalURg

3. Flight Modes

The flight mode is displayed in the lower right corner of the flight screen, corresponding to the flight mode of quadcopter. Pilot can choose different flight modes according to different flight environments and their flight control skills.

1. Normal Mode: When the quadcopter ascends, center the two joysticks at the same time, and the quadcopter will maintain at a fixed point in a horizontal attitude. The position of the direction joystick controls the tilt direction and tilt angle of the quadcopter. The quadcopter has an auxiliary flight function that can assist in adjusting the altitude and horizontal position, which makes it easier for pilot to control. N MODE is displayed in the OSD.

2. Sport Mode: When the quadcopter ascends, pilot needs to operate the throttle joystick to control and adjust the altitude of the quadcopter. The position of the direction joystick controls the tilt direction and tilt angle of the quadcopter. When the direction joystick is moved back to the center, the quadcopter will return to a horizontal attitude. The quadcopter has no auxiliary flight function, which makes the operation relatively difficult for pilot. S MODE is displayed in the OSD.

3. Manual Mode: When the quadcopter ascends, pilot needs to operate the throttle joystick to control and adjust the flight altitude. Position of the direction joystick controls the roll direction and the roll speed of the quadcopter. The quadcopter will maintain its current attitude when the direction joystick is moved to the center. The quadcopter has no auxiliary flight function, and the flight attitude and altitude are completely dependent on the pilot to control the quadcopter by the remote control radio transmitter, which makes the operation very difficult for pilot. M MODE is displayed in the OSD.

4. Turtle Mode: If the quadcopter crashes into the ground and the fuselage is flip, the turtle mode can be activated to reverse the motor and turn the quadcopter back to the front. When in use, the direction joystick is used to control the rotation of the motor to drive the blades to rotate in the reverse direction, thereby realizing the reverse rotation of the fuselage. TURTLE is displayed in the center of the OSD. For more details, please refer to the chapter "Turtle Mode".

Note: Please keep the flight altitude within 0.3-3m when it is in the Normal Mode. This can keep the quadcopter fly stably. The outdoor flying height of the quadcopter should not exceed 3m as far as possible.

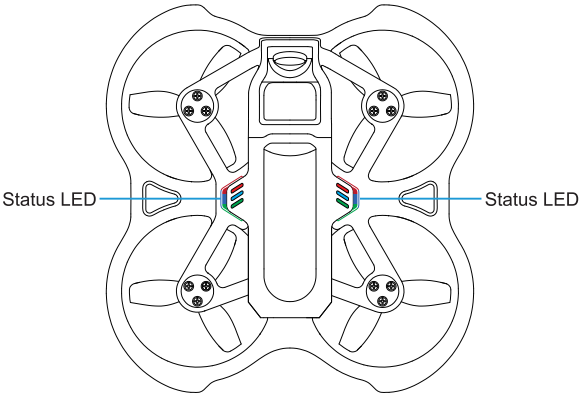
4. Binding the Quadcopter and Transmitter

The Aquila16 quadcopter integrated ExpressLRS 2.4G receiver with the default ExpressLRS 3.0 protocol.

Ensure that your transmitter is on the same protocol as Aquila16 quadcopter, which has all the channels preset beforehand (default channel map is AETR1234).

The following demonstrations are based on LiteRadio 2 SE transmitter (Mode 2 Left Stick Throttle) as an example to explain the binding process.

The binding steps are as follows:
- Ensure that the current protocol on the transmitter is ExpressLRS 2.4G 3.0 protocol;
- Power on and off the quadcopter 3 times rapidly. The status light on the quad turns green and starts to flash slowly, which means it enters the binding mode;
- Power on the transmitter and wait for the initialization to complete.
- Gently press the BIND button on the back of the transmitter, and the red LED on the transmitter will flash rapidly.
- If the status light on the quad turns solid blue, then the binding is successful.



Note:

1. The SPI ELRS 2.4G receiver integrated in Aquila16 supports the default ExpressLRS 3.0 protocol. It is not compatible with ExpressLRS 1.X or ExpressLRS 2.X protocols for frequency connection.

2. The SPI ELRS 2.4G receiver integrated in Aquila16 can use the Passthrought function through the ExpressLRS . It is recommended to only flash ExpressLRS 3.X firmwares. Down-grading to ExpressLRS 2.X may have the risk of firmware failure;

3. After one successful binding, restarting the quadcopter or transmitter will automatically binded. Re-bind is not needed.

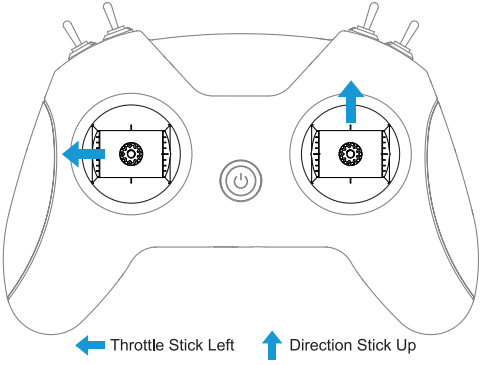
4. The re-binding of the remote control radio transmitter and the quadcopter may not be successful after pressing the BIND button of the remote control radio transmitter once. In this situation, pilot need to repress the BIND button to complete binding.

5. Kindly scan the QR code provided in point 7 of "Preflight Checks" to learn how to bind the transmitter to the quad through the instructional video.

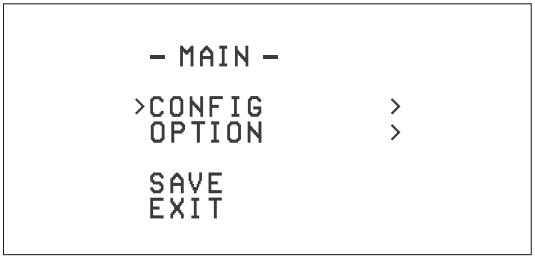
5. How to Access/Operate OSD Setting Menu

Below instruction applies to LiteRadio 2 SE Mode 2 Transmitter(Left Throttle).
The position of joysticks to access the OSD setting menu is shown below. The throttle joystick is moved to the left center and the direction joystick is towards the upward center.

Note: Make sure the quadcopter is disarmed before accessing the OSD menu.

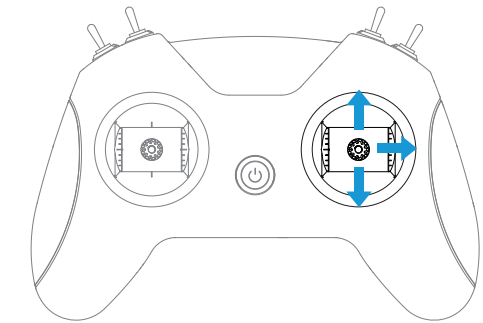


After accessing the OSD menu,
pilot will see the following menu interface on the FPV screen.



The OSD menu cursor can be controlled by the right joystick to operate the OSD interface:

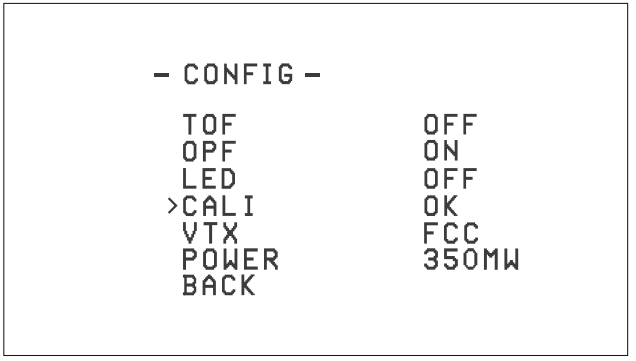
- Up: move the cursor up
- Down: move the cursor down
- Right: confirm/modify selection



5.1 Quadcopter Level Calibration

After the quadcopter has taken off and landed several times, the quadcopter gyroscope might be offset. This will cause the quadcopter to always tilt in the same direction during a flight. To fix it, the quadcopter gyroscope can be recalibrated. The steps are as follows:

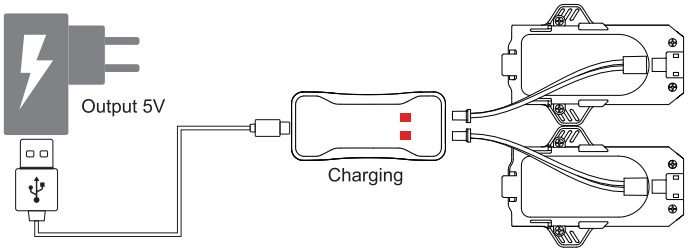
- Turn on the quadcopter and the remote control radio transmitter, and ensure that both devices are binded;
- Place the quadcopter on a horizontal plane;
- Enter the quadcopter's OSD menu (Refer to "OSD Menu Operation");
- In the MAIN menu, select CONFIG, then CALI;
- Push the direction joystick to the right to enter level calibration mode. The quadcopter's LED flashes blue;
- When the OK prompt appears and the LED returns to solid blue, the calibration is complete. Pilot can exit the OSD menu.



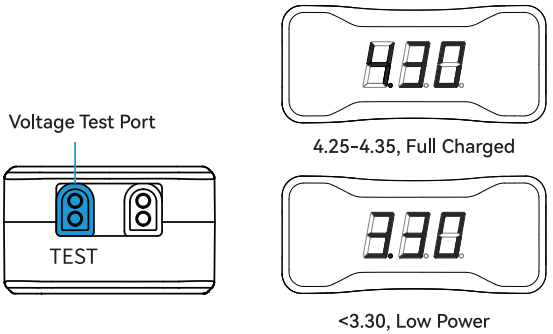
5.2 Battery Charging

Each battery provides 8 minutes of smooth flight. When LOW VOL is displayed in the OSD flight interface, which indicates that the battery is too low and needs to be charged. Charging steps are shown as below:

- Plug the charger into the Type-C port through a USB cable;
- Connect one or two batteries to the port on the right of the charger and the charger's LED will turn solid red while charging;
- When the charger's LED turns solid green, charging is complete.



Two batteries can be charged at the same time. Charging a fully discharged battery takes approximately 60 minutes. When the battery is inserted into the TEST port and the charger is not plugged in via USB cable, the current battery level will be displayed. The number of 4.25-4.35 represents a fully charged battery while 3.30 or lower indicates a low battery.

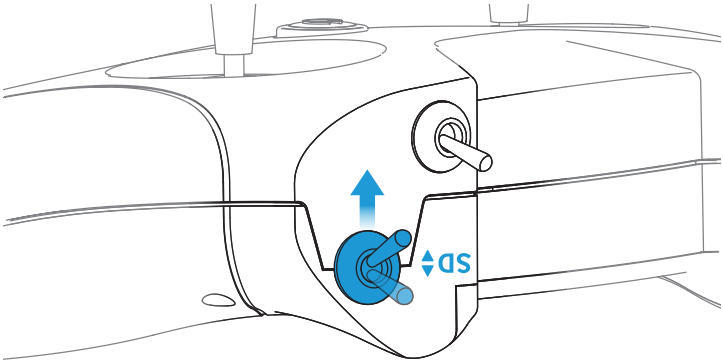


6. Turtle Mode

When the quadcopter falls to the ground and is facing down, we can activate turtle mode with the remote control radio transmitter to turn it over. To activate turtle mode:

The following example uses LiteRadio 2SE(Left Throttle) to demonstrate.

- Toggle switch SD from down to up to activate turtle mode. TURTLE is displayed in the OSD, as shown below;
- Move the direction joystick towards either direction. The motor will spin, and the quadcopter will reverse;
- Move switch SD down to turn off turtle mode;
- Arm the quadcopter and operate normally.



Quadcopter in Flip State:Toggle Switch SD from Down to Up to Activate Turtle Mode

Note:

1. Turtle mode is suitable for flat ground and it's not recommended to activate this mode on grass or fabrics as the motor may be obstructed, resulting in damage of the motors and ESC.

2. When the battery power of the quad is too low, such as ≤3.5V, the quad may not be able to complete the Turtle action. At this time, it is necessary to manually flip the quadcopter to the right position.

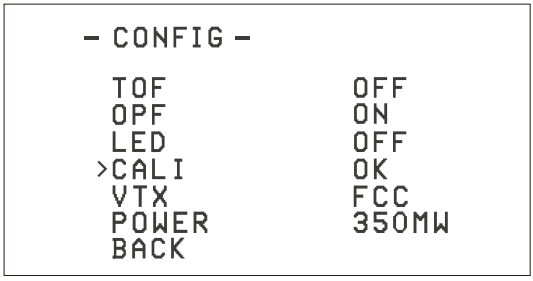
7. How to Fix Quadcopter Drift

In Normal Mode, the optical flow positioning function of quadcopter is turned on by default. When the drone starts to drift, here is a checklist you should look for to understand why your drone drift sideways and how to fix them.

Q1: The blades are blocked or damaged;
A1: Common solutions include cleaning hair and other foreign objects wrapped around the motor, or replacing damaged blades to avoid friction with the frame protection guard when the blades rotate;

Q2: The ambient light is too dark, or flying above water, causing the optical flow sensor of the hover positioning function to fail.
A2: Please fly in an environment with obvious ground features and sufficient light. Try to avoid adverse environments where it is difficult to identify ground features (such as dark environments or above water), otherwise the quad may drift or have difficulty controlling.
If you need to fly in the above-mentioned adverse environments, please turn off the quad's optical flow positioning function. After the optical flow positioning function is turned off, the quad will lose flight assistance in the horizontal direction. A good flying skill is required from pilot in such scenario. You can enter the OSD setting interface to turn off/on the optical flow positioning function.

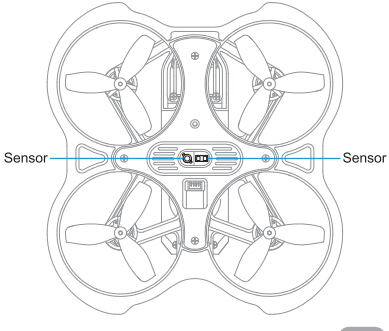
Q3: When the quad collides or falls, strong vibration causes the gyro sensor data to shift, and it cannot be automatically repaired.
A3: Enter the OSD menu to manually calibrate the gyroscope.
Enter the OSD menu, CONFIG page, select CALI, turn the joystick to the right to enter manual gyro calibration, the blue light on the quad flashes quickly; After the calibration is completed, the blue light stays on, and the word “OK” is displayed in the OSD menu (Please change Place the quad on a horizontal surface for calibration, do not move the quad during calibration);



Note: To set the OSD menu, please refer to the "How to Access/Operate OSD Setting Menu" chapter in the manual. For the detailed gyroscope calibration process, please refer to the "Quadcopter Level Calibration" chapter in the manual.

Q4: The ambient wind speed is greater than level 3, resulting in unstable hovering.
A4: In an environment with excessive wind speed, it is recommended to fly in S or M mode. Or turn off the optical flow positioning function and manually control the horizontal position of the flight. Kindly enter the OSD setting interface to turn off/on the optical flow positioning function.

Q5: Hovering is unstable due to dirty sensors.
A5: Please ensure that there is no covering object underneath the sensor and no dirt or dust on the sensor surface that affect its accuracy. When flight assistance is abnormal, please kindly wipe the sensor clean before continuing to use it.



1. 产品清单

1 * “云鹰16” Aquila16无刷整机

配件清单：
2 * Aquila16专用电池|1100mAh
1 * 1S电显充电器
2 * 充电转接线
4 * 桨叶（备用）
1 * 取桨器
1 * 专用螺丝包（备用）
1 * 十字螺丝刀
1 * 4Pin转接线
1 * USB Type-C转接板 （与4Pin转接线配合用于飞控连接上位机调参）
1 x 使用说明书

2. 飞行前注意事项

1. 取出所有设备，对照产品清单，确定配件齐全无损，确定飞机机架无变形。
2. 检查桨叶和电机是否安装正确和稳固。
3. 检查电机是否能够正常旋转，如果出现桨叶摩擦机架，或者异物缠绕等阻碍电机旋转情况，请先处理。
4. 确保遥控器电池、飞机电池以及FPV眼镜电池电量充足。
5. 请确保熟知每个摇杆的功能后再进行飞行。
6. 请选择空旷场地进行试飞，并且人与飞机保持一米以上距离，小心操作，注意安全。
7. 请扫描以下二维码，通过视频了解如何插拔飞机电池以及如何使遥控器与飞机对频。

3. 飞行模式介绍

飞行模式显示在飞行画面的右下角位置，对应飞机的飞行方式。操控者可以根据不同的飞行环境和自身操控飞行技巧，选择不同的飞行模式。

1. 普通模式：即定高定点模式，飞机启动上升之后，油门摇杆居中时，飞机会以水平姿态定点悬停，向上推动油门摇杆时，飞机垂直上升，向下推动油门摇杆时，飞机垂直下降，方向摇杆的位置对应飞机的倾斜方向和倾斜角度。难度较小。OSD中显示NMODE。
2. 运动模式：飞机启动上升后，飞行者需要操作油门摇杆来控制和调整飞机的高度。方向摇杆的位置对应飞机的倾斜方向和倾斜角度，摇杆回中后，飞机会恢复水平姿态。飞机无辅助飞行功能，难度较大。OSD中显示S MODE。
3. 手动模式：飞机启动上升后，飞行者需要操作油门摇杆来控制和调整飞机的高度。方向摇杆位置对应飞机的翻滚方向和速度，摇杆回中后，飞机会保持当前姿态。飞机无辅助飞行功能，完全依靠飞行者通过遥控器操控飞机飞行，难度大。OSD中显示MMODE。
4. 反乌龟模式：若飞机碰撞落地后机身是反面朝上的状态，可通过启用反乌龟模式，使电机反转，将飞机翻转回正面。使用时用方向摇杆控制马达转动带动桨叶反转，进而实现机身反转回正。OSD中在屏幕正中央显示TURTLE。详见“反乌龟模式”章节。

注意：在使用普通模式飞行时，尽量选择无风环境，飞机距地面高度保持在0.3~3m范围，可以使飞机更平稳地飞行。飞机室外飞行高度尽量不要超过3m。

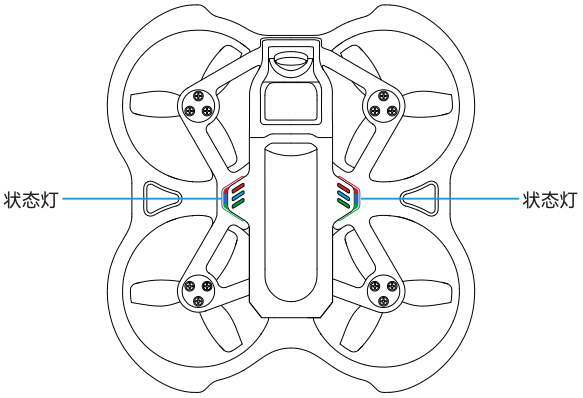
4. 遥控器和飞机对频

Aquila16整机集成ExpressLRS 2.4G接收机，出厂默认ExpressLRS 3.0协议。
使用遥控器与飞机对频，确保您的遥控器使用的协议和Aquila16整机的协议是一致的，并且已经配置正确了遥控器通道（通道配置为AETR1234）。

下面以遥控器LiteRadio 2 SE，美国手版本（左手油门）为例进行说明。

对频步骤如下所示：

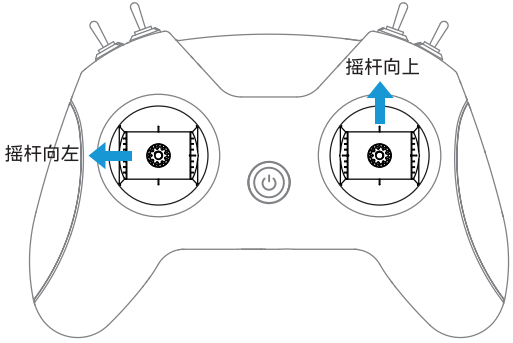
- 确保遥控器当前协议为ExpressLRS 2.4G协议第3版，即ELRS 3.0版本；
- 飞机快速连续上电三次，飞机上的状态灯变为绿色，并且开始缓慢闪烁，即进入对频模式；
- 遥控器开机，等待遥控器初始化完成；
- 用螺丝刀轻按遥控器背部的BIND按键，遥控器LED红色快速闪烁；
- 如果对频成功，则飞机状态灯变为蓝色常亮，连接正常。



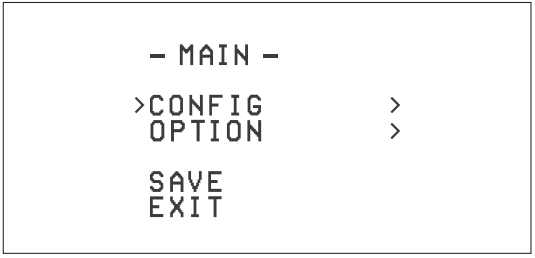
注意：
1. Aquila16集成的Serial ELRS 2.4G接收机出厂默认支持ExpressLRS 3.0协议；使用ExpressLRS 1.X或者ExpressLRS 2.X协议无法对频连接；
2. Aquila16集成的Serial ELRS 2.4G接收机可以通过ExpressLRS上位机使用Passthrought功能，建议更新ExpressLRS 3.X即可，更新为ExpressLRS 2.X可能存在失败的风险；
3. 对频成功之后，重启飞机或者遥控器，将会自动完成连接，无需每次上电重新对频。
4. 遥控器与飞机重新对频时，可能按压一次遥控器BIND键后无法完成对频操作，此时需要按压第二次遥控器对频键才能完成对频。
5. 您也可以通过扫描“飞行前注意事项”第7点提供的二维码，通过教学视频了解遥控器如何与飞机对频。

5. OSD设置菜单操作

下面以遥控器LiteRadio 2 SE，美国手版本（左手油门）为例进行说明。
进入OSD设置菜单的打杆方式如下图所示，油门摇杆在中位向左打杆到底，方向摇杆同时向上打杆到底。注意，必须确保飞机是在上锁状态才能进入OSD菜单

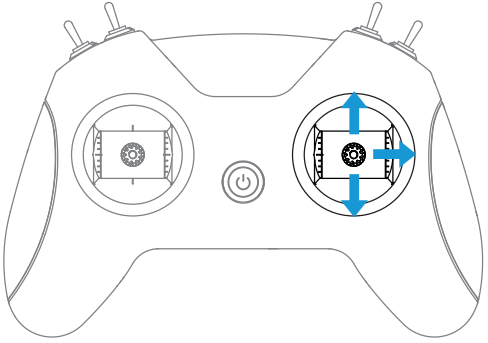


进入OSD菜单之后，可以在FPV图像中看到如下图所示的主菜单界面。



可以通过方向摇杆控制OSD菜单光标，从而进行OSD界面操作：

- 往上打，光标往上移动
- 往下打，光标往下移动
- 往右打，确定/修改



摇杆向上：
光标向上移动

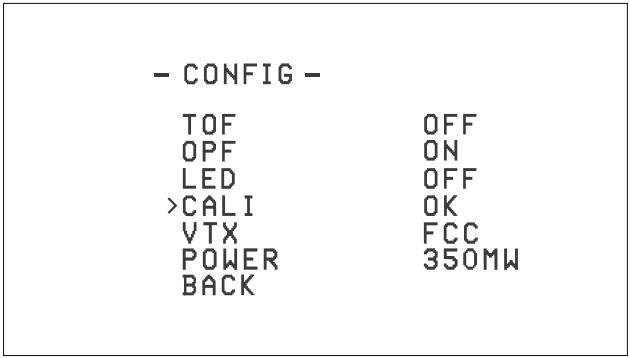
摇杆向下：
光标向下移动

摇杆向右：
进入子目录/确认

6. 飞机水平校准

飞机在多次起落之后，可能会出现飞机陀螺仪数据偏移的问题，表现为飞机飞起来之后，朝单一方向倾斜。这个时候，可以将飞机进行陀螺仪数据校准。校准步骤如下：

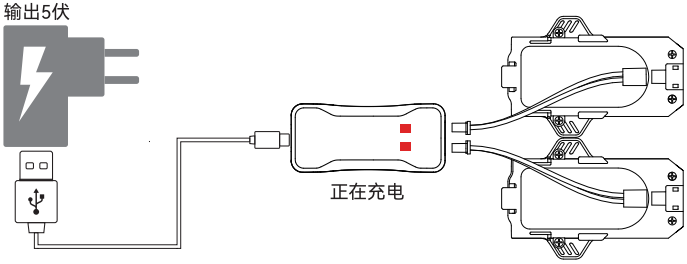
- 将飞机和遥控器开机，并且确保连接成功；
- 将飞机放置于水平平面上；
- 通过遥控器操作，进入OSD设置菜单；
- 在MAIN主界面，选中CONFIG并进入CONFIG界面，并且将光标移动到CALI所在行。如下图所示；
- 向右打方向摇杆，进入飞机水平校准，飞机蓝灯闪烁；
- 当后面出现OK提示，飞机恢复蓝灯常亮时，校准完成，退出OSD菜单即可。



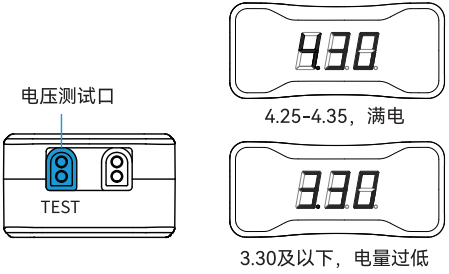
7. 飞机电池充电

一片电池最长可以飞行8分钟。当OSD飞行界面上显示LOW VOL，表示电池电量过低，需要充电。充电步骤如下：

- 取出充电器，并且通过连接线插入Type-C接口中；
- 将电池接入充电器右侧的接口中，充电器变为红色，表示正在充电；
- 充电器LED指示变为绿色，充电结束。



充电器一次可以充电2片电池，一片电池充电时间为60分钟左右。使用充电器上的测试口可以测试电池电量情况，电池插入测试口时会显示当前所插入电池的电量。显示4.25-4.35表示电池是满电；显示3.30及以下表示电池电量过低。

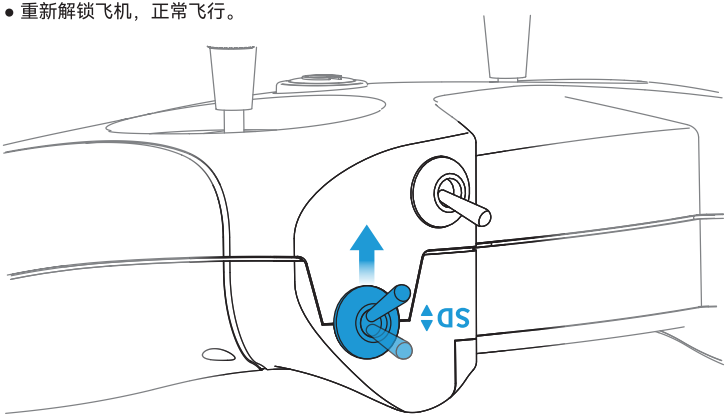


8. 反乌龟模式

当飞机掉落地上，并且正面朝下的时候，可以通过遥控器使用反乌龟模式把飞机反过来。基本步骤如下：

下面以遥控器LiteRadio 2 SE，美国手版本（左手油门）为例进行说明。

- 把SD拨杆从下到上拨动一次，开启反乌龟模式，OSD图像中显示TURTLE。如下图所示；
- 朝任一方向拨动方向摇杆，马达转动，飞机反转过来；
- 把SD拨杆拨到最下，关闭反乌龟模式；
- 重新解锁飞机，正常飞行。



飞机反面朝上时，从下到上拨动一次开启反乌龟模式

注意：

1. 反乌龟模式建议在较为平整地面进行。如果掉落在草地、织物等表面，飞机正面朝下时，可能会有异物卡住马达，若强行使用反乌龟转动马达，会导致飞机损坏。
2. 当飞机电池电量过低时，如≤3.5V时，飞机可能无法完成反乌龟动作，这时需要手动回正机身。

9. 悬停故障排除指南

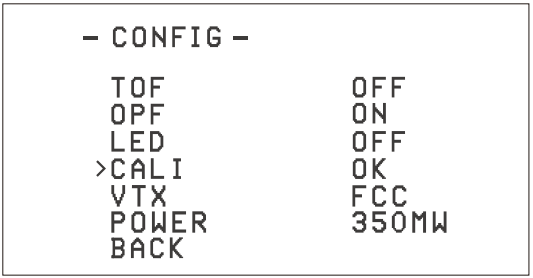
普通模式下，飞机的光流定位功能处于开启状态，该功能可以实现飞机水平方向的飞行辅助，将油门摇杆放至中位时，能够实现精准的定点悬停。如果起飞之后悬停不稳，朝某个方向偏飞，可以通过下面几个步骤排除故障。

常见问题一：马达桨叶出现堵转或者损坏；
解决方案：常见的如清理马达上缠绕的头发等异物，或者更换损坏的桨叶，避免桨叶旋转时摩擦到机架保护环；

常见问题二：环境光线太暗，或者在水面上方，导致悬停定位功能的光流传感器失效。
解决方案：请到地面特征较明显，光线较为充足的环境下飞行，需要尽量避开难以识别地面特征的不良环境（如光线较暗的环境或水面上方），否则飞机可能会出现有漂移或控制困难的问题。
若需要在上述不良环境中飞行，可以关闭飞机的光流定位功能。光流定位功能关闭后，飞机会失去水平方向上的飞行辅助，因此要求飞行者有较好的飞行基础。可以进入到OSD设置界面关闭/开启光流定位功能。

常见问题三：飞机在碰撞或者掉落时，强烈振动导致了陀螺仪传感器数据发生偏移，且无法自动修复。
解决方案：进入OSD菜单进行一次手动校准陀螺仪。

进入OSD菜单，CONFIG页面，选中CALI，向右打方向摇杆进入手动陀螺仪校准，飞机上蓝色灯快速闪烁；校准完成后蓝色灯常亮，并且OSD菜单中显示OK字样；（请将飞机放置在水平面上进行校准，不要在校准过程中移动飞机）



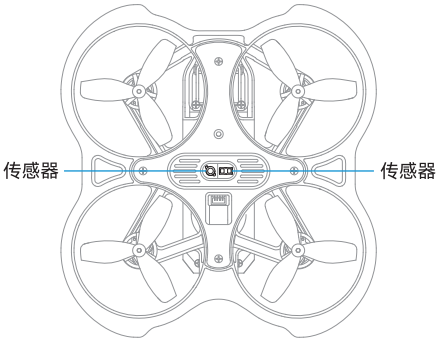
注意：设置OSD菜单请参考说明书“OSD设置菜单操作”章节，详细的陀螺仪校准过程请参考说明书“飞机水平校准”章节。

常见问题四：环境风速大于3级导致悬停不稳。

解决方案：在风速过大的环境下，建议使用S档或者M档飞行。或者关闭光流定位功能，手动控制飞行的水平位置。可以进入到OSD设置界面关闭/开启光流定位功能。

常见问题五：因传感器脏污导致悬停不稳。

解决方案：请确保传感器下方没有被异物遮挡，传感器表面没有影响其精度的污渍和灰尘。飞行辅助异常时可以擦拭干净传感器再继续使用。



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