

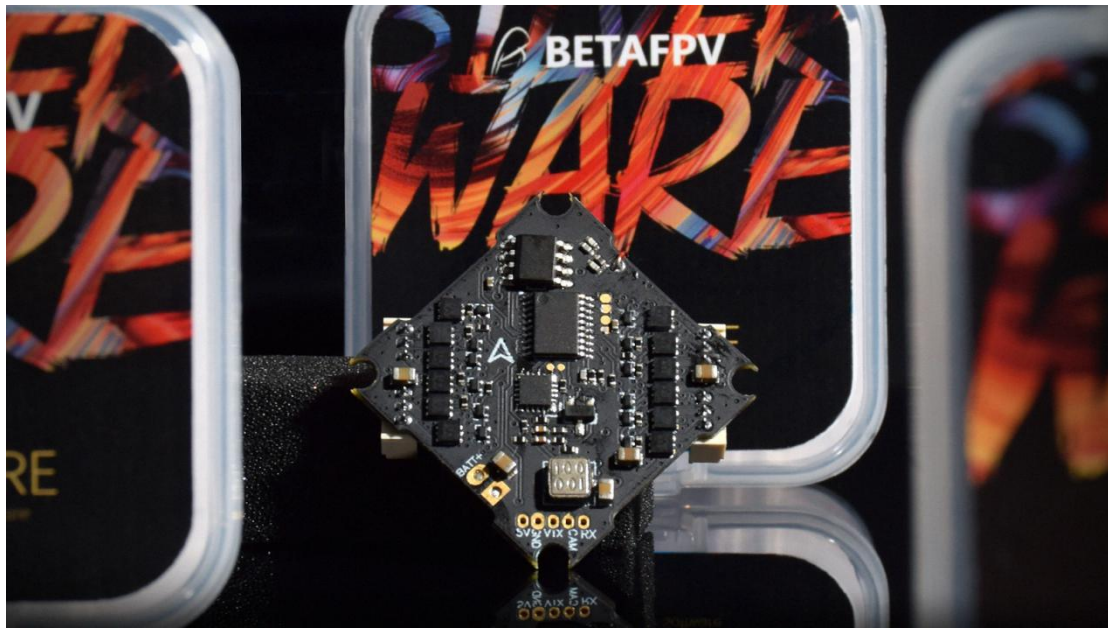
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# 1. INTRODUCTION

BETAFPV Lite 2S FC is the first brushless flight controller with Silverware firmware. For fans of Silverware firmware, now you could try it with brushless drone like Beta85 Pro 2. The stock firmware is based on brushed NFE\_Silverware, which is used on popular ZERO board. With an ingenious design of build-in OSD, it's convenient for users to observe the flying status and change the parameters like PID.



## 2. SPECIFICATION

Adopting updated and improved Silverware firmware brings you excellent flight experience on Lite 2S FC.

### SPECIFICATIONS OF FC

- CPU: STM32F031F6P6 ARM 32-bit Cortex-M0 (64MHZ )
- Six-Axis: MPU6050
- Size: 26mm x 26mm, whoop mounting pattern
- OSD: BETAFPV Lite OSD
- Build-in Receiver: Bayang protocol
- External Receiver: SBUS protocol or DSMX protocol
- Power Cable: 55mm, with XT30 cable

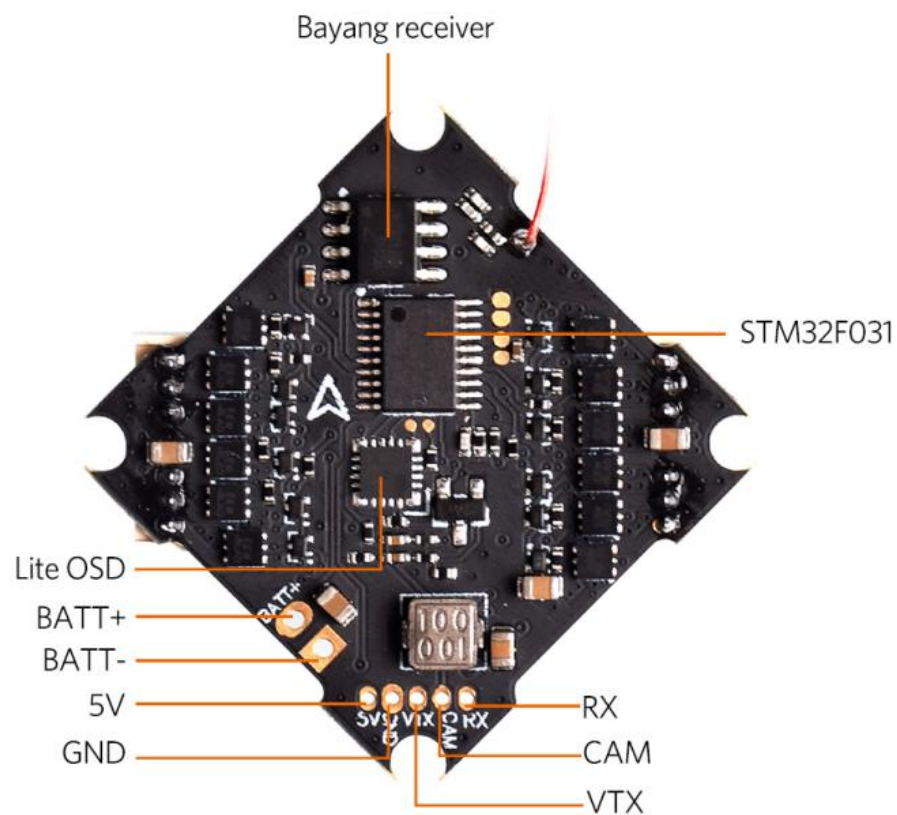
- Weight: 3.6g ( without cable )

## SPECIFICATIONS OF ESC

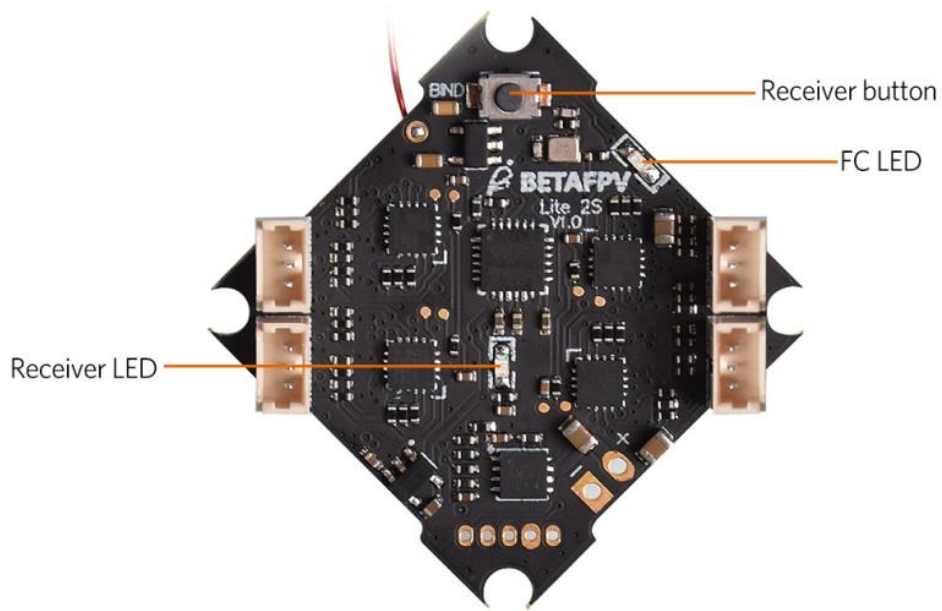
- Built-in ESC with 5A continuous and peak 6A current
- Input voltage: 2S lipo
- Support BLHeliSuite programmable
- Motor Connectors: 1.25mm header pins connector
- Factory firmware: S\_H\_50\_REV16\_7.HEX
- Signal Support: D-shot150, D-shot300, D-shot600(Default), Oneshot125

## 3. DIAGRAM

TOP FRONT ▲



## BOTTOM FRONT ▲

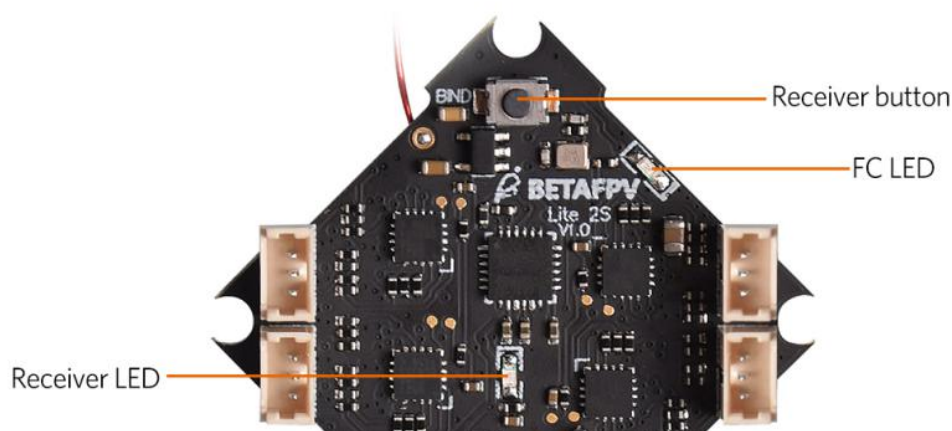


## 4. BASIC FUNCTION

- Supports brushless drone up to 2S battery power
- Includes the OSD menu. Supports PID tuning, motor rotation and channel mapping of AETR/TAER switching via OSD menu
- Build-in receiver with Bayang protocol and support for external receiver with SBUS protocol or DSMX protocol
- Supports various flying mode: Acromode / Levelmode / Racemode\_Angle / Racemode\_Horizon / Horizonmode
- Supports Turtle mode, easy to turn the drone over when the quad is inverted

## 5. RECEIVER CONNECTION AND BINDING METHOD

The FC integrates the SPI receiver compatible with the Bayang protocol, and also supports external receivers both SBUS and DSMX protocol. Users could switch receiver communication protocol directly via Receiver button. The status is indicated with 2 LED flashes. For more details, kindly check the picture below.

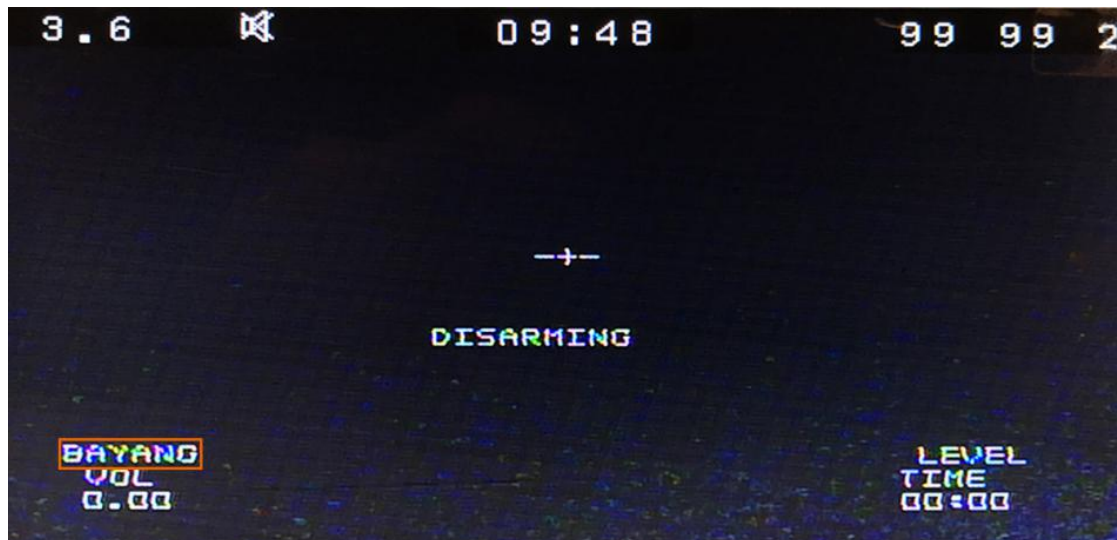


LED	Status	Description
FC LED (Green)	Solid On	Power On
FC LED (Green)	Off	Power Off
Receiver LED ( Blue)	Flash	Binding Status
Receiver LED ( Blue)	Off	Binding Successfully

### 5.1 Bayang Receiver

The Build-in SPI receiver is compatible with Bayang Protocol. The communication protocol should be set as Bayang protocol when using SPI receiver, as follows:

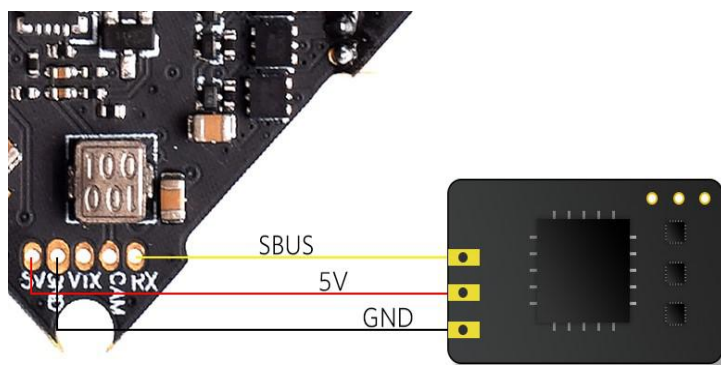
- Press the Receiver button on the bottom of the FC
- Plug the battery
- Release Receiver button when the FC has powered on
- Once “Bayang” shown, FC is successfully changed to Bayang mode



**Note:** If the data is successfully received, the Receiver LED (blue) flash will be off.

## 5.2 SBUS Protocol

Supports SBUS protocol, including Frsky xm / xm+ receiver, Futaba receiver and Crossfire receiver. Here is the diagram with SBUS protocol:



The communication protocol should be set as SBUS protocol when using the SBUS protocol, as follows:

- Press the Receiver button on the bottom of the FC
- Plug the battery
- Release Receiver button when the FC is power on
- Press the Receiver button again within 4 seconds
- Once "SBUS" shown, FC is successfully changed to SBUS mode.

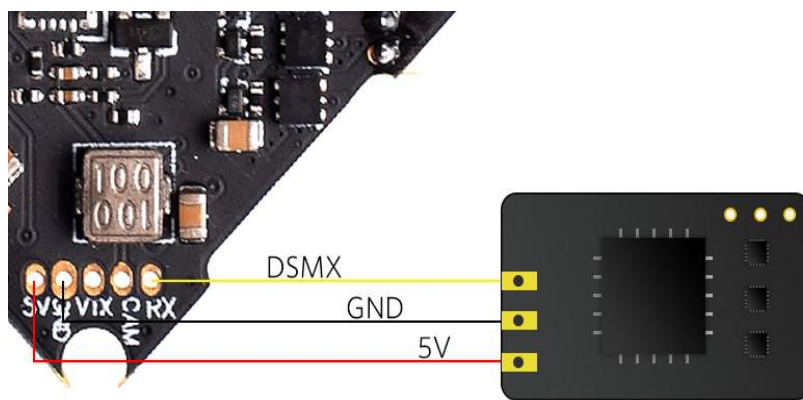




**Note:** If the data is successfully received, the Receiver LED (blue) flash will be off.

## 5.3 DSMX Protocol

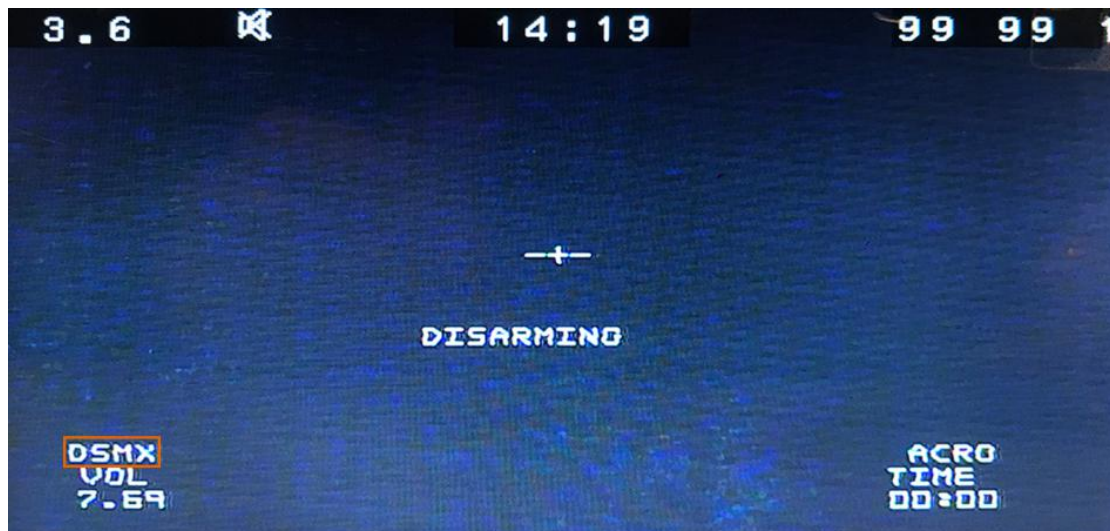
Supports DSMX protocol. Here is the diagram with DSMX protocol:



The communication protocol should be set as DSMX protocol when using DSMX receiver, as follows:

- Press the Receiver button on the bottom of the FC
- Plug the battery
- Release Receiver button when the FC is power on
- Press the Receiver button TWICE within 4 seconds
- Once “DSMX” shown, FC is successfully changed to DSMX mode.





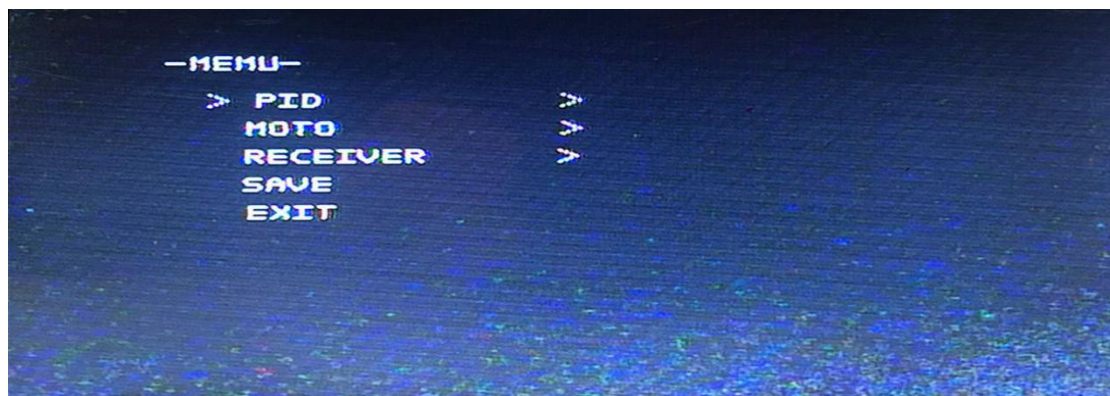
*Note: If the data is successfully received, the Receiver LED (blue) flash will be off.*

## 6. OSD MENU

*AETR is the default channel mapping of Lite 2S Brushless.*

Five options on OSD Menu: PID, MOTO, RECEIVER, SAVE and EXIT. When you choose PID, cursor will show on PID option.

Supports PID tuning, motor spinning direction changing and channel mapping of AETR / TAER switching via OSD menu. The operation of OSD Menu on Lite 2S Brushless FC is same as Betaflight.



### 6.1 How to Enter OSD Menu

The method of entering OSD Menu on Lite 2S Brushless FC is same as Betaflight, Make sure the drone is disarmed when entering OSD Menu on Lite 2S Brushless FC.



- ← Pull Left the Left Stick
- ↑ Pull Up the Right Stick

*-Use Mode 2 (American Mode) as example-*

**Note:** AETR is the default channel mapping of Lite 2S . If you can not enter the OSD menu, it might cause by unmatched channel mapping. How to switch the channel mapping, please look at the content in chapter 6.5.

## 6.2 How to Operate OSD Menu

By moving the cursor, you can enter sub-menu of PID, MOTO and RECEIVER to change the related parameters.

If the parameters are changed, you can choose the SAVE option, and then select EXIT to return, so that they will be saved and take effect.



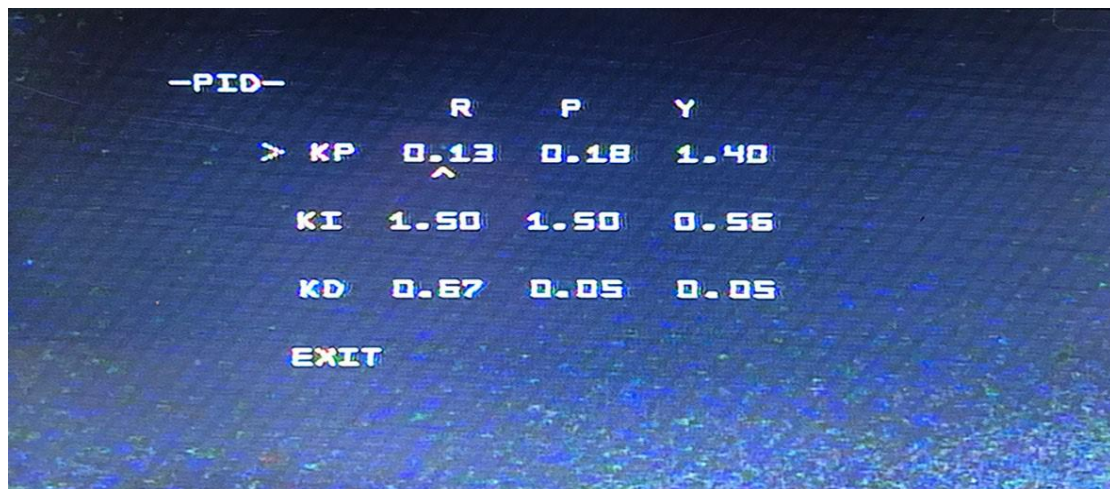
- ↑ Pull Up: Cursor moves to previous option
- ↓ Pull Down: Cursor moves to next option
- Pull Right: Confirm to enter the option you choosed

*-Use Mode 2 (American Mode) as example-*

## 6.3 How to Tune PID

Here is the method of PID tuning

- Enter OSD menu
- Move the cursor to PID option and enter PID sub-menu
- If you want to change the PID parameters, please choose the EXIT option to exit from PID sub-menu, then back to the OSD menu to select SAVE option, so that the parameters you changed will be saved and take effect.



*-PID menu interface-*



- ← Pull Left: Value will reduce 0.01
- Pull Right: Value will increase 0.01
- ↑ Pull Up: Cursor will move to previous option
- ↓ Pull Down: Cursor will move to next option

*-Use Mode two (American Mode) as example-*



## 6.4 How to Change Motor Rotation

Here is the method of Motor rotation Changing:

- Enter OSD menu.
- Move the cursor to MOTO option and enter MOTO sub-menu.
- When changed the motor rotation, go back to the previous menu. SAVE and EXIT. The changes will take effect and the FC will restart.



*-Motor menu interface-*



- ← Pull Left: Change the motor spinning direction to Normal
- Pull Right: Change the motor spinning direction to Reverse
- ↑ Pull Up: Cursor will move to previous option
- ↓ Pull Down: Cursor will move to next option

*-Use Mode two (American Mode) as example-*

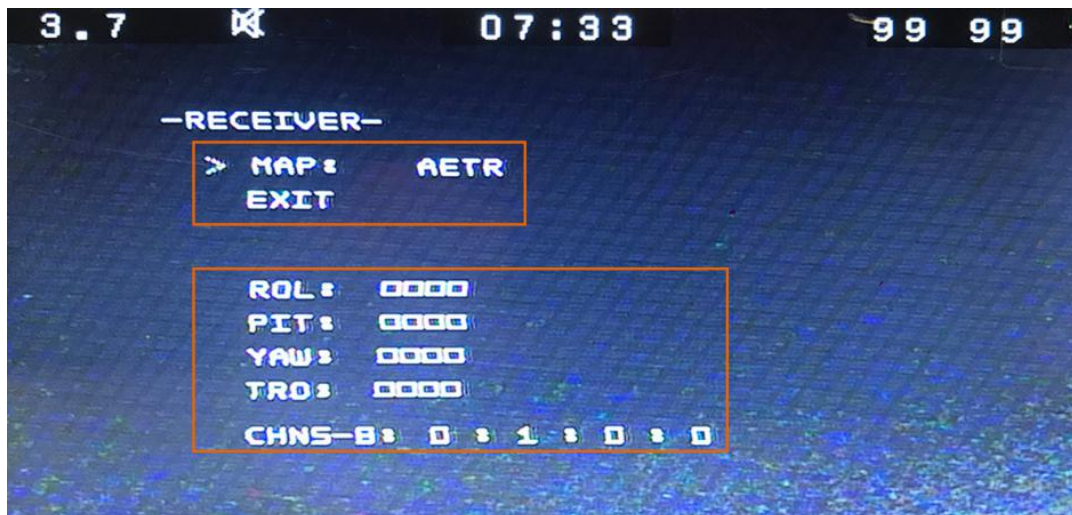
## 6.5 How to Change the Channel Mapping: AETR / TAER

**AETR** is the default channel mapping of Lite 2S Brushless FC. Please note that the failure of arming and OSD menu entering would be caused by the unmatched channel mapping between transmitter and Lite 2S Brushless FC.

**Solution:**

Change the channel mapping of the transmitter to AETR, then you can enter OSD menu as the method we mentioned in chapter 6.1.

- Enter OSD menu
- Move the cursor to RECEIVER option and enter RECEIVER sub-menu

***-RECEIVER menu interface-***

There are two functional zones for RECEIVER sub-menu. One functional zone is on the upper of sub-menu, from which you can switch AETR and TAER by the cursor. Another functional zone is on the bottom of sub-menu, from which you can examine whether the channel mapping relationship of transmitter among Roll, Pitch, Yaw and Throttle is correct. Please note that CHN5-8 on the bottom indicates the current AUX value of transmitter's channel 5 to channel 8.

Only when transmitter's CHN6 value is set to 1.(Shown as CHN5-8: 0:1:0:0), you can switch the channel mapping between AETR and TAER. If transmitter's CHN6 value is 0(Shown as CHN5-8: 0:0:0:0), you can only check whether the transmitter channel is correct in the below functional zone.



- ← Pull Left: Switch to ATER
- Pull Right: Switch to TAER
- ↑ Pull Up: Cursor will move to previous option
- ↓ Pull Down: Cursor will move to next option

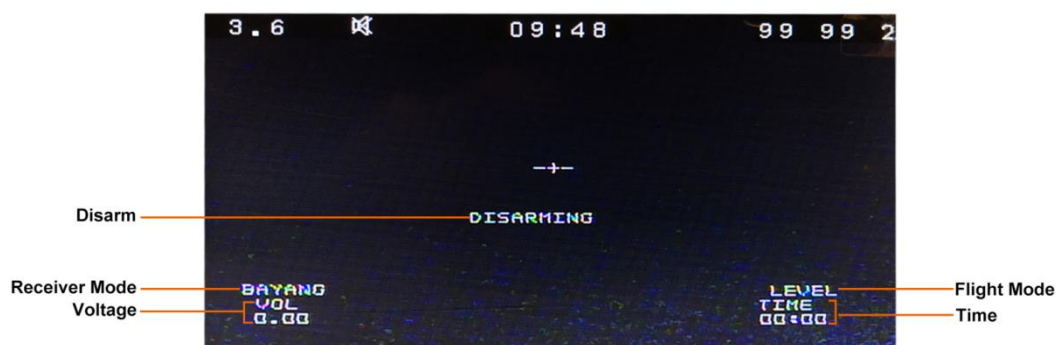
*-Use Mode two (American Mode) as example-*

## 7. MANUAL FOR SWITCHING FLIGHT MODE

### 7.1 OSD Illustration

There are five parts in OSD info interface: *(Use OSD info in the pic as example)*

- Arm or disarm: "DISARMING" mean that the drone is disarmed. The OSD info interface will display "ARMING" when the drone is armed.
- Receiver mode: "BAYANG" refers to the receiver mode you have choosed. If you choosed the DSMX mode, "DSMX" will show on OSD info interface.
- Voltage: "VOL 0.00" refers to the voltage.
- Flight mode: "LEVEL" refers to the flight mode you have choosed. If you choosed the Acromode, the OSD info interface will display "ACRO".
- Time: "TIME 00:00" refers to the flight time. If the drone fly about 30 seconds, the OSD info page will display "TIME 00:30"



**-OSD info interface-**

## 7.2 Flight Mode Channel Combination

Lite 2S Brushless FC uses the channel combination to arm and switch flight mode.

- Disarm: CH5 is AUX Low
- Arm: CH5 is AUX High
- Turtle: CH6 is AUX Low, CH7 is AUX High
- Acromode: CH6 is AUX Low, CH7 is AUX Low
- Levelmode: CH6 is AUX High, CH7 is AUX Low, CH8 is AUX Low
- Racemode\_angle: CH6 is AUX High, CH7 is AUX High, CH8 is AUX LOW
- Racemode\_horizon: CH6 is AUX High, CH7 is AUX High, CH8 is AUX High
- Horizonmode: CH6 is AUX High, CH7 is AUX Low, CH8 is AUX High

	CH5	CH6	CH7	CH8
Disarm	AUX Low			
arm	AUX High			
Turtle		AUX Low	AUX High	
Acromode		AUX Low	AUX Low	
Levelmode		AUX High	AUX Low	AUX Low
Racemode_angle		AUX High	AUX High	AUX Low
Racemode_horizon		AUX High	AUX High	AUX High
Horizonmode		AUX High	AUX Low	AUX High

AUX High



AUX Low





## 7.3 Features of Different Flight Mode

- Disarm: The motors are disabled and will not be allowed to run.
- Arm: The motors and controls are enabled, and props will be spinning at an idle speed.
- Turtle: Used to turn the plane over when the aircraft is inverted
- Acromode: A flight mode without auto-leveling, and stick deflection corresponds to a rotational rate around input axis.
- Levelmode: A flight mode in which the maximum tilt angle is limited to 65 degrees.
- Racemode\_Angle: A flight mode with levelmode behavior on roll axis and acromode behavior on pitch axis.
- Racemode\_Horizon: A flight mode with horizonmode behavior on roll axis and acromode behavior on pitch axis.
- Horizonmode: A flight mode with leveling near center stick but the ability to roll or flip at full stick deflection

## 8. ASSEMBLY GUIDE

### 8.1 Recommendation

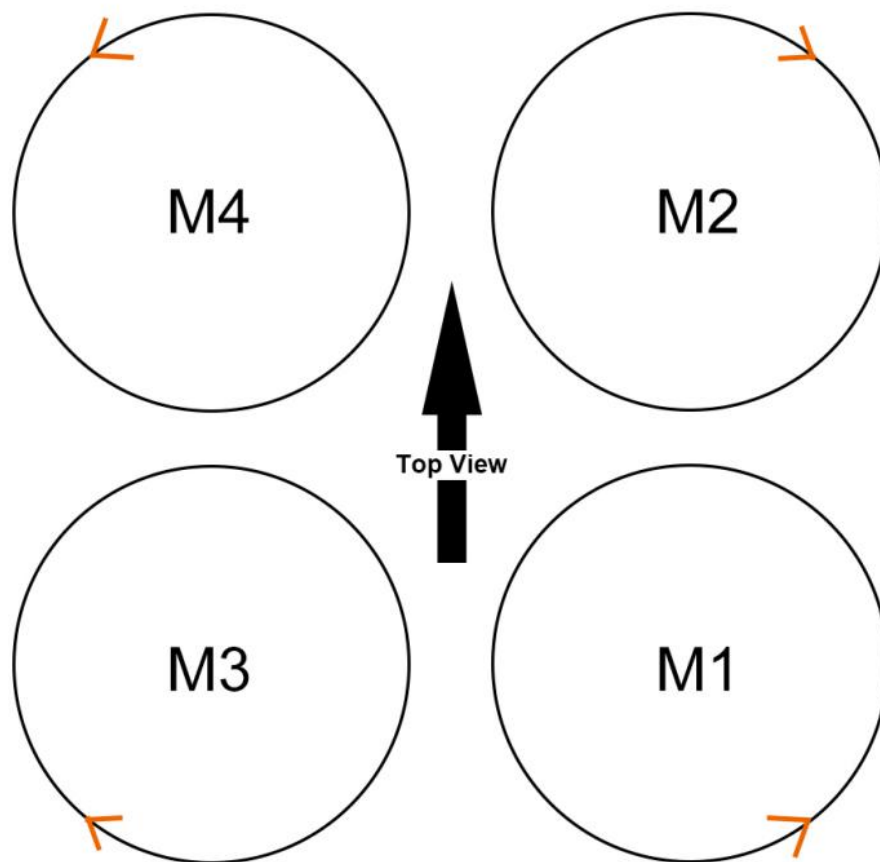
There are varied methods for building a quad with Lite 2S Brushless FC. But we highly recommend you to assemble the Lite 2S brushless FC on [Beta85 Pro 2](#) and [Beta75 Pro 2](#).

### 8.2 Prop Out

It must be installed as "props out" in default. Why we need "props out" direction?

*Default props direction, quadcopter dips and "washes out" in hard corners. With reversed props or "props out", no more dipping even in hardest cornering.*

[Know more about "Props Out".](#)



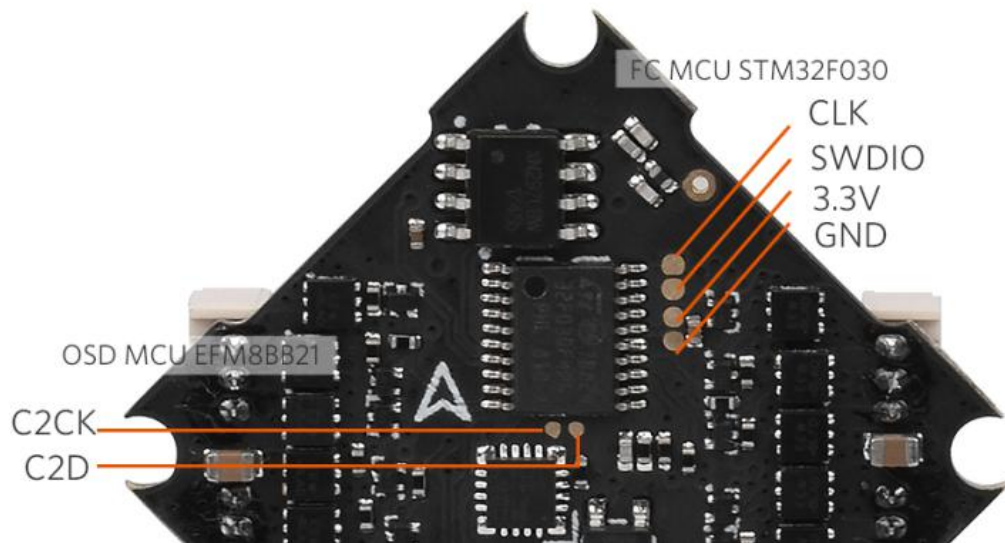
## 9. DEVELOPMENT

Contribution of bugfixes and new features is encouraged. All the source code for the flight controller and OSD is open in Github.

Source code of the flight controller: <https://github.com/BETAFPV/LiteSilverware>

Source code of the OSD: <https://github.com/BETAFPV/LiteOSD>

The programmer ports for the FC MCU STM32F030 and OSD MCU EFM8BB21 are showed as below.



STM32F030 is the processor of FC and a STM32 programmer is needed to flash the firmware through the SWD port (CLK, SWDIO) of the controller. We would recommend the ST-LINK or BeeLink USB Flasher.

EFM8BB21 is the processor of OSD. You need a efm8 programmer to upload the firmware through the C2 port (C2CK, C2D) of the controller. We would recommend the Silicon Lab debug adapter.