CONTENT

1. INTRODUCTION

BETAFPV Lite 1S FC is a brushless flight controller with Silverware firmware. It is with build - in Frsky D8 receiver, and it also supports external receiver with SBUS protocol and DSMX protocol. For fans of Silverware firmware, now you could try it with brushless drone like Beta65 Pro. The stock firmware is based on brushed NFE_Silverware, which is used on popular ZER0 board. With an ingenious design of build-in OSD, it's convenient for users to observe the flying status and change the configuration like PID.

2. SPECIFICATION

Adopting updated and improved LiteSilverware_f042_1S_bl_V1.0 firmware.

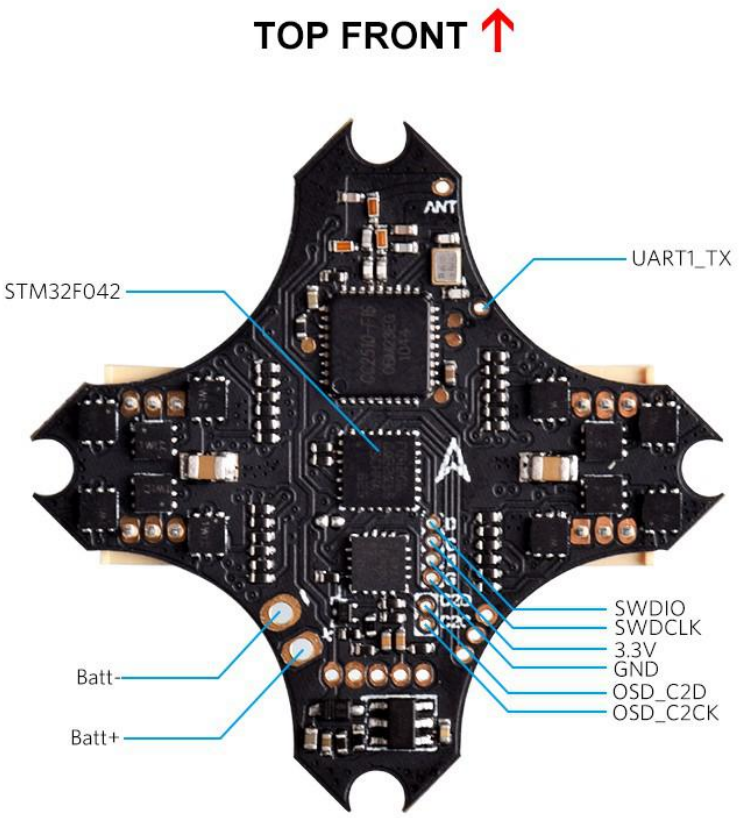
SPECIFICATIONS OF FC

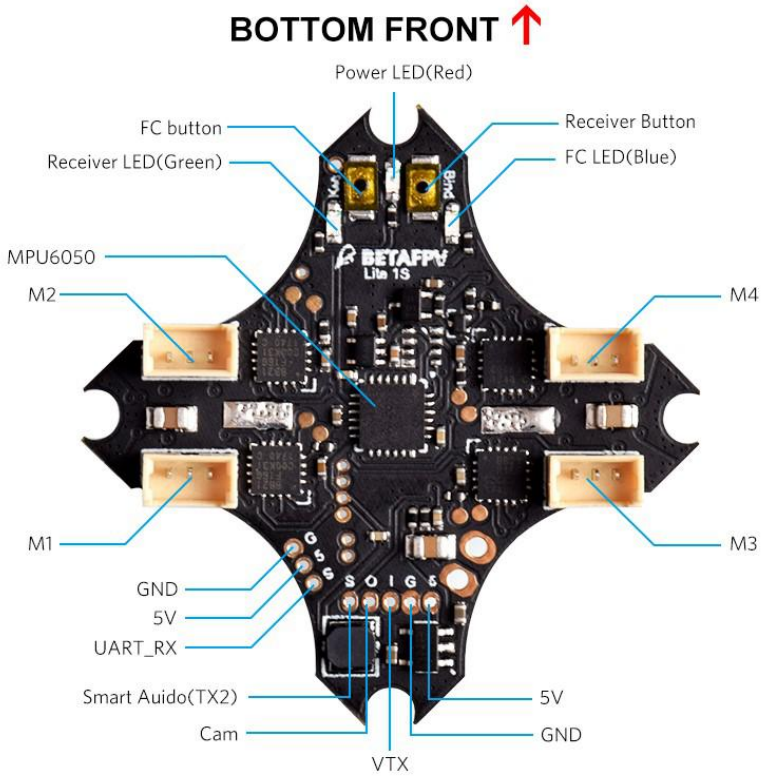
- CPU: STM32F031G6U6
- Six-Axis: MPU6050
- Size: 26mm x 26mm, whoop mounting pattern
- OSD：BETAFPV LiteOSD
- OSD firmware：LiteOSD_f042_1s_bl_v1.0.HEX
- Build-in Receiver: Frsky D8 RX
- Supported Receiver:SBUS protocol or DSMX protocol
- Weight：2.65g without connector
- FC Firmware：LiteSilverware_f042_1s_bl_v1.0.HEX

SPECIFICATIONS OF ESC

- Built-in ESC with 5A continuous and peak 6A current
- Input voltage: 1S lipo
- Motor Connectors: 1.25mm header pins connector
- Factory firmware: O_H_5_REV16_6.HEX
- Processor Chip: EFM8BB21
- Signal Support: D-shot150, D-shot300, D-shot600

3. DIAGRAM


TOP FRONT
ANT
UART1_TX
STM32F042
SWDIO
SWDCLK
3.3V
GND
OSD_C2D
OSD_C2CK
Batt-
Batt+

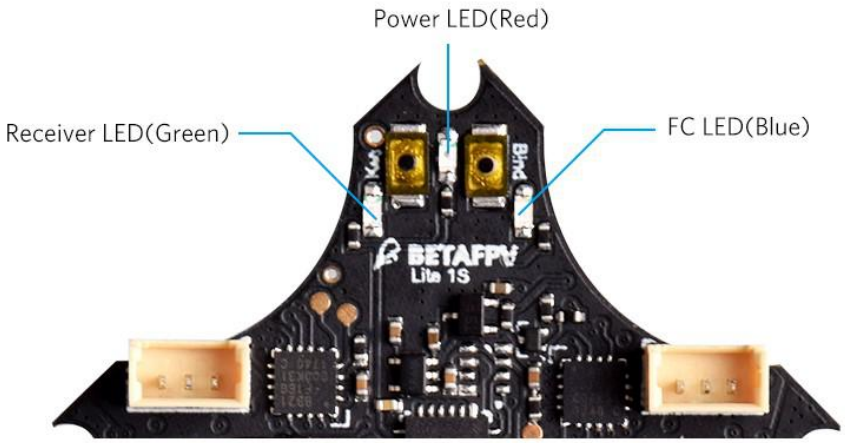

BOTTOM FRONT
Power LED(Red)
FC button
Receiver Button
Receiver LED(Green)
FC LED(Blue)
Key
Bind
BETAFPV
Lite 1S
MPU6050
M2
M4
M1
M3
G S S O I G S
GND
5V
UART_RX
Smart Auido(TX2)
5V
Cam
GND
VTX

4. BASIC FUNCTION

- Supports brushless drone up to 1S battery power
- Includes the OSD menu. Supports PID tuning, motor rotation, vtx frequency changing and channel mapping checking via OSD menu
- Build-in receiver with Frsky D8 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 with Frsky D8 receiver, and also supports external receivers both SBUS and DSMX protocol. Users could switch receiver communication protocol directly via FC button.The status is indicated with 3 LED flashes. Receiver communication protocol will be saved automatically when you power off, it will keep the same when you power up again.
For more details, kindly check the picture below.



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

5. 1 Frsky D8 Receiver

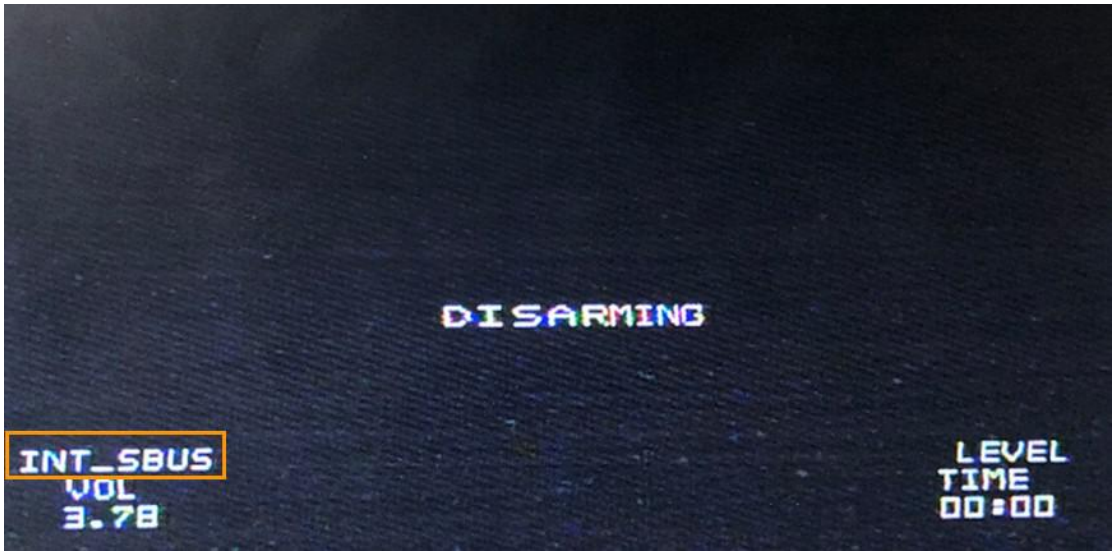
Lite 1S brushless FC is with build-in frsky D8 receiver. The communication protocol should be set as INT_SBUS protocol when using frsky D8 receiver, as follows:

- Press the FC button on the bottom of the FC and plug the battery at the same time
- Release the FC button after 4 seconds
- Once “INT_SBUS ” shown, FC is successfully changed to INT_SBUS mode

How to bind:

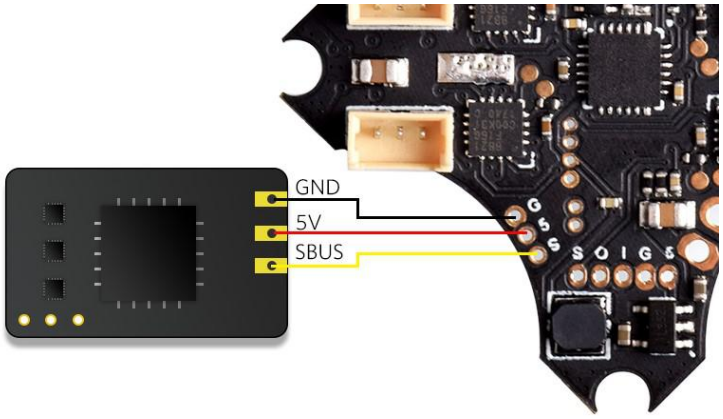
Note: Please ensure that the the receiver communication protocol is in INT_SBUS protocol.

- Press receiver button on the bottom of the FC and plug battery at the same time till blue LED flashes 6 times and becomes solid.
- Choose “bind” option in the transmitter, bind is successful when green led flashes.
- Power up again, if the data is successfully received, the green led will be solid.



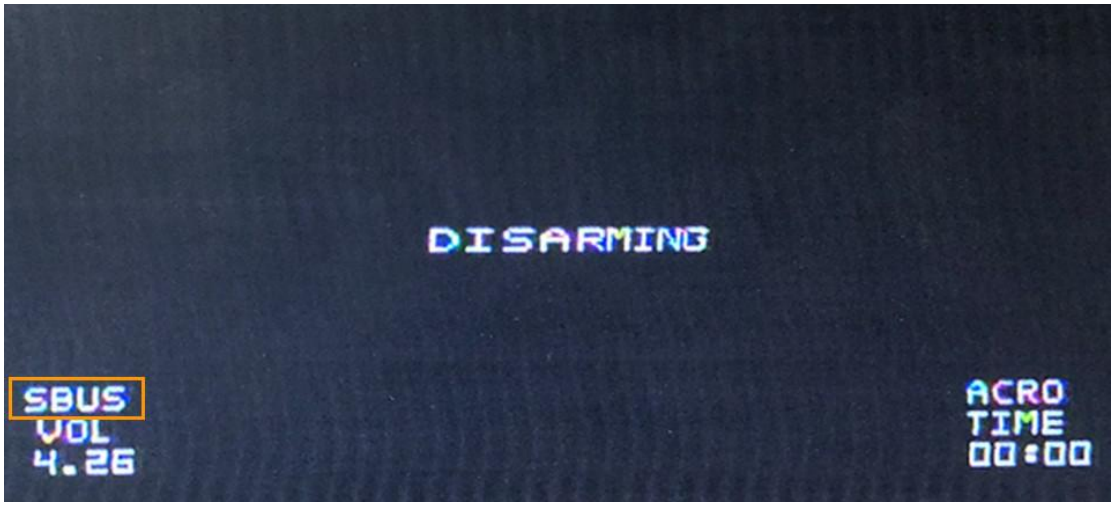
5. 2 SBUS Protocol

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



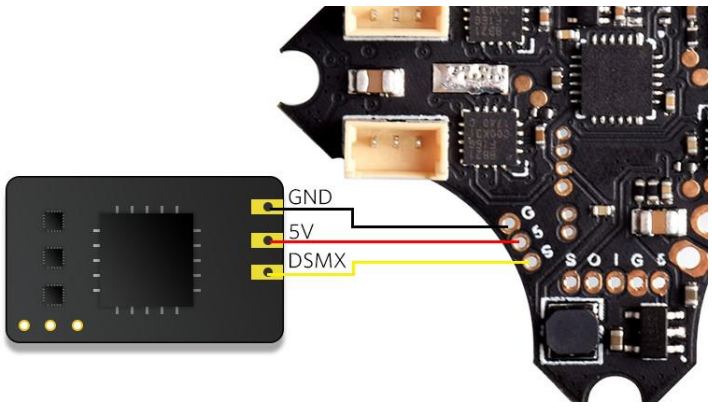
The communication protocol should be set as SBUS protocol when using the SBUS protocol, as follows:

- Press the FC button on the bottom of the FC and plug the battery at the same time
- Release the button and press the FC button again within 4 seconds
- Once “SBUS”shown, FC is successfully changed to SBUS mode.



5. 3 DSMX Protocol

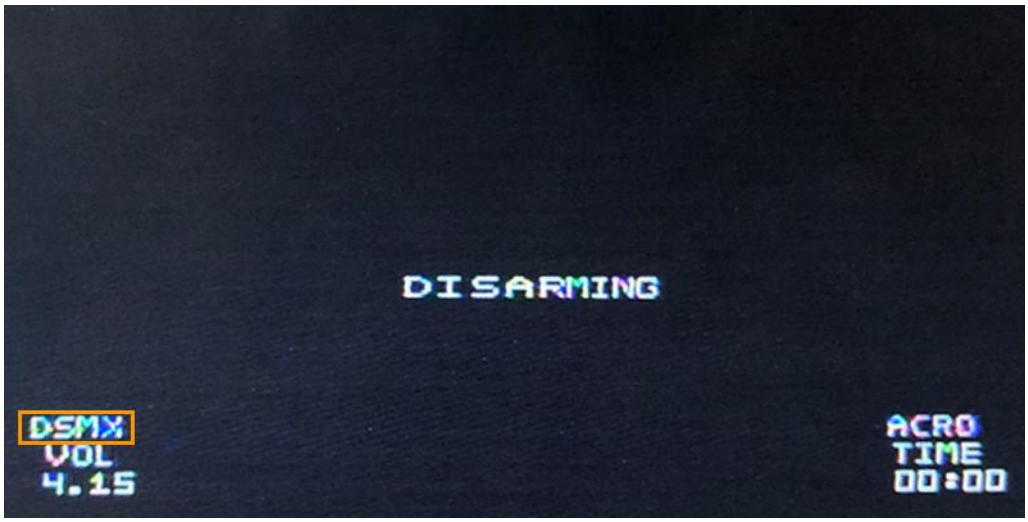
Supports DSMX protocol. Here is the diagram with DSMX protocol:



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

as follows:

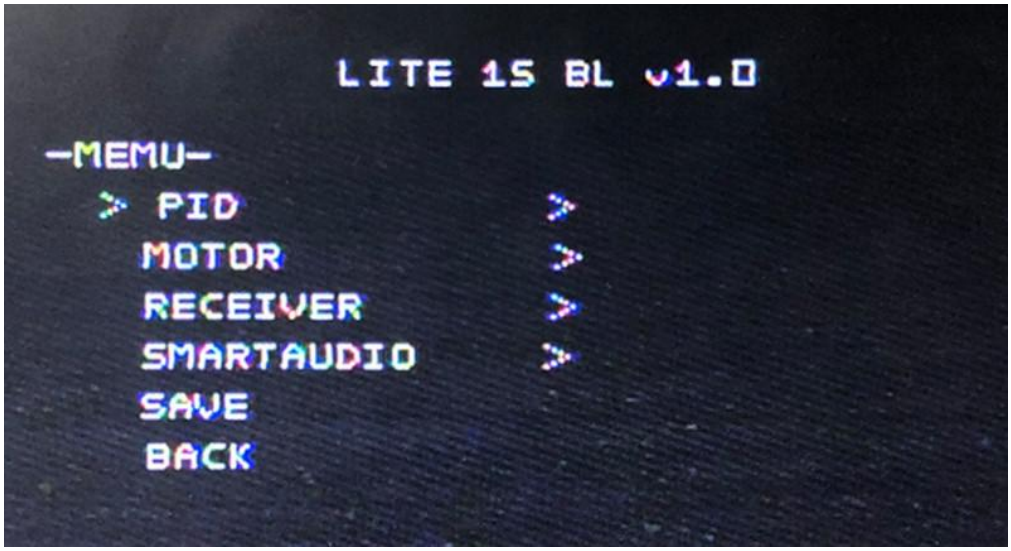
- Press the FC button on the bottom of the FC and plug the battery at the same time
- Release the button and press the FC button TWICE within 4 seconds
- Once “DSMX”shown, FC is successfully changed to DSMX mode.



6. OSD MENU

AETR is the default channel mapping of Lite 1S Brushless.
Six options on OSD Menu: PID, MOTO, RECEIVER, SMARTAUDIO, SAVE and BACK. When you choose PID, cursor will show on PID option.

Supports PID tuning, motor spinning direction changing, channel mapping checking, frequency and vtx power changing via OSD menu. The operation of OSD Menu on Lite 1S Brushless FC is same as Betaflight.



6.1 How to Enter OSD Menu

The method of entering OSD Menu on Lite 1S Brushless FC is same as Betaflight, Make sure the drone is disarmed when entering OSD Menu on Lite 1S Brushless FC.

-Use Mode 2 (American Mode) as example-

Note: AETR is the default channel mapping of Lite 1S . If you can not enter the OSD menu, it might cause by unmatched channel mapping.

6.2 How to Operate OSD Menu

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

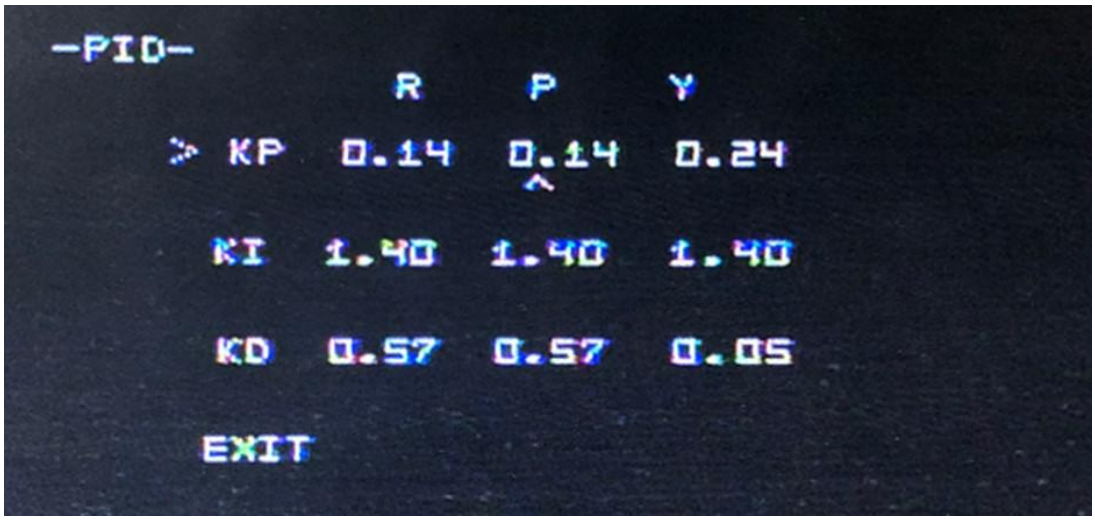
If the parameters are changed, you can choose the SAVE option, and then select EXIT to return, so that they will be saved and take effect.

-Use Mode 2 (American Mode) as example-

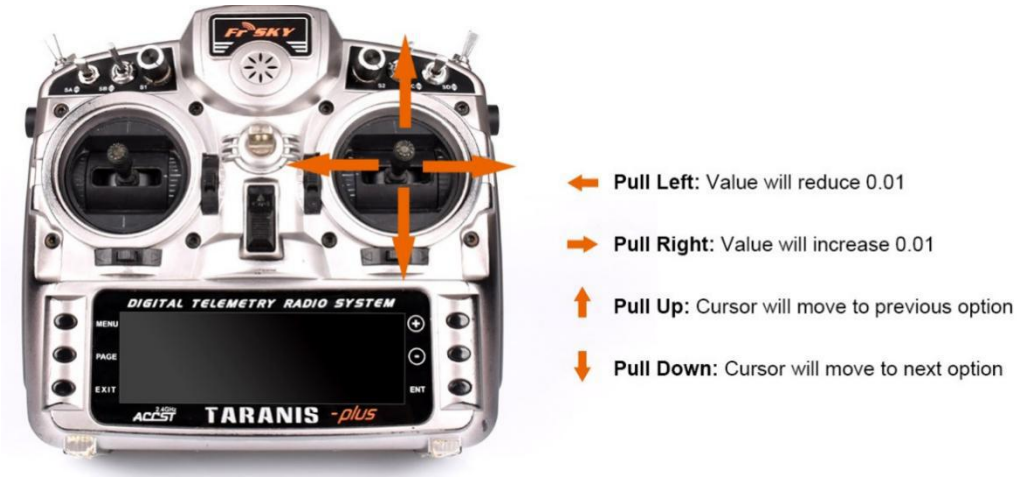
6. 3 How to Tune PID

Here is the method of PID tuning

- Enter OSD menu
- Move the cursor to PID option and enter PID sub-menu, the PID for ROLL, PITCH and YAW is available for tuning.
- 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-



-Use Mode two (American Mode) as example-

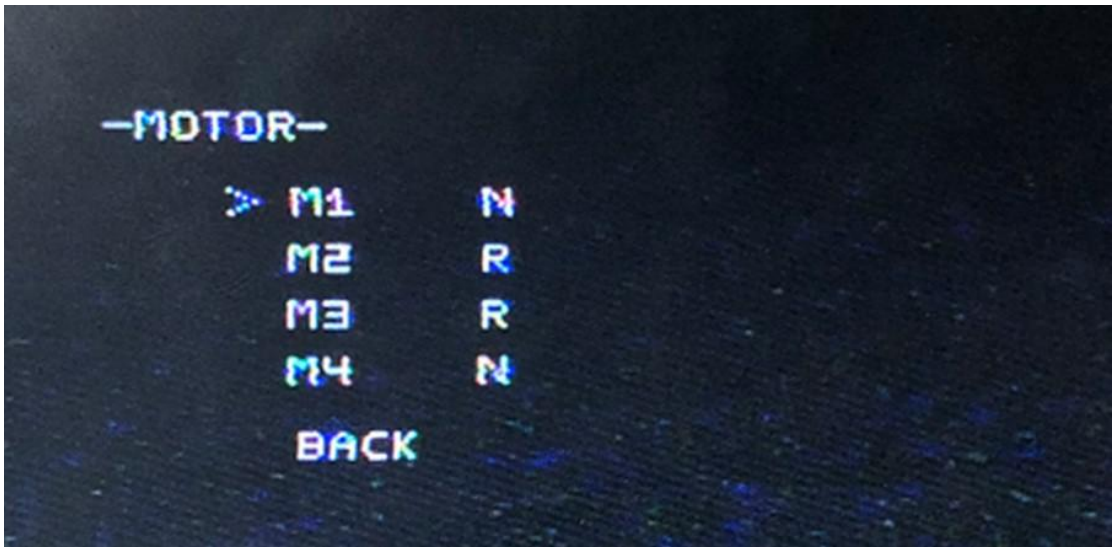
6.4 How to Change Motor Rotation

Here is the method of Motor rotation Changing

- Enter OSD menu.

• Move the cursor to MOTO option and enter MOTO sub-menu. M1, M2, M3 and M4 represent four motors on the drone. N represents normal, which means counter - clockwise rotation, R represents reversed, which means clockwise rotation

• 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-

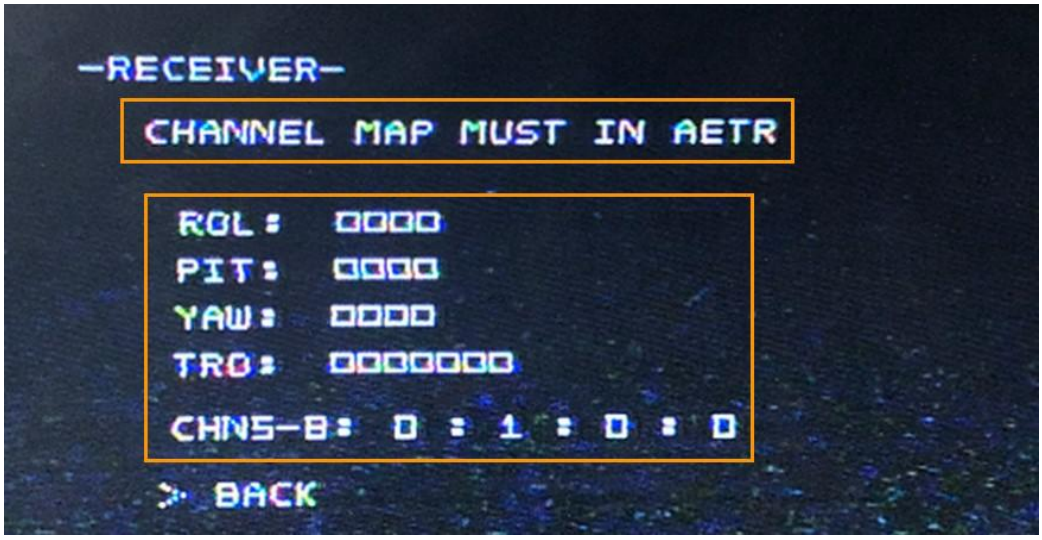
-Use Mode two (American Mode) as example-

6.5 How to Check the Channel Mapping: AETR / TAER

AETR is the default channel mapping of Lite 1S 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 1S Brushless FC, please change the channel mapping of the transmitter to AETR via transmitter.

How to check the channel mapping:

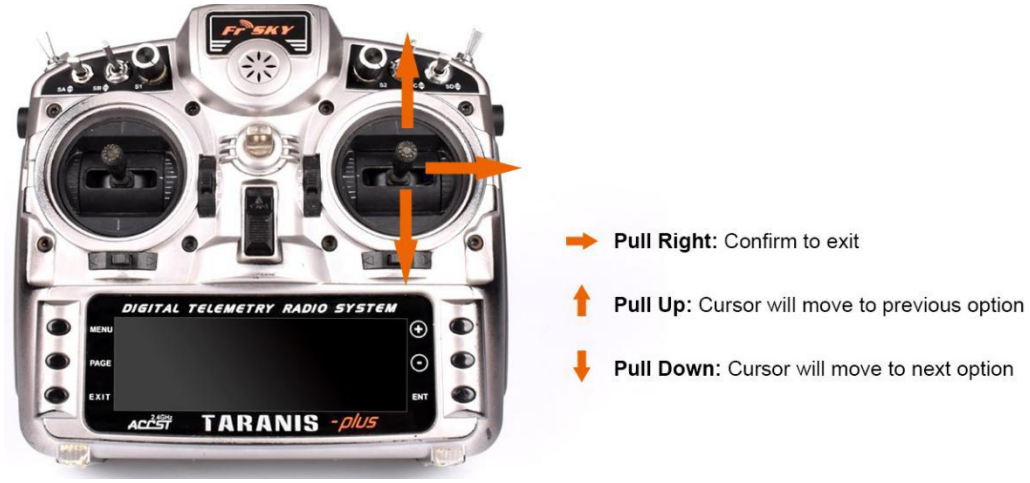
- Enter OSD menu
- Move the cursor to RECEIVER option and enter RECEIVER sub-menu



-RECEIVER menu interface-

There is one functional zone for RECEIVER sub-menu. It is on the bottom of sub-menu, from which you can examine whether the channel mapping relationship of transmitter among Roll, Pitch, Yaw and TRO is correct. Please note that CHN5-8 on the bottom indicates the current AUX value of transmitter's channel 5 to channel 8.

Please make sure transmitter's CHN6 value is 0(Shown as CHN5-8：0:0:0:0), then you can check whether the transmitter channel is correct in the below functional zone. To exit receiver menu, please change the transmitter's CHN6 value to 1(Shown as CHN5-8：0:1:0:0)



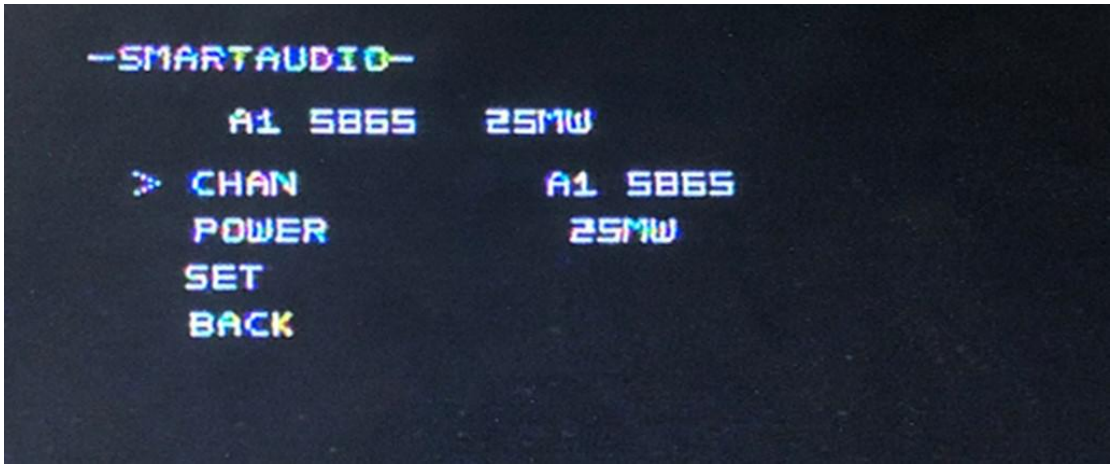
-Use Mode two (American Mode) as example-

6.6 How to Change Frequency and Power of VTX

Lite 1S FC supports 48CH frequency, from A1: 5865 to E8: 5917. The power of vtx can be switched between 25mW and 200mW directly via OSD menu.

How to change:

- Enter OSD menu
- Move the cursor to SMARTAUDIO option and enter SMARTAUDIO sub-menu
- Move the cursor to CHAN to change frequency or move the cursor to POWER to change vtx power.
- When changed the parameter, SET and BACK. The changes will be saved and take effect.



-SMARTAUDIO menu interface-

-Use Mode two (American Mode) as example-

7. MANUAL FOR SWITCHING FLIGHT MODE

7. 1 OSD Illustration

There are six 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 “ARMINO” when the drone is armed.

• Receiver mode: “DSMX” refers to the receiver mode you have choosed. If you choosed the SBUS mode, “SBUS” will show on OSD info interface.

• Voltage: “VOL 4.15” refers to the voltage.

• Flight mode: “ACRO” refers to the flight mode you have choosed. If you choosed the Levelmode, the OSD info interface will display “LEVEL”.

•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 1S 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 Hight,CH7 is AUX Low，CH8 is AUX High

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

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 drone 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

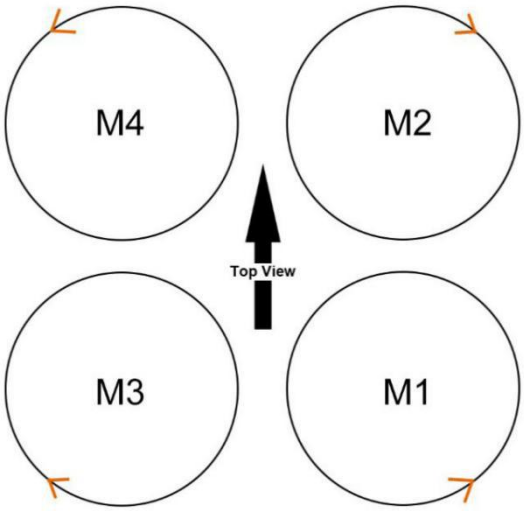
There are varied methods for building a quad with Lite 1S Brushless FC. But we highly recommend you to assemble the Lite 1S brushless FC on Beta65 Pro and Beta75 Pro.

8.2 Prop Out

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

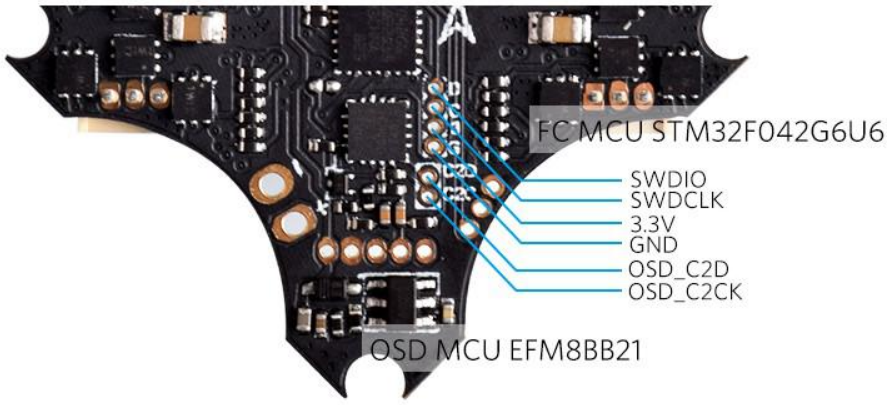
Default props direction, quadcopter dips and "washes out" in hard corners. With reversed props or "props out", no more dipping even in hardest cornering.

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 STM32F042G6U6 and OSD MCU EFM8BB21 are showed as below.



STM32F042 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.