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《FC451》

FC451 Mini Quad-copter Flight Control
Instruction Manual

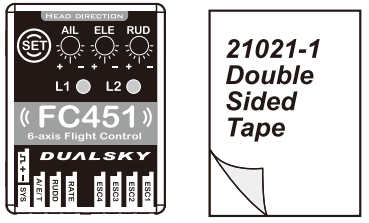
FC451四旋翼飞行控制器
使用说明书



#21408
http://www.dualsky.com

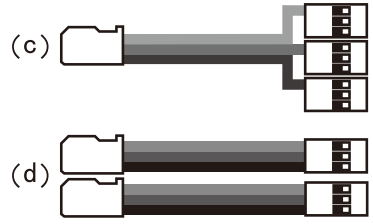
Packing List

(a) FC451 Flight control system x 1 (b) Shockproof double sided tape x 1	(c) 3 in 1 signal wire x 1 (d) Standard signal wire x 2



(a)

(b)



Equipment Needed

Besides FC451, you need the following equipment to complete your quadcopter: a 4-channel radio system (we recommend a 6-channel or higher radio system), one set of quadcopter motor and ESC (4 motors and 4 ESCs), propellers, one quadcopter frame, Lithium Polymer (LiPo) battery pack and battery charger.

Install Instruction

1. Please follow the instruction manual from the frame and power system manufacture to finish the installation of the frame and power system. Please notice the install direction of the flight control system and the running direction of the propellers, they must be the same as the following diagram 1 or 2. (Please make sure to use the double sided tape comes with FC451 to mount it on frame.)

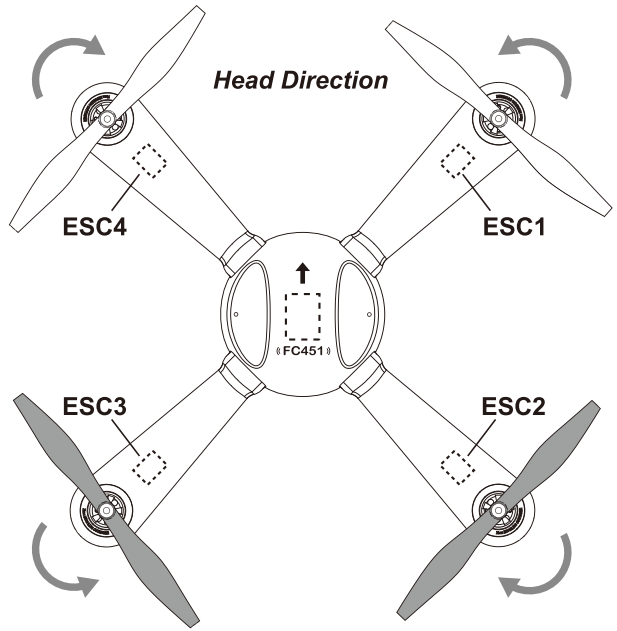
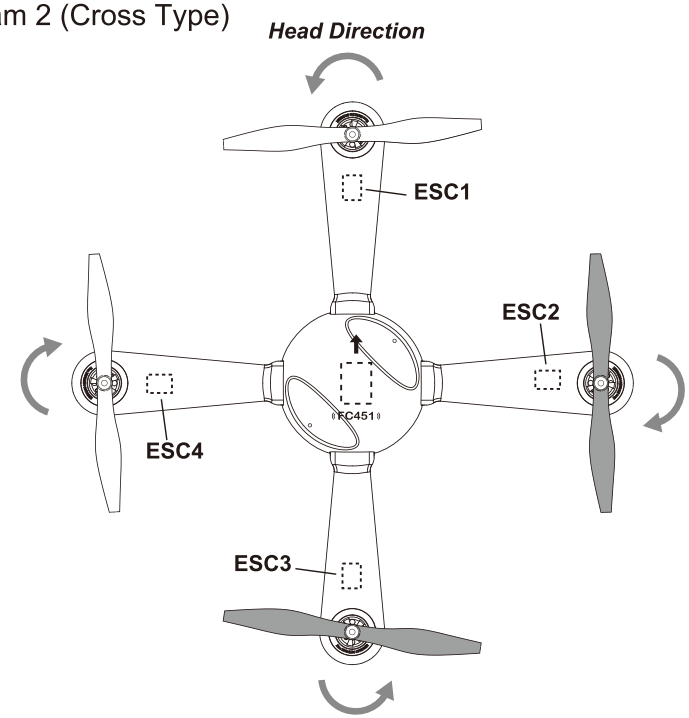
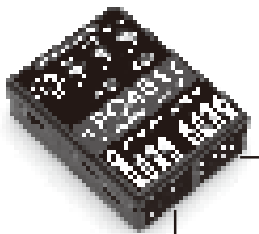


Diagram 1 (X Type)

Diagram 2 (Cross Type)



2.FC451 port diagram (Diagram 3)



Output			
ESC4	ESC3	ESC2	ESC1
+	+	+	+
-	-	-	-

Input			
SBUS	Aileron	Rudder	RATE
+	Elevator	+	+
-	Throttle	-	-

Diagram 3

3. FC451 supports 4.8V-7.4V input voltage. Since it shares the same input power with the receiver, the input voltage must also meet the requirements of the receiver.
   a) When use external power supply, please cut the ESC BEC output like Diagram 4;
   b) When use ESC BEC, please only use one BEC output, cut the other 3 as shown below.



Diagram 4

4.Connect FC451 to receiver as shown in Diagram 5

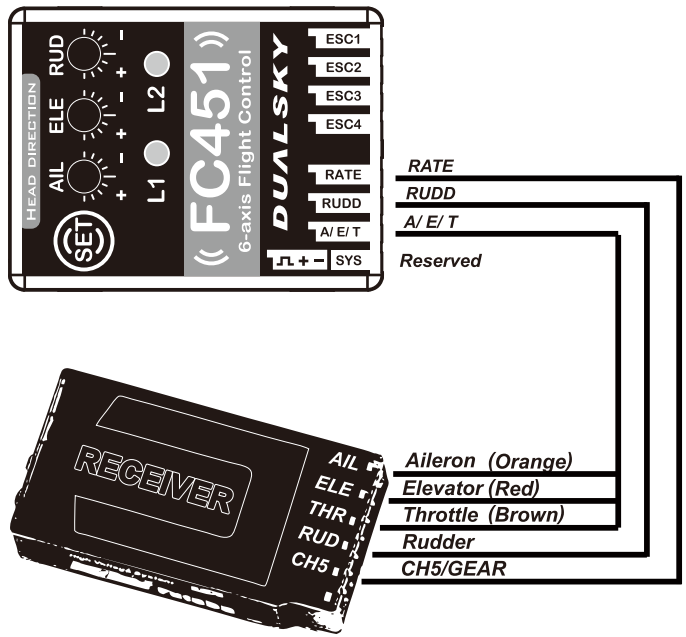


Diagram 5 (Normal Receiver)

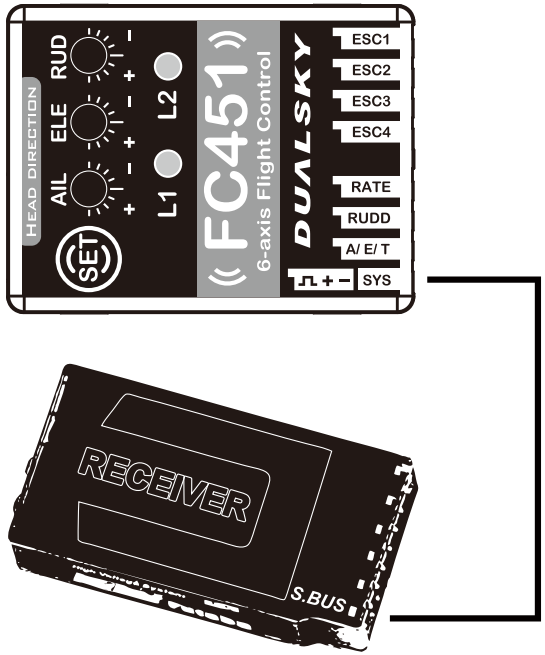


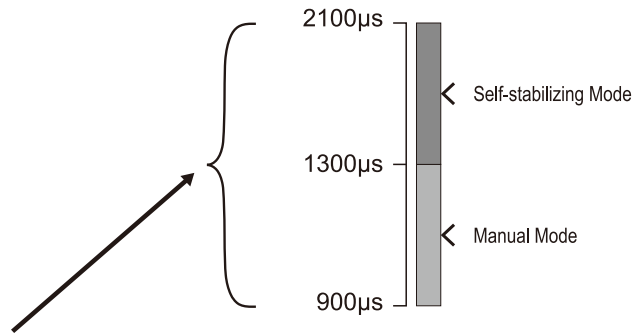
Diagram 5 (S.BUS Receiver)

S.BUS receiver channel mapping sequence chart:

Sequence	Ch1	Ch2	Ch3	Ch4	Ch5
Channel	Aileron	Elevator	Throttle	Rudder	Rate

Configuration

- The FC451 needs a 4-channel or higher radio controller to operate; If you are using a 5-channel or higher radio controller, please assign a 3-position or 2-position switch on the radio to CH5/GEAR channel and make sure the switch doesn't have other function, set this switch to Low (Switch channel pulse width range should be: low 900~1300μs, high 1300~2100μs). This channel is used to switch the flight mode.
  If you are using a 4-channel radio controller, the flight mode can be set in FC451.
- Set the radio to "Airplane Mode", turn off all the mixing functions, set all channel's D/R to 100%;
- Set all channel's trim, sub-trim and mechanical trim to "0";
- Set all channel's direction according to the below chart;
- Please check the Diagram 6 for corresponding value of channel direction.



	Futaba	*JR*	*Spektrum*	*HOTT*
AILERON	*NOR*	*REV*	*REV*	*REV*
ELEVATOR	*REV*	*NOR*	*NOR*	*NOR*
THROTTLE	*REV*	*NOR*	*NOR*	*NOR*
RUDDER	*NOR*	*REV*	*REV*	*REV*
CH5/GEAR	*NOR*	*REV*	*NOR*	*REV*

Diagram 6

ESC Initial Setting

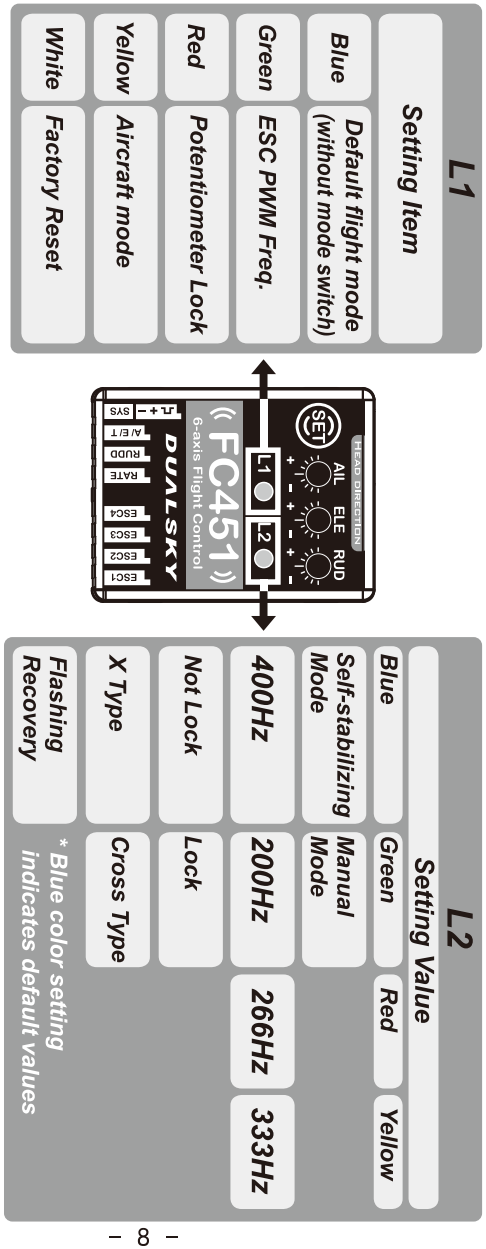
Before install FC451, please finish the ESC initial setting. Make sure ESCs and FC451 have the same stroke setting.If you use Dualsky ESC, you can set all ESCs after FC451 installation by the following steps:

- Turn on the radio controller, push the throttle stick to the top, turn on power to the quadcopter, when L1 shows blue in color, it means the ESC is in initial setting mode;
- Wait until the ESC's long beep (it means the top point of throttle has been confirmed), then pull the throttle stick to lowest point;
- Wait about 1 second for a short beep (it means the lowest point of throttle has also been confirmed), the ESC initial setting is finished;
- Don't move the throttle stick after initial setting, turn the power off to the quadcopter, then reconnect the power after 5 seconds, the new setting will be applied.

FC451 Setting

- How to enter Setting Mode: Turn on radio controller, move the throttle to lowest position; turn on power to the quadcopter, wait until the L1 LED finishes flashing Green and then changes to RED (Now the flight control is in Lock Mode); press the “SET” button on the flight control to enter Setting Mode. After you enter Setting Mode, L1 displays the corresponding SETTING ITEM menu attributes (color), and L2 displays the corresponding SETTING VALUE menu attribute (color).
- “SET” Button usage:
  1) Long Press (more than 2 sec) under Lock Mode: enter Setting Mode
  2) Single Click under Setting Mode: switch between SETTING ITEM
  3) Double Click (finish within 0.5 sec) under Setting Mode: change SETTING VALUE
  4) Long Press (more than 2 sec) under Setting Mode: Save and Quit to Lock Mode
- Please check the chart at the right side for all settings.

Some settings will take effect after the FC451 restarted. Cut the power to the quadcopter and reconnect after 5 seconds to apply the new settings.



Unlock & Propeller Direction Check

- Make sure your quadcopter's battery is fully charged, and you are in a wide and flat area;
- Turn on the radio, pull the throttle stick to lowest position, plug in the power to the quadcopter. L1 LED on FC451 Flight Control will flash Green (initial startup process), don't move sticks on the radio controller, keep the quadcopter still. When the L1 LED changes to Red, it means the initial startup process has finished and the quadcopter is now in Lock Mode (throttle will not operate). Move the sticks as shown in the diagram 7 and hold for about 0.5 sec to unlock the quadcopter. After unlock, motors will reach idle speed for about 1 sec. If you don't do any stick movements during this period after "unlock" (5-seconds) the quadcopter will return to Lock Mode again.

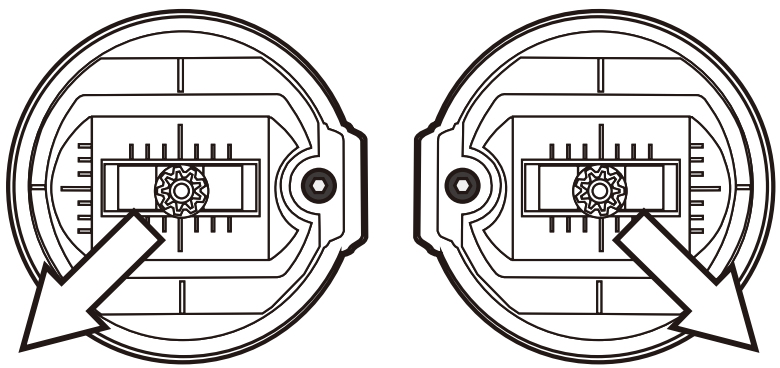
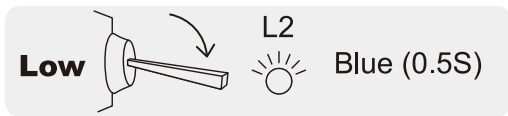


Diagram 7

- After unlock, push the throttle a fraction above idle speed, check if the propellers run in correct direction like shown in below diagram.

Ground Test

- Set all sensitivity potentiometers on FC451 to neutral.
- CH5 is used to adjust flight mode, if you are using it, please toggle the CH5 switch before flight, L2 LED will indicate the state of the current switch position: blue indicates low stick input, green indicates high stick input. Put the CH5 switch to high(auto level flight mode).





- Direction check: Controlling the throttle, make sure the quadcopter doesn't leave the ground. Slightly move each stick to observe if the quadcopter moves with your stick input direction. If the direction is opposite, please change the channel direction on the radio.

Low altitude Test Flight

- After unlock, control throttle to make the quadcopter maintain a 0.5 meter altitude. Observe if the quadcopter is stable. If it's not stable, you need to adjust the sensitivity of the FC451.
- The channel center point can differ depending on the choice of radio brand, the installation of FC451 can also cause deviation. If the quadcopter has deviation after take off, please adjust the trim on radio to find the center position.

Adjust the sensitivity

- 250 Mini (250mm class) quadcopter can use the default setting to get a good flight performance.
- The weight on the quadcopter can differ depending on the choice of battery. This will impact center of gravity, and the flight characteristics. To improve flight performance you can address the below.
- Normally, if the sensitivity is set too high on the "pitch" (elevator) axis, the opposing axis (i.e., aileron) will vibrate; if the sensitivity is set too low on the "pitch" (elevator) axis, the opposing axis (i.e., aileron) will respond with delay to stick movement.
- If the sensitivity is set too high on the rudder axis it will cause the motors to over react, which will make the quadcopter unstable in pitch and yaw direction; if the sensitivity is set too low on the rudder axis, the quadcopter will have difficulty on tail lock.
- When adjusting the sensitivity, don't change the setting value too much, 5-10 degrees a time is enough. When you find a stable range, then tweak it for optimum performance.

Caution

- Please don't pull throttle to the lowest position during flight, it might cause the motor suddenly be stopped and crash the quadcopter.
- When you fly in high maneuvering condition for a long time, the external acceleration will cause the FC451 to not be able to maintain a horizontal status. This is normal. After hovering the quadcopter for few seconds, FC451 will adjust the quadcopter to complete horizontal.

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《FC451》

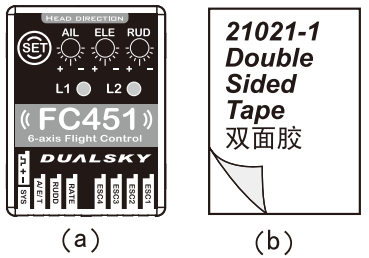
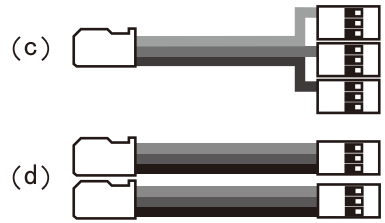
FC451四旋翼飞行控制器
使用说明书



#21408

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物品清单

(a)FC451平衡仪×1 (b)减震双面胶×1	(c)三信号排线×1 (d)单信号排线×2
 (a) (b)	

所需设备

除本产品外，为了安装您的四旋翼，您还需要以下设备：一套四通道或以上遥控设备、一套四旋翼电机电调(四对)、正反桨(两对)、四旋翼机架、动力锂电池及充电器。

安装指南

1. 机架与动力设备的安装请遵循机架与动力生产厂商的相关说明。注意螺旋桨的旋转方向和FC451(请使用随包装附送的减震双面胶固定)的方向必须如图1或图2所示。

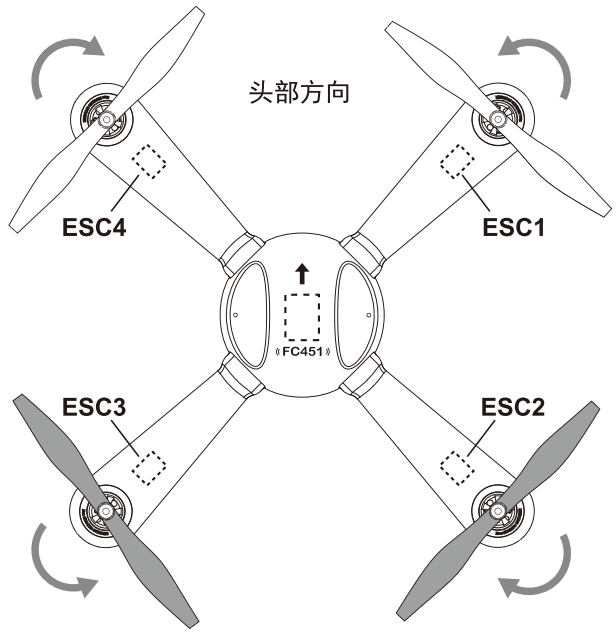
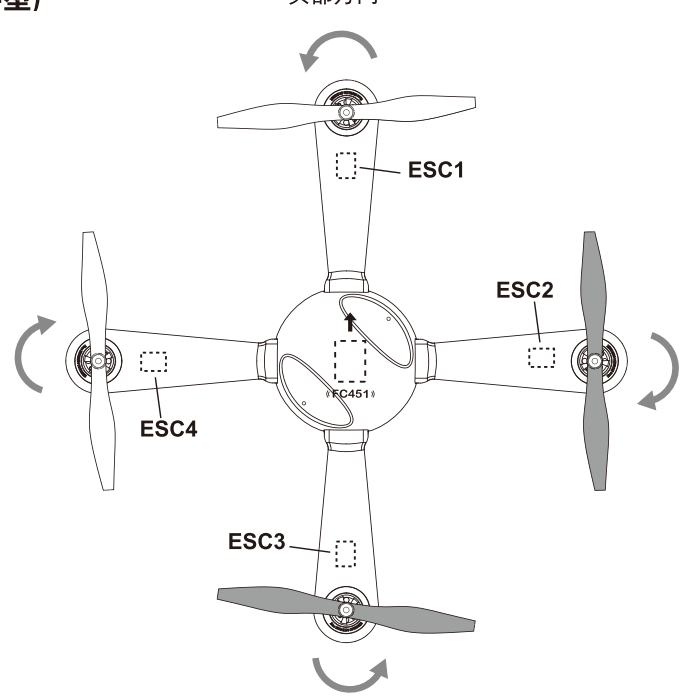
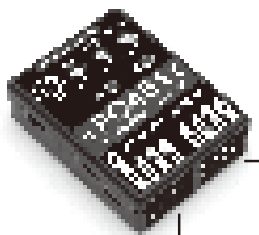


图 1 (X型)

图 2 (+型)



2. FC451的接口如图3所示



输出			
ESC4	ESC3	ESC2	ESC1
+	+	+	+
-	-	-	-

输入			
SBUS	Aileron	Rudder	RATE
+	Elevator	+	+
-	Throttle	-	-

图 3

3. FC451的供电方式，FC451支持4.8V-8.4V的电压输入，由于和接收机共用电源，输入电压也要符合接收机的要求。

a) 外部电源供电，此时应切断电调的BEC输出，如图4所示：

b) 电调BEC供电，请使用单电调BEC供电，切断其他电调的BEC输出 。



图 4

4. FC451与接收机连接图5所示

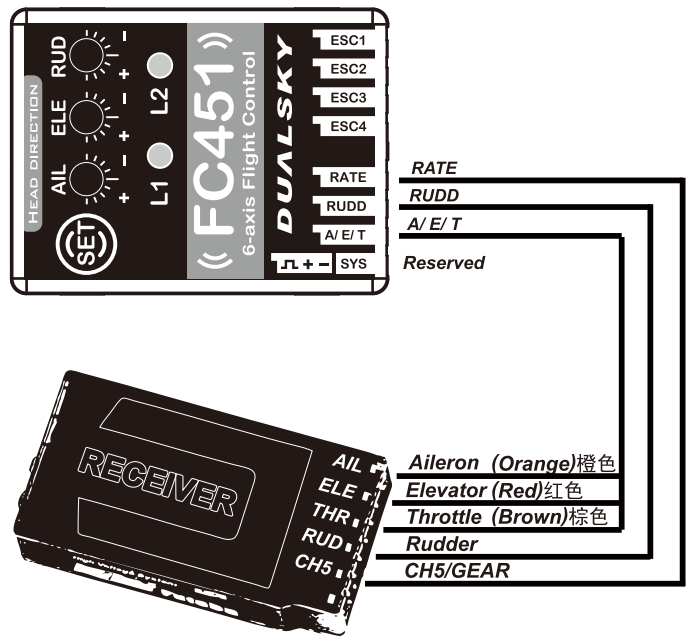


图 5 (普通接收机)

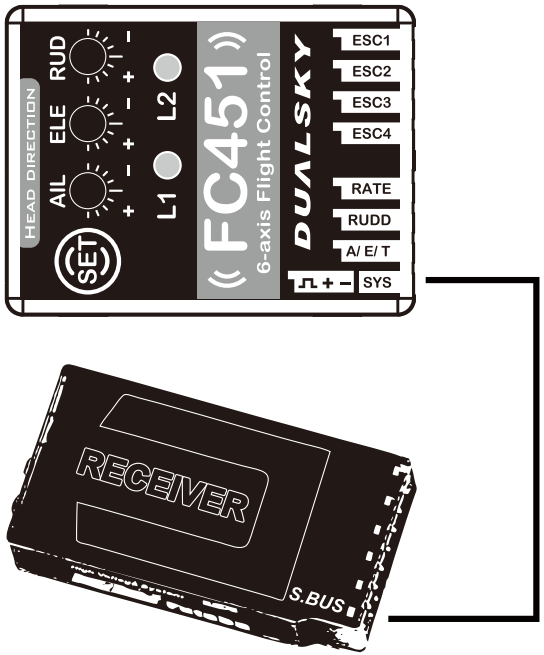


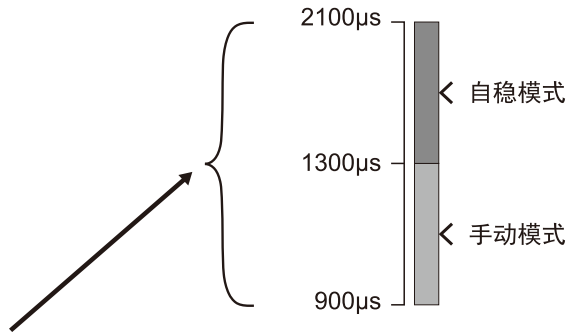
图 5 (S.BUS接收机)

S. BUS接收机通道映射顺序如下表：

顺序	Ch1	Ch2	Ch3	Ch4	Ch5
通道	Aileron	Elevator	Throttle	Rudder	Rate

设定与调试

- F451需要一台四通道或以上的遥控设备；
  如果您使用五通道或以上的遥控器，请在遥控器上将CH5 映射至三段或两段开关，行程设为100%，并确保在遥控器中该通道没有用作其他功能。开关通道脉宽区间为：低900-1300μs，高1300-2100μs。该通道用来调节四旋翼的飞行模式。如果使用四通道遥控器，飞行模式可在飞控设定项中设定；
- 设定遥控器为固定翼模式，如果遥控器有混控功能，请关闭所有混控，将各通道行程都设为100%；
- 各通道的电子微调（TRIM或SUBTRIM菜单）和摇杆的机械微调都归“0”；
- 如下图6所示，根据品牌设定遥控器各通道正反向。



	Futaba	*JR*	*Spektrum*	*HOTT*
AILERON	*NOR*	*REV*	*REV*	*REV*
ELEVATOR	*REV*	*NOR*	*NOR*	*NOR*
THROTTLE	*REV*	*NOR*	*NOR*	*NOR*
RUDDER	*NOR*	*REV*	*REV*	*REV*
CH5/GEAR	*NOR*	*REV*	*NOR*	*REV*

图 6

电调行程设定

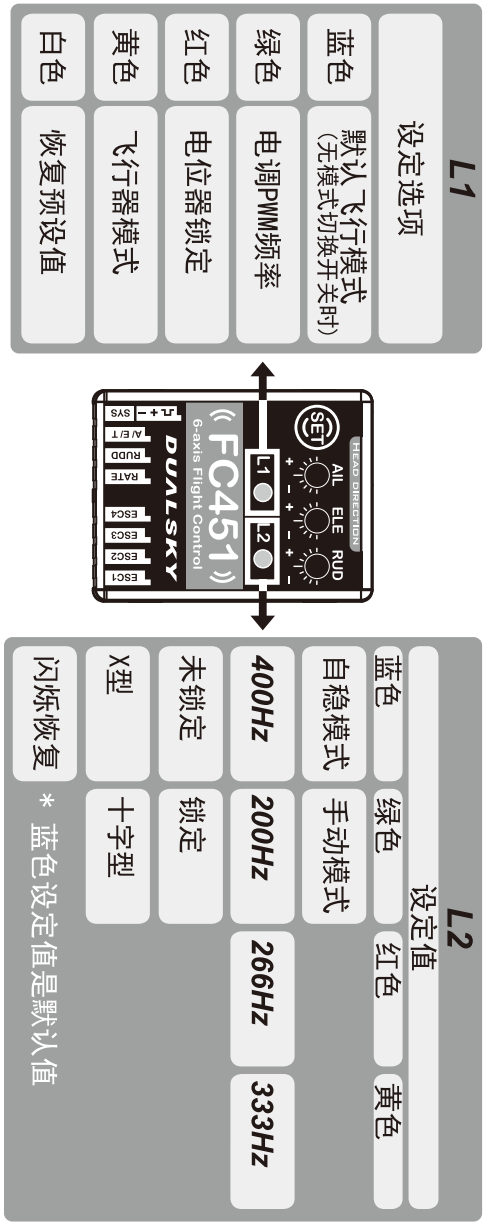
在安装F451前请设定电调行程，确保您的行程设定是在相同条件下进行。如果使用双天电调，可以在安装完成后统一设定电调，具体步骤如下：

- 开启遥控器，将油门推至最高，接通四旋翼飞行器的电源，L1蓝灯亮时，即进入电调行程设定模式；
- 等待电调发出“滴”声（长声），表明油门最高点已经确认，此时应立即将油门收至最低；
- 等待约1秒，电调再次发出“滴”声（短声，约0.2秒），表明油门最低点确认，即完成电调行程设定。电调设定完成后请勿推高油门（为确保安全，建议设定完成后断开电源）。

F451设置

- 如何进入设定模式：打开遥控器，油门收至最低，接通四旋翼飞行器的电源，等待飞控L1绿灯闪烁结束红灯常亮（此时为锁定状态）后，长按飞控上的“SET”按钮进入设定模式。此时，L1的颜色指示设定项目，L2的颜色指示该设定项当前设定值。
- 按键操作说明：
  1. 锁定状态下长按（大于两秒）：进入设定模式
  2. 设定状态下单击：改变设定项
  3. 设定状态下双击（双击有效间隔小于0.5秒）：改变该项设定值
  4. 设定状态下长按：保存并退出
- 具体设定项如右表所示：

部分设定需重启飞控后才能生效，因此在飞控设定完成后，请重新上电以应用新的设定值。



解锁与螺旋桨方向检查

- 确保您的四旋翼的动力电池电量充足，飞行器四周没有障碍物；
- 打开遥控器，油门收至最低，接通四旋翼飞行器的电源。飞控上的L1绿灯闪烁时为飞控初始化过程，此过程中请勿拨动操纵杆，并保持飞行器静止。L1绿灯闪烁结束红灯常亮后即进入锁定状态，此时推油门无效。执行图7中的拨杆动作并保持约0.5秒即可解锁，解锁后电机保持怠速约一秒。解锁后五秒内如不将油门推高或执行拨杆动作，飞控将会重新进入锁定状态。

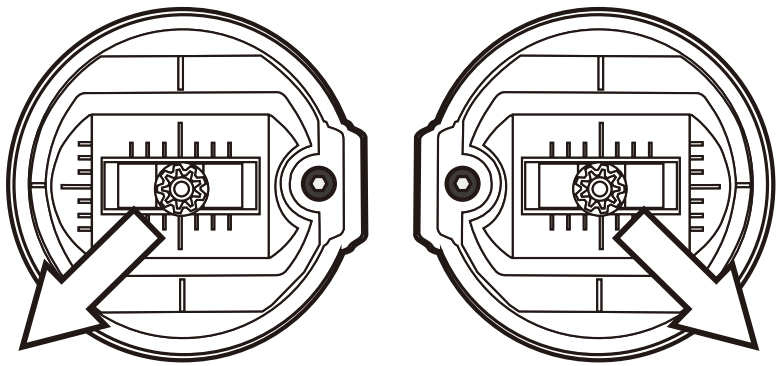
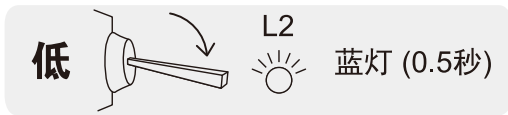


图 7

- 解锁后，将油门推至略高于怠速，查看螺旋桨旋转方向是否与图7所示一致。

地面测试

- 飞控上的感度电位器都旋至中间。
- CH5通道用于调节飞行模式，如果接入了CH5通道，在飞行前请拨动CH5通道的开关，观察飞控上的状态指示灯L2显示是否正确(低：蓝灯，高：绿灯)，初次飞行请将遥控器上的开关拨至高(自稳飞行)。





- 控制油门，保证飞行器不要离开地面，依次轻微拨动各通道操纵杆，观察飞行器在地面的倾斜状态与操纵杆的方向是否一致，如不一致，请在遥控器上更改相应通道的正反。

低高度试飞

- 解锁后推油门至飞行器离地约半米，查看飞行是否稳定，如不稳定，需对飞控进行感度调节。
- 因为各品牌遥控器的中点偏差和飞控的安装偏差，飞行器起飞后可能会偏向，此时可通过调节遥控器微调将飞行器调节至理想状态。

调节感度

- 250级（轴距250mm左右）四旋翼使用飞控默认电位器感度即可很好的飞行。
- 不同的四旋翼飞行器因为重量、重心、马达和螺旋桨的不同会导致感度也不同。
- 一般俯仰轴和横滚轴的感度过大会导致在该轴上的震荡；感度过低会导致在该轴上的动作偏软，突然打杆时飞行器停止不干脆、难以控制。
- 航向轴的感度过大会导致电机的加减速过于激烈，导致其他方向上的不稳定；过低则对航向的锁定有影响，打杆时飞行器停止不干脆。
- 每次感度调节请勿过大，每次旋转电位器5-10度即可，基本稳定后可继续进行细微调节。

注意事项

- 飞行过程中请勿将油门收到底，否则很容易因电机停转导致摔机。
- 长时间高机动飞行时，由于外加速度影响，导致飞行器的姿态不能完全水平，此为正常现象，悬停数秒钟后飞控会恢复水平。