

DUALSKY®
ADVANCED POWER SYSTEMS

《FC150》

FC150 Flight Control System
Instruction Manual

FC150固定翼飞行控制器使用说明书

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DUALSKY®
ADVANCED POWER SYSTEMS



Thank you for selecting Dualsky FC150 Flight Control System. This gyro equipped with latest MEMS gyro & G-sensor chipset, 32-bit MCU and Dualsky original algorithm. It features at mini dimensions, high sensitivity and friendly user interface, see more detailed features in below list:

- Mini dimension, MEMS 3 axis gyro and 3 axis accelerometer in one chipset, only 8 grams
- 32-bit high performance ARM MCU
- Original advanced airplane active attitude stabilization algorithm
- Support single/double aileron, fly wing and V-tail aircraft
- Independent sensitivity adjustment of each axis
- Support Futaba S. BUS Link
- Support mode switch via extra channel, can switch between different mode
- Programmable via button and LEDs
- Support HV input

Caution - FC150 will take over all control channels except the throttle channel, if the setting of FC150 is inappropriate, it might cause property damage or damage yourself. Please read the caution items and the rest of this manual carefully before using FC150.

- Recommend to use this gyro on electric powered model airplane or unpowered model glider
- FC150 need 2~3 sec start-up time after connect to the power, please remain the airplane still during this process
- Servos will only work after the FC150 start-up process finished, this is normal

- In self-stability mode, the control surfaces of model which is still on the ground may move to maximum travel. This is NORMAL.

Packing List

(a) FC150 Gyro x 1	(c) 3-signal wire (long) x 1
(b) Anti-shock double sided tape x 1	(d) Single-signal wire (long) x 2
 (a)	 (b)
	 (c)  (d)

Radio equipment

You need a 4-channel or higher transmitter. If transmitter only has 4 channels, FC150 will work under basic mode by default, cannot switch mode during flight. We recommend to use 5 channels or higher transmitter, so CH.5 (usually the GEAR channel) can be used as switching mode channel.

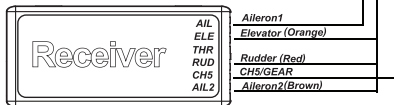
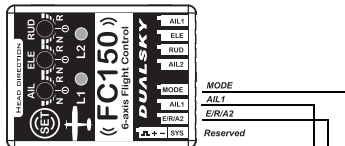
*** Before install FC150, please test fly your airplane, make sure all channel directions and trims are set to the correct position.**

Installation instruction

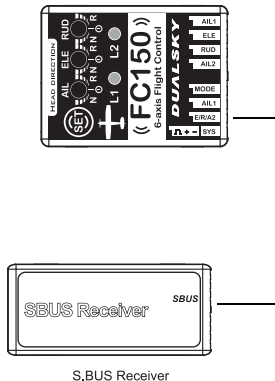
1. FC150 installation principal:

- FC150's heading direction must be the same as airplane heading direction
- FC150 MUST be mounted in line with the flight path perfectly. Otherwise the airplane will yaw
- FC150 should be installed inside of the airplane, close to the receiver and CG
- Install platform must be parallel to horizontal tail, rugged (recommend to use plywood), but do not use servo platform
- Must use the double sided tape comes with FC150, do not use belt, velcro or 3M Dual-Lock
- Do not use foam to cover FC150
- FC150 cannot be touched by servo horn, linkage or other movable parts
- FC150 must stay away from motor, engine, ESC and batteries
- FC150 cannot be installed at the outside of airplane, such as wings or tail

2. Connect the FC150 to receiver as shown below



Normal Receiver



- Input/output signal wires are close to the top of FC150, middle is VDD and bottom is GND.
- Input signal supports Futaba S.BUS, only one wire is needed to connect to SYS port on FC150 when using S.BUS link. SYS port has higher priority than other input ports. When SYS port is using, other input ports won't work, transmitter channel sequence must be the same as following chart:

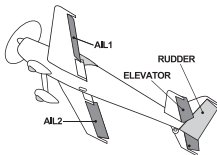
Sequence	CH1	CH2	CH3	CH4	CH5	CH6
Channel	Aileron 1	Elevator	Throttle	Rudder	Mode Switch	Aileron 2



Caution: Futaba and S.BUS is the trademark and technology of Futaba Corp., we don't provide technical support to future incompatibility.

3. FC150 corresponding control surface

- Normal type airplane with single or double ailerons

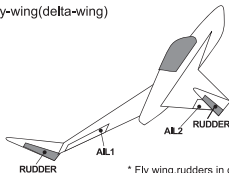


* Diagram show double aileron airplane

Normal Airplane		PIN Location		
		TOP	MIDDLE	BOTTOM
	OUTPUT	Aileron	VDD	GND
		Elevator	VDD	GND
		Rudder	VDD	GND
		Aileron 2	VDD	GND
	INPUT	Switch	VDD	GND
		Aileron	VDD	GND
		Elevator	Rudder	Aileron 2
		S.BUS	VDD	GND

* VDD is positive lead, *GND is negative lead.

• Fly-wing(delta-wing)

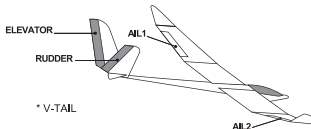


* Fly wing, rudders in diagram are paralleled by Y-wire

Fly-wing/Delta-wing		PIN Location		
		TOP	MIDDLE	BOTTOM
	OUTPUT	Aileron	VDD	GND
		N/A	VDD	GND
		Rudder	VDD	GND
		Aileron2	VDD	GND
	INPUT	Switch	VDD	GND
		Aileron	VDD	GND
		Elevator	Rudder	N/A
		S.BUS	VDD	GND

* VDD is positive lead. *GND is negative lead.

• V-tail airplane



* V-TAIL

V-tail Airplane		PIN Location		
		TOP	MIDDLE	BOTTOM
	OUTPUT	Aileron	VDD	GND
		Elevator	VDD	GND
		Rudder	VDD	GND
		Aileron2	VDD	GND
	INPUT	Switch	VDD	GND
		Aileron	VDD	GND
		Elevator	Rudder	Aileron2
		S.BUS	VDD	GND

* VDD is positive lead. *GND is negative lead.

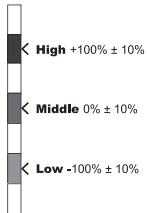
4. FC150 Power Supply

FC150 supports 4.8V-8.4V power input, share same power input with receiver, input power voltage should meet the requirements of receiver, too. Power supply could be battery or ESC.

Set mode switch

Connect a switch channel to the Mode/SW port. Then you can switch the flying model with it.

Please assign a 3-position switch to mode channel and make sure that channel doesn't have other function. Switch channel pulse width range should be low 1020~1180us, middle 1420~1580us, high 1820~1980us. If the mode channel is not connected, the FC150 will work in Beginner mode.





NOTE: If the positive pulse width of mode channel is out of the range that mentioned above, the FC150 will enter "recovery mode", please see the "recovery mode" section

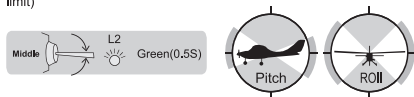


NOTE: You may need to reverse mode channel for correct switch operation.

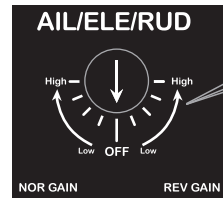
Beginner Mode: position low, self-stability, low rate (small angle limit), roll to pitch mixing



Advance Mode: position middle, self-stability, high rate (large angle limit)



Aerobatic Mode: Position high, 3 axis gyro only, you can do loops and rolls



- Correct Gain setting requires test flight to determine, it's recommend to use more conservative Gain (low) during test flight
- Fly in aerobatic mode at safety altitude, accelerate the airplane to its maximum speed, observe if there is oscillation in Pitch, Roll and Yaw axis. If there is oscillation, it indicates the Gain is too high, please slow down the airplane, decreasing the Gain after landing
- Please do not adjust the Gain too much a time, it's recommend to adjust 5-10 degrees a time
- Gain too low will cause the airplane become blunt, a basic principal

is - Gain cannot be too low to decrease the maximum travel of control surface

Ground Test

- Please do a ground test before flight
- Test if the mode switch is working properly. Do not turn on the motor/engine, toggle the mode switch on the transmitter to high position, LED2 will turn RED for 0.5 sec, now FC150 is under Aerobatic mode (Gyro only)
- Test gyro moving direction. Rotate the model on each axis, corresponded control surface should have excursion the same as moving direction. If moving direction is different, please reverse the pot of that axis
- Test transmitter moving direction. Move the sticks (except the throttle) to observe if each control surface moving at correct direction

Trim system

- Please trim model under Beginner/Advanced mode firstly, then trim model under Aerobatic mode
- Normally, it is not necessary to trim a RTF model under Beginner/Advanced mode

How to trim the neutral point offset of beginner/advanced mode?

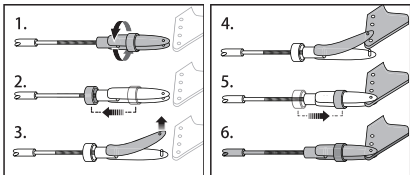
- Turn on the radio, ZERO the trim/sub-trim in radio
- Connect the power to the model
- Take off and fly the model in beginner mode(not advanced mode)
- Don't switch to Advanced or Aerobatic mode during the flight
- Adjust/Trim neutral point(offset) of accelerometer if model don't fly

horizontally

- Record the offset after landing. Note: don't turn off the model or radio
- Fast toggle the mode switch until the LED1 turn off, then turn on in bule. The offset will be saved automatically
- "Zero" the trim of radio, and fly and trim the model in Aerobatic Mode

How to trim the model under Aerobatic mode

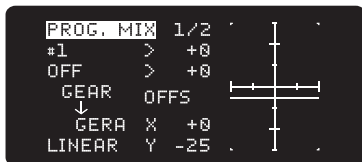
- We prefer disable FC150, fly and trim model without gyro
- If trim is larger than four steps. Zero the trim. Turn the clevis on the linkage to change the length of the linkage between the servo arm and the control horn



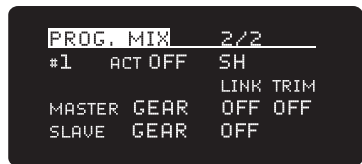
- Enable FC150
- The new neutral point of Aerobatic mode will not take effect in Beginner or Advance model after FC150 is restarted. FC150 will map sub-trim to neutral point of accelerometer under Beginner/Advanced mode

Recovery mode

Setup a "Recovery Mode" with transmitter. When "Recovery" switch is triggered in any flight mode, the airplane will roll wings level and pull out of a dive.



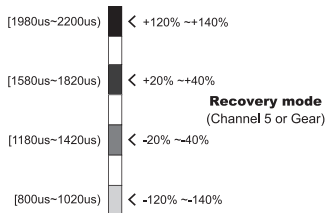
Futaba setting example(1)



Futaba setting example(2)



Tactic setting example



As mentioned earlier: When receiver is connected to FC150 mode channel, you can set the flight mode. When mode signal is in the four regions of above image(outside of normal signal range), "recover mode" is activated.

How to set "recovery mode" switch on the transmitter?

The "Recovery Mode Switch" and "Mode Switch" are different switches, but they both act on mode channel. You need to set up a "mixi" to activate "recovery mode":

Master channel: CH5/GEAR

Slave channel: CH5/GEAR

OFFSET: -25%

Mix Trigger Switch: SF (we recommend using an "automatic release" toggle switch to activate this feature.)

FC150 Setting

1. How to enter Setting Mode: Turn on radio controller, move the throttle to lowest position; turn on power to the model, wait until the L1 LED finishes flashing Green and then changes to RED; Long Press "SET" button(2 sec) 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).

2. "SET"Button usage:

- Long Press (more than 2 sec) under flight mode: enter Setting Mode
- Single Click under Setting Mode: switch between SETTING ITEM
- Double Click (finish within 0.5 sec) under Setting Mode: change SETTING VALUE
- Long Press (more than 2 sec) under Setting Mode: Save and Quit to flight mode

3. Please check the below chart for all settings

ITEM		VALUE			
L1(LED)		L2(LED)			
Blue	Install Direction	Blue(default)	Green	Red	Yellow
	Stability Mode (In Aerobatic mode)	Face up	Face down	Face right	Face left
Green		Aileron-normal	Aileron-heading hold	Aileron-heading hold	
		Elevator-normal	Elevator-heading hold	Elevator-heading hold	
		Rudder-normal	Rudder-normal	Rudder-heading hold	
Red	Airplane Type	Trainer-Cannot inverted flight	Sport-Can inverted flight		
Yellow	Wing Type	Normal	Delta Wing	V-Tail	

NOTE: Some settings will take effect after the FC150 is restarted. Cut the power to the FC150 and reconnect after 5 seconds to apply the new settings.

感谢使用双天公司出品的FC150固定翼飞行控制器。陀螺采用最新的MEMS陀螺仪,加速度传感器,32位高性能处理器和双天自主研发的姿态算法。它具备体积小,灵敏度高和容易使用等特点,更多特点见下表:

- 超小尺寸设计,使用MEMS陀螺仪、加速度计合一芯片,仅8克
- 32位高性能ARM内核处理器
- 自主研发高级飞机姿态稳定算法
- 支持单/双副翼,飞翼和V型尾翼飞行器
- 可独立调整3轴的感度
- 支持Futaba S. BUS单线输入
- 支持模式切换通道,作为模式切换
- 可通过按键和LED灯编程
- 支持高电压HV输入

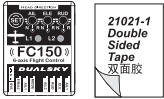
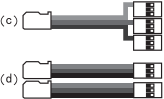
注意事项: FC150会接管除油门外的主要控制通道,如果设定不当会造成模型损失甚至人身伤害。请在使用本产品前仔细阅读注意事项和余下章节。

- 推荐在电动飞机或无动力滑翔机上使用此系统。
- 陀螺仪每次上电都有2-3秒初始化过程,请避免这个过程

中模型的晃动。

- 陀螺仪初始化结束后,舵机才会工作,这是正常情况。
- 自稳模式下,地面上静止的模型的舵面会向某个方向偏转到最大,这是正常现象。

物品清单

(a)FC150平衡仪 x 1 (b)减震双面胶 x 1	(c)三信号排线(长) x 1 (d)单信号排线(长) x 2
 (a) (b)	 (c) (d)

遥控设备

你需要一套四通道或以上遥控设备,如果遥控器只有4CH,FC150默认工作在增稳模式,不具备模式切换功能。我们推荐您使用5CH遥控设备,这样可以利用CH5(通常是GEAR)作为模式切换通道。

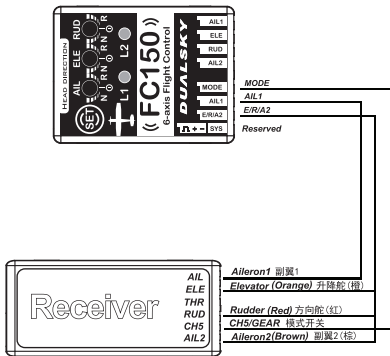
* 在安装FC150测试之前,请先试飞你的飞机,确保通道正反和微调都已设置正确。

安装指南

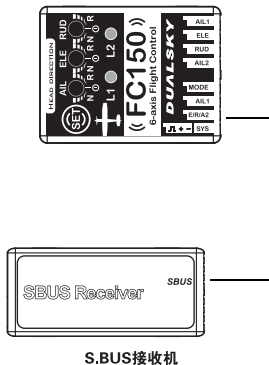
1. FC150安装原则:

- FC150的头部方向必须与模型机头方向一致
- FC150必须被精确地安装在飞行航线上,否则飞机将会偏航
- FC150应被安装在机身内部,接收机附近,靠近重心
- 固定面要与水平尾翼平行,有刚性(推荐层板),但不要固定在舵机安装板上
- 必须使用原厂提供的海绵双面胶固定,不能采用扎带,魔术贴或3M Dual-Lock
- 不要将陀螺仪整体包裹海绵后再固定
- 陀螺仪不能被舵机摇臂、连杆以及其他活动装置触碰到
- 远离电动机或发动机舱,远离电子调速器,尽量远离电池
- 陀螺仪不能放置在机身外部,机翼或尾翼上

2. FC150与接收机的连接。如下图所示:



普通接收机



- 输入输出信号线靠近FC150顶部，中部插针处为电源正极，底部对应电源地
- 输入(Input)支持Futaba S. Bus, 这是只需要采用一根“单信号排线”连接SYS口和接收机S. Bus接口。SYS接口优先级高于其他输入口。当采用SYS输入时，其他输入口不工作，遥控器通道顺序必须同下表：

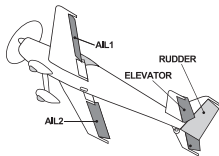
顺序通道	CH1	CH2	CH3	CH4	CH5	CH6
	副翼1	升降	油门	方向	模式开关	副翼2



注意：Futaba和S. Bus为双叶公司商标及技术，我们不对未来潜在的不兼容负责或提供技术支持。

3. FC150与舵面的连接

- 常规布局固定翼飞机

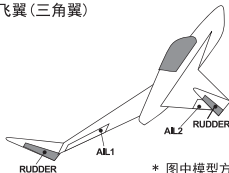


* 图示为双副翼飞机

Normal Airplane		PIN Location		
		TOP	MIDDLE	BOTTOM
	OUTPUT	Aileron	VDD	GND
		Elevator	VDD	GND
		Rudder	VDD	GND
		Aileron2	VDD	GND
	INPUT	Switch	VDD	GND
		Aileron	VDD	GND
		Elevator	Rudder	Aileron2
		S.BUS	VDD	GND

* VDD is positive lead. *GND is negative lead.

● 飞翼(三角翼)

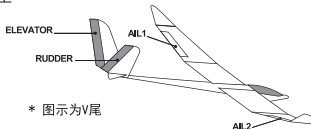


* 图中模型方向舵采用Y型线并联

Fly-wing/Delta-wing		PIN Location		
		TOP	MIDDLE	BOTTOM
	AIL1	VDD	GND	
	ELE	N/A	VDD	GND
	RUD	Rudder	VDD	GND
	AIL2	Aileron2	VDD	GND
	MODE	Switch	VDD	GND
	AIL1	Aileron	VDD	GND
	ELE/A2	Elevator	Rudder	N/A
	SYS	S.BUS	VDD	GND

* VDD is positive lead. *GND is negative lead.

● V尾模型



* 图示为V尾

V-tail Airplane		PIN Location		
		TOP	MIDDLE	BOTTOM
	AIL1	Aileron	VDD	GND
	ELE	Elevator	VDD	GND
	RUD	Rudder	VDD	GND
	AIL2	Aileron2	VDD	GND
	MODE	Switch	VDD	GND
	AIL1	Aileron	VDD	GND
	ELE/A2	Elevator	Rudder	Aileron2
	SYS	S.BUS	VDD	GND

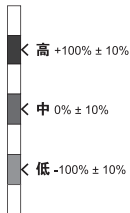
* VDD is positive lead. *GND is negative lead.

4. FC150的供电方式

FC150支持4.8V~8.4V的电压输入，与接收机共用电源，输入电压也要符合接收机的要求。电源可以是电池，也可以是ESC。

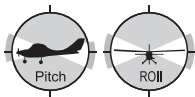
设置模式切换开关

模式开关用于在飞行中转换3种飞行模式。请在遥控器上将Mode通道连接到一个三段开关，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1020~1180us，中1420~1580us，高1820~1980us。如果没有连接模式通道FC150将工作在“初学者模式”。

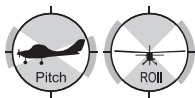


注意：如果开关信号超出范围，FC150会进入“恢复模式”，请参考“恢复模式章节”

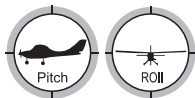
初学者模式: 开关位置低, 自稳, 角度限制小, 横滚—俯仰混控



高级模式: 开关位置中, 自稳, 角度限制大



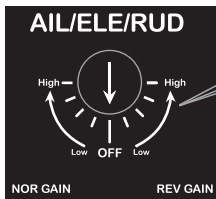
特技模式: 开关位置高, 只用了3轴陀螺仪, 可做筋斗或翻滚等特技动作



注意: 可能需要通过遥控器的REV功能改变模式开关的拨动方向。

调节感和方向

新飞机需要设置陀螺工作方向和感度。可以通过FC150正面的旋钮调整各个轴的感度和正反。如下图:



- 感度是否合适需要通过试飞来确定, 可以先采用较保守(较低)的感度试飞
- 在安全的高度将飞机加速到最大速度, 观察俯仰轴(Pitch)、横滚轴(Roll)和航向轴(Yaw)是否有震荡现象。如果有说明感度偏高, 立即降低飞行速度或关闭陀螺仪, 降落后调低感度
- 每次感度调节请勿过大, 每次旋转电位器5-10度
- 感度过低会导致飞机动作迟钝, 一个基本的原则是: 感度不能小到影响舵面的行程

地面测试

- 飞行前, 请进行地面测试
- 测试模式开关是否正常工作。动力不要被开启, 将遥控器模式SW开关拨到高, 此时L2亮红色(0.5秒), FC150处于特技模式
- 测试Gyro动作方向。在各个轴向上转动模型, 对应的舵面偏移方向应该和模型移动同方向。如果不同方向, 需要反转对应的电位器
- 测试遥控器动作方向。拨动遥控器各通道摇杆(除油门外), 观察模型各通道舵面是否偏转正确

微调系统

- 请先调节初学/高级模式的微调, 完成后再调节Aerobatic(特技)模式
- 配机版本的Beginner/Advanced(初学/高级)模式通常不需要微调

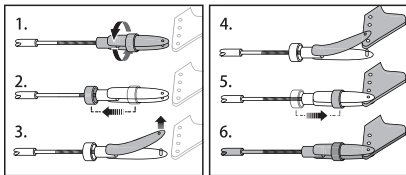
如何调节基础模式和高级模式下的中立点(角度补偿)?

- 打开遥控器, 将遥控器的微调与电子微调全部回零
- 给模型上电

- 切换到基础模式起飞模型
- 在本次飞行中请勿切换到高级或特技模式
- 调节微调使模型飞行水平
- 请在降落后再保存微调值(注意: 请不要关闭遥控或者模型的电源)
- 快速切换模式开关直至LED1熄灭, 然后LED1蓝灯亮起, 微调会自动保存在FC150中
- 将遥控器的微调归零, 可以进一步在特技模式下调整模型

如何在特技模式下调整模型?

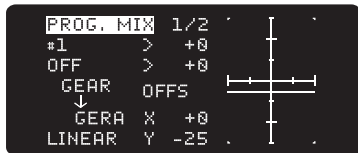
- 建议在不使用FC150的情况下调整模型
- 直接使用遥控器微调整, 但是如果遥控器的微调过大, 请将遥控器的微调归零, 通过调整舵机连杆长度来调整模型



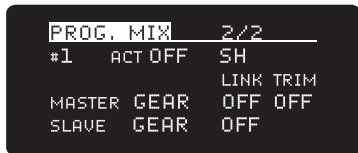
- 调整完后使用FC150
- 重新上电后特技模式下的微调不会影响基础模式与高级模式下的飞行。在基础模式和高级模式下, FC150将会把微调映射到飞机平飞的角度上

恢复模式

在遥控器上设置一个Recovery开关。在任意飞行模式中拨动“恢复”开关, 模型迅速恢复平飞状态。



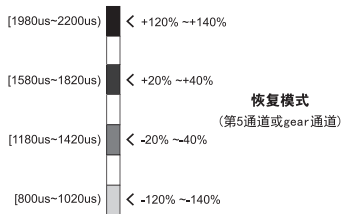
Futaba遥控器设置示例(1)



Futaba遥控器设置示例(2)



Tactic 遥控器设置示例



前面提到: 当接收机连接了FC150的模式通道(mode port), 可以设置飞行模式。模式通道的信号指令在上图所示4个区域(也就是模式信号区间之外)时, 即可激活“恢复模式”。

如何在遥控器上设置“恢复模式”开关?

“恢复模式开关”和“模式开关”是不同的开关，但是都作用于模式通道上。需要设置一个“混控”来激活“恢复模式”：

主动通道(master channel): CH5/GEAR

从动通道(Slave channel): CH5/GEAR

偏移量(OFFSET): -25%

混控激活开关(Mix Trigger Switch): SF(我们建议采用一个“自动释放”拨动开关来激活这个功能。)

FC150 设定

1. 如何进入设定模式：打开遥控器，油门收至最低，接通飞机的电源，等待飞控L1绿灯闪烁结束，长按飞控上的“SET”按钮(2秒)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。

2. 按键操作说明:

- ① 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

3. 具体设定项如下表所示:

选项		值			
L1(LED)		L2(LED)			
蓝色	安装方向	蓝色(默认)	绿色	红色	黄色
绿色	增稳锁定 选择 (仅在特技 模式下有效)	正面向上	正面向下	正面向右	正面向左
		副翼-不锁定 升降舵-不锁定 方向舵-不锁定	副翼-锁定 升降舵-锁定 方向舵-锁定	副翼-锁定 升降舵-锁定 方向舵-锁定	
红色	飞机特性	练习机-不可 倒飞机型	运动机-可倒 飞机型		
黄色	飞机类型	普通固定翼	飞翼	V型尾翼	

注意：飞控设定完成后，请重新上电以应用新的设定值。