

**DUALSKY**<sup>®</sup>  
ADVANCED POWER SYSTEMS

# 《FC120》

FC120 Flight Control System  
Instruction Manual

FC120固定翼飞行控制器使用说明书

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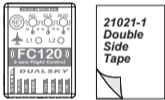
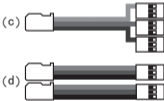
**Thank you for using Dualsky FC120 Flight Control System. This gyro is equipped with latest MEMS gyroscope, 32-bit MCU and Dualsky original algorithm. It features at mini dimensions, high sensitivity and friendly user interface, more features are listed below:**

- Mini dimension, MEMS gyroscope and accelerometer in one chip, only 8 grams
- 32-bit high performance ARM MCU
- Original advanced flight control algorithm
- Support single/double aileron, fly wing and V-tail aircraft
- Support flaperon mixing
- Support aerobatic/3D airplanes
- Independent sensitivity adjustment of all 3 axes
- Support Futaba S. BUS protocol
- Gyro can be turned off
- Program via button and LEDs
- Support HV inputs

**Caution: FC120 will take over all control channels except throttle, if the setting of FC120 is inappropriate, it might cause property damage or personal injury. Please read the caution items and the rest of this manual carefully before using FC120.**

- Recommended to use this gyro on electric powered airplane models or unpowered glider models
- FC120 need 2~3 sec start-up time after powered on, please keep the airplane still during the process
- Servos will only work after the FC120 start-up process ends, this is normal.

### Packing List

|  |   |
|--|---|
| (a) FC120 Gyro x 1<br>(b) Anti-shock double side tape x 1                          | (c) 3-signal wire (long) x 1<br>(d) Single-signal wire (long) x 2                   |
|  |  |

### Radio equipment

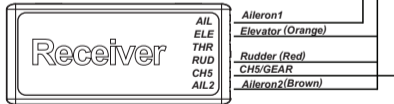
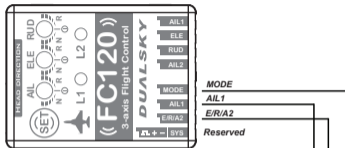
You need an at least 4-channel transmitter. If transmitter only has 4 channels, FC120 will work in aerobatic mode by default and can't be turned off during flight. We recommend you for 5 channel transmitter so that the 5th channel (usually the GEAR channel) can be used for turning off the gyro.

## 2.Connect the FC120 to receiver as shown below

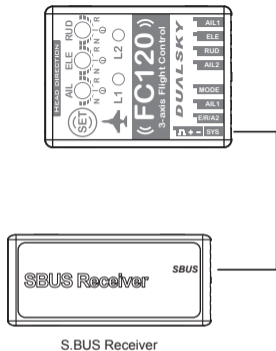
### Installation instruction

#### 1.FC120 installation principle:

- FC120's heading direction must be the same as airplane heading direction
- FC120 must be mounted parallel to flight path, otherwise airplane will yaw.
- FC120 should be installed inside of the airplane, close to the receiver and CG
- Install platform must be parallel to horizontal tail, solid (recommend to use plywood), but do not use servo mount platform
- Use accessory double side tape to fix FC120, do not use strap, patch or 3M Dual-Lock
- Do not wrap FC120 in foam
- FC120 cannot be touched by servo horn, linkage or other moveable parts
- FC120 must stay away from motor, engine, ESC and batteries
- FC120 cannot be installed outside the airplane, such as wings or tail



Normal Receiver

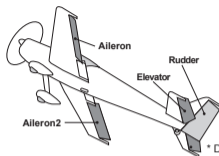


- Input/output signal wires are close to the top of FC120, middle is VDD and bottom is GND.
- Input signal supports Futaba S.BUS and S.BUS2, only need single-signal wire to connect SYS and receivers' SBUS port. SYS port has higher priority than other input ports. When using SYS port, other input ports 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 |

### 3.FC120 corresponding control surface

- Normal type airplane with single or double ailerons

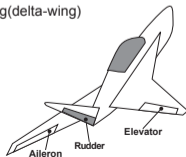


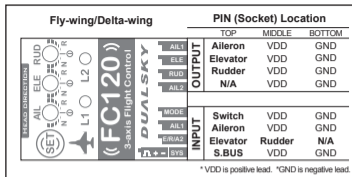
\* Diagram show double aileron airplane

|        | Normal Airplane | PIN (Socket) 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       |

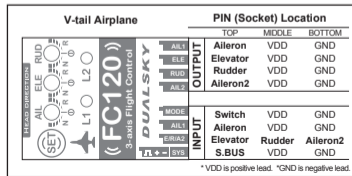
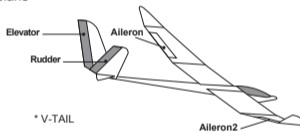
\*VDD is positive lead. \*GND is negative lead.

- Fly-wing(delta-wing)





- V-tail airplane

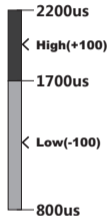


#### 4. FC120 Power Supply

FC120 supports 4.8V-8.4V voltage input, share the same power with receiver, input voltage should meet the requirements of receiver, too. Power supply could be battery or ESC.

#### Set mode switch

Mode select switch is used for turning on or turning off the gyro. Please assign a 2-position switch to mode channel and make sure that channel doesn't have other functions. Switch channel pulse width range should be low 800~1700us, high 1700~2200us. If the mode channel is not connected, the FC120 will work in aerobatic mode.



**Gyro Off Mode:** Position low, FC120 outputs receiver's signal directly



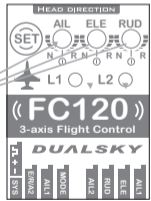
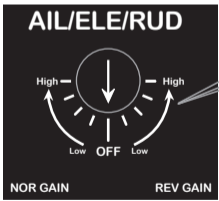
**Aerobatic Mode:** Position high, 3 axis gyroscope working



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

**How to setup gains and correction directions?**

There are 3 pots to adjust the correction directions and gains for aileron (roll), elevator (pitch) and rudder (yaw) channel. Please see the sketch below.

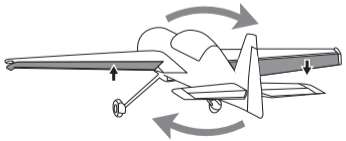


- It needs a few testing fly to determine appropriate gains, we recommend starting from conservative gains (low) first

- Fly in aerobatic mode at safety altitude, accelerate the airplane to its maximum speed to see if there is oscillation in pitch, roll or yaw axis. oscillation indicates the gain is too high, please slow down the airplane, decreasing the gain after landing
- Please don't adjust the gain too much one time, it's recommend adjusting 5-10 degrees one time

**Ground Test**

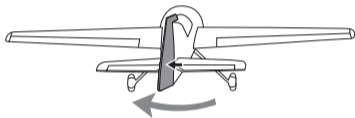
- Please do a ground test before first flight.
- Test if the mode switch is working properly. Do not turn on the motor/engine, toggle the mode switch on the transmitter to high position, LED2 will turn GREEN for 0.5sec, now FC120 is in Aerobatic mode.
- Test gyro correction direction. Rotate the model on each axis, corresponding control surface should act to against that rotation. If the action is wrong, please reverse the pot of that axis.



Roll & Aileron Movement



Pitch & Elevator Movement

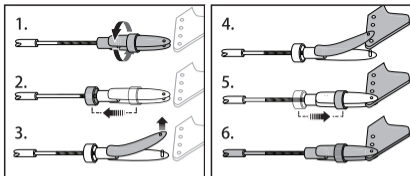


Yaw & Rudder Movement

- Test transmitter moving direction. Move the sticks (except the throttle) to see if each control surface is working rightly.

### Trim system

- First please trim model directly on your transmitter in gyro off mode. But if transmitter trim is too large, please zero the trim and adjust the model by changing the length of the linkage between the servo arm and the control horn.



- Do not directly switch to Aerobatic mode after trimming in gyro off mode, you need to land the plane and power on your plane again.
- There is no need to trim in Aerobatic mode if last step finished.

### FC120 Setting

- **How to enter Setting Mode:** Turn on the transmitter, move the throttle to its minimum; power on the model, wait until the L1 green LED ends flashing; Long Press "SET" button (2sec) to enter Setting Mode. After that, L1 displays the corresponding SETTING ITEM and L2 shows the corresponding SETTING VALUE.

● **“SET” Button usage:**

- (1). Long Press (more than 2 sec) : enter Setting Mode
- (2). Single click in Setting Mode: switch between SETTING ITEM
- (3). Double click (finish within 0.5sec) in Setting Mode: change SETTING VALUE
- (4). Long Press in Setting Mode: Save and quit to flight mode

● **Please check the chart below for all settings**

| Item    |                   | L2(LED)        |            |            |           |
|---------|-------------------|----------------|------------|------------|-----------|
| L1(LED) |                   | Blue (default) | Green      | Red        | Yellow    |
| Blue    | Install direction | Face up        | Face down  | Face right | Face left |
| Green   | Airplane type     | Normal         | Delta wing | V-tail     |           |

**LED Status**

| LED1 STATUS    | FC120 STATUS                        |
|----------------|-------------------------------------|
| Green flashing | Initializing                        |
| Green solid    | Initialization completed, signal OK |
| Red solid      | Initialization completed, no signal |

| LED2 STATUS             | FC120 STATUS      |
|-------------------------|-------------------|
| Blue on for 0.5 second  | In gyro off mode  |
| Green on for 0.5 second | In aerobatic mode |



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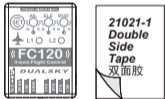
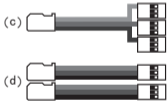
感谢使用双天公司出品的 FC120 固定翼飞行控制器。陀螺采用最新的 MEMS 陀螺仪，32 位高性能处理器和双天自主研发的控制算法。它具备体积小，灵敏度高和容易使用等特点，更多特点见下表：

- 超小尺寸设计，使用 MEMS 陀螺仪，仅 8 克
- 32 位高性能 ARM 内核处理器
- 自主研发高级飞行控制算法
- 支持单 / 双副翼，飞翼和 V 型尾翼飞行器
- 支持襟副翼混控功能
- 支持特技 3D 飞机
- 可独立调整 3 轴的感受度
- 支持 Futaba S.BUS 单线输入
- 支持陀螺仪关闭功能
- 可通过按键和 LED 灯编程
- 支持高电压 HV 输入

**注意事项：**FC120 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

## 物品清单

|   |  |
|---|--|
| <p>(a) FC120平衡仪 x 1<br/>(b) 减震双面胶 x 1</p>   | <p>(c) 三信号排线(长) x 1<br/>(d) 单信号排线(长) x 2</p>   |
|  <p>(a) (b)</p> |  <p>(c) (d)</p> |

## 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，FC120 默认工作在特技模式，不能关闭。我们推荐

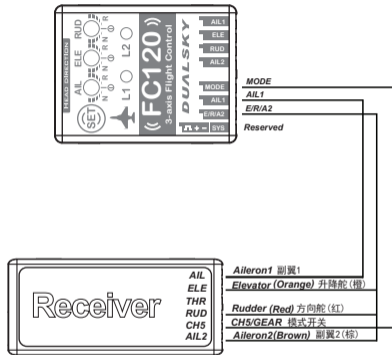
您使用 5CH 遥控设备，这样可以利用 CH5(通常是 GEAR) 切换关闭陀螺仪。

## 安装指南

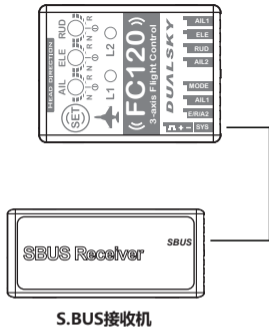
### 1.FC120安装原则：

- FC120的头部方向必须与模型机头方向一致
- FC120必须被精确地安装在飞行航线上，否则飞机将会偏航
- FC120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.FC120与接收机的连接。如下图所示：



普通接收机

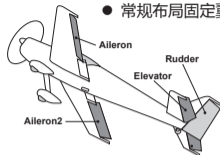


- 输入输出信号线靠近 FC120 顶部，中部插针处为电源正极，底部对应电源地
- 输入 (Input) 支持 Futaba S.Bus 和 S.Bus2, 这时只需要采用一根“单信号排线”连接 SYS 口和接收机 S.Bus 接口。SYS 接口优先级高于其他输入。当采用 SYS 输入时，其他输入不工作，遥控器通道顺序必须同下表：

| 顺序<br>通道 | CH1 | CH2 | CH3 | CH4 | CH5  | CH6 |
|----------|-----|-----|-----|-----|------|-----|
|          | 副翼1 | 升降  | 油门  | 方向  | 模式开关 | 副翼2 |

### 3.FC120与舵面的连接

- 常规布局固定翼飞机

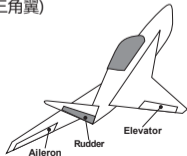


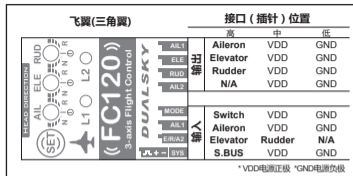
\* 图示为双副翼飞机

| 常规布局固定翼飞机 | 接口 (插针) 位置 |           |        |           |
|-----------|------------|-----------|--------|-----------|
|           |            | 高         | 中      | 低         |
|           | 输出         | Aileron   | VDD    | GND       |
|           |            | Elevator  | VDD    | GND       |
|           |            | Rudder    | VDD    | GND       |
|           |            | Aileron 2 | VDD    | GND       |
|           | 输入         | Switch    | VDD    | GND       |
|           |            | Aileron   | VDD    | GND       |
|           |            | Elevator  | Rudder | Aileron 2 |
|           |            | S.BUS     | VDD    | GND       |

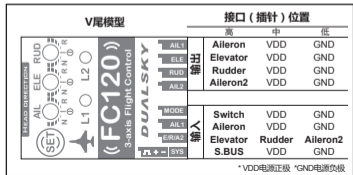
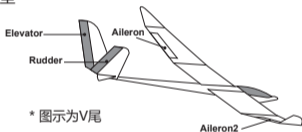
\*VDD电源正极 \*GND电源负极

- 飞翼(三角翼)





### ● V尾模型

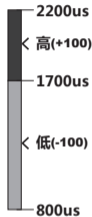


## 4.FC120的供电方式

FC120 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开启或关闭陀螺仪。请在遥控器上将 Mode 通道连接到一个两段开关，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 800~1700us，高 1700~2200us。如果没有连接模式通道 FC120 将工作在特技模式。



**关闭模式：**开关位置低，飞控直接输出接收机信号



**特技模式：**开关位置高，3轴陀螺仪开启

高



L2



绿灯(0.5秒)



**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。

## 调节感度和方向

新飞机需要设置陀螺工作方向和感度。可以通过FC120正面的旋钮调整各个轴的感度和正反。如下图：

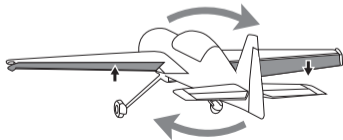


- 感度是否合适需要通过试飞来确定，可以先采用较保守（较低）的感度试飞

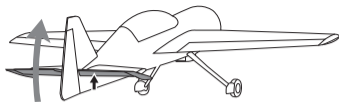
- 在安全的高度将飞机加速到最大速度 观察俯仰轴 (Pitch)、横滚轴 (Roll) 和航向轴 (Yaw) 是否有震荡现象。如果有说明感度偏高，立即降低飞行速度或关闭陀螺仪，降落 后调低感度
- 每次感度调节请勿过大，每次旋转电位器 5-10 度

## 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 亮绿色 (0.5 秒)，FC120 处于特技模式
- 测试陀螺修正方向。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



横滚 & 副翼动作



俯仰 & 升降舵动作

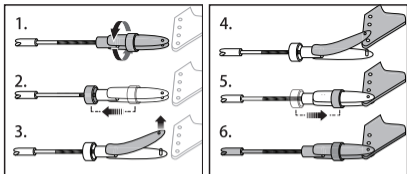


航向 & 方向舵动作

- 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

- 首先请先在陀螺关闭模式下调节微调，直接使用遥控器微调调整，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



- 当在陀螺关闭模式下试飞并调整微调后，请不要立即切换到特技模式（陀螺开启）。请先降落飞机，断开接收机 / 陀螺仪供电，再重新接通电源飞行
- 陀螺关闭模式下微调调节正确后，特技模式无需调节。

## FC120 设定

- **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。
- **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

● 具体设定项如下表所示 :

| 选项      |      | L2(LED)    |      |      |      |
|---------|------|------------|------|------|------|
| L1(LED) |      | 蓝色<br>(默认) | 绿色   | 红色   | 黄色   |
| 蓝色      | 安装方向 | 正面向上       | 正面向下 | 正面向右 | 正面向左 |
| 绿色      | 飞机类型 | 普通固定翼      | 飞翼   | V型尾翼 |      |

## LED状态说明

| LED1 状态       | FC120 状态           |
|---------------|--------------------|
| 绿灯闪           | 飞控初始化中             |
| 绿灯亮           | 飞控初始化完成,<br>输入信号正常 |
| 红灯亮           | 飞控初始化完成,<br>输入信号有误 |
| LED2 状态       | FC120 状态           |
| 蓝灯亮起 0.5s 后熄灭 | 进入陀螺仪关闭模式          |
| 绿灯亮起 0.5s 后熄灭 | 进入特技模式             |