Rev 0: 3rd December 2011

FEIYU TECH

FY31AP

Autopilot System
Installation & Operation Guide

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Manual Update list

Revision	Date	Updated page	Topic updated
0	3 December 2011	N/A	First Release of Manual
			•

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Dear Pilot,

Thank you for choosing FY31AP as your autopilot system. Please read this manual carefully before using the system to ensure proper use and operation.

The installation and use of this device require some skill and knowledge in flying remote controlled fixed wing aircraft.

- If you are a complete beginner and have never flown one before, we do not recommend you install this device on your own.
- Please find assistance from an experience RC Pilot who may provide you with the basic knowledge required to use this device successfully.
- If you are already an experienced flyer, you will find the FY31AP installation to be easy and logical. Just follow this manual and you won't go wrong.

INTRODUCTION

Attitude Flight Stabilization System (AFSS)

FY31AP is an inertial attitude measurement instrument used for automated stabilization of fixed wing model aircrafts and two axis camera gimbals.

FY31AP has an integrated three-axis gyro and three-axis accelerometer which controls the aircraft movement in three-dimensional space. By using your remote control, the unit can be turned on or off for the following functions:

- **Level flight** – When stabilization is activated, the FY31AP will automatically control the aircraft for smooth easy flying. For beginners in RC aircraft flying, this is advantages as it makes flight easier and increases the student pilot self-confidence. The system can be activated throughout the entire flight duration, from take off to landing.
- **Emergency Recovery** - If you lose orientation release all control sticks, maintain throttle and switch ON the FY31AP. The unit will automatically send the correct signals to balance of the aircraft and regain level flight, giving you time to get your orientation and fly the plane back to safety.
- **Autonomous flight** – with the GPS Receiver connected, the FY31AP will enable you to fly fully autonomous, with up to 8 waypoint settings using the FY Ground Control Station (GCS) software.
- **Ground Control Station** – the FY GCS software will enable you to fly autonomously to up to 8 waypoints, display in-flight telemetry data, and record that flight for replay and analysis (this requires the optional Data Radio hardware).
- **Return to Home** – You can set autonomous return to home via a 3 way switch or through your failsafe setting, enabling you plane returning to home should it lose your transmitter signal. Upon reaching the home point it will automatically engage auto circling, while it waits for your further instructions.
- **Automated circling** - by activating this function, the aircraft will automatically circle the selected area at a fixed altitude. You can set the circling radius.
- **First Person View** - for long-distance RC flight via video transmitter, the FY31AP will maintain the balance of your aircraft. You only need to control the heading of your aircraft and enjoy the view.
- **Firmware upgrade** – The FY31AP firmware is upgradable by connecting to your

computer via a USB TTL cable. As Feiyu Tech continuously improves the FY31AP system, firmware upgrades will be released periodically.

GPS Home Lock, Barometric Altitude and 8 Waypoint

a) FY31AP control module incorporates an accurate barometric pressure sensor. At start up, when five (5) or more GPS satellites are detected, the FY31AP will note this as the *Home* position.

b) The barometric air pressure and GPS data is merged to provide accurate relative altitude measurement.

c) The GPS data enables the FY31AP to fly to 8 Waypoints via the FY-GCS programme and Data Radio.

d) Note that if the FY31AP is not connected to the GPS receiver, autonomous flight cannot be engaged and it will function purely as a flight stabilizer.

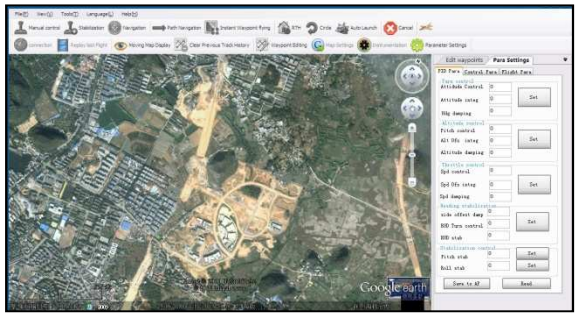
Optional Upgrades

a) The FY31AP is a standalone system that can function as an autopilot on its own.

b) However, adding the following optional upgrades allows you to expand the autopilot capabilities of the system.

- **Hornet OSD** – Allows you to display the autopilot telemetry data onto your downlinked video display. Refer the Hornet OSD Manual.

- **Ground Control Software** – You can download and use the software for free. Refer the FY31AP GCS Manual to understand the GCS functions.



- **Data Radio** – You can fly via the GCS and 8 waypoint settable.

- **FY3ZT Remote Adapter** – allows you to fly the aircraft with only the FY31AP and Data Radio on board. A simple way to increase your flight range when using 433 mHz data radio.

FY31AP Package Content

- FY31AP control module *1;
- RC receiver connecting wires * 1;
- GPS receiver module * 1;
- Velcro double sided tape * 2;
- Instruction manual * 1;
- Some related wires.

Technical Specification and Technical requirements

- **FY31AP module:**

  Input voltage: 4.0 ~ 6.0 Volt;
  Current draw: 50mA (5V);
  Size: 55 x 33 x 20 mm;
  Weight (excluding wires): 20g;
  Temperature range: -25 ° C ~ +70 ° C;
  Maximum rate of rotation : ≤ 2000 degrees

- **GPS Receiver Module:**

  Input voltage: 3.0 ~ 3.3 Volt;
  Current draw: 60mA (3.3V);
  Size: 25 x 25x 15 mm;
  Weight (excluding wires): 20g;
  Temperature range: -25 ° C ~ +70 ° C;

- **Application**

  The FY31AP can be installed in the following aircraft :

  1. Normal / Traditional fixed-wing planes
  2. Delta-winged plane with rudder
  3. Delta-winged plane without rudder
  4. Plane without aileron
  5. V-tail plane with and without ailerons
  6. Any other configuration , please e-mail us for enquiry: service@feiyu-tech.com

Remote control system requirement

The FY31AP has been tested to work with the following RC systems:

- Robbe-Futaba PPM / PCM 1024 / PCM G3 mode, 2.4 GHz systems ;
- Graupner/JR PPM 8, PPM 12, SPCM mode ;
- MPX PPM8, PPM 12 with UNI mode
- Any remote control system using the standard of 1.5 ms neutral position.

FY31AP Flight Modes (SW 1)

a) The FY31AP has three flight modes controlled by SW-1.

b) You can activate any of the flight modes via a free Receiver channel and a 3-position switch on your computer radio connected to the SW 1 interface on the FY31AP.

c) **Mode 1: Deactivated Mode**. In this mode, all control of the aircraft is by the pilot. The FY31AP does not participate in flight control.

d) **Mode 2: Stabilized mode**. In this mode and your transmitter control sticks at center, the FY31AP will continuously send out controlling signal (aileron, elevator, rudder) to ensure the aircraft maintains a stabilized, horizontal flight and constant flight direction. In this mode FY31AP will not allow acrobatic flights.

e) **Model 3: Airline flight mode**, in this mode, the waypoint will be set according to the flight path to automatic flight.

FY31AP Autonomous Flight Modes (SW 2)

a) Three autopilot modes are incorporated into the FY31AP controlled by SW 2.

b) You may set the modes via a free receiver channel and a 3-position switch.

c) **Autopilot mode 1: Deactivated**. The autopilot function is not activated.

d) **Autopilot mode 2: Auto Return To Launch (RCL)** . When activated in this mode, the FY31AP will automatically fly the plane back to the take-off point, while maintaining altitude. Upon reaching the launch area, the unit will automatically fly the plane in a circle at a default circling radius of 120 meters.

e) **Autopilot mode 3: Auto Circling Mode (ACM).** When activated in this mode, the plane will immediately fly in a circle. *The centre of the circle is the point of activation.* The default circle radius is 120 meters. The aircraft altitude will be automatically maintained throughout the ACM.

STALL WARNING

a. On its own, the FY31AP has no control over the throttle channel. Therefore, if your aircraft forward movement cannot compensate for the autopilot's active altitude hold in RTH and Auto Circling, your aircraft will stall.

b. This is especially important if RTL is part of your RC failsafe. In the event of RC Link lost, you may set RTL into your Receiver failsafe. However, DO NOT forget to also set your throttle failsafe to between 25 % to 50% to ensure the plane does not stall.

c. **Never set your throttle failsafe to zero**. If you do so, your aircraft will RTL in a continuous stalled flight which will result in a crash.

d. When flying under autonomous GCS control, FY31P will control the throttle level based on the target speed (refer GCS Manual). However, the throttle level on your radio transmitter has priority over the GCS Autonomous control. Please ensure that your throttle level is high enough to maintain the target speed and altitude hold. **Failing which, your aircraft may stall.**

Red LED Flashing & Gyroscope Re-set

If the following conditions occur, the FY31AP Gyro initialization is recommended:

(a) The device has not been used for a long time.

(b) There is a change in environmental temperature of over 30 degrees since last flight.

(c) The Red LED flashes continuously, even when the FY31AP remains stationary.

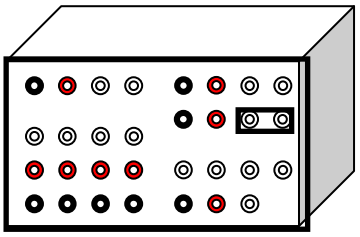
(d) If the Red LED light is on solid all the time even when the FY31AP is stationary, it means the gyroscope is faulty and that the unit needs to be sent back for repair.

Gyroscope Reset Procedure:

1. Carry out this re-setting procedure only if the above occur. We do not recommend regular re-setting. It is not necessary and not recommended.
2. The stabilizer unit does not need to be in a horizontal position during initialization. However, you must ensure there is no vibration during this process. If you suspect shaking occurred, just restart the initialization / resetting process.

Initialization / Reset Process

a) Install the jumper as shown in this picture:



b) Power-ON the FY31AP and keep it stationary for at least 20 seconds. You will notice the red light blink with two different rates.

c) After 20 seconds, the re-setting / initialization is complete.

d) Disconnect the power, unplug the jumper & remove it (keep safe for future use).

Flight Mode Indicator (Blue LED light)

By observing the flight indicator, you can easily re-confirm your Flight Mode switch settings of your radio.

Flight Mode Indicator:

SW-1 signal output	900-1200us	1200-1800us	1800-2100us
Functional mode	Deactivated Mode	Auto Stabilize Mode	Path Navigation Mode
Blue LED light indicator	continuous flash	Stay on solid	Single flash

Autopilot Indicator:

SW-2 signal output	900-1200us	1200-1800us	1800-2100us
Functional mode	Return To Launch Mode (RTL)	Cancel Mode	Auto Circling Mode (ACM)
Blue LED light indicator	Continuous Double flash each loop	/	Continuous flashing. 3 times each loop

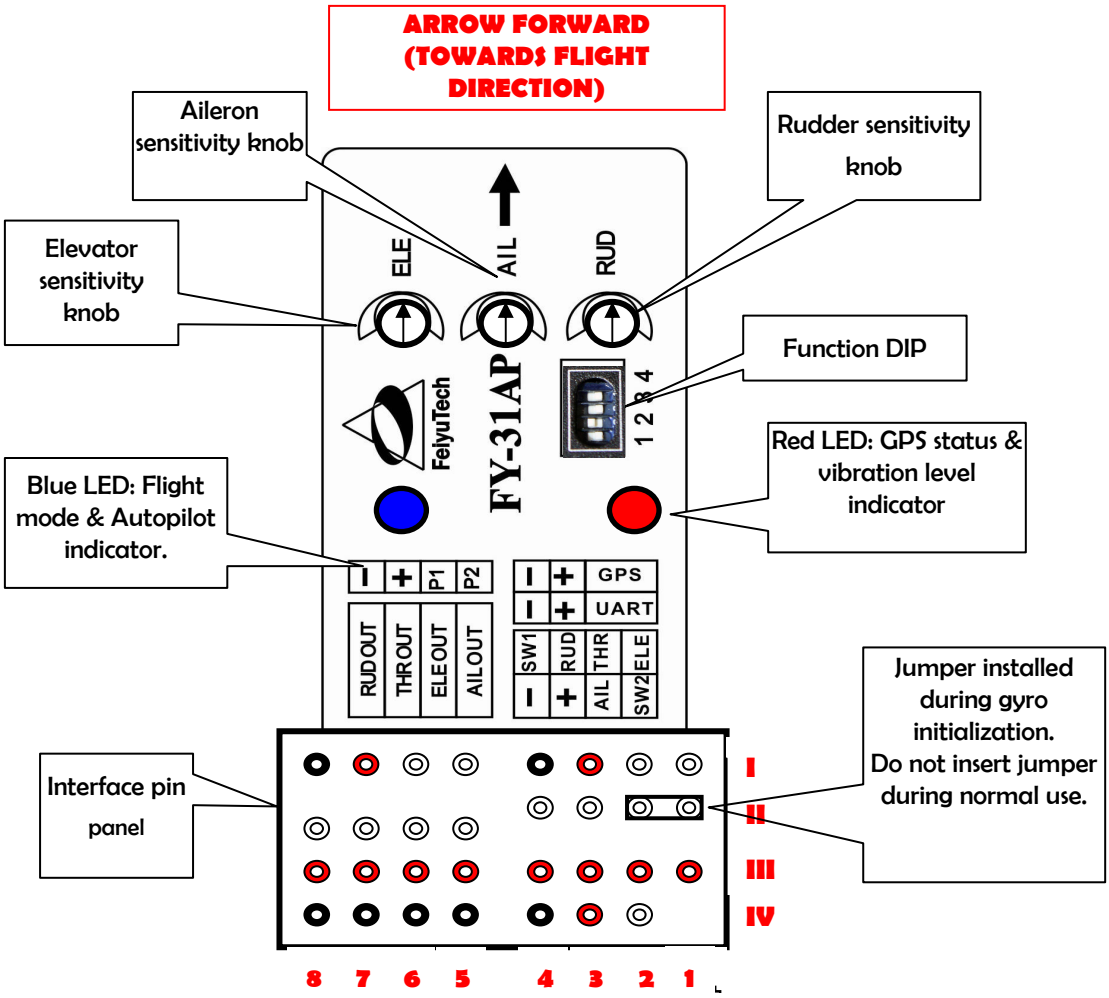
GPS status & vibration level indicator

You can check the GPS lock status and vibration level by observing the Red LED.

Red LED light:

Status	Too much vibration	No GPS	Need to initialize Gyro	GPS location fixed (4 satellites)
Red LED Flashing	Stay on solid	Stay off solid	Continuous flashing	Continuous double flash each loop

FY31AP Interface

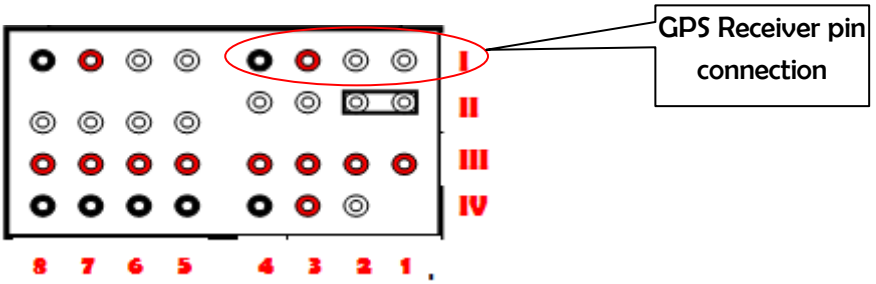


Pin Interface:

8	7	6	5	4	3	2	1	No.
GND	Power	P1	P2	GND	3.3V	TX0	RX0	Ⅰ
RUD	THR	ELE	AIL	GND	Power	TX1	TX1	Ⅱ
Power	Power	Power	Power	Switch 1	Rudder	Throttle	Elevator	Ⅲ
GND	GND	GND	GND	GND	Power	Aileron	Switch 2	Ⅳ

NOTE: The pin "Ⅰ-1,2,3,4" is for the GPS module. Pin "**Ⅰ-3**" outputs +3.3V of power, **DO NOT SUPPLY External Power to this pin**, you will burn the FY-31AP board.

GPS Receiver Connection (Pin Interface "I-1, I-2, I-3, I-4")



The FY31AP GPS pin consists of this interface: GND, 3.3V voltage, TX0, TX0. The parameters are:

- Data bits: 38400
- Interface Features: TTL level
- Data bits: 8
- Stop Bits: 1
- Parity: None

Connect the above pins to the GPS Receiver.

Data Protocol

The GPS data protocol is a standard NEMA0183 and the statement must be $ GPRMC, $ GPGGA.

NOTE: The pin "I-1,2,3,4" of the FY31AP pin interface is for the GPS module power supply. i.e. The FY31AP pin "**I-3**" outputs +3.3V of power via this pin.
DO NOT SUPPLY External Power to this pin, or you will burn the FY-31AP board.

GPS Related Functions

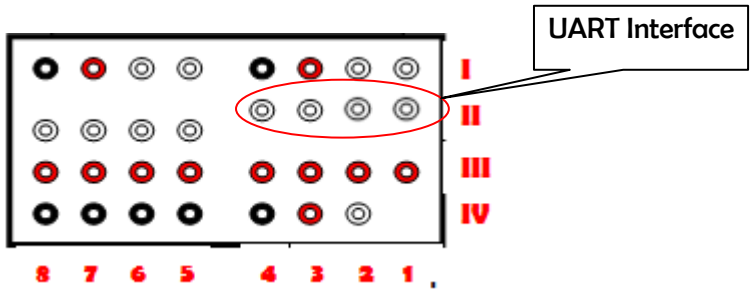
a. If GPS cannot fix the aircraft location (minimum 5 satellites), only **Mode 1 (Deactivated)** and **Mode 2 (Stabilized Mode)** will function. Mode 3 and Autopilot will not be functional.

b. Install the GPS Module with the antenna face up (see above). DO NOT install next to metal or carbon fiber and other shielding material, which may block satellite signal.
c. Install the GPS Module away from electromagnetic sources such as ESC's, power wires, servo wires and video transmitters.

GPS – Satellite Signal Lost During Autonomous Flight

- GPS provides the aircraft geographic positioning, altitude, speed and flight direction.
- Only if the GPS Data is available will the FY31AP perform its Autopilot Modes.
- In case GPS signal is lost during autopilot flight, the FY31AP will keep its height and maintain its last flight direction. After GPS signal is regained, the plane will resume its Autopilot Mode

UART Interface(Position is "II-1, II-2, II-3, II-4")



The UART pin interfaces consist of: GND, power, TX1, RX1. The characteristics are as follow:

- Baud Rate: 19200
- Data bits: 8
- Stop Bits: 1
- Parity: None
- Interface features: TTL

The pin interfaces output telemetry data. This interface connects to the data radio, PC computer serial port or OSD module. You can set the flight route, navigation and control parameters of FY31AP by this interface. The port is also used to upgrade FY31AP firmware. Please read the procedure for the firmware upgrading.

FY31AP Electrical Connection and Diagram

a) Power supply

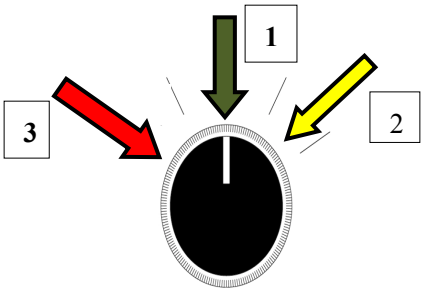
- The FY31AP operates between 5 to 6 volts input.
- FY31AP is powered via the Receiver connection (Channel 1).
- If your plane is Electric powered, the Receiver power may be supplied via the ESC built-in Battery Elimination Circuit (BEC). However, we highly recommend that a separate BEC with a 3A output.
- For Gas or Nitro powered planes, you will require a battery to power the Receiver and FY31AP.

b) The FY31AP is connected to your RC Receiver via a 6 wire cable. You need a minimum 6 Channel RC Receiver.

c) Note that the wire is arranged according to color :

Wire color	**Receive channel**	
White (bundled with red & black)	aileron	Channel 1
orange	elevator	Channel 2
green	throttle	Channel 3
yellow	rudder	Channel 4
brown	**SW 1** - Any free channel controlled by 3-way switch or dial knob	Channel 5
blue	**SW 2** - Any free channel controlled by 3-way switch or dial knob	Channel 6

d) Note that you need 2 free Receiver channels to control the FY31AP Flight Modes and Autopilot Mode, using either a 3-position switch or your dial knobs.



Vibration damping

a) The FY31AP flight controller algorithms can work under normal vibration levels. However if the vibration and shock experienced by the sensors are excessive, stabilization can fail of the system can shut down altogether.

b) To achieve the best stabilization and flight performance, minimize the amount of vibration on the aircraft as best you can.

c) Examples of vibration reduction steps that can be taken:

i) Ensure your motors are mounted properly and squarely.

ii) Balance your propellers regardless of the manufacturer's claim of perfect balance out of the box.

iii) Balance your motor bell housing (if possible).

iv) Ensure rigidity of your frame (no flexing with motor rotation).

v) Use appropriate propeller length and pitch for the size of your aircraft.

d) The FY31AP is supplied with the double-sided foam padding dampers. Please use them as shown below:

Checking for Vibration Levels

To confirm correct vibration damping, please follow this procedure:

a) After connecting all wires between to the FY31AP, including RC Receiver and ESC, install the unit on your plane (ensure correct orientation).

b) Run the plane engine or motor at different throttle levels. DO NOT TAKE OFF.

c) At each throttle position, observe the state of the red LED light. If it stays OFF, that means your vibration level is acceptable.

d) If instead the red LED lights up and stays ON solid, then the vibration dampening is not enough. You will need reduce the level of vibration on your aircraft. Refer above suggestions on vibration reduction.

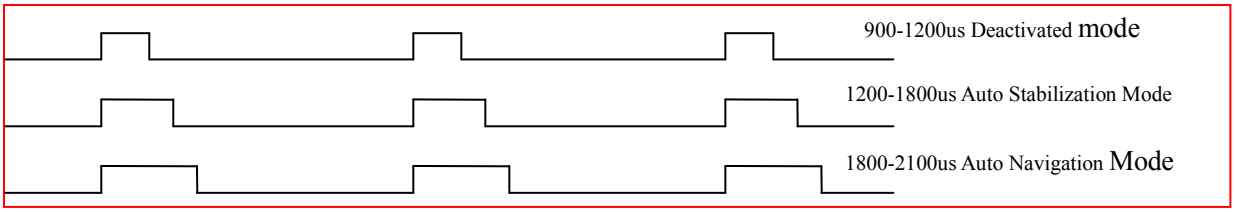
SW 1 and SW 2 : Switch Settings for FY31AP

a. **SW-1 Flight Modes**

The FY31AP has 3 Flight modes controlled via SW-1. To select the modes, use a free Receiver channel controlled via a 3 way-switch:

FY31AP FLIGHT MODES

SW-1 signal output	900-1200us	1200-1800us	1800-2100us
Functional mode	Stabilization deactivated	Auto Stabilization Mode	Auto Navigation Mode
Blue LED light indicator	Continuous flashing	Stay on solid	Single Flash

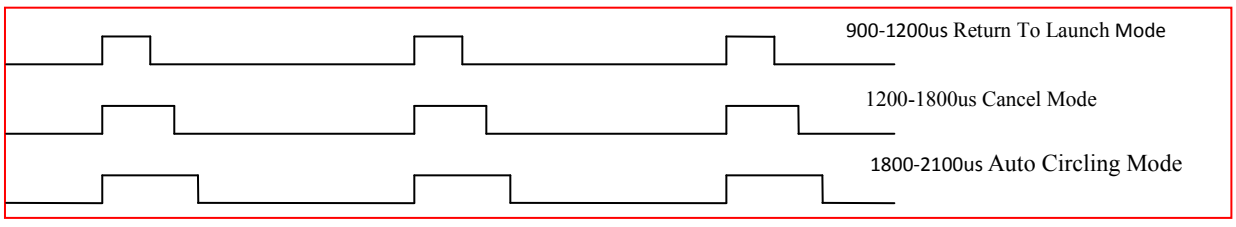


b. **SW-2 Autopilot Modes**

FY31AP Autopilot Modes is controlled via SW-2.

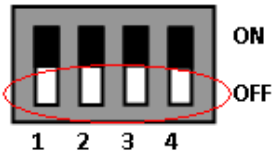
IMPORTANT: The Autopilot Mode (SW-2) has controlling priority over the Flight Modes (SW-1). If you wish to use the Flight Mode (SW-1), you must de-activate the Autopilot first.

SW-2 signal output	900-1200us	1200-1800us	1800-2100us
Functional mode	Return To Home (RTH)	Autopilot Deactivated	Auto Circling (ACM)
Blue LED light indicator	Continuous Double flash each loop	Flashing depends on SW 1 Signal	Continuous flashing 3 times each loop



Dip Switch Function

Switch number	1	2	3	4
ON	For Factory use only	Flight Mode Selection	Flight Mode Selection	Adjust flight patterns
OFF	Always OFF position	Flight Mode Selection	Flight Mode Selection	Normal mode



Note: In this manual, the switch direction is shown by white color.

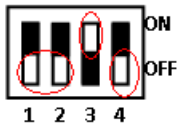
AIRCRAFT DIP SWITCH SETTING

1) FY31AP connection for traditional aircraft layout:

AIL OUT	ELE OUT	THR OUT	RUD OUT
Aileron Servo	Elevator Servo	Throttle Servo	Rudder Servo

2) FY31AP connection for flying wing aircraft: (with or without Rudder)

AIL OUT	ELE OUT	THR OUT	RUD OUT
Differential Servo 1	Differential Servo 2	Throttle Servo	Rudder Servo

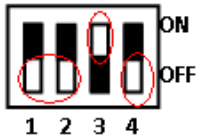


3) FY31AP connection for V tail aircraft with Aileron:

AIL OUT	ELE OUT	THR OUT	RUD OUT
Aileron Servo	Differential Servo 1	Throttle Servo	Differential Servo 2

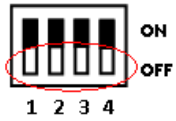
4) FY31AP connection for V tail aircraft without ailerons:

AIL OUT	ELE OUT	THR OUT	RUD OUT
Differential Servo 1	Differential Servo 2	Throttle servo	Null



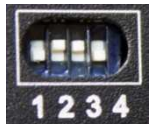
5) FY31AP connection for traditional layout aircraft with no Aileron:

AIL OUT	ELE OUT	THR OUT	RUD OUT
Rudder Servo	Elevator Servo	Throttle servo	Null



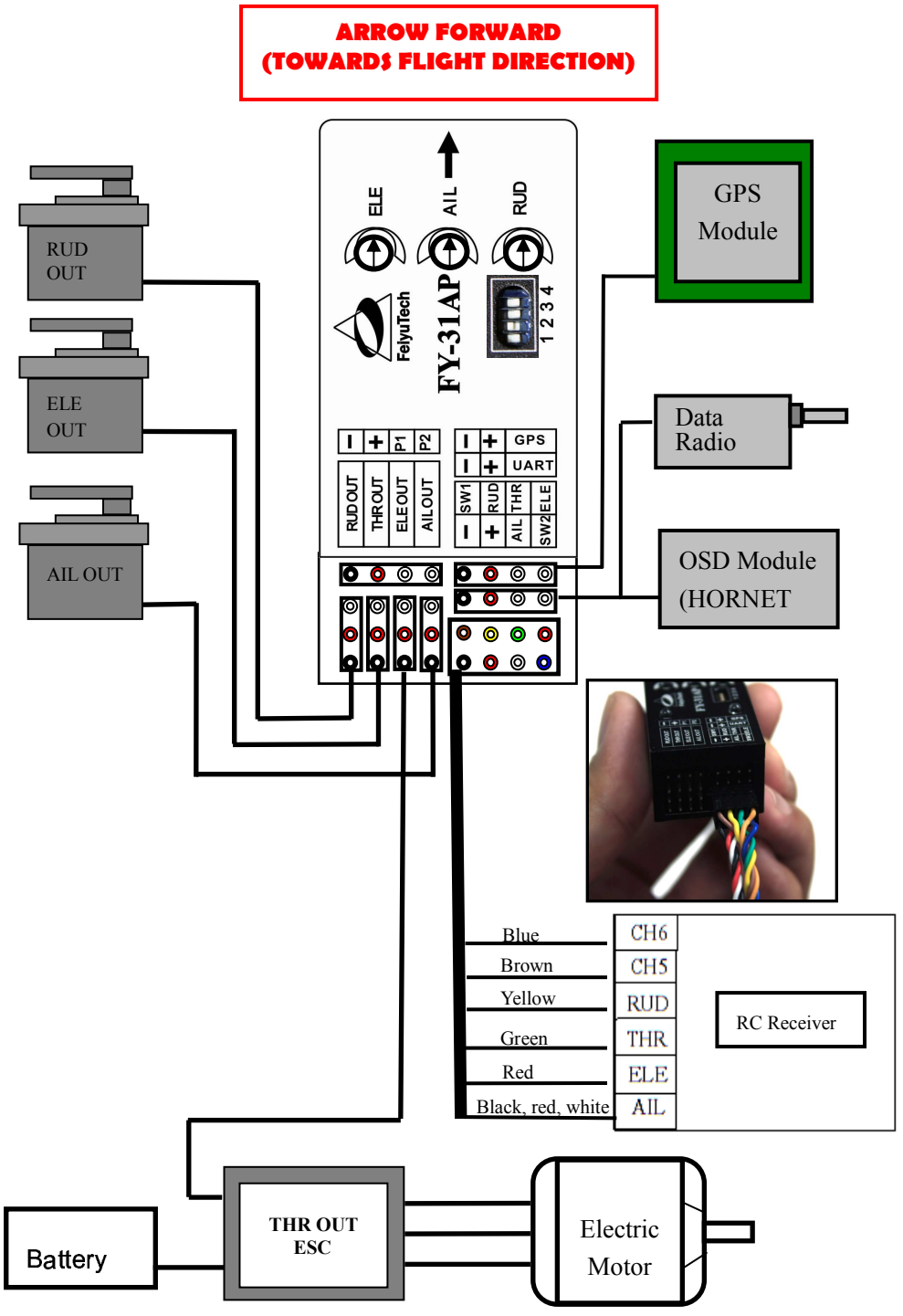
6) Camera Gimbal Stabilization:

AIL OUT	ELE OUT	THR OUT	RUD OUT
Roll Servo	Tilt Servo	Null	Pan Servo



* **Note:** The camera gimbal Roll, Tilt and Pan servos will counter any linear movement of the camera mount. You can move the camera at any angle and upon releasing the transmitter stick, the FY31AP will maintain stabilization at that angle.

Connection layout of FY31AP



When installing the FY31AP, keep it as horizontal as possible to the aircraft axis and as close as possible to the Centre of Gravity (COG).

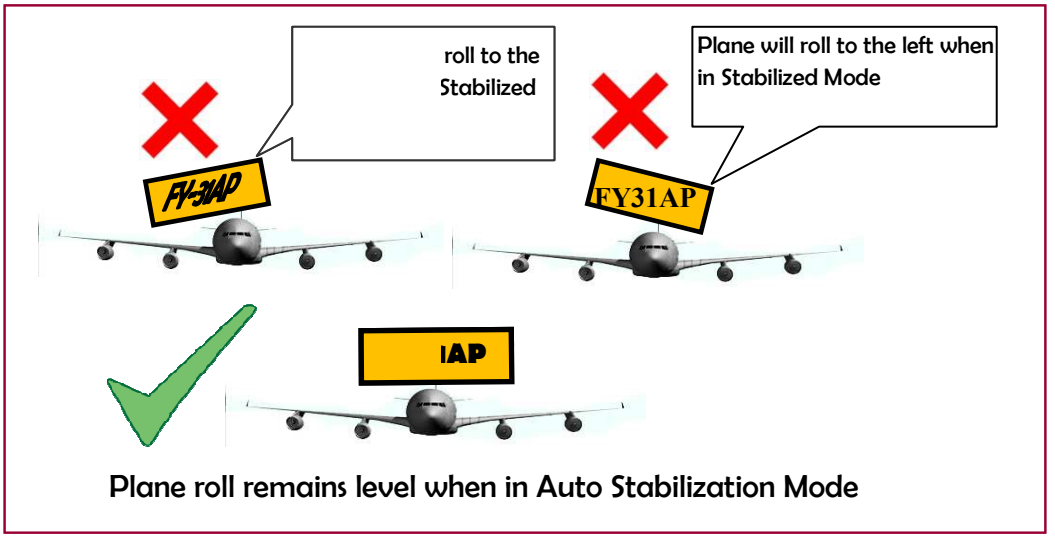
FY31AP installation: Orientation, Position and level

a) The FY31AP has an arrow printed on the top of it. Orientate the arrow towards the front of the craft (i.e. direction of flight).

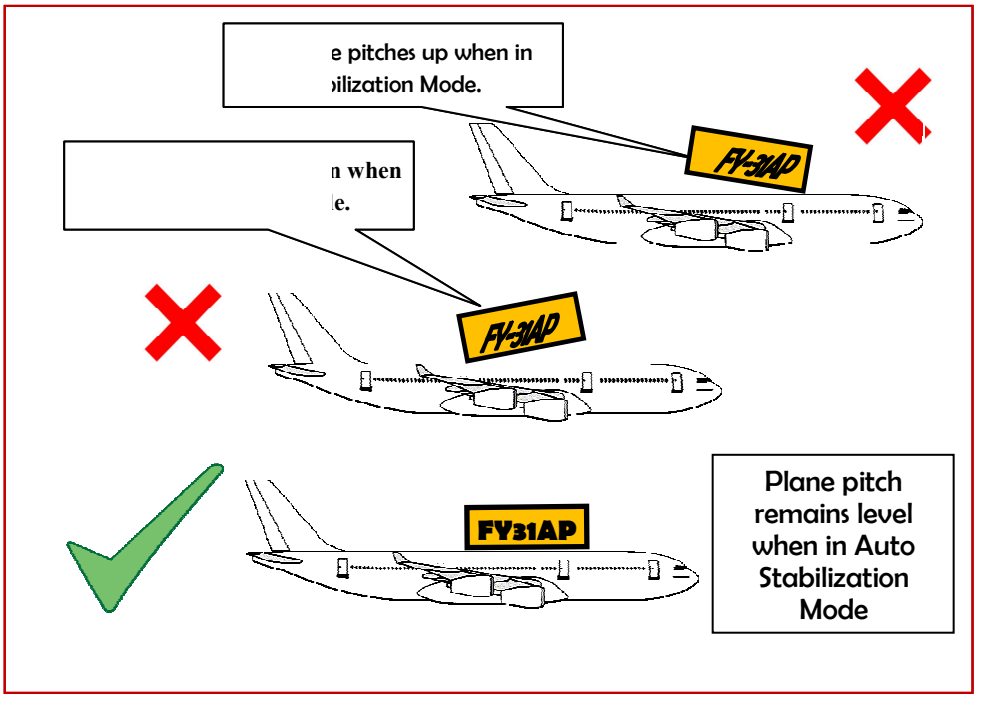
b). When installing, please keep the FY31AP horizontal and as close as possible to the "Centre of gravity" (CG) of the aircraft. (as the following diagram)

c) The control benchmark of FY31AP is its horizontal position. Therefore, ensure the FY31AP is in the horizontal position when the plane is in level flight.

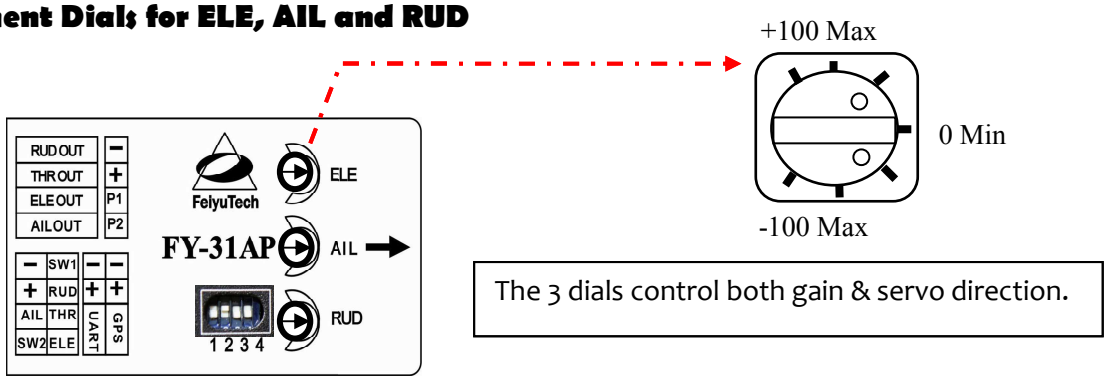
d) If there is deviation between the FY31AP horizontal position and the plane's level flight, it may cause deviation of fixing plane's level flight. See next topic.



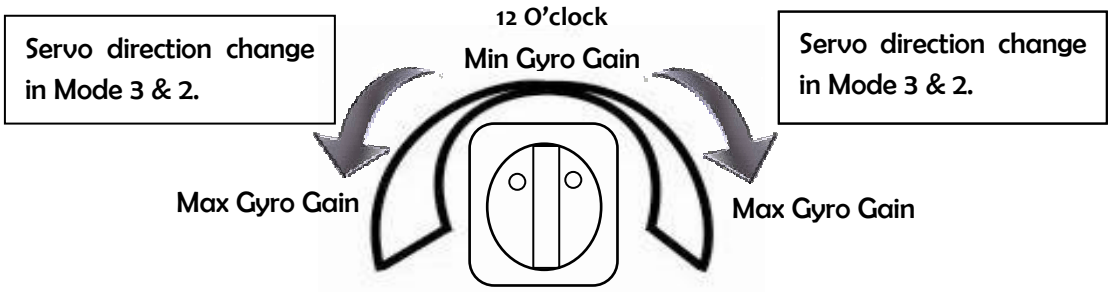
Plane roll remains level when in Auto Stabilization Mode



Adjustment Dials for ELE, AIL and RUD



1. There are 3 adjustment dials on the FY31AP. Each dial controls **both** gyro gain ***and*** servo direction during auto stabilization.



2. **Gyro Gain:** The further away from Centre (12 O'clock) the higher the Gyro gain (sensitivity). Too low gain result is poor auto stabilization, too high gain will cause oscillations of the aircraft. You need to adjust the gain setting based on the requirement of your aircraft.

3. **Servo Direction:** The dials also control the direction of your servo movement. Turning it clockwise or counter clockwise from 12 O'clock will change the direction of your servos during stabilized flight against tilting, roll and yaw.

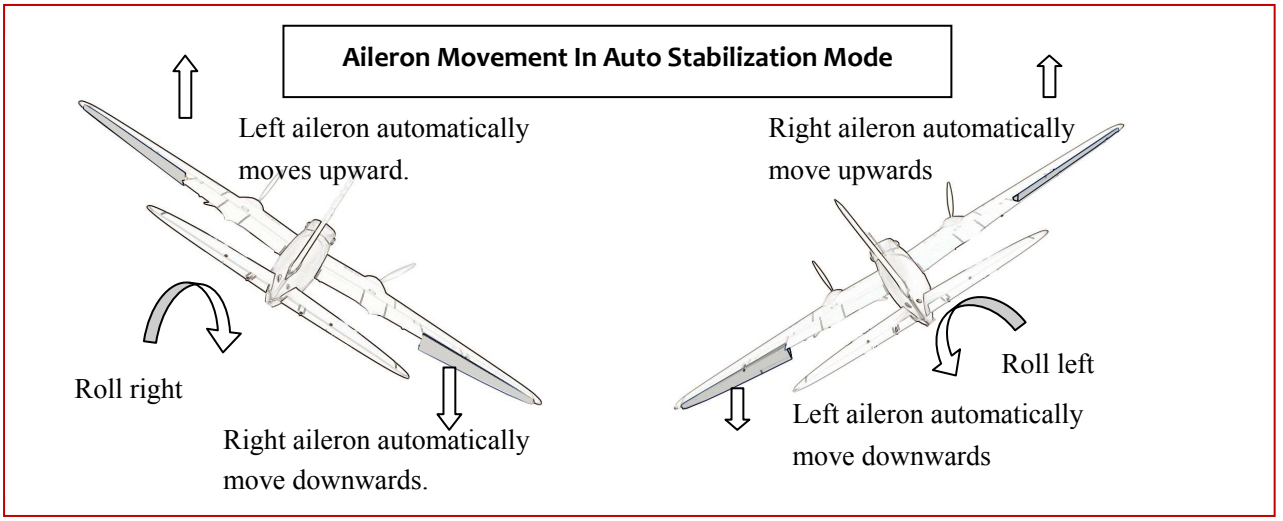
Control Surface Movement Check

Install FY31AP as recommended in this manual, then proceed to confirm correct control surface movement direction in Mode 2 or Mode 3.

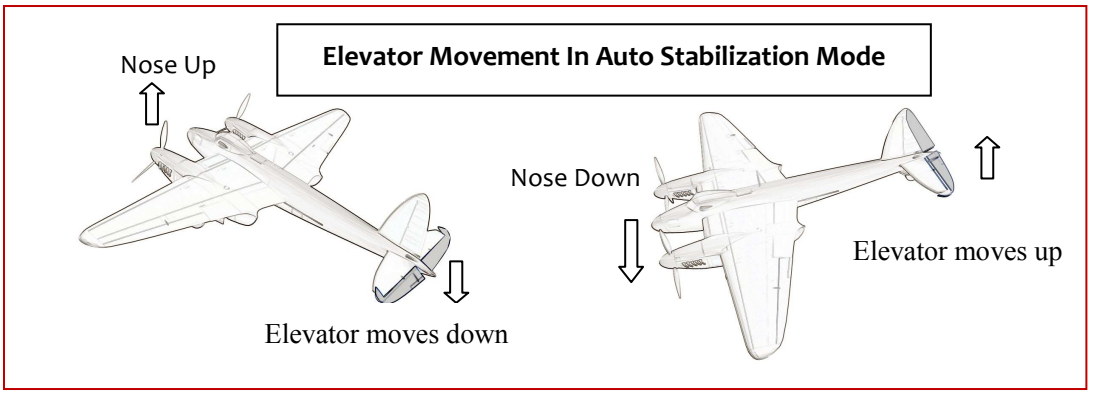
1. In Manual mode (stabilization deactivated) confirm that the control surfaces do to react when your aircraft is tilted or rolled.

2. Activate Mode 3 (Auto stabilize mode) and observe the movement direction of Aileron, Elevator and Rudder. The direction should be as shown below. If direction is wrong, turn the appropriate dial to the opposite side of 12 O'clock to get the action direction correct:

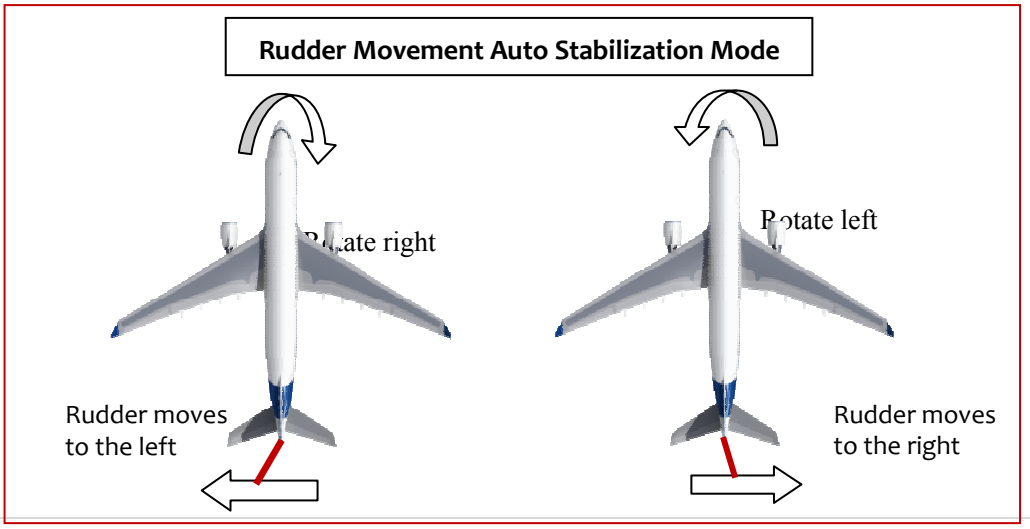
AILERONS - Roll the plane to see the following action:



ELEVATOR - Pitch the plane nose up and down to see the following elevator action:



RUDDER - Turn your plane clockwise or counter clockwise to see the rudder movement below:



Recording Your Aircraft Neutral Value

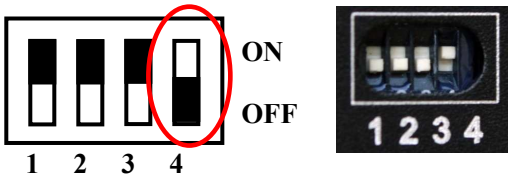
1. The FY31AP can record your aircraft best stabilization attitude in its memory. By recording this '**Neutral Value**', the FY31AP can know how best to control your aircraft for optimum stability.
2. **WARNING: Before flying the FY31AP for the first time, you must carry out this Neutral Value recording.**
3. The control benchmark of FY31AP is the NEUTRAL VALUE position. But the installed angle of the FY31AP to the horizontal level of the plane should not exceed 15 degrees.
4. You can do this procedure with the aircraft on the ground or in the air.
5. Setting the Neutral Value on the ground is quick and easy and will produce good stabilization results. However recording neutral value 'on the fly' will result in more accurate autonomous flight attitude control.

6. **NEUTRAL VALUE IMPORTANT NOTE:**

   As long as there are no major changes in your aircraft hardware (e.g. no shifting of CoG) your Neutral Value will not change. If there are major changes in hardware or your CoG have shifted, it is best you repeat this Neutral Value recording procedure.

Recording Neutral Value on the Ground

Step 1: Set up your aircraft and ensure correct FY31AP orientation, position & leveling. Ensure the Mode 3 (auto stabilization) Elevator, Aileron and Rudder movements are in the correct direction.



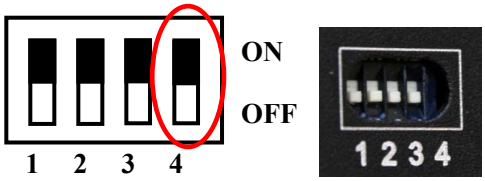
Step 2: With **power OFF**, move Dip Switch No. 4 to '**ON**' position.

Step 3: Place your aircraft on a table. Arrange the aircraft so that is perfectly level. Position the aircraft exactly as you wish it to be during auto stabilization flight (i.e. fuselage and wings perfectly level).

Step 4: ON your transmitter and zero all your trims. Power up the FY31AP in **Mode 1 (Manual Mode)**. Confirm there are no deflection to the Aileron, Elevator and Rudder surfaces by adjusting your servo links. Re-confirm that your aircraft is perfectly level. This is your aircraft Neutral position.

Step 5: While in Step 4 leveled position, activate Mode 3 (Auto Stabilization Mode) for **at least 2 seconds**. Since Dip Switch No. 4 is ON, the FY31AP will now record the Neutral Point.

Step 6: After 2 seconds, switch back to Manual Mode and power OFF.

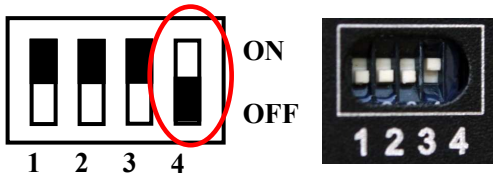


Step 7: Move Dip Switch No. 4 back to **OFF** position. The procedure is complete and the system is ready for flight.

Recording Neutral Value 'On the Fly'

It is best to carry out this procedure during minimal wind conditions.

Step 1: Set up your aircraft and ensure correct FY31AP orientation, position & level. Ensure the Mode 3 (auto stabilization) Elevator, Aileron and Rudder movements are in the correct direction.



Step 2: With power OFF, move Dip Switch No. 4 to 'ON' position.

Step 3: ON your transmitter and zero all your trims. Confirm there are no deflection to the Aileron, Elevator and Rudder surfaces by adjusting your servo links.

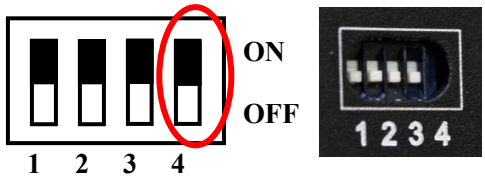
Step 4: Power ON the aircraft with the FY31AP **in Manual Mode**.

Step 5: Fly your aircraft to a safe height (still in Manual mode) and fly in a straight line.

Step 6: Adjust your throttle to maintain leveled cruising flight. Use your Aileron, Rudder and Elevator trims to attain level flight while in full manual control. By doing this you should be able to fly the aircraft in a straight line with the Aileron, Elevator and Rudder sticks in the middle position (i.e. fly using your trims only).

This condition of achieving level flight by trim adjustments alone and no stick input is your aircraft's **Neutral Value**.

Step 7: While in this Neutral Value, activate Mode 3 (Auto Stabilization Mode) for at least 2 seconds. Since Dip Switch No. 4 is ON, the FY31AP will now record your Neutral Value. After 2 seconds, switch back to manual mode and land your aircraft.



Step 8: After landing, power down your aircraft. Move Dip Switch No. 4 back to **OFF** position. Procedure is complete. The FY31AP is now ready for Auto Stabilized and 3D mode flights.

First Flight Test And Sensitivity Adjustment

1. At this stage, your aircraft should already have automated surface control with the right direction when in Auto Stabilized Mode and the Neutral Value is already recorded.

2. Now you need to fine tune your FY31AP stability gain via flight tests. For the first flight it is recommended that the gains not be set too high. To avoid excessive oscillation (flight overcorrection) put the gyro gain at mid point.

3. Take off in Manual Mode. After achieving safe height, activate Auto Stabilized Mode.

4. **Aileron Gain:** If you see oscillation of the wings, this indicates the Aileron gain is set too high. Switch back to Mode 1 and land the airplane.

5. Reduce the sensitivity (move dial toward centre position) and fly again. You should see improvement in wing attitude. Adjust until level of wing stabilization is acceptable.

6. **Elevator & Rudder Gain:** Too much Elevator gain will show the tail moving up and down (nodding). Too much Rudder gain will show tail wagging. Reduce gain until this flight over corrections disappears.

7. Alternately, if you find the flight correction is not enough (too low stability), you can increase gain accordingly.

Testing Autopilot Return To Launch (RTL)

a) After setting up stabilized mode, test your aircraft RTL autonomous function. Also called Return to Home, this function will bring your aircraft back to the home point automatically.

b) Fly the plane in stabilized mode, and keep the throttle at a good cruising speed and fly to a distance of 200 meters.

c) Switch the SW 2 to the Autopilot mode 2 (RTL). The plane should immediately return to the home point using its ailerons.

d) On reaching 'Home' the plane will auto circle the home point.

e) If this test is successfully, you can switch to stabilized mode, fly the plane further away and test the RTL again.

Testing Autopilot mode 3: Auto Circling Mode (ACM)

a) After you have completed the test for the RTL, you can now test the ACM mode.

b) Fly the plane in a constant cruising speed via your throttle control.

c) Switch SW 2 to the Autopilot mode 3 (ACM).

d) Then plane should immediately start circling. The centre of the circle is the point where you activated the SW 2 switch for ACM.

e) Disengage and fly home after you are satisfied with the test.

Test for the Model 3: Navigation mode

a) Complete your FY31AP connects via the FY31AP GCS manual.

b) Set the waypoints via the GCS software. The maximum number of waypoints is 8.

c) After attaining good cruising speed via your throttle control, switch SW 2 to Navigation Mode.

d) Since the aircraft will maintain altitude, monitor your cruising speed, maintain throttle control to make sure the aircraft does not stall.

e) The FY31AP should bring the aircraft through the Waypoints already programmed into the autopilot.

f) By default, the FY31AP will auto repeat the waypoints flying – after flying over the last waypoint coordinates, it will fly back to the first waypoint and carry out the flight route again.

g) You can cancel this default setting via the GCS software, so that upon reaching the last waypoint it will initiate auto circling over this last waypoint.

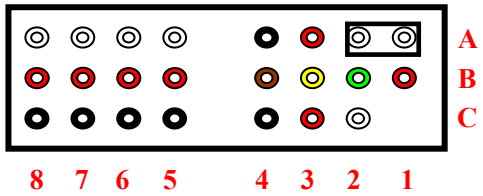
h) For more information about the Navigation Mode flying, please refer to the *FY31AP GCS Manual.*

Gyroscope initialization (re-setting):

Out of the box, the FY31AP has been fully initialized. However, if the following conditions occur, resetting the gyro is recommended:

1. The device has not been used for a long time.
2. There is a change in environmental temperature of over 30 degrees.
3. When the red LED light flashes even when the aircraft is stationary.

Initialization / Reset Procedure



Install the jumper as shown above:

Power-ON the FY31AP and keep it stationary for at least 20 seconds. You will notice the red light blink at two different rates (or turns off). Gyro re-setting is complete. Disconnect power, unplug the jumper and keep it in a safe place for future use).

NOTE: Carry out this re-setting procedure only if the 3 conditions (above) occur. The unit does not need to be horizontal during initialization. However, you must ensure there is no vibration during this process. If you suspect shaking had occurred, restart the reset process.

[END OF MANUAL]

Note: This manual may be updated from time to time.