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FEIYU TECH

FY31AP

Autopilot System
Installation & Operation Guide

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Dear Customer:

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.

If you need any technical support you can send mail directly to: service@feiyu-tech.com

1. Attitude Flight Stabilization System (AFSS)

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

FY31AP has an integrated three-axis gyro and three-axis accelerometer which controls the aircraft movement in three-dimensional space.

2. Barometric Sensing and GPS

FY-31AP control module incorporates an accurate barometric pressure sensor. At start up, the take-off air pressure is measured, providing the autopilot with an accurate relative height data. While the GPS module enables the autopilot to calculate the flight course and exact location of the aircraft. If the FY31AP is not connected GPS module, the autonomous flight system cannot be engaged and it will function purely as a flight stabilizer.
After connecting the GPS and booting up, the FY-31AP will search for GPS positioning signals, the first time the GPS positioning successfully and the satellites quantity at least 4, then the FY-31AP will remember this position as the home point

3. Function Of FY-31AP

By using your remote control, the FY-31AP 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 module the autonomous flight system of the FY31AP will enable you to fly fully autonomous, with up to 8 waypoints settings on the FY Ground Control Station 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).

- **Automated circling** - by activating this function, the aircraft will automatically circle the selected area at a fixed altitude, the centre of the circle is the current point. You can set the circling radius, the default radius is 80 meters.

- **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.

- **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.

4. Optional Upgrade with FY-OSD and Data Radio

The FY-31AP provides an optional upgrade combining with the FY-OSD and the Data Radio. With this add-on, you will receive:

- **First Person View (FPV)**: by connecting this interface to the FY-OSD, telemetric data such as GPS, flight navigation, AHI can be displayed on your downlink video. On the other hand, it will be easier to operate FPV with the functions of automatic balance and automated return to home.
- **Real time telemetry** – real time by-directional telemetry is monitored directly by your ground station computer. Changes to aircraft altitude and flight path can be controlled from your ground station computer.
- **Record and monitor your flight** - you can monitor and download your flight path into your ground station computer.

For more information, please refer to the FY-OSD and FY Data Radio manual.

5. FY-31AP Package Content

• FY-31AP control module *1;
• GPS receiver * 1;
• RC receiver connecting wires * 1;
• Velcro double sided tape * 2;
• Some related wire.
• Instruction manual * 1;

6. Technical Specification and working requirement

- **FY-31AP module:**

  Input voltage : 4.0 ~ 6.0 Volt;
  Current draw : 50mA (5V);
  Size : 47 x 27 x 20 mm;
  Weight (excluding wires) : 25g;
  Temperature range : -25 ° C ~ +70 ° C;
  Maximum rate of rotation : ≤ 2000 ° /s

- **GPS module:**

  Input voltage : 3.0 ~ 3.3 Volt;
  Current draw : 60mA (3.3V);
  Size : 32 x32x 10 mm;
  Weight (excluding wires) : 22g;
  Temperature range : -25 ° C ~ +70 ° C;

7. Application

The FY-31AP 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 aileron;
6 .V-tail plane without aileron;
7 .Any other configuration , please e-mail us for enquiry: service@feiyu-tech.com

8. Remote control system requirement

The FY-31AP 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.

9. FY-31AP Flight Modes

The FY-31AP has three flight modes, you can activate any of the flight modes via a free Receiver channel and a 3-position switch (named as “SW1”) on your computer radio.

- **Mode 1**: **Deactivated Mode**. In this mode, all control of the aircraft is by the pilot. The FY-31AP does not participate in flight control.
- **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 FY-31AP will not allow acrobatic flights.
- **Model 3: Path Navigation mode**, In this mode, the waypoint will be set according to the flight path to automatic flight.

10. FY-31AP Autonomous Flight Modes

Three autopilot modes are incorporated into the FY-31AP, you can set it via a free receiver channel and a 3-position switch (named as "SW2").

- **Autopilot mode 1: Deactivated**. The autopilot function is not activated , the flight modes are determined by the "SW1".
- **Autopilot mode 2**: **Auto Return To Launch(RTL)**. When activated in this mode, the FY-31AP 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 80 meters.
- **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 80 meters. The aircraft altitude will be automatically maintained throughout the ACM.

Autopilot stall warning

a. The FY-31AP has **some control** over the throttle channel. Therefore, when flying in Autopilot Modes, please ensure you have enough forward movement to prevent stalling.

b. FY-31AP may have a control over the throttle channel, but the throttle control signal is base on the stick control signal and will auto adjust according the altitude and speed then output the combined signal. If your forward movement cannot compensate for the autopilot's active altitude hold, your aircraft will stall.

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

d. 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.

Attention: FY-31AP can work in automatic flight mode, though without OSD module. Whether you have been connected the OSD or not, FY-31AP can work normally. But if the FY-31AP is not connected GPS module, it will function as purely as a flight stabilizer. The autonomous flight modes cannot be engaged.

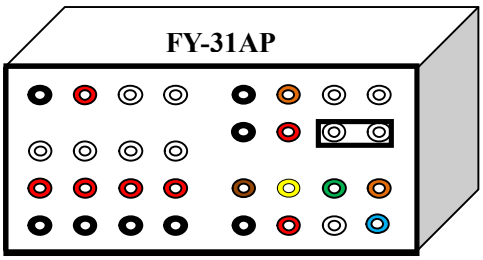
11. Red LED Flashing & Gyroscope Re-set:

If the following conditions occur, the FY-31AP initialization 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 since last flight.
(3) The Red LED flashes continuously even when the FY-31AP remains stationary about 20s, and you never activate the motor.
(4) If the Red LED is on solid all the time even when the FY-31AP is stationary, it means the gyroscope is faulty, and the unit need to be sent back for repair.

12. Gyroscope Re-set procedures :

(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



(1) Install the jumper as shown in this picture:
(2) Power-ON the FY-31AP and keep it stationary for at least 20 seconds. You will notice the red light blink with two different rates.
(3) After 20 seconds, the re-setting / initialization is complete.
(4) Disconnect the power, unplug the jumper & remove it (keep safe for future use).

13. Flight mode Indicator (Red or Blue light)

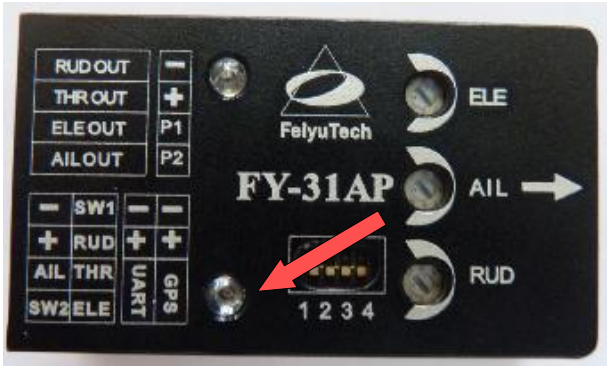
By observing the flight indicator, you can easily re-confirm your Flight Mode switch settings of your radio.

Blue light:

Flight mode	Stabilized Mode	Deactivated Mode	Path Navigation Mode	Return To Launch (RTL)	Auto Circling (ACM)
Blue LED light indicator	Stay on solid	continuous flash	Single flash	Double flash each loop	Continuous flashing. 3 times each loop

14. GPS status & vibration level indicator

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



Red light:

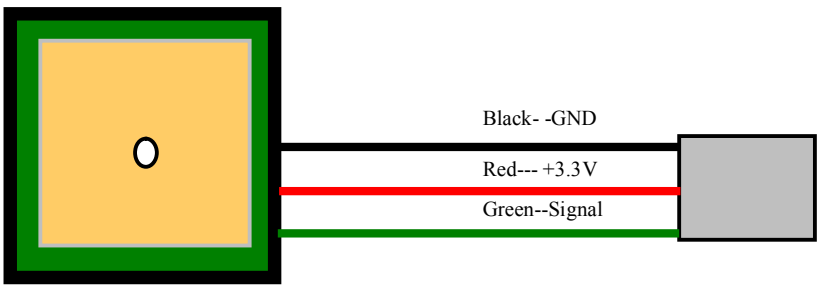
Status	Too much vibration	No GPS or GPS still not lock	Need to initialize Gyro or are moving	GPS location fixed (4 satellites)
Red LED light indicator	Stay on solid	Stay off solid	Continuous flashing	Continuous double flash each loop

15. GPS Receiver

a. If GPS cannot fix the aircraft location (minimum 4 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 following picture). DO NOT install next to metal or carbon fiber and other shielding material, which may block satellite signal.

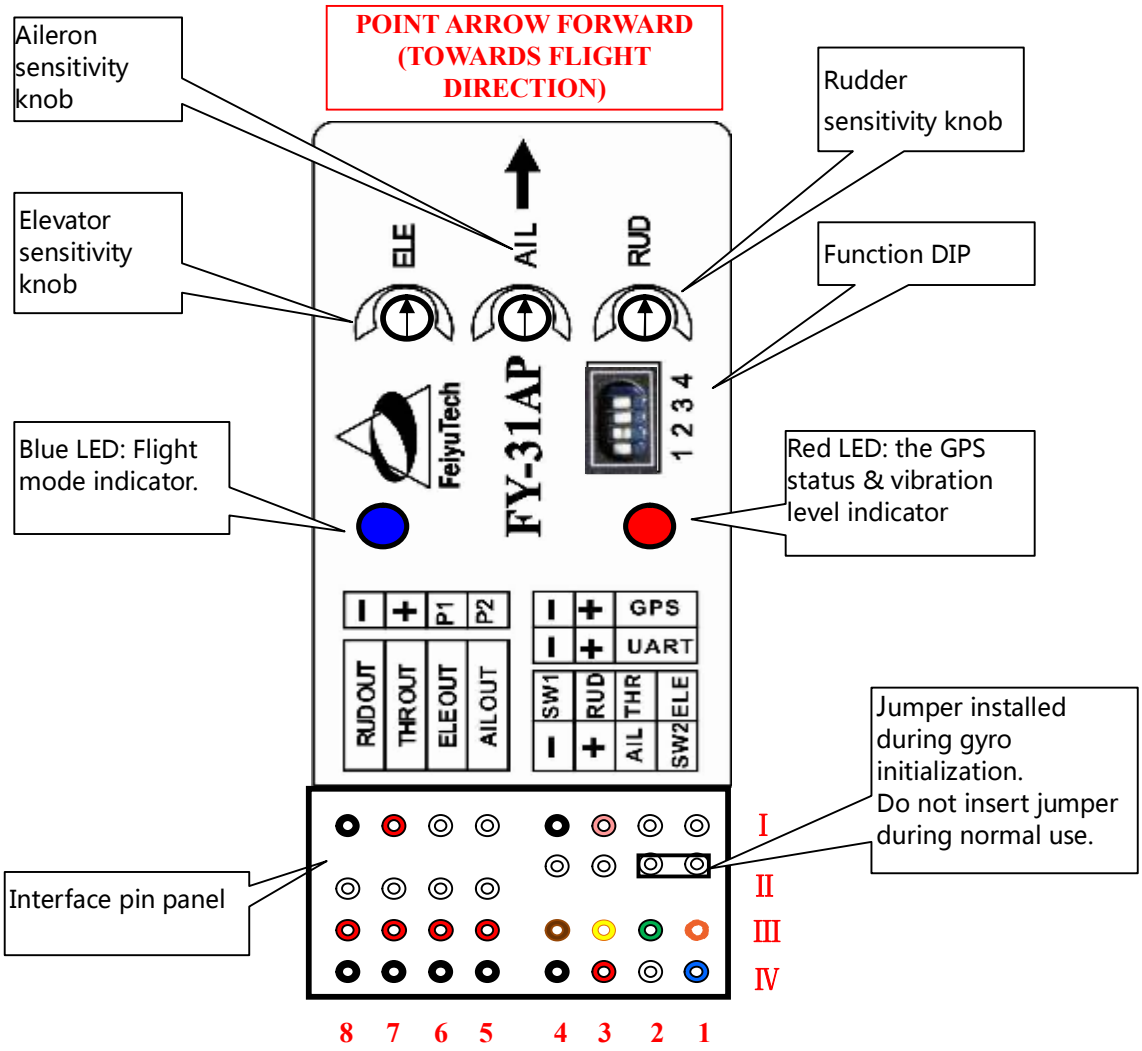
c. Install the GPS Module away from electromagnetic sources such as ESC’ s, power wires, servo wires and video transmitters.



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 flight , the autopilot will keep its height and course （not lock) in automatic navigation mode ,but its course may gradually drift**.** After GPS signal is regained the plane will resume the Autopilot Mode.

16. FY-31AP INTERFACE



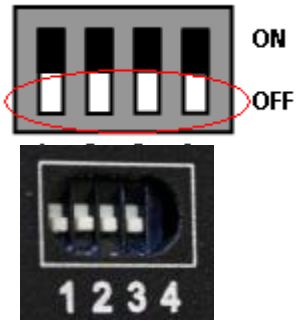
- **Pin interface to sort the list**

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	RX1	**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, "I-3" pin output +3.3V, so please don' t supply to this pin, or will burn the FY-31AP.

- **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:
1. In this manual, the direction for all the DIP switches is shown by white color .
2.the position for the DIP switch 1 is **OFF**, if it was put in ON, then the FY-31AP cannot work normally.

- **GPS features**

The FY31AP GPS pin interface consist of: GND, 3.3V voltage, TX0, RX0. The characteristics are:

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

Connect the above to the GPS Receiver. The GPS data protocol is a standard NEMA0183 and the statement must be $ GPRMC, $ GPGGA.
NOTE: The pin" I-1,2,3,4" is for the GPS module, "I-3" pin output +3.3V, so please don' t supply to this pin, or will burn the FY-31AP.

- **UART Interface**

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.

- **FY-31AP Electrical Connection and Diagram**

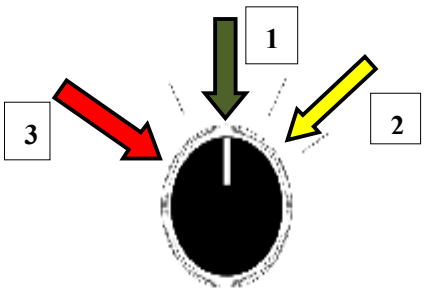
a) Power supply

- The FY-31AP operates between 4 to 6 volts input.
- FY-31AP is powered via the Receiver connection.
- If your plane is Electric powered, the Receiver power supply is normally from 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 FY-31AP.

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

- FY-31AP requires a minimum of 6-channel RC receiver.
- 4 Receiver channels are used for aileron (channel 1), elevator (channel 2) , throttle (channel 3) and rudder (channel 4) signal output. Connect these 4 receiver output signals to the FY-31AP with the supplied wires (pay attention to the color of each channel).
- 2 free Receiver channels are required to control the FY-31AP Flight Modes (3-position switch or dial knob, " SW1") and Autopilot Mode (3-position switch or dial knob, " SW2").



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

17. Vibration damping

A. FY-31AP is vibration-sensitive. To optimize its stabilization capability, vibrations reaching the

unit must be kept at a minimum.

B. When installing this flight stabilizer, we highly recommend that you install it with the supplied vibration absorbing pads (dampers).
C. The algorithm in the FY-31AP compensates for normal levels of flight vibration. However, if the vibration experienced by the unit exceeds the acceptable level, it will not work normally or may even stop working altogether.
D. To keep vibration at a minimum, install the FY-31AP away from the engine or any other vibration sources.
E. The included shock-absorbing pads will meet the damping requirements for electric powered aircrafts and most gas / nitro planes.
F. The FY-31AP is supplied with the double-sided foam padding dampers. Please use them as shown:

- **Checking for Vibration Levels**

Even with the shock absorbing mount, your aircraft installation may not meet the damping requirements of the FSS. To confirm correct vibration damping, please follow this procedure:

A. After connecting all wires between the FY-31AP , Receiver and ESC, install the unit as recommended (ensure correct orientation).
B. Run the plane engine or motor at different throttle levels. **DO NOT TAKE OFF**.
C. Move the throttle level to different positions and maintain it for 20 seconds at each position.
D. At each throttle position, observe the state of the red LED light. If it stays **OFF**, that means your vibration level is acceptable.
E. If instead the red LED lights up bright and stays ON solid, then the vibration dampening is not enough. You will need reduce the level of vibration on your aircraft, add additional dampening support or change the installation location.

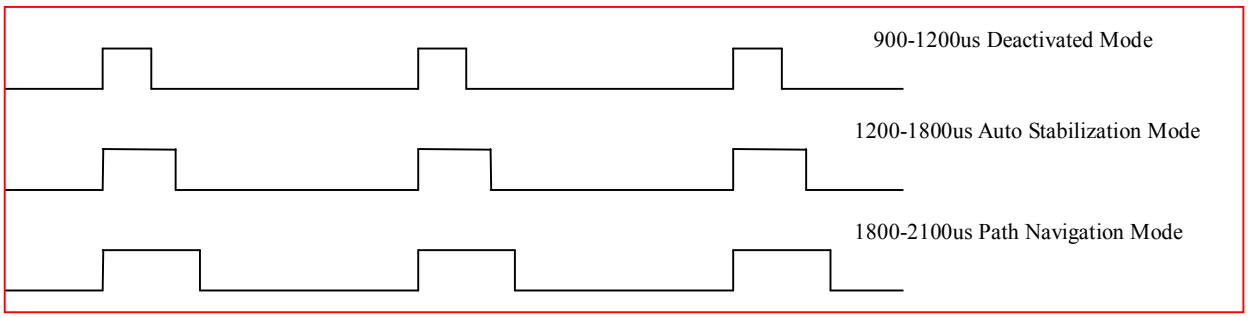
18. SW 1 and SW 2 : Switch Settings for FY31AP

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:

FY-31AP flight modes

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

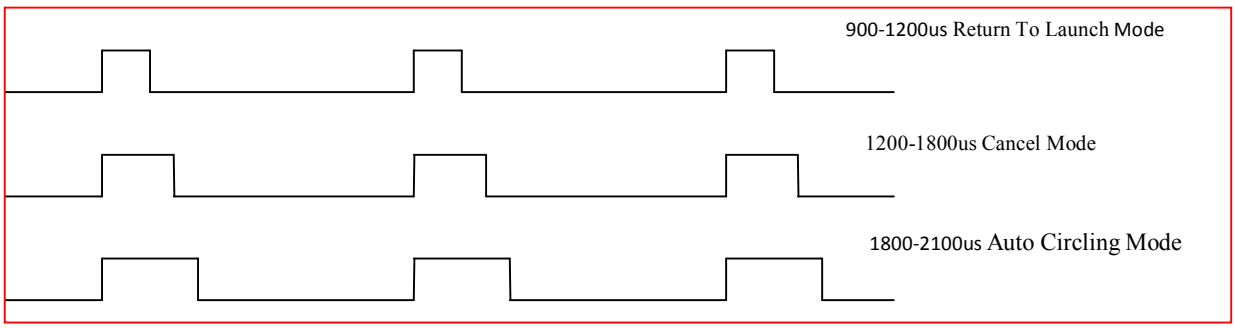


b. SW-2 Autopilot Modes

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 Launch Mode (RTL)	Cancel Mode	Auto Circling Mode (ACM)
Blue LED light indicator	Continuous Double flash each loop	/	Continuous flashing. 3 times each loop



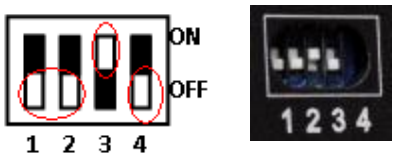
19. Plane connecting layout

1) FY-31AP connection for traditional aircraft layout:

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

2) FY-31AP 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) FY-31AP connection for V tail aircraft with Aileron:

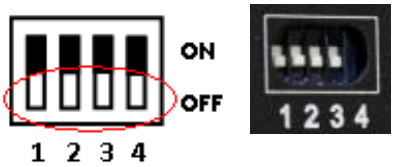
AIL OUT	ELE OUT	THR OUT	RUD OUT
Aileron Servo	Differential Servo 1	Throttle Servo	Differential Servo 2

4) FY-31AP connection for V tail aircraft without ailerons:

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

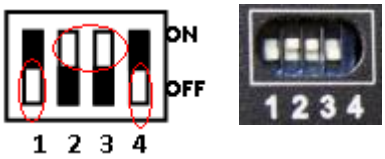
5) FY-31AP connection for traditional layout aircraft with no Aileron:

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



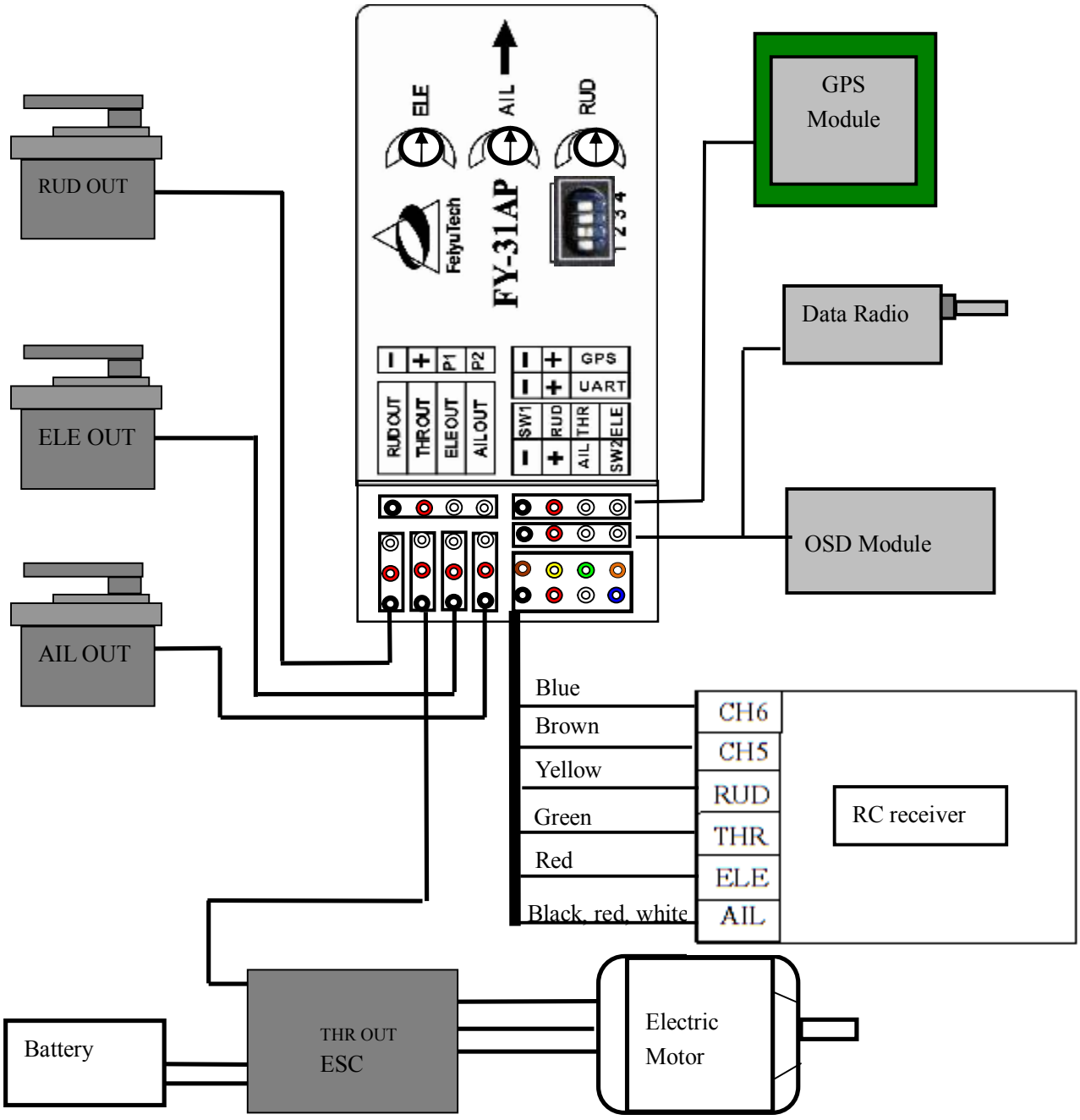
6) Camera Gimbal Stabilization:

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 stick, the FY-31AP will maintain stabilization at that angle. The FY-31AP is only suitable for the camera gimbal control which the control accuracy is not very high.

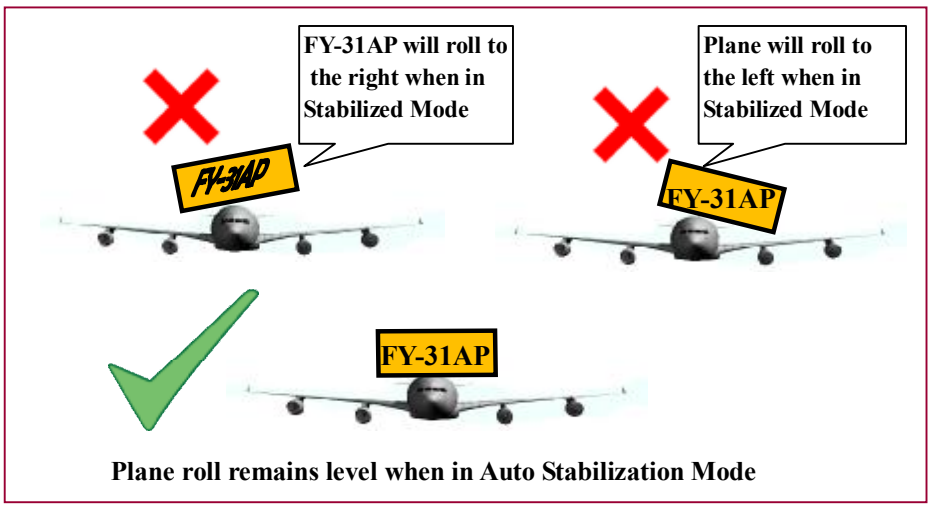
20. Connection of FY-31AP

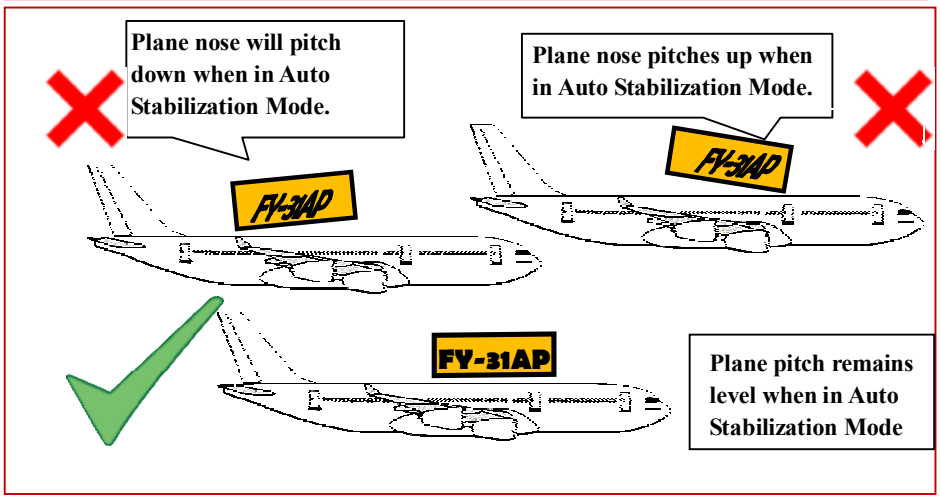


21. FY-31AP installation: Orientation, Position and level

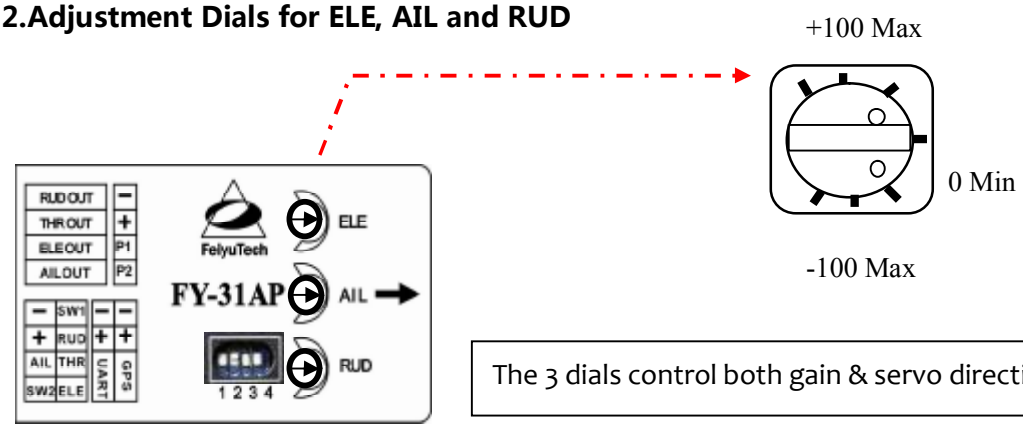
a) The FY-31AP has an arrow printed on the top of it. Orientate the arrow towards the front of the craft (i.e. direction of flight).
b) When installing, please keep the FY-31AP horizontal and as close as possible to the "Centre of gravity" (COG) of the aircraft. (as the following diagram)
c) The control benchmark of FY-31AP is the NEUTRAL VALUE position. But when install the dip angle between FY-31AP and the plane still should be not more than 15 deg .

d) If there is deviation between the neutral value position and the plane' s level flight, it may cause deviation of fixing plane' s level flight. See next topic. But these deviation can be amend by recording the neutral value. Please refer "RECORDING YOUR AIRCRAFT NEUTRAL VALUE."





22.Adjustment Dials for ELE, AIL and RUD



The 3 dials control both gain & servo direction.

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.

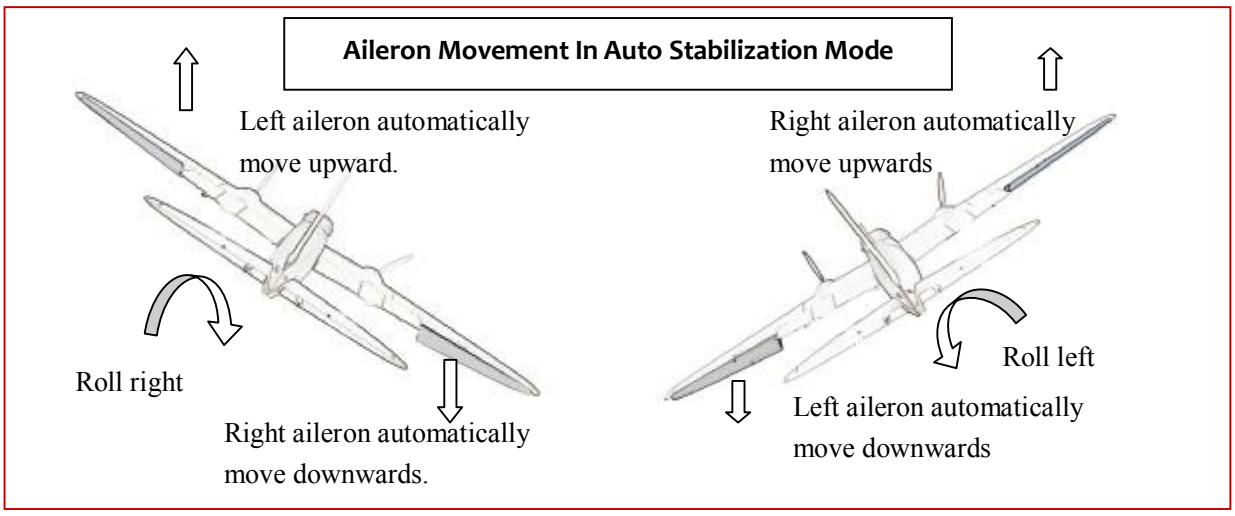
23. CONTROL SURFACE MOVEMENT CHECK

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 2 (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:

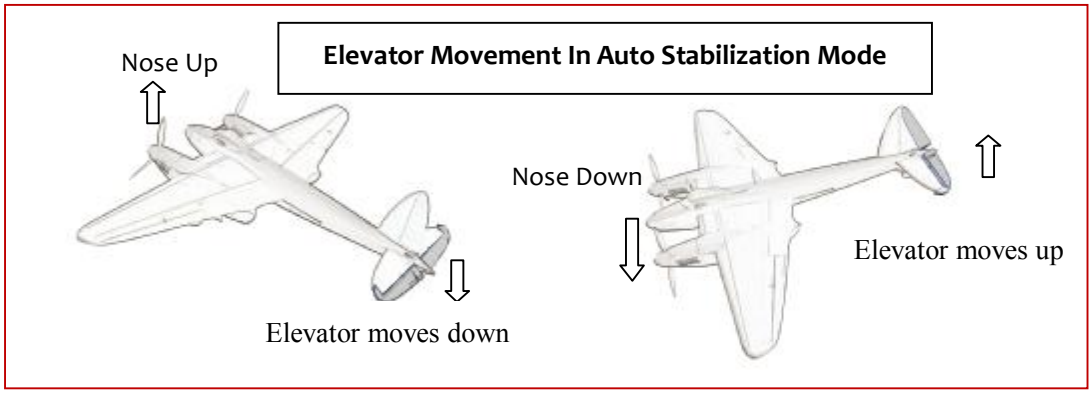
AILERONS - Roll the plane to see the following action:

- Incline the plane to the right (roll right). The ailerons should give a control signal to counter this roll direction (see below). Same as when rolled to the left. If the ailerons move correctly, the knob has been turned in the right direction. You can now adjust gain by moving nearer (low gain) or further away (high gain) from center;
- If the ailerons do not follow the movements shown above, simply turn the aileron knob to the opposite side (beyond centre). You should now see the correct aileron movement.



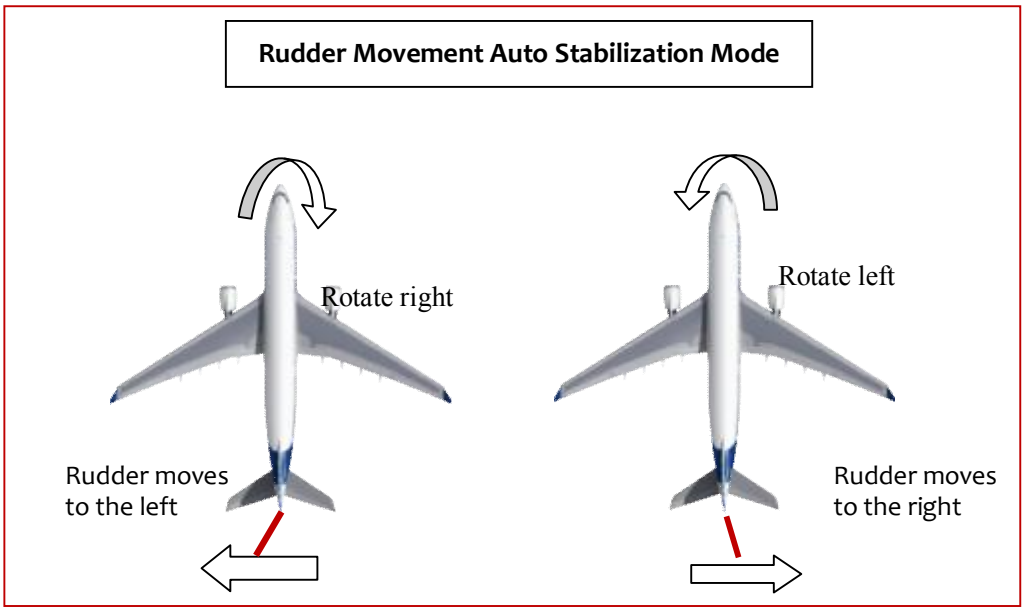
ELEVATOR - Pitch the plane nose up and down to see the following elevator action:

- Incline the plane NOSE UP. You should see the elevator move down. And when you move the NOSE DOWN, the elevator should move up.
- Move the Elevator knob to the opposite side (from Centre) if the servo movement is incorrect.



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

- Move the Rudder knob to the opposite side (from Centre) if the servo movement is incorrect.
- Adjust Rudder gain according to your aircraft requirement (lowest gain nearest to centre, highest gain further away from centre).



24. 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. You can do this procedure with the aircraft on the ground or in the air.
3. 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.

- **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.

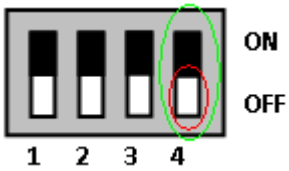
Step 2: Move Dip Switch No. 4 to '**ON**' position.

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, move Dip Switch No. 4 back to **OFF** position. The procedure is complete and the system is ready for flight.



Note: when the DIP Swith NO.4 is in the ON position,the FY-31AP will record the neutral point for each time you switch the mode from **Mode 1: Deactivated Mode** to **Mode 2: Stabilized mode**.

25. Checking the control surface & LED before fly

- Before your fly please reconfirm correct control surface movement direction both in RC control mode(Mode 1) and Stabilized mode(Mode2).
- Switch the SW1 and SW2, to observe if the blue LED flash in the correct way in each mode.
- Observe the Red LED to confirm if the GPS have locked, if yes, then you can take off your plane.

26. Stabilized mode (Mode2)Test And Sensitivity Adjustment

- 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.
- 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.
- Take off in Mode 1 (Manual Mode). After achieving safe height, activate Mode 3 (Auto Stabilized).
- **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.
- Reduce the sensitivity (move dial towards centre position) and fly again. You should see

improvement in wing attitude. Adjust until you are satisfied with the level of wing stabilization.

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

27. Recording Neutral Value 'On the Fly'

After the checking for the control surface, adjust the 3 knob switch to a suitable position(advice to adjust for about half),then you can test the fly now. The test for fly is in order to record the neutral value 'on the fly'. This can help you get more accurate autonomous flight attitude control.

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: 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.

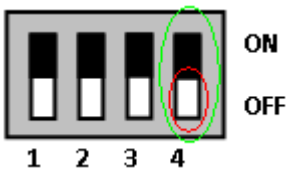
Step 4: Power ON the aircraft with the FY31AP **in Manual Mode**.

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

Step 6: While in this Neutral Value, activate Mode 2 (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 or keep in the Mode 3 (Auto Stabilization Mode)and land your aircraft.

(**Note:** Do not switch from Mode 1(Deactivated Mode) to Mode 2(Stabilized mode)for the second time, because when the DIP Switch NO.4 is in the ON position, the FY-31AP will record the neutral point each time you switch the mode from Mode 1 to Mode 2.)

Step 7: After landing, move Dip Switch No. 4 back to **OFF** position. Procedure is complete.



IMPORTANT NOTE: As long as there are no major changes in your aircraft hardware (e.g. no shifting of Centre of gravity, " 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.

Note: if you have data radio, you also can use the GCS software to record the neutral value ' on the fly' more easily! The detail please refer the manual of GCS software operate manual.

28. Test for the Autopilot mode 2: Auto Return To Launch (RTL)

After test well the stabilized mode, please keep the throttle at the cruising position , then switch the SW2 to the Autopilot mode 2(RTL), then the plane should return to the home point, and circle after it reach the home point. If this test successfully, then you can switch to the stabilized mode fly the plane to a farther distance to test the RTL again.

29. Test for the Autopilot mode 3: Auto Circling Mode (ACM)

After you complete the test for the RTL mode, you can test the ACM mode now. Please keep the throttle at the cruising position, switch the SW2 to the Autopilot mode 3(ACM), then the plane should circle, the centre of the circle is the current point when you switch.

30. Test for the Model 3: Path Navigation mode

- First, please connect the FY-31AP with the GCS, detail please refer the ***FY-31AP Path Navigation & GCS manual.***
- Set the waypoints. The most qty is 8 waypoints. Then switch into the path navigation mode for the waypoint fly.
- Don’ t forget to keep the throttle at the cruising position .
- When you switch into the path navigation mode, to observe if the plane fly according the path you set.
- The default path navigation in FY-31AP is auto repeat .when the plane fly over the last waypoint it will fly back to the first waypoint. You can cancel this default value via the GCS software, then the plane will not fly back, just circle in the last waypoint.

More about the path navigation fly please refer to the manual ***FY-31AP Path Navigation & GCS.***

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