

E52

Instruction Manual Freewing 6 Axis Gyro Stabilizer

High Performance 6 Axis Airplane gyro & stabilizer
Instruction Manual



/Catalog

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. Introduction to the Freewing E52 Gyro

- 1.The Freewing E52 gyro can automatically adjust the three channels of aileron, elevator, and rudder in real time to make the aircraft fly more smoothly, enhance stability during windy flight conditions, and overall enhance a pilot' s flying experience. Level flight, inverted flight, side flight, 3D flight, and other maneuvers become easier to accomplish while maintaining core user control.
- 2.Various types of flight configurations are supported by the E52, including ordinary fixed-wing aircraft, delta-wing aircraft (flying wing), V-tail control aircraft, etc. The factory default mode is set for a standard single wing, fixed-wing aircraft.
- 3.The E52 gyro also supports multi-channel output function, in addition to the three conventional channels of aileron, elevator, and rudder, two channels of dual aileron, and dual elevator. These multi-channel capabilities enable pilots to fine tune the performance of their RC model aircraft.
- 4.A standalone Programming Card enables users to quickly and accurately adjust the settings on the Freewing E52 gyro, without the need to rely on LED light signals or audible beeps.
- 5.Functions of the gyro can be changed in real time using the pilot' s radio transmitter. When flying in the air, you can use this switch to control the various functions, allowing you to experience and evaluate different control configurations, such as high gain or low gain.
- 6.Three working LED lights in blue, purple and red, are easy to read and help visually distinguish the various working modes and states of the Freewing E52 gyro.
- 7.Designed with low weight and small physical size, the Freewing E52 can be used in many fixed-wing aircraft without major modification. A screw-on base design allows reliable installation and consistent placement, and eliminates the risk of the gyro falling out of position during flight.

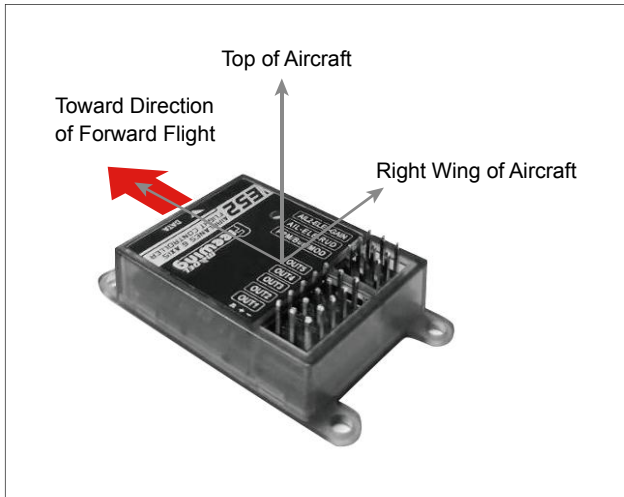
.Precautions for Initial Startup

- 1.Please read the instructions carefully before powering on the E52 gyro for the first time.
- 2.Verify that the direction and position of the connection line of each channel are correct.
- 3.Position the aircraft in a stable place to prevent it from shaking, and then turn on the power to ensure that the gyro is fully initialized. This process may take several seconds, during which time the aircraft must remain completely motionless. If the model aircraft is accidentally moved during this initial startup phase, please restart the process by unplugging the power then plugging in the power again.
- 4.Visually inspect the gyro' s LED indicators to confirm the gyro is in the intended Mode that you want to use.
- 5.To check the control signal output of the remote control, first use the remote control to check whether the control directions of the ailerons, elevator, and rudder are correct. If they are not correct, set the channels in the remote control to be positive or negative until the control directions of each channel are correct. Your finger' s inputs from your radio control/transmitter must correspond correctly to the movements of the aircraft' s control surfaces for the gyro' s inputs to compliment your inputs.
- 6.To check the output of the gyro correction signal, please carefully follow the introduction in the direction of the gyro correction, carefully check whether the direction of the output correction signal of each channel is completely correct. If not, please change the corresponding correction direction and set it to the correct direction. Failure to configure the gyro' s control surface direction properly will result in a crash.The Delta Wing (flying wing) Mode uses ailerons and elevators for mixing, and the V-Tail Mode uses elevator and rudder for mixing. The remote control does not need to be set to mixing. The mixing output is done by the gyro. Set the Model Type in your radio transmitter to Normal Wing configuration, so that it does not compete with the E52 gyro' s onboard mixing software.
7. "Gain" describes the amount of sensitivity with which the gyro reacts in physical movement of your aircraft in flight. If gain is set too low, the gyro will not influence your aircraft' s flight. If gain is set too high, the gyro will overreact to each motion of the aircraft. It is important for the user to adjust the amount gain to achieve their preferred balance between under-sensitivity and over-reaction. It is generally recommended to adjust it at 40%-50% first, and then fine-tune it according to the flight situation. If the aircraft control surface shakes more severely during flight, then reduce the sensitivity of the corresponding control surface and test it again. The higher the gain, the more likely the aircraft will shake, and the smaller the gain, the smaller the stabilization effect. Different aircraft require different stabilization effects. This requires you to adjust the gain during flight.

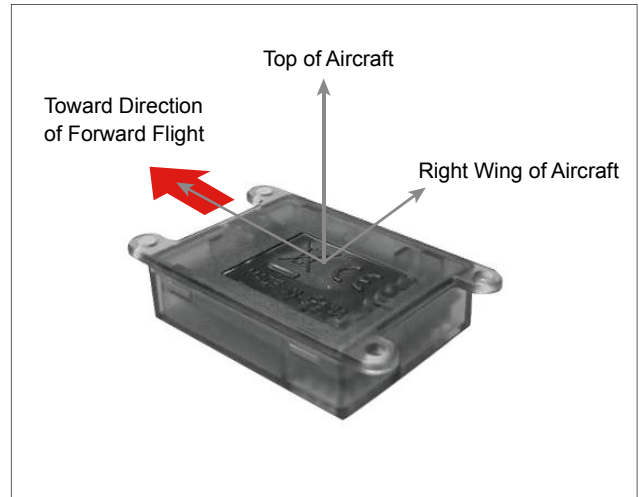
.Installation method

Use screws or 3M double-sided tape to install the E52 inside the fuselage, while being sure to keep the three sides of the gyro shell parallel to the three rotation axes of the aircraft. It is critical to keep the gyroscope parallel to the installation plane and minimize the installation angle deviation. Misaligned gyro installation will result in an uncontrollable aircraft.

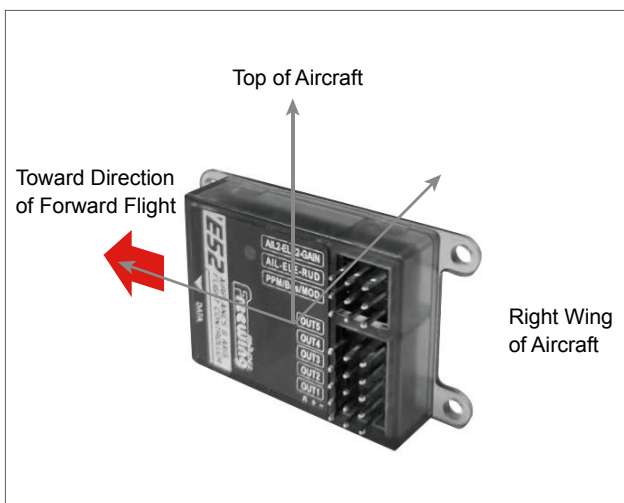
Horizontal forward position



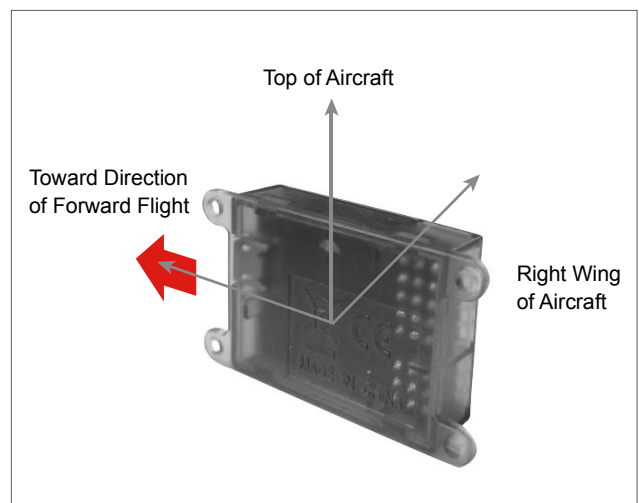
Horizontal reverse position



Vertical forward position



Vertical reverse position



. Connection method of receiver and servo

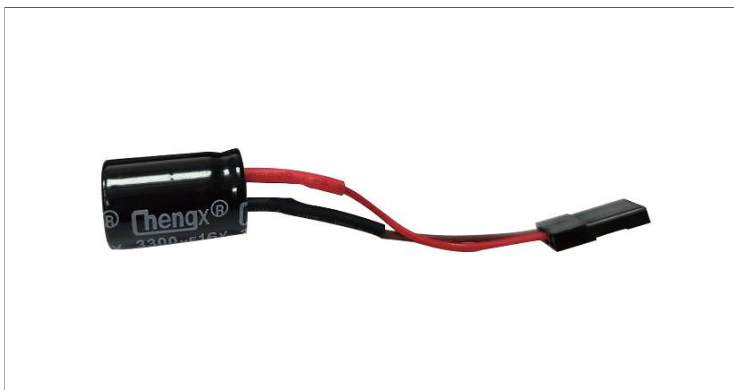
The Freewing E52 gyro supports traditional parallel receivers, standard PPM receivers and S.BUS receivers. The E52 provides 7 different control surface layouts to choose from. Different layouts have different wiring methods. However, in general, for most fixed-wing aircraft the input terminal [AIL] aileron, [ELE] elevator, and [RUD] rudder are all required. [PPM/BUS/MOD] The flight mode switching channel must also be connected. The other function of this channel is to power the E52. [GAIN] is the remote total gain control channel which can be programmed to your potentiometer dial on your radio transmitter. It is not necessary to use this remote gain channel, in which case the gyro will rely on the physical gain dials on the actual gyro itself. your radio transmitter. It is not necessary to use this remote gain channel, in which case the gyro will rely on the physical gain dials on the actual gyro itself.

1. Interface function description

INPUT CHANNEL	MEANING & FUNCTION	OUTPUT CHANNEL	MEANING & FUNCTION
AIL	Aileron,Connect the aileron channel of the receiver	OUT1	Connect to the aileron servo
ELE	Elevator,Elevator that connect with receiver	OUT2	Connect to the elevator servo
RUD	Rudder,Connect the rudder channel of the receiver	OUT3	Connect to the rudder servo
AIL2	Aileron2,Connect the aileron 2 channel of the receiver	OUT4	Connect to the aileron 2 servo
ELE2	Elevator2,Connect the elevator 2 channel of the receiver	OUT5	Connect to the elevator 2 servo
GAIN	Gain,Connect the Gain channel of the receiver		
PPM/BUS/MOD	Mode,connected to the flight mode switch channel of the receiver, or PPM, S.BUS output channel, and used as the power supply interface of the E52.		

. Use of external capacitors

While the gyro is in use, it will be directing the servos at a rate of hundreds of times per second, so the power draw will increase. It is therefore necessary to ensure that the BEC has enough power supply to the receiver, otherwise the supplied voltage to the gyro may decrease during flight, resulting in inconsistent performance. In order to provide a stable voltage to the E52, it is necessary to the distributed large capacitor is plugged into the free channel of the gyro or receiver. Note that the red wire is the positive pole and the black wire is the negative pole. Take care to avoid plugging the red wire into the negative pole!

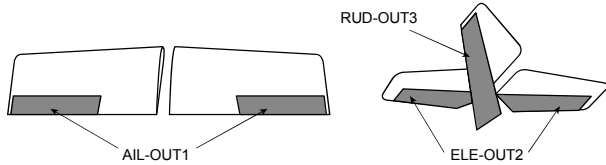


Supported control surface layout

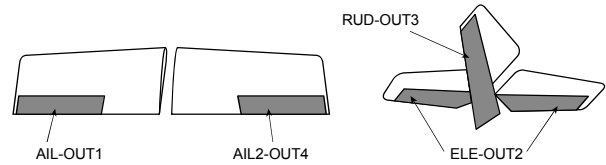
The E52 supports conventional fixed wing, V-tail and delta wing (flying wing) mixing control. A variety of control surface layouts can be selected. For details, please connect according to the following diagram:

Conventional Fixed Wing

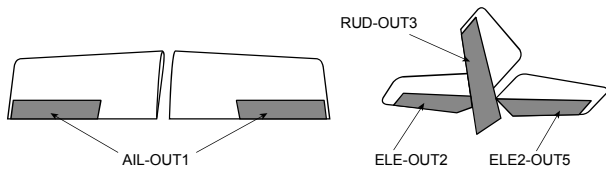
1AIL+1ELE+1RUD



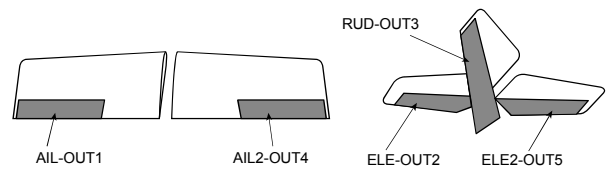
2AIL+1ELE+1RUD



1AIL+2ELE+1RUD

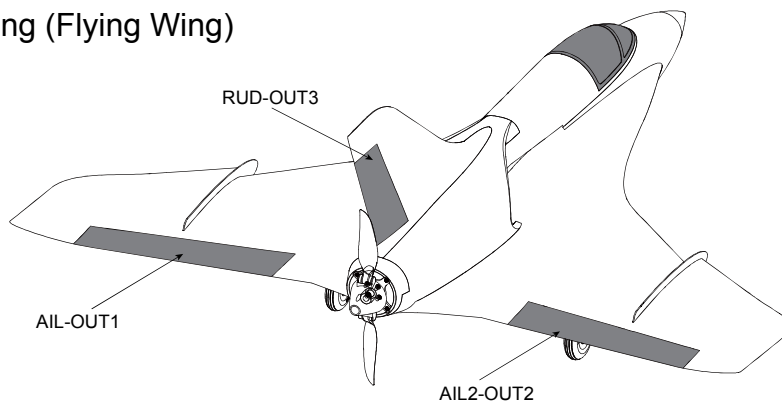


2AIL+2ELE+1RUD



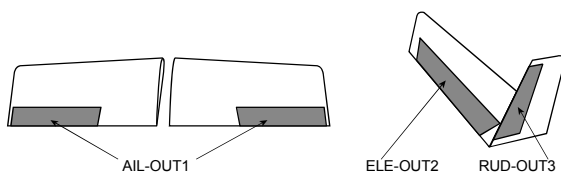
Delta Wing (Flying Wing)

Delta Wing (Flying Wing)

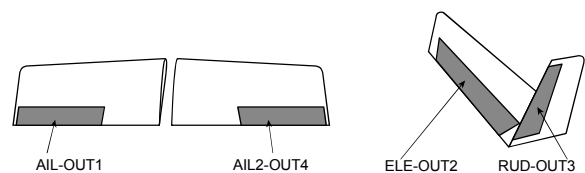


V-tail

1AIL+VTAIL



2AIL+1ELE+1RUD



Precaution

When using E52's V tail mixing and delta wing mixing, be sure to turn off the radio mixing setting.

Flight Mode

The E52 provides a variety of flight modes for selection, which can be switched and selected through the three-stage switch and programming card connected to the [PPM/BUS/MOD] channel.

■ Basic gain mode:

During the Basic Gain Mode, the red LED is always on. This mode is suitable for all fixed-wing aircraft and is the most commonly used mode. It can effectively improve the stability of the aircraft, improve the control accuracy, and reduce the stall point of the aircraft, which is especially suitable for the installation and use of aircraft that are difficult to control. This Basic Gain Mode is recommended as the initial starting point for new pilots with new installations of the Freewing E52 gyro.

■ Attitude lock mode:

During the Attitude Lock Mode, the red LED flashes slowly. In this mode, the gyro will make continuous corrections to the rotation of each axis. Moving the stick will make the aircraft rotate at a certain speed around the corresponding axis of rotation, and once the stick is released, the aircraft will be locked at the current position immediately. This Mode is useful for certain types of multi-rotors, and 3D acrobatic fixed wing aircraft.

■ Trainer mode:

While in Trainer Mode, the blue and purple LED light are always on. In this mode, the aircraft's roll and loop actions will be prohibited, and the aircraft will always be restricted to fly within a safe range of inclination. This is commonly referred to as "bank angle limitation", to reduce the likelihood of a pilot inadvertently putting the aircraft into too steep a turn or too steep a dive from which safe recovery is difficult. At any time during Training Mode, as long as the ailerons and elevator sticks are returned back to the center, the aircraft will be automatically brought back to the horizontal position. You can use this mode to achieve a one-key rescue or to assist a beginner in flying. When in doubt whenever using a Mode 2 radio, simply release the control sticks and allow the Freewing E52 Gyro to automatically return your aircraft back to level flight, after which you can retake control and return the aircraft's heading toward your direction.

■ Auto level gain mode:

In Auto Level Gain Mode, the blue and the purple LED light flash slowly. In this mode, once the radio stick is released, the aircraft will automatically return to the horizontal position. This differs from the Trainer Mode because in Auto Level Gain Mode, there is no bank angle limit protection in the automatic balance mode. The aircraft will only return to the level when the ailerons and the elevator stick are returned to the center. This mode is useful to training pilots who have graduated from Trainer Mode.

■ Auto hover mode:

Used primarily with 3D aerobatic aircraft, the blue and the purple LED light flash quickly. When the stick is released, the aircraft maintains the hovering mode with the nose up. This mode can be used to assist the hovering in flight. Please note that the aircraft's power system must be able to provide sufficient >1:1 thrust-to-weight ratio to be able to aerodynamically maintain a static, vertical hover.

■ Gyro off mode:

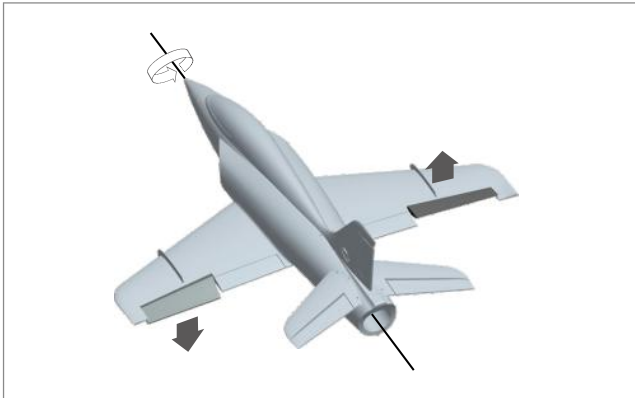
At this time, the blue LED light is always on. In this mode, the gyro function is completely turned off, and the gyro will not make any corrective actions to the aircraft. The pilot has full control of all parts of the aircraft.

.Indicator lights and corresponding functions

Indicator light status	Corresponding function
Power on, the red light flashes	Power on initialization, please keep the aircraft completely still until the red light stops flashing
Red light is always on	Basic gain mode
Red light flashes slowly	Attitude lock mode
Blue and Purple light are always on	Trainer mode
Blue and Purple flashes slowly	Auto level mode
Blue and Purple light flashes quickly	Auto hover mode
Blue light is always on	Gyro off mode
Blue light flashes	No receiver signal detected

.Gyro correction direction

Aileron turn left during flight---Aileron correction diagram



When the roll axis rotates to the left, please pay attention to the left and right ailerons to correct them as shown in the arrow direction. If the action is not correct, it should be reset.

Aileron turn right during flight---Aileron correction diagram



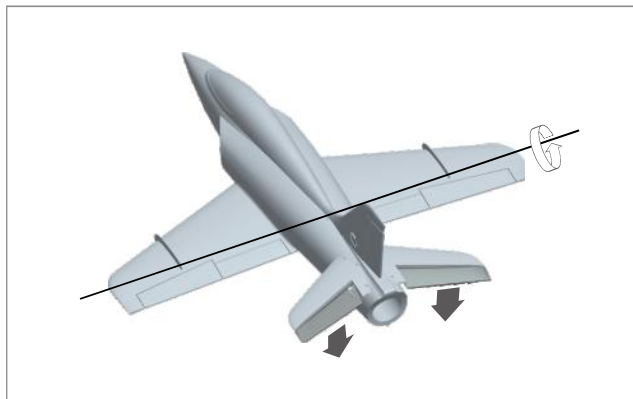
When the roll axis rotates to the right, please pay attention to the left and right ailerons to correct them as shown in the arrow direction. If the action is not correct, it should be reset.

Nose down during flight---Elevator correction diagram



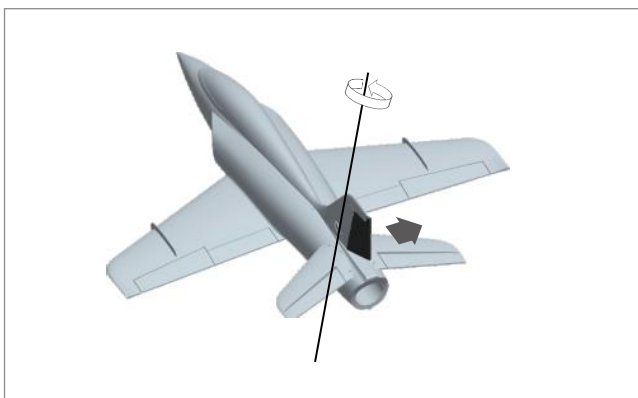
When the pitch axis rotates upwards, please make sure that the elevator is corrected as shown by the arrow direction. If the action is not correct, it should be reset.

Nose up during flight---Elevator correction diagram



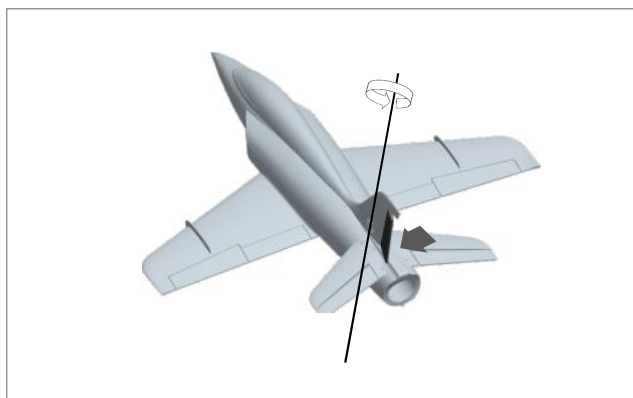
When the pitch axis rotates downwards, please make sure that the elevator is corrected as shown by the arrow direction. If the action is not correct, it should be reset.

Turn left during flight---Rudder correction diagram



When the auto shaft rotates to the left, please make sure that the rudder corrected as shown by the arrow direction. If the action is not correct, it should be reset.

Turn right during flight---Rudder correction diagram



When the auto shaft rotates to the right, please make sure that the rudder corrected as shown by the arrow direction. If the action is not correct, it should be reset.

.Gain Settings

Basic gain

Basic gain is the basis of all gain settings. Before adjusting other gains, you need to get an appropriate basic gain first. Basic gain is the adjustment of correction intensity of the related control surface by the gyro. For the first flight test it is recommended to use a 40%-50% basic gain setting, then, trim it according to the flight situation. If any control surface shakes more severely during flight, then the gain of its corresponding control surface gain should be reduced. During this "test and verify" process, we recommend using the remote gain feature of the Freewing E52 Gyro, which enables the pilot to adjust the gain in real time from a potentiometer dial on their radio transmitter while the aircraft is still in flight. Otherwise, you will need to turn the gyro off, land the aircraft under your own control inputs, then manually adjust the gyro's settings while the aircraft is back on the ground. Continue to adjust the gyro's gain settings until the aircraft performs with your desired amount of gain, without over-reacting oscillations. In general, the higher the gain setting, more stable the plane is, but it is also prone to excessive jitter. On the contrary, the smaller the gain, the smaller the basic gain effect. Different aircraft require different basic gain effects. This requires you to adjust the gain during flight.

Lock Gain

The Lock Gain adjusts how strictly the gyro maintains its attitude heading. If the lock gain is small, the airplane will not be able to maintain the current attitude, and if the lock gain is large, the airplane may “fish tail” or oscillate between opposite ends of the attitude’ s range. A moderate lock gain achieved when the aircraft can maintain the current attitude and continue to fly forward even when the control sticks are released by the pilot.

Attitude gain

Attitude gain is mainly to control the flexibility in Trainer Mode. A fine balance must be achieved between too high of an attitude gain, and too low of an attitude gain. Attitude Gain must not be set to zero. The higher the attitude gain value is, more flexible the aircraft control is. However, if the gain is too high, the aircraft will oscillate and appear uncontrollable because the gyro will be overcompensating for each attitude reaction. The lower the attitude gain is, the slower the aircraft control is. Attitude gain cannot be set too low or “0” , because the gyro will not be given enough control surface deflection to safely affect the aircraft’ s flight. When flying in the Trainer Mode, the attitude gain cannot be set too low or zero, and the basic gain and the master gain cannot be set too low or zero, otherwise the aircraft will not be able to be controlled.

Hover gain

The hover gain is used to adjust the amount of correction in the auto hover gain mode. If the gain is too low, the plane will lean sideways while hovering. In order to achieve stable hover, you can simply set the hover gain to maximum.

Level gain

The Level gain is used to adjust the speed of returning level position in auto level gain mode when releasing the sticks. The larger the level gain, the quicker the plane will be brought back to horizontal position. 30~50% level gain is recommended to let the plane recover to level flight more slowly and smoothly after you release the sticks. If the level gain is too large, the aircraft may snap too quickly into level, which may physically damage the aircraft. If the level gain is too low, the aircraft will be too slow to level itself, by which time the aircraft may have crashed. If you want to use the Auto-Level mode as emergency rescue during flight, then a larger level gain may be needed to make the plane quickly recover to level position before the aircraft impacts the ground.

Programming card function

If you purchased the E52 programming card, you can design the E52 detail functions, and the settings made in the programming card will take effect after confirming and exiting. The specific functions are introduced as follows:

1.Key function

KEY	FUNCTION
UP/+	Select the previous one or increase the set value
DN/-	Select the next or decrease the set value
ESC	Return to the previous menu or cancel
ENT	OK to save



2.Connection method

Use the provided data cable to connect the programming card to the gyro.

3.Language selection

The programming card provides English and Chinese (中文) language display for you to use, Select the language by navigating to System Menu // Language.

4. Main menu operation

Press the (UP/+) and (DN/-) keys to select the parameter options that need to be modified for modification, the unconfirmed option will then flash, then press the (ENT) key to confirm and save, and press the (ESC) key to cancel and exit.

5. Parameter setting

Press the [UP/+] and [DN/-] keys to select the parameter options that need to be modified for modification, the unconfirmed options will then flash, then press the [ENT] key to confirm and save, and press the [ESC] key to cancel and exit.

6. Value setting

Press [UP/+] and [DN/-] key to select the item that needs to modify the value, press [ENT] key to enter the setting, at this time the value will keep flashing, and then press [UP/+] and [DN/-] Key to modify the value, press [ENT] key to confirm and save, press [ESC] key to cancel and exit.

7. Programming card function table

(1)	Wing type setting	You can set kinds of control surface layout such as the delta wing, V-tail.	
(2)	Installation	You can choose a variety of installation methods, horizontal forward installation, horizontal reverse installation, vertical forward installation, vertical reverse installation.	
(3)	Flight mode	①.Flight mode type	Choose either 3-position or 6-position switch of Flight mode type, usually we choose the 3-position switch.
		②.Flight mode setting	You can define the corresponding flight mode for each position of the 3-position switch.
		③.User-Defined model	
		④.Max tilt angle in trainer model	Define the max tilt angle in trainer mode.
		⑤.R/R control mode	
		⑥.Max rotation rate	
(4)	Gain setting	①.Basic gain	The basic gain of aileron, elevator and rudder can be set.
		②.Lock gain	You can set the lock gain of aileron, elevator and rudder in lock mode
		③.Attitude gain	You can set the attitude gain of roll and pitch in trainer mode.
		④.Level gain	You can set the level gain of roll and pitch in the level mode.
		⑤.Hover gain	You can set the hover gain of rudder and pitch in hover mode.
		⑥.Gain drop curve	
(5)	Gyro settings	①.Gyro switch	You can close or open the aileron, elevator and rudder of the gyro.
		②.Gyro direction	The gyro correction direction can be modified for ailerons, elevator and rudder, this is a common item.
(6)	Remote control settings	①.Receiver type	You can choose traditional parallel receiver, standard PPM receiver and S.BUS receiver type.
		②.Channel allocation	

(7)	Servo settings		
(8)	Horizontal compensation		
(9)	Vertical compensation		
(10)	Advanced settings	①.Stick dead zone	
		②.Servo frequency	
		③.Gain level	You can set the Basic Gain level at one of three levels. There are small, medium and large to choose from. The default setting for the Basic Gain is "Medium" , which is a good starting point for most models.
		④.Gyro filter	
		⑤.Acceleration filter	
(11)	Menu	①.Save data	There are 5 groups of data that can be saved, to minimize the hassle of reprogramming the gyro if it was moved between multiple aircraft whose settings have been previously tested, verified, and saved to the gyro' s memory.
		②.Load data	The saved data can be loaded onto E52
		③.Language	You can select the display language of the menu, this is a common item.
		④.Equipment information	
		⑤.Programming card information	
		⑥.Restore factory settings	

.Material List

Gyro	No.	Name	Programming card	No.	Name
	1	Gyro *1		1	Programming card*1
	2	Connection cable *2		2	data cable *1
	3	Screw (PA2.6*10MM) *4			
	4	Manual *1			
	5	EVA Sponge sticker *1			
	6	External capacitor *1			

XI .Specification

Dimension: 51x29x14mm

Weight: 9g

Operating Voltage: 4.8-8.4V

Operating temperature: -20° C-50° C

Current: Max 50mAh

Gyro: 2000 degrees/S

Input signal: 50HZ PWM

Output signal: 50HZ PWM