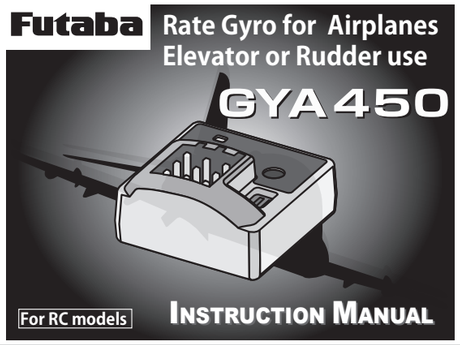
1M23N34802



Before using your new gyro, please read this manual thoroughly and use the gyro properly and safely. After reading this manual, store it in a safe place.

Features of GYA450

● Dedicated airplane setting
Stabilizes flight, even with hard-to-control scale models.

● Compatible with elevator or rudder control (Corresponds to 2 elevators and 2 rudders for S.BUS/S.BUS2 connection)
The GYA450 can choose and use an elevators or a rudder.

● Compatible with Alevon or V-tail wing
Two axes control is available with two of the GYA450 or GYA451 when using a combined connection. (S.BUS only)

● Remote gain function
The remote gain function allows the sensitivity of the gyro to be adjusted from the transmitter and the mode switching function allows AVCS/NORMAL gyro mode switching. Also the gain can be adjusted by the trimmer on the GYA450.

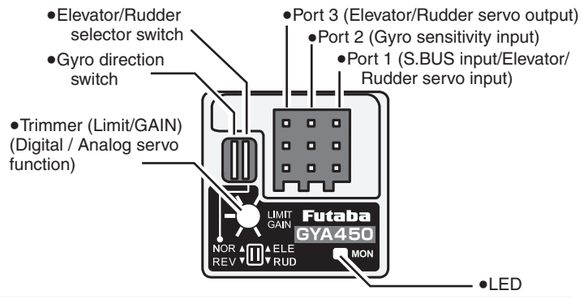
● Easy to mount, compact size, and lightweight
High-density mounting technology makes the GYA450 compact (20.5 x 20.5 x 11 mm) and lightweight (3.7 g).

● Easy setup
Basic settings let you be flight-ready in an instant.

● Supporting the S.BUS/S.BUS2 connection
Only one wire connection to the receiver can operate the GYA450.

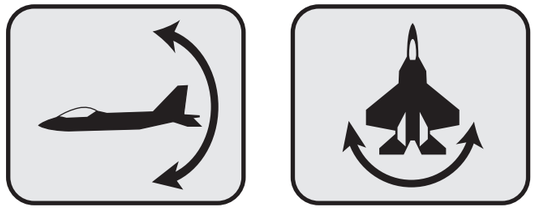
● This gyro is equipped with a sensor with excellent vibration resistance.
This gyro can also be used with large combustion engine powered models.

Name and Function of Each Part



Monitor LED display

Operation status	*Color*	*Display*	*Remarks*
1. No servo pulse / sensor error	*Red*	*3 flash*	
2. Start of initialization	*Green*	*Fast blink*	
3. End of initialization	*Red/ Green/ Orange*	*Steady light*	Servo Mode: Digital: AVCS: Red; Analog: Red; Normal: Orange; Green
4. Turn	*Red/ Green*	*Fast blink*	*Right / Up (Green) Left / Down (Red)*
5. Neutral deviation	*Orange*	*Slow blink*	*When stick operated*
6. Gyro sensitivity zero	*—*	*OFF*	
7. Switch switching	*Green*	*One blink*	*Each switching*
8. Low Battery	*Red*	*One flash*	*When power drops to 3.8V or less*

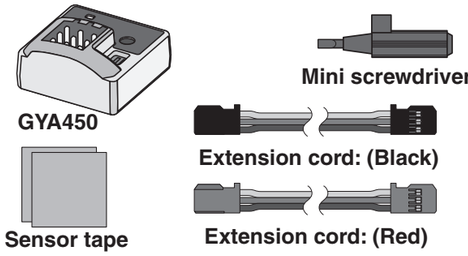


Thank you for purchasing the GYA450 airplane gyro. Compact and lightweight, the GYA450 is designed to control the elevators (pitch axis) or rudder (yaw axis). Features include simple set-up and S.BUS/S.BUS2 connectivity.

GYA450 Ratings:
(Integrated sensor type rate gyro)
- Gyro sensor: MEMS vibrating structure gyro
- Operating voltage: DC 4.0 V to 8.4V
- Current drain: 30 mA (excluding a servo)
- Operating temperature range: -10ºC to +45ºC
- Dimensions: 20.5 x 20.5 x 11.0 mm (except protrusion)
- Weight: 3.7 g
- Functions: (1) Gyro sensitivity trimmer, (2) Monitor LED, (3) CH change elevator or rudder, (4) S.BUS/S.BUS2 compatibility, (5) Digital/Analog servo function

Set Contents

The following items are supplied with the GYA450:



⚠WARNING

Failure to follow these safety precautions may result in severe injury to yourself and others.

❗ Check that there is sufficient transmitter battery capacity for flight.
- Determine the operating time of the receiver, gyro, and servo battery in the adjustment stage and decide the number of flights with a margin to spare.

❗ Analog servos cannot be used while in "digital servo" mode.
- Analog servos may break down if "digital servo" mode is selected.

⃠ Do not operate the airplane and transmitter sticks for about 3-5 seconds after turning on the GYA450 (When shared with the receiver).
- GYA450 initialization and neutral position reading. The GYA450 is initialized when the power is turned on. In the AVCS mode, the neutral position is also read at the same time. If initialization ends normally, the operator is informed by two repetitive movements of the servo to the left and right (a little).

❗ Always check the direction of operation of the gyro.
- Attempting to fly with the operating direction reversed is extremely dangerous. Always check your gyro's direction to ensure safe flights.

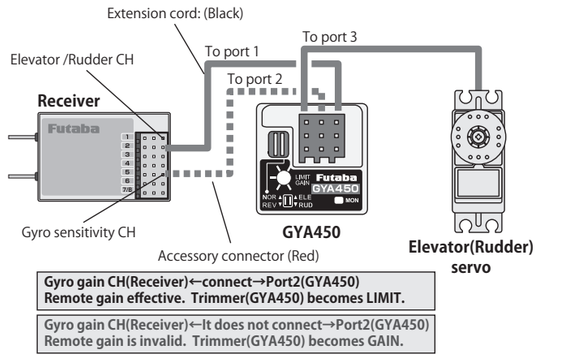
⃠ Do not strike the gyro with a hard object. Do not drop it onto a concrete surface or other hard floor.
- The sensor may become damaged during strong impacts.

⃠ Do not use trims or mixing in AVCS mode.
- In the AVCS mode all corrections are made by the gyro. Therefore, if trimming and mixing, are turned on, operation will be the same as deviating from the neutral position.

⃠ Do not use the GYA450 for applications other than RC airplanes.
- This gyro is designed for RC airplanes only. Do not use it for other applications.

⃠ Do not place gyro near heating equipment (engine, motor, ESC, battery, servo, etc.).
- Always allow the gyro to adjust to the surrounding environmental temperature before flight. A large temperature change during use will cause drift and other operational issues.

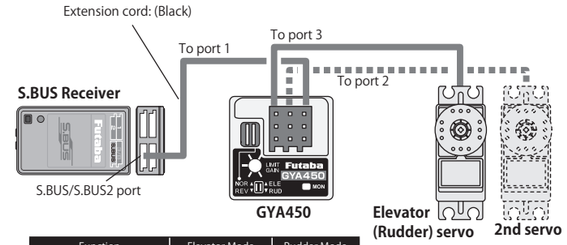
Connection



Gyro gain CH(Receiver)←connect→Port2(GYA450)
Remote gain effective. Trimmer(GYA450) becomes LIMIT.

Gyro gain CH(Receiver)←It does not connect→Port2(GYA450)
Remote gain is invalid. Trimmer(GYA450) becomes GAIN.

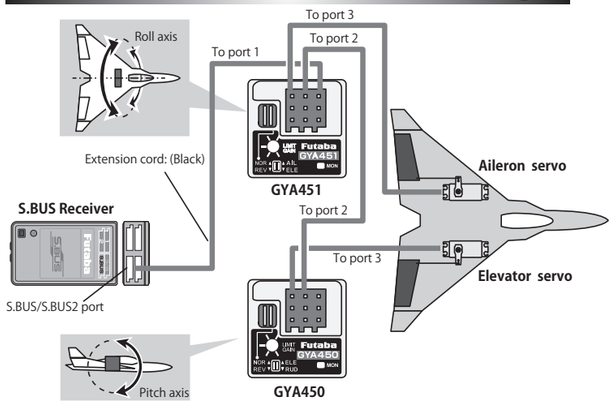
S.BUS Connection



Function	Elevator Mode	Rudder Mode
Elevator	CH2	
Rudder		CH4
2nd Elevator	CH9	
2nd Rudder		CH10
Gyro Gain (Elevator)	CH7	
Gyro Gain (Rudder)		CH8

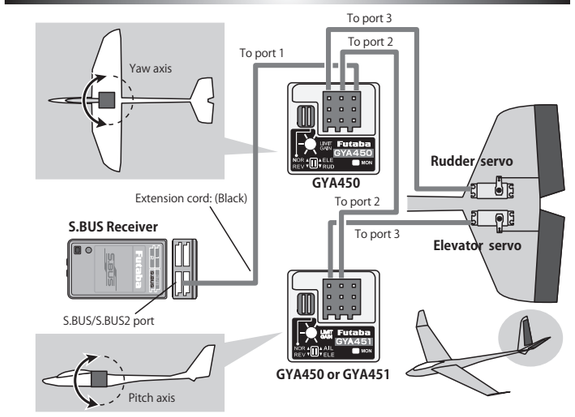
At S.BUS/S.BUS2 operation, the channels are fixed as shown in the table below. Match the transmitter channels to these.

S.BUS Elevon 2-axes Connection Example



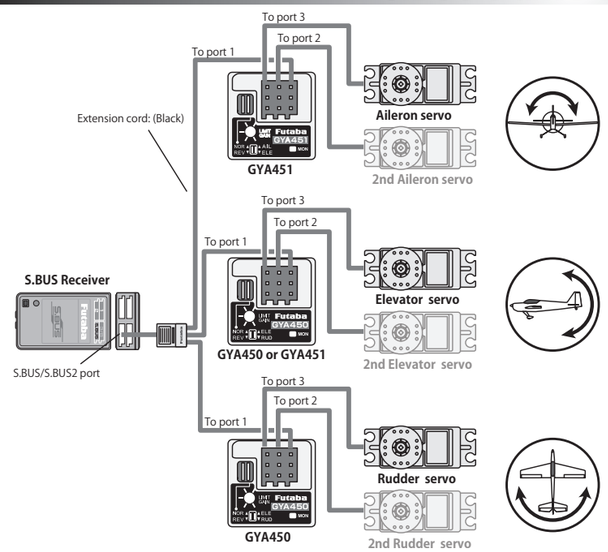
- In case of the Elevon operation, using the GYA451 for aileron control and GYA450 for elevator control. Set aileron mode to the GYA451 and elevator mode to the GYA450.
- Turn off the Elevon mixing on the transmitter. The gyro generates the Elevon mixing itself. Select the transmitter model type to 1AIL and normal tail.
- It will not allow to use the Sub-Trim function on the transmitter. Correct the aileron and elevator control surface to be flat by the mechanical linkage setting. When the aileron Sub-Trim moves, both aileron and elevator servo are moved at the same time.
- The power to the gyros must be supplied at the same time. It may happen the malfunction of recognizing the correct operation mode.

S.BUS V-Tail 2-axes connection Example



- In case of the V-tail operation, using the GYA451 or GYA450 for elevator control and GYA450 for rudder control. Set elevator mode to the GYA451 or GYA450 and rudder mode to the GYA450.
- Turn off the V-tail mixing on the transmitter. The gyro generates the V-tail mixing itself. Select the transmitter model type to normal tail.
- It will not allow to use the Sub-Trim function on the transmitter. Correct the elevator and rudder control surface to be flat by the mechanical linkage setting. When the elevator Sub-Trim moves, both elevator and rudder servo are moved at the same time.
- The power to the gyros must be supplied at the same time. It may happen the malfunction of recognizing the correct operation mode.

S.BUS 3-axes connection



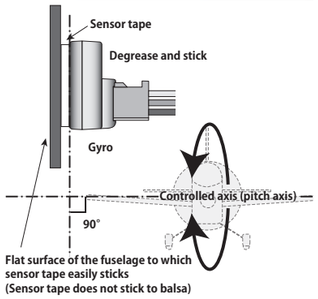
S.BUS connection makes the wiring extremely simple. The GYA450 and GYA451 can be connected by one 3-way hub. The aileron, elevator and rudder servos are output from the gyro. Servos other than S.BUS servos also can be used.

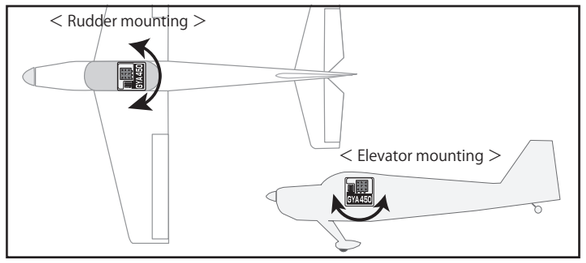
The example shows dual aileron, elevator and rudder operation. The transmitter function setting are shown below. A total 10 channels are used with 3 axes gyro control. The model type are set to 2AIL+AILVATOR. 2nd rudder is set to CH10.

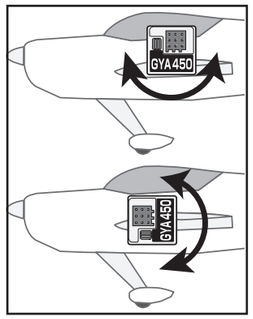
Function	GYA451(Aileron)	GYA450 (Elevator)	GYA450 (Rudder)
Aileron	CH1		
Elevator		CH2	
Rudder			CH4
2nd Aileron	CH6		
2nd Elevator		CH9	
2nd Rudder			CH10
Aileron Gain	CH5		
Elevator Gain		CH7	
Rudder Gain			CH8

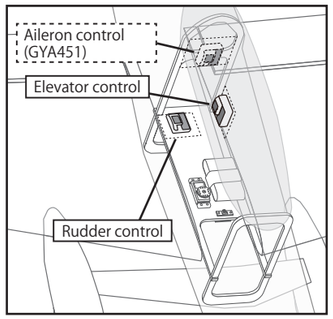
Mounting to the Chassis

The gyro is very sensitive to vibration. Securely mount it with the included double-sided sponge tape at a position where vibration is minimal and the gyro is perpendicular to the axis to be controlled. Since double-sided tape will not stick to balsa, make a smooth surface by cementing a smooth plastic sheet. to the frame and securely attach the gyro with double-sided tape. Provide a surplus in the wiring so that it will not interfere with the rod.









< GYA450 elevator mounting >

The turning direction which fixes the gyro can be any direction up to 360° relative to the pitch axis.

Servo

Link the servo in accordance with the model instruction manual. Adjust the linkage rod so that the trim amount is as small as possible.

Digital/Analog servo selection

Selection of an analog and digital servo is performed in a limit trimmer's setting position.

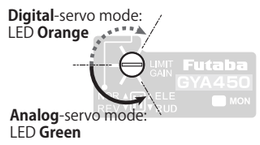
A limit trimmer's motion is as follows.

Digital servo → A trimmer is adjusted by the Right rotation from the middle point.

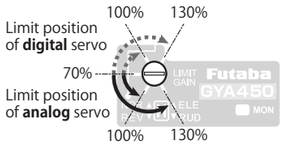
Analog servo → A trimmer is adjusted by the Left rotation from the middle point.

The amount of limits -- the halfway point -- the minimum -- it will become the maximum quantity if it is made to rotate to max, respectively. You can also check the mode by noting the color of the light. The stability of digital-servo mode of a flight increases in order to perform a high-speed control action.

Selection of digital /analog servo is chosen towards a trimmer turning.



[Limit position]



When a remote gain function is off, it becomes only analog servo mode. A trimmer becomes only for gain.

(Digital-servo use is possible)

*When you use an analog servo, please be sure to set to analog servo mode. If it sets to digital-servo mode and it is operated, there is a danger that a servo will be destroyed.

Preflight Adjustments

Setup before a flight [Remote gain use]

Adjust the gyro sensitivity at the transmitter.

At S.BUS connection or when gyro port 2 and the gyro sensitivity CH of the receiver are connected

1 Use the Elevator/Rudder selector switch to select elevator or rudder. (Elevator: ELE Rudder: RUD)

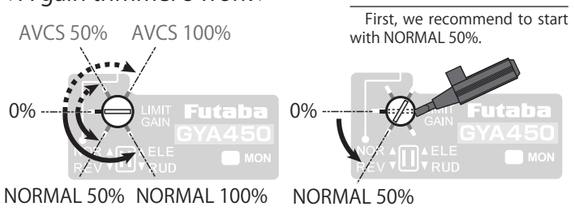
2 Turn on your transmitter's power. Set the gyro sensitivity to about 50% at the normal side (minus rate side) in accordance with the transmitter instruction manual. 50% of normal sensitivity will be about -70% at the rate of the sensitivity CH so that a next graph may be seen and understood.

Gyro sensitivity zero --- LED OFF
AVCS side --- LED red
NORMAL side --- LED green or Orange

3 Turn on the receiver power. When the gyro starts, the LED flashes green and initialization begins. When initialization ends, the servo performs reciprocating operation to the left and right. (a little)This places the gyro into the ready state. During initialization, secure the fuselage so that it will not move and fix the transmitter stick at the neutral position. Initialization takes about 3-5 seconds after the receiver operates. After initialization, the LED lights green/orange. If the neutral position has changed, the LED will slowly blink orange. In this case, restart the gyro. Move the stick and check that the servo operates.

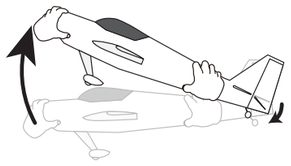
4 Move the stick to the maximum left and right. Adjust the gyro limit trimmer so that the servo operating angle is at the maximum position at which there is no interference with the linkage.

<Limit trimmer Adjustments>



● Trimmer operation
*Make trimmer adjustments gently by using the included mini screwdriver.

5 In the case of rudder control, move the gyro direction switch and adjust the direction of operation of the gyro so that the rudder move all the way to the right when the airplane is turned to the left. In the case of elevator control, move the gyro direction switch and adjust the direction of operation of the gyro so that the elevator servo moves in the down direction when the airplane is moved in the up direction. If the direction of operation of the gyro is incorrect, flight will become impossible, so please make sure the settings are correct.



Tilt the airplane to the up on the ground and check that the elevator operate to the down. (In the case of elevator control)

[When remote gain function is off]

Adjust the gyro sensitivity with the GYA450 trimmer.
Do not use the AVCS mode.

All remote gains are effective at S.BUS connection. When port 2 is not connected when S.BUS is not used, remote gain is inhibited. In this case, the limit trimmer is automatically changed to gyro sensitivity setting trimmer.
(Limit position is fixed at operating angle left and right 55° A servo is fixed to analog mode.)

* In this case, **2** gain setup with a transmitter and **4** limit adjustment of differing in a procedure are lost. And as shown in a figure, gain is adjusted of the trimmer of GYA450.

< A gain trimmer's work >

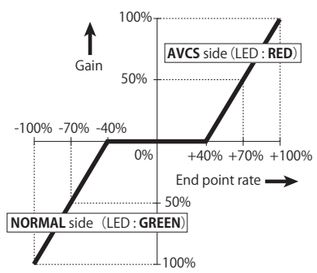
First, we recommend to start with NORMAL 50%.

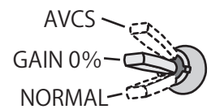
Gyro Sensitivity and AVCS Switching

When the remote gain function is used normally and AVCS mode switching is performed in accordance with the direction of operation of the transmitter's remote gain channel. At the + rate side, the AVCS mode is selected and at the – rate side, the NORMAL mode is selected. The sensitivity is changed by adjusting the end point rate. If the transmitter has a gyro sensitivity setting mixing function, the sensitivity setting is performed directly.

When the remote gain function is not used, the clockwise direction from the center of the sensitivity setting trimmer is the AVCS mode (not used) and the counterclockwise direction is the NORMAL mode. At the center position, the sensitivity becomes zero. When the trimmer is turned fully to the left or right, the sensitivity becomes 100%.

The sensitivity setting criteria by end point is shown in the figure below. The sensitivity becomes zero between end point -40% to +40% and becomes 100% at end point 100%.

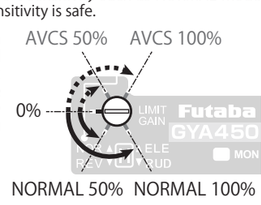




When AVCS is used we recommend that the sensitivity CH be set to the 3-position.

Refer to the transmitter instruction manual and set the end point. When AVCS is used, setting the 3-positions switch to the sensitivity CH (there are types which cannot be set by transmitter) and setting it as shown above is recommended. In the case of a 2-positions switch, inhibiting the gyro at 0% sensitivity such as NORMAL mode and sensitivity 0% and AVCS mode and 0% sensitivity is safe.

Trimmer movement when the remote gain function is not used (when S.BUS is not used and port 2 is not connected). Please do not use AVCS, when you do not use remote gain. Because, neutral memory cannot be performed. And taking off and landing being dangerous.



Flight Adjustment

Adjust the transmitter and gyro while repeatedly taking off and landing and with the aircraft on the ground.

Transmitter adjustments must not be made while flying because it is dangerous.

1 Fly the aircraft and trim it by turning off the gyro at 0% sensitivity or in the NORMAL mode. After trimming, switch the gain switch between 0% sensitivity (or NORMAL mode) and the AVCS mode three times at an interval of within one second and then set the gain switch to the AVCS mode position. This memorizes the AVCS mode neutral trim position at the gyro. In the AVCS mode, do not perform trimming during flight.

2 Adjust the gyro sensitivity so that hunting (deflection of the aircraft in small increments) does not occur in the control axis direction. The gyro sensitivity is different depending on the area of the aircraft rudder, air speed, and gyro used. Initially try changing the sensitivity in 5% steps. If hunting is excessive, the aircraft may be damaged. Hunting tends to stop when the airspeed is lowered.

Servo Operation on the Ground

If the stick is moved when the airplane is on the ground, the servo will move to the limit position. In the AVCS mode, the servo will not return to the neutral position even if the stick is set to the neutral position, but this is normal.

If the stick is moved fully to the left or right three or more times within one second, the servo will temporarily return to the neutral position.

AVCS/NORMAL Modes

The gyro has two operation modes: NORMAL mode and AVCS mode. In the AVCS mode, angle control is performed at the same time as NORMAL mode rate (rotating speed) control. In the AVCS mode, the neutral keeping force is stronger than the NORMAL mode and the flight attitude of the aircraft is forcefully maintained. During knife-edge flying, idiosyncrasies of the aircraft when climbing will be compensated automatically. On the other hand since the rudder follows when the aircraft stalls, pay special attention to the elevator axis. To be safe, switching to the NORMAL mode when taking off and landing is recommended.

Hints for best performance

It shows the gyro gain setting as a guidance.

*The setting gain is varied by the control surface area and angles. Please be remind the listed gyro gain values are just for reference. In addition, the setting gyro gain would be lower at the aircraft flying fast speed or higher at the aircraft flying slow speed. When you get the hunting at the initial flight, decrease the throttle and land the aircraft immediately. Change the gyro gain to lower for next flight.

◆ Sport flight

It is a sport flight setting example. The flying speed is moderate and flying the pattern flight. Installed the gyros to aileron, elevator and rudder for 3-axes operation. All gyros are set to normal mode at the taking off and landing. Aileron and elevator are set to AVCS mode and rudder is set to normal mode at the stunt flight. The reason for normal mode on the rudder axe is utilizing a weathercock effect to the rudder operation. When the rudder axe set to AVCS mode, it may be difficult to fly straight due to the no weathercock effect with AVCS gyro compensation. Do not care about this if you could put the correct rudder input.

The setting gain would be varied by the control surface area and flying speed. The setting gain will be lowest flying to against the wind with highest speed. Set the stunt flight gain with this condition. At the taking off and landing, the flying speed is slower. The gyro gain can be increased at this condition. You will feel more stable flight with higher gain setting. Utilizing the Gyro mixing on the transmitter, you could change the gyro gain by flipping the switches. Putting the gyro off mode, you can check the gyro effect by the gyro on or off. With the gyro compensation, the flight attitude are extremely improved, easier to make straight knife-edge, flat roll, straight line flight.

Control axe	Aileron		Elevator		Rudder	
	Mode	Gain	Mode	Gain	Mode	Gain
Take off/ Landing	Normal	70 %	Normal	70 %	Normal	70 %
Stunt flight	AVCS	60 %	AVCS	60 %	Normal	60 %
Gyro off	AVCS	0 %	AVCS	0 %	Normal	0 %

◆ 3D Aerobatic flight

It is an example of 3D Aerobatic flight setting. It has big control surface. Installed the gyros to aileron, elevator and rudder for 3-axes control. All gyros are set to normal mode at the taking off and landing. Aileron and elevator are set to AVCS mode and rudder is set to normal mode at the stunt flight. Basic setting is same as sports flight. In addition, the torque-roll mode is added. The aileron gyro is set to normal mode, elevator and rudder gyros are set to AVCS mode in this mode. The gyro gain value are lower by the bigger control surface usually. With the gyro compensation, easier to make the 4 point roll, knife-edge loop, torque-roll, etc.

At the torque-roll mode, the aircraft is vertically stayed, so the gyro gain can be set to 100% to both elevator and rudder to hold the vertical attitude as much as possible. The aileron gain is lower to make a free rolling. The gyro compensates an initial movement of the aircraft, so the attitude changes of the aircraft is to be moderate. It could say the gyro gives the thinking time of the counter rudder input to the pilot, very useful to training the torque-roll maneuver. If you want more elevator and rudder gyro gain, change the endpoint of the transmitter on elevator gyro gain (CH7) and rudder gyro gain (CH8) from 100% to 120%. The actual gyro gain is increased to 120% with this setting.

*Caution: It is not increased the gyro gain above 120% endpoint setting. 120% gain is maximum.

Control axe	Aileron		Elevator		Rudder	
	Mode	Gain	Mode	Gain	Mode	Gain
Take off/ Landing	Normal	70 %	Normal	70 %	Normal	70 %
Stunt flight	AVCS	40 %	AVCS	40 %	Normal	50 %
Torque-roll	Normal	20 %	AVCS	100 %	AVCS	100 %
Gyro off	AVCS	0 %	AVCS	0 %	Normal	0 %

◆ Elevon mode

It is an example of flying wing (delta wing) type of the aircraft. The flying speed is fast. This type of aircraft has sensitive control, so the gyro gain setting is relatively lower. The table shows the 3-axes control example. It will be 2-axes control at the no rudder control. It is unstable at the fast straight flight with this type of aircraft usually, but the gyros compensate the attitude changes quickly and stabilize the aircraft attitude, easier to make straight line flight and quick pylon turn.

Control axe	Aileron		Elevator		Rudder	
	Mode	Gain	Mode	Gain	Mode	Gain
Take off/ Landing	Normal	40 %	Normal	40 %	Normal	50 %
Stunt flight	AVCS	35 %	AVCS	35 %	Normal	40 %
Gyro off	AVCS	0 %	AVCS	0 %	Normal	0 %

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