



AVCS RATE GYRO GYA352

INSTRUCTION MANUAL

Thank you for purchasing a GYA352 AVCS gyro. 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.

- No part of this manual may be reproduced in any form without prior permission.
- The contents of this manual are subject to change without prior notice.
- This manual has been carefully written. Please write to Futaba if you feel that any corrections or clarifications should be made.

1 FOREWORD

The GYA352 is a high performance, compact, and light weight AVCS gyro developed for model airplane aileron, elevator, or rudder control. Two of these surfaces (axis) can be controlled by GYA352. Integrated sensor and control circuit simplifies mounting in the aircraft.

Features

•**Two axis control type (X-axis/Y-axis)**

Two axis of aileron, elevator or rudder can be simultaneously controlled by GYA352. (For aileron, always use X-axis.)

•**Built-in gyro mixing for Elevon/V-tail wing**

•**AVCS used**

Forward, climb, descent, back, knife edge, and other flying attitudes are maintained even when the wind shifts. Therefore, since meeting rudder is almost completely unnecessary, flying is easy. At the same time, the gyro automatically corrects bad tendencies of the aircraft.

•**SMM gyro sensor**

Newly developed very low drift SMM (Silicon Micro Machine) gyro sensor practically eliminates trim changes during flight.

•**Remote gain and mode switching functions**

Remote gain function lets you switch the gyro gain from the transmitter. AVCS mode/Normal mode/Gyro OFF can also be switched from the transmitter.

•**Integrated type, compact size, and light weight**

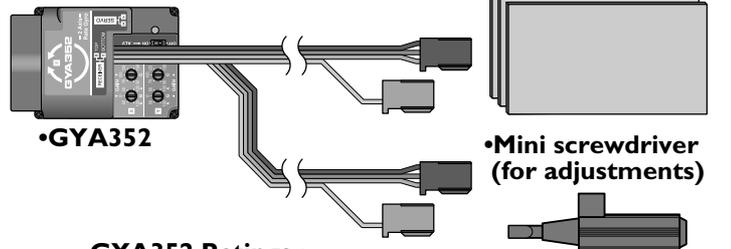
Compact size (43x30x30.5mm) and light weight (49.5g) have been achieved by the use of high density mounting technology.

•**Conductive resin case improves EMC resistance** (electrostatic, electromagnetic wave interference).



2 SET CONTENTS

The GYA352 comes with the following accessories:



•GYA352

•Double-sided tape (3 sheets)

•Mini screwdriver (for adjustments)

GYA352 Ratings :

- (Integrated sensor / two axis control type AVCS rate gyro)
- Control system: Digital advanced PI (Proportional Integration) control
- Gyro sensor: SMM (Silicon Micro Machine) system vibration gyro
- Operating voltage: +4 to +6VDC
- Dimensions: 43 x 30 x 30.5mm
- Weight: 49.5g (including connector)
- Functions: Gyro operation direction switch, Mixing switch, Gyro gain trimmer, and Control gain trimmer

Servos :

Gyro performance largely depends on the servo used. The faster and more responsive the servo, the higher the speed and the better the sensitivity and performance of the gyro.

3 NAME AND FUNCTION OF EACH PART

•**Monitor LED**

Monitors the operating status of the GYA352. See the table below for the display contents.

•**Servo output connector**

Connects the corresponding servo. (X-axis output/Y-axis output)

•**Control Gain trimmer (C GAIN)**

Adjusts the steering signal controlled variable. The effect of the rudder when the gyro is turned on can be adjusted. When the trimmer is turned clockwise, the controlled variable increases. (X-axis trimmer/Y-axis trimmer)

•**Gyro Gain trimmer (G GAIN)**

Adjusts the gyro gain. Adjust the gain to the maximum value at which hunting does not occur. The gain becomes "0" in the center. When Gain Switching connector is connected in the receiver, the gain adjustment is made from the transmitter. In this case, adjust within the "A" side. The value set with this trimmer becomes the reference. The gain can be adjusted by changing the servo deflection angle setting of the transmitter gain adjustment channel. When the gain adjustment is made only this trimmer, adjust within the "N" side. In this case, the gyro operates in the normal mode only. (X-axis trimmer/Y-axis trimmer)

•**Mixing on/off switch (ALV)**

Turns on or off the gyro mixing for Elevon/V-tail wing. When using the gyro mixing, this switch is set to the ON position. When not using the gyro mixing, this switch is set to the OFF position.

•**Control selector switch (CNT.X)**

Selects to match the flight control surface to be controlled (X-axis side). When using the GYA352 to control the ailerons, this switch is set to the AIL position. When using the GYA352 to control the elevator or rudder, this switch is set to the ELV position.

•**Gyro direction of operation selector switch (DIR.X, DIR.Y)**

Selects the direction of operation of the gyro. If the rudder moved when the fuselage was moved in the gyro control axis direction and the rudder moved to cancel this movement, the direction of operation is matched. If the aircraft is flown while the direction of operation is wrong, the gyro may apply reverse rudder and is very dangerous.

•**Servo input connector (black)**

Connects to the corresponding servo output connector of the receiver. (X-axis connector/Y-axis connector)

•**Gain switching connector (remote gain input)(red)**

Gyro gain switching signal input connector. Connects to the receiver gain switching channel output connector. The signal from this connector is also used to switch the AVCS and Normal operation modes simultaneously with gain switching. Since this connector is a single signal wire, do not pull on it forcefully. (X-axis connector/Y-axis connector)

(Monitor LED display)

LED display	Gyro operation status
Rapid flashing	Displayed while data is being initialized at power ON. (green)
Steady light	Shows that the gyro is operating in the AVCS mode.
Off	Shows that the power is OFF, or the gyro is operating in the Normal mode.
Slow flashing	Displayed when a control signal is not input from the transmitter.
Double flash	In the AVCS mode, displayed when the signal from the transmitter deviates from the neutral signal memorized at the gyro. Also displayed when a stick is operated.
Single flash	Displayed when the AVCS function is reset, and a neutral signal is sent to the servo. The LED flashes once when the gain selector switch was quickly switched between the Normal and AVCS positions three or more times and then left in the AVCS position, or when a transmitter stick was quickly moved to the left and right three or more times. After this display is performed, the servo moves to the neutral position. This display also flashes when the control selector switch was moved.

•Red; X-axis operation, Green; Y-axis operation, Orange; (simultaneous)

GYA352 operation modes

The GYA352 has two operations modes: AVCS mode and Normal mode.

Normal mode:

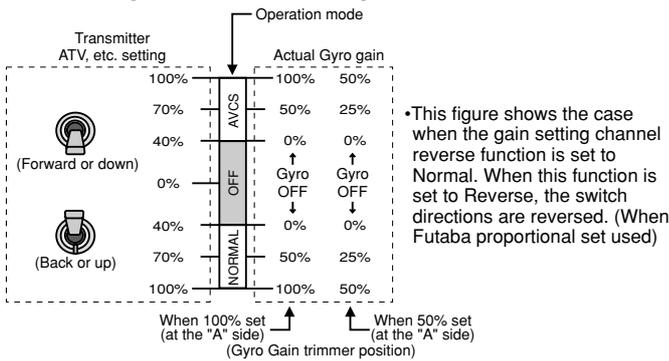
This mode performs general proportional control operation. For instance, it controls the gyro so that changes are countered when the attitude of the aircraft is changed by cross-wind, etc.

AVCS mode:

This mode performs both proportional and integrated control operation. The difference between Normal mode and AVCS mode operation is that whereas the Normal mode only counters changes in attitude, the AVCS mode returns to the original controlled variable simultaneously with countering changes in attitude. For example, during knife edge flying, aileron and elevator meeting rudder is normally necessary, but in the AVCS mode, meeting rudder is performed automatically by the gyro. Also, in the AVCS mode, high-speed control is possible, but when the usage method is incorrect, unintended operation may be performed. Before use, gain a thorough understanding by reading the Usage Precautions and Operation Instructions.

4 GAIN AND OPERATION MODE SETTING

The relationship between the travel adjustment functions (ATV, AFR, END POINT) settings and gyro gain when the gyro gain is switched using the transmitter switching channel is shown below.



•When Gyro Gain trimmer is set to the "N" side, the gyro operates in the normal mode at both side of the switch directions.

Gyro OFF setting:

As shown in the figure, when the ATV rate of the gain setting channel is 40% or less, the gyro gain becomes zero. When you want to turn off the gyro, set to this range (40% or less).

AVCS mode gain setting:

(in case of "A" side of the Gyro Gain trimmer)

When the ATV_B rate is 40% or more, the gyro operates in the AVCS mode. The actual gyro gain changes based on the Gyro Gain trimmer setting of the gyro itself. When the Gyro Gain trimmer is set to 100%, the gyro gain becomes 100% at 100% ATV rate and becomes 50% at 70% ATV rate. When the Gyro Gain trimmer is set to 50%, when the ATV rate is 100%, the gyro gain becomes 50% and when the ATV rate is 70%, the gyro gain becomes 25%.

Normal mode gain setting:

(in case of "A" side of the Gyro Gain trimmer)

When the ATV_A rate is 40% or more, the gyro operates in the Normal mode. The gyro gain setting can be adjusted the same as in the AVCS mode.

When gain switching from transmitter function not used:

The gyro gain switching connector is not connected to the receiver. In this case, when Gyro Gain trimmer is set to "A"/"B" side, the gyro operates in the AVCS/normal mode severally. The gyro gain is set using the Gyro Gain trimmer.

5 OPERATION INSTRUCTIONS

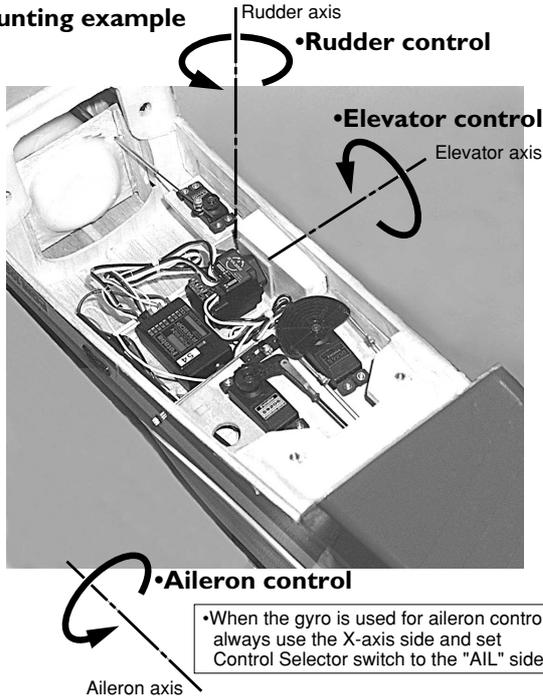
Mount and adjust the GYA352 as described below.

Gyro Mounting Method

Make a gyro bed so that the bottom of the gyro body is perpendicular to the direction of the axis (X-axis, Y-axis) to be controlled and securely install the gyro with the accessory double-sided sponge tape at a position which vibrations are minimal.

- If this axis changes, the gyro also responds to the changes of other axis.
- In order to raise attachment intensity, always fix two bottoms of the gyro body to fuselage with two double-sided sponge tapes.

Mounting example



Beginner setting

(When there is no vacant receiver channel)

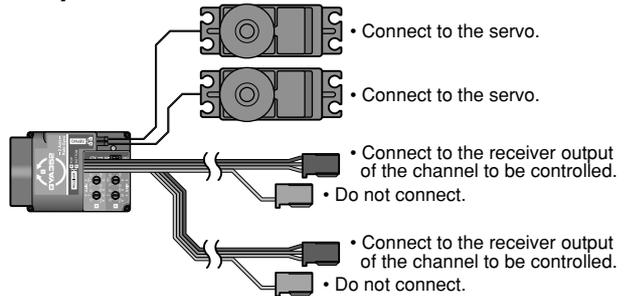
Use this setting method when there is no vacant receiver channel. Use the GYA352 in the Normal mode only.

Mounting to fuselage and initial setting

1. Gyro mounting

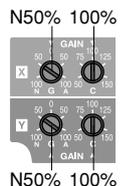
Mount the gyro to the axis you want to control in accordance with "Gyro Mounting Method".

2. Gyro connection



3. Trimmer setting (Initial)

Set the X-axis and Y-axis Gyro Gain trimmers to about the N50% position. Do not set them to the A side. Taking off and landing in the AVCS mode is dangerous. Set the X-axis and Y-axis Control Gain trimmers to about the 100% position.



4. Controlled axis selection

When using the GYA352 to control the ailerons, set the Control selector switch to the AIL position. When using the GYA352 to control the elevators or rudder, set the Control selector switch to the ELV position.

Control selector switch (CNT.X)

Mixing on/off switch (ALV)

5. Operation mode selection

When using the gyro mixing for Elevon/V-tail wing, this switch is set to the ON position. In this case, do not use the transmitter mixing function for Elevon/V-tail wing.

In case of Elevon wing, always use the X-axis for the aileron control and the Y-axis for the elevator control. In case of V-tail wing, always use the X-axis for the rudder control and the Y-axis for the elevator control. The linkage of two servos must be symmetrical. If not, the gyro will operate in the wrong direction and result in a dangerous situation.

When not using the gyro mixing, this switch is set to the OFF position.

6. Power ON procedure

Turn on the transmitter power, then turn on the receiver and gyro power. After the gyro power is turned on, initialization is automatically performed for about three seconds. Never move the aircraft during this period. During initialization, the gyro monitor LED flashes green.

7. Gyro direction of operation check

Tilt the aircraft about the controlled axis, and check if the gyro applies rudder in the direction opposite the direction of tilt. If the rudder moves in the opposite direction switch the gyro direction of operation selector switch.



Usage Precautions

- When taking off and landing, always switch to the Normal mode. Taking off and landing in the AVCS mode is dangerous.
- We recommend that you use the rudder control gyro in the Normal mode. In the AVCS mode, rudder operation is necessary when turning to prevent weathervaneing. Use the gyro in the Normal mode unless you are an expert in rudder operation.
- When the gyro is ON, the servo operating angle increases. Increase the travel width of the flight control surfaces so that they will not strike the linkage even when the servo is operated to its maximum deflection angle.



- Always use the miniature screwdriver supplied to operate the GYA352 selector switches and trimmers. Do not apply excessive force.

Flight adjustments

1. Power ON procedure

Turn on the transmitter power, then turn on the receiver and gyro power. If the gyro power is turned on, initialization is automatically performed for about three seconds. Never move the aircraft during this period.

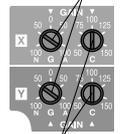
2. Trimming

Fly and trim the aircraft. If there is a large mechanical deviation, correct the linkage. Connect the linkage so that the servo horns are as close to the center position as possible and the transmitter trimmers are also at the center position.

3. Gyro gain adjustment

When the servo hunts, the gyro gain is too high. Lower the gain with the Gyro Gain trimmer until the hunting stops. The gyro will display best performance at a gain just before hunting occurs. Perform trimming by flying the aircraft repeatedly.

Gyro Gain trimmer (G GAIN)



Control Gain trimmer (C GAIN)

4. Rudder effect adjustment

Use the transmitter steering angle adjustment function to adjust the rudder effect.

However, when the rudder effect is substantially different from that when the gyro was not mounted, adjust it with the Control Gain trimmer.

When the gyro is turned on, the rudder will feel sluggish. Adjust the control gain so that the rudder effect matches the rudder effect when the rudder stick is set to its maximum position. When the control gain is increased, the rudder effect increases.

Standard Setting

(Setting using all GYA352 functions)

This standard setting controls gain switching and AVCS/Normal gyro operation mode switching from the transmitter.

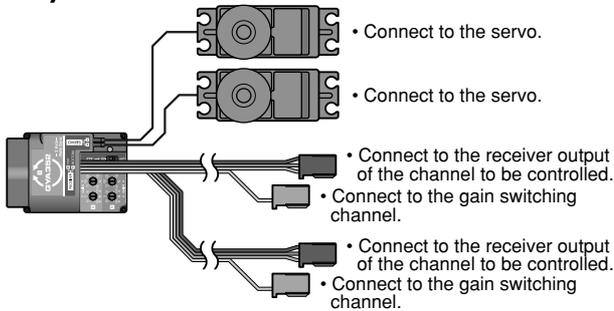
However, two vacant channels are necessary to switch the gain and operation mode. When there are not enough vacant channels, do not connect the gain switching connector and operate the gyro in the Normal mode only. The gain of the gyros of two axis can also be switched simultaneously using a branch cord.

Mounting to fuselage and initial setting

1 Gyro mounting

Install the gyro to the axis to be controlled in accordance with "Gyro Mounting Method".

2 Gyro connection

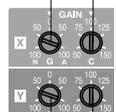


When there is no vacant channel that can be used for gain switching, "Standard setting" cannot be performed. See "Beginner setting". When there is one vacant channel only, use a branch cord to simultaneously switch the gain of two axis.

3. Trimmer setting (Initial)

Set the X-axis and Y-axis Gyro Gain trimmers to the A100% position. Set the X-axis and Y-axis Control Gain trimmers to about the 100% position.

A100% 100%



4. Controlled axis selection

When using the GYA352 to control the ailerons, set the Control selector switch to the AIL position. When using the GYA352 to control the elevators or rudder, set the Control selector switch to the ELV position.

A100% 100%



Control selector switch (CNT.X)

5. Operation mode selection

When using the gyro mixing for Elevon/V-tail wing, this switch is set to the ON position. In this case, do not use the transmitter mixing function for Elevon/V-tail wing.

In case of Elevon wing, always use the X-axis for the aileron control and the Y-axis for the elevator control. In case of V-tail wing, always use the X-axis for the rudder control and the Y-axis for the elevator control. The linkage of two servos must be symmetrical. If not, the gyro will operate in the wrong direction and result in a dangerous situation.

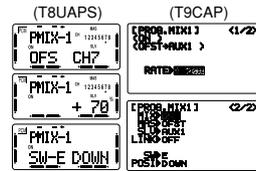
When not using the gyro mixing, this switch is set to the OFF position.

6. Gain setting

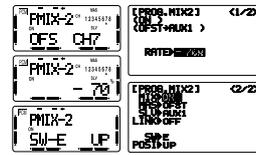
Set the gain as described below.

(Gain setting with T8UAPS or T9CAP example 1)

The following describes how to use CH7 to switch the X-axis gain and CH8 to switch the Y-axis gain.



- Call the transmitter P-MIX1 screen, and make the following settings:
 - Activate P-MIX1.
 - Set master channel to OFS(OFS).
 - Set slave channel to CH7(AUX1).
 - Set mixing rate to +70%.
 - Select switch SW-E.
 - Select switch direction DOWN.



- Call the transmitter P-MIX2 screen, and make the following settings:
 - Activate P-MIX2.
 - Set master channel to OFS(OFS).
 - Set slave channel to CH7(AUX1).
 - Set the mixing rate to -70%.
 - Select switch SW-E.
 - Select switch direction UP.



(CH7 knob)



- Lock the transmitter CH7 knob in the 0% position. This sets the X-axis gyro gain to 50%.
 - When SW-E is in the forward, center, and backward positions, the GYA352 operates in the AVCS, OFF, and Normal modes, respectively.



- Call the transmitter P-MIX3 screen, and make the following settings:
 - Activate P-MIX3.
 - Set master channel to OFS(OFS).
 - Set slave channel to CH8(AUX2).
 - Set mixing rate to +70%.
 - Select switch SW-E.
 - Select switch direction DOWN.



(CH8 knob)



- Call the transmitter P-MIX4 screen, and make the following settings:
 - Activate P-MIX4.
 - Set master channel to OFS(OFS).
 - Set slave channel to CH8(AUX2).
 - Set mixing rate to -70%.
 - Select switch SW-E.
 - Select switch direction UP.

- Lock the transmitter CH8 knob in the 0% position. This sets the Y-axis gyro gain to 50%.
 - When SW-E is in the forward, center, and backward positions, the GYA352 operates in the AVCS, OFF, and Normal modes, respectively.

(Gain setting with T8UAPS or T9CAP example 2)

The following describes how to use CH5 to switch the X-axis and Y-axis gains simultaneously. Connect the X-axis and Y-axis Gain switching connectors to the receiver CH5 output using a branch cord.

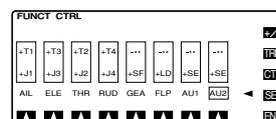


- Call the transmitter CH5 ATV(E.POINT) screen and make the following setting:
 - Set the rate of both directions of the CH5 switch to 70%. This sets the gyro gain to 50%.

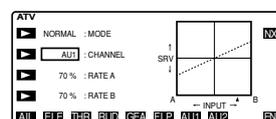
*In the switch forward position, the gyro operates in the AVCS mode and in the switch backward position, the gyro operates in the Normal mode.

(Gain setting with T9ZAP example)

The following describes how to use vacant channels 7 and 8 to switch the gain of the X-axis and Y-axis.



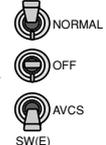
- Call the transmitter function control functions screen, and make the following settings:
 - Set switch SE to AU1(CH7) and AU2(CH8).



- Call the transmitter ATV function screen, and make the following settings:
 - Select AU1(7CH) and AU2(8CH) and set both RATEA and RATEB to 70%.

This sets the gain of the X-axis and Y-axis to 50% each.

*When SW(E) is set to the forward, center, and backward positions, the GYA352 operates in the AVCS, OFF, and Normal modes, respectively.



7. Power ON procedure

Turn on the transmitter power, then turn on the receiver and gyro power. Initialization is performed automatically for about three seconds after the gyro power comes on. Do not move the aircraft during this period. During initialization, the gyro monitor LED flashes green. When the gain selector switch is set to the AVCS position, the monitor LED changes to a steady light (X-axis; red, Y-axis; green.) When the gain selector switch is set to the Normal position, the LED goes off.

8. Gyro operation direction check

Tilt the aircraft about the control axis, and check if the gyro moves in the direction opposite the tilt direction.

If the gyro moves in the opposite direction, switch the Gyro direction of operation selector switch.



Flight adjustment

1. Power ON procedure

Turn on the transmitter power, then turn on the receiver and gyro power. Initialization is performed automatically for about three seconds after the gyro power comes on. Do not move the aircraft during this period.

2. Trim adjustment

Set the gyro gain switch to the Normal or OFF position. The monitor LED goes off. Fly and trim the aircraft in this state. When the mechanical deviation is large, correct the linkage. Connect the linkage so that the servo horn and transmitter trims are in the center position.

3. Gyro gain adjustment

When the servo hunts, the gyro gain is too high. Lower the gyro gain until the hunting stops. The gyro displays top performance at a gain just before hunting begins. Perform trimming by flying the aircraft repeatedly. Adjust the gain by raising and lowering the transmitter ATV or mixing rate.

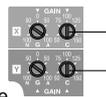
4. Rudder effect adjustment

Use the transmitter deflection angle adjustment function to adjust the rudder effect.

However, when the rudder effect is substantially different from that when the gyro is installed, adjust it using the control gain trimmer.

When the gyro is turned on, the rudder will feel sluggish. Adjust the control gain to match the rudder effect when the stick is set to its maximum position. When the control gain adjustment amount increases, the rudder effect increases. Adjust the linkage so that use is possible at a transmitter deflection angle setting of 70% or more.

Control gain trimmer (C GAIN)



5. AVCS side neutral data memorization

The neutral data can be memorized by following process. After landing the aircraft, set the rudder stick to the neutral position and rapidly switch the transmitter gain switch between the AVCS and Normal positions at least three times at an interval of within one second and then set the gain switch to the AVCS position. In this case, the monitor LED flashes once to show that memorization is complete. The neutral data can also be memorized by setting the gain switch to the AVCS position and turning on the gyro power again. When using flight conditions, verify that the gyro monitor LED lights under all the flight conditions used. If the LED flashes twice, trim of that flight condition has changed. Repeat transmitter trim adjustment. This ends AVCS side setting.

6. Switch to the AVCS or Normal mode, as desired.

In the AVCS mode, meeting rudder is seldom necessary because trim changes during knife edge and upside-down flight are compensated for by the gyro. Conversely, when the aircraft enters a stall condition in the low speed state, the gyro continues to apply correction rudder and the aircraft may enter an unintended attitude. To avoid stalling in such a state, return to normal attitude as soon as possible by increasing engine power and applying reverse rudder, or switch the gyro to the Normal mode.

Using AVCS correctly

The AVCS type gyro controls the attitude of the aircraft by constantly comparing the transmitter operation signals and the gyro internal reference signal (transmitter neutral signal). Therefore, for the AVCS function to operate normally, the rudder neutral signal must be memorized at the gyro before flight.

Neutral signal memorization

There are two methods of memorizing the neutral signal.

[Method 1] When the gyro power is turned on, the signal received from the transmitter at that time is assumed to be the neutral signal and is memorized at the gyro. The gyro is normally used in this state.

[Method 2] The neutral position can also be memorized by rapidly switching the transmitter gain switch between the AVCS and Normal positions at least three times at an interval of within one second. In this case, the monitor LED flashes once to show that memorization is complete.

When the trim was changed during flight, the memorized neutral position can be updated to the current neutral position by repeating this operation. When this performing this operation, kept the stick in the neutral position.

Neutral check method

In the AVCS mode, the servo does not return to the neutral position even though the stick is returned to neutral. When you want to check the servo neutral position during linkage neutral check, etc., set the gain switch to the Normal position, or quickly move the transmitter stick to the left and right at least three times and immediately return the stick to the neutral position.

Dead zone of servo operation

A dead zone is produced in servo operation relative to stick operation. However, this is because the stick control gain rises and is not an abnormality.

⚠ Caution Mounting Precautions

- ① Always use the accessory sensor tape to install the gyro to the fuselage.

This is necessary to securely fasten the gyro to the fuselage so that operation of the gyro does not transmit unwanted fuselage vibrations directly to the sensor.

- ① When mounting the gyro, provide a little surplus so that the gyro connection cables are not too taut.

If the gyro cables are too taut, the gyro will not display its full performance. If the gyro peels, control will be lost and result in a dangerous situation.

- ① When using the gyro with a airplane, install the GYA352 at least 10cm from the drive motor and at least 2 cm from the servo.

The drive motor etc. generates strong electromagnetic noise. This noise may interfere with the gyro sensor and cause erroneous operation.

- ① Mount the GYA352 so that metals or other conductive objects do not touch the gyro case.

The GYA352 uses a conductive resin case to reduce electromagnetic interference. Because the surface of the case is conductive, metal objects may cause a short circuit.

- ① Insert the connectors fully.

If a connector works loose due to vibration during flight, control may be lost and result in a dangerous situation.

- ① Always check the direction of operation of the servos.

If you attempt to fly the model when a servo operates in the wrong direction, the fuselage will spin in a fixed direction and enter an extremely dangerous state.

Operation Precautions

- ⊘ Never move the fuselage for about 3 seconds after turning on the gyro power. (when using in the AVCS mode)

Since the data inside the gyro is automatically initialized as soon as the power is turned on, if the fuselage is moved, the neutral position will change. If this occurs, turn the power off and on again. When turning on the power, set the transmitter switch to the AVCS position

and turn on the transmitter power switch, then turn on the gyro power.

- ⊘ Do not operate the trim while flying in the AVCS mode.

When the power is turned on, the GYA352 assumes that the stick is in the neutral position. If the trim is moved during flight, the neutral position will change.

- ⊘ Avoid sudden temperature changes.

Sudden temperature changes will cause the neutral position to change. For instance, do not fly the model immediately after removing it from inside a heated vehicle in the winter and an air conditioned vehicle in the summer. Let the model stand for about 10 minutes to allow the temperature inside the gyro to stabilize before turning on the power. Also, consider sudden temperature changes when the gyro is exposed to direct sunlight or is installed near the engine. Take measures so that the gyro is not exposed to direct sunlight.

- ⊘ Do not stall the aircraft.

When the aircraft enters the stall condition, and the gyro tries to maintain its original attitude by applying full rudder. This results in assisting the stall. If the nose remains up and the aircraft stalls when landing, etc., the gyro will try to maintain that attitude by applying more up elevator.

- ⊘ Do not use the AVCS mode when taking off and landing.

From the standpoint of the operation characteristics, taking off and landing in the AVCS mode is dangerous. When taking off and landing, use the gyro in the normal mode.

- ① When using the gyro in the AVCS mode, turn off mixing.

For example, if elevator down mixing is used by the air brake, the gyro will judge that an elevator down signal was received and will cause the aircraft to dive. In the AVCS mode, the gyro automatically changes the trim and, therefore, these mixings are unnecessary. When mixing is necessary, set so that the gyro enters the Normal mode when mixing is ON.

- ① Check the operating time of the receiver, gyro, and servo batteries at the adjustment stage and decide the number of remaining flights while allowing a margin.

Fuselage Maintenance Precautions

- ⊘ Do not turn the sensitivity trimmer with too much force.

The trimmer may break. Always use the miniature screwdriver supplied to make adjustments.

- ① Service the fuselage with a little vibration as possible.

Fuselage vibration has a very adverse effect on gyro performance.

Special Markings

Pay special attention to the safety at the parts of this manual that are indicated by the following marks.

Mark	Meaning
⚠ Danger	Procedures which may lead to a dangerous condition and cause death or serious injury to the user if not carried out properly.
⚠ Warning	Procedures which may lead to a dangerous condition or cause death or serious injury to the user if not carried out properly, or procedures where the probability of superficial injury or physical damage is high.
⚠ Caution	Procedures where the possibility of serious injury to the user is small, but there is a danger of injury, or physical damage, if not carried out properly.

Symbol: ⊘ ; Prohibited ① ; Mandatory