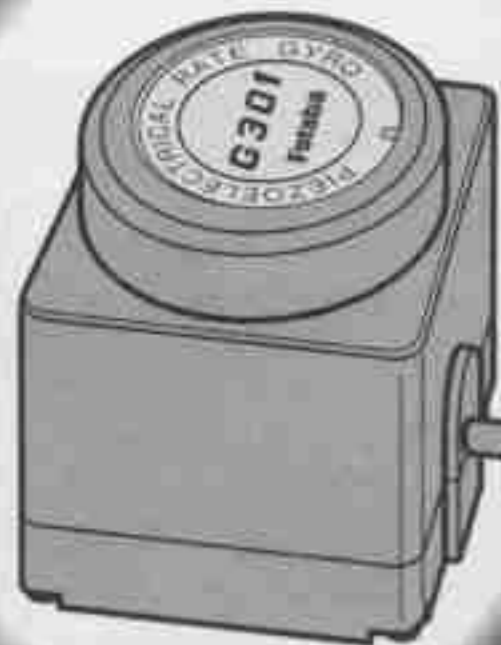


Futaba

**Piezoelectric
Rate Gyro**



G301

**INSTRUCTION
MANUAL**

Rate gyro for models

1M23N03802

- Please read this manual before using the G301.
- Keep this manual close at hand so that you can refer to it immediately.

Recommended Servo

When used with the S9203, G301 will yield maximum performance.

- All, or part, of this manual may not be reproduced without prior permission.
- The contents of this manual are subject to change without prior notice.
- This manual has been carefully written, but if you find anything that you do not understand or that is incorrect, please contact Futaba.
- Futaba is not responsible for use of this gyro by the user.
- "Futaba" is a registered trade mark.

1 Foreword

Thank you for purchasing a Futaba G301 piezoelectric rate gyro. The G301 is used with model helicopters and fixed wing aircraft when wanting to suppress changes in the aircraft's attitude by changes in air currents, engine torque, etc.

The G301 features a very fast response speed, high gyro sensitivity and wide dynamic range made possible by using a piezoelectric ceramic element as the angle sensor.

Explanation Of Symbols

For safety, the parts indicated by the following symbols require special attention.

⚠ Danger

Indicates a procedure that could result in death or serious injury to the user or other persons if ignored or not carried out properly.

⚠ Warning

Indicates a procedure that could result in death or serious or superficial injury to the user or other persons, or physical damage, if not carried out properly.

⚠ Caution

Indicates a procedure that could result in superficial injury to the user or other persons, or physical damage only, if not carried out properly.

Graphic Symbols

- ⊘ ; Operation that must not be performed.
- ⓘ ; Operation that always must be performed.

2 Features

Minimizes Changes In An Aircraft's Attitude By Wind, Etc.

The especially high frequency response of the piezoelectric gyro allows an increase in gyro sensitivity. The original ability of a gyro to suppress changes in an aircraft's attitude due to wind and engine torque changes and other unexpected phenomena has been increased substantially.

Angular Acceleration Commands Used.

To take advantage of the wide dynamic range of the piezoelectric gyro, angular acceleration commands are used. The transmitter stick operating angle becomes the aircraft command for angular acceleration and the aircraft rotating speed is proportional to the stick operating angle that is obtained while maintaining stabilization performance. This is the greatest merit of the piezoelectric rate gyro over conventional gyros. Fixed rotation of the aircraft can be commanded by the transmitter stick operating angle.

Piezoelectric Gyro Drift Cancellation.

Deviation of the gyro from the direction to be maintained (neutral) is called drift. When the power is turned on, the G301 senses this drift and automatically compensates it during gyro operation.

Sensor Vibrationproofing.

A special suspension is built into the gyro to vibration-proof the sensor element itself. The sensor is protected against unwanted vibrations around the sensor shaft while maintaining high response.

Simple Sensitivity Adjustment.

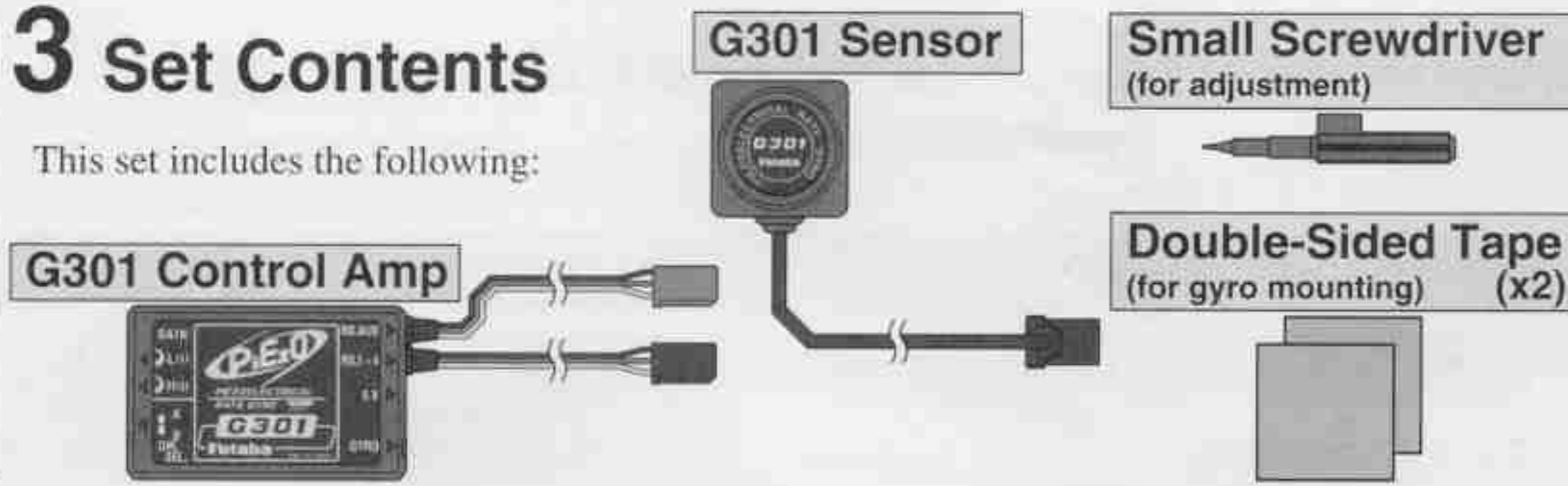
High side and low side sensitivity can be easily adjusted from 0 to 100% each by means of control amp trimmers. The sensitivity can also be adjusted from the transmitter.

(Terminology) Piezoelectric Gyro

Whereas the conventional gyro uses a rotating body to sense angular acceleration, the piezoelectric gyro uses a piezoelectric ceramic element. When rotation angular acceleration is applied while the piezoelectric ceramic element is vibrating, force proportional to the rotation angular acceleration is generated in the direction perpendicular to the direction of vibration. The piezoelectric element is flexed by this force and the angular acceleration is sensed by extracting the change of this vibration as an electric signal. The gyro is called a piezoelectric gyro because of this principle. An amplifier processes the sensed signal, together with the control signal from the transmitter, and controls the servo.

3 Set Contents

This set includes the following:



Ratings (G301)	
•Power supply voltage:	4.8V (shared with receiver)
•Current drain:	18mA (at 4.8V)
•Dimensions:	(Gyro sensor) 1.18x1.18x1.22in (30x30x31mm) (Control amp) 2.40x1.50x0.53in (61x38x13.5mm)
•Weight:	1.83oz (52g)

4 Mounting And Connections

Mount the gyro so that it is on a straight line with the axis you want to stabilize as shown in the mounting example.

Helicopter Yaw Axis Stabilization

Rudder use

Connector A: To receiver rudder channel
Rudder Servo: To sx output of control amp

Aircraft Roll Axis Stabilization

Aileron use

Connector A: To receiver aileron channel
Aileron Servo: To sx output of control amp

Aircraft Pitch Axis Stabilization

Elevator use

Connector A: To receiver elevator channel
Elevator Servo: To sx output of control amp

Caution

Mounting Precautions

- ❗ Use a tail rotor drive tube or other part with a high torsion performance for the tail drive.
- ❗ Take the strength of the tail into account during inspection and adjustment.

The amount of improvement of gyro performance has a considerable effect on the fuselage vibration level or the size, type, linkage method, looseness, etc. of the tail rotor.

Since a higher gain than usual can be used then the tail rotor is more effective, the load on the tail is also greater.

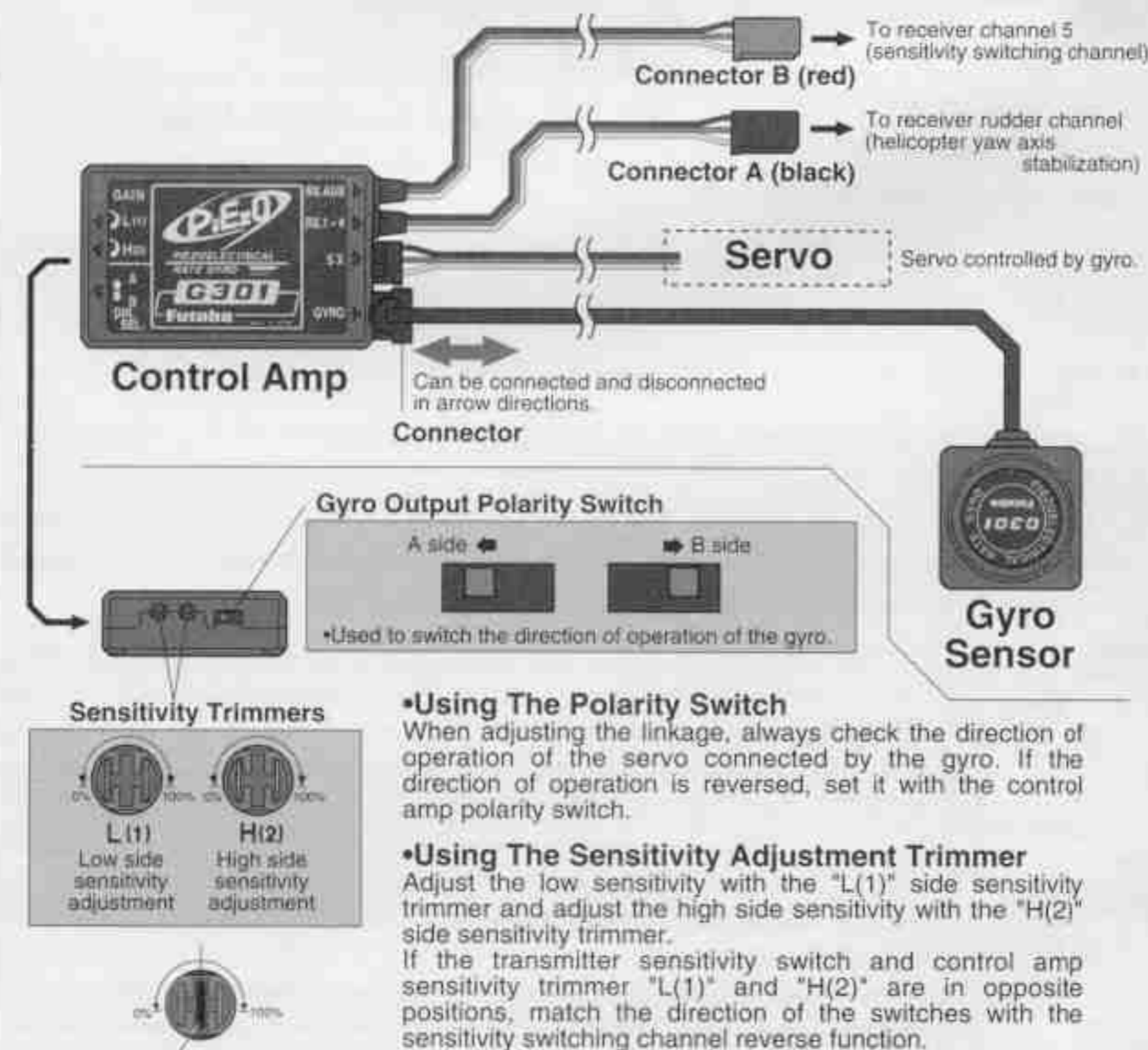
Gyro Sensor Mounting

- ❗ Stick one double-sided tape to the entire bottom of the sensor:
(Use the double-sided tape supplied with the gyro.)

So that unwanted vibrations of the fuselage are not directly transmitted to the sensor and the gyro is fastened firmly to the fuselage.

Control Amp Mounting

- ❗ Wrap the control amp in sponge and mount it the same as the receiver.



Caution

Precautions When Turning On The Receiver Power

- ⊘ Do not move the aircraft for four or five seconds after turning on the gyro power (shared with receiver).

Since initialization is automatically performed inside the gyro immediately after the power is turned on, if the aircraft is moved at that time, the neutral position will change. In this case, turn on the power again.

At this time, the rudder servo (servo controlled by gyro) moves to the home position after the servos on the other channels, but this is normal.

Using The Polarity Switch

When adjusting the linkage, always check the direction of operation of the servo connected by the gyro. If the direction of operation is reversed, set it with the control amp polarity switch.

Using The Sensitivity Adjustment Trimmer

Adjust the low sensitivity with the "L(1)" side sensitivity trimmer and adjust the high side sensitivity with the "H(2)" side sensitivity trimmer. If the transmitter sensitivity switch and control amp sensitivity trimmer "L(1)" and "H(2)" are in opposite positions, match the direction of the switches with the sensitivity switching channel reverse function.

Note: Set the direction of operation of the servo by transmitter stick operation with the transmitter reverse function and the direction of operation of the servo by gyro operation with the gyro polarity switch.

Always adjust the trimmer by inserting the accessory miniature screwdriver into the black painted part shown in the figure above.

Small Step Servo Operation

When the model is stopped, the servo may move a short step. However, this is normal and phenomena occurs because the gyro sensitivity is set to a high value.

5 Sensitivity Adjustment

There are two methods of adjusting the sensitivity.

Adjustment At The Gyro

The sensitivity can be arbitrarily set over the 0 to 100% range to correspond to the position of the transmitter sensitivity switch with the control amp sensitivity high side and low side trimmers.

1> Set the transmitter CH5 reverse function to the normal side and preset the ATV function to 90% in both directions.

2> (Hovering Sensitivity)

When the CH5 (sensitivity switching) switch is in the front position, the sensitivity can be adjusted from 0 to 100% with the control amp high side trimmer.

Setting criteria:

Approximately 75%



3> (Climbing Sensitivity)

When the CH5 (sensitivity switching) switch is in the rear position, the sensitivity can be adjusted from 0 to 100% with the control amp low side trimmer.

Setting criteria:

Approximately 45%



Adjustment From The Transmitter

When ATV Function Is Used

1> Set the transmitter CH5 reverse function to the normal side.

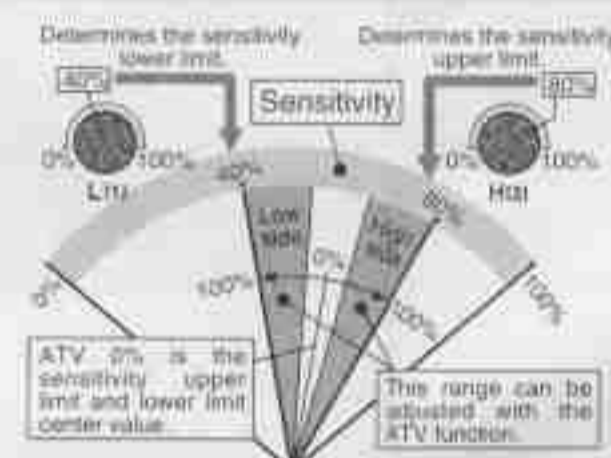
2> (Adjustment Range Setting)

The sensitivity adjustment range can be changed with the control amp high side and low side trimmers. The high side trimmer adjusts the sensitivity upper limit and the low side trimmer adjusts the sensitivity lower limit.

Setting criteria:

Upper limit: Approximately 80%

Lower limit: Approximately 40%



3> (Hovering Sensitivity)

Adjust the CH5 switch front position ATV rate and adjust the sensitivity high side. The higher the ATV value, the higher the sensitivity.

Setting criteria:

Approximately 75% (ATV rate)



4> (Climbing Sensitivity)

Adjust the CH5 switch rear side ATV rate and adjust the sensitivity low side. The higher the ATV value, the lower the sensitivity.

Setting criteria:

Approximately 75% (ATV rate)



Note: When a PCM1024Z Series transmitter is used, the entire sensitivity lower limit to upper limit range can be changed by using the AFR function instead of the previously mentioned ATV function.

When Using PCM1024Z Series Transmitter

1> (Adjustment Range Setting)

Set the control amp high side and low side trimmers as shown in the figure so that the sensitivity can be adjusted from 0 to 100% from the transmitter.

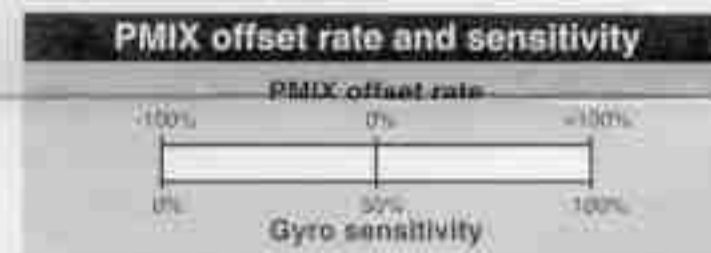


2> Next, set the transmitter as follows for each flight condition.

(Programmable Mixing Setting) (PMIX)

- Set PMIX to one circuit.
- Select "OFS" (offset) type.
- Make CH5 (GYR) the slave channel.

In this state, the gyro sensitivity for each flight condition (hovering, forward flight, etc.) can be arbitrarily set by setting the PMIX function rate. The following shows the relation between mixing rate and gyro sensitivity.



(Function Control Setting) (FNC)

At this time, release the CH5 (GYR) switch by software as follows:

- Set the CH5 (GYR) switch to "NUL" (not used state).

(ATV Function Setting) (ATV)

Also set the CH5 (GYR) ATV function to the following value:

- Set the CH5 (GYR) ATV function to 100% in both directions.

⚠ Caution

Operating precautions

- ⊘ Do not move the aircraft for four or five seconds after turning on the gyro power (shared with receiver).

Since initialization is automatically performed inside the gyro immediately after the power is turned on, if the aircraft is moved at that time, the neutral position may change. In this case, turn on the power again.

If the gyro remains in the static state for a long time, the neutral position may change. In this case, correct it by turning on the power again.

- ⊘ Do not adjust the rudder channel throw (ATV function) when the aircraft is static.

The transmitter rudder channel is operated as the angular acceleration command. Use ATV function to adjust the rudder effect.

- ⚠ Avoid sudden temperature changes.

Sudden temperature changes will cause the neutral position to change. For example, in the winter, do not fly immediately after removing the model from inside a heated car and in the summer, do not fly immediately after removing the model from inside an air conditioned car. Allow the model to stand for about 10 minutes and turn on the power after the temperature inside the gyro has stabilized. Also, if the gyro is exposed to direct sunlight or is mounted near the engine, the temperature may change suddenly. Take suitable measures so that the gyro is not exposed to direct sunlight, etc.

- ⚠ Check the remaining receiver and gyro servo nicd battery operating time during the adjustment stage and decide how many flights are remaining.

6 Adjustment Procedure

The following describes the adjustment procedure when the G301 is used with a helicopter. Make these adjustments after all the connections are complete.

Rudder Linkage Adjustment

Place the transmitter into the neutral state and adjust the rod as described below so that the neutral position is near the center.

1> Start the rudder ATV function from 100% in both directions. ----- (ATV Function Setting)

2> Set rudder subtrim to 0%. Set rudder trim to the center. Set the throttle stick to the center. (When revolution mixing is on.) ----- (Neutral Setting)

3> In this state, turn on the power in transmitter and receiver order. At this time, do not move the aircraft for about four or five seconds. ----- (Turn On The Power)

4> Operate the transmitter stick and check the direction of the rudders. If the direction is incorrect, reverse it. (Use the transmitter reverse function.) ----- (Rudder Direction)

5> Change the servo horn spline so that the horn is perpendicular to the rod and servo. ----- (Servo Horn Mounting)

* Basically, make the servo horn the length specified by the fuselage manufacturer.



6> When the nose of the aircraft swings back and forth, check the direction of rudder. If reversed, switch it with the gyro control amp polarity switch. ----- (Gyro output polarity check)

⚠ Caution

❗ Be sure that the gyro output polarity is correct.

If the aircraft is flown at reverse polarity, it may swing severely in a fixed direction and this is dangerous.

7> Set the control amp high side trimmer for maximum sensitivity (fully clockwise) and the low side trimmer for minimum sensitivity (fully counterclockwise) and check that the sensitivity switch high side (CH5 switch front position) and low side (CH5 switch rear position) relationship is correct. ----- (Sensitivity select switch direction check)

Adjustment during flight

Before Flight

- Since the piezoelectric gyro uses an angular acceleration command control system, the rudder has an excellent effect despite the high gain. If hovering was performed at 100% dual rate (rudder) in the past, reduce it to about 60 to 80%. When you want to perform a fast spin, use 100%.
- Since the rudder is very effective near the neutral position, use the rudder exponential function. (40 to 60% for hovering, 60 to 80% for forward flight)
- Set rudder trim, rudder offset, and revolution mixing rate to about 1/3 of their normal value. Start rudder offset from neutral.

Sensitivity Adjustment Points

- The suitable sensitivity depends on the fuselage, tail rotor, tail drive shaft, servo, and servo horn. However, when starting adjustment, start with the following value as the set value standard.

Sensitivity setting for hovering: 70 to 80%

Sensitivity setting for forward flight and aerobatics: 40 to 50%

- Adjust the sensitivity within the range at which hunting does not occur when moved during hovering.
- If the aircraft was suddenly stopped during operation at a high angular acceleration, hunting may occur. Adjust the sensitivity so that hunting does not occur over the necessary operating range.
- For forward flight, adjust the sensitivity within the range at which does not occur hunting.

Note 1) If the gyro sensitivity does not increase, make the diameter of the tail rotor smaller, or make the length of the servo horn shorter.

Note 2) If the gyro sensitivity is low, make the diameter of the tail rotor larger, or make the length of the servo horn longer.

Note 3) The characteristics change with the tail rotor blade. Try changing the diameter, etc..

Trim Adjustment

- If the trim changes, use the fuselage rod to adjust the trim to near the neutral position.

Revolution Mixing Adjustment

- Make the mixing amount small. If the mixing amount is large, control is in the reverse direction. (About 1/3 of normal)

Rudder Steering Angle Adjustment

- Perform left and right pirouette. If the left and right rotation speeds are different, reduce the high side by rudder ATV function.

Fuselage maintenance precautions

⊘ Do not turn the sensitivity adjustment trimmers with too much force.

The trimmers may be damaged.

❗ Always perform proper maintenance for ultimate performance.

The rigidity of the fuselage tail has a large effect on gyro performance.

❗ Make the fuselage vibration as small as possible.

Fuselage vibration has an adverse affect on gyro operation.

Repair Service

Before requesting repair, please refer to this instruction manual again and verify your settings. If you are still experiencing trouble, please request service as follows:

Address: Your nearest Futaba dealer.

Repair information: Describe the trouble in as much detail as possible.

- 1) Symptom: Including the state of the set when the trouble occurred.
- 2) Digital proportional set used: Transmitter, receiver, and servo model numbers.
- 3) Fuselage: Fuselage name and mounting conditions.
- 4) Your name, address, and telephone number.

Warranty contents:

Read the warranty card supplied with your set.

The warranty contents differ with geographic locations.

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