NEJ-1000 PIEZO GYRO SYSTEM

JR
feel the difference!

FEATURES

- **Highest performance gyro system available**
- **No moving parts with nearly unlimited lifetime**
- **Linear dynamic range up to 720 degrees per second**
- **10 times faster response time**
- **Remote proportional gain control adjustable from the transmitter**
- **Patented offset drift canceler**
- **Compatible with JR and Futaba systems**

SPECIFICATIONS

Operating Voltage:	4.8 - 6.0V
Operating Current:	80 mAh
Dimensions/Weight:	
Gyro Sensor:	33x33x34mm/43g
Amplifier:	38x53x16mm/12g
Remote Gain Controller:	24x53x16mm/12g
Dynamic Range:	0 - 720° per second

INTRODUCTION

JR's patented NEJ-1000 represents a tremendous innovative technological breakthrough. Unlike standard electro-mechanical gyros that use a motor, flyweights, bearings, etc., the Piezo Gyro System is totally free of moving parts that wear out, giving it a nearly unlimited service life.

The NEJ-1000 offers true linear response up to over 720° per second rotation rate. It is 10 times more sensitive and has a faster response time than any previously available electro-mechanical gyro system, making JR's NEJ-1000 the highest performing gyro available.

Important!: The Piezo Gyro's operational features and functions are very different than other types of gyros. The adjustments, including the travel volume, exponential, dual rates, and tail rotor compensation values, must all be changed from your previous normal settings in order to achieve the desired tail rotor response and performance.

Do not install the Piezo Gyro into your helicopter using your current set-up and expect it to work. The capabilities of the Piezo Gyro System are much greater; therefore, the adjustment values (i.e., travel volume, dual rate, exponential, revo mix, etc.) will be different and must be adjusted correctly to realize the gyro's full performance potential.

Carefully read this instruction sheet and be sure you fully understand and follow each segment **before** your first flights with the gyro.

INSTALLATION AND HOOK-UP

GYRO SENSING UNIT

There are three important criteria that must be considered in deciding on the position you should mount the Gyro Sensor.

#1 Heat. The Piezo Sensor is sensitive to drastic temperature changes — in some cases a neutral drift will occur.

When mounting the Gyro Sensing Unit, be sure that it is located away from the engine and exhaust system so that none of the heat will transfer to the Gyro Sensing Unit from these or any other helicopter parts that might get hot.

Also, when subjecting your helicopter to temperature differentials (e.g., going from your warm car to the cold outside), allow the gyro's temperature to stabilize for about 10 minutes before flying.

Special Note: Fuselages can circulate hot air throughout the internals. It is important to have adequate ventilation, both incoming and outgoing, to allow the hot air to escape (your engine will also thank you for this).

#2 Vibration. The Piezo Gyro is 10 times more sensitive to rotational motion. Plus, it has a 10 times faster response time (the time it takes the gyro system to react to motion). Because vibration is motion, the Piezo Gyro senses even minute vibrations and acts upon them (sending the servo an opposing command) 10 times faster than a standard gyro. The vibration frequency in a helicopter can be as high as 18,000 cycles per minute. Needless to say, this gyro can keep the servo very busy!

It is therefore important to reduce the vibration of your helicopter to a minimum by making sure that everything is balanced, straight and properly adjusted.

The greatest performance potential of any helicopter can only be realized when vibration is at a minimum. The Gyro Sensor

should be mounted away from inherent high vibration areas (i.e., engines).

#3 Location. The Gyro Sensing Unit should be mounted as close to the center of gravity (normally the main shaft) as possible while taking into account the points made in #1 and #2 above. Many helicopters provide mounting bases near the main shaft. Use them only if they are positioned away from heat-generating sources. If it is not possible to locate the sensor near the main shaft, an alternate location to consider is up front on the servo tray.

INSTALLING THE GYRO SENSOR

Now that you have located an appropriate position for your Gyro Sensing Unit, make sure that the mount is exactly at right angles (90 degrees) to the main shaft.

Thoroughly clean the bottom of the Gyro Sensor and the mounting area with rubbing alcohol. Use one layer of the supplied double-sided tape to securely mount the sensor in position **(don't use thick foam tape)**.

INSTALLING THE AMPLIFIER

Using 1/4" or thicker foam, wrap the amplifier and the receiver together, making sure that at least one thickness of foam is between the receiver and amplifier. Fasten the receiver and amplifier to the radio tray using rubber bands to make sure they are securely held in place. If space doesn't permit the amplifier and receiver to be mounted together, wrap them individually in foam and mount each of them in a convenient location. Use an optional servo extension lead if necessary.

INSTALLING THE REMOTE GAIN CONTROLLER

The Remote Gain Controller can be installed in any desired position that is free from vibration. Use double-sided tape or combine the controller with the amplifier and receiver in foam.

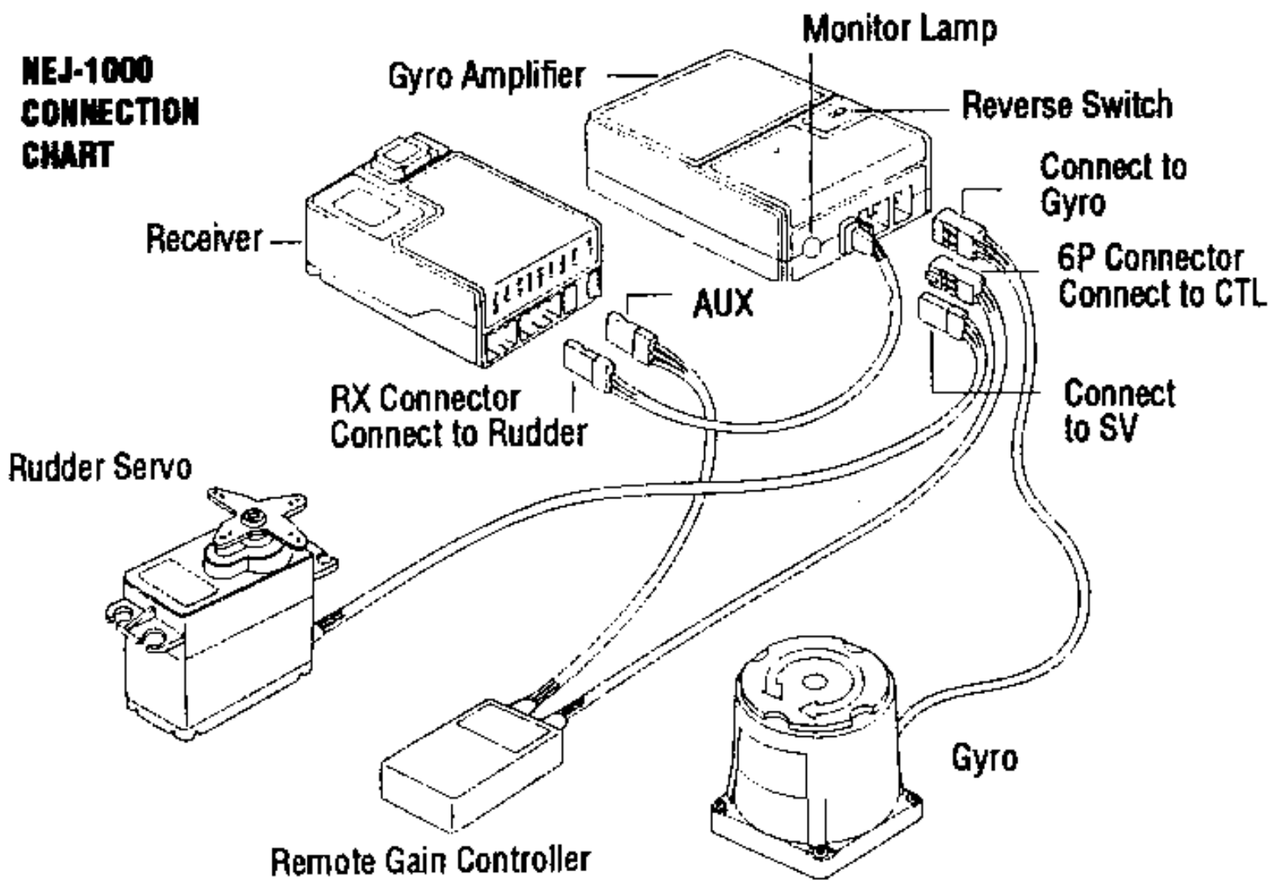
HOOK-UP

Step 1: Connect the Gyro Sensing Unit's connector to the gyro jack on the amplifier. The connector can be installed either way.

Step 2: Connect the Remote Gain Controller's AUX connector (white connector) to the AUX channel on the receiver from which you want the gain control to be activated. If you are using a PCM-10/10S, plug the AUX connector to the receiver's AUX 3 jack position.

Step 3: Connect the Remote Gain Controller's CTL connector (black) to the amplifier. Note that the connector has a tab on one side that must be properly inserted into the CTL jack to prevent polarity reversal.

NEJ-1000 CONNECTION CHART



Step 4: Connect the amplifier's Rx connector to the receiver's rudder channel. If the amplifier is located away from the receiver, an optional servo extension may be used.

Step 5: Connect the rudder servo's connector to the SV jack in the amplifier. Note that the connector will only install in one direction.

Important Servo Note: The Piezo Gyro offers greatly improved response time, sensitivity and performance. However, in order to realize these improvements, a high-quality coreless servo with accurate centering and a fast transit time must be used. JR's 4131 ultra-precision servo is highly recommended as a rudder servo even when using other brands of radio systems. The ultimate performance of the tail rotor system can only be as good as the servo operating within the system. The 4131 allows the gyro's superior performance to reach its full potential.

SET-UP AND ADJUSTMENT

The NEJ-1000 Piezo Gyro is totally unique in the way in which it senses rotational motion. The Piezo Gyro gives true linear feedback and response of rotation rates up to over 720 degrees per second (standard gyros are limited to approximately 250 degrees per second).

Thus, the gyro is still sensing at high rotation rates, giving appropriate feedback to the servo. This allows more consistent pirouettes in the wind and improved 540 stall turns with aggressive stops.

Because of this high rate of rotation sensing, the adjustment values (i.e., travel adjust, dual rates, exponential, tail rotor compensation) will be very different than what you are used to.

Following is the set-up and adjustment procedure that must be followed to achieve the highest level of performance from your system.

SET-UP

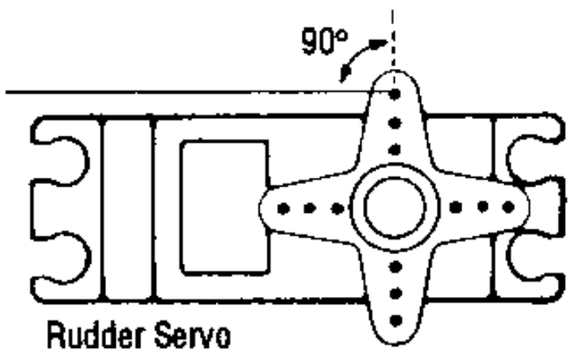
Step 1: Unhook the tail rotor linkage from your rudder servo and swing the servo arm out of the way. Lightly grasp the tail rotor pushrod at the servo end and run the tail rotor through its entire pitch range. The tail rotor linkage should move through its entire range smoothly with very little friction and no rough spots. Work on the linkage system until this is achieved.

Step 2: On your transmitter, set all rudder trimmers (sub-trim, trim offset, mechanical trim, etc.) to zero. Set the throttle/pitch stick at exactly the hover position (standard hover position is 50%, switchless inverted position is 75%). Turn off or zero out both the revolution mixing up and down and the acceleration mixing.

Step 3: Turn on your receiver and allow the helicopter to remain totally motionless for 3 seconds. A bright LED light on the amplifier will come on after 3 seconds indicating that the gyro has digitally stored the value of zero motion.

Step 4: Remove the servo arm and replace it so that it is exactly 90 degrees to the tail rotor pushrod (see diagram). You may find that the splines are just offset on your servo arm not allowing 90 degree positioning. Rotate the servo arm to another arm and try again. Find the arm that is closest to 90 degrees and secure it in place with the provided screw.

Re-attach the pushrod to the arm approximately 8mm out. Later we will optimize this position.

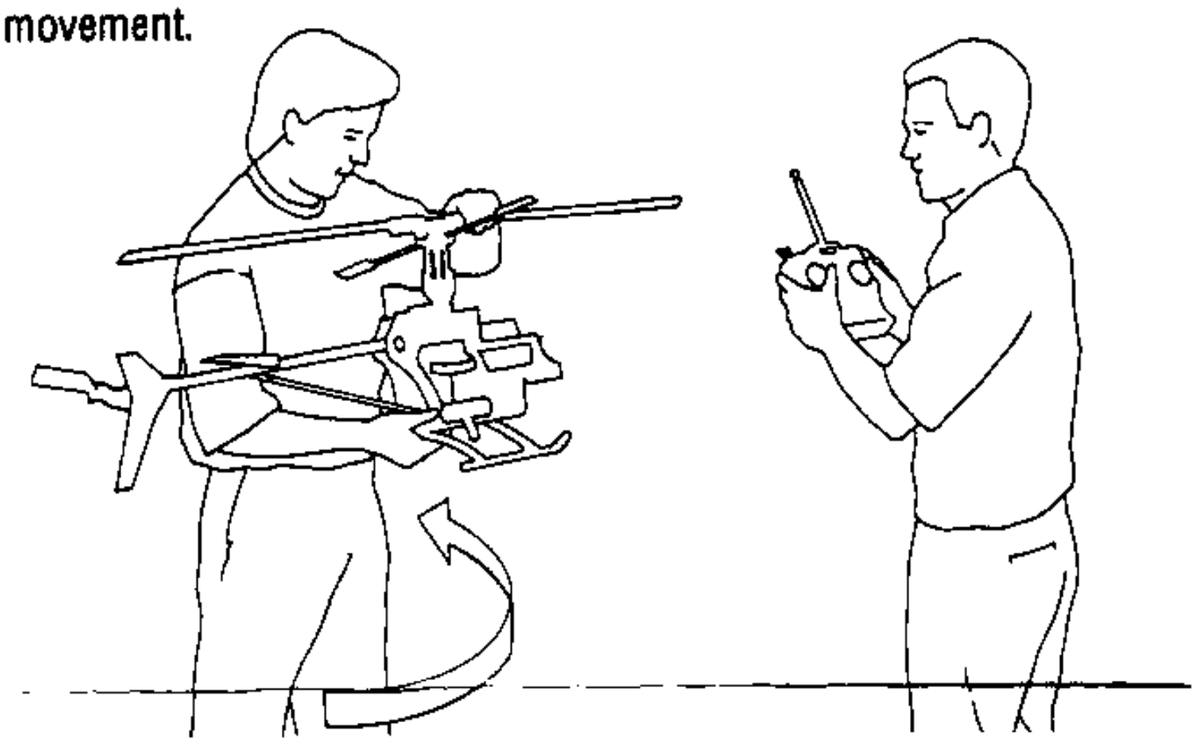


Step 5: Be sure the rudder servo is moving in the proper direction. A right servo command should move the nose to the right (if you're unsure, seek help from someone more experienced). Reverse the servo direction in the transmitter if necessary.

Step 6: Give a right rudder command and note the direction the rudder servo moves (clockwise or counterclockwise). Now pick up the helicopter and quickly move the nose to the left. The servo should move in the same direction. If it moves in the opposite direction, switch the small reverse switch located on the amplifier in the opposite direction.

ADJUSTMENT OF THE TRANSMITTER

Earlier we mentioned that, unlike standard electro-mechanical gyros with limited sensing ranges of approximately 250 degrees per second, the Piezo Gyro has sensing capabilities about three times greater (over 720 degrees per second). This requires a very different approach when setting up your tail rotor's control movement.



Try this: Take the canopy of your helicopter and hold the heli so that you can clearly see the rudder servo. With the radio on (both Tx and Rx), have a friend hold a full right tail rotor command on the transmitter while you watch the servo. Start by spinning to the right (clockwise) while holding the helicopter and watching the servo. Notice how the servo comes back opposite to the direction of your friend's input to the right rudder command. The final servo position is based on the amount of gain adjusted into the gyro plus the rate of rotation that you spin. The Piezo Gyro is many times more efficient at bringing the arm closer to the neutral position at high rotational rates than any other gyro. Because of this, the travel adjustment and exponential adjustment will be much greater than with other gyros to obtain the same rotation rate.

OVERDRIVING THE TAIL ROTOR

As illustrated above, the transmitter gives a command to the servo to find a specific position (e.g., full right rudder). The gyro senses the right rotation and gives the opposite command (left) to the servo. The final servo position (and hence the rotation rate) is based on the transmitter's command versus the gyro's gain setting versus the rotation rate.

In order to get really rapid rotation rates with some helicopters, it will be necessary to use a travel adjustment that on the ground (no rotational feedback from the gyro) actually exceeds the mechanical limitations of the tail rotor mechanism. In flight, the Piezo Gyro will reduce the travel so binding will not occur. But be very careful on the ground to ensure that you don't give hard over rudder commands.

TRANSMITTER ADJUSTMENTS

Travel Adjust

Set the rudder travel adjustment to maximum right and left. If you are using a JR PCM-10/10S, set this adjustment to 150% left and 150% right. **Note:** This may overdrive the tail rotor mechanism on the ground. However, in flight, the gyro will reduce the throw, preventing binding at the extremes. You can test this by physically spinning the helicopter as described previously.

Dual Rates

The recommended starting points for dual rates are:

Maneuver	Dual Rate	Flight Mode
Hover	60%	Normal
540 Stall Turn	90%	Flight Mode 1
Standard Aerobatics	60%	Flight Mode 2

After some experience and flight time is gained, these values can be adjusted to suit your preference. We recommend adjusting the dual rate values to obtain the desired maximum rotational rate during a maneuver.

Example:

If 90% dual rate yields too high of a rotation rate in the 540 stall turn when the rudder stick is fully displaced, reduce the dual rate value until the desired rotation rate is achieved.

Exponential

Because a very large servo stroke is utilized (150% L, 150% R), the control sensitivity around neutral is very high. Exponential is recommended to reduce this over-sensitivity around neutral. Following are the recommended expo settings:

Maneuver	Exponential Value	Flight Mode
Hover	30%	Normal
540 Stall Turns	30%	Flight Mode 1
Std Aerobatics	40%	Flight Mode 2

After some experience and flight time is gained, these values can be changed to suit your preference.

We recommend using exponential to adjust the control sensitivity from neutral to approximately 1/3 stick position.

Revo Mixing

The Piezo Gyro actually increases the total servo stroke by approximately 35%. Compared with previous gyro systems, the Piezo Gyro will require that you reduce the revo mixing, stunt trim, and +/-P values by approximately 35%.

Following are some basic starting values to work with.

Note: Because of the variables involved with each different helicopter (i.e., engines, fuel, blades, exhaust systems, aerodynamics, gear ratios, etc.), the optimum can only be achieved with careful tuning and adjustment to your particular helicopter.

PCM-10/10S Revo Mixing

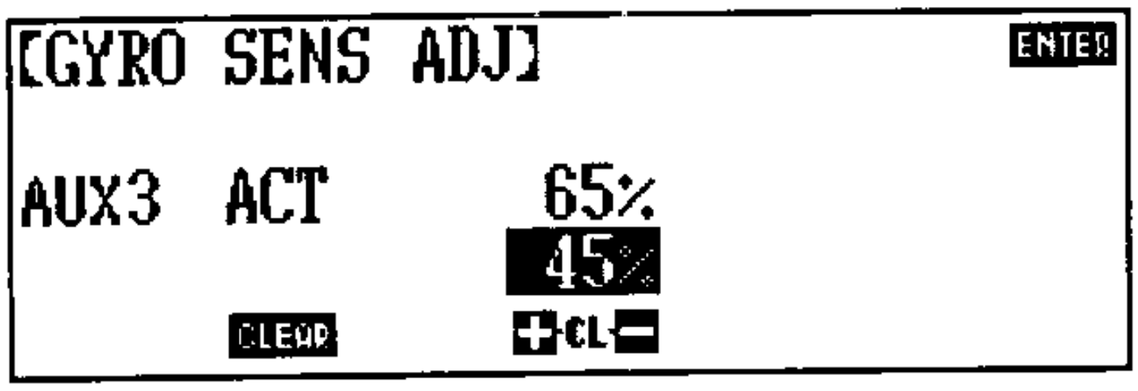
Normal	Up 20%	Down 15%		-P0
Flight Mode 1			+P5	-P5
Flight Mode 2			+P5	-P5

Stunt Trim

Test fly and adjust until the tail follows exactly behind the body in fast forward flight, full throttle/pitch.

REMOTE GAIN CONTROL SET-UP WITH THE JR PCM-10/10S

The Remote Gain Controller allows gain adjustments to be made from the transmitter. When using the PCM-10S, plug the Remote Gain Controller's AUX connector into the receiver's AUX 3 jack. This will allow gain control adjustments to be made in Code 44 of your transmitter. (Also see PCM-10/10S instruction manual, Code 44).



CODE 44

Enter Code 44 in your transmitter. Press the ACT on the screen to activate the gyro sensing adjustment. Notice that, by flipping the AUX 3 switch on the upper right of the Tx, the bold portion changes from top to bottom. The bolded value can be changed by depressing the + or –. For hover (normally the top value), set a starting value of 65%. For forward flight, set a value of 45%. See screen example above.

Now hover the helicopter. If necessary, adjust the linkage so that little, if any, trim is needed. Final "fine tuning" adjustments can be made with the rudder trim lever.

Increase the hover gain (preset at 65%) until the helicopter starts to oscillate (hunt). Back down the value just below the hunting point. The value should be between 65 and 95 percent. If so, proceed to the next step. If not, do the following:

Hunting occurs at less than 65% gain in hover – move the rudder pushrod connection at the servo inward one hole on the servo arm.

No hunting occurs even at 100% gain in hover – move the rudder pushrod connection at the servo outward one hole on the servo arm.

Next, fly the helicopter in fast forward flight and increase the low gyro gain value until oscillation (hunting) occurs. Reduce the value slightly, just below the point of hunting. Try a few rolls and see if hunting occurs. Reduce the gain if necessary.

Now go back and fine tune your revo mixing, stunt trim, +P, -P, etc., using your standard method or the method given in your PCM-10S instruction manual.

REMOTE GAIN CONTROL SET-UP WITH OTHER RADIOS

The NEJ-1000's remote gain adjustment also works with other systems that have AUX channels. In the case of a proportional knob, plug the white AUX connector in the appropriate receiver jack. Proportional gain is then achieved by rotating the knob to the desired position.

If a two-position switched channel is available, the gain sensitivity can be adjusted in each position using the travel adjustments.

When using a switched channel for gain control, the gain adjustment is achieved by adjusting the endpoints of that switched channel. See below:

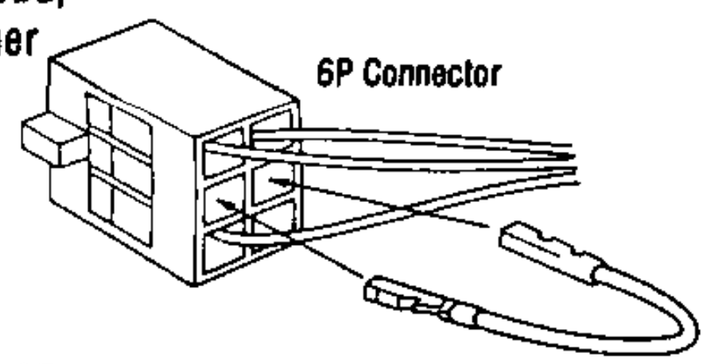
Switch position #1:	Gain is adjustable from 50% to 100% using the travel volume. 100% Travel volume= 100% gain 0% Travel volume= 50% gain
Switch position #2:	Gain is adjustable from 0% to 50% using the travel volume. 100% Travel volume= 0% gain 0% Travel volume= 50% gain

Note: In switch position #1, increasing the travel volume value increases the gain. In switch position #2, increasing the travel volume value decreases the gain.

Note: Depending on the position of the AUX channel's reversing switch, the switch position #1 and #2 may work in reverse.

If you want to bypass the use of the Remote Gain Sensor, the standard dual gain controller from the 120BB can be used. See diagram.

Remove the jumper cable from the 120BB connector and connect it to the 6P connector of the gain controller as shown in the diagram. Connect the AUX connector to the receiver's AUX channel. Similar to the 120BB, the gain controller's trimmer is now switchable by the transmitter and is adjustable at the gain controller.



Jumper cable

Important:

• Always turn on your transmitter first. Then turn on your receiver. Allow the model to sit motionless for 3 seconds (until the LED light comes on) before moving your model (e.g., starting).

• The NEJ-1000 incorporates sophisticated drift canceling circuitry that is activated in flight (not on the ground). The motion of the helicopter gives feedback to the gyro, and it compares this information with data previously stored during the 3 second start-up.

• Use a high-quality, coreless servo for your rudder control. JR's 4131 ultra-precision servo is recommended.

• During maneuvers (rotational), it is normal for the LED to go out and then come back on. This is part of the drift canceling circuitry. ■

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