Instruction Manual for Guardian™ Stabilization Expander

Document Version 1.5

Corresponds to Eagle Tree Software Version 10.01 or higher

Contents

Introduction

Thank you for your purchase! This instruction manual will guide you through the installation and operation of your Guardian Stabilization Expander. The latest version of this manual is available in the Product Manuals section of the Support tab on http://www.eagletreesystems.com. The online manual includes any updates that were made after your Guardian was purchased. Please read the entire manual carefully before proceeding. If, after you read the manual, you have further questions or problems, see the "Have Questions or Feedback?" section below.

What the Guardian Does

When used with the Eagle Tree OSD Pro™, the Guardian provides full featured inertial stabilization, and an on-screen Artificial Horizon display. No additional sensors are required.

The Guardian requires no warm-up period after your model is powered. The Guardian's advanced features make it easy for you to perform aerobatic maneuvers (if you are capable!) and immediately return to stabilized flight when desired.

The Guardian is a stabilizer, **not a stall-preventer!** In some airframes, stalling can create unrecoverable conditions, such as spins, that may result in a crash. Make sure that you operate your model in a way that avoids stalls.

Intended Uses

The Guardian is intended to be used exclusively for recreational purposes in model planes, boats and cars. Any other use is not supported.

Packing List

Your package should include the following: The Guardian, and a printed version of this manual.

Other Things You Need

To utilize the Guardian, you will need the OSD Pro system with an eLogger V3 or V4. Though stabilization will work without them, a video camera and video transmitter on your model, and a video receiver and video display on the ground are normally required. Many Eagle Tree FPV dealers sell the required video equipment. A list of our FPV dealers can be found on our website at http://www.eagletreesystems.com/OSD/OSD-Pro.htm.

Steps to Follow

Installation and use of your Guardian should be quite easy and enjoyable if you follow these few steps:

1. First, if you have not done so already, read through the manuals for your OSD Pro, eLogger, GPS Expander, and any other Eagle Tree sensors, to familiarize yourself with the connection and function of these devices, and set this equipment up.

2. Read through this manual to understand the warnings, determine the installation and setup sequence, pre-flight tests, etc., of the Guardian.

3. If anything is unclear, see the "Have Questions or Feedback?" section below.

4. Range test and enjoy!

Have questions or Feedback?

Eagle Tree is committed to providing great customer service. If you've read the manual and something is not clear, just ask.   We'd much prefer to take the time to answer your questions, rather than having you waste your valuable time struggling with an issue.

To get help, visit the Eagle Tree Guardian support thread at http://www.rcgroups.com/forums/showthread.php?t=1399687. Chances are someone has posted a solution to your problem already. If not, posting your problem there will get a very quick response from the Eagle Tree community.

If you prefer to not post on the forum, or you feel there is a problem with your Eagle Tree hardware, please open a support ticket with us at http://ticket.eagletreesystems.com and we will respond to your support ticket as soon as we can (normally 1-3 business days). Note that you may receive an answer to your question more quickly from our forum above, since many other Eagle Tree customers also monitor the forum. Note that when you create a support ticket, you will be emailed a link that will let you check the status of the ticket. If you do not receive the email, this most likely means that a spam filter is intercepting emails from Eagle Tree.

Also Eagle Tree greatly values your feedback on how we can improve our products. To leave us feedback for a new feature request or improvement, either post the feedback on our support thread above, create a support ticket with your feedback, or send feedback at http://www.eagletreesystems.com/Feature/feature.html

Connection and Mounting

Connecting the Guardian to the eLogger V4 or V3

The Guardian plugs into the "LCD/OSD" or "LCD/TX" port of your eLogger V4 or V3, as shown in Figure 3, or it can connect to the 4 pin expansion port of the OSD Pro.   If you have a PowerPanel or other MicroSensors, those can "daisy chain" connect to the pins on the side of your Guardian, with the polarity as indicated on the Guardian label.   Note that the Guardian can connect anywhere in the chain of sensors.   Once the Guardian has been powered, its status light should begin blinking rapidly to indicate correct operation.

Connecting the Servos

Connect your receiver's Aileron output (or Rudder receiver output, if the plane does not have Ailerons) and the Elevator receiver output to the OSD Pro's Aileron and Elevator servo inputs. Then, connect your servos to their corresponding OSD Pro servo outputs.

Note that when using the Guardian, the ailerons should be routed through the OSD Pro if the model has both ailerons and rudder, for proper stabilization and RTH. **Note that this is a change from the recommendation that the rudder be routed through the OSD Pro, when the Guardian is not present.**

Windows Software and Firmware Update

To use the Guardian, you must update your software to **Eagle Tree Windows Software version 9.76** or later.   To update, download the latest software from the support page of our website, located at http://eagletreesystems.com/Support/apps.htm.   After downloading and installing the software, the firmware of your Guardian may need to be updated.   To upgrade your firmware, connect your eLogger to USB, and just click "Hardware, Firmware Control" and click the Update button for the Guardian if the present firmware version is a higher number than the firmware stored in your Guardian.

Mounting the Guardian in your Model

Mount the Guardian in your model, placing it so the label is facing up and the "airplane" drawing on the label corresponds to the orientation of your aircraft. A properly mounted sensor will be perfectly flat with its front facing the direction of flight, when the aircraft is in level flight.

We recommended mounting the Guardian with a piece of two-sided foam tape or Velrco to hold it firmly to your airframe while reducing vibrations. To reduce the risk of the Guardian coming loose, tape, adhesive, or a mechanical restraint may be used.

Mounting the Guardian flat relative to level flight is important.   However, minor mounting offsets can be compensated for by invoking your OSD Pro menu and using the "Configure Guardian Stabilizer" -> "Reset Level Flight" option described below.

Vibrations

The Guardian is able to reject most levels of vibration. However, very strong vibrations can impact stability. To check for this issue after mounting the sensor, perform a vibration test by securing your model to a test bench or stand and ramping up the throttle slowly while watching the AHI on your OSD Pro. If the AHI begins to pitch or roll significantly during this test, remount your Guardian sensor further away from the motor, wires and any other sources of vibration or electromagnetic interference.

Important Differences in OSD Pro Configuration when using Stabilization

There are a few differences in how you configure the OSD Pro, when stabilization is enabled vs disabled.   These are described elsewhere in the document in more detail:

- When running the Servo Analysis Wizard, full elevator and aileron stick deflection should be given, rather than partial stick deflection. Partial stick deflection is recommended when stabilization is disabled, to limit RTH servo deflections.
- If your model has both ailerons and a rudder, the ailerons should be routed through the OSD Pro when stabilization is turned on, rather than rudder.
- In Elevon mode, with stabilization enabled, the Guardian performs the servo mixing, so you must turn off mixing in your radio. **But, if you disable stabilization, the OSD Pro will again expect mixed inputs from your radio. Never turn stabilization off or on during flight if you have an elvon model! Use the stabilization gain setting instead.**
- If you have previously configured RTH with your OSD Pro, it is recommended that you return all RTH gains/limits to their default values when stabilization is enabled.
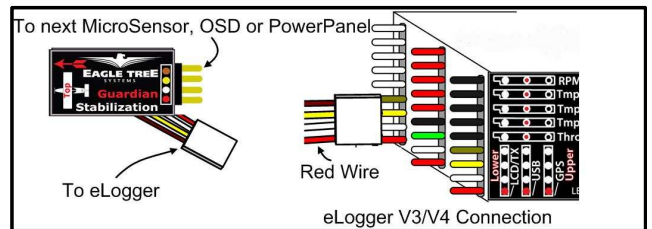
Guardian Stabilization On-screen Menus

Guardian configuration is done via the On-screen OSD Pro menus. Please see the OSD Pro manuals for more information on accessing the menus.

Here is a description of each menu item that may need to be adjusted for the Guardian. Note that additional information for each menu item is provided in the following manual sections. Note also that the default values are shown in parentheses and where relevant, the range is displayed as (min-max: default).

Configure Radio Control Menu

- **Reset Cruise Sticks/Throtl:** recaptures the model's aileron/rudder, elevator, and throttle settings for level flight. These settings are captured during the Servo Analysis Wizard, but need to be recaptured if you have re-trimmed your plane. **NOTE: the throttle needs to be set at "cruising speed" position when this option is selected, if the RTH feature is enabled!**
- **Run Servo Analysis Wizard:** lets the Guardian learn about your servo directions and extents. See the Guardian Configuration section below for more information.
- **Choose Model Wing Type (Fixed):** This option lets you choose whether your model uses standard or elevon control. Note that when the wing type is set to Elevon, and Guardian stabilization is enabled, the Guardian will do the servo mixing. So, your radio's servo mixing must be disabled. But, if you later turn off stabilization, the Guardian will no longer do the mixing! **WARNING: Never change this option during flight!**
- **Stabilization / Elevn Mixing On? (No):** Enables Guardian Stabilization and (if you have an elevon model) turns on Elevon Mixing. **WARNING: Never turn this option off or on during flight if you have an elevon model! Disabling stabilization will also disable the OSD Pro's elevon mixing. Use the stabilization gain setting instead to turn off stabilization.**
- **Elevon Recvr Microsecs(0-3000: 1500):** This sets the number of microseconds for a neutral pulse from your RC controller. Do not change this unless you know the pulse length of your controller. Most people do not need to adjust this, and it is only relevant for elevon models.

Configure Guardian Stabilizer Menu

- **Reset Level Pitch and Roll:** Click this option while holding the model level after installing the Guardian, if the AHI line is not centered and level. It will mitigate most mounting errors and provide a level AHI.
- **Stabilizer Pitch Gain (0-10: 5):** This controls the amount of stabilization in the pitch Axis. If your airframe is oscillating along its pitch axis, but never its roll axis, it might help to reduce the Pitch gain.
- **Stabilizer Roll Gain (0-10: 5):** This controls the amount of stabilization in the roll Axis. If your airframe is oscillating along its roll axis, but never its pitch axis, it might help to reduce the Pitch gain.
- **Stabilizer Turn Gain (0-10: 5)**: This parameter helps counteract trim issues that can cause gradual turns. The higher the value, the more compensation is added to normal flight.
- **Stabilizer Overall Gain (0-10: 8):** This scales the Pitch and Roll gains. When set to 10, both Pitch and Roll will be very strongly stabilized. When set to 0, all stabilization will be disabled. This setting is overridden by the Aux2 input on the OSD Pro if the Menu Navigation Switch is configured for "3-Position" or "None" and a valid servo signal is present on Aux2. If RTH is engaged, the menu's "Stabilization Overall Gain" will be used. See **Stabilization "Master Gain" Knob** section for more information.
- **Max Stab Pitch/Roll Normal (0-90: 50):** The maximum attitudes (pitch angle or bank angle) that the airplane is allowed to maneuver to in Stabilization mode.
- **Max Stab Pitch/Roll RTH (0-90: 35):** The maximum attitudes (pitch angle or bank angle) that the airplane is allowed to maneuver to when RTH is Engaged.
- **Stabilizer Responsiveness (1-10: 7)**: How responsive you want your Fly-By-Wire to be with your model. A high value will provide very fast response, but could accidentally stall your model on takeoff if the control stick is moved too quickly. A low value will yield a very smooth flight.
- **Enable Heading Hold (Off):** Locks onto your current heading and trims your plane to fly that heading until the stick is moved from its centered position. See: "Heading Hold" section for more information.
- **Center Stick Stabilize Only (Off)**: This advanced feature enables Guardian Stabilization only when the control stick is centered within the area defined by "Center Stick Tolerance" Box, making it easier to do aerobatic maneuvers. Note that stabilization will be reduced or disabled when your sticks are not centered! See: "Center-Stick Only Stabilization"
- **Center Stick Box Size (1-10: 5):** Defines the size of the Center Stick Box used by "Center-Stick Only Stabilization." Small values make the area smaller and vice versa. See: "Center-Stick Only Stabilization".

Select Items to be Displayed Menu

- **Servo Deflections Display:** This turns on Servo Deflections display, which is useful for initial Guardian testing.
- **Artificial Horizon Line:** This turns on the AHI display, which is also useful for Guardian setup and testing, as well as in normal flight.

Trimming

It is recommended that the airplane be trimmed for level flight before running the Servo Analysis Wizard. This ensures that the Guardian Stabilizer will also be trimmed.

If a change in trim occurs once Stabilization has been configured, make sure to execute the "Reset Cruise Sticks/Throtl" to inform the OSD Pro of your change. Remember that your throttle needs to be in the "Cruise" position (the throttle position for level flight) if the RTH feature is enabled.

Guardian Configuration

Before you can fly for the first time, it is necessary to tell the Guardian a few things about your model. These settings are made by using the OSD Pro menus described above and in the OSD Pro manual.

1. Run the "Servo Analysis Wizard." This step lets the Guardian know how much deflection it can use when stabilizing your airframe. Additionally, this teaches the Guardian the directions of your servos. When the wizard asks you to "Mov Rudder/Aileron Stick Left," deflect the aileron stick to the maximum extent that you would normally use in flight (normally the maximum throw). Do the same with the elevator stick when requested to "Mov Elev Tx Stick Back(Climb)." **Note: When not using the Guardian, the amount of stick deflection during the wizard was used to set the maximum elevator and**

aileron/rudder stick throws for RTH, so it was recommended to use only limited stick movement. **However with the Guardian, the RTH limits are set as angles, as described below, and giving the full stick movement during the wizard is necessary.**

2. For initial testing, we recommend turning on "Servo Deflection Display". When stabilization is turned on, the present Overall Gain setting is displayed as "G" in the servo deflections, and the present pitch and roll of the model are also displayed. Further, we recommend enabling the Artificial Horizon display, which will help to validate that the Guardian is mounted and operating correctly.

3. Choose your airframe type with the "Choose Model Wing Type" menu, by selecting either "Fixed Wing" or "Elevon" type. **Both of these modes require that your radio supplies un-mixed Aileron/Elevator signals. Mixed inputs to the OSD Pro are not supported with Guardian Stabilization enabled.** Note that the OSD Pro supports mixed elevon inputs when stabilization is disabled, but requires unmixed inputs when stabilization is enabled, to provide the best stabilization experience.

4. Enable Stabilization by setting the " Stabilization / Elevn Mixing On?" option in the Radio Control Configuration menu to "Yes." **Warning: Never turn this option off or on during flight if you have an elevon model, since the mixing mode will change! Adjust the stabilization gain setting instead.**

5. Orient your model as it would be during level flight. If the Artificial Horizon display is not centered on the Home indicator or is tilted, click "Reset Level Pitch and Roll." This step will minimize the impact of minor mounting errors with your Guardian.

6. Configure the "Max Stab Pitch/Roll Normal" angles that the Guardian will allow your airplane to attain. For greater maneuverability, set these values to 60 degrees. For easier flight behavior, set them to around 40 degrees.
Warning: Setting these values to greater than 60 degrees will result in very responsive flight characteristics from your airframe. Going into maneuvers that your airframe is incapable of sustaining will still result in a stall! Additionally, setting the max angles too low may make your airplane difficult to turn.

7. If you will be using the Return to Home feature, adjust the "RTH" Max Pitch/Roll angles. These parameters act the same as the Stabilizer Pitch/Roll angles, but are only used for limiting the Return to Home. It is recommended that these values be around 25 degrees, depending on user preference, airframe stability and wind conditions. Once again, a larger angle will result in a more maneuverable RTH, with a smaller turn radius, but may result in oscillations depending on the RTH gain values.
Warning: A smaller number will result in smooth RTH behavior, but may prevent your airframe from returning in strong wind conditions or if the Guardian is mounted improperly. It is recommended that you test RTH after changing these values.

8. It is recommended that your Safety Mode RTH gain settings be returned to their default values, if you have changed them in the past, when flying without the Guardian. When the Guardian is properly configured, most airframes should work with the default RTH gains.
Note: If the RTH does not turn quickly enough, increase the Max Stab Roll RTH value before changing the RTH gains. Do not exceed 35 degrees. For further information, see the RTH section of the OSD Pro manual.

9. The Stabilizer Pitch/Roll and Overall gains can be left at their default values of 5, 5 and 8 respectively. You will tune these gains later.

The Servo Analysis Wizard

Since Guardian Stabilization interprets your stick movements as attitude commands, rather than direct servo deflections, it is important to tell it how far your RC controller's sticks move in the pitch/roll axes. At the same time, the Guardian needs to know the trim conditions of your plane as well as the centered position of your control stick. The Servo Analysis Wizard figures this out for you.

When requested to "Set Sticks for level flight," your control stick should be centered (trimmed for level flight with stabilization turned down) and your throttle set to its cruise level. The throttle levels are not required by the Guardian, but are required for Return to Home. Please see the OSD Pro manual for information regarding the throttle / failsafe features of the Servo Analysis Wizard.

When asked to "Mov Rudder/Aileron Stick Left," make sure to assert maximum servo deflection on your RC controller. The same should be done when asked to "Mov Elev TX STICK Back(Climb)." These steps tell your OSD Pro the maximum servo deflections allowed for Guardian Stabilization. If the stick is not moved to its maximum extents for this portion of the wizard, your control commands may be clipped, impacting performance and stability.

Note: After trimming your airplane on your RC controller, it is important to run the "Reset Cruise Sticks/Throtl" to inform the controller of the change, otherwise Heading Hold and Center-Stick Only Stabilization may be impacted.

Reset Cruise Sticks/Throtl

It can be cumbersome to re-run the Servo Analysis Wizard after changing the trim of your airplane. To let your OSD Pro know about changes to trim, it is important to run the "Reset Cruise Sticks/Throtl" command. This resets the center position of your control stick, as well as the cruise position of your throttle, ensuring that features like Heading Hold and Center-Stick Only Stabilization work optimally.

Tuning Stabilization Gains

Stabilization Theory

The Guardian Stabilizer works by measuring the orientation of your model airplane relative to the local direction of Earth's gravity. In addition, it interprets pitch and roll attitudes commanded by the servo signals received through your elevator and aileron channels respectively.

With this information, it is able to determine the error between your requested flight attitude and your plane's true orientation. By passing this error through a controller algorithm and sending it as servo commands through the elevator and aileron outputs on your OSD Pro, the Guardian can turn your squirrely model into a smooth-flying wing on rails!

Each axis has a separate control gain used to tune stabilization. These are defined by, "Stabilizer Pitch Gain," "Stabilizer Roll Gain" and "Stabilizer Overall Gain." The Pitch and Roll Gains are scaled by the Overall Gain to provide individual axis tuning while also providing On-The-Fly adjustment depending on conditions and aerodynamic performance.

In general, the higher the gain, the more responsive and resilient your plane will be to disturbances such as wind, balance and trim issues. Tuning the gains too high however may result in oscillations of the airframe. It is recommended that the Overall Gain be used to tune the airframe until it oscillates and then be turned back down. This will ensure the best performance while preventing future oscillations.

Warning: Be careful while tuning the Overall Gain. Some airframes may oscillate very strongly at higher gains, possibly damaging themselves. To avoid strong oscillations, increase the Overall Gain slowly and reduce it as soon as oscillations are noticed.

Stabilization "Master Gain" Knob

When the OSD Pro's "Choose Menu Receiver Inputs" option is set to "3-Position" or "None", the OSD Pro's Aux2 input channel can be used as a Master Gain for the Guardian. This overrides the OSD Pro's menu option "Overall Gain" during normal flight (the "Overall Gain" setting is always used during RTH). This Master Gain multiplies the individual Pitch/Roll gains and serves as a way to easily tune both. If you have an RC controller that has an analog knob, this can be mapped to the Aux2 channel to allow for On-The-Fly stabilization gain adjustment.

This knob gives the ability to transition smoothly from stabilized flight to un-stabilized flight. Additionally, since your airspeed can change your airframe's flight characteristics, it is often helpful to be able to tune the controller in flight. Increasing its value will turn on stabilization, increasing the Guardian's effect until a full fly-by-wire behavior is achieved.

When this feature is used, the stabilizer's control characteristics given the Master Gain Knob's position are as follows:

- -100%: Stabilization is OFF. You can fly normally.

- -100%-~0% (depending on Pitch/Roll gain values): Medium Stabilization. Your airframe is now inherently stable, but depending on your knob selection, may still be rolled by strong stick movements or turbulence.

  Note: The Max Stabilized Pitch/Roll angles specified in the "Configure Guardian Stabilizer" menu may be exceeded in this range, depending on the Master Gain knob's position, flight behavior of your model and type of maneuvers attempted. **Do not attempt maneuvers that may destabilize your airplane!**

- ~0% - 100%: Maximum stabilization. The model should not roll over when in this range. Servo commands will become exaggerated, leading to tighter control of the plane and true Fly-By-Wire functionality.

Note that if you don't have a knob available on your radio, you can also use the OSD Pro Aux 2 input as an "on/off" switch for stabilization. This is done by connecting a spare switch channel to the Aux 2 input. Then, depending on the endpoints programmed for your switch in your radio, you can set the on and off stabilization levels and turn off stabilization by flipping the switch.

If no connection is made to the OSD Pro Aux 2 input, or you have not configured your OSD switch mode to "3-position" or "None", the on-screen "Stabilizer Overall Gain" setting is always used. The "Stabilizer Overall Gain" setting is also always used during RTH.

Note: The described behavior assumes a standard deflection controller, with -100% being defined by a 1.1ms servo pulse and +100% being a 1.9ms pulse.

Warning: When RTH is enabled, the Guardian Overall Gain from the "Configure Guardian Stabilizer" menu is used, even if the Aux2 input is configured to provide the Overall Gain as well. If the menu value of Overall Gain in this menu is set too low, *then RTH will not be stabilized.*

Displaying the Master Gain Onscreen

To display the Master Gain on all OSD Pages, turn on the "Servo Deflections Display" as described above. With the Servo Deflection Display line enabled, the "G" parameter on that line represents the Overall Gain.

Oscillations

Sometimes, when the controller gains are set very high or if there is a very high airspeed, oscillations can develop. If oscillations occur, turn down the Master Gain knob, change the inputs of your master gain switch, or adjust the Overall Gain menu setting if a knob or switch is not being used, until the oscillations stop.

Additional Features

**Center-Stick Only Stabilization**

Some people looking for more aerobatic capabilities from their airplane prefer to disable the stabilizer until they need it for crash avoidance or just to take a short break without needing to land. Center-Stick Only Stabilization allows for a quick return to stabilized flight at any time by letting go of the control stick. It can be enabled in the "Configure Guardian Stabilizer" menu.

After turning on this feature, choose the size of the Center-Stick Box by adjusting the "Center Stick Box Size". Choosing "1" will size the box to 10% of your control stick movement range (best for 3D flight) while "10" will cover the entire physical range of your control stick (smoother turns). Moving the control stick away from its centered position will decrease your Overall Gain until it reaches zero at the edge of the Center Stick Box as illustrated in Figure 1.

Moving the control stick outside the Center-Stick Box will accomplish the same as turning your Overall Gain Knob to 0%. Bringing the stick back to center will bring the Overall Gain back to its original value, set either by the "Stabilizer Overall Gain" parameter or by the Aux2 servo input as explained in the section "Stabilization "Master Gain" Knob."

IMPORTANT: Remember that when Center Stick stabilization is enabled, moving *or trimming* your control stick will reduce stabilization, including during takeoff or hand launch! After trimming, remember to execute the "Reset Cruise Sticks / Throtl" command to ensure full stabilization.

Heading Hold (Recommended)

...rall Gain vs. Stick Position within Center Stick Box
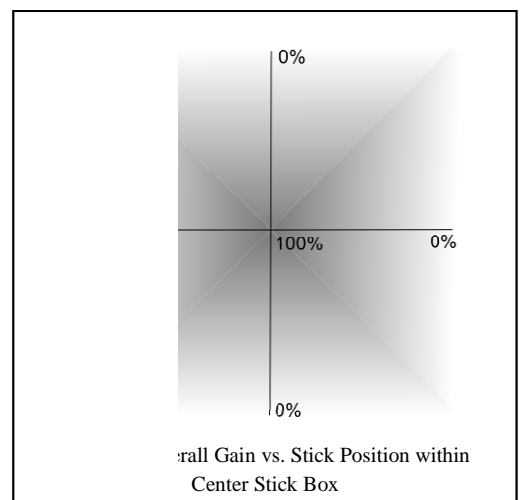
When the Guardian tries to stabilize an un-trimmed or off-balance airframe, a gradual turn can occur even if level flight is commanded. To counteract this, it is recommended to enable the Heading Hold feature by ensuring the "Stabilizer Turn Gain" in the "Configure Guardian Stabilizer" menu is set to its default value of "5" and setting "Enable Heading Hold" to "Yes."

Once enabled, Heading Hold keeps track of your current heading and, when your control stick's roll axis becomes centered, will lock onto that heading. As soon as the control stick is moved to command any roll, the current heading will be reset. The pitch axis can still be commanded with Heading Hold enabled to allow for a heading locked climb or descent.

At this time, the Heading Hold's directional lock does not use GPS, so a small amount of drift over time can occur. Additionally for safety reasons, the Heading Hold will not track yaw movements beyond 45 degrees from the locked heading. If the plane yaws further than this, the locked heading will be automatically adjusted so as to be within 45 degrees of the current heading.

While the default of "5" for "Stabilizer Turn Gain" should work for most airframes, a higher number may be needed if the airplane does not track closely enough due to trim issues. If, when flying at normal Pitch, Roll and Overall Gains, your airplane begins to oscillate in the Yaw axis during Heading Hold, reduce the Turn Gain until no oscillation is detected.

After enabling Heading Hold on the ground, it is recommended that as part of your preflight checks you "yaw" the model (rotate it gently so that the wings rotate around like helicopter blades) and observe the Ailerons/Elevons. Confirm that the control surfaces are asserting a turn that would bring the airplane back to its original heading. When the airplane is pointing directly at its currently locked heading, the control surfaces should be oriented for level flight.

Note: Remember to reset your current heading before takeoff to prevent an immediate turn. This is done by pointing your model in the direction of takeoff and moving the Ailerons via the control stick.Note: Heading Hold will not work with the Stabilization Overall Gain set to "0."
Note: After trimming your Aileron / Roll axis control stick, remember to run "Reset Cruise Sticks / Throtl" or Heading Hold may become disabled.

Preflight

The Guardian requires no "warm up" period before flying. But, before every flight, it is strongly recommended that you perform the following steps:

1. Perform your normal preflight check. Ensure your servos respond correctly to your RC control stick commands.
2. To test that the Guardian is working, hold the airplane level. Now, pitch and roll the model. You should see the control surfaces deflecting appropriately to level the airplane. If the control surfaces do not move at all, ensure that, if connected, the Master Gain knob or Gain switch is set so that stabilization will occur. If the control surfaces are moving the wrong direction, it might be necessary to run the Servo Analysis wizard again, making sure to follow the onscreen instructions closely.

First Flight

First, orient your model as it should be for level flight and execute the "Reset Level Pitch and Roll" command under the "Configure Guardian Stabilizer" menu. This helps to compensate for any mounting errors with your Guardian.

On your first flight, it is recommended that you do an unpowered hand-toss of your airplane, if yours is capable of hand-toss launches. If the airplane safely glides to the ground with little or no input, then your configuration is correct. If the model oscillates during the hand-toss, your Overall Gain is probably too high.

Once it has been shown that the Guardian has been correctly configured, perform one last preflight check and take off with power.

Warning: If taking off with stabilization turned up to a high gain, be very careful to avoid overcompensation. If the Max Pitch/Roll angles for Stabilization are set to a large number, say 60 degrees, there could be a very strong response that might stall your airplane. Move your sticks smoothly at first to get the feel for your more responsive airframe.

Once in the air and only when safe, release the control stick so it sits at zero input. Your airplane should fly straight and level. If not, your Guardian may be mounted improperly. You can land and run the "Reset Level Flight" command again. This may be done in the air also, if your piloting skills permit it.

Troubleshooting

Below is a list of problems that may be encountered, and steps to remedy them. A good first step to troubleshooting is to download our latest software and update the eLogger, OSD Pro and Guardian's Firmware via "Hardware, Firmware Control." Doing this will ensure that you have the latest software and firmware available. Just click "Help, Download latest updates…" in the software to check to see if a newer version of our software is available.

If your particular issue is not addressed by this update, or by the suggestions below, please visit our web support page for additional support options, at http://www.eagletreesystems.com/Support/support.html.

Issue: The message "**Stabilizer Disabled in Menu!!**" appears on the video screen during OSD Pro startup.
Solution: This message indicates that you need to turn on stabilization (if desired) by setting the "Stabilization / Elevn Mixing On?" setting to YES, as described in the Guardian Configuration section above.

Issue: The message "**Ailron or Elevatr undetected!**" appears on the video screen during OSD Pro startup.
Solution: This message indicates that receiver pulses from either Ailron or Elevator channel were not detected. Both of these channels are required for stabilizataoin to work correctly. Make sure that the channels are connected correctly from your receiver. Also, note that some receivers will not send any pulses until the radio transmitter is turned on.

Issue: The message "**Run RC Wiz for Stabilize!**" appears on the video screen during OSD Pro startup.
Solution: This message indicates that you need to run the Servo Analysis Wizard under the Configure Radio Control menu.

Issue: The message "**Stabilizer using Menu Gain!**" appears on the video screen during OSD Pro startup.
Solution: This message indicates that the Aux2 input for Overall Gain adjustment is not being used. The menu overall gain setting will be used instead.

Issue: The message "**Stabilizer Disconnected!**" appears on the video screen during OSD Pro startup.
Solution: This message indicates that the Guardian Expander is not detected by the system. Check your connections on the Guardian expander, and read further troubleshooting steps below.

Issue: Guardian does not seem to be working correctly and the Guardian's status LED **IS** flashing rapidly.
Solution: Make sure you have updated the OSD Pro, eLogger and Guardian firmware as described above.

Issue: Guardian does not seem to be working correctly and the Guardian's status LED **IS NOT** flashing rapidly.
Solution: Make sure that the Guardian is connected correctly to the LCD/TX line on your eLogger and that your eLogger is powered. If the Guardian's status LED is blinking three times in a repeating fashion, then your unit has likely been damaged.

Issue: Servo deflections are limited, compared to when Stabilization is disabled.
Solution: Run the Servo Analysis Wizard under the Configure Radio Control menu. Make sure to assert full stick deflections when asked to turn and climb during the wizard. See the section on the Servo Analysis Wizard under Guardian Stabilization.

Issue: Elevator or ailerons are unresponsive to radio commands
Solution: Make sure you have run the Servo Analysis Wizard after installing Guardian.

Issue: Servos are responding to control inputs, but not to movements of the airplane.
Solution: Ensure that the Guardian's 4 pin cable is connected as described in the Connection and Mounting section above. Check that "Stabilizaton/Elevn Mixing On?" is set to "YES" under the Configure Radio Control menu. Confirm that the Pitch, Roll and Overall Gains are set to their default values. If you are using the Aux2 input for Overall Gain adjustment, ensure that your knob, switch, or slider is positioned to enable stabilization.

Issue: Heading Hold does not appear to be working or is drifting more than a few degrees per second.
Solution: If you have trimmed your airplane recently, you may need to execute the "Reset Cruise Sticks/Throtl" command under "Configure Radio Control." The Heading Hold feature only engages when your Roll command is very close to level flight. (Less than ~15% stick deflection)

Limited Warranty

Eagle Tree Systems, LLC, warrants the Guardian to be free from defects in materials and workmanship for a period of one (1) year from the date of original purchase. This warranty is nontransferable. If your unit requires warranty service during this period, we will replace or repair it at our option. Shipping cost to us is your responsibility. To obtain warranty service, email support@eagletreesystems.com for further instructions.

This limited warranty does not cover:

- The Software. See the Software license agreement for more information on Software restrictions.

- Problems that result from:

    o   External causes such as accident, abuse, misuse, or problems with electrical power

    o   Servicing not authorized by us

    o   Usage that is not in accordance with product instructions

    o   Failure to follow the product instructions

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE (OR JURISDICTION TO JURISDICTION). OUR RESPONSIBILITY FOR MALFUNCITONS AND DEFECTS IN HARDWARE IS LIMITED TO REPAIR AND REPLACEMENT AS SET FORTH IN THIS WARRANTY STATEMENT. ALL EXPRESS AND IMPLIED WARRANTIES FOR THE PRODUCT, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN TIME TO THE TERM OF THE LIMITED WARRANTY PERIOD AS DESCRIBED ABOVE. NO WARRANTIES, WHETHER EXPRESS OR IMPLIED, WILL APPLY AFTER THE LIMITED WARRANTY PERIOD HAS EXPIRED. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THIS LIMITATION MAY NOT APPLY TO YOU.

WE DO NOT ACCEPT LIABILITY BEYOND THE REMEDIES PROVIDED FOR IN THIS LIMITED WARRANTY OR FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, ANY LIABILTY FOR THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES, FOR PRODUCTS NOT BEING AVAILABLE FOR USE, OR FOR LOST DATA OR LOST SOFTWARE. OUR LIABILITY WILL BE NO MORE THAN THE AMOUNT YOU PAID FOR THE PRODUCT THAT IS THE SUBJECT OF A CLAIM. THIS IS THE MAXIMUM AMOUNT FOR WHICH WE ARE RESPONSIBLE. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.