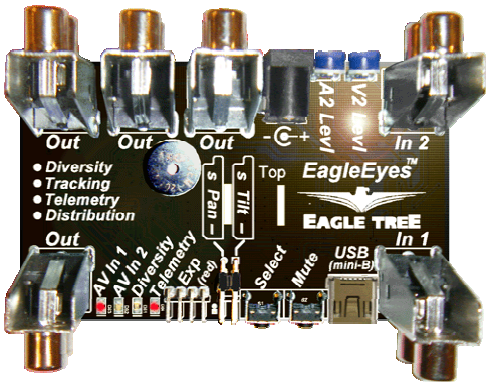



**Instruction Manual for EagleEyes™ FPV Station**

**Document Version 1.8**

# *Introduction*

Thank you for your purchase! This instruction manual will guide you through the configuration and operation of your EagleEyes™ FPV Station (the EagleEyes).

Please click on the "Support" tab of our web page at http://www.eagletreesystems.com for a link to the full color, electronic version of this manual, which may be updated if changes were made after printing. ***Please read the entire manual carefully, including all cautions and warnings, before proceeding***.

If, after you read the manual, you have further questions or problems, we have several options for technical support. Please click on the "support" tab of our web page for information on how to get answers to your questions, 24 hours a day.

# *Packing List*

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

# *What the EagleEyes Does*

The EagleEyes provides all of the following features:

- **Receiver Diversity** - when you connect two NTSC or PAL audio/video receivers (of any frequency), the EagleEyes picks the better signal at any given time, which can greatly reduce video fades and improve your FPV experience. A variety of diversity settings are configurable with the on-board switches and LED indicators.
- **Antenna Tracking** - when coupled with our OSD Pro airborne system, the EagleEyes is the heart of a full-featured pan/tilt antenna tracker. Powerful, flexible, and easy to use on-screen menus are provided for calibrating the EagleEyes to work flawlessly with the tracker of your choice. The built-in regulator drives even large pan/tilt servos, with no need for an external BEC.
- **Telemetry** - When coupled with our OSD Pro airborne system, all Eagle Tree data (not just GPS position) are transmitted to your laptop, via your video transmitter and the EagleEyes USB port (separate USB cable required). Your flight can then be graphed and displayed with our powerful software, or visualized (either in real time or after your flight) with Google Earth! A "no telemetry" alarm buzzer can be turned on to indicate loss of telemetry.
- **Four Channel A/V Distribution** - Ever wish you had more video/audio outputs? The EagleEyes has four built-in outputs!
- **Programmable Low Voltage Alarm** - You can program a low voltage alarm buzzer, which alerts you when your ground station battery is below your chosen voltage.
- **Expansion Port** – we plan to provide support for new features and accessories, such as the PowerPanel™ LCD Display. Let us know what features you'd like to see!

# *Additional Equipment Required (not included)*

A standard "Mini-B" USB cable is not included, but recommended. Most likely, you already have a compatible USB cable. New features and enhancements are provided online, and are loaded into your EagleEyes via USB. And, the telemetry function requires USB to connect to your laptop.

To use the tracking function, a pan/tilt antenna mount with servos is required. Also a suitable battery or power supply with a 2mm barrel power plug is required to power the pan/tilt servos.

To use the tracking and telemetry functions, our OSD Pro airborne system is required.

RCA male-male cables are required for hookup to your A/V equipment.

A small Phillips or flathead screwdriver is required to rotate the adjustment potentiometers.

## *General Safety Precautions*

In addition to the warnings and other precautions in this manual, the following precautions should always be observed:

1) If you have never set up or operated an RC model before, you will need help from an experienced modeler. Local RC clubs are great ways to meet experienced modelers, and receive the required training. This requirement is especially true for "FPV" flying, which can be more challenging than visual-only flying.
2) Never operate your model aircraft near or over buildings, power/telephone lines, or other obstacles. Never operate your model aircraft near or over other people!
3) RC models and accessories are not toys, and should be kept away from children, without proper adult supervision.

## *Firmware Updates*

Note that, like most Eagle Tree products, the EagleEyes is a "living" device. Quite often we add new features and enhancements to our products by changing the firmware. If you have a feature request for the EagleEyes, or have a problem, contact us via the "Support" tab on our website. If enough people ask for a feature, we will most likely add it!

To download the latest firmware for your EagleEyes, move your mouse over the "Support" tab of our website at http://www.eagletreesystems.com, and select "Download Latest Software." Note that software version 8.28 or later is required for updating the EagleEyes. Then, connect your EagleEyes to USB, and click "Hardware, Firmware Control." The EagleEyes should appear in the list of devices that are available for update. NOTE: make sure that you have connected the EagleEyes to USB before powering the EagleEyes with the barrel power connector, for proper operation. **Also, note that with some PC's, it may be necessary to power the EagleEyes via the barrel connector when it is connected to USB, for firmware update. If a firmware update error is generated in the software, please repeat the firmware update procedure with power connected to the barrel connector.**

**IMPORTANT: If you will be using the EagleEyes with your OSD Pro, you must download software version 8.57 or later, and update the firmware of your EagleEyes, and your OSD Pro and your recorder if prompted to do so.** It is required that all of your hardware has matching firmware installed, for correct operation.

## *Mounting the EagleEyes*

How the EagleEyes is mounted depends primarily on your other ground equipment, and the EagleEyes features you will be using.

The EagleEyes can simply be set on a table-top at your flying location. The EagleEyes board is protected and covered with clear heatshrink tubing. If you plan on mounting the EagleEyes board directly to a pan/tilt tracker, two ways to do this are to use a long plastic "zip" tie or a Velcro strip passed through two holes in your tracker mount, or to use pieces of adhesive Velcro tape on the bottom of the EagleEyes board, attached to the heatshrink. Other mounting options are possible.

**CAUTION: like any other electronic equipment, the EagleEyes should not be exposed to water!**

# *EagleEyes Connections*

**IMPORTANT: when connecting or disconnecting the RCA cables, please ensure that you do not put pressure on the components on the bottom side of the EagleEyes board with your fingers! Though they are protected with the clear heatshrink, components can be damaged or detached if too much force is applied. Instead, grip the edge of the circuit board itself, or the metal RCA connectors, when plugging RCA cables. In particular, the large capacitors on the component (bottom) side of the board should not be subjected to force.**

Please refer to Figure 1. The connections to the EagleEyes are as follows:

**Primary Audio/Video In –** This input, consisting of two RCA connectors, supplies the EagleEyes with the video and audio input signal. Normally, your wireless video receiver is connected to this input via two RCA male-male cables. The audio input (the upper RCA connector, red in color) is a "line level" or "mic level" low power input. Never connect amplified audio to this input! The video input (the lower RCA connector, yellow in color) accepts standard 75 ohm composite video. Either PAL or NTSC inputs are supported – the input type is automatically detected.

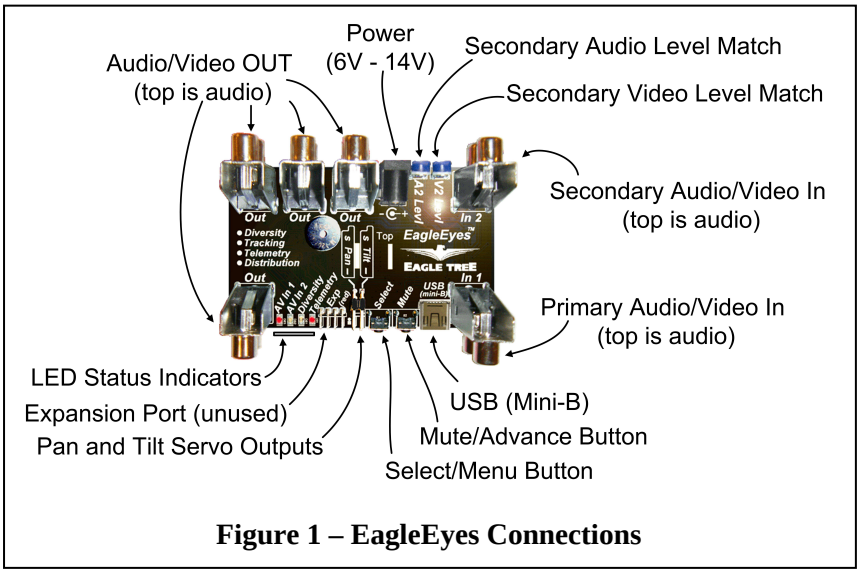



**Figure 1 – EagleEyes Connections**

**Secondary Audio/Video In –** This input is identical to the Primary input. It is normally used when you have two receivers connected, for receiver diversity support. Please see the "Receiver Diversity" section below for more information.

**Audio/Video Out Channels** – These four outputs are identical. Each provides the signal from the presently selected input (either primary or secondary). Each audio output (the upper RCA connector, red in color) is a "line level" or "mic level" output. Only connect the audio outputs to line level or mic level inputs of your A/V devices. **Never attempt to connect speakers directly to the audio outputs!** The video outputs (the lower RCA connector, yellow in color) are designed to be connected to a standard 75 ohm composite video input.

**Power Connection** – The power connection is a standard 2mm "barrel" jack, that accepts the barrel plug commonly used with FPV equipment. The voltage input can range from 6V to 14V.

**USB Connection** – A standard "Mini-B" USB connection is provided. This connection is used for EagleEyes firmware update, and for telemetry.

**LED Status Indicators** – there are four LED indicators on the EagleEyes, described below:

- **AV In 1** - indicates that the primary A/V input is selected for routing to the A/V outputs.
- **AV In 2** - indicates that the secondary A/V input is selected for routing to the A/V outputs.
- **Diversity** – indicates that the diversity function is active. See the Diversity section in the manual for more information.
- **Telemetry** – this LED flashes each time new telemetry data is received from the OSD Pro airborne system. If no telemetry information is being received, this LED will be off.

**Buttons** – there are two buttons on the EagleEyes, as described below:

- **Select/Menu button –** the primary function of this button is to select the active A/V input. Each time the button is pressed, the next A/V input mode is selected. The selection cycle is: Primary Input, Secondary Input, Diversity.

The LEDs indicate the present input mode. The secondary function of this button is for configuration, which is described in the "Built in Configuration Menu" section below.

- **Mute/Advance button –** the primary function of this button is to mute (or unmute) the buzzer. The secondary function is for configuration, which is described in the "Built in Configuration Menu" section below.

**Pan/Tilt Servo Connections** – these connections are for the pan and tilt servos of your tracking antenna. The pin-out of the servo connections is as follows:

- Ground – pin nearest the EagleEyes board
- Power – middle pin
- Signal – pin farthest from the EagleEyes board

If Futaba style servo plugs are used, the plugs are polarized by the EagleEyes board – the small tab on the Futaba plug forces the plug to be connected in the correct orientation. If JR style servo plugs are used, you must ensure the correct polarity is achieved. The legend on the EagleEyes board indicates the correct polarity. See the "Antenna Tracking" section below for more information.
NOTE: if you see "video lines" or similar noise after connecting your servos, please see the troubleshooting section below.

**Adjustment Potentiometers** – The two blue potentiometers adjust the secondary A/V input levels. These are used to attempt to match the secondary A/V inputs with the primary A/V inputs, when using the Diversity function. A small screwdriver is required to rotate the potentiometers. See the "Diversity Function" section below for more information. **CAUTION: rotate the potentiometers gently, and do not rotate the potentiometers past their stops. They do not rotate 360 degrees! Forcing the potentiometers past their stops could damage the EagleEyes board or other equipment.**

**Expansion Port** – the expansion port is presently unused. Planned features for the port include support for our PowerPanel™ LCD display. Please let us know if you want this supported, or if you have other suggestions!

# *Configuring the EagleEyes with the Built-in Menus*

The EagleEyes has a built-in menu system for setting up features. The menus use the four LED's and the two pushbuttons. The four LED's indicate the present menu parameter being configured, as well as the present value for that parameter.

**IMPORTANT: If you are going to be using the EagleEyes with the OSD Pro system, do not use the built-in menus to configure the EagleEyes.** Use the OSD Pro's on-screen menus, described in the "Configuring the EagleEyes with the OSD Pro On-screen Menus" section below. The on-screen settings take precedence over the built-in menu settings when the OSD Pro is in use.

***Menu Options***

There are five built-in menu parameters that can be configured, as shown in Figure 2:

1. **Low Battery Alarm Enable? -** this menu parameter lets you select whether the EagleEyes make a periodic beep when the voltage powering the EagleEyes (at the "barrel" connector) is below the programmed voltage. The options for this menu are either "No" or "Yes." If this parameter is set to "Yes" the alarm will sound when the present voltage is less than the minimum voltage (programmed below).
2. **Low Battery Alarm Integer –** This menu parameter lets you set the integer portion of the minimum voltage for alarm. For example, if you wanted to set a minimum voltage of 11.6V, you would set this parameter to "11".
3. **Low Battery Alarm Fraction -** This menu parameter lets you set the fractional (tenths) portion of the minimum voltage for alarm. For example, if you wanted to set a minimum voltage of 11.6V, you would set this parameter to "6".
4. **Diversity Sensitivity -** This menu parameter lets you set the sensitivity of the diversity function. The lowest sensitivity is 1, and the highest is 10. The default setting is 5. Please see the Diversity section below for more information.
5. **Diversity Switch Chirp? -** This menu item lets you select whether the EagleEyes beeps when the diversity function switches between video channels. The options for this menu are either "No" or "Yes."

**Figure 2: Built-in Menu Items (use these menus only if the OSD-Pro airborne system is not used)**

***Entering and Exiting Menu Mode***

To enter menu mode, hold the SELECT/MENU button down for about two seconds, until two beeps are heard. To exit menu mode, hold the SELECT/MENU button down again for two seconds, until two beeps are heard.

***Selecting the Menu Parameter to Change***

The present menu parameter is indicated by the state of the four LEDs on the EagleEyes. Figure 3 indicates which menu parameter is selected for editing, based on the state of the four LEDs. When menu mode is entered, the first parameter (Enable Low Battery Alarm?) will be selected.

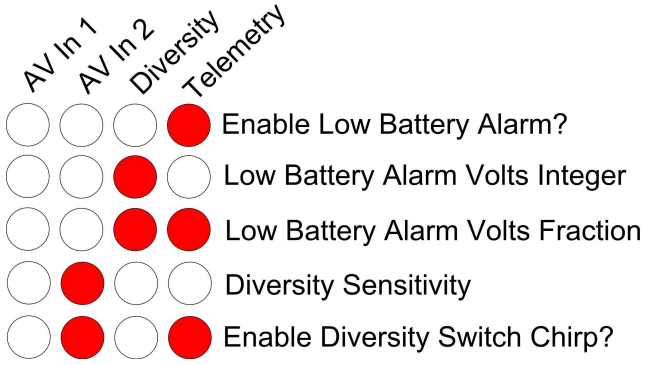



**Figure 3: Selected Menu Item Indication**

The menu parameter selected will be shown on the LEDs for about 2 seconds, as shown in Figure 3. Then, the present value of that menu item will be shown, as indicated in Figure 4.

To select a different menu parameter for editing, just tap the SELECT/MENU button, and the next menu item will be selected for editing. The LEDs will indicate which menu item is being edited for about 2 seconds, then the present value of that menu item will be displayed.

***Changing the Value of the Selected Menu Item***

Figure 4 indicates how the present value of the selected menu item is displayed.

Note that "No" is indicated by no LEDs illuminated, and "Yes" is indicated by one LED illuminated.

To increase the value of a menu item, tap the MUTE/ADVANCE button. Then, the value will be incremented by one, and the new value will be displayed. Once the value reaches the maximum value supported by that menu item (as indicated in Figure 2 above) then the lowest value will be displayed. In other words, the values cycle through their valid ranges as the "MUTE/ADVANCE" button is successively tapped.

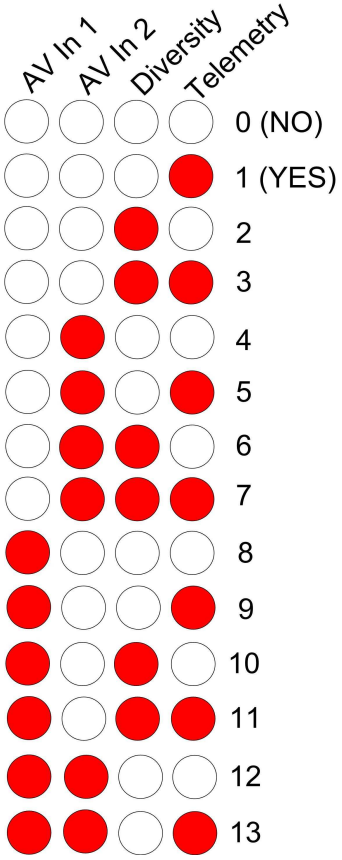



**Figure 4: Menu Item Values on LEDs**

***Menu Example: changing the Diversity Sensitivity***

In this example, the Diversity Sensitivity is already set to "5" and I want to change it to "3". To enter menu mode, I first hold the SELECT/MENU button down for about two seconds, until two beeps are heard. Then, the indication that I am editing the "Enable Battery Alarm?" option appears (as shown in Figure 3) for about 2 seconds. Then, the present value of the "Enable Battery Alarm?" setting (either "0" or "1") is displayed on the LEDs. To advance to the Diversity Sensitivity menu, I press the SELECT/MENU button 3 times, and then the LED pattern corresponding to Diversity Sensitivity menu (as shown in Figure 3) is displayed for about 2 seconds. Then the present value of Diversity Sensitivity (5) is displayed on the LEDs, as shown in Figure 4. Now, the MUTE/ADVANCE button is tapped over and over to increase the Diversity Sensitivity until it reaches 10, and then it rolls over to 1 as I continue to tap, and finally reaches 3. Then, I hold the "SELECT/MENU" button for 2 seconds until two beeps are heard, to exit menu mode. Now, the Diversity Sensitivity value is programmed to be 3, and this value will be saved until I change it again.

# *Configuring the EagleEyes with the OSD Pro On-screen Menus*

All of the EagleEyes features can be configured using the OSD Pro On-screen menus. Please see the OSD Pro instruction manual for information on how to use the On-screen menus.

**Note that the EagleEyes must be connected to your video receiver, and the EagleEyes telemetry LED must be blinking, for On-Screen configuration to work!**

After invoking the OSD Pro On-screen menus, select the "Configure EagleEyes Station" item from the main menu. Then, the EagleEyes main setup menu will appear, as shown in Figure 5. The additional EagleEyes On-screen menus are described below, in Figure 6 and Figure 7.

**EagleEyes FPV Station Setup**

a) **Set Zero Pan Compass Reading** - this menu item lets you manually set the compass angle at which the antenna is pointing, when it is centered, at your flying site. For example, if the antenna is pointing exactly West when centered, you would enter "270" in this field.
b) **Use Model Location as 0 Pan** – this menu item automatically sets the compass angle at which the patch antenna's pan function is pointing, when it is centered, at your flying site. To use this option you must first ensure that the OSD Pro has established its "home" GPS location. Then, move the model as far away from the antenna as practical, ensuring that the model is lined up with the patch antenna on the pan/tilt mount. Then, select this option, and the Zero Pan compass angle reading is automatically computed.
c) **Min Radius frm Home for Trak** – this menu item lets you enter the minimum radius for tracking. This radius is in either meters or feet, depending on your uints setting. If the model is closer to home than this radius, the pan/tilt mount will stop moving. The purpose of this option is to keep the pan/tilt mount from swinging around wildly when the model is close to home, since the GPS position location can vary, depending on the GPS fix quality.
**d) Configure Pan/Tilt –** this menu item invokes the EagleEyes Antenna Tracking configuration menu, described in Figure 6
**e) Configure Diversity + Alarms –** this menu item invokes the EagleEyes Diversity and Alarms configuration menu, described in Figure 7

**Figure 5: EagleEyes Main On-screen Menu**

# *The Diversity Function*

This section describes the diversity function of the EagleEyes ground station. This function can be used with or without the OSD Pro airborne system.

***What the Diversity Function Does***

The diversity function constantly inspects the signal quality of two A/V receivers connected to the input channels of the EagleEyes, and switches to the highest quality signal. The two receivers can be either NTSC or PAL. The EagleEyes automatically detects the video mode. Video links of any frequency can be used, or can even be mixed if transmitters of two different frequencies are used on the model.

The diversity function can help to eliminate loss of video signal due to "multipath" that often occurs with a single receiver. As an example, those who have ever watched television using "rabbit ears" antennas know that even slight movements of the antenna can improve signal. If you are using two receivers, it is more likely that at least one of them will be in a good position at any given time.

Further, if you use a directional antenna for flying at longer range, that antenna may not work well when you are close to your takeoff point. To solve this problem, many pilots use an omni-directional antenna when close in, and a directional

antenna when flying far away. If both of these receivers are connected to the EagleEyes, the diversity function will pick the stronger of the two automatically.

***How to Set Up the Diversity Function***

To set up the diversity function, simply connect two receivers to the EagleEyes Primary and Secondary A/V inputs, as described in the "Connections" section above. The "SELECT/MUTE" switch is tapped to switch between Input 1, Input 2, and Diversity mode. The LEDs indicate the present mode. When Diversity mode is entered, the LED corresponding to the presently selected input is illuminated, and also the "Diversity" LED is illuminated. Then, as the diversity automatically switches between the two inputs, the LED corresponding to the new input is illuminated.

If you notice that the audio levels or video images of the two input channels do not match in appearance, the two blue potentiometers can be used to adjust the secondary A/V input levels. A small screwdriver is required to rotate the potentiometers. If the video signal of the secondary input appears to be lighter or darker than that the primary input, gently rotate the "Secondary Video Level Match" potentiometer, while switching between the two inputs with the Select/Menu button, to match the inputs. Similarly, if the audio signal of the secondary input appears to be softer or louder than that of the primary input, gently rotate the "Secondary Audio Level Match" potentiometer. **CAUTION: rotate the potentiometers gently, and do not rotate the potentiometers past their stops. They do not rotate 360 degrees! Forcing the potentiometers past their stops could damage the EagleEyes board or other equipment.**

***How to Configure the Diversity Function***

There are two diversity related configuration options.

First, the diversity sensitivity is adjustable. The adjustment range is from 1 (least sensitive, with many video glitches required in a short period before switching), to 10 (most sensitive, with almost instantaneous switching with only one video glitch). The default setting is 5.

Secondly, the EagleEyes will produce a short beep when the diversity channel is automatically switched, if you desire. If you are using our OSD Pro airborne system, both of these parameters are configured on-screen, with the menu described in Figure 6. If you are not using the OSD Pro, the diversity parameters are configured via the pushbuttons, as described in the "Configuring the EagleEyes with the Built-in Menus."

**EagleEyes Diversity/Alarm Setup**

NOTE: See the "How to Configure the Diversity Function" section for details on the diversity menu items.

- **Enable Volt Alarm?** - this menu item enables or disables the low voltage alarm
- **Set Alarm Voltage –** this menu item lets you set the low voltage alarm. Valid range is between 5.0V and 13.9V.
- **Enable No Telemetry Alarm? –** this menu item turns on the "no telemetry alarm" which periodically beeps if no telemetry has been received for a few seconds. Also note that the telemetry LED will turn off if no telemetry is received.
- **Select Video Input Channel –** this menu item lets you select the video input. The choices are Input 1, Input 2, and Diversity.
- **Set Diversity Sensitivity -** this menu item lets you set the diversity sensitivity. Valid range is between 1 and 10, 10 being most sensitive.
- **Enable Diversity Switch Beep –** this menu item determines whether the EagleEyes will briefly beep each time the input channel is automatically switched with Diversity.

**Figure 6: EagleEyes Diversity and Alarms On-screen Menu**

# *The Antenna Tracking Function*

This section describes the antenna tracking function of the EagleEyes ground station. This function requires the OSD Pro airborne system, and a servo based antenna panning or pan/tilt mount (tracker).

**IMPORTANT: please read through this entire section before attempting to calibrate tracker.** Calibration is relatively simple as long as you understand how the calibration procedure is done.

### *What the Tracking Function Does*

The tracking function points a pan/tilt capable antenna tracker directly towards your model, based on the position of the model in relation to home. The EagleEyes drives the pan and (optionally) tilt servo of your tracker. The EagleEyes is easily calibrated to work with virtually any type of servo based antenna tracker. Some sources for pan/tilt antenna mounts are http://www.readymaderc.com and http://www.servocity.com.

### *How to Set Up the Antenna Tracking Function*

The Pan servo, and optionally the tilt servo, of your pan/tilt mount are connected to the EagleEyes pan and tilt servo outputs, as described in the "Connections" section above. The EagleEyes board is capable of providing a maximum burst current of approximately 5 amps to the servos, dependent on the capabilities of your power supply. **Caution: when a tracker is being used, the EagleEyes printed circuit board, especially the center of the board, can become hot to the touch!** The maximum continuous current available to the servos depends on the input voltage, as well as the capability of your power supply. Higher input voltages cause the on-board regulator to produce more heat. If the regulator becomes too hot, it will shut off briefly (for about 20 seconds) and then start again. Note that the rest of the EagleEyes functionality will not shut off - only the power to the servos. With the standard sized servos used for typical pan/tilt trackers, there should never be a regulator shutoff, even at the maximum input voltage of 14 volts. If your tracker uses very large servos, and they are constantly under heavy load, the regulator may shut off briefly at higher input voltages. If this occurs, see the Troubleshooting section below.

### *How to Configure the Antenna Tracking Function*

The Antenna Tracking function is easily configured using the on-screen menus built into the OSD Pro. The Windows software can not presently be used to configure the Antenna Tracking function, so it's necessary to use the OSD display for this. Please see the OSD Pro instruction manual for information on how to use the On-screen menus.
To calibrate your tracker, select the "Configure Pan/Tilt" on-screen menu option, and the menu shown in Figure 7 will appear.

**EagleEyes Antenna Track Setup Menu**

NOTE: See the "How to Configure the Antenna Tracking Function" section for details about these menu items.

- **Select Pan Angle to Calibrat –** with this menu item, you choose the pan angle that you will next calibrate. A "*" displayed next to the angle indicates that this angle has been calibrated already.
- **Pan to angle selected above –** here you use the SELECT and UP/DOWN on-screen menu switches (on your radio) to position the pan angle of your tracker to the angle specified above. When you select this option by clicking the SELECT switch, the pan servo starts moving either clockwise or counterclockwise, depending on the position of the "UP/DOWN" switch. If the pan servo is moving in the incorrect direction, just flip the UP/DOWN switch to reverse the motion. When the angle selected above is approached, immediately flip up the SELECT switch, which will stop the motion, and record the position as the antenna position that corresponds with the angle selected above. **WARNING: make sure you stop the motion of the servo before it reaches its maximum rotation, or the servo could be damaged!**
- **Finish Pan Calibration –** select this menu item when you have calibrated all the pan angles that are applicable
- **Set Tilt to Lowest -** with this menu item, you use the SELECT and UP/DOWN on-screen menu switches (on your radio) to position the tilt angle of your tracker its lowest position (normally 0 degrees, but must be greater than or equal to 0 degrees). When you select this option by clicking the SELECT switch, the tilt servo starts moving either up or down, depending on the position of the "UP/DOWN" switch. If the tilt servo is moving in the incorrect direction, just flip the UP/DOWN switch to reverse the motion. When the lowest tilt angle is approached, immediately flip the SELECT switch, which will stop the motion, and record the position as the lowest position. **WARNING: make sure you stop the servo motion before it reaches its maximum rotation, or the servo could be damaged!**
- **Enter Tilt Low Angle –** with this menu item, you enter the position to which you just set the tilt angle of your tracker, with the above menu item. For example, if you set the tracker's tilt angle to 0, you would enter "0" in this field.
- **Set Tilt to Highest -** with this menu item, you use the SELECT and UP/DOWN on-screen menu switches (on your radio) to position the tilt angle of your tracker to its highest position (normally 90 degrees). When you select this option by clicking the SELECT switch, the tilt servo starts moving either up or down, depending on the position of the "UP/DOWN" switch. If the tilt servo is moving in the incorrect direction, just flip the UP/DOWN switch to reverse the motion. When the highest tilt angle is approached, immediately flip the SELECT switch, which will stop the motion, and record the position as the lowest position. **WARNING: make sure you stop the motion of the servo before it reaches its maximum rotation, or the servo could be damaged!**
- **Enter Tilt High Angle -** with this menu item, you enter the position to which you just set the tilt angle of your tracker, with the above menu item. For example, if you set the tracker's tilt angle to 90 degrees above, you would enter "90" in this field.
- **Set Panning Speed –** this menu item lets you adjust the panning speed of your tracker. Valid range is 1 to 9
- **Set Tilting Speed –** this menu item lets you adjust the tilting speed of your tracker. Valid range is 1 to 9
- **Pan Test - Select Position –**Select one of the angles from this menu item, and the tracker should correctly pan to the selected angle. Note that you need to first calibrate the pan angles above, before using this option.
- **Tilt Test - Select Position -** Select one of the angles from this menu item, and the tracker should correctly tilt to the selected angle. Note that you need to first calibrate the tilt angles above, before using this option**.**
- **Force Pan/Tilt Angle Hold? -** this menu item lets you enable forced pan and tilt angles (entered below). Note that when this item is set to "YES", the pan and tilt angle of your tracker will be forced to the angles specified below, until you turn this option off. This option is useful if you wish to set your antenna to hold a fixed position, if you are not using the tracking function.
- **Forced Pan Angle -** this menu item sets the fixed pan angle that is used, if the "Force Pan/Tilt Angle Hold?" menu item is set to "YES".
- **Forced Tilt Angle -** this menu item sets the fixed tilt angle that is used, if the "Force Pan/Tilt Angle Hold?" menu item is set to "YES".
- **Reset Pan/Tilt Settings! –** this menu item resets ALL of the pan/tilt settings to default values, and clears all angle calibration. This is useful if you have miscalibrated the tracker, or otherwise wish to recalibrate.

**Figure 7: EagleEyes Pan/Tilt Setup On-screen Menu**

Follow this order in calibrating your antenna:

- Calibrate the Pan angles
- Calibrate the tilt angles
- Test the pan and tilt angles using the Pan Test and Tilt Test menu items
- Increase the panning speed and tilting speed as desired, using the Pan Speed and Tilt Speed menu items
- Click "Exit" to leave the pan/tilt calibration menu. **Important: the calibration settings are not permanently saved until you click "Exit" on the pan/tilt menu screen**! So, make sure you click "Exit" on the menu, rather than just powering off your OSD Pro after calibration.
- Use the OSD Pro's simulator to test the pan/tilt function
- At the field, each time you fly (unless your tracker is set up in the exact same orientation each time), set the "Pan Zero Angle" so that the EagleEyes knows the actual compass direction to which its zero degree (center) pan position points.

Note that, as an aid to calibration, the Pan and Tilt PWM values that the EagleEyes is presently sending to the servos is displayed whenever the "Configure Pan/Tilt" menu item is active. The PWM values displayed are in 100 millisecond units.

The pan and tilt functions of your tracker are calibrated slightly differently. In general, accurate pan calibration is the most critical, since the pan function has greater range of rotation than the tilt function, and the and the antenna will not tilt very much when your model is far away from you.

***Calibrating Pan Angle***

Regarding pan calibration, servos may have "nonlinearities" in their full rotation. In other words, the relationship between the pan angle and the servo position may vary slightly depending on the angle selected. The EagleEyes helps to minimize this issue by optionally letting you calibrate several different angles during pan calibration.

Further, some trackers allow for greater than 360 degrees of rotation when the servo moves between its extents. The EagleEyes accommodates these trackers, allowing rotation of up to about 720 degrees.

To calibrate the pan, the first step is to make sure you can physically measure your tracker's pan angle, using a compass, (with the tracker positioned so that the pan servo center point is pointing toward magnetic north), by installing a paper compass rose around the tracker, so that "0 degrees" corresponds to the center point of the pan servo, or by physically drawing a compass rose on your tracker. See Figure 8 for the angles you may need to calibrate.

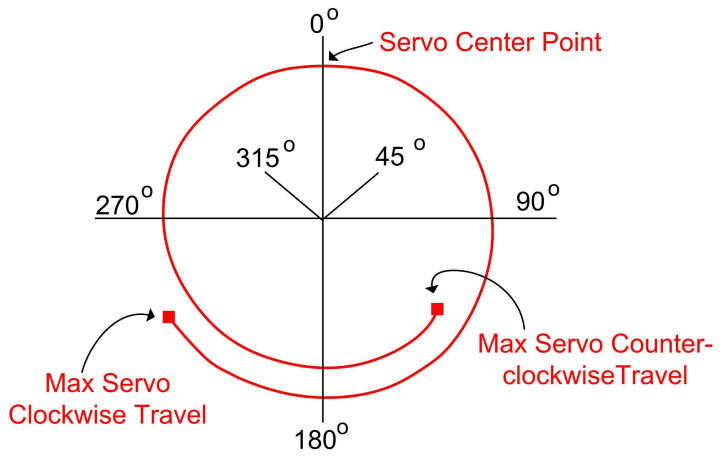



**Figure 8 – Pan Angles for tracker (this one rotates more than 360 degrees)**

Pan angle is defined just like it is on a compass: 0 degrees is the midpoint of your pan servo's travel and corresponds to "North" on a compass, 90 degrees corresponds to the "East" on a compass, 180 degrees corresponds to "South" on a compass, 270 degrees corresponds to "West", etc., as shown in Figure 8.

Each pan angle is calibrated as follows:

1) Select the panning speed to be used for calibration. The higher the speed, the more difficult it is to precisely set the angles. So, a value of 3 or lower is recommended during calibration.

2) Select the pan angle you would like to calibrate, using the "Select Pan Angle to Calibrat" menu item. Note that once a particular angle is calibrated, a "*" appears beside it, indicating that it's already calibrated. But, you can recalibrate it and the new calibration overwrites the old one.
3) Pan the antenna to that angle, using the "Pan to angle selected above" menu option. With this menu item, you will use the SELECT and UP/DOWN on-screen menu switches (on your radio) to position the pan angle of your tracker to the angle specified in step 2 above. When you select this option by clicking the SELECT switch, the pan servo starts moving either clockwise or counterclockwise, depending on the position of the "UP/DOWN" switch. If the pan servo is moving in the incorrect direction for you to reach the selected angle, just flip the UP/DOWN switch to reverse the motion. When the angle selected above is approached, immediately flip the SELECT switch, which will stop the motion, and record the position as the antenna position that corresponds with the angle selected above. **WARNING: make sure you stop the motion of the servo before it reaches its maximum rotation, or the servo could be damaged!**

   Note: Steps 2 and 3 are repeated for each pan angle you wish to calibrate.

4) After calibrating the desired pan angles, select the "Finish Pan Calibration" menu item, which completes the pan angle calibration process.

Here are some examples of how to calibrate the pan angles for various types of antennas. Follow the detailed steps above, using the angles indicated below:

***Calibrating pan with an antenna that rotates 360 degrees, when slight pointing inaccuracy is ok (this is the most common and simplest calibration):***

1) Select "180 (CW)" angle to calibrate
2) Pan the antenna clockwise to 180 degrees
3) Select "180 (CCW)" angle to calibrate
4) Pan the antenna all the way around, counterclockwise, back to 180 degrees
5) Click "Finish Pan Calibration"

***Calibrating pan with an antenna that rotates more than 360 degrees, when slight pointing inaccuracy is ok:***

1) Select "180 (CW)" angle to calibrate
2) Pan the antenna clockwise to 180 degrees
3) Select "Max CW" angle to calibrate
4) Pan the antenna clockwise to its maximum clockwise position.
5) Select "180 (CCW)" angle to calibrate
6) Pan the antenna counterclockwise, all the way around, back to 180 degrees.
7) Select "Max CCW" angle to calibrate
8) Pan the antenna counter-clockwise to its maximum counter-clockwise position
9) Click "Finish Pan Calibration"

***Calibrating pan with an antenna that rotates at least 180 degrees total, but less than 360 degrees total***

1) Select "90 (CW)" angle to calibrate
2) Pan the antenna clockwise to 90 degrees
3) If the antenna cannot pan more than 180 degrees total, skip to step 6.
4) Select "Max CW" angle to calibrate
5) Pan the antenna clockwise to its maximum clockwise position.
6) Select "270 (CCW)" angle to calibrate
7) Pan the antenna counterclockwise to 270 degrees.
8) If the antenna cannot pan more than 180 degrees total, skip to step 11.
9) Select "Max CCW" angle to calibrate
10) Pan the antenna counterclockwise to its maximum counter-clockwise position
11) Click "Finish Pan Calibration"

***Calibrating pan with an antenna that rotates at least 90 degrees total, but less than 180 degrees total***

1) Select "45 (CW)" angle to calibrate
2) Pan the antenna clockwise to 45 degrees

3) If the antenna cannot pan more than 90 degrees total, skip to step 6.
4) Select "Max CW" angle to calibrate
5) Pan the antenna clockwise to its maximum clockwise position.
6) Select "315 (CCW)" angle to calibrate
7) Pan the antenna counter-clockwise to 315 degrees.
8) If the antenna cannot pan more than 90 degrees total, skip to step 11.
9) Select "Max CCW" angle to calibrate
10) Pan the antenna counter-clockwise to its maximum counter-clockwise position
11) Click "Finish Pan Calibration"

***Increasing the antenna pointing accuracy, in case there are nonlinearities present in your pan servo***

For antennas that pan at least 360 degrees, the EagleEyes can help counteract any nonlinearities that might be present in your pan servo through its full extent of travel, thus improving pointing accuracy. To take advantage of this feature, follow the steps above for calibration, but also calibrate these additional angles. Note: the order in calibrating angles does not matter.

- 90 degrees
- 270 degrees
- 0 degrees.

After all the angles (including the ones above) are calibrated, click "Finish Pan Calibration".

***Calibrating Tilt Angle (if supported by your tracker)***

To calibrate the tilt function, the first step is to make sure you can physically measure your tracker's tilt angle at 0 degrees (horizontal) and 90 degrees (vertical), which can be done either approximately by sight, or with an "L" shaped carpenter's square, a bubble level, or similar.

Tilt angles is defined as follows: 0 degrees corresponds to horizontal (model at same altitude as tracker), and 90 degrees as vertical (model is directly above the tracker).

The tilt function of your tracker is calibrated as follows:

1) Select the tilting speed to be used for calibration. The higher the speed, the more difficult it is to precisely set the angles. So, a value of 3 or lower is recommended during calibration.
2) Select the "Set Tilt to Lowest" menu item to move the antenna to its lowest position (0 degrees or greater). With this menu item, you will use the SELECT and UP/DOWN on-screen menu switches (on your radio) to position the tilt angle of your tracker to its lowest setting (but not less than 0 degrees). When you select this option by clicking the SELECT switch, the tilt servo starts moving either up or down, depending on the position of the "UP/DOWN" switch. If the tilt servo is moving in the incorrect direction for you to reach the lowest angle, just flip the UP/DOWN switch to reverse the motion. When the lowest angle is approached, immediately flip the SELECT switch, which will stop the motion, and record the present position as the antenna position that corresponds with the lowest tilt angle. **WARNING: make sure you stop the motion of the servo before it reaches its maximum rotation, or the servo could be damaged!**
3) Select the "Enter Tilt Low Angle" menu item, and enter the angle corresponding to the position to which you just set the tilt angle of your tracker. For example, if you set the tracker's tilt angle to 0 degrees, you would enter "0" in this field.
4) Select the "Set Tilt to Highest" menu item to move the antenna to its highest position. Normally, you would position the tracker to be pointing straight up (90 degrees) with this step. With this menu item, you will use the SELECT and UP/DOWN on-screen menu switches (on your radio) to position the tilt angle of your tracker to its highest setting (normally 90 degrees). When you select this option by clicking the SELECT switch, the tilt servo starts moving either up or down, depending on the position of the "UP/DOWN" switch. If the tilt servo is moving in the incorrect direction for you to reach the highest angle, just flip the UP/DOWN switch to reverse the motion. When the highest angle is approached, immediately flip the SELECT switch, which will stop the motion, and record the present position as the antenna position that corresponds with the highest tilt angle. **WARNING: make sure you stop the motion of the servo before it reaches its maximum rotation, or the servo could be damaged!**

5) Select the "Enter Tilt High Angle" menu item, and enter the angle corresponding to the position to which you just set the tilt angle of your tracker. For example, if you set the tracker's tilt angle to 90 degrees, you would enter "90" in this field.

***Special Tilt feature for trackers that can tilt at least 165 degrees, but can pan less than 360 degrees***

The EagleEyes has a special feature in its tracking function that will tilt your tracker farther than 90 degrees, if your pan function cannot do a full 360 degree rotation. This feature partially or completely eliminates the "dead zone" when your model is flying outside of the pan range of the tracker. For this feature to be invoked, your tracker must be able to tilt to a high angle of at least 165 degrees (almost to horizontal).

If the model is outside of the pan range, the EagleEyes will use the tilt function to tilt the antenna so that it is pointing "backwards" so that the antenna will still point to the model. This feature will be automatically enabled when a) you calibrate your total pan angle to be less than 360 degrees, but at least 180 degrees, and b) you calibrate your tilt high angle to be 165 degrees or higher.

***Testing the Calibrated Pan and Tilt Angles***

There are three features built into the EagleEyes to help you validate your pan and tilt calibration:

1) The Pan Test and Tilt Test menu items on the Pan/Tilt calibration menu, as described in Figure 7, let you select various pan and tilt angles. After selecting an angle, the tracker should move to that angle. If it does not, recalibrate either the pan or tilt, as appropriate.
2) The OSD Pro's flight simulator will drive your tracker, based on the location of the model relative to home, on the simulator screen. See the OSD Pro manual for more information on using the simulator.
3) If "Servo Deflections" are displayed by selecting this option under the "Configure OSD Display" menu, the present pan angle ("P: XXX") and tilt angle (T:YYY) will be displayed on the screen, both in simulator mode and in actual flight.

***Setting the Pan Zero Angle at the Field***

Each time your tracker is physically moved, you need to set the "Pan Zero Angle" so that the EagleEyes knows the actual compass direction pointed to when the when the tracker is panned to its zero degree (center) pan position. There are two ways to do this:

a) Use the "Set Zero Pan Compass Reading" option from the EagleEyes main on-screen menu (shown in Figure 5) to manually set the compass direction at which the antenna is pointing, when at zero degrees pan (centered). For example, if the antenna is pointing exactly West when centered, you would enter "270" in this field. A handheld compass is needed at the field to use this method.
b) Use the "Model Location as 0 Pan" from the EagleEyes main on-screen menu (shown in Figure 5) to set the compass direction at which the antenna is pointing, when at zero degrees pan (centered). To use this option, you must first ensure that the OSD Pro has established its "home" GPS location, and has a good GPS fix. Then, move the model as far away from the antenna as practical. Ensuring that the model is lined up with the front of the antenna (and ensuring that the antenna pan angle is at zero degrees), select this menu item, and the Zero Pan compass angle reading is automatically computed.

# *The Telemetry Function*

The EagleEyes, when coupled with our Windows Data Recorder software program, provides telemetry display of all Eagle Tree sensors which are connected to your OSD Pro. In addition to displaying the telemetry, the software can save the telemetry to a file for later use, graph the telemetry data in real time or postflight, and show the GPS telemetry data in Google Earth™. An example of the telemetry software screen is shown below.

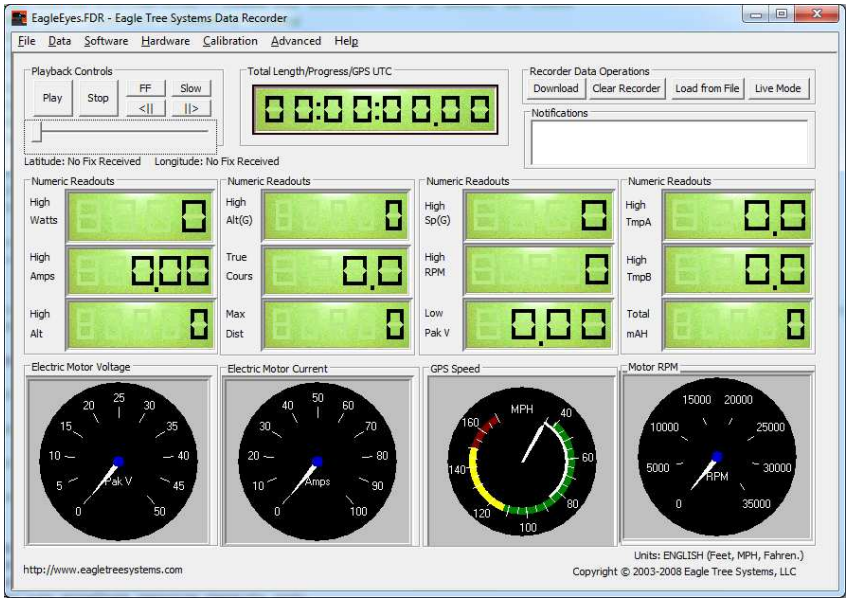
To utilize the telemetry function, just connect a USB mini-B cable (not included) between your PC, notebook, or netbook, and the EagleEyes. Then, make sure telemetry is being received by the EagleEyes – the "Telemetry" LED should be flashing. Next run the software, and click "Live Mode." Then, telemetry data should be displayed on the Data Recorder

screen. Please see the manual that came with your eLogger or Data Recorder for more information on using the software.

NOTE: make sure that you have connected the EagleEyes to USB before powering the EagleEyes with the barrel power connector, for proper USB operation. Also, note that it is not necessary to power the EagleEyes via the barrel connector when it is connected to USB, unless you are using the antenna tracker function.

Note that in some cases the data displayed in the software could be different than the data displayed on the OSD Pro:

- Some parameters, such as voltages, speeds, and altitudes, will be slightly different in the software than on the OSD Pro screen. This is because the software uses slightly different algorithms for computing and averaging these parameters. But, the differences should be small.
- The first barometric altitude and airspeed readings received by the software are treated as the "zero" values, when Live Mode is invoked. So, it's important to start Live Mode before the model is moving.
- The "Home" point is set as the first GPS fix received by the software after Live Mode is started. So, it's important to start Live Mode after the OSD Pro has established its home position, but before the model is moved. Otherwise, the "Distance to Pilot" parameter displayed in the software will be different from the Distance parameter displayed on the OSD Pro.




- The software only displays ground distance, and does not take into account the altitude. But, the OSD Pro lets you choose whether to calculate "LOS" distance using altitude and ground distance.
- GPS Altitude displayed in the software is NOT zero referenced. In other words, if the GPS is reporting the MSL altitude at your home location as 300 feet, the OSD Pro will display "0" since it zero references the GPS altitude, but the software will display "300".
- The units in the software are either English or Metric. The same applies to the OSD Pro, unless units other than the default units are chosen for speed, altitude, etc., in the OSD Pro's on-screen menus.

# *Troubleshooting*

Below is a list of problems that may be encountered, and steps to remedy them. If your particular issue is not addressed by the below, click on the Support tab at http://www.eagletreesystems.com for easy options for getting answers to your questions, 24 hours a day.

**Issue**: I am seeing lines in my video when using the EagleEyes with my tracking antenna. I have the EagleEyes and my Video Receiver(s) powered with the same battery.
**Solution :** Noise can be generated by the servos, which passes through the EagleEyes power connector to the power input of the receiver(s). Some receivers filter this noise, but some do not. If you are seeing video lines, any one of the following should fix the problem:

a) Use a low cost "LC" filter with your single battery, such as the DPCAV.COM PSF-001 filter. The filter should be installed in the power cord, between the EagleEyes and the Receiver(s).
b) Use separate batteries to power the EagleEyes and the Receiver(s).
c) Use short, high quality RCA cables. We have received many reports that this completely resolves the issue, with no separate battery or filter needed, and our own tests have confirmed this.

**Issue**: I am using the EagleEyes with the OSD Pro, but I am having trouble getting tracking or telemetry

**Solution:** Make sure that you have installed software version 8.28 or later, as described in the "Firmware Updates" section above, and that you have updated your OSD Pro, eLogger or Data Recorder, and EagleEyes with the firmware from that software version.
**Solution:** Make sure telemetry is being received by the EagleEyes – the "Telemetry" LED should be flashing if telemetry is being received by the EagleEyes
**Solution:** Make sure that the OSD Pro is active. The OSD Pro must be active for tracking or telemetry to work, as it inserts the telemetry signals in the video.

**Issue**: Tracking is not correctly following my model
**Solution:** Make sure telemetry is being received by the EagleEyes – the "Telemetry" LED should be flashing if telemetry is being received by the EagleEyes
**Solution:** Make sure you have calibrated the antenna correctly. This is easily tested by using the "Flight Simulator" built into the OSD Pro.
**Solution:** Make sure that the GPS has a position fix. If the GPS loses its fix, the antenna will stop moving. The telemetry light on the EagleEyes will continue to flash in this case, but the antenna will not move.
**Solution:** If the tracker is moving, but not pointing the antenna at your model, make sure you have set the "Pan Zero Angle" at your field, as described in the Tracking Function section above.

**Issue**: When testing the tracking function with the simulator, or at the field, the tracker stops moving
**Solution:** make sure telemetry is working correctly – the "Telemetry" LED should be flashing if telemetry is being received by the EagleEyes
**Solution:** Make sure that the GPS has a position fix. If the GPS loses its fix, the antenna will stop moving. The telemetry light on the EagleEyes will continue to flash in this case, but the antenna will not move.
**Solution:** If the tracker stops moving (and returns to the "off" position) for about 20 seconds, then starts moving again, the on-board regulator may be overheating. This should never happen with standard sized servos, or even with very large servos that are not binding. If the regulator is overheating, one solution is to reduce the voltage supplied to the barrel connector. The higher the voltage, the more heat the regulator will generate. Also, check to make sure that your servos are not binding. If the antenna is out of balance on the mount, and is very large, the servos may be constantly binding. If these solutions do not solve your problem, there is a relatively simple hardware change you can make, that may solve your issue. Please open a support web ticket with us, at http://ticket.eagletreesystems.com and we will send you the information for this.
**Issue:** The software "hangs" when I connect my EagleEyes to USB.
**Solution:** make sure that you have connected the EagleEyes to USB before inserting the barrel power connector, for proper operation of the USB function.
**Issue:** I am getting a firmwawre update error when I try to update the EagleEyes firmware
**Solution:** With some PC's, it may be necessary to power the EagleEyes via the barrel connector when it is connected to USB, for firmware update. If a firmware update error is generated in the software, please repeat the firmware update procedure with power connected to the barrel connector.

# *Specifications*

- Two video inputs -NTSC/PAL, using your video receivers of any frequency. Video Input 2 is adjustable to match Video Input 1. Note that only one input needs to be used, if you are not using the Diversity feature.
- Two audio inputs - Two monaural audio inputs are supported. Audio Input 2 is adjustable to match Audio Input 1. Note that only one input needs to be used, if you are not using the Diversity feature.
- Four A/V outputs - Four video outputs (75 ohm) and four "line level" audio outputs
- Power Input - Power input range approximately 6V to 14V. Barrel style power input with standard 2mm center pin.
- Two Servo Outputs for pan and tilt trackers - Unit is capable of delivering 5A burst output to drive even large pan/tilt servos.
- USB Port for connecting to PC, for live PC display of telemetry and firmware update. Note: A standard USB "Mini-B" cable is required for these features, but is not included.
- Dimensions: Approximately 7cm wide, 10cm long, 4cm high
- Mass: Approximately 78 grams

# *Limited Warranty*

Eagle Tree Systems, LLC, warrants the EagleEyes 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:
    - External causes such as accident, abuse, misuse, or problems with electrical power
    - Servicing not authorized by us
    - Usage that is not in accordance with product instructions
    - 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.