RC1500B Quick-Start Guide

Patriot 1.2M & 1.8M
Inclined Orbit
Tracker
V 2.60

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Controller Menu Overview

The chart below outlines the menus for the RC1500. The menus can be accessed by tapping the mode button. Holding down the mode button for 5 seconds will allow the user to toggle between the operation and programming sides of the software.

Details regarding each menu screen can be found in the RC1500 manual. The menu items which are unique to the RC1500B have been documented throughout this guide.

Track mode can be accessed via either Setup or Auto modes.

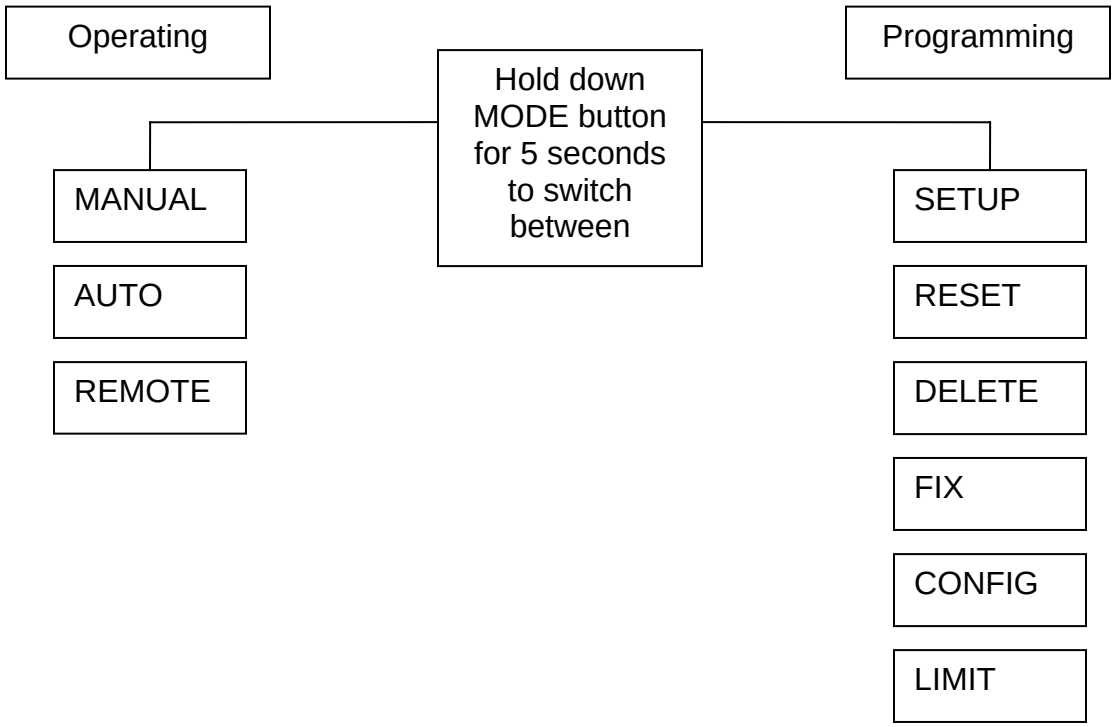


Figure 1 - Controller Menu Chart

Antenna Setup

Single Axis Inclined Orbit Satellite Tracking with a Polar Mount

The apparent motion of an inclined orbit satellite appears as a narrow figure 8 pattern aligned perpendicular to the geo-stationary satellite arc. As the inclination of the satellite increases both the height and the width of the figure 8 pattern increase. The single axis tracker can follow the long dimension of the figure 8 but cannot compensate for the width of the figure 8 pattern.

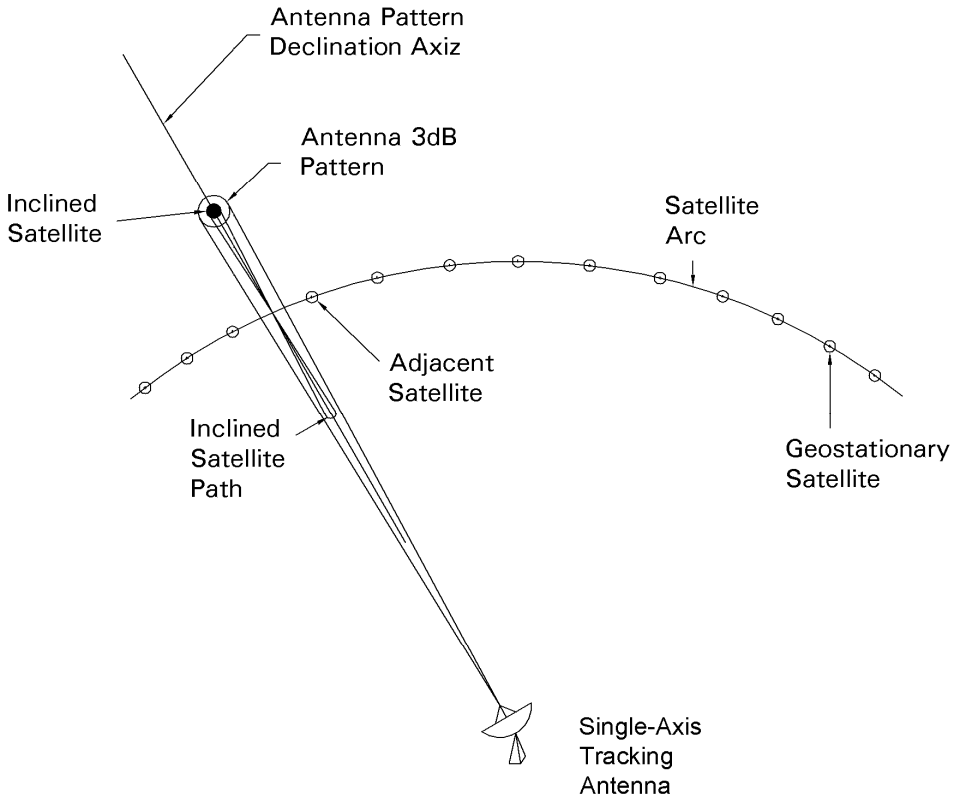


Figure 2 - Apparent Motion of an Inclined Orbit Satellite Relative to the Geostationary Satellite Arc

A single axis tracking system must be in precise mechanical alignment to minimize loss due to the mount's inability to compensate for the width of the figure eight pattern. For this reason, a single axis tracker is more difficult to setup than other inclined orbit satellite tracking mounts. Conversely, the operation of a single axis tracking antenna is more straightforward than that of dual axis antennas. The satellite will always be located somewhere within the antenna's range of travel so there is no danger of peaking up on an adjacent satellite. The controller can be operated with the search feature enabled – even for transmit applications.

Tools & Supplies Needed to setup Patriot single axis mount:

3/4 Socket
3/4 Crescent Wrench
1/4 Allen Wrench
1/8 Star Wrench
Large adjustable Crescent Wrench
Small Flathead Screwdriver
Wire Strippers (14-22 AWG)
Wire Cutters
Cable Jacket Stripper (Greenlee p/n 45109)
Hand-Held Inclinometer
Heat Shrink/Heat Gun (3/16, 3/64, 1/8 inch in diameter)
Cable Ties (Small, Medium and Large)

A diagram of a polar mount is shown below. A polar axis antenna mount with a motorized declination angle adjustment can track an inclined orbit satellite. The other angles associated with the polar mount must be set correctly for the mount to properly track the satellite.

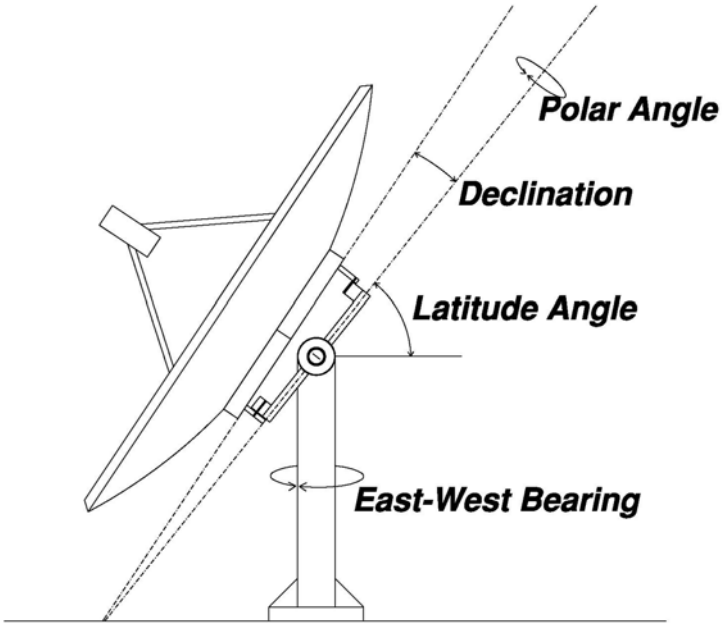


***Figure 3 - Angles Associated with a Polar Antenna Mount**

**Figure3 - Polar Angle also referred to as Mount Hour Angle and Mount Polar Angle*

This document describes how to setup the Patriot 1.2M & 1.8M single axis inclined orbit tracking antenna mounts. A diagram of the Patriot antenna mount is given below.

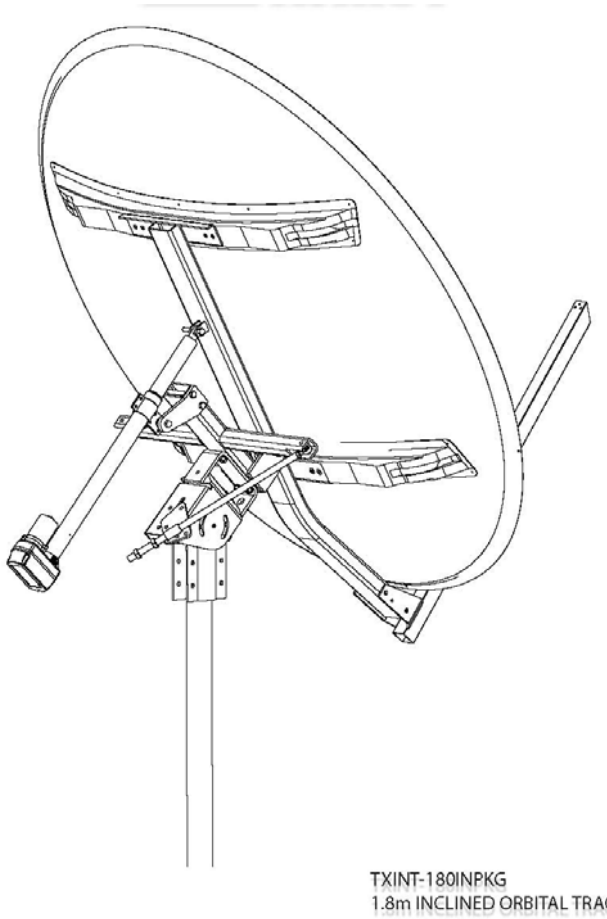


Figure 4 - Patriot Single Axis Inclined Orbit Satellite Tracking Antenna Mount

Patriot Single Axis Inclined Orbit Tracking Wiring Procedure

The RC1500B's wiring is provided by a single actuator cable which consists of two 16-gauge wires for motor voltage and three shielded 22-gauge wires for the position sensor.

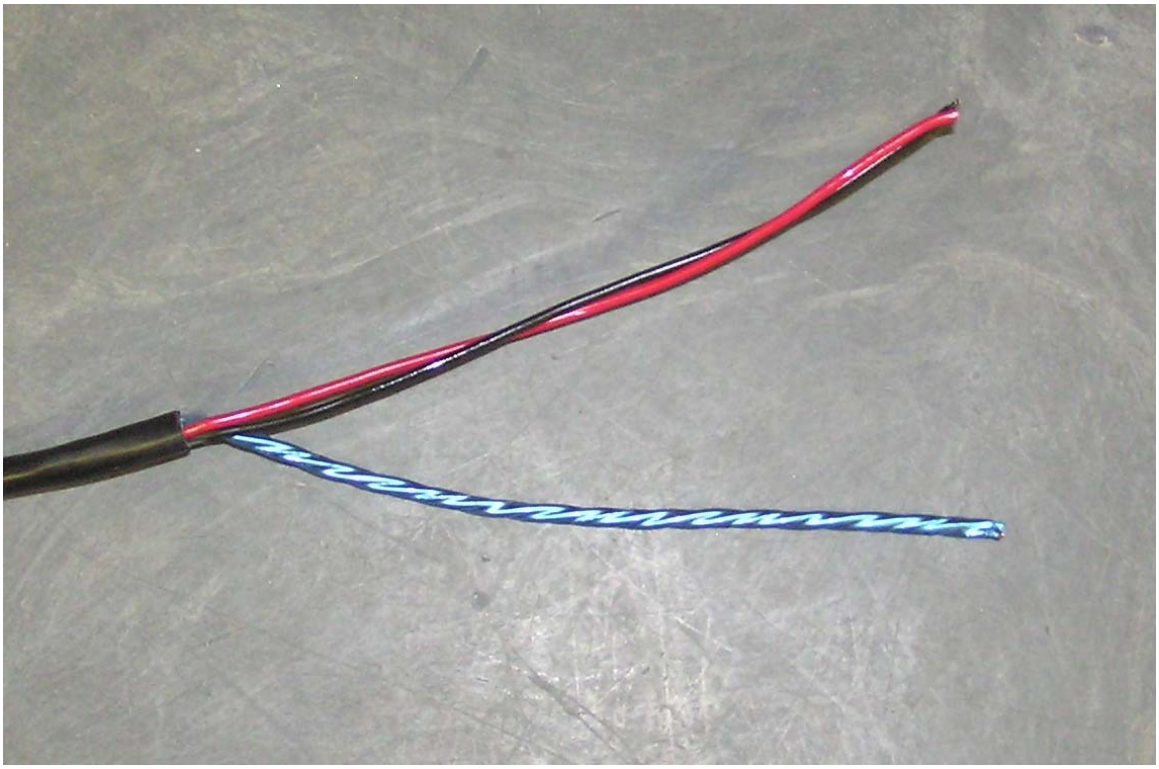


Figure 5 – Stripped Outer Jacket

1. The first step in wiring the back of the RC1500 is to cut back the outer jacket 9 ¼ inches and remove the plastic film exposing the two sub-cables.

2. The removal of the outer jackets will reveal two 16 gauge wires (red and black in color) and 3 triple shielded wires for the position sensor enclosed in a foil shield with a bare drain wire.

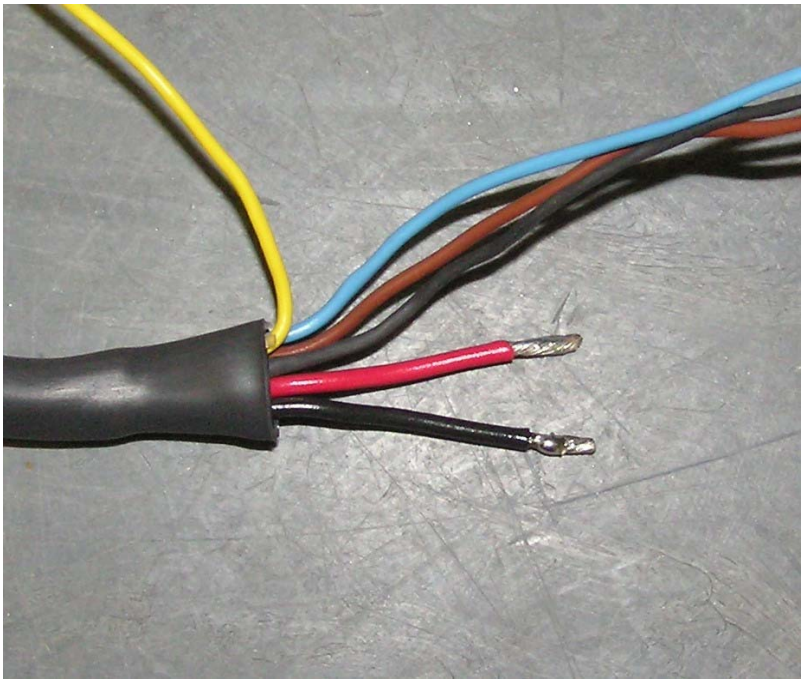


Figure 6 – Stripped Sub-cables

3. Cut the two red and black 16 AWG conductors to 2 ½ inch length.
4. Cut the drain, brown and blue 22 AWG conductors to 7 inch length.
5. Cut the yellow 22 AWG conductor away at the base. This wire is not needed.
6. Strip every wire ¼ inch at the tip to allow insertion into the J1 and J2 Molex connectors.
7. Add 3/64 or 1/8 inch in diameter piece of heat shrink to drain wire. Make the heat shrink 6 ¾ inches long. Slide heat shrink over entire drain wire to avoid a short circuit, leaving ¼ inch of conductor exposed at the tip. Use heat gun to set heat shrink.
8. Add a 1 inch piece of heat shrink (3/16 inch diameter) around outer jacket to cover the first cut made at 9 ¼ inches.
9. For best results, either tin the end of each conductor or use wire ferrels.
10. Place cable ties for added strain relief as shown in Figure 8.

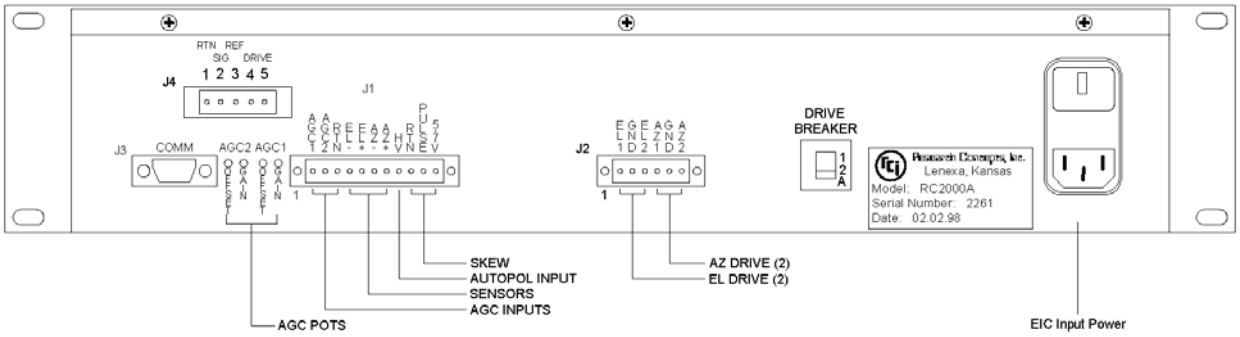


Figure 7 – RC1500 Back Panel Diagram

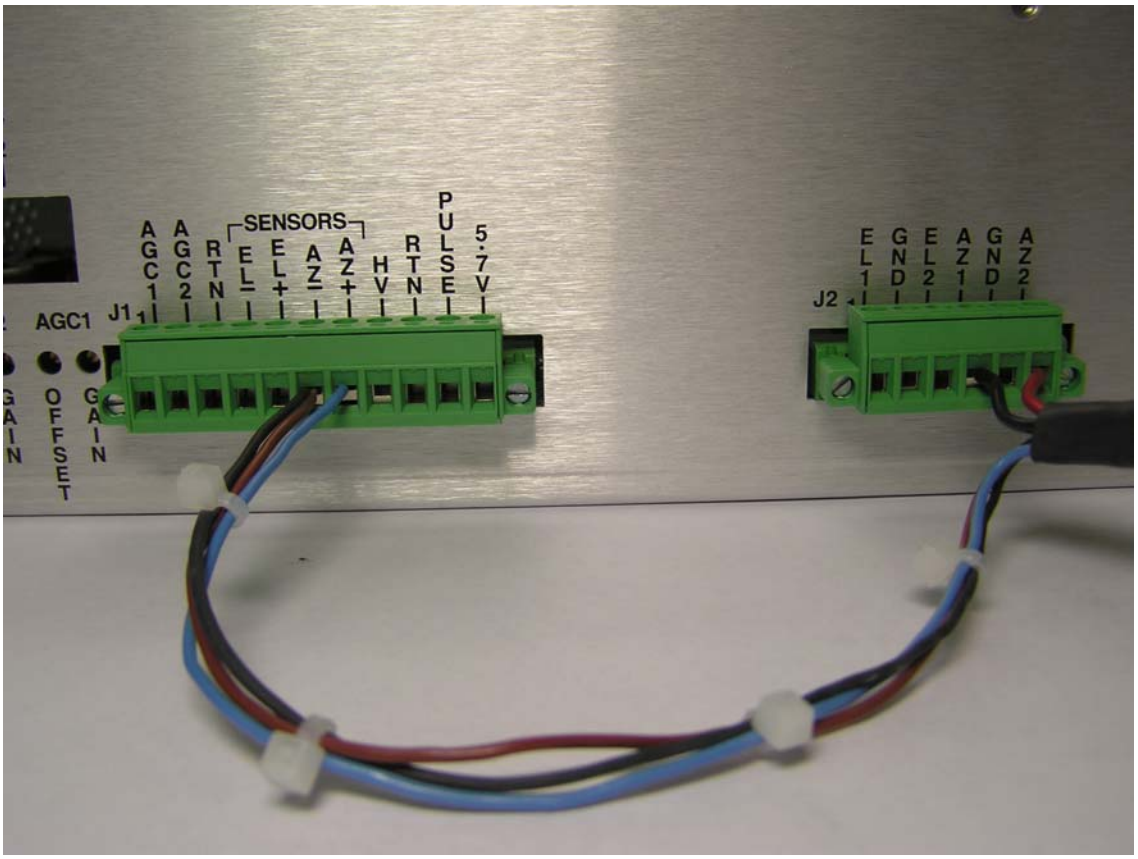


Figure 8 – Connection at RC1500 Back Panel / Strain Relief

Figure 8 shows the proper inches of cable to protect against cable stress. The larger 16-gauge cables are cut 5 ½ shorter to take any type of stress caused by the controller being moved or the cables stretched. The sensor AZ- should have the brown and drain wires connected to it. The drain wire appears black in this picture due to the heat shrink on it which protects against short circuiting.

11. Insert Motor and Sensor conductors into the J1 and J2 Molex connectors. See Table 1.

J1: 6 AZ – (sensor connection)	22 AWG Brown
J1: 6 AZ – (Drain)	22 AWG Bare Drain wire (Cover with heat Shrink)
J1: 7 AZ + (sensor connection)	22 AWG Blue
J2: 6 AZ2 (Motor Drive Connection)	16 AWG Red
J2: 4 AZ1 (Motor Drive Connection)	16 AWG Black

Table 1

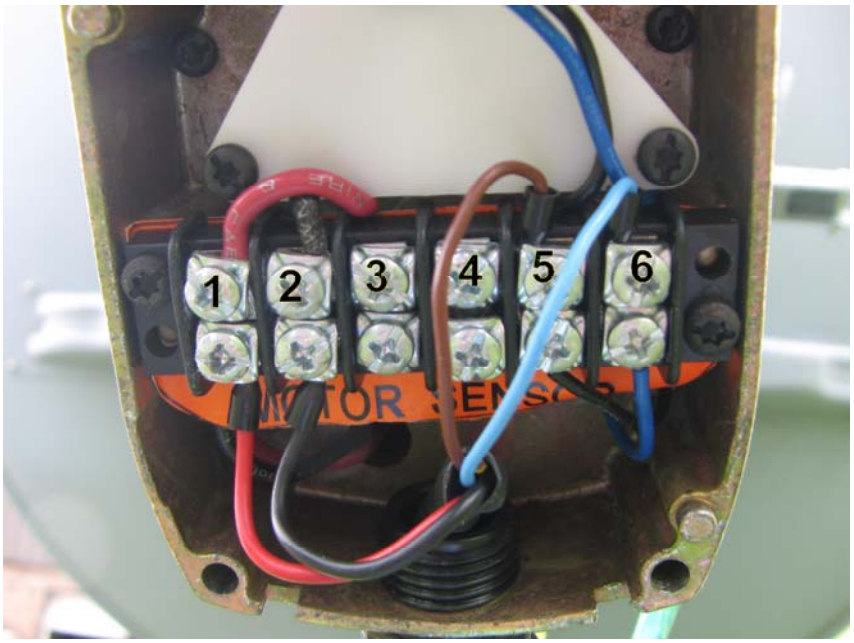


Figure 9 – Wiring Connection at Actuator

Table 2 explains the connections at the actuator. The connections are labeled 1-6. **Do not connect the drain wire at the antenna**. Having the drain wire connected at the antenna can cause a ground loop resulting in runaway errors.
Insulate drain wire to prevent it from making contact with earth ground.

12. At the actuator end of cable, cut the outer jacket back about 3 ½ inches, exposing the two sub-cables. Remove the sub-cable jacket from the 16 AWG conductors. Also remove the foil from position feedback conductors.

13. Strip all wires ¼ inch at the tip to allow insertion into screw terminal inside of the actuator head. Tin or use wire ferrels on each tip for best results.

14. Cut the yellow and bare drain wire at the base. Use heat shrink to cover break.

15. Add a 1 inch piece of heat shrink (3/16 inch diameter) around outer jacket to cover the first cut made at 3 ½ inches.

16. Run cable through hole in actuator head and insert conductors into screw terminals. Refer to Figure 9 and Table 2.

Actuator	Signal	Cable
1	+ Motor Drive Connection	16 AWG Red
2	- Motor Drive Connection	16 AWG Black
3	No Connection	
4	No Connection	
5	AZ – Reed Sensor Connection	22 AWG Brown
6	AZ + Reed Sensor Connection	22 AWG Blue

Table 2

Patriot Single Axis Inclined Orbit Tracking Mount Setup Procedure

1. The antenna mounting pipe is 3 ½ inches (outside diameter). Install the antenna mounting pipe so that it is plumb.

2. Assemble the Patriot 1.8M Orbital Tracker according to Patriot's Assembly Manual. The actuator power head has a weep hole. Install the actuator as depicted in the photo so that water that collects in the actuator head can drain.
The mount should initially be pointing as close as possible to true South if installed in the Northern Hemisphere. Initially point the mount as close as possible to true North if installed in the Southern Hemisphere.

Figure 10 – Assembled Antenna Mount

3. The actuator will be in the fully retracted position. To ensure the maximum range of upward travel, slide the clamp on the tube of the actuator towards the clevis end of the actuator until the clamp touches the actuator bellows boot.

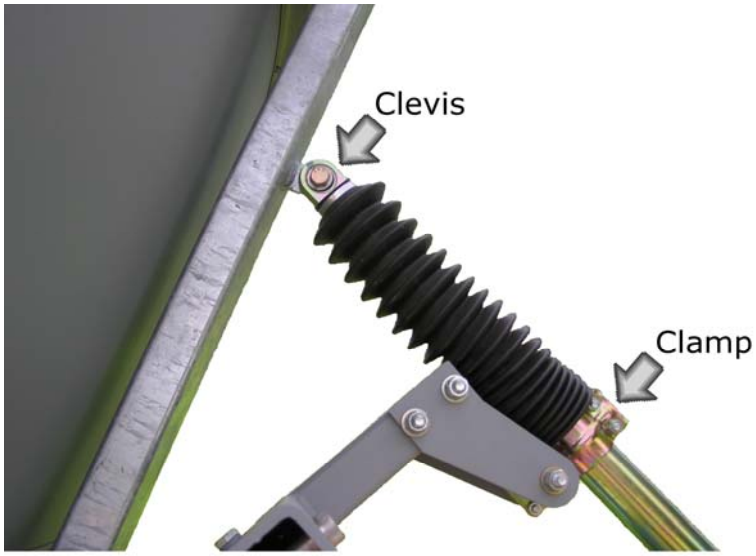


Figure 11 – Actuator Boot Placement

4. The antenna mount can be assembled so that the threaded rod which sets the Mount Hour Angle can be installed on either side of the antenna to adjust the Mount Hour angle so that the antenna points either east or west. If the satellite is located to the west of the antenna, place the hour angle adjustment threaded rod on the west side of the antenna. If the satellite is located to the east of the antenna place the hour angle adjustment rod on the east side of the antenna.

Figure 12 – Satellite is East of Antenna

Figure 13 – Satellite is West of Antenna

Note: Figure 12 and 13 are correct for the Northern Hemisphere, reverse for Southern Hemisphere.

Single Axis Tracker TLE Setup

5. Run the **SingleAxisTrackerTLESetup.EXE** program to calculate the Mount setup angles. The program takes *as its input the Antenna Latitude and Longitude, Antenna Offset, Declination of the Actuator* and the *Satellite Longitude.* The outputs of the program are the Mount Latitude Angle, the Mount Hour Angle, and the Elevation Angle for a Satellite whose Longitude is the same as the Earth Station Longitude (RF). Record the values below. Other outputs given are Elevation, True Heading, Magnetic Heading, Magnetic Variation and Mechanical angles.

CONFIG.TXT file contains setup data for the SingleAxisTrackerTLESetup.exe program. Use Notepad to customize this file for your satellite and antenna. Use of this file is optional. If the file is not present, the program can still be used. When the program is invoked without a CONFIG.TXT file present, a CONFIG.TXT file is created.

NOTE: *NORAD Two Line Element (TLE*) sets can be used to predict az/el angles as a function of time for an inclined orbit satellite. Using the power declination adjustment, set the antenna elevation angle (taking into account antenna offset angle) to the elevation angle predicted (for the current UTC time) by the TLE data. See Appendix A for Local time vs. UTC time conversion map.

Use a satellite pointing calculator (like ANTENNA.EXE on the RCI web site) to predict the antenna magnetic heading required to align the antenna with the satellite. Adjust the mount East-West Bearing angle to find the satellite. Slight adjustments to the declination angle may be required.

The TLE data file geo.txt can be downloaded from the CelesTrak website, http://celestrak.com. The website has TLE sets for commercial communication satellites as well as programs to calculate az/el angles from TLE data.
The direct address of geo.txt is http://celestrak.com/NORAD/elements/geo.txt

The declination actuator has an 11 count per degree characteristic, i.e. if the declination actuator is positioned 11 position counts above the Base_Elevation ACU Position Count the antenna is pointing 1 degree Above the Geostationary Arc when the East – West Bearing angle is adjusted so that the antenna is pointing at or near the inclined orbit satellite

Mount Latitude Angle: _____

Mount Hour Angle:**_____**

RF: Elevation Angle With Hour Angle @ 0 Degrees: **_____**
(this value will be referred to as the 'Base_Elevation')

Example: (Screen shots correlate to example problems found in setup procedure)

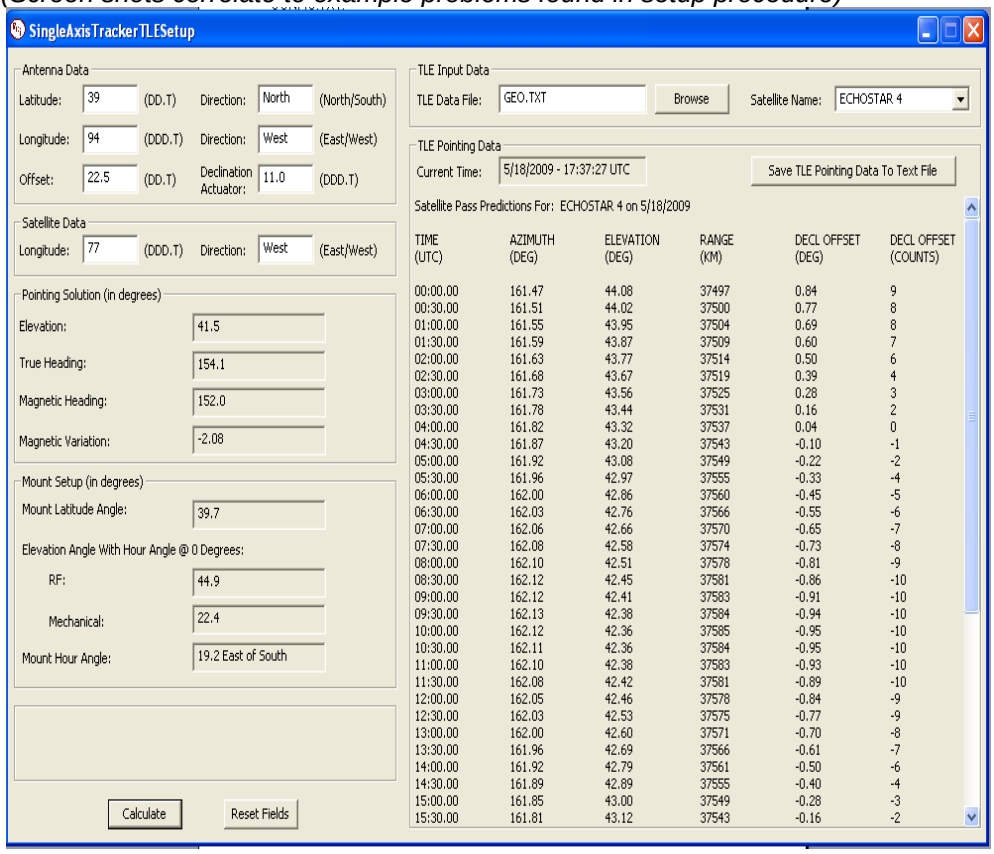


Figure 14 – SingleAxisTrackerTLESetup.EXE

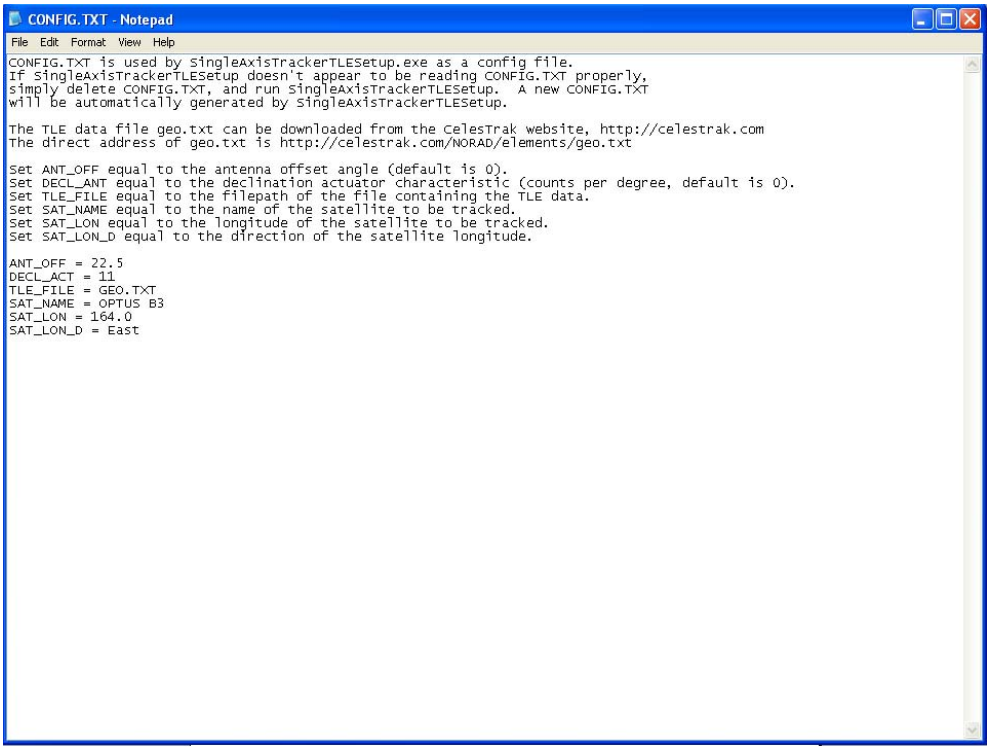


Figure 15 – CONFIG.TXT

Mount Latitude Angle

The mount should initially be pointing as close as possible to true South if in the Northern Hemisphere. Point the mount North if in the Southern Hemisphere.

6. Set Latitude Angle using the threaded eye bolt. Use the built-in Latitude scale to set the latitude angle to the earth station latitude. Example: 39.7 degrees

Figure 16 – Threaded Eye Bolt

Figure 17 – Built-in Latitude Scale

7. As a final adjustment, use an inclinometer to measure the angle. Place the inclinometer as depicted in the photo below. Adjust the eye bolt so that the inclinometer reading is 90 – Mount Latitude_Angle degrees *with respect to horizontal.*
Example 50.3 degrees.

Figure 18 – Placement of Inclinometer for Adjustment of Latitude Angle

Example:
Mount Latitude Angle = **39.7 degrees**
90 degrees - Mount Latitude Angle

90 degrees - 39.7 degrees= 50.3 degrees (Mount Latitude with respect to horizontal as seen with an inclinometer)

Mount Hour Angle also referred to as the Mount Polar Angle

8. Position the large nuts on the Mount Hour Angle adjustment threaded rod so that the Hour angle is zero. Use built-in protractor shown in Figure 19.

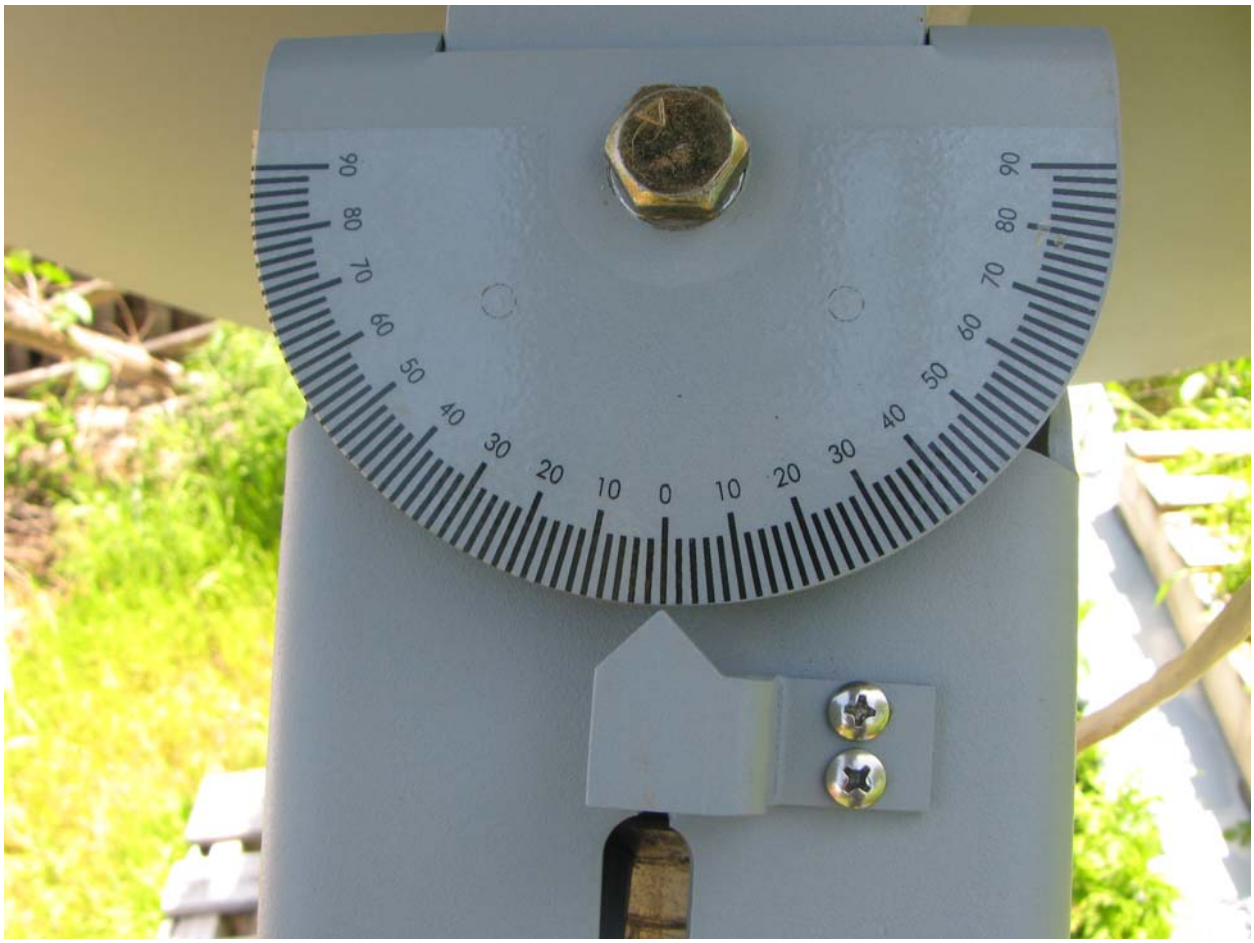


Figure 19 – Set Hour Angle to Zero Using Long Threaded Rod

Down Limit

9. In this step we set the ACU's (antenna control unit's) Down limit. With the Mount Hour angle set at zero, the Down limit is set when the antenna's **RF Pointing Angle** is equal to the **Base_Elevation Minus 10 Degrees**. Base_Elevation was found in step 4. The Patriot 1.2 and 1.8 meter antennas have a 22.5 degree offset. To achieve an RF Pointing Angle of Base_Elevation Minus 10 Degrees, the backstructure of the antenna must be inclined at an angle of **Base_Elevation – (22.5 + 10) degrees** *with respect to vertical.* Figure 20 below shows placement of the inclinometer on the antenna backstructure.

Example:
Base_Elevation – (22.5 + 10) degrees
44.9 – (22.5 + 10)
44.9 – (32.5)
= 12.4 degrees (Down Limit with respect to vertical)

90 – 12.4
= **77.6** degrees (Down limit with respect to horizontal)

Figure 20 – Inclinometer Placement to Set Down Limit

Power up the RC1500.

Activate the LIMITS mode by first locating the following screen. Hit ENTER to proceed past the prompt message.

POS **SS**

```
ENTER   TO   PROCEED
MODE  TO  EXIT   LIM
```

MODE

Next you will be prompted with the following display.

POS **SS**

```
174              210
7 –  SET  Down LIM
```

MODE

Use the UP and DOWN keys to position the actuator. Hit the 7 key to set the Down Limit.

Up Limit

10. In this step the ACU Up limit is set. Motor the antenna up until the position reading is 260. Hit the 7 key to set the up limit. Once the up limit is set, the controller should move to the CONFIG mode.

Slow Speed

The slow speed in the CONFIG mode can be adjusted to aid in initially locating the satellite. It is best to set the slow speed to the value shown below.

POS **SS**

```
SLOW  SPEED:  135
0 – 254        CFG
```

MODE

Locate Inclined Orbit Satellite

11. Place the ACU in Manual mode. Position the inclinometer as shown in step 9. Motor the antenna until the RF pointing angle is equal to the Base_Elevation value found in step 3. The Patriot 1.2 and 1.8 meter antennas have an offset angle of 22.5 degrees. To achieve an RF Pointing Angle of Base_Elevation the antenna backstructure must be inclined at an angle of (Base_Elevation – 22.5 degrees) w*ith respect to vertical*. Record the ACU position count below.
Base_Elevation ACU Position Count: ____ (should be around 145)

Example:
(Elevation Angle With Hour Angle @ 0 degrees referred to as the "Base_Elevation"

Base_Elevation – 22.5 degrees
44.9 – 22.5
= 22.5 degrees

90 – 22.4
= **67.4** degrees (With respect to Vertical)

Figure 21 – Inclinometer Placement

Set Mount Hour Angle

12. Position the large nuts on the Hour angle adjustment threaded rod so the Hour angle is set to the calculated Mount Hour Angle found in step 4.

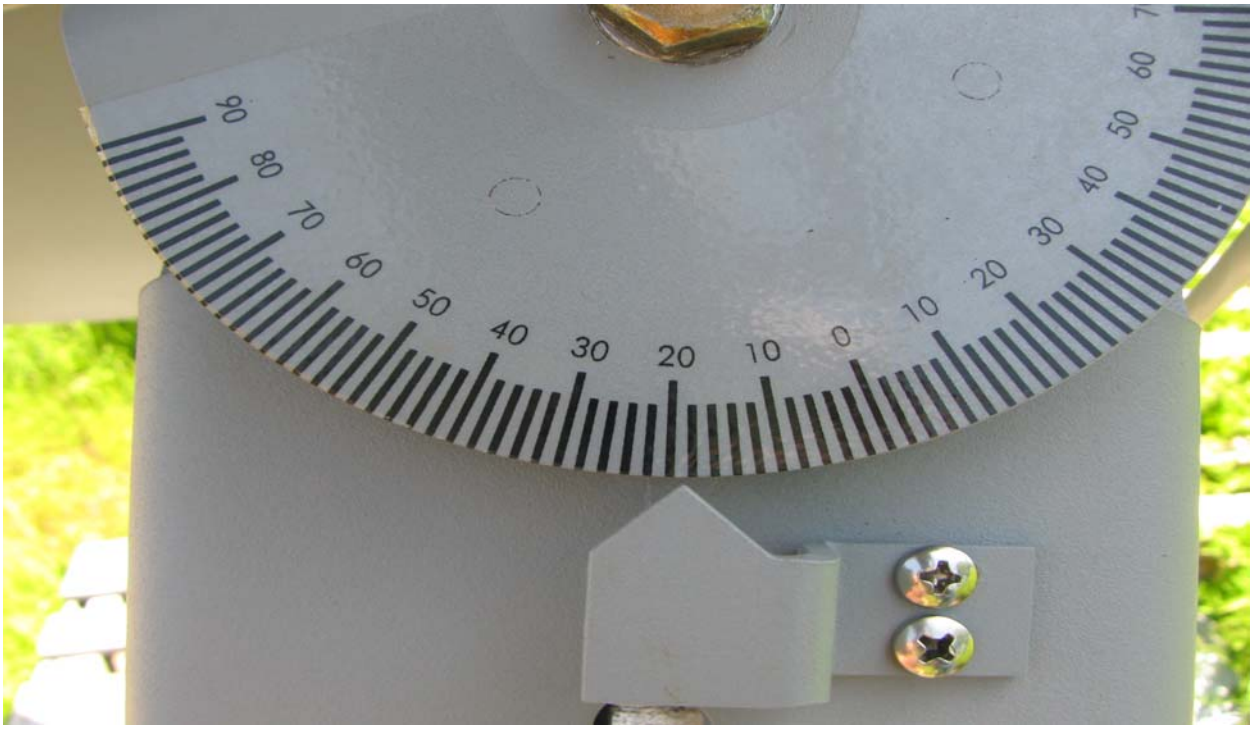


Figure 22 - Set Mount Hour Angle

Example:
Mount Hour Angle = **19.2** degrees

Adjusting the East- West Bearing Angle/Varying Antenna Declination Angle via the Actuator

13. Locate the inclined orbit satellite by adjusting the East – West bearing angle and by varying the antenna Declination angle via the actuator (see the Polar Mount diagram earlier in this document). On the Patriot 1.2 and 1.8 meter single axis tracking mount this is accomplished by loosening the mount clamp that secures the mount to the vertical pipe and rotating the mount in small increments. Small increments will result in hitting the arc without over-shooting. After each small rotation, adjust the Declination angle via the RC1500 looking for a signal. If no signal is found move the Declination angle back to the original count value on the RC1500 and rotate the mount clamp another small increment and jog the Declination angle again.

Once the satellite is located, without moving the pole mount, tighten down the mount clamp bolts. Be sure to tighten the bolts securely because a strong wind can move the mount around on the pole.

Geostationary satellites in the vicinity of the inclined orbit satellite that the mount was setup for should be found at or near the actuator position found in step 11, the Base_Elevation ACU Position Count.

The declination actuator has an 11 count per degree characteristic, i.e. if the declination actuator is positioned 11 position counts above the Base_Elevation ACU Position Count the antenna is pointing 1 degree Above the Geostationary Arc when the East – West Bearing angle is adjusted so that the antenna is pointing at or near the inclined orbit satellite

Figure 23 – Loosen Mount Clamp Bolts to Adjust East-West Bearing Angle

AGC Tuning

Before continuing on, read through the Idirect Interface guide of this document. The information on that page will help clarify this AGC tuning procedure.

To implement the tracking algorithms, the controller requires an input signal which indicates the strength of the received signal. Such a signal is generated within a satellite receiver, and is referred to as an AGC signal. (AGC is the abbreviation for Automatic Gain Control.) On satellite receivers, this signal may also be referred to as a 'Signal Strength' or 'Tuning Meter' output. An AGC output typically varies in proportion to the received power of the transponder which the receiver is currently tuned to.

1. Once the antenna is aligned with the satellite, place a voltmeter on the receiver's AGC output. Measure and record the voltage. In the description that follows, the term 'on satellite' will be used to refer to the antenna aligned with a strong satellite.

2. Jog the antenna off of the satellite so the antenna is looking at nothing. Measure and record the receiver's AGC voltage. In the description that follows, the term 'off satellite' will be used to refer to this case where the antenna is positioned well off of any satellite, looking at nothing.

3. Connect the receiver's AGC output to the controller's AGC2 input. Be sure to connect the ground return of the controller to a ground on the receiver.

4. If the AGC voltage associated with the 'on satellite' case is greater than that of the 'off satellite' case, the receiver has POSITIVE AGC polarity (otherwise the receiver has NEGATIVE AGC polarity). Go to CONFIG mode and use the SCROLL keys to bring up the *AGC Polarity Flag* item. Key in the proper polarity using either the 0 or 1 key, and terminate the entry with the ENTER key.

5a. If the receiver's AGC has NEGATIVE polarity, go to step 5b. If the receiver's AGC has POSITIVE polarity, go to LIMIT mode and examine the signal strength for the AGC channel which was not selected in step 3. If the signal strength reading for that channel is greater than 10, adjust the OFFSET and GAIN for that channel until the signal strength reading for that channel is less than 10. To lower the displayed signal strength turn the OFFSET pot clockwise and the SCALE pot counter-clockwise. Be sure not to turn the controller off while the controller is in LIMITS mode, or else the limits which have previously been set will be corrupted. Proceed to step 6.

5b. If the receiver's AGC has NEGATIVE polarity, connect a jumper from the controller's unused AGC input channel to connector J1, pin 11. Go to LIMIT

mode and examine the signal strength for the AGC channel which was not selected in step 3 above. If the signal strength reading for that channel is greater than 10, adjust the OFFSET and GAIN pots for that channel until the signal strength reading for that channel is less than 10. To lower the displayed signal strength value, turn the OFFSET pot counter-clockwise and the SCALE pot clockwise. When this is accomplished proceed to step 6.

6. In the next few steps of the procedure, the OFFSET and GAIN pots of the AGC channel connected to the receiver's AGC output are adjusted so that the 'off satellite' signal strength value is between 50 and 100 and the 'on satellite' signal strength value is between about 950..
   Note that the GAIN and OFFSET adjustments are implemented using 20 turn pots. A lot of turns may be required.

7. Go to MANUAL mode, position the antenna 'off satellite', and adjust the OFFSET pot (for POSITIVE polarity receivers) or the GAIN pot (for NEGATIVE polarity receivers) so that the signal strength reading is about 75. If the AGC has POSITIVE polarity and the signal strength is too low, turn the OFFSET pot counter-clockwise. If the AGC has POSITIVE polarity and the signal strength is too high (or is '***'), turn the OFFSET pot clockwise.
   If the AGC has NEGATIVE polarity and the signal strength is too low, turn the GAIN pot counter-clockwise. If the AGC has NEGATIVE polarity and the signal strength is too high (or is '***'), turn the GAIN pot clockwise.

8. While still in MANUAL mode, position the antenna 'on satellite' and adjust the GAIN pot (for POSITIVE polarity receivers) or the OFFSET pot (for NEGATIVE polarity receivers) so that the signal strength value is about 950. If the AGC has POSITIVE polarity and the signal strength is too low, adjust the GAIN pot clockwise. If the AGC has POSITIVE polarity and the signal strength value is too high (or is '***'), adjust the GAIN pot counter-clockwise. If the AGC has NEGATIVE polarity and the signal strength is too low, adjust the OFFSET pot clockwise. If the AGC has NEGATIVE polarity and the signal strength value is too high (or is '***'), adjust the OFFSET pot counter-clockwise.

9. Position the antenna 'off satellite'. If the signal strength is between 50 and 100, proceed to step 10. If the signal strength is less than 50 or greater than 100 perform steps 7 and 8 again.

10. Position the antenna ‘on satellite’. Jog the antenna off of the satellite until the picture is just barely watchable. Note the signal strength value. Go to CONFIG mode and use the SCROLL keys to bring up either the *AGC C Band Threshold* item or the *AGC K/L Band Threshold* item, whichever is appropriate for the frequency band that the user has chosen to operate at (and has adjusted the pots at). Key in the signal strength value noted above. Terminate the entry with the ENTER key.

SET Mode

POS **SS**

MODE

SET mode allows a user to store a satellite name, position, and horizontal and vertical polarization presets into the controller's non-volatile memory. Once a satellite has been stored in non-volatile memory, it may be recalled using the AUTO MODE

Note*: The MODE key may be pressed at any time to exit the mode which is currently active.*

When SET mode is activated, the following screen is displayed.

POS **SS**

MODE

Preset Satellite Names

When the above screen is displayed, the ARROW keys may be used to jog the antenna and the SPEED key may be used to toggle the jog speed. The SCROLL UP and SCROLL DOWN keys may be used to select the satellite name (shown on the second line the "Select" field which will be stored in non-volatile memory.)

POS **SS**

Mode

If the satellite name present in the "Select" field when the ENTER key was depressed is already stored in non-volatile memory, the user is presented with the above screen. If the user selects NO the initial screen is displayed and the selection process is repeated.

The user is next prompted to specify whether or not the satellite is in an inclined orbit.

POS **SS**

MODE

When the user has flagged the satellite "YES" with the Scroll Up/Yes key, the "DATA ACCEPTED" message will appear for a few seconds, and the controller will switch to "TRACK" mode. If the satellite just entered was not an inclined orbit satellite, after the "DATA ACCEPTED" message appears the controller remains in "SETUP" mode. Control transfers to the initial screen, and the process may be repeated.

User-Defined Satellite Names

If the desired satellite name is not in memory, you can assign a new name of up to ten (10) alphanumeric characters (A-Z, 0-9, hyphen (-), or space) by accessing the **USER** entry mode as follows.

From the screen which allows the user to jog the antenna in azimuth and elevation, use the SCROLL keys to bring up the '**USER**' entry in the list, and press ENTER. The following screen will display:

POS **SS**

MODE

Note: The cursor will be displayed under the '*' character. The SCROLL UP and SCROLL DOWN keys may be used to select alpha-numeric characters (A-Z, 0-9, hyphen (-), and space). A space can be entered in the name by pressing SCROLL UP once, and SCROLL DOWN once, then ENTER. The BKSP key may be used to delete the character to the left of the cursor.

During alpha-numeric data entry, the ENTER key has two functions. If the ENTER key is depressed while the '*' character is displayed, the alpha-numeric data entry session is terminated. If the ENTER key is depressed when the '*' character is not displayed, the cursor will advance to the right one space and the user will be prompted again with the '*' character.

TRACK MENUS

The TRACK mode MENU system allows the user to view and modify data relating to the satellite being tracked. The MENU system may be invoked whenever the CONFIG mode *Expert Access Flag* is set by hitting the 0 key while in the SEARCH IDLE, STEP IDLE, and PROGRAM IDLE states. When the menu system is invoked, the user will be presented with the following display, referred to as the main MENU display.

POS SS

```
1vu 2mod 3algn:
ENT to exit MNU
```

MODE

The contents of the third field shown as “algn” will be either ‘REPEAK’, ‘SEARCH’, or ‘ALIGN’, depending on the track submode which is currently active. Note that track operations cease when the MENU system is active. Make sure that you always exit the MENU system. Hitting the ENTER key repeatedly will always cause the MENU system to terminate by returning control to the IDLE state.

VIEW

From the main MENU display, hit the 1 key to select the VIEW system. Here is the initial view display.

POS SS

```
TIME   9952
SCR  ^v,ENT MNU
```

MODE

In the above example image the value 9952 is the sidereal time in seconds. Pressing the SCROLL UP/DOWN keys will display the following information from the track table.

POS SS

```
 6   10770 412F
SCR  ^v,ENT MNU
```

MODE

In the above example image, the value “6” is shown as the current entry index which varies from 0-47. The value 10770 is shown as the current sidereal time at

the entry. The value 412 is shown as the declination position value at the current entry. To the right of the position one of the following characters will display:

- The character 'F' which indicates the state of an update flag
- A period '.' Which indicates that the update flag has been set
- A blank which indicates that the update flag is reset

After the 47th entry has been displayed, the first screen will appear again and the entire process will repeat. To exit this option, press ENTER to return to the MENU screen.

MODIFY

From the main MENU display hit the 2 key to select the MODIFY system. There are 8 data items that the user is allowed to modify with this option. Each is successively accessed by pressing the SCROLL UP/DN keys and advancing through the list. Each entry is shown below.

POS **SS**

```
UPDATE CHECK:33
0-999 HRS     MNU
```

MODE

UPDATE CHECK 0-999 hours: The period of time between track table basepoint update checks. The default is 72 hours.

POS **SS**

```
SEARCH RETRY:33
0-999 MIN     MNU
```

MODE

SEARCH RETRY 0-999 minutes: The period of time between successive SEARCH attempts when no signal is present and track table data is not available. The default value is 10 minutes.

POS **SS**

```
BAND: 0
1-C,  2-KU  MNU
```

MODE

BAND: select 1 for C or 2 for Ku: For dual band inclined orbit satellites, this prompt allows the user to change the frequency band.

POS **SS**

MODE

CLEAR TRACK select 0 or 1: Press 1 to clear the track table entries or press 0 to not modify the existing data.

POS **SS**

MODE

RESET UPDATE select 0 or 1: Press 1 to clear the UPDATE flags for the track data or press 0 to not modify the existing data.

POS **SS**

MODE

FORCE UPDATE select 0 or 1: Press 1 to set UPDATE flags or press 0 to not modify the existing data. (Opposite function of RESET UPDATE)

POS **SS**

MODE

STEP SIZE select 0-99 counts: The number of pulse counts that are moved when the controller makes a step. Too large of a step size can result in overshooting the satellite.

REPEAK, SEARCH, or ALIGN

Hitting the 3 key followed by the ENTER key at the main MENU display will initiate some action by the controller. The action taken depends on the TRACK sub-mode which is active. The below table describes the action taken for each of the track sub-modes.

Sub-Mode	xxxxxx	Action
STEP	REPEAK	Causes the controller to immediately repeak the antenna.
SEARCH	SEARCH	Causes the controller to initiate another search
PROGRAM	ALIGN	The controller will reposition the antenna based on the current sidereal time and the data in the track table.

Table 3

Selecting item number 3 from the main MENU display will always cause the MENU system to terminate and initiate the selected action.

Config Menu Settings for 1.8M Patriot

- Remote Enable: 0
- Elev 0 CNT: 0
- Slow Speed: 140
- 24vdc Rot Feed: 0
- Auto Move Cnfg: 0
- Fst/Slo Thrsh: 80
- Retry Attempts: 3
- Fst Deadbnd: 2000
- Slow Deadbnd: 800
- Coast Thrsh: 4
- Max Pos Error: 0
- Time: current time in HH.MM.SS format
- Date: current date in MM.DD.YY format
- AGC Polarity: 1
- AGC Threshold: 500
- Step Size: 3
- Pk Interval: 300
- Search Enable: 1
- Expert On: use code to toggle
- Reset Sys: use code to reset controller

Interfacing an iDirect Modem to the RC1500B Tracking Antenna Controller

iDirect modems can produce an analog voltage suitable for the AGC of an ACU to track an inclined orbit satellite. To enable the voltage output on the iDirect modem, set “tx_handshake_enabled = 1” in the modem options file. The modem console port is an RJ45 receptacle on the back panel of the modem.

Here are the connections between the modem and the ACU.

Modem RJ-45 Console Port Terminal	ACU Terminal	Description
Console Port RJ45-4	ACU AGC RTN, J1-3 (ACU Chassis Potential)	Analog return
Console Port RJ45-8	ACU AGC 2, J1-2	The analog voltage varies with received signal strength (RSS). The voltage is 0 to 2.5 volts when modem is unlocked and 2.6 to 5 volts when modem is locked.

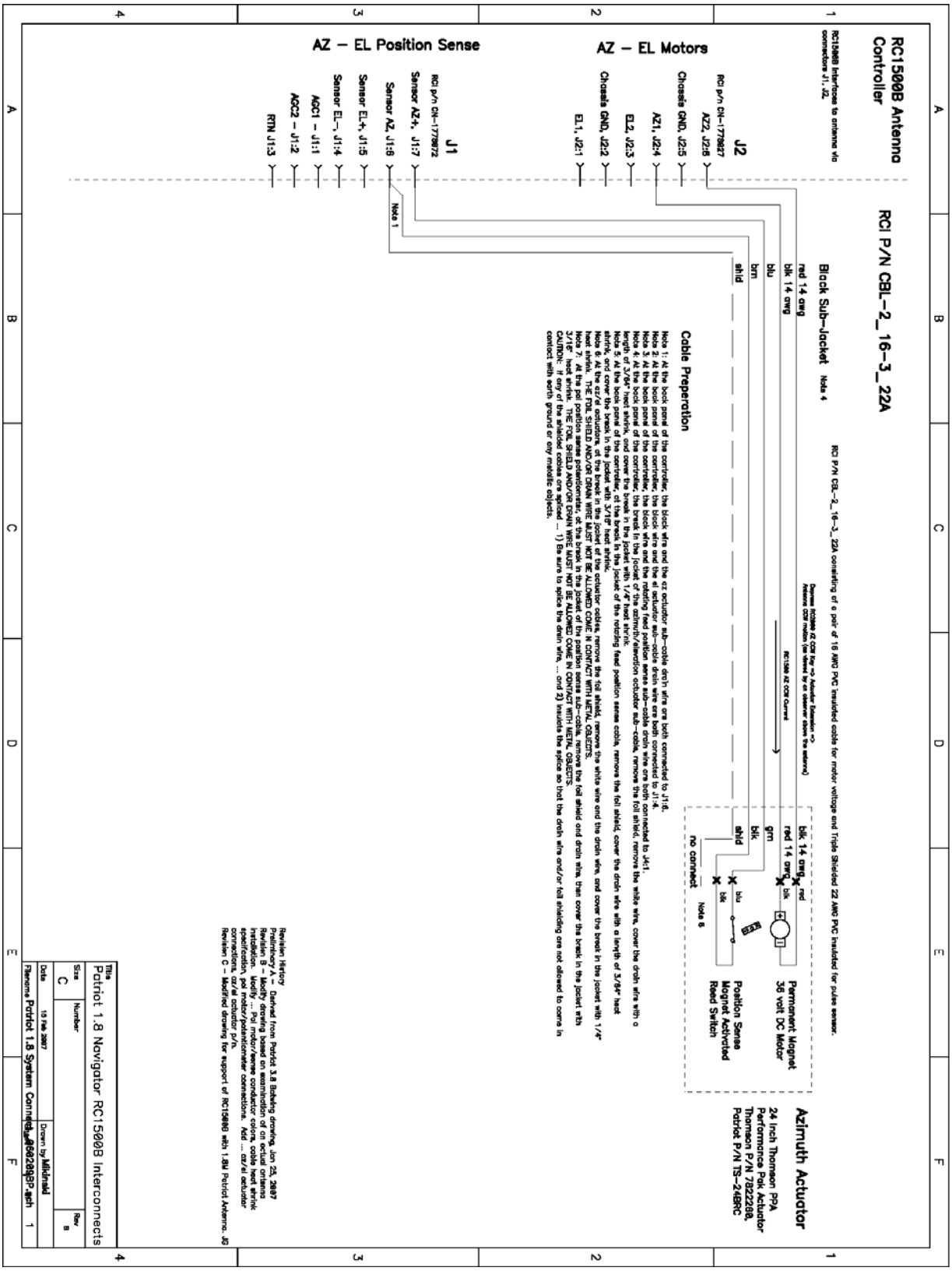
Table 4 – iDirect Modem Connections

AGC Configuration

The AGC has two analog input channels. In this case, it is recommended to use AGC2. Each AGC channel has a gain and offset potentiometer adjustment accessible via openings in the back panel. Details on adjusting the gain and offset can be found in the AGC Tuning section starting on page 22.
The AGC2 Gain and Offset pots should be adjusted so that when 0 volts is presented to the controller, on the AGC2, the displayed signal strength value is approximately 0 *and* when 5 volts is input on AGC2 the displayed signal strength reading is around 950. The displayed signal strength value should vary as the input voltage changes from 0 to 5 volts.

The ACU maintains user defined ‘AGC Threshold’ items found in the CONFIG menu. When the AGC input signal strength value is greater than this value, the ACU assumes that a satellite signal is present and antenna peaking can occur. When the AGC2 Gain and Offset pots are configured as specified above, an appropriate value for the AGC Threshold is ‘500’. A signal strength value of 500 corresponds to an analog input voltage of approximately 2.5 volts. When the signal strength input level is above 2.5 volts the modem is locked and peaking can occur.

Interconnect Schematic



Appendix A

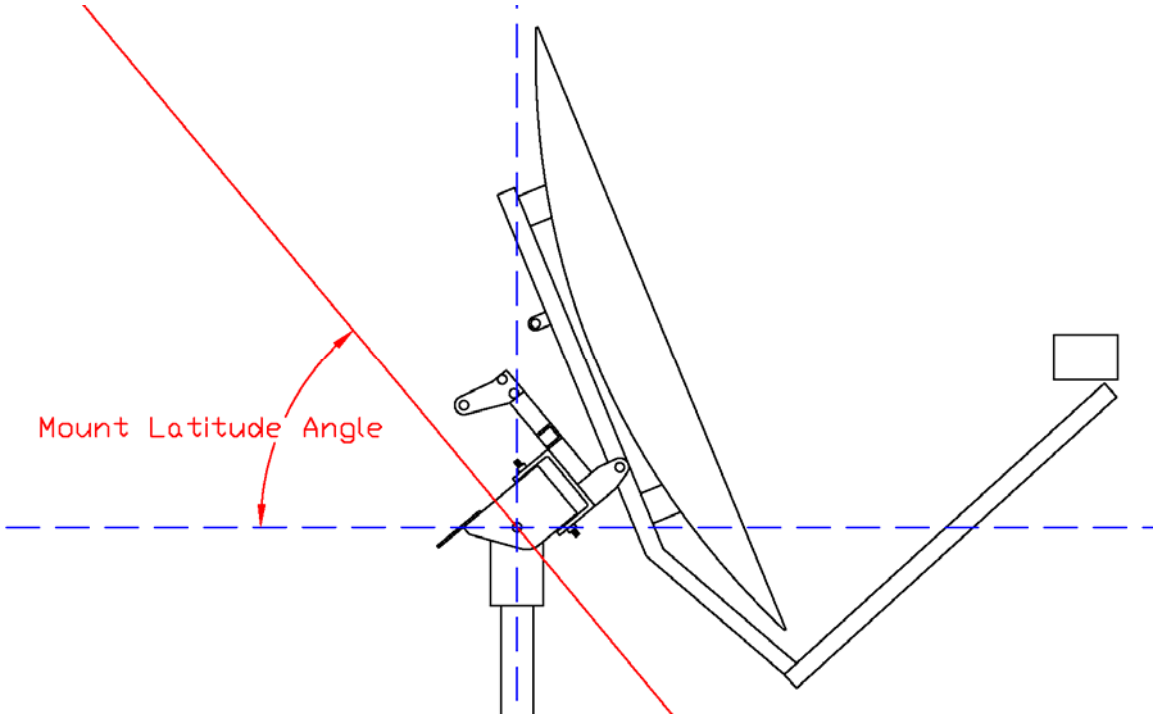


Figure 24 - Mount Latitude Angle Drawing

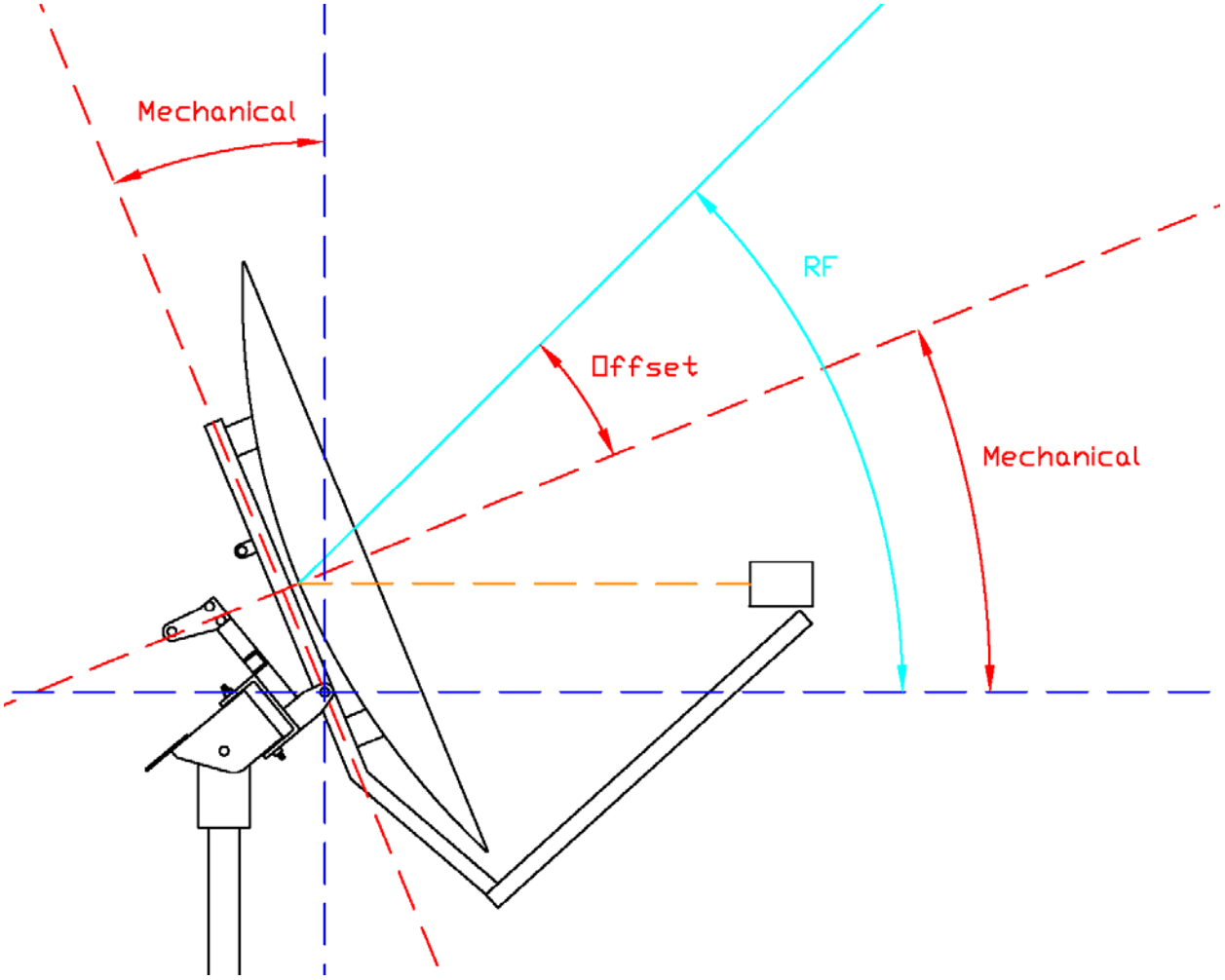


Figure 25 - Antenna Angles Drawing

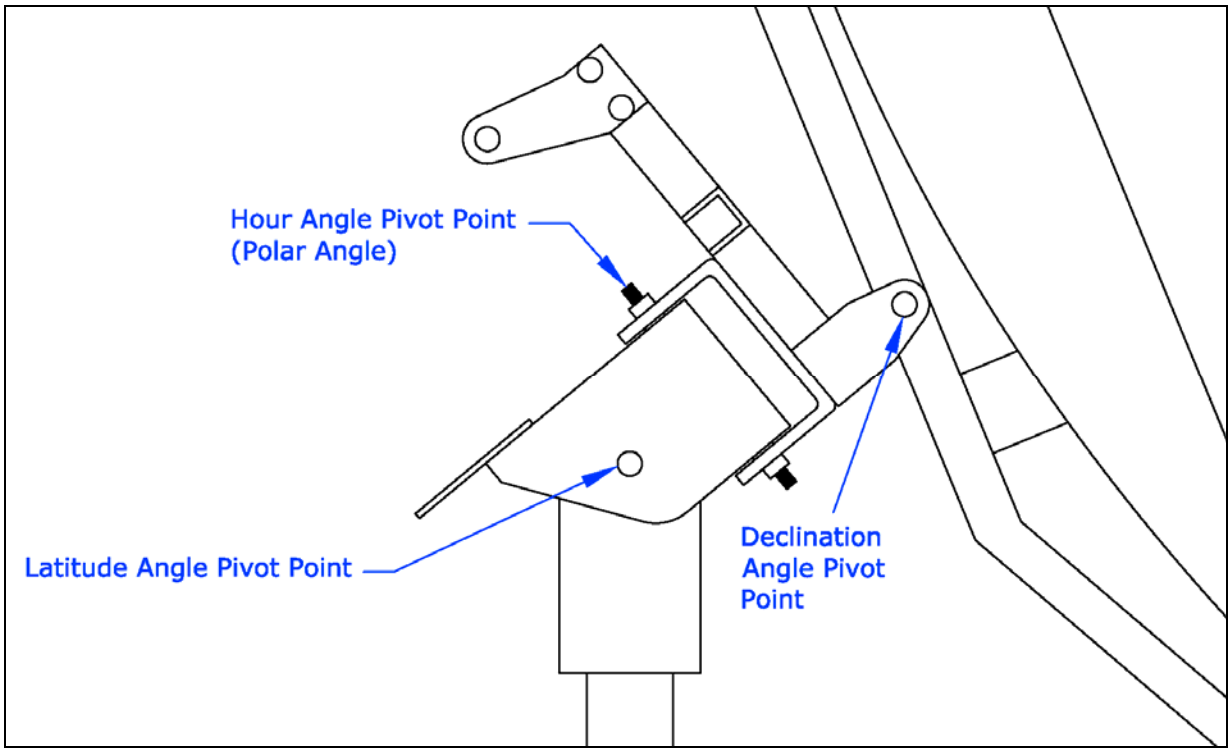


Figure 26 - Pivot Points Drawing

Universal Time vs. Local Time

We use **Universal Coordinated Time** (UTC) to define a time that doesn't depend on where we are on Earth. Universal Time, Greenwich Mean Time (GMT), and **Z**ulu (Z), are based at the prime meridian (0° longitude) of Earth and are used by scientists to avoid confusion of time zones.

The map and charts below guide the conversion to local time from Universal Time.

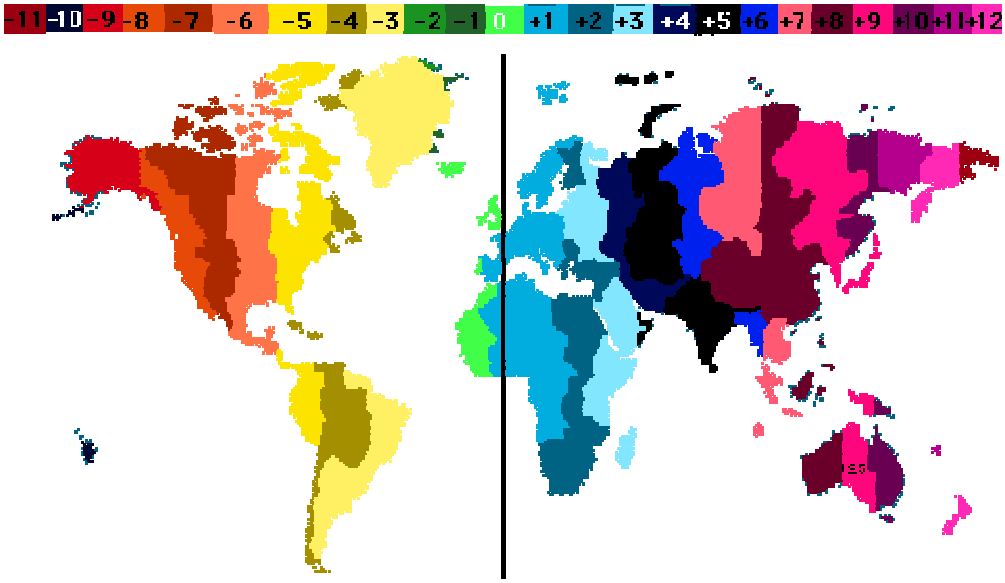


Figure 27 - Local time to UTC time conversion

On the west coast of the United States, subtract 8 hours (7 hours during daylight savings time) from Universal Time to get local time. For example, when it's 01:00 UTC, it's 5:00 pm in Seattle (PST) or 6:00 pm (PDT).

Definitions

Pointing Solution – Provides the user with the Elevation and Heading to point at the satellite so that the user can verify that there are no obstructions in the antenna's bore sight.

Elevation – The number of degrees above horizontal (0˚) in order to point at the given satellite.

True Heading – The heading relative to true north.

Magnetic Heading – The heading relative to magnetic north.

Magnetic Variation – The angle between magnetic north and true north. The magnetic variation is considered positive east of true north and is considered negative west of true north.

Mount Setup – The setup data of the antenna required in order to point to the desired satellite.

Mount Latitude Angle – The amount of tilt at the latitude angle pivot point that is approximately equal to the antenna's latitudinal position on the Earth.

RF – The angle of the antenna bore sight above horizontal (0˚) that is required to point at the desired satellite when the hour angle is positioned at 0˚.

Mechanical –The angle that can be measured on the back-structure of the antenna to point the antenna to the correct RF angle for the desired satellite when the hour angle is positioned at 0˚ (requires that the Mount Latitude Angle is already set).

Mount Hour Angle – The amount of tilt at the Hour Angle pivot required to point to the desired satellite.

Document Revision History

3/11/2009 Rev 1.01 Corrected various punctuation and layout errors. Added different headers and footers.

5/19/09 Rev 2.01 Added new pictures of new mount, corrected various punctuation and layout errors. Added text in antenna setup, steps 5 and 11. Deleted various returns and put in page breaks. Formatted Table of Contents. Corrected figure numbers. Added software version and latest Patriot mount to cover page. Annotated polar mount diagram. Corrected wiring pic and table to have correct motor connection designation. Deleted instructions to use Hand held protractor and hour scale and use built-in protractor and hour scale. Deleted set mode screens that are no longer part of the firmware. Added pics of Boot clamp, and threaded rod.
B.P.

6/01/09. Added interconnect schem. Added Definitions. Added Mount Latitude Angle, Pivot points and Antenna Angle Drawings. Added Caption to Threaded Eye Bolt pic. B.P

6/03/09. Added CONFIG.TXT pic. Added NORAD TLE data information. Fixed Headers, Corrected Motor wire colors on interconnect schem. B.P.

6.05.09. Added steps for wire connections. Added 1.2m to cover page.added drain wire connection to back of panel connection chart. Added AWG to actuator connection chart, Added figure numbers to each pick. Corrected some grammer and instruction mistakes. Added new pic of figure 8 showing zip ties. Added local time vs. UTC time chart in appendix A. Added table numbers to tables 1,2, and 3. B.P.

6.11.09. Added new pic of Actuator head connection. Changed page ref. Fixed diameter sizes in tools needed. B.P.

6.22.08. Added new pics of threaded rod figure 12 & 13, Changed yellow letters on the Figure 9 to black.