



## RC2000

- ❖ **Cable Preparation**
- ❖ **ACU Installation**
- ❖ **Troubleshooting/Alarm codes**



**Patriot 1.8m**

Strip outer jacket back  
9 1/4 inches and remove  
the plastic film exposing  
the 4 sub-cables.



Patriot p/n CAB-CC-15L

Black Jacket (without stripe). The cable consists of  
two 14 AWG conductors (red and black) plus three 22 AWG conductors  
(white, black and green) enclosed in a foil shield with a bare drain  
wire. Use this for the azimuth actuator.

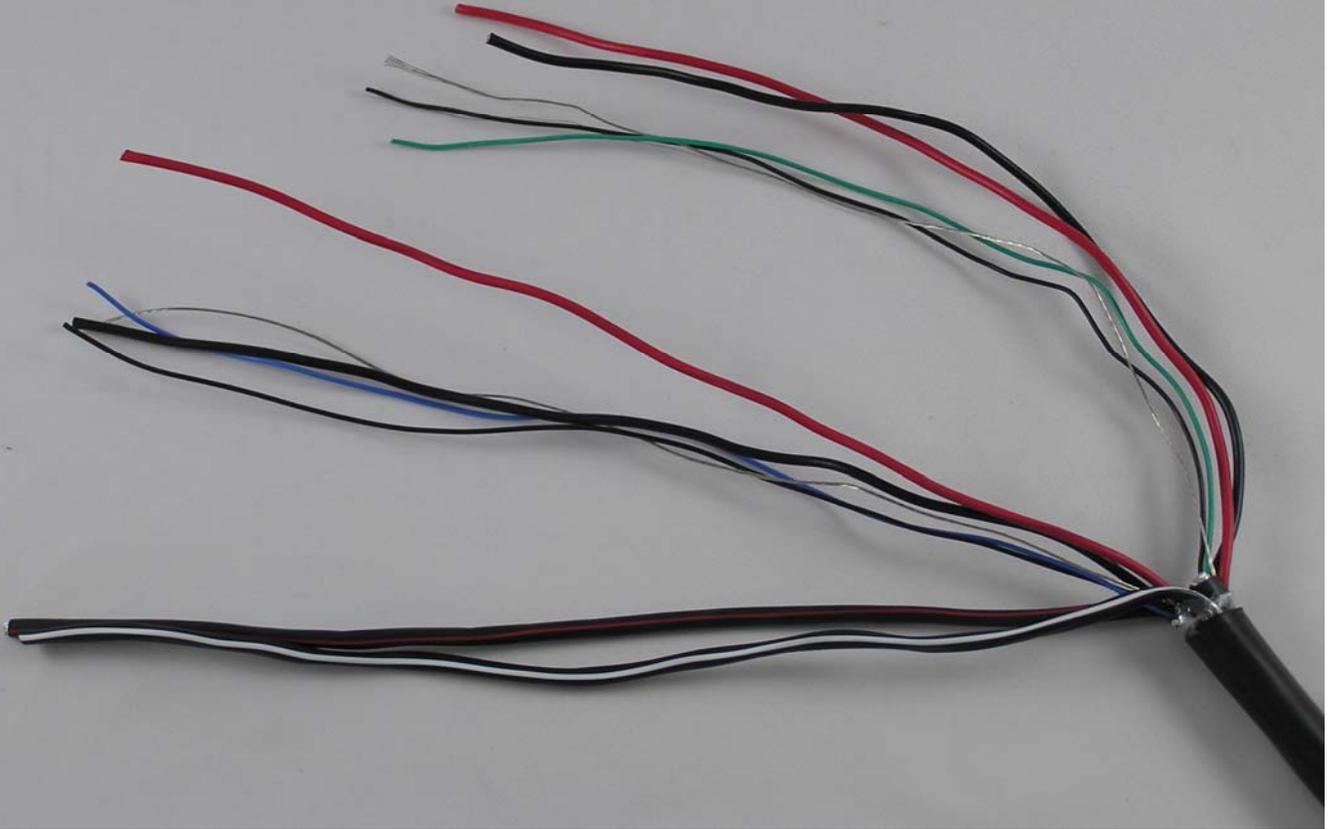
Black Jacket (without stripe). The cable consists of two 14 AWG  
conductors (red and black) plus three 22 AWG conductors (white,  
black and blue) enclosed in a foil shield with a bare drain wire.  
Use this for the elevation actuator.

\*Note: These two sub-cables listed above are nearly identical.  
The only difference is the color of one of the 22 AWG conductors

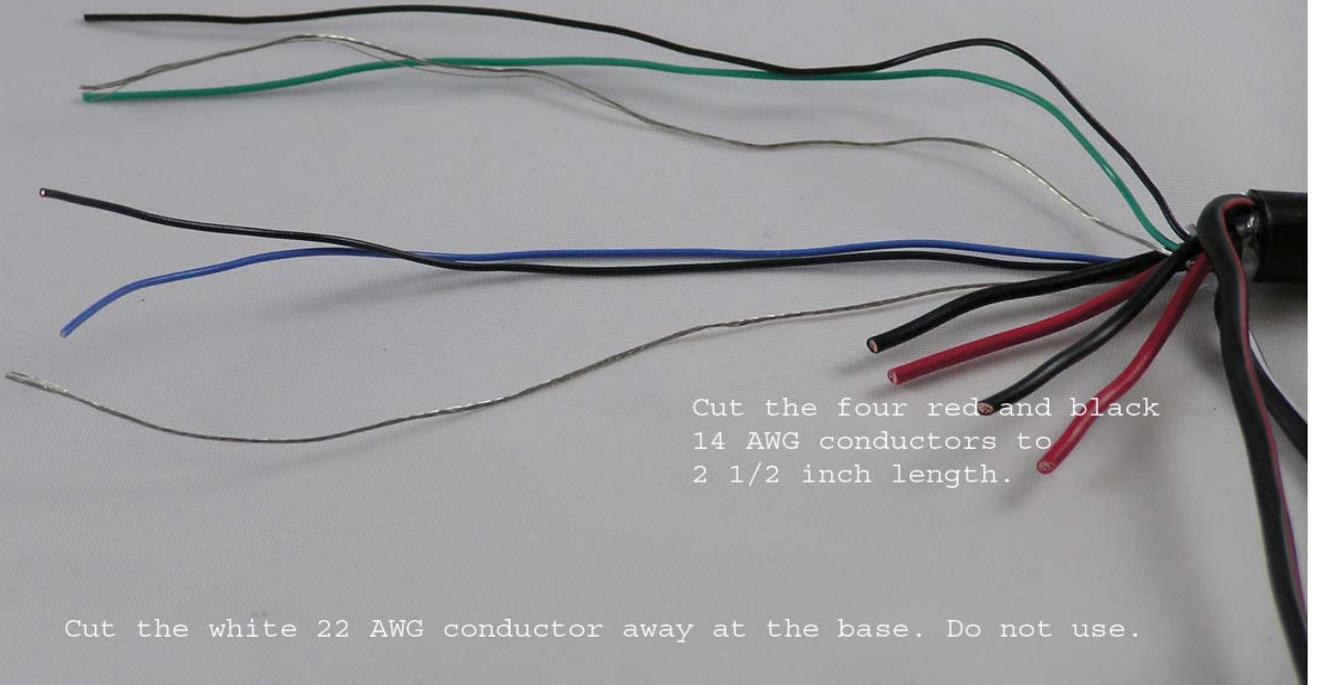
Black Jacket (with white stripe). This cable  
is unshielded and contains two 18 AWG  
conductors (red and white).  
Use for the rotating feed motor.

Black Jacket (with red stripe).  
This cable contains three  
20 AWG conductors (red, black and white)  
in a foil shield with a bare drain wire.  
Use for rotating feed position sense.

Black jacket without stripe (2): Strip outer jacket back 9 1/4 inches exposing the three 22 AWG and two 14 AWG conductors in each one. Remove foil from shield from the three position feedback conductors.



Cut the other four 22 AWG conductors and drain wires to 7 inches length.



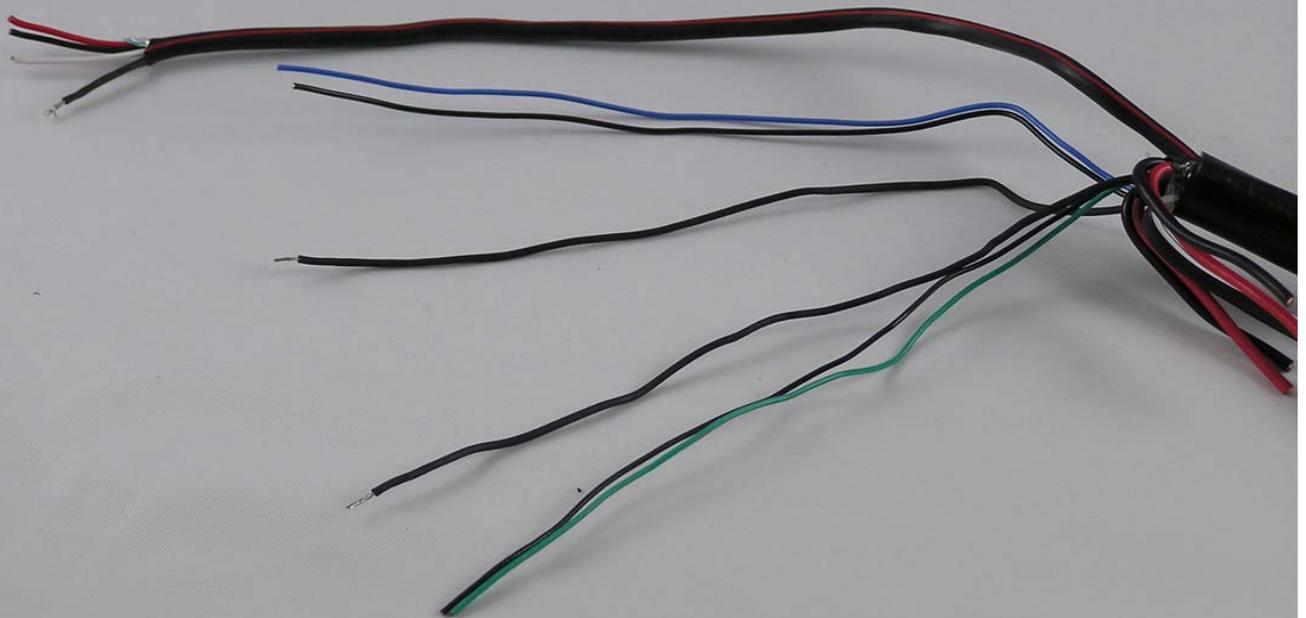
Cut the four red and black 14 AWG conductors to 2 1/2 inch length.

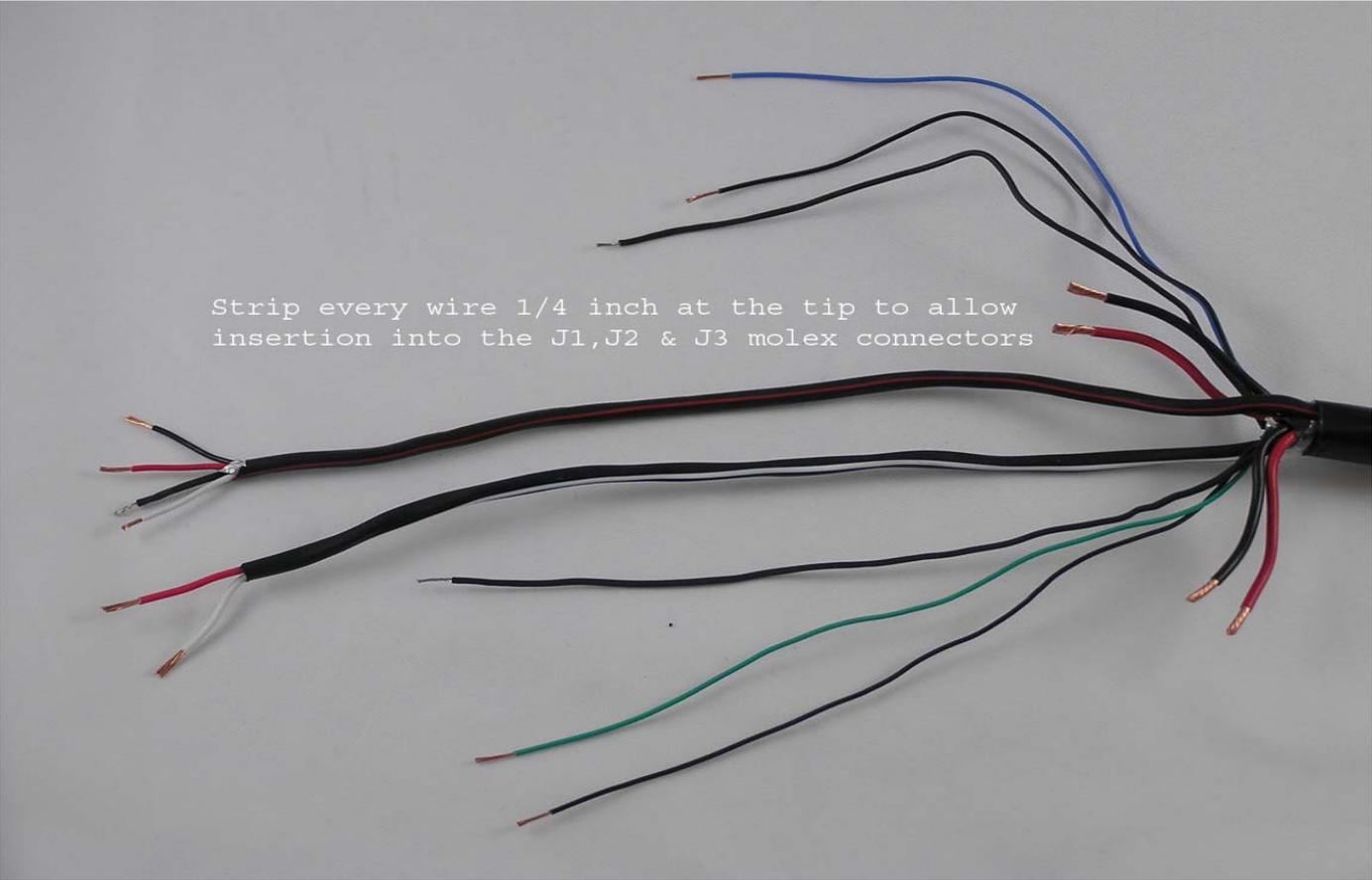
Cut the white 22 AWG conductor away at the base. Do not use.

Black jacket with white stripe and black jacket with red stripe:  
Strip the outer jacket back 2 inches.  
Remove foil from the feedback conductors.

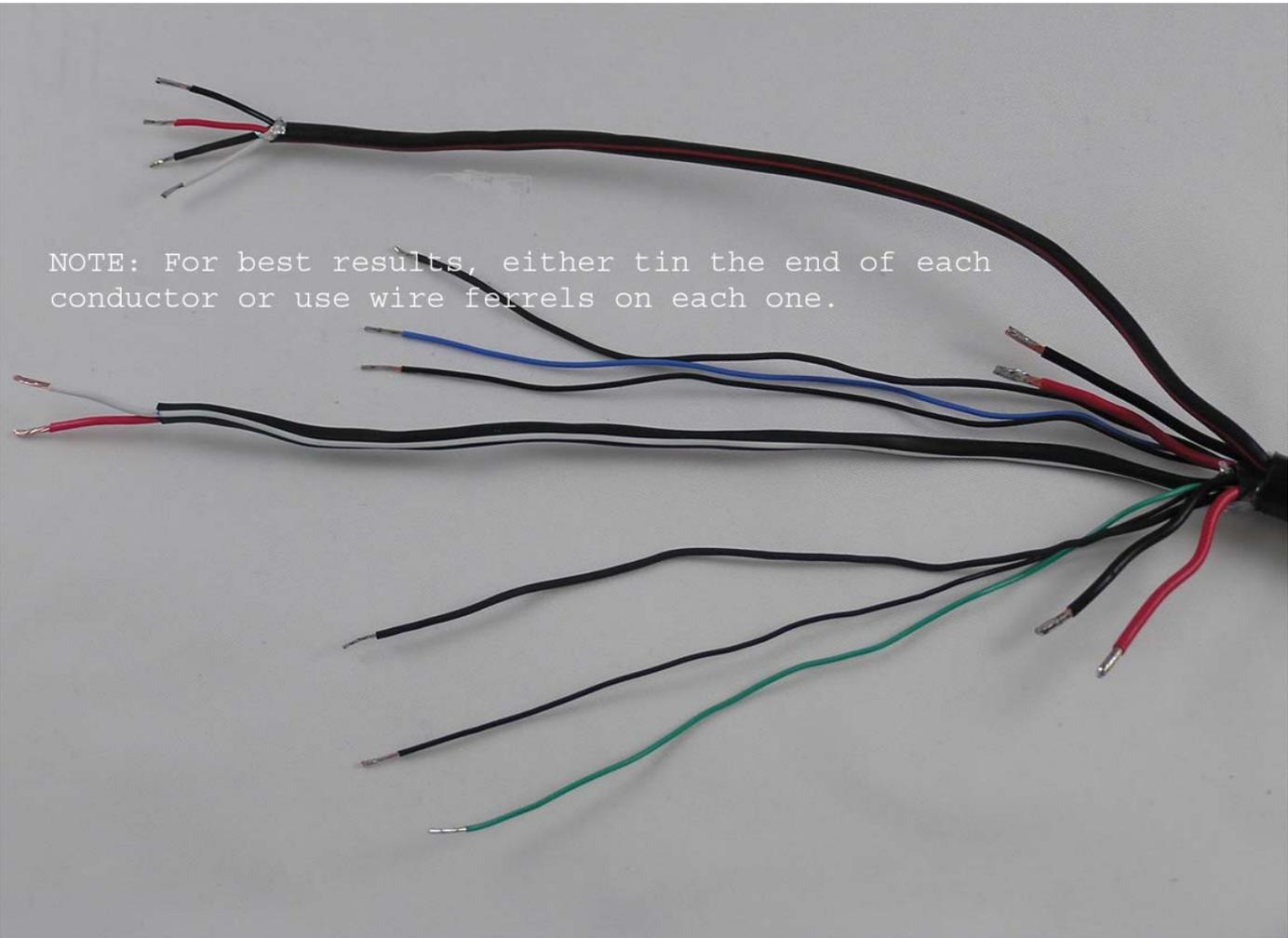


Black jacket with red stripe use  $\frac{3}{64}$  inch or  $\frac{1}{8}$  inch heat shrink.  
Slide heat shrink over entire drain wire leaving  $\frac{1}{4}$  inch of  
conductor exposed at the tip to prevent noise pickup.  
Make heat shrink  $6 \frac{3}{4}$  inches long. Use heat gun to heat the heat shrink.



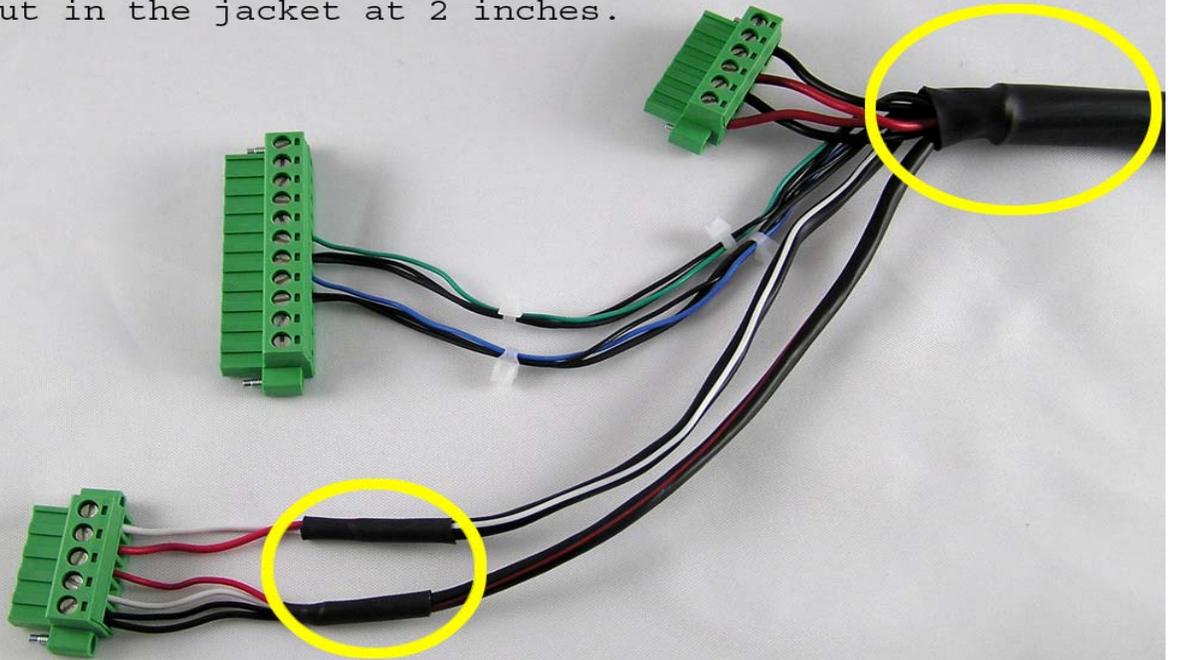


Strip every wire 1/4 inch at the tip to allow insertion into the J1, J2 & J3 molex connectors



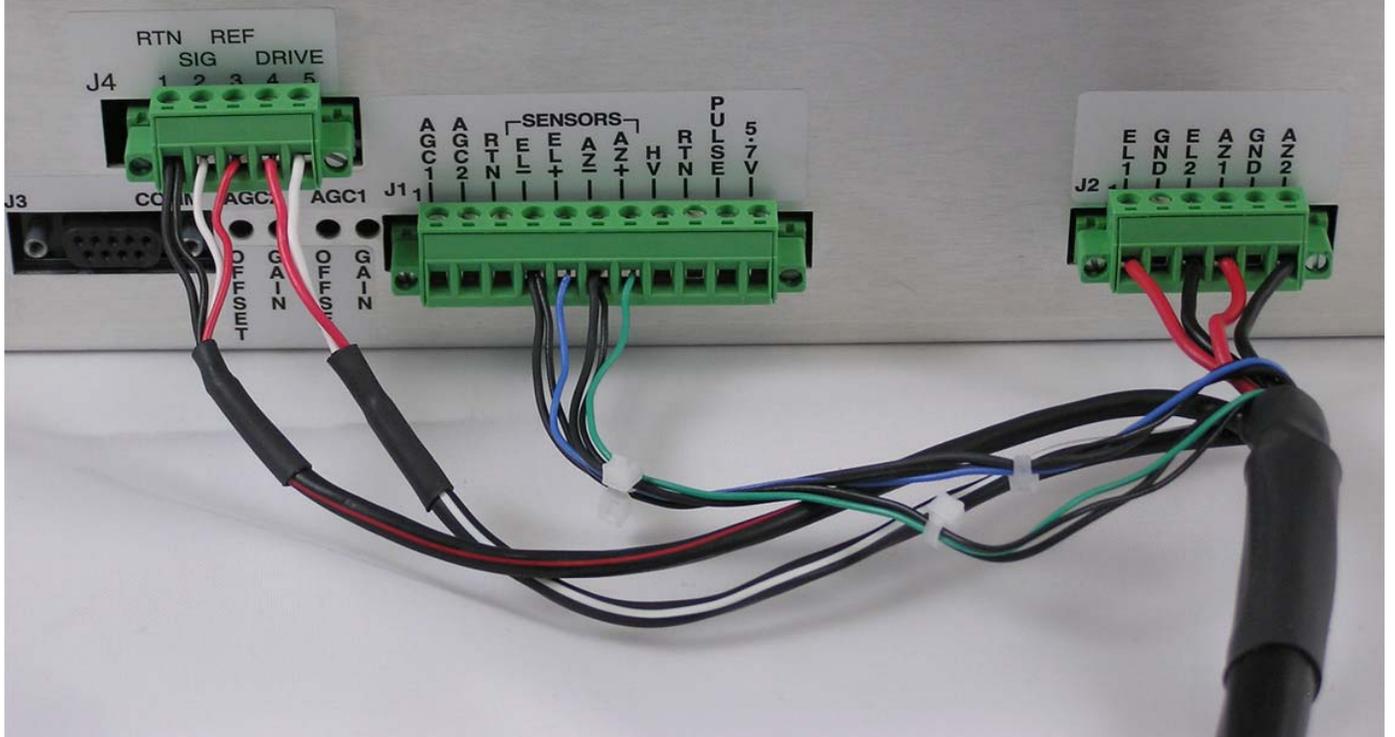
NOTE: For best results, either tin the end of each conductor or use wire ferrules on each one.

Add 1 inch heat shrink (3/16 inch size) to black cable with red stripe and black cable with white stripe to cover the first cut in the jacket at 2 inches.

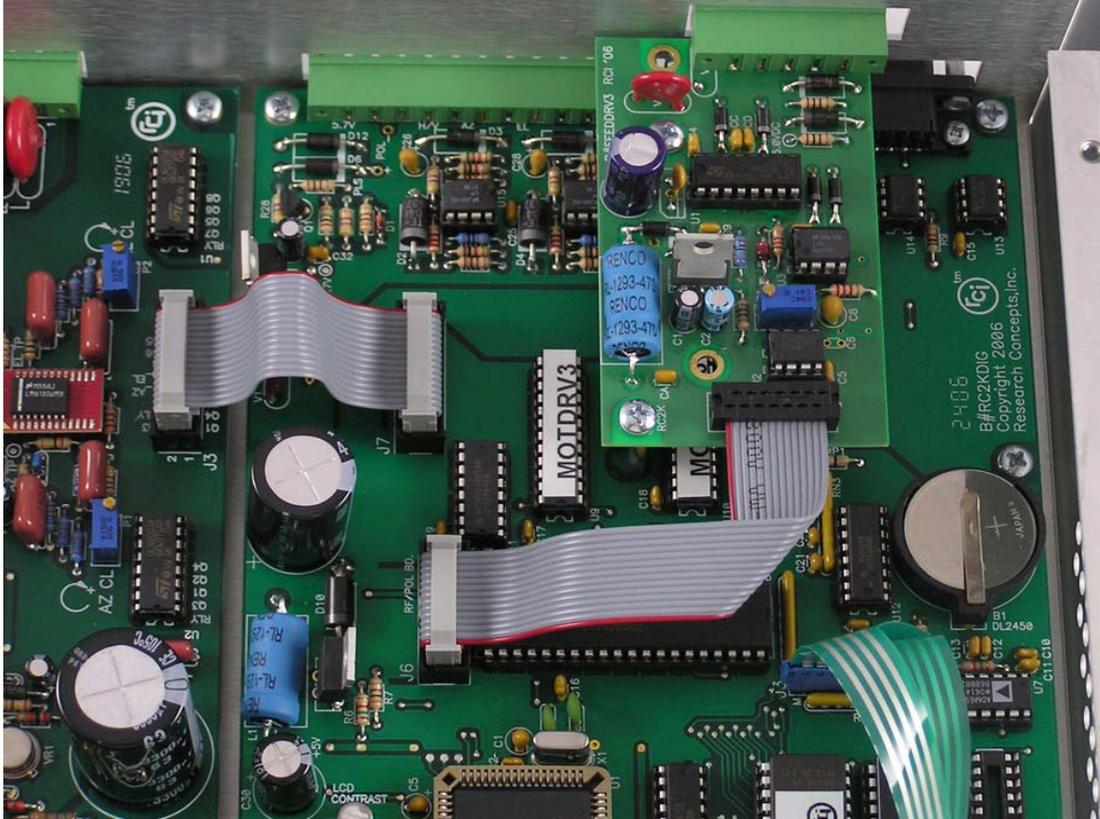


Add 1 1/2 inch heat shrink (3/4 inch size) around outer jackets first cut.

NOTE: When you move the cable in any direction, the strain relief should be on J2 because it contains the heaviest gauge conductors.



Feed card installed inside of RC2000



## **Installation Instructions**

### **I. Needed equipment:**

Multimeter, small flathead screwdriver, large phillips screwdriver, test/extra potentiometer (Contelec PD2205h, 5K, 5 turn), allen wrench (to center potentiometer), heat gun for heat shrink, cable jacket strippers (Greenlee p/n 45109), wire cutter, wire stripper (14-22 AWG), crimp connector tool.

### **II. Supplies:**

Spare fuses (5A slow blow), Heat shrink (Drain wire, Actuator cabling, Pol Pot cable.), 3M UR style connectors for the feed potentiometer connections, Cable Ties (Kingpost, actuator tube, wire strain relief.)

### **III. Installation:**

A. Install RC2000 into rack using provided rack screws.

B. Plug in power cord. Be sure that the line voltage is correct; the installer should check the controller to ensure that the proper line voltage has been selected

**NOTE: Shielded cables are required for the position sensors. The shields must be connected to pins J1-4 or J1-6 on the back of the controller and must not be connected at the antenna. Shielded cables are required to minimize noise pickup, which can result in antenna positioning errors. At the actuator, the shield should not be allowed to come in contact with any metal objects. At the actuator, insulate the break in the cable jacket with 3/8 inch heat shrink.**

**The RC2000 is equipped with removable terminals:**

**Note: “Caution” Do not attempt to drive the AZ, EL or POL with an external power supply while the controller is connected to the antenna. This will result in damage to the controller’s internal driver circuitry.**

**A. Connect AZ motor:**

Az motor Drive:	
J2 on RC2000:	Azimuth acuator/DC motor
AZ Drive 2; J2:6; black 14 AWG	Negative terminals
AZ Drive 1; J2:4; red 14 AWG	Positive terminal

**B. Connect AZ sensor:**

AZ sensor:	
J1 on RC2000	AZ position sense/reed switch
AZ sensor Pulse; J1:7	Green
AZ sensor Ground; J1:6	Black
AZ sensor Shield; J1:6 shields	No connect

Moving the antenna by pressing the AZ/CCW will always result in a decreasing count value. Pressing the AZ/CCW button must result in AZ/CCW movement as seen by an observer behind the antenna. In the Northern hemisphere, AZ/CCW movement corresponds to East movement. Verify correct antenna movement while in LIMITS mode. Be sure to use caution (LIMITS mode has unrestricted movement.)

**C. Connect EL motor:**

El motor Drive:	
J2 on RC2000:	Elevation Actuator/DC Motor
EL Drive 2; J2:3 black 14 AWG	Negative terminals
EL Drive 1; J2:1 red 14 AWG	Positive terminal

**D. Connect EL sensor:**

El sensor:	
J1 on RC2000	EL Position Sense/Reed switch
EL sensor Pulse; J1:5	Blue
EL sensor Ground; J1:4	Black
EL sensor Shield; J1:4 shield	No connect

Moving the antenna by pressing the EL/Down will always result in a decreasing count value. Pressing the EL/Down button must result in EL/Down movement as seen by an observer behind the antenna. Verify correct antenna movement while in AZ/EL LIMITS mode. Be sure to use caution (LIMITS mode has unrestricted movement.)

## **IV. 24V Rotating Feed (RC2KPOL):**

**Feed type: TXFD-KLMOTGAM AKU (Single Port)**

**Verify potentiometer is at center position or damage may result to pot.  
(Refer to Ch. 3, Section 3.3. in user manual)**

### **Note: Caution**

**Do not attempt to drive the AZ, EL or POL with a external power supply while the controller is connected to the antenna. This will result in damage to the controller's internal driver circuitry.**

### **A. Install Feed Card:**

Enable the Feed option via CONFIG Mode and use the SCROLL UP or SCROLL DOWN key to bring up the Pol Control menu inside the CONFIG mode. This option should be set to a 1 '1 port ' followed by the ENTER key to save.

### **B. Connect POL motor:**

Pol motor:	24VDC Rotating Feed
Pol Drive 2: J4:5 White 18 AWG	Negative terminals (red)
Pol Drive 1: J4:4 Red 18 AWG	Positive terminals (black)

### **C. Connect Pol Potentiometer: (Contelec PD22005h, 5K, 5 turn)**

Sensor Ref: J4:3 red	CW pin of Pot
Sensor Sig: J4:2 white	Wiper of Pot
Sensor Rtn: J4:1 black	CCW pin of Pot
Sensor shld: J4:1 shield	No connect

POL/CCW should increase counts

POL/ CW should decrease counts

Moving the antenna by pressing the POL/CW key will always result in a decreasing count value. Pressing the POL/CW button must result in POL/CW movement as seen by an observer. Verify correct antenna movement while in POL/LIMITS mode. Be sure to use caution (LIMITS mode has unrestricted movement.)

## V. Set AZ/EL Limits

**Caution:** In LIMITS mode the user has unrestricted movement of the antenna, there are no software azimuth or elevation limits, and antenna jammed sensing does not take place. When moving the antenna in LIMITS mode, an assistant should be stationed at the antenna to ensure that the antenna does not move past a physical limit. Note also that the CW and CCW polarization keys are active.

### A. Setting AZ/EL Limits

Enter into the AZ/EL LIMITS menu.

1. Jog AZ/CCW/East as far as physically possible without damaging the dish. Press 7 and the AZ CCW limit will automatically set to a position count of 30.

2. Jog AZ/CW/West as far as physically possible without damaging the dish. Press 7 to set the AZ CW/ East limit.

3. Jog back AZ/CCW/East approximately to the middle of the AZ range to ensure to obtain the best EL range of travel.  
Press BSKP key to confirm

4. Jog EL/Down as far down as physically possible without damaging the dish. Press 9 and the EL/Down limit will automatically set to a position count of 30.

5. Jog EL/Up as far as physically possible without damaging the dish and press 9. This will set the EL/Up limit.  
Press the BKSP key to confirm

**\*You do not need to set the Geo Elevation. Press MODE and get out of the limits screen.**

### B. Set Pol Limits (RC2KPOL option)

1. First, enable the 'Pol control' option via CONFIG mode. The menu item should be set to a 1 for a one port feed.

2. Press the MODE key and go to the Pol limits menu. The screen reads: 'Caution-This mode sets CW/CCW Pol Limits: Enter to Continue'

3. Press ENTER once. The screen now reads:

‘Caution-Unrestricted POL movement, See manual! Enter to Continue.’

4. Press Enter;

The count value next to PL: should be a 3 digit number. When jogging CCW the count value should increase. CW decreases counts.

5. Skew pol all the way one direction, as far as the feed can physically go, without damaging the feed or the potentiometer, using the 1(POL CCW) and 3 (POL CW) keys.

Press the 5 key and this will set the first limit.

6. Skew Pol all the way in the opposite direction as far as the feed can physically go without damaging the feed or the potentiometer.

Press the 5 key and this will set the second limit.

**Note:**

**The Feed position should not be allowed to go less than 25 or greater than 950. If these positions are reached, the pot needs to be centered.( Refer to Ch. 3, Section 3.3. in user manual)**

## **VI. Programming Satellites in the non-volatile memory.**

SETUP mode allows the user to store satellite name, azimuth and elevation positions, and horizontal and vertical polarization positions into non-volatile memory. Once stored in non-volatile memory, satellite positions may be recalled via AUTO mode. SETUP mode is only accessible when the Expert Access mode is active via CONFIG mode.

### **A.**

1. While the SETUP screen is active, the user peaks up the antenna on the satellite which is to be stored in the non-volatile memory.

The SCROLL UP and SCROLL DOWN keys may be used to select the satellite name (in the ‘SELECT:’ field) that is stored in the controller’s EPROM memory. If the user selects the ‘USER’ entry from the satellite list, he or she will be prompted to enter a string of characters (after the ENTER key is depressed.)

2. When the ENTER key is depressed, the user is prompted to specify the satellite longitude. If the satellite was not user defined and came from the controller’s

internal list, the user is presented with a longitude value also from the controller's internal list.

3. Screen reads: 'Select Band. 0 – C, 1 – K, 2-C&K. Enter'  
Select 1 for KU band.

4. The next screen prompts the user to specify the Pol CW/CCW position.  
Skew the POL to the Horizontal position and press the H/7 key. The screen will briefly say H POL set. Skew the POL to the Vertical position and press the V key and the menu will display 'DATA ACCEPTED'.

Repeat Steps 1-4 to program in additional satellites.

## **B.**

After programming in a pair of satellites, the user should repeatedly move between those two satellites (at least 10 times) using the AUTO mode. Note the AZ and EL positions associated with each satellite. At the conclusion of the moves, manually peak up received signal strength on each of the satellites (using MANUAL mode). Verify that the AZ and EL positions that result in peaking signal strength is the same as the position associated with each satellite. **IF NOT**, position counts from the actuator pulse position sensors are not being accumulated properly. In most cases, this is caused by improper shielding of the sensor cable. Ensure that the actuator drain wires are connected at the back of the controller and that the actuator shield is not allowed to come into contact with any metal object. If the actuator cable is spliced, the shield drain must also be spliced.

## **TROUBLESHOOTING/ALARM CODES**

The alarm system monitors important system parameters and flashes a message on the bottom line of the LCD display if an error is found. The parameters monitored include the condition of the lithium battery, status of the azimuth and elevation antenna drive systems, and the values of certain variables. Some error codes have priority over others. Alarm conditions are sampled sequentially, with the highest priority sampled first. As corrective action is taken for each error, the code is eliminated, and if there is a lesser error, it will then appear.

### **Note: Caution**

**Do not attempt to drive the AZ, EL or POL with a external power supply while the controller is connected to the antenna. This will result in damage to the controller's internal driver circuitry.**

## **SYSTEM ERROR CODES**

### **LOW BATTERY**

The RC2000A constantly monitors the level of the lithium battery. When the power level is low, this error code will appear. Replace the battery with a Duracell DL2450. Make sure that the unit is unplugged from the AC power before removing the cover to change the battery. Take care to hold the battery tab away from the battery housing while replacing the battery and it will not be necessary to reprogram the memory. Since there is a chance that the non-volatile memory will be corrupted when the battery is changed, please refer to the appendix entitled 'Restoring the Non-Volatile Memory' before changing the battery.

### **AZIM LIMITS, ELEV LIMITS**

One of the antenna software limits has been corrupted. Go into LIMITS mode and reset the software limits. See Section 4.11

### **POL LIMITS**

This error indicates that the polarization motor limits have been corrupted when either the RC2KPOL or RC2KHPP option is installed (allowing the RC2000A to interface to a motorized feed with potentiometer feedback). The limits for the polarization motor are set via POL LIMITS mode. See sections 3.3 and 4.10.12.

## **ANT AZIM, ANT ELEV, ANT POL**

These alarm messages indicate that an error has been detected for the axis referenced in the alarm message. When one of these alarms is detected, the axis is disabled. Go to RESET mode (section 4.5) to view the actual fault condition which was detected and to clear the fault.

A Reset mode JAMMED indication may mean that the drive breaker is open. This can occur if simultaneous movement is enabled, and the total current draw from both motors exceeds 8 amps. Reset the breaker by pressing it back into place, and disable Simultaneous AZ/EL movement via CONFIG mode. See Section 4.10.2

**NOTE: The following alarm conditions are cleared by going into CONFIG mode and re-initializing the applicable CONFIG mode items. Access to certain items is controlled by other CONFIG mode items - these controlling items can sometimes make it difficult to clear a CONFIG mode data related alarm. Please review the explanation of the role of these controlling CONFIG mode items in section 2.4.**

## **AZIM COUNT, ELEV COUNT**

The internal position count has been corrupted. Manually find a satellite and go into RE-SYNC mode to update positions. See Section 4.7

## **AZIM SLOW SPEED, ELEV SLOW SPEED**

The code entered by the user for the azimuth or elevation slow speed has been corrupted. Go to the corresponding speed mode and reenter the slow speed code. See Section 4.8

## **AUTOPOL CONFIG DATA**

The user has the option to configure the system for AutoPol ON or OFF, and to denote a HI or LO level for the vertical polarization. If either of these values is corrupted, this error will appear. Go to CONFIG mode and reenter the correct values. See Section 4.10.1

## **SIMULTANEOUS AZIM/ELEV**

This error indicates that the value for the *Simultaneous Az/El Enable* CONFIG mode item has been corrupted. See section 4.10.2.

## **GEO POSITION**

The checksum associated with the GEO COUNT value does not agree with geo position in memory. Move the antenna to the proper GEO POSITION and reenter the GEO ELEV POSITION in the CONFIG mode. Section 4.10.4

## **COMM PORT**

This alarm indicates that the checksums associated with the CONFIG mode *Remote Mode Enable*, *Comm Port Baud Rate*, and *Comm Port Address* items indicate that at least one of these items is invalid. See section 4.10.3.

## **AZ/EL ANGLE DISPLAY**

This alarm indicates that the CONFIG mode items associated with the display of azimuth and elevation position in an angle format have been corrupted. Please see section 4.10.6.

## **POL OPTIONS**

This error indicates that at least one of the CONFIG mode items associated with the polarization control and display options is invalid. If the system uses a polarotor, these items must still be initialized properly to avoid this error. Please see section 4.10.7.

## **AZIM OPTIONS, ELEV OPTIONS**

This error indicates that at least one of the CONFIG mode items associated with the azimuth or elevation drive options are invalid. Note that all of the config mode items associated with these options must be properly initialized even if the *Az/El Drive Options Enable* CONFIG mode item is disabled. If this item is disabled and these errors occur, the '*Options Enable*' item should be enabled to gain access to the other CONFIG mode items associated with these options. These other items can then be initialized to their default values. See section 4.10.10 for default values.

## **OPERATIONAL TROUBLESHOOTING TIPS**

### **THE CONTROLLER DOES NOT RETURN TO THE PROPER SATELLITE LOCATION (AND IS NOT EVEN CLOSE)**

When this occurs the controller is generally losing or gaining position counts for a given axis as the antenna moves about that axis. Please review the items mentioned in Section 3.2 - Azimuth and Elevation Position Sense.

If the cause of the problem is not found and only one axis is affected, consider replacing the position sense module and/or magnets in the actuator. If both axis are affected the motor drive wires may have to be shielded. This is seldom necessary, but if it is, follows the rules for connecting the shields as outlined in Section 3.2.

### **THE CONTROLLER RETURNS TO APPROXIMATELY THE CORRECT POSITION BUT MUST BE PEAKED MANUALLY TO ACHIEVE A GOOD SIGNAL**

This is generally an indication of mechanical hysteresis (slop) in either the actuator or the mount. When this occurs the antenna will peak up at one position

when approaching the satellite from the azimuth clockwise direction and another when approaching the satellite from the azimuth counter-clockwise direction. To test for this, move the antenna well past the satellite in the azimuth clockwise direction and then manually move the antenna counter-clockwise at slow speed until the peak is reached. Repeat the procedure approaching the satellite from the opposite direction. The difference in azimuth position between the 2 peaks is the mechanical hysteresis. If mechanical hysteresis exists try to eliminate the it. If this is not possible, always approach each satellite from the same direction as it was approached when the satellite was originally programmed into memory.

### **THE ANTENNA AZIM ERROR or ANTENNA ELEV ERROR OCCUR**

To determine the cause of this error, go the RESET mode. One of the following error messages will be displayed: JAMMED, RUNAWAY, or DRIVE. Here are the likely causes of each of these errors:

#### **JAMMED**

This error indicates that the drive was commanded to move, but movement was not sensed. This can be caused by a mechanical jam at the antenna, or the antenna may be moving but position feedback pulses are not getting back to the controller. Determine which condition exists.

If the antenna is not moving there may either be a faulty motor, a wiring problem, a mechanical limit switch has been encountered, or the breaker in the drive circuit has tripped (the breaker may be reset from the back of the unit). If the antenna is moving but position pulses are not reaching the controller, check the sensor wiring of the sensor module in the antenna actuator.

#### **RUNAWAY**

This error occurs when position pulses are recorded but the antenna has not been commanded to move. Check the items listed in Section 3.2 - Azimuth and Elevation Position Sense. If this error occurs just after the antenna has been moving and the drive signals are released, review the '*Deadband*' CONFIG mode items described at the end of section 4.10.8. Also see the paragraph in this section entitled 'CONFIGURING THE RUNAWAY SENSING SYTEM'.

#### **DRIVE**

This error indicates that the controller's electronic over-current sensing has detected an over-current condition and has shut the drive down. There are pots which control the level at which the electronic over-current sensing trips. These pots may have to be adjusted. Please consult the factory. Under no circumstances should the load current supplied by the controller be allowed to exceed 8 amps for more than several seconds.

### **THE AUTOPOL SYSTEM DOES NOT SEEM TO WORK PROPERLY**

This error is usually caused by the horizontal and vertical polarizations for a given satellite being programmed at the same position. If you turn off the

AutoPol function and the controller does not toggle the polarization position as the H and V keys are depressed in MANUAL mode, the polarization positions have probably been programmed at the same value. Other AutoPol problems result from not having a ground wire connected between the satellite receiver and the controller. Please refer to figures 3.2 and 3.3. The AutoPol system should not be enabled when the controller is used with feeds that receive both polarizations simultaneously.

**WHEN A SATELLITE IS SELECTED VIA AUTO MODE THE CONTROLLER DISPLAYS THE MESSAGE 'ENTRY SELECTED HOLDS INVALID DATA'.**

Before the controller executes an automatic move it checks to see if the azimuth, elevation, horizontal polarization, and vertical polarization are within their respective limits. If they are not, the error message is displayed. This error can occur if the limits were reset after the satellite position was programmed into memory via SETUP mode. This error can also occur if the state of the *POL Control?* CONFIG mode item was changed after the satellite was programmed into non-volatile memory.

**Recovering From Unexpected Memory Upsets**

The key to restoring the non-volatile memory is getting the azimuth and elevation limits and position counts right. The position counts are initialized to 30 when the azimuth counter-clockwise and down limits are set. If the antenna can be unambiguously placed at the counter-clockwise and down limits, non-volatile memory can be restored quite easily. It is probably a good idea to use a punch or a waterproof magic marker to mark the antenna and mount assembly so that the azimuth counter-clockwise and down limit positions can be identified. In addition, it may be useful to identify and mark other places on the mount where slippage could occur. This would allow the mount to be restored to its original configuration. The procedure for restoring non-volatile memory is outlined in Appendix B *Field Upgrading*.

Note that the procedure for restoring non-volatile memory only works if the count characteristics of the actuators are not changed. If the actuator count characteristics are changed, the count values that correspond to the west and up limit will change, as will the positions of all of the satellites

## Revision Page

1/24 Rough draft\_B.P

1/25 Revised some spelling. Added in AZ/EL motor and sensor connection per the Patriot 1.8 Navigator schematic. Added in troubleshooting tips. \_B.P

1/26 Added in troubleshooting tips about controller not going back to sat.  
Change Equipment needed from Big Phillips to Large Phillips screwdriver.  
Changed Pol limits section from 2 port feed to a 1 port feed. I added the word internal in the troubleshooting tips in the paragraph about not using an external battery. Corrected a lot of spelling and grammar mistakes. Added in verify shielding to troubleshooting tips. Added Shielded cables are required to minimize noise pickup which can result in antenna positioning errors at the beginning.

B.P.

2/4. Made revisions per S.M.M. Added some equipment and supplies needed. Moved the Troubleshooting tips to beginning. Changed wording of verifying sat after programming. Added in 25-950 pot limits note.

2/5. Added in all the troubleshooting tip word for word out the manual.

3/09- Added in the Wire colors for the AZ, EL and PL motors and sensors.

3/14- Added in Roman numeral Bullets.

4/11. Added more caution messages about using external power supply.  
Added more detail to centering the Pot.

4/30 Fixed spelling and grammatical errors. –JDK

## Notes