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Service Manual Introduction

This manual is intended for use by trained service technicians. It is designed as a troubleshooting aid. The manual contains instructions for disassembly and repair of the Winegard 2-Way Satellite System.

Warnings and Cautions

The procedures in this manual should only be attempted by authorized service technicians. Personal injury, damage to the antenna system, or damage to surrounding equipment can result if untrained individuals attempt repair processes.

Related Documents

DirecStar Installation Manual v9
DirecStar Owners Manual

Theory Of Operation

The Winegard 2-Way satellite system has been modularly designed. The system can utilize several different antenna sizes as well as different satellite modems. The basic antenna pointing mechanism is the same for all platforms. The 2 major differences between platforms are antenna size and skew methodology. Some systems are designed to skew the entire antenna and some are designed to skew the feed horn assembly.

The antenna system requires an internet modem and suitable 110/220 volt AC power source to operate. The modem is connected to the Indoor Control Unit (IDU) through a CAT5 telnet cable and to the antenna system through 2 RG6 (or equivalent) coaxial cables. These cables are terminated with environmentally sealed F connectors. The modem supplies the DC voltage necessary for the LNB. The IDU supplies 48 volts DC to the antenna system through an RG6 (or equivalent) cable. Communications between the IDU and the antenna's Outdoor Control Unit (ODU) are carried over the antenna's power cable utilizing Bluetooth Protocol. This cable is terminated with BNC connectors.

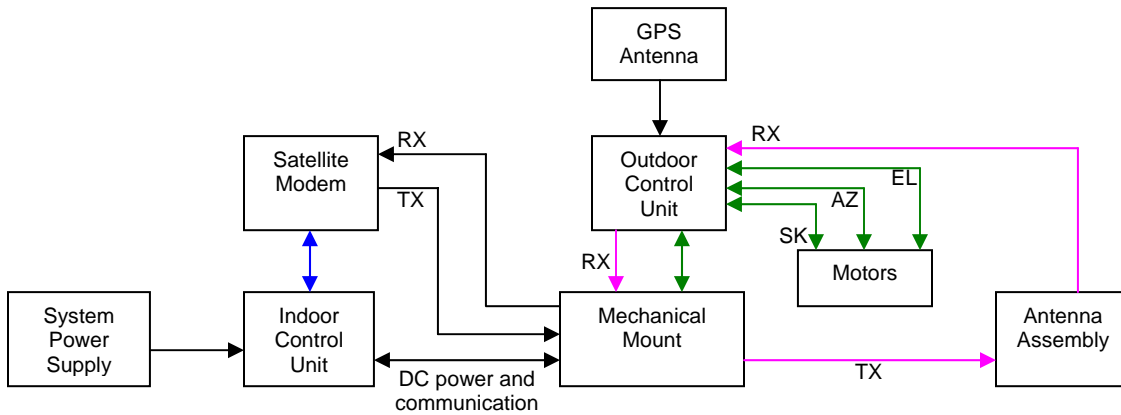
The modular design was used to make assembly and repair as efficient as possible (see the Functional Block Diagram).

The system was designed to utilize an onboard GPS receiver to determine pointing elevation and correct skew angle. The pointing angle is also compensated by pitch and roll detectors. It also uses an onboard compass to automatically determine the correct pointing direction. An antenna heading can also be entered into the system which will by-pass the compass (fixed heading mode). This should be used when compass calibration is impractical.

The antenna uses an onboard DVB receiver to find the correct satellite. The system then fine tunes the pointing position. The preferred method for fine tuning is to use information from the modem and adjust the azimuth, elevation, and skew for optimal signal integrity. If the system is set to generic mode the antenna's fine tuning is completed using the onboard DVB receiver. This second method requires no modem communication and is not recommended.

There are several safety features built into the antenna system. These features automatically stow the antenna if certain criteria are met. These include loss of receive signal lock, detected motion (pitch, roll, velocity) as well as turning the power off to the system by pressing the power button on the IDU.

Functional Block Diagram



Legend

- CAT5 Telnet — (blue line)
- DC Wiring Harness — (green line)
- RF Wiring Harness — (pink line)
- Antenna Assembly – Contains the RX LNB, TX BUC and the Antenna Dish
- Motors – The motor block contains the Azimuth motor, Skew motor, and the Elevation actuator.
- Outdoor Control Unit (ODU) – The ODU contains a DVB/DSS receiver and controls all motor movements.

Software Update

Under normal circumstances the software can be automatically downloaded over the internet while the system is pointed and operational. The software can not be updated over the internet if the system is set to “Generic Mode”. Refer to the Owners Manual for instructions on updating software over the internet.

There may be circumstances which prohibit the automatic download of software. The following procedures describe methods which can be used to download software and program the antenna system manually.

The first procedure provides instructions on how to use a semi-automatic procedure utilizing a USB memory device. The following files must be located in the root directory of the USB memory device: bootdcm.b, dcm.b, DT740.exe, DT740.tmp, Launcher.exe, Launcher.tmp, trk_app.bin, update.xml. Do not install the USB memory device until step 3.

Copy the unzipped files onto the USB drive. Do not insert the drive into the controller.

1. Turn on the controller.
2. When the “Main Menu” screen is displayed, insert the USB drive into the port on the back of the controller.
3. Press the wrench button and navigate through the user status screens until the “Update” screen is displayed.
4. Press the “Update Now” button to begin an update. NOTE: If the dish is not deployed, this will automatically search for files on the USB drive instead of the online download area.
5. Cycle the power on the controller when the system returns to the Main Menu.

The second procedure describes how to load software manually from the IDU. This normally requires a USB keyboard and a USB memory device. This procedure should be used when the automatic procedures do not work and software corruption is suspected. The files can be transferred from a USB memory device into the folder "Onboard Flash" in the IDU. Once the files have been loaded into the IDU the Outdoor Unit (ODU) can be programmed. If a USB keyboard is not available additional steps must be taken in order to utilize the touch keyboard on the IDU screen.

There are 2 methods to copy the files. The first method is to place the files in the root of a USB memory device, insert the device into the IDU, and turn power on to the system. The application should ask you if you want to copy the files. If you select yes the files will automatically be copied from the USB memory device into the "Onboard Flash" folder in Windows CE. This will copy the DT740.exe application so the next time power is cycled the new version will be active. This also copies the trk_app.bin and DCMB.bin files. It does not program them into the ODU. This will have to be completed manually.

The second method that can be used to copy the files is to manually place the files into the "Onboard Flash" folder. This will cause the DT740.exe file to be executed next time the power is cycled. This will not program the ODU. This must be done manually via a USB keyboard.

Coping the files manually into the "Onboard Flash" folder.

1. Plug the USB memory device into the appropriate USB slot.
2. Turn the system on.
3. Watch the IDU screen. There is a progress bar that moves across the bottom of the screen. After the progress bar completes the screen will flash white briefly. Tap the screen several times as soon as the screen flashes. This should bring up the Windows CE operating system.
4. Open the file "My Device".
5. Open the file "Hard Drive". This should contain the file(s) that needs to be copied.
6. Highlight the file and select "edit" and "copy" from the pull down menu.
7. Press the back button in the tool bar.
8. Highlight and open the folder "Onboard Flash".
9. Select "edit" and "paste" from the tool bar. This will copy the file from the USB device to the Onboard Flash folder. The system may warn you that you are copying over an existing file.

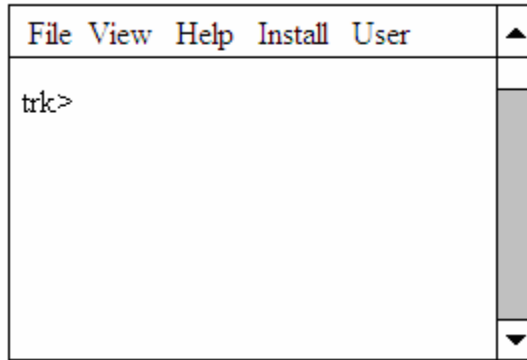
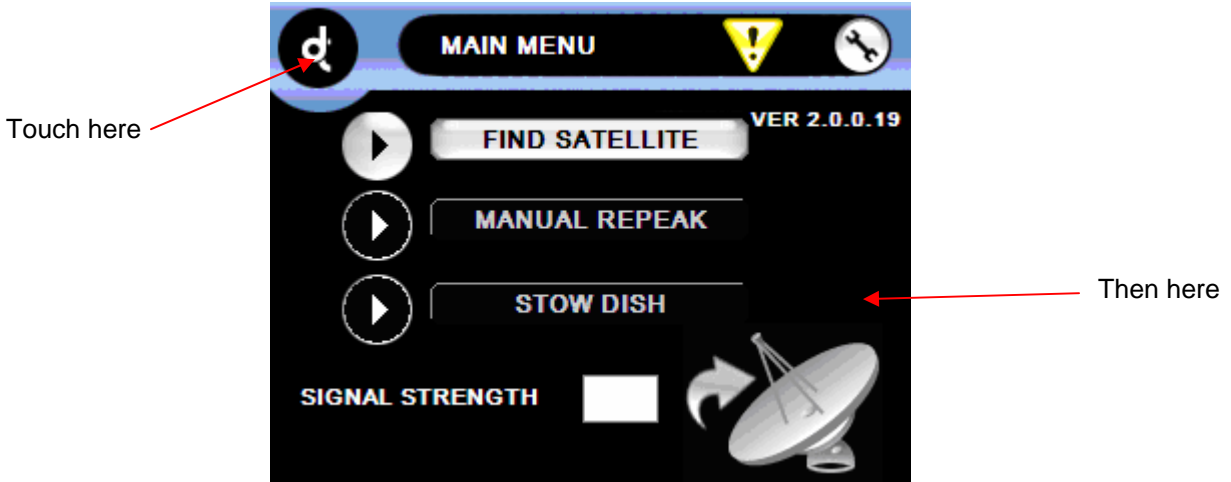
Manually flashing the Outdoor Unit (ODU) using a USB keyboard. Do not have a USB memory device and USB keyboard plugged into the IDU USB ports at the same time. One of the devices may not function.

The following procedure explains how to manually program DCMB.bin and trk_app.bin into the ODU. Verify that the correct files have been placed in the IDU's "Onboard Flash" folder. In order to complete this procedure the system must be placed in debug mode. Some of the IDU screens will not allow access to the debug menus. The Main Menu screen works the best for entering debug. Other screens will allow access to the debug menus it just takes longer and may involve several more screen taps including mixing in the a "GO" or "NEXT" button.

Debug Mode

Tap the icon in the upper left hand corner of the screen and then tap the screen somewhere in the lower right hand quadrant of the screen. Do this repeatedly until the screen turns white. The

tool bar should display the following options: File, View, Help, Install, and User. This is the debug screen. The screen should also display the “trk>” prompt.



Debug Screen

System Identification

There are serial numbers assigned to all systems. This should be located on one of the lift link arms. All serial numbers start with DT740.

In addition to the serial number there is a system id stored in the Outdoor Control Unit. This id is important for troubleshooting as well as manually loading software.

It is very important to know exactly what antenna system you are updating. The current models include DT740, DS980, DS980P2, DT960, DT960P2, DT1200A and DT1200AP2. The ODU will be updated using one of these models.

The System ID is also displayed in the ‘Versions’ screen in the Advanced Users section.

Verify that the USB keyboard is connected and functioning properly. Press the enter key a couple of times and verify that the screen displays several “trk>” prompts.

1. The IDU screen must be displaying the “trk>” prompt.
2. Type “i” and press return.
 - a. The following should be displayed on the IDU screen indicating that the system id is a DT960P2.

trk>i

Mode: App
App Ver: 1.03.24
Boot Ver: 1.06.07
System ID: DT960P2
Board: 0.10
CPU: 0X6
trk>

Manual Software Update

Procedure to update the ODU.

1. The IDU screen must be displaying the “trk>” prompt.
2. Type “u -(model)” and press enter.
 - b. If the system is a DT740 the command would be u -dt740 (no quotes and a minus sign before the model).
 - c. The IDU screen may display the error message “Bluetooth Error”. Do not touch the OK button. The system is updating and should be untouched for 10 minutes.
 - d. After 10 minutes press the OK button.
3. Re-enter the debug screen by pressing the icon in the upper left hand part of the screen. If the system does not enter the debug menus complete the procedure described above.
4. The IDU should be displaying the “trk>” prompt.
5. Type “dc” and press return. The IDU should now be displaying the “dc>” prompt.
6. Type “u” and press return. The IDU will now update the motor control board in the ODU.
7. Wait for this to complete.
8. Power cycle the system.
9. Navigate to the Version screen on the IDU by pressing the wrench in the upper right hand corner of the main menu screen. Refer to the Owners Manual for specific instructions.
10. The system should be power cycled before continuing.

Calibration Procedure

There are several different systems that require calibration. The first group of calibration procedures are factory set calibrations and will only be required if the Outdoor Unit (ODU) or the azimuth position sensor are replaced. These include calibration of the azimuth home position, calibration of the skew position, or calibration of the Vehicle Attitude Board (pitch and roll).

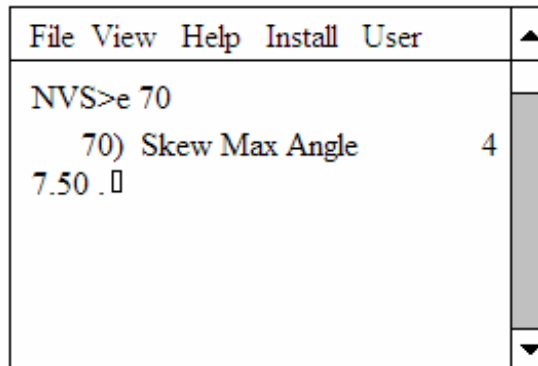
The second calibration procedure involves systems that may require periodic calibration. This include setting the antenna system’s home position and calibration of the on-board compass. Both of these procedures can be accomplished using either the USB keyboard or the Indoor Unit (IDU) in normal operation.

Calibration of the Skew Home Position (zero degree skew)

This procedure should be performed if the antenna does not return to the zero degree skew position during motor calibration. This procedure requires a USB keyboard (or alternate method). The system must be in debug mode as described earlier in this document.

It is very important that the antenna elevation is high enough that antenna can skew freely. When the skew motor is calibrated it will rotate the skew all of the way in one direction and then return the skew to zero degrees. If the system does not return to zero degrees it will be necessary to adjust the maximum skew angle in the ODU memory.

1. The IDU screen should display “trk>”.
2. Hold down the control key (ctrl), press “t”, release both keys and then press enter.
 - a. The IDU screen should change to the capital “TRK>” prompt.
3. At the “TRK>” prompt type “home” and press enter.
 - a. The IDU screen should now display the ‘HOME>’ prompt.
4. At the “HOME>” prompt type “h 2” and press enter.
 - a. The command will calibrate the skew motor.
 - b. If the skew does not return to the zero degree position than the maximum skew angle will need to be changed.
 - c. If the skew returns to the zero degree skew position no adjustment is necessary.
5. If adjustment is needed estimate how far off the skew is from zero degrees and continue.
6. Type “NVS” from any capitalized screen prompt (ie: TRK>, HOME>, etc).
 - a. The IDU screen should now display the “NVS>” prompt.
7. At the “NVS>” prompt type “e 70” and press enter.
 - a. The value displayed is the current maximum value for the skew.
 - b. **CAUTION** : The system is now ready to enter the new value. If the value doesn’t need changed press enter. Do not save the new values.



- c. The picture above depicts a typical value for a DT740 (47.5 degrees).
 - d. This value may be different depending on model and skew configuration.
 - e. If the system rotated past the zero degree skew position during skew motor calibration than this value is too large.
 - f. If the system did not reach the zero degree position during skew motor calibration than this value is too small.
8. Type the new value into the IDU and press enter.
 - a. Start with small value changes.
 - b. To increase the Skew Max Angle 1 degree type “48.5” and press enter.
9. Press enter again and the system will display the “NVS>” prompt.
10. From the “NVS>” prompt type “s” and press enter.

- a. This saves the new value into memory.
11. The system needs to be power cycled in order for the new values to take effect.
 - a. Once the system has been power cycled start back at step 1 and calibrate the skew motor.

Calibration of the Azimuth Home Position

This procedure should be performed if the LNB arm does not line up with the stow position bracket. This procedure requires a USB keyboard (or alternate method). The system must be in debug mode as described earlier in this document.

It is very important that the antenna elevation is high enough that the LNB arm will clear all obstacles.

1. The IDU screen should display "trk>".
2. Hold down the control key (ctrl), press "t", release both keys and then press enter.
 - a. The IDU screen should change to the capital "TRK>" prompt.
3. Type "dc" and press enter.
 - a. The IDU prompt should change to "DC>"
4. Type "p 1 1500" and press enter.
 - a. The LNB arm should lift off of the stow tray.
 - b. Verify that the LNB arm will not hit any obstacles when the azimuth motor is engaged.
 - c. If the LNB arm must be raised farther type "p 1 1600" Keep increasing the position value until the LNB arm is at a safe elevation.
5. Center the azimuth.
 - a. Visually inspect the front of the antenna assembly to see if the unit is aligned in the middle of the stow tray.
 - b. If the unit is aligned skip to step 6.
 - c. At the "DC>" prompt type "p 0 -500" and press enter. This will rotate the azimuth motor clockwise past the magnetic sensor.
 - d. At the "DC>" prompt enter the command "p 0 +100" and press enter. This will rotate the azimuth counterclockwise back towards the center of the tray.
 - e. Continue to rotate the azimuth towards the center. It may be necessary to decrease the amount of travel by entering values less than 100 in order to stop at exactly the center position.
 - f. The system must be brought to the center position from this direction. If the system overshoots the center position it will be necessary to start back at step c.
6. Calibrate the center (0) position.
 - a. From the "DC>" prompt type "calib" and press enter.
 - b. Then type "y" when asked if the azimuth is at 0.
 - c. The azimuth should move in both directions. It may not return to the centered position.
7. From the "DC>" menu type "home" and press enter.
 - a. The IDU screen should change to the "HOME>" prompt.
8. At the "HOME>" prompt type "h" and press enter.
 - a. The system should go through a motor calibration.
 - b. Verify that when the system stows it is centered on the stow tray.
 - c. If the system is not centered it will be necessary to return to step 3 and repeat this procedure.

Calibrating Pitch and Roll

This procedure requires the use of a digital inclinometer that is accurate to at least +/-0.1 degrees.

The system should be stowed. Enter the debug menu as described above.

1. The IDU screen should display "trk>".
2. Hold down the control key (ctrl), press "t", release both keys and then press enter.
 - a. The IDU screen should change to the capital "TRK>" prompt.
3. At the "TRK>" prompt type "tilt" and press enter.
 - a. The IDU screen should now display the "TILT>" prompt.
4. At the "TILT>" prompt type "mount [pitch] [roll]" and press enter.
 - a. [pitch] and [roll] are the values obtained using the inclinometer (see figures below).
 - b. The command for the example below would be "mount -0.5 -0.4"
 - c. The IDU will display the message "Is the antenna stowed with p=[pitch], r=[roll]? y/n"
 - d. Selecting "n" will cancel the calibration.
 - e. Selecting "y" will display the message "Calibration Successful".
5. The pitch and roll should be verified. Type "att" and press return.
 - a. The IDU should now display the "ATT>" prompt.
6. Type "att" and press return.
 - a. Values for pitch, roll, and heading will now be displayed on the IDU screen.
 - b. Press any key to stop.
 - c. The pitch and roll should be +/- 0.2 degrees from the values entered.

Pitch – If the front of the system is higher than the rear the pitch is a positive value. The front of the system is the antenna dish and the rear is the actuator.



Pitch – In this example the front of the system is lower than the rear so the pitch is -0.5 degrees.

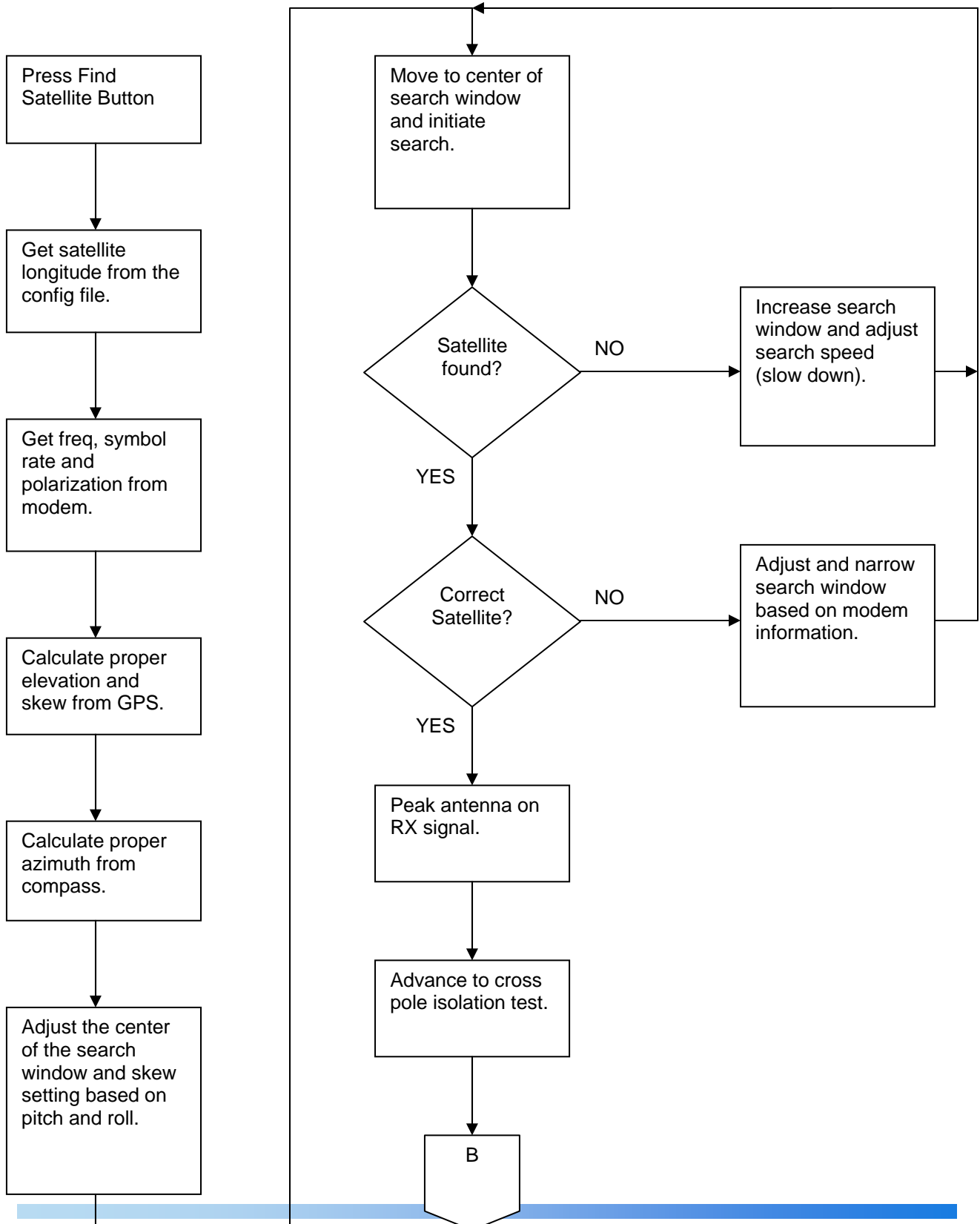
Roll – If the left side of the system (looking from the rear) is higher than the right side the amount of roll is a positive value.

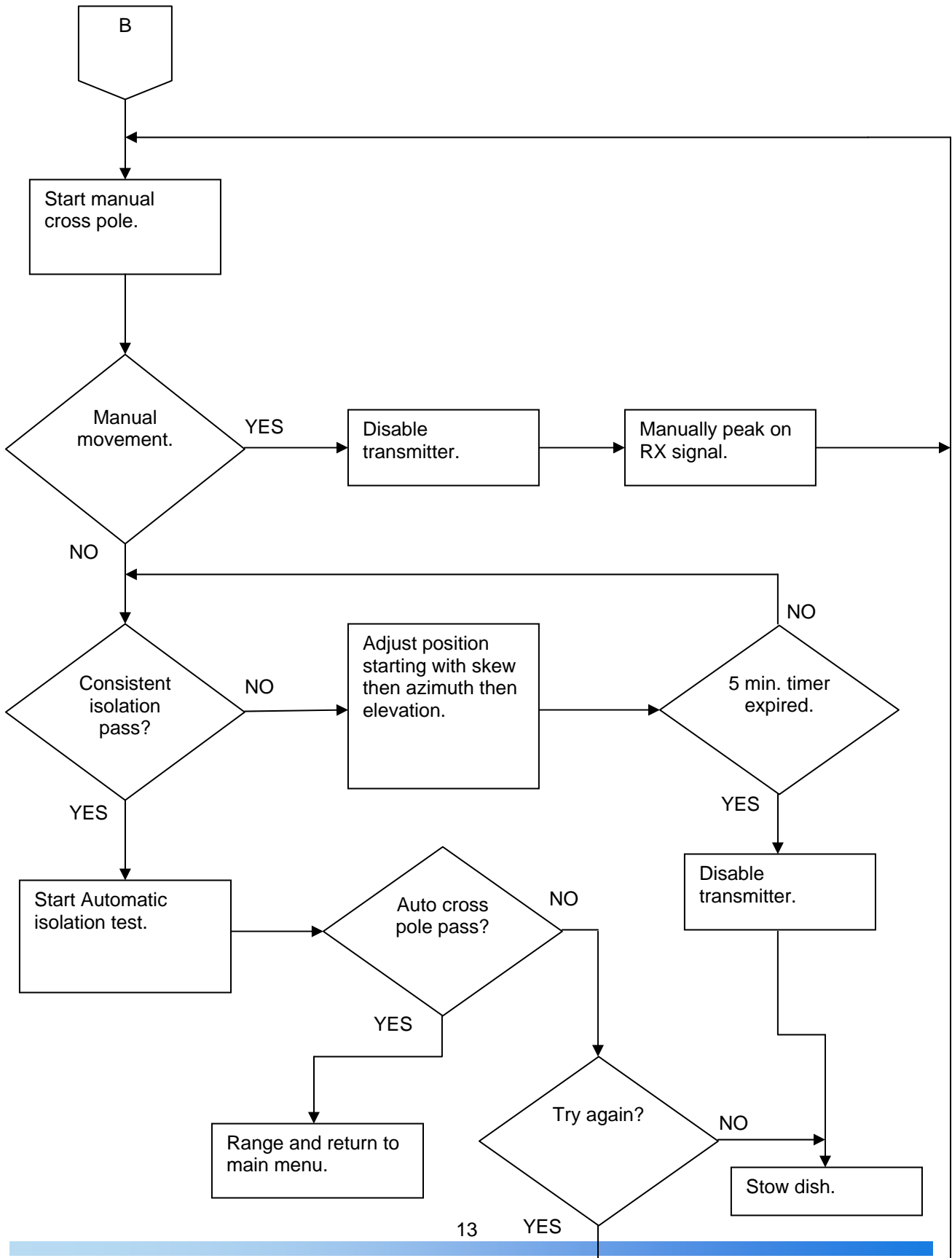


Roll – In this example the left side of the dish is lower than the right side. The roll is -0.4 degrees.

Search Routine Flowchart

This example is for a Hughes Net 7000 modem. Other types of modems are similar.





Troubleshooting

Symptom	
Antenna searches in the wrong part of the sky.	<p>Stow the antenna and navigate back to the main menu. Press the wrench (advanced user menu) and verify the antenna heading.</p> <p>Verify the compass mode is set for desired operation.</p> <p>If the compass is set for fixed mount mode verify that the proper heading has been chosen.</p>
System takes longer than 20 minutes to find satellite.	<p>Stow the antenna and check antenna heading, compass setting, GPS and pitch/roll.</p> <p>Verify power to the modem and that it is connected to the DirecStar control unit.</p> <p>Verify that the cables are securely connected to the back of the modem and are in the proper position.</p> <p>Verify that the cables are securely attached to the base plate of the antenna mount (outside) and are in the proper position.</p> <p>Verify that the receive cable to the LNB is securely fastened. The LNB sticks out from the end of the dish when the antenna is stowed.</p> <p>Disconnect the RX LNB cable and there is 11 to 18 volts DC.</p> <p>Stow the dish and turn the system off. Power cycle the modem. This has to be done by unplugging the modem's power supply.</p> <p>Verify that the system is searching for the correct satellite. During the search the satellite longitude is displayed.</p>
System stops during the Antenna (GPS) portion of the Initializing screen (when power is turned on to the system).	It sometimes takes several minutes for the GPS system to acquire the number of satellites it needs for proper positioning.
"VAB or Tilt sensor not found" error during system initialization.	Power cycle the controller by pressing the green power button and then immediately pushing it again.
System stops during Comm portion of the Initializing screen. This can also show up as a BT No-Connection Error during operation.	Verify that the BNC cable and connector are properly installed on the back of the DirecStar Control Unit.

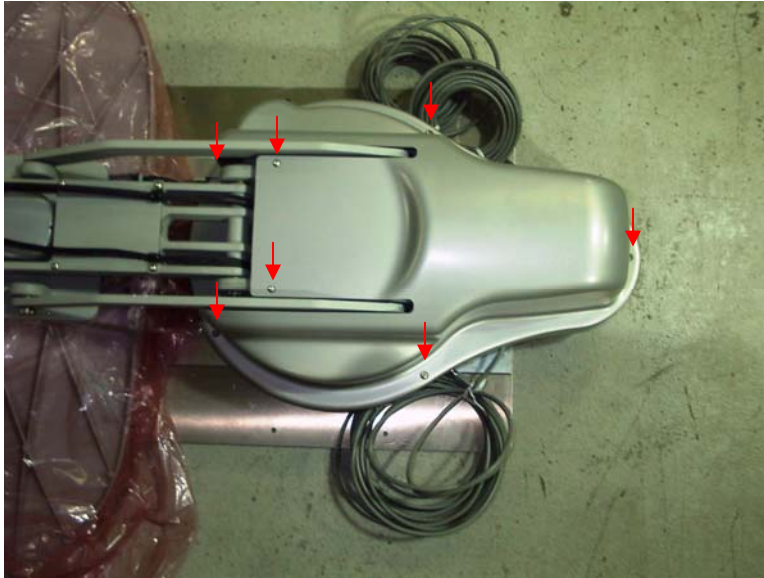
	<p>Verify that the BNC cable and connector are properly installed on the base plate of the antenna.</p> <p>Verify that there is 48 VDC at the BNC connector of the ODU.</p>
The IDU doesn't respond for several seconds.	<p>This happens when the IDU is not communicating with the modem.</p> <p>Verify that the IDU is connected to the proper modem.</p> <p>Turn the entire system off. Turn the modem on and wait several seconds before turning the IDU on.</p> <p>Verify that the IDU is getting the proper DHCP address (or static address).</p>
Dish raises but will not skew or move in azimuth. This may happen when calibrating the motors or normal operation.	<p>Enter the debug menus and try to move the motors individually. See appendix A.</p> <p>Determine if any motor indicates an invalid position command.</p> <p>Verify motor positioning is working through the DC> debug commands.</p>

Disassembly and Repair

Main Cover

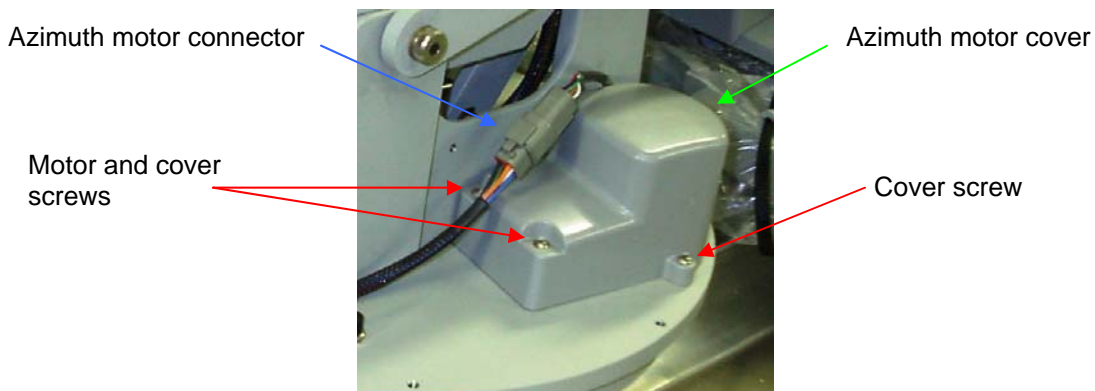
In order to replace either the azimuth motor, elevation actuator, magnetic sensor, or the Outdoor Control Unit (ODU) it is necessary to remove the main cover.

The main cover is held on by 5, ¼ - 20 X ¾ button head hex screws and 2, 10 – 32 X 1 ¼ button head hex screws.



Azimuth Motor

If the azimuth motor needs to be replaced the Main Cover needs to be removed. Disconnect the azimuth motor connector. Remove the 3 azimuth cover screws. 2 of the motor screws are used to hold the motor cover in place.



Remove the final 2 motor screws and carefully lift out the motor.

The system must be calibrated (homed) before returning to normal operation.

Azimuth Magnetic Sensor

The magnetic sensor is the only positional sensor in the Winegard 2-Way Antenna system. It is located under the main cover next to the azimuth motor.

The sensor is used to calibrate the azimuth position as well as verify azimuth position before stowing. The sensor will need to be calibrated before returning the system to normal operation.

The sensor is threaded into the base of the antenna mount and is held in place by 2 nuts which lock the sensor in place. In order to remove the sensor disconnect the sensor's connector. Loosen both lock nuts starting with the top nut. Unscrew the sensor from the azimuth base plate.

Rotate the azimuth base until the sensors magnet can be seen from through the mounting hole. This position should be very close to the azimuth stowing position. Carefully screw the sensor into the mounting hole until the sensor contacts the magnet. Unscrew the sensor 1 to 1 ½ turns. Lock the sensor in place by tightening the lock nuts in place starting with the bottom nut first. Make sure the sensor does not turn when tightening the lock nuts.

Skew Motor

The skew motor can be located in 2 different locations depending on which type of model is being serviced.

The system must be calibrated (homed) before returning to normal operation.

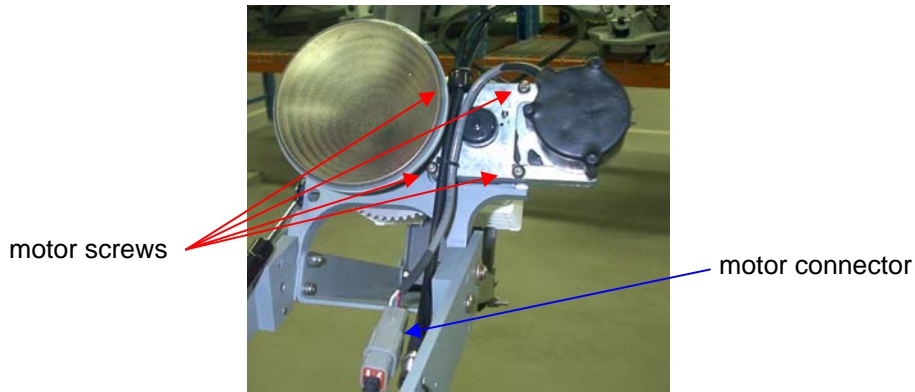
DT740, DT840, DS980P2

The skew motor for these models is located behind the antenna. This causes the entire antenna assembly to rotate. On these models the skew motor is located under the skew motor cover. Two of the skew motor screws are used to hold the cover in place.



DT960, DT1200A

The skew motor for these models is located next to the LNB/BUC assembly. This causes only the feed horn, OMT, BUC and LNB to rotate. Disconnect the skew motor connector and remove the 4 skew motor screws.



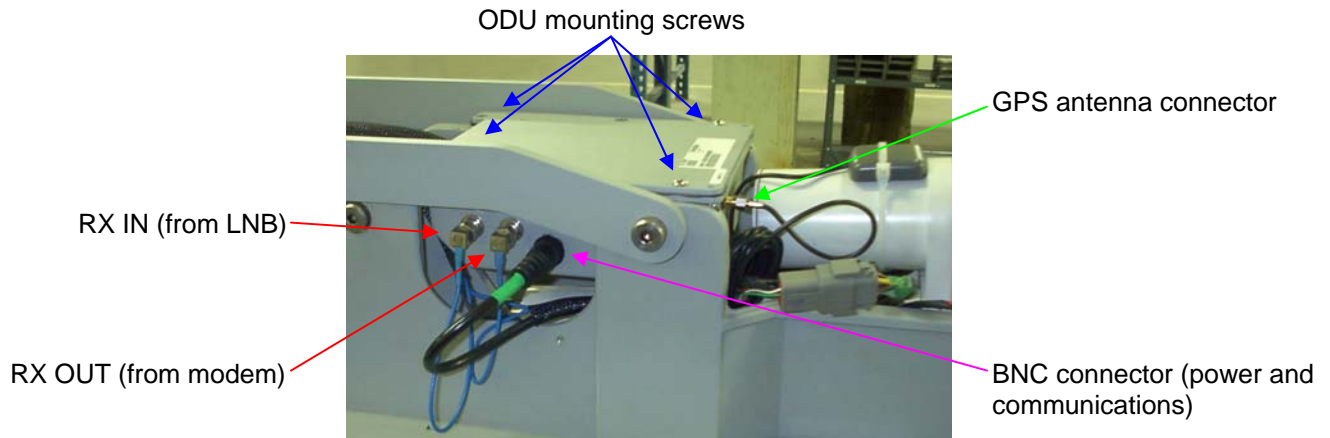
Outdoor Control Unit (ODU)

The Outdoor Control Unit is located under the main cover. It is held in place by 4 hex screws. It is easiest to replace the ODU if the system is in the stowed position.

The following parameters need to be checked and/or calibrated if the ODU is replaced: Azimuth home position, skew home position, elevation home position and the Pitch/Roll sensor.

Make sure the power is turned off to the system.

There are 5 connectors that need to be disconnected. Mark the position of the 2 RF connectors (F connectors) before removing them so they can be reassembled into the same position. Disconnect the 2 F connectors and then remove the BNC cable connector. Remove the GPS antenna connector. Unscrew the 4 ODU mounting screws located in the corners of the ODU. Carefully raise the ODU and remove the 28 pin AMP connector by unscrewing the outer ring. This connector is located on the bottom of the ODU.



28 pin AMP connector



Elevation Actuator

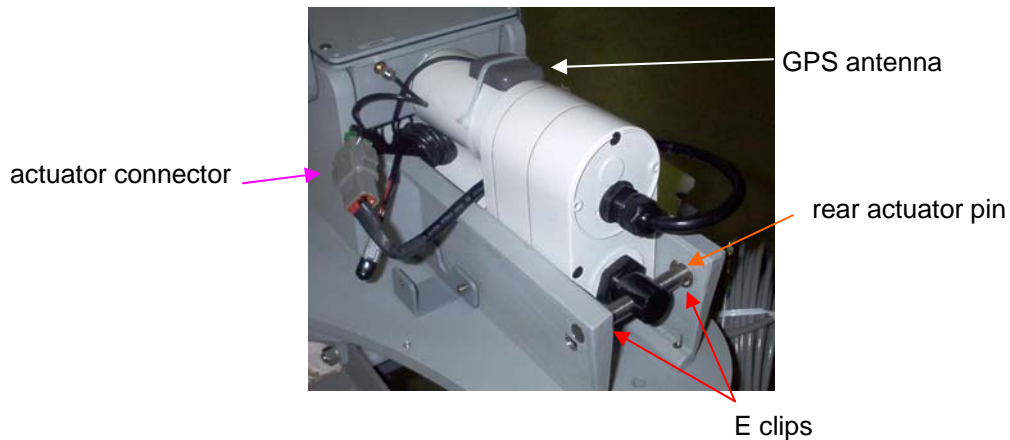
In order to replace the elevation actuator the satellite dish assembly may need to be raised and lowered manually. The dish assembly is very heavy and it is recommended that 2 people are used to complete this procedure.

The elevation actuator is located under the main cover. It is necessary to raise the dish in order to remove the elevation actuator. If it is not possible to raise the dish the ODU will have to be removed first.

Disconnect the actuator power connector. Remove the GPS antenna from the top of the actuator. Raise the dish until the front actuator pin can be removed. The dish should be raised high enough so the lift link can be blocked. With the block in place lower the dish until the actuator stops moving. This will prevent the dish from lowering and help with the installation. Once the lift link is blocked remove the e-clips (or retaining screw) and remove the front actuator pin. Remove the e-clips from the rear actuator pin. Remove the rear actuator pin and carefully slide the actuator out towards the back. Reverse the procedure for installation. The system must be calibrated (homed) before returning to normal operation.



front actuator pin



Motor Controls

There are several motor processes that can be completed using the debug interface.

Motor Movement Using The Debug Menus

It is sometime necessary to move the system during troubleshooting. The proper precautions must be taken when moving the system through the debug interface.

Caution: There are several safety features which are disabled during some commands such as the motor stall timer and azimuth-skew lock out. Make sure the system can move in all axis and unintended movements will not damage the antenna or surrounding structures. Make sure the antenna is raised to a safe elevation before moving the azimuth or skew motors. The MOTOR commands require a minimum elevation before the other axis can be rotated. This is not the case for velocity commands (DC). Stay clear of the system during all system movements. Typing "s" and pressing enter at any time from the debug menus MOTOR>, DC>, and HOME> will stop all motors.

There are 3 major types of motor commands.

Angular Movement

The first type of movement is an angular movement command that is done from the "MOTOR>" menu. Movements are given using angular commands. Below is a screen shot from the debug menu. The motor command was issued from the "TRK" prompt and the "a" command (angle) displays the current motor angles.

Important Note: Typing "s" and pressing enter at any time stops all motors.

```
MOTOR>s  
AZ stopped.  
EL stopped.  
SK stopped.  
MOTOR>
```

```
TRK>motor
```

```
MOTOR>a  
AZ = 355.93° wrap = -4.07°  
EL = 29.52°  
SK = 325.64°  
MOTOR>
```

Each motor is identified by a number. The azimuth is motor 0, the elevation is motor 1, and the skew is motor 2. The format for a motor movement command is "a [motor#] [angle]."

Use the command "a 1 35" to raise the actuator to 35 degrees.

```
MOTOR>a 1 35  
Angle = 30.00°  
MOTOR>a  
AZ = 359.97° wrap = -0.03°  
EL = 34.91°  
SK = 0.04°  
MOTOR>
```

Use the command "a 0 315" to rotate the azimuth counter clockwise from zero 45 degrees.

```
MOTOR>a 0 315  
Angle = 315.00°  
MOTOR>a  
AZ = 314.96° wrap = -45.04°  
EL = 29.91°  
SK = 0.04°  
MOTOR>
```

Use the command "a 0 45" to rotate the azimuth clockwise from zero 45 degrees.

```
MOTOR>a 0 45  
Angle = 45.00°  
MOTOR>a  
AZ = 44.99° wrap = 44.99°  
EL = 29.91°  
SK = 0.04°  
MOTOR>
```

The skew motor operates in the same manor.

Positional Movement

The second type of movement command is called positional movement. The position is based on the number of individual steps per revolution (motor pulse counts). This position is reset when the system performs a motor calibration (homing routine) This command is entered from the "DC>" prompt in the debug mode. The format is similar to the motor movement command described above. If a "p" is entered the system will respond with the current motor position.

```
DC>p  
AZ = 15193  
EL = 2636  
SK = 8949  
DC>
```

Each motor is identified by a number. The azimuth is motor 0, the elevation is motor 1, and the skew is motor 2. The format for a positional movement command is “p [motor#] [position].

The number of possible positions (steps per revolution) is different for each axis. It also differs for each type of mount. The azimuth is the same for all systems and the number of steps per revolution is 17363. In this case 17363 is the same as 0.

Important Note: Typing “s” and pressing enter at any time stops all motors.

```
DC>s  
AZ stopped.  
EL stopped.  
SK stopped.  
DC>
```

Caution: The system will move in azimuth and skew regardless of what the elevation is. Make sure the system is at a safe elevation before attempting to move the azimuth or skew motors. Stay clear of the entire system during movement commands.

Caution: The elevation will raise and lower its full range regardless of the azimuth and skew position. This means it is possible to lower the antenna on either side of the LNB landing ramp possibly causing damage to the antenna mount or surrounding equipment.

Use the command “p 0 100” to move the azimuth motor to position 100.

```
DC>p 0 100  
DC>p  
AZ = 98  
EL = 2636  
SK = 8949  
DC>
```

These commands are very useful to test individual motors. They can also be used to test motors that are connected to the system but are not installed for troubleshooting verification.

Velocity Movements

Each motor is identified by a number. The azimuth is motor 0, the elevation is motor 1, and the skew is motor 2. The format for a velocity movement command is “v [motor#] [velocity]. The velocity is any number between -255 and 255. Negative numbers move the motors in on direction and positive numbers move the motor in the opposite direction.

Important Note: Typing “s” and pressing enter at any time stops all motors.

```
DC>s  
AZ stopped.  
EL stopped.  
SK stopped.  
DC>
```

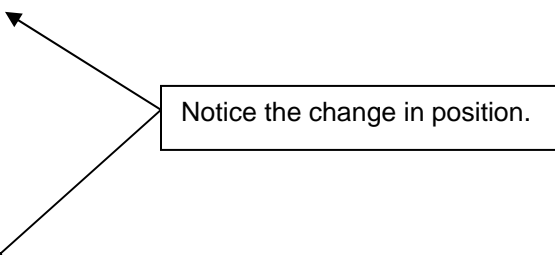
Caution: The system will move in azimuth and skew regardless of what the elevation is. Make sure the system is at a safe elevation before attempting to move the azimuth or skew motors. Stay clear of the entire system during movement commands.

Caution: The elevation will raise and lower its full range regardless of the azimuth and skew position. This means it is possible to lower the antenna on either side of the LNB landing ramp possibly causing damage to the antenna mount or surrounding equipment.

Caution: Once the motor has been given a velocity command it will continue to rotate until it hits a hard stop or the stop "s" command is given.

To start the azimuth rotating counter clockwise use "v 0 200". The system will continue rotating until the "s" (stop) command is given.

```
DC>p
AZ = 17362
EL = 2636
SK = 8949
DC>v 0 200
DC>s
AZ stopped.
EL stopped.
SK stopped.
DC>p
AZ = 840
EL = 2636
SK = 8949
DC>
```



Notice the change in position.

Motor Calibration

The system can be homed from the debug menu. Type "home" from any capitalized debug prompt and press enter. This should display the "HOME>" prompt.

The system (or individual axis) will need to be homed if an "invalid position" indicator shows up in either the angle or position commands.

```
DC>home
HOME>
```

The system can go through a full, 3-axis calibration by typing "h" and pressing enter. The elevation will raise (or lower) to a predetermined elevation. The skew will then rotate all of the way in one direction until it encounters a hard stop and then return to zero degrees. The azimuth will rotate clockwise until it encounters the magnetic position sensor or hits the hard stop. If it hits the hard stop it will rotate counter clockwise until it senses the magnetic sensor. The azimuth will then return to zero degrees. The elevation actuator will then lower the dish until it hits the hard stop. The elevation actuator may clutch several times. This is normal and does not cause any damage.

Each axis can be calibrated (homed) individually. In order to calibrate the skew and azimuth motors the system must be at or above a minimum elevation angle (10 degrees). In order to home the elevation motor the azimuth and skew must be at zero degrees.

Each motor is identified by a number. The azimuth is motor 0, the elevation is motor 1, and the skew is motor 2. The format for a specific motor calibration command is "h [motor#]."

The following command homes the azimuth. Wait for the system to complete moving before attempting to issue another command.

```
HOME>h 0  
HOME>
```

Important Note: Typing “s” and pressing enter at any time stops all motors. The calibration may not be complete.

Communications

Communications between the IDU and ODU are established using Bluetooth Protocol over the 48 volt DC power cable.

Bluetooth (BT) Commands

If the IDU and ODU will not communicate it is possible that the Bluetooth protocol has not been properly established.

The Bluetooth initialization is completed from the lower case debug prompt. Type “bt” and press return from any lower case debug prompt.

Two commands are necessary in order to set up the BT command structure these are the inquiry command “inq” and initialization command “i”. The initialization command must be given after a BT connection has been established.

The following is the correct process for establishing a BT connection.

```
bt>inq  
Releasing Link ... Success  
Inquiry (5 Seconds) ... 0 Devices Found  
bt>inq  
Inquiry (5 Seconds) ... 1 Devices Found  
* 0800172C0D32 WCS (000000) 3111  
* Remote Name 0800172C0D32 ... WCS Tracker  
* Saving Remote Addr 0800172C0D32 ... Success  
bt>i  
* Release Link: BT No Connection  
* Req Establish: Success  
* Link Indicator  
* Success  
bt>
```

Note: The “inq” command was given twice because it failed to establish the proper connection the first time. Having to do this 2 or 3 times is not unusual.

Null Modem

A null modem cable can be connected between the IDU and a computers serial port. The IDU can then be controlled in debug mode using a terminal emulator program. The baud rate should be set to 56000, and the rest of the settings are 8 data bits, No parity, 1 stop bit and no flow control.

There is additional debug information that can be captured using this method.

Enter debug mode as described earlier after the derail cable is connected. Commands are entered exactly as described in other parts of this document. This replaces the need for a USB keyboard.

On-Screen Keypad (Windows CE)

The touch screen keypad can be activated and used instead of a USB keyboard.

In order to activate the onscreen keypad the system must be running Windows CE.

1. Turn the system on by pressing the button on the IDU.
 - a. A progress bar will scroll across the bottom of the screen.
 - b. The screen will flash white and then change color.
2. Start tapping the screen when the screen flashes white and continue tapping the screen when it changes color.
3. The Windows operating screen should be displayed.
4. In the lower right hand of the IDU screen is the keypad icon.
 - a. Touching this icon brings up the keypad.
 - b. Leave the keypad on the screen during the following commands.
5. Open the My Device folder (double tap).
6. Open the OnBoard Flash folder (double tap).
7. Run the AUTOEXEC program (double tap).

The onboard keypad should now be displayed in front of the antenna program.

The debug mode can be entered as described earlier and the touch keypad can be used instead of a USB keyboard.

Performance Adjustments

Search Window

The default search window can be modified. This information is stored in the configuration file (config.html).

If the configuration file is deleted or reset all satellite settings will default to their original values.

1. Enter the debug menus as described previously.
2. From the "trk>" prompt type "cfg" and press enter.
3. From the "cfg>" prompt type "search" and press enter.
 - a. trk>cfg
 - b. cfg>search
 - c. Search 50 x 8, spaced 0.75, speed 1.5, vspeed 0
4. The search window settings will be displayed.
 - a. The settings above searches +/- 25 degrees in azimuth and +/- 4 degrees in elevation from the target look angle.
 - b. The vertical spacing is 0.75 degrees.
 - c. It is not recommended that the speed is increased.
 - d. The vspeed setting is not used at this time.
5. In order to change the window to 60 X 12, with elevation spaced at 1 degree and a speed of 1 enter "search 60 12 1 1" (an entry for vspeed is not necessary) and press enter.
 - a. cfg>search 60 12 1 1
 - b. Search 60 x 12, spaced 1, speed 1, vspeed 0
6. The IDU will confirm the settings.
7. At the "cfg>" prompt type "save" and press enter.
 - a. This saves the setting in the config.html file.

8. The system must be power cycled in order to use the new search window.

Compass Calibration and Verification

The compass can be calibrated from the debug menus.

1. Enter the debug menus as described above.
2. At the "trk>" prompt type "ctrl - t" and press enter.
3. From the "TRK>" prompt type "compass" and press enter.
4. From the "COMP>" prompt type "calib" and press enter.
 - a. TRK>compass
 - b. COMP>calib
 - c. Calibrate Compass: X,Y axis
 - d.
 - e. Rotate compass in X-Y plane, press key when finished
 - f. Vx (1753, 1974) Vy (1651, 1853)
 - g. Calibration offsets: Vx=-21, Vy=-111, Vz=0
 - h. COMP>
5. The values in parenthesis on line 4f should be about 200 steps apart.
 - a. 1974-1753=221 and 1853-1651=202
 - b. 180 to 250 is acceptable.
6. From the "COMP>" prompt type "h" and press return.
 - a. COMP>h
 - b. heading: 212.58°
7. The current compass heading will start scrolling on the screen. Press any key to stop the scrolling.

Backing Up Current Software

The first step in troubleshooting systems that appear to move properly but are having trouble finding the correct satellite or communicating with the modem is to delete the config file. The easiest way to do this is to reset the config in the advanced user section (wrench) on the IDU. It can also be deleted from the Onboard Flash folder in the Windows CE system.

It is advisable to make a copy of the current software before making changes to any of the files. The software application can be copied to another folder or saved to a USB memory device.

1. Power the system on by pressing the green power button. The splash screen will be displayed with a progress bar at the bottom. The screen will flash white momentarily. Touch the screen immediately when the logo reappears. This will exit the DT740 application and start running Windows CE.
2. Open the "My Device" folder located on the desktop.
3. Open the "Onboard Flash" folder.
4. If you are using a USB memory device copy all of the files from the "Onboard Flash" file to the external memory device.
5. If you are saving a copy on the IDU press the "File" option from the tool bar and then select "New Folder".
6. Name this folder "backup"
7. Copy all of the files located in "Onboard Flash" into this folder.
8. Open the "backup" file and rename the "autoexec" and "launcher" files (ie: autoexecbak, launcherbak). This will prevent the system from accidentally running the copied files.

Changing the iDirect Default Password

The iDirect password can be changed in the config file.

1. Enter the debug menus as described above.
2. At the “trk>” prompt type “cfg” and press enter.
 - a. This will change the prompt to “cfg>”.
3. Type “modempass <new password>” and press enter. This is case sensitive.
 - a. A message will be returned that states “Password = <new password>”.
4. Type “save” and press enter. This saves the change to the configuration file. The system will now use the new password to access the iDirect modem.
5. Cycle power on the IDU.

Miscellaneous

There are several commands and procedures that may enhance operation and troubleshooting.

1. A mouse can be connected to the USB port of the IDU and used instead of the touch screen.
2. Pressing ctrl-t and ctrl-i switches between the capitalized debug prompts and the lower case debug prompts. The capital prompts come directly from the ODU and the lower case prompts come from the IDU.