




## **Field Service Spares Replacement Procedure - EL & AZ Motor Kit, Non-Encoder, Coastal**

Approval:

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### Revision History

Rev.	ECO	Description of Change	Date
A	9117	Initial release	11-15-2011

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# Field Service Procedure – Replacement EL & AZ Motor Kit, Non-Encoder, Coastal

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## 1. Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the azimuth motor on the Coastal series antennas and the elevation motor on the Coastal 18 antenna.

## 2. Checklist:

- Verify Drive / Motor
- Check the Motor for Dead Spots
- Run the Built-In Test (BIT) Test

## 3. Theory of Operation:

The azimuth stepper motor on the Coastal series antennas is used to drive the system in 360 degree rotations during the initial search for the satellite, once the satellite has been located and identified changes in the vessels heading will be sensed by the azimuth rate sensor in the PCU and in turn drive will be issued to the azimuth motor to maintain the look angle to the satellite. Once the tracking function of the antenna is enabled azimuth drive will also be issued to optimize the receive signal level, based on feedback from each dishscan revolution.

The same motor is also used on the elevation axis of the Coastal 18 (larger Coastal antennas use a different motor with an integrated encoder). During the initialization process the system drives down in elevation until the reflector comes into contact with the end stop, the system then recognizes this position as 0 degrees and from then on the PCU issues drive based on how many steps are required from the motor (12 steps per degree) to adjust the look angle of the system the required amount.

After initialization the system will target the elevation look angle for the desired satellite based on the vessels GPS location. Once the satellite has been acquired elevation drive will be issued to counteract the vessels movement and maintain stabilization based on feedback from the rate and tilt sensors in the PCU. Once the tracking function of the antenna is enabled elevation drive will also be issued to optimize the receive signal level, based on feedback from each dishscan revolution.

## 4. Verify the Drive of the Azimuth or Elevation Axis:

Drive from the elevation motor should be consistent, rolling the system will cause the PCU to issue drive (this can be done by removing the radome top, unbolting the system from its mounting point and rolling the dome base from front to back). Observe the motor and verify if it's functioning correctly. If the motor skips instead of driving smoothly it's possible a winding has failed or if no drive is present its possible there is a short in the motor. The same can be done for the azimuth axis by rotating the radome base around the antenna and verifying the function of the azimuth motor.

If it is suspected there is a dead spot in the motor power down the system and gently rotate the axis by moving the belt backwards and forwards. This in turn will rotate the motor pulley and shaft and it should be apparent if there is a dead spot as the rotation will feel taught at that position.



**\*Caution:** Be extremely careful rotating the pedestal around while your fingers are in this area to prevent pinching or crushing your fingers in the pedestal assembly.

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## **5. Run the Built-In Test (BIT):**

Coastal PCU software 2.06 and above supports a built in test function used to isolate problems with components in the antenna system. To run the BIT test power off the antenna by pressing the Power button on the control panel, now press and hold the Next button, and then press the Power button. As opposed to initializing the control panel will now display "Built In Test Next to Begin".

Pressing the Next button will run automatically until completed, if no faults are found with the system "BIT Finished No Errors" will be displayed or unless a an error is discovered the test will pause while the specific error is highlighted, this should be recorded for further diagnostics. Pressing next will continue to run the test. Any errors recorded require further diagnostics as per the below information.

### **5.1. Analogue to Digital Convertor Test.**

This test checks for basic communication with the Analogue-to-Digital Converter on the PCU main board. A bad A/D could make all other tests fail.

"Testing ADC" will be displayed as the test runs. An Error code 1.01-1.08 will be displayed if one of these tests fails. If any test fails, replace the PCU and re-run BIT tests.

### **5.2. Digital to Analogue Convertor Test.**

This test checks the basic integrity of the Digital-to-Analogue Converter on the PCU main board by looping back one of its outputs to the D/A.

"Testing DAC" will be displayed as the test runs. An Error code 2.01-2.21 will be displayed if one of these tests fails. If any test fails, replace the PCU and re-run BIT tests.

### **5.3. Azimuth Motor Drive Test.**

This test checks the ability of the motor driver to drive current through the azimuth motor. The current to the motor is controlled by a PWM circuit. The PWM current is repeatedly sampled and statistically analyzed during this test.

"Testing AZ MTR" will be displayed as the test runs. An Error code 3.01-3.17 will be displayed if one of these tests fails.

A failure indicates a defective motor, motor driver PCB or harness. Temporarily connect a spare motor to the PCU in place of the failed motor (or swap the azimuth motor with the pol motor connection at the PCU) to isolate the failure to the PCU or motor. Then re-run the same test.

If the test passes, replace the failed motor (if you swapped the azimuth and pol motor connections and the pol motor test did not fail) and rerun the BIT tests.

If the test fails, replace the PCU and re-run the BIT tests.

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### **5.4. Elevation Motor Drive Test.**

This test checks the ability of the motor driver to drive current through the Elevation motor. The current to the motor is controlled by a PWM circuit. The PWM current is repeatedly sampled and statistically analyzed during this test.

“Testing EL MTR” will be displayed as the test runs. An Error code 4.01-4.17 will be displayed if one of these tests fails.

A failure indicates a failed motor, motor driver PCB or harness. Temporarily connect a spare motor to the PCU in place of the failed motor (or swap the elevation motor with the azimuth motor connection at the PCU) to isolate the failure to the PCU or motor. Then re-run the same test.

If the test passes, replace the failed motor (if you swapped the elevation and azimuth motor connections and the azimuth motor test did not fail) and rerun the BIT tests.

If the test fails, replace the PCU and re-run the BIT tests.

### **5.5. POL Motor Driver Test.**

This test checks the ability of the motor driver to drive current through the pol motor. The current to the motor is controlled by a PWM circuit. The PWM current is repeatedly sampled and statistically analyzed during this test. “Testing POL MTR” will be displayed as the test runs. An Error code 5.01-5.17 will be displayed if one of these tests fails.

A failure indicates a failed motor, motor driver PCB or harness. Temporarily connect a spare motor to the PCU in place of the failed motor (or swap the POL motor with the AZ motor connection at the PCU) to isolate the failure to the PCU or motor. Then re-run the same test.

If the test passes, replace the failed motor (if you swapped motors the other motor test will not fail) and rerun the BIT tests.

If the test fails, replace the PCU and re-run the BIT tests.

### **5.6. Sensor Test.**

This test checks for null sensor offsets for a level, motionless system. The checks have fairly wide pass/fail criteria, but can still fail if pedestal is in motion or out of level more than a few degrees.

“Test Sensor Bias” will be displayed as the test runs. An Error code 6.01-6.05 will be displayed if one of these tests fails. If any test fails, replace the PCU and re-run BIT tests.

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### **5.7. Azimuth Move / Rate Sensor Test.**

This test command moves the dish at various speeds in azimuth and checks the results using the azimuth rate sensor. "Test AZ Sensor" will be displayed as the test runs. An Error code 7.01-7.05 will be displayed if one of these tests fails. An error indicates a motor drive rate or sensor failure. This could be due to:

1. Mechanical binding of the pedestal or the azimuth bearing - With the power off, visually inspect the antenna and radome (inside of base and top) for drag against the radome or binding/fouling of pedestal in the antenna cables or against the cable connector bracket. Rotate the antenna in azimuth by hand to feel for any binding in the azimuth axis. Re-route cables and/or bend connector bracket to remove fouling with the pedestal. If the pedestal is dragging inside the radome itself or if the azimuth bearing has failed, the radome and/or pedestal will have to be replaced. If this check found a problem and you have corrected it, re-run the BIT tests.
2. Azimuth belt dragging, or slipping - Inspect the azimuth drive belt for chaffing or wear (leaves black dust). Inspect the azimuth drive belt for proper tension (belt should be taught when pinched in on both sides of the azimuth motor drive sprocket, it should not flex more than 1/16th inch on both sides when pinched). Re-align and tension the motor for correct belt path and tension. If this check found a problem and you have corrected it, re-run the BIT tests.
3. Azimuth motor failure - Replace the azimuth motor and re-run the BIT tests.
4. Azimuth drive or azimuth rate sensor failure - Replace the PCU and re-run the BIT tests.

### **5.8. Pol Pot / Motor Move Test.**

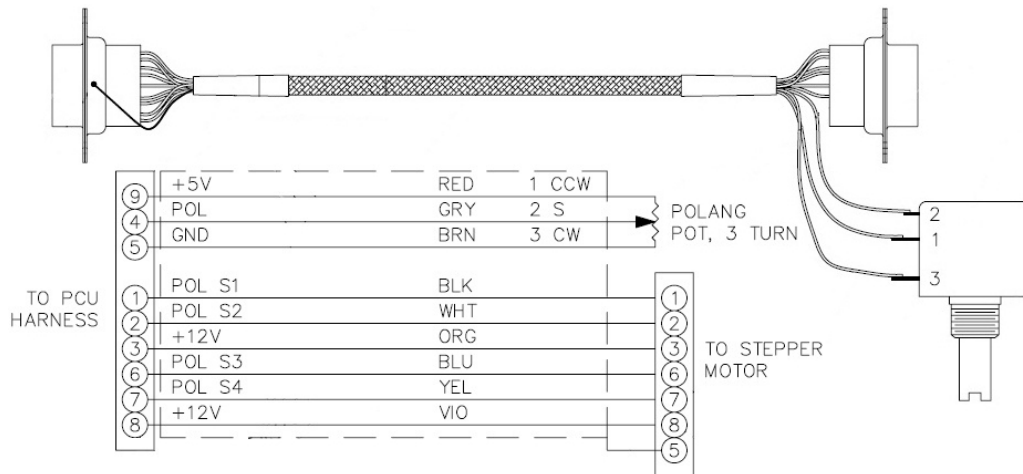
This test moves the feed assembly at various speeds in Polarization and checks the results using the POL potentiometer. "Test POL Assy" will be displayed as the test runs. An Error code 8.01-8.07 will be displayed if one of these tests fails. A failure indicates a failed motor, belt or potentiometer. This could be due to:

1. Mechanical binding of the polarization assembly - With the antenna powered down, visually inspect the polarization assembly (including LNB and cables) for drag against the pedestal or dish. Rotate the polarization assembly by hand to feel for any binding in rotation. Re-route cables to remove fouling with the pedestal. If binding is felt, remove motor belt and re-check binding. If the polarization assembly is still binding (indicating bearing failure) it must be replaced. If this check found a problem, and you have corrected it, re-run the BIT tests.

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2. Pol drive belt or pol pot drive belt dragging or slipping - Inspect drive belts for chaffing or wear (leaves black dust). Inspect the drive belts proper tension (belts should be semi-taut when pinched in on both sides of the motor drive sprocket or pot drive sprocket. The belts should not flex more than 1/16th inch on both sides when pinched). Re-align and tension the motor and pot for correct belt path and tension. If this check found a problem, and you have corrected it, re-run the BIT tests.
3. Rotate the polarization assembly to center of its mechanical range (LNB vertical) and observe while BIT test runs. If the pol motor does not drive during the test, replace the pol motor and re-run the BIT tests. If the polang potentiometer (pol pot) is mounted out of position or has failed, rotate the polarization assembly to the center of its mechanical range. Loosen pot mounting bracket to de-couple the belt and rotate the pot sprocket. If the sprocket is loose on the shaft of the pot, tighten the set screws. If the pot does not rotate, replace it.

Check continuity of the pot from the wiper and both the clockwise and counter-clockwise contacts. Clockwise to counter-clockwise ends and vice versa, a steady resistance from 0 – 5 or 5 – 0 ohms should be measured (depending on the direction of rotation) from wiper to clockwise, or counter-clockwise, to verify proper operation. The pot is a three turn potentiometer, rotate the sprocket to find one end stop and then rotate it exactly 1 ½ turns away from that stop to the center of rotation. Hold the sprocket in place while re-coupling the belt, tension the belt as you tighten the pot mounting bracket. If this check found a problem, and you have corrected it, re-run the BIT tests.



Check the harness for good continuity from point-to-point and that there are no shorts from wire-to-wire or from wire-to-ground that are not supposed to be there as per the above diagram. Repair any harness problems found and re-run the BIT tests. If there are no problems with any of the steps above, replace the PCU and re-run the BIT tests.

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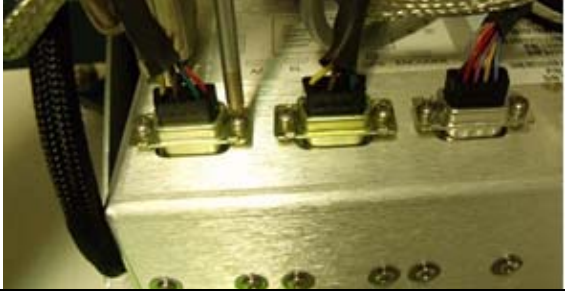
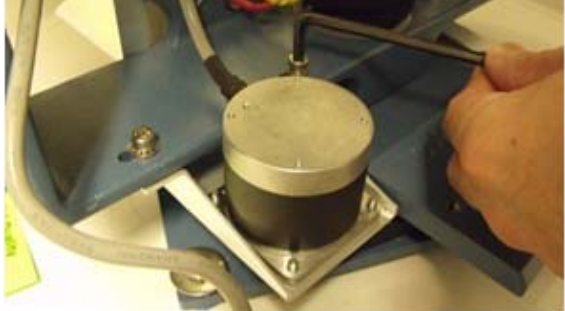
## 6. Replacing the Azimuth Motor:

### 6.1. Tools.





- Snips/Cutters
- #1 Phillips Screwdriver
- 3/16" Allen Wrench
- 1/16" Allen Wrench/Key
- Cable ties/ Tie Wraps
- 222, 242, 638 and 2760

### 6.2. Procedure.

Procedure for replacing the Azimuth motor on the Coastal series antennas, Sea Tel kit part number: 125224-1 (motor part number: 116778).





<p><b>*Caution:</b> Power down the pedestal before following this procedure.</p> <p>1. Snip the cable ties securing the azimuth motor harness.</p>	
<p>3. Using a #1 Phillips screwdriver remove the two screws and washers securing the azimuth motor harness connector to the PCU. Save the hardware for future use.</p>	
<p>4. Using a 3/16" Allen wrench remove the two screws securing the azimuth motor bracket to the yoke. Save the hardware for future use.</p>	

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<p>5. Rotate the bracket clockwise to allow clearance and remove the motor and bracket assembly, slipping the motor pulley out of the belt. Ensure to remove the spacers which mount between the bracket and yoke (as shown on the right).</p>	
<p>6. Remove the 4 screws securing the motor to the bracket using a #1 Phillips screwdriver, save the hardware for future use.</p>	
<p>7. Install the replacement pulley onto the motor shaft in the same position as on the defective motor. Apply Loctite 638 to the shaft of the motor and install the set screw with Loctite 222 making sure it's against the flat edge of the motor shaft, tighten with a 1/16" Allen wrench.</p> <p><b>*Note:</b> For further information refer to the Loctite Procedure 121730 provided with this kit.</p>	
<p>8. Apply Loctite 242 to the four screws and install the bracket to the replacement motor assembly with the harness cable exiting towards the mounting points (as shown on the right).</p>	



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<p>9. Apply Loctite 2760 to the two screws and install the azimuth motor assembly. Slot the motor pulley into the belt and rotate it to align the mounting points. Tension the belt by applying pressure to the motor away from the main drive sprocket and tighten the retaining screws. Rotate the pedestal in azimuth verifying the motor pulley does not foul on the base plate.</p> <p><b>*Note:</b> If access is tight the azimuth belt retainer can be removed temporarily to allow additional clearance.</p>	
<p>10. Verify the tension of the belt by pressing on it at the central point between the motor pulley and main drive sprocket. The belt should be tight enough that the access can rotate without the belt skipping on the teeth but not too tight (the tension of the elevation belt can be used for reference).</p> <p>11. If the belt tension is correct tighten the two remaining screws, if not repeat the above step until correct.</p>	
<p>12. Connect the azimuth motor connection to the PCU ensuring the split washers are used (no need to apply Loctite).</p>	
<p>13. Secure the azimuth motor harness and GPS cable to the cable clamp on the PCU using a cable tie.</p> <p>14. Secure the excess azimuth motor harness to the elevation motor harness.</p>	

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## 7. Replacing the Elevation Motor:

### 7.1. Tools.





- Snips/Cutters
- #1 Phillips Screwdriver
- 1/16" Allen Wrench/Key
- Cable Ties/Tie Wraps
- 222, 242 and 638

### 7.2. Procedure.

Procedure for replacing the elevation motor on the Coastal 18 antennas, Sea Tel kit part number: 125224-1 (motor part number: 116778).

<p><b>*Caution:</b> Power down the pedestal before following this procedure.</p> <p>1. Cut the cable ties securing the elevation motor harness using a pair of snips.</p>	
<p>2. Disconnect the elevation motor D-sub connector from the PCU using a #1 Phillips screwdriver. Save the hardware for future use.</p>	
<p>3. Using a #1 Phillips screwdriver remove the 4 screws securing the elevation motor to its bracket. The pulley will have to be rotated to allow access to the upper left screw (as shown on the right). Save the hardware for future use.</p>	

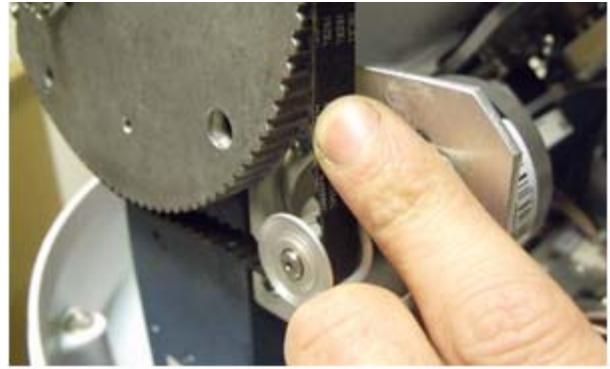
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<p>4. Slip the motor pulley out of the elevation drive belt and remove the motor assembly.</p> <p><b>*Note:</b> The upper right screw is still in the mounting point of the bracket at this point.</p>	
<p>5. Install the replacement pulley onto the motor shaft in the same position as on the defective motor. Apply Loctite 638 to the shaft of the motor and install the set screw with Loctite 222 making sure it's against the flat edge of the motor shaft, tighten with a 1/16" Allen wrench.</p> <p><b>*Note:</b> For further information refer to the Loctite Procedure 121730 provided with this kit.</p>	
<p>6. Apply Loctite 242 to the upper left screw (still on the motor bracket).</p> <p>7. Insert the #1 Phillips screwdriver through the access point in the elevation pulley and locate it into the upper left screw.</p> <p>8. Slip the motor through the elevation drive belt, ensuring the motor harness is pointing downwards and install the upper left screw (do not fully tighten at this time).</p>	
<p>9. Apply Loctite 242 to the remaining 3 screws and loosely install them.</p> <p>10. Tension the belt by applying pressure to the motor and tighten two of the screws.</p>	

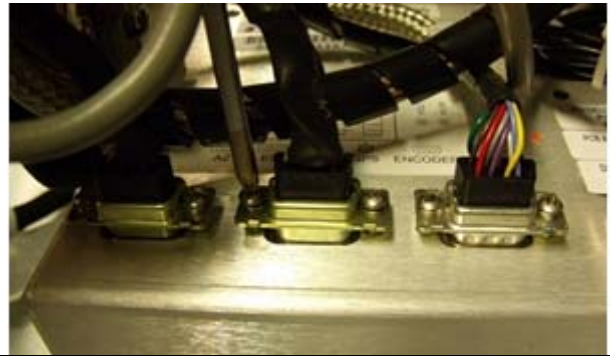
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11. Verify the tension of the belt by pressing on it at the central point between the motor pulley and main drive sprocket. The belt should be tight enough that the access can rotate without the belt skipping on the teeth but not too tight (the tension of the azimuth belt can be used for reference).

12. If the belt tension is correct tighten the two remaining screws, if not repeat the above step until correct.



13. Install the elevation motor D-sub connector to the PCU assembly using the hardware which was removed in step 2 with a #1 Phillips screw driver. Ensure that the split washers are installed under the screws.



14. Secure the elevation motor harness using cable ties.

**\*Note:** Do not restrict the movement to the pol harness when securing the elevation motor harness. Verify the pol range of the feed after securing.

