Field Service Spares Replacement Procedure - EL Motor Kit, W-Encoder, Hi-Torque, Coastal 20, 24 & 30

Approval:

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Revision History

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A	9117	Initial release	11-15-2011

Field Service Procedure – Replacement EL Motor Kit, W-Encoder, Hi-Torque, Coastal 24 & 30

1. Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the hi-torque elevation motor with encoder on the Coastal series antennas.

2. Checklist:

- Initialize the Pedestal
- Verify Drive / Motor
- Verify the Encoder Feedback

3. Theory of Operation:

The Hi-Torque elevation stepper motor on the Coastal 20, 24 and 30 antennas features an integrated encoder for feedback into the PCU of the elevation look angle of the system. During the initialization process the system drives down in elevation until the reflector comes into contact with the end stop, at this point the elevation position is calibrated & the encoder will count elevation increments/decrements accordingly.

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 & maintain stabilization based on feedback from the rate and tilt sensors on the PCU motherboard. 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. Initialize the Pedestal:

Cycle the power to the pedestal by toggling the on/off switch on the front panel of the DACP control unit. During the initialization process the control panel will display "initializing", the elevation motor will drive the reflector down into its end stop at which point the encoder will be calibrated. The next step will be the elevation motor will drive the reflector to 45 degrees. Observe the system and verify the elevation drive is smooth and that the reflector is physically positioned at 45 degrees.

If the drive isn't smooth it's possible that the motor has a fault and the motor will require further diagnostics. Should the elevation axis not point at 45 degrees during the initialization process then it's possible the encoder is defective and further diagnostics are required.

5. Verify the Drive of the 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.

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.

Another indication that the system isn't driving correctly is if the unwrap light is illuminated on the control panel, yet the elevation position isn't changing, this usually indicates that the motor can't drive in elevation, therefore isn't searching correctly and in turn the elevation feedback from the encoder isn't moving (the other option is the encoder is defective).

6. 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.

6.1. 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.

6.2. 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.

6.3. 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.

6.4. 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.

6.5. 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.

6.6. 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.

6.7. Azimuth Move / Rate Sensor Test.

This test command moves the dish at various speeds in azimuth and checks the results using the azimutrh 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.

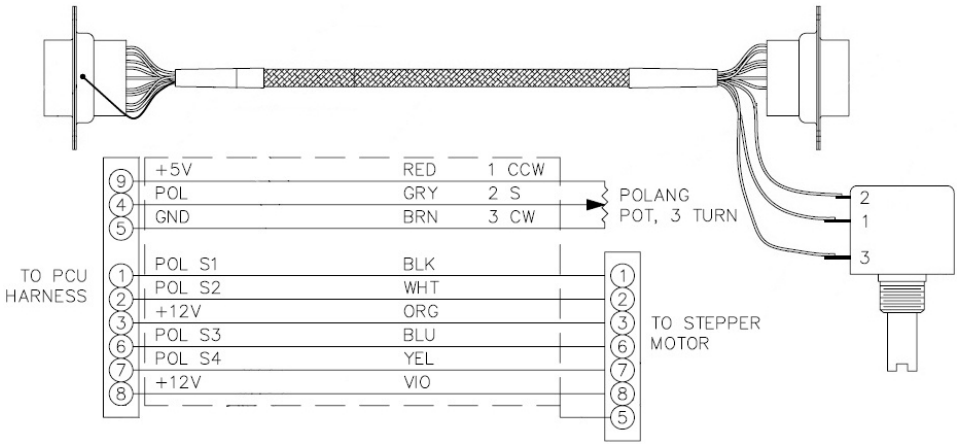
6.8. Pol Pot / Motor Move Test.

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.

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.

7. Verify the Encoder Feedback:

If the system initializes with the display on the control panel reading 45 degrees of elevation, yet the reflector is at a different angle, then it's possible that the elevation end stop is in the incorrect position and is calibrating the encoder position incorrectly. Move the reflector by hand down to the end stop, the display on the control panel should read 0; now verify that the reflector is physically pointing at 0 degrees of elevation. If not adjust the elevation end stop until the reflector initializes at 0 & test the function of the encoder.

If the reflector is physically at 0 degrees of elevation when the system initializes, physically move the reflector by hand to different elevation points and verify that the elevation position on the control panel is correct in relation to the look angle of the reflector. The elevation positing should also increment/decrement smoothly as the axis is rotated without jumping or skipping. Any failure of the above steps means the encoder is defective and the motor assembly will need to be replaced.

Another test which can be performed is to power down the system and disconnect the encoder harness from the PCU. When reinitialized the antenna will count the steps of the stepper motor to gauge the elevation look angle and the elevation position on the control panel will be a calculated valve (as opposed to live encoder feedback). If after disconnecting the encoder the antenna operates correctly the encoder is defective and the motor assembly will need to be replaced.

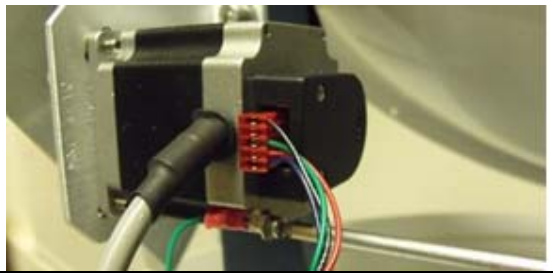
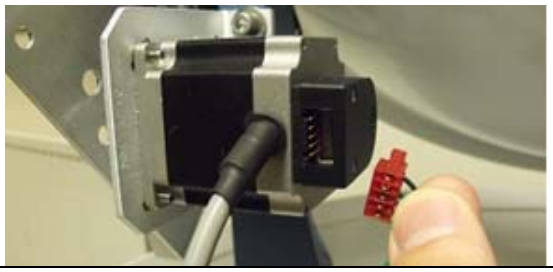
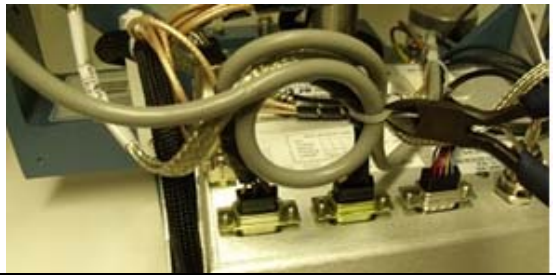
8. Replacing the Elevation Motor:

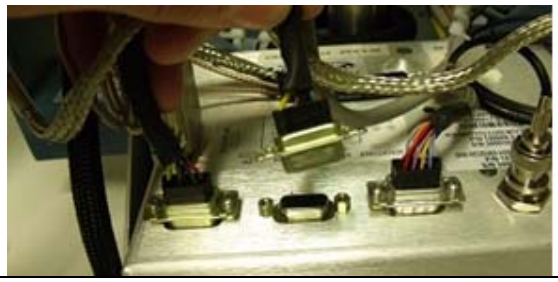
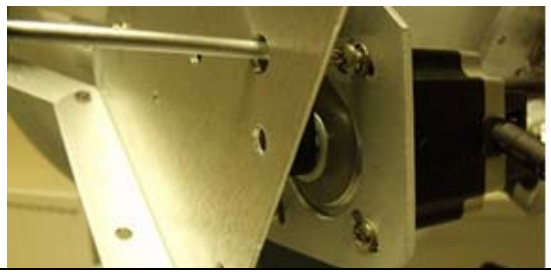
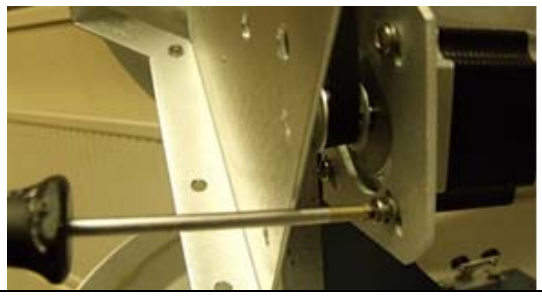
8.1. Tools.

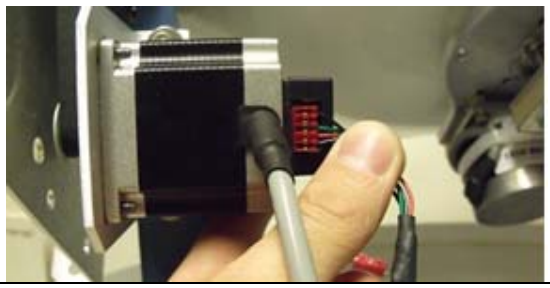
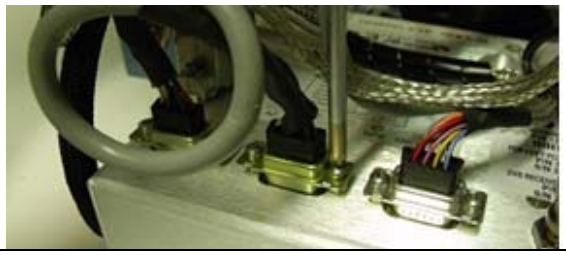
- Snips/Cutters
- #1 Phillips Screwdriver
- 1/16" Allen Wrench/Key
- Cable Ties/Tie Wraps
- Loctite 222, 242 and 638

8.2. Procedure.

Procedure for replacing the elevation motor on the Coastal 20, 24 and 30 antennas, Sea Tel kit part number: 125228-1 (motor part number: 125519).

***Caution:** Power down the pedestal before following this procedure. 1. Using a #1 Phillips screwdriver remove the ground connector from the body of the motor, save the hardware for future use.	
2. Disconnect the IDC connector from the encoder on the elevation motor.	
3. Snip the cable ties securing the elevation motor and encoder harness.	

4. Using a #1 Phillips screw driver remove the two screws securing the elevation motor connector to the PCU. Save the hardware for future use.	
5. Using a #1 Phillips screwdriver remove the 4 screws securing the motor to its bracket. Holes allowing access are in the elevation pan, the system will need to be rotated in elevation to align them.	
6. Install the pulley to the replacement motor 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 using a 1/16" Allen wrench. Ensure the set screw is installed against the flat edge of the motor shaft. Save the hardware for future use. ***Note:** For further information refer to the Loctite Procedure 121730 provided with this kit.	
7. Install the replacement motor assembly with harness exiting away from the antenna using the hardware removed in step 5. Apply Loctite 242 to the four screws but do not fully tighten at this time.	
8. Pressure the motor away from the main drive sprocket and tighten two of the screws. Verify the belt tension and if correct tighten the two remaining screws, if not repeat the previous step until the tension is correct.	

9. Verify the alignment between the two sprockets is correct and the belt runs straight; rotate the system up and down in elevation to verify the system moves freely. Failure of this step is down to improper alignment of the motor pulley.	
10. Reinstall the encoder harness and ground connection to the motor assembly using the hardware removed in step 1.	
11. Reconnect the elevation motor harness to the PCU, ensuring the split washers are installed (no need to Loctite).	
12. Secure the elevation motor harness and encoder harness with cable ties.