Field Service Spares Replacement Procedure - PCU Kit, Coastal

Approval:

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Revision History

Rev.	ECO	Description of Change	Date
A	9145	Initial release	XX-XX-2012

1. Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the PCU assembly on the coastal series antennas.

2. Checklist:

- Initialization
- Rate Sensor Outputs
- Run the Built-In Test (BIT)

3. Theory of Operation:

The Coastal series are two axis antennas (elevation and azimuth) with a motorized polarization assembly to keep the LNB in the correct reception position under dynamic conditions. The PCU assembly houses a motherboard PCB for stabilization and motor drive and a DVB receiver for tracking the RF signal.

The PCU motherboard is responsible for the stabilization of the antenna, housing a fluid filled tilt sensor which acts as the horizon reference for elevation and pol axis and 3 rate sensors for stabilization for the azimuth, elevation pol axis. When motion is detected by the relevant rate sensor the PCU motherboard will issue the drive the move the axis the opposite amount maintain stabilization.

No gyro connection is integrated in the system, when searching the antenna targets in elevation based on the vessels GPS position and desired satellite, the azimuth axis then sweeps and searches for signal above threshold. Once the NID for the desired satellite has been decoded tracking will be enabled.

The DVB receiver in the PCU takes a feed directly from the LNB to receive the satellite signal and will also decode the NID (Network Identity) from the carrier the antenna is tracking, as the output of the receiver is passed to the multi-switch.

4. Initialization:

Verify the initialization of the pedestal:

1. Power cycle the DACP control panel (this provides the 12VDC to power the pedestals PCU).
2. The control panel will then display the following software versions: DACP, antenna model preset in the PCU, PCU software version, DVB software version, antenna serial number and elevation encoder engagement (if applicable).
3. "Initializing" will then be displayed with a flashing "o" until the GPS position have been acquired at which point the "o" will turn into a "*".
4. The elevation axis will drive down onto its end stop, if an encoder is installed it will be calibrated at this point, if not this position will be recognized as zero and the stepper motor will count the increments of elevation drive.
5. The pol motor will drive to its "P90" position at which point the LNB will be vertical (if using a system with a motorized pol assembly).
6. The elevation axis will then drive to 45 degrees.
7. Once the initialization process is complete the antenna will target the last preset satellite.

If any of these steps take excessive time or do not complete properly, further diagnostics will need to be undertaken. If the antenna model isn't displayed after the initialization process, this will need to be preset in the PCU before the antenna can operate. If the antenna does not come out of the initialization process its possible it cannot see the last preset satellite from the current GPS location, if this is the case enter into the setup menu and verify if the settings are correct.

5. Rate Sensor Outputs:

If the antenna isn't stabilizing correctly it could be due to a faulty rate sensor. A typical indication of this is that the antenna will operate correctly in static conditions such as in the port, but will not remain on the satellite under dynamic conditions.

To test the rate sensors remove the radome top and unbolt the radome base from its mounting position. Now physically rotate the system in each axis to verify if the motor drives the opposite amount of movement

1. To test azimuth:

   Rotate the radome base around the system in each direction, simulating the vessels heading incrementing/decrementing. The antenna should remain pointed at the satellite without losing the signal and going into a search.
2. To test elevation:

   Tilt the radome base from front to back, simulating the vessel pitching from bow to aft. The antenna should remain pointed at the satellite without losing the signal and going into a search.
3. To test the pol drive (if applicable):

   Tilt the radome base from side to side, simulating the vessel rolling from starboard to port. The LNB should move an equal amount to the movement exerted on the system and should remain stable without losing the signal and going into a search.

Note: The Coastal 18 feed assembly (LNB) will rotate left when tilted right and right when tilted left. The Coastal 24 and 30 antennas have a phase card installed in the feedhorn which reverses the polarity of the linear signal, as you rotate the antenna to the right, the feed (LNB) will drive to the right and as you rotate the antenna to the left the feed (LNB) will drive to the left.

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 the Built-In Test automatically until completed, if no faults are found with the system "BIT Finished No Errors" will be displayed. Unless 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 rerun 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 rerun 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 rerun 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 rerun 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:

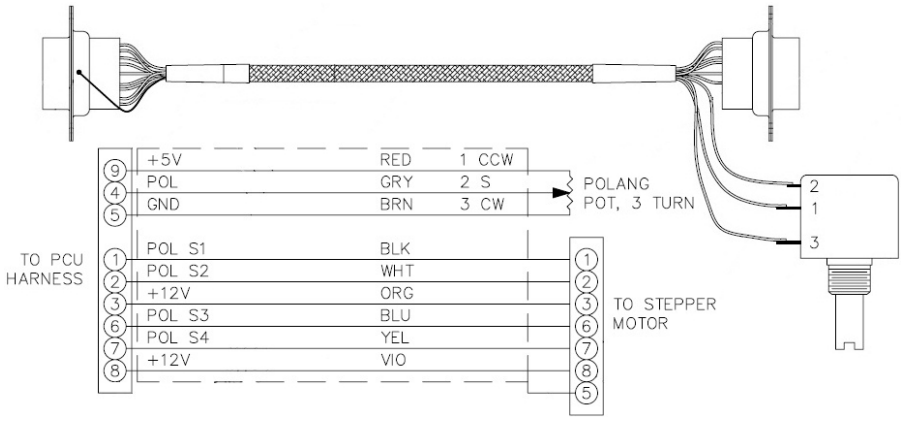
1. Mechanical binding of the pedestal or the azimuth bearing - With the power off, visually inspect the antenna and radome (inside of base and top) for drag against the radome or binding/fouling of pedestal in the antenna cables or against the cable connector bracket. Rotate the antenna in azimuth by 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, rerun 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, rerun the BIT tests.
3. Azimuth motor failure - Replace the azimuth motor and rerun the BIT tests.
4. Azimuth drive or azimuth rate sensor failure - Replace the PCU and rerun 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, rerun 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 rerun the BIT tests. If there are no problems with any of the steps above, replace the PCU and rerun the BIT tests.

7. Procedure for Replacing the PCU Assembly:

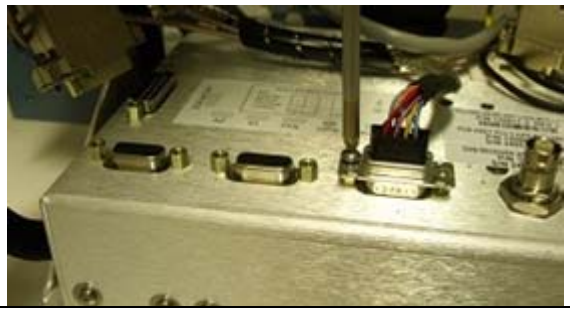
7.1. Tools.

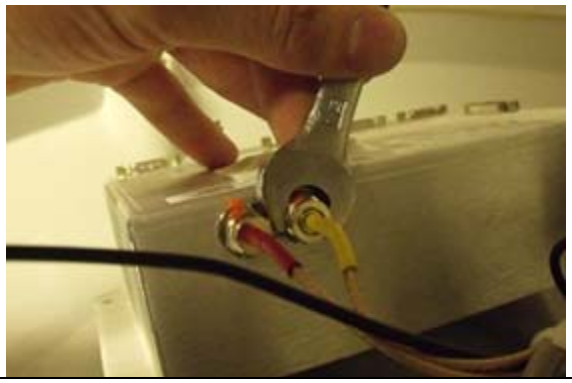
- Snips/Cutters
- 2mm Flat Blade (Terminal) Screwdriver
- #1 Phillips Screwdriver
- 7/16" Wrench/Spanner
- Cable Ties/Tie Wraps
- Loctite 242

7.2. Procedure.

Procedure for replacing the PCU assembly on the Coastal series antennas, Sea Tel Kit part number: 135912 (PCU assembly part number: 125517-3).

***Caution:** Power down the pedestal before following this procedure. 1. Disconnect the BNC connector for the GPS antenna from the PCU.	
2. Snip the cable tie securing the GPS antenna cable, coax cables and azimuth motor cable to the PCU.	
3. Using a 2mm flat blade screw driver undo the two screws securing the encoder harness to the PCU. ***Note:** The Coastal 18 and older model Coastal antennas do not have an encoder on the elevation motor.	

4. Using a 2mm flat blade screwdriver disconnect the interface harness from the PCU.	
5. Now using a #1 Phillips screwdriver remove the six screws securing the AZ, EL and POL motor connections to the PCU. Be careful not to lose the 6 split washers and save the hardware for future use.	
6. Using a #1 Phillips screwdriver remove the for screws securing the PCU to the mounting plate. ***Note:** Do not remove the PCU at this time as the coax cables are still connected.	
7. Raise the PCU from the mounting plate to allow clearance and disconnect the two coax cables from the PCU using a 7/16" wench, noting the orientation of the RF in and RF out cables.	
8. Apply Loctite 242 to the four holes on the PCU mounting plate.	

9. Install the coax cables onto the replacement PCU, the one from the LNB feeds into the RF in port, the RF out port exits with the harness to the bracket in the radome base. ***Note:** Older revisions of the Coastal PCU used a splitter to split the RF between the DVB receiver and below decks. If replacing one of these PCU's with a later revision the coax which runs through the pedestal will need to be connected to the RF out port and another coax will need to be run from the LNB to the RF in port. (Sea Tel part number: 127963-30YEL).	
10. Reinstall the four screws and washers that secure the PCU to its mounting bracket.	
11. Connect the interface harness to the replacement PCU.	
12. Install the 6 screws and washers to secure the AZ, EL and POL motor harnesses to the replacement PCU, no need to apply Loctite as split washers are used.	

13. Install the elevation encoder harness to the PCU. ***Note:** If replacing the PCU on a coastal 18 or older model with no encoder this connection will be left empty.	
14. Secure the coax cables, azimuth motor harness and GPS antenna cable to the tie holder installed on top of the PCU using a cable tie. 15. Reconnect the GPS antennas BNC connector to the PCU.	

8. System Configuration:

Once the replacement PCU has been installed it will need to be configured to the work with the antenna it's installed on. Press and hold the save and down arrow button to enter into the setup menu. Press the down arrow to scroll through the presets to the "factory settings" option and press the enter button. Scroll through to the "Model" option and press the enter button. Now use the up and down arrow keys to select the model of antenna and press the enter button. Hold the save button to store this setting in the PCU.

9. Tilt Bias:

Once the PCU has been replaced its level reference (tilt bias) will need to be calibrated to align the sensors with the relevant axis. Level of the antenna by using a level bubble or similar on the PCU so that it's true to horizon. Once the PCU is level open Sea Tels Progterm software and select "Coastal PCU Direct" from the CommPort settings, once communications have been established type "5" on the keyboard to calibrate the tilt sensor and then enter "shift+w" (W) to save the settings. This will calibrate the antennas horizon reference.