

***Procedure, Field Replacement, PCU Kit, XX04***

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**Revision History**

Rev.	ECO	Description of Change	Date
A	8791	Initial release	08-05-2011
B	9041	Clerical revisions	10-03-2011

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# ***Procedure, Field Replacement, PCU Kit, XX04***

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## **1. Brief Summary:**

Troubleshooting document for diagnosing a fault with and replacing the XX04 series PCU assembly.

## **2. Checklist:**

- Verify Initialization
- No Parameter
- Pedestal Error
- Test Motor

## **3. Theory of Operation:**

The PCU motherboard calculates the amount of movement from the vessel based on feedback from the sensors in the level cage and directional changes from the vessels gyro compass which are then fed into the antennas control loop. The PCU motherboard then sends a command to the motor driver PCB to drive the motor of the relevant axis an equal and opposite amount of movement of the vessel to maintain stabilization and control the antennas dishscan pattern.

All tracking, targeting, pointing and polarization commands are sent from the DAC to the PCU, based on the vessels GPS location, targeting calculations or operator inputs. The PCU in turn then sends a command to drive the relevant axis. The PCU software configures the function of the pedestal and is calibrated by the No parameter, which sets the motor gains for each axis and the dishscan pattern based on the size of the antenna.

Should the PCU flag a pedestal error (error 8) further diagnostics will need to be completed to identify which axis the error is located in, and also the component(s) which are potentially faulty. This document will run through decoding the pedestal error then further troubleshooting the relevant axis to diagnose which component(s) may be defective.

## **4. Verify Initialization:**

- Power cycle the pedestal
  1. Level cage drives to its end stop, then turns to 45 degrees.
  2. Elevation axis drives to 45 degrees based on the level cages horizon reference (from previous step).
  3. Cross level axis drives to level based on the level cages horizon reference.
  4. Limited azimuth axis drives clockwise into the end stop, then back to 630 degrees of relative.

If the ACU reports model "xx04", the PCU's No parameter needs calibrating. Refer to the "calibrating the PCU System Parameter (No)" section of this document. Failure of any of the initialization steps or a pedestal error requires further troubleshooting.

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### 5. Pedestal Error (Error 8):

#### 5.1. Decoding a Pedestal Error.

When the DAC displays a pedestal error, enter the remote command window and input "Soooo" then press enter twice. The error code will now be displayed in the Remote Monitor screen. Decode the 4<sup>th</sup> character of the error code from the below table...

@	None	K	Ref + LV + CL	V	Stab Limit + AZ + LV
A	CL	L	Ref + AZ	W	Stab Limit + AZ + LV + CL
B	LV	M	Ref + AZ + CL	X	Stab Limit + Ref
C	CL + LV	N	Ref + AZ + LV	Y	Stab Limit + Ref + CL
D	AZ	O	Ref + AZ + LV + CL	Z	Stab Limit + Ref + LV
E	AZ + CL	P	Stab Limit	[	Stab Limit + Ref + LV + CL
F	AZ + LV	Q	Stab Limit + CL	\	Stab Limit + Ref + AZ
G	AZ + LV + CL	R	Stab Limit + LV	]	Stab Limit + Ref + AZ + CL
H	Ref	S	Stab Limit + CL + LV	^	Stab Limit + Ref + AZ + LV
I	Ref + CL	T	Stab Limit + AZ	_	Stab Limit + Ref + AZ + LV + CL
J	Ref + LV	U	Stab Limit + AZ + CL		

#### 5.2. Error Types.

The 3 types of pedestal error are:

1. **Servo Limit (CL, LV and AZ)** – A servo limit error means the PCU motherboard is issuing the command to the motor driver PCB/servo amp to drive the relevant axis harder than it should under normal operation (the servo limit has been reached). This could be whilst the antenna is trying to maintain its pointing angle or whilst the antenna is driving the axis to a target position.
2. **Stability Limit** – A stability limit error means the antenna has mispointed from its desired target position by more than half a degree. When a stability limit error is flagged on a VSAT antenna, the DAC will send the TX Mute command to inhibit the transmit function of the satellite modem (It is common to see the servo limit and stability limit errors together).
3. **AZ Reference Error** – An azimuth reference error means there is a corrupt reading in the relative scale. This could be caused by the encoder failing, the system hitting its end stop under normal operation, or a physical problem such as the belt slipping on the motor pulley or the pulley slipping on the motor shaft.

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### **5.3. Troubleshooting Pedestal Errors – Servo Limit and Stability Limit.**

1. Reinitialize the pedestal; does it drive correctly or not at all? If none of the axis drive, verify the No and motor gain parameters (N<sub>1</sub> = CL, N<sub>2</sub> = EL and N<sub>3</sub> = AZ) are correctly configured in the PCU through the Remote Command window of the DAC or this might be steps in a procedure that does not require a table.
2. Verify the balance of the antenna and check for physical restrictions on the pedestal. If the axis isn't correctly balanced, the PCU will be outputting additional drive commands to maintain the antennas level position.
3. Is the motor driving correctly or is no motor drive present, test the motor for faults using the below procedure. If the motor is defective replace it and then retest the function of the antenna. If the axis still fails to drive correctly, the defective motor may have damaged the motor driver PCB. Replace the PCU assembly.
4. Another potential problem could be a damaged or intermittent harness connection. Remove the harness back shells and verify all the pins are seated correctly, check continuity from pin to pin and also across the pins to verify there is no short in the connections.

### **5.4. Troubleshooting Pedestal Errors – Azimuth Reference Error.**

1. Reinitialize the system and verify that the antenna drives clockwise to its end stop. Drive the azimuth axis in 90 degree increments and verify that the antenna points correctly, and that the DAC displays the correct relative position. Also verify that there is no physical restriction on the azimuth axis such as the belt slipping on the motor pulley or the pulley slipping on the motor shaft.

### **5.5. Test the Motor.**

1. Check continuity between ground (the motor connector back shell) and the 3 driver outputs on pins 1, 2 and 3 of the harness.
2. Now check continuity between pins 4, 5, 6, 7 and 8, and the ground (the motor connector back shell).
3. Check between the individual pins 1, 2 and 3, and the rest of the pins (i.e. test pin 1 to pin 4, 5, 6, 7 and 8 and so on, not between pins 1 and 2, 1 and 3 or 2 and 3).
4. If there is any continuity measured on the steps mentioned above, the motor is defective. If the motor has drawn excessive current then there is a possibility the motor driver PCB (and potentially the PCU motherboard) has been damaged. The antennas operation should be verified with a replacement motor. If after replacing the motor the antenna is still not operational, replace the PCU assembly as per the following procedure.

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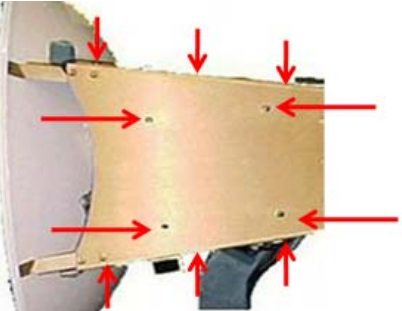
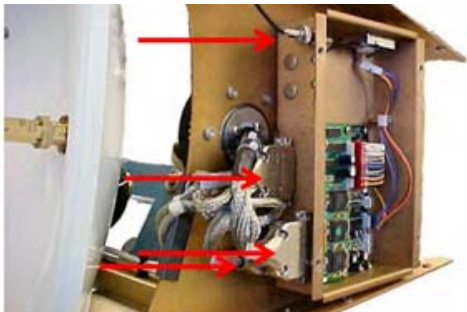
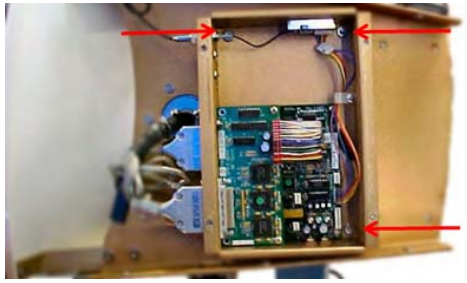
### 6. Replacing the XXo4 Series PCU Assembly:

#### 6.1. Tools.

- #2 Phillips Screwdriver
- 2mm Flat Blade (Terminal) Screwdriver
- 3/8" Socket/Ratchet
- Loctite 242

#### 6.2. Procedure.

Procedure for replacing the XXo4 PCU Assembly, Sea Tel kit part Number: 135336 (PCU assembly part number: 122203).

<p><b>*CAUTION:</b> Power down the pedestal before following this procedure.</p> <ol style="list-style-type: none"><li>1. Using a #2 Phillips screwdriver, remove the four screws from the side of the EL pan cover, which attach it to the EL pan.</li><li>2. Then remove the six screws from the upper and lower edges of the EL pan cover.</li><li>3. Remove the EL pan cover by sliding it away from the reflector.</li></ol>	
<ol style="list-style-type: none"><li>4. Remove the BNC cable from the GPS antenna.</li><li>5. Then, using a 2mm flat blade screwdriver, loosen the retaining screws on each of the harness D-Sub connectors and unplug all 3 connectors.</li></ol>	
<ol style="list-style-type: none"><li>6. Being careful not to damage the GPS pigtail cable, use a 3/8" socket to remove the 3 nuts securing the PCU assembly inside the EL pan, and remove the PCU. Approach with caution as the antenna will drop hard to the right due the weight imbalance.</li><li>7. Install the replacement PCU and secure to the EL pan using Loctite 242 on all screws, and Re-Connect the D-sub connectors and BNC connector. Re-install the EL pan cover and secure using Loctite 242 on all hardware.</li></ol>	
<ol style="list-style-type: none"><li>8. Configure the PCU's No parameter and adjust remote tilt setting.</li></ol>	

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### 7. Calibrating the XXo4 Series PCU Software and No parameter:

#### 7.1. Software Revisions.

The XXo4 has several variations, the standard 3004, 4004 and 5004 PCU part number: 122203. If using this PCU on an XXo4UA (unlimited azimuth) or DTVo4 (Direct TV) pedestal the software will need to be reprogrammed as per the below table.

**\*Note:** Correct at time of press. Contact your local Sea Tel service department for the latest software release.

Model	PCU Part Number	Software Part No	Software Revision
XXo4	122203	122844	2.53L
XXo4UA	122203-2	121449	2.53
DTV04	122203-3	129951	2.48L

#### 7.2. No Parameter.

As PCU's are universal across the model range, it is necessary to configure the No parameter of the replacement PCU to the specification of the pedestal it will be installed on. This will set the motor gains for CL (N1), EL (N2) and AZ (N3) and also configure the dishscan pattern (N7) for the size of the pedestals reflector.

Without the No parameter configured in the PCU the antenna won't initialize as none of the motor gains will be set, only the level cage will drive. The status window of the DAC will also display the model number of the antenna as "xx04" as opposed to 3004, 4004 or 5004.

- Enter into the remote command screen and input the correct No parameter for the model of antenna as per the below table. I.e. the No parameter for a 4004 is "006" so enter "N006" ("No" for the system parameter + "006" for the antenna model).
- Save the remote parameters.
- Cycle power to the system to reinitialize the pedestal, verifying the No has saved and the system initializes correctly.


Model	No	N1	N2	N3	N7
3004	005	024	020	010	029
4004	006	024	024	014	025
5004	007	051	051	021	029
DTV04	004	030	024	014	025




### 8. Calibrating the Remote Tilt Setting:



This procedure is required to calibrate the level cage so that all the sensors will be accurately aligned to their axis. The fluid filled tilt sensor provides a two dimensional horizon reference. The system is not able to automatically calculate the exact center value, therefore it is necessary to perform this procedure to manually enter any offset required to make sure the PCU receives a true horizon reference.

1. Turn dishscan off:




Enter into the Setup Menu by pressing and holding the  arrows together until the EL Trim or Auto Trim parameter is displayed.





Use the  arrow key to scroll through the menu until the dishscan window is displayed.

Press the  arrow to activate the window and then press the  arrow, followed by the  button to turn dishscan from on to off.

**\*Note:** When you press the  arrow to turn dishscan off you won't see the display change until you press the  button.

*(Steps 2-7 requires assistance to observe and operate antenna simultaneously)*

2. Enter into the Setup Menu by pressing and holding the  arrows together until the EL Trim or Auto Trim parameter is displayed.
3. Push the  arrow key until the Remote Tilt window is displayed.
4. Push the  arrow key to activate the Remote Tilt setting.
5. Use the arrow keys to position the bubble as close to the center as possible. Each press of an arrow key on the directional pad will move the Remote Tilt ½ a degree. It is advised that you only press the button once and wait for the axis to move before pressing it again.

When standing behind the antenna looking at the bubble, if the bubble is over to the right, you need to press the  (right) arrow to bring the bubble into the center. If the bubble is down towards you, you need to press the  (down) arrow to bring it towards the center. If the bubble is to the left, you need to press the  (left) arrow and if the bubble is up towards the top, you need press the  (up) arrow to move it towards the center.



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When correct the bubble should be as close to the center of the fluid as possible








6. When the bubble is as central as possible press the  button to deactivate the Remote Tilt setting.

7. Turn dishscan on:


Enter into the Setup Menu by pressing and holding the   arrows until either the EL Trim or Auto Trim parameter is displayed.



Use the  arrow key to scroll through the menu until the dishscan window is displayed.

Press the  arrow key to activate the window and then press the  arrow key, followed by the  button to turn dishscan from off to on.

**\*Note:** When you press the  arrow to turn dishscan on you won't see the display change until you press the  button.

8. Save the Remote Tilt setting in the PCU:

Press the  arrow key until the Remote Parameters window is displayed.

Press the  arrow key to activate the window followed by the  button (you'll see a confirmation on the display saying "Saved").

9. As good practice make a note of your N4 and N5 parameters once you have correctly set the remote tilt. The N4 and N5 parameters are a numeric read of the remote tilt. To do this go to the remote command window and key in N4999 to read the CL setting, followed by N5999 to read the EL setting.