Field Service Spares Replacement Procedure – PCU Kit, XX97, XX97A & XX00

Approval:

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Revision History

Rev.	ECO	Description of Change	Date
X1	8870	Initial release	08-18-2011
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1. Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the PCU assembly on the XX97, XX97A and XX00 series antennas.

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 the feedback from the sensors in the level cage and directional changes from the vessels gyro compass which are fed into the control loop. It then sends the command to the motor driver PCB or servo amplifier to drive the relevant axis an equal and opposite amount of movement to maintain stabilization and control the antennas dishscan pattern.

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

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

4. Verify initialization:

- Power cycle the pedestal
    1. Level cage drives to its end stop, then backs off exactly 45 degrees
    2. Elevation axis drives to 45 degrees based on the level cages horizon reference
    3. Cross level axis drives to level based on the level cages horizon reference
    4. Unlimited azimuth axis drives clockwise until the home flag and sensor make contact

If the ACU reports model "xx97", the PCUs 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.

5. Pedestal Error (Error 8):

5.1. Decoding a Pedestal Error.

When the DAC displays a pedestal error enter into 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 4th 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's 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 antennas relative scale. This could be caused by the system completing a 360 degree rotation without the switch coming into contact with the home flag, the switch coming into contact with the home flag to early, or a physical problem such as the chain slipping on the motor pulley or the pulley slipping on the motor shaft.

5.3. Troubleshooting Pedestal Errors – Servo and Stability Limit.

1. Reinitialize the pedestal; does it drive correctly or at all? If none of the axis drive verify the No and motor gain parameters (N1 = CL, N2 = EL and N3 = AZ) are correctly configured in the PCU through the Remote Command window of the DAC.
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. If the motor isn't driving correctly or no motor drive is present, test the motor for faults using the below procedure, if the motor is defective replace it and then test the function of the servo amplifier. If the axis still fails to drive correctly the defective motor has damaged the servo amplifier, replace it. Excessive current draw from a defective motor could potentially damage the PCU, if normal operation doesn't return after replacing the motor and servo amplifier the PCU should be replaced.
4. If the antenna has braked motors have the brakes released properly? If the movement of the axis is restricted measure the output to the motor to verify if the 12V is present. If so the brake hasn't released the motor is defective. If the 12V isn't present trouble shoot the harness / brake servo PCB to diagnose the fault.
5. 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 the switch comes into contact with the home flag as the system drives in azimuth. If not verify if the switch is present.
2. 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 chain 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. Also 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).

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 servo amplifier has also been damaged and its operation should be verified with a replacement motor. If after replacing the motor the system is still not operational replace the servo amplifier. If after replacing both the motor and the servo amplifier the system is still not operational it's possible the current draw has damaged the PCU which will need to be replaced as per the following procedure.

6. Home Flag offset:

If an unlimited azimuth antenna has been installed, with an offset from the bow of the vessel it's possible the Home Flag Offset (HFO) has been calibrated in the PCU to correct the relative scale. Before replacing a PCU it's advisable to query the HFO (N6) parameter to verify if it will need to be configured in the replacement PCU.

To query the HFO combine the parameter code "N6" with the query code "999" and enter "N6999" into the remote command window of the DAC and press the enter button. If there is a home flag offset the response will show the value of "XXX" meaning the relative scale of the antenna has been calibrated, if the value "000" is returned, no HFO has been configured.

N6 – _____

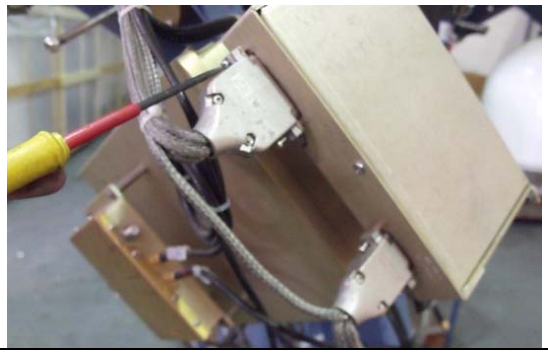
7. Replacing the PCU Assembly:

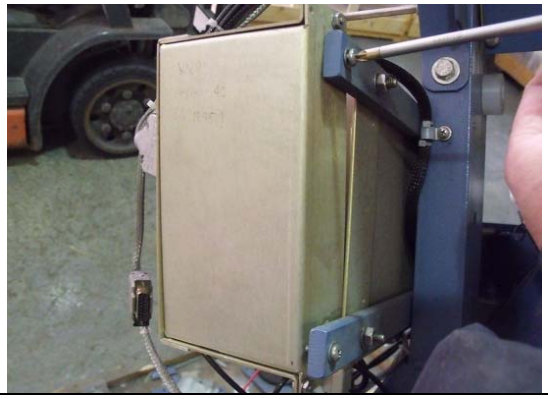
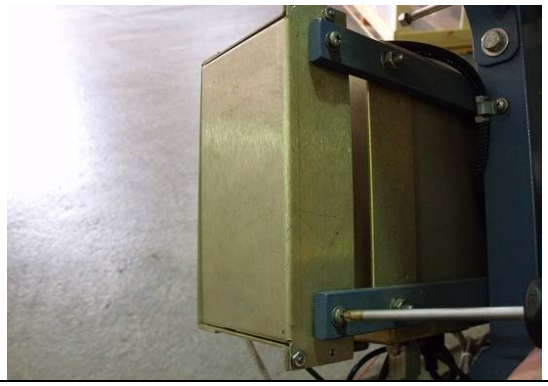
7.1. Tools.

- 2mm Flat Blade (Terminal) Screwdriver
- #2 Phillips Screwdriver
- Loctite 242

7.2. Procedure.

Procedure for replacing the XX97, XX97A and XX00 PCU, Sea Tel kit part number: 135383 (PCU assembly part number: 125160-1).

***CAUTION:** Power down the pedestal before following this procedure. 1. Using a 2mm flat blade screwdriver undo the two D-sub harness connections from the PCU assembly.	

2. Using a #2 Phillips Screwdriver remove the two screws securing the defective PCU assembly to the equipment frame and remove it.	
3. Apply Loctite 242 to the two screws removed in the previous step and install the replacement PCU assembly.	
4. Reconnect the harness D-sub connectors using a 2mm flat blade screw driver. 5. Configure the PCUs No parameter and calibrate the remote tilt setting as per the following procedures.	

8. Software:

The standard F97_211 software installed on the PCU is the default software revision for the majority of the XX97, XX97A and XX00 series antennas, however if the PCU is to be used on either a 9797-50 or 14600-50 the software will need to replaced with F97_2.08t (Sea Tel part number: 125213) to enable the tone switching function. If you require this software revision please contact your local Sea Tel service department.

9. Calibrating the XX97, XX97A and XX00 PCU No Parameter:

As PCUs are universal across the model range it's 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 "xx97" opposed to 9497A, 9797B or 14400B.

- 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 9497B is "206" so enter "N0206" ("N0" for the system parameter + "206" 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
8897	133	050	050	050	214
9497	134	050	050	050	214
12097	135	050	050	050	193
14497	136	050	050	050	193
8797	137	040	040	040	214
9697	138	050	050	050	214
9797	139	050	050	050	214
9997	140	050	050	050	214
8897A	205	050	050	050	133
9497A	206	050	050	050	133
12097A	207	050	050	050	193
14400	208	71	71	71	214
8797A	209	050	050	050	133
9697A	210	050	050	050	133
9797A	211	050	050	050	133
14600	212	91	91	91	133
9597A	213	71	71	71	192

10. 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.

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 ENTER 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 ENTER 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 ENTER 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 ENTER 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.