Procedure, Field Replacement, PCU Motherboard PCB Kit, XX09 MK2 & XX10

Approval:

Approving Authority	Signature	Date
Doc Control:	Ron Chaffee / Signature on file.	10-26
Assistant Service Manager, Global	John VanderJagt / Signature on file.	10-26
Author:	Stuart Broadfield / Signature on file.	10.26.11

Revision History

Rev.	ECO	Description of Change	Date
A	8791	Initial release	08-05-2011
B	9041	Clerical revisions	10-18-2011

Procedure, Field Replacement, PCU Motherboard PCB Kit, XX09 MK2 & XX10

1. Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the PCU Motherboard on the XX09 MK2 and XX10 series antennas.

2. Checklist:

- Verify Initialization
- Verify LED Status
- Pedestal Error
- Pol Drive

3. Theory of Operation:

The PCU motherboard calculates the amount of movement from the vessel based on the feedback from the sensors on the motion platform PCB & directional changed from the vessels gyro compass which are fed into the control loop. It then sends the command to the MDE enclosure to drive the relevant axis by an equal & opposite amount of movement to maintain stabilization & control the antennas dishscan pattern.

All tracking, targeting, pointing & polarization commands are sent from the DAC 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 & is calibrated by the No parameter which sets the motor gains for the size of the antenna as well as configuring the dishscan pattern. The MK2 XX09 PCU Motherboard PCB features an integrated Pol Aux relay PCB as well as status LEDs for diagnostic purposes, a Mini USB port for software uploads & service serial port for Bluetooth connection.

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 & also the component(s) that is/are faulty. This document will run through decoding the pedestal error then further troubleshooting the relevant axis to diagnose which component(s) that is /are defective.

4. Verify Initialization:

- Power cycle the pedestal
    1. Brakes release from the EL & CL motors
    2. Elevation axis drives to 45 degrees based on the motion platform PCBs horizon reference
    3. Cross level axis drives to level based on the motion platform PCBs horizon reference
    4. Azimuth axis drives clockwise until the home flag & sensor make contact

Note: If the PCU software 2.01a or higher the EL & CL axis will initialize at the same time saving 20 seconds on the initialization process.

If the ACU reports model "xx09", 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. PCU Status LED Diagnostics

A status LED is installed on the PCU Motherboard & can be viewed from the underside of the PCU assembly. The different colors statuses indicate…

Solid Green	PCU status is good.
Solid Red	PCU fault detection. Operational software will never leave the status LED solid RED. Reprogram the PCU software. Replace the motherboard PCB.
Solid Orange	Software update to the PCU motherboard is in process.
Blinking Orange	Software update to the motor driver enclosure (through the PCU) is in process.
Blinking Red	Communication error with the motor driver enclosure. Check the MDE status LEDs. If MDE is good, check to assure that the harness connections are seated properly. Check harness connections (pin-pin, wire-wire & wire-ground) for good continuity. Replace main PCB. Replace MDE.

6. Pedestal Error (Error 8):

6.1. Decoding a Pedestal Error (Error 8).

When the DAC displays a pedestal error enter into the remote command window & 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		

6.2. Error Types.

The 3 types of pedestal error are…..

1. **Servo Limit (CL, LV & 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 & 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 sensor coming into contact with the home flag, the sensor coming into contact with the home flag too early, or a physical problem such as the chain or belt slipping on the motor pulley or the pulley slipping on the motor shaft.

6.3. Troubleshooting Pedestal Errors – Servo Limit and Stability Limit.

1. Reinitialize the pedestal. Does it drive correctly or at all? - If none of the axis drive verify the No & motor gain parameters (N1 = CL, N2 = EL & N3 = AZ) are correctly configured in the PCU through the Remote Command window of the DAC.
2. Verify the balance of the antenna & 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 you find the motor is defective replace it and then test the function of the motor driver. If the axis still fails to drive correctly the motor may have damaged it. Replace the motor driver.
4. Verify if the brakes have 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 / motor driver enclosure.
5. Another potential problem could be a damaged or intermittent harness connection. Remove the harness back shells & verify all the pins are seated correctly, check continuity from pin to pin & also across the pins to verify there is no short in the connections.

6.4. Troubleshooting Pedestal Errors – Azimuth Reference Error.

1. Reinitialize the system & verify the sensor comes into contact with the home flag as the system drives clockwise in azimuth (the LED will illuminate). If not verify if the home flag/sensor is present, if correct then it's a sensor/feedback failure.
2. Drive the azimuth axis in 90 degree increments & verify that the antenna points correctly & that the DAC displays the correct relative position. Also verify that there is no physical restriction on the azimuth axis such as the chain or belt slipping on the motor pulley or the pulley slipping on the motor shaft.

6.5. Test The Motor.

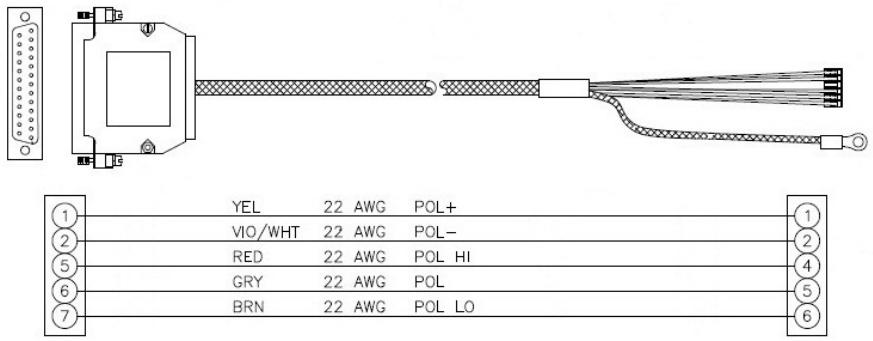
1. Check continuity between ground (the motor connector back shell) & the 3 driver outputs on pins 1, 2 & 3 of the harness.
2. Now check continuity between pins 4, 5, 6, 7, 8 and the ground (the motor connector back shell). Or this might be steps in a procedure that does not require a table.
3. Also check between the individual pins 1, 2, 3 and the rest of the pins (i.e. test pin 1 to pin 4, 5, 6, 7, 8 and so on, not between pins 1 & 2, 1 & 3 or 2 & 3).

If there is any continuity measured on the steps mentioned above, the motor is defective (which would be highlighted by the diagnostic LEDs on the MDE). The antennas operation should be verified with a replacement motor. If normal operation doesn't return the MDE/PCU will require further troubleshooting.

7. Pol Drive:

As the pol aux relay is integrated into the XX09 MK2 & XX10 PCU motherboard a fault with the pol alignment could potentially be caused by this PCB. If no pol drive is present set the pol type to manual mode (0009), apply drive to the feed assembly & measure the voltage to the motor on the IDC connector, 24VDC should be present. If voltage is present but the motor isn't driving the motor is defective & needs replacing.

If no voltage is present verify the connections of the reflector harness by measuring pin to pin as per the below diagram.



If the harness connections are good, then the PCU Motherboard isn't outputting the voltage to drive the motor & needs replacing.

As long as the pol range is within the pot limits the DAC will issue the pol drive command to the PCU motherboard, based on the antenna targeting, a change in the vessels GPS position or operator inputs. The PCU motherboard will then drive the pol motor, which will drive the feed until the correct output from the pot has been received. At which point the feed will be in the correct reception position (providing the system is functioning & calibrated correctly). Therefore there is also the possibility for a pol drive fault to be caused by the PCU motherboard.

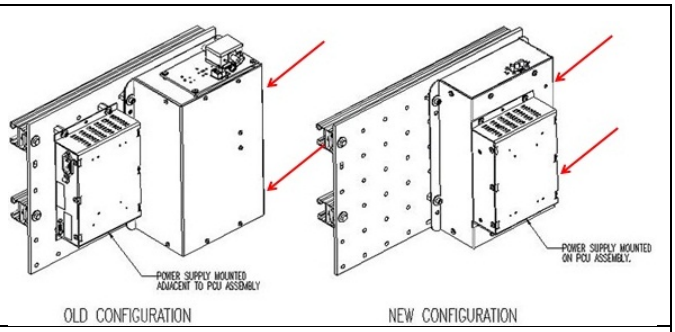
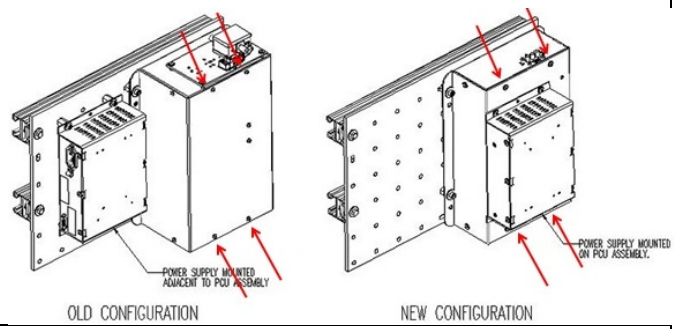
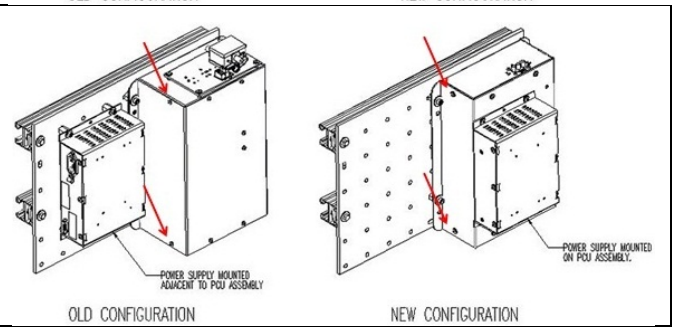
8. Replacing the XX09 MK2 and XX10 PCU Motherboard PCB:

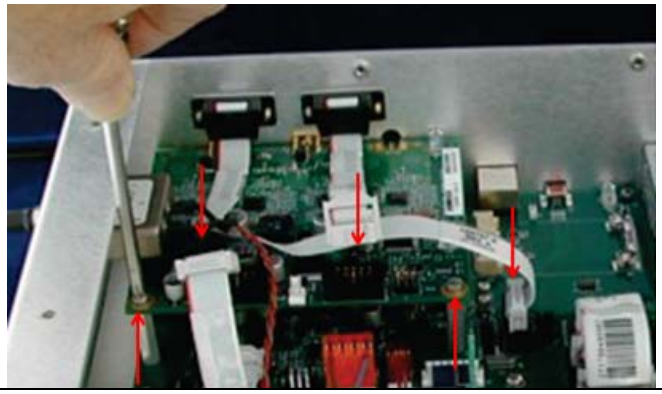
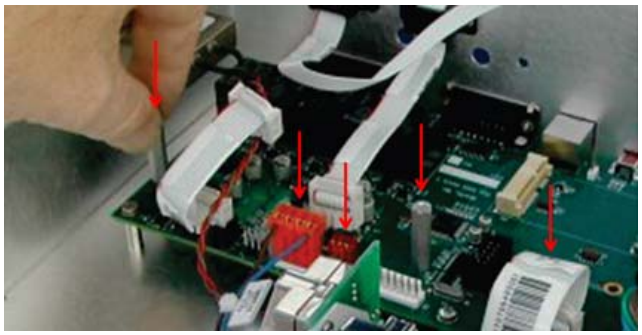
8.1. Tools.

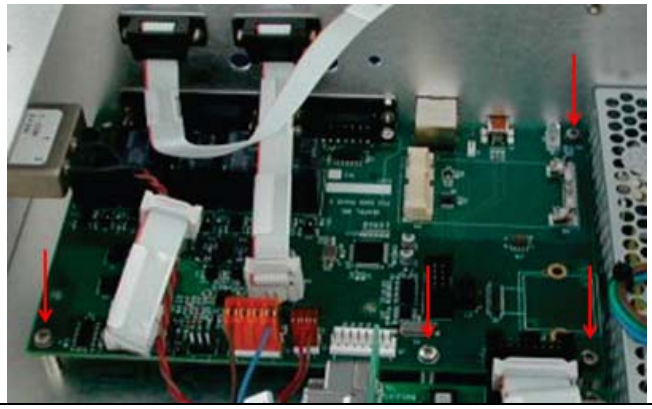
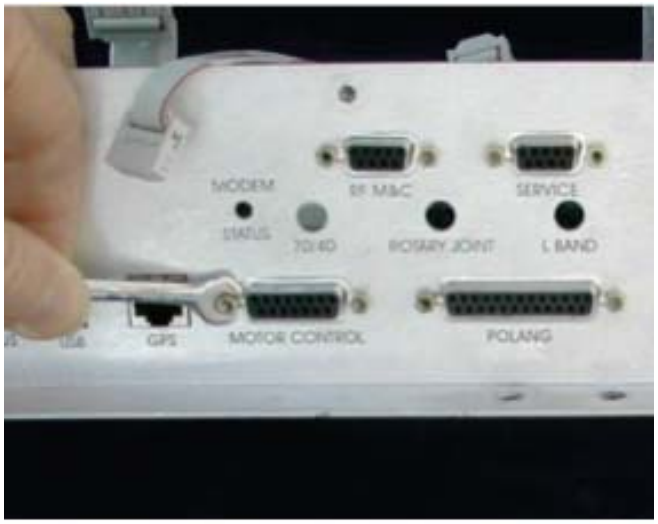
- #1 Phillips Screwdriver
- 5/16" Wrench/Spanner
- ¼" Wrench/Spanner
- Loctite 242

8.2. Procedure.

Procedure for replacing the PCU Motherboard PCB, Sea Tel kit part number: 135275 (PCU Motherboard PCB part number: 130432-1).

***CAUTION:** Power down the pedestal before following this procedure. ***Note:** PCB components are static sensitive and correct handling procedures must be adhered to. 1. Using the #1 Phillips screwdriver, remove the 2 Phillips screws in the lip edge above the connectors.	
2. Remove the 4 Phillips screws on the top of the PCU.	
3. Remove the 2 Phillips screws on the back side of the PCU. 4. Retain all of the screws for later reuse. 5. Remove the cover off of the PCU	

6. Remove the 400MHz Modem PCB. 7. Remove the three ribbon cables above the 400 MHZ modem PCB. 8. Using a #1 Phillips screwdriver, remove the 2 Phillips screws on the 400 MHZ modem PCB. Retain all of the screws for later reuse.	
9. From the outside of the PCU enclosure, using a 5/16" wrench, remove the nuts and washers from the SMA connectors that protrude through the PCU enclosure. Retain all hardware for later reuse. 10. Remove the 400MHz modem PCB.	
11. Using the ¼" open end wrench, remove the two standoffs. Retain these for later reuse. 12. Remove the Blue/Brown wire pair IDC connector (Orange) from J9. 13. From inside the PCU enclosure, unplug the Red-Brown twisted pair wire IDC connector (Red) from J10. 14. Disconnect the ribbon cable from the Level Platform PCB J5.	

15. Using a #1 Phillips screwdriver, remove the 4 Phillips screws that mount the Main PCB. Retain all of the screws for later reuse.	
16. From the outside of the PCU enclosure, Using a 3/16" wrench or nut driver, remove the 4 retainer screw standoffs from the "Motor Control" and the "polang" D-Sub connectors. Retain these for later reuse. 17. Remove the defective Main PCB. 18. Install the replacement Main PCB. 19. Apply Loctite 242 to, and reinstall, the 4 retainer screw standoffs from the "Motor Control" and the "polang" D-Sub connectors. 20. Apply Loctite 242 to, and reinstall, the 4 Phillips screws to mount the Main PCB. 21. Reconnect the ribbon cable from the Level Platform PCB. 22. Reconnect the Red-Brown twisted pair wire IDC connector (Red). 23. Reconnect the Blue/Brown wire pair IDC connector (Orange).	
24. Apply Loctite 242 to, and reinstall, 2 standoffs on top of the Main PCB. 25. Reinstall the 400 MHz modem. 26. If all repair work is now completed reinstall the PCU cover (refer to "Reinstalling the PCU cover" below).	

9. Calibrating the XX09 and XX10 PCUs 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), 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, the status window of the DAC will display the model number of the antenna as "xx09" opposed to 4009, 5009 or 4010.

- 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 4009 is "004" so enter "N0004" ("No" for the system parameter + "004" for the antenna model).
- Enter into the Remote Parameters screen of the DAC and save the settings to the PCU motherboard.
- 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
4009	004	040	020	020	026
4009 Gilat	002	020	016	016	026
4009 Mini	007	030	016	016	026
5009	005	050	040	020	021
6009 KU	006	060	034	034	022
6009 C	003	060	034	034	022
4010	076	040	030	014	025
4010KX	078	050	050	026	025
5010	077	050	050	026	025