Field Service Spares Replacement Procedure – PCU Assembly Kit, ST88, ST94 & ST144

Approval:

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Revision History

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1. Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the PCU assembly on the ST88, ST94 and ST144 antennas.

2. Checklist:

- Verify Initialization
- Measure the Power Supply Input / Output Voltages
- PCU Status
- Pedestal Error
- Verify Stabilization
- Verify Targeting
- Test for Azimuth Drift
- Verify the Communications Path
- Test Pol Drive

3. Theory of Operation:

The MK2 PCU assembly contains the 24VDC pedestal power supply (kit: 135341), PCU motherboard PCB (kit: 135338), motion platform PCB (kit: 135342) and above decks 400MHz modem PCB (kit: 135349).

The PCU motherboard calculates the amount of movement from the vessel based on the feedback from the sensors on the motion platform PCB and directional changes 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 and opposite amount of movement to maintain stabilization and control the antennas dishscan pattern. 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. 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 and service serial port for Bluetooth connection.

The motion platform PCB houses 5 sensors. Two solid state MEM sensors which are used as the antennas horizon reference (level position) and long term stabilization reference, and 3 solid state rate sensors, one for each axis, which are used for short term stabilization reference. A faulty sensor on the motion platform PCB will cause the antenna to lose stability and mispoint from the satellite under dynamic conditions; however the system may appear to be operational in the port when there is no motion to counteract.

RS-422 Pedestal communications from the DAC-2202 are modulated into a frequency by the base 400MHz modem and diplexed with the L-Band receive signal. The communications frequency will then be demodulated by the pedestal 400MHz modem and converted back into RS-422 before being sent to the PCU. Radio MandC signals (RS-232, RS-422, or RS-485) can also be multiplexed along with the pedestal communications to interface with the SSPB.

The 150W, 24VDC power supply is switch mode and will convert either 110VAC or 220VAC into 24VDC. This component is universally used in the DAC-2202, XX97 and XX06 pedestal power supplies as well as the XX09 and XX10 PCU's and NJRC 24V BUC power supplies, meaning only a single unit is needed as a spare to cover a wide range of applications.

4. Verify Initialization:

- Power cycle the pedestal
    1. Brakes release from the EL and 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 and sensor make contact

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

If the ACU reports model "xx09", 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.

5. Power Supply Troubleshooting:

***Caution:** Electrical Hazard - Dangerous AC voltages exist on the power supply. Observe proper safety precautions when working on the power supply. 1. Remove the cover from the PCU to allow access to the power supply for testing. 2. Measure the input voltage into the power supply on the 2 pins to the right of the connection block, 110 - 240 volts AC should be present. If no AC voltage is present verify the unit is switched on. If there is still no voltage present troubleshoot the source.	
3. Now measure the output voltage from the power supply on the 2 pins to the left of the connection block, the output should be 24VDC. ***Note:** This procedure shows a DAC-2202 in the images; however the DAC and PCU power supply is the same component so the procedure is the same.	

If the units AC input has been verified and the 24VDC is not present, the power supply is defective. If the power supply is outputting the 24VDC consistently then the power supply is operational and the problem lies elsewhere (possible failure with the PCU, DAC motherboard or harness connection).

6. PCU Status LED Diagnostics

A status LED is installed on the PCU Motherboard and 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 and wire-ground) for good continuity. Replace main PCB. Replace MDE.

7. Pedestal Error (Error 8):

7.1. Decoding a Pedestal Error (Error 8).

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		

7.2. 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 enclosure 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 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.

7.3. 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_1 = CL, N_2 = EL and N_3 = 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 procedure in section 8 of this document. 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 12VDC is present. If so the brake hasn't released the motor is defective. If the 12VDC 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 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.

7.4. Troubleshooting Pedestal Errors – Azimuth Reference Error.

1. Reinitialize the system and 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 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 or belt slipping on the motor pulley or the pulley slipping on the motor shaft.

8. Test The Motor:

Check continuity between ground (the motor connector back shell) and the 3 driver outputs on pins 1, 2 and 3 of the harness.

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.

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 and 2, 1 and 3 or 2 and 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.

9. Verify Stabilization:

The purpose of this procedure is to physically move the systems axis under static conditions, introducing error into the PCU's control loop, and then verify the system is able to return to its level position (stabilize itself). These tests can be performed by monitoring the sensor outputs on DacRemP or also by physically moving the antenna and observing how it responds.

1. Turn tracking off and open the DISP_V screen of DacRemP. The software will now plot the level position of the LV and CL MEM sensors. Observe for any abnormalities.
2. Verify Cross Level response:

   Standing behind the system, push the cross level beam down to the left and hold it in position. Verify that the CL trace on DacRemP moves down an equal amount to the movement exerted on the axis. Release the axis and verify the DacRemP trace and system axis both return back to their original positions instantly, without deviating or taking time to settle. Now push the cross level beam down to the right and hold it in position. Verify that the CL trace on DacRemP moves up an equal amount to the movement exerted on the axis. Release the axis and verify the DacRemP trace and system axis both return back to their original positions instantly, without deviating or taking time to settle.
3. Verify Level (Elevation) response:

   Push the reflector up in elevation and hold it in position. Verify that the LV trace on DacRemP moves down an equal amount to the movement exerted on the axis. Release the axis and verify the DacRemP trace and system axis both return back to their original positions instantly, without deviating or taking time to settle. Push the reflector down in elevation and hold it in position. Verify that the LV trace on DacRemP moves up an equal amount to the movement exerted on the axis. Release the axis and verify the DacRemP trace and system axis both return back to their original positions instantly, without deviating or taking time to settle.
4. In DacRemP, the trace should look similar to the below image. Note how after each movement the system returns to its level position efficiently without taking time to settle.

10. Rate Sensor Monitoring:

Rate sensor outputs can also be monitored using the DISP_W screen of DacRemP to verify any deviations under static conditions. The traces should remain consistent; any drifting or spikes are an indication the sensors voltage output is changing and the sensor is defective (provided no forces are being exerted on the system).

11. Azimuth Targeting:

Should the antenna have issues targeting in azimuth, such as not accurately finding the satellite or repeatedly finding the satellite in different azimuth positions, then it's important to diagnose if the system is mispointing in azimuth or relative. Relative feedback from the AZ encoder can be verified by initializing the system, verifying it calibrates itself correctly, and then driving the pedestal clockwise in 90 degree increments over a 360 degree rotation. Note that the system points correctly relative to the vessel and that no AZ reference error is flagged by the PCU. A mechanical problem such as the belt slipping on the sprocket could also cause this kind of error.

If the system keeps finding the satellite at different azimuth positions but at the same relative, then the encoder is functioning correctly and the azimuth rate sensor is calculating the movement incorrectly causing the antenna to mispoint.

12. Drift:

If a rate sensor is "drifting", its nominal voltage output has changed from the correct 2.5VDC. This will cause error in the axis control loop and cause the antenna to move. It is more common to see this drift in the azimuth axis as the CL and EL axis both have a long term reference, provided by the tilt sensor. However, should the rate sensors drift be large enough, it can over-compensate the tilt sensor and the system will drive into one of the CL or EL end stops.

To verify if the system is drifting in azimuth, turn tracking off and monitor the relative position. Under static conditions, when the vessels heading is unchanged, the relative count should remain stationary. If the relative value begins to change from its current position, the azimuth rate sensor is drifting, introducing error into the axis control loop.

If the rate sensors are checked as OK, a ships gyro can induce drift. This will introduce loop error into the PCU control loop and cause the antenna to drift. This can be verified by checking the heading displayed on the DAC against the ships actual heading. The two headings should be the same. If there is a difference, enable Sat Ref Mode to temporarily bypass the ships gyro to prove the fault. If enabling Sat Ref Mode does prevent drift, verify the heading source.

13. Further Diagnostics:

If any of the above checks have indicated a problem, one or more of the axis control loops have incorrect loop errors. The most likely cause of this is a defective rate sensor. To rectify this, replace the motion platform PCB and repeat the checks above, to verify the antenna now functions correctly.

Should the problem persist, there are other possibilities that can produce the same results. These can be bad connections between the motion platform PCB and PCU motherboard or the PCU itself.

14. 400MHz Modem LED Indicators:

For diagnostic purposes, the 400MHz FSK Modem Assemblies have an LED Indicator (located on the bottom left hand side of the Enclosure for BDE modems and directly underneath the Rotary Joint port on the 09 Series PCU). By observing the amount of amber colored flashes during power up, the modems configuration may be established. You can also verify the communications link between above decks and below decks modems themselves. Refer to the below list for an explanation of the different LED states.

- Upon power up, the modems' LED will flash amber. The number of flashes indicates the dash number configuration of the modem. Refer to the configuration on page 8 of this document for the appropriate dash number configuration for your modem assembly.
- Solid green indicates dual channel communications lock between modems (i.e. there is enough signal being received to establish communications).
- Red and Green alternating LEDs indicates a single channel failure (i.e. there is low RSSI signal strength on one channel).
- A flashing Red LED indicates no communication between both modems (2 failed channels), (i.e. there is low RSSI signal strength on both channels).
- Solid RED - Modem fault detection, hardware or software failure of the modem.
- Solid ORANGE - Software update to the Modem in progress.

Below Decks Modem Assembly	Above Decks Modem (Located in the PCU Assembly)
LED Illuminated Green  LED Illuminated Red 	

15. 400MHz Modem Queries:

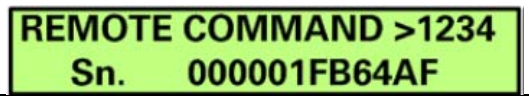
The 400MHz modem assemblies facilitate the use of line-based commands via the ACU's front panel, the internal HTML page, or using remote diagnostic software such as DacRemP and ProgTerm. The use of these commands will aid in troubleshooting communication failures between the above decks and below decks modems. Listed below are the available commands:

Command	Description	Typical Response
<0000 <cr>	BDE Modem RSSI (Receive Signal Strength Indicator)	**RSSI P-43 R-44** P = Pedestal Control Channel R = Radio Control Channel
<1234 <cr>	BDE Modem Serial Number Query	**Sn 000001D2F1F1**
<0273 <cr>	BDE Modem Temperature Query	**Temp = 34.9c** Temperature expressed in Celsius
<0411 <cr>	BDE Modem Software Version and Configuration Query	**Modem Ver 1.00B-1** Software version – configuration Dash #
>0000 <cr>	ADE Modem RSSI (Receive Signal Strength Indicator)	**RSSI P-43 R-50** P = Pedestal Control Channel R = Radio Control Channel
>1234 <cr>	ADE Modem Serial Number Query	**Sn. 00000102FC18**
>0273 <cr>	ADE Modem Temperature Query	**Temp = 27.5c** Temperature expressed in Celsius
>0411 <cr>	ADE Modem Software Version and Configuration Query	**Modem Ver 1.00B-2** Software version – configuration Dash #

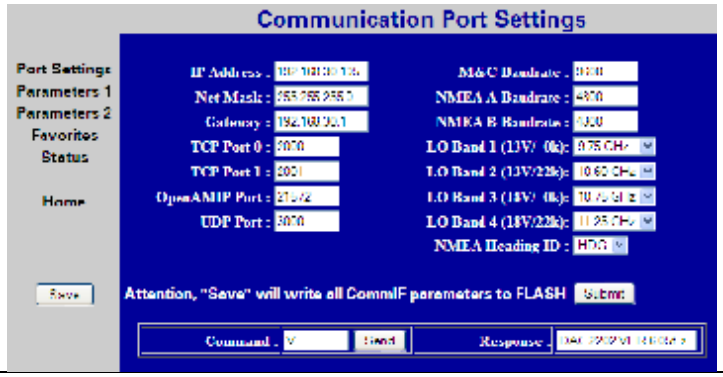
16. Modem Query Methods:

The following text provides instruction on how to submit modem queries using any one of four different methods as listed below. These instructions assume that the operator have a clear understanding of Menu navigation and entry via the Antenna Control Unit front panel, or connection requirements for using remote diagnostic software, and/or the internal HTML page of the ACU. Refer to the appropriate manual text if further instruction on wiring connections or button pushing is required.

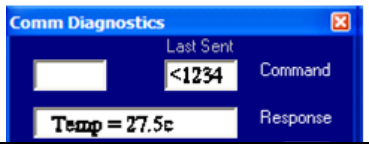
16.1. Using the ACU Front Panel:

1. Using the ACU's front panel, navigate through the setup menu to access the remote command sub-menu.	
2. Enter in the desired modem query then press the enter key.	
3. Observe and/or record the displayed response.	

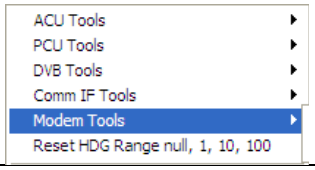
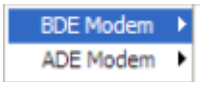
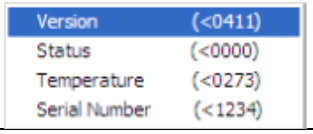
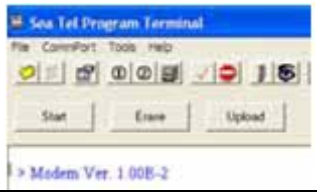
16.2. Using the Internal HTML Page:

1. Logon to the ACU's internal HTML page. 2. Browse to the "communication port settings" page.	
3. In the command window, type in the desired modem query and hit send.	
4. Observe and/or record the displayed response. 5. Repeat as required until all desired modem queries are noted.	

16.3. Using DacRemP:

6. Open up DacRemP and select the comm diagnostics Tool (cntrl + c).	
7. In the Remote Command Entry Window, type in the desired modem query and hit enter. I.e "<1234 <CR>"	
8. Observe and/or record the displayed response. 9. Repeat as required until all desired modem queries are noted.	

16.4. Using ProgTerm:

10. Open up ProgTerm and select the tools menu.	
11. Select "modem tools".	
12. Select the desired modem location. BDE is the Below Decks Modem. ADE is the Above Decks Modem.	
13. Select the desired modem query.	
14. Observe and/or record the displayed response. 15. Repeat as desired until all desired modem queries are noted.	

17. 400MHz Modem Fault Diagnostic Procedure:

17.1. Query the ADE and BDE modems:

1. Issue "<0000" and ">0000" queries to the ADE and BDE modems and record the responses.

   ADE (>0000)_____ BDE (<0000)_____

2. Compare your recorded responses to the list below to determine which modem fault(s) (if any) are present.
3. Use the appropriate text following the failure table for a list of possible failures attributed to the failure type established.

400MHz FSK Modem Fault Reference Table		
ADE Modem RSSI	**BDE Modem RSSI**	**Failure**
P= <65, R= <65	P= <65, R= <65	None
P= >65, R= >65	P= >65, R= >65	Receive IF Path
No Response	No Response	BDE/ADE No Response
No Response	P= <65, R= <65	ADE No Response 1
No Response	P= >65, R= >65	ADE No Response 2
P= <65, R= <65	P= >65, R= <65	BDE Receive Or ADE Transmit (PED M&C)
P= <65, R= >65	P= <65, R= <65	BDE Transmit Or ADE Receive (PED M&C)
P= <65, R= <65	P= <65, R= >65	BDE Receive Or ADE Transmit (RF M&C)
P= <65, R= >65	P= <65, R= <65	BDE Transmit Or ADE Receive (RF M&C)

17.2. Tools Suggested:

Laptop or PC w/ an available comport and diagnostic software installed	ProgTerm Ver. 1.35 or Later DacRemP Ver. 0.20 or Later
9 pin Serial cable	Straight thru (1-1 Pin out) For Serial Based Connections
CAT5 Cross-over cable	Required for IP based connections (HTML, DacRemP IP)
Serial Loopback Connector Build a Loop Back Test Adapter by Shorting Pin 1 to Pin 8 and Shorting Pin 2 to Pin 3 on a female DB9(S) connector.	
SMA "T" splitter or N type "T" splitter	Or equivalent cabling
Spectrum Analyzer	Capable of handling 100KHz up to 3GHz and up to 48VDC

18. Failure Table:

Diagnostics from the above table, section: 17.1.

18.1. None.

No communication failures between ADE and BDE modems.

18.2. Receive IF Path.

The following points of failures assumes LED illumination on both modems.

1. Modem Configuration.

   Verify BDE modem and ADE modem are properly configured (jumper block settings).

2. Coax Cable failure

   Verify continuity on the below coaxes, repair or replace as required.

   1. BDE Modem connector bracket (Base Rack Panel Assembly)
   2. (CFE) BDE to ADE Rx IF (Base Rack Panel to radome Connector Bracket)
   3. Rx N to SMA Adapter (Located on connector bracket at radome base)
   4. SMA to SMA (From connector bracket to bottom the bottom side of the rotary joint)
   5. SMA to SMA (From top side rotary joint to PCU/ADE Modem

3. Rotary Joint (Receive channel).

   Verify continuity on the receive channel for its entire 360 degree range of motion. Replace rotary joint if any sector of it has failed.

18.3. BDE/ADE No Response.

The Following points of failures assumes LED illumination on both modems.

1. Modem Configuration

   Verify BDE modem and ADE modem are properly configured (jumper block settings).

2. ACU to BDE modem interface cable failure

   Verify harness continuity. Repair or replace as required

3. ACU Antenna Port Failure

   Install an RS232 Loopback connector** on Antenna Port of the ACU. Enter an "n0999" Remote Command and verify that it echoes back on the bottom line of the display.

   1. If loop back works, BDE Modem failure or ACU to BDE Interface cable failure.
   2. If loop back does not work, ACU failure.

18.4. ADE No Response 1 (assumes LED illumination on both modems).

1. Modem Configuration

   Verify BDE modem and ADE modem are properly configured (jumper block settings).

   Install Spectrum Analyzer in line with the Rx IF coax path.

   1. If 465.0MHz Transmit Beacon is present, the fault is the BDE modem.
   2. If 465.0MHz Transmit Beacon is NOT present fault is with the ADE modem.

18.5. ADE No Response 2.

1. ADE Modem Configuration

   Verify the ADE modem is properly configured (jumper block settings).

2. Coax Cable failure

   Verify continuity on the items listed below, repair or replace as required.

   1. Base Modem to connector bracket (Base Rack Panel Assembly)
   2. (CFE) BDE to ADE Rx (LMR-400)
   3. Rx N to SMA Adapter (Connector bracket at radome base)
   4. SMA to SMA connector bracket to bottom side rotary joint
   5. SMA to SMA top side rotary joint to PCU/ADE Modem

3. Rotary Joint (Receive channel)

   Verify continuity on the receive channel for its entire 360 degree range of motion. Replace rotary joint if any sector of it has failed.

18.6. BDE Receive Or ADE Transmit (PED MandC).

1. BDE Modem Rx Port Failure (Not receiving at 465.0MHz) or
2. ADE Modem Tx Port Failure (Not transmitting at 465.0MHz)

   Install Spectrum Analyzer in line with the Rx IF coax path.

   1. If 465.0MHz Transmit Beacon is present, the fault is the BDE modem.
   2. If 465.0MHz Transmit Beacon is NOT present fault is with the ADE modem.

18.7. BDE Transmit Or ADE Receive (PED MandC).

1. BDE Modem Tx Port Failure (Not transmitting at 452.5MHz) or
2. ADE Modem Rx Port Failure (Not receiving at 452.50MHz)

   Install Spectrum Analyzer in line with the Rx IF coax path.

   1. If 452.5MHz Transmit Beacon is present, the fault is the BDE modem.
   2. If 452.5MHz Transmit Beacon is NOT present, the fault is with the ADE modem.

18.8. BDE Receive or ADE Transmit (RF MandC).

1. BDE Modem Rx Port Failure (Not receiving at 460.0MHz) or
2. ADE Modem Tx Port Failure (Not transmitting at 460.0MHz)

Install Spectrum Analyzer in line with the Rx IF coax path.

1. If 465.0MHz Transmit Beacon in present, the fault is the BDE modem.
2. If 465.0MHz Transmit Beacon is NOT present, the fault is with the ADE modem.

18.9. BDE Transmit Or ADE Receive (Radio MandC).

1. BDE Modem Tx Port Failure (Not transmitting at 447.5MHz) or
2. ADE Modem Rx Port Failure (Not receiving at 447.5MHz)

Install Spectrum Analyzer in line with the Rx IF coax path.

1. If 465.0MHz Transmit Beacon in present, the fault is the BDE modem.
2. If 465.0MHz Transmit Beacon is NOT present, the fault is with the ADE modem.

19. 400MHz Modem PCB Configuration:

The 400MHz modem PCB has a jumper block (located component side of PCB) that is used to configure it for above decks or below decks operation as well as to configure the serial communications protocol (RS232, RS422, or RS485). So a single PCB can be configured to work in either the above or below decks based on the jumper setting(s) of the below table.

Verify the configuration of the defective modem installed on your antenna for the correct configuration. Standard configurations for the XX09, XX10, XX11 and 9797B VSAT systems use RS232 protocol so are configured to -1 in the above decks and -2 in the below decks.

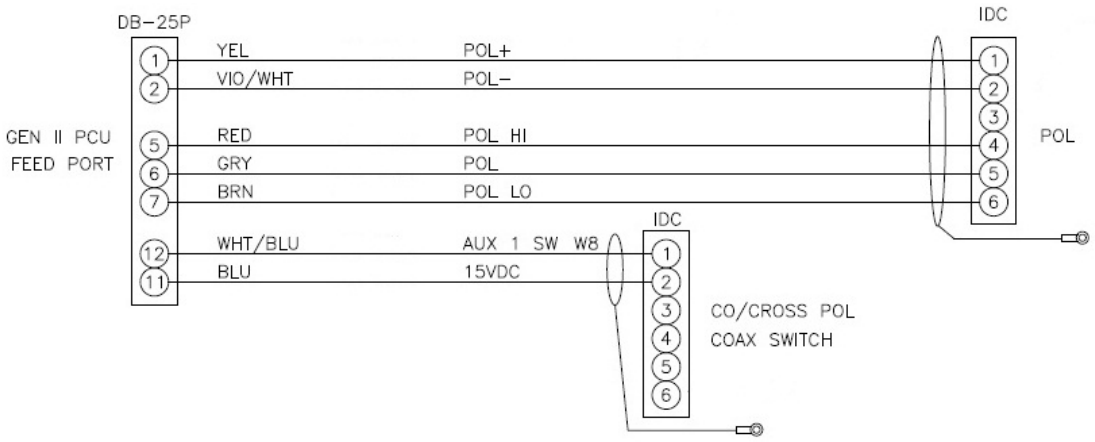
The ST88, ST94 and ST144 TVRO antennas with MK2 electronics use RS422 protocol (as opposed to the RS232 protocol used on the XX09, XX10, XX11 and 9797B series VSAT antennas) therefore the PCB is configured to a -3 as per the below table. Should the above decks 400MHz modem PCB need replacing on one of the ST series antenna an additional jumper is provided in the kit to place between pins 3-4 on the PCB jumper block to correctly configure the communication protocol of the PCB.

Assembly Dash Number	Modem Mounting Location	Serial Communication Protocol	Jumper Settings	Visual Jumper Reference
-1	Above Decks	RS232	1-2	
-2	Below Decks	RS232	None	
-3	Above Decks	RS422	1-2 3-4	
-4	Below Decks	RS422	3-4	
-5	Above Decks	2 Wire RS485 (Half Duplex)	1-2 5-6 7-8 9-10	
-6	Below Decks	2 Wire RS485 (Half Duplex)	5-6 7-8 9-10	

20. Pol Drive – ST88, ST94 and ST144:

As the pol aux relay is integrated into the MK2 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 and 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 and 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 and 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 and calibrated correctly). Therefore there is also the possibility for a pol drive fault to be caused by the PCU motherboard.

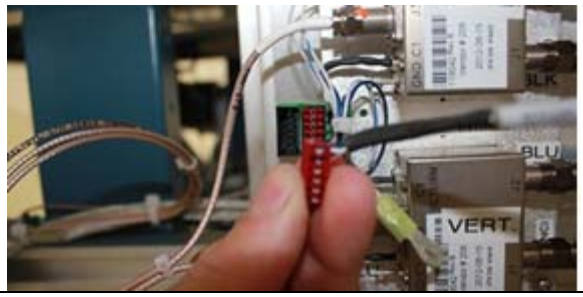
21. Replacing the MK2 PCU Assembly:

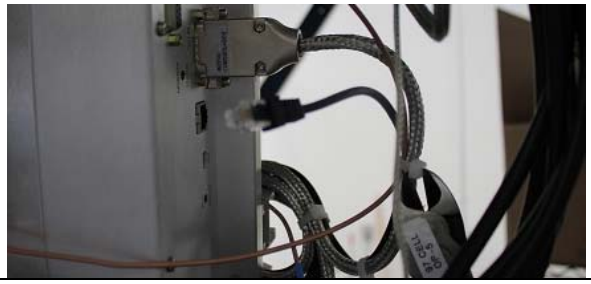
21.1. Tools.

- #1 Phillips Screwdriver
- 7/16" Wrench/Spanner
- 5/16" Wrench/Spanner
- Snips/Cutters
- 2mm Flat Blade (Terminal) Screwdriver
- Cable Ties/Tie Wraps
- Loctite 242

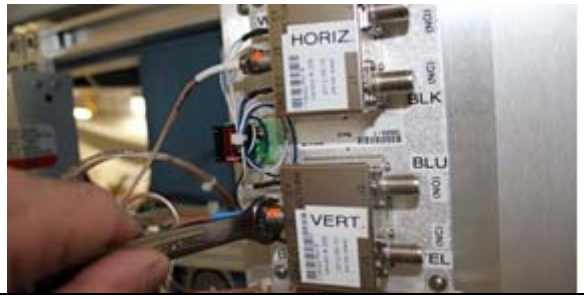
21.2. Procedure.

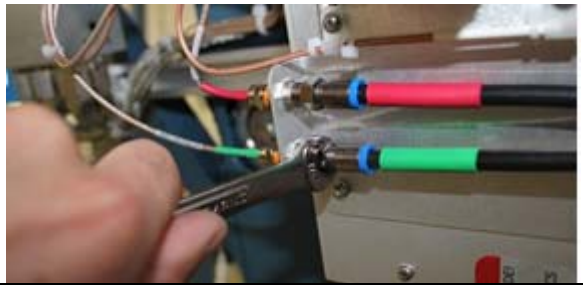
Procedure for replacing the PCU assembly, Sea Tel kit part number: 137737 (PCU part number part number: 131057-3).

***Caution:** Power down the pedestal before following this procedure. 1. Using a #1 Phillips screwdriver remove the screw securing the coax switch connection of the reflector harness from the termination block. 2. Remove the coax switch IDC connector from the termination block.	
3. Using a 7/16" wrench remove the two RG-179 coax cables from the lower mounting bracket installed on top of the PCU, noting their orientation.	
4. Now disconnect the two RG-60 coax cables from the other side of the mounting bracket using a 7/16" wrench.	

5. Now disconnect the two RG-179 coax cables from the in output side of the coax switches using a 7/16" wrench.	
6. Now disconnect the four RG-60 coax cables from the input side of the coax switches using a 7/16" wrench, noting their orientation.	
7. Using a 5/16" wrench disconnect the two SMA cables from the 400MHz modem PCB.	
8. Disconnect the GPS antennas RJ-45 connector from the PCU.	
9. Using a pair of snips cut the cable tie securing the RG-179 coax from the coax switch to the 400MHz modem (inside the PCU).	

10. Using a pair of cutters snip the cable securing the AC power connector to the PCU and disconnect the connector.	
11. Using a 2mm flat blade screwdriver undo the screws securing the reflector and motor driver D-sub connectors to the PCU and disconnect them.	
12. Check all cabling from the PCU assembly and coax switch has been disconnected from the pedestal and remove the PCU and coax switch assembly using a 3/16" Allen wrench. Save the hardware for future use. ***Note:*** Secure the weight of the assembly while removing the mounting hardware.	
13. With the defective PCU removed from the pedestal use a #1 Phillips screwdriver to remove the coax switch mounting plate from it. Save the hardware for future use.	
14. Using the hardware removed in step 13 install the coax switch on the replacement PCU assembly, noting its orientation. Apply Loctite 242 to the threads.	

15. With the coax switch installed install the replacement PCU to the equipment frame using the hardware removed in step 12. Ensure the screws are installed with both the washer and split washer and that Loctite 242 is applied to the threads. Ensure the ground point is connected to the lower left hand mounting point.	
16. Reconnect the red and green RG-179 coax cables to the lower mounting bracket	
17. Reconnect the white and blue RG-179 coax cables to the coax switches as per the labels on the mounting plate.	
18. Reconnect the D-sub connectors using a 2mm flat blade screwdriver. 19. Connect the GPS antennas RJ-45 connector to the replacement PCU.	
20. Connect the blue RG-179 coax cable from the coax switch to the "L-band" port on the 400MHz modem connection. 21. Connect the blue RG-179 coax cable from the rotary joint to the "rotary joint" port on the 400MHz modem connection.	

22. Secure the RG-179 coax cable from the coax switch to the modem using a cable tie.	
23. Connect the AC input connection and secure the connection to the assembly using a cable tie.	
24. Secure the red and green RG-60 coax cables to the red and green RG-179 coax cables using a 7/16" wrench.	
25. Reconnect the four RG-60 coax cables to the coax switches matching the colors to the labels on the mounting plate.	
26. Reconnect the IDC connector to the termination block on the PCB. 27. Secure the grounding point to the screw securing the termination PCB using a #1 Phillips screwdriver. Apply Loctite 242 to the thread.	

22. Calibrating the MK2 PCUs No Parameter:

As PCUs are universal across the models ranges 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(s) (N7) for the size of the pedestals reflector(s).

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 ST88, ST94, or ST144 etc.

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 ST88 is "212" so enter "No212 ("No" for the system parameter + "212" 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	N7A
ST88	212	050	050	030	149
ST94	213	050	050	030	149
ST144 / 144S	208	051	051	035	192