Field Service Spares Replacement Procedure – CL Motor Kit, Braked, XX97B, XX00B & XX07

Approval:

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Revision History

Rev.	ECO	Description of Change	Date
X1	8869	Initial release	08-18-2011
A	9059	Clerical revisions	10-30-2011

1. Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the elevation and cross level motor on the XX97B, XX00B & XX07 series antennas.

2. Checklist:

- Verify Initialization
- Check Motor Drive
- Pedestal Error

3. Theory of Operation:

The cross level motor is used for stabilization, during stabilization the motor drives in response to motion of the stabilized mass of the antenna in 3-dimensional free space (as sensed by the rate and tilt sensors, which are both located inside the level cage). An integrated brake mechanism in the elevation and cross level motors is used to restrict the axis from moving when AC power is lost to the antenna.

The BLDC motor does not have brushes, therefore, it must be commutated by a servo amp/motor controller. Hall sensors in the motor provide feedback to the controller so it can commutate and control the torque output of the motor. When no drive is applied to the motor it offers very little rotational friction allowing inertia to provide 98 percent of stabilization.

4. Verify Initialization:

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

If any of these steps fail or the ACU reports model "xx97" the PCUs No parameter needs calibrating and verifying that it saves correctly. A drive issue or pedestal error requires further troubleshooting.

5. Pedestal Error (Error 8):

5.1. Decoding the 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 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 Limit 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. Then retest the function of the antenna, if the axis still fails to drive correctly the defective motor has damaged the motor driver PCB. Replace the PCU assembly.
4. Verify if the brakes have released from the motors 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 been damaged and its operation should be verified with a replacement motor. If after replacing the motor the system is still not operational it's possible the antennas servo amplifier may be defective and will need to be replaced.

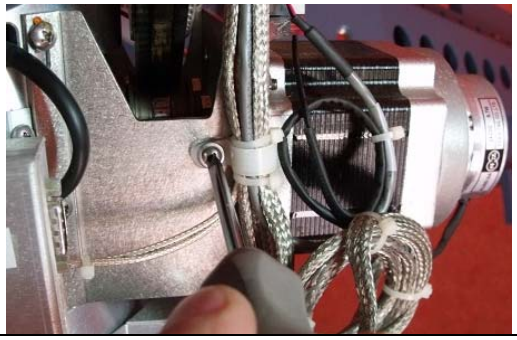
6. Replacing the Cross Level Motor:

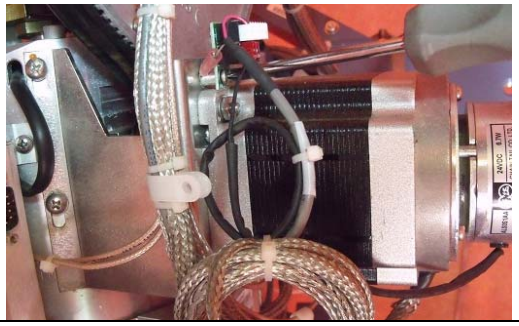
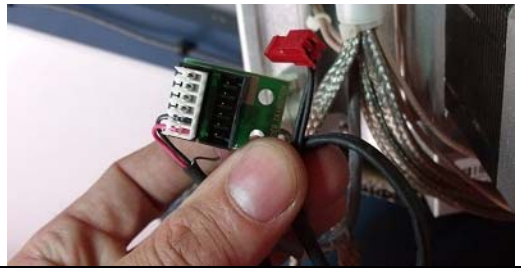
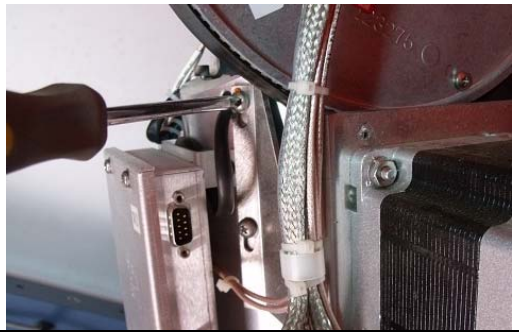
6.1. Tools.

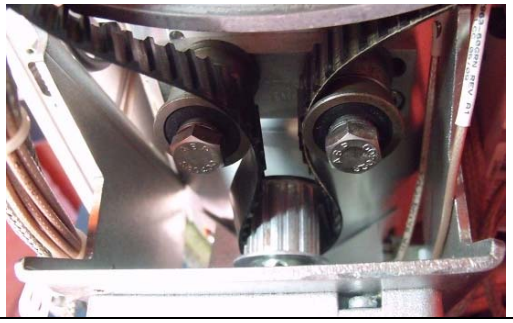
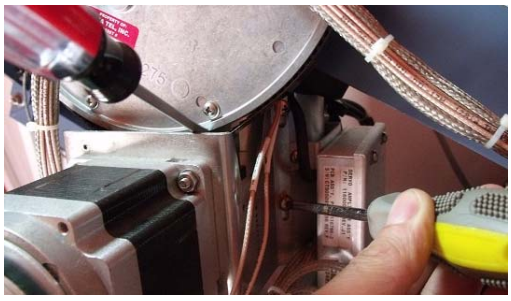
- 2mm Flat Blade (Terminal) Screwdriver
- Snips/Cutters
- #1 Phillips Screwdriver
- #2 Phillips Screwdriver
- Loctite 242
- Cable Ties/Tie Wraps

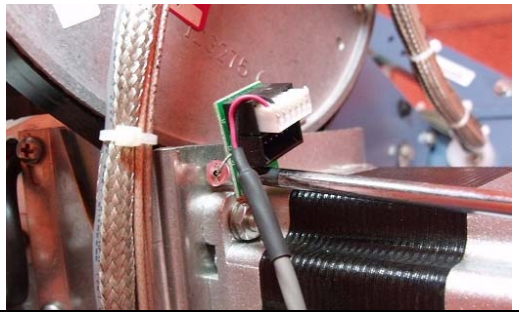
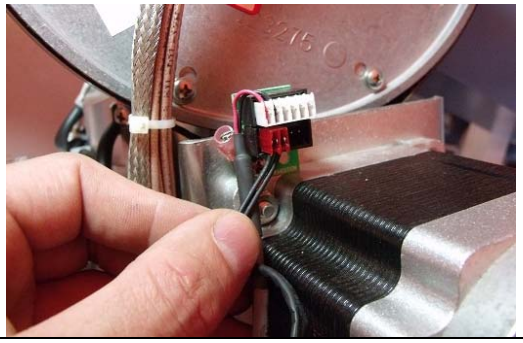
6.2. Procedure.

Procedure for replacing the cross level motor assembly on the XX97B, XX00B and XX07 series antennas, Sea Tel kit part number: 135551 (motor part number: 127901-1).

***CAUTION:** Power down the pedestal before following this procedure. 1. Using a 2mm flat blade screwdriver undo the harness D-sub connectors from the servo amplifier.	
2. Undo the screw securing the P-clip and motor harness to the cross level motor bracket.	
3. Remove the cable ties securing the motor harness.	

4. Using a #1 Phillips screwdriver undo the hardware securing the ground point for the brake harness	
5. Disconnect the IDC connector for the cross level motor brake from the termination block (leave the main harness connected). Take care not to lose the hardware.	
6. Cut the cable ties securing the cross level belt to the drive sprocket.	
7. Using a #2 Phillips screwdriver undo the four screws securing the cross level motor bracket to the canister. 8. Support the motor and slip the belt off the main sprocket to allow access to remove the motor assembly.	

9. Slot the replacement motor assembly into the belt and align the belt between the tensioners.	
10. Support the motor and pull the belt over the top of the cross level sprocket, then rotate the cross level axis from left to right and work the belt onto the main sprocket.	
11. Apply Loctite 242 to the four screws and loosely install the cross level motor assembly.	
12. Apply downward pressure on the motor assembly and tighten two of the screws. 13. Verify the belt tension. If the belt tension is correct tighten the remaining two screws, if not repeat until correct.	

14. Reinstall the termination PCB and ground point to the motor bracket.	
15. Reconnect the IDC connector from the motor to the termination PCB.	
16. Reinstall the harness D-sub connectors to the servo amplifier.	
17. Secure the excess harnesses with cable ties.