

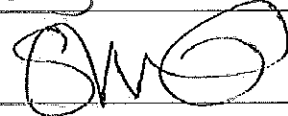


**Field Service Spares Replacement Procedure – EL Motor Kit, Braked
XX97B, XX00B & XX07**

Approval:

Approving Authority	Signature	Date
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Revision History

Rev.	ECO	Description of Change	Date
X1	8878	Initial release	08-18-2011
A	9059	Clerical revisions	10-30-2011

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Field Service Procedure - EL & CL Motor Kit, XX97B, XX00B & XX07

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 elevation motor is used for stabilization, during stabilization the motors drive 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). Elevation targeting and signal tracking decisions also require drive. 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.

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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 too early, or a physical problem such as the chain 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 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 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 / 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.

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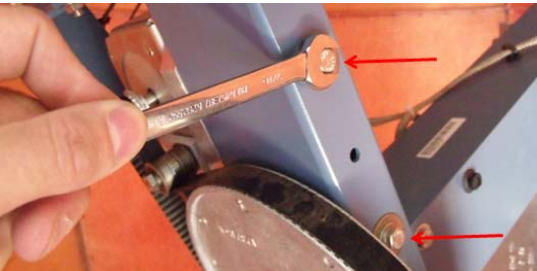
6. Replacing the Elevation Motor:

6.1. Tools.


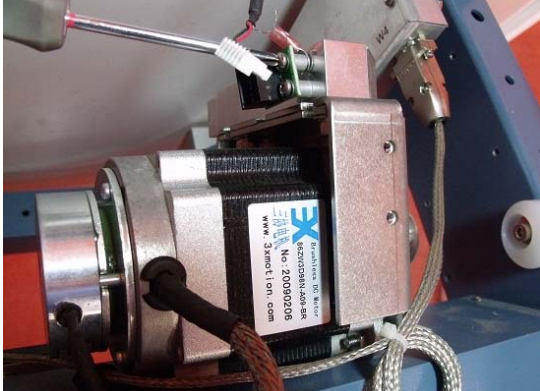


- 2mm Flat Blade (Terminal) Screwdriver
- Snips/Cutters
- 7/16" Wrench/Spanner or Socket
- #1 Phillips Screwdriver
- 9/64" Allen Wrench/Key
- 1/8" Allen Wrench/Key
- Large Long nose Pliers
- Loctite 242, 2760 and 638

6.2. Procedure.

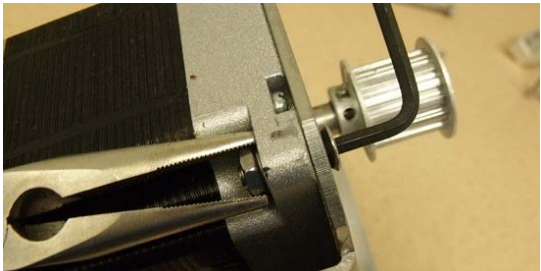

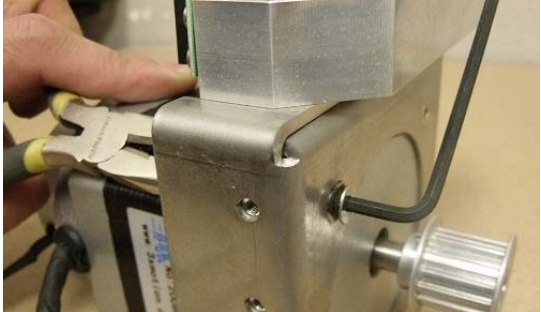


Procedure for replacing the elevation motor on the XX97B, XX007 & XX00B series antennas, Sea Tel kit part number: 134932 (motor part number: 125974-1).

<p>*CAUTION: Power down the pedestal before following this procedure.</p> <ol style="list-style-type: none">1. Raise the system to 90 degrees of elevation for easy access to the motor assembly.2. Undo the Elevation motor D-sub connector from the servo Amplifier using a 2mm flat blade screwdriver.	
<ol style="list-style-type: none">3. Snip the cable tie securing the motor harness & brake harness to the equipment frame.	
<ol style="list-style-type: none">4. Hold the weight of the motor and undo the two bolts securing the motor to the equipment frame using a 7/16" wrench (the upper nut is fixed in the assembly, take care not to drop the lower nut).	

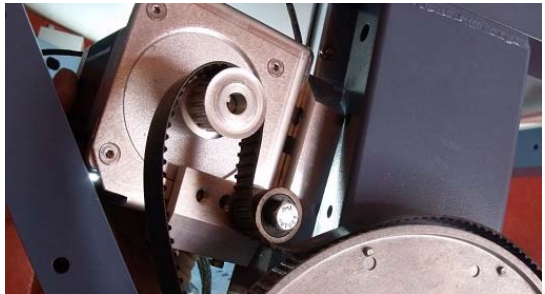
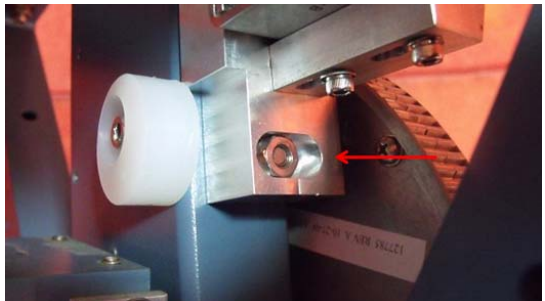
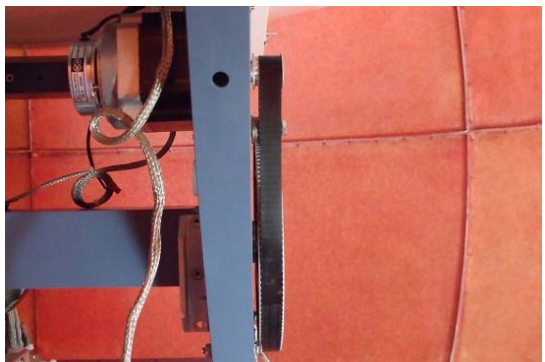
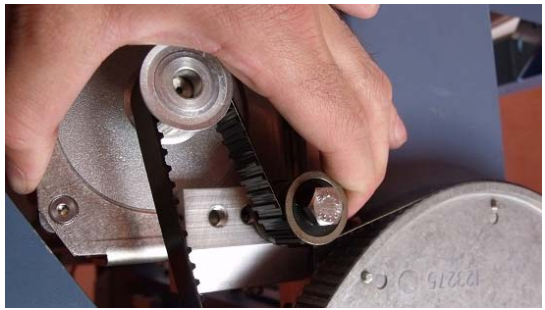
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<p>*Note: The ground and motor brake harness is still connected to the motor assembly at this point!</p> <p>5. Support the motor assembly & slip it out of the elevation belt.</p>	
<p>6. Rest the motor assembly on the cross level beam to allow access to the brake harness and ground connection, taking care not to stress the harness.</p> <p>7. Disconnect the IDC connector from the brake harness to the termination block.</p>	
<p>8. Loosen the lower screw using a #1 Phillips screwdriver & undo the top one to allow removal of the ground connection from the assembly.</p>	
<p>9. Using a 9/64" Allen wrench remove the two bolts securing the tensioning pulley to the motor assembly.</p>	



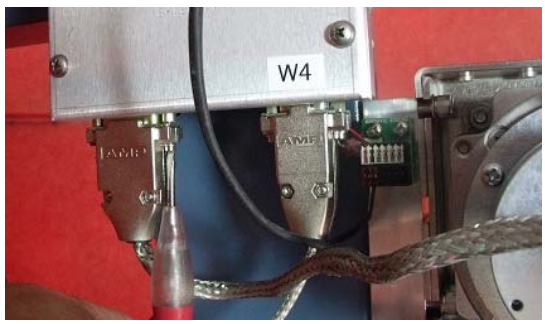

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<p>10. Now using a pair of large long nose pliers secure the nut holding the motor to the bracket & undo the four countersunk screws using a 1/8" Allen wrench.</p>	
<p>11. Apply Loctite 638 to the shaft of the motor and fit the pulley in place.</p> <p>12. Align the pulley in the same position as on the defective motor & secure the dowel pin with Loctite 638.</p> <p>*Note: For further information refer to the Loctite Procedure 121730 provided with this kit.</p>	
<p>13. Apply Loctite 242 to the threads of the four countersunk screws and secure the motor to the bracket using a larger pair of long nose pliers to secure the nuts.</p> <p>*Note: The orientation the harness exits in relation to the orientation of the bracket assembly (as shown on the right).</p>	
<p>14. Apply Loctite 242 to the screws securing the belt tensioning pulley assembly to the motor bracket. Do not fully tighten them at this time.</p>	
<p>15. Place the motor assembly on the cross level beam of the antenna and connect the brake harness IDC connector and ground point to the motor termination block.</p>	

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<p>16. Slot the motor assembly into place and engage the elevation drive belt around the motor pulley, tensioning wheel and main drive sprocket.</p> <p>*Note: The tensioning wheel can be adjusted for more clearance at this time.</p> <p>17. Apply Loctite 2760 to the threads of the upper bolt and install the motor assembly. Do not fully tighten at this time.</p>	
<p>18. Apply Loctite 2760 to the threads of the lower bolt and install it onto the nut removed earlier (as shown on the right). Do not fully tighten at this time.</p>	
<p>19. Verify the alignment of the motor pulley to make sure the motor pulley and main drive sprocket run parallel with each other.</p> <p>20. Then verify that the motor bracket is aligned correctly by using the equipment frame as a guide and measuring the distance from the upper and lower points of the motor bracket to verify the motor assembly is square on the equipment frame.</p>	
<p>21. Once the motor is aligned correctly apply pressure to the tensioning pulley and secure the tensioner assembly in place using a 9/64" Allen wrench.</p>	

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<p>22. Verify the tension of the belt and repeat the previous step if the belt tensioner isn't correctly adjusted.</p>	 A close-up photograph showing a person's hand adjusting a metal belt tensioner. The tensioner is connected to a black rubber belt. The background shows a blue metal frame and a silver motor housing with some markings.
<p>23. Reconnect the IDC connector from the brake to the termination block.</p>	 A close-up photograph showing a hand connecting a green IDC connector to a termination block. The block is labeled 'W4'. A silver motor housing is visible in the background.
<p>24. Reconnect the motor harness to the servo amplifier.</p>	 A close-up photograph showing a hand connecting a motor harness to a servo amplifier. The amplifier is labeled 'W4'. The harness is being plugged into a connector on the amplifier.
<p>25. Secure the excess motor and brake harness to the equipment frame using a cable tie.</p>	 A close-up photograph showing a hand using a white cable tie to secure a bundle of cables. The cables are attached to a blue metal frame. A 'W4' label is visible on the frame.