Field Service Spares Replacement Procedure – EL & CL Motor Kit, XX04 & XX06, EL Motor Kit, 6003A/6004

Approval:

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Revision History

Rev.	ECO	Description of Change	Date
A	8800	Initial release	08-12-2011
B	9041	Clerical revisions	10-18-2011

Field Service Procedure – Replacement EL & CL Motor Kit, XX04 & XX06, EL Motor Kit, 6003A/6004

1. Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the elevation or cross level motor on the XX04 and XX06 series antennas, or the elevation motor on the 6003A/6004 antennas.

2. Checklist:

- Verify Initialization
- Check Motor Drive
- Pedestal Error

3. Theory of Operation:

The elevation and cross level motors are 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 in elevation.

The BLDC motor is driven by a servo amp/motor controller. Hall sensors in the motor provide feedback to the controller so it can drive 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. Level cage drive 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 systems drive clockwise until the home flag and sensor make contact
    5. Limited azimuth systems drive clockwise into the end stop, then backs off to 630 degrees of relative

If any of these steps fail, or the DAC reports model "xx03/xx04", the PCUs No parameter needs calibrating. Verify that it saves correctly. A drive issue, pedestal error or error LED 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 & 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 mis-pointed 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 the there is a corrupt reading in the relative scale. This could be caused by the encoder failing, a limited azimuth antenna hitting its end stop under normal operation, an unlimited antenna 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 belt slipping on the motor pulley.

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 & 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 the motor is defective replace it & then retest the function of the antenna. If the axis still fails to drive correctly the defective motor may have damaged the motor driver PCB. Replace the PCU assembly.
4. 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.

5.4. Troubleshooting Pedestal Errors – Azimuth Reference Error.

1. Reinitialize the system & verify that the antenna drives clockwise to its end stop & backs of the 630 degrees if it's limited azimuth. Or if the system is unlimited azimuth verify that the antenna drives clockwise until the sensor comes into contact with the home flag. If not verify if the magnet/sensor is present or attempt to move the sensor closer to the magnet. Failing this 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 belt 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) & the 3 driver outputs on pins 1, 2 & 3 of the harness.
2. Now check continuity between pins 4, 5, 6, 7 & 8 & the ground (the motor connector back shell).
3. Also check between the individual pins 1, 2 & 3 & the rest of the pins (i.e. test pin 1 to pin 4, 5, 6, 7 & 8 & so on, not between pins 1 & 2, 1 & 3 or 2 & 3).
4. 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 motor driver PCB (inside the PCU) has been damaged & its operation should be verified with a replacement motor. If after replacing the motor the system is still not operational the antennas PCU maybe defective & should be replaced.

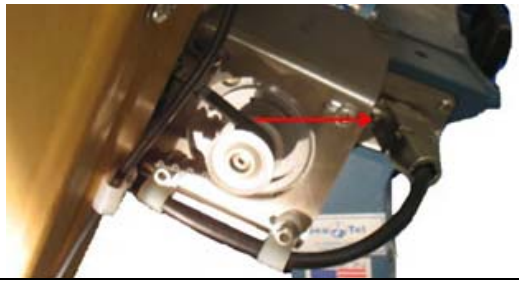
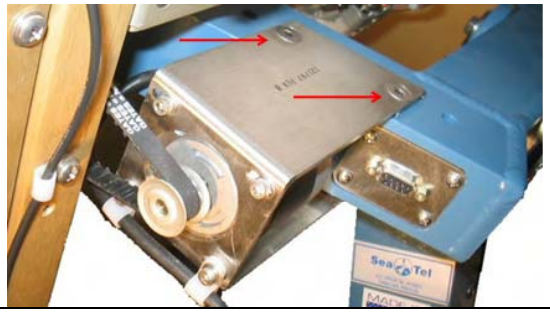
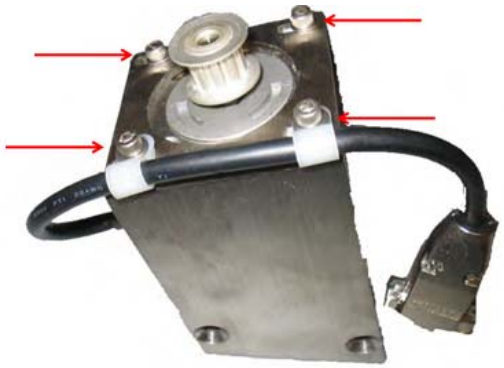
6. Replacing the Elevation Motor:

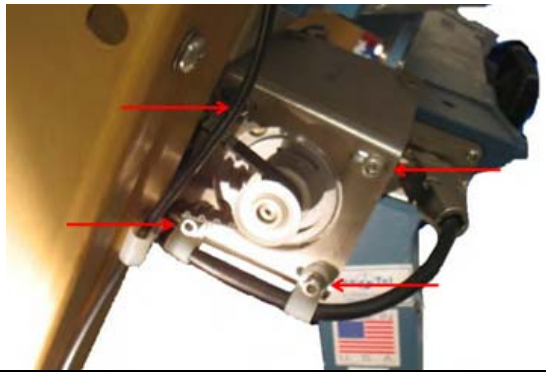
6.1. Tools.

- 2mm Flat Blade (Terminal) Screwdriver
- 5/32" Allen Wrench/Key
- 9/64" Allen Wrench/Key
- 1/16" Allen Wrench/Key
- Loctite 222, 242 and 638

6.2. Procedure.

Procedure for replacing the elevation motor, Sea Tel kit part number: 124110-2 (motor part number: 116139-3).

***CAUTION:** Power down the pedestal before following this procedure. 1. Using a 2mm flat blade screwdriver, loosen the two retaining screws on the EL motor harness and remove it from the CL beam.	
2. Using a 5/32" Allen wrench, remove the four Allen head screws attaching elevation motor bracket to CL beam and remove motor assembly.	
3. Observe the cable orientation and remove the motor from the bracket. Using a 9/64" Allen wrench, remove the four Allen head screws attaching the motor to the bracket. 4. Fit the pulley to the replacement motor shaft using Loctite 638 in the same position as the original motor to maintain alignment with the main sprocket. Secure the set screw with Loctite 222 and tighten with a 1/16" Allen wrench. ***Note:** For further information refer to the Loctite Procedure 121730 provided with this kit. 5. Install the replacement motor and cable onto the bracket (noting cable orientation). Install the hardware with Loctite 242, but do not tighten at this time.	

6. Re-install the bracket onto the CL beam using two of the Allen head screws, do not fully tighten. Place the belt around the elevation drive sprocket and then elevation motor pulley. 7. Install the other two Allen head screws and secure the motor bracket onto CL Beam using Loctite 242 on all four screws. 8. Increase the belt tension until the belt can only be easily twisted just ¼ turn with your fingers.	
9. Reconnect the EL motor harness and rotate the reflector to its upper physical stop to access the Elevation motor mounting hardware. Push back on the motor body to tension the elevation belt and tighten the four mounting screws. 10. Rotate reflector from the upper physical stop to the lower physical stop and verify that the motor sprocket and the belt do not rub against the elevation pan and that the belt runs in-line with both sprockets. (Failure of this step is normally due to incorrect sprocket placement on elevation motor assembly)	

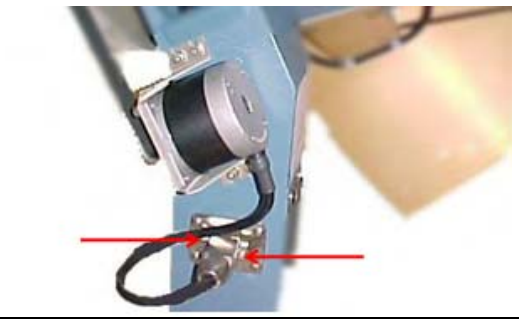
7. Replacing the Cross Level Motor:

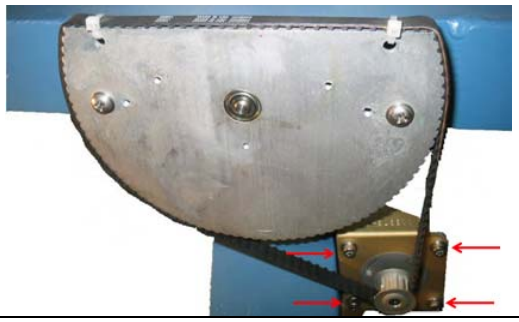
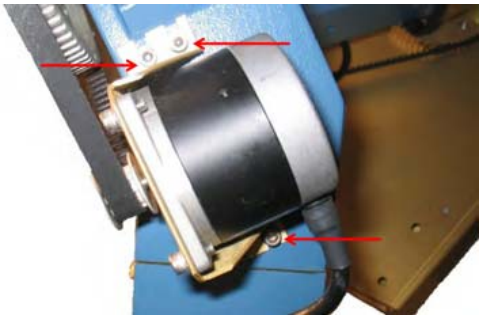
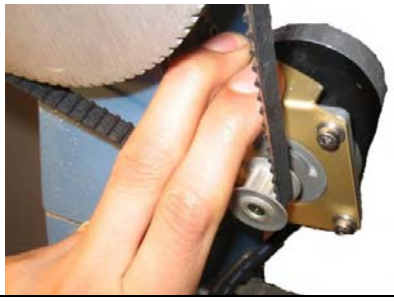
7.1. Tools.

- 2mm Flat Blade (Terminal) Screwdriver
- 9/64" Allen Wrench/Key
- Loctite 222, 242 and 638

7.2. Procedure.

Procedure for replacing the cross level motor, Sea Tel kit part number: 124110-2 (motor part number: 116139-3).

***CAUTION:** Power down the pedestal before following this procedure. 1. Using a 2mm flat blade screwdriver, loosen two retaining screws on the CL motor harness and remove it from the AZ post.	

2. Using a 9/64" Allen wrench, remove the four Allen head screws securing the CL motor to its bracket and remove it.	
3. Apply Loctite 638 to the shaft of the replacement motor and fit the pulley in the same position as the one on the defective motor. Fit the set screws into the pulley with Loctite 222 using a 1/16" Allen wrench. ***Note:** For further information refer to the Loctite Procedure 121730 provided with this kit. 4. Install the replacement motor assembly onto the CL motor bracket with Loctite 242. 5. Loosen the four Allen head screws securing the CL motor bracket to the AZ post, complete removal of the hardware is not required.	
6. Install the belt around the CL motor pulley and tension it by pulling the motor bracket down towards the antenna base and tighten the four screws. 7. Increase the belt tension until the belt can only be easily twisted just ¼ turn with your fingers.	
8. Rotate the CL beam from the CCW stop to the CW stop (Left to right) and verify the CL belt does not rub against the AZ post and runs in line with both sprockets. ***Note:** Failure of this step is normally due to incorrect sprocket placement on the CL motor shaft.