
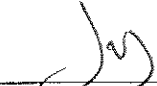
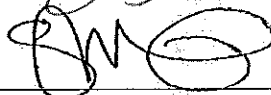


Field Service Spares Replacement Procedure – AZ Motor Kit, XX09

Approval:

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Revision History

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

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Field Service Procedure – Replacement AZ Motor Kit, XX09

1. Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the azimuth motor on the MK1 and MK2 XX09 antennas.

2. Checklist:

- Verify Initialization
- Verify MDE LED Status (MK2 Only)
- Pedestal Error
- Verify Encoder Feedback

3. Theory of Operation:

The azimuth motor is used for azimuth stabilization, satellite targeting and signal tracking decisions requiring drive in azimuth. During stabilization, the azimuth motor drives only in response to motion of the stabilized mass of the antenna in 3-dimensional free space (as sensed by the azimuth rate sensor located on the motion platform PCB inside the in the PCU). The PCU receives azimuth drive commands and ships heading input from the DAC.

The BLDC motor does not have brushes, therefore, it must be 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.

A high output digital encoder is integrated into the top of the azimuth motor to provide the relative position into the PCUs azimuth control loop. During initialization the relative position will be calibrated when the sensor comes into contact with the home flag. The PCU receives relative drive commands from changes in heading which are fed into the DAC from the vessels gyro compass.

4. Verify Initialization:

- Power cycle the pedestal
 1. 24VDC is supplied to the motors brakes to release them, then 12VDC holds them open
 2. Elevation axis drives to 45 degrees based on the PCU's horizon reference
 3. Cross level axis drives to level based on the PCU's horizon reference
 4. Unlimited azimuth axis will drive clockwise until the home flag and 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 any of these steps fail, or the DAC reports model "xx09", the PCUs No parameter needs calibrating and verifying that it saves correctly. A drive issue, pedestal error or error LED requires further troubleshooting.

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5. MDE Status LEDs (MK2 Only):

5.1. MDE Motor Status LEDs.

Green	Motor is good.
Solid Red	Motor or harness short circuit (winding-winding, winding-ground, or winding to supply). Replace the appropriate motor. If that does not clear the LED status, replace the MDE.
Solid Orange	Hall sensor error (hall sensor or harness wire). Replace the motor. If that does not clear the LED status, replace the MDE.

5.2. MDE Status LED.

Green	Motor Driver is good.
Solid Red	Motor Driver fault detection. Operational software will never leave the status LED solid red. Replace MDE.
Solid Orange	Software update to the MDE in process.
Blinking Red	Communication error with PCU. Check to assure that the harness connections are seated properly. Check harness (pin-pin, wire-wire and wire-ground) for good continuity. Replace MDE. Replace Main PCB.

6. Pedestal Error (Error 8):

6.1. 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	

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6.2. 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 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 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 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 and motor gain parameters (N₁ = CL, N₂ = EL and N₃ = AZ) are correctly configured in the PCU
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 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.

6.4. 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 there is 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 slipping on the motor pulley or the pulley slipping on the motor shaft.

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6.5. 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 (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. Verify Encoder Feedback:

During initialization the sensor and home flag will come into contact (typically when the antenna is facing the bow of the ship) at which point the relative position will be calibrated. Changes in relative should be equal to the amount of drive from the pedestal. Drive the azimuth axis of the antenna in 90 degree increments and verify that the pedestal and relative position on the DAC move the correct amount.

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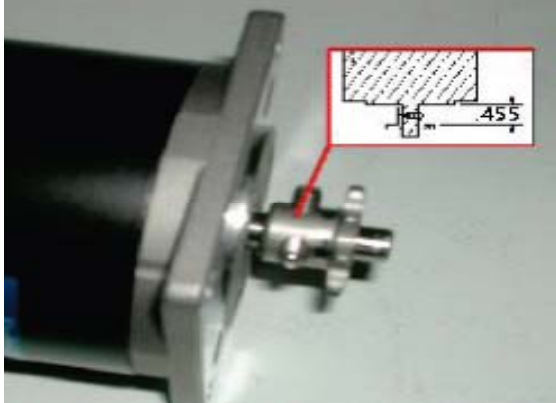


8. Replacing the Azimuth Motor:

8.1. Tools.






- 2mm Flat Blade (Terminal) Screwdriver
- Snips/Cutters
- 3mm Allen Wrench/Key
- 1/16" Allen Wrench/Key
- Loctite 222, 242 and 638

8.2. Procedure.

Procedure for replacing the XX09 azimuth motor, Sea Tel kit part number: 134938 (motor part number: 121951-3).

<p>*CAUTION: Power down the pedestal before following this procedure.</p> <ol style="list-style-type: none">1. Apply Loctite 638 to the internal hub of sprocket and place onto motor shaft spaced .455" from the motor case as shown in the graphic to the right. Or compare the position to the defective motor.2. Apply Loctite 222 onto the set screws and secure sprocket to motor shaft using a 1/16" Allen wrench. <p>*Note: For further information refer to the Loctite Procedure 121730 provided with this kit.</p>	
<ol style="list-style-type: none">3. Using a small flat blade screwdriver remove the azimuth motor cable from the MDE.	
<ol style="list-style-type: none">4. Using snips, carefully cut the tie wraps that secure the azimuth motor cable to the home sensor interface cable and the MDE.	

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<p>5. Remove one side of the spring tensioner.</p>	
<p>6. Using a 3mm Allen wrench, remove the hardware that secures the azimuth Motor to its mounting bracket. Retain hardware for future use.</p> <p>7. Remove the motor and set aside.</p>	
<p>8. Using the hardware removed earlier, install and secure the replacement azimuth motor to its bracket. Do not forget to apply Loctite 242 to hardware.</p>	
<p>9. Wrap the other side of the chain to the azimuth drive pulley.</p>	
<p>10. By hand rotate the antenna in azimuth to fully engage chain to the main drive pulley.</p>	
<p>11. Re-connect the spring tensioner with the tensioner sprocket and fully engage it with the chain.</p> <p>12. With the chain drive fully engaged, drive the antenna in azimuth while checking/feeling for any physical obstructions.</p> <p>13. Install and secure the motor cable to the MDE.</p>	