Field Service Spares Replacement Procedure - Pol Motor Kit, USAT

Approval:

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Revision History

Rev.	ECO	Description of Change	Date
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1.   Brief Summary:

Troubleshooting document for diagnosing a fault with and replacing the pol motor on the USAT series antennas.

2.   Checklist:

- Pedestal Error
- Verify Motor Drive
- Drive the Pol
- Measure Motor Voltage

3.   Theory of Operation:

Based on the vessels GPS position and the desired satellite the pol motor will drive the feed assembly to align it in the correct reception position for the linear satellite signal, then as the vessel sails and the GPS position changes the pol motor will be driven to maintain the correct reception position as the look angle the satellite changes.

Under dynamic conditions feedback from the sensors are fed into the PCU where the amount of voltage change overtime is calculated into the amount of physical movement being exerted on the system and in turn the PCU will drive the elevation and azimuth axis's to counteract this motion. While the elevation and azimuth axis's are driven the feed will also need to be driven to maintain the correct look angle to the satellite and retain good cross pol isolation. For added stability a fourth rate sensor is installed on the feed assembly of the USAT to monitor the stabilization of the feed assembly, offering the performance of a 3 axis pedestal.

4.   Verify the Range of Motion:

Note: Do not try to drive the polarity of the antenna using the pol window of the DAC, remote commands must be used. Also no update on the pol value will be displayed on the DAC when the pot is rotated; it works solely from drive commands entered into the remote command screen.

First verify the settings in the DAC are correct, the pol scale should be set to 0090 to give the feed 180 degrees of motion. The default pol offset setting for a USAT antenna is 0030 (however this may have been modified slightly to "trim" the pol angle). Turn tracking off (if applicable) and drive the elevation to 0 degrees to make it easier to view the feed assembly for diagnostic purposes.

Set the pol type setting in the setup menu of the DAC to "0009" to set the system into manual pol mode.

Now enter the remote command window (in the setup menu) and input the command "g0020" to drive the feed assembly to its lower limit. The LNB should be vertical, to the left of the OMT with the coax cable pointing downwards.

Now drive the feed to its upper limit by inputting "g0210" into the remote command screen of the DAC. The LNB should be vertical to the right of the OMT with the coax cable pointing upwards.

If no drive is issued verify if the motor is receiving voltage as per section 8 of this document. If the feed doesn't have the correct 180 degrees on motion for the targeted commands this is an indication that the pot is outputting an incorrect value.

5. Verify Pot Range:

If no feed drive is present verify the pol reading on the DAC isn't out of range (i.e. displaying a value of either 0 or 255). If one of these values are displayed it's possible the pot isn't aligned correctly and that adjusting it may bring within its range. Back the pot off from the main gear sprocket and rotate its pulley, then reinstall it and re-enter one of the pol drive commands into the remote command screen of the DAC.

Re-enter one of the drive commands into the remote command screen of the DAC, if the feed assembly still fails to move and the pol count doesn't change then the pot has failed and is outputting a default value. No drive will be issued to the pol motor as the value is out of the range which the system operates in, therefore the pol pot must be replaced.

6. Pedestal Error (Error 8):

6.1. Decoding a Pedestal Error.

Note: A "CL" error on the USAT series antennas relates to the pol axis.

When the DAC displays a pedestal error enter into the remote command window and input "S0000" 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		

6.2.   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 while the antenna is trying to maintain its pointing angle, or while 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 and 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.

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 N0 & 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 and 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 and 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.

6.4.   Troubleshooting Pedestal Errors – Azimuth Reference Error.

1. Reinitialize the system and verify that the USAT 24 antenna drives clockwise to its end stop or the USAT 30 drives counter clockwise to its end stop.

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 belt slipping on the motor pulley or the pulley slipping on the motor shaft.

7.   Test the Pol Motor Drive:

Pol motor drive can be verified by introducing an error into the system which the pol motor will have to counteract. Remove the radome top and unbolt the pedestal from its mounting point, now if you rock the antenna from side to side the pol motor will drive the feed assembly to counteract the motion being exerted on the system.

If it is suspected there is a dead spot in the motor power down the system and gently rotate the axis by moving the belt backwards and forwards. This in turn will rotate the motor pulley and shaft and it should be apparent if there is a dead spot as the rotation will feel taught at that position.

 Caution: Be extremely careful rotating the pedestal around while your fingers are in this area to prevent pinching or crushing your fingers in the pedestal assembly.

8.   Measure the Motor Voltage:

If no drive is present verify if the pol motor is receiving the 24VDC from the PCU. Power down the pedestal by switching off the DAC then disconnect the reflector harness from the pol motor connector and re initialize the pedestal (a pedestal error will be displayed as the pol axis can't initialize).

Once initialized you should be able to measure 24VDC should be present between pin 3 and ground (pin 5 or the harness back shell) and pin 8 and ground (pin 5 or the harness back shell). If the voltage is present and the motor isn't driving the motor is defective and needs to be replaced, if the voltage is not present then the PCU isn't outputting the voltage and is defective.

9.   Procedure for Replacing the Pol Motor:

9.1.   Tools.

- #1 Phillips Screwdriver
- 7/64" Allen Wrench/Key
- 5/16" Allen Wrench/Key
- 3/16" Wrench/Spanner
- Long-Nose Pliers
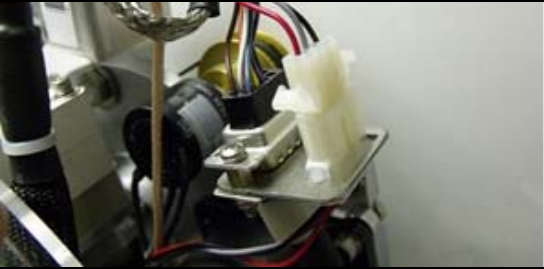- Loctite 222, 242, and 638

9.2.   Procedure.

Procedure for replacing the pol motor on the USAT series antennas, Sea Tel kit part number: 125266-1 (motor part number: 124700).

Caution: Power down the pedestal before following this procedure. 1. Using a #1 Phillips screwdriver remove the two screws securing the pol harness into the 9-pin connector. Save the hardware for future use.	
2. Disconnect the pol pot connector and remove it from the mounting bracket.	
3. Using a 7/64" Allen wrench remove the screw securing the harness connector to the polang plate. Save the hardware for future use.	
4. Using a 5/16" Allen wrench remove the 3 sets of hardware securing the pol motor assembly to the polang plate. Save the hardware for future use. 5. Remove the defective pol motor assembly.	

6. Using a pair of 3/16" wrenches remove the standoffs securing the bracket to the defective pol motors D-sub connector.	
7. Install the pulley on the replacement motor in the same position as on the defective pot assembly. Apply Loctite 638 to the motor shaft and secure the set screw with Loctite 222 using a 1/16" Allen wrench. *Note:* For further information refer to the Loctite Procedure 121730 provided with this kit.	
8. Install the bracket to the replacement motor assembly using the hardware removed in step 6. *Note:* The orientation of the connector in relation to the bracket.	
9. Locate the pulley into the belt and install the motor assembly to the feed using the hardware removed in step 4.n Align the motor with harness exiting downwards, apply Loctite 242 to the threads, do not fully tighten at this time.	
10. Apply downward pressure to the motor to tension the belt and tighten 2 of the retaining screws.	

11. Verify the tension of the belt by pressing on it at the central position between the motor pulley and the main drive sprocket. There should be a little give, but the belt should be tight enough that the axis will drive correctly, without skipping on the teeth of the pulley. If the belt is too tight/loose repeat the previous step until the belt tension is correct and tighten all three of the screws.	
12. Install the pol motor bracket to the feed using the hardware removed in step 3. Apply Loctite 242 to the thread. *Note:* Angle the bracket away from the connector to allow sufficient clearance to connect the	
13. Connect the reflector harness D-sub connector to the motor connection using the hardware removed in step 1.	
14. Insert the pol pot connector into the bracket and connect the reflector harness connection.	
15. Secure the pol motor harness to the body of the motor using a cable tie.	

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