

APPENDIX B - MOUNT SPECIFIC DATA

For

6 meter SPAWAR

This appendix describes RC3000 operations unique for the 6 meter SPAWAR mount. Differences between this version and the operation described in the "baseline" RC3000 manual are noted on a paragraph by paragraph basis.

1.1 Manual Organization

This appendix is provided as a supplement to the baseline RC3000 manual. The corresponding paragraphs in the baseline RC3000 manual are referred to when data specific to the SPAWAR mount are described.

1.2 RC3000 Features

All basic features of the RC3000 are utilized to provide the operations for the SPAWAR mount. Some features have been modified (as described below) to customize operations for this antenna.

Hardware Configuration. A RC3000A version of hardware is utilized for this mount.

Software Configuration. The mount model will be designated as **LS**. Software will be designated as RC3K-LS-xxx.

1.3.2 System Interface Requirements

The SPAWAR interface differs from baseline RC3000 interface requirements as follows:

- 1) an elevation potentiometer instead of an electronic inclinometer provides angle feedback
- 2) Cross-Elevation (X-EL) axis drive and position sensing replaces normal azimuth axis
- 3) high resolution pulse sensors are present on the X-EL and elevation axis to support inclined orbit tracking
- 4) X-EL Left and Right limits implemented via discrete limit switches
- 5) No azimuth (X-EL) or Elevation stow limit switches implemented
- 6) A master antenna disable discrete input is present
- 7) A transmit disable interlock input is present

1.3.3 Operational Overview

The baseline RC3000 modes are modified to accommodate the operational scenario for the SPAWAR mount. The following provides an overview of the intended operational sequence. Detailed description of the each mode will be provided in section 3.

POWER UP. After the RC3000 is powered up, the controller enters MENU mode. The MENU selections for the SPAWAR mount are shown below:

```
1-SATELLITE  2-MOVETO  3-SEARCH      MENU
4-STORE      5-RECALL  6-DELETE
7-LAT/LON    8-SETTINGS      UTC
<0-9>SELECT <MODE>MANUAL      14:37:23
```

NOTE: If (at power up) the RC3000 determines that track data has been STOREd, a prompt will appear asking the user to confirm that the stored data is to be retained.

SATELLITE. This mode provides pointing data to the selected satellite as an aid in initially positioning the mount.

```
POS:   39°01N  94°49W      SATELLITE
SAT:TELSTAR 4   89.0W      MAG: 167.2
1-MANUAL 2-PRESET 3-SATLIST  EL:  44.4
<1-3>SELECT SAT SOURCE H:  82.9 V:  -7.1
```

SATELLITE mode determines the magnetic heading and elevation (RF look angle) required given the current latitude and longitude of the mount. Latitude and longitude may be entered manually via the LAT/LON mode. SATELLITE mode also determines nominal horizontal and vertical (H/V) polarization angles as an aid in orienting the polarization axis.

While the satellite pointing solution may be obtained from other sources (operational orders, other software programs, etc.), it is required that a satellite's name be selected via the SATELLITE mode. This selected satellite name will be used by subsequent STORE functions.

MOVETO. MOVETO mode provides the ability to automatically move the mount (in X-EL and EL) to a selected target position.

```
X-EL: -13.4 ( -13.4)      MOVETO
ELEV:  41.5 (  41.5)
                                SPEED:FAST
<1>AZ <2>EL <3>SPEED <4>START MOVE
```

SEARCH. As an aid in finding an inclined orbit satellite, SEARCH mode performs a flat spiral search pattern.

```
AZIM:10456      SS1:375  SEARCH
ELEV:17429

SPIRAL SEARCH(CCW 12)      <STOP>HALT
```

MANUAL. In MANUAL mode the mount may be manually jogged in the X-EL, elevation and polarization axis in order to peak up on the satellite. The relative signal strength indication (SS2:) will provide an aid in positioning the mount on the satellite.

At this time the user should make a positive identification of the satellite.

```
X-EL: 20.9 RIGHT SS2: 50 MANUAL
ELEV: 0.2 DOWN
POL: -89.9 CCW SPD:FAST SF TX UTC
<0-9>JOG ANTENNA <MODE>MENU 14:39:01
```

STORE. After verifying the antenna is precisely on the intended satellite, the user may STORE the mount's azimuth and elevation angles for subsequent RECALLs.

If the satellite has been defined as having an inclined orbit, the TRACK mode will be automatically entered.

```
X-EL: 155.9 750 SS2:735(Ku) TRACK
ELEV: 42.0 750 SAT:BRASIL A1
STEP:PEAKING SIG
JOGGING ANTENNA TO FIND MAXIMUM SIGNAL
```

LAT/LON. This mode is provided to allow the user to manually enter the mount's latitude and longitude for use by the SATELLITE mode. When a new latitude and longitude are entered, the local magnetic variation is recalculated.

1.3.7 Drive System

Position Sensing and Limits. Discrete Left and Right X-EL limit switches are provided.

Jam and Runaway Sensing. Jammed and runaway sensing is based on pulse counts.

2.0 INSTALLATION

2.1 Equipment Mounting

No electronic inclinometer, fluxgate compass or GPS receiver are present.

2.2 Electrical Connections

Electrical connections between the RC3000 and the SF mount are made via an adapter panel and a cable assembly. Schematics for the panel and cable are shown in section 4.2.

The following subparagraphs describe any unique items with respect to the SF system.

2.2.1 Power Entry. A RC3000A model configured for 115 VAC power is used.

2.2.2 Motor Drive. The azimuth motor drive lines will be used to drive the X-EL axis.

2.2.3 Drive Sense. The X-EL position potentiometer are input to the azimuth position inputs. Instead of an electronic inclinometer a position potentiometer is used for the elevation axis.

2.2.4 Limit Switches. The input normally used for Elevation Stow will be used for the Elevation Up limit switch. The input normally used for Elevation Up will be used for the X-EL Left limit switch. The input normally used for Azimuth Stow will be used for the X-EL Right limit switch. These assignments are reflected on the cabling schematic in section 4.2.

2.2.5 Signal Strength. Connect any signal strength inputs as shown in this section of the baseline manual.

2.2.6 Navigation Sensors. No GPS receiver and Fluxgate Compass are present.

2.2.7 Accessories. Outputs from this connector are available as described in the baseline manual.

2.2.8 RF Autopeak. This input is available but it is intended to only use the signal strength indication from the tracking receivers.

2.2.9 Hand Held Remote. This option is available.

2.2.10 Pulse Sensors. The X-EL (azimuth) and elevation pulse sensors are wired as shown in the baseline manual.

The input normally used for Azimuth Quadrature pulse will be used for the transmit interlock signal. This modification is shown on the cabling schematic in section 4.2.

2.2.11 PC Remote Control. The remote control interface is wired as shown in the baseline manual.

2.2.12 Waveguide Switch. The optional waveguide switch module is not provided.

2.3 Initial Configuration

Calibration of the SPAWAR mount is very similar to that described in the baseline manual. Unique Items are described in the following subsections.

2.3.1 Software Initialization. Per baseline manual.

2.3.2 Elevation Calibration.

Elevation Reference Position. Elevation reference voltage should be set when the RF look angle equals 45.0 degrees.

2.3.3 Azimuth Calibration. Perform X-EL calibration per the baseline manual description of azimuth calibration.

2.3.4 Polarization Calibration. Per baseline manual.

2.3.5 Fast/Slow Motor Speed. Per baseline manual.

2.3.6 Pulse Sensor Checkout

NOTE: The X-EL and EL pulse counts will be reset to mid-range (32768) whenever a SEARCH or TRACK function is initiated and no satellite data is currently STOREd. Due to this dynamic resetting of pulse counts, the X-EL and EL pulse limits should be left at their extreme values.

2.3.7 Drive System Checkout. Per baseline manual

2.3.8 Navigation Sensor Communication. Not Applicable.

2.4 Final Calibration

2.4.1 Compass Calibration. Not Applicable.

2.4.2 Azimuth and Elevation Alignment. Per baseline manual

2.4.3 Signal Strength Adjustment. Calibrate the signal strength input with the tracking receiver's output.

2.4.4 Pulse Scale Factors .

The X-EL and EL pulse scale factors should be characterized.

3.0 Detailed Operation

3.1.1 Modes

While the basic functionality of the RC3000 is as described in the baseline manual, several modes are customized and several modes are unique for operation with the SPAWAR version mount.

3.2.1 Manual Mode

MANUAL mode will display X-EL position in the area where azimuth is normally displayed. The AZ CCW (4) key will initiate left X-EL movement and the AZ CW (6) key will initiate right X-EL movement.

X-EL: 141.1	SS2:579	MANUAL
ELEV: -67.5		
POL: -77.8 CCW	SPD:FAST	SF TX UTC
<0-9>JOG ANTENNA	<MODE>MENU	14:25:47

X-EL: 10553

ELEV: 17837

When the Scroll Up/Yes key is pressed in MANUAL mode, the data toggles between X-EL and elevation angles to display the current pulse counts for the X-EL and elevation axis.

SF TX

These fields display the state of the antenna safety (SF) and transmit disable (TX) inputs.

SF is displayed when the neither the antenna safety button nor the handcrank interlock switch have deactivated antenna movement. When either of these conditions is present, the ANT SF alarm is flashed as described in section 3.4.

TX is displayed when the transmit disable circuitry of the junction box allows transmission. When transmit disable is disabled the TX INTRLK alarm is flashed as described in section 3.4.

3.2.2 Menu Mode

MENU mode provides a customized selection of functions. As described in the baseline manual, pressing the Mode key will move to MANUAL mode.

1-SATELLITE	2-MOVETO	3-SEARCH	MENU
4-STORE	5-RECALL	6-DELETE	
7-LAT/LON	8-SETTINGS		UTC
<0-9>SELECT	<MODE>MANUAL		14:37:23

The following subparagraphs describe how the various modes are customized for the operation of the SPAWAR mount.

3.2.2.1 DEPLOY

3.2.2.2 STOW

The STOW and DEPLOY modes described in the baseline manual are intended for use by vehicle mounted antennas. For the SPAWAR mount, STOW and DEPLOY have been replaced by the MOVETO mode.

MOVETO mode operates in the same manner as the AZEL mode described in section 3.3.2.8 of the baseline manual.

3.2.2.3 LOCATE

A modified version of the LOCATE mode described in the baseline manual is provided for the SPAWAR mount. Unique characteristics of the SATELLITE mode are described next.

SATELLITE

SATELLITE mode determines a pointing solution (magnetic heading and elevation look angle) to the selected satellite given the present latitude and longitude.

POS: 39°01N 94°49W	CALCULATE
SAT: TELSTAR 4 89.0W	MAG: 167.2
1-MANUAL 2-PRESET 3-SATLIST	EL: 44.4
<1-3>SELECT SAT SOURCE	H: 82.9 V: -7.1

The user may also manually insert a latitude and longitude via the LAT/LON mode described later.

LAT/LON mode will determine the magnetic variation for the given latitude, longitude and date. The azimuth part of the pointing solution will be displayed as a magnetic heading (MAG:) since SATELLITE is intended to be used as an aid in initially positioning the mount.

SATELLITE mode displays nominal horizontal (H) and vertical (V) polarization angles. Section 1.3.8 of baseline manual should be reviewed for definition of the sign convention for polarization used by the RC3000.

Search

SEARCH mode is provided as an automatic way to search for an inclined orbit satellite. SEARCH mode functions as described in section 3.2.2.4 “Spiral Search Autopeak” of the baseline manual. For the SPAWAR mount, SEARCH mode will implement a “flat” spiral search. When SEARCH is initiated, the mount will first move to the Left edge of the search pattern in order to implement a flat search pattern.

3.2.2.4 STORE

3.2.2.5 RECALL

3.2.2.6 DELETE

STORE, RECALL and DELETE modes function as described in the baseline manual.

3.2.2.7 POSITION

Only the LAT/LON section of the baseline POSITION mode is made available. LAT/LON mode is described in section 3.2.2.7.1 of the baseline manual.

LAT/LON is intended to be used to supply latitude and longitude to the SATELLITE mode.

NOTE: Since the SPAWAR mount is effectively a fixed-based (non-mobile) mount, the “heading” of the antenna will be fixed at 0.0 degrees true heading. Fixing the “heading” at 0.0 true allows the SATELLITE mode calculations to display the magnetic heading to the selected satellite. The magnetic variation calculated by the LAT/LON mode will be used in determining the magnetic heading to the satellite.

3.2.2.8 SETTINGS

The SETTINGS mode allows the user to 1) select the signal source for tracking, 2) turn on and off the expert access mode and 3) reset any drive errors.

SETTINGS mode is described in section 3.2.2.8 of the baseline manual.

3.2.2.9 TRACK

3.2.2.10 REMOTE

TRACK and REMOTE modes perform as described in the baseline manual.

3.3 Programming Group

All programming group modes described in the baseline manual are provided. Again note that configuration items described for the azimuth axis pertain to the X-EL axis of the SPAWAR mount.

3.3.1.2 Reset Defaults

The following table supplies the default configuration item values for this mount. Space has also been provided to record installation specific changes to the configuration items. Note: recording of installation specific changes to defaults may prove valuable when trying to restore system configuration.

CONFIGURATION ITEM	LS	COMMENTS	INSTALL VALUE
SYSTEM DEFINITION			
GPS_present	0		
Compass_present	0		
Initial_mode	2		
antenna_size_cm	492		
Waveguide_present	0		
ELEVATION CALIBRATION			
Zero Voltage	2.50	Set during calibration	
Elev_offset	0.0		
Up_elev_limit	90		
Down_elev_limit	0		
Elevation_Scale_Factor	55.55	Set during calibration	
Elevation_look_configuration	10	will disable HG,TX alarms	
AZIMUTH CALIBRATION			
USE FOR X-EL			
Zero Voltage	2.50		
Azim_offset	0.0		
ccw_azim_limit	0	Do not change	
Cw_azim_limit	360	Do not change	
Azim_Scale_Factor	8.33		
POLARIZATION CALIBRATION			
Zero Voltage	2.50	Set during calibration	
Polarization_Offset	0.0		
CW Polarization Limit	90.0		
CCW Polarization Limit	90.0		
Pol_Scale_Factor	31.11	Set during calibration	
Polarization_type	2		
H/V_Reference	1		
Default Horizontal Position	-45.0		
Default Vertical Position	45.0		
Pol_Automove_Enable	1		
SIGNAL PARAMETERS			
Channel 1 Polarity	1		
Channel 1 Threshold	100		
Channel 1 Delay	0.1		
Channel 1 Lock Type	0		
Channel 2 Polarity	1		
Channel 2 Threshold	100		
Channel 2 Delay	0.1		
Channel 2 Lock Type	0		
AUTOPEAK			
Autopeak Enabled	0		
Signal Source	3	3=SS2	
RF Band	1	1=Ku	
Spiral Search AZ Limit	3		
Spiral Search EL Limit	3		
Spiral Signal Threshold	200		
Scan Range Limit	8		
Scan Signal Threshold	200		

CONFIGURATION ITEM	LS	COMMENTS	INSTALL VALUE
AZIMUTH POT DRIVE			
USE FOR X-EL			
Fast/Slow Threshold	2.5		
Maximum Position Error	0.20		
Coast Threshold	0.1		
Maximum Retry Count	3		
AZIMUTH PULSE DRIVE			
USE FOR X-EL			
Pulse Scale Factor	31400	Set during calibration	
CW Pulse Limit	65535	Do Not Change	
CCW Pulse Limit	0	Do Not Change	
Fast/Slow Threshold	50		
Maximum Position Error	0		
Coast Threshold	3		
Maximum Retry Count	3		
AZIM DRIVE MONITORING			
USE FOR X-EL			
Jam Slop	1		
Runaway Slop	200		
Fast Deadband	1000		
Slow Deadband	500		
ELEV POT DRIVE			
Fast/Slow Threshold	3.0		
Maximum Position Error	0.2		
Coast Threshold	0.4		
Maximum Retry Count	3		
ELEV PULSE DRIVE			
Pulse Scale Factor	23645	Set during calibration	
UP Pulse Limit	65535	Do Not Change	
Down Pulse Limit	0	Do Not Change	
Fast/Slow Threshold	50		
Maximum Position Error	0		
Coast Threshold	3		
Maximum Retry Count	3		
ELEV DRIVE MONITORING			
Jam Slop	1		
Runaway Slop	200		
Fast Deadband	1000		
Slow Deadband	500		
POL POT DRIVE			
Fast/Slow Threshold	2.0		
Maximum Position Error	0.5		
Coast Threshold	0.3		
Maximum Retry Count	3		
POL DRIVE MONITORING			
Jam Slop	1		
Runaway Slop	200		
Fast Deadband	1000		
Slow Deadband	500		

CONFIGURATION ITEM	VC	COMMENTS	INSTALL VALUE
TRACK			
Search Enable	0		
Max Track Error	3		
Search Width	4		
Peakup Holdoff Time	120		
Track Signal Source	2	2=SS1	
Signal Sample Time	2		
REMOTE CONTROL			
Remote Enabled	1		
Bus Address	50		
Baud Rate	6		
Jog	20		
STOW / DEPLOY			
AZ STOW	0.0		
EL STOW	-67.5		
PL STOW	0.0		
AZ DEPLOY	0.0		
EL DEPLOY	20.0		
PL DEPLOY	0.0		
PL ENABLED	1		

3.4 Alarm Displays

In addition to the alarms described in the baseline manual, the following two unique alarms are provided for the SPAWAR mount.

ANT SF INTRLK

The antenna safety interlock input is activated by either the antenna safety button being pushed or by the handcrank stow interlock. When either of these conditions exist, the "ANT SF INTRLK" alarm message will be displayed.

When this alarm condition is active, all elevation, X-EL and polarization movement will be disabled and the HPA disable relay will be activated.

TX INTRLK

The transmit interlock input is activated by the "J BOX". When this condition is active, the "TX INTRLK" alarm message will be displayed.

When this alarm condition is active, the HPA disable relay will be activated.

4.2 Schematics