

APPENDIX B - MOUNT SPECIFIC DATA

For Swe-Dish Patrick

Revision: 18 September 2002

This appendix describes RC3000 operations unique for the Swe-Dish Patrick 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 Swe-Dish Patrick mount are described.

1.2 RC3000 Features

All basic features of the RC3000 are utilized to provide the operations for the Swe-Dish Patrick mount. Some features have been modified (as described below) to customize operations for a "deployable" antenna.

Hardware Configuration. A RC3000A version of hardware is utilized for this mount. A unique analog board is provided to interface with the unique actuators of the Swe-Dish Patrick mount.

***** any documents on the actuators, new analog board, etc. may be referenced here *****

Software Configuration. The mount model will be designated as **S4**. Software will be designated as RC3K-S4-xxx.

1.3.2 System Interface Requirements

The S4 interface differs from baseline RC3000 interface requirements as follows:

- 1) no azimuth angle sensor is present
- 2) high resolution pulse sensors are present on the azimuth and elevation axis to support inclined orbit tracking
- 3) the "inner" and "outer" actuator limits are mapped to azimuth cw/ccw and elevation up/down.

4) * any other differences worth mentioning ?????? ******

The following diagram shows the RC3000 connected to the relevant components of the S4 mount system.

***** insert system diagram**

1.3.3 Operational Overview

The baseline RC3000 modes are modified to accommodate the operational scenario of the S4 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.

The RC3000 will power up to one of the following two modes:

1) If a PACK operation was performed before powering off the controller, the RC3000 will not have a stored latitude and longitude of the mount. The RC3000 will automatically go to the MENU mode. The MENU selections for the S4 mount are shown below:

1 - SETUP	2 - LAT/LON	3 - CALCULATE	MENU
4 - SEARCH	5 - STORE		
8 - PACK			UTC
<0-8>SELECT	<MODE>MANUAL		14:37:23

2) If the RC3000 was powered down with a lat/lon entered, it will enter the POSITION CONFIRM mode. The user will be prompted to select if he wants to keep the currently entered lat/lon.

SETUP. As an aid to mount assembly, the SETUP mode automatically extends the azimuth and elevation actuators to their "setup" positions.

This step is required to initialize the relative azimuth and elevation pulse counts. The azimuth actuator is positioned to its approximate midway position so the most azimuth range of motion is available for finding the selected satellite.

AZIM: 10553	SETUP
ELEV: 17837	
CONFIRM SETUP POSITION	
<MODE>RETURN TO MENU	

LAT/LON. This mode is provided to allow the user to manually enter the mount's latitude and longitude for use by the CALCULATE mode.

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

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

CALCULATE mode determines the magnetic heading and elevation (RF look angle) required given the current latitude and longitude of the mount and the longitude of the selected satellite. The user may select another satellite either manually or from a list. Upon selection of another satellite, a new pointing solution will be automatically calculated.

CALCULATE mode also determines nominal horizontal and vertical (H/V) polarization angles as an aid in orienting the polarization axis.

After the pointing solution is calculated, the user may initiate an automatic movement of the elevation axis and (optionally) the polarization axis.

MANUAL. After performing a CALCULATE operation, the controller transitions to MANUAL mode. In MANUAL mode the mount may be manually jogged in azimuth and elevation in order to peak up on the satellite. The target magnetic heading and elevation angles will be displayed along with the relative signal strength indication (SS1:) as an aid in positioning the mount on the satellite.

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

```
AZIM: 10345 (170.8)  SS1: 50          MANUAL
ELEV:  44.5 ( 44.4)  SAT:telstar 4
                        SPD:FAST          UTC
<0-9>JOG ANTENNA    <MODE>MENU    14:39:01
```

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

```
AZIM:10456          SEARCH
ELEV:17429
SPIRAL SEARCH (CCW 12)    <STOP>HALT
```

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.

PACK. When it is time to disassemble the mount, the PACK mode automatically retracts the actuators to their storage position in a manner similar to how the SETUP mode initially extended the actuators. PACKing the actuators causes the RC3000 to invalidate the calculated pointing solution and existing track tables.

1.3.7 Drive System

Position Sensing and Limits. A true elevation sensing inclinometer is fitted to the elevation axis. The azimuth and elevation actuators provided position pulse counts. Limit switch information is also provided from the actuators.

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

2.0 INSTALLATION

2.1 Equipment Mounting

2.1.1 RC3000 Antenna Controller

The S4 chassis is slightly longer (19.1" vs. 17.05").

2.1.2 GPS Receiver

2.1.3 Fluxgate Compass

The GPS and Compass options are not available for the S4 mount.

2.1.4 Electronic Clinometer

As shown in the system diagram in 1.3.2, the inclinometer is mounted on the elevation axis. The inclinometer is mounted on the antenna's structure in the *?????* position when the antenna's elevation RF look angle is *????* degrees

***** face vertical - what inclinometer angle?? *****

2.2.1 Power Entry

The S4 version has the same fuse requirements as the RC3050A model (8 A. for 115, 4 A. for 230).

2.2.2 Motor Drive

2.2.3 Drive Sense

2.2.4 Limit Switches

2.2.7 Accessories

2.2.10 Pulse Sensors

Internal to the S4 is cabling that adapts these standard interface connections shown in the baseline manual to the S4 style connectors on the backpanel. A schematic is provided in section 4.2 showing this adaptation.

The individual S4 connectors are now discussed.

J1 AGC DB9M

****** pinouts *******

J2 Inclinometer DB9F

****** pinouts *******

J3 Az Act DB15F

Motor drive, pulse sensor, limits

**** *pinouts* ****

J4 EI Act DB15F

Motor drive, pulse sensor, limits

**** *pinouts* ****

J5 Pol Drive DB9F

Motor drive, position feedback

**** *pinouts* ****

J6 PCRC DB9F

**** *pinouts* ****

J7 HHRC

**** *pinouts* ****

2.3 Initial Configuration

Calibration of the S4 mount is similar to that described in the baseline manual. Unique Items are described in the following subsections.

2.3.2 Elevation Calibration.

Elevation Reference Position. Elevation reference voltage should be set when the antenna face is vertical (RF look angle equals 27.2 degrees).

2.3.3 Azimuth Calibration.

Azimuth limits will be set as part of the Pulse Sensor Checkout (2.3.6).

2.3.4 Polarization Calibration. No action required.

2.3.5 Fast/Slow Motor Speed. Per baseline manual.

2.3.6 Pulse Sensor Checkout

The SETUP function will initialize the pulse counts for the azimuth and elevation axis. Since the actuator assemblies may have slight variations, the azimuth CW and Elevation DOWN pulse limits should be set per mount.

2.3.7 Drive System Checkout. Per baseline manual

2.3.8 Navigation Sensor Communication. Per baseline manual

2.4 Final Calibration

2.4.1 Compass Calibration. N/A

2.4.2 Azimuth and Elevation Alignment. Per baseline manual

2.4.3 Signal Strength Adjustment. Calibrate the AGC1 input with the tracking receiver.

2.4.4 Pulse Scale Factors .

The azimuth and elevation pulse scale factors have been characterized for the S4 mount and are reflected in the default values.

******* need to characterize these scale factors *******

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 S4 version mount.

3.2.1 Manual Mode

```
AZIM: 14131 (157.6)  SS2:579          MANUAL
ELEV: -67.5 ( 42.4)  SAT:telstar 402
                    SPD:FAST          UTC
<0-9>JOG ANTENNA   <MODE>MENU    14:25:47
```

AZIM: 14131(157.6)

Since no azimuth angle sensor is present, MANUAL mode will display an azimuth pulse count only. Following a CALCULATE function, the target magnetic heading will be displayed in parenthesis.

AZIM: 10553 ELEV: 17837

When the Scroll Up/Yes key is pressed in MANUAL mode, the elevation data toggles between elevation angle to display the current pulse count for the elevation axis.

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-SETUP  2-LAT/LON  3-CALCULATE  MENU
4-SEARCH 5-STORE
8-PACK          UTC
<0-8>SELECT <MODE>MANUAL    14:37:23
```

The following subparagraphs describe how the various modes are customized for the operation of the S4 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 S4 mount, STOW and DEPLOY have been replaced by SETUP and PACK modes that are more appropriate for a deployable mount.

Setup Mode

****** MIKE/JIM ****** **WHETHER OR NOT THE SETUP AND PACK ROUTINES START AT A HIGH VALUE OR LOW VALUE CAN BE CONTROLLED VIA THE EL_TIME (for azimuth) AND PL_ENABLE (for elevation) IN THE STOW/DEPLOY SCREEN. 0 (default) MEANS THAT THE COUNT WILL START AT 64000, DRIVE TO RETRACTION AND RESET AT 1000, THEN GO TO THE SELECTED VALUE IN THE SET SCREEN. 1 MEANS IT WILL START AT 1000, DRIVE TO RETRACTION AND RESET TO 64000.**

The SETUP mode automatically moves the actuators to their “setup” position in preparation for initial positioning of the mount.

The opening screen of the SETUP mode asks the user to confirm that the actuator movement is to start. If the actuators are not in a safe position for them to be extended, they should be put in a safe position before pressing the Enter key.

```

START
<MODE>RETURN TO MENU
<ENTER>INITIATE MOVEMENT
```

When the SETUP movement is initiated, the first action is to move the azimuth actuator to the fully compressed position. During this movement the message “RETRACTING AZIM ACTUATOR <STOP>HALT” is displayed.

NOTE: During all movements the name of the actuator (AZIM/ELEV) that is currently being commanded to move will flash. At the beginning of the SETUP function the pulse count value for azimuth and elevation actuators will be set to ***** 1000 or 64000 ***** and ***** 1000 or 64000 ***** respectively.

Several seconds after becoming fully compressed, the controller will sense that movement has “jammed” and will begin extending the actuator to the SETUP position. After sensing the “jammed” condition the number of counts is reset to ***** 1000 or 64000 ***** for azimuth and ***** 1000 or 64000 ***** for elevation. The number of counts the actuator extends to is set in the SET configuration screen (see 3.3.1.3.14 of this appendix).

```

AZIM: 10553SETUP
ELEV: 16345
RETRACTING ELEV ACTUATOR<STOP>HALT
```

When both actuators have been extended to their setup position the following screen appears.

```

AZIM: 10553SETUP
ELEV: 17837
CONFIRM SETUP POSITION
<MODE>RETURN TO MENU
```

PACK MODE

The PACK mode automatically moves the tracking actuators to their storage position.

PACK mode operates much in the same way the SETUP mode does. The number of counts the actuators extend to after jamming is set by the AZ_PACK and EL_PACK configuration items.

NOTE: As soon as the user initiates PACK movement, several items are invalidated to signal that the current pointing solution, mount position and track tables can no longer be considered valid.

3.2.2.3 LOCATE

A modified version of the LOCATE mode described in the baseline manual is provided for the S4 mount. Unique characteristics of CALCULATE mode is described next.

Calculate

CALCULATE 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 TO MOVE ELEVATION
```

Prior to generating a pointing solution, the user must manually insert a latitude and longitude via the LAT/LON mode described later. The 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 CALCULATE is intended to be used as an aid in initially positioning the mount.

<PRESS ENTER>

TO MOVE ELEVATION

After a pointing solution is calculated, the messages “<PRESS ENTER>” and “TO MOVE ELEVATION” will flash. The user may initiate an automatic movement of the mount to the target elevation by pressing the ENTER key. The user will also be prompted to select a desired polarization angle to automatically move to if so desired.

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. SEARCH mode will begin the spiral search from the current location of the mount.

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.

3.2.2.8 SETTINGS

No SETTINGS mode is applicable to the operation of the S4 mount.

NOTE: in case of an azimuth of elevation jammed condition, the axis may be reset via the DRIVE RESET mode described in section 3.3.2.2 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.

In addition to the baseline modes, one unique configuration mode (CONFIG-SFX) is provided for programming the final positions of the SETUP and PACK functions.

3.3.1.3.14 SET

When scrolling through the configuration menu system, this mode will be shown as "SET-AZ/EL SETUP/PACK TARGETS".

The CONFIG-SET screen allows the user to set the target positions for the SETUP and PACK modes.

```
CONFIG-SET
AZ_SETUP:10553  AZ_PACK:10000
EL_SETUP:17837  EL_PACK:20000
AZIMUTH SETUP TARGET(10000-20000 PULSES>
```

AZ_SETUP: 10553 AZIMUTH SETUP TARGET(1000-64000 PULSES>

This field allows the user to set the target position that the SETUP mode extends the azimuth actuator.

EL_SETUP: 17837 ELEV SETUP TARGET(1000-64000 PULSES>

This field allows the user to set the target position that the SETUP mode extends the elevation actuator.

AZ_PACK:10000 AZIMUTH PACK TARGET<1000-64000 PULSES>

This field allows the user to set the target position that the PACK mode extends the azimuth actuator.

EL_PACK:20000 ELEV PACK TARGET<1000-64000 PULSES>

This field allows the user to set the target position that the PACK mode extends the elevation actuator.

3.3.2 Maintenance Items

Several maintenance functions have been slightly altered for the S4 version.

3.3.2.2 Drive Error Resets

Pulse reset will set the azimuth and elevation count values to 32768.

3.3.2.5 Limits Maintenance

The state of the middle and ready signal from the actuators are shown.

****** NOTE: 0/1 is somewhat arbitrary - pick what makes most sense and we can change it ******

3.3.2.8 AZEL

An angle (primary sensor) based movement in elevation can be accomplished. An attempt at doing a primary (angle) based movement in azimuth would result in unknown results since there is no angle sensor on azimuth.

Secondary (pulse based) movements may be accomplished in both azimuth and elevation.

3.3.2.10 Shake

There is a special version of SHAKE mode for S4. When SHAKE is initiated, the sequence of 4 movements will constitute a "cycle". The sequence of movements is:

- 1) elevation to within 20 counts of the down_elev_pulse_limit,
- 2) azimuth to within 20 counts of the ccw_azim_pulse_limit,
- 3) elevation to within 20 counts of the up_elev_pulse_limit and
- 4) azimuth to within 20 counts of the cw_azim_pulse_limit.

Note that the only item valid in the CONFIG-SHAKE screen is the number_of_cycles item.

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	S4	COMMENTS	INSTALL VALUE
SYSTEM DEFINITION			
GPS_present	0	GPS option not supported	
Compass_present	0	Compass option not supported	
Initial_mode	2	2= MENU, could be changed	
antenna_size_cm	140		
Waveguide_present	0	Waveguide not supported	
ELEVATION CALIBRATION			
Zero Voltage	1.69	Set during calibration	
Elevation_offset	0.0		
Up_elev_limit	90	??	
Down_elev_limit	0	??	
Elevation_Scale_Factor	50.00	Set during calibration	
Elevation_look_configuration	1		
AZIMUTH CALIBRATION			
Zero Voltage	2.50	N/A	
Azim_offset	0.0	N/A	
ccw_azim_limit	0	DO NOT MODIFY	
Cw_azim_limit	360	DO NOT MODIFY	
Azim_Scale_Factor	75.00	N/A	
POLARIZATION CALIBRATION			
Zero Voltage	2.50	Set during calibration	
Polarization_Offset	0.0		
CW Polarization Limit	98.0	??	
CCW Polarization Limit	98.0	??	
Pol_Scale_Factor	42.80		
Polarization_type	2	2 = "single pol" feed	
H/V_Reference	1		
Default Horizontal Position	90.0		
Default Vertical Position	0.0		
Pol_Automove_Enable	1	0= no H/V prompt from CALC	
SIGNAL PARAMETERS			
RF Lock	0	N/A	
RF Time	0.1	N/A	
Channel 1 Polarity	1	??	
Channel 1 Threshold	100	??	
Channel 1 Delay	0.1	??	
Channel 1 Lock Type	0	??	
Channel 2 Polarity	1	N/A	
Channel 2 Threshold	100	N/A	
Channel 2 Delay	0.1	N/A	
Channel 2 Lock Type	0	N/A	
AUTOPEAK			
Autopeak Enabled	0	?? for spiral search ???	
Signal Source	2	2 = SS1	
RF Band	1	1 = Ku	
Spiral Search AZ Limit	3	??	
Spiral Search EL Limit	3	??	
Spiral Signal Threshold	200	??	
Scan Range Limit	8	N/A	
Scan Signal Threshold	200	N/A	

CONFIGURATION ITEM	S4	COMMENTS	INSTALL VALUE
AZIMUTH POT DRIVE			
Fast/Slow Threshold	2.5	N/A	
Maximum Position Error	0.20	N/A	
Coast Threshold	0.1	N/A	
Maximum Retry Count	3	N/A	
AZIMUTH PULSE DRIVE			
Pulse Scale Factor	1604	??	
CW Pulse Limit	63000	??	
CCW Pulse Limit	1000	??	
Fast/Slow Threshold	50	??	
Maximum Position Error	0	??	
Coast Threshold	3	??	
Maximum Retry Count	3	??	
AZIM DRIVE MONITORING			
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	3128	??	
UP Pulse Limit	64000	??	
Down Pulse Limit	1000	??	
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	S4	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	N/A	
EL STOW	-67.5	N/A	
PL STOW	0.0	N/A	
AZ DEPLOY	0.0	N/A	
EL DEPLOY	20.0	N/A	
PL DEPLOY	0.0	N/A	
EL_TIME	0	** AZ SET/PACK 0-start high **	
PL_ENABLED	0	** EL SET/PACK 1-start low **	
SETUP / PACK			
AZ_SETUP	63000	??	
EL_SETUP	63000	??	
AZ_PACK	64000	Fully retracted ??	
EL_PACK	64000	Fully retracted ??	
SHAKE			
Cycles	5	Only SHAKE item used	

4.2 Schematics

**** *Patrick board* ****

**** *S4 connector adapter cabling* *****