APPENDIX REM - REMOTE CONTROL PROTOCOL

Software Version: 2.04

Build Number: 22+

This appendix describes the remote commands available to monitor and control the RC4500 antenna controller. It is provided as a supplement to the RC4500 baseline manual. Sections in the baseline manual will be cited where additional information may be found.

NOTE: RC4500 software is built on a per-mount basis. Some commands may not be available on all devices.

Revision History

DATE	MODIFICATION	INITIALS
03 MAY 2016	Initial document created from RC4000 remote control protocol.	ECG
01 AUG 2016	First document revision and release for RC4500.	ECG
03 AUG 2016	Fixed description of Read Navigation Data command.	ECG
05 AUG 2016	Removed TRACK mode special case from Polarization command notes.	ECG
10 AUG 2016	Added DELETE to Write Satellite Data command.	ECG
12 AUG 2016	Added Form L to Auto Move Command for moving to a longitude. Rename Read Pulse Count to Read Count Sensor. Fixed multiple cases where Azimuth was not described as a true angle.	ECG
31 AUG 2016	Updated Device Type command reply.	ECG
29 NOV 2016	Added count bounds to Auto Move Command description.	ECG
10 MAY 2017	Added sensor error alarm for all axes.	ECG
10 AUG 2017	Updated document sections and formatting.	ECG
21 JAN 2019	Updated Read Count Sensor regarding sensors that don’t exist.	ECG
13 FEB 2019	Changed reference to IP hardware.	JFR

1 Introduction

1.1 Overview

The RC4500 supports a variety of remote monitor and control commands. The controller functions as a slave device within a network. The network is expected to consist of one master and multiple slaves communicating over a single interface (or “bus”). Each slave is internally configured with a unique address.

1.2 Message Protocol

Message format and protocol over the bus is a derivative of IBM's binary synchronous communications protocol (BISYNC). The master station sends a command over the bus to all slave devices. The device whose address is specified in the command message carries out the requested commands, and then replies with a response message containing the result. A device does not respond if the command does not contain its address. This prevents bus contention caused by more than one device communicating over the bus at the same time. NOTE: Even if the antenna controller is the only device on the network, it still must be addressed.

1.2.1 Data Format

All data should be in 7-bit ASCII format. The control character subset 00-1F (hex) is reserved for message control. The printable ASCII characters 20-7F (hex) are used for address, command and data characters.

1.2.2 Message Format

Command messages begin with the STX (Start-of-text) byte followed by a remote address, a command byte and multiple data bytes. The ETX (End-of-text) byte is sent following the last data byte, and the message is terminated by a Checksum character. Response messages are identical to command messages in format with the exception of the ACK (Acknowledge) or NAK (Not Acknowledge) byte at the start of the message instead of STX. Figure 1 illustrates the format of the command and response messages. A command or reply message may have a variable length.

Command Message

STX	ADDR	CMD	D_1	D_2	D_3	…	D_N	ETX	CHKSUM

Response Message – Command Acknowledged

ACK	ADDR	CMD	D_1	D_2	D_3	…	D_N	ETX	CHKSUM

Response Message – Command Not Acknowledged (Unable To Execute or Incorrect Command)

NAK	ADDR	CMD	ETX	CHKSUM

Figure 1 – Message Format

1.2.3 Message Delimiters

A command message begins with STX (02 hex). A reply begins with ACK (06 hex) or NAK (15 hex) depending on the result of the command execution. All messages end with the ETX (03 hex), the ASCII End-of-text control character, followed by the Checksum byte.

1.2.4 Address Byte

The device address (ADDR) must be a valid ASCII printable character between 49 (31 hex) and 111 (6F hex); thus, 63 addresses are possible.

1.2.5 Command Byte

The command byte (CMD) immediately follows the device address and specifies one of several possible commands for a particular device.

1.2.6 Checksum Byte

The last character of any message is the Checksum byte (CHK). This character is simply the bit-by-bit exclusive OR of all characters in the message starting with the STX character through the ETX character. This forms a Longitudinal Redundancy parity check over the entire message.

1.2.7 Message Timing

Every message that is received generates a reply. After sending a command, the master should wait for a reply before sending a subsequent command. All replies will be sent within 500 milliseconds.

NOTE: The NAK or ACK reply does not signify that an operation has actually taken place, but only that the message was received and understood. The user should query the controller later to see if the command was actually carried out, or is still in progress.

1.2.8 Command Restrictions

All devices will respond to a command "0" (30 hex) with 6 data bytes of ASCII characters in the following form:

ACK	ADDR	30h	4	K	D_1	.	D_2	D_3	ETX	CHKSUM

where $D_1.D_2D_3$ are ASCII characters representing a software version number (e.g. 1.12).

1.3 State Diagram

The state diagram illustrated below presents the implementation of the slave device. Each state that the device can assume is represented by a numbered circle. Transitions between states are represented by an arrow. Each arrow is labeled with the conditions that must be true to move between states.

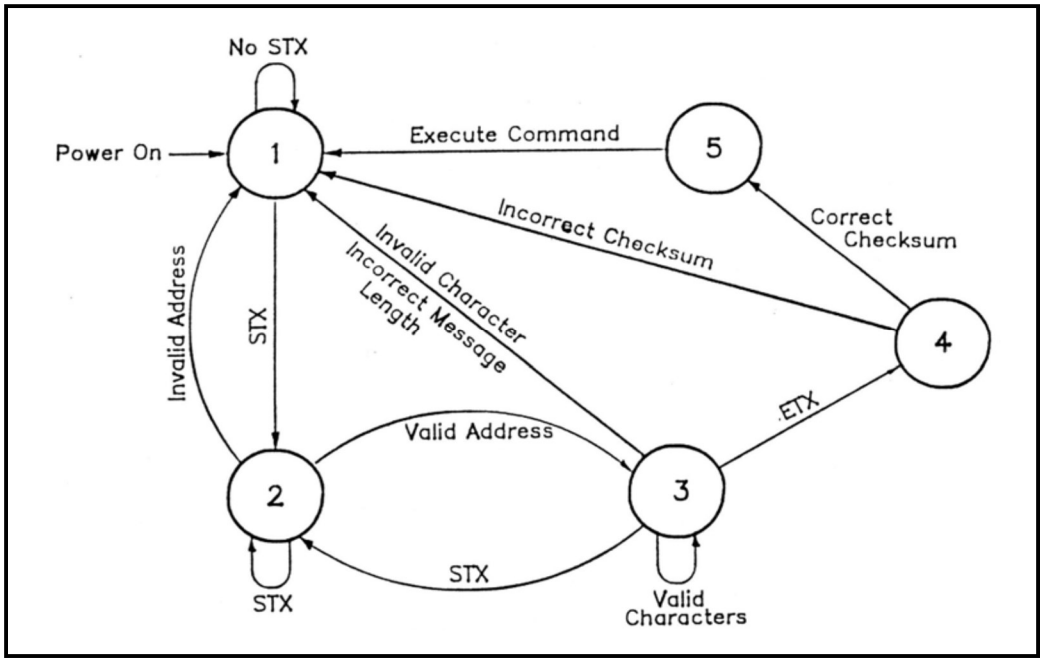

Figure 2 – SA Bus Protocol State Diagram

- State 1 – Idle State
  - The device is ready to receive a new message. A device always powers on in State 1.
  - The device will enter State 2 only if the STX byte is received.
- State 2 – Addressed State
  - The device is waiting to receive the address byte.
  - The device will enter:
    - State 3 if the received address byte is correct.
    - State 1 if the received address byte is not correct.
  - The device will stay in State 2 if the STX byte is received.
- State 3 – Data State
  - The device is engaged in receiving the command data from the master.
  - The device will enter:
    - State 4 if the ETX byte is received signifying the end of data in the message.
    - State 1 if the STX byte, an invalid byte, or the incorrect number of data bytes is received.
- State 4 – Data Error State
  - The device is waiting to receive a Checksum byte.
  - A slave will enter:
    - State 5 if the received byte equals the LRC value computed during message reception.
    - State 1 if the received byte does not equal the LRC value computed.
- State 5 – Command Execute State
  - The device begins execution of the received command.
  - The device begins sending the appropriate response message to the master.
  - The device will enter State 1 only when the entire response has been transmitted.

2 Configuration

2.1 Electrical Interface

The device can use a variety of physical interfaces including RS-232, RS-422, and Ethernet. Refer to section 2.1.2.4.9 of the baseline manual and Appendix IP for more information on interfacing with an Ethernet network. Refer to section 2.1.2.2.4 of the baseline manual for more information on interfacing with a RS-232 or RS-422 network.

2.2 Communications Parameters

When the device is controlled via RS-232 or RS-422, an additional configuration screen allows several parameters to be specified.

```
  ENABLED:1                 CONFIG-REMOTE
  ADDRESS: 50       MODE:1
BAUD RATE:6
REMOTE CONTROL <0>DISABLED <1>ENABLED
```

ENABLED: **REMOTE CONTROL <0>DISABLED <1>ENABLED**

This item allows the user to enable/disable remote control. This may prove useful if the user wants to only operate from the front panel. The default value is enabled.

ADDRESS: **BUS ADDRESS <49-111>**

This item allows the user to specify a unique bus address. The default address is 50.

BAUD RATE: **BAUD <1-48 2-96 3-192 4-384 5-560>(x100)**

This item allows the user to choose one of five possible baud rates from 4800 to 56000. The default baud rate is 9600.

MODE: **REMOTE MODE <0-RS232 1-RS422>**

This item allows the user to select RS232 or RS422/RS485 operation. The default value is RS-232 operation.

3 Detailed Operation

3.1 Online/Offline Reply

The software must include the remote control option to process commands. If remote control is not available (or is disabled), and a valid message is received, the offline reply is sent to the host. This reply has the following format:

byte 0	ACK	
byte 1	A	address
byte 2	CC	command code of the received message
byte 3	'F'	ASCII 'F', for offline.
byte 4	ETX	
byte 5	Checksum	

3.2 Command Acknowledged – ACK Reply

In many cases, if a command is received but no response is required, a standard ACK reply is sent to the host. The standard ACK reply has the following format:

byte 0	ACK	
byte 1	A	address
byte 2	CC	command code of the received message
byte 3	ETX	
byte 4	Checksum	

3.3 Unrecognized Commands – NAK Reply

If a valid message is received but the command code is unrecognized or unavailable, or if an error occurred while processing the command data, a NAK reply is sent to the host. Additional failure information may be available for specific commands. The NAK reply has the following format:

byte 0	NAK	
byte 1	A	address
byte 2	CC	command code of the received message
byte 3	ETX	
byte 4	Checksum	

3.4 Command Set

The following table lists the available remote commands. Each command is detailed in the paragraph listed.

Table 1 – Command Set List

CODE (hex)	COMMAND	PARAGRAPH
30	Device Type	3.4.1
31	Device Status	3.4.2
32	Auto Move	3.4.3
33	Azimuth / Elevation / Polarization Jog	3.4.4
34	Polarization	3.4.5
35	Reserved	
36	Miscellaneous	3.4.6
37	Reflect Display	3.4.7
38	Reserved (proprietary)	
39	Write Satellite Data[1]	3.4.8
3A	Read Satellite Data	3.4.9
3B	Write Two-Line Element Data[1]	3.4.10
3C	Read Two-Line Element Data	3.4.11
3D	Write Beacon Data[1]	3.4.12
3E	Read Beacon Data	3.4.13
3F	Read Count Sensor	3.4.14
40	Reserved	
41	Reserved	
42	Reserved	
43	Reserved	
44	Reserved	
45	Read Navigation Data	3.4.15
46	Reserved	
47	Jog with Minimal Reply	3.4.16
48	Remote Key Press	3.4.17
49	Write Config Data[1]	3.4.18
4A	Reserved	
4B	Custom Device Status[2]	3.4.19
4C	Reserved	
4D	Write Track Table Data[2]	3.4.20
4E	Read Track Table Data[2]	3.4.21
	1 – requires flash save via Write Config Data	
	2 – experimental	

3.4.1 Device Type Command

This command returns the six-byte device type string. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	30h	command code
byte 3	ETX	
byte 4	Checksum	

The reply to this command will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	30h	command code
bytes 3-7	Device Type	The device type identifier. This field will start with “RC45” for RC4500 antenna controllers. Left-justified and padded with blanks.
bytes 8-12	Version	The device version number descriptor. This field will contain the software version in the format “vA.BC”.
byte 13	ETX	
byte 14	Checksum	

3.4.2 Device Status Command

This command returns general device status information. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	31h	command code
byte 3	ETX	
byte 4	Checksum	

The reply will consist of a combination of ASCII and binary data fields. The response will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	31h	command code
bytes 3-5	Satellite Index	The index of the currently selected satellite. This field will contain ‘***’ if nothing is selected. Right-justified and padded with blanks.
bytes 6-15	Satellite Name	The name of the currently selected satellite. Left-justified and padded with blanks.

Device Status Command (continued)

byte 16-23	Azimuth Position	0.000 to 360.000 degrees
byte 24-31	Elevation Position	-20.000 to 120.000 degrees
byte 32-39	Polarization Position	+/-100.000 degrees

The current angular position
+ddd.ddd (decimal-degrees format)
Right-justified and padded with blanks or '********' if sensor error

byte 40 Azimuth Limits – binary data
byte 41 Elevation Limits – binary data
byte 42 Polarization Limits – binary data

```
7 6 5 4   3 2 1 0
0 1 0 0 $ 0 A B C
```

Where bits 'A', 'B', and 'C' are defined as:

.

A – Maximum Limit (CW, UP, CW)
B – Minimum Limit (CCW, DOWN, CCW)
C – Stow Limit

A '0' in a bit position implies that the antenna is not at the limit,
a '1' in the bit position implies that the antenna is at the limit.

byte 43 Feed Type/Polarization Code – binary data

```
7 6 5 4   3 2 1 0
0 1 X X $ 0 Y Y Y
```

Where 'XX' is defined as:

00 – Rotating Feed Is Not Present
01 – Single-Port Rotating Feed Is Present
10 – Dual-Port Rotating Feed Is Present

Where 'YYY' is defined as:

000 – No Polarization Code Displayed
001 – 'h' Polarization Code
010 – 'H' Polarization Code
011 – 'v' Polarization Code
100 – 'V' Polarization Code

Device Status Command (continued)

byte 44 Azimuth Movement/Alarm Status – binary data
byte 45 Elevation Movement/Alarm Status – binary data
byte 46 Polarization Movement/Alarm Status – binary data

```
7 6 5 4   3 2 1 0
0 1 0 S $ A A A A
```

Where 'S' is defined as:
0 – Axis Is Configured for Slow Speed Movement
1 – Axis Is Configured for Fast Speed Movement

Where 'AAAA' is defined as:
0000 – No Alarms or Movement
0010 – Negative Jog Movement (CCW, DOWN, CCW)
0011 – Positive Jog Movement (CW, UP, CW)
01xx – Auto Move In-Progress
0110 – Negative Automatic Movement (CCW, DOWN, CCW)
0111 – Positive Automatic Movement (CW, UP, CW)
1xxx – Alarm Active
1000 – Off-Axis Alarm
1001 – Sensor Alarm
1010 – Runaway Alarm
1011 – Jammed Alarm
1100 – Drive Alarm

Higher value status codes have priority over lower value ones. If as part of an auto move command the antenna is moving clockwise the status will be reported as 'Positive Automatic Movement' rather than 'Auto Move In-Progress'.

byte 47 Alarm Code – binary data

```
7 6 5 4   3 2 1 0
0 1 A A $ A A A A
```

Where 'AAAAAA' specify the alarm code (0-63). Alarm messages flash on the bottom row of the display. NOTE: Some software versions have mount-specific alarm codes.

0 – No Alarm Active
1 – Flash Version Mismatch
2 – Flash Data Corrupt
3 – NVRAM Version Mismatch
4 – NVRAM Data Corrupt
5 – Low Battery
6 – Invalid Time/Date
7 – Azimuth Jammed
8 – Azimuth Runaway
9 – Elevation Jammed
10 – Elevation Runaway
11 – Polarization Jammed
12 – Polarization Runaway
13 – Limits Inactive Warning
14 – Drive System Error
15 – Emergency Stop Active
16 – Maintenance Interlock Active
17 – Movement Interlock Active
18 – Local Jog Connected
19 – Summary Limit Warning
20 – Azimuth Sensor
21 – Elevation Sensor
22 – Polarization Sensor

Device Status Command (continued)

byte 48 Track Status – binary data

```
7 6 5 4   3 2 1 0
0 1 0 0 $ S S S S
```

Where ‘SSSS’ is defined as:

0000 – Track Mode Not Active
0001 – Setup Active
0010 – Recall Active
0011 – Step-Track Active
0100 – Wait Active
0101 – Search Active
0110 – Memory-Track Active
0111 – TLE-Track Active
1001 – ACU Alarm Error
1010 – Checksum Error
1011 – TLE Data Error
1100 – Peak Limit Error

bytes 49-52 AGC Level Current AGC channel voltage
0 to 5000
Right-justified and padded with blanks

byte 53 AGC Channel/Lock Status – binary data

```
7 6 5 4   3 2 1 0
0 1 0 L $ 0 C C C
```

Where ‘CCC’ is defined as:

000 – RF
001 – SS1
010 – SS2
011 – DVB
1xx – Reserved

Where ‘L’ is defined as:

1 – Lock Indicated
0 – No Lock Indicated

Device Status Command (continued)

byte 54 HPA Relay/Feed ID Status – binary data

```
7 6 5 4   3 2 1 0
0 1 0 B $ B B A A
```

Where ‘AA’ is defined as:

00 – HPA Relay Disabled by ACU Software
01 – HPA Relay Disabled by External TX Mute
10 – HPA Relay Enabled
11 – Reserved

The bit field ‘BBB’ indicates the current feed id index which will be a value between 0 and 7. The value will be 0 if feed id bits are not supported.

byte 55 Special Axis Limits/Movement Status – binary data

```
7 6 5 4   3 2 1 0
0 1 0 S $ A B C D
```

Where ‘S’ is defined as:

0 – Axis Not Moving
1 – Axis Auto Move Is In-Progress

Where A, B, C, and D indicate the current special axis limit state as:

SPECIAL AXIS	STATE DESCRIPTION	LIMIT CONDITION
Waveguide	Horizontal (Position 1)	B = 1
	Vertical (Position 2)	C = 1
RF Switch	Path 1	A = 0
	Path 2	A = 1
Polarization Mode	Linear Mode	B = 1
	Circular Mode	C = 1

bytes 56-60 Reserved

byte 61 Current Mode
byte 62 Current State
byte 63 Last Mode
byte 64 Last State

ACU mode and mode state indicators, see section 5.3 for possible values.

byte 61 ETX
byte 62 Checksum

3.4.3 Auto Move Command

This command causes the controller to automatically position the antenna in azimuth, elevation, and polarization. This command has several forms.

Form 1: This form of the command automates the controller RECALL mode. The satellite requested must have previously been saved via the STORE operation. The controller will move the antenna to the azimuth, elevation, and polarization positions associated with the satellite. If the command specifies polarization movement but the Feed Type is set to CIRCULAR, no polarization movement will occur.

This command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	32h	command code
byte 3	Form Code	'1'
bytes 4-6	Index	The index of the satellite to RECALL Right-justified and padded with blanks
byte 7	Polarization	'H' = horizontal, 'V' = vertical
bytes 8-13	Reserved	Fill with zeros or blanks
byte 14	ETX	
byte 15	Checksum	

The ACK reply to this command will be in the same format as the Device Status Command. The NAK reply will be received if no valid data was found with the given parameters.

Auto Move Command (continued)

Form 2: With this form of the command, the controller will position the antenna at the azimuth, elevation, and polarization positions specified. The axis mask field controls which axes will move. If the simultaneous drive option is not enabled, the controller will move elevation, azimuth, then polarization. If the command specifies polarization movement but the Feed Type is set to CIRCULAR, no polarization movement will occur.

This command has the following format:

byte 0	STX		
byte 1	A	address	
byte 2	32h	command code	
byte 3	Form Code	'2'	
byte 4	Sensor	'A' = angular sensor, 'C' = count sensor	
byte 5	Axis Mask	'0' – No Axis	'4' – Pol
		'1' – Azim	'5' – Azim & Pol
		'2' – Elev	'6' – Elev & Pol
		'3' – Azim & Elev	'7' – Azim & Elev & Pol
bytes 6-13	Azimuth Position	0.000 to 359.999 degrees	0 to 65535 counts
bytes 14-21	Elevation Position	-20.000 to 120.000 degrees	0 to 65535 counts
bytes 22-29	Polarization Position	+/-100.000 degrees	0 to 65535 counts
		When using angular sensors: +ddd.ddd (decimal-degrees format) Right-justified and padded with blanks	
		When using count sensors: dddddddd (unsigned integer format) Right-justified and padded with blanks	
byte 30	ETX		
byte 31	Checksum		

The ACK reply to this command will be in the same format as the Device Status Command. The NAK reply will be received if any parameter is invalid.

Auto Move Command (continued)

Form L: With this form of the command, the controller will calculate and move the antenna to the azimuth, elevation, and polarization positions associated with the given satellite longitude. The polarization used will be the horizontal positon. If the Feed Type is set to CIRCULAR, no polarization movement will occur.

This command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	32h	command code
byte 3	Form Code	'L'
bytes 4-9	Longitude	Nominal satellite longitude -179.9 to 180.0 (West longitude negative) Left justified and padded with blanks
byte 10-13	Reserved	Fill with zeros or blanks
byte 14	ETX	
byte 15	Checksum	

The ACK reply to this command will be in the same format as the Device Status Command. The NAK reply will be received if any parameter is invalid.

Auto Move Command (continued)

Form S: This form is only available on mount types where the antenna system is equipped with a special "fourth axis" of motion.

This command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	32h	command code
byte 3	Form Code	'S'
byte 4	Axis Code	
byte 5	Direction Code	

Where special axis and direction codes are defined as follows:

SPECIAL AXIS	AXIS CODE	DIRECTION CODE
Waveguide	'W'	'H' – Horizontal (Position 1) 'V' – Vertical (Position 2)
RF Switch	'R'	'1' – Path 1 '2' – Path 2
Polarization Mode	'P'	'C' – Circular Mode 'L '– Linear Mode

byte 6	ETX	
byte 7	Checksum	

The ACK reply to this command will be in the same format as the Device Status Command. The NAK reply will be received if any parameter is invalid.

3.4.4 Azimuth/Elevation/Polarization Jog Command

This command jogs the antenna in azimuth, elevation, or polarization. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	33h	command code
byte 3	Direction	This field can specify one of the following: 'E' – Azimuth Counter Clockwise 'W' – Azimuth Clockwise 'D' – Elevation Down 'U' – Elevation Up 'O' – Polarization Counter Clockwise 'L' – Polarization Clockwise 'X' – Stop All Movement
byte 4	Speed	Specifies the jog speed, either 'F' (Fast) or 'S' (Slow). This field must contain a valid value even if the direction field specifies 'X' (Stop).
bytes 5-8	Duration	Length to continue the jog milliseconds from '0000' to '9999'. This field must contain a valid value even if the direction field specifies 'X' (Stop). NOTE: The resolution of the timer used to make the move is approximately 10 milliseconds. All durations converted to the closest multiple.
byte 9	ETX	
byte 10	Checksum	

The ACK reply to this command will be in the same format as the Device Status Command. The NAK reply will be received if any parameter is invalid.

NOTE 1: The controller can only support a remote jog about a single axis. For example, if a remote jog is in progress about the azimuth axis and a remote elevation jog command is received, the azimuth jog will terminate regardless of the duration specified for the remote azimuth jog.

NOTE 2: The controller will automatically switch to MANUAL mode to execute this command.

3.4.5 Polarization Command

This command moves the polarization to the specified calculated position. If the Polarization Type is set to DUAL (2 Port Feed) either the ‘H’ or ‘V’ argument will result in a move to the single polarization position associated with the satellite. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	34h	command code
byte 3	'X'	This field must specify either ‘H’, ‘V’, or ‘X’ where: H/V – moves the polarization to the horizontal/vertical polarization position associated with the last auto move target satellite X – moves the polarization 90 degrees from the current polarization position
byte 4	ETX	
byte 5	Checksum	

The ACK reply to any form of this command will be in the same format as the Device Status Command. The NAK reply will be received if any parameter is invalid.

NOTE: The controller will automatically switch to MANUAL mode to execute this command.

3.4.6 Miscellaneous Command

This command performs miscellaneous functions. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	36h	command code
byte 3	'X'	sub-command code
byte 4	'Y'	sub-command parameter
byte 5	ETX	
byte 6	Checksum	

The sub-command code 'X' can have the following values:

'X' = 'R'	This sub-command is used to reset the azimuth, elevation, or polarization drives. The sub-command parameter 'Y' must be 'A', 'E', or 'P' (for azimuth, elevation, or polarization respectively).
'X' = 'T'	This sub-command is used to clear tracking errors and restart TRACK mode. The sub-command parameter 'Y' must be 'R'. The reply will be a NAK if TRACK mode is not active. NOTE: If a system error is active (an error message flashing on the bottom row of the display) the error condition must be rectified or the controller will immediately return to the TRACK mode ERROR sub-mode.

The ACK reply to this command will be in the same format as the Device Status Command. The NAK reply will be received if any parameter is invalid.

3.4.7 Reflect Display Command

This command requests contents of the 4x40 LCD. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	37h	command code
byte 3	ETX	
byte 4	Checksum	

The ACK reply will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	37h	command code
bytes 3-42	Row 1	40 characters displayed on row 1 of the LCD
bytes 43-82	Row 2	40 characters displayed on row 2 of the LCD
bytes 83-122	Row 3	40 characters displayed on row 3 of the LCD
bytes 123-162	Row 4	40 characters displayed on row 4 of the LCD
byte 163	Cursor Row	cursor row position (1–4)
bytes 164-165	Cursor Column	cursor column (01–40)
byte 166	Cursor Status	0 = cursor off, blink off 1 = cursor off, blink on 2 = cursor on, blink off 3 = cursor on, blink on
byte 167	ETX	
byte 168	Checksum	

NOTE: The reply to this command is very lengthy and should be limited to a frequency less than 2 Hz.

3.4.8 Write Satellite Data Command

This command is used to manage stored satellites in the controller memory. There are two forms of this command.

Form 1: This form is used to add a stored satellite to an empty index in memory. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	39h	command code
bytes 3-5	Index	The stored satellite index
bytes 6-15	Satellite Name	10-character satellite name Left justified and padded with blanks
bytes 16-21	Longitude	Nominal satellite longitude -179.9 to 180.0 (West longitude negative) Left justified and padded with blanks
bytes 22-23	Inclination	Satellite inclination 0 to 19 degrees Left justified and padded with blanks
byte 24	Band	0 = C, 1 = Ku, 2 = L, 3 = X, 4 = Ka, 5 = S
bytes 25-29	Reserved	Fill with zeros or blanks
byte 30	Track Mode	'0' – No Tracking '1' – Memory/Step '2' – Step/Memory '3' – Step/TLE ‘4’ – TLE Only
byte 31	Signal Source	‘0’ – None ‘1’ – External ‘2’ – Internal (or internal beacon) ‘5’ – RF ‘6’ – DVB (if available) ‘7’ – Remote (if available)

Write Satellite Data Command (continued)

bytes 32-39	Azimuth Position	0.000 to 359.999 degrees
bytes 40-47	Elevation Position	-20.000 to 120.000 degrees
bytes 48-55	H Pol Position	+/-100.000 degrees
bytes 56-63	V Pol Position	+/-100.000 degrees
	Angular position of satellite +ddd.ddd (decimal-degrees format) Right-justified and padded with blanks	
bytes 64-71	Reserved	Fill with zeros or blanks
byte 72	ETX	
byte 73	Checksum	

The reply to this command will be the standard ACK or NAK reply. The given index must be empty for this command to be successful. The NAK reply will be received if data already exists for the given index or if any parameter is invalid.

NOTE: Data written with this form must be saved to persist between power cycles. The Write Config Data Command should be executed after all changes have been made. Refer to section 3.4.18 of this document for more information.

Form 2: This form is used to delete stored satellites from memory. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	39h	command code
bytes 3-5	Index	The stored satellite index
bytes 6-15	“DELETE”	Clear stored satellite data for this index Left justified and padded with blanks
	or	
	“DELETE ALL”	Clear all stored satellite data Left justified and padded with blanks
bytes 16-18	Reserved	Fill with zeros or blanks
byte 19	ETX	
byte 20	Checksum	

The reply to this command will be the standard ACK or NAK reply.

NOTE: This command also clears any associated tracking or receiver data.

3.4.9 Read Satellite Data Command

This command reads a stored satellite from the controller memory. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	3Ah	command code
bytes 3-5	Index	The stored satellite index
byte 6	ETX	
byte 7	Checksum	

The ACK reply will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	3Ah	command code
bytes 3-5	Index	The stored satellite index
bytes 6-15	Satellite Name	10-character satellite name Left justified and padded with blanks
bytes 16-21	Longitude	Nominal satellite longitude -179.9 to 180.0 (West longitude negative) Left justified and padded with blanks
bytes 22-23	Inclination	Satellite inclination 0 to 19 degrees Left justified and padded with blanks
byte 24	Band	0 = C, 1 = Ku, 2 = L, 3 = X, 4 = Ka, 5 = S
bytes 25-29	Reserved	Filled with zeros or blanks
byte 30	Track Mode	'0' – No Tracking '1' – Memory/Step '2' – Step/Memory '3' – Step/TLE ‘4’ – TLE Only
byte 31	Signal Source	‘0’ – None ‘1’ – External ‘2’ – Internal (or internal beacon) ‘5’ – RF ‘6’ – DVB (if available) ‘7’ – Remote (if available)

Read Satellite Data Command (continued)

bytes 32-39	Azimuth Position	0.000 to 359.999 degrees
bytes 40-47	Elevation Position	-20.000 to 120.000 degrees
bytes 48-55	H Pol Position	+/-100.000 degrees
bytes 56-63	V Pol Position	+/-100.000 degrees
	Angular position of satellite +ddd.ddd (decimal-degrees format) Right-justified and padded with blanks	
bytes 64-71	Reserved	Filled with zeros or blanks
byte 72	ETX	
byte 73	Checksum	

The NAK reply indicates no stored satellite exists at the specified index.

3.4.10 Write Two-Line Element Data Command

This command writes NORAD Two Line Element (TLE) ephemeris data into the controller memory. The index must be the same as the associated stored satellite index. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	3Bh	command code
bytes 3-5	Index	The stored satellite index
bytes 6-74	TLE Line 1	69 characters (including checksum) of TLE Line 1
bytes 75-143	TLE Line 2	69 characters (including checksum) of TLE Line 2
byte 144	ETX	
byte 145	Checksum	

The reply to this command will be the standard ACK or NAK reply. The associated stored satellite must be setup as trackable for this command to be successful. The NAK reply will be received if no stored satellite exists at the specified index, if the stored satellite is not setup as trackable, or if any parameter is invalid.

NOTE: Data written with this command must be saved to persist between power cycles. The Write Config Data Command should be executed after all changes have been made. Refer to section 3.4.18 of this document for more information.

3.4.11 Read Two-Line Element Data Command

This command reads a stored set of Two Line Element (TLE) data from the controller memory. The index must be the same as the associated stored satellite index. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	3Ch	command code
bytes 3-5	Index	The stored satellite index
byte 6	ETX	
byte 7	Checksum	

The ACK reply will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	3Ch	command code
bytes 3-5	Index	The stored satellite index
bytes 6-74	TLE Line 1	69 characters (including checksum) of TLE Line 1
bytes 75-143	TLE Line 2	69 characters (including checksum) of TLE Line 2
byte 144	ETX	
byte 145	Checksum	

The associated stored satellite must be setup as trackable for this command to be successful. The NAK reply will be received if no stored satellite exists at the specified index or if the stored satellite is not setup as trackable.

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3.4.12 Write Beacon Data Command

This command writes beacon tuning data into the controller memory. The index must be the same as the associated stored satellite index. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	3Dh	command code
bytes 3-5	Index	The stored satellite index
bytes 6-13	H-Frequency	Horizontal beacon frequency (MHz) ddddd.dd Right-justified and padded with blanks
byte 14	H-Modulation	Horizontal beacon modulation 0 = CW, 1 = BPSK
bytes 15-22	V-Frequency	Vertical beacon frequency (MHz) ddddd.dd Right-justified and padded with blanks
byte 23	V-Modulation	Vertical beacon modulation 0 = CW, 1 = BPSK
bytes 24-31	Reserved	Fill with zeros or blanks
byte 32	ETX	
byte 33	Checksum	

The reply to this command will be the standard ACK or NAK reply. The associated stored satellite must be setup to use beacon signal strength for this command to be successful. The NAK reply will be received if no stored satellite exists at the specified index, if the stored satellite is not setup to use beacon signal strength, or if any parameter is invalid.

NOTE: Data written with this command must be saved to persist between power cycles. The Write Config Data Command should be executed after all changes have been made. Refer to section 3.4.18 of this document for more information.

3.4.13 Read Beacon Data Command

This command reads beacon tuning data from the controller memory. The index must be the same as the associated stored satellite index. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	3Eh	command code
bytes 3-5	Index	The stored satellite index
byte 6	ETX	
byte 7	Checksum	

The ACK reply will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	3Eh	command code
bytes 3-5	Index	The stored satellite index
bytes 6-13	H-Frequency	Horizontal beacon frequency (MHz) ddddd.dd Right-justified and padded with blanks
byte 14	H-Modulation	Horizontal beacon modulation 0 = CW, 1 = BPSK
bytes 15-22	V-Frequency	Vertical beacon frequency (MHz) ddddd.dd Right-justified and padded with blanks
byte 23	V-Modulation	Vertical beacon modulation 0 = CW, 1 = BPSK
bytes 24-31	Reserved	Filled with zeros or blanks
byte 32		ETX
byte 33		Checksum

The associated stored satellite must be setup to use beacon signal strength for this command to be successful. The NAK reply will be received if no stored satellite exists at the specified index or if the stored satellite is not setup to use beacon signal strength.

3.4.14 Read Count Sensor Command

This command returns the current pulse or resolver count value for azimuth, elevation, and polarization. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	3Fh	command code
byte 3	ETX	
byte 4	Checksum	

The ACK reply will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	3Fh	command code
bytes 3-8	Azimuth Count	0 to 65535
bytes 9-14	Elevation Count	0 to 65535
bytes 15-20	Polarization Count	0 to 65535
	Pulse sensor or resolver count value dddddd (unsigned integer format) Right-justified and padded with blanks Filled with blanks if sensor does not exist Filled with '*' if sensor reports an error	
byte 21	ETX	
byte 22	Checksum	

3.4.15 Read Navigation Data Command

This command returns the current values of navigation data. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	45h	command code
byte 3	ETX	
byte 4	Checksum	

The ACK reply will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	45h	command code
byte 3	Latitude/Longitude Source	

```
7 6 5 4   3 2 1 0
0 1 0 0 $ 0 X X X
```

	where 'XXX' is ...	001 – Lat/Lon data invalid 010 – Lat/Lon read from GPS 011 – User entered location 100 – User selected preset location 101 – Reserved 110 – Remotely entered lat/lon
bytes 4-12	Latitude	+ddd.dddd (decimal-degrees format) Right-justified and padded with blanks -90.0000 to +90.0000 or blanks if not available positive (implied) = North, negative = South
bytes 13-21	Longitude	+ddd.dddd (decimal-degrees format) Right-justified and padded with blanks -180.0000 to +180.0000 or blanks if not available positive (implied) = East, negative = West
bytes 22-28	Reserved	Filled with zeros or blanks

Read Navigation Data Command (continued)

byte 29	True Heading Source	
	7 6 5 4 3 2 1 0 0 1 0 0 $ 0 X X X	
	where 'XXX' is ...	001 – Heading data invalid 010 – Heading read from compass 011 – User entered magnetic heading 100 – User entered true heading 101 – Heading fixed by user 110 – Heading fixed automatically 111 – Remotely entered heading
bytes 30-34	True Heading	ddd.d (decimal degrees format) 0.0 to 359.9 or blanks if not available True Heading of mount at azimuth 0.0
byte 35	Magvar Status	0x41h if magvar ready (calculated) 0x40h if magvar not ready
bytes 36-40	Magnetic Variation	+dd.d (decimal-degrees format) Right-justified and padded with blanks -99.9 to 99.9 or blanks if magvar not available (westerly variation negative)
byte 41-48	Reserved	Filled with zeros or blanks
byte 49	Platform Tilt Source	
	7 6 5 4 3 2 1 0 0 1 0 0 $ 0 X X X	
	where 'XXX' is ...	001 – Currently no tilt data 010 – Automatically determined tilt data 011 – Remotely entered tilt data
bytes 50-54	Platform Pitch	+dd.d (decimal-degrees format) Right-justified and padded with blanks -99.9 to 99.9 or blanks if not available
bytes 55-59	Platform Roll	+dd.d (decimal-degrees format) Right-justified and padded with blanks -99.9 to 99.9 or blanks if not available
byte 60	ETX	
byte 61	Checksum	

3.4.16 Azimuth/Elevation/Polarization Jog Command (with minimal reply)

This command jogs the antenna in azimuth, elevation or polarization. It is functionally the same command as described in section 3.4 but with a much shorter reply. Rather than sending the full status reply, only the position (at the time the command is received) of the selected axis is returned.

The ACK reply will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	47h	command code
byte 3	Axis	The axis that is being jogged: 'A' – Azimuth 'E' – Elevation 'P' – Polarization
bytes 4-11	Axis Position	The current azimuth, elevation, or polarization angle +ddd.ddd (decimal-degrees format) or '********' if sensor error
byte 12	ETX	
byte 13	Checksum	

3.4.17 Remote Key Press Command

This command sends a keypad value to the RC4000. The RC4000 will react to the keypad value as if the corresponding key on the RC4000 front panel was pushed. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	48h	command code
byte 3	Key Code	Key code as defined below

CODE	KEY
30h	0/Speed
31h	1/Pol CCW
32h	2/N/EL UP
33h	3/Pol CW
34h	4/E/AZ CCW
35h	5
36h	6/W/AZ CW
37h	7/H
38h	8/S/EL DN
39h	9/V
3A-3Fh	-- unused –
41h	Stop/decimal pt.
42h	+/-/BKSP
43h	Mode
44h	Scroll Up/Yes
45h	Scroll Dn/No
46h	Enter
47h	Mode Group Change
48h	Null Key

byte 4	ETX
byte 5	Checksum

NOTE: The 47h key code can be used to initiate a mode group change which normally requires the Mode key to be held down for five seconds.

The reply to this command will be the standard ACK or NAK reply.

3.4.18 Write Config Data Command

This command writes CONFIG item values to the controller memory. Data values written by some remote commands are not committed to the flash memory until the save command is sent.

Flash memory has a limited number of write times. Care should be taken to avoid unnecessary calling of this command. For example, if changing a number of preset satellites, don't call Write Config Data until all Write Satellite Data commands have been sent and acknowledged.

The save command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	49h	command code
byte 3-15	"SAVE"	Left-justified and padded with blanks
byte 16	ETX	
byte 17	Checksum	

The reply to this command will be the standard ACK or NAK reply.

NOTE: The ACU current mode will change to FLASH_SAVE_MODE temporarily while flash data is saved.

3.4.19 Custom Device Status Command

This command requests status information given a variable list of Object IDs. A full list of available OIDs is given in section A.4 of this document. The command has the following format:

byte 0		STX
byte 1	A	address
byte 2	4Bh	command code
byte 3-n	Object IDs	A comma-delimited list of up to 16 OIDs. Each code should be in ASCII format with no padding. Example: 1.62.0,1.62.1 requests the azimuth and elevation angles
byte n+1	ETX	
byte n+2	Checksum	

The response to this command will be a comma-delimited list of the requested OIDs and related status values in the same order as they were requested. The return values will be the ASCII representation of character, numeric, or hexadecimal data. The return type is given in section A.4 of this document.

The ACK reply will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	4Bh	command code
byte 3-n	Object Values	A comma-delimited list of status object values. Each value will be in ASCII format with no padding. No data will be returned if a requested object ID is invalid. Example: 1.62.0=-22.3,1.62.0=47.1 is the reply containing the current azimuth angle (-22.3) and elevation angle (47.1)
byte n+1	ETX	
byte n+2	Checksum	

The NAK reply will be received if any parameter is invalid.

NOTE: This functionality is experimental and may change without notice.

3.4.20 Write Track Table Command

This command is used to manage track table data for a given stored satellite. There are two forms of this command.

Form 1: This command is used to modify track table entries. This command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	4Dh	command code
bytes 3-5	Index	The stored satellite index
bytes 6-7	Table Entry	Zero-based track table entry number (00–47)
bytes 8-13	Azimuth Position	0 to 65535
bytes 14-19	Elevation Position	0 to 65535
	Pulse sensor or resolver count value dddddd (unsigned integer format) Right-justified and padded with blanks	
byte 20	Update Flag	'Y' – set entry update flag 'N' – clear entry update flag
byte 21	ETX	
byte 22	Checksum	

The reply to this command will be the standard ACK or NAK reply. The associated stored satellite must be setup as trackable for this command to be successful. The NAK reply will be received if no stored satellite exists at the specified index, if the stored satellite is not setup as trackable, or if any parameter is invalid.

NOTE: In general, track table data should not be modified. This command is provided only to allow a track table to be restored in the event that the data has been corrupted or lost.

Write Track Table Command (continued)

Form 2: This form is used to clear track table entries. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	4Dh	command code
bytes 3-5	Index	The stored satellite index
bytes 6-7	Table Entry	Zero-based track table entry number (00–47)
bytes 8-17	“CLEAR”	Clear track table data for this entry Left-justified and padded with blanks
	or	
	“CLEAR ALL”	Clear all track table entries Left-justified and padded with blanks
bytes 18-20	Reserved	Fill with zeros or blanks
byte 21	ETX	
byte 22	Checksum	

The reply to this command will be the standard ACK or NAK reply.

3.4.21 Read Track Table Command

This command reads track table data from a given stored satellite. The command has the following format:

byte 0	STX	
byte 1	A	address
byte 2	4Eh	command code
bytes 3-5	Index	The stored satellite index
bytes 6-7	Table Entry	Zero-based track table entry number (00–47)
byte 8	ETX	
byte 9	Checksum	

The ACK reply will be in the following format:

byte 0	ACK	
byte 1	A	address
byte 2	4Eh	command code
bytes 3-5	Index	The stored satellite index
bytes 6-7	Table Entry	Track table entry number (00–47)
bytes 8-12	Sidereal Time	Sidereal time of this entry
bytes 13-18	Azimuth Position	0 to 65535
bytes 19-24	Elevation Position	0 to 65535
	Pulse sensor or resolver count value dddddd (unsigned integer format) Right-justified and padded with blanks or '******' if data is invalid	
byte 25	Update Flag	'Y' – entry update flag is set 'N' – entry update flag is not set
byte 26	Ephemeris Flag	'0' – ephemeris data not used '1' – ephemeris data used
byte 27-30	Reserved	filled with zeros or blanks
byte 31	ETX	
byte 32	Checksum	

The associated stored satellite must be setup as trackable for this command to be successful. The NAK reply will be received if no stored satellite exists at the specified index or if the stored satellite is not setup as trackable.

4 Troubleshooting

4.1 No Communication Between RC4000 And Remote-Control Computer

There are numerous situations that could cause no communication:

1) The address set in the RC4000 is not being used by the remote commands. Check the address in the REMOTE configuration screen and ensure that address is being sent with the commands. Incorrectly addressed commands will be ignored by the RC4000.
2) The baud rate set in the RC4000 is not being used by the remote commands. Check the baud rate in the REMOTE configuration screen and ensure that it is the same as being used by the remote computer. Commands sent at the incorrect baud rate will not be recognized by the RC4000.
3) The remote computer or RC4000 are not both set to RS-232 or RS-422/RS-485. The remote control system should determine whether it is to work in RS-232, -422 or -485 mode. Check the configuration of the remote jumper and the placement of the cable inside of the RC4000, as described in 2.2.11. Also check the cabling between the RC4000 and the remote computer.
4) The RS-422 adapter is not compatible with the RC4000. Occasionally it has been found that a commercially available RS-422 adapter will just not work with the RC4000. To check for this possibility, temporarily mechanize the interface via RS-232 and see if communications is established.
5) The remote computer is not actually transmitting through the intended communication port. To check for this possibility, mechanize a “loop back” right at the communication port of the remote computer. The receive mode of the remote control software should see an exact reflection of the transmitted command.

4.2 Unreliable Communications/ACU Reset

There are some situations that may cause the remote control communications to be unreliable (such as a garbled status reply) or in the extreme situation to cause the ACU to reset.

1) Allow a previous command to ACK or NAK before sending another command.
2) Don't repeatedly ask for "static" information such as navigation or satellite data.
3) The general recommendation is not to send commands (particularly status requests) at a rate greater than once a second.

5 Reference Information

5.1.1 Message Delimiters

Here are the delimiters used with SA bus messages, along with their values in hex and decimal.

ASCII Name	Value (hex)	Value (dec)
STX	0x02	2
ETX	0x03	3
ACK	0x06	6
NAK	0x15	21

5.2 ASCII Table

As reference, the following table shows the set of ASCII codes available for use by the RC4000 remote protocol.

HEX	*0_*	*1_*	*2_*	*3_*	*4_*	*5_*	*6_*	*7_*
_0			Blank	0	@	P		p
_1			!	1	A	Q	a	q
_2	STX		"	2	B	R	b	r
_3	ETX		#	3	C	S	c	s
_4			$	4	D	T	d	t
_5		NAK	%	5	E	U	e	u
_6	ACK		&	6	F	V	f	v
_7			'	7	G	W	g	w
_8			(	8	H	X	h	x
_9			)	9	I	Y	i	y
_A			*	:	J	Z	j	Z
_B			+	;	K	[	k	{
_C			,	<	L	\	l	|
_D			-	=	M	]	m	}
_E			.	>	N	^	n	
_F			/	?	O	_	o	

5.3 Status Reply Mode and State Values

The following table defines values for bytes 45-48 of the Device Status Poll reply. Possible values are listed for operating modes and mode states which are common to all modes.

Table 5.3.1 – Operating Modes and Common Mode States

Value (hex)	Value (dec)	Mode (byte 45 & 47)	Common Mode States (byte 46 & 48)
20	32	MANUAL	INITIALIZING_MODE
21	33	MENU	WAITING_FOR_USER_INPUT
22	34		
23	35		
24	36		
25	37		
26	38		MOVING_OUT_OF_DOWN
27	39	SETUP	MOVING_AZIMUTH
28	40	TRACK	MOVING_ELEVATION
29	41		MOVING_POLARIZATION
2A	42	SPECIAL_AXIS	MOVING_AZELPL
2B	43	POWER_UP	MOVING_SPECIAL_AXIS
2C	44		
2D	45		
2E	46		
2F	47		
30	48		ERROR_ELEV_NOT_IN_POSITION
31	49	RECALL	ERROR_SPECIAL_AXIS_NOT_IN_POSITION
32	50	MOVETO	
33	51		
34	52		
35	53		
36	54		
37	55	DELETE	
38	56	FLASH_SAVE	
39	57		
3A	58		
3B	59		
3C	60		
3D	61		MOVING_TO_SYNC_PULSES
3E	62	SHAKE	
3F	63		

The following tables define additional values for bytes 46 and 48 of the Device Status Poll reply. Possible values are listed for unique mode states. No unique states exist if the mode is not found in the following table.

Table 5.3.2 – Unique Mode States

Value (hex)	Value (dec)	MANUAL States	SETUP States	TRACK States
40	64	JOG_AZIM_CCW	SAT_MEMORY_FULL	INIT_PARAMETERS
41	65	JOG_AZIM_CW	TRACK_MEMORY_FULL	CONFIRM_EXIT
42	66	JOG_ELEV_DOWN		
43	67	JOG_ELEV_UP		
44	68	JOG_POL_CCW		TUNE_DVB
45	69	JOG_POL_CW		TUNE_BEACON
46	70	AUTO_MOVE_POL		TUNE_FAILURE
47	71	IDLE		ATTEN_BEACON
48	72		SAVING_DATA	
49	73		MOVING_POL_TO_SELECTED	STEP_PEAKING
4A	74			STEP_WAITING_FOR_SIGNAL_TO_RETURN
4B	75			STEP_IDLE
4C	76			SEARCH_ACTIVE
4D	77			SEARCH_MOVING_TO_FOUND_PEAK
4E	78			SEARCH_WAITING_TO_SEARCH_AGAIN
4F	79			
50	80			SEARCH_MANUAL_ACTIVE
51	81			MEMORY_IDLE
52	82			MEMORY_REPOSITION
53	83			MEMORY_UPDATING
54	84			MEMORY_CHECKING
55	85			TLE_IDLE
56	86			TLE_REPOSITION
57	87			
58	88			
59	89			
5A	90			
5B	91			
5C	92			
5D	93			
5E	94			
5F	95			
60	96			ERROR_PEAK_LIMIT
61	97			ERROR_ACU_ALARM
62	98			ERROR_CHECKSUM
63	99			ERROR_TLE_DATA
64	100			ERROR_UNDEFINED

Table 5.3.2 – Unique Mode States (continued)

Value (hex)	Value (dec)	POWER_UP States	RECALL States	
40	64	CONFIRM_TRACK_RESTART	SAT_MEMORY_EMPTY	
41	65	CONFIRM_SAVED_POSITION		
42	66	ENTER_ANTENNA_POSITION		
43	67			
44	68		MOVING_TO_SAT_POSITION	
45	69			
46	70			
47	71			
48	72			
49	73			

5.4 Status Object IDs and Return Value Types

NOTE: This functionality is experimental and may change at any time without notice.

The following table defines the available status OIDs and their return value types. All values are returned as ASCII characters formatted in the manner described. Supplemental tables follow with individual item detail where indicated.

Table 5.4.1 – Object IDs

OID	Status Item	Format	Description
x.0.0	CURRENT_MODE_ITEM	Unsigned	See Section **Error! Reference source not found.**
x.1.0	CURRENT_SUBMODE_ITEM	Unsigned	See Section **Error! Reference source not found.**
x.2.0	LAST_MODE_ITEM	Unsigned	See Section **Error! Reference source not found.**
x.3.0	LAST_SUBMODE_ITEM	Unsigned	See Section **Error! Reference source not found.**
x.5.0	TIMEDATE_ITEM (future)	ASCII String	HH:MM:SS (8 Characters)
x.6.0	ACTIVE_ALARM_ITEM	Enumeration	Table 5.4.5
x.8.0	LOCAL_JOG_CONNECTED_ITEM	Unsigned	0=Not Connected, 1=Connected
x.10.0	POS_SAVED_ITEM	Unsigned	0 = Not Saved, 1=Saved
x.11.0	POS_LOC_SOURCE_ITEM	Enumeration	Table 5.4.2
x.12.0	POS_LOC_LAT_ITEM	Signed	+DDMM (degrees/minutes)
x.13.0	POS_LOC_LON_ITEM	Signed	+DDDMM (degrees/minutes)
x.14.0	POS_LOC_ALT_ITEM (future)	Unsigned	AAAA (meters)
x.15.0	POS_HDG_SOURCE_ITEM	Enumeration	Table 5.4.2
x.16.0	POS_HDG_ITEM	Float	DDD.DD (degrees)
x.17.0	POS_TILT_SOURCE_ITEM	Enumeration	Table 5.4.2
x.18.0	POS_TILT_PITCH_ITEM	Signed	+DD.D (degrees)
x.19.0	POS_TILT_ROLL_ITEM	Signed	+DD.D (degrees)
x.21.0	SAT_INDEX_ITEM	Unsigned	0 – 19
x.22.0	SAT_NAME_ITEM	ASCII String	10 Characters
x.23.0	SAT_LON_ITEM	Float	+DDD.D (degrees)
x.24.0	SAT_INCLIN_ITEM	Signed	+DD (degrees)
x.25.0	SAT_BAND_ITEM	Enumeration	Table 5.4.3
x.26.0	SAT_POL_OFFSET_ITEM	Float	+DD.D (degrees)
x.40.0	DVB_FREQ_ITEM	Unsigned	DDDDD (Mhz)
x.41.0	DVB_SYMRATE_ITEM	Unsigned	DDDDD (kS/sec)
x.42.0	DVB_FEC_ITEM	Unsigned	1 – 7, (3=3/4)
x.43.0	DVB_STD_ITEM	Unsigned	1=S1, 2=S2
x.50.0	BCN_FREQ_ITEM	Float	DDDDDD.DD (kHz)
x.51.0	BCN_ATTEN_ITEM	Unsigned	DD (dB)
x.52.0	BCN_DEMOD_ITEM	Unsigned	0=CW, 1=BPSK
x.70.0	AXIS_ANGLE_ITEM: AZ	Float	+DDD.D (degrees)
x.70.1	AXIS_ANGLE_ITEM: EL	Float	+DDD.D (degrees)
x.70.2	AXIS_ANGLE_ITEM: PL	Float	+DDD.D (degrees)
x.71.0	AXIS_COUNT_ITEM: AZ	Unsigned	0 – 65535
x.71.1	AXIS_COUNT_ITEM: EL	Unsigned	0 – 65535
x.71.2	AXIS_COUNT_ITEM: PL	Unsigned	0 – 65535
x.72.0	AXIS_LIMITS_ITEM: AZ	Hexadecimal	Table 5.4.6
x.72.1	AXIS_LIMITS_ITEM: EL	Hexadecimal	Table 5.4.6
x.72.2	AXIS_LIMITS_ITEM: PL	Hexadecimal	Table 5.4.6
x.72.0	AXIS_ALARMS_ITEM: AZ	Hexadecimal	Table 5.4.7
x.72.1	AXIS_ALARMS_ITEM: EL	Hexadecimal	Table 5.4.7
x.72.2	AXIS_ALARMS_ITEM: PL	Hexadecimal	Table 5.4.7
x.73.0	AXIS_STATE_ITEM: AZ	Unsigned	Table 5.4.5
x.73.1	AXIS_STATE_ITEM: EL	Unsigned	Table 5.4.5
x.73.2	AXIS_STATE_ITEM: PL	Unsigned	Table 5.4.5

Table 5.4.1 – Object IDs (continued)

OID	Status Item	Format	Description
x.80.0	FEED_INDEX_ITEM	Unsigned	0 – 7
x.81.0	FEED_LNB_INDEX	Unsigned	0 – 2
x.89.0	HPA_ENABLE_ITEM	Unsigned	0=Disabled, 1=Tx Mute, 2=Enabled
x.90.0	SIGNAL_SOURCE_ITEM	Enumeration	Table 5.4.5
x.91.0	SIGNAL_LEVEL_ITEM	Unsigned	0 – 4095
x.92.0	SIGNAL_LOCK_ITEM	Unsigned	0=Off, 1=On, 2=None Defined
x.101.0	TRACK_SIDEREAL_TIME_ITEM	Unsigned	0 -- 84365
x.102.0	TRACK_STATUS_ITEM	Unsigned	Table 5.4.4
x.103.0	TRACK_ERROR_ITEM	Unsigned	Table 5.4.4

The following tables list enumerated values for multiple status items. Only values listed below should be considered valid.

Table 5.4.2 – Location, Heading, and Tilt Source Enumerated Values

Value (dec)	POS_LOC_SOURCE _ITEM	POS_HDG_SOURCE _ITEM	POS_TILT_SOURCE _ITEM
0	None	None	None
1	GPS	Compass	Auto
2	Manual	Manual Magnetic	Manual
3	Preset	Manual True	Remote
4	Reserved	Heading Fixed	
5	Remote	Auto Fixed	
6		Remote	
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			

Table 5.4.3 – Satellite Source, Band, and Polarization Enumerated Values

Value (dec)	SAT_SOURCE _ITEM	SAT_BAND _ITEM	SAT_POLARIZATION _ITEM
0	None	C	None
1	Manual	Ku	Horizontal
2	Preset	L	Vertical
3	Longitude	X	Right-Hand
4		Ka	Left-Hand
5		S	Neutral
6			
7			

Table 5.4.4 – Track Status and Error Enumerated Values

Value (dec)	TRACK_STATUS _ITEM	TRACK_ERROR _ITEM
0	Track Setup Sub-Mode Active	
1	Track Auto Mode Entry	
2	Step Track Sub-Mode Active	
3	Auto Search Sub-Mode Active	
4	Memory Track Sub-Mode Active	
5	Track Error Sub-Mode Active	
6	NORAD Track Sub-Mode Active	
7	Manual Search Sub-Mode Active	
33		Move Jammed Error
34		Move Limit Error
35		Move Drive Error
36		Peak Limit Error
37		Azim Scale Factor Error
38		Track Geo Error
39		Track System Error
40		Track Checksum Error

Table 5.4.5 – Alarm, Signal Source, and Axis State Enumerated Values

Value (dec)	ACTIVE_ALARM _ITEM	SIGNAL_SOURCE _ITEM	AXIS_STATE _ITEM
0	None	None	Idle
1	Flash Version Mismatch	Receiver 1 (External)	Coast
2	Flash Data Corrupted	Receiver 2 (Internal)	Jog Negative
3	NVRAM Version Mismatch	Reserved	Jog Positive
4	NVRAM Data Corrupted	Reserved	Auto Move Config
5	Low Battery	L-Band Power	Auto Move Negative
6	Invalid Time/Date	DVB	Auto Move Positive
7	Azimuth Jammed		
8	Azimuth Runaway		
9	Elevation Jammed		
10	Elevation Runaway		
11	Polarization Jammed	Remote	Alarm
12	Polarization Runaway		
13	Limits Inactive Warning		
14	Drive System Error		
15	Emergency Stop Active		
16	Maintenance Interlock		
17	Movement Interlock		
18	Local Jog Connected		
19	Summary Limit Warning		
20	Azimuth Sensor		
21	Elevation Sensor		
22	Polarization Sensor		

The following table lists possible values for the AXIS_LIMITS_ITEM. The hexadecimal value represents a 3-byte bitmask containing limit information. An 'x' indicates a "don't care". Any combination from 000000 to 030303 is possible.

Table 5.4.6 – AXIS_LIMITS_ITEM Mask

Value (hex)	MAX Limit	MIN Limit	STOW Limit
000000	None	None	None
01xxxx	Hard		
02xxxx	Soft		
03xxxx	Both		
xx01xx		Hard	
xx02xx		Soft	
xx03xx		Both	
xxxx01			Hard
xxxx02			Soft
xxxx03			Both

The following table lists possible values for the AXIS_ALARMS_ITEM mask. The hexadecimal value represents a 2-byte bitmask containing axis alarm information. An 'x' indicates a "don't care". Any combination from 0000 to FFFF is possible.

Table 5.4.7 – AXIS_ALARMS_ITEM Mask

Value (hex)	SENSOR	JAMMED	RUNAWAY	DRIVE	OFF-AXIS	HALT	MAINT	INTERLOCK
xxx1	Yes							
xxx2		Yes						
xxx4			Yes					
xxx8				Yes				
xx8x					Yes			
x1xx						Yes		
x2xx							Yes	
x4xx								Yes