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APPLICATION	
DASH	NEXT ASSEMBLY
–01	
–02	
–03	
–04	

REV STATUS OF SHEETS														
REV	D													
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PRECISION CONTROLS DIVISION

DWG TITLE **SPEC, MODEL 100/133 SOFTWARE INTERFACE**

SIZE A | CAGE NO. OPON7 | DWG NO. 90-003-0008 | REV D

SCALE NONE | SHEET 1 OF 118

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1.0 INTRODUCTION

This is the interface specification for the Radiation Systems, Precision Control model 100 antenna control system. The model 100 commands that follow also apply to the model 133, while model 133 specific commands are in a separate section towards the end of this document. Models 100 and 133 consists of an OCU (Operations Control Unit) and a CCU (Central Control Unit). The command source is normally a computer and is termed the station computer. This interface specification includes all available commands. As such, some commands may not apply to specific systems. Obvious examples include polarization commands for systems without polarization axes and Manual Rate mode for systems without a manual rate unit. This interface specification also applies to the model 133 antenna control system.

Optional Feature	Comments
Polarization Axis Control	This affects polarization commands, optional arguments relating to the polarization axis, fault and status messages.
Manual Rate Unit	This affects the availability of the Manual Rate mode.
Acquisition and Pointing Mode Package	This provides Box Scan, Geo Scan, Raster Scan, and Star Track modes.
Travel Avoidance Package	Delete.
Special circuit cards such as IRIG, IEEE-488, GPS, receiver, and serial expansion. These are provided on a system-specific basis.	This affects fault and status messages.
Dual OCUs	This affects some of the status and fault commands.
Dual CCUs	This affects some of the status and fault commands.
NORAD Option	This affects the availability of the NORAD mode(s) and commands.
Monopulse Option	This affects the availability of the monopulse mode, commands and monopulse optional arguments.
Monopulse Polarization Option	This affects the commands listed in this option.
Beam Waveguide Monopulse Option	The commands in this section are only useful if the antenna is a beam waveguide.
Spiral Scan Option	This affects the commands listed in this option.
Hour Angle/Declination Mount	This affects labeling of parameter load/recall for axes. Azimuth becomes Hour Angle, Elevation becomes declination. Does not affect Fundamental Modes
Data Logger Option	This affects the availability of the commands listed for this option.

Table 1-1, Common Optional Features Affecting Interface Commands

2.0 GENERAL OPERATION

The interface is designed so that the station computer sends only commands and the OCU sends only responses. No unsolicited output is issued from the OCU. Upper case ASCII characters are required unless specifically noted otherwise below. The interface is a positive response system. Each command will have a response unless otherwise noted. For data inquiry type commands, the response is the data requested. Commands without a natural response are either acknowledged <ack> by a "A" (ASCII A character) or not acknowledged <NAK> by a "N" (ASCII N character). The following responses apply to many commands.

"<ack> <cr> <lf>"	Command recognized and accepted.
"<NAK> <cr> <lf>"	Command is not recognized. This is the general response to commands which do not have an identifiable failure.
"<NAK> <sp> TIME <cr> <lf>"	The command was not completed during the timeout period.
"<NAK> <sp> BADD <cr> <lf>"	One or more of the command arguments are not correct. This include out-of-range errors. (BADD indicates BAD Data.)
"<NAK> <sp> NIC <cr> <lf>"	The station computer is not in control of the antenna. This command is only acceptable when the station computer is in control (NIC indicates Not In Control.)
"<NAK> <sp> MINH <cr> <lf>"	This command is not allowed in the present operational mode. (MINH indicates Mode INHibit.)
"<NAK> <sp> NOLD <cr> <lf>"	The NORAD data is not accepted because it is older than the existing set.
"<NAK> <sp> FULL <cr> <lf>"	The data is not accepted because the data table is full.
"<NAK> <sp> NSET <cr> <lf>"	The data is not accepted because the NORAD data set fails the checksum or validity tests.
"<NAK> <sp> NOD <cr> <lf>"	The command is not accepted because the data does not exist (no data).

The first two responses can apply to any command. A bad data response only occurs to commands with arguments. Not in control responses apply to many mode and data load commands and the necessary mode conditions are discussed on a command by command basis. Mode inhibit responses apply to a few data loading and mode operations and are discussed on a command by command basis. Commands are accepted or rejected as a single entity. The entire command is accepted or the entire command is rejected.

A <cr> indicates an ASCII carriage return. A <lf> indicates an ASCII line feed. An ASCII comma (,) is the delimiter between arguments. A <"> is an ASCII double quote character. To support testing and for terminals used in place of a station computer, the two characters "<-> <cr>" (minus or dash and carriage return) are treated as a continuation command

rather than the terminator "<cr>". This allows commands which exceed one line to be easily entered. Another testing feature is the use of line feeds <lf>. While the carriage return is the standard command terminator, a line feed following the return displays commands more clearly on a monitor. Thus while the standard format is "<cmd> <cr>", the form "<cmd> <cr> <lf>" will also be accepted. In general, line feeds are ignored by the OCU. A <sp> is an ASCII blank (or space).

The "< >" characters are used as delimiters of parameters or special characters and do not appear in the actual command or response. For example, "<param>" indicates a parameter and the "< >" characters are not actually transmitted.

Brackets ([]) are used to show command elements that are optional. In general, optional elements are shown as [, <element>]. If there are multiple optional arguments, any combination of arguments is usually acceptable, but the delimiting character <,> is required even for arguments which are not used. Consider a command of "CMD <sp> [<e1>] [, <e2>] [, <e3>]". If only the third optional element is to be sent, then the actual command would be "CMD <sp> ,, <e3>". The additional commas are required to indicate that the third argument is the only one to change. In some cases, two optional arguments are logically required. A command of the form "CMD <sp> [<e1>] [, <e2> , <e3>]" indicates that arguments <e2> and <e3> are an inseparable pair. Arguments which are omitted are not changed and the existing values are used.

Some commands are not allowed when the OCU is in certain modes. General exceptions will be noted below, but customized systems may have other exceptions which will be described in either the system-specific appendix or the Operation and Maintenance (O&M) manual.

Parameters are in ASCII unless otherwise noted. For example an <azp> parameter with a value of 359.999 would consist of the ASCII characters for "3", "5", "9", ".", "9", "9", and "9" or "359.999".

Parameter formats, when provided, are suggested only. The actual length of the data may vary. The suggested format is chosen since greater precision is not meaningful and/or inefficient in terms of data link bandwidth. For example, an azimuth command of "359.999999" is not meaningful for any available encoder. On the other extreme, a command of "359.9" is perfectly acceptable provided that this means "359.900" (there is no significant round off error). The decimal point is required for all real (non-integer) numerical arguments and is rejected for all integer arguments. Thus "359" is not acceptable but "359." will be accepted for a real argument. Also note that exceeding the recommended command length may lead to out-of-range commands. A command of 359.9999 is greater than the maximum value of 359.999 and thus would be rejected.

The software task that implements the computer interface defined by this document is referred to as the Command Interpreter or equivalently, the Command Line Interpreter. The Command Interpreter accepts input commands from the station computer and the OCU console. When multiple commands are received at the input of the Command Interpreter, they are queued. After the Command Interpreter has processed a command and determined that the command was valid, the proper action is taken in response to the command.

Note that the travel ranges as checked by the CLI are fixed. The ranges may not match the physical travel range of the specific antenna. The physical travel command is checked by other processes against the parameters in section 3.3.15 to confirm that the final command is valid. Thus it is possible to issue a command which is accepted and acknowledged but is not physically achievable. This condition is indicated by a fault message rather than a <NAK> response from the unit.

When the station computer is in control of the OCU, at least one valid command in each 10 second (user adjustable) period is required. Failure to receive commands causes the OCU to assume there is a data link or station computer failure. This results in any computer-supplied velocity feedforward being disabled. In other words, the system will hold the last valid position at the time the error is detected but the mode will not change. Depending on the control keyswitch position, a change in control from the station computer to the OCU console may occur. See the Operation and Maintenance manual (O&M) for details.

In addition to the hardware buffer on the serial chips, there is a 253 byte buffer in software to store serial commands. Thus any command (or group of concatenated commands) should be somewhat less than 253 bytes. Larger commands may be used if the clear to send CTS and ready to send RTS interface lines are used.

Many commands are not allowed when the station computer is not in control of the antenna. This can happen several ways. The station computer may not be in control of the OCU. Or the OCU may not be in control of the antenna (via the CCU).

Responses are in the returned in the order of the commands sent.

2.1 DATA LINK

The primary data links supported are RS-232 or RS-422 serial link. The standard configuration is a data rate of 4800 baud, 8 data bits, one start bit, two stop bits, with odd parity. The parameters of the data link are adjustable. The Model 100 system is designed to support 5 commands per second, plus one status inquiry per second at peak processor loading. Refer to section 12 for model 133 interface data. This does not apply to mode change commands, as they require about 0.25 seconds to process and implement. Position designate commands following the initial position designate command are not considered mode changes and may be issued at 5 per second. In many cases, a faster rate may be achieved, but this should not be relied upon without consultation with the engineering staff. Commands may be transmitted and buffered up to the previously discussed limit, or new commands may be issued as soon as a response (ack or NAK) is received by the station computer. Using the latter method, the station computer commands need not be limited by strict timing constraints inside the station computer. Note, however, that acknowledgement does not necessarily mean that the commanded action is complete. Some commands require internal processing time after the response is issued.

2.2 PHYSICAL INTERFACE

The connector for the station computer link is a 9 pin sub-D style connector. The cable connector is female, the OCU chassis connector is male and is labeled J6. Table 2.2-1 shows

the pins for the options of RS-232 or RS-422 operation. These pin assignments correspond to a DTE configuration. Transmit (TX) and receive (RX) signals are required. Ground is optional for RS-422 (used primarily for the cable shield), but is required for RS-232 signals. The ready-to-send (RTS) and clear-to-send (CTS) signals are supported but not required. RTS and CTS are recommended for control links which are heavily used. These lines provide protection against buffer overflow.

Pin No.	RS-232	RS-232 Optional Connections	RS-422	RS-422 Optional Connections
1			RX-	
2	RX+		RX+	
3	TX+		TX+	
4			TX-	
5	GND			GND
6				RTS-
7		RTS+		RTS+
8		CTS+		CTS+
9				CTS-

Table 2.2-1, Pin Assignments

3.0 MODEL 100 COMMANDS

3.1 FUNDAMENTAL MODE COMMANDS

The OCU has pseudo-independent mode operation for the polarization axis from the azimuth/elevation axis. Only the Polarization Preset Position, Polarization Position Designate mode, Polarization Stop, Polarization Monopulse, and Polarization Program Table Track mode commands are fully independent equivalent modes. Table 3.1-1 shows the mode commands and how they affect the az/el and polarization operational states.

For example, beginning with both az/el and pol in the Stop mode, Manual Position command would take all axes to Manual Position mode. A subsequent Stop mode command would change all axes to Stop mode. A Preset Position command would then change the az/el mode to Preset, leaving the pol mode in Stop.

Command	Applies to Az/El	Applies to Pol	Applies to Both
Stop	YES	YES	YES
Memory Track	YES	NO	NO
Preset Pos	YES	NO	NO
Pol Preset Pos	NO	YES	NO
Manual Rate[1,3]	YES	YES	YES
Manual Pos	YES	YES	YES
Steptrack	YES	NO	NO
Optrack	YES	NO	NO
INTELSAT	YES	NO	NO
Geo Desig	YES	NO	NO
Geo Preset	YES	NO	NO
Stow[2]	YES	NO	NO
Program Table Track	YES	NO	NO
Pol Prog Table Track	NO	YES	NO
Star Track	YES	NO	NO
Maintenance[1]	YES	YES	YES
Pol Stop	NO	YES	NO
Pol Pos Desig	NO	YES	NO
Pol INTELSAT[1]	NO	YES	NO
Pol Optrack[1]	NO	YES	NO
Position Desig	YES	NO	NO
Monopulse	YES	NO	NO
Pol Monopulse	NO	YES	NO
Spiral Scan	YES	NO	NO

Table 3.1-1, Mode Command Application

[1] While in these modes a change of the az/el mode always results in a change of the pol mode. If the new az/el mode command does not normally change the pol mode, then the pol mode will become Stop. For example Manual Rate mode followed by a Memory Track command will result in Memory Track mode for az/el and Stop mode for pol. Manual Rate mode followed by a Stop command results in Stop for az/el and pol. An example of a mode

command which normally changes the pol mode is a Maintenance mode command while in Optrack with pol Optrack. This sequence results in both az/el and pol in Maintenance mode.

[2] A Stow command places the polarization axis in Stop mode.

[3] For AC systems manual control consists of jog control switches and indicators. This is termed Manual Rate mode.

3.1.1 Position Designate Mode

The OCU will change the operational state to the Position Designate mode in response to this command. This command affects only the az/el axes. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The antenna is driven to the command angles provided in response to this command.

Command: "PD <sp> <azp> , <elp> [, <time>] [, <cw>] [, <azvel>] [, <elvel>] <cr>"

Where:
- azp = The commanded azimuth position in degrees (0.0 to 359.9999).
- elp = The commanded elevation position in degrees (-5.000 to 95.000)
- cw = The cable wrap desired. 'C' = clockwise, 'W' = counterclockwise, 'S' = shortest path.
- azvel = The desired azimuth velocity. This velocity will be used for feedforward and to extrapolate position commands. The range is +/- 20.000 deg/s.
- elvel = The desired elevation velocity. This velocity will be used for feedforward and to extrapolate position commands. The range is +/- 20.000 deg/s.
- time = The UTC time at which the position command is valid. This is in seconds and fractions of a second (per day). The range is 0.00 to 86400.00.

Response: "<ack> <cr> <lf>"

Example Commands:

"PD <sp> 180.018 , 30.001 , 77000.10 <cr>"
"PD <sp> 180.045 , 30.000 , 77245.05 , C , 1.767 , 0.001 <cr>"

3.1.1.1 Position Designate Options

The position designate command is designed to support three styles of operation, depending on the optional arguments contained in the command. This section discusses these command styles.

The first and simplest style is position only commands. Commands are executed upon receipt. Any cable wrap is acceptable. This type of command is suitable for low to moderate target dynamics.

The second style is position and velocity. Commands are executed upon receipt. Any cable wrap is acceptable. The velocity is used for velocity feedforward and position command extrapolation. Position extrapolation continues until the next command (or until a timeout occurs if the link fails). This type of command is suitable for moderate to high target dynamics. It is appropriate for applications in which the OCU is slaved to another sensor (such as a radar) issuing commands as quickly as information becomes available.

The third style of commands is position, velocity, and time. Commands are executed upon reaching the time value. Position commands are extrapolated beginning at the time value. Position extrapolation continues until the next command (or until a timeout occurs if the link fails). This type of command is suitable for moderate to high target dynamics. It is appropriate for applications which have trajectory information available ahead in time. Because this style is inherently ahead in time, a 3 slot buffer exists in the OCU. If the buffer is full and a new command is received, the command will be NAKed. Position and time commands are considered to be identical to a position, time and velocity command with a zero velocity. If the current time is less than 1000 seconds and command > 85400, command is assumed for yesterday. If command is more than 3600 seconds earlier than current time, it is assumed tomorrow.

Mixing command styles is not recommended with the following two exceptions. First, mixing position and position and velocity commands is acceptable. Second, a position or position and velocity command can be used to reset the position, velocity and time buffer. A position only (or position and velocity only) command will clear the buffer and execute immediately. This may be useful in avoiding delays if a target change is desired.

Summarizing the command styles, the position only command indicates that the target position is accurate immediately. Position and velocity commands indicate that the target position and velocity are known and are accurate immediately. Position, velocity and time commands indicate that the target position and velocity are known at the reference time.

Switching from a specific cable wrap to shortest path cable wrap may cause unanticipated behavior. Consider commanding a cable wrap which is not the shortest path and immediately commanding the shortest path thereafter. This would cause the antenna to start motion toward the first cable wrap specific command and then reverse direction to travel in the shortest path direction. Thus if the cable wrap is significant, the cable wrap argument must continue to be issued until the shortest path is towards the desired cable wrap (the antenna is within 180 degrees of the desired position).

3.1.2 Stop Mode (Disable)

The OCU will change the operational state to Stop mode in response to this command. This command affects both the az/el and pol axes. The drives are disabled and the brakes, if any, are set. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command.

Command: "STOP <cr>"

Response: "<ack> <cr> <lf>"

3.1.3 Preset Position Mode

The OCU will change the operational state to the Preset Position mode in response to this command. This command affects only the az/el axes. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The antenna is driven to the commanded preset angles in response to this command. The polarization mode and position are not changed by this command.

Command: "POS <sp> <N> <cr>"

Where: N = The number of the preset position. There are 40 preset positions in the OCU so this can be a number from 1 to 40.

Response: "<ack> <cr> <lf>"

3.1.3.1 Preset Position Load/Recall

The station computer can load (when in control of the OCU and when the OCU is in control of the antenna) or recall (anytime) the preset AZ/EL/POL positions. The pol position will be zero if the system does not have a polarization axis.

Load
Command: "SAT <sp> <N> [, <azp>] [, <elp>] [, <polp>] [, <config>] [, <"> <name> <">] <cr>"

Recall
Command: "SAT? <sp> <N> <cr>"

Where:
- N = The number of the preset position. There are 40 preset positions in the OCU so this can be a number from 1 to 40. azp = The azimuth preset position in degrees (0.0 to 359.999).
- elp = The elevation preset position in degrees (-5.000 to 95.000).
- polp = The polarization preset position in degrees (0.0 to 359.999).
- name = An alphanumeric name assigned to the position. This can be 1 to 20 characters. The valid characters are limited to a through z, A through Z, 0 through 9 and "," , "." and " " (<sp>, the blank or space character).
- config = The default configuration number desired. If omitted, the configuration is not changed. The value is 0 to 10. A setting of 0 insures that the system config is not changed upon entry of preset position mode.

Response to load command: "<ack> <cr> <lf>"

Response to recall command:

"<azp> , <elp> , <polp> , <config> , <"> <name> <"> <cr> <lf>"

Example Response to recall command:

"314.789 , 77.487 , 111.938 , 7 , <"> PRESET 7 <"> <cr> <lf>"

3.1.4 Geo Designate Mode

The OCU will change the operational state to the Geo Designate mode in response to this command. This command affects only the az/el axes. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The antenna is driven to the command angles computed from the lat/lon arguments in response to this command.

Command: "GEOD <sp> <slat> , <slon> <cr>"

Where:
- slon = The longitude (orbital slot) of the target (0.0 to 359.9999 (east)).
- slat = The latitude location of the target in degrees (-90.0000 (south) to 90.0000 (north)).

Response: "<ack> <cr> <lf>"

3.1.5 Geo Preset Mode

The OCU will change the operational state to the Geo Preset mode in response to this command. This command affects only the az/el axes. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The antenna is driven to the command angles computed from the lat/lon arguments in response to this command.

Command: "GEOP <sp> <N> <cr>"

Where:
- N = The position number for the geocentric preset position from which to operate this mode. (The satellite on which this mode is to operate.) There are 10 preset positions numbered 1 through 10.

Response: "<ack> <cr> <lf>"

3.1.5.1 Geo Preset Position Load/Recall

The station computer can load (when in control of the OCU and when the OCU is in control of the antenna) or recall (anytime) the preset LAT/LON positions.

Load
Command: "GP <sp> <N> [, <lat>] [, <lon>] [, <config>] [, <"> <name> <">] <cr>"

Recall
Command: "GP? <sp> <N> <cr>"

Where:
- N = The number of the preset position. There are 10 preset positions allowed in the OCU so this can be a number 1 to 10.
- lat = The preset position of the target's latitude. (-90.0000 (south) to 90.0000 (north)).
- lon = The preset position of the target's longitude. (0.0 to 359.9999 (east)).
- config = The default configuration number desired. If omitted, the configuration is not changed. The value is 0 to 10 (integer). A setting of 0 insures that the system config is not changed upon entry of Geo Preset Position mode.
- name = An alphanumeric name assigned to the position. This can be 1 to 20 characters.

Response to load: "<ack> <cr> <lf>"

Response to recall: "<lat> , <lon> , <config> , <"> <name> <"> <cr> <lf>"

Example Response to recall:

"51.1111 , 321.0101 , 6 , <"> INTELSAT VI A 180 W <"> <cr> <lf>"

3.1.6 Optrack Mode

The OCU will change the operational state to the Optrack mode in response to this command. This command affects only the az/el axes. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The antenna is driven to internally derived command angles in response to this command.

Command: "TRACK <sp> <N> <cr>"

Where:
- N = The number of the Optrack data set to use. This value may be 1 to 3.

Response: "<ack> <cr> <lf>"

3.1.6.1 Optrack Parameters Load/Recall

The station computer can load (when in control of the OCU and when the OCU is in control of the antenna) or recall (anytime) the Optrack parameters. The parameters of the Optrack set in use may not be changed.

Load
Command: "OT <sp> <N> [, <recycle>] [, <sct>] [, <config>] [, <track_type>] [, <"> <name> <">] <cr>"

Recall
Command: "OT? <sp> <N> <cr>"

Alternate Recall
Command: "OTA? <sp> <N> <cr>"

Where:

N	=	The number of the Optrack data set (1 to 3).
recycle	=	Recycle level in dB (-50.0 to 0.0)
sct	=	Scan cycle time in minutes (10.0, 20.0, or 30.0)
config	=	The default configuration number desired. If omitted, the configuration is not changed. The value is 0 to 10 (integer). A setting of 0 insures that the system config is not changed upon entry of Optrack mode.
track_type	=	A "0" for steptrack, a "1" for monopulse. If monopulse option is not available, track-type must be "0" for steptrack.
name	=	Alphanumeric name assigned to the data set. This can be 1 to 20 characters.
axis	=	Indication of the axis setting for this optrack data set. This setting is used in the Optrack Detail window in the OCU display. It determines which axes will be in Optrack mode when commanded from the OCU front panel. A "0" indicates all axes. A "1" indicates only the AZ and EL axes (not POL).

Response to load: "<ack> <cr> <lf>"

Response to recall: "<recycle> , <sct> , <config> , <track_type> , <"> <name> <"> <cr> <lf>"

Response to alternate: "<recycle> , <sct> , <config> , <track_type> , <axis> , <"> <name> <"> <cr> <lf>"

Example Response to recall: "-10.0 , 10.0 , 4 , 0 , <"> INTELSAT VI A 180 W <"> <cr> <lf>"

3.1.6.2 Optrack Data Charge

The station computer can charge (when in control of the OCU) the Optrack data table. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The charge command will also be rejected if charging is attempted while in Optrack mode on the data set in use or if the data set used to charge Optrack is not valid. The charge command will be rejected if a previous charge command is not complete.

Command: "CHARGE <sp> <N1> , <N2> <cr>"

Where:

N1	=	The number of the Optrack data set to charge. This value may be 1 to 3.
N2	=	The number of the INTELSAT set to use to charge the Optrack data set (1 to 10).

Response: "<ack> <cr> <lf>"

If no INTELSAT data response: "<NAK> <sp> <NOD> <cr> <lf>"

3.1.6.3 Optrack Data Clear

The station computer can clear (when in control of the OCU) the Optrack data storage. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The clear command will also be rejected if charging is attempted while in Optrack mode on the data set in use. The clear command will be rejected if a previous clear command is not complete.
WARNING: this will cause all data stored for this Optrack target to be deleted.

Command: "CLEAR <sp> <N> <cr>"

Where:

N	=	The number of the Optrack data set to clear. This value may be 1 to 3.

Response: "<ack> <cr> <lf>"

3.1.7 INTELSAT Pointing Mode

The OCU will change the operational state to the INTELSAT mode in response to this command. This command affects only the az/el axes. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The antenna is driven to the command angles derived from the previously loaded INTELSAT parameters in response to this command.

Command: "PMTK <sp> <N> <cr>"

Where:

N	=	The INTELSAT set ephemeris number. The OCU stores and allows use of 10 different INTELSAT parameter sets (1 to 10).

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Response: "<ack> <cr> <lf>"

If no INTELSAT data response: "<NAK> <sp> <NOD> <cr> <lf>"

3.1.7.1 INTELSAT Ephemeris Load/Recall

The station computer can load (when in control of the OCU and when the OCU is in control of the antenna) or recall (anytime) INTELSAT parameters. The recall command allows the computer to recall any one of the 10 reports. If the station computer is not in control of OCU, the OCU will reject load commands. If the OCU is not in control of the antenna, the OCU will reject load commands. Recall commands are allowed at any time, but will be rejected if the data set does not exist (has not been loaded). The following load command allows the data set to be changed while in INTELSAT mode, including the set in use. Set deletion is not allowed on the set in use.

Load Command: "INTELSAT <sp> <lm0> , <lm1> , <lm2> , <lonc> , <lonc1> , <lons> , <lons1> , <latc> , <latc1> , <lats> , <lats1> , <epoch_time> , <lat_answer> , <lon_answer> , <check_time> , <N> [, <config>] [, <"> <name> <">] <cr>"

Recall Command: "INTELSAT? <sp> <N> <cr>"

Delete Command: "ERASE <sp> <N> <cr>"

Where:

lm0..lats1 = The 11 parameters of the INTELSAT ephemeris data. These are the same mnemonics used by INTELSAT on their transmitted reports. See table 3.1.7.1-1 for ranges and formats.

epoch_time = The UTC reference time used by the INTELSAT predict equation. Format is "mm:dd:yyyy <sp> hh:mm:ss".

lat_answer = The latitude of the satellite at the check time provided. Used to verify that the set has been properly entered in the OCU.

lon_answer = The longitude of the satellite at the check time provided. Used to verify that the set has been properly entered in the OCU.

check_time = The UTC time at which the satellite is located at (lat_answer,lon_answer). Provided in hours since epoch.

N = The OCU INTELSAT set that is to be recalled or loaded. There are ten possible so this value can be 1 to 10.

config = The default configuration number desired. If omitted, the configuration is not changed. The value is 0 to 10 (integer). A setting of 0 insures that the system config is not changed upon entry of Optrack mode.

name = An alphanumeric name assigned to the position. This can be 1 to 20 characters.

Response to load and delete: "<ack> <cr> <lf>"

Response to recall: "<lm0> , <lm1> , <lm2> , <lonc> , <lonc1> , <lons> , <lons1> , <latc> , <latc1> , <lats> , <lats1> , <epoch_time> , <config> , <"> <name> <"> <cr> <lf>"

Response upon check failure: "<NAK> BADD <cr> <lf>"

Example Response to recall:

"325.4451 , -0.0075 , -0.004890 , 0.0132 , -0.0019 , -0.0113 , -0.0016 , 3.1537 , 0.0011 , 1.7348 , -0.0003 , 11:01:1990 <sp> 20:00:00 , 9 , <"> INTELSAT VI A 180 W <"> <cr> <lf>"

Response to recall for empty or erased set:

"<NAK> <sp> NOD <cr> <lf>"

Parameter	Standard Format	Range
lmo	xxx.xxxx	0.0-359.9999
lm1	xx.xxxx	+/-0.5000
lm2	xx.xxxxxx	+/-0.100000
lonc	xx.xxxx	+/-0.2000
lonc1	xx.xxxx	+/-0.0200
lons	xx.xxxx	+/-0.2000
lons1	xx.xxxx	+/-0.0200
latc	xxx.xxxx	+/-15.0000
latc1	xx.xxxx	+/-0.1000
lats	xxx.xxxx	+/-15.0000
lats1	xx.xxxx	+/-0.1000
lat_answer	xxx.xxxx	+/-15.0000
lon_answer	xxx.xxxx	0.0-359.9999
check_time	xxxx	0-1000

Table 3.1.7.1-1, INTELSAT Parameters

3.1.8 Memory Track Mode

The OCU will change the operational state to the Memory Track mode in response to this command. This command affects only the az/el axes. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command.

Command: "MEMT <cr>"

Response: "<ack> <cr> <lf>"

3.1.8.1 Memtrack Load/Recall

The station computer can load (when in control of the OCU and when the OCU is in control of the antenna) or recall (anytime) Memory Track parameters.

Load
Command: "MTLD <sp> <accur> [, <config>] <cr>"

Recall
Command: "MTLD? <cr>"

Where: accur = The accuracy required of the Memory Track data. This is % of beamwidth and ranges from 5.0 to 100.0.
config = The default configuration number desired. If omitted, the configuration is not changed. The value is 0 to 10 (integer). A setting of 0 insures that the system config is not changed upon entry of Memory Track mode.

Load
Response: "<cr> <lf>"

Recall
Response: "<accur> , <config> <cr> <lf>"

Example Response: "20.3 , 3 <cr> <lf>"

3.1.8.2 Memtrack Data Charge

The station computer can charge (when in control of the OCU) the memory track data table. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The charge command will also be rejected if a previous charge command is not complete, or if the mode is Memory Track.

Command: "CHARGEM <sp> <N1> <cr>"

Where: N1 = The number of the INTELSAT set to use to charge the memtrack data set (1 to 10).

Response: "<ack> <cr> <lf>"

If no INTELSAT data response: "<NAK> <sp> <NOD> <cr> <lf>"

3.1.8.3 Memtrack Data Clear

The station computer can clear (when in control of the OCU) the memory track data storage. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. WARNING: this will cause all data stored for memory track to be deleted. The clear command will also be rejected if a previous clear command is not complete, or if the mode is Memory Track.

Command: "CLEARM <cr>"

Response: "<ack> <cr> <lf>"

3.1.9 Stow Mode

The OCU will go into Stow mode operation and stow the antenna in response to this command. If the station computer is not in control of this OCU, the OCU will reject this command. If this OCU is not in control of the antenna, the OCU will reject this command. The Stow command places the polarization axis in the Stop mode.

Command: "STOW [<sp> N] <cr>"

Where: N = The number of the stow position. There are two stow positions so N may be "1" or "2". If no value is provided, "1" is assumed.

Response: "<ack> <cr> <lf>"

3.1.9.1 Stow Position Load/Recall

The station computer can load (when in control of the OCU and when the OCU is in control of the antenna) or recall (anytime) the two preset stow positions.

Load
Command: "SWP <sp> <N> , <azp> , <elp> [, <"> <name> <">] <cr>"

Recall
Command: "SWP? [<sp> <N>] <cr>"

Where: N = A 1 or a 2 to indicate which preset stow position to load/recall. If omitted from the recall command, the OCU responds by transmitting both stow positions.
azp = The azimuth stow position in degrees (0.0 to 359.999)
elp = The elevation stow position in degrees (-5.000 to 95.000)
name = An alphanumeric name assigned to the position. This can be 1 to 20 characters.

Response: "<ack> <cr> <lf>"

Response to recall:

"<azp> , <elp> , <"> <name> <"> <cr> <lf>"

Response to recall with no arguments:

"<az1p> , <el1p> , <"> <name> <"> <cr> <lf>"
"<az2p> , <el2p> , <"> <name> <"> <cr> <lf>"

Example Response to recall:

"333.333 , 11.777 , <"> INTELSAT VI A 180 W <"> <cr> <lf>"

3.1.10 Maintenance Mode

The OCU will change the operational state to the Maintenance mode in response to this command. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The OCU diagnostic tests can only be performed when the OCU is in this mode. This mode also allows the Portable Maintenance Unit (PMU) to be used to drive the antenna. Once Maintenance mode has begun and the PMU has taken control, the computer is no longer in control of the antenna. Maintenance mode may be exited (if the PMU is not in control) by issuing a fundamental mode change. Enhanced modes and pol modes do not exit maintenance mode.

Command: "MAINT <cr>"

Response: "<ack> <cr> <lf>"

3.1.11 Manual Position Mode

The OCU will change the operational state to the Manual Position mode in response to this command. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. Once in the Manual Position mode, the computer controls antenna movement through the use of the manual offsets and manual jog commands.

Command: "MANPOS <cr>"

Response: "<ack> <cr> <lf>"

3.1.12 Manual Rate Mode

The OCU will change the operational state to the Manual Rate mode in response to this command. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command.

This mode allows the (optional) Manual Rate Unit (MRU) to drive the antenna. Once Manual Rate mode has begun and the MRU has taken control, the computer is no longer in control of the antenna. Manual rate mode may be exited (if the PMU is not in control) by issuing a Fundam mode change. Enhanced modes or pol modes do not exit manual rate mode.

Command: "MANRATE <cr>"

Response: "<ack> <cr> <lf>"

3.2 ENHANCED MODE COMMANDS

Enhanced modes are designed to support or improve the operation of the fundamental modes. Selection of an enhanced mode normally results in dual-mode operation. For example, INTELSAT command followed by a Steptrack command results in Steptrack mode operation in conjunction with the INTELSAT trajectory; both modes are active simultaneously. Both modes affect the system positioning and, properly chosen, the combination of modes provides superior performance to either mode alone. Unless specifically noted otherwise, enhanced modes do not affect the polarization axis.

3.2.1 Steptrack Mode

The OCU operation will begin Steptrack mode operation in conjunction with the current fundamental mode in response to this command. This operation affects only the az/el axes. If the station computer is not in control of the OCU, the OCU will reject this command. If this OCU is not in control of the antenna, the OCU will reject this command. This command is accepted as shown in table 3.2.1-1 below. The first column shows the fundamental mode at the time the enhanced mode command is received. The second column shows the mode after the enhanced mode command is processed, and the third column shows the resulting enhanced mode. The acceptance of enhanced modes is also a function of the existing enhanced mode. Table 3.2.1-2 shows the initial enhanced mode (at the time of the new enhanced mode command) in column one with the command result in column two.

Depending on the system configuration, steptrack may go through intermediate modes either while in steptrack or before tracking begins. Box, Raster, and Geo scan be used for target acquisition or reacquisition with the mode reverting to steptrack when an acceptable signal is located. For details on how to select the desired system behavior, see the Operation and Maintenance Manual.

Command: "STEPT <sp> <N> [, <scan_pattern> , <scan_number>] <cr>"

Response: "<ack> <cr> <lf>"

Where:

N	=	The number of the steptrack data set (1 to 11). The automatic set is set 11.
scan_pattern	=	The desired scan pattern. A "0" indicates no scan, a "1" indicates box scan, a "2" indicates raster scan, and a "3" indicates spiral scan. Omission of these optional parameters results in

operation with the stored scan pattern and scan number. Box and raster scans are available only if the acquisition and pointing option is selected. Spiral scan is available only if the spiral scan option is selected.

scan_number = The number of the scan data set to use. The range is 1 to 11, with 1 to 10 manual parameters and 11 is the automatic set.

Initial Fundamental Mode	Resulting Fundamental Mode	Enhanced Mode
Stop	Position Hold	Steptrack
Memory Track	Memory Track	Steptrack
Preset Pos	Preset Pos	Steptrack
Manual Rate	Manual Rate	None, Not Allowed
Manual Pos	Manual Pos	None, Not Allowed
Optrack	Optrack	None, Not Allowed
INTELSAT	INTELSAT	Steptrack
Geo Designate	Geo Designate	Steptrack
Geo Preset	Geo Preset	Steptrack
Maintenance	Maintenance	None, Not Allowed
Position Designate	Position Designate	Steptrack
Stow	Stow	None, Not Allowed
NORAD Track	NORAD Track	Steptrack
Star Track	Star Track	Steptrack
Program Table Track	Program Table Track	Steptrack

Table 3.2.1-1, Steptrack Mode Command Response

Initial Enhanced Mode	Command Result
None	Steptrack Accepted
Box Scan	NAK
Raster Scan	NAK
Geo Scan	NAK
Steptrack	NAK
Monopulse	NAK
Spiral Scan	NAK

Table 3.2.1-2, Steptrack Command Response

3.2.1.1 Steptrack Data Load/Recall

The station computer can load steptrack parameters. If the OCU is not in control of the antenna or the station computer is not in control of the OCU, the OCU will reject load commands. Recall commands are allowed at any time.

Load Command: "STEPM <sp> <N> , <recycle> , <snt> , <size> , <data> , <sct> , <gain> , <park> , <limit> , <scan_pattern> , <scan_number> [, <"> <name> <">] <cr>"

Load Command: "STEPA <sp> <recycle> , <incl> , <scan_pattern> , <scan_number> [, <"> <name> <">] <cr>"

Recall Command: "STEPM? <sp> <N> <cr>"

Recall Command: "STEPA? <cr>"

Where:
- N = The number of the steptrack data set (1 to 10). For STEPM (manual), N = 1 to 10.
- recycle = Recycle level in dB (-50.0 to 0.0) (Degraded signal level)
- snt = Integration time in seconds (1 to 4).
- size = Box step size in % of beamwidth (5.0 to 20.0)
- data = Data point rejection (1 = on, 0 = off)

sct	=	Scan cycle time in minutes (0.0 to 240.0)
gain	=	Steptrack gain (0.0 to 1.00). The unitless gain between sensed position error and actual corrective position movement.
scan_pattern	=	The desired scan pattern. A "0" indicates no scan, a "1" indicates box scan, a "2" indicates raster scan, and a "3" indicates spiral scan. Box and raster are scans available only if acquisition and pointing option is selected. Spiral scan available only if the spiral scan option is selected.
scan_number	=	The number of the scan data set to use. The range is 1 to 11, with 1 to 10 manual parameters and 11 is the automatic set.
park	=	Park threshold in % of beamwidth (3.0 to 10.0)
limit	=	Corrective step limit in % of beamwidth (0.0 to 10.0) (Peak Center Corrections)
name	=	Alphanumeric name assigned to the data set. This can be 1 to 20 characters.
incl	=	Inclination in degrees, (0.0 to 15.0). This is the apparent inclination of a geosynchronous target or the equivalent inclination due to target velocity of other types of trajectories.

Response to load: "<ack> <cr> <lf>"

Response to recall (manual): "<recycle> , <snt> , <size> , <data> , <sct> , <gain> , <park> , <limit> , <scan_pattern> , <scan_number> , <"> <name> <"> <cr> <lf>"

Response to recall (auto): "<recycle> , <incl> , <scan_pattern> , <scan_number> , <"> <name> <"> <cr> <lf>"

Example Response to recall (manual): "-10.0 , 2 , 10.0 , 1 , 10.0 , 0.50 , 6.0 , 8.1 , 1 , 11 , <"> INTELSAT VI A 180 W <"> <cr> <lf>"

3.2.1.2 Steptrack Track Cycle Initiate Command

The station computer can command Steptrack mode to peak the signal. If the OCU is not in control of the antenna or the station computer is not in control of the OCU, the OCU will reject the command. This command is accepted only if the OCU is in the Steptrack (enhanced) mode and is not in Optrack mode.

Command: "TRKCY <cr>"

Response: "<ack> <cr> <lf>"

3.2.2 Cancel Enhanced Mode Command

The OCU will cancel (halt) any enhanced mode operation in response to this command. This operation affects only the az/el axes. If the station computer is not in control of the OCU, the OCU will reject this command. If this OCU is not in control of the antenna, the OCU will reject this command. This command is not allowed in Optrack mode.

Command: "CANE <cr>"

Response: "<ack> <cr> <lf>"

3.3 PARAMETER COMMANDS

3.3.1 Beacon Frequency/Configuration Select/Recall

The station computer can select (when in control of the OCU) or recall (anytime) the system configuration. The configuration includes selection of the beacon frequency and rf frequency data used to monitor the receive signal level and used to track the satellite. This command will cause the active enhanced mode to reset. This command is not allowed in Optrack mode.

Select
Command: "SB <sp> <config> <cr>"

Recall
Command: "S? <cr>"

Where: config = Which configuration to use. There are 10 configurations numbered 1 to 10.

Response to select: "<ack> <cr> <lf>"

Response to recall: "<config> <cr> <lf>"

Example Response to recall: "9 <cr> <lf>"

3.3.2 RF Parameters Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the rf parameters. The load command is not accepted for the RF parameters in use if the mode is Optrack. The load command for the RF parameters in use causes the enhanced mode to be reset (restarted). The elevation feed offset correction is defined as positive if the RF el axis is above the mechanical el axis. Thus a positive angle will cause the elevation axis to rotate down. The cross elevation feed offset is defined as positive if the RF cross el position is clockwise (greater) than the mechanical position. Thus a positive angle will cause the azimuth axis to rotate counterclockwise.

Note on Bandwidth: The RF Bandwidth change will make the error bandwidth (in mono RF) change if the monopulse option is on and they are different narrow bandwidths. See Section 8.3.1.

Load
Command: "RF <sp> <N> , <center_frequency> , <bandwidth> , <slope> , <offset> , <active_search> , <feed_off_el> , <feed_off_xel> [, <path>] [,<Narrow_band_sweep_width>] [, <"> <name> <">] <cr>"

Recall
Command: "RF? <sp> <N> <cr>"

Recall
Response: "<center_frequency> , <bandwidth> , <slope> , <offset> , <active_search> , <feed_off_el> , <feed_off_xel> , <path> , <narrow_band_sweep_width> <"> <name> <"> <cr> <lf>"

Where:
- N = The RF parameters number from 1 to 10.
- center_frequency = The frequency of the beacon in GHz. The range is 0.100000 to 100.000000.
- bandwidth = The bandwidth of the signal in GHz. The range is wide: 0.00028000, narrow1: 0.00000250, narrow2: 0.00000670.
- slope = The signal slope in dB/V. The range is 0.1 to 100.0000.
- offset = The signal offset required to normalize the input signal. The range is +/-100.0000 dB.
- active_search = A "1" indicates this setting is on the active search path (when auto search is selected). A "0" indicates this setting should not be searched.
- feed_off_el = The feed offset in elevation (degrees -5.000 to 5.000).
- feed_off_xel = The feed offset in cross elevation (degrees -5.000 to 5.000).
- path = A "1" or "2" to indicate the input path of the RF signal. A "1" is used if this argument is omitted.
- name = Alphanumeric name assigned to the configuration. This can be 1 to 20 characters.
- Narrow_band_sweep_width = The range to search for the carrier of the beacon in kHz. The range is 40 to 145.

Example Recall: "3.938700 , 0.00000670 , 4.3100 , 1.7345 , 1 , 0.075 , -1.289 , 2 , 100 , 47 , <"> IF BW 1.00000670 MHZ <"> <cr> <lf>"

3.3.3 Configuration Parameters Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) configuration parameters. This command is not accepted when the OCU is in the Optrack mode. This command will cause the active enhanced mode to be reset. Other configuration parameters may be loaded and recalled using the commands in sections 3.3.22, 3.3.23, 3.3.24 and 3.3.14.

Load
Command: "CFG <sp> <N> , <acquire_threshold> , <low_signal_threshold> , <RF_number> [, <"> <name> <">] <cr>"

Recall
Command: "CFG? <sp> <N> <cr>"

Recall
Response: "<acquire_threshold> , <low_signal_threshold> , <RF_number> , <"> <name> <"> <cr> <lf>"

Where:
- N = The configuration number from 1 to 10.
- acquire_threshold = The minimum signal required to autotrack (0.0 to -40.0 dB).
- low_signal_threshold = The signal level which is considered unacceptable. Steptrack is inhibited below this threshold (0.0 to -40.0 dB).
- RF_number = The RF parameters number for the parameters to be used for tracking. This is a number from 0 to 10. A "0" indicates that autosearch is desired. The other numbers are fixed selections.
- name = Alphanumeric name assigned to the configuration. This can be 1 to 20 characters.

Example Recall: "-10.3 , -0.7 , 10 , <"> YOUR CHOICE <"> <cr> <lf>"

3.3.4 Manual Offset Load/Recall

Manual offsets are used to move the antenna manually from the station computer console or the OCU console. The manual offset loading feature is inhibited by the OCU during active steptracking or scanning (STEPTRACK ACTIVE, SCAN ACTIVE or START submodes). Manual offsets are also inhibited during Stow, Maintenance, and Manual Rate modes. Pol offsets are inhibited in Pol Monopulse mode and Az/El offsets are inhibited in Az/El Monopulse mode. Azimuth and elevation manual offsets are automatically cleared upon any fundamental mode change. The manual offset load is also inhibited if the fundamental submode is transition. Polarization offsets are automatically cleared upon any pol mode change.

The station computer can load (when in control of the OCU and when the OCU is in control of the antenna) or recall (anytime) the manual offsets used to manually move the antenna from the operator console or from the station computer. If the manual offsets are changed, the antenna will move in response by the amount of that change. The manual offset command is an absolute offset; the previous offset is replaced by the new offset. The manual jog offset command is an incremental offset; the previous offset is supplemented by the new offset. The polarization offset will be zero if there is no polarization axis.

Load
Commands: "OFFSET <sp> [<azoff>] [, <eloff>] [, <poloff>] <cr>"
"JOG <sp> [<azinc>] [, <elinc>] [, <polinc>] <cr>"

Recall
Command: "OFFSET? <cr>"

Where:

azoff	=	The azimuth manual offset value in degrees (-20.000 to 20.000).
eloff	=	The elevation manual offset value in degrees (-20.000 to 20.000).
azinc	=	The amount to add to the current azimuth manual offset value in degrees (-20.000 to 20.000).
elinc	=	The amount to add to the current elevation manual offset value in degrees (-20.000 to 20.000).
poloff	=	The pol manual offset value in degrees (-20.000 to 20.000).
polinc	=	The pol manual increment value in degrees (-20.000 to 20.000).
NOTE	=	The total offset may not exceed the range of the argument. For example, if the azimuth offset is -1 and an azimuth increment of -20 was commanded, this would be rejected because (-1 + -20) exceeds the limit of -20. A new fundamental mode clears the manual offsets.

Response to load: "<ack> <cr> <lf>"

Response to recall: "<azoff> , <eloff> , <poloff> <cr> <lf>"

Example Response to recall: "-4.111 , 11.030 , 0.000 <cr> <lf>"

3.3.5 Site Parameters Load/Recall

The site parameters can only be loaded when the OCU is in Stop mode and Pol Stop (for pol systems). The station computer is allowed to load (when the station computer is in control of the OCU and when the OCU is in control of the antenna) and recall (always) the site altitude, latitude and longitude values in the OCU.

Load
Command: "SITE <sp> <lat> , <lon> , <alt> [, <"> <name> <">] <cr>"

Recall
Command: "SITE? <cr>"

Where:

alt	=	The site altitude in meters (-1000.0 to 10000.0).
lat	=	The site latitude in degrees (-90.0000 (south) to +90.0000 (north))
lon	=	The site longitude in degrees (0.0-359.9999 (east)).
name	=	Alphanumeric name assigned to the site. This can be 1 to 20 characters.

Response: "<ack> <cr> <lf>"

Response to recall: "<lat> , <lon> , <alt> , <"> <name> <"> <cr> <lf>"

Example Response to recall: "35.3510 , 221.0208 , 1100.0 , "STAR 7" <cr> <lf>"

3.3.6 Binary Status Request

The OCU will transmit all fault and status indications in binary form to the station computer in response to this request. This command is valid in all modes. Table 3.3.25-1 lists the position of the fault and status messages. The binary values are set based on the fault or status message location in the table. A "1" indicates the fault or status is TRUE.

Command: "FB <sp> <N> <cr>"

Response: "X.....X <cr> <lf>"

Where:

X	=	Hexadecimal representation of eight bits of status for each status byte. There are 30 CCU status bytes (40 for OCU responses), each of which requires two (hex) characters to encode. Thus there are 60 total CCU characters (80 for OCU responses).
N	=	The number of the request. (A 1 indicates a request for fault and status for the OCU queried. A 2 applies for the other OCU. Either OCU request contains 40 bytes of raw binary information. A 3 is a request of CCU number 1, and a 4 is a request for CCU number 2. Either CCU request contains 30 bytes of raw binary information.)

Example Response: "C7A53393.... BBFFAD3A <cr> <lf>"
(60 or 80 characters plus <cr> <lf>).

See Section 3.3.25 for tracking receiver status.

3.3.7 Status Request

The OCU will transmit basic status information to the station computer in response to this request. This status information includes the azimuth position, the elevation position, the polarization position, the current OCU mode and the tracking signal strength. Table 3.3.7-1 contains a list of possible modes. All modes listed in the table do not apply to all systems. This command is valid at any time. The polarization position will be zero if there is no polarization axis. The polarization mode will be stop if there is no polarization axis.

Command: "STAT <cr>"

Response: "<azp> , <elp> , <polp> , <mode> , <signal> <cr> <lf>"

Where:
- azp = the azimuth position in degrees (0.0 to 359.9999)
- elp = the elevation position in degrees (-5.0000 to 95.0000)
- polp = the polarization position in degrees (system dependent, 0.0 to 359.999).
- mode = The current OCU operational mode. This consists of the fundamental mode, the fundamental submode, the enhanced mode, the enhanced submode, the polarization mode, and the polarization submode. Thus the mode format is <fundm> <fundsub> <enhancedm> <enhancedsub> <polm> <polsub>. Each of the modes is a two digit symbol defined in the table below.
- signal = The level in dB of the tracking signal (-50.00 to 10.00)

Example Response:

"299.9999, 73.1234, 123.777, 020231005000, -21.31 <cr> <lf>"

Fundamental Mode	Mode Symbol	Enhanced Mode	Mode Symbol	Polarization Mode	Mode Symbol
Stop	00	None	30	Stop	50
Preset Pos	02	Steptrack	31	Preset Pos	52
Man Rate	07	Box Scan	32	Man Rate	54
Man Pos	08	Raster Scan	34	Man Pos	55
Memory Trk	11	Geo Scan	35		
Optrack	10	Monopulse	33	Optrack	56
INTELSAT	04	Spiral Scan	36	INTELSAT	57
Geo Desig	05			Monopulse	60

Fundamental Mode	Mode Symbol	Enhanced Mode	Mode Symbol	Polarization Mode	Mode Symbol
Geo Preset	03				
Maintenance	06			Maint	53
Pos Desig	01			Pos Desig	51
Stow	09				
Pos Hold	29				
Star Track	12				
Program Table Track	13			Program Table Track	59
NORAD Track	14				

Table 3.3.7-1, Mode Codes

Fundamental Mode Submodes	Submode Symbol
Reset	00
Transition	01
Active	02
Off Target	03
Stop	04
Disabled	05
Pending	06
Wait to Start	07
Finished	08
Pos Hold	09
Reserved	10-19

Table 3.3.7-2, Fundamental Submode Codes

Enhanced Mode Submodes	Submode Symbol
Reset	00
Start	01
Steptrack Active	02, 03, 04, 05 [or]
Steptrack Parked	06

Enhanced Mode Submodes	Submode Symbol
Disabled	07
Locate	08
Interrupt	09
Poor Signal	10
Shutdown	11
Other OCU In Control	12
Scan Active	13, 14, 15, 16, 17, 19 (or)
Located	18
Monopulse Active	20
Target Not Visible	21
NORAD Halt	22
Pending	23

Table 3.3.7-3, Enhanced Submode Codes

Polarization Submodes	Submode Symbol
Reset	00
Active	02
Wait To Start	07
Finished	08

Table 3.3.7-4, Polarization Submode Codes

3.3.8 Status Message Requests

The OCU will send all the fault or status messages that are displayed at the OCU console (text strings) to the station computer in response to these requests. This command is valid at any time. Table 3.3.8-1 lists the standard fault and status messages. **Job specific fault and status messages are common, so the standard list may not be applicable.** Reserved indicates that the status/faults is previously allocated or is used for internal purposes. Undefined indicates that the status/fault is available for use in custom applications.

Command: "M [<sp> <N>] <cr> (faults)

"STM [<sp> <N>] <cr>" (status)

Response: "<string1> <cr> <lf> <string2> <cr> <lf> ... <stringN> <cr> <lf> <etx>"

Where: stringN = Up to 25 characters describing the status or fault message. The number of status messages depends on how many status events occur.

N = The number of the request. (A 1 indicates a request for fault and status for the OCU queried. A 2 applies for the other OCU. A 3 is a request of CCU number 1, and a 4 is a request for CCU number 2. No argument results in all four responses.)

Example Response: "PEDESTAL EMERGENCY SWITCH <cr> <lf> CONFIGURATION 2 ACTIVE <cr> <lf> <etx>"

<etx> = ASCII etx character (hex 03)

/* CCU #1 (the standard CCU) Status */

Note: (Azimuth is replaced with Hour Angle, Elevation is replaced with declination on HA/DEC systems.)

Text String		Fault/Status	
/* Status Byte 1 */			/* COMMENTS */
"AZIMUTH DRIVE FAULT	"	F	/* LSB, bit 0 */
"AZ CW PRELIMIT	"	F	/* Depends on System Wiring */
"CABLE WRAP SWITCH OPEN	"	S	/* Depends on System Wiring */
"AZ STOW PIN EXTENDED	"	S	/* If Az Stow mechanism */
"AXIS DIFFERENCE	"	S	
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"AZ PLD DIFFERENCE	"	S	/* Multi Motor DC PDU Only */
"EL PLD DIFFERENCE	"	S	/* " DC PDU */ /* MSB, bit 7 */
/* Status Byte 2 */			
"ELEVATION DRIVE FAULT	"	F	
"AZ CCW PRELIMIT	"	F	/* Depends on System Wiring */
"RESERVED	"	S	
"EL STOW PIN EXTENDED	"	F	/* If El Stow mechanism */
"REDUNDANT SUPPLY	"	S	/* If xtra CCU Pwr Supply */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"AZ SINGLE MOTOR	"	S	/* Multi Motor DC PDU Only */
"EL SINGLE MOTOR	"	S	/* Multi Motor DC PDU Only */
/* Status Byte 3 */			
"POL DRIVE FAULT	"	S	
"AZ CW LIMIT	"	F	/* Depends on System Wiring */
"RESERVED	"	S	
"AZ BRAKE FAULT	"	F	/* If Az brakes used */
"WARNING HORN ACTIVE	"	S	
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"AZ CURRENT CLAMPED	"	S	/* Multi Motor DC PDU Only */
"EL CURRENT CLAMPED	"	S	/* Multi Motor DC PDU Only */
/* Status Byte 4 */			
"OCU EMERGENCY STOP	"	F	
"AZ CCW LIMIT	"	F	/* Depends on System Wiring */
"RESERVED	"	S	
"EL BRAKE FAULT	"	F	/* If El brakes used */
"AZ STOWED	"	S	/* If Stow Mechanism */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"AZ PRELOAD OFF	"	S	/* Multi Motor DC PDU Only */
"EL PRELOAD OFF	"	S	/* Multi Motor DC PDU Only */
/* Status Byte 5 */			
"#2 EMERGENCY	"	F	/* Depends on System Wiring */
"EL UP PRELIMIT	"	F	/* Depends on System Wiring */
"EL BRAKE CB OFF	"	S	/* If Separate Brakes */
"POL BRAKE FAULT	"	S	/* If Pol brakes used */
"AZ STOW ALIGNED	"	S	/* If Az Stow mechanism */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */

/* Status Byte 6 */			
"#3 EMERGENCY	"	F	/* Depends on System Wiring */
"EL DOWN PRELIMIT	"	F	/* Depends on System Wiring */
"AZ BRAKE CB OFF	"	S	/* If Separate Brakes */
"PMU IN CONTROL	"	S	
"EL STOWED	"	S	/* If Stow Mechanism */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
/* Status Byte 7 */			
"POL CW LIMIT	"	S	/* Depends on System Wiring */
"EL UP LIMIT	"	F	/* Depends on System Wiring */
"EL MOTOR OVERTEMP	"	F	
"MRU IN CONTROL	"	S	/* If MRU supplied */
"EL STOW ALIGNED	"	S	/* If El Stow mechanism */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
/* Status Byte 8 */			
"POL CCW LIMIT	"	S	/* Depends on System Wiring */
"EL DOWN LIMIT	"	F	/* Depends on System Wiring */
"RESERVED	"	S	
"RESERVED	"	S	
"RESERVED	"	F	
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */
"UNDEFINED	"	S	/* Multi Motor DC PDU Only */

BEGIN MULTI MOTOR DC PDU ONLY FAULTS/STATUS
(Not Meaningful on Other Systems)

/* Status Byte 9 */			
"AZ MOTOR CONTROL 1 FAULT	"	F	
"AZ MOTOR 2 OVERTEMP	"	F	
"EMERGENCY 1	"	F	/* Depends on System Wiring */
"EL MOTOR CONTROL 1 FAULT	"	F	
"EL MOTOR 2 OVERTEMP	"	F	/* If El motor 2 provided */
"EL STOW CB OFF	"	F	/* If Lube pumps used */
"RESERVED	"	S	
"EL LUBE PUMP 2 CB OFF	"	S	/* If Lube pumps used */
/* Status Byte 10 */			
"AZ MOTOR 1 OVERTEMP	"	F	
"AZ MTR 2 3-PHASE OFF	"	F	
"EMERGENCY 2	"	F	/* Depends on System Wiring */
"EL MOTOR 1 OVERTEMP	"	F	
"EL MTR 2 3-PHASE OFF	"	F	/* If El motor 2 provided */
"RESERVED	"	S	/* If Lube pumps used */
"RESERVED	"	S	
"EL LUBE PUMP 1 CB OFF	"	S	/* If Lube pumps used */

```
/* Status Byte 11 */
"AZ MTR 1 3-PHASE OFF      "        F
"AZ MOTOR CONTROL 3 FAULT  "        S     /* If 4 Motors in Az */
"EMERGENCY 3               "        F     /* Depends on System Wiring */
"EL MTR 1 3-PHASE OFF      "        S
"EL MOTOR CONTROL 3 FAULT  "        S     /* If 4 Motors in El */
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S

/* Status Byte 12 */
"AZ MOTOR 1 HANDCRANK      "        F     /* If Handcranks */
"AZ MOTOR 3 OVERTEMP       "        S     /* If 4 Motors in Az */
"EMERGENCY 4               "        F     /* Depends on System Wiring */
"EL MOTOR 1 HANDCRANK      "        F     /* If Handcranks */
"EL MOTOR 3 OVERTEMP       "        S     /* If 4 Motors in El */
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S

/* Status Byte 13 */
"AZ MOTOR 2 HANDCRANK      "        F     /* If Handcranks available */
"AZ MTR 3 3-PHASE OFF      "        S     /* If 4 Motors in Az */
"EMERGENCY 5               "        F     /* Depends on System Wiring */
"EL MOTOR 2 HANDCRANK      "        F     /* If Handcranks & 2 el motors
*/
"RESERVED                  "        S     /* If 4 Motors in El */
"EL LUBE PUMP 1 CB         "        S     /* If Lube pumps used */
"RESERVED                  "        S
"RESERVED                  "        S

/* Status Byte 14 */
"AZ AUX INTERLOCK          "        F     /* If Lube pumps used */
"AZ MOTOR CONTROL 4 FAULT  "        S     /* If 4 Motors in Az */
"EMERGENCY 6               "        F     /* Depends on System Wiring */
"EL AUX INTERLOCK          "        F     /* If Lube pumps used */
"EL MOTOR CONTROL 4 FAULT  "        F     /* If 4 Motors in El */
"EL LUBE PUMP 2 CB OFF     "        S
"RESERVED                  "        S
"RESERVED                  "        S

/* Status Byte 15 */
"AZ LUBE PUMP 2 PRESS LOW  "        S     /* If Lube pumps used */
"TRACKING RECEIVER FAULT   "        F     /* If RSi Tracking Receiver */
"EMERGENCY 7               "        F     /* Depends on System Wiring */
"EL LUBE PUMP 2 PRESS LOW  "        S     /* If Lube pumps used */
"EL MOTOR 4 OVERTEMP       "        S     /* If 4 Motors in El */
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S
```



```
/* Status Byte 16 */
"AZ MOTOR CONTROL 2 FAULT  "        F
"AZ MTR 4 3-PHASE OFF      "        S     /* If 4 Motors in Az */
"208 V CB EMERGENCY        "        F
"EL MOTOR CONTROL 2 FAULT  "        F     /* If 2 motors in el */
"RESERVED                  "        F     /* If 4 Motors in El */
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S

          END MULTI MOTOR DC PDU ONLY FAULTS/STATUS

/* Status Byte 17 */
"CCU-OCU #1 LINK DOWN      "        F     /* If Dual OCU */
"CCU-OCU #2 LINK DOWN      "        F     /* If Dual OCU */
"OCU IN CONTROL            "        S     /* If Dual OCU */
"OCU #2 IN CONTROL         "        S     /* If Dual OCU */
"CCU DATABASE EMPTY        "        F
"CCU SOFTWARE FAULT        "        F
"CCU SIMULATION ACTIVE     "        S
"RESERVED                  "        S

/* Status Byte 18 */
"RESERVED                  "        S
"AZ DISABLED               "        S
"PMU ENABLED               "        S
"EL DISABLED               "        S
"MRU ENABLED               "        S     /* If MRU */
"POL DISABLED              "        S     /* If Pol Axis */
"AZ INSIDE DEADBAND        "        S
"EL INSIDE DEADBAND        "        S

/* Status Byte 19 */
"POL INSIDE DEADBAND       "        S     /* If Pol Axis */
"AZ OSCILLATION            "        F
"EL OSCILLATION            "        F
"POL OSCILLATION           "        F     /* If Pol Axis */
"AZ ENCODER FAULT          "        F
"EL ENCODER FAULT          "        F
"POL ENCODER FAULT         "        F     /* If Pol Axis */
"UNDEFINED                 "        S

/* Status Byte 20 */
"AZ TACH / ENCODER ERROR   "        F     /* If DC system */
"EL TACH / ENCODER ERROR   "        F     /* If DC system */
"POL TACH / ENCODER ERROR  "        F     /* If Pol DC Axis */
"AZ XDCR COARSE FAULT      "        F     /* If Resolvers used */
"AZ LOW XDCR REF VOLTAGE   "        F     /* If Resolvers used */
"EL XDCR COARSE FAULT      "        F     /* If Resolvers used */
"EL LOW XDCR REF VOLTAGE   "        F     /* If Resolvers used */
"POL CONVERTER FAULT       "        F     /* If Pol Axis */
```

```
/* Status Byte 21 */
"POL LOW XDCR REF VOLTAGE "         F     /* If Pol Axis */
"AZ AUTOTRACK RUNAWAY     "         F     /* If Monopulse */
"EL AUTOTRACK RUNAWAY     "         F     /* If Monopulse */
"POL AUTOTRACK RUNAWAY    "         F     /* If Pol Monopulse */
"UNDEFINED                "         F
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S

/* Status Byte 22 */
"CCU MEMORY FAULT         "         F
"RESERVED                 "         F
"CCU IRIG BD ERROR        "         F     /* If Special Hardware */
"CCU ROM ERROR            "         F
"CCU ENCODER BD ERROR     "         F
"CCU SERIAL BD ERROR      "         F
"CCU IEEE-488 BD ERR      "         F     /* If Special Hardware */
"CCU RECEIVER BD ERR      "         S     /* If Monopulse or CCU Rcvr */

/* Status Byte 23 */
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S

/* Status Byte 24 DUAL OCU */
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S

/* Status Byte 25 */
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
```



```
/* Status Byte 26 */
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S

/* Status Byte 27 */
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
```

BEGIN MULTI MOTOR DC PDU ONLY FAULTS/STATUS
(Not Meaningful on Other Systems)

```
/* Status Byte 28 */
"RESERVED                 "         S
"PMU AVAILABLE            "         S
"MRU AVAILABLE            "         S     /* If MRU provided */
"HORN AVAILABLE           "         S
"RESERVED                 "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S

/* Status Byte 29 */
"EL STOW EXTEND OVERTORQUE"         F     /* If Stow Pin */
"AZ MOTOR 1 BLOWER CB OFF "         F     /* If motor blowers used */
"EL STOW RETRACT OVERTORQ "         F     /* If Stow Pin */
"AZ MOTOR 2 BLOWER CB OFF "         F     /* If motor blowers used */
"UNDEFINED                "         S
"EL MOTOR 1 BLOWER CB OFF "         F     /* If motor blowers used */
"UNDEFINED                "         S
"EL MOTOR 2 BLOWER CB OFF "         F     /* If motor blowers used */

/* Status Byte 30 */
"UNDEFINED                "         S
"POL DRIVE FAULT          "         F     /* If DC POL Drive */
"AZ BRAKE CB OFF          "         F     /* If Brakes used */
"POL DRIVE POWER          "         F     /* If DC POL Drive */
"EL BRAKE CB OFF          "         F     /* If Brakes used */
"EL OPT DIFFERENCE        "         F
"AZ OPT DIFFERENCE        "         F
"CURRENT CLAMP OVERRIDE   "         S
```

END MULTI MOTOR DC PDU ONLY FAULTS/STATUS

/* CCU #2 (the 2nd CCU in a dual CCU system) Status */

/* These bytes (31 to 60) are copies of bytes 1 through 30 */
/* for the 2nd CCU */
/* Any exceptions are listed below */

NO DIFFERENCES

/* OCU #1 (the standard OCU) Status */

Text String		Fault/Status	
/* Status Byte 61 : Software Travel Limits */			
"COMMAND > REGION AZ+	"	F	
"COMMAND > REGION AZ-	"	F	
"COMMAND > REGION EL+	"	F	
"COMMAND > REGION EL-	"	F	
"AZ+ SOFTWARE LIMIT	"	F	
"AZ- SOFTWARE LIMIT	"	F	
"EL+ SOFTWARE LIMIT	"	F	
"EL- SOFTWARE LIMIT	"	F	
/* Status Byte 62 : Software Box Limits */			
"COMMAND > BOX AZ+	"	F	
"COMMAND > BOX AZ-	"	F	
"COMMAND > BOX EL+	"	F	
"COMMAND > BOX EL-	"	F	
"AZ+ BOX LIMIT	"	F	
"AZ- BOX LIMIT	"	F	
"EL+ BOX LIMIT	"	F	
"EL- BOX LIMIT	"	F	
/* Status Byte 63 : Orbital Slot Limits */			
"COMMAND > SLOT LAT+	"	F	
"COMMAND > SLOT LAT-	"	F	
"COMMAND > SLOT LON+	"	F	
"COMMAND > SLOT LON-	"	F	
"LAT+ SLOT LIMIT	"	F	
"LAT- SLOT LIMIT	"	F	
"LON+ SLOT LIMIT	"	F	
"LON- SLOT LIMIT	"	F	
/* Status Byte 64 : Misc Limit Status */			
"BOX LIMITS ACTIVE	"	S	
"SLOT LIMITS ACTIVE	"	S	
"CMND > REGION POL+	"	F	/* If Pol */
"CMND > REGION POL-	"	F	/* If Pol */
"POL+ SOFTWARE LIMIT	"	F	/* If Pol */
"POL- SOFTWARE LIMIT	"	F	/* If Pol */
"UNDEFINED	"	S	
"UNDEFINED	"	S	
/* Status Byte 65 : Sun outage */			
"POSSIBLE SUN OUTAGE	"	S	/* Not yet implemented */
"UNDEFINED	"	S	
"MONO PHASING FAULT	"	F	
"UNDEFINED	"	S	
"UNDEFINED	"	S	
"UNDEFINED	"	S	
"HONKING HORN	"	S	
"AUTOSEARCH INHIBIT	"	S	/* Not Pointing Only */

```
/* Status Byte 66 : Simulation and diagnostics */
"SIMULATION ON - OCU       "        S
"SIMULATION ON - CCU       "        S
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S

/* Status Byte 67 : Simulation and diagnostics */
"RESERVED                  "        S
"RESERVED                  "        S
"SIMULATION SHUTDOWN - OCU"         S
"POSITION LOOP TEST ON     "        S     /* All DC Systems */
"UNDEFINED                 "        S     /* All DC Systems */
"UNDEFINED                 "        S     /* All DC Systems */
"CORRECTS OFF NEAR ZENITH  "        S
"DIAG TEST COMPLETED       "        S

/* Status Byte 68 : Comm link status */
"OCU-OCU LINK DOWN         "        F     /* Dual OCU Only */
"OCU-CCU LINK DOWN         "        F
"OCU-COMPTR LINK DOWN      "        S
"LOADING CCU DATABASE      "        S
"OCU-CCU LINK RESET        "        S
"KEYSWITCH = NORMAL        "        S
"KEYSWITCH = COMPUTER      "        S
"RESERVED                  "        S

/* Status Byte 69 : Comm link and control status */
"COMP IN CONTROL -OCU      "        S
"NORMAL CONTROL - OCU      "        S
"PMU ALLOWED               "        S
"UNDEFINED                 "        S
"MRU ALLOWED               "        S     /* If MRU Provided */
"UNDEFINED                 "        S     /* If MRU Provided */
"UNDEFINED                 "        S
"OTHER OCU IN CONTROL      "        S     /* If Dual OCU */

/* Status Byte 70 : Control status */
"COMPUTER REQUEST          "        S
"CONTROL CHANGE ALLOWED    "        S
"TAKE CCU CONTROL          "        S     /* If Dual OCU */
"RELINQUISH CCU CONTROL    "        S     /* If Dual OCU */
"RCVR-OCU LINK DOWN        "        F     /* If TRU */
"UNDEFINED                 "        S
"UNDEFINED                 "        S
"UNDEFINED                 "        S
```



```
/* Status Byte 71 : INTELSAT operation status */
"INTELSAT DATA DATED       "        S     /* All Except Pointing Only */
"INTELSAT DATA EARLY       "        S     /* All Except Pointing Only */
"INTELSAT COEFS AVAILABLE  "        S     /* All Except Pointing Only */
"INTELSAT POL DATA ERROR   "        F     /* All Except Pointing Only */
"UNDEFINED                 "        S
"UNDEFINED                 "        S
"UNDEFINED                 "        S
"UNDEFINED                 "        S

/* Status Byte 72 : Norad operation status */
"OBJECT BELOW EL TRAVEL    "        S
"RESERVED                  "        S
"RESERVED                  "        S
"UNDEFINED                 "        S
"UNDEFINED                 "        S
"UNDEFINED                 "        S
"STAR BELOW EL TRAVEL      "        S
"TARGET BELOW HORIZON      "        S

/* Status Byte 73 : Memory Track operation status */
"MEMTRACK COEFFS AVAILABLE"         S     /* All Except Pointing Only */
"MEMTRACK TABLE ERROR      "        F     /* All Except Pointing Only */
"MEMTRACK DATA ERROR       "        F     /* All Except Pointing Only */
"CHARGING MEMTRACK         "        S     /* All Except Pointing Only */
"CLEARING MEMTRACK         "        S     /* All Except Pointing Only */
"UNDEFINED                 "        S
"UNDEFINED                 "        S
"UNDEFINED                 "        S

/* Status Byte 74 : Miscellaneous tracking status */
"LOW SIGNAL                "        F     /* All Except Pointing Only */
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S
"RESERVED                  "        S
"AUTOSEARCH ACTIVE         "        S     /* All Except Pointing Only */
"FREQ MISMATCH             "        F
"RESERVED                  "        S

/* Status Byte 75 : Miscellaneous tracking status */
"UNACQUIRABLE SIGNAL       "        S     /* All Except Pointing Only */
"BAD TRACK DATA POINT      "        F     /* All Except Pointing Only */
"RUN TIME OPERATION        "        S     /* All Except Pointing Only */
"HIGH SIGNAL               "        F     /* All Except Pointing Only */
"RESERVED                  "        S
"RESERVED                  "        S
"POL TABLE WAIT FOR START  "        S     /* Pol and Acquisition Option */
"POL TABLE FINISHED        "        S     /* Pol and Acquisition Option */
```

```
/* Status Byte 76 : OCU data checks */
"UNDEFINED                "        S
"UNDEFINED                "        S
"LOAD SITE LOCATION       "        F
"UNDEFINED                "        S
"UNDEFINED                "        S
"UNDEFINED                "        S
"UNDEFINED                "        S
"UNDEFINED                "        S

/* Status Byte 77 : Low-level faults */
"UNDEFINED                "        S
"UNDEFINED                "        S
"UNDEFINED                "        S
"UNDEFINED                "        S
"OCU SOFTWARE ERROR       "        F
"UNDEFINED                "        F
"UNDEFINED                "        S
"UNDEFINED                "        S

/* Status Byte 78 : Software task operation */
"CONSOLE TASK ERROR       "        F
"CLI TASK ERROR           "        F
"MODE TASK ERROR          "        F
"DATABASE TASK ERROR      "        F
"RESERVED                 "        F
"CP TASK ERROR            "        F
"DATA LOGGER TASK ERROR   "        F     /* If Data Logger */
"KEYPAD TASK ERROR        "        F

/* Status Byte 79 : Software task operation */
"STATUS TASK ERROR        "        F
"OPTRACK TASK ERROR       "        F     /* All Except Pointing Only */
"MEMORY TRACK TASK ERROR  "        F     /* All Except Pointing Only */
"SIGNAL PROCESSING TSK ERR"        F     /* All Except Pointing Only */
"TRACK SUPPORT TASK ERROR "        F     /* All Except Pointing Only */
"CONSOLE CLI COMM ERROR   "        F
"UNDEFINED                "        S
"UNDEFINED                "        S

/* Status Byte 80 : Cable wrap operation */
"RESERVED                 "        S
"RESERVED                 "        S
"RESERVED                 "        S
"RESERVED                 "        S
"RESERVED                 "        S
"UNDEFINED                "        S
"UNDEFINED                "        S
"UNDEFINED                "        S
```



```
/* Status Byte 81 : axis disable status */
"RESERVED                 "        S
"RESERVED                 "        S
"RESERVED                 "        S
"UNDEFINED                "        S
"UNDEFINED                "        S
"DISABLE AZ KEY DEPRESSED "        F
"DISABLE EL KEY DEPRESSED "        F
"DISABLE POL KEY DEPRESSED"        F     /* If Pol */

/* Status Byte 82 */
"UNDEFINED                "        S
"RESERVED                 "        S
"RESERVED                 "        S
"RESERVED                 "        S
"UNDEFINED                "        S
"UNDEFINED                "        S
"UNDEFINED                "        S
"UNDEFINED                "        S

/* Status Byte 83 : Optrack operation status  */
"CHARGING AZEL OPTRACK1   "        S     /* All Except Pointing Only */
"CLEARING AZEL OPTRACK1   "        S     /* All Except Pointing Only */
"CHARGING POL OPTRACK1    "        S     /* If Pol */
"CLEARING POL OPTRACK1    "        S     /* If Pol */
"CHARGING AZEL OPTRACK2   "        S     /* All Except Pointing Only */
"CLEARING AZEL OPTRACK2   "        S     /* All Except Pointing Only */
"CHARGING POL OPTRACK2    "        S     /* If Pol */
"CLEARING POL OPTRACK2    "        S     /* If Pol */

/* Status Byte 84 : Optrack operation status  */
"CHARGING AZEL OPTRACK3   "        S     /* All Except Pointing Only */
"CLEARING AZEL OPTRACK3   "        S     /* All Except Pointing Only */
"CHARGING POL OPTRACK3    "        S     /* If Pol */
"CLEARING POL OPTRACK3    "        S     /* If Pol */
"RESERVED                 "        S
"RESERVED                 "        S
"RESERVED                 "        S
"UNDEFINED                "        S

/* Status Byte 85 : Optrack 1 operation status */
"OPTRACK1 COEFS AVAILABLE "        S     /* All Except Pointing Only */
"OPTRACK1 TABLE ERROR     "        F     /* All Except Pointing Only */
"OPTRACK1 DATA OLD        "        S     /* All Except Pointing Only */
"OPTRACK1 12 HOURS GOOD   "        S
"OPTRACK1 24 HOURS GOOD   "        S
"OPTRACK1 AZEL DATA ERROR "        F     /* All Except Pointing Only */
"OPTRACK1 POL DATA ERROR  "        F     /* If Pol */
"UNDEFINED                "        S
```

```
/* Status Byte 86 : Optrack 2 operation status */
"OPTRACK2 COEFS AVAILABLE "         S     /* All Except Pointing Only */
"OPTRACK2 TABLE ERROR     "         F     /* All Except Pointing Only */
"OPTRACK2 DATA OLD        "         S     /* All Except Pointing Only */
"OPTRACK2 12 HOURS GOOD   "         S
"OPTRACK2 24 HOURS GOOD   "         S
"OPTRACK2 AZEL DATA ERROR "         F     /* All Except Pointing Only */
"OPTRACK2 POL DATA ERROR  "         F     /* If Pol */
"UNDEFINED                "         S

/* Status Byte 87 : Optrack 3 operation status */
"OPTRACK3 COEFS AVAILABLE "         S     /* All Except Pointing Only */
"OPTRACK3 TABLE ERROR     "         F     /* All Except Pointing Only */
"OPTRACK3 DATA OLD        "         S     /* All Except Pointing Only */
"OPTRACK3 12 HOURS GOOD   "         S
"OPTRACK3 24 HOURS GOOD   "         S
"OPTRACK3 AZEL DATA ERROR "         F     /* All Except Pointing Only */
"OPTRACK3 POL DATA ERROR  "         F     /* If Pol */
"OPTRACK COEFS AVAILABLE  "         S     /* All Except Pointing Only */

/* Summary Bit */

/* Status Byte 88 : Selftest status  */
"RESERVED                 "         S
"RESERVED                 "         S
"RESERVED                 "         S
"RESERVED                 "         S
"RESERVED                 "         S
"RESERVED                 "         S
"POWER SUPPLY TEST FAIL   "         S
"BATTERY TEST FAIL        "         S

/* Status Byte 89 : Selftest status */
"REAL TIME CLOCK ERROR    "         F
"UNDEFINED                "         S
"REAL TIME CLOCK STUCK    "         F
"IRIG SIGNAL LOSS         "         S     /* Special HW */
"IRIG BOARD ERROR         "         F     /* Special HW */
"XCO TIMER ERROR          "         S     /* Special HW */
"EXT TIME SIGNAL LOSS     "         S     /* Special HW */
"1 PPS SIGNAL LOSS        "         S     /* Special HW */

/* Status Byte 90 */
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
```



```
/* Status Byte 91 */
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S

/* Status Byte 92 */
"DATABASE BACKUPS OFF     "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S

/* Status Byte 93 */
"RCVR TEMPERATURE FAULT   "         S
"RCVR DC POWER FAULT      "         S
"RCVR IF SYNTH UNLOCKED   "         S
"RCVR RF SYNTH UNLOCKED   "         S
"RCVR MANUAL CONTROL      "         S
"RCVR PLL NEAR LIMIT      "         S
"RCVR VCO NEAR LIMIT      "         S
"UNDEFINED                "         S

/* Status Byte 94 */
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S

/* Status Byte 95 */
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
"UNDEFINED                "         S
```

```
/* Status Byte 96 : Obstruction Avoidance */
"RESERVED                   "        S
"COMMAND IN SECTOR          "        F     /* Alarm */
"RESERVED                   "        S
"ANTENNA IN SECTOR          "        F     /* Switch Thrown */
"SECTOR 1                   "        S
"SECTOR 2                   "        S
"SECTOR 3                   "        S
"SECTOR 4                   "        S

/* Status Byte 97 : Obstruction Avoidance */
"SECTOR 5                   "        S
"SECTOR 6                   "        S
"SECTOR 7                   "        S
"SECTOR 8                   "        S
"SECTOR 9                   "        S
"SECTOR 10                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S

/* Status Byte 98 : Obstruction Avoidance */
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S

/* Status Byte 99 : Obstruction Avoidance */
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S

/* Status Byte 100 : Obstruction Avoidance */
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
"UNDEFINED                  "        S
```



```
    /* OCU #2 (2nd OCU in a dual OCU system) */
/* These bytes (101 to 140) are copies of bytes 61 through 100 */
/* for the 2nd OCU */
/* Any exceptions are listed below */
```

Table 3.3.8-1, Status and Fault Messages

3.3.9 Fault Acknowledge

The station computer may acknowledge faults provided that it is in control of the OCU. Acknowledging faults allows any latching faults to clear if the originating condition clears.

Command: "ACKF <cr>"

Response: "<ack> <cr> <lf>"

3.3.10 Echo Command

This command will toggle echo/noecho state. Echo means that the OCU echoes each character in the commands. No echo is the usual state for remote computer operation, as echoing has performance penalties. No echo will be the OCU mode upon power up. A "<cr>" is converted to "<cr> <lf>" in the echo response.

Command: "ECHO <cr>"

Response: "<ack> <cr> <lf>"

3.3.11 Time Load/Recall

The station computer can load (when in control of the OCU and when the OCU is in control of the antenna) or recall (anytime) the OCU time. Time loading is allowed only in the Stop mode and Pol Stop (for Pol systems). The entered time must be UTC time. The time is loaded upon the next 1 PPS signal.

Load
Command: "TIME <sp> <hh:mm:ss:ddd:yyyy> [, <UTC_offset>] <cr>"

Recall
Command: "TIME? <cr>"

Where:	ddd	=	Day of the year (1 to 366)
	yyyy	=	Year(1990 to 2045)
	hh	=	Hours (0 to 23)
	mm	=	Minutes (0 to 59)
	ss	=	Seconds (0 to 59)
	UTC_offset	=	Offset from UTC to local time (-12.0 to 12.0 hours)

Response to load: "<ack> <cr> <lf>"

Response to recall:

"<hh:mm:ss:ddd:yyyy> , <UTC_offset> <cr> <lf>"

Example Response to recall:

"23:50:45:222:1991 , 1.5 <cr> <lf>"

3.3.12 Encoder Offset Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the axis encoder offsets values in the OCU. The load command is only allowed in Stop mode and Pol Stop (for pol systems). The polarization encoder offset will be zero if there is no polarization axis. The encoder offsets are added to the actual encoder readings. A positive offset will increase the apparent antenna position (increase the position readout). For HA/DEC systems the azimuth value is hour angle and the elevation value is declination.

Load
Command: "ENC <sp> [<az_offset>] [, <el_offset>] [, <pol_offset>] <cr>"

Recall
Command: "ENC? <cr>"

Where:	az_offset	=	The azimuth encoder offset in degrees (+/-180.0000).
	el_offset	=	The elevation encoder offset in degrees (+/-180.0000).
	pol_offset	=	The pol encoder offset in degrees (+/-180.0000).

Response to load: "<ack> <cr> <lf>"

Response to recall: "<az_offset> , <el_offset> , <pol_offset> <cr> <lf>"

Example Response to recall: "23.0013 , 111.4973 , 2.098 <cr> <lf>"

3.3.13 Elevation Droop Table Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the table of elevation droop correction values in the OCU. The load command is only allowed in Stop mode. The el droop values are added to the command before being sent to the pedestal. Thus a positive el droop value will cause the beam to rotate up in elevation.

Load
Command: "EL_DROOP <sp> <eld-5> , <eld0> , <eld5> , ... <eld85> , <eld90> , <eld95> <cr>"

Recall
Command: "EL_DROOP? <cr>"

Where: eld5 through eld95 = The correction for elevation droop that is made to the elevation position every 5 degrees rotation of the elevation encoder. (Example: if eld5 is +0.100 and the elevation encoder reads 5 degrees, the corrected elevation angle is 5.100 degrees.) The range is +/-1.000 degrees.

Response to load: "<ack> <cr> <lf>"

Response to recall:

"<eld5> , <eld0> , <eld5> , ... , <eld90> , <eld95> <cr> <lf>"

Example Response to recall:

"0.010 , 0.021 , 0.033 , 0.044 , 0.084 , 0.108 , 0.099 , 0.077 , 0.063 , 0.042 , 0.022 , 0.011 , 0.001 , -0.010 , -0.020 , -0.033 , -0.055 , -0.077 , -0.050 , -0.030 , -0.041 <cr> <lf>"

3.3.14 Box Limit Enable/Disable

The station computer is allowed to enable or disable (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the box limit feature of the OCU. The EBOX command enables the box limit for the configuration in use and may change the box limit arguments. The DBOX command disables the slot limit for the configuration in use. The SBOX command changes the box limit arguments for any configuration and may change the data without changing the enable/disable state.

Enable Command: "EBOX [<sp> <box_width>] <cr>"

Disable Command: "DBOX <cr>"

Load Command: "SBOX <sp> <N> , <on/off> , <box_width> [, < box_length>] [, <auto/spec> , <az_center> , <el_center>] <cr>"

Recall Command: "SBOX? <sp> <N> <cr>"

Where:
- box_width = The size of the box desired in degrees (0.0 to 30.000). The width (XEL) will be secant corrected based on the current elevation. If the length is omitted, the box width and length are the same value.
- N = The configuration location to load the data (1 to 10).

- on/off = Whether the box limits are enabled or disabled. "1" is on and "0" is off.
- box_length = The height (el) of the box in degrees (0.0 to 30.000). If this field is used, the width is the azimuth size.
- auto/spec = Automatic is a "1", specified is a "0". Automatic is a box about the present command. Specified is a box about the optional az and el positions.
- az_center = The azimuth box center (0.0 to 359.999 degrees).
- el_center = The elevation box center (-5.0 to 95.000 degrees.)

Response: "<ack> <cr> <lf>"

Recall Response: "<on/off> , <box_width> , <box_length> , <auto/spec> , <az_center> , <el_center> <cr> <lf>"

Example Response for recall: "1 , 10.000 , 10.000 , 0 , 265.890 , 33.456 <cr> <lf>"

3.3.15 Software Travel Limits

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the software travel limit values in the OCU. The load commands are only accepted while in the Stop mode and Pol Stop (for pol systems). The polarization travel limits will be zero if there is no polarization axis. For HA/DEC systems the azimuth entry is hour angle and the elevation entry is declination.

Load Command: "TD <sp> <zero> , <az+> , <az-> , <el+> , <el-> [, <pol+> , <pol->] <cr>"

Recall Command: "TD? <cr>"

Where:
- az+ = The CW travel limit angle in azimuth in degrees (0.0 to 359.999).
- az- = The CCW travel limit angle in azimuth in degrees (0.0 to 359.999).
- el+ = The up travel limit angle in elevation in degrees (-5.000 to +95.000) (-95.0 to 95.0 if HA/DEC).
- el- = The down travel limit angle in elevation in degrees (-5.000 to +95.000) (-95.0 to 95.0 if HA/DEC).
- pol+ = The CW travel limit angle in polarization in degrees (0.0 to 359.999).

pol- = The CCW travel limit angle in polarization in degrees (0.0 to 359.999).

zero = The location of the cable wrap sector switch in degrees (0.0 to 359.999). (For limited-motion systems, this should be set equal to the cw travel limit since there is no cable wrap switch.)

Load Response: "<ack> <cr> <lf>"

Recall Response: "<zero> , <az+> , <az-> , <el+> , <el-> , <pol+> , <pol-> <cr> <lf>"

Example Recall Response: "90.000 , 90.000 , 330.100 , 85.700 , 1.300 , 355.000 , 350.000 <cr> <lf>"

3.3.16 Deadband Parameters Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna and when the OCU is in the Stop mode) and recall (always) the following parameters in the OCU. The deadband feature may be defeated by setting the parameter to 0.000. WARNING: too small or zero deadband values may lead to instability for AC motor systems. The hysteresis feature may be defeated by setting the parameter to 1.0. The load commands are only accepted while in the Stop mode. For HA/DEC systems azimuth is hour angle and elevation is declination.

Load Command:
"DBA <sp> <az_deadband> <cr>"
"HYA <sp> <az_hysteresis> <cr>"
"DBE <sp> <el_deadband> <cr>"
"HYE <sp> <el_hysteresis> <cr>"

Recall Command:
"DBA? <cr>"
"HYA? <cr>"
"DBE? <cr>"
"HYE? <cr>"

Where: el_deadband = A band about the axis position command in degrees (0.0 to 1.000). When the antenna is driven inside this band, the axis drives will disable.

az_deadband = A band about the axis position command in degrees (0.0 to 1.000). When the antenna is driven inside this band, the axis drives will disable.

az_hysteresis = The deadband hysteresis (1.0 to 10.000). The position error (position - position command) must be larger than the axis deadband times this value for the axis drives to re-enable.

el_hysteresis = The deadband hysteresis (1.0 to 10.000). The position error (position - position command) must be larger than the axis deadband times this value for the axis drives to re-enable.

Response to load: "<ack> <cr> <lf>"

Responses to recall:
"<az_deadband> <cr> <lf>"
"<az_hysteresis> <cr> <lf>"
"<el_deadband> <cr> <lf>"
"<el_hysteresis> <cr> <lf>"

Example Response to recall: "0.100 <cr> <lf>"

3.3.17 Tracking Velocity Load/Recall

The station computer is allowed to load (when the station computer in control of the OCU and when the OCU is in control of the antenna) and recall (always) the tracking velocity parameter value for each axis. The load commands are only accepted while in the Stop mode. For hour angle/declination systems the azimuth is hour angle and the declination is elevation.

Load Command:
"VAZ <sp> <aztrack_vel> <cr>"
"VEL <sp> <eltrack_vel> <cr>"

Recall Command:
"VAZ? <cr>"
"VEL? <cr>"

Where: aztrack_vel = The velocity of the azimuth axis in degrees per second (0.001 to 0.500) when the OCU is performing active run-time steptracking. (For AC systems, this is the speed of the azimuth tracking motor.)

eltrack_vel = The velocity of the elevation axis in degrees per second (0.001 to 0.500) when the OCU is performing active run-time steptracking. (For AC systems, this is the speed of the elevation tracking motor.

Response to load: "<ack> <cr> <lf>"

Responses to recall:
"<aztrack_vel> <cr> <lf>"
"<eltrack_vel> <cr> <lf>"

Example Response to recall: "0.025 <cr> <lf>"

3.3.18 Data Backup

This command copies all nonvolatile data to the disk. It is allowed whenever the station computer is in control of the OCU. The OCU does not need to be in control of the antenna.

Command: "FBU <cr>"

Response: "<ack> <cr> <lf>"

3.3.19 Computer Timeout Load/Recall

This command adjusts the time allowed between valid computer commands before the computer link is declared inoperative.

Load
Command: "LINK <sp> <time> <cr>"

Recall
Command: "LINK? <cr>"

Load
Response: "<ack> <cr> <lf>"

Recall
Response: "<time> <cr> <lf>"

Where: time = The time between commands in seconds. The range is 0.01 to 600.00.

Example Recall Response: "14.71 <cr> <lf>"

3.3.20 Time Tagged Status Request

The OCU will transmit basic status information to the station computer in response to this request. Table 3.3.7-1 contains a list of possible modes. All modes listed in the table do not apply to all systems. This command is valid at any time. The polarization position will be zero if there is no polarization axis. The polarization mode will be stop if there is no polarization axis.

Command: "SS <cr>"

Response: "<time> , <azp> , <cw> , <elp> , <polp> , <mode> , <signal> , <low_signal> , <fault> , <nfault> , <on_target> <cr> <lf>"

Where: time = The UTC time of the most recent position information. The format is HH:MM:SS:FF where FF is the decimal fractional second.
azp = The azimuth position in degrees (0.0 to 359.9999).

cw = The cable wrap. A "C" indicates clockwise and a "W" indicates counter clockwise.
elp = The elevation position in degrees (-5.0000 to 95.0000).
polp = The polarization position in degrees (system dependent, 0.0 to 359.999).
mode = The current OCU operational mode. This consists of the fundamental mode, the fundamental submode, the enhanced mode, the enhanced submode, the polarization mode, and the polarization submode. Thus the mode format is <fundm> <fundsub> <fundno> <enhancedm> <enhancedsub> <enhancedno> <polm> <polsub> <polno>. Each of the modes is a two digit symbol defined in tables 3.3.7-1 to 3.3.7-4. The <fundno> value is the three-digit data set number used by the current fundamental mode. The <enhancedno> value is the two-digit data set number used by the current enhanced mode.
signal = The level in dB of the tracking signal (-50.00 to 10.00)
low_signal = A "1" if the signal is outside the fault threshold. A "0" if the signal is acceptable.
fault = A summary fault indication. A "1" means a summary fault exists, a "0" indicates no fault.
nfault = An indication of a new fault since the last fault acknowledge. A "1" indicates a new fault and a "0" means no new fault.
on_target = A "1" indicates the antenna is "on target" (within a given threshold).

Example Response:

"22:30:46:12 , 299.9999 , W , 73.1234 , 123.777, 0202004310000500000 , -21.31 , 1, 0 , 0 , 1 <cr> <lf>"

3.3.21 Time Tagged Geo Status Request

The OCU will transmit basic status information to the station computer in response to this request. Table 3.3.7-1 contains a list of possible modes. All modes listed in the table do not apply to all systems. This command is valid at any time. The polarization position will be zero if there is no polarization axis. The polarization mode will be stop if there is no polarization axis.

Command: "GEOS <cr>"

Response: "<time> , <latitude> , <longitude> , <cw>, <polp> , <mode> , <signal> , <low_signal> , <fault> , <nfault> , <on_target> <cr> <lf>"

Where:

time	=	The UTC time of the most recent position information. The format is HH:MM:SS:FF where FF is the decimal fractional second.
latitude	=	The latitude of a target at geosynchronous radius and along the RF boresite of the antenna (+/-90.0000).
longitude	=	The longitude of a target at geosynchronous radius and along the RF boresite of the antenna (0.0 to 359.9999).
cw	=	The cable wrap. A "C" indicates clockwise and a "W" indicates counter clockwise.
polp	=	The polarization position in degrees (system dependent, 0.0 to 359.999).
mode	=	The current OCU operational mode. This consists of the fundamental mode, the fundamental submode, the enhanced mode, the enhanced submode, the polarization mode, and the polarization submode. Thus the mode format is <fundm> <fundsub> <enhancedm> <enhancedsub> <polm> <polsub>. Each of the modes is a two digit symbol defined in tables 3.3.7-1 to 3.3.7-4.
signal	=	The level in dB of the tracking signal (-50.00 to 10.00)
low_signal	=	A "1" if the signal is outside the fault threshold. A "0" if the signal is acceptable.
fault	=	A summary fault indication. A "1" means a summary fault exists, a "0" indicates no fault.
nfault	=	An indication of a new fault since the last fault acknowledge. A "1" indicates a new fault and a "0" means no new fault.
on_target	=	A "1" indicates the antenna is "on target" (within a given threshold).

Example Response:

"22:30:46:12 , 89.9999 , 243.1234 , W , 123.777, 020231005000 , -21.31 , 1, 0 , 0 , 1 <cr> <lf>"

3.3.22 Orbital Slot Limit Enable/Disable

The station computer is allowed to enable or disable (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the orbital slot limit feature of the OCU. The ESLOT command enables the slot limit for the configuration in use and may change the slot limit arguments. The DSLOT command disables the slot limit for the configuration in use. The SSLOT command changes the slot limit arguments for any configuration and may change the data without changing the enable/disable state. If any arguments are used for this command, either two (width and height) or all four arguments are required.

Enable
Command: "ESLOT [<sp> <slot_width> , <slot_height> [, <slot_lon_center> , <slot_lat_center>]] <cr>"

Disable
Command: "DSLOT <cr>"

Load
Command: "SSLOT <sp> <N> , <on/off> , <slot_width> , <slot_height> [, <slot_lon_cntr> , <slot_lat_cntr>] <cr>"

Recall
Command: "SSLOT? <sp> <N> <cr>"

Where:

slot_width	=	The total width of the orbital slot in degrees longitude. Range is 0.00 to 5.00 degrees.
slot_height	=	The total height of the orbital slot in degrees latitude. Range is 0.00 to 20.00 degrees.
slot_lon_cntr	=	The center longitude of the scan. Range is 0.0 to 359.999.
slot_lat_cntr	=	The center latitude of the scan. Range is +/- 90.000.
N	=	The configuration number (1 to 10) identifying where to load the data.
on/off	=	Whether the box limits are enabled or disabled. "1" is on and "0" is off.

Response to load commands: "<ack> <cr> <lf>"

Response to recall command: "<slot_width> , <slot_height> , <slot_lon_center> , <slot_lat_center>, <on/off> <cr> <lf>"

Example Response to recall: "1.21 , 10.70 , 255.777 , 11.111 , 1 <cr> <lf>"

3.3.23 Miscellaneous Feature Load/Recall

The station computer is allowed to enable or disable (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the following features of the OCU. The load command is only accepted in Stop mode.

Load
Command: "MSLC <sp> <droop> , <refract> , <latch> , <feed> , <found> , <ortho> [,<wobble>] <cr>"

Recall
Command: "MSLC? <cr>"

Load
Response: "<cr> <lf>"

Recall
Response: "<droop> , <refract> , <latch> , <feed> , <found> , <ortho> , <wobble> <cr> <lf>"

Where:

droop	=	A "1" to enable droop correction and a "0" to disable.
refract	=	A "1" to enable refraction correction and a "0" to disable.
latch	=	A "1" to enable fault latching and a "0" to disable.
feed	=	A "1" to enable feed offset correction and a "0" to disable. Must always be "0" in Model 100 systems.
found	=	A "1" to enable foundation tilt correction and a "0" to disable. Must always be "0" in Model 100 systems.
ortho	=	A "1" to enable orthogonality correction and a "0" to disable. Must always be "0" in Model 100 systems.
wobble	=	A "1" to enable wobble correction and a "0" to disable. Must always by "0" in Model 100 systems.

Example Recall
Response: "1 , 0 , 1 , 1 , 1 , 0 , 0 <cr> <lf>"

3.3.24 Aperture Load/Recall

The station computer is allowed to enable or disable (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the antenna aperture. The load command is only accepted in Stop mode.

Load
Command: "MSLA <sp> <aperture> <cr>"

Recall
Command: "MSLA? <cr>"

Load
Response: "<cr> <lf>"

Recall
Response: "<aperture> <cr> <lf>"

Where: aperture = The dish aperture in meters (0.1 to 100.0).

Example Recall
Response: "11.3 <cr> <lf>"

3.3.25 Tracking Receiver Binary Status Request

This command is meaningful only if a Model 233 tracking receiver is used in the system. The OCU will transmit the fault and status information to the station computer in response to this request. Table 3.3.25-1 lists the fault and status indicators. A "1" indicates the fault or status is TRUE.

Command: "RFB <cr>"

Response: "X...X" <cr> <lf>"

Where: X = Hexadecimal representation of eight bits of status for the 10 tracking receiver status bytes. There are,therefore, 20 total status characters.

Example Response: "A233000000334477BBDF <cr> <lf>"

3.3.26 Tracking Receiver Monitor Request

This command is meaningful only if a Model 233 steptrack tracking receiver is used in the system. The OCU will transmit values of the tracking receiver parameters which it monitors. These are the same values as appear in the Tracking Receiver Monitor Window on the OCU front-panel screen. This command is valid at any time. Note there are two possible responses. The second response applies only if the Model 233 receiver is embedded in the OCU, else the first applies.

Command: " RFM <cr> "

Response #1: " <freq> , <bandwidth> , <vco_offset> , <auto_sweep> , <vbatt> , <v5> , <v12p> , <v12n> , <v15p> , <v15n> , <temp> , <cr> <lf> "

Response #2: "<bandwidth> , <vco_offset> , <auto_sweep> <cr> <lf> "

Where:

freq	=	The current tracking frequency, in GHz, used by the receiver.
bandwidth	=	The narrowband beacon detection bandwidth, in kHz, used by the receiver. (2.5 or 6.7) [See NOTE in this section.]
vco_offset	=	In narrowband operation, the tracking receiver's vco in the phase lock loop has a 150 kHz range. This offset indicates the percentage offset from mid-range at which the vco is currently operating. ["]
auto_sweep	=	This indicates a frequency range which is sweeped by the narrow bands (2.5 and 6.7 kHz) to locate a beacon. In kHz range is 40.0 to 145 kHz. ["]
vbatt	=	The tracking receiver battery voltage.

v5	=	The tracking receiver +5V power supply voltage.
v12p	=	The tracking receiver +12V power supply voltage.
v12n	=	The tracking receiver -12V power supply voltage.
v15p	=	The tracking receiver +15V power supply voltage.
v15n	=	The tracking receiver -15V power supply voltage.
temp	=	The temperature in celsius inside the tracking receiver.

Example Response #1: " 3.625 , 2.5 , 0 , 120 , 3.0 , 5.0 , 12.0 , -12.0 , 14.9 , -15.1 , 12 <cr> "

NOTE: The tracking receiver outputs both a wideband and a narrowband tracking signal. (OCU will only use one of these signals. The selection is made using the RF Command detailed in section 3.3.2.) This parameter applies only to the narrowband signal. The narrowbands are 2.5 and 6.7 kHz. The wideband is 280 kHz.

3.3.27 Power Supplies Monitor Request

The OCU will transmit values of the power supply voltages which it monitors. These are the same voltage values which appear in the Power Supply Monitor Window on the OCU front-panel screen. This command is valid at any time.

Command: " PWM <cr> "

Response: " <o5vp> , <o5vn> , <o12vp> , <o12vn> , <obatt> , <cf5vp> , <cf5vn> , <cf12vp> , <cf12vn> , <cftemp> , <cl15vp> , <cl15vn> , <cl5vp> , <cl24vp> <cr> "

Where:

o5vp	=	The voltage of the OCU's +5V power supply.
o5vn	=	The voltage of the OCU's -5V power supply.
o12vp	=	The voltage of the OCU's +12V power supply.
o12vn	=	The voltage of the OCU's -12V power supply.
obatt	=	The voltage of the OCU's battery.
cf5vp	=	The voltage of the CCU Interface Board's +5V power supply.
cf5vn	=	The voltage of the CCU Interface Board's -5V power supply.
cf12vp	=	The voltage of the CCU Interface Board's +12V power supply.
cf12vn	=	The voltage of the CCU Interface Board's -12V power supply.
cftemp	=	The temperature in °C in the CCU at the CCU Interface Board.
cl15vp	=	The voltage of the CCU Interlock Board's +15V power supply.

cl15vn	=	The voltage of the CCU Interlock Board's -15V power supply.
cl5vp	=	The voltage of the CCU Interlock Board's +5V power supply.
cl24vp	=	The voltage of the CCU Interlock Board's +24V power supply.

Example Response: " 5.0 , -5.0 , 12.0 , -11.9 , 3.0 , 5.0 , -5.0 , 12.0 , -12.0 , 10.0 , 15.0 , -15.0 , 5.1 , 23.9 <cr> "

Tracking Receiver Status and Fault Messages

```
/* Status Byte 1  :  Tracking Receiver status */
"RESERVED                "   S
"RCVR IN CONTROL         "   S
"RCVR NARROW BAND        "   S
"RCVR VCO AUTO CONTROL   "   S
"RCVR PLL NEAR LIMIT     "   S
"RCVR DC POWER FAULT     "   S
"RCVR TEMPERATURE FAULT  "   S
"RESERVED                "   S

/* Status Byte 2  :  Tracking Receiver status */
"RCVR SUMMARY FAULT ACTIVE"  S
"RCVR TRACK FAULT ACTIVE "   S
"RCVR STATUS BIT D       "   S
"RCVR STATUS BIT 7       "   S    /* External Status */
"RCVR VCO NEAR LIMIT     "   S
"RESERVED                "   S
"RESERVED                "   S
"RESERVED                "   S

/* Status Byte 3  :  Tracking Receiver status */
"RCVR PLL LOCKED         "   S
"RESERVED                "   S
"RCVR RF SYNTH UNLOCKED  "   F
"RCVR IF SYNTH UNLOCKED  "   F
"RCVR STATUS BIT A       "   S
"RCVR STATUS BIT B       "   S
"RCVR STATUS BIT C       "   S
"RESERVED                "   S

/* Status Byte 4  :  Tracking Receiver status */
"RCVR LNA STATUS         "   S
"RCVR STATUS BIT 1       "   S    /* External Status */
"RCVR STATUS BIT 2       "   S    /* External Status */
"RCVR STATUS BIT 3       "   S    /* External Status */
"RCVR STATUS BIT 4       "   S    /* External Status */
"RCVR STATUS BIT 5       "   S    /* External Status */
"RCVR STATUS BIT 6       "   S    /* External Status */
"RESERVED                "   S
```



```
/* Status Byte 5 */
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S

/* Status Byte 6 */
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S

/* Status Byte 7 */
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S

/* Status Byte 8 */
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
"UNDEFINED               "   S
```

```
/* Status Byte 9 */
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S

/* Status Byte 10 */
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
"UNDEFINED                "    S
```

Table 3.3.25-1, Tracking Receiver Status and Fault Messages

4.0 CONTROL COMMANDS

The station computer must actively take control of the OCU to issue commands which are control dependent (almost all mode and data load commands). The station computer may relinquish control of the OCU to allow front panel control or control by additional computers or other sources. The issue of OCU control is somewhat complicated and depends upon front panel keyswitch position, operator actions, and other conditions. The O&M manual details the OCU control operations. For purposes of this document, take control commands will be NAKed if not legal, and relinquish control commands are always legal.

4.1 COMPUTER OCU CONTROL REQUEST

The station computer may request control of the OCU at any time. This command will be NAKed if control is not available. The basic condition in which control is not available is when another unit has control of the OCU and has not released control. Control of the OCU may not grant control of the antenna, as the Manual Rate Panel or the Maintenance Control Unit may be in control of the antenna.

Command: "CTAKE <cr>"

Response: "<ack> <cr> <lf>"

4.2 COMPUTER OCU CONTROL RELEASE

The station computer may release control of the OCU at any time, but it may remain in control until another unit accepts control. See the O&M Manual for details. The station computer may check if it is in control with a status inquiry.

Command: "CREL <cr>"

Response: "<ack> <cr> <lf>"

5.0 POLARIZATION OPTION COMMANDS

5.1 FUNDAMENTAL MODE COMMANDS

There are no fundamental mode commands for this option.

5.2 ENHANCED MODE COMMANDS

There are no enhanced mode commands for this option.

5.3 POLARIZATION MODE COMMANDS

5.3.1 Polarization Position Designate Mode

The OCU will change the polarization operational state to the Position Designate mode in response to this command. This command affects only the pol axis. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The polarization axis is driven to the command angles in response to this command. The azimuth and elevation mode is not changed by this command.

Command: "POLD <sp> <pol> [, <time>] [, <polvel>] <cr>"

Where: pol = The commanded polarization position in degrees (0.0 to 359.999).
polvel = The desired polarization velocity. This velocity will be used for feedforward and to extrapolate position commands. The range is +/- 20.000 deg/s.
time = The UTC time at which the position command is valid. This is in seconds and fractions of a second (per day). The range is 0.00 to 86400.00.

Response: "<ack> <cr> <lf>"

Example Command:

"POLD <sp> 180.018 , 10.01 , 77000.10 <cr>"

5.3.2 Polarization Preset Position Mode

The OCU will change the polarization operational state to the Preset Position mode in response to this command. This command affects only the pol axis. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The polarization axis is driven to the commanded preset angles in response to this command. The azimuth and elevation mode and positions are not changed by this command.

Command: "PL <sp> <N> <cr>"

Where: N = The number of the preset position. There are 40 preset positions in the OCU so this can be a number 1 to 40.

Response: "<ack> <cr> <lf>"

5.3.2.1 Polarization Preset Position Load/Recall

See section 3.1.3.1 for the polarization preset load/recall commands.

5.3.3 Polarization Stop Mode (Disable)

The OCU will change the polarization operational state to the Stop mode in response to this command. This command affects only the pol axis. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The azimuth and elevation mode and positions are not changed by this command.

Command: "PSTOP <cr>"

Response: "<ack> <cr> <lf>"

5.3.4 Polarization Optrack Mode

The OCU will change the polarization operational state to the Optrack mode in response to this command. The azimuth and elevation mode must be Optrack for this command to be valid. The az/el data set number will be used for polarization axis operation. This command affects only the pol axis. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The azimuth and elevation mode and positions are not changed by this command.

Command: "POT <cr>"

Response: "<ack> <cr> <lf>"

5.3.5 Polarization Optrack Reference

The OCU will reference the Polarization Optrack operation to the current polarization angle in response to this command. This command affects only the pol axis. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. If the polarization mode is not Optrack the command will be rejected. This command references polarization operation for the Optrack data set in use. The azimuth and elevation mode and position are not changed by this command.

Command: "POTR <cr>"

Response: "<cr> <lf>"

5.3.6 Polarization INTELSAT Mode

The OCU will change the polarization operational state to the INTELSAT mode in response to this command. The azimuth and elevation mode must be INTELSAT for this command to be valid. The az/el data set number will be used for polarization axis operation. This command affects only the pol axis. If the station computer is not in control of OCU, the OCU will reject

this command. If the OCU is not in control of the antenna, the OCU will reject the command. The azimuth and elevation mode and positions are not changed by this command. This mode uses the Optrack polarization correction algorithm on the INTELSAT pointing data.

Command: "PI <cr>"

Response: "<ack> <cr> <lf>"

5.3.7 Polarization INTELSAT Reference

The OCU will reference the Polarization INTELSAT operation to the current polarization angle in response to this command. This command affects only the pol axis. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. If the polarization mode is not INTELSAT the command will be rejected. This command references polarization operation for the INTELSAT data set in use. The azimuth and elevation mode and position are not changed by this command.

Command: "PIR <cr>"

Response: "<cr> <lf>"

5.4 PARAMETER COMMANDS

There are no specific additional parameter commands with this option. Note that many of the standard commands have optional polarization parameters which are useful only with this option.

6.0 ACQUISITION AND POINTING OPTION COMMANDS

6.1 FUNDAMENTAL MODE COMMANDS

6.1.1 Star Track Mode

The OCU will change the operational state to Star Track mode in response to this command. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command.

Command: "STRTK <sp> <N> <cr>"

Where: N = The star to track. The range is 1 to 10.

Response: "<ack> <cr> <lf>"

6.1.1.1 Star Track Parameters Load/Recall

The station computer is allowed to load (when the station computer in control of the OCU and when the OCU is in control of the antenna) and recall (always) the star track parameters.

Load
Command: "STAR <sp> <N> , <rt_asc> , <dec> , <epoch_type> , <epoch> [, <config>] [, <cw>] [, <"> <name> <">] <cr>"

Recall
Command: "STAR? <sp> <N> <cr>"

Load Response: "<ack> <cr> <lf>"

Recall Response: "<rt_asc> , <dec> , <epoch_type> , <epoch> , <config> , <cw> <"> <name> <"> <cr> <lf>"

Where:	N	=	The location to load. The range is 1 to 10.
	rt_asc	=	The right ascension in degrees. The range is 0.0 to 359.9999.
	dec	=	The declination in degrees. The range is +/-90.0000.
	epoch_type	=	"J" for Julian and "B" for Besselian.
	epoch	=	The reference epoch. The range is 1900.0 to 2100.0
	config	=	Which configuration to use. The range is 0 to 10. A setting of 0 insures that the system config is not changed upon entry of Star Track mode.
	name	=	Alphanumeric name assigned to the star. This can be 1 to 20 characters.
	cw	=	Cable wrap ("C" = clockwise, "W" = counter clockwise, "S" = shortest path.) An "S" is assumed if this entry is omitted.

Example Recall Response: "167.3899 , 27.4567 , B , 1950.0 , 7 , <"> CYGNUS A <"> <cr> <lf>"

6.1.2 Program Table Track Mode

The OCU will change the operational state to Program Table Track mode in response to this command. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The mode command will be rejected if the table is empty.

Command: "PROG <sp> <N> <cr>"

Response: "<ack> <cr> <lf>"

Where: N = The table to use. The range is 1 to 10.

If no Program Table Data response: "<NAK> <sp> <NOD> <cr> <lf>"

6.1.2.1 Program Table Track Parameters Load/Recall

The station computer is allowed to load (when the station computer in control of the OCU and when the OCU is in control of the antenna) and recall (always) the table track parameters. The load and clear commands are not accepted for the data set in use while in Program Table Track mode.

Data Load
Command: "PT <sp> <N> , <time1> , <az1> , <el1> [, <cw>] <cr>"

Data Recall
Command: "PT? <sp> <N> <cr>"

Clear
Command: "PTC <sp> <N> <cr>"

Load and clear Response: "<ack> <cr> <lf>"

Recall Response: "<time1> , <az1> , <el1> , <cw1> <cr> <lf>
<time2> , <az2> , <el2> , <cw2> <cr> <lf>...
<timen> , <azn> , <eln> , <cwn> <cr> <lf>
<etx>"

Option Load
Command: "PTT <sp> <N> , <interpolate> , <config> [,<"> <name> <">]
<cr>"

Option Recall
Command: "PTT? <sp> <N> <cr>"

Option Recall
Response: "<interpolate> , <config> <cr>"

Where:
- time = The UTC time of the data point. Format mm:dd:yyyy:hh:mm:ss.
- az = The azimuth angle of the data point (0.0 to 359.999).
- el = The elevation angle of the data point (-5.000 to 95.000).
- N = The table to use. The range is 1 to 10.

- cw = The cable wrap. If omitted, shortest path is selected. The choices are "C" for clockwise, "W" for counterclockwise, and "S" for shortest path. NOTE: if shortest path is selected, all successive commands must be shortest path. If an explicit cable wrap is selected (C or W), then all successive commands must include the cable wrap (C or W). If a change between these types of commands is required, the cable wrap is reset by exiting and reentering the mode.
- interpolate = A "1" if the command should use interpolation between data points and a "0" if no interpolation is to be used.
- config = The selection here is from 0 to 10. A setting of 0 insures that the system config is not changed upon entry of Program Track mode.
- name = Alphanumeric name assigned to the table. This can be 1 to 20 characters.
- <etx> = ASCII etx character (hex 03)

The maximum number of data points is 144; if this is exceeded the command will be NAKed. The time values of successive data points must increase (or the command will be NAKed), but need not have uniform spacing. The clear command should be exercised before a new table load begins to avoid mixed data.

Response to recall (PT?) for empty or erased set:

"<NAK> <sp> NOD <cr> <lf>"

6.1.2.2 Optrack Table Data Charge

The station computer can charge (when in control of the OCU) the Optrack data table. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The charge command will also be rejected if charging is attempted while in Optrack mode on the data set in use or if the data set used to charge Optrack is not valid.

Command: "CHARGET <sp> <N1> , <N2> <cr>"

Where:
- N1 = The number of the Optrack data set to charge. This value may be 1 to 3.
- N2 = The number of the Program table to use to charge the Optrack data set (1 to 10).

Response: "<ack> <cr> <lf>"

If no Program Table Data response: "<NAK> <sp> <NOD> <cr> <lf>"

6.1.2.3 Memory Track Table Data Charge

The station computer may charge the Memory Track data. If the station computer is not in control of the OCU, the OCU will reject this command. If the OCU is not in control of the

antenna, the OCU will reject the command. The charge command will also be rejected if charging is attempted while in Memory Track mode or if the data set used to charge Memory Track is not valid. Memory Track should be cleared before charging.

Command: "CHARGEMT <sp> <N> <cr>"

Where: N = The number of the Program Table to use to charge Memory Track (1 to 10).

Response: "<ack> <cr> <lf>"

If there is no data in the Program Table selected, the response is:

"<nak> <sp> <NOD> <cr> <lf>"

6.1.3 Polarization Program Table Track Mode

The OCU will change the operational state to Polarization Program Table Track mode in response to this command. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The mode command will be rejected if the table is empty.

Command: "PPROG <sp> <N> <cr>"

Response: "<ack> <cr> <lf>"

Where: N = The table to use. The range is 1 to 10.

If no Program Table Data response: "<NAK> <sp> <NOD> <cr> <lf>"

6.1.3.1 Polarization Program Table Track Parameters Load/Recall

The station computer is allowed to load (when the station computer in control of the OCU and when the OCU is in control of the antenna) and recall (always) the pol table track parameters.

The load and clear commands are not accepted for the data set in use while in Polarization Program Table Track mode.

Data Load
Command: "PPT <sp> <N> , <time> , <pol> <cr>"

Data Recall
Command: "PPT? <sp> <N> <cr>"

Clear
Command: "PPTC <sp> <N> <cr>"

Load and clear Response: "<ack> <cr> <lf>"

Recall Response: "<time1> , <pol1> <cr> <lf> .....
<timen> , <poln> <cr> <lf> <etx>"

Option Load
Command: "PPTT <sp> <N> , <interpolate> [, <"> <name> <">] <cr>"

Option Recall
Command: "PPTT? <sp> <N> <cr>"

Option Recall
Response: "<interpolate> <"> <name> <"> <cr> <lf>"

Where:
- time = The UTC time of the data point (mm:dd:yyyy:hh:mm:ss).
- pol = The pol angle of the data point (0.0 to 359.999).
- N = The table to use. The range is 1 to 10.
- interpolate = A "1" if the command should use interpolation between data points and a "0" if no interpolation is to be used.
- Name = Alphanumeric name assigned to the table. This can be 1 to 20 characters.

The maximum number of data points is 144; if this is exceeded the command will be NAKed. The time values of successive data points must increase (or the command will be NAKed), but need not have uniform spacing. The clear command should be exercised before a new table load begins to avoid mixed data.

Response to recall (PPT?) for empty or erased set:

"<NAK> <sp> NOD <cr> <lf>"

6.2 ENHANCED MODE COMMANDS

6.2.1 Box Scan Mode

The OCU operation will begin Box Scan mode operation in conjunction with the current fundamental mode in response to this command. This operation affects only the az/el (or HA/DEC) axes. If the station computer is not in control of the OCU, the OCU will reject this command. If this OCU is not in control of the antenna, the OCU will reject this command. This command is accepted as shown in table 6.2.1-1 below. The first column shows the fundamental mode at the time the enhanced mode command is received. The second column shows the mode after the enhanced mode command is processed, and the third column shows the resulting enhanced mode. The acceptance of enhanced modes is also a function of the existing enhanced mode. Table 6.2.1-2 shows the initial enhanced mode (at the time of the new enhanced mode command) in column one with the resulting mode in column two.

Command: "BOX [<sp> <N>] <cr>"

Response: "<ack> <cr> <lf>"

Where: N = A value of 1 to 11. Values of 1 to 10 are manual parameter sets. The automatic scan parameter selection is the number of manual sets +1, or 11. Scan will occur on the automatic data set if this parameter is omitted.

Initial Fundamental Mode	Resulting Fundamental Mode	Enhanced Mode
Stop	Position Hold	Box Scan
Memory Track	Memory Track	Box Scan
Preset Pos	Preset Pos	Box Scan
Manual Rate	Manual Rate	None, Not Allowed
Manual Pos	Manual Pos	None, Not Allowed
Optrack	Optrack	None, Not Allowed
INTELSAT	INTELSAT	Box Scan
Geo Designate	Geo Designate	None, Not Allowed
Geo Preset	Geo Preset	None, Not Allowed
Maintenance	Maintenance	None, Not Allowed
Position Designate	Position Designate	Box Scan
Stow	Stow	None, Not Allowed
Star Track	Star Track	Box Scan
Program Table Track	Program Table Track	Box Scan
NORAD Track	NORAD Track	Box Scan

Table 6.2.1-1, Box Scan Mode Command Response

Initial Enhanced Mode	Command Result
None	Box Scan Accepted
Box Scan	NAK
Raster Scan	NAK
Geo Scan	NAK
Steptrack	NAK
Monopulse	NAK
Spiral Scan	NAK

Table 6.2.1-2, Box Scan Command Response

6.2.1.1 Box Scan Parameters Load/Recall

The station computer is allowed to load (when the station computer in control of the OCU and when the OCU is in control of the antenna) and recall (always) the box scan parameters. Changing the scan parameters in use will cause the scan to restart.

Load
Auto
Command: "BSCANA <sp> <box_length> , <box_width> , <scan_choice> , <scan_type> , <in_track> , <rotation> [, <"> <name> <">] <cr>"

Load
Manual
Command: "BSCANM <sp> <N> , <box_length> , <box_width> , <scan_choice> , <scan_type> , <in_track> , <rotation> , <scan_sep> [, <lock_time>] [, <"> <name> <">] <cr>"

Recall
Auto
Command: "BSCANA? <cr>"

Recall
Manual
Command: "BSCANM? <sp> <N> <cr>"

Load Response: "<ack> <cr> <lf>"

Recall Response, Auto: "<box_length> , <box_width> , <scan_choice> , <scan_type> , <in_track> , <rotation> , <"> <name> <"> <cr> <lf>"

Recall Response, Manual: "<box_length> , <box_width> , <scan_choice> , <scan_type> , <in_track> , <rotation> , <scan_sep> , <lock_time> , <"> <name> <"> <cr> <lf>"

Where:
- N = The number of the manual box scan parameter set. N may be 1 to 10.
- box_length = The total side-to-side box length in degrees (0.001 to 20.000). This is nominally the azimuth axis. If the box is aligned with a trajectory, this is the in-track (target velocity vector) direction.
- box_width = The total side-to-side box width in degrees (0.001 to 20.000). This is nominally the elevation axis. If the box is aligned with a trajectory, this is the cross-track (perpendicular to the target velocity vector) direction.

scan_choice = A "0" forces the scan to stop upon detecting an adequate tracking signal. A "1" indicates that the scan will end upon completing a full scan pattern. The antenna will then return to the highest signal level detected during the scan.

scan_type = A "1" to allow scanning only upon the first occurrence of a low signal. This normally occurs during the target acquisition. A "2" selects scan every time a low signal occurs.

in_track = This controls the rotation of the box. A "1" indicates that this feature is on and the system is to align the box scan axes parallel to the in track and cross track target directions. A "2" indicates that this feature is on and the system is to align the box scan axes perpendicular to the in track and cross track target directions. A "0" turns this feature off and enables the rotation angle feature.

rotation = The desired box rotation angle. The box scan may be rotated an arbitrary angle by this parameter. Looking out the line of sight, azimuth motion corresponds to the x axis and elevation motion corresponds to the y axis. The rotation angle is defined as zero when it aligns with the x/azimuth axis and increases with counterclockwise rotation. The range is 0 to 359.999.

scan_sep = The separation in dB between scans (0.01 to 5.000).

lock_time = The time required for the RF to recognize a signal used to scan. (0.1 to 20.000 second). This is meaningful only for DC systems and should be omitted in commands for AC systems.

name = Alphanumeric name assigned to the scan. This can be 1 to 20 characters.

Example Response to Manual Recall: "11.400 , 11.400 , 1 , 2 , 0.440 , 0 , 0.000 , 1.100 , -1.000 , <"> SMALL SCAN <"> <cr> <lf>"

6.2.2 Geo Scan Mode

The OCU operation will begin Geo Scan mode operation in conjunction with the current fundamental mode in response to this command. This operation affects only the az/el (or HA/DEC) axes. If the station computer is not in control of the OCU, the OCU will reject this command. If this OCU is not in control of the antenna, the OCU will reject this command. This command is accepted as shown in table 6.2.2-1 below. The first column shows the fundamental mode at the time the enhanced mode command is received. The second column shows the mode after the enhanced mode command is processed, and the third column

shows the resulting enhanced mode. The acceptance of enhanced modes is also a function of the existing enhanced mode. Table 6.2.2-2 shows the initial enhanced mode (at the time of the new enhanced mode command) in column one with the resulting mode in column two. The command will be rejected if the current latitude command is greater than 15° in magnitude.

Command: "GEOSC [<sp> <N>] <cr>"

Response: "<ack> <cr> <lf>"

Where: N = A value of 1 to 10 for manual scan parameters. The automatic scan parameter selection is Nmax+1, or 11. Scan will occur on data set 11 (Nmax+1) if this parameter is omitted.

Initial Fundamental Mode	Resulting Fundamental Mode	Enhanced Mode
Stop	Stop	None, Not Allowed
Memory Track	Memory Track	None, Not Allowed
Preset Pos	Preset Pos	None, Not Allowed
Manual Rate	Manual Rate	None, Not Allowed
Manual Pos	Manual Pos	None, Not Allowed
Optrack	Optrack	None, Not Allowed
INTELSAT	INTELSAT	None, Not Allowed
Geo Designate	Geo Designate	Geo Scan
Geo Preset	Geo Preset	Geo Scan
Maintenance	Maintenance	None, Not Allowed
Position Designate	Position Designate	None, Not Allowed
Stow	Stow	None, Not Allowed
Star Track	Star Track	None, Not Allowed
Program Table Track	Program Table Track	None, Not Allowed
NORAD Track	NORAD Track	None, Not Allowed

Table 6.2.2-1, Geo Scan Mode Command Response

Initial Enhanced Mode	Command Result
None	Geo Scan Accepted
Box Scan	NAK
Raster Scan	NAK
Geo Scan	NAK
Steptrack	NAK
Monopulse	NAK
Spiral Scan	NAK

Table 6.2.2-2, Geo Scan Command Response

6.2.2.1 Geo Scan Parameters Load/Recall

The station computer is allowed to load (when the station computer in control of the OCU and when the OCU is in control of the antenna) and recall (always) the geo scan parameters. Changing the scan parameters in use will cause the scan to restart.

Load
Auto
Command: "GSCANA <sp> <lat_size> , <lon_size> , <scan_choice> [, <"> <name> <">] <cr>"

Load
Manual
Command: "GSCANM <sp> <N> , <lat_size> , <lon_size> , <scan_choice> , <scan_sep> [, <lock_time>] [, <"> <name> <">] <cr>"

Recall
Auto
Command: "GSCANA? <cr>"

Recall
Manual
Command: "GSCANM? <sp> <N> <cr>"

Load Response: "<ack> <cr> <lf>"

Recall Response, Auto: "<lat_size> , <lon_size> , <scan_choice> , <"> <name> <"> <cr> <lf>"

Recall Response, Manual: "<lat_size> , <lon_size> , <scan_choice> , <scan_sep> , <lock_time> , <"> <name> <"> <cr> <lf>"

Where:
- N = The number of the manual scan parameter set. N may be 1 to 10.
- lat_size = The total side-to-side latitude size in degrees (0.001 to 30.0000).
- lon_size = The total side-to-side longitude size in degrees (0.001 to 180.0000).
- scan_choice = A "0" forces the scan to stop upon detecting an adequate tracking signal. A "1" indicates that the scan will end upon completing a full scan pattern. The antenna will then return to the highest signal level detected during the scan.
- scan_sep = The separation in dB between scans (0.01 to 5.000).
- lock_time = The time required for the RF to recognize a signal used to scan. (0.1 to 20.000 second). This is meaningful only for DC systems and should be omitted in commands for AC systems.
- name = Alphanumeric name assigned to the scan. This can be 1 to 20 characters.

Example Response to Manual Recall: "11.4000 , 1.9000 , 0, 0.440 , 1.100 , <"> SCAN FOR GSTAR 3 <"> <cr> <lf>"

6.2.3 Raster Scan Mode

The OCU operation will begin Raster Scan mode operation in conjunction with the current fundamental mode in response to this command. This operation affects only the az/el (or HA/DEC) axes. If the station computer is not in control of the OCU, the OCU will reject this command. If this OCU is not in control of the antenna, the OCU will reject this command. This command is accepted as shown in table 6.2.3-1 below. The first column shows the fundamental mode at the time the enhanced mode command is received. The second column shows the mode after the enhanced mode command is processed, and the third column shows the resulting enhanced mode. The acceptance of enhanced modes is also a function of the existing enhanced mode. Table 6.2.3-2 shows the initial enhanced mode (at the time of the new enhanced mode command) in column one with the resulting mode in column two.

Command: "RASTER [<sp> <N>] <cr>"

Response: "<ack> <cr> <lf>"

Where:
- N = A value of 1 to 11. Values of 1 to 10 are manual parameter sets. The automatic scan parameter selection is the number of manual sets +1, or 11. Scan will occur on the automatic data set if this parameter is omitted.

Initial Fundamental Mode	Resulting Fundamental Mode	Enhanced Mode
Stop	Position Hold	Raster Scan
Memory Track	Memory Track	Raster Scan
Preset Pos	Preset Pos	Raster Scan
Manual Rate	Manual Rate	None, Not Allowed
Manual Pos	Manual Pos	None, Not Allowed
Optrack	Optrack	None, Not Allowed
INTELSAT	INTELSAT	Raster Scan
Geo Designate	Geo Designate	None, Not Allowed
Geo Preset	Geo Preset	None, Not Allowed
Maintenance	Maintenance	None, Not Allowed
Position Designate	Position Designate	Raster Scan
Stow	Stow	None, Not Allowed
Program Table Track	Program Table Track	Raster Scan
Star Track	Star Track	Raster Scan
NORAD Track	NORAD Track	Raster Scan

Table 6.2.3-1, Raster Scan Mode Command Response

Initial Enhanced Mode	Command Result
None	Raster Scan Accepted
Box Scan	NAK
Raster Scan	NAK
Geo Scan	NAK
Steptrack	NAK
Monopulse	NAK
Spiral Scan	NAK

Table 6.2.3-2, Raster Scan Command Response

6.2.3.1 Raster Scan Parameters Load/Recall

The station computer is allowed to load (when the station computer in control of the OCU and when the OCU is in control of the antenna) and recall (always) the raster scan parameters. Changing the scan parameters in use will cause the scan to restart. For HA/DEC systems, box length (AZ) is hour angle and box width (EL) is declination.

Load
Auto
Command: "RSCANA <sp> <box_length> , <box_width> , <scan_choice> , <scan_type> , <in_track> , <rotation> [, <"> <name> <">] <cr>"

Load
Manual
Command: "RSCANM <sp> <N> , <box_length> , <box_width> , <scan_choice> , <scan_type> , <in_track> , <rotation> , <scan_sep> [, <lock_time>] [, <"> <name> <">] <cr>"

Recall
Auto
Command: "RSCANA? <cr>"

Recall
Manual
Command: "RSCANM? <sp> <N> <cr>"

Load Response: "<ack> <cr> <lf>"

Recall Response, Auto: "<box_length> , <box_width> , <scan_choice> , <scan_type> , <in_track> , <rotation> , <"> <name> <"> <cr> <lf>"

Recall Response, Manual: "<box_length> , <box_width> , <scan_choice> , <scan_type> , <in_track> , <rotation> , <scan_sep> , <lock_time> , <"> <name> <"> <cr> <lf>"

Where:
- N = The number of the manual box scan parameter set. N may be 1 to 10.
- box_length = The total side-to-side box size in degrees (0.001 to 20.000). This is nominally the azimuth axis. If the box is aligned with a trajectory, this is the in-track (target velocity vector) direction.

box_width	=	The total side-to-side box width in degrees (0.001 to 20.000). This is nominally the elevation axis. If the box is aligned with a trajectory, this is the cross-track (perpendicular to the target velocity vector) direction.
scan_choice	=	A "0" forces the scan to stop upon detecting an adequate tracking signal. A "1" indicates that the scan will end upon completing a full scan pattern. The antenna will then return to the highest signal level detected during the scan.
scan_type	=	A "1" to allow scanning only upon the first occurrence of a low signal. This normally occurs during the target acquisition. A "2" selects scan every time a low signal occurs.
in_track	=	This controls the rotation of the box. A "1" indicates that this feature is on and the system is to align the box scan axes parallel to the in track and cross track target directions. A "2" indicates that this feature is on and the system is to align the box scan axes perpendicular to the in track and cross track target directions. A "0" turns this feature off and enables the rotation angle feature.
rotation	=	The desired box rotation angle. The box scan may be rotated an arbitrary angle by this parameter. Looking out the line of sight, azimuth motion corresponds to the x axis and elevation motion corresponds to the y axis. The rotation angle is defined as zero when it aligns with the x/azimuth axis and increases with counterclockwise rotation. The range is 0 to 359.999.
scan_sep	=	The separation in dB between scans (0.01 to 5.000).
lock_time	=	The time required for the RF to recognize a signal used to scan. (0.1 to 20.000 second). This is meaningful only for DC systems and should be omitted in commands for AC systems.
name	=	Alphanumeric name assigned to the scan. This can be 1 to 20 characters.

Example Response to Manual Recall: "11.400 , 10.700 , 1 , 2 , 1 , 345.678 , 0.440 , 1.100 , 1.000 , <"> SMALL SCAN <"> <cr> <lf>"

6.3 PARAMETER COMMANDS

6.3.1 Sun Monitor Enable/Disable

The Sun monitor feature is not yet implemented. The station computer is allowed to enable or disable (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the sun monitor feature of the OCU. The ESUN command enables the monitor. The DSUN command disables the monitor.

Enable
Command: "ESUN <sp> <N> <cr>"

Disable
Command: "DSUN <sp> <N> <cr>"

Response: "<ack> <cr> <lf>"

Where: N = The number of the configuration to load (1 to 10).

6.3.1.1 Sun Monitor Parameters Load/Recall

The station computer is allowed to change (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the sun monitor data of the OCU.

Load
Command: "SSUN <sp> <N> , <on/off> , <size> <cr>"

Recall
Command: "SSUN? <sp> <N> <cr>"

Where: N = The number of the configuration to load (1 to 10).
on/off = Whether the box limits are enabled or disabled. "1" is on and "0" is off.
size = The size of the circular detection zone in degrees (0.0 to 5.000).

Load Response: "<ack> <cr> <lf>"

Recall Response: "<on/off> , <size> <cr> <lf>"

Example Recall Response: "1 , 4.300 <cr> <lf>"

7.0 TRAVEL AVOIDANCE OPTION COMMANDS

7.1 FUNDAMENTAL MODE COMMANDS

There are no fundamental mode commands for this option.

7.2 ENHANCED MODE COMMANDS

There are no enhanced mode commands for this option.

7.3 PARAMETER COMMANDS

7.3.1 Sector Alarm Enable

The station computer may enable or disable the sector alarm if it is in control of the OCU and the OCU is in control of the antenna.

Load
Command: "SSECTORA <sp> <on/off> <cr>"

Recall
Command: 'SSECTORA? <cr>"

Load
Response: "<ack> <cr> <lf>"

Recall
Response: "<on/off> <cr> <lf>"

Where: on/off = A "0" indicates off and "1" indicates on.

The sector alarm sets the "Command in Sector" fault if a command is issued inside a sector. The command is not rejected, but the fault is set as an operator warning. The sector alarm sets the "Antenna in Sector" fault if the antenna encoders indicate that the antenna is inside a sector. This fault also causes the CCU to throw the RF inhibit relay. The usual purpose of this relay is to inhibit transmission of RF energy at low elevation angles.

The sector alarm functions as follows: A single entry of zero AZ and elevation angle causes the RF inhibit relay to be thrown if the antenna travels to or below the elevation angle specified. Additional entries of AZ, EL pairs cause relay closure if a smaller elevation angle is achieved in the specified azimuth sector. For example, entries of (5, 5), (35, 6), (270, 10) (AZ, EL pairs) cause the following behavior. For azimuth angles of less than 5°, no operation occurs. For azimuths between 5 and 35° (inclusive) the elevation inhibit angle is 5°. For azimuth angles between 35 and 270, the elevation inhibit angle is 6° and for azimuths between 270 and 0°, the elevation inhibit angle is 10°.

Sector numbers are available for the first ten sectors. For the example above, the "Sector 1" status will occur if either the command or feedback is below the EL inhibit angle and the azimuth is between 5 and 35°. Similarly, the "Sector 2" message occurs for the same conditions and if the azimuth is between 35 and 270 and the "Sector 3" message for azimuths greater than 270.

WARNING: The sector alarm and RF inhibit are operational only if the OCU is operational. A mechanical inhibit is strongly recommended.

7.3.2 Sector Alarm Load/Recall

The station computer may load (if in control of the OCU and if the OCU is in control of the antenna) and recall (anytime) the sector alarm table. Up to 72 data points may be loaded into the table. The clear command erases the data in the table. The on/off status is not changed by the clear command.

Load
Command: "SECTORA <sp> <az>, <el> <cr>"

Recall
Command: "SECTORA? <cr>"

Load
Response: "<ack> <cr> <lf>"

Recall
Response: "<az1>, <el1> <cr> <lf>
<az2>, <el2> <cr> <lf> ....
<azn>, <eln> <cr> <lf> <etx>"

Clear
Command: "CLEARSA <cr>"

Where:
Az = The azimuth angle of the entry (0.0 - 359.999).
El = The elevation angle of the entry (-5.0 - 95.000).
etx = The ascii etx character indicating the end of the data. Only non zero entries are transmitted.

8.0 MONOPULSE OPTION COMMANDS

8.1 FUNDAMENTAL MODE COMMANDS

There are no fundamental mode commands for this option.

8.2 ENHANCED MODE COMMANDS

8.2.1 Monopulse Mode

The OCU operation will begin Monopulse mode operation in conjunction with the current fundamental mode in response to this command. This operation affects only the az/el axes. If the station computer is not in control of the OCU, the OCU will reject this command. If this OCU is not in control of the antenna, the OCU will reject this command. This command is accepted as shown in table 8.2.1-1 below. The first column shows the fundamental mode at the time the enhanced mode command is received. The second column shows the mode after the enhanced mode command is processed, and the third column shows the resulting enhanced mode. The acceptance of enhanced modes is also a function of the existing enhanced mode. Table 8.2.1-2 shows the initial enhanced mode (at the time of the new enhanced mode command) in column one with the resulting mode in column two.

Command: "MONOP [<sp> <N>] <cr>"

Response: "<ack> <cr> <lf>"

Where: N = A value of 1 to 10 for the optional monopulse number. If omitted, a 1 is assumed.

Initial Fundamental Mode	Resulting Fundamental Mode	Enhanced Mode
Stop	Position Hold	Monopulse
Memory Track	Memory Track	Monopulse
Preset Pos	Preset Pos	Monopulse
Manual Rate	Manual Rate	None, Not Allowed
Manual Pos	Manual Pos	None, Not Allowed
Optrack	Optrack	None, Not Allowed[1]
INTELSAT	INTELSAT	Monopulse
Geo Designate	Geo Designate	None, Not Allowed
Geo Preset	Geo Preset	None, Not Allowed
Maintenance	Maintenance	None, Not Allowed
Position Designate	Position Designate	Monopulse
Stow	Stow	None, Not Allowed
Star Track	Star Track	None, Not Allowed
Program Table Track	Program Table Track	Monopulse
NORAD Track	NORAD Track	Monopulse

[1]Must be selected before entering Optrack.

Table 8.2.1-1, Monopulse Mode Command Response

Initial Enhanced Mode	Command Result
None	Monopulse Accepted
Box Scan	NAK
Raster Scan	NAK
Geo Scan	NAK
Steptrack	NAK
Monopulse	NAK
Spiral Scan	NAK

Table 8.2.1-2, Monopulse Command Response

8.3 PARAMETER COMMANDS

8.3.1 Monopulse RF Parameters Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) in the OCU. These parameters supplement the RF parameters in section 3.3.2 and these monopulse parameters are referenced by the RF number. The data load is rejected unless the mode is Stop.

Load Command: "MPS <sp> <N> , <el_slope> , <xel_slope> , <el_off> , <xel_off> , <pol_ref> , <el_ps> , <xel_ps> [, <error_bw>] [, scan_mode>] [, <phase_mode>] <cr>"

Recall Command: "MPS? <sp> <N> <cr>"

Load Response: "<ack> <cr> <lf>"

Recall Response: "<el_slope> , <xel_slope> , <el_off> , <xel_off> , <pol_ref> , <el_ps> , <xel_ps> , <error_bw> , <scan_mode> , <phase_mode> <cr> <lf>"

Where:

- N = The RF parameters number from 1 to 10.
- el_slope = The slope of the error signal in degrees per volt (0.0 to 200.00) (declination slope).
- xel_slope = The slope of the error signal in volts per degree (0.0 to 200.00) (cross declination slope).
- el_off = The null offset in degrees (-1.000 to 1.000) (declination offset).
- xel_off = The null offset in degrees (-1.000 to 1.000) (cross declination offset).
- pol_ref = The polarization angle at which the monopulse RF chain is correctly phased (0.0 to 359.999).
- error_bw = The error signal bandwidth in GHz. Allowable values are: 0.000280, 0.00000250, and 0.00000670. See the tables below for selection rules.
- scan_mode = The pseudo-monopulse scan mode. A "0" turns scanning off (monopulse is not available). A "1" indicates constant scanning (this is the normal selection). A "2" gives random scanning for anti-jamming purposes.
- phase_mode = The phase shift mode. A "0" indicates manual mode and uses the manual phase shift settings. A "1" indicates table and uses the phase shift values in the tables. See 8.3.3 for table details.
- el_ps = The elevation (declination) phase shifter angle at the reference polarization angle (0.0 to 359.999).
- xel_ps = The cross-elevation (cross-declination) phase shifter angle at the reference polarization angle (0.0 to 359.999).

Example
Response: "28.00 , 28.01 , 0.000 , -0.001 , 267.450 , 333.125 , 194.506, 0.000280, 1, 1 <cr> <lf>"

The error bandwidth selection is constrained to match the RF bandwidth as indicated in Table 8.3.1-1. If the RF bandwidth is changed, then the error bandwidth may change as indicated in Table 8.3.1-2.

Existing RF BW	Commanded Error BW	Action
0.0000.250	0.00000250	OK
0.00000250	0.00000670	NAK
0.00000250	0.000280	OK
0.00000670	0.00000250	NAK
0.00000670	0.00000670	OK
0.00000670	0.000280	OK
0.000280	0.00000250	OK
0.000280	0.00000670	OK
0.000280	0.000280	OK

Table 8.3.1-1, Error RF Bandwidth Selection

RF BW Changes		Error BW Resulting Change	
From	To	From	To
0.00000250	0.00000670	0.00000250	0.00000670
0.00000250	0.00000670	0.000280	0.000280
0.00000670	0.00000250	0.00000670	0.00000250
0.00000670	0.00000670	0.000280	0.000280
0.000280	0.00000250	0.00000250	0.00000250
0.000280	0.00000250	0.00000670	0.00000250
0.000280	0.00000250	0.000280	0.000280
0.000280	0.00000670	0.00000250	0.00000670
0.000280	0.00000670	0.00000670	0.00000670
0.000280	0.00000670	0.000280	0.000280

Table 8.3.1-2, Error RF Bandwidth

8.3.2 Monopulse Parameters Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) in the OCU.

Load
Command: "MSC <sp> <N> , <scan_pattern> , <scan_number> , <target_vel> [, <max_error>] [, <"> <name> <">] <cr>"

Recall
Command: "MSC? <sp> <N> <cr>"

Load
Response: "<ack> <cr> <lf>"

Recall
Response: "<scan_pattern> , <scan_number> , <target_vel> , <max_error> <"> <name> <"> <cr> <lf>"

Where:
- N = A value of 1 to 10 for the monopulse number.
- scan_pattern = The desired scan pattern. A "0" indicates no scan, a "1" indicates box scan, a "2" indicates raster scan, and a "3" indicates spiral scan. Box and raster scans are available if the acquisition and pointing option is available. Spiral scan is available only if the spiral scan option is available.
- scan_number = The number of the scan data set to use. The range is 1 to 11, with 1 to 10 manual parameters and 11 is the automatic set.
- name = Alphanumeric name assigned to the scan. This can be 1 to 20 characters.
- target_vel = The target velocity used for monopulse rate error detection (0.00001 to 20.0 deg/s).
- max_error = The maximum angular error (in AZ/EL) desired when autotracking with monopulse. Provided in dB with a range of from 0.10 to 20.00.

Example
Response: "1 , 10 , 0.00070 , 0.90 , <"> MONOPULSE SETTING 1 <"> <cr> <lf>"

8.3.3 Phase Shift Table Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) the phase shift table.

The phase shift table settings provide automatic rephasing of the monopulse RF chain in the event that the RF equipment changes. The status of the RF equipment (such as redundant LNAs) is monitored by the Tracking Receiver. The bits labeled "External Status" in the

Tracking Receiver status report (see section 3.3.25). If the phase_mode parameter is set to TABLE ("1", see section 8.3.1), then the OCU attempts to match the External Status bits with the Table settings. The first match located provides the phase shift settings used to correct for the RF equipment in use. Thus, the table contains the External Status bit patterns and the phase shifts which the bit patterns represent.

Load
Command: "PSTAB <sp> <N>, <bit7>, <bit6>, <bit5>, <bit4>, <bit3>, <bit2>, <bit1>, <el_ps>, <az_ps> [,<pol_ps>] <cr>"

Where:

N	=	the table entry number (1-10).
bit1-7	=	the Tracking Receiver External Status input "0" is open, "1" is closed and "2" indicates don't care.
el_ps	=	the elevation axis phase shift in degrees (0-359.999).
az_ps	=	the azimuth axis phase shift in degrees (0-359.999)
pol_ps	=	the polarization axis phase shift in degrees (0-359.999).

Recall
Command: "PSTAB? <sp> <N> <cr>"

Load
Response "<ack> <cr> <lf>"

Recall
Response: "<bit7>, <bit6>, <bit5>, <bit4>, <bit3>, <bit2>, <bit1>, (el_ps>, <az_ps>, <pol_ps> <cr> <lf>"

Example Recall
Response: "1, 0, 0, 1, 1, 2, 2, 235.987, 111.111, 333.444 <cr> <lf>"

9.0 POLARIZATION MONOPULSE OPTION COMMANDS

9.1 FUNDAMENTAL MODE COMMANDS

There are no fundamental mode commands for this option.

9.2 ENHANCED MODE COMMANDS

9.2.1 Polarization Monopulse Mode

The OCU operation will begin polarization axis monopulse mode operation in response to this command. This operation affects only the polarization axes. If the station computer is not in control of the OCU, the OCU will reject this command. If this OCU is not in control of the

antenna, the OCU will reject this command. The azimuth and elevation mode is not changed by this command.

Command: "POLM [<sp> <N>] <cr>"

Response: "<ack> <cr> <lf>"

Where: N: A value of 1 to 10 for the monopulse number. If omitted, a value of 7 is used.

9.3 PARAMETER COMMANDS

9.3.1 Polarization Monopulse RF Parameters Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) in the OCU. The data load is rejected unless the Pol mode is Stop.

Load
Command: "MPP <sp> <N> , <pol_slope> , <pol_off> , <pol_ps> <cr>"

Recall
Command: "MPP? <sp> <N> <cr>"

Load
Response: "<ack> <cr> <lf>"

Recall
Response: "<pol_slope> , <pol_off> , <pol_ps> <cr> <lf>"

Where:

N	=	The RF parameters number from 1 to 10.
pol_slope	=	The slope of the error signal in volts per degree (0.0 to 200.00).
pol_off	=	The null offset in degrees (-1.000 to 1.000).
pol_ps	=	The cross-elevation phase shifter angle at the reference polarization angle (0.0 to 359.999).

Example
Response: "30.97 , 0.003 , 222.987 <cr> <lf>"

9.3.2 Polarization Monopulse Parameters Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) in the OCU.

Load
Command: "PVD <sp> <N> , <target_vel> [, <max_error>] <cr>"

Recall
Command: "PVD? <sp> <N> <cr>"

Load
Response: "<ack> <cr> <lf>"

Recall
Response: "<target_vel> <cr> <max_error> <lf>"

Where:	N	=	A value of 1 to 10 for the monopulse number.
	target_vel	=	The target velocity used for monopulse rate error detection (0.00001 to 20.0 deg/s).
	max_error	=	The maximum Pol angular error desired when autotracking with monopulse (0.01 to 90.0 degrees).

Example
Response: "0.00070 , 0.35 <cr> <lf>"

10.0 DUAL OCU CONTROL COMMANDS

For dual OCU systems, the OCU must actively take control of the CCU. The OCU man relinquish control to the other OCU, but remains in control until control is accepted.

10.1 COMPUTER CCU CONTROL REQUEST

The station computer may request control of the CCU (via the OCU) at any time. This command will be NAKed if control is not available. The basic condition in which control is not available is when another unit has control of the CCU and has not released control.

Command: "CCTAKE <cr>"

Response: "<ack> <cr> <lf>"

10.2 COMPUTER CCU CONTROL RELEASE

The station computer may instruct the OCU to release control of the CCU at any time, but the OCU remains in control of the CCU until another unit accepts control. The station computer may check control configuration with a status inquiry. It requires approximately 1-2 seconds for a control charge to be accurately reflected in both OCU's status.

Command: "CCREL <cr>"

Response: "<ack> <cr> <lf>"

11.0 DATA LOGGER OPTION COMMANDS

11.1 FUNDAMENTAL MODE COMMANDS

There are no fundamental mode commands for this option.

11.2 ENHANCED MODE COMMANDS

There are no enhanced mode commands for this option.

11.3 PARAMETER COMMANDS

11.3.1 Data Logger Load/Recall

The station computer can load (when in control of the OCU) or recall (anytime) the parameters used to control the operation of the data logger.

Load
Command: "DL <sp> <on_off> [, <output_device>] [, <log_time>] <cr> "

Recall
Command: "DL? <cr>"

Where:

on_off	=	0 to turn OFF the data logger 1 to turn ON the data logger
output_device	=	0 to send data logger output to a parallel printer.
log_time	=	The time between data logger reports. A "0" represents 1 minute spacing with reports on the 1 minute mark. A "1" represents 5 minute spacing with reports on the 5 minute mark. A "2" represents 10 minute spacing with reports on the 10 minute mark. A "3" represents 15 minute spacing with reports on the quarter hour mark. A "4" represents 20 minute spacing with reports on the 1/3 hour mark. A "5" represents 30 minute spacing with reports on the half hour. A "6" represents 60 minute spacing with reports on the hour.

Response
to Load: "<ack> <cr> <lf>"

Response
to Recall: "<on_off> , <output_device> , <log_time> , <c> , <lf>"

12.0 MODEL 133

The model 133 antenna control system is intended primarily for dual DC drive systems. The previous model 100 commands are accepted. The following sections detail the additional

commands to support the additional functionality of the model 133. The system is designed to process 10 commands per second, plus one status inquiry per second at peak processor loading. Some commands and/or responses are sufficiently long that 10 commands per second will not fit in the link bandwidth. Thus any specific string of commands which are time critical should be examined against the link bandwidth restrictions.

12.1 DATA LINK

The model 133 also supports the RS-232 or RS-422 style serial links. Higher baud rates are available on the model 133. The standard configuration is a data rate of 9600 baud, 8 data bits, one start bit, two stop bits, with odd parity. The parameters of the data link are adjustable. The system is designed to support 10 commands per second, plus one status inquiry per second at peak processor loading. This does not apply to mode change commands, as they require about 0.25 seconds to process and implement. Position designate commands following the initial position designate command are not considered mode changes and may be issued at 10 per second. In many cases, a faster rate may be achieved, but this should not be relied upon without consultation with the engineering staff. Commands may be transmitted and buffered up to the previously discussed limit, or new commands may be issued as soon as a response (ack or NAK) is received by the station computer. Using the latter method, the station computer commands need not be limited by strict timing constraints inside the station computer. Note, however, that acknowledgement does not necessarily mean that the command action is complete. Some commands require internal processing time after the response is issued.

12.2 PHYSICAL INTERFACE

The physical interface for the model 133 is identical to the model 100.

12.3 MODEL 133 COMMANDS

12.4 FUNDAMENTAL MODE COMMANDS

12.5 ENHANCED MODE COMMANDS

12.6 PARAMETER COMMANDS

12.6.1 Non Orthogonality Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna and when the OCU is in Stop mode) and recall (always) the non orthogonality correction values in the OCU. If the antenna is facing north, the elevation axis is along an east-west line. The nonorthogonality angle is defined as positive if the western elevation bearing is higher than the eastern elevation bearing. For a positive angle nonorthogonality and elevation command greater than zero, the antenna will rotate counter clockwise in azimuth and up in elevation.

Load
Command: "ORTHO <sp> <angle> <cr>"

Recall
Command: "ORTHO? <cr>"

Where: angle = The non orthogonality correction value. The range is +/- 5.0000 degrees.

Response to load: "<ack> <cr> <lf>"

Response to recall: "<angle> <cr> <lf>"

Example Response to recall:

"0.0732 <cr> <lf>"

12.6.2 Foundation Tilt Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna and when the OCU is in Stop mode) and recall (always) the foundation tilt correction values in the OCU. The foundation tilt is defined as a east-west over north-south ordered pair. This means that the north south correction is performed first, followed by the east-west correction. The north-south tilt angle is defined as positive if the northern side is higher than the southern side. With the antenna facing north, a positive n-s tilt angle will cause the elevation axis to rotate down to compensate for the tilt. The east-west angle is defined as positive if the west side of the antenna is higher than the east side. With the antenna facing west, a positive e-w angle will cause the elevation axis to rotate down to compensate for the tilt.

Load
Command: "FOUND <sp> <NS> , <EW> <cr>"

Recall
Command: "FOUND? <cr>"

Where: NS = The north-south correction component. The range is +/- 5.0000.
EW = The east-west correction component. The range is +/- 5.0000.

Response to load: "<ack> <cr> <lf>"

Response to recall: "<NS> , <EW> <cr> <lf>"

Example Response to recall:

"0.0098 , -0.0881 <cr> <lf>"

12.6.3 Bearing Wobble Table Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna and when the OCU is in Stop mode) and recall (always) the bearing wobble table. Facing out from the center of rotation, up is positive and down is negative. The wobble table is loaded incrementally with each data point added to the table. The table will be sorted by increasing azimuth angle. The wobble offset is used to correct all the azimuth data points as necessary.

Load
Command: "WOBBLE <sp> <az angle> , <connection data> <cr>"

Recall
Command: "WOBBLE? <cr>"

Where:
- az angle = AZ angle to allow the arbitrary spacing of the Wobble Table. The range is 0 thru 359.999.
- correction data = Correction data for each az angle. The range is ±1.0.

Response
to Load: "<ack> <cr> <lf>"

Response
to Recall: "<az1> , <data1> , <az2> , <data2, . . . <azn> , <datan> <cr> <lf>"

Where:
- az[i] data [i] = sets of Az angle and correction data will be listed in numerical order of Az. The Wobble table can hold the data points up to 72 (5° separation). The response will be sorted in increasing azimuth.
- az_offset = The bias correction between the table azimuth and the azimuth in use. A value between -15.000 and 15.000.

Example Response
to Recall
(3 points loaded): "10.379, 0.032, 30.300, 0.061, 40.900, 0.364 <cr> <lf>"

Offset Load
Command: "WOFFSET <sp> <az offset> <cr>"

Offset Recall
Command: "WOFFSET? <cr>"

Response to
Offset Load: "<ack <cr> <lf>"

Response to
Offset Recall: "<az offset> <cr> <lf>"

The wobble data may be deleted by:

Delete Command: "DWOBBLE <cr>"

Response to Delete: "<ack> <cr> <lf>"

13.0 NORAD OPTION COMMANDS

13.1 FUNDAMENTAL MODE COMMANDS

13.1.1 NORAD Track Mode Command

The OCU will change the operational state to the NORAD Track mode in response to this command. This command affects only the az/el axes. If the station computer is not in control of OCU, the OCU will reject this command. If the OCU is not in control of the antenna, the OCU will reject the command. The antenna is driven to the commanded NORAD trajectory angles in response to this command. The polarization mode and position is not changed by this command. If the NORAD set selected is not available, the command will be NAKed.

Command: "NORADT <sp> <object> [, <start_time>] [, <stop_time>] [, <cable_wrap>] <cr>"

Where:
- object = The five digit object number of the element set. The range is 0 to 99999.
- start_time = The UTC time to begin tracking. If omitted, the value is 1 January 1990. The format is HH:MM:SS:DDD:YYYY.
- stop_time = The UTC time to stop tracking. If omitted, the value is 1 January 2042. The format is HH:MM:SS:DDD:YYYY.
- cable_wrap = The initial cable wrap of the trajectory. If omitted, shortest path is selected. The choices are "C" for clockwise, "W" for counterclockwise, and "S" for shortest path.

Response: "<ack> <cr> <lf>"

13.2 ENHANCED MODE COMMANDS

There are no enhanced mode commands for this option.

13.3 PARAMETER COMMANDS

13.3.1 NORAD Element Set Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) NORAD Element Sets in the OCU. If a NORAD mode is active, the element set in use may not be changed and the command will be NAKed. The validity tests on the element set are checksum tests, consistent object number test, and proper line number test. Failure of one of these tests results in a NAK (NSET). The storage algorithm is as follows. If an existing set with a matching object number exists and the load command epoch is the same as or more recent the existing set will be replaced. If the load command epoch is older, the command will be NAKed (NOLD). If there is no matching object, the command will be stored in the first available storage area. If all areas are full, the command will be NAKed (FULL).

Load
Command: "LOAD_NORAD <sp> <"> <element set line 1> <cr> <element set line 2> <"> [, <config>] [, <az_offset>] [, <el_offset>] [, <time_offset>] [, <offset_op>] [, <cw>] <cr>"

Where: Element set line 1 consists of the following 69 characters (this is a fixed length, fixed format field):

LINENO	=	Line number (a "1")
BLANK	=	An ASCII blank or space (<sp>)
SATNO	=	A 5 digit Satellite or object number.
CLASS	=	A classification character (U, C, S, ...)
BLANK	=	An ASCII blank or space (<sp>)
IDYR	=	International year designator; the last two digits of the year
IDLNO	=	International launch designator; a three digit launch number
IDPNO	=	International launch place; three characters.
BLANK	=	An ASCII blank or space (<sp>)
EPYR	=	Epoch year; the last two digits of the year.
EPOCH	=	The epoch day and fractional day. The format is xxx.xxxxxxxx.
BLANK	=	An ASCII blank or space (<sp>)
NDOT2 or BTERM	=	The first time derivative of the mean motion or the ballistic coefficient. The selection depends on the ephemeris type. The format is +/-.xxxxxxxx (10 total characters). This represents either revolutions/day^2 or meter^2/kg.
BLANK	=	An ASCII blank or space (<sp>)
NDDOT6	=	The second time derivative of the mean motion. The format is +/-x<.>xx<->xx or +/-x<.>xxxx<->x. The decimal is implied and is not part of the command. The exponent sign (<->) is "+" or "-" or <sp> (" "). This represents revolutions/day^3. This parameter may be blank, which is interpreted as zero.

BLANK	=	An ASCII blank or space (<sp>)
BSTAR or AGOM	=	The BSTAR drag term or the radiation pressure coefficient, depending upon the ephemeris type. The format is +/-xxxx<->xx or +/-xxxxx<->x or eight characters. The exponent sign (<->) is "+" or "-" or <sp> (" ").
BLANK	=	An ASCII blank or space (<sp>)
EPHTYP	=	A single character for the ephemeris type.
BLANK	=	An ASCII blank or space (<sp>)
ELNO	=	A four digit element number.
CKSUM	=	A single digit checksum module 10 for numbers and a "-" is equivalent to a "1".

Element set line 2 consists of the following 69 characters (this is a fixed length, fixed format field):

LINENO	=	Line number (a "2")
BLANK	=	An ASCII blank or space (<sp>)
SATNO	=	A 5 digit Satellite or object number.
BLANK	=	An ASCII blank or space (<sp>)
II	=	The inclination in degrees. The format is xxx.xxxx or 8 total characters.
BLANK	=	An ASCII blank or space (<sp>)
NODE	=	The right ascension of the ascending node in degrees. The format is xxx.xxxx or 8 total characters.
BLANK	=	An ASCII blank or space (<sp>)
EE	=	The eccentricity with an assumed decimal point of the form <.>xxxxxxx.
BLANK	=	An ASCII blank or space (<sp>)
OMEGA	=	The argument of Perigee in degrees. The format is xxx.xxxx or 8 total characters.
BLANK	=	An ASCII blank or space (<sp>)
MM	=	The mean anomaly in degrees of the form xxx.xxxx or 8 total characters
BLANK	=	An ASCII blank or space (<sp>)
NN	=	The mean motion in revolutions/day of the form xx.xxxxxxxx or 11 total characters.
REVNO	=	The five digit revolution number at the epoch.
CKSUM	=	A single digit checksum module 10 for numbers and a "-" is equivalent to a "1".

The optional parameters are:

config	=	A value of 0 to 10 for the configuration. If this value is omitted and a matching set is found, the configuration of the existing set is used. A setting of 0 insures that the system config is not changed upon entry of NORAD mode.

az_offset	=	The stored azimuth offset in degrees (+/-20.000).
el_offset	=	The stored elevation offset in degrees (+/-20.000).
time_offset	=	The time offset, in seconds (+/- 60.0).
cw	=	The initial cable wrap of the trajectory. If omitted, shortest path is selected. The choices are "C" for clockwise, "W" for counterclockwise, and "S" for shortest path.
offset_op	=	A 0 selects NORAD operation such that the NORAD offsets are cleared upon exit of the mode. A 1 selects operation such that the offsets are saved upon exit of the NORAD mode.

Load
Response: "<ack> <cr> <lf>"

Recall
Command: "LOAD_NORAD? <sp> <object> <cr>"

Where: object = The five digit object number of the element set. The range is 0 to 99999.

Recall
Response: " <"> <element set line 1> <cr> <element set line 2> <"> , <config> , <az_offset> , <el_offset> , <time_offset> , <cw> <cr> <lf> "

Example Load (spaces are significant inside the <"> marks):

"LOAD_NORAD <sp> <">1 88888U 80275.98708465 .00073094 13844-3 66816-4 0 87 <cr> 2 88888 72.8435 115.9689 0086731 52.6988 110.5714 16.05824518 1057<"> , 1, 3.964 , 4.567 , 20.0 , C <cr>"

Example Recall (spaces are significant inside the <"> marks):

"<">1 88888U 80275.98708465 .00073094 13844-3 66816-4 0 87 <cr> 2 88888 72.8435 115.9689 0086731 52.6988 110.5714 16.05824518 1057<"> , 1 , 3.964 , 4.567 , 20.0 , 0 , C <cr> <lf>"

If data recall response: "<NAK> <sp> <NOD> <cr> <lf>"

13.3.2 NORAD Element Set Delete

The station computer is allowed to delete (when in control of the OCU and when the OCU is in control of the antenna) NORAD Element Sets in the OCU. If a NORAD mode is active, the element set in use may not be deleted.

Command: "NORADD <sp> <object> <cr>"

Where: object = The five digit object number of the element set. The range is 00000 to 99999.

Response: "<ack> <cr> <lf>"

Example Command: "NORADD <sp> 34567 <cr>"

13.3.3 NORAD Element Set List

The station computer is allowed to recall a list of the NORAD Element Sets in the OCU.

Command: "LNORAD <cr>"

Response: "<object1> , <object2> , ... <objectN> <cr> <lf>"

Where: object[i] = The five digit object number of the element set. The range is 00000 to 99999. There are up to 120 object numbers and they will be listed in numerical order.

13.3.4 NORAD Offset Load/Recall

The station computer is allowed to change (when in control of the OCU and when the OCU is in control of the antenna) NORAD offsets in the OCU. The offset loading feature is inhibited by the OCU during active steptracking, active monopulse or scanning (ACTIVELY TRACKING, or ACTIVELY SCANNING). The recall command is valid regardless of the control status. A NORAD mode must be active, and the offsets for the element set in use are loaded or recalled.

Load
Command: "NJOG <sp> [<az_inc>] [, <el_inc>] [, <time_inc>] <cr>"

Where:	az_inc	=	The azimuth increment in degrees (+/-20.000).
	el_inc	=	The elevation increment in degrees (+/-20.000).
	time_inc	=	The time increment in seconds (±60.0).

Example Response: "<ack> <cr> <lf>"

Recall
Command: "NOFFSET? <cr>"

Response: "<az_offset> , <el_offset> , <time_offset> <cr> <lf>"

Where:	az_offset	=	The azimuth offset in degrees (+/-20.000).
	el_offset	=	The elevation offset in degrees (+/-20.000).
	time_offset	=	The time offset in seconds (±60.0).

Example Response: "10.789 , -13.000 , -30:53 <cr> <lf>"

14.0 BEAM WAVEGUIDE MONOPULSE OPTION COMMANDS

14.1 FUNDAMENTAL MODE COMMANDS

There are no fundamental mode commands for this option.

14.2 ENHANCED MODE COMMANDS

There are no enhanced mode commands for this option.

14.3 PARAMETER COMMANDS

14.3.1 Beam Waveguide Monopulse RF Parameters Load/Recall

The station computer is allowed to load (when in control of the OCU and when the OCU is in control of the antenna) and recall (always) in the OCU. This command is applicable only for beam waveguide antennas.

Load
Command: "MBW <sp> <N> , <el_ref> , <az_ref> <cr>"

Recall
Command: "MBW? <sp> <N> <cr>"

Load
Response: "<ack> <cr> <lf>"

Recall
Response: "<el_ref> , <az_ref> <cr> <lf>"

Where:
- N = The RF parameters number from 1 to 10.
- el_ref = The elevation angle at which the monopulse RF chain is correctly phased (-5.000 to 95.000).
- az_ref = The azimuth angle at which the monopulse RF chain is correctly phased (0.0 to 359.999). NOTE: for beam waveguide antennas, the phase shifter angles in the monopulse load/recall command are correct at the location defined by (az_ref, el_ref, pol_ref).

Example
Response: "39.567 , 178.497 <cr> <lf>"

15.0 SPIRAL SCAN OPTION COMMANDS

15.1 FUNDAMENTAL MODE COMMANDS

There are no fundamental mode commands for this option.

15.2 ENHANCED MODE COMMANDS

15.2.1 Spiral Scan Mode

The OCU operation will begin Spiral Scan mode operation in conjunction with the current fundamental mode in response to this command. This operation affects only the Az/El (HA/DAC) axes. If the station computer is not in control of the OCU, the OCU will reject this command. If this OCU is not in control of the antenna, the OCU will reject this command. This command is accepted as shown in table 15.2.1-1 below. The first column shows the fundamental mode at the time the enhanced mode command is received. The second column shows the mode after the enhanced mode command is processed, and the third column shows the resulting enhanced mode. The acceptance of enhanced modes is also a function of the existing enhanced mode. Table 15.2.1-2 shows the initial enhanced mode (at the time of the new enhanced mode command) in column one with the resulting mode in column two.

Command: "SPIR [<sp> <N>] <cr>"

Response: "<ack> <cr> <lf>"

Where: N = A value of 1 to 11. Values of 1 to 10 are manual parameter sets. The automatic scan parameter selection is the number of manual sets +1, or 11. Scan will occur on the automatic data set if this parameter is omitted.

Initial Fundamental Mode	Resulting Fundamental Mode	Enhanced Mode
Stop	Position Hold	Spiral Scan
Memory Track	Memory Track	Spiral Scan
Preset Pos	Preset Pos	Spiral Scan
Manual Rate	Manual Rate	None, Not Allowed
Manual Pos	Manual Pos	None, Not Allowed
Optrack	Optrack	None, Not Allowed
INTELSAT	INTELSAT	Spiral Scan
Geo Designate	Geo Designate	None, Not Allowed
Geo Preset	Geo Preset	None, Not Allowed
Maintenance	Maintenance	None, Not Allowed
Position Designate	Position Designate	Spiral Scan
Stow	Stow	None, Not Allowed
Program Table Track	Program Table Track	Spiral Scan
Star Track	Star Track	Spiral Scan
NORAD Track	NORAD Track	Spiral Scan

Table 15.2.1-1, Spiral Scan Mode Command Response

Initial Enhanced Mode	Command Result
None	Spiral Scan Accepted
Box Scan	NAK
Raster Scan	NAK
Geo Scan	NAK
Steptrack	NAK
Monopulse	NAK
Spiral Scan	NAK

Table 15.2.1-2, Spiral Scan Command Response

15.3 PARAMETER COMMANDS

15.3.1 Spiral Scan Parameters Load/Recall

The station computer is allowed to load (when the station computer in control of the OCU and when the OCU is in control of the antenna) and recall (always) the spiral scan parameters. Changing the scan parameters in use will cause the scan to restart.

Load
Auto
Command: "SSA <sp> [<scan_radius>], <scan_choice> , <scan_type> [, <"> <name> <">] <cr>"

Load
Manual
Command: "SSM <sp> <N> [, <scan_radius>] , <scan_choice> , <scan_type> [, <scan_sep>] [, <lock_time>] [, <"> <name> <">] <cr>"

Recall
Auto
Command: "SSA? <cr>"

Recall
Manual
Command: "SSM? <sp> <N> <cr>"

Load Response: "<ack> <cr> <lf>"

Recall Response, Auto: "<scan_radius> , <scan_choice> , <scan_type> , <"> <name> <"> <cr> <lf>"

Recall Response, Manual: "<scan_radius> , <scan_choice> , <scan_type> , <scan_sep> , <lock_time> , <"> <name> <"> <cr> <lf>"

Where:

N	=	The number of the manual spiral scan parameter set. N may be 1 to 10.
scan_radius	=	The maximum radius of the spiral scan in degrees (0.001 to 20.000).
scan_choice	=	A "0" forces the scan to stop upon detecting an adequate tracking signal. A "1" indicates that the scan will end upon completing a full scan pattern. The antenna will then return to the highest signal level detected during the scan.
scan_type	=	A "1" to allow scanning only upon the first occurrence of a low signal. This normally occurs during the target acquisition. A "2" selects scan every time a low signal occurs.
scan_sep	=	The separation in dB between scans (0.01 to 5.000).
lock_time	=	The time required for the RF to recognize a signal used to scan. (0.1 to 20.000 second). This is meaningful only for DC systems and should be omitted in commands for AC systems.
name	=	Alphanumeric name assigned to the scan. This can be 1 to 20 characters.

Example Response to Manual Recall: "11.400 , 1 , 2 , 1.100 , 1.000 , <"> SMALL SCAN <"> <cr> <lf>"

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