SECTION 7

7 VERTEXRSI EQUIPMENT & INTERFACE INFORMATION

See Drawing 99-236-0008 attached - Software Interface Specification.
See Drawing 90-003-0008 attached – Generic Software Interface Specification

CAGE NO.	DWG. NO.	SH
OPON7	99-236-000	1

DASH NO. REV STATUS					REVISIONS			
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Notes:

1. **Interpret this drawing in accordance with DOD-STD-100.**

DWN	D. YORK
CHK	D. FULLER
ORIG	B. HINES
PROD MGR	B. HINES
CE MGR	

Vertex RSI™

DWG TITLE

OSCHIN
SOFTWARE INTERFACE SPC

SIZE	CAGE NO.	DWG NO.
A	OPON7	99-236-0008

SCALE NONE | REV A | SHEET 1 OF 60

FORM 4501 VDD

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1.0 INTRODUCTION

This is the interface specification for the VertexRSI (VRSI) Richardson Facility Controls Model 100 Antenna Control System. The Model 100 commands that the following also apply to the Model 133, while Model 133 specific commands are in a separate section toward the end of this document. Models 100 and 133 consist of an ACU (Antenna Control Unit) and a CCU (Central Control Unit). The command source is normally a computer and is termed the station computer.

2.0 GENERAL OPERATION

The interface is designed so that the station computer sends only commands and the ACU sends only responses. No unsolicited output is issued from the ACU. Uppercase 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 an "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> BAD <cr> <lf>"	One or more of the command arguments are not correct. This includes out-of-range errors. (BADD indicates BAD Data.)
"<NAK> <sp> NIC <cr> <lf>"	The station computer is in control of the antenna. The issued command is only acceptable when the station computer is not 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> FULL <cr> <lf>"	The data is not accepted because the data table is full.
"<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 that 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 ACU. 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 "[ ]" indicate optional 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 ACU 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 ACU 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 0 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 ACU, at least one valid command in each 10 second (user adjustable) period is required. Failure to receive commands causes the ACU 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 ACU 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 for 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 ACU or the ACU 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 9600 baud, 8 data bits, one start bit, two stop bits, with odd parity. The parameters of the data link are adjustable. The Model 133 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 consulting 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 ACU chassis connector is male and is labeled J6. Table 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 that 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 2-1, Pin Assignments

3.0 FUNDAMENTAL MODE COMMANDS

The ACU has pseudo-independent mode operation for the Focus, Dome and Windscreen axes from the fundamental (hour angle/declination) axes. Only the Focus/Dome/Windscreen Position Designate Mode/Windscreen Slave Mode, and Dome/Windscreen Stop Mode commands are fully independent equivalent modes. Table 2-1 shows the mode commands and how they affect the ha/dec, focus, dome and windscreen operational states.

For example, beginning with both HA/Dec and Focus in the Stop Mode, Manual Position command would take all three axes to Manual Position Mode. A subsequent Stop Mode command would change all three axes to Stop Mode. A Preset Position command would then change the HA/Dec Mode to Preset, leaving the Focus Mode in Stop.

Command	Applies To HA/Dec	Applies To Focus	Applies To Dome	Applies To Windscreen
Stop	YES	YES	YES	YES
Star Track	YES	NO[1]	YES[2]	YES[2]
Preset Position	YES	NO[1]	YES[2]	YES[2]
Position Designate Mode	Yes	NO[1]	NO[3]	NO[3]
Manual Rate	YES	YES	NO[3]	NO[3]
Manual Pos	YES	NO[1]	NO[3]	NO3
Maintenance	YES	YES	NO[3]	NO[3]
Stow	YES	NO[1]	YES	YES[4]
Dome Stop	NO	NO	YES	NO
Windscreen Stop	NO	NO	NO	YES
Dome Slave	NO	NO	YES	NO
Windscreen Slave	NO	NO	NO	YES
Focus Designate	NO	YES	NO	NO
Dome Designate	NO	NO	YES	NO
Windscreen Designate	NO	NO	NO	YES
Focus Stop	NO	YES	NO	NO

Table 3-1, Mode Command Application

[1]The Focus Axis Mode will be changed to Stop Mode if the current Focus Mode is either Manual Rate Mode or Maintenance Mode.

[2]The fundamental mode command places the axis in Slave Mode.

[3]This axis is placed in Stop Mode if the current mode for this axis is Slave Mode.

[4]The fundamental mode command places the axis in Stop Mode.

3.1 POSITION DESIGNATE MODE

The ACU will change the operational state to the Position Designate Mode in response to this command. This command affects only the HA/Dec Axes with the exceptions detailed in Table 3-1. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command. The antenna is driven to the command angles provided in response to this command.

Command: ""PD <sp> <hap> , <decp> [,[<time>] [,[<cw>] [,[<havel>] [,<decvel>]]]] <cr>"

Where:	hap	=	The commanded hour angle position in degrees (0.0 to 359.9999).
	decp	=	The commanded declination position in degrees (-95.000 to 95.000)
	cw	=	The cable wrap desired. 'C' = clockwise, 'W' = counterclockwise, 'S' = shortest path. (Since this system is limited motion in the hour angle axes, only 'S' should be used. If omitted, then shortest path is used.)
	havel	=	The desired hour angle velocity. This velocity will be used for feedforward and to extrapolate position commands. The range is ± 20.000 deg/s.
	decvel	=	The desired declination 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 , , 1.767 , 0.001 <cr>"

3.1.1 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. 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 ACU 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 ACU. 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.

3.2 STOP MODE (DISABLE)

The ACU will change the operational state to Stop Mode in response to this command. This command affects all axes. The drives are disabled and the brakes, if any, are set. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command.

Command: "STOP <cr>"

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

3.3 PRESET POSITION MODE

The ACU will change the operational state to the Preset Position Mode in response to this command. This command affects only the HA/Dec Axes. The Dome and Windscreen Axes are placed in Slave Mode. The Focus Axis is unaffected, except as detailed in Table 3-1.

If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command. The antenna is driven to the commanded preset angles in response to this command.

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

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

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

3.3.1 Preset Position Load/Recall

The station computer can load (when in control of the ACU and when the ACU is in control of the antenna) or recall (anytime) the preset HA/DEC Positions.

Load
Command: "SAT <sp> <N> ,[<hap>] ,[<decp>] ,[<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 ACU so this can be a number from 1 to 40.
	hap	=	The hour angle preset position in degrees (0.0 to 359.999).
	decp	=	The declination preset position in degrees (-95.000 to 95.000).
	polp	=	Use 0.0.
	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	=	Use 1.

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

Response to recall command: "<hap > , <decp > , <polp> , <config> , <"> <name> <"> ,S<cr> <lf>"

Example Response to recall command: "314.789 , 77.487 , 0.000 , 1, <"> PRESET 7 <"> , S <cr> <lf>"

3.4 STAR TRACK MODE

The ACU will change the operational state to the Star Track Mode in response to this command. This command affects only the HA/Dec Axes. The Dome and Windscreen Axes are placed in Slave Mode. The Focus Axis is unaffected, except as detailed in Table 3-1. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command.

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

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

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

3.4.1 Star Track Parameter Load/Recall

The station computer is allowed to load (when the station computer in control of the ACU and when the ACU 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	=	Use '1'.
	name	=	Alphanumeric name assigned to the star. This can be 1 to 20 characters.
	cw	=	Use 'S'.

Example Recall Response : "167.3899 , 27.4567 , B , 1950.0 , 1 , S , <"> CYGNUS A <"> <cr> <lf>"

3.5 STOW MODE

The ACU 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 ACU, the ACU will reject this command. If this ACU is not in control of the antenna, the ACU will reject this command. The Stow command places the HA/Dec and Dome Axes in Stow Mode and the Windscreen Axis in Stop Mode. The Focus Axis is unaffected, except as detailed in Table 3-1.

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>"

3.5.1 Stow Positions Load/Recall

The station computer can load (when in control of the ACU and when the ACU is in control of the antenna) or recall (anytime) the two preset Stow Positions.

Load
Command "SWP <sp> <N> , <hap> , <decp> [, [domep>],], <"> <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 ACU responds by transmitting both Stow Positions.

hap = The hour angle stow position in degrees (0.0 to 359.999)

decp = The declination stow position in degrees (-95.000 to 95.000)

domep = The dome stow position in degrees (0.0 to 359.999)

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

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

Response to recall: "<azp> , <elp> , <domep> , <"> <name> <"> <cr> <lf>"

Response to recall with no arguments:

"<az1p> , <el1p> , <dome1p> , <"> <name> <"> <cr> <lf>"
"<az2p> , <el2p> , <dome2p> , <"> <name> <"> <cr> <lf>"

Example Response to recall:

"333.333 , 11.777 , 222.222, <"> PRIMARY STOW POS <"> <cr> <lf>"

3.6 MAINTENANCE MODE

The ACU will change the operational state to the Maintenance mode in response to this command. This mode affects the HA/Dec and Focus Axes. The Dome and Windscreen Axes are unaffected except as noted in Table 3-1. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command. The ACU diagnostic tests can only be performed when the ACU 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 the antenna. Maintenance Mode may be exited if the PMU is not in control, by issuing a mode change. Modes for the other axes do not exit maintenance mode.

Command: "MAINT <cr>"

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

3.7 MANUAL POSITION MODE

The ACU will change the operational state to the Manual Position Mode in response to this command. This mode affects the HA/Dec Axes. All other axes are unaffected, except as noted in Table 3-1. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject this 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>"

3.8 MANUAL RATE MODE

The ACU will change the operational state to the Manual Rate Mode in response to this command. This mode affects the HA/Dec and Focus Axes. All other axes are unaffected, except as noted in Table 3-1. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU 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 Fundamental Mode change. Modes for the other axis do not exit manual rate mode.

Command: "MANRATE <cr>"

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

4.0 FOCUS MODE COMMANDS

4.1 FOCUS POSITION DESIGNATE MODE

The ACU will change the Focus operational state to the Position Designate Mode in response to this command. This command affects only the Focus Axis. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command. The Focus Axis is driven to the command angles in response to this command.

Command: "POLD <sp> <focus> [,[<time>] [, <focusvel>]] <cr>"

Where:	focus	=	The commanded focus position in millimeters. The range for this argument is dependent on the range and offset values of the Focus encoder. As an example, if the Encoder Range parameter is set to be 60 mm and the Encoder Offset is set a -30 mm, then the focus encoder will display from +30 mm to -30 mm. This will also be the range for this argument.
	focusvel	=	The desired focus velocity. This velocity will be used for feedforward and to extrapolate position commands. The range is ± 20.000 mm/s.
	time	=	The UTC Time at which the position commanded 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> 0.018, 0.001, 77000.10 <cr>"

4.2 FOCUS STOP MODE (DISABLE)

The ACU will change the Focus operational state to the Stop Mode in response to this command. This command affects only the Focus Axis. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command.

Command: "PSTOP <cr>"

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

5.0 DOME MODE COMMANDS

5.1 DOME POSITION DESIGNATE MODE

The ACU will change the Dome operational state to the Position Designate Mode in response to command. This command affects only the Dome Axis. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command. The Dome Axis is driven to the command angles in response to this command.

Command: "D1D <sp> <domep> [,[<cw>][,[<time>] [, <domevel>]]] <cr>"

Where:	domep	=	The commanded dome position in degrees (0.000 to 359.999).
	cw	=	Use 'S'.
	domevel	=	The desired dome velocity. This velocity will be used for feedfoward 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: "D1D <sp> 20.234 , S , 0.012 , 77000.10 <cr>"

5.2 DOME STOP MODE (DISABLE)

The ACU will change the Dome operational state to the Stop Mode in response to this command. This command affects only the Dome Axis. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command.

Command: "D1STOP <cr>"

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

5.3 DOME SLAVE MODE (DISABLE)

The ACU will change the Dome operational state to the Slave Mode in response to this command. This command affects only the Dome Axis. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command.

Command: "D1SLAVE <cr>"

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

6.0 WINDSCREEN MODE COMMANDS

6.1 WINDSCREEN POSITION DESIGNATE MODE

Command: "D2D <sp> <wscrp> [,[<cw>][,[<time>] [, <wscrvel>]]] <cr>"

Where:	wscrp	=	The commanded windscreen position in degrees (-5.000 to 95.000).
	cw	=	Use 'S'.
	domevel	=	The desired windscreen 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: "D2D <sp> 20.234 , S , 0.012 , 77000.10 <cr>"

6.2 WINDSCREEN STOP MODE (DISABLE)

The ACU will change the Windscreen operational state to the Stop Mode in response to this command. This command affects only the Windscreen Axis. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command.

Command: "D2STOP <cr>"

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

6.3 WINDSCREEN SLAVE MODE (DISABLE)

The ACU will change the Windscreen operational state to the Slave Mode in response to this command. This command affects only the Windscreen Axis. If the station computer is not in control of the ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command.

Command: "D2SLAVE <cr>"

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

7.0 DOME SHUTTER CONTROL COMMANDS

7.1 DOME SHUTTER OPEN REQUEST

The ACU will open the dome shutter in response to this request. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command.

Command: "DSO <cr>"

7.2 DOME SHUTTER CLOSE REQUEST

The ACU will close the dome shutter in response to this request. If the station computer is not in control of ACU, the ACU will reject this command. If the ACU is not in control of the antenna, the ACU will reject the command.

Command: "DSC <cr>"

8.0 PARAMETER COMMANDS

8.1 MANUAL OFFSET LOAD/RECALL

Manual offsets are used to move the antenna manually from the station computer console or the ACU console. Manual offsets are inhibited during Stow, Maintenance, and Manual Rate Modes. Hour angle and declination manual offsets are automatically cleared upon any fundamental mode change. The manual offset load is also inhibited if the fundamental submode is transition.

The station computer can load (when in control of the ACU and when the ACU is in control of the antenna) or recall (anytime) the manual offsets used to manually move the antenna from the operation 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 job offset command is an incremental offset; the previous offset is supplemented by the new offset.

Load
Command: "OFFSET <sp> [<haoff>] [, <decoff>] <cr>"
"JOG <sp> [<hainc>] [, <decinc>] <cr>"

Recall
Command: "OFFSET? <cr>"

Where:	haoff	=	The hour angle manual offset value in degrees (-20.000 to 20.000).
	decoff	=	The declination manual offset value in degrees (-20.000 to 20.000).

hainc	=	The amount to add to the current hour angle manual offset value in degrees (-20.000 to 20.000).
decinc	=	The amount to add to the current declination manual offset value in degrees (-20.000 to 20.000).
NOTE	=	The total offset may not exceed the range of the argument. For example, if the HA offset is -1 and an HA 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 command: "<ack> <cr> <lf>"

Response to recall command: "<haoff> , <decoff> , 0.000 <cr> <lf>"

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

8.2 RATE OFFSET LOAD/RECALL

Rate offsets are used to move the antenna manually from the station computer console or the ACU console. Rate offsets are inhibited during Stow, Maintenance, and Manual Rate Modes. Hour angle and declination rate offsets are automatically cleared upon any fundamental mode change. The rate offset load is also inhibited if the fundamental submode is transition.

The station computer can load (when in control of the ACU and when the ACU is in control of the antenna) or recall (anytime) the rate offsets used to manually move the antenna from the operator console or from the station computer. If the rate offsets are changed, the antenna will move in response by the amount of that change. The rate offset command is an absolute offset; the previous offset is replaced by the new offset. The rate jog offset command is an incremental offset; the previous offset is supplemented by the new offset.

Load
Command: "ROFFS <sp> [haoff>] [, <decoff>] <cr>"
"RJOG <sp> [<hainc>] [, <decinc>] <cr>"

Recall
Command: "ROFFS? <cr>"

Where:	haoff	=	The hour angle rate offset value in arcseconds per hour (-3600.0 to 3600.0).
	decoff	=	The declination manual offset value in arcseconds per hour (-3600.0 to 3600.0).
	hainc	=	The amount to add to the current hour angle manual offset value in arcseconds per hour (-3600.0 to 3600.0).

	decinc	=	The amount to add to the current declination manual offset value in arcseconds per hour (-3600.0 to 3600.0).
	NOTE	=	The total offset may not exceed the range of the argument. For example, if the HA offset is -1 and an azimuth increment of -3600 was commanded, this would be rejected, because (-1 + -3600) exceeds the limit of -3600. A new fundamental mode clears the rate offsets.

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

Response to recall command: "<haoff> , <decoff> <cr> <lf>"

Example Response to recall: "-4.1 , 11.3 <cr> <lf>"

8.2.1 Rate Offset Monitor

Rate offsets are used by the ACU to generate equivalent manual position and velocity commands. These generated values can be monitored via the use of the Rate Offset Monitor Command. (The values reported are the same as those displayed in the Command/Offsets Monitor Screen, which can be viewed at the ACU front panel.)

Command: "RMON <cr>"

Response: "<haoff> , <decoff> , <havel> , <decvel> <cr> <lf>"

Where:	haoff	=	The hour angle manual position command offset value due to rate offsets in degrees.
	decoff	=	The declination manual position command offset value due to rate offsets in degrees.
	havel	=	The hour angle offsets in degrees per second.
	decvel	=	The declination manual velocity command offset value due to rate offsets in degrees per second.

Example Response: "-0.0012 , 1.0075 , -0.000002 , 0.000024 <cr> <lf>"

8.3 SITE PARAMETERS LOAD/RECALL

The site parameters can only be loaded when the ACU is in Stop Mode (all axes). The station computer is allowed to load, (when the station computer is in control of the ACU and when the ACU is in control of the antenna), and recall (always) the site altitude, latitude and longitude values in the ACU.

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 (-90.000 (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 command: "<lat> , <lon> , <alt> , <"> <name> <"> <cr> <lf>"

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

8.4 HORIZON LINE LOAD/RECALL

The station computer is allowed to load, (when the station computer is in control of the ACU and when the ACU is in control of the antenna), and recall (always) the horizon line value in the ACU.

Load
Command: "HRZ <sp> <hrzline> <cr>"

Recall
Command: "HRZ? <cr>"

Where:	hrzline	=	The local elevation position at which the horizon is defined in degrees (-20.0 to 20.0).

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

Response to recall command: "<hrzline> <cr> <lf>"

Example Response to recall: "-1.510 <cr> <lf>"

8.5 ANTENNA MISMATCH DISTANCE LOAD/RECALL

The station computer is allowed to load, (when the station computer is in control of the ACU and when the ACU is in control of the antenna), and recall (always) the antenna mismatch distance value in the ACU. (This parameter determines how much angular difference there can be between the antenna and the dome/windscreen before the ANTENNA/DOME MISMATCH message is displayed.)

Load
Command: "MSM <sp> <dist> <cr>"

Recall
Command: "MSM? <cr>"

Where: dist = The antenna mismatch distance in degrees (0.00 to 90.0).

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

Response to recall command: "<dist > , <cr > , <lf >

Example Response to recall: "2.100 <cr> <lf>"

8.6 BINARY STATUS REQUEST

The ACU 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 8-4 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 ACU responses), each of which requires two (hex) characters to encode. Thus there are 60 total CCU characters (80 for ACU responses).

N = The number of the request. (A 1 indicates a request for fault and status for the ACU queried. A 2 applies for the other ACU. Either ACU 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>).

8.7 STATUS REQUEST

The ACU will transmit basic status information to the station computer in response to this request. This status information includes the hour angle position, the declination position, the focus position, the dome position, the windscreen position and the current ACU Modes Strength. Table 8-1 contains a list of possible modes. This command is valid at any time.

Command: "STAT <cr>"

Response: "<hap> , <decp> , <focusp> , <domep> , <windscrp> <mode> <cr> <lf>"

Where:

hap	=	The hour angle position in degrees (0.0 to 359.9999)
decp	=	The declination position in degrees (-5.0000 to 95.0000)
focusp	=	The focus position in millimeters (-40.0000 to 40.0000)
domep	=	The dome position in degrees (-0.0000 to 359.999)
windscrp	=	The windscreen position in degrees (-5.000 to 95.000)
mode	=	The current ACU Operational Mode. This consists of the fundamental mode, the fundamental submode, the focus mode, the focus submode, the dome mode, the dome submode, the windscreen mode and the windscreen submode. Thus the mode format is <fundm> <fundsub> <focusm> <focussub> <domem> <domesub> <windm> <windsub>. Each of the modes is a two digit symbol defined in the table below.

NOTE: The <domesub> and <windsub> field will always be 00.

Example Response:

"299.9999, 73.1234, -23.7777, 141.000, 59.000, 0004510071007000 <cr> <lf>"

Fundamental Mode	Mode Symbol	Focus Mode	Mode Symbol	Dome and Windscreen Mode	Mode Symbol
Stop	00	Stop	50	Stop	70
Preset Pos	02	Pos Desig	51	Pos Desig	71
Man Rate	07	Maint	53	Stow	72
Man Pos	08	Man Rate	54	Slave	73
Maintenance	06			Maint	53
Pos Desig	01				
Stow	09				
Pos Hold	29				
Star Track	12				

Table 8-1, 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 8-2, Fundamental Submode Codes

Focus Submodes	Submode Symbol
Off-Target	00
On-Target	01

Table 8-3, Focus Submode Codes

8.8 STATUS MESSAGE REQUESTS

The ACU will send all the fault or status messages that are displayed at the ACU console (text strings) to the station computer in response to these requests. These commands are valid at any time. Table 8-4 lists the standard fault and status messages. 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.

Commands: "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 ACU queried (bytes 31 through 70).. A 3 is a request of the CCU status (bytes 1 through 30). Status Blocks 2 and 4 exist, but are not applicable for this system. 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)

Text String		Fault/Status
/* Status Byte 1 */		
"HOUR ANGLE DRIVE FAULT	"	F
"HOUR ANGLE CW PRELIMIT	"	F
"WINDSCREEN UP LIMIT	"	S
"RESERVED	"	S
"AXIS DEFFERENCE	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 2 */		
"DECLINATION DRIVE FAULT	"	F
"HOUR ANGLE CCW PRELIMIT	"	F
"WINDSCREEN DN LIMIT	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 3 */		
"FOCUS MOTOR CB OPEN	"	F
"RESERVED	"	S
"SHUTTER OPEN LIMIT	"	S
"HOUR ANGLE BRAKE FAULT	"	F
"WARNING HORN ACTIVE	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 4 */		
"ACU EMERGENCY STOP	"	F
"RESERVED	"	S
"SHUTTER CLOSED LIMIT	"	S
"DECLINATION BRAKE FAULT	"	F
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String		Fault/Status
/* Status Byte 5 */		
"PSU INTERLOCK	"	F
"DECLINATION UP PRELIMIT	"	F
"HA MOTOR OVERTEMP	"	F
"FOCUS HUB FAULT	"	F
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 6 */		
"TELESCOPE GENERAL INTLK	"	F
"DECLINATION DOWN PRELIMIT	"	F
"DEC MOTOR OVERTEMP	"	F
"PMU IN CONTROL	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 7 */		
"FOCUS + LIMIT	"	F
"RESERVED	"	S
"PDU CB/CONTACTOR OPEN	"	F
"MRU IN CONTROL	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 8 */		
"FOCUS - LIMIT	"	F
"RESERVED	"	S
"MOISTURE ALARM	"	F
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String	Fault/Status
/* Status Byte 9 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 10 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 11 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 12 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S

Text String	Fault/Status
/* Status Byte 13 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 14 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 15 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 16 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S

Text String		Fault/Status
/* Status Byte 17 */		
"CCU-ACU #1 LINK DOWN	"	F
"RESERVED	"	S
"ACU IN CONTROL	"	S
"RESERVED	"	S
"CCU DATABASE EMPTY	"	F
"RESERVED	"	S
"CCU SIMULATION ACTIVE	"	S
"RESERVED	"	S
/* Status Byte 18 */		
"RESERVED	"	S
"HA DISABLED	"	S
"RESERVED	"	S
"DEC DISABLED	"	S
"RESERVED	"	S
"FOCUS DISABLED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 19 */		
"WINDSCREEN ENCODER FAULT	"	F
"HA OSCILLATION	"	F
"DEC OSCILLATION	"	F
"FOCUS OSCILLATION	"	F
"HA ENCODER FAULT	"	F
"DEC ENCODER FAULT	"	F
"FOCUS ENCODER FAULT	"	F
"DOME ENCODER FAULT	"	F
/* Status Byte 20 */		
"HA TACH / ENCODER ERROR	"	F
"DEC TACH / ENCODER ERROR	"	F
"FOCUS TACH / ENCODER ERROR	"	F
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String	Fault/Status
/* Status Byte 21 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 22 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 23 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 24 */	
"ACU RELINQUISHING CONTROL	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S

Text String		Fault/Status
/* Status Byte 25 */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 26 */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 27 */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 28 : Interlock Board 'B' side status */		
"RESERVED	"	S
"PMU AVAILABLE	"	S
"MRU AVAILABLE	"	S
"HORN AVAILABLE	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String		Fault/Status
/* Status Byte 29 : DC Board 'B' side status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 30 : DC Board 'B' side status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* This ACU's Status */		
[ACU status indications originating in ACU Software]		
/* Status Byte 31 : Software Travel Limits */		
"COMMAND > REGION HA+	"	F
"COMMAND > REGION HA-	"	F
"COMMAND > REGION DEC+	"	F
"COMMAND > REGION DEC-	"	F
"HA+ SOFTWARE LIMIT	"	F
"HA- SOFTWARE LIMIT	"	F
"DEC+ SOFTWARE LIMIT	"	F
"DEC- SOFTWARE LIMIT	"	F
/* Status Byte 32 : Software Box Limits */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String		Fault/Status
/* Status Byte 33 : Dome Software Limits */		
"RESERVED	"	S
"RESERVED	"	S
"COMMAND > REGION WINDSCR+	"	F
"COMMAND > REGION WINDSCR-	"	F
"RESERVED	"	S
"RESERVED	"	S
"WINDSCR+ SOFTWARE LIMIT	"	F
"WINDSCR- SOFTWARE LIMIT	"	F
/* Status Byte 34 : Misc. Limit Status */		
"RESERVED	"	S
"RESERVED	"	S
"CMND > REGION FOCUS+	"	F
"CMND > REGION FOCUS-	"	F
"FOCUS+ SOFTWARE LIMIT	"	F
"FOCUS- SOFTWARE LIMIT	"	F
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 35 : Sun outage */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"HONKING HORN	"	S
"RESERVED	"	S
/* Status Byte 36 : Simulation and diagnostics */		
"SIMULATION ON - ACU	"	F
"SIMULATION ON - CCU	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String		Fault/Status
/* Status Byte 37 : Simulation and diagnostics */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"POSITION LOOP TEST ON	"	F
"RESERVED	"	S
"RESERVED	"	S
"CORRECTS OFF NEAR ZENITH	"	S
"RESERVED	"	S
/* Status Byte 38 : Comm link status */		
"RESERVED	"	S
"ACU-CCU LINK DOWN	"	F
"ACU-CMPTR LINK DOWN	"	S
"LOADING CCU DATABASE	"	S
"ACU-CCU LINK RESET	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 39 : Comm link and control status */		
"COMP IN CONTROL - ACU	"	S
"NORMAL CONTROL - ACU	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 40 : Comm link and control status */		
"COMPUTER REQUEST	"	S
"CONTROL CHANGE ALLOWED	"	S
"TAKE CCU CONTROL	"	S
"RELINQUISH CCU CONTROL	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String		Fault/Status
/* Status Byte 41 : Intelsat operation status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 42 : Norad operation status */		
"OBJECT BELOW EL TRAVEL	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"STAR BELOW EL TRAVEL	"	S
"TARGET BELOW HORIZON	"	S
/* Status Byte 43 : Memory Track operation status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 44 : Miscellaneous tracking status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String		Fault/Status
/* Status Byte 45 : Miscellaneous tracking status */		
"RESERVED	"	S
"RESERVED	"	S
"RUN TIME OPERATION	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 46 : ACU data checks */		
"RESERVED	"	S
"RESERVED	"	S
"LOAD SITE LOCATION	"	F
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 47 : Low-level faults */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"ACU SOFTWARE ERROR	"	F
"EXECUTE STOP MODE	"	F
"RESERVED	"	S
"DUAL CLI TASK ERROR	"	F
/* Status Byte 48 : Software task operation */		
"CONSOLE TASK ERROR	"	F
"CLI TASK ERROR	"	F
"MODE TASK ERROR	"	F
"DATABASE TASK ERROR	"	F
"RESERVED	"	S
"CP TASK ERROR	"	F
"RESERVED	"	S
"KEYPAD TASK ERROR	"	F

Text String		Fault/Status
/* Status Byte 49 : Software task operation */		
"STATUS TASK ERROR	"	F
"OPTRACK TASK ERROR	"	F
"MEMORY TRACK TASK ERROR	"	F
"SIGNAL PROCESS TASK ERROR	"	F
"TRACKING SUPPORT TSK ERROR	"	F
"CONSOLE CLI COMM ERROR	"	F
"SIMULATION TASK ERROR	"	F
"MACRO CLI COMM ERROR	"	F
/* Status Byte 50 : Cable wrap operation */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 51 : axis disable status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"DISABLE HA KEY DEPRESSED	"	F
"DISABLE DEC KEY DEPRESSED	"	F
"DISABLE FOCUS KEY DEPRESSED	"	F
/* Status Byte 52 */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"DISABLE DOME KEY DEPRESS	"	F
"DISABLE WINDSCR KEY PRESS	"	F
"RESERVED	"	S

Text String		Fault/Status
/* Status Byte 53 : Optrack operation status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 54 : Optrack operation status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 55 : Optrack 1 operation status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 56 : Optrack 2 operation status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String		Fault/Status
/* Status Byte 57 : Optrack 3 operation status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 58 : 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 59 : Selftest status */		
"REAL TIME CLOCK ERROR	"	F
"RESERVED	"	S
"REAL TIME CLOCK STUCK	"	F
"IRIG SIGNAL LOSS	"	F
"IRIG BOARD ERROR	"	F
"XCO TIMER ERROR	"	F
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 60 */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String		Fault/Status
/* Status Byte 61 */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 62 */		
"DATABASE BACKUPS OFF	"	S
"MACRO ERROR	"	F
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 63 : Tracking Receiver status */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
/* Status Byte 64 : Obstruction Avoidance */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

Text String	Fault/Status
/* Status Byte 65 Obstruction Avoidance */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 66 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 67 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
/* Status Byte 68 */	
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S
"RESERVED	" S

Text String		Fault/Status
/* Status Byte 69 */		
"SHUTTER CMND FOR 60 SECS	"	S
"SHUTTER POSITION UKNOWN	"	F
"TELESCOPE BELOW HORIZON	"	F
"TELESCOPE/DOME MISMATCH	"	F
"HIGH WINDS	"	F
"DOME SHUTTER OVERRIDE	"	F
"TEMPERATURE NEAR DEWPOINT	"	F
"RESERVED	"	S
/* Status Byte 70 */		
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S
"RESERVED	"	S

/* The other ACU's Status */
/* Bytes 71-110 */
/* These Bytes are copies of Bytes 31-70 */
/* That is Byte 71 is the same mapping as Byte 31 */

Table 8-4, Model 133 Status and Fault Messages

8.9 FAULT ACKNOWLEDGE

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

Command: "ACKF <cr>"

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

8.10 ECHO COMMAND

This command will toggle echo/noecho state. Echo means that the ACU 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 ACU mode upon power up. A "<cr>" is converted to "<cr> <lf>" in the echo response.

Command: "ECHO <cr>"

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

8.11 TIME LOAD/RECALL

The station computer can load (when in control of the ACU and when the ACU is in control of the antenna) or recall (anytime) the ACU Time.. Time loading is allowed only when. all axes are in Stop Mode. The entered time must be UTC time.

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 command: "<ack> <cr> <lf>"

Response to recall command: "<hh:mm:ss:ddd:yyyy> , <UTC_offset> <cr> <lf>"

Example Response to recall: "23:50:45:222:1991 , 1.5 <cr> <lf>"

8.12 ENCODER DATA LOAD/RECALL

This command contains encoder data parameters. This command is only accepted when all axes are in Stop Mode and is allowed whenever the station computer is in control of the ACU and ACU is in control of the antenna. Recall is allowed at any time.

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

Recall
Command: "ENCD? <sp> <axis> <cr>"

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

Recall
Response: "<rotation> , <scale> , <offset> , <cr> <lf>"

Where:	axis	=	a "1" for Hour Angle, a "2" for Declination, a "3" for Focus, a "4" for Dome and a "5" for Windscreen.
	rotation	=	A "1" for CW rotation and a "2" for CCW rotation.
	scale	=	The scale factor correction between the axis and the encoder (0.5 to 2.00000000).
	offset	=	The offset for given axis (-180.0 to 180.0 degrees). The offset range for the Focus Axis is -50 to 50 mm.

Example
Response: "2 , 1.00111000, 5.100 <cr> <lf>"

8.13 SOFTWARE TRAVEL LIMITS

The station computer is allowed to load, (when in control of the ACU and when the ACU is in control of the antenna), and recall (always) the software travel limit values in the ACU. The load commands are only accepted while all axes are in the Stop Mode.

Load
Command: "TD <sp> <zero> , <ha+> , <ha-> , <dec+> , <dec-> [, <focus +> , <focus-> [, <dome+> , <dome-> [, <wind+> , <wind->]]] <cr>"

Recall
Command: "TD? <cr>"

Where:	ha+	=	The CW Travel Limit Angle in hour angle in degrees (0.0 to 359.999).

ha-	=	The CCW Travel Limit Angle in hour angle in degrees (0.0 to 359.999).
dec+	=	The UP Travel Limit Angle in declination in degrees (-95.000 to +95.000).
dec-	=	The Down Travel Limit Angle in declination in degrees (-95.000 to +95.000).
focus+	=	The POS Travel Limit Angle in the focus axis in millimeters. The range for this argument is dependent on the range and offset values of the Focus encoder. As an example, if the Encoder Range Parameter is set to be 60 mm and the Encoder Offset is set at -20 mm, then the focus encoder will display from +40 mm to -20 mm. This will also be the range for this argument.
focus-	=	The NEG Travel Limit Angle in the focus axis in millimeters. The range for this argument is dependent on the range and offset values of the Focus encoder. As an example, if the Encoder Range parameter is set to be 80 mm and the Encoder Offset is set at -40 mm, then the focus encoder will display from +40 mm to -40 mm, then the focus encoder will display from +40 mm to -40 mm. This will aslo be the range for this argument.
dome+	=	The CW Travel Limit Angle in the dome axis in degrees (0.000 to +359.999). Note that the dome axis for this system allows for continuous rotational travel and thus even though the dome limit values can be set and recalled, they have no effect on system operation.
dome-	=	The CCW Travel Limit Angle in the dome axis in degrees (0.000 to +359.999). Note that the dome axis for this system allows for continuous rotational travel and thus even though the dome limit values can be set and recalled, they have no effect on system operation.
wind+	=	The UP Travel Limit Angle in the windscreen axis in degrees (-5.000 to +95.000).
wind-	=	The Down Travel Limit Angle in Elevation in degrees (-5.000 to +95.000).
zero	=	The location of the cable wrap sector switch in degrees (0.0 to 359.999). (For limited-motion systems like this system, this should be set equal to the CCW Travel Limit, since there is no cable wrap switch.)

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

Recall Response: "<zero> , <ha+> , <ha-> , <dec+> , <dec-> , <focus+>, <focus-> , <dome+> , <dome-> , <wind+> , <wind-> <cr> <lf>"

Example Recall Response: ""210.000 , 150.000 , 210.000 , 85.700 , 1.300 , 40.000 , -40.000 , 345.000 , 15.000 , 89.000 , -5.000 <cr> <lf>"

8.14 DEADBAND PARAMETERS LOAD/RECALL

The station computer is allowed to load (when in control of the ACU and when the ACU is in control of the antenna and when the ACU is in Stop Mode. 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 Drives. The Hysteresis feature may be defeated by setting the parameter to 1.0.

Load
Command: "DBA <sp> <ha_deadband> <cr>"
"HYA <sp> <ha_hysteresis> <cr>"
"DBE <sp> <dec_deadband> <cr>"
"HYE <sp> <dec_hysteresis> <cr>"
"DBP <sp> <focus_deadband> <cr>"
"HYP <sp> <focus_hysteresis> <cr>"
"DBHY <sp> <axis> , <deadband> , <hysteresis> <cr>"

Recall
Command: "DBA? <cr>"
"HYA? <cr>"
"DBE? <cr>"
"HYE? <cr>"
"DBP? <cr>"
"HYP? <cr>"
"DBHY? <axis>"

Where:	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.
	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.
	axis	=	Which axis the command applies 1, 2, 3, 4, and 5 correspond to HA, DEC, FOCUS, DOME, and WINDSCREEN.

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

Response to recall command: "<deadband> <cr> <lf>"
"<hysteresis> <cr> <lf>"
"<deadband> , <hysteresis> <cr> <lf>"

Example Response to recall: "0.100 <cr> <lf>"
"0.100 , 1.500 <cr> <lf>"

8.15 MAXIMUM/TRACKING VELOCITY LOAD/RECALL

The station computer is allowed to load (when the station computer in control of the ACU and when the ACU is in control of the antenna) and recall (always) the tracking velocity parameter value for each axis. The load commands are only accepted while all axes are in Stop Mode. When using the VELS command on an axis with DC Motor Drives, the max_vel field is used to determine the maximum velocity and the track_vel field is ignored.

Load
Command: "VELS <sp> <axis> , <max_vel> , <track_vel> <cr>"

Recall
Command: "VELS? <sp> <axis> <cr>"

Where:	track_vel	=	The velocity of the axis in degrees per second (0.001 to 0.500) when the ACU is performing active runtime steptracking. (For axes with AC motor drives, this is the speed of the azimuth tracking motor.)
	max_vel	=	The maximum velocity in degrees per second (0.001 to 20.000) (slew motor in an AC system).
	Axis	=	Which axis the command applies to. 1, 2, 3, 4, and 5 correspond to HA, DEC, FOCUS, DOME and WINDSCREEN. For the FOCUS Axis, the velocity values are in different units (mm per second).

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

Response to recall command: "<max_vel>, <track_vel> <cr> <lf>"

Example Response to recall: "5.011, 0.025 <cr> <lf>"

8.16 DATA BACKUP

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

Command: "FBU <cr>"

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

8.17 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>"

8.18 TIME TAGGED STATUS REQUEST

The ACU will transmit basic status information to the station computer in response to this request. Table 8-1 contains a list of possible modes. This command is valid at any time.

Command: "SS <cr>"

Response: "<time> , <hap> , <decp> , <focusp> , <domep> , <windp> , <mode> , <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.
	hap	=	The hour angle position in degrees (0.0 to 359.9999).
	decp	=	The declination position in degrees (-95.0000 to 95.0000).
	focusp	=	The focus position in millimeters (-40.0000 to 40.000).
	domep	=	The dome position in degrees (-0.0000 to 359.999)

windscrp	=	The windscreen position in degrees (-5.000 to 95.000)
mode	=	The current ACU operational mode. This consists of the fundamental mode, the fundamental submode, the focus mode, the focus submode, the dome mode, the dome submode, the windscreen mode and the windscreen submode. Thus the mode format is <fundm> <fundsub> <fundno> <focusm> <focussub> <domem> <domesub> <windm> <windsub>. Each of the modes is a two digit symbol defined in the table below.
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). This applies only to the HA/DEC Axes.

Example Response:

12:05:20:96 , 340.0000 , 17.0000 , -31.9810 , 0202003500073007300 , 1 , 0 , 1 <cr> <lf>"

8.19 MISCELLANEOUS FEATURE LOAD/RECALL

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

IMPORANT NOTE: **The current ACU software has the command as documented here. However, this command is expected to change since these pointing error corrections controlled by this command are not applicable for this system. This system has its own unique correction algorithms, (e.g. Flexure-correction), that will need to be turned ON or OFF using this command.**

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>"

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 be "0" in Model 100 Systems.

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

8.20 POWER SUPPLIES MONITOR REQUEST

The ACU 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 ACU front panel screen. This command is valid at any time.

Command: "PWM <cr>"

Response: "<o5vp> , <o5vn> , <o12vp> , <o12np> , <obatt> , ,<cf5vp> , <cf5vn> , <cf12vp> , <cf12vn> , <cftemp> , <cl15vp> , <cl15vn> , <cl5vp> , <cl24vp> , <cr>"

Where:	o5vp	=	The voltage of the ACU's +5V power supply.
	o5vn	=	The voltage of the ACU's -5V power supply.
	o12vp	=	The voltage of the ACU's +12V power supply.
	o12vn	=	The voltage of the ACU's -12V power supply
	obatt	=	The voltage of the ACU'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.
	cf12vp	=	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 +15V power supply.
	cl24vp	=	The voltage of the CCU Interlock Board's +24V power supply.

Example Response: "5.0 , 12.0 , -11.9 , 3.0 , 5.0 , -5.0 , 12.0 , -12.0 , 10 , 0 , 15.0 , -15.0 , 15.1 , 23.9 <cr> <lf>"

8.21 DATA LOGGER LOAD/RECALL

The station computer can load, (when in control of the ACU), 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 command: " "<ack> <cr> <lf>"

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

8.22 SLEW DECISION POINT LOAD/RECALL

The station computer can load (when in control of the ACU) or recall (anytime) the parameter used to control when a given axis (which uses two-speed AC motor drives) switches between high-speed and low speed operation. The Load commands are allowed only when the HA/Dec Axes are in Stop Mode. The Recall Commands are allowed at any time.

Load
Command: "SDA <sp> <sdp_ha> <cr>"
"SDE <sp> <sdp_dec> <cr>"
"SDP <sp> <sdp_focus> <cr>"
"SHA <sp> <hyst_ha> <cr>"
"SHE <sp> <hyst_dec> <cr>"
[An SHP command is planned but not implemented yet.]

Recall
Command: "SDA? <cr>"
"SDE <cr>"
"SDP? <cr>"
"SHA? <cr>"
"SHE? <cr>"
[An SHP command is planned but not implemented yet.]

Where:	sdp_ha	=	The slew decision point for the Hour Angle Axis in degrees (0.000 to 359.999).
	sdp_dec	=	The slew decision point for the Declination Axis in degrees (-95.0 to 95.0).
	sdp_focus	=	The slew decision point for the Focus Axis in millimeters (-40.0 to 40.0).
	hyst_ha	=	The hysteresis applied to the slew decision point for the Hour Axis (1.0 to 10.0).

	hyst_dec	=	The hysteresis applied to the slew decision point for the Declination Axis (1.0 to 10.0).

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

Response to recall command: "<sdp_axis> <cr> , <lf>"

8.23 POSITION LOOP PARAMETER LOAD/RECALL

The station computer can load (when in control of the ACU) or recall (anytime) the position loop parameters. These commands should be used only for the Axes, which use DC motor drives. The Load Command is allowed only when all axes are in Stop Mode. The Recall command is valid at any time.

Load Command: "POSLF <sp> <axis> , <filter_type> , <xover> , <lead> , <lag1> , <lag2> , <linear> , <hyst> , <max_accel> , <scan_accel> [, <dampening>] <cr>"

Recall Command: "POSLF? <sp> <axis> , <filter_type> <cr>"

Where:	axis	=	Which axis the command applies to 1, 2, 3, 4, and 5 correspond to HA, DEC, FOCUS, DOME and WINDSCREEN. For the FOCUS Axis, the parameter values are in different units (mm instead of degs).
	filter_type		Which position loop filter type the parameters apply to. 0 is a Type 1 filter used primarily for driving a single DC Motor. 1 is a Type 2 filter used primarily for driving a dual set of DC Motors. 2 is a Type 2+ filter used for special dual DC Motor situations.
	xover	=	The crossover frequency in hertz (0.01 t o1.0).
	lead	=	The lead break point in hertz (0.001 to 0.3).
	lag1	=	The first lag break point in hertz (0.0 to 0.3).
	lag2	=	The second lag break point in hertz (0.2 to 0.10).
	linear	=	The square-root to linear transition point in degrees (0.01 to 0.5).
	hyst	=	The hysteresis of square-root to linear transition point (1.0 to 5.0).
	max_accel	=	The maximum acceleration capability of the system in degrees per second squared (0.001 to 10.00).
	scan_accel	=	The typical maximum acceleration (as a system's operational targets (0.01 to 1.0 with 1.0 being 100 percent).

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

Response to recall command: "<xover> , <lead> , <lag1> , <lag2> , <linear> , <hyst> , <max_accel> , <scan_accel> <cr> <lf>"

Example Response to Recall:

"0.25000,0.05000,0.00100,0.90000,0.04400,1.50000,0.5000,1.00000<cr> <lf>"

8.24 WEATHER RELATED PARAMETERS LOAD/RECALL

The station computer can load (when in control of the ACU) or recall (anytime) the weather related parameters.

Load Command: "MWS <sp> <max_wind> <cr>"
"THT <sp> <dewpt_tol> <cr>"

Recall Command: "MSW? <cr>"
"THT? <cr>"

Where:

max-wind	=	The maximum wind speed, in miles per hour, at which the dome shutter can remain open (0.0 to 250.0).
dewpt_tol	=	The difference in degrees Fahrenheit between the current dew point and the current temperature that triggers the TEMPERATURE NEAR DEWPOINT fault message and associated dome shutter closure. (0.1 to 9.9).

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

Responses to recalls: "<max_wind> <cr> <lf>"
"<dewpt_tol> <cr> <lf>"

Example Response to Recall: "50.0 <cr> <lf>"

8.25 WEATHER CONDITIONS MONITOR

The station computer can recall (anytime) the current weather conditions.

Command: "WEA? <cr>"

Response: "<temp> , <humidity> , <wind_speed> , <wind_dir> <dew_point> <cr> <lf>"

Where:			
	temp	=	The current temperature, in degrees Fahrenheit.
	humidity	=	The current relative humidity.
	wind_speed	=	The current wind speed in miles per hour.
	wind_dir	=	The current wind direction expressed in degrees with 0 being due North and 180 due being South.
	dew_point	=	The dew point in degrees Fahrenheit.

Example Response to Recall: "150.0,100.0,43.7,0.0<cr> <lf>"

8.26 FLEXURE-CORRECTION COEFFICIENT LOAD/RECALL

The station computer can load (when in control of the ACU) or recall (anytime) the flexure-correction coefficients. The Load Command is allowed only when all axes are in Stop Mode. The Recall Command is valid at anytime.

Load
Command: "FLX <sp> <N> <value> <cr>"

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

Where:			
	N	=	There are 16 coefficients that can be loaded or recalled. This number (1 to 16) specifies which one the command applies to.
	value	=	The value of the coefficient (-1000.00000000 to 1000.000000000).

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

Responses to recalls: "<value> <cr> <lf>"

Example Response to Recall: "-0.00023660 <cr> <lf>"

9.0 CONTROL

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

9.1 COMPUTER ACU CONTROL REQUEST

The station computer may request control of the ACU 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 ACU and has not released control. Control of the ACU 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>"

9.2 COMPUTER ACU CONTROL RELEASE

The station computer may release control of the ACU 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>"

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