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OPERATIONS MANUAL
SYSTEM CONTROLLER MODEL SC98V

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This manual should be read in its entirety before connecting and operating any device with the System Controller. After connecting the System Controller to the devices as described in section 1, follow the examples in section 2 to become familiar with controller operation. Appendix A contains special instructions for the tilting antenna tower. Appendix B contains the Programmer's Command Guide. Through this manual the two words **device** and **channel** are used interchangeably.

Front panel controls are logically divided into:

1) immediate access to either channel,
2) access to the selected channel, and
3) numerical inputs, as depicted in Figure 1.

The display gives Channel 1 status on the upper register and Channel 2 status on the lower register.

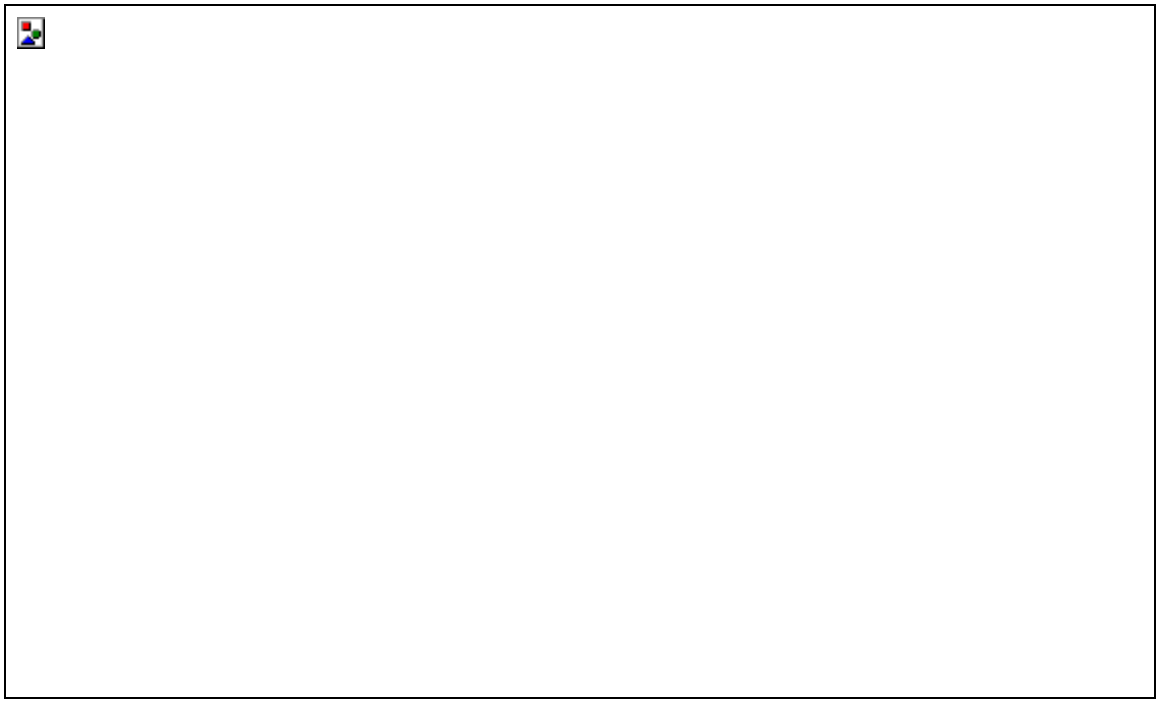

Figure 1- System Controller Front Panel

1.0 INSTALLATION

1.1 Connection To Target Devices

Each of two control channels is connected to an antenna positioning tower or turntable by a duplex (two fibers) optical cable as depicted in Figure 2. The cables connect to the controller rear panel and to similar connectors on the device. One fiber of each cable transmits command signals from the controller to the device. The second fiber transmits position data from the device to the controller. This convention must be assured by matching color marks as depicted.

Connect the System Controller to devices as depicted in Figure 2. Leave controller power off, but supply power to the devices. If an antenna positioning tower is used, be sure that tower hard limits have been set to prevent the trolley from striking either the base or the top, and to prevent damage of the antenna or shield room ceiling material. Use the local control to set antenna height at 100cm. **WARNING, MAKE SURE THERE ARE NO OBSTRUCTIONS TO DEVICE MOVEMENT BY PERSONNEL, EQUIPMENT OR CABLING**. Damage and injury may otherwise occur.

Hard limits of turntables are shipped in the mid position and should not interfere with setup and checkout.

Turn System Controller power on. The controller will first display the firmware version. Record this information for future reference.

The display will then change to display parameters in non-volatile memory. The display will be consistent with the following set up and scan parameters:

Table 1- Factory Set Parameters (SETUP)

PARAMETER	CHANNEL 1 ANTENNA TOWER	CHANNEL 2 TURNTABLE
GPIB Address	20	21
Device Type	0	1(low profile) or 2(flush mount)
Maximum Limit	405	365
Minimum Limit	95	-5
Current Position	100	0
Speed	0	0

Table 2- Factory Set Parameters (SCAN)

PARAMETER	ANTENNA TOWER	TURNTABLE
Minimum Scan Limit	100	0
Maximum Scan Limit	200	360
Number of Repetitions	50	50

Figure 2- Connection to Target Devices

1.2 Display

An example display is depicted in Figure 3 when Channel 1 is connected to a antenna positioning tower, and Channel 2 is connected to a flush-mount (metal) turntable.

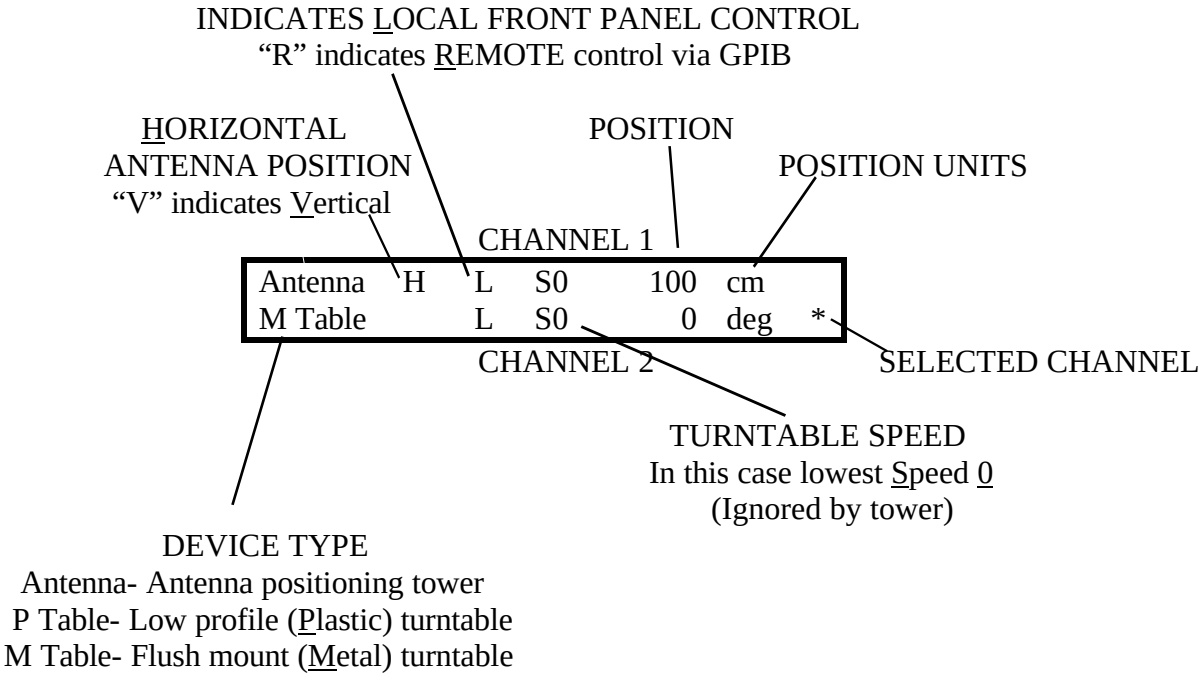

Figure 3- Example of Displayed Information Fields

1.3 Verification

Perform the following tests of installation and operation. In general, STOP must be pressed after a hard limit is reached before subsequent commands will be executed. Also, "CH SEL" means to toggle the CHANNEL SELECT key until the (*) is in the last field of the channel listed.

Table 3- Verification Tests

TEST SEQUENCE					
TEST NO.	CH SEL	KEY IN	KEY IN	EXPECTED OBSERVATION	KEY IN
1	1	UP/CW		1) Displayed position increases 2) Tower moves up or turntable rotates clockwise	STOP
2	2	DN/CCW		1) Displayed position decreases 2) Tower moves down or turntable rotates counter-clockwise	STOP
3	1	200	START	Device on Channel 1 moves to position 200 and stops	
4	1	100	START	Device on Channel 1 moves to position 100 and stops	
5	2	200	START	Device on Channel 2 moves to position 200 and stops	
6	2	100	START	Device on Channel 2 moves to position 100 and stops	
7	1	SCAN	START	1) Device on Channel 1 moves to position 100 2) Device begins repetitive scans between positions 100 and 200	STOP when near 100
8	2	SCAN	START	1) Device on Channel 2 moves to position 100 2) Device begins repetitive scans between positions 100 and 200	STOP when near 100
9	1	200	START	Device on Channel 1 moves toward position 200	
After 5s, press HOLD...			HOLD	Device stops	
After pause, press START.			START	Device resumes motion to position 200 and stops	
10	2	200	START	Device on Channel 2 moves toward position 200	
After 5s press HOLD...			HOLD	Device stops	
After pause , press START			START	Device resumes motion to position 200 and stops	

2.0 BASIC OPERATIONS

The following table is meant to familiarize the user with operations. More comprehensive explanations are given in later sections. In general, CH1 and CH2 mean Channel 1 and Channel 2. Also, the CHANNEL SELECT key toggles between channels. The selected channel has the (*) in the last field of its display line.

Table 4- Basic Operations

CONTROL FUNCTION	OPERATION
Move device on CH1 in positive direction.	Press UP/CW for CH1.
Stop device on CH1.	Press STOP for CH1.
Move device on CH2 in negative direction.	Press DN/CCW for CH2.
Stop device on CH2.	Press STOP for CH2.
Send device on CH1 to position 180.	1) SELECT CH1. 2) Key in 180. 3) Press START.
Send device on CH2 to position -90.	1) SELECT CH2. 2) Key in 90. 3) Press (-). 4) Press START.
Change polarization of antenna on CH2	1) SELECT CH2. 2) Press ANT. H/V
Begin scan of device on CH1 in accordance with previously defined scan parameters when both devices are STOPPED.	1) SELECT CH1. 2) Press SCAN. 3) Press START
Begin scan of device on CH1 in accordance with previously defined scan parameters when Device 2 is moving.	1) SELECT CH1. 2) Press SCAN.
Begin scan of device on CH1 between positions 100 and 400 for 10 repetitions, when both devices are STOPPED.	1) SELECT CH1. 2) Press SCAN. 3) Key in 100 then ENTER. 4) Press SCAN. 5) Key in 400 then ENTER. 6) Press SCAN. 7) Key in 10 then ENTER. 8) Press START.
Select turntable speed when turntable is STOPPED.	1) SELECT turntable channel. 2) Press SPEED. 3) Press numeric key associated with preset speed then ENTER, then STOP.
Select turntable speed when turntable is rotating.	1) SELECT turntable channel. 2) Press numeric key associated with preset speed.

3.0 KEY FUNCTIONS

Front panel keys are listed in Table 5 along with a brief description of functions.

Table 5- Function of Front-Panel Keys

KEY	FUNCTION
0 to 9	1) Display numbers. 2) Select turntable speed if applicable.
(-)	After number entry, change number polarity.
UP/CW	Move device associated with this key in direction of increasing position.
DN/CCW	Move device associated with this key in direction of decreasing position.
ENTER	Save displayed values of setup and scan parameters.
CLEAR	Clear numeric entry.
CHANNEL SELECT	Toggle changes selected channel, denoted by the asterisk (*).
ANT. H/V	Toggle changes antenna polarization of the selected device. Ignored if the selected device is not an antenna.
SETUP	Repetitive pressing scrolls through setup parameters for selected channel: 1) IEEE-488 address, 2) device type, 3) upper limit, 4) lower limit, and 5) current position.
SPEED	Allows subsequent speed selection by numeric key when in idle state (both devices STOPPED) . Ignored if device is not turntable with variable speed option.
SCAN	In idle state (both devices STOPPED), repetitive pressing scrolls through scan parameters of selected channel: 1) minimum limit, 2) maximum limit, and 3) number of repetitive scans. If either device is in motion, selecting the second device and pressing SCAN, causes the second device to scan in accordance with stored scan parameters.
START	Execute pre-defined command: 1) move selected device to target position, 2) SCAN selected device, 3) resume motion after HOLD
HOLD	Interrupt but not cancel command. START resumes command.
STOP	Cancels device command and places channel in idle mode.

4.0 OPERATION

4.1 Parameter Retention

All setup, scan and speed parameters, as well as current position, are retained in non-volatile memory.

4.2 Current Position Monitoring

With power on, the System Controller will monitor device motion even if motion commands are not given by the controller. For example, with power on the System Controller and tower, if local switches at the tower base are used to change antenna height, the controller will keep proper account of tower position. If device position is changed when power to either the controller or device is off, controller current position will not change.

4.3 Cancellation Of Active Commands

An active command must be cancelled before a subsequent command will be executed. STOP cancels any active command for the applicable channel.

Commands that send a device to a target position are self-canceling when the position is reached.

If a soft limit is reached, the active command is canceled.

If a hard limit is reached, the active command IS NOT canceled and STOP must be given before a subsequent command can be executed.

4.4 Idle Mode [IM]

The controller is in Idle mode, or IM, when neither channel is under an active command. IM is entered from power up. IM may be entered by pressing STOP for both channels. IM is entered when both channels complete commands having self-cancellation.

4.5 Setup

Setup parameters for both channels may be changed when the controller is in IM. The general procedure is: 1) Press both STOP keys to ensure the system is in IM. 2) Select the desired channel with the CHANNEL SELECT key. 3) Press SETUP repeatedly to locate the parameter of interest. 4) Key in the desired parameter value. 5) Press ENTER. Table 6 lists parameters in setup menu locations, depicts the display for each location, and explains options.

Table 6- Setup Menu Parameters and Options

LOC.	DISPLAY	OPTIONS	METHOD
1	488 ADDRESS nn*	1) Leave unchanged. 2) Change to new address 0 thru 31.	1) Press SETUP. 2) Key in new "nn", press ENTER .
2	ANT=0 P.T=1 M.T=2 n*	1) Leave unchanged. 2) Redefine device as: 0=Antenna. 1=Surface-mount turntable. 2=Flush-mount turntable.	1) Press SETUP. 2) Press 0 or 1 or 2, press ENTER.
3	MAX. DEVICE LIMIT nnnn*	1) Leave unchanged. 2) Define new maximum position limit.	1) Press SETUP. 2) Key in new value, press ENTER.
4	MIN. DEVICE LIMIT nnnn*	1) Leave unchanged. 2) Define new minimum position limit.	1) Press SETUP. 2) Key in new value, press ENTER.
5	CURRENT POSITION nnnn*	1) Leave unchanged. 2) Define new current position.	1) Press SETUP. 2) Key in new value, press ENTER.
1	488 ADDRESS nn*	Menu has returned to Location 1	
Press STOP to exit setup			

4.6 Scan

Both devices may scan simultaneously. When scanning, the device moves repeatedly between the set scan limits for a set number of cycles. The number of remaining cycles is displayed at the end of each cycle. Scanning is canceled by pressing STOP. If the user attempts to set the scan limits outside of the device limits, the controller shrinks them to fit within the device limits.

4.6.1 Three Possible Consequences of Pressing SCAN

1) Press SCAN when in IM and the scan menu of the selected channel is entered... Scan parameters may now be changed.

2) Press SCAN then START... The selected device will begin scanning in accordance with current scan parameters.

3) **WARNING! PRESS SCAN WHEN A DEVICE IS IN MOTION... THE SELECTED DEVICE WILL BEGIN SCANNING** in accordance with current scan parameters.

The general procedure to set scan parameters is: 1) Press STOP for both channels to ensure IM. 2) Toggle CHANNEL SELECT... to select the desired channel. 3) Press SCAN repeatedly... to locate the parameter of interest. 4) Key in the desired parameter value then ENTER... places new value in non-volatile memory.

Table 7 lists parameters in scan menu locations, depicts the display for each location, and explains options.

Table 7- Scan Menu Parameters and Options

LOC.	DISPLAY	OPTIONS	METHOD
1	SCAN MIN. LIMIT nnn*	1) Leave unchanged. 2) Define new minimum scan limit.	1) Press SCAN. 2) Key in new value, press ENTER .
2	SCAN MAX. LIMIT nnn*	1) Leave unchanged. 2) Define new maximum scan limit.	1) Press SCAN. 2) Key in new value, press ENTER.
3	SCAN CYCLE(S) nnnn*	1) Leave unchanged. 2) Change number of repetitions.	1) Press SETUP. 2) Key in new value, press ENTER.
1	SCAN MIN. LIMIT nnn*	Menu has returned to Location 1	
Press STOP to exit scan, or Press START to begin scanning			

4.7 Hold

Press HOLD to halt motion of the selected device without canceling the active command. When halted, only START and STOP commands are recognized. Press START to resume the active command. Press STOP to cancel the active command.

4.8 Speed

The SPEED key has no effect unless the selected device has the variable speed option. Distinct preset speeds (S0, S1, S2.....) are set at the factory according to customer specifications. For example, S0=0.5 rpm, S1=1 rpm, S2=2 rpm & S3=3 rpm, are common settings.

Speed selection via the GPIB port may be made at any time.

Speed selection via the front panel is made in two ways:

1) When the selected device is in motion, speed selection is made simply by pressing the corresponding numeric key. The device will respond immediately.

2) When the device is stopped, press SPEED then press the corresponding numeric key then ENTER. Press both STOP keys to exit speed setup.

Correspondence between speed and numeric keys is given in Table 8.

Table 8- Correspondence of Numeric Keys with Speed

NUMERIC KEY	SPEED
0	S0
1	S1
2	S2
.	.
.	.

4.9 Safety Time-Out

(displayed as SAFE T.O. 3 ..6 Sec)

For devices under a motion command, if the controller detects no motion over the time set as SAFETY TIME OUT, the controller sends the device a STOP command.

SAFETY TIME OUT is set by pressing SPEED twice, then key in the desired value. The default value is 5 seconds.

5.0 REMOTE MODE

Usually, the remote mode will be activated automatically by the IEEE-488 master system controller when the master controller becomes active. In the remote mode, an "R" character is displayed. In remote mode, all keyboard keys are ignored except the STOP keys. Pressing the STOP key will stop target device motion and return the controller to the local, idle mode.

In the remote mode, the controller only responds to commands received via the IEEE-488 (GPIB) port. The GPIB port is configured to respond in compliance with IEEE Std. 488.2-1992. Commands are separated into three groups, those necessary to meet 488.2 compliance, those that cause target device response, and configuration commands. Each of these groups is described in detail below. Presently, the choice of target device is restricted to an antenna tower, a surface mount turntable, or a flush mount turntable.

All GPIB commands are comprised of sequences of the capital letters A to Z. For example, the character sequence UP is a valid command which produces the response described below. Commands are separated by either the space, comma or semicolon character, for example UP ST is interpreted as being the same as UP,ST. The last character sent in a command must be the linefeed character which has the value 10 decimal or 0A hexadecimal. Commands requiring a number expect the number to be comprised of a sequence of the numeric characters 0 to 9 with an optional leading plus (+) or minus (-) sign, the decimal point character is not allowed.

5.1 GPIB Commands for Target Device Control

****

**********Any GPIB command(s) string must end with Line Feed **********

****

UP or CW

Move the target device in increasing direction of motion for a tower or in clockwise direction for a turntable. If the direction of motion associated with this command is inappropriate for the device, contact the factory.

DN or CC

Move the target device in decreasing direction of motion for a tower or in counter clockwise direction for a turntable.

GOTO nnn

Move the target device to nnn position.

UL or WL (device higher limit)

Configure the controller to return an ASCII numeric string containing the current device upper limit value on subsequent read commands. The UL or WL command may also be followed by a numeric string to change the current upper limit value. In this case, there is no effect on subsequent read commands. Note that an optional plus or minus sign may precede the numeric string, and if omitted, a positive value is assumed. Examples:

UL	Return the upper limit value on subsequent reads.
UL +456	Set the upper limit value to 456 but do not effect context of subsequent read commands.
LL UL 456	Configure the controller to return the lower limit value on subsequent reads and change the upper limit value 456.
CL WL 456	does same as the previous.

UL 243CM UL or LD243CM UL UL

Set the upper limit 243 cm and return the upper limit value on subsequent reads. Space is mandatory between any two adjacent groups of alphabetical characters that carries a meaning. For example:

Valid commands:
LD100DEG WL CL *or* LD 100DEG WL
LL UL456 *or* LL UL 456

Invalid commands:
LD100DEGCL ; no space between DEG and CL
LLUL456 ; no space between LL and UL.

LL or CL (device lower limit)

Configure the controller to return an ASCII numeric string containing the current device lower limit value on subsequent read commands. The LL or CL command may also be followed by a numeric string to change the current lower limit value. In this case, there is no effect on subsequent read commands. Note that an optional plus or minus sign may precede the numeric string, and if omitted, a positive value is assumed. Examples:

LL	Return the lower limit value on subsequent reads.
LL -100	Set the lower limit value to -100 but do not context of subsequent read commands.
UL LL -120	Configure the controller to return the upper value on subsequent reads and change the lower limit value to -120.

SUL nnn

Set the scan max. limit to nnn. *

SLL kkk

Set the scan min. limit to kkk. *

SCY mm

Set the scan cycle(s) to mm

SCY

Returns the current scan cycles in subsequent read command.

SCAN

Start scanning mm times between the nnn and kkk.
a multiple commands string can be sent as:
SUL 200 SLL 100 SCY 20 SCAN
set the scan limits and start scanning for 20 cycles.
* Scan limits have to be within the device limits UL(WL) and LL(CL) exclusively. Otherwise will be trimmed to fit within the device limits.

LL|<----------scan limits selection---------->|UL

If the scan limits and cycles are set once, they stay there. At any time you can send SCAN command to start scanning.

DEVT n

Set the device type to be n . Where n = 0,1,or 2. Antenna (0), Plastic table(1), Metal Table (2).

DEVT

Returns the type of the current device in subsequent read command .

ST Stop target device motion.

HLD Hold target device motion; it does not cancel the current command.

UHLD Release the target device if it was on hold; the suspended command is commenced

CP

Configure the controller to return an ASCII numeric string containing the current position on subsequent read commands. The CP command may also be followed by a numeric string to change the current position value. In this case, there is no effect on subsequent read commands. Note that an optional plus or minus sign may precede the numeric string, and if omitted, a positive value is assumed. Examples:

CP Return the current position on subsequent reads.

CP -123 Set the current position value to -123 but do not effect context of subsequent read commands.

LL CP -123 Configure the controller to return the lower limit on subsequent reads and change the current position value to -123.

PV Rotate antenna to the vertical polarization position, not used for turntables.

PH Rotate antenna to the horizontal polarization position, not used for turntables.

P? Return antenna polarization, 1 for horizontal or 0 for vertical polarization.

SP n

Sets the speed of the motion to n, where n= 0,1,2, or 3. Each value of n represents a specific number of rpm. Sending SP without n, the controller returns the current speed setting.

LD LD sNNNxx yy Save the number following the LD in the indicated location: current position, upper limit, or lower limit according to the identifier characters at the end of the command. The s represents an optional plus or minus sign character, NNN represents any 3 digit numeric string, xx represents an optional two character non-numeric ASCII string which is ignored, and yy represents the destination of the load command, only CP, UL or LL are allowed. The space following LD is optional. Examples:

LD +234DG CP Loads the value 234 into the current position. This sequence would be useful for setting the position value after a power on/off/on.

LD -234FA LL Changes the lower limit value to -234.

LD 345 UL Changes the upper limit value to 345.

LD +345BE UL UL Changes the upper limit value to 345 and returns the upper limit on subsequent reads to allow verification. Note there are two commands present in this, the LD command followed by the UL.

5.2 GPIB Utility And Configuration Commands

RESET Stops all motion and returns the controller to the idle state in the remote mode.

ADDRESS# Permanently change the GPIB address of the active GPIB device. The format of this command is:

ADDRESS# XX

Where XX is the ASCII representation of the new address, an integer ranging in value from 0 to 31. If the value lies outside this range it will be set to 31. If the current device is the primary GPIB device, the address of the secondary device will be changed.

ADDRESS? Returns the ASCII representation address of device A and B.

SPOLL Enables serial poll service request. The format of this command is:

SPOLL X Where X is the ASCII representation of the number formed by the sum of any of the following values:

1 Request service if current position is outside the previously set limit values.

2 Request service if the position value has changed since it was last read.

3 Request service if either of the above conditions are met.

If X is set to the ASCII zero character, serial poll service requests will be disabled.

LISTCMDS Returns a single string contains all the commands the controller will respond to. Commands are separated with commas.

CMDCHG Permanently replaces the currently saved command string with a new command string, the format of this command is:

CMDCHG OLDCMD NEWCMD

Where OLDCMD represents the old command string and NEWCMD represents the new command string. Command strings must only contain the ASCII upper case characters A to Z. Each command string saved takes up one more character space than its length, for example the command DN takes up three characters spaces. Total command string storage space is 255 characters, therefore command string changes must not exceed storage space limitations. Other than this restriction, command strings may be of any length. Only the following command strings may be changed:
UP, DN, PV, PH, ST, LL, UL, CP, LD, RESET, ADDRESS#, ADDRESS?, SPOLL, CMDCHG, LISTCMDS
All other commands may not be changed.

STDCMDS Returns the permanently saved command strings to their original factory default settings as contained in the remote command description sections within this manual.

5.3 GPIB Commands Required For IEEE Std. 488.2-1992 Compliance

To properly use most of these commands, the referenced standard should be consulted. Note that all commands in this group begin with the asterisk (*) character.

*RST Reset command. Stops target device motion clears all GPIB internal status registers.

*CLS Clear Status Command. Clears the event status register.

*WAI Wait to continue command. According to IEEE Std. 488.2-1992, all target devices for this controller, i.e. antenna towers and turntables, can be categorized as sequential devices, and therefore this command must always return a value of 1.

*ESR? Standard Event Status Register Query. Returns the ASCII representation of the numeric value contained in the Standard Event Status Register, an integer ranging in value from 0 to 255. The returned value is the arithmetic sum of the following values representing events defined in IEEE Std. 488.2-1992:

Value	Event
16	Exception error. Device is at a programmed limit.
32	Command parser detected an error.
128	Power on.

This command also sets the Event Status Register to zero.

*ESE Standard Event Status Enable Command. This command must be followed by an ASCII representation of a number ranging in value from 0 to 255. Use this command and the *SRE command to enable serial poll service requests according to the numeric values following each command. The value following this command is stored in the Standard Event Status Enable register and is the arithmetic sum of the following values representing the associated events:

Value	Event
16	Exception error. Device is at a programmed limit.
32	Command parser detected an error.
128	Power on.

The value contained in the Event Status Enable register is logically anded with the value contained in the Event Status Register and if this results in a non-zero value, 32 is added to the Serial Poll Status Register.

*ESE? Standard Event Status Enable Query Command. Returns the ASCII representation of the numeric value of the contents of the Event Status Enable Register, an integer ranging in value from 0 to 255.

*IDN? Identification Query. Returns four comma separated fields:

Field 1 Manufacturer
Field 2 Model number
Field 3 Serial number
Field 4 ROM revision number

*OPC Operation Complete Command.

According to IEEE Std. 488.2-1992, all allowable target devices, i.e. antenna towers and turntables, are sequential devices, for which all operations are complete immediately after the command is accepted. This command is therefore ignored.

*OPC? Operation Complete Query. Always returns a value of one. See *OPC.

*SRE Service Request Enable Command. This command must be followed by an ASCII representation of a number ranging in value from 0 to 255. Use this command to enable serial poll service requests according to the numeric value passed. The value passed is stored in the Service Request Enable register and is the arithmetic sum of the following values:

Value	Event
1	Position of the device is equal to a soft limit value.
2	Position has changed since the last position read.
32	An event enabled by the *ESE command has occurred.
64	Serial poll service requested.

The value contained in the Service Request Enable register is logically anded with the value contained in the Serial Poll Status Register and if this results in a non-zero value, 64 is added to the Serial Poll Status Register to generate the actual service request.

*SRE? Service Request Enable Query. Returns the ASCII representation of the numeric value contained in the Service Request Enable register, an integer ranging in value from 0 to 255. The returned value is the arithmetic sum of the values defined in the *SRE command description.

*STB? Read Status Byte Query. Returns the ASCII representation of the numeric value contained in the Serial Poll Status Register, an integer ranging in value from 0 to 255. The returned value is the arithmetic sum of the values defined in the *SRE command description.

*TST? Self Test Query. Returns a value of one if the self test was successful, and zero if the self test fails.

5.4 Valid GPIB Commands

As mentioned in section 3.4 REMOTE MODE, a GPIB command may consist of several commands separated by a space character such as:

ST CP UL 400 UP

The last character sent in the above command sequence MUST be an ASCII linefeed character (value of 10 decimal or 0A hexadecimal) as the controller will not process the command until it receives the linefeed character. The above sequence is interpreted by the controller as follows: Stop motion, return the value of the current position on subsequent reads, set the upper limit value to 400, start the device moving in the positive direction. Another way of expressing the above command is:

ST CP LD 400 UL UP

The only difference here is the use of the load command in place of the UL 400 command sequence.

Note that only 63 characters or less, including the linefeed, may be sent in any given command sequence. Characters sent after character number 63 are ignored.

APPENDIX A
SPECIAL INSTRUCTIONS FOR TILTING ANTENNA TOWER

The trolley motor unit ***must*** be connected to channel one, and the tilt motor unit connected to channel two, of the SYSTEM CONTROLLER for proper operation. Sections 1,2, and 3 of this manual should be read in their entirety to properly utilize the information contained in this appendix.

All front panel and GPIB commands for channel one are the same as for the standard tower with the exception of two setup parameters, EUT distance and height. The EUT distance is the horizontal distance, in centimeters, between the tilt mechanism pivot point and the EUT, ***not*** the antenna and EUT. The EUT height is the vertical distance above the ground plane, in centimeters, of the antenna line of sight target point on the EUT. Valid numeric values must be entered with the front panel key board or erratic tilting motion of the antenna will result. For example, if a value of zero is entered for EUT distance, the antenna will tilt to what ever tilt angle limit value has been entered and then stop, regardless of trolley height or trolley movement.

Once the setup parameters have been entered with the front panel keyboard, all movement commands issued to channel one will cause simultaneous vertical and tilting motion. The controller calculates the required tilt angle based on current position and setup parameters, and then starts both trolley and tilt motor units. Note that negative tilt angles correspond to a downward antenna line of sight angle, and positive tilt angles correspond to a vertical angle. A “CP” command written to the channel one GPIB address will result in the return of the current vertical position, in centimeters, of the trolley on subsequent reads of that address

Commands issued to channel two only cause motion of the tilting mechanism, there will be no corresponding vertical trolley movement. In all other respects, channel two will behave as described in the SYSTEM CONTROLLER Operations Manual. A “CP” command written to the channel two GPIB address will result in the return of the current tilt angle, in degrees, of the antenna on subsequent reads of that address.

To operate the antenna with no tilting motion, first use the select key to make channel two the active channel and move the antenna to the desired tilt angle, next use the setup procedure to set the upper and lower tilt angle limits to this angle, and finally press the select key to return to channel one. All channel one movement commands will now only cause vertical movement of the trolley, no tilt movement will occur. Channel two movement commands will have no effect.

APPENDIX B
PROGRAMMER'S COMMAND GUIDE

COMMAND	**MEANING**
CP nnn	set the current position to nnn
CP	inquire current position
DEVT n	set the device type; 0 (ant),1 (PTT), or 2 (MT)
DEVT	inquire the device type
DN or CC	start motion in negative direction
UP or CW	start motion in positive direction
GOTO nnn	go to nnn position
HLD	hold motion
UHLD	release motion
LL nnn	set the *device* lower limit to nnn
CL nnn	similar to the above
LL	inquire the *device* lower limit
CL	similar to the above
P?	inquire antenna polarization. Replay 0 (vertical) or 1(horizontal)
PH	rotate the antenna to horizontal position
PV	rotate the antenna to vertical position
RESET	clean any command in the buffer
SUL nnn	set the upper limit of scanning to nnn
SLL nnn	set the lower limit of scanning to nnn
	SUL and SLL have to be within the *device* limits exclusively
SCY n	set the number of cycle(s) to n
SCY	inquire the number of cycle(s)
SCAN	scan n cycle(s) between SUL and SLL limits
SP n	set the motion speed n rpm
SP	inquire the motion speed
ST	stop motion
UL nnn	set the *device* upper limit to nnn
WL nnn	similar to the above
UL	inquire *device* upper limit
WL	similar to the above