INSTRUCTION MANUAL

TURNTABLE/TOWER

CONTROLLER

MODEL EM-4700

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TURNTABLE/TOWER CONTROLLER

ELECTRO-METRICS

MODEL EM-4700

SERIAL NO: N/A

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WARRANTY

This Model EM-4700 Turntable/Tower Controller is warranted for a period of 12 months (USA only) from date of shipment against defective materials and workmanship. This warranty is limited to the repair of or replacement of defective parts and is void if unauthorized repair or modification is attempted. Repairs for damage due to misuse or abnormal operating conditions will be performed at the factory and will be billed at our commercial hourly rates. Our estimate will be provided before the work is started.

DESCRIPTION AND USE--ELECTRO-METRICS MODEL EM-4700 CONTROLLER FOR EM-4700 SERIES TURNTABLES/ANTENNA TOWERS

1.0 Description

The Electro-Metrics Model EM-4700 Controller is used to operate and control the Electro-Metrics Model EM-4700 Series Turntables and Antenna Towers. The controller is capable of operating both units, either manually or via computer, using a time multiplexing method.

The EM-4700 Controller is a separate rack mountable module that is connected to the turntable rotation drive system interface module and/or tower motion drive system via multi-conductor control cables.

The controller is an integral part of each drive system and neither unit can be operated independently without the controller connected.

2.0 Specifications

2.1 Electrical

Resolution:	1° or 1 cm.
Accuracy:	±1°, ±1 cm.
Total Rotation:	370°.
Total Height:	0.5 m to 4.0 m, 0.5 m to 6.0 m.
Tower Arm Polarization:	90° horizontal to vertical.
Sweep:	Continuous between two desired positions.
GPIB Interface:	IEEE Std 488.2-1987.
GPIB Interface Supports:	AH1, L4, SH1, T6, SR1, PP1, DC1, DT0, RL1, C0, E1, TEO, LEO.
AC Power Source:	90-250 VAC, 48-63 Hz @ 1 A.

2.2 Mechanical

Length:	33.0 cm (13").
Width:	48.3 cm (19").

Height:	8.9 cm (3.5").
Weight:	1.8 kg (4 lbs).

3.0 Power Supply

3.1 Power Requirements

a. AC Power Source:

90 VAC to 250 VAC, 48 Hz-63 Hz.

NOTE: The internal power supplies of the Controller can operate over the stated voltage and frequency ranges without modifications.

CAUTION

TO AVOID ELECTRICAL SHOCK, THE PROTECTIVE GROUNDING CONDUCTOR MUST BE CONNECTED TO EARTH GROUND.

3.2 Fuse Specifications

The EM-4700 Controller Module uses the following fuse:

a. 250 VAC 2.0 AMP 3AG SLO-BLO.

CAUTION

FOR CONTINUOUS FIRE PROTECTION, REPLACE ONLY WITH 250 VAC 2 A FUSE.

4.0 Description Front/Rear Panel

4.1 Front Panel

4.1.1 Controller Display

Type: Liquid Crystal Display, 3 digits backlighted.

Function: Indicates in degrees or centimeters one of three settings:

1) Current Table or Tower Position,

2) Lower Position,

3) Upper Position.

The setting being displayed is indicated by an LED integrated into the pushbutton switch for that function.

4.1.1.1 Lower Position Switch

Type: Momentary pushbutton switch.

Indicator: LED, integrated into switch.

Color: Red.

Function: Selects the Tower or Turntable lower position indication for the continuous sweep mode of operation.

4.1.1.2 Current Position Switch

Type: Momentary pushbutton switch.

Indicator: LED, integrated into switch.

Color: Red.

Function: Selects the Tower or Turntable current position indication.

4.1.1.3 Upper Position Switch

Type: Momentary pushbutton switch.

Indicator: LED, integrated into switch.

Color: Red.

Function: Selects the Tower or Turntable upper position indication for the continuous sweep mode of operation.

4.1.1.4 Resolution Indicators

Type: LED.

Color: Red.

Quantity: Two (2), marked DEG and cm.

Function: To indicate that the Controller Display reading is denoted in either degrees (DEG) for the Turntable rotation from zero start point or centimeters (cm) for the Tower height from lower limit point.

4.1.2 Start/Stop Sweep Switch

Type: Momentary pushbutton switch.

Indicator: LED, integrated into switch.

Color: Red.

Function: Starts/Stops the Tower or Turntable continuous sweep mode of operation. LED is activated whenever the Tower is in motion or the Turntable is rotating.

4.1.3 Select Switch

Type: Momentary pushbutton switch.

Indicator: LED, integrated into switch.

Color: Red.

Quantity: Two (2), marked TOWER and TABLE.

Function: To select between either Tower operation (Tower LED activated) or Turntable operation(Turntable LED activated).

4.1.4 Seek Switch

Type: Momentary pushbutton switch.

Indicator: LED, integrated into switch.

Color: Red.

Function: Two-part function.

Part 1: To allow selection of either the turntable azimuth (in degrees) or antenna tower height (in cm) for the device to obtain. The actual selection is performed using the Multi-Function Control Knob.

Part 2: After the setting is selected, to initiate the seek function.

4.1.5 Polarization Switch

Type: Momentary pushbutton switch.

Indicator: LED, integrated into switch.

Color: Red.

Quantity: Two (2), marked HOR and VERT.

Function: In Tower operation, to select between either horizontal (Horizontal LED activated) or vertical (Vertical LED activated) polarization of the antenna mounting arm on the tower.

4.1.6 Multi-Function Control Knob

NOTE: The Multi-Function (MF) Control Knob is not marked on the front panel of the Controller. Denoted as MF Knob in the following sections.

Type: Digital Pulse Generator.

Function: Two (2) assigned functions.

a. Function 1

Conditions: Manual (Local) mode of operation, Current Position setting selected.

Azimuth Mode: The MF Control Knob is used to rotate the turntable in either a clockwise or counterclockwise direction. This is accomplished by rotating the Knob in the direction desired, i.e., clockwise for clockwise direction and vice versa.

Height Mode: The MF Control Knob is used to raise or lower the tower. This is accomplished by rotating the Knob clockwise to raise the tower and counterclockwise to lower the tower.

b. Function 2

Conditions: Manual (Local) mode of operation, Remote/Local pushed once, the LED will blink continuously and the EM-4700 Firmware Version is displayed for approximately 10 seconds. After 10 seconds, the controller enters the special function mode.

In the special function mode, various instrument settings can be adjusted using the MF Control Knob. Refer to Section 4.1.7 (Remote/Local Switch) for a complete explanation

4.1.7 Remote/Local Switch

Type: Momentary pushbutton switch.

Indicator: LED, integrated into switch.

Color: Red.

Function: Two assigned functions.

a. Function 1

Conditions: EM-4700 in the remote of operation, no Local Lockout command in effect.

If the REMOTE Switch is pushed, returns control of the EM-4700 to the local (manual) mode of operation from the remote (computer) mode of operation.

The REMOTE LED indicator is activated whenever the remote mode of operation is selected (via computer command only, IEEE Bus).

b. Function 2

Conditions: EM-4700 in the local mode of operation, REMOTE LED off.

1) REMOTE Switch is pushed once:

The LED will blink continuously and the EM-4700 Firmware Version is displayed for approximately 10 seconds. After 10 seconds, the controller enters the special function mode.

In the special function mode, various instrument settings can be adjusted. The SELECT Switch is used to change between tower (Tower LED activated), turntable (Turntable LED activated), and GPIB Bus Address (both LEDs' off).

2) GPIB Bus Address Mode selected:

The MF Knob is used to change the Bus Address. Clockwise to increase, counterclockwise to decrease. Press the START/ STOP SWEEP Switch to store the Bus Address in RAM:

3) Turntable Mode selected (Turntable LED activiated):

The value for the current position is displayed whenever the Current Position LED is activated. This value can be adjusted using the MF Knob (CW increase, CCW decrease). Pressing the START/STOP SWEEP Switch stores the value in RAM. The Current Position can be set from 0 to 370 (turntable rotation range).

Pressing the LOWER POSITION Switch activates the Lower Position LED and displays the value of the counterclockwise limit for the turntable. This value can be adjusted using the MF Knob (CW increase, CCW decrease). Pressing the START/STOP SWEEP Switch stores the value in RAM. The Lower Position can be set from 0 to the Upper Position -5.

Pressing the UPPER POSITION Switch activates the Upper Position LED and displays the value of the clockwise limit. This value can be adjusted by following the procedure described above for the Lower Position. The Upper Position can be set from Lower Position +5 to 370.

4) Tower mode selected (Tower LED activated):

The value for the current position is displayed (whenever the Current Position LED is activated) for the polarization selected. The value can be adjusted using the MF Knob (CW increase, CCW decrease). Pressing the START/STOP SWEEP Switch Switch stores the value in RAM. The Current Position can be set to any value within the range of the tower.

CAUTION

To prevent damage to either the tower or the mounted antenna, *always verify* that the Current Position value selected is correct for the situation being set up. *Never assume* that the Current Position value is correct or close enough. As a minimum requirement, verify daily with actual measurements and enter the value required.

Depending on how the antenna is mounted on the mounting boom, different current positions can be set for vertical and horizontal polarization. The POLARIZATION Switch is used to select the type of polarization for the values being set.

Pressing the LOWER POSITION Switch activates the Lower Position LED and displays either the vertical lower limit or the horizontal lower limit, depending on the status of the POLARIZATION Switch. The value can be adjusted using the MF Knob and then pressing the START/STOP SWEEP Switch as described in previous paragraphs. The lower limit can be from 40 to the upper limit -1.

The vertical and horizontal upper limits can be changed in a similar fashion by selecting the UPPER POSITION Switch. The upper limits can be set from Lower Position +1 to 400 or 600 depending on mast height of the tower.

4.1.8 ON/OFF (Power) Switch

Type: Two cycle rocker switch

Function: Self-explanatory.

4.2 Rear Panel

4.2.1 AC Power Connector

Type: Integrated AC power connector with RFI power line filter.

Current Rating: 1 Amp.

Operating Frequency: 48-63 Hz.

Voltage Range: 90-250 VAC.

Function: Self explanatory.

4.2.2 GPIB Connector

Type: IEEE Std 488.2-1987 General Purpose Interface Bus Connector (24-pin).

Function: Interfacing a computer with the EM-4700.

4.2.3 Controller/Antenna Tower/Turntable Interface Connectors

Type: 17-pin PT Pygmy, socket.

Quantity: 2. Denoted as Antenna Tower Interface and Turntable interface.

Function: Interfacing the Controller to the Antenna Tower Drive Systems and the Turntable Drive System.

5.0 Controller/Antenna Tower/Turntable Manual Operation

NOTE: The following procedure assumes a setup using:

1) EM-4717 Turntable and EM-4720 Antenna Tower,

2) Each unit connected to its AC power source.

5.1 Initial Power-Up Procedure

a. Connect the AC power cord for the Controller to the selected AC power source.

CAUTION

To avoid electrical shock, the EM-4700 must be plugged into a grounded outlet.

b. Connect the EM-4700 Controller and EM-4717 Turntable Interface Cable between the Controller and Turntable Interface Module.

c. Connect the EM-4700 Controller and EM-4720Antenna Tower Interface Cable between the Controller and Antenna Tower drive system module.

d. The Controller is turned on by pushing the power switch to the **"ON"** position.

e. A self-test procedure is initiated at power turn-on, sequencing as follows:

1) All front panel LEDs' activated,

2) LCD Display activated showing 888 across the display.

3) At end of self-test sequence, the front panels control settings will revert to the control settings at the moment the unit was turned off.

If the above self-test sequence does not occur, or all LEDs' do not activate, or the front panel controls do not revert to the identical settings at the moment of unit turn off, it may indicate problems with the microprocessor or front panel PC board. Contact Electro-Metrics (518) 762-2600 or your nearest Electro-Metrics representative for any assistance required.

f. After the Controller finishes the self-test procedure in Step e, the internal firmware activates relays within the Antenna Tower and Turntable Drive System Modules to apply AC power to these units.

g. The unit is now ready for manual operation of the Antenna Tower and Turntable.

NOTE: The front panel LOCAL Switch can only switch the unit to LOCAL from the REMOTE mode of operation.

5.2 Manual Operation

5.2.1 Turntable Manual Operation

In the manual mode of operation, the Controller has three methods of controlling the turntable: Direct, Seek, or Continuous Sweep.

5.2.1.1 Direct Mode

In the Direct Mode, the Controller can rotate the turntable either clockwise or counterclockwise. This is accomplished as follows:

a. Select Turntable operation using the SELECT Switch to select the turntable mode (Turntable LED activated).

b. Push the Current Position Switch to display the current position of the turntable with respect to the zero reference position.

c. Rotate the MF Knob in the direction the table is to turn (clockwise for clockwise table rotation and vice versa). The table will rotate in the direction the knob is being rotated. Clockwise rotation will increment (increase from zero reference) the display while counterclockwise rotation will decrement (decrease towards zero reference) the display.

5.2.1.2 Seek Mode

In the Seek Mode, the Controller can rotate the turntable either clockwise or counterclockwise to the position desired. This is accomplished as follows:

a. Select Turntable operation using the Select Switch to select the turntable mode (Turntable LED activated).

b. Push the Seek Switch (LED will flash) to display the current position of the turntable with respect to the zero reference position.

c. Use the MF Knob to select the table azimuth setting (in degrees) desired.

d. Push the Seek Switch again, the table will rotate to the setting select (accuracy ±0.5 degree). Table rotation will depend on start position and end position.

5.2.1.3 Reset System Reference

The Turntable Rotation Drive System has no mechanical zero position location. To reset the Drive System reference:

a. In the Local Mode of Operation, push the Remote/Local Switch.

b. Use the MF Knob to select the reference setting (in degrees) desired.

c. Then push the Start/Stop Sweep Switch.

d. Push the Remote/Local Switch again. This will reset the Drive System to zero degree.

5.2.1.4 Continuous Sweep Mode

In the Continuous Sweep Mode, the Controller sweeps continuously between two user definable limits. This is accomplished as follows:

a. Select Turntable operation using the SELECT Switch to select the turntable mode (Turntable LED activated).

b. If required, set the zero position following the procedure in Section 5.2.1.3.

c. To set the sweep start position, push Lower Position Switch and rotate the MF Knob to the start position desired.

d. To set the sweep stop position, push Upper Position Switch and rotate the MF Knob to the stop position desired.

e. After the sweep end positions have been set, push the Start/Stop Sweep Switch.

NOTE: The Start/Stop Sweep Switch LED will be activated whenever the turntable is rotating.

f. The turntable will rotate in a clockwise direction to the stop positon. When the stop positon is reached, the turntable will continuously rotate between the two defined end points at a rate of one revolution per minute.

g. To stop the sweep function, push the Start/Stop Sweep Switch. Sweep will immediately stop, LED on the Start/Stop Sweep Switch will go off.

5.2.2 Tower Manual Operation

In the manual mode of operation, the Controller has three methods of controlling the tower: Direct, Seek, or Continuous Sweep.

Before commencing manual operation of the tower, the lower limit (both vertical and horizontal polarization) of the tower antenna mounting arm should be set for the type of antenna being used. Follow the instructions in Section 4.1.7.b-4 to set the required limits. This should be done every time a different antenna is mounted on the tower.

5.2.2.1 Direct Mode

In the Direct Mode, the Controller can either raise or lower the antenna mounting arm in 1 centimeter increments. This is accomplished as follows:

a. Select Tower operation using the SELECT Switch to select the tower mode (Tower LED activated).

b. Set the Polarization to the position required.

c. Push the Current Position Switch to display the current position of the tower antenna mounting arm with respect to the lower limit setting.

CAUTION

To prevent damage to either the tower or the mounted antenna, *always verify* that the Current Position value selected is correct for the situation being set up. *Never assume* that the Current Position value is correct or close enough. As a minimum requirement, verify daily with actual measurements and enter the value required.

d. Rotate the MF Knob in the direction the tower antenna mounting arm is to move (clockwise for raising and counterclockwise for lowing). The mounting arm will move in one centimeter increments in the direction the MF Knob is being rotated. Clockwise rotation will increment (increase from lower limit) the display while counterclockwise rotation will decrement (decrease towards lower limits) the display.

5.2.2.2 Seek Mode

In the Seek Mode, the Controller can either raise or lower the antenna mounting to the position desired. This is accomplished as follows:

a. Select Tower operation using the SELECT Switch to select the tower mode (Tower LED activated).

b. Set the Polarization to the position required.

c. Push the Seek Switch (LED will flash) to display the current position of the antenna mounting arm with respect to the lower limit setting.

d. Use the MF Knob to select the antenna mounting arm height setting (in centimeters) desired.

d. Push the Seek Switch again, the antenna mounting arm will go to the setting select (accuracy ±0.5 centimeter). Antenna mounting arm direction of motion will depend on start position and end position.

5.2.2.3 Continuous Sweep Mode

In the Continuous Sweep Mode, the Controller sweeps continuously between two user definable limits. This is accomplished as follows:

a. Select Tower operation using the SELECT Switch to select the tower mode (Tower LED activated).

b. Set the Polarization to the position required.

CAUTION

Always verify that the stop and start positions are within the default limits set for the polarization selected. If not, the antenna could be damaged during the cycling mode.

c. To set the sweep start position, push Lower Position Switch and rotate the MF Knob to the start position desired.

d. To set the sweep stop position, push Upper Position Switch and rotate the MF Knob to the stop position desired.

e. After the sweep end positions have been set, push the Start/Stop Sweep Switch.

NOTE: **The Start/Stop Sweep Switch LED will be activated whenever the tower antenna mounting arm is cycling.**

f. The tower antenna mounting arm will rise to the stop positon. When the stop positon is reached, the tower mounting arm will continuously cycle between the two defined end points at a rate of approximately one complete cycle each 40 seconds.

g. To stop the sweep function, push the Start/Stop Sweep Switch. Sweep will immediately stop, LED on the Start/Stop Sweep Switch will go off.

6.0 Controller/Turntable Remote Operation

The EM-4700 Controller is operated remotely using a computer supplying control information through the IEEE Std 488.2-1987 General Purpose Interface Bus (GPIB).

Section 6.1 provides a typical equipment setup for operation using the GPIB interface.

Sections 6.2 thru 6.9 are intended to provide the user with a ***Brief Explanation*** of the GPIB IEEE codes and command information plus the overall Controller/computer operating command structure. For more complete and detailed information, refer to the

ANSI/IEEE Std 488.2-1987 Standards handbook on Standard Codes, Formats, Protocols, and Common Commands.

The commands listed in Section 6.0 are all EM-4700 Controller device dependent commands issued as ASCII commands over the GPIB. EM-4700 Controller Device Dependent Commands are listed in Section 6.9.1. The syntax of each command is given in Section 6.9.2. In each case listed, the EM-4700 Controller is a listener as defined in IEEE Std 488.2-1987.

6.1 Equipment Setup

NOTE: The following setup assumes a test system consisting of an EM-4700 Controller, EM-4717 Turntable, EM-4720 Series Antenna Tower, and computer.

To operate the EM-4700 Controller remotely:

a. Connect the GPIB Cable (24 pin) to the EM-4700 Controller rear panel IEEE STD 488 PORT Connector.

b. Connect the EM-4700 Controller and EM-4717 Turntable Interface Cable between the Controller and Turntable Interface Module.

c. Connect the EM-4700 Controller and EM-4720 Series Antenna Tower Interface Cable between the Controller and Antenna Tower drive system module.

d. Verify that no other device is assigned the Bus Address for the EM-4700 Controller. If assigned to another device, use the procedure in 4.1.7.b-2 to select a new bus address for the unit. The new bus address is implemented immediately upon being entered.

NOTE: Always verify that each device on the GPIB network is assign its own unique bus address before activating the network.

e. Follow the Initial Power-Up procedure in Section 5.1 a thru f.

f. Turn on the computer and initiate the software being used.

g. The EM-4700 Controller/Turntable/Antenna Tower is now ready for remote operation.

6.2 Interface Function Codes

The EM-4700 Controller GPIB operates as both a talker and a listener. The GPIB is compatibile with the IEEE STD 488 interface function codes listed in Table 6.1.

TABLE 6.1
IEEE STD 488 INTERFACE FUNCTION CODES

CODE	DESCRIPTION
AH1	Acceptor Handshake Capability
L4	Listener (Basic Listener, Unaddressed To Listen On TAG)
SH1	Source Handshake Capability
T6	Talker (Basic Talker, Serial Poll, Unaddressed To Talk On LAG)
SR1	Service Request Capability
PP1	Parallel Poll Capability (Remote Configuration)
DC1	Device Clear Capability
DT0	No Device Trigger Capability
RL1	Remote/Local Capability
C0	No Controller Capabiliy
E1	Open Collector Bus Drivers
TE0	No Extended Talker Capabilities
LE0	No Extended Listener Capabilities

6.3 Bus Address

The bus address can be changed at any time, refer to the procedure in Paragraph 4.1.7.b-2. The new bus address is implemented immediately upon being entered.

6.4 Remote Operation

To put the device into the remote mode, the remote command must be used to toggle the REN line. If the remote command is sent as an addressed command group (UAGC), the EM-4700 Controller will go into the remote mode immediately. The format of the commands are shown below for the HP-9836 Computer.

REMOTE 710 <EXECUTE>

Where 710 corresponds to device 10 on the bus.

If a universal command is used, i.e. REMOTE 7 on a HP9836, the device will not go into remote until addressed as a listener or talker.

The Remote/Local Switch LED is activated whenever the unit is in the remote mode of operation.

The EM-4700 Controller can be controlled via the computer without going into the remote mode of operation. This is accomplished by not toggling the REN line. The EM-4700 Controller will now accept commands from the computer but is still in the local mode of operation.

6.5 Local/Local Lockout Commands

The EM-4700 Controller may be commanded to lockout all the front panel pushbutton switches using a GPIB command. The local lockout command can only be cancelled with a GPIB "GO TO LOCAL" command. The format of the commands are shown below for the HP-9836 Computer.

LOCAL LOCKOUT: **LOCAL LOCKOUT 7**

LOCAL: **LOCAL 7**

NOTE: This command should not be implemented unless the REN line has been asserted by using the Remote command. Otherwise, the user will not be able to control the EM-4700 Controller manually or remotely.

If a LOCAL LOCKOUT has not been commanded, the EM-4700 Controller may be brought into the LOCAL mode by pushing the front panel Remote/Local Switch.

6.6 Polling

The computer may periodically check devices on the bus to determine if a particular device needs service, or in response to SRQ to determine which device requested service. Two types of polling may be performed, serial or parallel.

6.6.1 Serial Poll

When performing a serial poll, the computer can access each device on the bus individually to read an eight-bit status byte. The computer is then informed of the nature of service required by the polled device. The EM-4700 Controller returns a status byte as shown in Table 6.2.

TABLE 6.2
STATUS BYTE INFORMATION

LINES	(8)	(7)	(6)	(5)	(4)	(3)	(2)	(1)
BITS	7	6	5	4	3	2	1	0
VALUE	128	64	32	16	8	4	2	1

MEANING: **BIT 0: 1 = hardware error**
BIT 4: 1 = MAV: Message Available
BIT 5: 1 = ESB
BIT 6: 1 = requested service

If the status byte read back is equal to 65, then this indicates that **BIT 6 = 1 (64)** and **BIT 0 = 1 (1)**. In this case, the EM-4700 Controller has requested service for a hardware error.

6.6.2 Parallel Poll

Parallel polling provides the computer a quick way to check if any devices require service or to determine which device requested service. The computer can configure the EM-4700 Controller to respond on any one of eight data lines with up to two devices per data line. When performing a parallel poll, the device needing service will assert the particular line assigned to it. This allows the computer to see all devices on the bus at once and attend to only those requiring service. When two devices are assigned to one line, a serial poll of each device will be necessary to determine which of the two require service.

Please refer to your computer software manual for complete details of parallel poll configure and parallel poll unconfigure.

6.7 SRQ (Service Request)

The service request is a signal that the EM-4700 Controller can send to the computer to let it know that the unit requires some kind of attention. When the SRQ is enabled, using the Service Request Enable Register (*SRE) common command, the unit will assert the SRQ line of the GPIB. This can occur whenever a hardware error has occurred in the unit dependent upon the SRQ Mask settings.

The unit will assert SRQ until the computer performs a serial poll or the fault condition is corrected.

To enable the EM-4700 Controller to SRQ the computer, the *SRE function must be used in the following form:

*SRExxx where xxx is equal to the value of the bits corresponding to the condition which will SRQ the Controller.

If an SRQ is desired for a hardware error condition then the value of xxx will be 1 (**BIT 0 = 1**).

An example is shown below for an HP-9836 Computer:

Type: OUTPUT 701;"*SRE1" (hit Execute)

With **xxx = 0**, the EM-4700 Controller will never request service (default condition).

Please refer to previous section on Serial Poll for bit assignments.

NOTE: The SRE function will not put the EM-4700 Controller Module into the remote mode. Only numeric values in the range of 0 to 255 should be used with the *SRE function, otherwise unexpected results may occur.

6.8 Device Clear

The DCL command may be used to clear the output/input buffers, event status register, and reset the command parser of the unit.

An example is shown below for an HP-9836 Computer:

Type: CLEAR 7 (hit Execute)

The SDC command performs the same function as DCL except that only the addressed device responds.

An example is shown below for an HP-9836 Computer:

Type: CLEAR 701 (hit Execute)

6.9 Control Commands

6.9.1 EM-4700 Controller Device Dependent Commands

EM-4700 Controller Device Dependent Commands are listed in the folowing section.

6.9.1.1 Definitions

Auto Increment.

The AUTOINCREMENT parameter is associated with the SEEK function. Each time a SEEK is completed, the value of the TARGET parameter will be incremented by the amount contained in the AUTOINCREMENT parameter. This value may be either positive or negative. The result of this is a step function, each time the SEEK function is invoked, the tower or turntable will travel the amount contained in the AUTOINCREMENT parameter.

The Scan Function.

The SCAN function allows the operator to initiate cyclic motion in the tower orturntable. A cycle is defined as movement from the LOWER LIMIT to the UPPER LIMIT and back to the LOWER LIMIT.

6.9.1.2 Instruction Set

“AD” Activate Device.

This command activates the selected device.

Device 1 = Turntable,

Device 2 = Tower.

Only one active device is allowed at a time and can not be changed while a device is in motion. Issuing a command to commence motion on an inactive device results in an execution error.

“AD?” Query Active Device.

This command readies the instrument to respond with the number of the current active device. A response of:

1 = Turntable

2 = Tower.

"AI" Set Autoincrement.

This command sets the value of the autoincrement parameter. This command requires a decimal argument from 1 to 370.

"AI?" Query the Autoincrement

This command readies the instrument to respond with the autoincrement parameter current setting when queried. The value returned will be a signed decimal number from -360 to +360.

"CC" Counterclockwise.

This command causes the turntable (when selected as active device) to begin a counterclockwise motion. This assumes that it has not already reached the counterclockwise limit.

"CL" Counterclockwise Limit.

This command sets the current value of the counterclockwise limit. This command requires a decimal argument from 0 to 370.

Example:

```
10  OUTPUT 709;"CL 250"     !set counter clockwise limit to 250
                            degrees
```

NOTE: When setting the clockwise and counterclockwise limits, special attention should be given to the status of the counter part limit. For example, one cannot set the clockwise limit to a value less than or equal to the counterclockwise limit, and vice versa.

"CL?" Query the Counterclockwise Limit.

This command readies the instrument to respond with the counter-clockwise limit of the turntable when queried. The value returned is a decimal number from 0 to 370.

Example:

```
10   OUTPUT 709;"CL?"     !ready the instrument to respond
20   ENTER 709;LIMIT      !read the current setting
30   DISP LIMIT           !display the decimal value
```

"CP" Set the Current Position.

This command requires a decimal argument from 0 to 370.

"CP?" Query the Current Position.

This command readies the instrument to respond with the current turntable position when queried. The value returned will be a decimal number from 0 to 370.

"CW" Clockwise.

This command causes the turntable (when selected as active device) to begin a clockwise motion. This assumes that it has not already reached its clockwise limit.

"CY" Set cycles.

This command sets the value of the CYCLES parameter. This command requires a decimal argument from 0 to 100.

"CY?" Query Cycles.

This command readies the instrument to respond with the current setting of the CYCLES parameter when queried. The value returned will be a decimal number from 0 to 100.

“DN” Down.

This command causes the tower (when selected as active device) to begin a downward motion. This assumes that it has not already reached its lower limit.

“LH” Set the Horizontal Lower Limit.

This command sets the lower limit for tower horizontal polarization. A decimal value of 40 to 399 is required.

“LH?” Query the Horizontal Lower Limit.

This command readies the instrument to respond with the current setting of the horizontal lower limit parameter when queried. The value returned will be a decimal number from 40 to 399.

“LL” Set the Lower Limits

This command sets the lower limits for both the vertical and horizontal polarizations. A decimal value of 40 to 399 is required.

“LV” Set the Vertical Lower Limit.

This command sets the lower limit for tower vertical polarization. A decimal value of 40 to 399 is required.

“LV?” Query the Vertical Lower Limit.

This command readies the instrument to respond with the current setting of the vertical lower limit parameter when queried. The value returned will be a decimal number from 40 to 399.

“PH” Horizontal Polarization.

This command causes the antenna mounting boom to rotate 90 degrees to a horizontal antenna polarization. This assumes that the device is not already in this position.

“PV” Vertical Polarization.

This command causes the antenna mounting boom to rotate 90 degrees to a vertical antenna polarization. This assumes that the device is not already in this position.

“P?” Query Polarization.

This command readies the instrument to respond with the current polarization setting when queried. The value returned is either a character "V" (current polarization vertical) or "H" (current polarization horizontal).

"SC" Scan.

This command causes the turntable to begin scanning between the preset clockwise and counterclockwise lower limits. The number of scans performed is determined by the value of the CYCLES parameter which must be independently set prior to issuing the SCAN command.

"SK" Seek.

This command causes the device to begin seeking the preset TARGET azimuth or height. The TARGET parameter must be independently set prior to issuing the SEEK command.

"ST" Stop.

This command causes the immediate cessation of motion in all devices.

"TG" Set the Target.

This command sets the TARGET azimuth of the turntable or the TARGET height of the tower. A decimal argument is required, and must be within the range of the active device.

"TG?" Query the Target.

This command readies the instrument to respond with the present TARGET azimuth setting of the turntable or TARGET height of the tower when queried. Upon query, the instrument will return a decimal value.

“UH” Set the Horizontal upper limit

This command sets the upper limit for the tower when in the horizontal polarization. A decimal value of 41 to 400 is required.

“UH?” Query the Horizontal Upper Limit

This command readies the instrument to respond with the current setting of the horizontal upper limit parameter when queried. The value returned will be a decimal number from 41 to 400.

“UL” Set the Upper limits

This command set the upper limits for both the vertical and horizontal polarization’s. A decimal value of 41 to 400 is required.

“UP” Up.

This command causes the tower (when selected as active device) to begin an upward motion. This assumes that it has not already reached its upper limit.

“UV” Set the Vertical upper limit

This command sets the upper limit for the tower when in the vertical polarization. A decimal value of 41 to 400 is required.

“UV?” Query the Vertical Upper Limit

This command readies the instrument to respond with the current setting of the horizontal upper limit parameter when queried. The value returned will be a decimal number from 41 to 400.

"WL" Set Clockwise Limit.

This command changes the clockwise limit parameter for all active devices. This command requires a decimal argument from 0 to 370.

NOTE: When setting the clockwise and/or counter-clockwise limits special attention should be given to the status of the counter part limit. For example, one cannot set the clockwise limit to a value less than or equal to the counter-clockwise limit, and vice versa.

"WL?" *Query the Clockwise Limit.

This command sets the current value of the clockwise limit. This command requires a decimal argument from 0 to 370

6.9.2 Common Commands Available

The common commands used to operate the EM-4700 Controller via the GPIB interface are listed in Table 6.3.

TABLE 6.3
IEEE COMMON COMMANDS

MNEMONIC	COMMAND NAME
*CLS	Clear Status Command
*ESE	Standard Event Status Enable Command
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*IDN?22	Identification Query
*IST?	Individual Status Query
*OPC22	Operation Complete Command
*OPC?	Operation Complete Query
*PRE[1]	Parallel Poll Register Enable Command
*PRE?	Parallel Poll Register Enable Query
*RST	Reset Command
*SRE22	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query
*TST?	Self Test Query
*WAI	Wait-To-Continue Command

NOTE: **1)** *PRE command is limited to a value of 0-255 ASCII encoded data byte since the status byte register is only 8-bits in length.

"***OPC"** **Operation Complete**

This command (when executed) causes the EM-4700 Controller to put a 1 in the OPC bit of the Event Status Register at the completion of the current or pending task.

"*OPC?" **Operation Complete Query**

This command will make the computer put a decimal 1 into the output queue of the EM-4700 Controller, at the completion of the current or pending task, for subsequent read back by the computer.

"*WAI" **Wait to Continue**

This command prevents the EM-4700 Controller from implementing any subsequent commands until the current operation is complete.

CAUTION

Special attention should be placed on the operation of the synchronization commands *OPC, *OPC?, and *WAI. Depending on the operation being implemented, the period of time required for completion can vary greatly. For example, when performing a SCAN command between the limits of 0 to 360 degrees for 50 CYCLES @ 1 R.P.M. the time to completion will be approximately 100 minutes, or 1 hour and 40 minutes.

If a *OPC? query and immediate read back are implemented, the GPIB bus will effectively be tied up for 100 minutes until the response message is received by the computer.

WARNING

If the *WAI command is issued during this time, no other commands will be executed until the completion of the assigned task. This includes the ST "STOP" command. The only way to remotely stop the tower or turntable would be to issue a DEVICE CLEAR COMMAND.