SUNOL SCIENCES MOTION CONTROLLER

MODEL SC110V

SECTION 3 - FEATURES AND OPERATION 7

SECTION 4 - MAINTENANCE 19

SECTION 1 - SPECIFICATION

1.1 Dimension
   17" L X 17" W X 6" H X 15" D
1.2 Weight
   15 lb
1.3 Enclosure
   Fully covered
1.4 Display
  Each channel is provided with a Liquid Crystal Display (LCD). The
  LCD is 16 characters X 2 lines, and the character size is 2.95W x 5.55H mm.
1.5 Mounting
   Rack mount or stand alone.
1.6 Keypad
  Each channel is provided with two keypads, one for numerical entry and a second for
  functions.
1.7 Electrical
   Power Specification
   Each channel is supplied with 5 DCV and consumes ~ 470 mA. A total of 1.41 A is
   consumed if the SC110V PC is fully loaded with three channels.
   Power Requirement
   Upon request, factory made to work on either 110 VAC or 230 VAC.
1.8 Environment
   Temperature
   The operating temperature range is –5 ~ +50 °C (23 ~ 112 F).
   The storage temperature range is –20 ~ +60 °C (-4 ~140 F)

Section 2 - Introduction
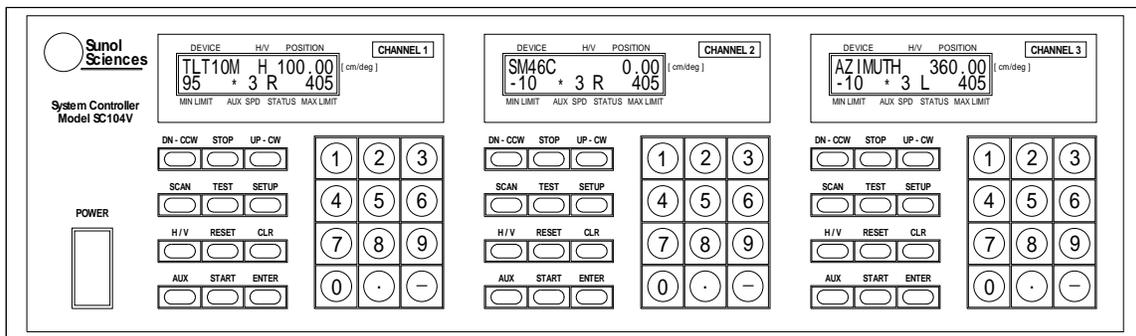
Figure 1-SC110VPC – Three Channels

SC110V-Ed.03
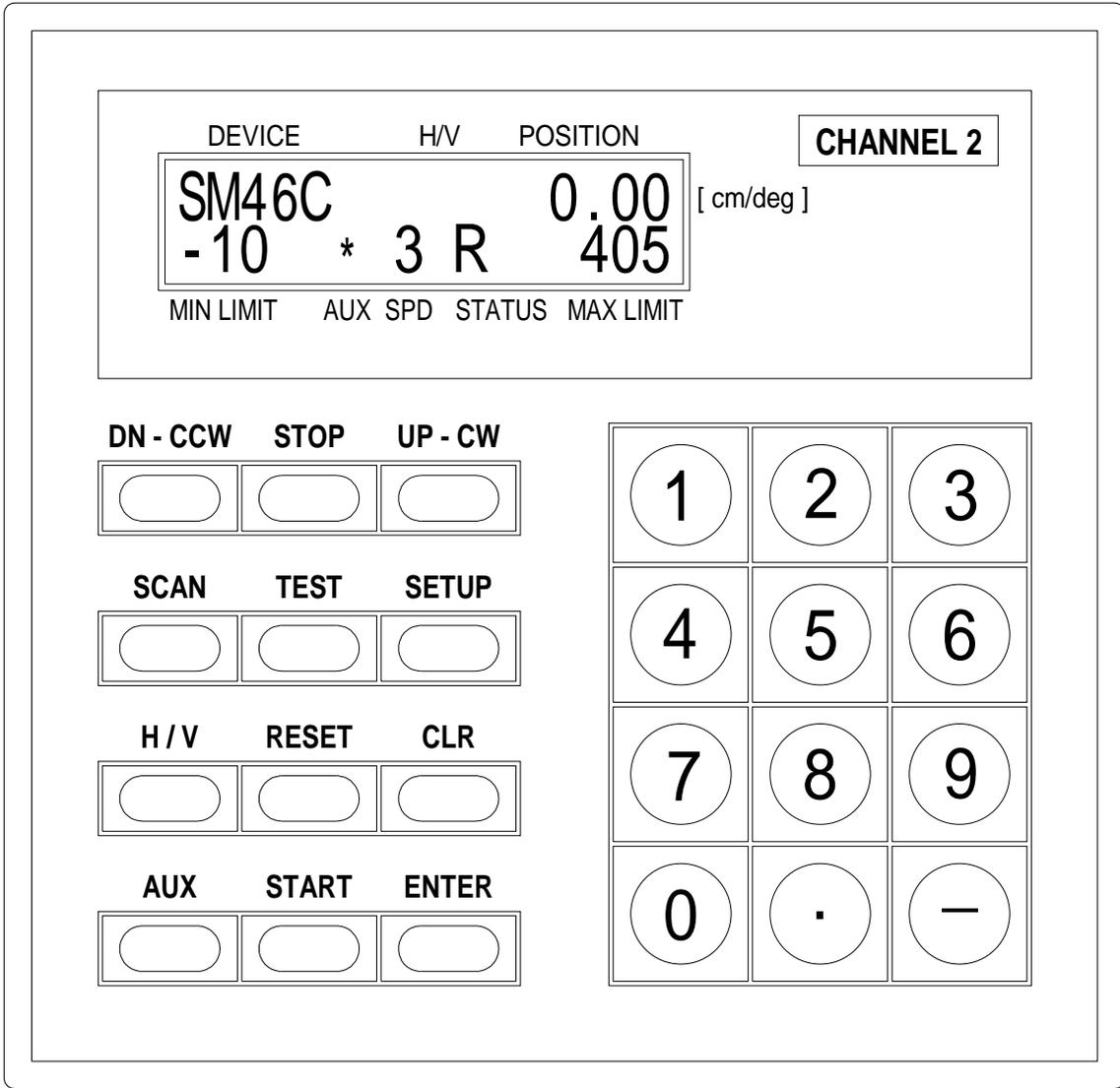
Figure 1-B SC10VPC - One Channel

2.1 Controller Description

The SC110V Positioner Controller (PC) can be ordered with up to three independent channels. Each channel can be configured to control any type of Sunol Positioner made for EMC testing. All controls are located on the front panel. Connections to SC110V PC are made into the back panel. Each channel connects a Positioner, a toggle switch through a fiber optic cable and a triggering output (TTL) through a BNC connector, as well as a GPIB controller. The displayed menu shows what parameters are applied to your equipment .

2.2 Front Panel Features and Controls

Each channel of the SC110V PC features the keypad and the liquid crystal display (LCD).

2.2.1 Keypad Description

The SC110V PC channel keypad has two components: numeric keypad, and function keys.

Numeric Keypad

The numeric keypad consists of the digits 0 through 9, a (–) key, and a decimal key. Keys 0 through 3 can also be used to change the Positioner motion speed during motion.

Function Keypad

The function keypad consists of several keys and the label of each key appears on the front panel.

DN-CCW

Moves the Positioner in a downward (or CCW) direction or scrolls through menu options after SETUP key has been pressed.

STOP

Stops the Positioner motion or exits SETUP.

UP-CW

Moves the Positioner in a upward (or CW) direction or scrolls through menu options after SETUP key has been pressed.

SCAN

Starts the pre configured scan.

TEST

Tests the Positioner connection and interfaces.

SETUP

Activates the menu selection (see DN-CCW and UP-CW).

H/V

Changes the position of the Antenna mounted on the Positioner from vertical to horizontal and vice versa.

RESET

This is a hardware reset key. It reinitialize GPIB , and clears the accumulated over-shoot calibration values.

CLEAR

Clears the numeric entry during SETUP and clears

run time error message from the display.

AUX
Toggles any switch connected, via fiber optic, to the AUX output connector.

START
This key , in conjunction with the numeric keys, moves the Positioner to a position specified by the numeric key entries.

ENTER
Acknowledges the selected Positioner type or numerical entry in SETUP menu.

2.2.2 Liquid Crystal Display

The SC110V PC Liquid Crystal Display (LCD) displays the current parameters, entries, and any change in the current positions. The LCD is divided into eight fields.

DEVICE
This field displays the Positioner name.

H/V
This field works in conjunction with the Positioner type. The field is clear if the Positioner does not support vertical motion. If the Positioner supports vertical motion, this field displays "H" when the mounted Antenna on the Positioner is in horizontal position, or displays "V" when the Antenna is in vertical position.

POSITION
This field displays the Positioner current position.

MIN LIMIT
This field displays the minimum soft limit. The minimum soft limit is a position limit that blocks the Positioner from moving below this position limit.

AUX
This field displays the status of the toggle switch connected to the AUX connector. When this field is cleared, the toggle switch is off, and when it displays an "*", the toggle switch is on.

SPD
This field displays the current selected speed, 0,1,2, or 3 of the Positioner. 0 is the lowest is speed and 3 is the highest speed.

STATUS
This field consists of three character spaces. From the left, the first space displays "L", Local when the SC110V PC is in local mode or displays "R ", remote when the SC110V PC is in communication with a software application over GPIB bus. The second and the third character spaces are clear or display a run time error, E#; where # is a digit from 1 to 6 to represent the type of error.

MAX LIMIT
This field displays the maximum soft limit. The maximum soft limit is a position limit that blocks the Positioner from moving above this position limit.

Section 3 - Features and Operation

3.1 Positioner Types

1- B-sight Tilt 3M (TLT3M)
A Boresight antenna-positioning tower set to Boresight at 3 m EUT distance.

2- B-sight Tilt 5M (TLT5M)
A Boresight antenna-positioning tower set to Boresight at 5 m EUT distance.

3- B-sight Tilt 10M (TLT5M)
A Boresight antenna-positioning tower set to Boresight at 10 m EUT distance.

4- B-sight no tilt (NO-TLT)
A Boresight antenna-positioning tower set to non-Boresight.

5- TWR95/99
A standard antenna positioning tower.

6- Flush mount TT (FMTT)
A metal turntable with a deck flushed with ground plane.

7- Surface mount TT (SMTT)
A surface mount, non-conductive turntable lying on top of the ground plane.

8- Elevation (Elev/Roll)
Elevation / Roll Positioner

9- Azimuth (Az)
Azimuth Positioner

10- Hemi
Hemi Positioner

3.2 Setup Menu

Linear Positioners

L.1 488 Address
Each channel of the SC110V PC must be assigned a unique GPIB address. This address is a number in the range 1 to 30. The GPIB controller uses this address to communicate with the SC110V PC.

L.2 Positioner name
The first line displays the Positioner name and the second line displays the message "Use UP-DN-ENTER". The message in the second line guides the user to use UP or DN key to step through the listed Positioner names and then use ENTER key to acknowledge the selected Positioner name. After the user presses ENTER key, a new guide message appears "Press UP/DN/STOP". The user has the option either to press STOP key to exit the Setup menu or press UP or DN key to continue to the next configurable parameter.

L.3 Ant. cal. Point
The antenna calibration point is a distance from the front-trolley pivot point to the calibration point of a mounted antenna. Only three values are allowed: 61,120, or 150 cm. This configuration only appears if the Positioner under configuration is a Boresight tilt.

L.4 Current position
The current position is the current position of the Positioner.

L.5 Soft min. limit
The minimum soft limit is a position limit that blocks the Positioner from moving below this position limit.

L.6 Soft max. limit
The maximum soft limit is a position limit that blocks the Positioner from moving above this position limit.

L.7 Ver. min. limit
The minimum vertical limit is a position limit that blocks the Positioner from moving below this position limit when the mounted Antenna on the Positioner is in vertical position. This configuration appears when the Positioner under configuration is either Boresight or Standard Tower.

L.8   Ver. max. limit
        The maximum vertical limit is a position limit that blocks the Positioner from
        moving below this position limit when the mounted Antenna on the Positioner
        is in vertical position. This configuration appears when the Positioner under
        configuration is either Boresight or Standard Tower.

L.9   Speed [0..3]
        This option allows the user to select one of the four predefined speeds. Speed
        zero is the lowest speed.

L.10   S.T.O [5..6] sec
        The safety time out is the amount of time within which the Positioner under
        control must update the position, otherwise the SC110V PC declares the
        Positioner in abnormal condition and E1 message is displayed on STATUS
        field and a stop command is sent to the Positioner. The default value is 5
        seconds.

L.11   OSC yes/no 1/0
        The over-shoot or under-shoot correction is an option which enables the
        SC110V PC to participate in minimizing the over/under-shoot. It takes two
        sweeps of motion for each speed for the SC110V PC to learn how to
        minimize the over/under-shoot.

L.12   Tolerance [0..2]
        The tolerance value is 0,1,or 2 cm/degree within which the under-shoot is
        acceptable. under-shoot correction works well with MOVE TO, GOTO, or
        SCAN command, in that the SC10V PC issues the stop command and not the
        user. This option works in conjunction with OSC option. For example, when
        the Tolerance value is 2; if the user issues a command "GOTO 100", the
        SC110V PC would accept if the Positioner stops at 98. On the other hand,
        when the Tolerance is 0, the SC10V PC wouldn't allow to the Positioner to
        stop below the 100.

L.13   Scan min. limit
        The Scan minimum limit is a position limit that blocks the Positioner from
        moving below this position limit during a scan function. The scan minimum
        limit must be selected within the soft limits and must be smaller than the scan
        maximum limit.

L.14   Scan max. limit
        The Scan maximum limit is a position limit that blocks the Positioner from
        moving above this position limit during a scan function. The scan maximum
        limit must be selected within the soft limits and must be greater than the scan
        minimum limit.

L.15   Scan cycle(s)
        The Scan cycle is the number of sweeps the Positioner makes between the
        scan limits. The Scan function sends the Positioner to the Scan minimum
        limit position, then from there the Positioner moves back and forth between
        the min-max scan limits until the scan cycle becomes zero. The cycle is one
        direction only.

L.16   Trig. on/off 1/0
        The user uses this option to send a TTL triggering pulse to the NBC
        connector every n.n change in the position (Trig. Freq.) . The triggering pulse
        is used as an external trigger to a Spectrum analyzer or other device.

L.17   Trig. freq
        The triggering frequency is the amount of change in the position that makes
        the SC110V PC puts a triggering pulse on the NBC connector.

L.18   Trig. min. limit
        This is the triggering minimum limit position. Below this value, the SC110V
        PC stop sending triggering pulses. The minimum limit could be the start
        triggering position and from there any n.n increment in the position would
        make the SC110V PC put a triggering pulse on the NBC connector.

L.19   Trig. max. limit
        This is the triggering maximum limit position. Above this value, the SC110V
        PC stops sending triggering pulses. The maximum limit could be the start
        triggering position and from there any n.n decrement in the position would
        make the SC110V PC put a triggering pulse on the NBC connector.

L.20   LCD Speed ON/OFF
        This option remains off during normal operation. This option is turned on to
        observe the positioner speed (cm/m).

Angular Positioners

A.1   488 Address
      Each channel of the SC110V PC must be assigned a unique GPIB address.
      This address is a number in the range 1 to 30. The GPIB controller uses this
      address to communicate with the SC110V PC.

A.2   Positioner name
      The first line displays the Positioner name and the second line displays the
      message "Use UP-DN-ENTER". The message in the second line guides the
      user to use UP or DN key to step through the listed Positioner names and then
      use ENTER key to acknowledge the selected Positioner name. After the user
      presses ENTER key, a new guide message appears "Press UP/DN/STOP". The
      user has the option either to press STOP key to exit the Setup menu or press
      UP or DN key to continue to the next configurable parameter.

A.3   Current position
      The current position is the current position of the Positioner.

A.4   Limit On/Off 1/0
      The Limit On option imposes the soft limits on the Positioner motion. The
      Positioner can't move beyond the Soft limit. The Limit Off option removes the
      soft limits restriction on the Positioner motion. *This option is not applicable to
      the Tilt Positioner and the Standard Tower. The user must ensure that this
      option wouldn't cause cabling damage*.

A.5   Soft min. limit
      The minimum soft limit is a position limit that blocks the Positioner from
      moving below this position limit.

A.6   Soft max. limit
      The maximum soft limit is a position limit that blocks the Positioner from
      moving above this position limit.

A.7   Speed [0..3]
      This option allows the user to select one of the four predefined speeds. Speed
      zero is the lowest speed.

A.8   S.T.O [5..6] sec
      The safety time out is the amount of time within which the Positioner under
      control must update the position, otherwise the SC110V PC declares the
      Positioner in abnormal condition and E1 message is displayed on STATUS
      field and a stop command is sent to the Positioner. The default value is 5
      seconds.

A.9   OSC yes/no 1/0
      The over-shoot or under-shoot correction is an option which enables the
      SC110V PC to participate in minimizing the over/under-shoot. It takes two
      sweeps of motion for each speed for the SC110V PC to learn how to
      minimize the over/under-shoot.

A.10 Tolerance [0..2]
      The tolerance value is 0,1,or 2 cm/degree within which the under-shoot is
      acceptable. under-shoot correction works well with MOVE TO, GOTO, or
      SCAN command, in that the SC10V PC issues the stop command and not the
      user. This option works in conjunction with OSC option. For example, when
      the Tolerance value is 2; if the user issues a command "GOTO 100", the
      SC110V PC would accept if the Positioner stops at 98. On the other hand,
      when the Tolerance is 0, the SC10V PC wouldn't allow to the Positioner to
      stop below the 100.

A.11   Scan min. limit
        The Scan minimum limit is a position limit that blocks the Positioner from
        moving below this position limit during a scan function. The scan minimum
        limit must be selected within the soft limits and must be smaller than the scan
        maximum limit.

A.12   Scan max. limit
        The Scan maximum limit is a position limit that blocks the Positioner from
        moving above this position limit during a scan function. The scan maximum
        limit must be selected within the soft limits and must be greater than the scan
        minimum limit.

A.13   Scan cycle(s)
        The Scan cycle is the number of sweeps the Positioner makes between the
        scan limits. The Scan function sends the Positioner to the Scan minimum
        limit position, then from there the Positioner moves back and forth between
        the min-max scan limits until the scan cycle becomes zero. The cycle is one
        direction only.

A.14   Trig. on/off 1/0
        The user uses this option to send a TTL triggering pulse to the NBC
        connector every n.n change in the position (Trig. Freq.) . The triggering pulse
        is used as an external trigger to a Spectrum analyzer or other device.

A.15   Trig. freq
        The triggering frequency is the amount of change in the position that makes
        the SC110V PC puts a triggering pulse on the NBC connector.

A.16   Trig. min. limit
        This is the triggering minimum limit position. Below this value, the SC110V
        PC stop sending triggering pulses. The minimum limit could be the start
        triggering position and from there any n.n increment in the position would
        make the SC110V PC put a triggering pulse on the NBC connector.

A.17   Trig. max. limit
        This is the triggering maximum limit position. Above this value, the SC110V
        PC stops sending triggering pulses. The maximum limit could be the start
        triggering position and from there any n.n decrement in the position would
        make the SC110V PC put a triggering pulse on the NBC connector.

A.18   LCD Speed ON/OFF
        This option remains off during normal operation. This option is turned on to
        observe the positioner speed (deg/m).

3.3 Units and Data Formats

Units:

All units are in degrees (deg) except Tilt and Tower units are in centimeters (cm).

Data Formats:

Soft limits, Scan limits, Scan cycles, Vertical limits, EUT distance, and Calibration points are whole numbers. Current position, Triggering limits, Triggering frequency, and Target position are a whole or a mixed number

3.4 Continuous Rotation

The user enables the continuous rotation feature by setting the SC110V PC to continuous rotation "limits off" and removing the hard limits attached to the motor. Setting the limits to off, overrides the soft limits. When the SC110V PC is set to continuous rotation, the soft limits disappear from the LCD and when positioner crosses zero position, the position changes from 0 to 359.99 instead of 0 to –0.01 , and the position changes form 359.99 to 0.00 instead to 360 .

Continuous Rotation is not applicable to the Tilt Positioner and Tower positioners.

The user must ensure that this Continuous Rotation wouldn't cause cabling damage.

3.5 GPIB Operation

SC110V PC is configured to respond in compliance with IEEE Std. 488.2-1992.

3.5.1 Address

Each channel of SC110V PC must be assigned a unique address in the range 1 to 30.

3.5.2 Command Format

The SC110V PC command is composed of sequences of capital letters A to Z and is called a string. More than one command can be cascaded in one string and a space within the string separates the commands from each other. For example, if the user wants to set the soft limits in one command string. A line feed may be used as a string terminator but is not required.

Read Command

The read command is a string that is not followed by a numerical string. For example, reading the current position "CP", reading lower soft limits "LL", or reading the polarization "P?". A numerical string terminated by line feed is returned back in response to a read command.

Write Command

The write command is a string that is followed by a numerical string. For example, setting the current position to 125 is "CP 125", where 125 is a numerical string.

3.5.3 Standard Commands for Programmable Instruments (SCPI)

*CLS
Clear status command

*ESE <NRF>
Set *Standard Event Status Enable register* to NRF.. NRF is an ASCII numeric value in the range 0 to 255.

*ESE?
Get *Standard Events Status Enable register*. It returns the ASCII representation of a numerical value in the range 0 to 255.

*ESR?
Get *Standard Events Status Register*. It <u>returns</u> the ASCII representation of a numerical value in the range 0 to 255 and <u>clears</u> *Standard Events Status Register*.

*IDN?
Get *the Identification*. It returns a string organized into four fields separated by commas.

Field 1: Manufacturer
Field 2: Model
Field 3: Serial number   ASCII character 0 if not available
Field 4: Firmware   ASCII character 0 if not available
For example firmware version 2, the response is "SC,104V,0,02"

*OPC
Operation Complete. The *OPC command is not applicable and it does nothing

*OPC?
Ge*t Operation Complete*. It returns the ASCII character 1 if the Positioner is in stall or the ASCII character 0 if in motion.

*RST
Reset command. Clears the status command.

*SRE <NRF>
SET *Service Request Enable register* to NRF. NRF is a ASCII numerical value in the range 0 to 255.

*SRE?
Get *Service Request Enable register*. It returns the ASCII representation of a numerical value in the range 0 to 255.

STB?
Get *Status Byte register*. It returns the ASCII representation of a numerical value in the range 0 to 255.

TST
Perform *Self-Test*. The SC110V PC tests the Tx/Rx fiber optic links, the interface, the Positioner hard limits as well as the motor status.

TST?
Get Self-Test result. The SC110V PC returns the result of a previous conducted test. The result is an ASCII numerical value 1 if the test passes or a different value if the test fails. Section 2.4.2.2 describes the meaning for the returned value.

WAI {SC10VPC usage}
Wait-to-continue. The command does nothing because any preceding sequential command would complete execution before the parser parses and executes the next command (including the *WAI* command). *However, this command is used to stop the SC110V PC from sending the change in the current position to the LCD during motion. The LCD is updated at the targeted position when the Positioner comes to the stall state*.

3.5.4 SC110V PC Commands
The SC110V PC Communicates over GPIB and recognized the commands list in section 2.5.

3.5.5 Serial Polling and IEEE 488.2 Standard Status Structures

Standard Event Status Register (SESR)	*Standard Event Status Enable Register (SESER)*
D7: Power On	D7:
D6: User Request	D6:
D5: Command Error	D5:
D4: Execution Error	D4:
D3: Device Dependent Error	D3:
D2: Query Error	D2:
D1: Request Control	D1:
D0: Operation Complete	D0:

Status Byte Register (SBR)	*Service request Enable Register (SRER)*
D7: Unused	D7
D6: *RQS/MSS*	D6

D5: *ESB*   D5
D4: MAV   D4
D3: Motion direction   D3
D2: Trigger assert/deassert (1/0)   D2
D1: Enable/disable triggering (1/0)   D1
D0: motion/stall (1/0)   D0

$X[7..0] = SESR\ [7..0]\ \&\ SESER[7..0]$
$Y[7..0] =\ SBR\ \ [7..0]\ \&\ SRER\ \ [7..0]$
$SBR[6] = RQS/MSS=$ Logical OR $Y[7..0]$
$SBR[5] = ESB =$ Logical OR $X[7..0]$
$SBR[4] = MAV =$ Queue Not-Empty

The RQS bit indicates the device has requested service by asserting the *SRQ* line. The *ESB* indicates that one of the standard events defined in the Standard Event Status Register has occurred. By setting the corresponding bits in the Standard Event Status Register, you define which standard events will set the *ESB*. The *MAV* bit indicates whether a message is available in the output queue. By setting the corresponding bits in the Service Request Enable Register, you can configure the SC110V PC to assert the *SRQ* line based on the bits of its status register.

IEEE 488.2 defines a dual role for the *RQS* bit. This bit is also known as the Master Summary Status (*MSS*) bit. The *MSS* bit indicates whether there is at least one reason for the instrument to request service. The status of this bit is returned only in response to the status byte (*STB*) query and in response to a serial polling.

3.5.6 SC110V PC Events
Standard Event and status byte describes the events supported by SC110V PC. The corresponding bit in the enable register enables each event.

Status Byte Definition

B0: Motion
    0: stalled
    1: in motion
B1: Triggering
    0: disabled
    1: enabled
B2: Triggering event
    0: de-asserted
    1: asserted
B3: Motion direction
    0: decrement

1: incremental
B4: Message available
    0: no message
    1: there is a message
B5: Standard event status
    0: either no event(s) or event(s) are disabled
    1: event(s) occurred that has (have) been previously enabled.
B6: Service request for B0, B1, B2, B3, B4, B5, or/and B7
    0: either no event(s) occurred or no service(s) request enabled
    1: service(s) is (are) requested
B7: not used

To enable service request for event(s), use the command "*SRE <NRF>" as
follow:

*SRE 1   Requests service for motion
*SRE 4   Requests service for triggering event
*SRE 5   Requests service for motion and triggering events
*SRE 37 Requests service for motion, triggering and standard events

Standard Event Status Definition

B0: Operation complete
    0: in motion
    1: stalled
B1: Request control
    0: in control
    1: moving against control
B2: Query error
    0: normal
    1: GPIB parser is overflowed with commands
B3: Device Dependent error
    0: normal
    1: Positioner is not responding for motion commands or blocked by hard
        limits.
B4: Execution error
    0: motion is achieved
    1: motion is not achieved due soft limits or vertical limits.
      Also this bit is set as a result of trying to change the polarization from
      horizontal to vertical while the antenna beyond the vertical limits.
B5: Command error
    0: command is valid
    1: command is invalid
B6: not used
B7: Power on
    0: no power cycling or reset is occurred since the last read

1: power cycling or reset is occurred and the event not yet read.

To enable event(s), use the command "*ESE <NRF>" as follow:
*ESE 32Enables command error event
*ESE 16Enables execution error event
*ESE 48Enables command and execution error events

If the standard event(s) is (are) enabled and the event(s) occurred, B5 (Standard event status), would be set and in turn if the service request of B5 was enabled, B6 (Service request) would be set.

Section 4 - Maintenance

4.1 Calibration

Changing the current position from the front panel or by GPIB command without changing the physical position of the Positioner tends to desynchronize the Positioner with the SC110V PC. In turn, the hard limits may become an obstructer to the Positioner motion. This case is called hard limit and position inconsistency. To remove the inconsistency without having to adjust the hard limits, perform the following:

Press *STOP* key.
Set the *Current Position* to 0
Set the *Soft min. limit* to –600 and the *Soft max. limit* to 600 .
Press *STOP* key. Now, –600 is displayed on lower left corner of the LCD display field, 600 is displayed on lower right corner of the LCD display field, and 0 on the current position field.
Press *UP-CW* key. The Positioner will start moving,
Wait until the motion stops. This indicates that *UP-CW* hard limit is activated.
Set the *Current position* to zero.
Press *DN-CCW* key, the Positioner would start moving,
Wait until the motion stops. This indicates that *DN-CCW* hard limit is activated.
Record the *current position*. Let's assume you recorded N(current position)=480
If the type of Positioner you are calibrating moves vertically, apply case 1 otherwise apply case 2

Case 1: Vertical motion such as Tower

The distance allowed for Tower to move within is 400 cm. Therefore, the hard limits departure is 480-400 = 80. Each hard limit sets 40 cm away from the moving range.
Set the current position to -40
Set the *Soft min. limit* to 100
Set the *Soft max. limit* to 400
Set the *Ver. min. limit* to 100 (restricted by the room's floor)
Set the *Ver. max. limit* to 400 (restricted by the room's roof)

Case 2: Horizontal motion such as Table

The distance allowed for Table to move within is 360 degree. Therefore, the hard limits departure is 480-360 = 120. Each hard limit sets 60 degree away from the moving range.
Set the current position to -60
Set the *Soft min. limit* to 100
Set the *Soft max. limit* to 360

4.2 Self-Test

The self-test can be done either from the front panel or by send sending "*TST" command over GPIB bus.

Front Panel Test

Press the TEST key. The SC110V PC executes a test procedure by which it tests the Tx/Rx fiber optic links, the interface, the Positioner hard limits as well as the motor status.
A sequence of messages are displayed in each section of the test procedure. Pressing STOP Key would abort the test and quit execution at the end of the aborted section.

GPIB Command Test

Sending "*TST" command string is similar to pressing TEST key from the front panel. The test takes approximately 5 – 10 seconds to finish and reports the result. The software can obtain the test result by sending "*TST?" command. The SC110V PC returns a byte which contains 1 for success or different for failure. Each bit in the returned byte symbolizes an encounter error as explained in the byte bits pattern next .

| D15|D14|D13|D12|D11|D10|D9|D8|D7|D6|D5|D4|D3|D2|D1|D0|

D1: Fiber optic link is down or the Positioner has power outage.
D2: Hard limit for positive direction is obstructing the motion in this direction.
D3: Hard limit for negative direction is obstructing the motion in this direction
D4: Encoder or motor is missing.
D5: Motor connection is reversed
D6: Encoder is damaged
D7: Circuitry timing problem.

<div align="center">Test Byte Bits Pattern</div>

4.2.3 Interpretation of Self Test Code Errors

Code error (hex)   Meaning

Code error (hex)	Meaning
02	Fiber optic link is down
04	Hard limit for positive direction is active
08	Hard limit for negative direction is active
0C	Hard limit for positive and negative directions are active
10	Encoder or motor is missing
20	Motor connection is reversed

40   Encoder is damaged timing error

4.2.4 Run Time Error
The LCD displays the run time errors in the status field.

Error Meaning

E1: Positioner is not responding to motion command, motion is blocked by hard
limits or communication link is out of ordered.
E2: Positive motion (increment) is requested, but negative motion (decrement)
detected.
E3: Negative motion (decrement) is requested, but positive motion (increment)
detected.
E4: GPIB parser overflowed with commands.
E5: The Positioner is stalled at the soft limit and received a command to move
beyond the limit.
E6: The antenna mounted on the Positioner is beyond the vertical limit and
received a command to change polarization from horizontal to vertical.

Note:
 A diagnostic software for test and calibration is posted on Sunol Sciences web site
 http://www.sunolsciences.com

Section 5 - SC110V PC GPIB Command List

5.1 Command List

COMMAND	MEANING
ST	stops motion
CP	reads/writes the current position
GOTO nn.nn	moves to nn.nn position
UP or CW	starts motion in positive direction
DN or CC	starts motion in negative direction
PV	rotates the antenna to vertical position
PH	rotates the antenna to horizontal position
P?	reads antenna polarization. 0 (vertical) or 1(horizontal)
UL	reads/writes the upper limit
WL	reads/writes the upper limit
LL	reads/writes the lower limit
CL	reads/writes the lower limit
SP	reads/writes the motion speed
SC	scans n cycle(s) between SUL and SLL limits
SUL	writes the upper limit of scanning
SLL	writes the lower limit of scanning
SCY	reads/writes the number of cycle(s) . One cycle n= 2; ½ cycle n =1
*OPC?	It returns 1 if the Positioner is in stall or 0 if in motion.
AUX	reads/writes the status of aux channel. 1/0 = on/off
VU	reads/writes the vertical upper limit
VL	reads/writes the vertical lower limit
CL	similar to the above
TS	reads/writes the triggering state. 1/ 0 = enabled / disabled
TPF	reads/writes the triggering frequency
TPH	reads/writes the triggering upper limit
TPL	reads/writes the triggering lower limit
CR	reads/writes the continuous rotation state. 0/ 1 = enabled / disabled *
EUT	reads/writes the EUT distance
ACP	reads/writes the Antenna Calibration Point
OSC	reads/writes the over-shoot correction. 1/ 0 = enabled / disabled
TOL	reads/writes the tolerance . Value is 0,1 or 2

A read/write command followed by a value means write the value .A read/write
command by itself means read a value.
* Limits on/off (1/0) = CR disabled/enabled (1/0)

5.2 Programming The SC110V PC

5.2.1 Sample program

```
1    !*******************************************************************************
2    !This program moves the equipment  in positive  and  negative directions in a specific distance
3    ! increment.  When it reaches the target distance, stop command is issued, then waits for operation
4    ! complete flag to be set which indicates the equipment is in stall state. The program loops 500 times.
12   ! Written by: Amin Shamsan
13   ! *******************************************************************************
20   ASSIGN @Adrs TO 1420
30    CLEAR SCREEN
40    CLEAR @Adrs
50    REMOTE @Adrs
60    Maxup=180
70    Distance=60
80    Posi=0
90    High=300
100   Mindn=-181
110   Low=0
120    OUTPUT @Adrs;"CP"&VAL$(Posi)&CHR$(10)
130    OUTPUT @Adrs;"LL"&VAL$(Low)&CHR$(10)
140    OUTPUT @Adrs;"UL"&VAL$(High)&CHR$(10)
160   FOR Loop1=1 TO 500 STEP 1
170      Increment=Increment+Distance
171  New_targ_inc:    OUTPUT @Adrs;"UL "&VAL$(Increment)&CHR$(10)
180      OUTPUT @Adrs;"UP"&CHR$(10)
190  Get_pos_inc:    OUTPUT @Adrs;"CP"&CHR$(10)
200      ENTER @Adrs;Here8$
210      Here8up=VAL(Here8$)
220      PRINT "Ch1 : ";Here8up;"UP now  ; ";" Prev.DN: ";Here8dn;" LOOP#:";Loop1;"Inc:";Increment
230      IF Here8up<Increment THEN
240      GOTO Get_pos_inc
250      END IF
260      OUTPUT @Adrs;"ST"&CHR$(10)
261      Wait1_:WAIT .01
270      OUTPUT @Adrs;"*OPC?"&CHR$(10)
280      ENTER @Adrs;Here8$
290      Stat=VAL(Here8$)
300      IF Stat=0 THEN
301      GOTO Wait1_
310      END IF
320      Increment=Increment+Distance
330      IF Increment<Maxup+1 THEN
340      GOTO New_targ_inc
350      END IF
360      Increment=Maxup-Distance
370      !***************************
371  New_targ_dec     OUTPUT @Adrs;"LL "&VAL$(Increment)&CHR$(10)
380      OUTPUT @Adrs;"DN"&CHR$(10)
390  Get_pos_dec:    OUTPUT @Adrs;"CP"&CHR$(10)
400      ENTER @Adrs;Here8$
410      Here8dn=VAL(Here8$)
```

```
420     PRINT "Ch1 : ";Here8dn;"DN now  ; ";" Prev.up : ";Here8up;"LOOP#: ";Loop1;"Inc:";Increment
430     IF Here8dn>Increment THEN
440     GOTO Get_pos_dec
450     END IF

460     OUTPUT @Adrs;"ST"&CHR$(10)
461 Wait2_:     WAIT .01
470     OUTPUT @Adrs;"*OPC?"&CHR$(10)
480     ENTER @Adrs;Here8$
490     Stat=VAL(Here8$)
500     IF Stat=0 THEN
510     GOTO Wait2_
520     END IF
530     Increment=Increment-Distance
540     IF Increment>Mindn THEN
550     GOTO New_targ_dec
560     PRINT "NEXT LOOP: ";Loop1
570     END IF
580     NEXT Loop1
590     PRINT "*********** GOODBYE********"
  END
```

5.2.2 Increasing Throughput over GPIB BUS

To increase the throughput over GPIB bus, you must inform the SC110VPC to stop updating the LCD every time changes occurs in position during GPIB communication. In this case the SC110V PC would change update the LCD at every transition between motion and stall state.

Example:

```
DIM Out$[60]
Out$=”*WAI  “&VAL$(1) &CHR$(10)
OUTPUT address;Out$
```

Where CHR$(10) is a line feed string and it's an optional command string terminator.

5.2.3 String with Multi-Commands
Set the Soft minimum limit to 95, set the soft maximum limit to 405, set the current position to 100 and move upward "increment direction".

```
DIM Out$[60]
Out$=”LL “&VAL$(95) & “ UL “&VAL$(405)&” CP ” &VAL$(100)
Out$= Out$ & “ UP “&CHR$(10)
OUTPUT address;Out$
```

Set the Soft minimum limit to 95, set the soft maximum limit to 405, set the current position to 100, move upward "increment direction" and return the current position.

Out$="LL "&VAL$(95) & " UL "&VAL$(405)&" CP " &VAL$(100)
Out$= Out$ & " UP "& " CP "&CHR$(10)
OUTPUT address;Out$
ENTER address;Out$

5.2.4 Command String Length
In case of multi-command string, the maximum length of the string including the line feed terminator must not exceed 40 characters.