# APC100 ANTENNA PROGRAMMABLE CONTROLLER OPERATION AND MAINTENANCE MANUAL

## AP/N - OM100

## SOFTWARE VERSION 2.11

**(February 1995)**

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# CHAPTER 1

# INTRODUCTION

## A. Purpose of Manual

This manual provides information on the operation and maintenance of the APC100. The material provided is for personnel responsible for monitoring and controlling the operation of a Satellite Earth Station.

## B. Manual Layout

This manual is organized into the following chapters:

Chapter 1 - “Introduction” discusses the purpose and layout of the manual as well as the conventions used throughout. The Technical Services Hotline number is provided.

Chapter 2 - “General System Description” outlines unit specifications, interfaces and provides general unit information.

Chapter 3 - “Theory of Operation” describes device hardware and software.

Chapter 4 - “Installing the APC100" provides procedures for installing the APC100.

Chapter 5 - “General Operation” discusses general operation of the unit.

Chapter 6 - “APC100 Hardware” provides a brief functional description of APC100 component parts.

Chapter 7 - “APC100 Communications Protocol” describes software protocol for the unit.

Chapter 8 - “Drawings and Schematics” provides assembly drawings and schematics for the APC100.

Chapter 9 - “Parts Lists” provides parts lists for the APC100. Ordering information is also provided.

Appendix A - “APC100 Setup to SNG 2.3/2.4 Meter Antennas” describes procedures for setting up the APC100 to an SNG antenna.

## C. Unit Specifications

Unit specifications are as follows:

### 1. Physical Description

| | |
|---|---|
| Dimensions: | 1.75" high (1 rack unit)<br>19.0" wide<br>8" deep |

### 2. Electrical

| | | | |
|---|---|---|---|
| ** | a) | Rev.-002 | 115 Volts AC ± 10%, 60/50Hz single phase |
| *** | b) | Rev.-003 | 95-265 Volts AC, 60/50/Hz single phase |
| | c) | | 75 VA maximum |
| | d) | | Power Connection: 3-wire, removable power cord |
| | e) | | Fused AC power-line |
| | f) | | RFI/EMI in-line filter |
| | g) | | Transient protection |

### 3. Environmental

| | | | |
|---|---|---|---|
| | a) | | 0° to 40° Celsius (32° to 104° Fahrenheit) operating |
| | b) | | -40° to 75° Celsius (-40° to 167° Fahrenheit) storage |
| | c) | | 95% humidity non-condensing |
| | d) | | Shock and vibration as encountered in an on-road vehicle |
| ** | | APC100, | Andrew P/N AE01A-D0182 through AE01A-D0182-002 |
| *** | | APC100, | Andrew P/N AE01A-D0182-003 |

## D. Customer Support

For part ordering information, call the Customer Service Center at 1-800-255-1479, 7:30 am - 5:30 pm CST. For 24 hour emergency assistance and technical support, call Technical Services Hotline in Orland Park, Illinois at 1-708-349-5900.

# CHAPTER 2

# GENERAL SYSTEM DESCRIPTION

## A. Introduction

The Andrew Programmable Antenna Controller, APC100, is designed to permit manual or automatic positioning of an earth station antenna from a distant location. The basic APC100 features are:

Manual bidirectional jogging of all antenna axes.

Positioning the antenna to a set of entered coordinates.

Positioning the antenna to previously stored satellite pointing angles.

Selectable RS232C or RS422A remote communications interface port allows for APC100 operation from a suitable remote control device.

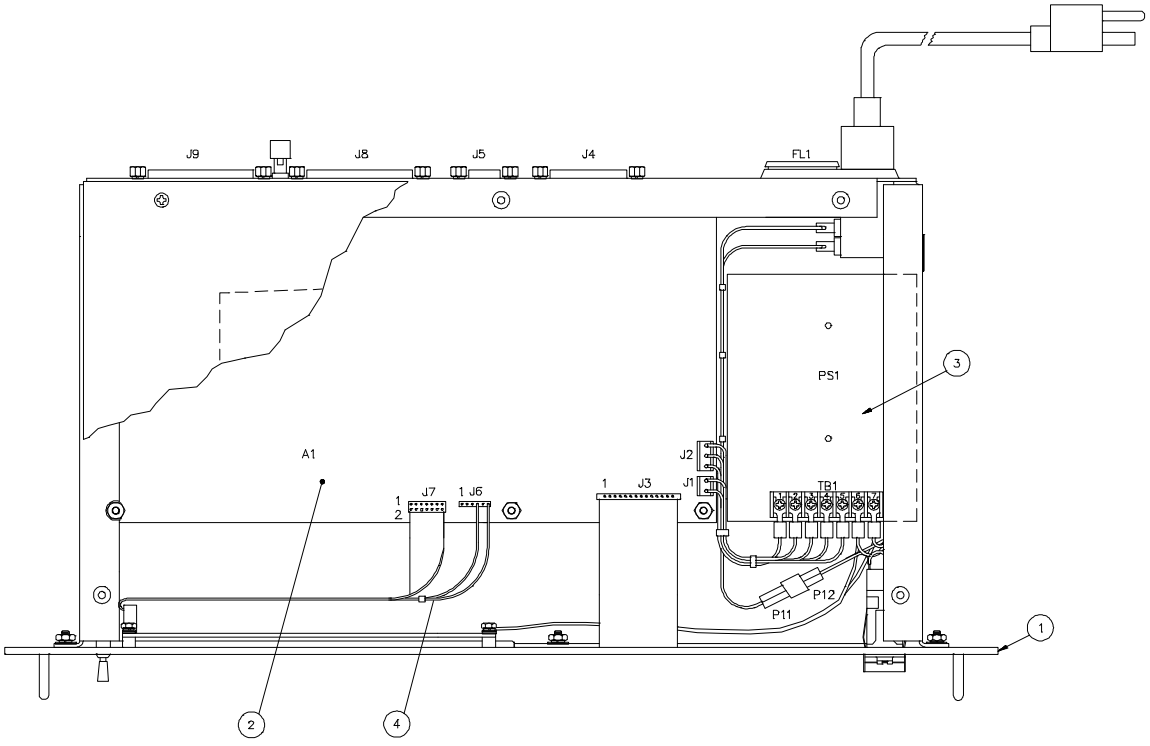



**Figure 2-1** APC100 Cutaway View From Top (AE01A-D0182 and AE01A-D0182-002)
**NOTE: DRAWING FOR REFERENCE ONLY**

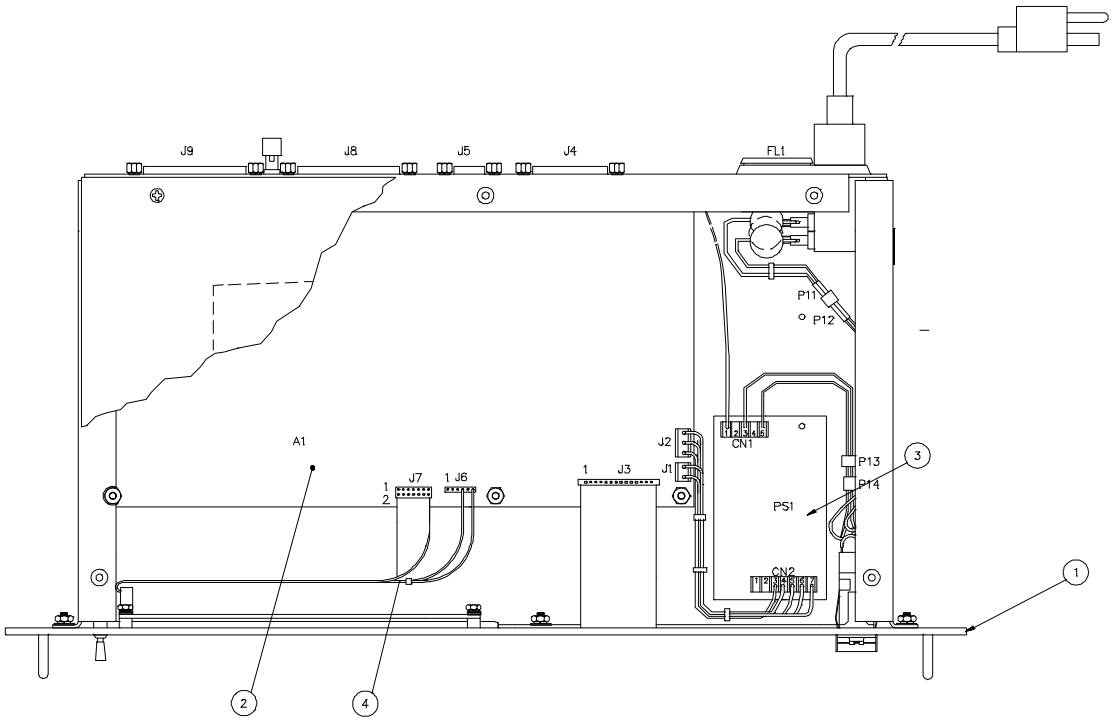



**Figure 2-2** APC100 Cutaway View From Top (AE01A-D0182-003)

## B. Front Panel Description

The front panel is functionally divided into four groups. Refer to **50** for an illustration of the front panel keyboard.

**POWER SWITCH** - Switches AC power to the controller. This switch has a safety cover to prevent accidental actuation.

**REMOTE/LOCAL CONTROL SWITCH** - Switches between local operation from the keypad to remote operation from the serial port. The switch is a 'locking-lever' switch which has a special Pull-to-unlock feature.

> **NOTE: Switching from LOCAL to REMOTE or REMOTE to LOCAL causes the controller to RESET. This clears any partial entries that were entered before switching.**

**Table II** Reference Designators, APC100 Subassemblies

| ITEM NO. | QTY | -002 | -003 | ANDREW PART NO. | DESCRIPTION |
|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | AE01A-D0195 | PRGM ANT CONT PANEL ASSY |
| | 0 | 1 | 0 | AE01A-D0195-002 | PRGM ANT CONT PANEL ASSY |
| | 0 | 0 | 1 | AE01A-D0195-003 | PRGM ANT CONT PANEL ASSY |
| 2 | 1 | 0 | 0 | AE01A-D0196 | PRGM ANT CONT BOARD ASSY |
| | 0 | 1 | 0 | AE01A-D0196-002 | PRGM ANT CONT BOARD ASSY |
| | 0 | 0 | 1 | AE01A-D0196-003 | PRGM ANT CONT BOARD ASSY |
| 3 | 1 | 1 | 0 | EPWSP-13301 | PWR SPLY, 3 DC OUT AC IN |
| | 0 | 0 | 1 | EPWSP-12302 | PWR SPLY, 3 DC OUT AC IN |
| 4 | 1 | 1 | 1 | AE01C-C0199 | CABLE ASSY, INTCON, DSPL BD |

**KEYPAD** - The keypad is a multi-function user input. These inputs can be used for antenna positioning, parameter setting, and system maintenance.

**LCD DISPLAY** - The visual presentation is a 40 column, 2 line back-lit display. This display provides all relevant antenna positioning information.

## C. Key Description

The keypad is used to initiate local commands. When a key is pressed the APC100 internal beeper sounds for the duration of the keypress. When the key is released, the beeper stops.

The keypad is functionally divided into three groups:

**JOG KEYS** - Three sets of keys operate the azimuth, elevation, and polarization motors on the antenna. Motion is enabled only while a key is depressed. When the antenna is equipped with dual speed motor systems

only the slow motors are JOG activated.

**NUMERIC KEYS** - These keys are used to enter decimal data values or menu selections.

**FUNCTION KEYS** - These keys allow operation of the controller in local mode:

**[ENTER KEY]** - Input termination. This key is used to indicate that entry of a data field is complete.

**[START KEY]** - This key is used to initiate antenna movement when parameter entry is complete for a movement command.

**[POS] KEY** - This key is used to select the POSITION function.

**[SET] KEY** - This key is used to select the SET function.

**[NEXT] KEY** - This key is used to scroll through the POS # table in memory.

**[SETUP] KEY** - This key gives access to the setup menu.

**[BK SP] KEY** - This key is used to backspace over a character when entering a data field.

**[CLEAR] KEY** - This key allows a function to be canceled before it is initiated.

**[STOP] KEY** - This key stops all movement and resets the controller.

# CHAPTER 3

# THEORY OF OPERATION

# A. Modes of Operation

The APC100 can be controlled locally or remotely. The local display for all angle requirements may be in degrees or resolver units.

## 1. Local Mode

When in local mode, access to the antenna is only available at the antenna controller. Movement commands via the serial port are ignored. Status information is still available, however, from the host control device connected to the serial port.

Select the local mode by switching the LOCAL/REMOTE switch from remote to local. When switching from remote to local the controller is reset and a copyright message displays for 3 seconds, before switching to the idle default display.

## 2. Remote Mode

When in remote mode, antenna positioning is only available at the host. Front panel keys are disabled, with the exception of the [STOP] key.

The remote mode is selected by switching the LOCAL/REMOTE switch from local to remote. When switching from local to remote the controller is reset and a copyright message displays for 3 seconds, before switching to the idle default display.

## 3. Degree Display Mode

Degree display is the default mode after power on or reset. In this mode all angle information is displayed in degrees. Degrees are locally calibrated to reflect true look angles of the antenna. The controller may be calibrated to 0.01 degree.

## 4. Resolver Unit Display Mode

In the resolver unit display mode, all angle information is displayed in resolver units. The resolver unit display is the most accurate representation of the antenna location. The controller converts one degree from the resolver into approximately 182 resolver units or 65,536 resolver

units for a full circle. A "toggle" is provided through the setup menu to select the resolver unit display mode. There is no remote command to place the controller in resolver unit mode. The toggle is available only in local mode.

Except for the calibration function the resolver units displayed are un-calibrated resolver units. These values are read directly from the resolvers.

When the antenna elevation resolver is mechanically aligned, the antenna is placed at approximately a forty-five degree look angle. While referencing the APC100 controller elevation resolver unit position display, the resolver is physically adjusted to obtain a mid-range reading of approximately 32768 ± 200 units. 32768 is the un-calibrated resolver value. The calibrated value for 45° would be 45 x 182.044 = 8192. The calibration function permits continuous interpretation of the un-calibrated resolver values into the local site pointing angles.

**5. Serial Motor Mode**

Select the serial motor mode by setting a DIP switch. Serial motor mode permits each axis to operate in a sequential fashion. When operated in serial motor mode the fast azimuth motor is turned on and travels to within the fast motor coefficient of the destination. Once this predestination has been reached for the azimuth axis the fast motor is stopped. The azimuth slow motor is started and continues to run until it reaches the azimuth slow motor coefficient and the azimuth slow motor stops. Then the elevation fast motor is started and continues to run until it reaches the elevation fast motor coefficient. The elevation fast motor stopped and the elevation slow motor is started and continues to run until it reaches the elevation slow motor coefficient. Then the elevation slow motor is stopped and the polarity motor is started and runs until it reaches the polarity motor coefficient. The polarity motor is stopped completing the antenna repositioning.

**6. Concurrent Motor Mode**

This mode is selected by setting a DIP switch. Concurrent motor mode permits all axes to start movement at the same time. When operated in concurrent motor mode approximately twenty-five percent less

repositioning time is required to reach a target position then serial motor mode.

In this mode all motors are turned on and travel to within the fast motor coefficient of the destination. Once this predestination has been reached for each axis the fast motor is stopped. After all axes have arrived at their predestination points the azimuth slow motor is started. It continues to run until it has reached the azimuth slow motor coefficient and the azimuth motor is stopped. The elevation slow motor is started and continues to run until it has reached the elevation slow motor coefficient. Then the elevation motor is stopped and the polarity motor is started and runs until it has reached the polarity slow motor coefficient. The polarity motor is stopped completing the antenna repositioning.

### 7. News Gathering by Satellite Mode (Extended Mode)

This mode is selected by setting an internal DIP switch. For news gathering by satellite applications the antenna becomes a traveler and the pointing orientation is determined when the antenna carrying vehicle is parked. Preprogrammed satellite names for specific pointing angles are meaningless in azimuth when the reference keeps moving. As this type antenna has unique motorized travel ranges, particularly in the elevation and azimuth axes the absolute minimum and maximum software encoded (hard) limits are tailored to accommodate these greater distances.

### 8. Fixed Earth Station Mode

This mode is selected by setting an internal DIP switch. For fixed Earth station applications a default Satellite Name and Location Table is enabled. The absolute minimum and maximum software encoded (hard) limits are tailored to accommodate the best operating range for the position resolvers.

## B. Local Commands

There are four basic command groups; jog control, position to a defined location, set to entered locations, and setup. A complete description of each of these are in the following sections.

## 1. Jog Control

The jog keys and display are interactive when using the APC100. The jog key section of the keypad is presented in **4**. The text which follows explain how to use the various jogging functions.

**NOTE: Exceeding software limits stops antenna motion. In addition, antenna motion stops if the mechanical limit switch is activated.**

| | | |
|---|---|---|
| WEST | UP | CW |
| AZ | EL | POL |
| EAST | DOWN | CCW |

**Figure 3-1** APC100 Jog Keypad Layout

### a. West/Az/East

These keys are enabled in LOCAL mode and allow the operator to move the antenna in Azimuth (AZ). The distinction between northern and southern hemisphere is made by an internal dip switch setting. See Table 2, DIP SWITCH FUNCTIONS & SETTINGS.

WEST - When held depressed, the antenna Azimuth is moved in a clockwise (CW) direction, referenced from true north in the northern hemisphere and true south in the southern hemisphere, until the key is released.

EAST - When held depressed, the antenna Azimuth is moved in a counter clockwise (CCW) direction, referenced from true north in the northern hemisphere and true south in the southern hemisphere, until the key is released.

### b. Up/El/Down

These keys are enabled in LOCAL mode and allow the operator to move the antenna in Elevation (EL).

UP - When held depressed, the antenna elevation is moved upward referenced from the horizon until the key is released.

DOWN - When held depressed, the antenna elevation is moved downward referenced from the horizon until the key is released.

### c. CW/Pol/CCW

These keys are enabled in LOCAL mode and allows the operator to rotate the feed assembly and thus change the antenna Polarization (POL) angle.

CW - When held depressed, the antenna polarization angle moves clockwise (CW), referenced from the rear of the antenna, until the key is released.

CCW - When held depressed, the antenna polarization angle moves counterclockwise (CCW), referenced from the rear of the antenna, until the key is released.

## 2. Position

The numeric keypad and display are interactive when using the Programmable Antenna Controller. The keypad layout is presented in **Figure 4-1**. The text which follows explains how to use the various functions of the Programmable Antenna Controller and the corresponding responses shown on the front panel display.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | ENTER | START |
| 6 | 7 | 8 | 9 | 0 | | |
| POS | SET | NEXT | SETUP | BK SP | CLEAR | STOP |

**Figure 3-2** APC100 Keypad Layout

There are forty different positions that may be defined with look angles for given satellites. Each position is given a satellite name, satellite position longitude, and local site look angles. When satellite positions have been defined, the position function is used to move and set the antenna to the predetermined location. Once the antenna has been pointed to one of these locations, along with displaying the position number, it displays the satellite name, and current pointing angles. When the antenna is not pointing to one of these locations, the display shows the current angles. A message indicates the antenna it is not on a satellite.

To use this function, press the [POS] key. A prompt for a position number is displayed. When a position number is entered, the current information on that satellite location is displayed. The message "PUSH START" appears in the upper right display corner, indicating a defined position. "UNDEFINED" indicates an undefined position. While this message is being displayed, there are three options for the user.

1. Pressing the [NEXT] key increments the display to the next position number.

2. Pressing the [CLEAR] key returns the controller to the default screen mode.

3. If the message is PUSH START then pressing [START] will move the antenna to that position.

If the display mode is in the degree mode all displayed angles are in degrees. If the display mode is in the resolver unit mode, all displayed angles are displayed in un-calibrated resolver units. The [POS] key for this function is only available while the controller is in local mode.

### 3. Set

The SET function is used to position the antenna to a location that is several degrees from the current location. It does not have a defined location. Once the [SET] key has been pressed, any or all three axes may have new positions entered. After the last entry is made, a [START] keypress causes the controller to direct the antenna to the requested position. The controller is normally operated in the degree display mode.

Entries are made in absolute degrees for the angle of each axes. If desired the controller may be "toggled" to the resolver display mode. In this mode, entries are made in un-calibrated resolver units for the angle of each axes.

Some restrictions apply to values entered into the set command. Values entered in degrees may have up to two decimal places. If a third decimal place is entered, the value is rejected. In either display mode, angles entered that are greater than or equal to the software limits are rejected. Entries in resolver units must be at least 1 resolver unit inside the entered limit. Entries in degrees must be 0.01 degrees inside the entered limits. The SET key for this function is only available in the local mode.

## 4. Setup

There are seven different setup parameters employed to fully activate the controller. These parameters are: calibration, limits, coefficients, time outs, defining positions, toggling between degrees and resolver units, and clear. Pressing the SETUP key activates the SETUP menu allowing selection of each of these parameters. All SETUP functions are available only in the local mode.

### a. Calibration

During antenna installation or maintenance, it is very difficult to precisely set the resolvers, the mechanical positions for the controller, or to display the antenna's absolute pointing angles. For this reason, a calibration feature has been incorporated within the APC100. This calibration factor is added to interpret the value read from the resolvers into the actual pointing angles of the antenna.

To calibrate the controller, press the [SETUP] key. Once the SETUP MENU is displayed, select CAL by pressing the [1] key. When prompted, enter the current antenna pointing angles.

When looking through the position table, either with the POS - NEXT functions or from the Andrew System Controller, angles that have a un-calibrated resolver value of zero display the calibration factor. The calibration factor is added to un-calibrated resolver units to

make calibrated resolver units. The calibration factor is always a positive number and does a numeric wraparound at 360°.

For example, if the un-calibrated resolver reading indicated 190° and the look angle is 180°, the calibration factor is 350°, 190 + 350 = 540. Since this value is greater than 360, the value, 360 is subtracted, 540 - 360 = 180. The addition and subtraction is done in resolver units, 0 - 65535, hexadecimal 0 - FFFF. FFFF hex is the same as 359.99°. The addition of 1 changes to 10000 but the high order fifth digit is lost leaving 0000 which is equal to 0°. The above example 190° = 871C hexadecimal and 350° = F8E3 hexadecimal. 871C + F8E3 = 17FFF, the high order 1 is lost leaving 7FFF which is equal to 180°.

### b. Limits

Enter limits in the setup to configure minimum and maximum travel ranges for the three antenna axes. Set these values so as to prevent the antenna from hitting a structure, such as a building, or as a redundance to the antenna hardware limit switches.

To set the controller LIMITS, press the [SETUP] key. Once the SETUP MENU is displayed, select LIMIT by pressing the [2] key. Once prompted, the desired high and low antenna travel range limits are entered for each axes.

Limits are stored in un-calibrated resolver units, and may be entered in either un-calibrated resolver units or degrees. The controller has maximum and minimum software encoded (hard) limits. Operation outside hard limits is not permitted. For News Gathering by Satellite applications, the minimum and maximum software encoded (hard) limits are widened. Limits on all axes are 140 minimum and 65395 maximum. These limits are encoded (hard) limits in un-calibrated resolver units.

The delta between the minimum and maximum Fixed Earth Station Azimuth limit is 32768. This is 180° of travel. Andrew fixed Earth station antennas limit azimuth travel from 180° to 120°, this provides a ± 30 degree window for setting the AZ resolver.

The following implementation examples explain this feature. A fixed Earth station antenna has been installed to travel from 100° true to 220° true. The mid-range of travel for this antenna would be 160° true. First, the antenna is physically positioned to approximately 160° true. The resolver mechanical position is then adjusted for a controller azimuth display readout of precisely 32768 ± 200 units, (32768 = 180°, center of resolver). Then the controller AZ is calibrated to 160° for this position, the hard limits in degrees would be 70 and 250, 30° above and below the hardware limits.

If, on the other hand, when the antenna was centered at 160° the resolver was adjusted to 25486, (25486 = 140°, 40° from resolver center). If this value is calibrated to 160°, the minimum and maximum limits are 110° true and 290° true. In this case the antenna could not be moved to the lower hardware limit. For the AZ to function with the antenna at the center of its range, the resolver reading must be between 27307 and 38229.

The delta between the minimum and maximum for the Elevation axis is 21845. This represents 120° of travel. Elevation travel is between 0°, looking straight at the horizon to 90°, looking up at zenith. This provides a ± 15 degree window for setting the elevation resolver. If the antenna is elevated to a 45 degree pointing angle and the resolver is set precisely to 32768, the minimum and maximum limits would be 345 and 105. 360 - 345 = 15, 15° below the horizon. For the elevation axis to function with the antenna at 45°, the resolver must be between 30038 and 35498.

Andrew antennas have two different gearing configurations that move the polarity axis resolver in relationship to the feed rotation assembly. 1:1 gearing moves the resolver the same number of degrees that the feed assembly moves. 2:1 gearing moves the resolver 2° for every degree that the feed assembly moves. When in the 2:1 configuration, the controller compensates and displays the angle of the feed assembly. The delta between the minimum and maximum for polarity is 65255. 1:1 gearing allows 358.46° of travel, 2:1 gearing allows 179.23° of travel. The hardware limits in either case should not permit more that 175° of travel. Andrew antennas are specified to operate well within this range of polarity travel.

Mechanical resolver positioning for 1:1 gearing is not very critical; with the 2:1 gearing configuration positioning is critical. A small tolerance of only ± 2.115° is permitted for a full 175 degree polarity travel range.

With the resolver centered in the precise center of feed rotation, a reading of 32768, the hard coded limits would be 0.38° and 179.61°. Care must be taken to prevent the resolver reading from being allowed to numerically wraparound.

## 5. Coefficients

When the motors are turned off the antenna coasts for a short distance. Andrew dual speed motor systems operate at approximately 0.6 to 2° per second travel in high speed mode and 0.1 to 0.5° per second travel in slow speed mode. Polarity motors are single speed and travel at approximately 2.5° rotation per second. The fast coefficient is adjusted to a value that allows the antenna to slow down to the slower speed before the slow coefficient is required to turn off the motors.

The slow coefficient is the distance that the antenna coasts after turning off the slow motor. Due to weight distribution, the slow coast coefficient may vary from one direction to the other. Therefore, each axis has two slow coefficients.

To set the controller COEFFICIENTS press the [SETUP] key. Once the SETUP MENU is displayed, select LIMIT by pressing the [3] key. Once prompted, the desired high speed and slow speed antenna coast coefficients are entered for each axes.

The slow coefficient has a minimum of 0 and a maximum of 546 resolver units or 3°. On polarity axes equipped with 2:1 gearing this is a maximum of 1092 (which is still 3°). The fast coefficient has a minimum of 1 degree greater than the selected slow coefficient and a maximum of 10°. For example, if a slow coefficient was set at 0.8°, the minimum fast coefficient would be 1.8°. The fast maximum for azimuth, elevation, and polarity axis equipped with 1:1 gearing is 10 or 1820 resolver units.

## 6. Time-Outs

If for some reason a motor has had power applied and does not run or moves at too slow a rate, the motor could be damaged. The programmable delay motor time-out feature senses this problem. It turns off the power and indicates the faulted motor axis.

To set the controller TIME-OUTS press the [SETUP] key. Once the SETUP MENU is displayed, select TIME-OUT by pressing the [4] key. Once prompted, the desired high speed and slow speed motor time-out is entered for each axis.

The time-out value is entered in the time-out (T/O) units of 10 milliseconds. For example a time-out value of 100 equals 1 second. 0.0549° of arc is the antenna axis travel expected to occur during the selected time-out period. For a time-out value of 100 should the antenna not travel 0.0549° of arc in the 1 second period a motor time-out will occur. The troubled motor is shut off and the appropriate axis flag displayed. **Table 1** provides suggested motor time-out values for various antenna travel rates.

In the concurrent motor mode, resolver sampling is constantly switching axes. The APC100 is reading the same axis about every 270 milliseconds during fast motor movement. The antenna mechanical delays; contactor pull in time, the motor starting delay, and the mechanical linkage slack when factored with the concurrent sampling determines practical time-out value

**Table III** Antenna Drive Motor Recommended Time-Out Values

| ANTENNA SPEED (DEG./SEC) | SUGGESTED TIME-OUT VALUE (T/O UNITS) | MINIMUM SPEED (DEG./SEC | TIME-OUT PERIOD (SECONDS) |
|---|---|---|---|
| 0.01 | 700 | O.OO78 | 7.00 |
| 0.10 | 100 | 0.0549 | 1.00 |
| 0.20 | 75 | 0.0730 | 0.75 |
| 0.50 | 31 | 0.1770 | 0.31 |
| 2.00 | 31 | 0.1770 | 0.31 |
| 2.50 | 31 | 0.1770 | 0.31 |
| SNG (VAR | 900/700 | NOTE: On SNG/Trifolds the T/O adjusted for serial mode delays. | |

The "IN MOTION" display has a higher priority than the Time-Out Error display ("T/O ERR"). Should a time-out error occur on an axis during fast movement, the display continues to indicate "IN MOTION" while another axis is in motion. When all axes have completed, the fast motor movement the slow motor attempts to complete the movement for each axis. If the slow motor functions on the faulted axis, the fault is cleared. The error is flagged on the local display if the slow motor fails. The fast motor error is sent to the remote host (if used) and the host can be used to indicate a fast motor time-out failure while the fast motors are running.

## 7. Define Position

Define position allows the operator to assign a given set of look angles to a position number. There are a total of 40 position numbers that a location can be assigned. The antenna should be peaked on the desired satellite signal using the jog controls.

After checking for maximum signal strength and best cross polarity discrimination, press the controller [SETUP] key. Once the SETUP MENU is displayed, press the [5] key to obtain a POSITION number prompt. Once the satellite position number (1 - 39) is entered, the current look angles and the satellite name for the position number is displayed. If this is the correct name for the satellite, press enter to accept this data into the position table.

If there is a position to be removed from the position list, then the process is the same, except that when the angles and name are displayed instead of pressing [ENTER], press the [CLEAR] key twice.

## 8. Degree/Resolver Unit Display Toggle

To set the controller DEGREE/RESOLVER UNIT DISPLAY TOGGLE press the [SETUP] key. Once the SETUP MENU is displayed, select Resolver Units or Degrees by pressing the [6] key.

## 9. Clear RAM

Local site position information and all setup data is stored in battery backed memory. If for some reason this information is contaminated and the setup of the antenna has to be entered again, this feature allows the random access memory to be cleared.

To erase the controller random access memory press the [SETUP] key. Once the SETUP MENU is displayed, select CLEAR RAM by pressing the [7] key. The "Initialize Memory ?", prompt is displayed. Once prompted either push the [START] key to clear the memory or push the [CLEAR] key to abort the request.

When memory is cleared the following actions take place.

1. Any location table position becomes undefined.
2. Axes position angle values are set to 0.
3. The calibration is set to 0 for all axes.
4. Slow coast coefficients are set to 0.05° and fast coast coefficients, to 2°.
5. Limits are set to the hard coded limits.
6. Motor time-outs are set to 100.

## C. Error Messages

The APC100 front panel error field may display "limit", "time-out", and "direction" errors or the "in motion" and "inhibit" motion flags. Error messages, when displayed, include the title of the error and the first letter of each axis that has failed; Azimuth = A, Elevation = E, and Polarity = P. The error or flag message remains until the condition is cleared or a higher priority message occurs.

ERROR FIELD DISPLAY PRIORITY

1st - INHIBIT MOTION FLAG

2nd - IN MOTION FLAG

3rd -DIRECTION ERROR

4th - LIMIT ERROR

5th - TIME-OUT ERROR

### 1. Limit Errors

Limit errors are generated when the antenna is moved into a software limit. When the antenna is in a software limit, it can no longer be moved in that direction. An error message is displayed. Once the antenna has been moved into a limit the controller only accepts movement commands away from the limit. When the antenna has been moved out of the limit the error message clears.

A typical Limit Error Display with an azimuth west, an elevation down, and polarity clockwise errors flagged is shown below.

```
AZ=249.90 EL= 5.10 POL = 268.2 LIMERR AEP
```

### 2. Time Out Errors

Time-out errors are generated when a motion command has been issued,

and movement does not take place within a preset period. If another movement command is issued for the same axis and the movement does occur, the error message is cleared.

A typical Time-out Error Display with azimuth, elevation, and polarity motor drive time-out errors flagged is shown below.

```
AZ=149.60 EL=45.78 POL=168.4 T/OERR AEP
```

### 3. Direction Errors

A Direction error is generated when an axis movement is given in one direction and the associated resolver indicates movement has taken place in the other direction. This error is cleared if another movement command is issued for the troubled axis and movement takes place in the correct direction.

Typical Direction Error Display with azimuth, elevation, and polarity direction errors flagged.

```
AZ=188.50 EL=36.44 POL=135.7 DIRERR AEP
```

### 4. Inhibit

Inhibit is not an error input, but it is handled as one. Whenever the APC100 Motion Interface Inhibit Input is active the "INHIBIT" message is displayed and no APC100 directed antenna motion is permitted. If an antenna motor is manually operated while the inhibit input is active (using the Local Motor Controller located at the antenna) the APC100 senses motion. The APC100 Motion Interface IN MOTION output line would be active during the manually controlled movement. The display error field continues to display the "INHIBIT" message until the inhibit input is removed.

See Section 6, APC100 HARDWARE, IN-MOTION PINOUT INFORMATION, Table XI for interconnection details.

# CHAPTER 4

# INSTALLING THE APC100

## A. Introduction

The APC100 Antenna Programmable Controller is packaged in a corrugated cardboard container with Foam-Pak for protection against physical damage during shipment. Exercise extreme care when unpacking system components. Check for shipping damage and file damage claim promptly with transportation company should damage be found.

## B. APC100 System Start-up

This procedure provides the system installer with a sequenced list of instructions for commissioning the Andrew Programmable Antenna Controller, type APC100. Following this procedure assures proper APC100 operation.

**C. APC100 DETAIL** -003 USERS JUMP TO STEP 4.4. LMC VERIFICATION: Updating Earlier APC100's to Detail -003 Version 2.11 Software, EPROM Replacement and PC Board Settings.

**WARNING**

**Remove Primary AC power before attempting maintenance.**

**NOTE: For APC100 Software Versions 2.0 and below, order the Software Update Kit, p/n AE01K-B0222 from Andrew Customer Support Center at 1-800-255-1479, (7:30 a.m. - 5:30 p.m. CST). For 24 hour emergency assistance, call Technical Services Hotline in Orland Park, Illinois at 1-708-349-5900.**

1. Current release Version 2.11 Software installation requires that the RAM memory be cleared. Any current setup or satellite position data must be reentered. Record the setup data and satellite position table information before proceeding. The axes position resolvers may require mechanical calibration as described in Section ?.

   **NOTE: Andrew System Controller (ASC) users - An upload from an APC100 equipped with V1.0 or V1.1 software is NOT compatible with V2.1 or later. Setup and position data MUST be re-entered into the**

**APC100 then UPLOADED to the Andrew System Controller.**

2. Turn off the APC100 power. Disconnect the rear panel cables.

3. Remove the APC100 from the equipment rack. Open the top cover.

**WARNING**

**Electrostatic discharge can damage the EPROM. Ensure proper grounding technique is used when handling device.**

4. Locate the U5 socket (**Figure 4-1**, Item 1). U5 is a 28 pin 27C512 EPROM IC located in the upper left area of the printed circuit board (when viewed from the rear). Carefully remove the old EPROM from the U5 position. A small jeweler's screwdriver may be used if an IC extractor tool is not available. Place the jeweler's screwdriver between the socket and the IC body. Cautiously elevate one side of the IC, then the opposite side until free. Be very careful not to damage the IC socket.

5. Remove the new V2.11 EPROM from the anti-static wrapper. Check the pins are straight and properly orientated for insertion. Note the IC position as diagramed in **Figure 12-1**. Pin 1 or the IC body notch is closest to the front panel. Install the U5 EPROM IC.

6. Refer to **Figure 4-1** to find the U24 socket (Item 2). Check position U24 located in the lower right area of the printer circuit board (when viewed from the rear). If U24 is the "daughter board" AE01A-D0247, skip to step 8. If U24 is a 32 pin 1S60 Resolver to Digital Converter IC, carefully remove the old 1S60 IC from the U24 position. A small jeweler's screwdriver may be used if an IC extractor tool is not

available. Place the jeweler's screwdriver between the socket and the IC body. Cautiously elevate one side of the IC, then the opposite side until free. Be very careful not to damage the IC socket.

7. Remove the "new" AE01A-D0247, 2S80 Adapter (Daughter Board) from the anti-static wrapper. Verify the pins are straight and properly orientated for insertion. Note the "old" 1S60 IC position as diagramed in **Figure 12-1** is OPPOSITE the orientation of the "new" 2S80 IC installed upon the AE01A-D0247 adapter board. The 2S80 IC body notch is closest to the rear panel when the daughter board has been installed properly. Component clearances in the U24 area do NOT permit the daughter board to be installed incorrectly.

8. If current software version is 1.11 or higher, skip to step 11.

9. Refer to **Figure 4-1** to find the U15 socket (Item 3). U15 is a 24 pin PAL IC located in the center rear area of the printed circuit board (when viewed from the rear). Carefully remove the "old" PAL IC from the U15 position. A small jeweler's screwdriver may be used if an IC extractor tool is not available. Place the jeweler's screwdriver between the socket and the IC body. Cautiously elevate each side of the IC until free. Be very careful not to damage the IC socket.

10. Remove the "new" V1.11 PAL from the anti-static wrapper. Verify the pins are straight and properly orientated for insertion. Note the IC position as diagramed in **Figure 12-1**. Pin 1 or the IC body notch is closest to the front panel. Install the U15 V1.11 PAL IC.

11. If electronic beeper is present in upper right corner of board (when facing rear), skip to step 13.

12. Using the RTV sealant, attach the beeper at location XB1 (**Figure 4-1**, Item 5) Route the wires to JU15 (Item 6). The black beeper wire is soldered to JU15 - E1. The red beeper wire is soldered to JU15 - E2. Masking tape may be used to hold the beeper in place while the RTV is curing.

    R19, a 330 Ω ¼ watt resistor located near JU15 (Item 4, **Figure 4-1**) may be increased in value to reduce the sound level from the beeper. A factory suggested value of 10 kΩ has been included for

this purpose. If the area where the APC100 is installed has a high noise level, this modification is not necessary. Installation may be done without removing the printed circuit board by carefully clipping R19 (330 Ω) resistor leads close to the resistor body. Straighten the leads coming from the printed circuit board. "Tack" solder the new resistor across the extended leads. Trim excess lead length when completed.

13. Verify the following jumper and switch positions are set to:

13.1 JU2, Jumper E1-E2 (**Figure 4-1**, Item 7)

13.2 JU11, Jumper E2-E3 (**Figure 4-1**, Item 9)

13.3 JU12, Jumper E2-E3 (**Figure 4-1**, Item 10)

13.4 JU10, Remove Jumper, note step 13.6., this is the only jumper permitted on JU10 (**Figure 4-1**, Item 8).

** 13.5 JU14, Jumper E2-E3, If the key stroke beeper is to sound when a key is depressed (**Figure 4-1**, Item 11).

Jumper E1-E2, If the key stroke beeper is not to sound when a key is pressed.

** 13.6 JU10, Jumper E2 to JU12 E1, Use #30 wire wrap wire approximately 2.5" long if external "INHIBIT" feature is enabled.

13.7 Set S1, position 7 to "ON" or closed for a value of "0". Refer to (**Figure 4-1**, Item 12). This selects the AE01A-D0247, 2S80 Adapter Board necessary for concurrent motor operation.

** 13.8 Set S1 position 8 for CONCURRENT motor operation. Verify that switch is set to "OFF" or open for a value of "1". If SERIAL motor operation is desired, switch S1-8 is set "ON" or closed for a value of "0". Normal operation is concurrent motor, switch S1-8 set to "OFF".

** Optional jumper and switch positions.

14. Remove the adhesive protective backing from the top cover label, P/N AE01N-C0018-003. Install the top cover label over the old label. Replace the APC100 cover. Reinstall the unit into the equipment rack and re-cable the rear panel. Turn on the primary AC power. Refer to Section ? to proceed with antenna system setup.

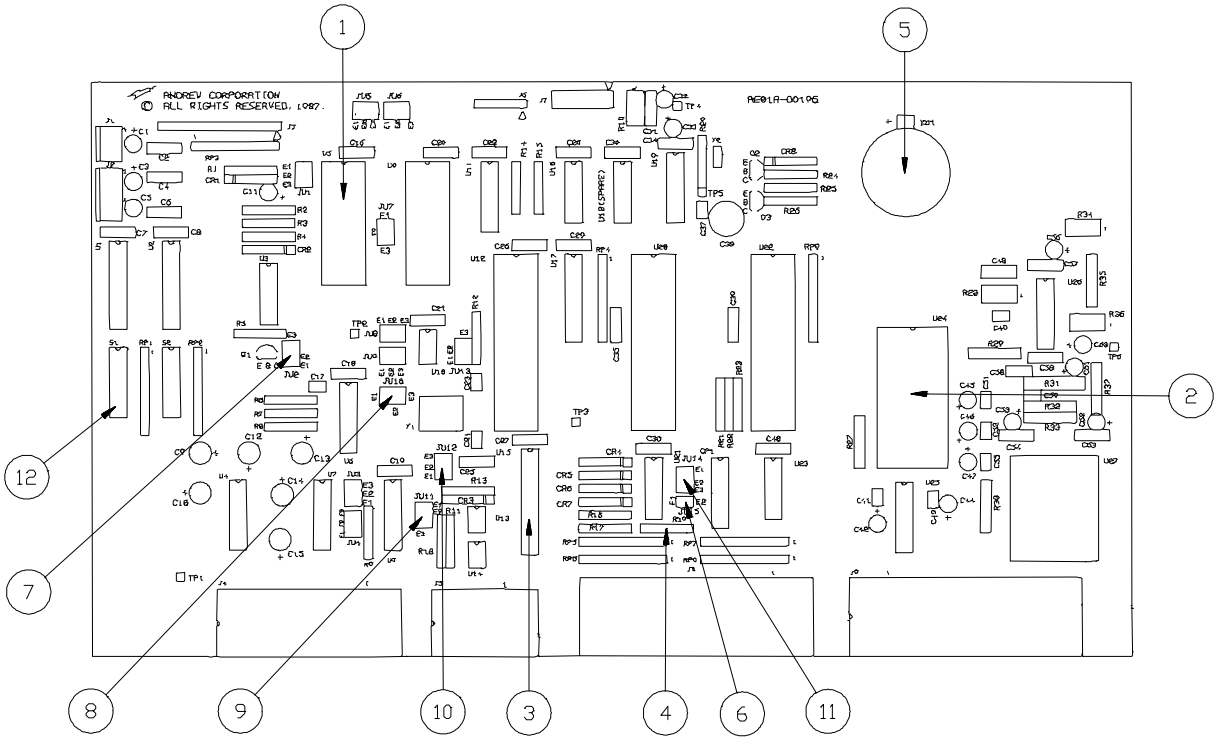



**Figure 4-1** APC100 Board Assembly with Reference Designators

## D. Local Motor Controller Verification

After completing the motorized antenna construction and motor testing, reapply commercial power to the Local Motor Controller. Operate the Local Motor Controller manual positioning switches to verify the proper Azimuth, Elevation, and Polarity motorized movements. Check the proper setting of the hardware limit switches.

**NOTE: On antennas equipped with DUAL speed motors, verify both the fast and slow Azimuth and Elevation motor functions.**

**WARNING!**
**Failure to verify proper local antenna movement and setting of limit switches may cause damage to equipment or injury to personnel!**

## E. Connecting the APC100 to the Local Motor Controller Box

**NOTE: APC100 connections to the Local Motor Controller remote control cable are detailed in Table 6 and Table 6-d of this manual. Also see Andrew Instruction Bulletin for the Andrew LMKDS remote control cable termination kits, P/N's CCK - (*) and "INSTALLATION INSTRUCTIONS CONTROL CABLE KIT", Dwg. No. AE01E-A0554 for interconnecting information.** * = Cable Wire Length

Once the Azimuth, Elevation, and Polarity motion range has been locally tested and limit switch stopping point settings checked, the APC100 control cable may be connected. Leave the Local Motor Controller in the LOCAL operating mode and apply power to the APC100.

## F. Verifying and Setting the Resolver Inputs to the APC100

### 1. Verifying the Resolver Inputs

After the APC100 completes the start-up sequence, the idle display appears. Depress the [SETUP] key to display the setup display.

```
CAL:1 LIM:2 COEF:3 T/O:4 POS:5 DEG>RU:6
CLEAR RAM:                EXIT:0
```

The display changes to RU>DEG:6 when the [6] key is depressed. This toggles the display into the resolver units mode. Depressing zero [0]

displays the default display in resolver units.

| AZ=32584 EL=33089 POL=12117 |
|---|

Depending upon the mechanical orientation in which the resolvers were installed, the display may read as low as "0" or as high as 65,536 for each of the Azimuth, Elevation, and Polarity positions.

Verify the Azimuth, Elevation, and Polarity display readings are stable and within 0 and 65,536. Coarse mechanical adjustment of the resolvers will align the antenna movements to the APC100 electronics.

## 2. Setting the Resolver Inputs

**NOTE: A resolver interconnection wiring error may cause a reversal in the indicated antenna travel direction.**

### a. Azimuth

Using the Local Motor Controller manual positioning switches, move the antenna azimuth position to the approximate center line of antenna travel. Loosen the screws holding the azimuth resolver. Rotate the resolver body until the APC100 AZ display reads between 27307 and 38229. Tighten the resolver mounting screws. Record the exact AZ display reading. Use the Local Motor Controller to move the antenna several degrees of travel to the WEST (EAST in southern hemisphere). The new AZ display value when compared to the previously recorded value should be larger. Resolver Units increase in number when the antenna travels WEST (EAST in southern hemisphere) and decrease in number when the antenna travels EAST (WEST in southern hemisphere).

### b. Elevation

Using the Local Motor Controller manual positioning switches, move the antenna elevation position to the midpoint or approximately forty-five degree (45°) antenna elevation. An inclinometer may be used as a reference to set the coarse elevation position. Loosen the screws holding the elevation resolver, rotate the resolver body until

the APC100 EL display reads between 30038 and 35498. Tighten the resolver mounting screws. Record the exact EL display reading. Use the Local Motor Controller to move the antenna several degrees of travel UP. The new EL display value when compared to the previously recorded value should be larger. Resolver Units increase in number when the antenna travels UP and decrease in number when the antenna travels DOWN.

**c. Polarity**

**WARNING**
**Failure to properly set antenna polarity limit switches may cause damage to equipment.**

Using the Local Motor Controller manual positioning switches, move the antenna polarity position to the extreme clockwise limit when being viewed from the rear of the antenna. Loosen the screws holding the polarity resolver. Rotate the resolver body until the APC100 POL display reads approximately between 64500 and 65000. Tighten the resolver mounting screws. Record the exact CLOCKWISE POL LIMIT display reading.

Use the Local Motor Controller to move the antenna polarity position to the extreme counterclockwise limit when being viewed from the rear of the antenna. The COUNTERCLOCKWISE POL LIMIT display value when compared to the CLOCKWISE POL LIMIT display value should be much smaller. For polarity mechanism gearing of 1:1 the resolver units are approximately one-half the previous value, between 32642 and 33142; for the polarity gearing mechanism of 2:1 the new value is much less, between 784 and 1284.

Resolver Units increase in number when antenna polarity travels clockwise and decrease in number when antenna polarity travels counterclockwise.

**NOTE: Some readjustment may be needed for 2:1 polarity mechanisms. It is absolutely necessary for the polarity resolver crossover point (display "wraps around" from 0 to 65,536 or from 65,536 to 0) to remain outside the normal mechanical polarity travel.**

### d. Verifying APC100 to Antenna Direction Assignments

Depress [SETUP] and the Setup Menu display appears.

```
Cal:1 LIM:2 COEF:3 T/O:4 POS:5 DEG>RU:6
```

Depress seven [7] and the Clear Ram display with the "Initialize Memory?" message appears

```
Initialize Memory?   If YES PUSH START
                     If NO  PUSH CLEAR
```

Push the [START] key. The copyright display appears for approximately three seconds, then changes to the default idle mode display. This action assures the memory is clear and the system default values have been initialized.

```
AZ=200.47 EL=225.76 POL=192.35
Not on Satellite
```

Depress [SETUP] and the Setup Menu display appears.

```
CAL:1 LIM:2 COEF:3 T/O:4 POS:5 DEG>RU:6
CLEAR RAM:7                EXIT:O
```

Depress four [4] and the motor time-out AZ display prompt with the system default values appears.

**NOTE: Each time-out value is 10 milliseconds, the default T/O value of 100 = 1 second. With the time-out value of 100, the APC100 monitors each axis for motion for 1 second. If no motion is detected the controller reports the T/O error and flags the axis.**

```
AZ: LO T/O = _ 100 HI T/O =    100
```

Depress [ENTER] to retain the AZ LO time-out value of 100.
Depress [ENTER] again to retain the AZ HI time-out value of 100.
The elevation time-out display with the system defaults appears.

```
EL: LO T/O = _ 100 HI T/0 =   100
```

Depress [ENTER] to retain the EL LO time-out value of 100.
Depress [ENTER] again to retain the EL HI time-out value of 100.
The polarity time-out display with the system default value appears.

```
POL: LO T/O = _ 100
```

Depress [ENTER] to retain the POL LO time-out value of 100, the default idle mode display appears.

By completing the above steps, the APC100 memory has been cleared. The motor time-out default values have been checked, reentered in memory, and are set to monitor motion for one second.

Once the Azimuth, Elevation, and Polarity resolvers have been mechanically aligned to the approximate center of each respective

range of travel, place the Local Motor Controller in the REMOTE operating mode. At the APC100 depress the jog keys one at a time to check Azimuth, Elevation, and Polarity positioning controls.

Antenna motions Azimuth - East, Elevation - Down, and Polarity - Counterclockwise cause the resolver unit readings to decrease. Azimuth and Elevation resolver unit readings change 182 units per degree of travel. Polarity resolver unit readings change 182 units/degree for 1:1 geared mechanism and 364 units/degree for 2:1 geared mechanism.

## G. Calibrating APC100 and Antenna in Reference to Satellite

### 1. Locating the Satellite

Determine from the local site data, the pointing angles for a known satellite. Connect an LNA/LNB and a receiver or spectrum analyzer to the antenna for signal monitoring. At the antenna, return the Local Motor Controller to the LOCAL control mode. Using the Local Motor Controller manual positioning switches, change the antenna elevation position (measured with the inclinometer or equivalent device) for coincidence to that of the selected known satellite. Move the antenna azimuth position until the desired satellite is found. Peak the signal in azimuth and elevation, then adjust the polarity for best cross polarization rejection. Peak all three axes again.

### 2. Calibrating the APC100 to the Antenna

Local site azimuth, elevation, and polarity positions for the known satellite are now being displayed in resolver units on the APC100. On the APC100, depress the [SETUP] key, the Setup Menu display appears.

| | |
|---|---|
| CAL:1 LIM:2 COEF:3 T/O:4 POS:5 | RU>DEG:6 |
| CLEAR RAM:7 | EXIT: 0 |

Depress six [6] to toggle the degree display.

Depress the one [1] key to activate the calibrate display. The calibrate display appears with the cursor under the azimuth readout.

```
AZ=200.47 3L=225.76 POL=192.3
```

### a. Azimuth

From the local site pointing data, determine the LOCAL azimuth for the known satellite. Using the numeric [0 - 9], decimal point [.] and [ENTER] keys, enter a five place local azimuth position. Example: 189.75, 240.9, 178.00, etc., back space [BK SP] key may be used to correct a number before entry. Once the correct azimuth has been displayed depress [ENTER]. Should an improperly formatted OR out of limit number be entered, the ERR display appears. The cursor moves back to the starting position. The APC100 does not accept an improperly formatted or out of limits number.

```
AZ=400.47 EL=225.76 POL=192.3       ERR
```

After the APC100 accepts the azimuth number, the cursor moves to the elevation display position.

```
AZ=189.75   EL=225.76   POL = 192.3
```

### b. Elevation

Using the numeric [0 - 9], decimal point [.] and [ENTER] keys, enter a five place local elevation position. The back space [BK SP] key may be used to correct a number before entry.

```
AZ=189.75   EL= 45.55    POL=192.3
```

Leading 0's are blanked and the cursor moves to the polarity position

display once the elevation has been entered.

### c. Polarity

Although the local polarity position may be predicted, many customers, especially those operating uplinks, usually assign the polarity position to a transmit port and a specific satellite.

On TVRO antennas the practice has been to assign the most used port the primary position. Most North American locations require approximately 120° of polarity travel, including 90° of back up rotation for "replacement" of a failed LNA/LNB. This is accomplished by using the operating opposite polarity unit as a spare. Pick the port closest to the center of the polarity travel and assign it a position of 90°.

**NOTE: The assigned port should be the one being used to optimize the antenna.**

Using the numeric [0 - 9], decimal point [.] and [ENTER] keys, enter a four place polarity position. Example: 180.0, 99.9, 178.0, etc., back space [BK SP] key may be used to correct a number before entry. Once the desired polarity has been displayed, depress [ENTER]. Should an improperly formatted OR out of limit number be entered, the ERR display will appear and the cursor will move back to the starting position.

```
AZ=189.75   EL= 45.55   POL=380.0   ERR
```

When APC100 accepts the polarity number, the setup menu appears.

```
CAL:1 LIM:2 COEF:3 T/O:4 POS:5          DEG>RU: 6
CLEAR RAM:7                               EXIT: 0
```

Depress zero [0] and the idle mode display appears. The previously

entered local site pointing angles for the known satellite appears. Because no position has been assigned, the "NOT ON A SATELLITE" message is also displayed.

```
AZ=189.75   EL= 45.55   POL=90.0
NOT ON A SATELLITE
```

Depress [SETUP] to display the Setup Menu.

```
CAL:1  LIM:2 COEF:3 T/O:4 POS:5     DEG>RU: 6
CLEAR RAM:7                              EXIT: 0
```

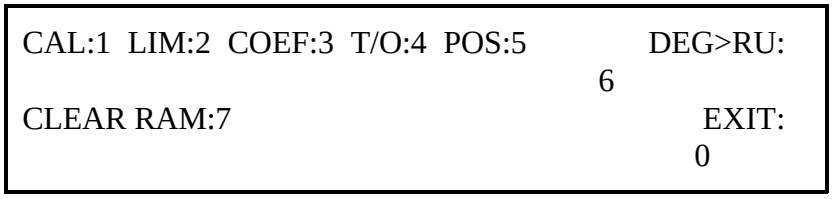
Depress five [5] and the position display prompt appears.

```
POS #:___
```

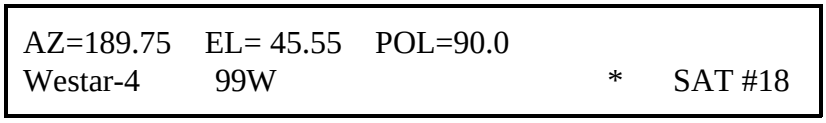
Default Satellite names defined in the current APC100 software are displayed in Table 4-a. If the known satellite is listed in the table, enter its position number using [0 - 9] and [ENTER] keys. If the known satellite is not listed, assign position 39 as a default installation position. For example, a known satellite is POS # 18, WESTAR-4, 99°. Depress [1], [8], and, [ENTER]. Current Satellite position information is displayed.

```
AZ=189.75 E;= 45.55 POL=90.0
Westar-4      99W                    *    SAT #18
```

Depress [ENTER] to display the Setup Menu.




Depress [0] to Exit. POS # 18 display appears.




Satellite Position # 18 Display

**Table 4-a** Default Satellite Names

| POS # | NAME | LONGITUDE |
|---|---|---|
| 1 | INTELSAT-V F8 | 53.0°W |
| 2 | PAN AM SAT-I | 57.0°W |
| 3 | SPACENET-2 | 69.0°W |
| 4 | SATCOM F2R | 72.0°W |
| 5 | GALAXY-2 | 74.0°W |
| 6 | COMSTAR 2 & 4 | 76.0°W |
| 7 | GE-K2 | 81.0°W |
| 8 | SATCOM F4 | 82.0°W |
| 9 | GE-K1 | 85.0°W |
| 10 | TELSTAR-302 | 85.0°W |
| 11 | SPACENET-3 | 87.0°W |
| 12 | WESSTAR-3 | 91.0°W |
| 13 | SBS-4 | 91.0°W |
| 14 | GALAXY-3 | 93.5°W |
| 15 | SBS-3 | 95.0°W |
| 16 | TELSTAR-301 | 96.0°W |
| 17 | SBS-2 | 97.0°W |
| 18 | WESTAR-4 | 99.0°W |
| 19 | SBS-1 | 99.0°W |
| 20 | GSTAR-1 | 103.0°W |
| 21 | ANIK-D1 | 104.5°W |
| 22 | GSTAR-2 | 105.0°W |
| 23 | ANIK-C2 | 110.0°W |
| 24 | ANIK-D2 | 110.5°W |
| 25 | MORELOS-1 | 113.5°W |
| 26 | ANIK-C3 | 117.5°W |
| 27 | SPACENET-1 | 120.0°W |
| 28 | WESTAR-5 | 122.5°W |
| 29 | TELSTAR-303 | 125.0°W |
| 30 | CONTEL ASC-1 | 128.0°W |
| 31 | SATCOM-F3R | 131.0°W |
| 32 | GALAXY-1 | 134.0°W |
| 33 | SATCOM-F1R | 139.0°W |
| 34 | AURORA-1 | 143.0°W |
| 35 | INTELSAT-IVA F3 | 179.0°W |

## H. Setting Antenna Travel Software Limits

### 1. Setting Software Limits

Using the Local Motor Controller MANUAL positioning switches, move the antenna position to the hardware limits and record the readings in TRAVEL LIMIT column of Table 4-b. Set software limits 2° before the hard limits

are engaged. Position must be between hard limits.
Table 4-b is a list of names representing satellite positions as of 3/1/91. Additional names not appearing on Table 4-a represent satellites added or repositioned since the APC100 software was released.

**Table 4-b** Satellite Names and Positions (March 1991)

| POS # | NAME | LONGITUDE |
|---|---|---|
| 1 | PAN AM SAT-I | 45.0°W |
| 2 | INTELSAT-V F8 | 57.0°W |
| 3 | SPACENET-2 | 69.0°W |
| 4 | SATCOM F2R | 72.0°W |
| 5 | GALAXY-2 | 74.0°W |
| 6 | COMSTAR 2 & 4 | 76.0°W |
| 7 | GE-K2 | 81.0°W |
| 8 | SATCOM F4 | 82.0°W |
| 9 | GE-K1 | 85.0°W |
| 10 | TELSTAR-302 | 85.0°W |
| 11 | SPACENET-3 | 87.0°W |
| 12 | GALAXY-6 | 91.0°W |
| 13 | SBS-4 | 91.0°W |
| 14 | GSTAR-3 | 93.0°W |
| 15 | GALAXY-3 | 93.5°W |
| 16 | SBS-3 | 95.0°W |
| 17 | TELSTAR-301 | 96.0°W |
| 18 | SBS-2 | 97.0°W |
| 19 | WESTAR-4 | 99.0°W |
| 20 | SBS-6 | 99.0°W |
| 21 | GSTAR-1 | 103.0°W |
| 22 | ANIK-D1 | 104.5°W |
| 23 | GSTAR-2 | 105.0°W |
| 24 | ANIK-C1 | 107.3°W |
| 25 | ANIK-C2 | 110.0°W |
| 26 | ANIK-D2 | 110.8°W |
| 27 | MORELOS-1 | 113.5°W |
| 28 | ANIK-C3 | 117.5°W |
| 29 | MORELOS-2 | 116.8°W |
| 30 | SPACENET-1 | 120.0°W |
| 31 | WESTAR-5 | 122.5°W |
| 32 | SBS-5 | 123.0°W |
| 33 | TELSTAR-303 | 125.0°W |
| 34 | GSTAR-4 | 125.0°W |
| 35 | CONTEL ASC-1 | 128.0°W |
| 36 | SATCOM-F1R | 131.0°W |
| 37 | GALAXY-1 | 134.0°W |
| 38 | SATCOM-C1 | 139.0°W |
| 39 | AURORA-1 | 143.0°W |
| 40 | INTELSAT-IVA F3 | 179.0°W |

## **Table VI** Travel Limit/Set Point Computation

| | | Hardware Limit | Travel Limit | | Set Point | |
|---|---|---|---|---|---|---|
| Azimuth | - | WEST | _____ -2° | = | _____ AZ | HI |
| | - | EAST | _____ +2° | = | _____ AZ | LO |
| Elevation | - | UP | _____ -2° | = | _____ EL | HI |
| | - | DOWN | _____ +2° | = | _____ EL | LO |
| Polarity | - | CLOCKWISE | _____ -2° | = | _____ POL | HI |
| | - | COUNTERCLOCKWISE | +2° | = | POL | LO |

Computation Work Space:

| | | Hardware Limit | Travel Limit | | Set Point | |
|---|---|---|---|---|---|---|
| Azimuth | - | WEST | _____ -2° | = | _____ AZ | HI |
| | - | EAST | _____ +2° | = | _____ AZ | LO |
| Elevation | - | UP | _____ -2° | = | _____ EL | HI |
| | - | DOWN | _____ +2° | = | _____ EL | LO |
| Polarity | - | CLOCKWISE | _____ -2° | = | _____ POL | HI |
| | - | COUNTERCLOCKWISE | +2° | = | POL | LO |

| | | Hardware Limit | Travel Limit | | Set Point | |
|---|---|---|---|---|---|---|
| Azimuth | - | WEST | _____ -2° | = | _____ AZ | HI |
| | - | EAST | _____ +2° | = | _____ AZ | LO |
| Elevation | - | UP | _____ -2° | = | _____ EL | HI |
| | - | DOWN | _____ +2° | = | _____ EL | LO |
| Polarity | - | CLOCKWISE | _____ -2° | = | _____ POL | HI |
| | - | COUNTERCLOCKWISE | +2° | = | POL | LO |

Add to the TRAVEL LIMIT ± 2 degrees as indicated in the above table to arrive at the maximum recommended SOFTWARE LIMIT SET POINTS. Calculate and enter the maximum recommended SOFTWARE LIMIT SET POINTS in the table.

**NOTE: If desired, the user may set the LIMITS anywhere within the travel range of each motion axes, but it should be kept in mind that:**

1. **Antenna travel beyond a SOFTWARE LIMIT will not be permitted.**

2. **Setting the SOFTWARE LIMITS outside the physical TRAVEL LIMITS forces the hard limit stop switches to be the only stopping mechanism for those axes in the directions which are in error.**

## 2. Entering Calculated Software Limits Into the APC100

### a. Azimuth

On the APC100 depress [SETUP], the Setup Menu display appears.

```
CAL:1 LIM:2 COEF:3 T/O:4 POS:5 DEG>RU:6
CLEAR RAM:7                EXIT:0
```

Depress two [2] and the Azimuth Limit display appears. Enter the calculated Azimuth EAST set point for the AZ LO LIM position using the numeric [0 - 9], decimal point [.] and [ENTER] keys, enter a five place azimuth position. For example, 122.00, 119.99, 140.09, etc., back space [BK SP] key may be used to correct a number before entry.

```
AZ LO = 122.00          AZ HI = 250.00
```

Depress the [ENTER] key, AZ LO LIM is entered and cursor moves to the AZ HI LIM position. Enter the Azimuth WEST calculated set point.

| AZ LO =122.00 AZ HI = 238.00 |
|---|

Once the enter key has been depressed the elevation display appears.

**b. Elevation**

After the Elevation Limit display appears, enter the calculated Elevation DOWN set point for the EL LO LIM position. Use the numeric [0 - 9], decimal point [.] and [ENTER] keys to enter a five place elevation position. For example, 7.00, 19.99, 6.09, etc., back space [BK SP] key may be used to correct a number before entry. Depress the [ENTER] key, EL LO LIM is entered and cursor moves to the EL HI LIM position.

| EL LO = 7.00 EL HI = 90.00 |
|---|

Depress the [ENTER] key, EL LO LIM is entered and cursor moves to the EL HI LIM position. Enter the Elevation UP calculated set point.

| EL LO = 7.00 EL HI = 88.00 |
|---|

Enter the Elevation UP calculated set point. Once the enter key has been depressed, the Polarity display appears.

**c. Polarity**

When the Polarity Limit display appears, enter the calculated Polarity COUNTERCLOCKWISE set point for the POL LO LIM position. Use the numeric [0 - 9], decimal point [.] and [ENTER] keys, enter a four place polarity position. For example, 99.9, 100.0, 111.1, etc., back space [BK SP] key may be used to correct a

number before entry. Depress the [ENTER] key, POL LO LIM is entered and cursor moves to the POL HI LIM position.

```
POL   LO = 5.0          POL   HI = 175.0
```

Enter the Polarity CLOCKWISE calculated set point.

```
POL   LO = 5.0        POL   HI = 175.0
```

Once the enter key has been depressed the Setup Menu display appears.

```
CAL:1 LIM:2 COEF:3 T/O:4 POS:5          DEG>RU: 6
CLEAR   RAM:7                             EXIT: 0
```

## I. Setting Motor Coast Coefficients

Motor Coast Coefficients, measured in degrees or resolver units, represent the distance to the desired antenna stopping point when a motor is shut off. The HI SPEED number represents the fast motor turn off and the LO SPEED the slow motor turn off.

### 1. Azimuth

On the APC100, depress the three [3] key to select COEF, Coast Coefficient display appears.

```
AZ: EAST = XXXXX         WEST = XXXXX
   HIGH SPEED = XXXXX
```

The current AZ COAST COEFFICIENTS is displayed, the cursor is under the AZ: EAST position. To change the AZ: EAST data use the numeric [0 -

9] and [ENTER] keys. The [BK SP] key may be used to change erroneous data before depressing the [ENTER] key. After entering the AZ: EAST Coast Coefficient the cursor moves to a position under the AZ: WEST place holder. After entering the AZ: WEST coefficient, the cursor moves to a position under the high speed place holder.

**NOTE: The HIGH SPEED Motor Coast Coefficient must be set to 2° (364 resolver units) OR GREATER from the desired antenna stopping point to insure proper LOW SPEED performance.**

AZ and EL HI SPEED Coast Coefficients should be between 400 and 600, 182 resolver units is equivalent to one degree of travel.

### 2. Elevation

After entering the AZ HIGH SPEED Coast Coefficient the cursor moves position to under the EL LO SPEED position. Entering the EL HI SPEED Coast Coefficient causes the POL STD Coast Coefficient screens to appear.

| EL LO SPEED = 0.05 EL HI SPEED = 2.00 |
|---|

### 3. Polarization

The cursor moves under the POL STD SPEED position.

| POL STD SPEED = 0.50 |
|---|

After entering the POL STD SPEED Coast Coefficient the Setup Menu display appears. Depress zero [0] and the idle mode display appears.

### 4. Verifying APC100 Coast Coefficients

At the Local Motor Controller place the REMOTE/LOCAL switch in the REMOTE position. On the APC100 depress [POS], the position prompt appears, enter the known satellite position selected in Section ?, using the numeric [0 - 9] keys and [ENTER]. The position display appears, depress

[START] as prompted, the antenna in motion flag appears. The antenna stops near the known satellite local coordinates entered in Section.

### a. Fine Tuning Coast Coefficients

The AZ, EL and POL Coast Coefficients may be fine "adjusted". A simple way to approximate the required resolver units needed for the LO SPEED motors is as follows:

Fine Tuning Coast Coefficients Procedure

1. Set AZ and EL Coast Coefficients to one (1).

2. Enter into the APC100, using the [SET] feature, a position approximately 20° away from the current AZ and EL positions. Record the exact azimuth and elevation position requested. Depress the [START] key when prompted.

3. Record the exact azimuth and elevation positions when the antenna has stopped moving. Determine the difference between the desired stopping point and the actual stopping point in degrees. If the controller is in the RESOLVER UNIT DISPLAY mode, multiply the difference in degrees by 182. This number is then rounded off to the nearest whole number and entered for the appropriate axis LO SPEED Coast Coefficient. If the APC100 is in the DEGREE DISPLAY mode enter the difference in degrees.

**TABLE VII** Example of Fine Tuning Coast Coefficients Calculations

| | | | | | |
|---|---|---|---|---|---|
| ACTUAL | Stopping Point | AZ | 190.04 | EL | 55.05 |
| DESIRED | Stopping Point | AZ | 190.00 | EL | 55.00 |
| | DEGREE MODE COEF: | AZ = | 0.04 | EL = | 0.05 |
| | X Resolver Units per Degree: | | x 182 | | x 182 |
| | Round off to Nearest Whole No. | | 7.28 | | 9.10 |
| | ENTER APPROPRIATE LO SPEED | | | | |
| | Resolver Mode Coast Coefficient | | | | |
| | RESOLVER MODE COEF: | AZ = | 7 | EL = | 9 |

4. The same technique may be applied to the Polarity Standard Speed Coast Coefficient. The polarity resolver mechanism gearing must be taken into account. For 1:1 polarity geared mechanism the multiplier is still 182, but for 2:1 polarity geared mechanism the multiplier becomes 364.

### b. Verifying APC100 Software Limits Assignments

Check that the Local Motor Controller is in the REMOTE operating mode and the APC100 is in LOCAL operating mode. Use the [SET] function to position the antenna near, but within, the SOFTWARE LIMITS entered previously in Section ?. The antenna should arrive near the values entered in Section ?. Attempting to move past the SOFTWARE LIMITS set in Section ? by using the jog keypad should not be possible. If the coast coefficients have been set properly, jogging through the SOFTWARE LIMITS should not be possible.

## J. Configuration Procedure

Refer to Andrew System Controller Manual device configuration chapter for proper configuration procedure for the APC100.

## K. Repackaging for Shipment or Storage

If the APC100 is to be packaged for shipment, use original packing materials. If materials have been discarded, follow these instructions:

1. Wrap unit in heavy paper or plastic. Use strong container, preferably one made of 275-350 pound test material.

2. Use sufficient shock absorbing material around unit sides to prevent movement inside container. Mark shipping container FRAGILE to assure careful handling.

# CHAPTER 5

# GENERAL OPERATION

# A. Controls and Indicators

Figure 5-1 shows the APC100 front panel.

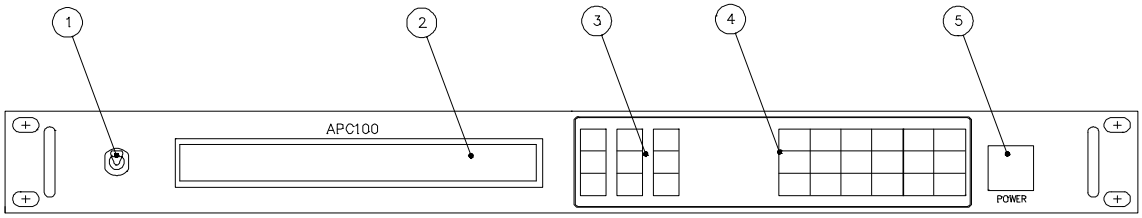



**Figure 1** APC100 Front Panel

Controls and indicators are defined as follows:

**Table V** APC100 Controls and Indicators

| NO | DESCRIPTION | FUNCTION |
|---|---|---|
| 1 | LOCAL/REMOTE MODE SELECT | Selects operating mode, local or remote. |
| 2 | LCD DISPLAY | Back lit display, providing 40x2 column visual presentation of antenna positioning parameters. |
| 3 | JOG KEYS | Initiates azimuth, elevation and polarization antenna motion while unit is in LOCAL (front panel) mode. |
| 4 | NUMERIC/FUNCTION KEYS | Numeric keys used to enter decimal data values and menu selections. Function keys allow local mode operations for APC100. |
| 5 | PWR SUPPLY | Provides power to unit. Plastic cover prevents accidental depression. |

## B. Tutorial of Operation

### 1. Current Position (Idle Mode Displays)

The idle mode displays appear as shown in the following representative examples.

Antenna is pointing at a defined satellite position:

```
AZ=228.35   EL=   32.43   POL=100.8
ANIK-D1              104 W              *       SAT   #21
```

Antenna not pointing at a defined satellite position:

```
AZ=180.00   EL=   45.00   POL=180.0
Not on Satellite
```

Antenna is moving:

```
AZ=170.25   EL=   45.00   POL=180.0       IN MOTION
```

### 2. Review/Move to a Programmed Satellite Position

| STEP | KEY | DESCRIPTION |
|---|---|---|
| 1 | LOCAL | Select LOCAL mode. Current location is displayed. |

```
AZ=235.46   EL=   34.85   POL=171.5
```

| | | |
|---|---|---|
| 2 | POS | Press the position [POS] key. |

```
POS  # :  ____
```

| | | |
|---|---|---|
| 3 | XX | Press one or two digits corresponding to the satellite number. |

```
POS  # :  21
```

| | | |
|---|---|---|
| 4 | ENTER | Press the [ENTER] key. Current defined satellite position is displayed. |

```
AZ=180.00  EL=  40.00  POL=185.0
ANIK-D1            104.5 W       *       SAT  # 21
```

| | | |
|---|---|---|
| (Optional) | NEXT | Press the [NEXT] key to sequence through stored satellite positions. |

```
AZ=189.00  EL=  45.00  POL=180.0
GSTAR-2            105 W         *       SAT  # 22
```

| | | |
|---|---|---|
| 5 | ENTER | Press [ENTER] to accept choice. |

```
AZ=189.00  EL=  45.00  POL=180.0       PUSH START
GSTAR-2            105 w         *       SAT  # 22
```

| | | |
|---|---|---|
| 6 | START | Press the [START] key, as prompted to move to the position displayed. |

```
AZ=189.00  EL=  45.00  POL=180.0       IN MOTION
```

Additional keys:

| | |
|---|---|
| BK SP | Use the [BK SP] key to correct or change entered data before pressing ENTER. |
| CLEAR | Press the [CLEAR] key to EXIT POS mode without selecting a satellite position. |
| STOP | Press the [STOP] key at any time to stop antenna motion and to return to the Idle mode display. |

After reaching a satellite position (current position) the following idle mode display is seen.

```
AZ=189.00   EL=   45.02   POL=180.1
GSTAR-2              105 W                  *     SAT   # 22
```

### 3. Set-Move Antenna to Operator Entered Coordinates

In this command, the changed data is validated to be in limits before the operator is allowed to go to the next field.

| STEP | KEY | DESCRIPTION |
|---|---|---|
| 1 | LOCAL | Select LOCAL mode. |
| 2 | SET | Press the [SET] key. Current position is displayed wiwth the cursor positioned at the start of the AZ field. |

```
AZ=185.65   EL=   50.15   POL=175.2
```

| | | |
|---|---|---|
| 3 | XXX.X | Either enter AZ position data using the numeric keys press or the [ENTER] key to keep the current AZ position. Press this [BK SP] key to change inputted data before pressing the [ENTER] key. |
| 4 | ENTER | Press the [ENTER] key. |

The following display appears if out-of-range Azimuth position data is entered in the prior step.

```
AZ=185.65   EL=   50.15   POL=175.2        EER
```

The following display appears if in-range Azimuth position data 160 is entered in the prior step. The cursor moves to the EL display.

```
AZ=160.00   EL=   50.15   POL=175.2
```

| | | |
|---|---|---|
| 5 | XXX.X | Either enter EL position data using the numeric key or press the [ENTER] key to keep the current EL position. |
| 6 | ENTER | Press the [ENTER] key. |

The following display appears if in-range elevation position data 82 is entered in the prior step. The cursor moves to the POL display.

```
AZ=160.00   EL=   82.00   POL=175.2
```

| | | |
|---|---|---|
| 7 | XXX.X | Either enter POL position data using the numeric keys or press the [ENTER] key to keep the current POL position. |
| 8 | ENTER | Press the [ENTER] key. |

The following display appears if in-range POL position data 110.0 is

entered in the prior step. The cursor disappears.

| AZ=180.00 EL= 82.00 POL=110.0 PUSH START |
|---|

| | | |
|---|---|---|
| 9 | START | Press the [START] key, and the antenna moves to the operator-entered coordinates. |

Additional keys:

| | |
|---|---|
| BK SP | The backspace [BK SP] key is used to move to previously changed data in a given field such as AZ, EL OR POL before the [ENTER] key is depressed. |
| CLEAR | Enter [CLEAR] to exit the SET command without going to entered destination. |
| STOP | Press the [STOP] key at any time to stop antenna motion and to return to the Idle mode display. |

## 4. Calibrate Antenna Position

**WARNING**

Antenna position calibration, limits setting, coast coefficients and motor time out values should be done initially. Thereafter, the procedure should not be attempted by other than qualified personnel.

| STEP | KEY | DESCRIPTION |
|---|---|---|

1 LOCAL Select LOCAL mode.

2 SET Press the [SETUP] key.

```
CAL: 1 LIM: 2   COEF: 3   T/O:4   POS: 5      DEG>RU:6
CLEAR   RAM: 7                                EXIT: 0
```

Setup parameters are defined as follows:

| | | |
|---|---|---|
| CAL | denotes | Calibrate |
| LIMIT | denotes | Software Limits |
| COEF | denotes | Coast Coefficients |
| T/O | denotes | Motor Time Out |
| POS | denotes | Position |
| RU>DEG | denotes | Absolute Resolver Units/Relative Degrees (toggles display readings) |
| CLEAR RAM | Clears internal tables to default settings | |

**NOTE: The CLEAR RAM option is for use by QUALIFIED PERSONNEL only. This option clears antenna calibration and setup parameters as well as all satellite name and position data. Clearing RAM requires re-calibrating the antenna if information was not uploaded from the APC100 and available for subsequent downloading from the system controller or APCEDIT program back into the APC100.**

3 1 Press the one [1] key. Current coordinates are displayed.

```
AZ=200.47   E;=225.76   POL=192.35
```

4 Enter new values as described below in steps 5 and 6 for each axis.

```
AZ=187.50   EL=   40.00   POL=180.0
```

The entered values will become the current position.

| | | |
|---|---|---|
| 5 | XXX.XX | Key in the calibrated angle. (Note: POL data field is XXX.X). Press the [BK SP] key to change inputted data before pressing the [Enter] Key. |
| 6 | ENTER | Press the [ENTER] key. Pressing the [ENTER] key with changing values retains the current values. |
| 7 | 0 | After POL is entered and setup menu reappears, press the [0] key to exit the SETUP menu and return to the idle mode display. |

Additional keys:

| | |
|---|---|
| BK SP | Press the [BK SP] key to delete incorrectly entered data in a given filed. Repeat step 5 as required to input corrected data. |
| STOP | Press the [STOP] key at any time to stop antenna motion and to return to the Idle mode display. |

## 5. Review/Change Software Antenna Limits

> WARNING
> Software antenna limits should be set initially. Thereafter, the procedure should not be attempted by other than qualified personnel.

| STEP | KEY | DESCRIPTION |
|---|---|---|
| 1 | LOCAL | Select LOCAL mode. |
| 2 | SET | Press the [SET] key. |

```
CAL: 1   LIM: 2   COEF: 3   T/0: 4   POS:5     DEG> RU:6
CLEAR RAM: 7                                      EXIT:0
```

| | | |
|---|---|---|
| 3 | 2 | Press the two [2] key to select LIMITS. Current AZ limits are displayed. |

| AZ LO = 122.00 | AZ HI = 238.00 |
|---|---|

| | | |
|---|---|---|
| 4 | XXX.XX | Either enter AZ position data using the numeric keyspress or the [ENTER] key to keep the current AZ position. Press this [BK SP] key to change inputted data before pressing the [ENTER] key. |
| 5. | ENTER | Press the [ENTER] key. |
| 6 | XXX.X | Enter AZ HI limit data using numeric keys. |
| 7 | ENTER | Press the [ENTER] KEY. El limits will be displayed. |

| EL LO = 10.00 | EL HI = 88.00 |
|---|---|

| | | |
|---|---|---|
| 8 | XXX.XX | Enter EL LO limit data using numeric keys. |

| AZ LO = 122.00 | AZ HI = 238.00 |
|---|---|

| | | |
|---|---|---|
| 9 | ENTER | Press the [ENTER] key. (If 20 was entered, the display shows): |

| EL LO = 20.00 | EL HI = 88.00 |
|---|---|

| | | |
|---|---|---|
| 10 | XXX.XX | Enter EL HI limit data using numeric keys. |

| | | |
|---|---|---|
| 11 | ENTER | Press the [ENTER] key. POL limits are displayed. |

```
POL   LO = 92.0                    POL HI = 268.00
```

| | | |
|---|---|---|
| 12 | XXX.X | Enter POL LO limit data using numeric keys. |
| 13 | ENTER | Press the [ENTER] key. (If 16 was entered, and is found to be outside of the acceptable range of travel, the display shows): |

```
POL   LO =  92.0                   POL   HI = 268.00 ERR
```

where the current POL LO limit is redisplayed for re-entry.

| | | |
|---|---|---|
| 14 | XXX.X | Enter POL HI limit data using the numeric keys. |
| 15 | ENTER | Press the [ENTER] key. The values entered are stored and the SETUP menu returns to the display. |

```
CAL: 1   LIM: 2   COEF: 3   T/O: 4 POS: 5      DEG>RU:6
CLEAR   RAM: 7                                  EXIT: 0
```

| | | |
|---|---|---|
| 16 | 0 | Press the [0] key to exit the SETUP menu and return to the idle mode display. |

## 6. Review/Change Antenna Cost Coefficients

WARNING

Antenna cost coefficients should be set initially. Thereafter, the procedure should not be attempted by other than qualified personnel.

| STEP | KEY | DESCRIPTION |
|---|---|---|
| 1 | LOCAL | Select LOCAL mode. |
| 2 | SET | Press the [SETUP] key. |

CAL: 1 LIM: 2 COEF: 3 T/O: 4 POS: 5 DEG>RU: 6
CLEAR RAM: 7 EXIT: 0

| | | |
|---|---|---|
| 3 | 3 | Press the three [3] key to select coast coefficients. |

AZ LO SPEED = 0.05 HI SPEED = 2.00

| | | |
|---|---|---|
| 4 | XXXXX | Either enter AZ EAST speed data using the numeric keys or press the [ENTER} key to keep the current AZ EAST speed data. Press the [BK SP] key to correct data before pressing the [ENTER] key. |
| 5 | ENTER | Press the [ENTER] key. (If 0.05 was entered, the display shows): |

| AZ LO SPEED = 0.05 | HI SPEED = 2.00 |
|---|---|

6 XXXXX Enter the AZ HI speed data using numeric keys as described in Step 4.

7 ENTER Press the [ENTER] key. If AZ HI speed value is accepted, then Elevation values are displayed.

| EL LO SPEED = 0.05 | HI SPEED = 2.00 |
|---|---|

8 XXXXX Same as Steps 4-7, except enter EL LO and HI SPEED data using the numeric keys. Press [ENTER] after entering each coefficient. This causes the POL coefficient screen to be displayed.

| POL STD SPEED = 1.00 |
|---|

9 ENTER Same as Step 4 and 5, enter only single POL Standard Speed coefficient data using the numeric keys.

| POL STD SPEED = 1.00 |
|---|

10 ENTER Press the [ENTER] key while displaying th POL coast coefficients. The values entered are stored and the SETUP menu returns to the display.

```
CAL:1   LIM: 2   COEF: 3   T/O: 4   POS5
                                          RU>DE
                                          G:6
CLEAR   RAM: 7                          EXIT: 0
```

| | | |
|---|---|---|
| 11 | 0 | Press the [0] key to exit the SETUP menu and return to the idle mode display. |

## 7. Setting Motor Time-Outs

> WARNING
>
> Motor time out values should be set initially. Thereafter, the procedure should not be attempted by other than qualified personnel.

The MINIMUM SPEED is the average rate the antenna must maintain during the TIME-OUT PERIOD to prevent a time-out error. The suggested TIME-OUT VALUES have added delay factors to compensate for variations in motor and antenna drive mechanisms. Factors such as temperature changes, average operating angles and travel direction also affect antenna motion, particularly elevation.

| STEP | KEY | DESCRIPTION |
|---|---|---|
| 1 | LOCAL | Select LOCAL mode. |
| 2 | SET | Press the [SET] key. |

```
CAL: 1   LIM: 2   COEF: 3   T/O: 4 POS: 5      DEG>RU:6
CLEAR   RAM: 7                                  EXIT: 0
```

| | | |
|---|---|---|
| 3 | 1 | Press the four [4] key. Azimuth time-out display appears. Refer to the Recommended Time-out |

Values in Table 3-a.

| | | |
|---|---|---|
| 4 | XXX | Either enter AZ LO T/O data using the numeric keys or press the [ENTER] key to keep the current AZ LO T/O value. Press the [BK SP] key to change inputted data before pressing the [ENTER] key. |

| |
|---|
| AZ: LO T/O = ___ 100 HI T/O = 100 |

| | | |
|---|---|---|
| 5 | ENTER | Press the [ENTER] key while displaying the POL coast coefficients. The values entered are stored and the SETUP menu returns to the display. |
| 6 | XXX | Either enter AZ HI T/O data using the numeric keys or press the [ENTER] key to keep the current AZ HI T/O value. |
| 7 | ENTER | Press the [ENTER] key. The display changes, and the cursor moves to EL LO T/O display field. |

| |
|---|
| EL: LO T/O = ____100 HI T/O = 100 |

| | | |
|---|---|---|
| 8 | XXX | Either enter EL LO T/O data using the numeric keys or press the [ENTER] key to keep the current EL LO T/O value. |
| 9 | ENTER | Press the [ENTER] key. The cursor moves to EL HI T/O display field. |

| |
|---|
| EL: LO T/O = 100 HI T/O = ____100 |

| | | |
|---|---|---|
| 10 | XXX | Either enter EL HI T/O data using the numeric |

keys or press the [ENTER] key to keep the current EL HI T/O value.

| | | |
|---|---|---|
| 11 | ENTER | Press the [ENTER] key. The display changes and the cursor moves to the POL LO T/O display field. |

```
POL:  LO  T/O  = __ 100
```

| | | |
|---|---|---|
| 12 | XXX | Either enter POL HI T/O data using the numeric keys or press the [ENTER] key to keep the current POL LO T/O value. |
| 13 | ENTER | Press the [ENTER] key. The display returns to the SETUP menu. |

```
CAL: 1   LIM: 2   COEF: 3   T/O: 4   POS:5
                                        DEG>R
                                        U: 6
CLEAR RAM: 7                            EXIT: 0
```

| | | |
|---|---|---|
| 14 | 0 | Press the [0] key to exit the SETUP menu and return to the idle mode display. |

### 8. Store Current Coordinates as Satellite Position

| STEP | KEY | DESCRIPTION |
|---|---|---|
| 1 | LOCAL | Select LOCAL mode. Current location is displayed in the screen shown below. |

```
AZ=18.23   EL=39.86   POL=185.1
Not on Satellite
```

| | | |
|---|---|---|
| 2 | SET | Press the [SETUP] key. |

```
CAL: 1   LIM: 2   COEF: 3   T/O: 4   POS: 5     RU>DEG:6
CLEAR   RAM:7                                    EXIT: 0
```

| | | |
|---|---|---|
| 3 | 5 | Press the Five [5] key |

```
POS # : _____
```

| | | |
|---|---|---|
| 4 | XX | Press one or two digits corresponding to the satellite number. |
| 5 | ENTER | Press the [ENTER] key. If 21 was entered, then position 21 will be displayed as: |

```
AZ=180.23   EL= 39.86   POL=185.1
ANIK-D1                104.52                    *   SAT
                                                 # 21
```

| | | |
|---|---|---|
| 6 | ENTER | Press the [ENTER] key, again. The selected position and current pointing angles will be stored. SETUP menu will be displayed. |

```
CAL: 1   LIM: 2   COEF: 3   T/O: 4   POS: 5     RU>DEG: 6
CLEAR  RAM:7                                     EXIT: 0
```

| | | |
|---|---|---|
| 7 | 0 | Press the [0] key. SETUP menu is replaced by the current satellite position display. |

```
AZ=180.23   EL= 39.86   POL=185.1
ANIK-D1                      104.5W        *      SAT # 21
```

This position of the antenna, as displayed, is stored in the position table in battery backed-up RAM. A list of default satellite names is shown in Table 4-1. The names can be changed using the APCEDIT software supplied.

### 9. View Antenna Position in Resolver Reading

| STEP | KEY | DESCRIPTION |
|---|---|---|
| 1 | LOCAL | Select LOCAL mode. |
| 2 | SET | Press the [SET] key. |

```
CAL: 1   LIM: 2   COEF: 3   T/O: 4   POS:5      RU>DEG:6
CLEAR   RAM:7                                    EXIT: 0
```

| | | |
|---|---|---|
| 3 | 6 | Press the six [6] key. |
| 4 | 0 | Press the [0] key. Current position in Absolute Resolver Units will be displayed. |

```
AZ=32584   EL=33978   POL=42117
```

The APC100 returns to IDLE mode, displaying the current position. The controller will continue to display positions in Absolute Resolver Units until it is toggled, using the SETUP screen. All other APC100 system settings such as calibration values, limits, etc. may also be reviewed in resolver units. Select the SETUP menu, then enter option 6 to toggle resolver measurements units before entering other SETUP menu options.

## C. Using APCEDIT

### 1. Introduction

The APCEDIT is a software produce of ANDREW CORPORATION that provides a user-friendly interface between a personal computer (PC) and the APC100 controller. It is included as part of the APC100 package. The program is written in ′C′ language, using the IBM DOS operating system functions for data display and communication functions. It provides the

following functions:

1 View and Modify Satellite Names and Longitudes

- 1.1 Modify - Allows satellite names, longitudes, and pointing angles to be edited.
- 1.2 Save - Writes modified data to diskette.
- 1.3 Upload - Retrieves Satellite names and longitudes from the APC100.
- 1.4 Download - Sends saved satellite names and longitudes to the APC100.

2 View Setup Parameters

- 2.1 Upload - Retrieves setup from the APC100.
- 2.2 Save - Saves parameters to diskette.
- 2.3 Display - Displays parameters
- 2.4 Download - Sends the saved setup parameters to the APC100
- 2.5 View Only - Reads and displays parameters from disk.

Setup parameters are automatically saved to disk when uploaded. Satellite position data can also be saved to disk via a menu option on the 'VIEW & MODIFY SAT NAMES' submenu (Figure 5-3). All data files are written to the data storage media where the APCEDIT.EXE file resides. This could be the hard drive, a floppy disk, or other memory storage device. This allows for easy removal, and off-site storage, of APC100 setup data.

## 2. Installation

Boot the IBM PC, or compatible, using DOS version 3.1 or greater. Follow the suggested steps to verify the APC100 is configured for RS232 communications. Communication port operates at 9600 Baud, even parity, 8 data bits, and 1 stop bit.

WARNING

Remove Primary AC power before attempting maintenance.

1 Turn off the APC100 power and disconnect the rear panel cables.

2 Remove the APC100 from the equipment rack and open the top cover.

3 Verify the APC100 jumper/switch settings enable RS232 communications and set the address to 50H.

| | | |
|---|---|---|
| JU3 | 1-2 | Sets RS232 |
| JU4 | 1-2 | Sets RS232 |
| Ju11 | 1-2 | Comm port enable |

S2 - 1, 2, 3, and 4 = 0, **ON**
- 5, 6, 7, and 8 = 1, **OFF**

4 Replace the APC100 cover. Reinstall the unit into the equipment rack. Re-cable the rear panel.

5 Turn on the primary AC power and the APC100 is ready to operate.

6 A standard 25 pin connector null modem cable allowing PC to APC100 communications is provided. One end must be a pin (male) connector and the other end a socket (female) connector.

The cable connects the asynchronous serial COM1 port of the PC and the Remote Communications port of the APC100. The APC100 remote communications port has a 25-pin socket connector. Therefore, its end of the cable will need to be the pin connect (or Male) end of cable.

For the PC COM1 port, a 25-pin socket connection is provided. It there is a 9-pin COM1 port connection in back of the PC, a straight through "AT", 25-pin to 9-pin adaptor may be obtained at most

computer stores.

7 Connect the cable between the IBM PC and the APC100

8 Insert the APCEDIT program diskette in a 3.5" HD floppy drive (assumed to be A:) of the PC.

9 Make **D**irectory, “APCEDIT” on the hard drive (assumed to be drive C:). Change directory to C:\APCEDIT>. Copy the executable program to the hard drive, using the following command.

COPY A:\APCEDIT.EXE C:\APCEDIT

If desired the work copy of the execute program may be copied to another floppy disk. After inserting a blank, formatted diskette in drive B:, type in the following command:

COPY A:\APCEDIT.EXE B:

10 Remove the master APCEDIT Program diskette from drive A:. Store the master APCEDIT program diskette in a safe place.

11 Where the APCEDIT.EXE resides is where the APC100 data files will be created.

## 3. Starting the Program

1 The IBM PC or compatible should have the following:

The executable program APCEDIT.EXE, on either the hard drive, C:\APCEDIT>, or on a installed floppy disk.

2 The APC100 Local/Remote switch placed in Remote.

3 From C:\APCEDIT> directory (or the A:\ B: drive for floppy operation), type in the following command:

APCEDIT [RETURN]

4 The main menu should appear on the PC screen.

5 For the Initial run, it is necessary to first upload SETUP and POSITION data from the APC100. The uploaded data may then be modified, stored, and downloaded from disk media where the APCEDIT.EXE program resides.

6 The APCEDIT program does **NOT** automatically save POS information. It is necessary for the operator to select the menu option, and then “SAVE” to save. Changes should be made, saved to disk, then downloaded to the APC100.

**NOTE: The APC100 does not accept satellite position data for a position containing out-of-range coordinates. An undefined position has out-of-range coordinates (zeros). Therefore, the APC100 will only accept name and longitude changes form the PC for defined positions.**

## 4. APCEDIT Menue

The following figures illustrate how the menus are structured. They show examples of the data screens available with the APCEDIT program.

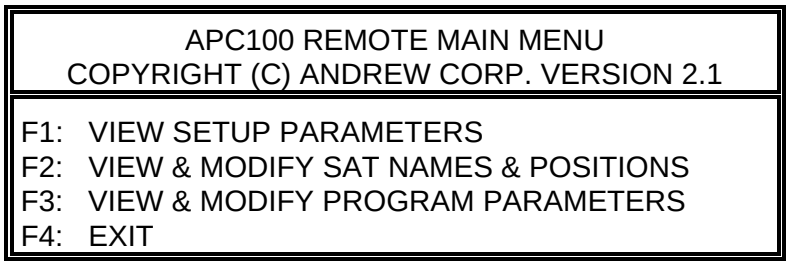



**Figure 6** Main Menu Display

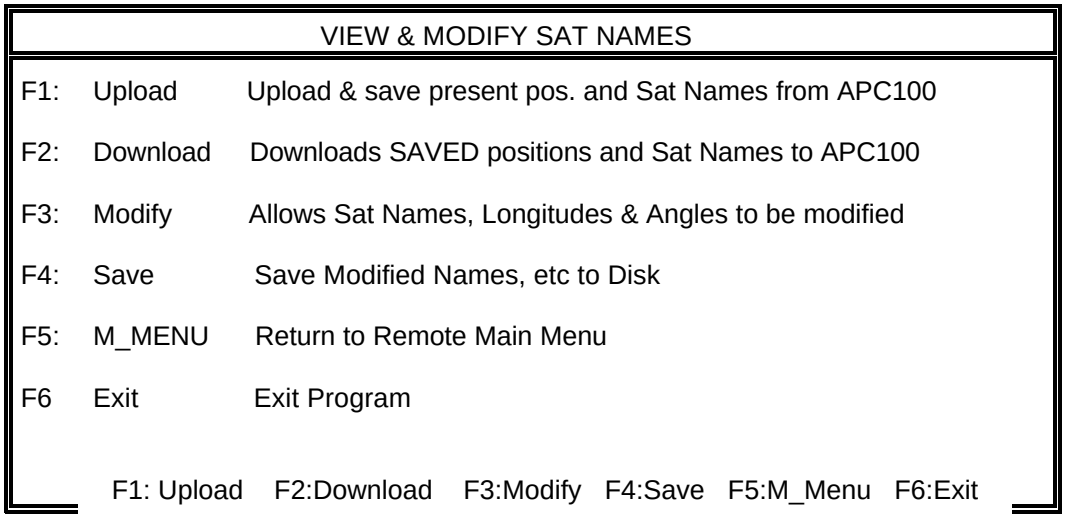



**Figure 7** View & Modify Satellite Names Screen

| POS# | SAT NAME | LONGITUDE | AZ | EL | POL |
|---|---|---|---|---|---|
| 01 | GSTAR IV | 89 W | 180.0 | 45.0 | 180.0 |
| 02 | Satcom GE K2 | 81 W | 178.7 | 45.0 | 180.0 |
| 03 | Satcom GE K1 | 85 W | 174.8 | 45.0 | 179.9 |
| 04 | SPACENET III | 87 W | 172.6 | 45.0 | 179.9 |
| 05 | SBS 4 | 97 W | 170.8 | 45.0 | 180.0 |
| 06 | GStar | 93 W | 168.8 | 45.0 | 180.0 |
| 07 | SBS 3 | 95 W | 168.4 | 44.9 | 179.8 |
| 08 | Telstar 401 | 97 W | 160.5 | 94.0 | 225.4 |
| 09 | GALAXY VI | 99 W | 157.2 | 80.9 | 190.6 |
| 10 | SPACENET 1 | 101W | 154.0 | 98.4 | 233.1 |
| 11 | GStar 1 | 103W | 150.4 | 100.6 | 236.9 |
| 12 | GStar 2 | 105W | 180.0 | 90.0 | 180.0 |
| 13 | SPACENET 1 | 120W | 185.4 | 45.0 | 179.9 |
| 14 | SBS 5 | 123W | 150.3 | 100.2 | 210.8 |
| 15 | GStar 4 | 125W | 157.3 | 89.0 | 178.9 |
| 16 | ASC 1 | 128W | 180.1 | 46.0 | 180.4 |
| 16 | ASC1 | 128.W | 180.1 | 46.0 | 180.4 |
| 17 | SBS 2 | 97 W | 150.4 | 100.6 | 237.0 |
| 18 | WESTAR 5 | 99 W | 180.0 | 45.0 | 180.0 |
| 19 | SBS 1 | 99 W | 180.0 | 45.0 | 180.0 |
| 20 | GStar 1 | 103W | 180.0 | 45.0 | 180.0 |

F2:Next_Page F3:Mod_Menu F9:Tab-L F10:Tab-R
Arrows:Move_Cursor

**Figure 8** Satellite Position Table

**NOTE: The position table displayed in Figure 8 represents satellite names and positions programmed in the current APC100 software. For default satellites refer to Table 4-b.**

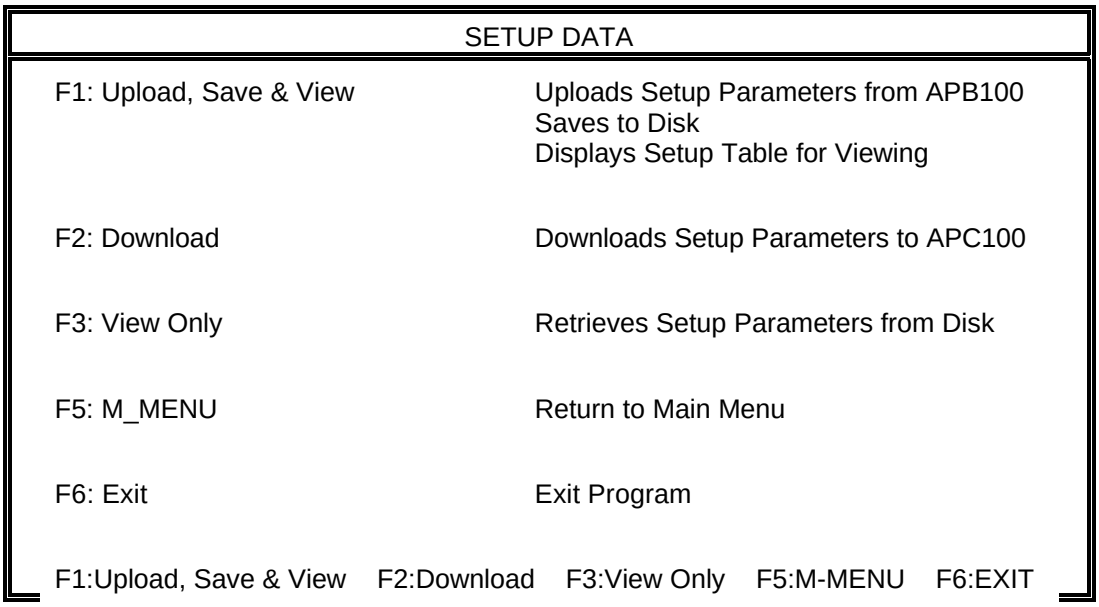



**Figure 9** View Setup Parameters Menu

| SETUP DATA | | |
|---|---|---|
| AZ__LO__COAST | = | 0050 |
| AZ__HI__COAST | = | 0600 |
| EL__LO__COAST | = | 0650 |
| EL__HI__COAST | = | 0600 |
| POL__COAST | = | 0050 |
| AZ__CAL | = | 00992 |
| EL__CAL | = | 24261 |
| POL__CAL | = | 17939 |
| AZ__SL__TIMEOUT | = | 0100 |
| AZ__FS__TIMEOUT | = | 0050 |
| EL__SL__TIMEOUT | = | 0100 |
| EL__FS__TIMEOUT | = | 0050 |
| POL__TIMEOUT | = | 0050 |
| AZ__LO__LIMIT | = | 01820 |
| AZ__HI__LIMIT | = | 45511 |
| EL__LO__LIMIT | = | 01820 |
| EL__HI__LIMIT | = | 16384 |
| POL__LO__LIMIT | = | 01820 |
| POL__HI__LIMIT | = | 32768 |
| PRESS ENTER | | |

**Figure 10** Setup Data Example Screen

| PROGRAM PARAMETERS SCREEN | |
|---|---|
| APC100 Software Version | 2.11 or less |
| APC100 Address: | 50 |
| Comm. Port: | COM1 |
| Baud Rate: | 9600 |
| Parity: | EVEN |
| Data Bits: | 8 |
| Use up and down arrow keys to select field s and the left and right arrow keys to change the selected field. | |

**Figure 11** Program Parameters Screen

## 5. Error Messages

1. APC100 IN LOCAL - The APC100 Local/Remote switch must be in the REMOTE position to allow communications with the PC.

   Corrective Action:

   – Flip the APC100 switch to REMOTE and retry the operation.

2. NOR RESPONSE FROM APC100 - The APC did not respond to a request or command sent from the PC.

   Corrective Action:

   – Verify the cable between the APC100 and the PC is firmly attached at both ends.

   – Verify the cable is attached to the correct APC100 and PC ports.

- Verify the PC Com1 port is serial - not parallel.
- Verify the proper PC Com port is selected, Com1 or Com2.
- Verify the RS232 configuration switches are set in the APC100.

## D. APC100 Operation, Remote Mode

Refer to device control sections of the Andrew System Controller manual for information on APC100 remote control operation.

# CHAPTER 6

# APC100 HARDWARE

## A. Hardware Configuration

The APC100 may be configured to operate with different antenna motor types, polarity resolver gearing ratios of 1:1 or 2:1, two different types of resolver decoders, and antennas located in the Northern or Southern Hemisphere. More than on controller may be connected to a single RS-422 interface. An APC100 configuration is defined by DIP switch and JUMPER pin settings annotated within Table VI and Table VII.

## **Table VI** Dip Switch Functions and Settings

| SWITCH # | FEATURE DESCRIPTION | SWITCH SETTINGS 0N = (0)/OFF = (1) | FACTORY DEFAULT SETTING | | |
|---|---|---|---|---|---|
| S1-1 | Motor Speed | Dual/Single | Dual | 0 | (ON) |
| S1-2* | Motor Type, | Demag/Reuland & Eurodrive | Reuland & Eurodrive | 1 | (OFF) |
| S1-3 | Number of Antenna Axis | 2 Axis/3 Axis | 3 Axis | 1 | (OFF) |
| S1-4** | Polarity Reslvr Gearing, Extended | 2:1/1:1 | 1:1 | 1 | (OFF) |
| S1-5 | Antenna Mode | (Mobile)/Fixed | | 1 | (OFF) |
| S1-6 | Hemisphere of Operation | Southern/Northern | Northern | 1 | (OFF) |
| S1-7*** | Resolvr Converter | AE01-R0247/1S61RD | MANF. OPT | 0 | (ON) |
| S1-8*** | Motor Operation | Serial/Concurrent | CONCURRENT | 1 | (ON |
| | | | | | |
| S2-1 | Unit Address MSB | | | 0 | (ON |
| S2-2 | Unit Address | | | 0 | (ON |
| S2-3 | Unit Address | | | 0 | (ON |
| S2-4 | Unit Address LSB | | | 0 | (ON |
| S2-5 | Unused | | MUST BE | 1 | (OFF) |
| S2-6 | Unused | | MUST BE | 1 | (OFF) |
| S2-7 | Unused | | MUST BE | 1 | (OFF) |
| S2-8 | Unused | | MUST BE | 1 | (OFF) |

NOTES:
1. S1 defines Motor/Axis Environment.
2. S2 defines Address, Hex 50 thru 5F
3. 0 = Switch CLOSED, GROUNDED or ON 1 = Switch OPEN, OFF - SET Unused Positions to 1.
4. Andrew Local Motor Controllers: Dual speed P/N LMKDS and Single speed P/N AE01A-D0259 are configured by S1-2, MOTOR TYPE = 1, **OFF**.

** 5. 7.3M, 7.6M, 9.1M AND 9.3M Antennas use 2:1 polarity gearing mechanisms, S1-4 = **OFF**

*** 6. When RDC sub-assy AE01AD0247 installed, S1-7 is set to **ON**. Must be installed for **Concurrent Motor** operation.

7. 3.7M and 4.5M Trifolds and 2.4M SNG antennas use variable speed motors. For Trifolds S1-1 is set **OFF**. For 2.4M SNG antennas S1-1 is set **ON**. Both Trifolds and SNG antennas set S1-8 to **ON** (Serial motor mode) and S1-5 set to **ON** (Extended mode).

**1. Motor Systems**, Dual Speed = "ON", Single Speed = "OFF"

Antennas can be supplied with either dual speed, single, or variable speed motors. Switch S1-1, DUAL is closed, = "ON" to select dual speed motor operation, giving a value of "0". S1-1 is left open = "OFF" for a single speed system, giving a value of "1".

**2. Motor Type**, LMKDS w/any motor type = "OFF".

Fixed Antennas supplied with Andrew Local Motor Controllers are dual speed, Andrew P/N LMKDS, configured by S1-2, MOTOR TYPE = "OFF", "1", regardless of motor manufacture type supplied.

2.4M SNG antennas are also dual speed, S1-2, MOTOR TYPE = "OFF", "1". Transportable Trifold antennas are single speed, configured by S1-2, MOTOR TYPE = "OFF", "1".

Andrew LMCs ending in P/N -D0259 and -D0644 are single speed types configured S1-1, SINGLE = "OFF", "1", and S1-2, MOTOR TYPE = "OFF", "1". Andrew LMCs ending in P/N -D0260, and -D0645 are dual speed types configured S1-1, DUAL = "ON", "0", and S1-2, MOTOR TYPE = "OFF", "1".

Antennas supplied with other P/N Local Motor Controllers are configured according to the motor manufacturer. Three different types of motors are supplied for Andrew antennas, Demag, Reuland, and Eurodrive. Eurodrive and Reuland use the same configuration. Demag motors are only used in the dual speed configuration. Eurodrive and Reuland have single and dual speed options. For Demag motors switch S1-2 is closed or "ON", giving a value of "0". Reuland or Eurodrive motors require switch S1-2 to be open or "OFF", giving a value of "1" regardless of the speed option set by S1-1.

**3. Number of Antenna Axes**, 3 Axis = "OFF", 2 Axis = "ON"

Circularly Polarized Antenna Feed systems do not require polarization rotation, therefore only the azimuth and elevation require motorization. When operating a two axes antenna system switch S1-3 is closed or "on", giving a value of "0". In this case only azimuth and elevation information will be displayed and the polarity axis resolver reading is not taken.

All Domestic United States Satellites use Linear Polarization and require polarization adjustment. For Linear Polarized Antenna Feed systems S1-3 is to be left open or "off", giving a value of "1". United States Domestic Satellites use 3 Axis supported antennas.

**4. Polarity Motor Gearing**, 1:1 = "OFF", 2:1 = "ON"

7.3M, 7.6M, 9.1M and 9.3M Motorized antennas use 2:1 polarity gearing mechanisms. 4.5M C-Band, 3.6, 4.5, 4.6 and 5.6 Motorized Ku-Band antennas use 1:1 polarity gearing mechanisms. For 2:1 gearing switch S1-4 is closed or "on", giving a value of "0". 1:1 gearing requires this switch to be left open or "off", giving a value of "1".

**5. Extended/Fixed Earth Station Antenna Operation Mode**, Extended = "ON", Fixed = "OFF"

For FIXED Earth station applications, a default Satellite Name and Location Table is enabled. The absolute maximum software encoded (hard) limits are tailored to accommodate the best operating range for the position resolvers. The Fixed Earth station operating mode is selected by setting S1-5 to open or "off", giving a value of "1".

The EXTENDED mode is used for NEWS GATHERING BY SATELLITE applications when the antenna becomes mobile. The pointing angle to a specific satellite is determined when the antenna carrying vehicle is parked. This mode is selected by setting S1-5 to the closed or "on" position, giving a value of "0". For more information, see Table 6-a.

**6. Hemisphere of Operation**, Northern = "OFF", Southern = "ON"

The APC100 is designed to work in either the Northern or Southern Hemisphere. In the Northern Hemisphere, easterly movement is in a counter clockwise direction when referenced from True North and looking

down on the antenna installation. Azimuth readings, when measured in degrees from True North, decrease as the antenna moves eastward. In the Southern Hemisphere, easterly movement is in a clockwise direction when referenced from True North. Hence, Azimuth readings when measured in degrees from True North, increase as the antenna moves eastward in the southern hemisphere. Once the antenna azimuth reaches True North the azimuth display wraps around to 0 from 359.99 degrees. Switch S1-6 is placed in the closed or "on" position for Southern Hemisphere Operation, giving a value of "0". For the United States and other North Hemisphere locations switch S1-6 is left open or "off" giving a value of "1".

**7. AEO1A-D0247 (w/2S80)/1S61 RD**, = "ON"

AE01A-D0247 MUST BE INSTALLED TO SUPPORT SOFTWARE VERSION 2.11 used for concurrent motor operation. The APC100 is designed to operate with two different resolver to digital converter chips. This switch must be set to reflect the type of resolver to digital chip installed. If a AE01A-D0247 subassembly with a 2S80 converter is installed, the switch S1-7 must be closed or "on", giving a value of "0". If a 1S61 converter is installed switch S1-7 must be open or "off", giving a value of "1". Note: If this assembly is installed and S1-7 is set to "OFF", the maximum RU reading will 400.

**8. Serial/Concurrent Motor Operation**, Concurrent = "OFF"

The AE01A-D0247 MUST BE INSTALLED TO SUPPORT SOFTWARE VERSION 2.11 used for concurrent motor operation. Serial motor mode permits antenna repositioning of each axis to be completed before starting the next. The axes movements are sequenced starting with azimuth, then elevation, and finishing with the polarity. This mode is selected by setting S1-8 to "on" for a value of "0". Concurrent motor mode permits two axes to start movement at the same time. The APC100 starts AZ and EL, then EL and POL to complete positioning requirements. When operated in concurrent motor mode approximately twenty-five percent less repositioning time is required to reach a target position than serial motor mode. This mode is selected by setting S1-8 to "off" for a value of "1".

**9. Unit Address**, Default S2-1, 2, 3, & 4 = "ON" for 50H

The APC100 may have up to 16 units connected on a single RS-422

interface line responding to a host controller. For the host controller to be able to distinguish individual units they must be assigned unique addresses. Switches S2-1 (MSB) thru S2-4 (LSB) provide the unique addressing capability for the APC100.

The address of the APC100 is a one character byte. The high nibble of this byte is always "5". The low nibble is selected with switches S2-1 thru S2-4. This gives an address range from 50 hexadecimal to 5F hexadecimal. See Figure 6:

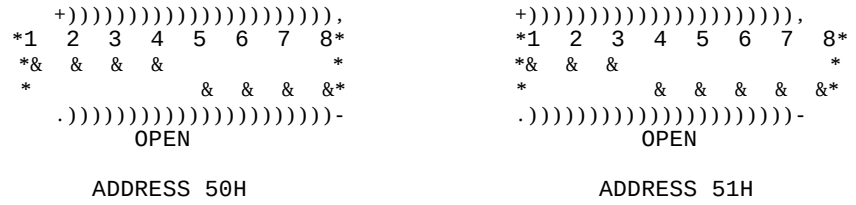



**Figure 6** APC100 Dip Switch, **S2**, Address Setting, 50H and 51H

**Table 1** Jumper Functions and Settings

| JUMPER LOCATION | FACTORY DEFAULT | FEATURE |
|---|---|---|
| JU1 E1-E2 | | UNUSED |
| E2-E3 | * | 27C512 EPROM |
| JU2 E1-E2 | * | INTERNAL BEEPER POWER |
| E2-E3 | | UNUSED |
| JU3 E1-E2 | * | TX RS-232 |
| ** E2-E3 | | TX RS-422 (USE WITH ASCx000) |
| JU4 E1-E2 | * | RX RS-232 |
| ** E2-E3 | | RX RS-422 (USE WITH ASCx000) |
| JU5 E1-E2 | | UNUSED |
| E2-E3 | * | 62256 RAM |
| JU6 E1-E2 | | UNUSED |
| E2-E3 | * | 62256 RAM |
| JU7 E1-E2 | | UNUSED |
| E2-E3 | * | 27C512 EPROM |
| JU8 E1-E2 | | 4.50V WATCHDOG RESET |
| E2-E3 | * | 4.75V WATCHDOG RESET |
| JU9 E1-E2 | * | 1 SEC WATCHDOG RESET |
| E2-E3 | | 100 mS. WATCHDOG RESET |
| JU10 E2 <)))<br>JU12 E1 <)))- | * | HARDWARE JUMPER, TO JU12 - E1 |
| E2-E3 | * | HARDWARE JUMPER, ENABLES MOTION INHIBIT<br>ENABLES EXTERNAL ANTENNA MOVEMENT REPORTING |
| JU11 E1-E2 | | PORT HARDWARE ENABLE (SINGLE APC100, RS232 OR 422). |
| E2-E3 | * | PORT SOFTWARE ENABLE (MULTI DROP/RS422 ONLY). |
| JU13 E1-E2 | * | WATCHDOG ENABLE |
| E2-E3 | | WATCHDOG DISABLE |
| JU14 E1-E2 | | KEY STROKE BEEPER DISABLE |
| E2-E3 | * | KEY STROKE BEEPER ENABLE |

**NOTE: * Denotes jumper position set at factory.**
**** Configuring the 422 COM PORT without the cable connected allows the differential receiver input to float. The receiver driver in this mode is highly susceptible to falsing from noise.**

## B. Jumper Pins, Functional Descriptions

Jumper Plug Location JU-1:

The APC100 software is contained within a 27C512 EPROM. For the 27C512 EPROM a jumper is placed between E2 - E3. This connection provides address line A15 to the EPROM.

Jumper Plug Location JU-2:

This jumper supplies power to the internal beeper. A jumper is placed between E1 - E2 to power the internal beeper.

Jumper Plug Location JU-3:

Serial communications may be conducted over an RS-232 or RS-422 interface. A jumper is placed between E1 - E2 to connect the transmit data line to the RS-232 interface. A jumper is placed between E2 - E3 to connect the transmit data line to the RS-422 interface.

Jumper Plug Location JU-4:

Serial communications may be conducted over a RS-232 or RS-422 interface. A jumper is placed between E1 - E2 to connect the receive data line to the RS-232 interface. A jumper is placed between E2 - E3 to connect the receive data line to the RS-422 interface.

Jumper Plug Location JU-5:

The APC100 variable data is contained within a 66256 RAM. For the 66256 RAM a jumper is placed between E2 - E3. This connection provides the required address line A14 to the RAM.

Jumper Plug Location JU-6:

The APC100 variable data is contained within a 66256 RAM. For the 66256 RAM a jumper is placed between E2 - E3. This connection provides the required address line A13 to the RAM.

Jumper Plug Location JU-7:

The APC100 software is contained within a 27C512 EPROM. For the 27C512 EPROM a jumper is placed between E2 - E3. This connection provides address line A14 to the EPROM.

Jumper Plug Location JU-8:

The APC100 incorporates a watchdog timer circuit. Should the 5 volt power supply drop below a preset value the watchdog timer resets the system. A jumper is placed between E2 - E3 to preset the system reset voltage at 4.75 volts. A jumper is placed between E1 - E2 to preset the system reset voltage at 4.50 volts.

Jumper Plug Location JU-9:

This jumper selects the time constant of the watchdog timer. A jumper is placed between E1 - E2 to select a time constant of 1 second. A jumper is placed between E2 - E3 to select a time constant of 100 milliseconds. If no jumper connection is made the time constant is 500 milliseconds.

Jumper Plug Location JU-10:

Jumper location JU10-E2 is jumpered to JU12-E1. This enables the Motion Inhibit accessible thru the motion interface.

Jumper Plug Location JU-12:

Antenna motion activates an optical isolator. This signal is accessed thru the motion interface and may be used to activate other devices when the antenna is in motion. To enable this feature a jumper is placed between E2 - E3.

Jumper Plug Location JU-11:

This jumper determines how the communications port transceiver will be enabled. A jumper is placed between E1 - E2 to enable the transceiver at all times, this is the hardware enable. This will prevent more than one APC100 from operating on a single RS-422 or RS-232 interface.

A jumper is connected between E2 - E3 to place the transceiver enable under software control, this is the software enable. This will allow more than one APC100 to operate on a single RS-422 interface. The APC100 software will enable the RS-422 transmitter only after requested to do so. This mode is NOT suitable for RS-232 operation.

Jumper Plug Location JU-13:

The APC100 watchdog timer feature is enabled by placing a jumper

between E1 - E2. When enabled the watchdog timer monitors the APC100 power supply and processor activity, should a problem be sensed, a processor reset is issued. To disable this feature a jumper is placed between E2 - E3.

Jumper Plug Location JU-14:

This jumper enables the internal keypress beeper. A jumper is placed between E2 - E3 to enable the internal beeper. When the jumper is placed between E1 - E2, the beeper is bypassed.

## C. Antenna Interface

The antenna interface consists of a maximum of three axes, Azimuth, Elevation and Polarization. The polarization axis may be optional. Three motor types are supported: single speed (Eurodrive or equivalent), dual speed (Nord or Eurodrive) and dual speed Demag. Single speed resolvers encode antenna position.

**NOTE: Dual speed resolvers may be used; however, only the x 1 sine and cosine windings are used.**

### 1. Display

The APC100 contains a dual line presentation utilizing a back lit liquid crystal display. The display is 40 characters in length, all characters equally spaced. The characters are ¼" high. The display shows antenna position coordinates with a resolution of 0.01 degree for AZ and EL directions. Polarity is shown with 0.1 degree resolution. The display range of travel is as follows:

| Range-of-Travel | |
|---|---|
| Azimuth: | 0.00 to 360.00° |
| | 0.00 to 180.00° (Southern Hemisphere) |
| Elevation: | 0.00 to 120.00° |
| Polarization: | 0.0 to 358.46°, 1:1 gearing |
| | 0.0 to 179.61°, 2:1 gearing |

The display uses a standard alphanumeric character set. The maximum viewing distance is 15 feet in low light. Viewing is brightest perpendicular to the display plane.

The display module has its own display driver circuitry with a mass terminated I/O connection. The parallel TTL level ASCII data bus interfaces with the CPU board.

## 2. Data Entry - Front Panel

The front panel data entry keys manually adjust three antenna axis (Azimuth, Elevation, and Polarization) in plus and minus direction. The keyboard contains, among others, a Power ON/OFF, a START key, a STOP key, and a 3 X 10 keypad for data entry. For a complete description of keys and key functions, see Section ?.

A two position locking toggle switch selects LOCAL/REMOTE mode operation. The STOP key provides a reset signal to the microprocessor, which also stops all antenna motion. The jog keypad consists of membrane keys with a momentary feature. The 30 digit keypad is equipped with tactile feedback. The power switch has a protective guard cover to prevent accidental actuation. The membrane keys and the LOCAL/REMOTE switch each interface from single connectors.

## 3. Encoder Inputs

The shaft encoder provides true position of the three independent axes. The encoder output is linear over the entire range-of-travel. The encoder inputs are decoded at the controller.

Three single speed resolvers are multiplexed into one analog hybrid resolver-to-digital convertor module (Andrew P/N AE01A-D0247 (w/2s80) Subassembly preferred and 1S60 or 1S61 or equivalent.) The resolver inputs and outputs terminate at a 50-pin D type male connector. The resolver pinout is shown in Table VIII.

## 4. Encoder Line Driver

The encoder line driver provides the reference input to drive the resolver-to-digital converter IC. A 1000 Hz sine wave oscillator provides power for three size 11 resolvers. It provides 4 volt RMS nominal output signal to the resolver and 2 volt RMS nominal input signal to the converter. A Resolver-to-Digital converter IC is located on the CPU board. The resolver signal outputs are through the same connector as the encoder

input. A pinout diagram is shown in Table VIII.

### 5. Motor Drive

The motor drive consists of 10 bits of motor I/O, configured to control single or dual speed motors. Azimuth and Elevation drives may use either single or dual speed motors. Optional polarization is only single speed. Outputs are open until activated. Operation is ON or OFF only.

Each line has ± 12 VDC interface at 17 milliamp. A ± 12 VDC unregulated voltage is supplied by the antenna controller. The Motor control signals terminate at a 50-pin D type socket (female) connector. See Table IX and Table X for motor control pinouts.

### 6. In-Motion Output

The in motion output supplies opto isolated output when any axis is 'IN MOTION'. It disables transmit equipment when the antenna has moved 10 resolver units. It does not reflect depressed keys. A visual 'IN MOTION' text appearing on the LCD alerts the operator of antenna movement. The driver is an open collector opto-isolator IC. The inhibit input is also an opto-isolator.

The in motion output operates at 12 VDC and 50ma. It is terminated with a female 9-pin D type connector. Refer to Table XI for a pinout listing.

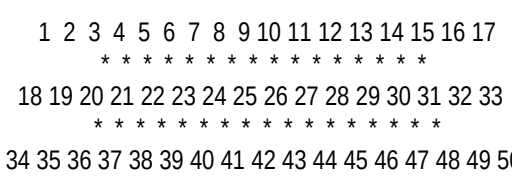
### 7. Remote Interface

The remote interface communicates with a remote terminal. It transmits at 9600 Baud, even parity, 8 data bits, 1 stop and supports full duplex, Transmit and Receive portions of RS-422 or RS-232 specifications.

The communications interface is Data Terminal Equipment (DTE) operating at Half duplex, polled, with an 11 bit word. The connector is a 25-pin D type sockets (female).

## D. Resolver and Power Oscillator Interface Connections

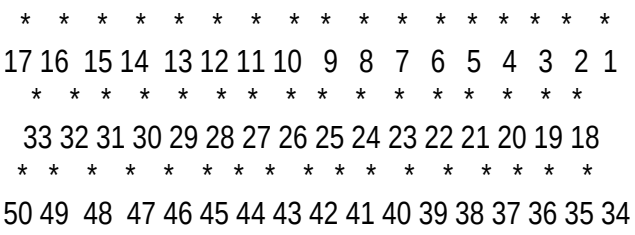
**Table VIII** Connector Resolver/Power Oscillator Pinout Information




| PINOUT | FUNCTION | SIGNAL |
|---|---|---|
| 1 | Azimuth SIN | HIGH |
| 34 | Azimuth SIN Return | Ground |
| 35 | Azimuth COS | HIGH |
| 19 | Azimuth COS Return | Ground |
| 39 | Elevation SIN | HIGH |
| 23 | Elevation SIN Return | Ground |
| 24 | Elevation COS | HIGH |
| 8 | Elevation COS Return | Ground |
| 28 | Polarization SIN | HIGH |
| 12 | Polarization SIN Return | Ground |
| 13 | Polarization COS | HIGH |
| 46 | Polarization COS Return | Ground |
| 47 | Azimuth reference | HIGH |
| 31 | Azimuth reference Return | Ground |
| 32 | Elevation reference | HIGH |
| 16 | Elevation reference Return | Ground |
| 17 | Polarization reference | HIGH |
| 50 | Polarization reference Return | Ground |

## E. Motor Drive Interface Connections

**Table IX** Motor Drive Interface Connections




| PIN | PORT | PIN | PORT | PIN | PORT | PIN | PORT |
|---|---|---|---|---|---|---|---|
| 1 | A- | 5 | E- | 9 | I- | 13 | N/A |
| 18 | A+ | 22 | E+ | 26 | I+ | 30 | N/A |
| 2 | B- | 6 | F- | 10 | J- | 14 | N/A |
| 19 | B+ | 23 | F+ | 27 | J+ | 31 | N/A |
| 3 | C- | 7 | G- | 11 | SPARE | 15 | N/A |
| 20 | C+ | 24 | G+ | 28 | K+ | 32 | N/A |
| 4 | D- | 8 | H- | 12 | SPARE | 16 | N/A |
| 21 | D+ | 25 | H+ | 29 | L+ | 33 | N/A |

## **Table X** Motor Drive Configurations Supported

| (EURODRIVE) | | (REULAND) | | (DEMAG) | |
|---|---|---|---|---|---|
| Single Speed Motor | | Dual Wound Motor | | Dual Speed | |
| AXIS/DIR | OUTPUT | AXIS/DIR | OUTPUT | AXIS/DIR | OUTPUT |
| AZ EAST | A | AZ EAST SLOW | A&D | AZ EAST SLOW | C |
| AZ WEST | B | AZ WEST SLOW | B&D | AZ WEST SLOW | D |
| | | AZ EAST FAST | A&C | AZ EAST FAST | A&C |
| | | AZ WEST FAST | B&C | AZ WEST FAST | B&C |
| EL DOWN | E | EL DOWN SLOW | E&H | EL DOWN SLOW | G |
| EL UP | F | EL UP SLOW | F&H | EL UP SLOW | H |
| | | EL DOWN FAST | E&G | EL DOWN FAST | E&G |
| | | EL UP FAST | F&G | EL UP FAST | F&H |
| POL CW | I | POL CW | I | POL CW | I |
| POL CCW | J | POL CCW | J | POL CCQ | J |

NOTE: The same motor type is installed on the AZ and EL axes.

## E. In-Motion Interface Connections

**Table XI** In-Motion Interface Pinout Information

J5 9-CONTACT TYPE SUB-D FEMALE CONNECTOR

```
*   *   *   *   *
5   4   3   2   1
  *   *   *   *
  9   8   7   6
```

| PINOUT | FUNCTION | | |
|---|---|---|---|
| 1 | Signal Ground | | |
| 4 | +12 VDC unregulated | | |
| 5 | Cathode of Optical-Isolator IC ( - ) | , * | INHIBIT INPUT |
| 6 | Anode of Optical-Isolator IC ( + ) | - | |
| 7 | Emitter of Optical-Isolator IC ( - ) | , * | MOTION INDICATOR |
| 8 | Collector of Optical-Isolator IC ( + ) | - | |

**NOTE: Optical-Isolator circuit may be powered from internal source (PINS 1 and 4) or externally.**

RS232 “NULL MODEM” CABLE

| DTE COMPUTER | | | DTE APC100 |
|---|---|---|---|
| TX | 2 | | 3 RX |
| RX | 3 | | 2 TX |
| GND | 7 | | 7 GND |

RS422 CABLE

| APC100 | |
|---|---|
| 14 | TX + |
| 15 | TX - |
| 18 | RX + |
| 1 | GND |

Figure 7 RS232C/RS422 Communications Interface Connections

**NOTE: RS232C and RS422 are standard industry signals. If further information is required please contact Customer Service at 1-800-255-1479.**

**Table XII** RS-232C/RS422 Communications Interface Pinout Information

J4 25-CONTACT TYPE SUB-D FEMALE CONNECTOR

```
        * * * * * * * * * * * * *
     13 12 11 10  9  8  7  6  5  4  3  2  1
        * * * * * * * * * * * * *
     25 24 23 22 21 20 19 18 17 16 14 29
```

| PINOUT | FUNCTION |
|---|---|
| 1 | Ground |
| 2 | Transmit Data |
| 3 | Receive Data |
| 4 | Request-to-Send |
| 5 | Clear-to-Send |
| 7 | Ground |
| 8 | Data Carrier Detect |
| 14 | RS-422 TX+ |
| 15 | RS-422 TX- |
| 18 | RS-422 RX+ |
| 19 | RS-422 RX- |
| 20 | Data Terminal Ready |
| 22 | Ring Indicator |
| 24 | Data Set Ready, Secondary |

# CHAPTER 7

# APC100 COMMUNICATIONS PORT PROTOCOL

## A. Introduction

An APC100 can respond to commands from a host controller as well as to local commands from the front panel. The communication port operates at 9600 baud, even parity, 8 data bits, and 1 stop bit. The following sections contain information describing how communication with a host controller is conducted.

## B. Message Format

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER, Incoming message header |
| 1 | 50H-5FH | Address of the APC100 |
| 2 thru 3 | ** | Command |
| 4 thru 4+n | | DATA, variable length field that can be 0 to 127 bytes (n is length of data) |
| 4+n+1 | 03H | ETX message terminator |
| 4+n+2 | 00H-FFH | Check Sum of bytes 0 thru 4+n+1 |

** Command is a two byte ASCII field containing the command to be acted upon. A list of these commands are given in section 7.4.

## C. Response Format

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER, Out bound message header |
| 1 | 50H-5FH | Address of the APC100 |
| 2 | 30H-3FH | Status response |
| 3 | 40H-4FH | Primary error response |
| 4 | 50H-5FH | Secondary error response |
| 5 thru 5+n | | DATA, variable length field that can be 0 to 127 bytes (n is length of data) |
| 5+n+1 | 03H | ETX message terminator |
| 5+n+2 | 00H-FFH | Check Sum of bytes 0 through 4+n+1 |

## D. General Command List

The APC100 has 15 remote commands that can be issued from a host controller. The commands indicated with L/R in the first column send their response when the APC100 is in either the local or remote mode. The commands indicated by an "R" only respond in the remote mode. In local mode these commands are not acted upon. There is no response to them.

| LOCAL/REMOTE | COMMAND | DESCRIPTION |
|---|---|---|
| L/R | AB | Abort |
| R | DP | Download specified position |
| R | DS | Download setup |
| R | MA | Move AZ to specified AZ |
| R | ME | Move EL to specified EL |
| R | MP | Move POL to specified position |
| R | PS | Move to specified position |
| L/R | QA | Query angle, degrees |
| L/R | QR | Query angle, resolver units |
| L/R | RT | Reset |
| L/R | SE | Status error request |
| L/R | SR | Status request |
| L/R | SS | Switch status |
| R | UP | Upload specified position |
| R | US | Upload setup |

## E. Status

There is one status response character. There are two status error characters. The two status error characters are the primary status and secondary status. The upper nibble of each character indicates what character it is, and the lower nibble indicates the status conditions. Following is a description of each status bit.

STATUS RESPONSE UPPER NIBBLE "3"

| BIT | DESCRIPTION |
|---|---|
| 0 | REMOTE MODE |
| 1 | MOTION |
| 2 | BUSY |
| 3 | ERROR |

PRIMARY STATUS UPPER NIBBLE "4"

| BIT | DESCRIPTION |
|---|---|
| 0 | LIMIT ERROR |
| 1 | SETUP DATA UPDATE REQUIRED |
| 2 | POSITION DATA UPDATE REQUIRED |
| 3 | MOTION INHIBIT |

SECONDARY STATUS UPPER NIBBLE "5"

| BIT | DESCRIPTION |
|---|---|
| 0 | DOWNLOAD LIMIT ERROR |
| 1 | MOTOR TIME-OUT |
| 2 | UNDEFINED POSITION |
| 3 | NOT USED |

## 1. Remote Mode

When the APC100 is in the remote mode the remote bit in the status response is set. When in the local mode this bit is cleared.

## 2. Motion Bit

The motion bit in the status response is set when the antenna has moved for at least 10 resolver units, 0.0549°. If slow motor movement stays within this distance, there is no IN MOTION display. This bit is not set. When movement exceeds this distance, the bit is set and the IN MOTION message is displayed. The motion bit time period is determined by the azimuth slow motor time-out value. If motion is detected within this time frame the motion bit remains set. If motion is controlled by some other source, such as the local motor controller, the resolver for any given axis is sampled at 960ms intervals. If the azimuth slow motor time-out value is less than 100, the IN MOTION display and the motion bit will toggle at approximately a 1 second rate. An output circuit, accessed through a back panel DB 9 connector, mimics the motion bit state.

## 3. Busy

The busy bit is set when a movement command is issued and is cleared when all motion is stopped. The motion bit will be toggled when the APC100 stops one axis and then starts another. The busy flag will remain set for the duration of the movement on all axes. If an external device, such as the local motor controller, moves the antenna the busy flag is not set.

### 4. Error

The error bit is set when any of the bits in the primary or secondary status is set. This bit is cleared when both upper nibbles of these two bytes are zero.

### 5. Limit Error

This bit is set when the antenna position is at or beyond the limit for a given axis. The APC100 display indicates which axis is out of limits. However, that level of detail is not communicated to a host controller. When the antenna is moved back within limits, this bit is cleared and the error for that axis is removed from the APC100 display.

### 6. Setup Data Update Required

This bit is set when the APC100 is in the local mode and setup information is changed. This includes any change to calibration, limit settings, time-out values, and coast coefficients. This bit can only be cleared while in remote mode. When the host issues an upload setup command and data is loaded into the transmit buffer this bit is cleared.

### 7. Position Data Update Required

This bit is set while the APC100 is in the local mode and a position is defined or deleted. This bit can only be cleared while in remote mode. When the host issues an upload position command this bit is cleared.

> **NOTE: The Andrew System Controller, ASC20000, upload position command issues 40 separate commands, one for each position, insuring that all possible locations are uploaded at once. This bit is cleared when the first command is initiated. Any remote host must make allowances for the fact that the bit may be cleared before the update is complete.**

For example, if position 10 is defined locally, this bit is set to flag a position data change to the host. Any subsequent request to upload position data clears this flag. Therefore, if a remote host requests position 30, the flag is cleared but the host does not have the latest satellite position data. To handle this situation, the host can read the flag to determine if all position data needs to be updated.

### 8. Inhibit

This bit is set whenever the external motion inhibit input is active. When this input is active, motion is stopped. The inhibit is cleared when the external input is deactivated.

### 9. Download Limit Error

This bit is set when a move command or a download pos command downloads an angle that is out of limits. No movement takes place. This bit is cleared the next time a status error command is issued by the host.

### 10. Motor Time-Out

This bit is set whenever a valid movement command has been issued and a motor fails to move the antenna. This can be caused by a tripped breaker, the local motor controller being in the local operating mode, the time-out values being set too low, or equipment failure. This error is only cleared when another move command is successful.

### 11. Undefined Position

This bit is set whenever a "PS" command is issued for an undefined position. This bit is cleared when the next status error request is received.

## F. Switch Status

Often it is useful for the host controlling the APC100 to know the DIP switch settings. The DIP switch settings may be uploaded to the host through a switch status command. Following is a description of the bits in each byte as they are uploaded to the host (see Section 7.7.13).

SWITCH 1 BITS (RESPONSE BYTE 3, SWITCH STATUS COMMAND)

| POSITION | BIT | DESCRIPTION |
|---|---|---|
| 8 | 0 | SERIAL MOTOR |
| 7 | 1 | RESOLVER TO DIGITAL CONVERTER |
| 6 | 2 | HEMISPHERE OF OPERATION |
| 5 | 3 | SATELLITE NEWS GATHERING |
| 4 | 4 | POLARITY RESOLVER GEARING |
| 3 | 5 | NUMBER OF ANTENNA AXES |
| 2 | 6 | MOTOR TYPE |

| | | |
|---|---|---|
| 1 | 7 | MOTOR SPEED |

SWITCH 2 BITS (RESPONSE BYTE 4, SWITCH STATUS COMMAND)

| POSITION | BIT | DESCRIPTION |
|---|---|---|
| 8-5 | 0-3 | UNUSED |
| 4-1 | 4-7 | ADDRESS |

## 1. Serial/Concurrent Motor

The APC100 can run the motors in either concurrent or serial (sequential) operation. Serial motor mode permits each axis to operate in a sequential fashion. When operated in serial motor mode the fast azimuth motor is turned on and travels to within the fast motor coefficient of the destination. Once this predesignated point has been reached for the azimuth axis the fast motor is stopped. The azimuth slow motor is started and continues to run until it reaches the azimuth slow motor coefficient and the azimuth slow motor stops. Next, the elevation fast motor is started and continues to run until it reaches the elevation fast motor coefficient. The elevation fast motor is stopped an d the elevation slow motor is started and continues to run until it reaches the elevation slow motor coefficient. Then the elevation slow motor is stopped and the polarity motor is started. The polarity motor runs until it reaches the polarity motor coefficient. The motor is stopped at this point, completing the antenna repositioning.

In concurrent motor mode two axes run the fast motors at the same time. The fast motor travels to within the fast motor coefficient of the target destination for the AZ and EL axes. Next, the EL and POL axes are adjusted simultaneously. Once all axes have reached their fast coefficient the fast motors are stopped. The slow motors are then operated in the serial or sequential motor mode starting with the azimuth motor. Each axis runs its slow motor to the slow coefficient and stops.

When the S1-8 response bit is "0" then serial motors are selected. When this bit is "1" then concurrent motors are selected.

## 2. Resolver to Digital Converter

Two different resolver to digital converters are available for the APC100. Version 2.0 software can use either of these resolver chips. The

AE01A-D0247 assembly is used with Software Versions 2.1 and above. The 1S61 device can not switch axes quickly enough to permit concurrent motor operation.

When the S1-7 response bit is "0" then the AE01A-D0247 is selected. When this bit is "1", the 1S61 is selected.

### 3. Hemisphere of Operation

In the Northern hemisphere, all satellites are South of the antenna site location. The antenna azimuth axis motion ranges between 80° True North and 270° True North. In the Southern hemisphere all satellites are North of the antenna site location. The antenna azimuth axis motion ranges between 280° True North and 60° True North with 0° True North (due north) being near the center of the arc.

When operating in the Southern hemisphere mode, the antenna may move across 0° True North. Southern hemisphere mode permits the azimuth counterclockwise limit DEGREE display value to be a higher number than the clockwise limit DEGREE display value. East/West jog key functions are also reversed in the Southern hemisphere.

When the Hemisphere of Operation bit (S1-6) is "0", the Southern hemisphere is selected. When this bit is "1" then northern hemisphere is selected.

### 4. Extended/Fixed Antenna Mode

If an antenna is mobile (mounted on a vehicle such as a NEWS GATHERING BY SATELLITE application), the positions are all relative to the vehicle location. When the vehicle has moved the satellite pointing angles change. Because vehicle mounted antennas usually require a stow configuration for transit, mobile antennas have a much larger travel range. Because of these two factors the satellite names are displayed. Instead a Position # is displayed and the software encoded (hard) limits are broadened in EXTENDED mode (mobile) applications.

FIXED Earth station Antenna mode enables the default satellite name table and the software encoded (hard) limits are just outside of the mechanical antenna travel range. When the EXTENDED/FIXED Antenna Mode bit

(S1-5) is "0" the EXTENDED Mode is selected. When this bit is "1" the FIXED Earth Station Mode is selected.

### 5. Polarity Resolver Gearing

7.3M, 7.6M, 9.1M and 9.3M Antenna feeds turn the polarity resolver two degrees for every degree the feed assembly moves. All other Andrew C-Band and Ku-Band Antennas employ 1:1 feed polarity resolvers. When the Polarity Resolver Gearing bit is "0" 2:1 gearing is selected. When the S1-4 status bit is "1" then 1:1 gearing is selected.

### 6. Number of Antenna Axes

Depending on the application an antenna may or may not need to have the feed assembly rotated. Circularly polarized feeds do not require feed rotation.

When the Number of Antenna axes bit (S1-3) is "0" two axis operation is selected. When this bit is "1" then 3 axis operation is selected. In two axis operation, the POL settings are not monitored or controlled by the APC100.

### 7. Motor Type

There are two types of motor control logic that are supported by the APC100. There are 10 output bits from the APC100 to control the motors, 4 for AZ, 4 for EL, and 2 for POL. The two different configurations differ in what bits are turned on to operate the motor. These are defined by the type of motor that is used or the type and part number of the local motor controller.

When the Motor Type status bit (S1-2) is "0" then Demag motors are selected. When this bit is "1" then Reuland, Eurodrive motors, or Andrew Local Motor Controllers; Dual speed P/N LMKDS and Single speed P/N AE01A-D0259 are configured.

### 8. Motor Speed

Dual speed motor operation requires both fast and slow coefficients. The fast coefficient for each axis must be greater than the slow coefficient for the same axis.

When the Motor Speed status bit (S1-1) is "0" dual speed motors are selected. When this bit is "1" the single speed motors are selected.

### 9. Addressing

The APC100 may be multi-dropped with additional APC100 units or other RS422 devices if the devices follow some of the same guidelines on protocol. To permit this, each APC100 is given an address that distinguishes it from other devices on the same line. The addressing range of the APC100 is 50H to 5FH. The high order nibble of switch S-2 is used to select the address. This high nibble is shifted right 4 times and "or" functioned with 5 to acquire the address. This produces the address range of 50H to 5FH.

## G. Command Descriptions

The APC100 has a response format corresponding to each command generated by the host. Those commands listed in 7.4 as being Remote only are not acted upon if the APC100 is in Local mode. Therefore, if the APC100 is in Local mode when a Remote command is received, no response is sent. In this section a functional description, the format, and response for each command is provided.

### 1. Abort

The abort command tells the APC100 to terminate any movement currently taking place. Once movement is terminated, a status response is generated and returned to the host.

If this command is issued while the motors are running, the status BUSY flag is cleared and the motors are stopped. During the next idle task pass through, the IN MOTION flag is cleared. The immediate response given reflects the BUSY flag being cleared. It may, or may not reflect the IN MOTION flag being cleared.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | 'AB' | COMMAND, ASCII VALUE |
| 4 | 03H | ETX MESSAGE TERMINATOR |
| 5 | OOH | ETX MESSAGE TERMINATOR |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3 | 03H | ETX MESSAGE TERMINATOR |
| 4 | 00H-FFH | CHECK SUM |

The average time required for this command to execute is 190 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## 2. Download Position

This command defines an APC100 positon. A position number with satellite information is sent to the APC100 in this command. A later command can be issued to move the antenna to that satellite position. This command is used to edit the satellite names and locations loaded in the APC100.

If the satellite number is not in the range of 1 to 40 or any of the axis information is out of the limits specified within the APC100 setup data, the DOWNLOAD LIMIT flag is set. The data is not accepted into the satellite table. If this flag is set, it is cleared on the next status error request.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | ′O′ | COMMAND, ASCII VALUE |
| 4-5 | ′01′ - ′40′ | SATELLITE POSITION NUMBER (ASCII VALUE) |
| 6 | ′ , ′ | COMMA FIELD SEPARATOR |
| 7-25 | ′ name′ | SATELLITE NAME |
| 26 | ′ , ′ | COMMA, FIELD SEPARATOR |
| 27-32 | ′long′ | SATELLITE LONGITUDE |
| 33 | ′ , ′ | COMMA , FIELD SEPARATOR |
| 34-38 | ′00000′ - ′65535′ | ABSOLUTE ANTENNA AZIMUTH IN RESOLVER UNITS, (ASCII VALUE) |
| 39 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 40 - 44 | ‘00000' - ‘65535′ | ABSOLUTE ANTENNA ELEVATION IN RESOLVER UNITS, (ASCII VALUE) |
| 45 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 46 - 50 | ‘00000' - ‘65535′ | ABSOLUTE ANTENNA POLARIZATION IN RESOLVER UNITS (ASCII VALUE) |
| 51 | 03H | ETX, MESSAGE TERMINATOR |
| 52 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTHE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | DEDSCRIPTION |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3 | 03H | EXT, MESSAGE TERMINATOR |
| 4 | 00H-FFH | CHECKSUM |

The average time for this command to execute is 370ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

### 3. Download Setup

This command downloads the setup information into the APC100. This information is required to have been previously uploaded from the APC100. If the APC100 has its memory cleared, this command can download all the setup data back into the APC100. This is a much faster method than using the keypad entry and the setup commands.

Before this command is issued, make a status request to verify that the BUSY flag and the IN MOTION flag are both clear.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | ‘DS’ | COMMAND, ASCII VALUE |
| 4-7 | ‘00000' - ‘0546’ | AZ SLOW COEFFICIENT IN RESOLVER UNITS (ASCII VALUE) |
| 8 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 9-12 | ‘0182' - ‘1820' | AZ FAST COEFFICIENT IN RESOLVER UNITS (ASCII VALUE) |
| 13 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 14-17 | ‘0000' - | EL SLOW COEFFICIENT IN RESOLVER UNITS (ASCII VALUE) |
| 18 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 19-22 | ‘0182' - ‘1820 | EL FAST COEFFICIENT IN RESOLVER UNITS, (ASCII VALUE) |
| 23 | ‘ , ‘ | COMMA, FIELD SEPARATOR |

| | | |
|---|---|---|
| 24-27 | '0000' - '1092' | POL COEFFICIENT IN RESOLVER UNITS, (ASCII VALUE) |
| 28 | ' , ' | COMMA, FILED SEPARATOR |
| 29-33 | '00000' - 65535' | AZ CALIBRATION FACTOR IN RESOLVER UNITS, (ASCII VALUE) |
| 34 | ' , ' | COMMA, FIELD SEPARATOR |
| 35-39 | '00000' '65535' | EL CALIBRATION FACTOR IN RESOLVER UNITS, (ASCII VALUE) |
| 40 | ' , ' | COMMA, FIELD SEPARATOR |
| 41-45 | '00000' '65535' | POL CALIBRATION FACTOR IN RESOLVER UNITS, (ASCII VALUE) |
| 46 | ' , ' | COMMA, FIELD SEPARATOR |
| 47-50 | '0010' - '65535' | AZ HIGH SPEED TIME OUT VALUE (ASCII) |
| 51 | ' , ' | COMMA, FIELD SEPARATOR |
| 52-55 | '0010' - '0400' | AZ LOW SPEED TIME OUT VALUE (ASCII) |
| 56 | ' , ' | COMMA, FIELD SEPARATOR |
| 57-60 | '0010' - '0400 | EL HIGH SPEED TIME OUT VALUE (ASCII) |
| 61 | ' , ' | COMMA FIELD SEPARATOR |
| 62-65 | '0010' - '0400' | EL LOW SPEED TIME OUT VALUE (ASCII) |
| 66 | ' , ' | COMMA, FIELD SEPARATOR |
| 67-70 | '0010' - '0400 | POL TIME OUT VALUE (ASCII) |
| 71 | ' , ' | COMMA, FIELD SEPARATOR |
| 72-76 | '00000' '65535' | AZ LW LIMIT, CALIBRATED RESOLVER UNITS |
| 77 | ' , ' | COMMA, FIELD SEPARATOR |
| 78-82 | '00000' - '65535' | AZ HI LIMIT, CALIBRATED RESOLVER UNITS |
| 83 | ' , ' | COMMA, FIELD SEPARATOR |
| 84-88 | '00000' - '65535' | EL LOW LIMIT, CALIBRATED RESOLVER UNITS |

| | | |
|---|---|---|
| 89 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 90-94 | ‘00000' - ‘65535' | EL HI LIMIT, CALIBRATED RESOLVER UNITS |
| 95 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 96-100 | ‘00000' - ‘65535' | POL LOW LIMIT, CALIBRATED RESOLVER UNITS |
| 101 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 102-106 | ‘00000' - ‘65535' | POL HI LIMIT, CALIBRATED RESOLVER UNITS |
| 107 | 03H | EXT, MESSAGE TERMINATOR |
| 108 | OOH-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3 | 03H | ETX, MESSAGE TERMINATOR |
| 4 | OOH-FFH | CHECKSUM |

The average time required for this command to execute is 370ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

### 4. Move Azimuth

The move azimuth command moves the AZ axis of the antenna to a desired location. This command sends the azimuth axis destination as a calibrated resolver value to the APC100.

The APC100 sets the BUSY flag and starts the azimuth motor if the destination is a distance greater than the slow coefficient. When the antenna is moving, the IN MOTION bit is set. Once the destination is reached, the antenna comes to a stop. The BUSY and the IN MOTION flags are cleared.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | 'MA' | COMMAND, ASCII VALUE |
| 4-8 | '00000' - '65535' | (ASCII VALUE) |
| 9 | 03H | ETX, MESSAGE TERMINATOR |
| 10 | OOH-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3 | 03H | ETX, MESSAGE TERMINATOR |
| 4 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 190ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## 5. Move Elevation

The move elevation command moves the elevation axis of the antenna to a desired location. This command sends an elevation axis destination as a calibrated resolver value to the APC100.

The APC100 sets the BUSY flag and starts the EL motor if the destination is a distance greater than the slow coefficient. When the antenna is moving the IN MOTION bit is set. When the destination is reached the BUSY flag is cleared. The IN MOTION flag is cleared when the antenna comes to a stop.

If the destination is outside the limit and the current location is inside the limit, the destination is modified and the antenna is moved to the limit. If the antenna is out of a limit and this command tries to move further out of the limit, no antenna movement occurs. The status response is returned.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | 'ME' | COMMAND. ASCII VALUE |
| 4-8 | '00000' - '65535' | DESTINATION IN RESOLVER UNITS (ASCII VALUE) |
| 9 | 03H | ETX, MESSAGE TERMINATOR |
| 10 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3 | 03H | ETX, MESSAGE TERMINATOR |
| 4 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 190 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## 6. Move Polarization

The move polarization command moves the polarity axis of the antenna to a desired location. This command sends a polarization axis destination as

a calibrated resolver value to the APC100.

The APC100 sets the BUSY flag and starts the polarity motor if the destination is a distance greater than the slow coefficient. When the antenna is moving, the IN MOTION bit is set. When the destination is reached the BUSY flag is cleared. The IN MOTION flag is cleared when the antenna comes to a stop.

If the destination is outside the limits and the current location is inside the limit, the destination is modified and the antenna is moved to the limit. If the antenna is out of a limit and this command tries to move further out of the limit, the antenna is not moved. The status response is returned.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | ‘ME’ | COMMAND. ASCII VALUE |
| 4-8 | ‘00000' - ‘65535' | DESTINATION IN RESOLVER UNITS (ASCII VALUE) |
| 9 | 03H | ETX, MESSAGE TERMINATOR |
| 10 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3 | 03H | ETX, MESSAGE TERMINATOR |
| 4 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 190 ms. This period is from the moment the APC100 receives the last character of the

command to the time it sends the last character of the response.

## 7. Position Set

This command moves the APC100 antenna a specified position. There are 40 positions, 1 - 40, any or all may be undefined. If the command position number is smaller than 1 or larger than 40, or the position is not defined, the UNDEFINED POSITION flag is set. No movement is attempted. This flag is cleared on the next status error request.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | 'PS' | COMMAND, ASCII VALUE |
| 4-5 | '01' - '40' | POSITION NUMBER (ASCII VALUE) |
| 6 | 03H | ETX, MESSAGE TERMINATOR |
| 7 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3 | 03H | ETX, MESSAGE TERMINATOR |
| 4 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 160 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## 8. Query Angle in Degrees

This sends the current antenna position location to the host in degrees. This information is in ASCII and can be directly displayed on the host display device.

The returned data contains angle coordinates for each axis and satellite number, if any, for the current position. If the position number value is zero, the location of the antenna is undefined. If this value is nonzero, the antenna is at a defined location. This location is updated when the APC100 stops movement and once every quarter second when the antenna is not being moved. If the local motor controller is used to move the antenna the check for location continues to be made on a regular basis.

This command has no effect on any flags.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | ‘QA’ | COMMAND, ASCII VALUE |
| 4 | 03H | ETX, MESSAGE TERMINATOR |
| 5 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3-8 | ‘ 0.00' - ‘359.99' | CURRENT AZ ANGLE IN DEGREES (ASCII VALUE) |
| 9 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 10-15 | ‘ 0.00' - ‘359.99' | CURRENT EL ANGLE IN DEGREES (ASCII VALUE) |
| 16 | ‘ , ‘ | COMMA, FIELD SEPARATOR |

| | | |
|---|---|---|
| 17-22 | ‘ 0.00' - ‘359.99' | CURRENT POL ANGLE IN DEGREES (ASCII VALUE) |
| 23 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 24-25 | ‘ 00' - ‘40' | POSITION NUMBER (ASCII VALUE) |
| 26 | 03H | ETX, MESSAGE TERMINATOR |
| 27 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 600 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## 9. Query Angle in Resolver Units

This command sends the current antenna location to the host in absolute resolver units. This information can be directly displayed on the host display device. The APC100 uses resolver units to determine position. All movement commands use calibrated resolver units instead of degrees. Therefore, this command is supplied for the host to read the location. This allows the host to read a location, add an offset delta to it, and request a move to the delta position. This is how the Andrew System Controller initiates a jog via the APC100.

The returned data contains angle coordinates for each axis and satellite number, if any, associated with the current position. If the position number value is zero, the location of the antenna is undefined. If this value is nonzero, the antenna is at a defined location. This location is updated when the APC100 stops movement and once every quarter second when the antenna is not being moved. If the local motor controller is used to move the antenna, the location check continues to be made on a regular basis.

This command has no effect on any flags.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|

| | | | |
|---|---|---|---|
| | 0 | 01H | SOH HEADER |
| | 1 | 50H-5FH | APC100 ADDRESS |
| | 2-3 | ‘QR’ | COMMAND, ASCII VALUE |
| | 4 | 03H | ETX, MESSAGE TERMINATOR |
| | 5 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3-7 | ‘00000' - ‘65535' | CURRENT AZ ANGLE IN RESOLVER UNITS (ASCII VALUE) |
| 8 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 9-13 | ‘00000' - ‘65535' | CURRENT EL ANGLE IN RESOLVER UNITS (ASCII VALUE) |
| 14 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 15-19 | ‘00000' - ‘65535' | CURRENT POL ANGLE IN RESOLVER UNITS (ASCII VALUE) |
| 20 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 21-22 | ‘ 00' - ‘40' | POSITION NUMBER |
| 23 | 03H | ETX, MESSAGE TERMINATOR |
| 24 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 500 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## 10. Reset

This command generated an APC100 reset and is functionally the same as turning the unit off and on. With this command all motors are stopped, the BUSY flag is cleared, the UNDEFINED POSITION flag is cleared, and the

DOWNLOAD LIMIT ERROR flag is cleared. All other flags remain unchanged.

The command format and response follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | 'RT' | COMMAND, ASCII VALUE |
| 4 | 03H | ETX, MESSAGE TERMINATOR |
| 5 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3 | 03H | EXT, MESSAGE TERMINATOR |
| 4 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 300 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## 11. Status Error Request

This command returns the APC100 status and error conditions to the host. All status and error flags are explained in detail in Section 7.5. This command clears the DOWNLOAD LIMIT ERROR and the UNDEFINED POSITION flags.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | 'SE' | COMMAND, ASCII VALUE |
| 4 | 03H | ETX, MESSAGE TERMINATOR |
| 5 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3 | 40H-4FH | PRIMARY STATUS ERRORS |
| 4 | 50H-5FH | SECONDARY STATUS ERRORS |
| 5 | 03H | ETX, MESSAGE TERMINATOR |
| 6 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 320 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## 12. Status Request

This command returns the APC100 general status to the host. This allows the host to monitor the REMOTE, IN MOTION< BUSY< and ERROR flags. When the ERROR flag is set, the status error request command is sent by the host to the APC100. This command does not modify any flags but does permit the host to monitor the flags.

The command and response format follows.

COMMAND

| | BYTE | VALUE | DESCRIPTION |
|---|---|---|---|
| | 0 | 01H | SOH HEADER |
| | 1 | 50H-5FH | APC100 ADDRESS |
| | 2-3 | 'SR' | COMMAND, ASCII VALUE |
| | 4 | 03H | ETX, MESSAGE TERMINATOR |
| | 5 | 00H-FFH | CHECKSUM |

RESPONSE

| | BYTE | VALUE | DESCRIPTION |
|---|---|---|---|
| | 0 | 02H | STX HEADER |
| | 1 | 50H-5FH | APC100 ADDRESS |
| | 2 | 30H-3FH | STATUS |
| | 3 | 03H | EXT, MESSAGE TERMINATOR |
| | 4 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 320 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## 13. Switch Status

This command returns the APC100 internal DIP switch status. The switches are read upon power up and on reset. The read values are returned to the host by use of the Switch Status command.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | 'SS' | COMMAND, ASCII VALUE |
| 4 | 03H | ETX, MESSAGE TERMINATOR |

| | | | |
|---|---|---|---|
| | 5 | 00H-FFH | CHECKSUM |

RESPONSE

| | BYTE | VALUE | DESCRIPTION |
|---|---|---|---|
| | 0 | 02H | STX HEADER |
| | 1 | 50H-5FH | APC100 ADDRESS |
| | 2 | 30H-3FH | STATUS |
| | 3 | 00H-FFH | SWITCH 1 |
| | 4 | 00H-FFH | SWITCH 2 |
| | 5 | 03H | EXT, MESSAGE TERMINATOR |
| | 6 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 320 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

SWITCH 1 BITS (RESPONSE BYTE 3, SWITCH STATUS COMMAND)

| POSITION | BIT | DESCRIPTION |
|---|---|---|
| 8 | 0 | SERIAL MOTOR |
| 7 | 1 | RESOLVER TO DIGITAL CONVERTER |
| 6 | 2 | HEMISPHERE OF OPERATION |
| 5 | 3 | SATELLITE NEWS GATHERING |
| 4 | 4 | POLARITY RESOLVER GEARING |
| 3 | 5 | NUMBER OF ANTENNA AXES |
| 2 | 6 | MOTOR TYPE |
| 1 | 7 | MOTOR SPEED |

SWITCH 2 BITS (RESPONSE BYTE 4, SWITCH STATUS COMMAND)

| POSITION | BIT | DESCRIPTION |
|---|---|---|
| 8-5 | 0-3 | UNUSED |
| 4-1 | 4-7 | ADDRESS |

## 14. Upload Position

This command returns satellite position data from the APC100 to the host. A position number and satellite information are sent to the host in the response to this command. This command is used by the host to view the satellite names that are in the APC100 memory. The locations may then

be redefined from the host.

If the satellite number is not in the range of 1 to 40, the APC100 attempts to satisfy the request returning undetermined data.

When a request is made for an undefined position, the location table contains "0" for each axis. When axes coordinates for a defined position are uploaded the calibration factor is added to the angle. Therefore the values uploaded include the calibration factors. If the position had previously been defined , and then cleared by the host, the old values will be uploaded from the APC100. Since the download position command sends the values recorded by the host to the APC100 and the next download initiated by the host redefines this undefined location.

The command and response format follows.

The average time required for this command to execute is 370 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | ‘UP’ | COMMAND, ASCII VALUE |
| 4-5 | ‘01' - ‘40' | POSITION NUMBER (ASCII VALUE) |
| 6 | 03H | ETX, MESSAGE TERMINATOR |
| 7 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 02H | STX HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3-4 | ‘01' - ‘40' | SATELLITE POSITION NUMBER (ASCII VALUE) |
| 5 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 6-24 | ‘NAME' | SATELLITE NAME |
| 25 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 26-31 | ‘LONG' | SATELLITE LONGITUDE |
| 32 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 33-37 | ‘000 00' - ‘65535' | ABSOLUTE ANTENNA AZIMUTH IN RESOLVER UNITS, (ASCII VALUES) |
| 38 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 39-43 | ‘00000' - ‘65535' | ABSOLUTE ANTENNA ELEVATION IN RESOLVER UNITS, (ASCII VALUES) |
| 44 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 45-49 | ‘00000' - ‘65535' | ABSOLUTE ANTENNA POLARIZATION IN RESOLVER UNITS, (ASCII VALUES) |
| 50 | 03H | ETX, MESSAGE TERMINATOR |
| 51 | 00H-FFH | CHECKSUM |

## 15. Upload Setup

This command uploads the setup information from the APC100 to the host. Before this command is issued, make a status request to verify that the BUSY flag and the IN MOTION flag are both clear.

The command and response format follows.

COMMAND

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2-3 | ‘US’ | COMMAND, ASCII VALUE |
| 4 | 03H | ETX, MESSAGE TERMINATOR |
| 5 | 00H-FFH | CHECKSUM |

RESPONSE

| BYTE | VALUE | DESCRIPTION |
|---|---|---|
| 0 | 01H | SOH HEADER |
| 1 | 50H-5FH | APC100 ADDRESS |
| 2 | 30H-3FH | STATUS |
| 3-6 | ‘00000' - ‘0546’ | AZ SLOW COEFFICIENT IN RESOLVER UNITS (ASCII VALUE) |
| 7 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 8-11 | ‘0182' - ‘1820' | AZ FAST COEFFICIENT IN RESOLVER UNITS (ASCII VALUE) |
| 12 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 13-16 | ‘0000' - | EL SLOW COEFFICIENT IN RESOLVER UNITS (ASCII VALUE) |
| 17 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 18-21 | ‘0182' - ‘1820 | EL FAST COEFFICIENT IN RESOLVER UNITS, (ASCII VALUE) |
| 22 | ‘ , ‘ | COMMA, FIELD SEPARATOR |

| | | |
|---|---|---|
| 23-26 | ‘0000' - ‘1092' | POL COEFFICIENT IN RESOLVER UNITS, (ASCII VALUE) |
| 27 | ‘ , ‘ | COMMA, FILED SEPARATOR |
| 28-33 | ‘00000' - 65535' | AZ CALIBRATION FACTOR IN RESOLVER UNITS, (ASCII VALUE) |
| 34 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 35-40 | ‘00000' ‘65535' | EL CALIBRATION FACTOR IN RESOLVER UNITS, (ASCII VALUE) |
| 41 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 42-47 | ‘00000' ‘65535' | POL CALIBRATION FACTOR IN RESOLVER UNITS, (ASCII VALUE) |
| 48 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 49-52 | ‘0010' - ‘0400' | AZ LOW SPEED TIME OUT VALUE (ASCII) |
| 53 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 54-57 | ‘0010' -' | AZ HIGH SPEED TIME OUT VALUE (ASCII) |
| 58 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 59-62 | ‘0010' - | EL HIGH SPEED TIME OUT VALUE (ASCII) |
| 63 | ‘ , ‘ | COMMA FIELD SEPARATOR |
| 64-67 | ‘0010' - | EL LOW SPEED TIME OUT VALUE (ASCII) |
| 68 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 69-72 | ‘0010' - | POL TIME OUT VALUE (ASCII) |
| 73 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 74-78 | ‘00000' ‘65535' | AZ LW LIMIT, CALIBRATED RESOLVER UNITS |
| 79 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 80-84 | ‘00000' - ‘65535' | AZ HI LIMIT, CALIBRATED RESOLVER UNITS |
| 85 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 86-90 | ‘00000' - ‘65535' | EL LOW LIMIT, CALIBRATED RESOLVER UNITS |

| | | |
|---|---|---|
| 91 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 92-96 | ‘00000'-‘65535' | EL HI LIMIT, CALIBRATED RESOLVER UNITS |
| 97 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 98-102 | ‘00000' - ‘65535' | POL LOW LIMIT, CALIBRATED RESOLVER UNITS |
| 103 | ‘ , ‘ | COMMA, FIELD SEPARATOR |
| 104-109 | ‘00000' - ‘65535 | POL HI LIMIT, CALIBRATED RESOLVER UNITS |
| 110 | 03H | ETX. , MESSAGE TERMINATOR |
| 111 | 00H-FFH | CHECKSUM |

The average time required for this command to execute is 370 ms. This period is from the moment the APC100 receives the last character of the command to the time it sends the last character of the response.

## H. Checksum Calculation

All bytes are added together, the total is subtracted from 00H (zero). This includes the START OF HEADER/START OF TEXT (SOH/STX) and the END OF TEXT (ETX). The example following is for an APC100 with an address of 50H:

01H + 50H + 53H + 52H + 03H = F9H
00H - F9H = 07H

COMMAND = 01H, 50H, 53H, 52H, 03H, 07H

# CHAPTER 8

# DRAWINGS AND SCHEMATICS

## A. Introduction

This section contains subassembly mechanical assembly drawings and schematics. These drawings are supplied for identification, engineering evaluation and/or inspection purposes only. They may not be used as a basis for manufacture and/or sale of products without written permission of Andrew Corporation.

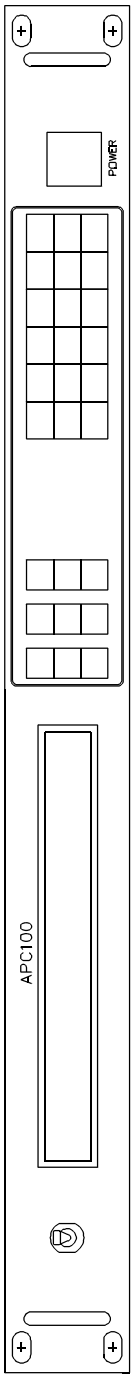



**Figure 1** APC100 Front Panel

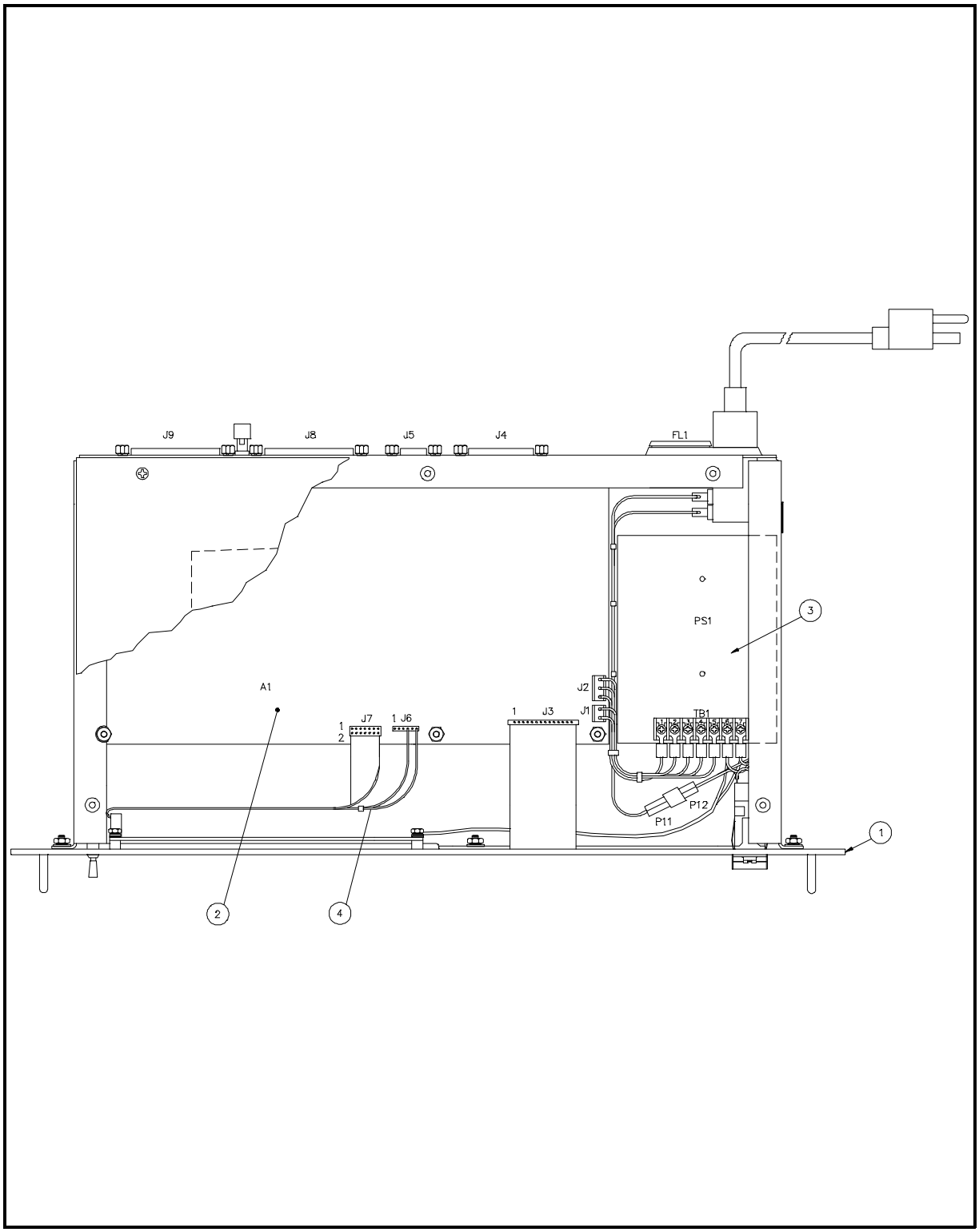



**Figure 2** APC100 Cutaway View From Top (AE01A-D0182 and AE01A-D0182-002

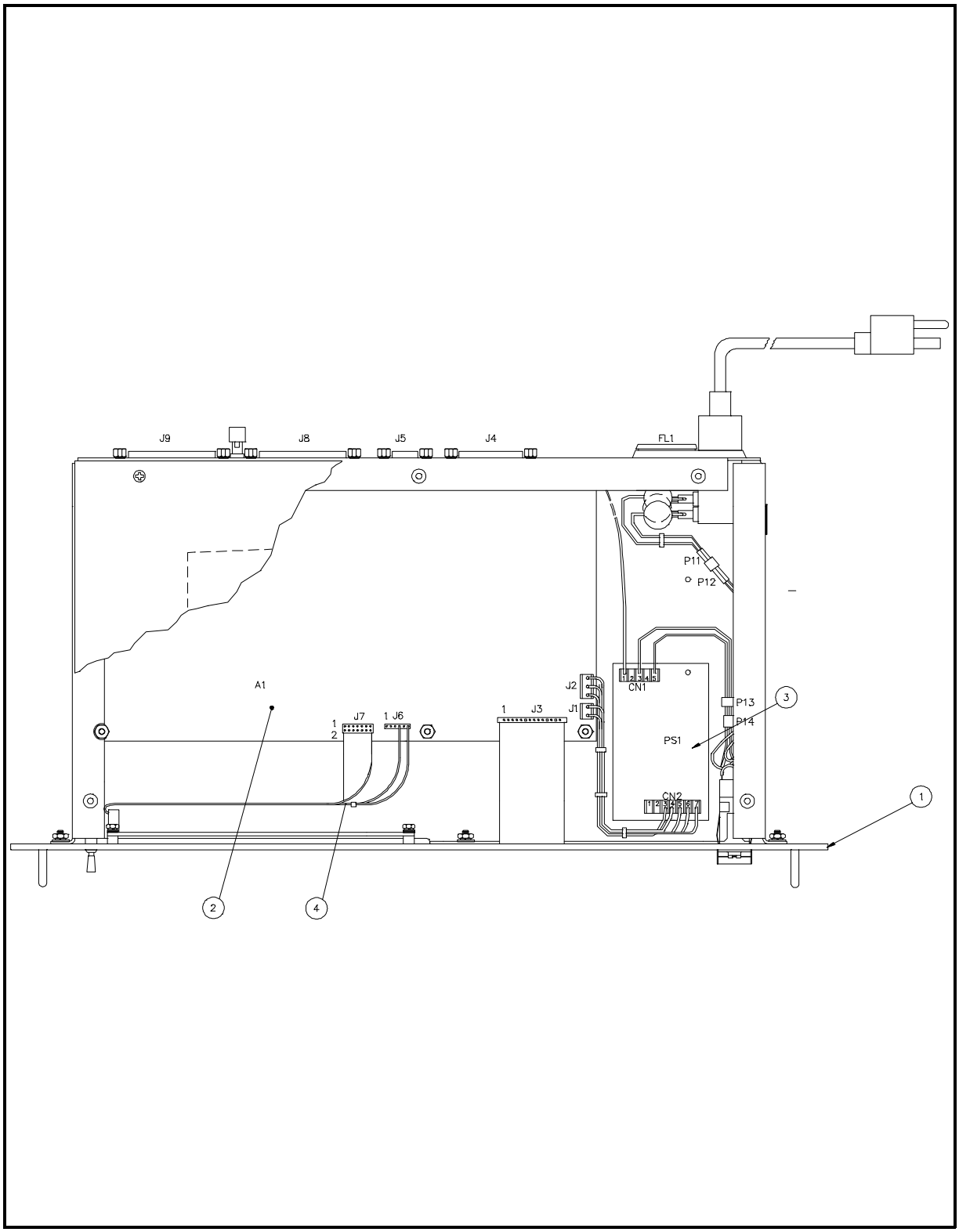



**Figure 3** APC100 Cutaway View From Top (AE01A-D0182-003)

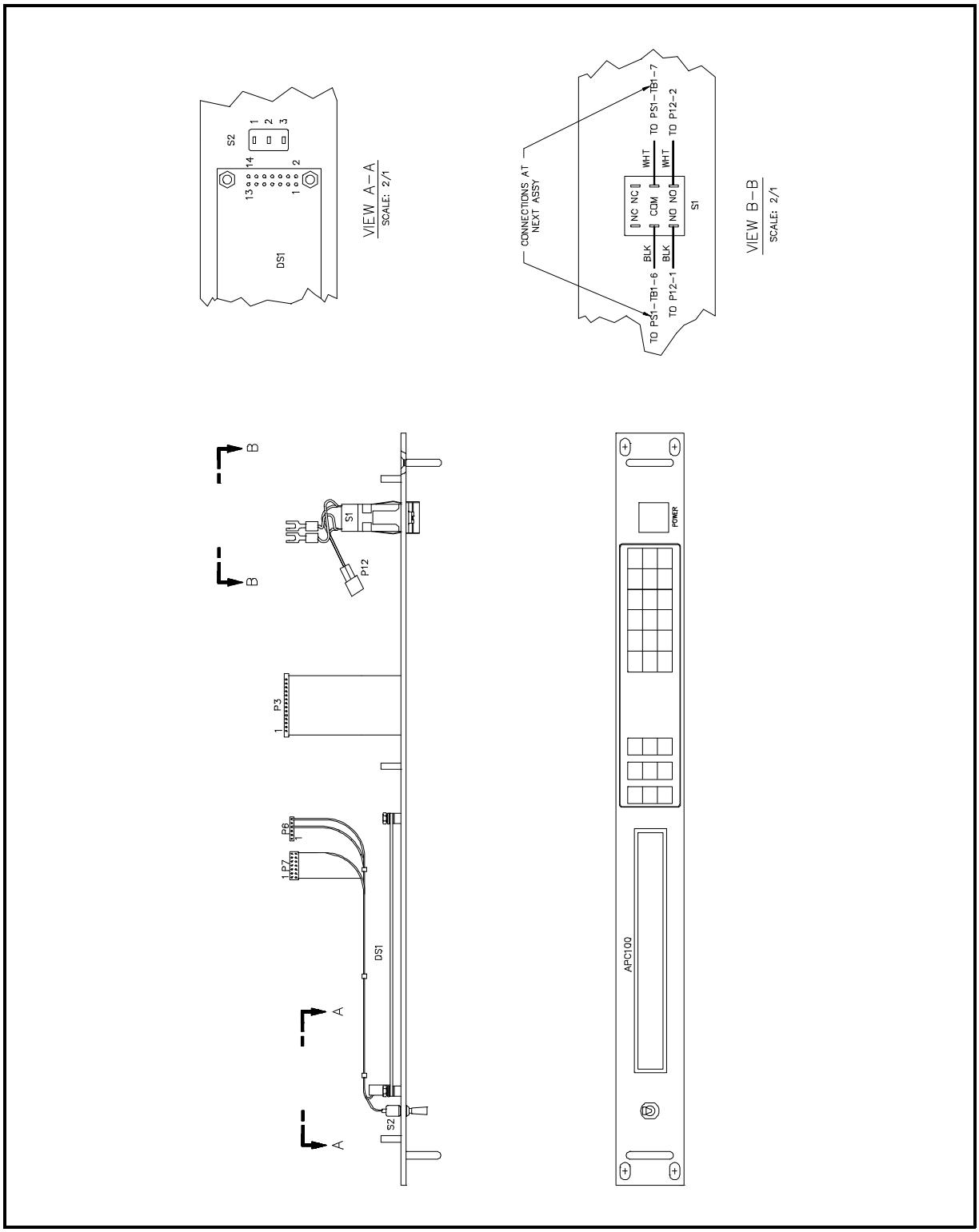



**Figure 4** APC100 Display Panel Assembly (AE01A-D0195 and AE01A-D0195-002)

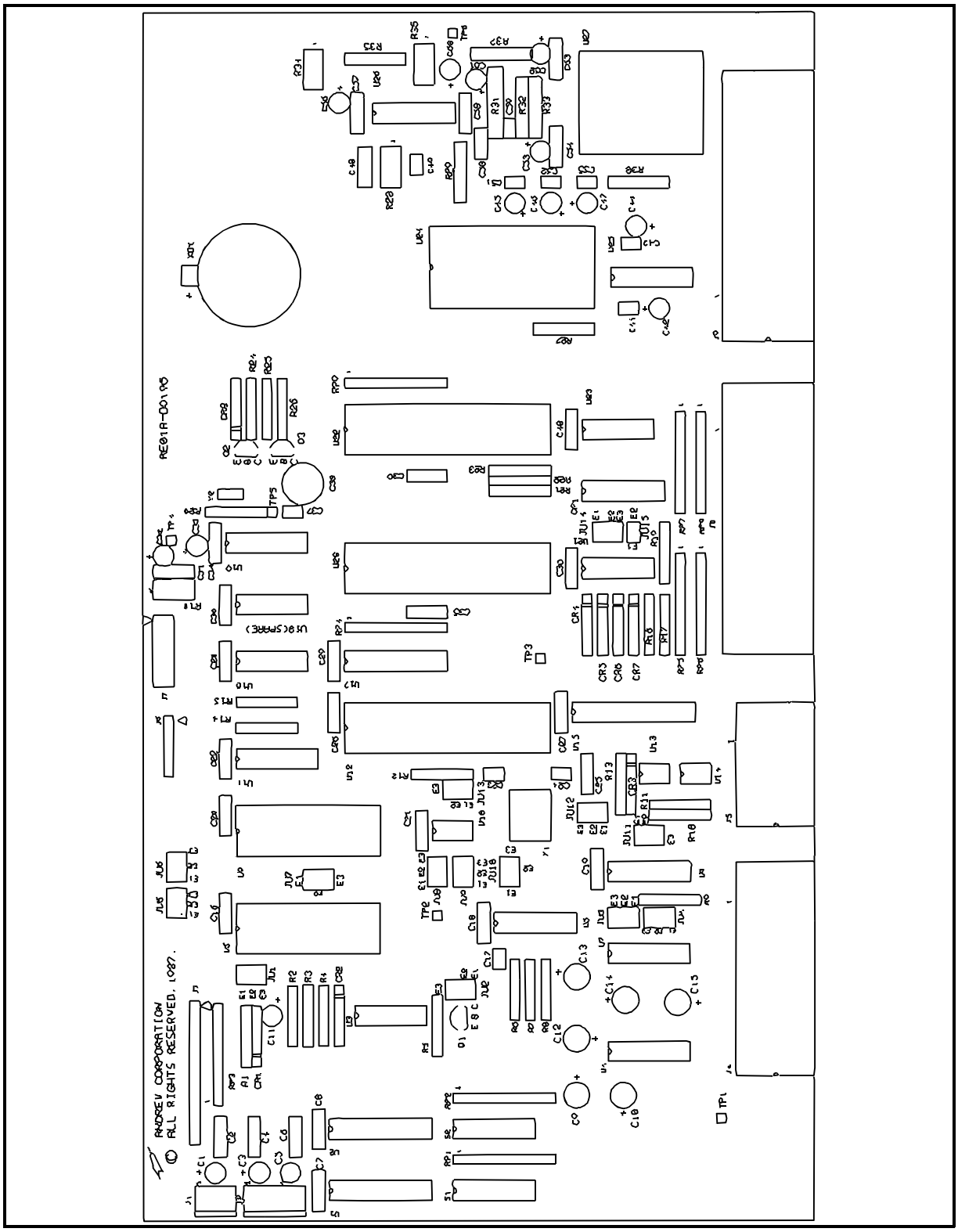



**Figure 5** APC100 Board Assembly

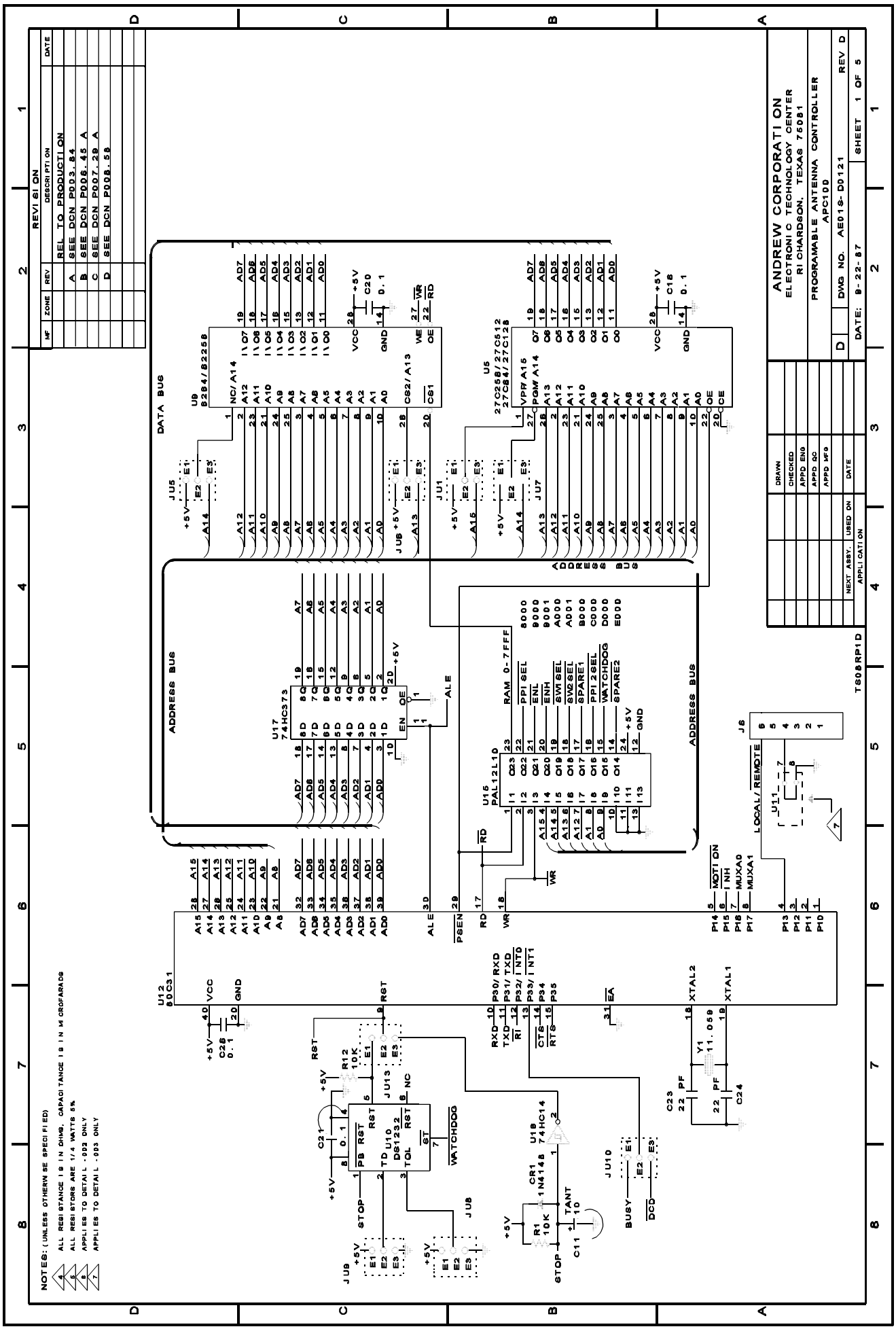



**Figure 6** APC100 Schematic, Sheet 1

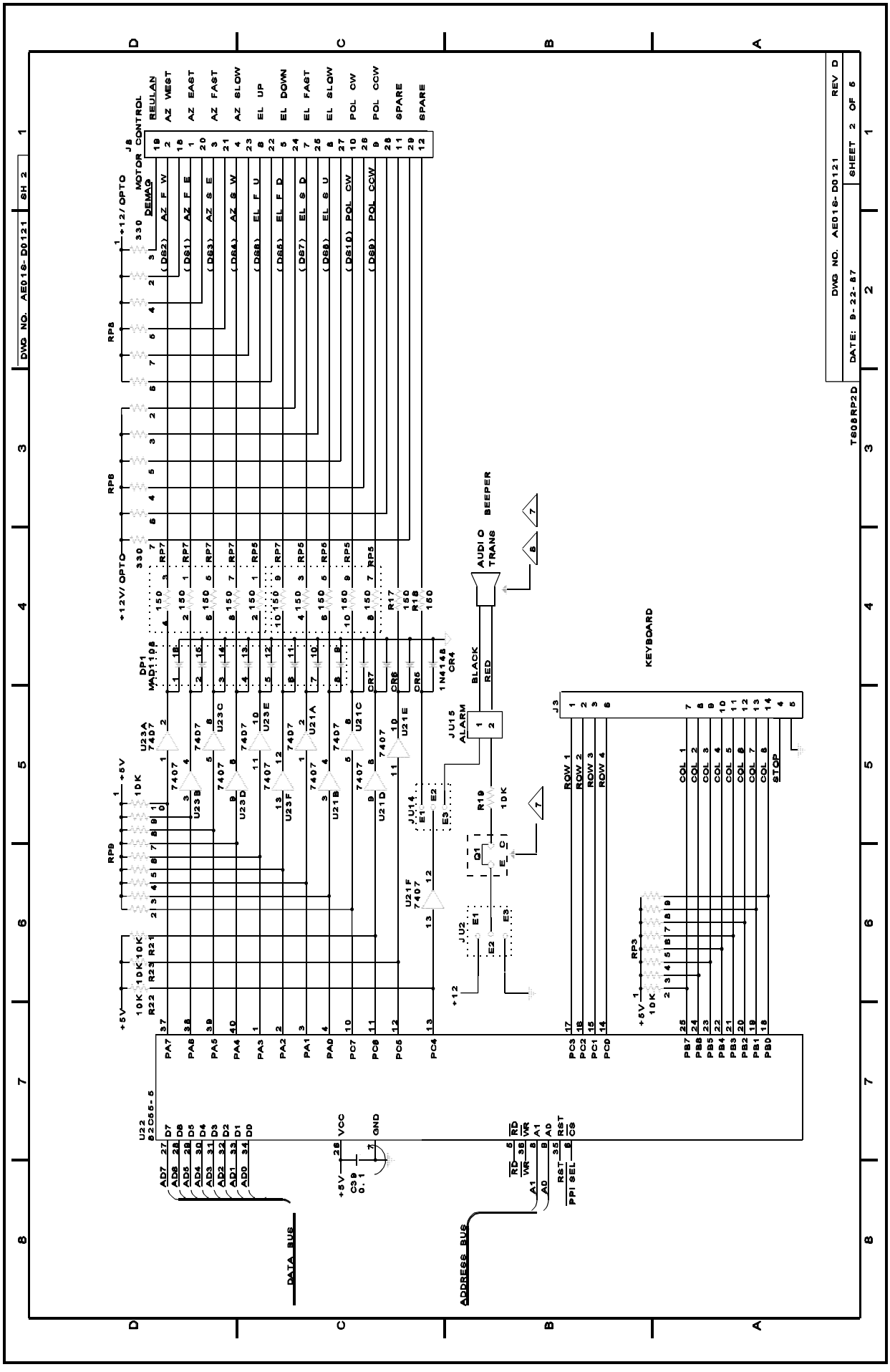



**Figure 7** APC100 Schematic, Sheet 2

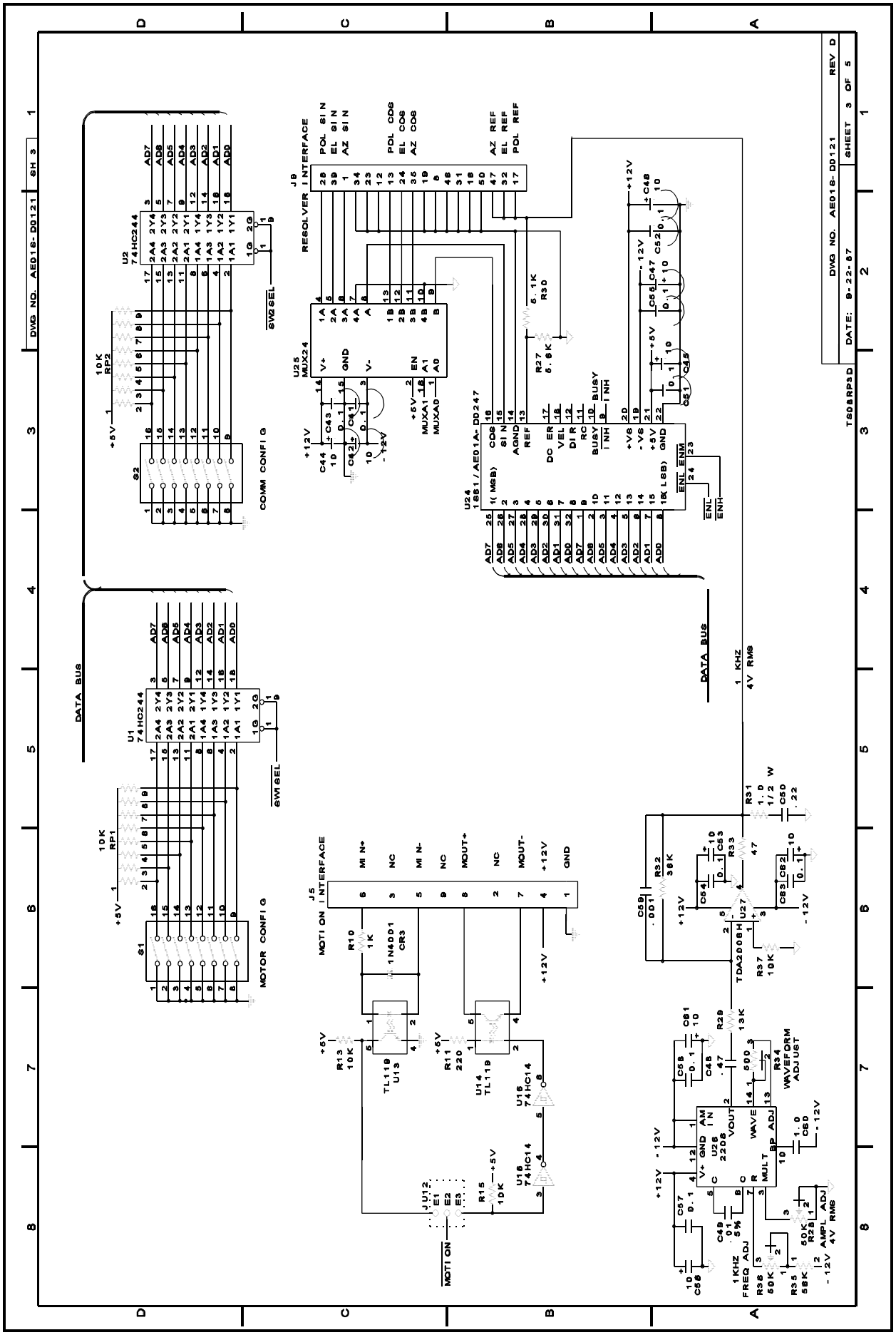



**Figure 8** APC100 Schematic, Sheet 3

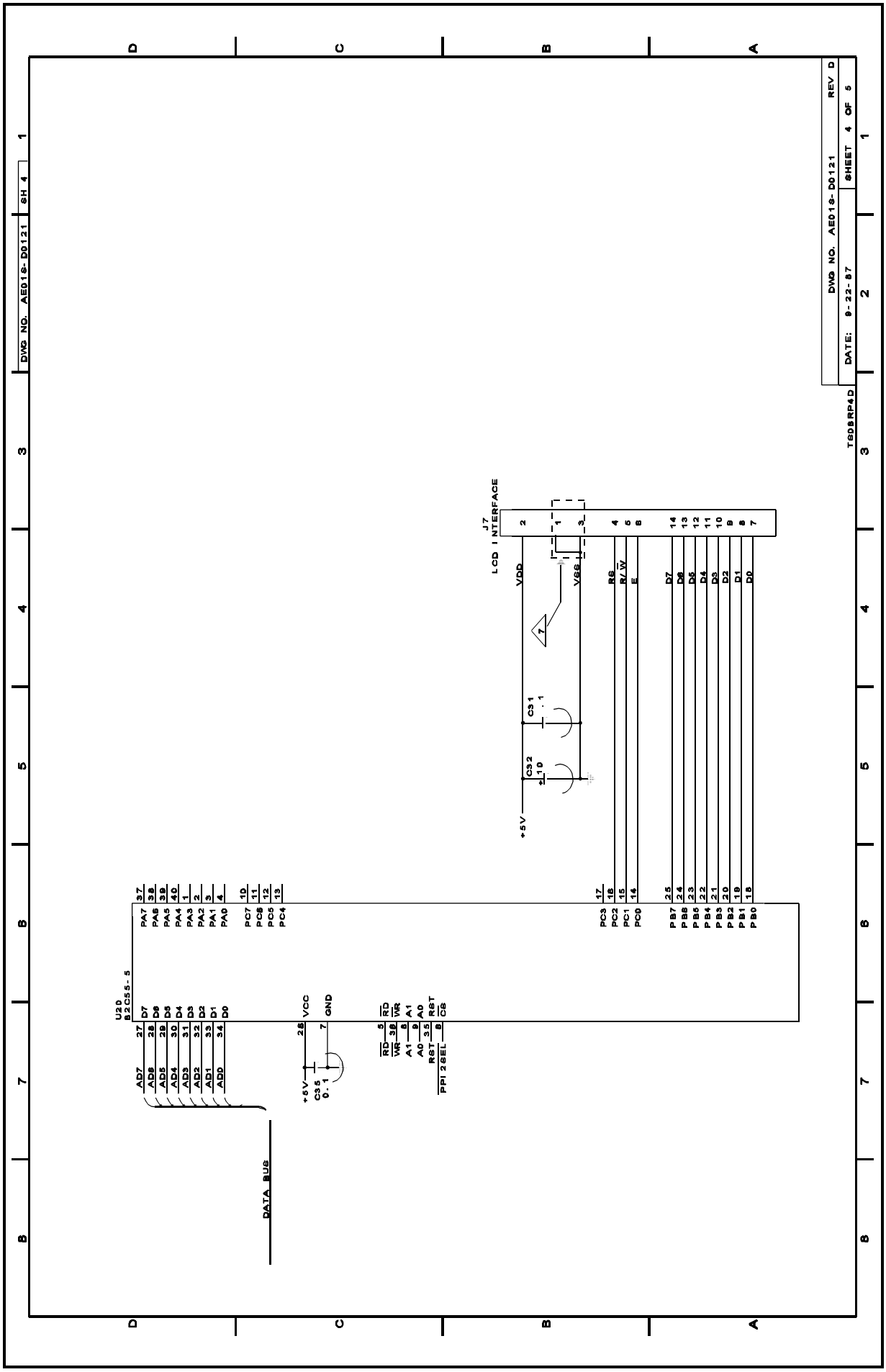



**Figure 9** APC100 Schematic, Sheet 4

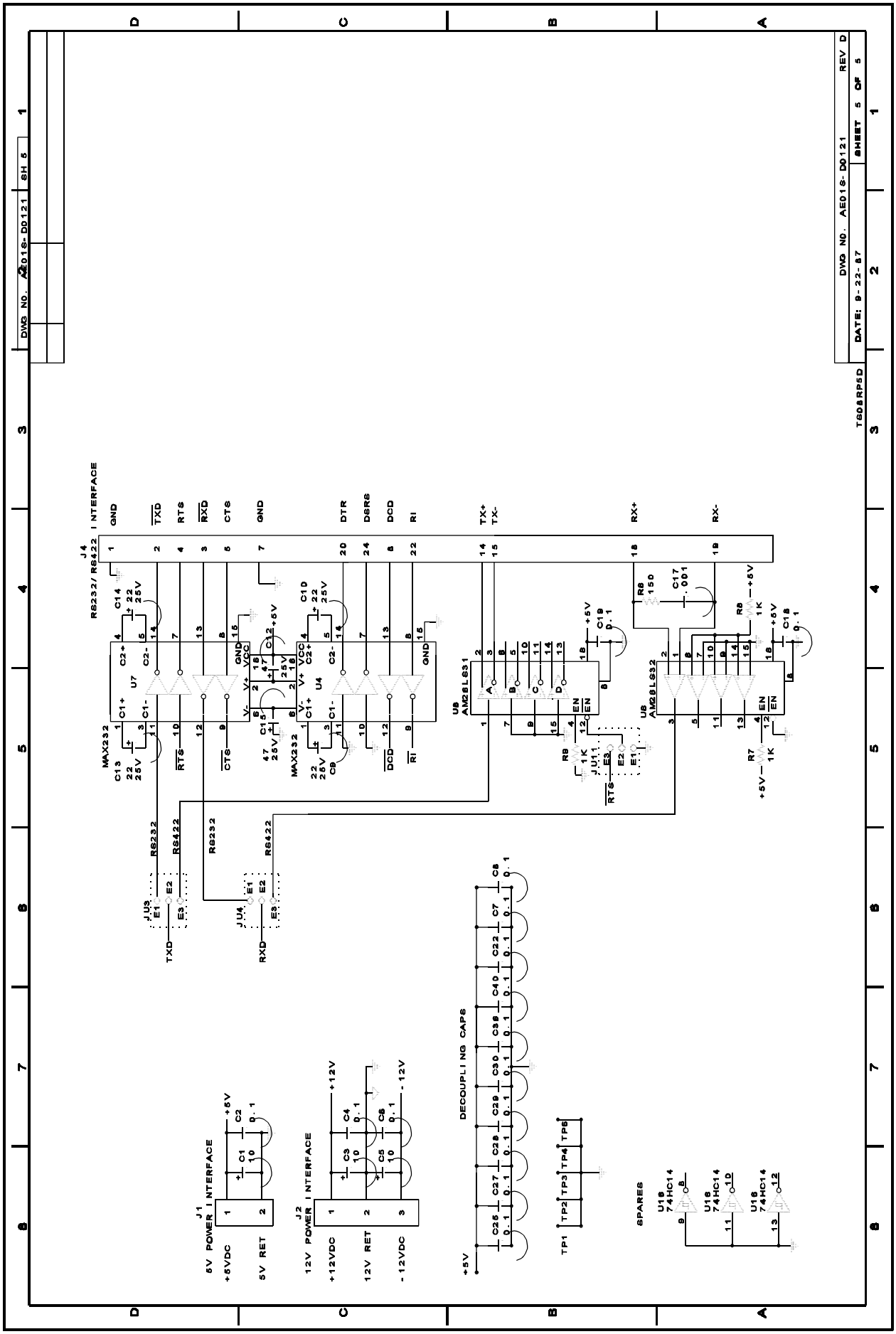



**Figure 10** APC100 Schematic, Sheet 5

# CHAPTER 9

# PARTS LISTS

## A. Introduction

A complete list of all field replaceable electronic components and mechanical parts subject to normal wear or failure is provided in this chapter.

## B. Parts Ordering Information

Replacements for all parts used in the APC100 Alarm Control Panel may be obtained from Andrew. When ordering replacement parts directly from Andrew, as in the case of proprietary parts, be sure to specify all information included in the parts list. Also include information which identifies the specific assembly in which the part is used, as well as the name, part number, and serial number, if indicated on the next higher assembly. To order replacement parts, contact Andrew Technical Service at 1-708-349-5900 (7:30 a.m. to 5:30 p.m). For 24 hour emergency service, contact Andrew Technical Support at 1-800-255-1479.

## C. PARTS LIST, APC100

| QTY. | FIG. NO. | UNIT | | ANDREW PN | DESCRIPTION | REF DES |
|---|---|---|---|---|---|---|
| 1 | 8-11 | 1 | EA. | AE01A-D0195 | PANEL ASSY, APC100 (-003) | |
| 1 | 8-5 | 2 | EA. | AE01A-D0196 | BOARD ASSY, APC100 (-003) | |
| 1 | 8-9 | 3 | EA. | EPWSP-13301 | POWER SUPPLY, 3 DC OUT, AC IN* | |
| 1 | 8-10 | 3 | EA. | EPWSP-12302 | POWER SUPPLY, 3 DC OUT AC IN (-002) | |
| 1 | 8-10 | 4 | EA. | AE01C-C0199 | CABLE ASSY, INTCON, DISPLAY BOARD | |
| 1 | | | EA. | ELCDD-50402 | LCD 40X2 DOT MATRIX FOR DETAIL -003 APC100. | |
| 1 | | | EA. | ECNNP-23140 | HEADER, DBL ROW, 14 PIN, STR FOR LCD | |
| 1 | | | EA. | ERESX-03092 | RESISTOR, 3.90 OHM, 1W | |
| 2 | | | EA. | EICHC-24414 | IC, 74HC244, OCTAL BFR/LD | U1, U2 |
| 1 | | | EA. | EICHC-37314 | IC, 74HC373, OCTAL D | U17 |
| 2 | | | EA. | EICRS-23212 | IC, RS-232 RCVR/XMTR | U4, U7 |
| 1 | | | EA. | AE01M-B0049 | EPROM, PROGRAMMED | U5 |
| 1 | | | EA. | EICLD-03212 | IC, 26LS32, QUAD LINE RCVR | U6 |
| 1 | | | EA. | EICLD-03112 | IC, 26LS31, QUAD LINE DRIVER | U8 |
| 1 | | | EA. | ECMOS-12160 | IC, CMOS, STATIC RAM 256KB | U9 |
| 1 | | | EA. | EICDS-12310 | IC, DS 1232 TIMER | U10 |
| 1 | | | EA. | EICSK-20960 | SMART SOCKET, DS 1213 | XU9 |
| 1 | | | EA. | EICMP-80328 | IC, 80C31 MICROCNTRL | U12 |
| 2 | | | EA. | EOPIS-11920 | IC, TIL119 OPTO ISOLATOR | U13, U14 |
| 1 | | | EA. | AE01M-B0048 | PAL, PROGRAMMED | U15 |
| 2 | | | EA. | EICPP-82519 | IC, 82C55A, PRGM I/O | U20, U22 |
| 1 | | | EA. | AE01A-D0247 | 2S80 ADAPTER CKT BRD | U24 |
| 1 | | | EA. | EICPU-28029 | IC, 2S80, R-D CONV. | U1 |
| 2 | | | EA. | EICTL-00711 | IC, 7407, HEX, BUF | U21, U23 |
| 1 | | | EA. | EICHC-01411 | IC, 74HC14, HEX, INV | U16 |
| 1 | | | EA. | EICFC-20612 | IC, FUNCTION GEN. | U26 |
| 1 | | | EA. | EICAA-20063 | AUDIO AMP, 10W | U27 |
| 1 | | | EA. | ECMAS-50922 | IC, 509A, ANALOG | U25 |

SWITCH

## D. PARTS LIST, APC100

| QTY. | FIG. | NO. | UNIT | ANDREW PN | DESCRIPTION | REF DES |
|---|---|---|---|---|---|---|
| 1 | 8-11 | 1 | EA. | ESWTG-35101 | SWITCH, LK TGL, SPDT REMOTE/LOCAL SWITCH | S2 |
| 1 | 8-11 | 1 | EA. | ESWPB-52210 | SWITCH, DPDT, ALT ACT POWER SWITCH | S1 |
| 1 | | 1 | EA. | ESWPB-92010 | GUARD, SWITCH, PB | S1 |
| 1 | | 1 | EA. | ESWPB-91210 | COVER, SWITCH, PB | S1 |
| 1 | | 1 | EA. | EDIOA-81440 | DIODE ARRAY, 8 CKT,DIP | DP1 |
| 5 | | | EA. | EDIOS-41481 | DIODE 1N4148 | CR1, 4-7 |
| 1 | | 1 | EA. | EXTLP-21105 | CRYSTAL, 11.059 MHz. | Y1 |
| 1 | | 1 | EA. | AE01K-B0156 | APCEDIT KIT. | |

# Appendix 1 - APC100 Setup to SNG 2.3/2.4 Meter Antennas

## A-I APC100 Andrew Antenna Controller Installation

1. Configure the APC100 for the SNG installation. Remove the top of the controller. Reset the dip switch for an extended or mobile antenna. Set dip switch S1-1 ON, for Dual speed motor (2.4M) **OR** S1-1 OFF for Single speed motor (2.3M). Set dip switch S1-2 OFF, indicating Reuland motor type. Set dip switch S1-3 OFF, indicating 3 Axis type antenna. Set dip switch S1-4 OFF, indicating 1:1 Polarity Gearing ratio. Set dip switch S1-5 ON, indicating Extended (Mobile) operation. Set dip switch S1-6 OFF, Northern Hemisphere. Set dip switch S1-7 ON, AE01A-D0247. Set dip switch S1-8 ON, indicating Serial Motor operation. See Table 6-a for more information on dip switch settings.

2. Reinstall cover when the switches are set.

3. Install motor drive cable assembly to the contactor box and the APC100 controller. Install cable assembly AE01C-C0476 to the motor control box. Terminate cable as per installation bulletin 239985.

4. Install the resolver cable to the APC100.

5. Install the power cord and bring power up on the APC100. Determine if the resolver readings are fluctuating. If they are, check the pinout in the amphenol cable connector for the resolvers inputs. See installation drawing 239985 or the interconnect diagram 239983 for the correct pinout. If this does not stop the fluctuation, check all cables and connectors for damage or miswiring. If the resolver readings are steady, proceed with setup.

## A-2 Powering Up the Antenna Contactor Box

1. Operate the antenna with the local hand held controller. Place the REMOTE/LOCAL switch to LOCAL. Verify that the antenna moves in the correct direction for all axes, according to the direction selected on the hand held control box.

**NOTE: When looking down on the antenna assembly, azimuth readings increase when the antenna is rotated clockwise. Additionally, azimuth readings, when measured in degrees from True North, decrease as the antenna moves eastward when in the Northern Hemisphere. In the Southern Hemisphere, easterly movement is in a clockwise direction when referenced from True North and therefore will increase the azimuth readings.**

Operate the antenna at the low and high speed of the speed control dial (pot) on the hand held controller. Correct all problems, before continuing with the procedure.

2. Place the APC100 in LOCAL mode using the REMOTE/LOCAL switch located on the front of the APC100. Switch the hand held controller to "REMOTE". Operate the APC100 in the jog mode to determine if the antenna moves in the correct direction in all axes. If they are not, check the pinout in the amphenol cable connector for the motor control outputs. See installation drawing 239985 or the interconnect diagram 239983 for the correct pinout. If this does correct the axis selected and/or direction of movement, check all cables and connectors for damage or mis-wiring.

## A-3 APC100 Resolver Setup/Adjustment

1. The SNG vehicle or antenna mount must be level within 1∘. The antenna elevation "RF" line of sight must be parallel to the horizontal or 0∘ elevation (feed boom level). The azimuth direction should be parallel to the center of the vehicle. The polarization axis should be at the midpoint of rotation between the motorized limits. Use the hand held control to position the antenna as described above.

2. Turn the APC100 power on and press the following keys: [SETUP], "7", "START" and "0".

**NOTE: This clears all setups and commands in the APC100 memory. This should only be done at the start of the APC100 and resolver setup. If this step is repeated, the entire setup and adjustment must be re-entered. This procedure also erases any saved satellite names and their respective position information.**

## A-4 Setting the Elevation Resolver

1. Adjust the mechanical position of the resolver as follows: Change the APC100 angle measurement to resolver units "RU" by pressing [SETUP] from the APC100 keypad. Press "6" to toggle angle measurement units to resolver units. Enter "0" to exit setup display. Loosen the resolver mounting screws. Rotate the elevation resolver until the APC100 display reads 33698 ± 50 resolver units. Tighten the screws. This is 5◦ above the the 32768 centerline of the resolver in order to allow for a -75◦ (285◦) stow position. The total span of elevation in extended (mobile) mode is 140◦, resulting in a high limit of 65◦. The antenna elevation range of travel is shown in Figure A-1.

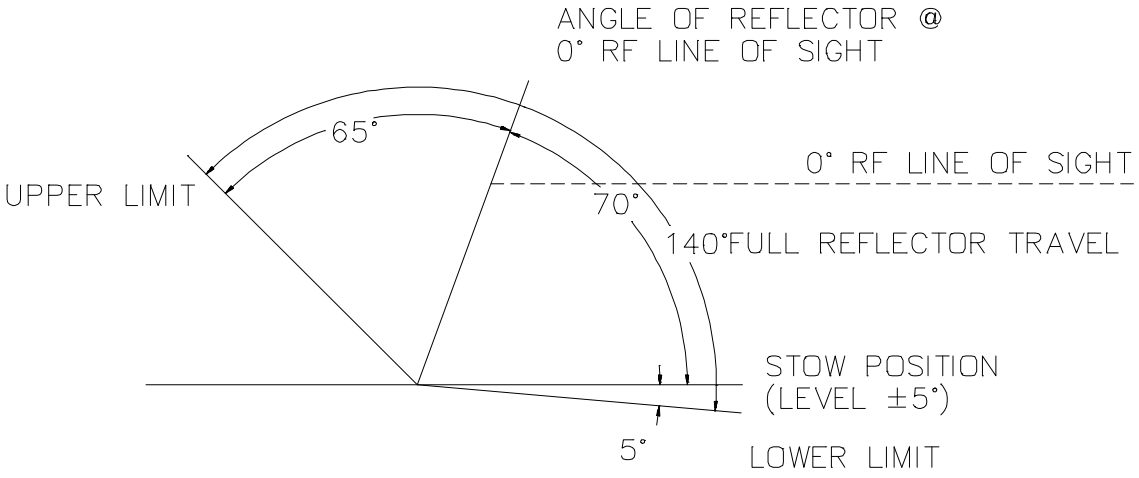



**Figure A-1** Antenna Elevation Range of Motion

2. Verify the vehicle or antenna mount is in the proper position, as defined in Section – step 1.

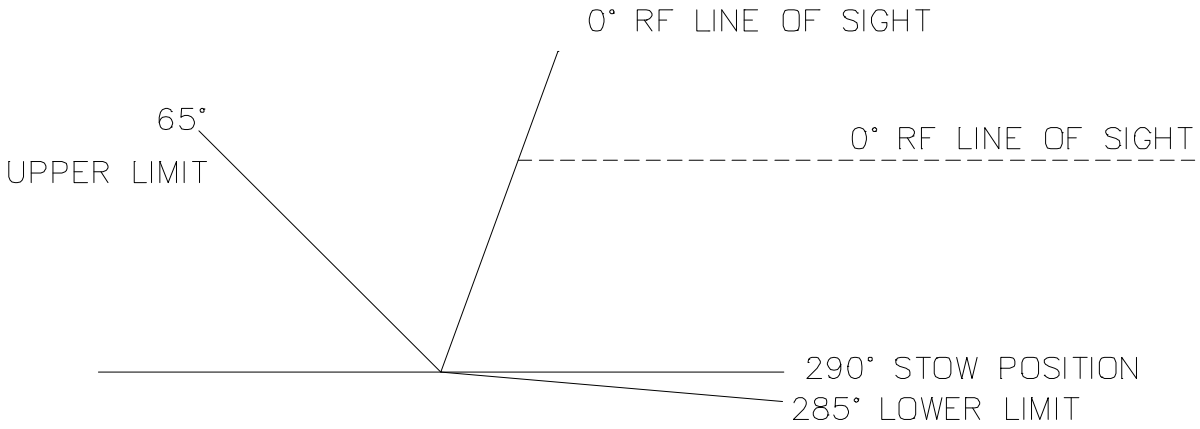



**Figure A-2** Relative APC100 Elevation Readouts

3. Change resolver units back to degrees by pressing [SETUP], and "6" from the APC100.

4. Set the low and high elevation limits as follows: Press [SETUP] then "2" on the APC100 front panel. Press [ENTER] twice to bypass the azimuth limit setup screen. Set the low elevation limit to "110" degrees, then press [ENTER]. Set the elevation high limit to "250" degrees, then press [ENTER]. Press [ENTER] twice to bypass the polarization limit setup screen. Press "0" to exit the limits display.

5. Re-calibrate the elevation midpoint as follows: Press [SETUP], and "1", from the APC100 keyboard. Press [ENTER] to bypass the azimuth axis setting. Set the degree reading to "0.0∘". Press [ENTER] to bypass polarization axis setting. This sets an upper limit 65° and a lower limit of 285° (-75° below horizontal, about 5° below stow position).

## A-5 Setting the Azimuth

1. The vehicle or antenna mount must be in the position as noted in – step 1. Raise the antenna elevation to prevent damage while moving the azimuth.

2. Set the east and west azimuth limits. Press the following keys on the APC100: [SETUP], "2". Set AZ EAST limit at 50○ degrees, then press [ENTER]. Set AZ WEST limits at 310○ degrees, then press [ENTER]. Press [ENTER] to bypass elevation and polarization limit setup. Press "0" to exit.

3. Adjust the midpoint range of the resolver. Change the APC100 to resolver units by pressing the APC100 [SETUP] key. Press "6" toggle angle measurements to resolver units (RU) and enter "0". Loosen the resolver mounting screws (motor mount cleat P/N 97384-2). Rotate the azimuth resolver until the APC100 reads 32768 ± 50 resolver units. Tighten the screws.

4. Change resolver units to degrees by pressing [SETUP], and "6" from the APC100.

5. Re-calibrate the azimuth midpoint. Press [SETUP], and "1", from the APC100 keyboard to select "AZ". Set the degree reading to "180○". Press [ENTER] to bypass the elevation and polarization axes setup screens. This sets a lower (east) limit of 50° and an upper (west) limit of 310°.

## A-6 Setting the Polarization Limits

1. The SNG vehicle and antenna mount does <u>not</u> need to be in the position as noted in Section ., however, the feed must be positioned correctly as follows:

   a. Check the full feed movement ± 90°.

   b. Set the polarization axis midpoint halfway between the motorized limits.

2. Set the polarization limits. Press [SETUP] then "2" on the APC100 front panel. Press [ENTER] to step through the azimuth and elevation limit setup screens. Set the low limit to "95○" then press [ENTER]. Set the high limit to "265○" then press [ENTER] to exit the limits display.

3. Adjust the midpoint range of the resolver. Change the APC100 angle measurement to resolver units "RU" by pressing [SETUP] from the APC100 keypad. Press "6" to toggle angle measurement units to resolver units. Enter "0" to exit setup display. Loosen the resolver mounting screws. Rotate the polarization resolver until the APC100 display reads 32768 ± 50 resolver units. Tighten the screws.

4. Change resolver units back to degrees by pressing [SETUP], and "6" from the APC100.

5. Re-calibrate the polarization midpoint. Press [SETUP], and "1", from the APC100 keyboard. Press [ENTER] four times to bypass azimuth and elevation limit setting to select "POL". Set the degree reading to "90". Press [ENTER] exit the limits screen. This sets a lower (CW) limit of 175° and an upper (CCW) limit of 5°.

## A-7 Additional Settings Needed

### 7.1 Time Out T/O

Time out is the amount of time required for the APC100 to turn off the power to the motors if the motors are not moving or are moving too slowly. These values are based on a given set speed for a particular antenna. Set the speed on variable speed antennas to the slowest setting before proceeding. Because the creep speed is quite slow in azimuth, it is necessary to set it at a high value. The following settings are recommended (all units shown below are resolver units). Press [SETUP] then "6" to toggle the angle measurement mode to resolver units. Press "4" for Time/Out:

| | | |
|---|---|---|
| AZIMUTH | LOW SPEED: 900 | HIGH SPEED: 700 |
| ELEVATION | LOW SPEED: 900 | HIGH SPEED: 700 |
| POLARIZATION | LOW SPEED: 400 | |

Refer to paragraph ? for additional information.

### 7.2 Coast Coefficient COEF

This option modifies the distance the antenna coasts after the motors have

been turned off. This parameter varies from antenna to antenna and axis to axis. Too little coast allows the reflector to travel past the set position. Too much coast causes the reflector not to reach the set position. If the antenna goes past or does not reach the set position, it does not try to relocate it.

To set coast coefficients, follow the instruction in Section ?. The antenna must be operated for at least 20° for each setup.

**NOTE: 182.0444 RU EQUALS 1 DEGREE.**

Once limits are established in the APC100 memory, changing them is not recommended. The parameters are unique to the vehicle or vehicles and not to a satellite. The vehicle is always moving from one fixed position to another. The position coordinates are never the same.

## A-8 Establishing Stow and Deploy Positions

### 8.1 Stow Position (Antenna On Stops)

1 Locate the antenna to the stow position on the stops.

2 Remove the cover from the True Elevation Resolver Assembly. Rotate the pendulum "CCW" until the elevation readout on the APC100 is as low as possible. Hold in place.

3 With the pendulum held in noted above position, press the APC100 [SETUP] then "5" for position, "39" for position number, [ENTER] and "0" to exit. This position should read AZ=180, EL=(less than 285), POL=175 TO 5.

**NOTE: The number 39 was used in the above step for example purposes, only. Any position number may be used. Use the program "APCEDIT", which is included, to change names.**

4 Loosen the pendulum so that it rotates freely. Install the cover on the noted assembly.

### 8.2 Deploy

1 Move the antenna to approximately 50°.

2 With the antenna elevation at the desired position, and azimuth at 180°, select [SETUP] from the APC100 keyboard. Select "5" for position, "38" for position number, [ENTER] and "0" to exit. This position should read: AZ=180, EL=50, POL=5 TO 175.

**NOTE: The number 38 was used in the above step for example purposes, only. Any position number may be used. Use the program "APCEDIT", which is included to change names.**

**NOTE: Assign deploy and stow names using APCEDIT.**

## A-9 Renaming the Position Satellite Names

Use the APCEDIT program modification kit, AE01K-B0156, to change position satellite names. APCEDIT also saves and retrieves parameter information from a diskette via an IBM compatible PC. The APC100 has pre-assigned satellite names for positions 1-35 (see Table 4-a). This kit provides a floppy disk with the program, cable and installation instructions.