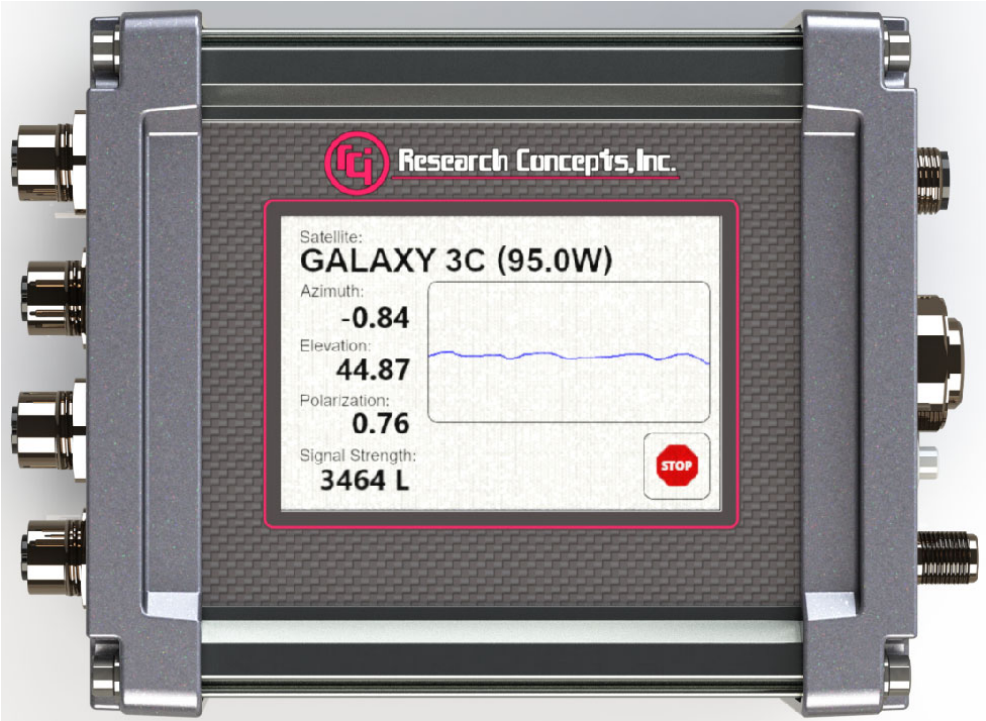# RC4080 ANTENNA CONTROLLER INTEGRATION MANUAL

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Contents subject to change

Serial No_____

Revision History

DATE	MODIFICATION	SW VERSION	INITIALS
	Initial Version	3.10	RLE

Limited Warranty

New Products

Research Concepts, Inc., RCI, warrants to the original purchaser this product shall be free from defects in material and workmanship for one year, unless expressed otherwise, from the date of the original purchase. During the warranty period, RCI will provide, free of charge, both parts and labor necessary to correct such defects.

To obtain such a warranty service, the **original purchaser** must:

1. Notify RCI as soon as possible after discovery of a possible defect, with:
    a. Model and serial number
    b. Purchase date
    c. Detailed description of the problem and circumstances when problem appears, including details on the electrical connection to associated equipment
2. Obtain an RMA number from RCI, then ship the product to RCI in original packaging or its equivalent, fully insured and shipping/customs charges prepaid. RCI is not responsible for damage during shipping.

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‾‾‾

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Correct maintenance, repair, and use are important to obtain proper performance from this product. Therefore, read the instruction manual carefully and completely. This warranty does not apply to any defect that RCI determines is due to, but not limited to:

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RC4080

Table of Contents

1 INTRODUCTION

The RC4080 Antenna Control Unit (ACU) consists of a single 6.60"x4.75"x2.80" enclosure and external GPS and compass module. The standard unit will include a 3.5" touchscreen on the front face of the ACU enclosure.

PLEASE READ AND UNDERSTAND THE MANUAL. Due to the complexity of the functions performed by the RC4080, time invested in understanding its installation and operation will be well spent.

1.1 Manual Organization

The RC4080 implements a standard set of hardware and allows for the use of multiple software options to provide flexibility in the operation of the ACU. This manual is organized to:

1) Describe common hardware and software elements that will apply to all instances of the RC4080
2) Provide a structure to allow definition of elements unique to a specific use of the RC4080

Chapter 1 summarizes the contents of the manual and highlights the functionality and features of the RC4080.

Chapter 2 describes the core software features of the RC4080.

Chapter 0 describes various support and troubleshooting for the RC4080

Appendix A supplies the expert access codes on a single page, which at management's discretion, may be removed to eliminate the possibility of inexperienced users inadvertently corrupting configuration data.

Appendix B, titled "MOUNT SPECIFIC DATA", details unique functions and values unique to a specific antenna mount.

Separate appendices describe additional features of the RC4080. Example optional appendices that could accompany the manual include:

APPENDIX OPENAMIP – OpenAMIP interface option
APPENDIX DVB – Integrated DVB receiver
APPENDIX REM – M&C remote protocol

1.2 Manual Conventions

Throughout the manual, representations of the four row LCD screen the user will see will be shown in the boxed format that follows:

```
AZIM:    0.0 STOW    DVB:1576        MANUAL
ELEV:  16.0          SAT:
 POL:   0.0          SPD:FAST            UTC
<MODE>MENU <0-9>JOG ANTENNA       14:25:47
```

The following table shows typical abbreviations used both on RC4080 screens and in the manual's text.

ITEM	ABREVIATION(S)
Azimuth Angles	AZIM, MAG, TRUE
Elevation Angles	ELEV
Polarization Angles	POL
Clockwise	CW
Counter-Clockwise (Anti-Clockwise)	CCW
Down	DN
Latitude	LAT
Longitude	LON
Satellite	SAT
Global Positioning System	GPS
Liquid Crystal Display	LCD
Signal Strength	SS

Satellite longitudes are presented in degree/decimal degree (79.0 W) format since that is the standard representation of satellite positions. Latitude and longitude of the mount are presented in degree/decimal (38.9554N, 94.7543W) format.

When referring to an RC4080 mode of operation, that mode's name will be capitalized – ex. LOCATE.

Throughout the RC4080 manual and software, the latitude, longitude and true heading of the antenna are collectively referred to as the antenna's "position".

Movements of the antenna (as seen from behind the antenna, looking at the arc of satellites) are represented by graphing the azimuth and elevation axes as shown below.
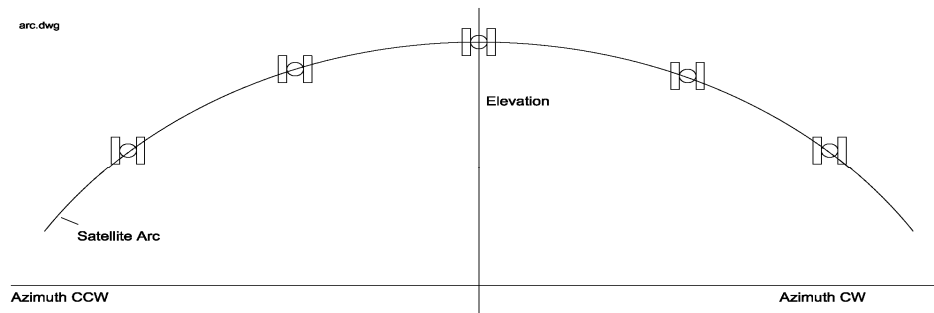
1.3 RC4080 Features

The RC4080 performs its functions via digital and analog electronic equipment interfaced to the antenna's motor drive and position sensor systems. This equipment is controlled through embedded software algorithms run by the RC4080's microcontroller.

The RC4080 ACU is designed to automate the operation of fly-away style antennas. Features provided include:

- Automatic azimuth and elevation pointing solution calculation
- GPS receiver for determination of antenna latitude and longitude
- Automatic polarization control of rotating feeds
- Battery backed-up non-volatile memory for storing satellite locations and configuration data
- Continuous monitoring of antenna drive status
- Magnetic heading sensor
- Multiple User Interface Options
- Integrated 3.5" TFT touchscreen display
- Ethernet (IP-based) remote control Options
        - Remote Front Panel
        - Webpage Graphical User Interface (GUI)
        - Rich M&C Protocol

1.4 Hardware Overview

The following figures show the dimensions for both the main ACU enclosure and the external GPS+Compass unit.
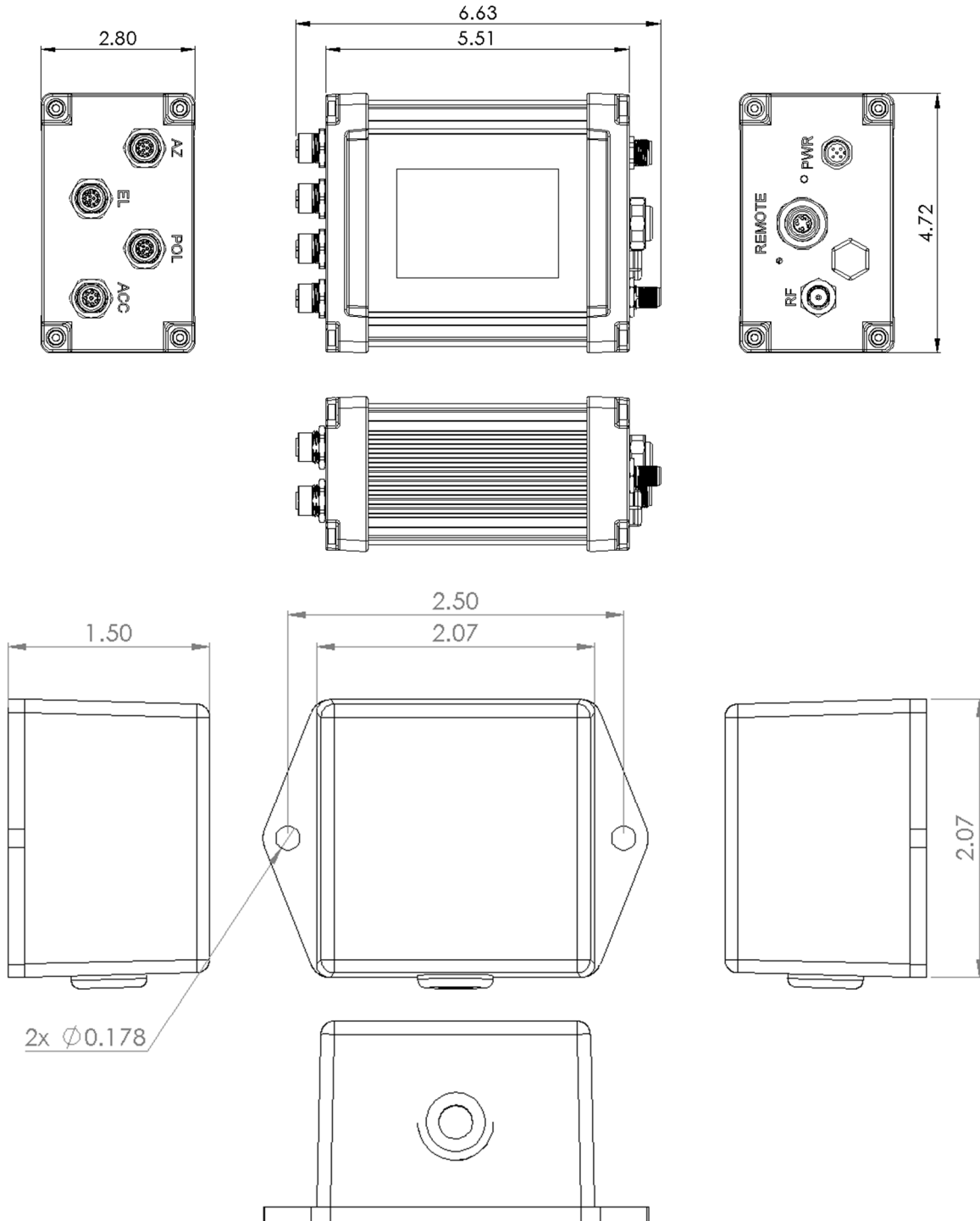
1.5 Software Overview

The RC4080 allows easy antenna control via its mode-based operation. Multiple user interfaces (local and remote control) options exist. Section 2.1.1 highlights software functions from the touchscreen interface. Section 2.1.2 highlights the software functions by showing data that would be presented if a user interface utilizes the 4x4 keypad and 4x40 LCD screen. Section 2.1.3 highlights the software functions by showing data that would be presented when using the graphical user interface option. The screen displayed to the user is based on the current controller mode. Controller modes are divided into two major groups: operational and programming. The operational modes provide for the normal operation of the antenna. The programming group provides for initial configuration of the controller and will typically not be used on a day by day basis. The following example highlights the basic modes of operation provided by the RC4080.

1.5.1 Touchscreen Overview

When using the touchscreen LCD, the display is based on the current controller mode. The touchscreen has unique screens for various operational group functions. For all other operational and programming group functions, the touchscreen will provide the same display and functionality as the 4x40 LCD and 4x4 keypad as described in the Section 1.5.2.

1.5.2 Front Panel Overview

When using the remote front panel or the touchscreen front panel the screen displayed to the user is based on the current controller mode. Controller modes are divided into two major groups: operational and programming. The operational modes provide for the normal operation of the antenna. The programming group provides for initial configuration of the controller and will typically not be used on a day by day basis.

1.5.2.1 Operational Group Functions

1.5.2.1.1 <u>Manual</u>

In MANUAL mode the user may jog the antenna in Azimuth, Elevation and Polarization

```
AZIM:    0.0 STOW    DVB:1576         MANUAL
ELEV:   16.0         SAT:
 POL:    0.0         SPD:FAST            UTC
<MODE>MENU <0-9>JOG ANTENNA        14:25:47
```

1.5.2.1.2   <u>Automatic Locate</u>

In LOCATE mode, azimuth and elevation pointing angles are automatically calculated based on position data (Lat/Lon), platform heading, platform pitch/roll and the selected satellite. Position data may be obtained automatically from a GPS receiver or entered manually (2.1.2.2.2.3.1). Heading may be automatically obtained from a compass or entered manually (2.1.2.2.2.3.2). The platform pitch/roll will be automatically obtained from a tilt sensor or entered manually (2.1.2.2.2.3.3). The user selects which satellite to locate from the satellite database. The RC4080 checks that the calculated pointing solution is within the antenna's range of movement and prompts the user to automatically position the antenna.

```
ANT:38.9554N   94.7543W   181.8       LOCATE
SAT:WB-1            111.1W       AZ:     22.6
                                 EL:     41.8
<1>SELECT NEW SAT            READY TO LOCATE
```

1.5.2.1.3   Automatic Antenna Stow

From STOW mode, the user may ask for the antenna to be automatically moved to the stow position.

```
AZIM:    0.0 (    0.0)                    STOW
ELEV:   19.6 (   16.0)
 POL:    0.0 (    0.0)
MOVING  ANTENNA  TO STOW         <STOP>HALT
```

1.5.2.2   Programming Group Functions

1.5.2.2.1   Configuration Screens

Configuration mode screens allow the user to customize and calibrate the operation of the RC4080 for use with a particular antenna. Note that most configuration items will be factory set for correct operation with a particular antenna.

```
MODE:2   ANT SIZE:   80        CONFIG-SYSTEM
 GPS:2   ANT LOOK:1              DRIVE:1
COMP:2   COMP OFF:    0.0   AZ DISP:1
<1-LOCATE 2-MENU 3-MANUAL 4-VSAT 5-POS>
```

1.5.2.2.2   Maintenance Screens

Maintenance mode screens allow the user to monitor sensor inputs and perform periodic maintenance actions such as setting time and resetting drive errors.

```
 SYSTEM:10/22/18 16:57:45               TIME
DISPLAY:10/22/18 16:57:45          ZONE:UTC
GPS UTC:10/22/18 16:57:45       OFFSET:   0
1-DATE/TIME 2-ZONE 3-OFFSET 4-GPS SYNC
```

1.5.3   Graphical User Interface Overview

The graphical user interface control option is available via the IP interface of the controller. It is designed to provide all the functions available from the front panel operation in an easy to use interface. As well as provide current status information of the system 2.1.3.
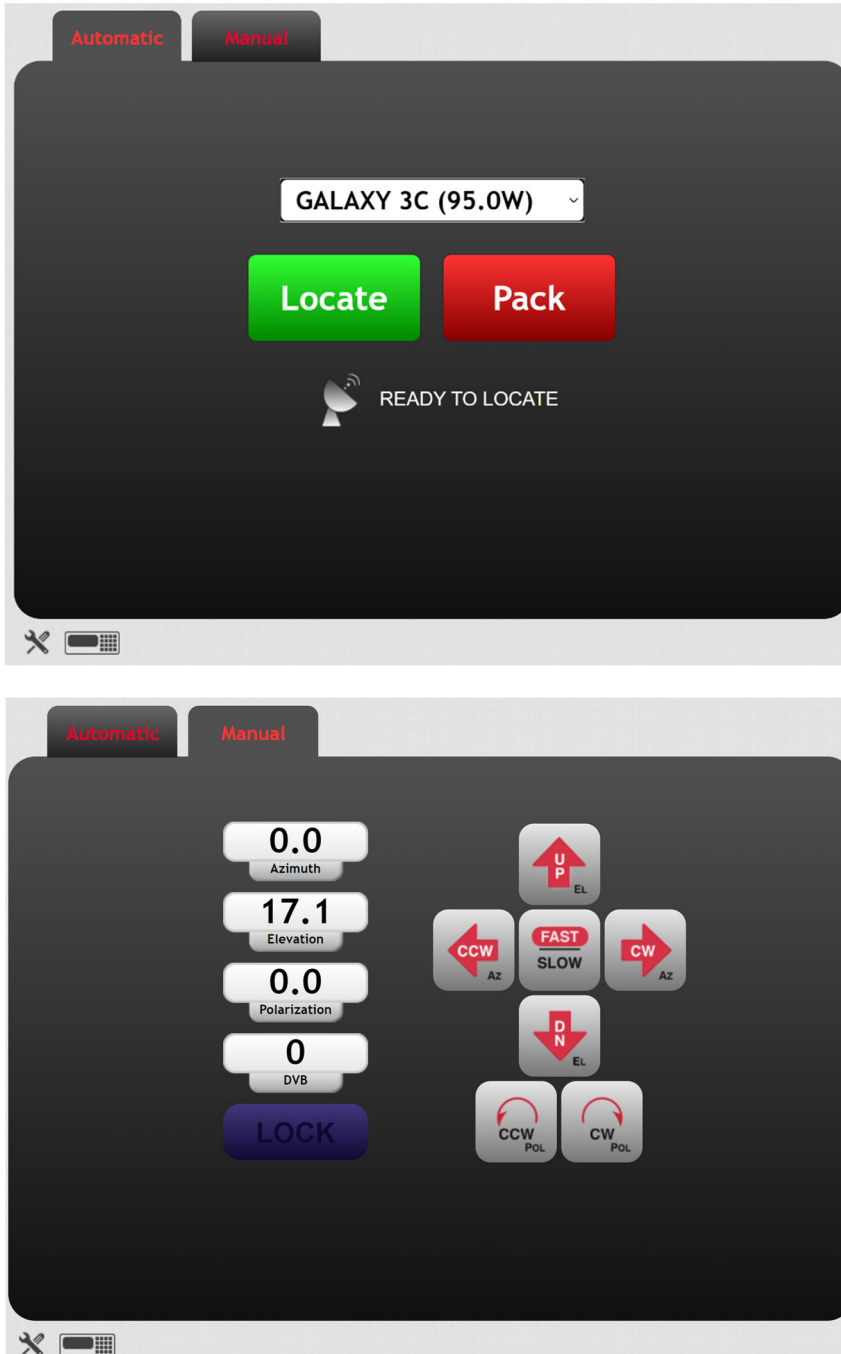
1.6 Specifications

RC4080 ACU	
Physical	
Size	6.60"x4.75"x2.80"
Weight	5.6 lbs.
Input Power	24VDC ±5%
Fusing	6 Amps
Temperature (Operational)	-20 to +60 deg. C.
Temperature (Storage)	-30 to +70 deg C.
Humidity	10% to 85% (optional special-environmental kit available)
Antenna Drive	
Azimuth/Elevation/Polarization	24VDC @ 3 Amps Continuous, 6 Amps Peak
Position Sense	
Azimuth	Potentiometer (12-bit ADC), Quadrature Pulse Sensor
Elevation	Compass Based Inclinometer, Quadrature Pulse Sensor
Polarization	Potentiometer (12-bit ADC)
Limit Switch Inputs	No limit switch inputs
Locate Mode	
AZ/EL Pointing Accuracy	±0.02° typical (antenna dependent)
POL Pointing Accuracy	±0.08° typical (feed dependent)
Pitch and Roll Sensing	±10° pitch and roll
VSAT Mode	Single key-press-to-locate-operation for untrained operators
Positive Satellite Identification	DVB-S/S2 or External OpenAMIP Modem

1.7 Part Number Scheme

As of September 2020, the RC4080 part numbering scheme consisted of 20 digits. This scheme is introduced here to highlight many of the options (both hardware and software) associated with customizing an ACU solution using the RC4080.

Table 1: Part Number Scheme

DIGIT	ITEM	DESCRIPTION
19	Always '4'	common starting digit for RC4000-based products
18	ACU Version	8 - 4080
15, 16, 17	Mount Designator	3 digits identifying unique mount/antenna software support
14	Navigation	Specifies optional navigation equipment (GPS, Compass, etc)
13	Tracking	Tracking Option Available
12	Remote Control	Remote Control Option
11	Receiver 2 (internal)	Receiver support (DVB)
10	Receiver 1 (external)	Receiver support (OpenAMIP)
9	Enclosure	ACU Packaging
8	User Interface	
7	Antenna Interface	
6	Power Input	DC Power Input Range
5	Reserved	
4	Reserved	
3	Reserved	
2	Reserved	
1	Reserved	
0	Reserved	

2   SOFTWARE

2.1 Operation Overview

The RC4080 allows multiple options for mechanizing the user interface. These can be divided into 3 distinct groups.

The first is the 3.5" touchscreen. Operation using this method will be described in section 2.1.1. The second is a 4x4 keypad and 4x40 display. Operation using this method will be described in section 2.1.2 and includes the following methods of control:

- IP based remote front panel
- Touchscreen modes without unique operating screens

The third is an IP based graphical user interface (GUI) method of control. Operation using this method will be described in section 2.1.3.

2.1.1 Touchscreen Software Operation

The RC4080 Touchscreen interface will have five unique mode screens. These include MENU, MANUAL, LOCATE, STOW and a simulated front panel. The first four will map to modes described in the front panel operation, the simulated front panel will be displayed anytime the RC4080 is outside of MENU, MANUAL, LOCATE, and STOW modes.

2.1.1.1 MENU Mode

When booting the RC4080, the first mode would be MENU mode as shown below.
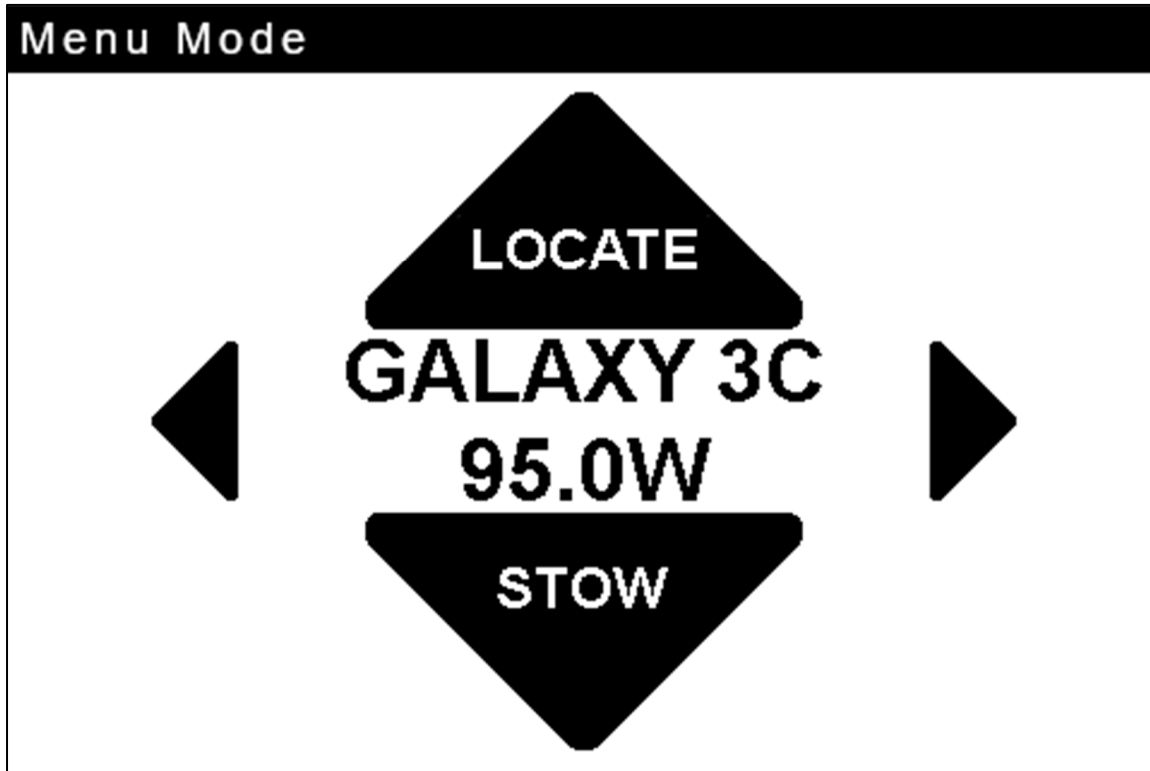
From this screen the user can swipe right of left to enter MANUAL mode. If configured for the DVB option, the left and right arrows will allow the user to scroll through the list of three preset satellites. When using the OpenAMIP version, no scrollable satellites will be available and the RC4080 will use the information from the connected modem to determine the appropriate satellite.

Pressing the LOCATE button, will begin an acquisition operation to the satellite currently listed on the display or the satellite provided by the modem.

Pressing the STOW button will begin a movement of the antenna to the predefined stow position.

2.1.1.2 MANUAL Mode
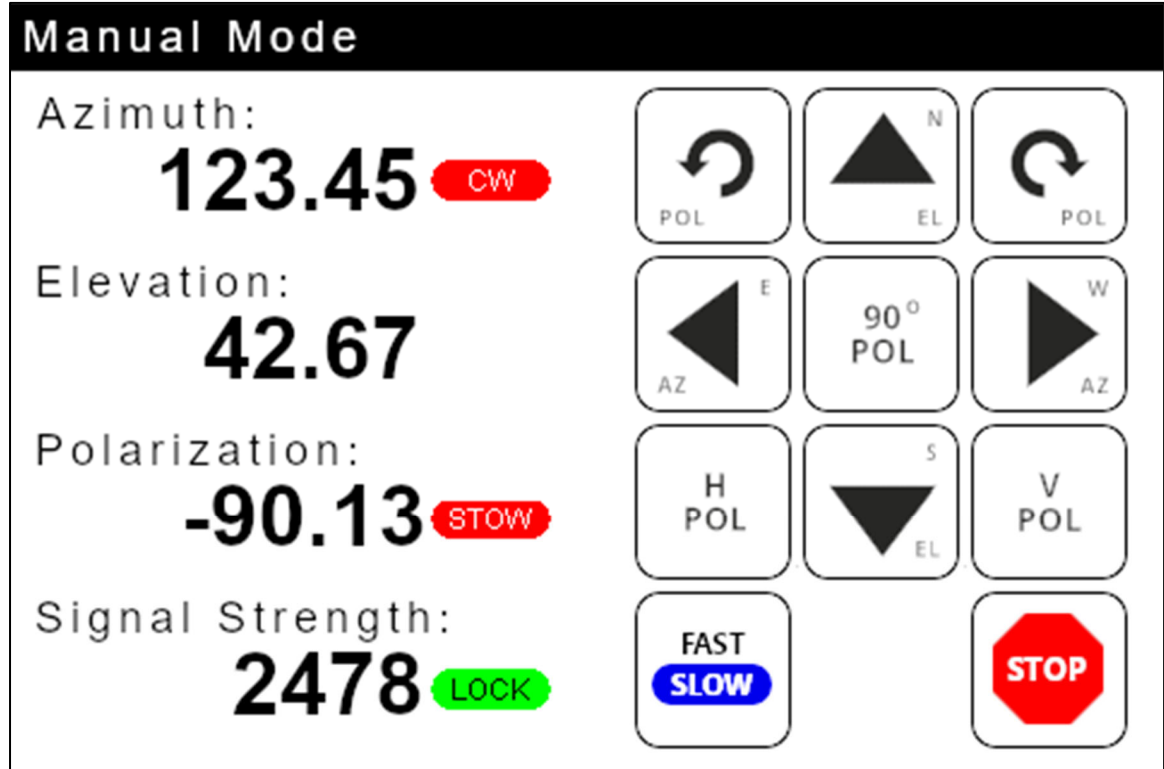
MANUAL mode will allow the user to monitor the status of the antenna as well as perform manual jog operations of the antenna in both fast and slow speed.

Each axis will display the current angle from the analog position sensors, as well as any limit status that may exist. In the image above, the RC4080 is reporting that the Azimuth axis is at an angle of 123.45° and at a CW limit. Likewise, the Elevation axis is at an angle of 42.67° with no limit conditions present. The Polarization axis is at an angle of -90.13° which corresponds to the stow position for the Polarization axis.

The Signal Strength field will display information on the signal quality, and the status of any lock information that would be available. This Signal Strength and lock information can either be reported from the DVB receiver or the connected OpenAMIP compatible modem.

The jog panel consists of 11 keys for manual motion control. The bottom left key will allow the user to toggle between Fast and Slow speed motion. The bottom right key will allow the user to stop any automatic movement that is active. The remainder of the keys are divided up into each of the three axes.

The <POL CCW> and <POL CW> buttons will allow the user to jog the polarization axis in the corresponding direction. This jog will occur at the speed currently selected by the blue indicator on the <FAST/SLOW> button. The <90° POL> button will rotate the polarization 90° from the current position to allow for easy cross polarization operation. The <H POL> and <V POL> buttons will move to the calculated Horizontal and Vertical positions for the most recent satellite used for a LOCATE operation. When using a circular polarization, the polarization keys will have no functionality.

The 'Left' arrow and 'Right' arrow will allow the user to jog the Azimuth axis in the CCW or CW direction respectively. This jog will occur at the speed currently selected by the blue indicator on the <FAST/SLOW> button.

The 'Up' arrow and 'Down' arrow will allow the user to jog the Elevation Axis in the Up or Down direction respectively. This jog will occur at the speed currently selected by the blue indicator on the <FAST/SLOW> button.

To exist MANUAL mode and return to MENU mode the user can swipe to the left or right on the display.

2.1.1.3 LOCATE Mode
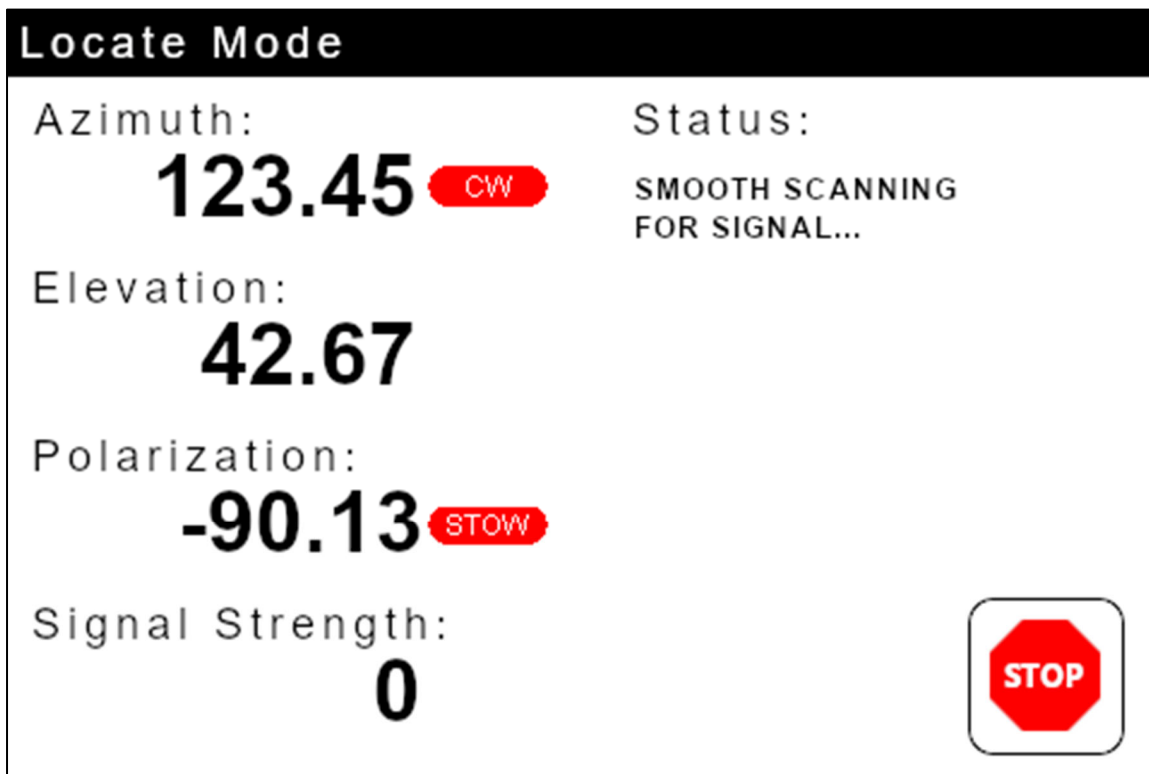
After pressing the <LOCATE> button from MENU mode, the RC4080 will automatically transition into LOCATE mode. LOCATE mode will provide the same axis and signal strength status information as described in the MANUAL mode section (2.1.1.2). The <STOP> key will allow the user to end the locate operation and return to MENU mode.

Additionally, LOCATE mode provides for the status of the locate sequence. In the image above, the RC4080 is reporting that an operation to scan for the satellite in Azimuth is currently occurring. Other messages may describe operations that include acquiring navigation data, peaking on the satellite, or locate complete.

Once the locate operation finishes, the RC4080 will return the user to MANUAL mode. This will allow the user to continue to see the appropriate status information for the antenna.
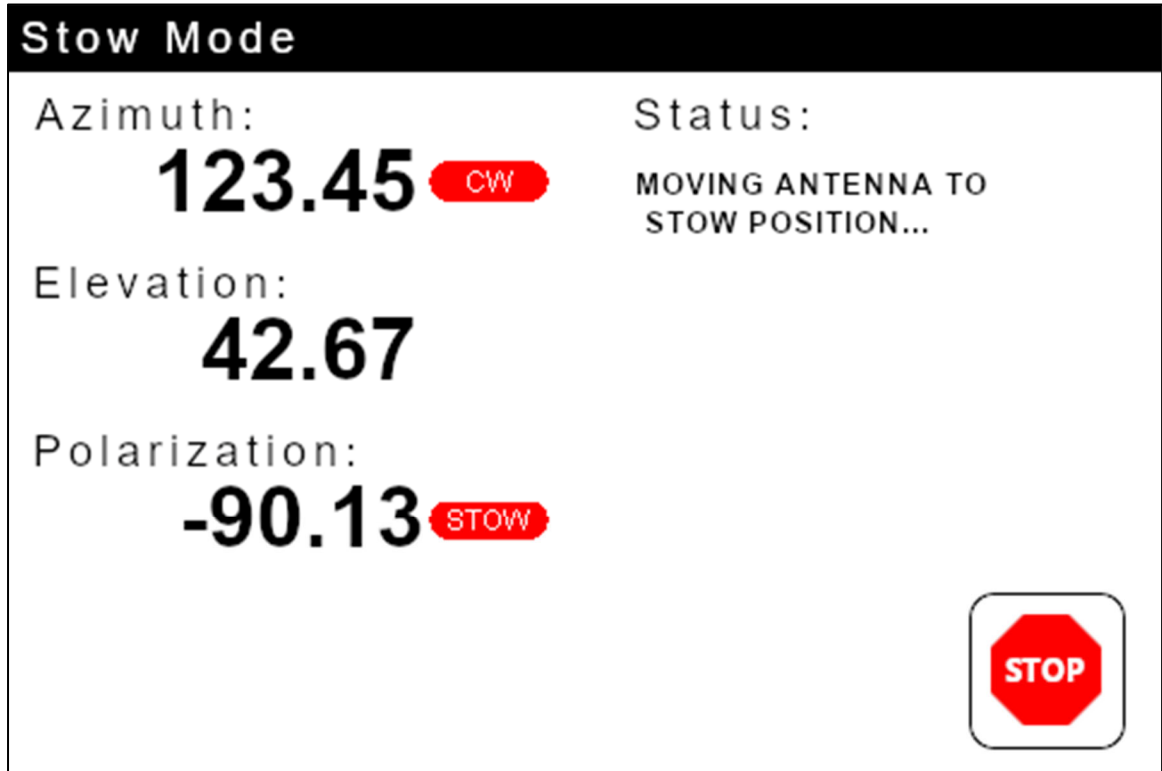
2.1.1.4   STOW Mode

After pressing the <STOW> button from MENU mode, the RC4080 will automatically transition into STOW mode. STOW mode will provide the same axis status information as described in the MANUAL mode section (2.1.1.2). The <STOP> key will allow the user to end the stow operation and return to MENU mode.

Additionally, STOW mode provides for the status of the stow sequence. In the image above, the RC4080 is reporting that an operation to move the antenna to the stow. The other message that would be displayed is a stow complete message.

Once the stow operation finishes, the RC4080 will return the user to MANUAL mode. This will allow the user to continue to see the appropriate status information for the antenna.

2.1.1.5   Simulated Front Panel Mode

When in this mode, the RC4080 touchscreen will provide a simulated 4x40 LCD display and a 4x4 keypad. Full operation from this screen can be found in the front panel operation section (2.1.2).

2.1.2 Front Panel Software Operation

2.1.2.1 Front Panel Software Overview

2.1.2.1.1 <u>Modes</u>

The functionality of the RC4080 is achieved by placing the controller in the desired mode of operation. The diagram below shows the hierarchy of the RC4080's operatings modes. Each mode has a unique display screen that presents the information applicable to that mode's operation.

OPERATING GROUP

Transition between modes by pressing the
MODE key

MANUAL Mode	MENU Mode
2.1.2.2.1	2.1.2.2.2

LOCATE
2.1.2.2.2.1

STOW
2.1.2.2.2.2

LOCATION
2.1.2.2.2.3
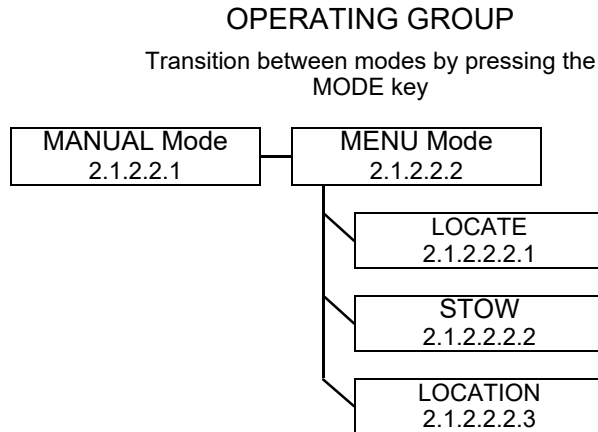
Section 2.1.2.2 will give further details on the operating modes. The rest of section 2.1.2.1 introduces common elements of all modes.
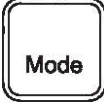
2.1.2.1.2   Keypad Usage

The keypad provides a flexible method of controlling the functionality of the RC4080. While each RC4080 mode has different requirements for user input, the use of the keypad remains consistent throughout all modes.
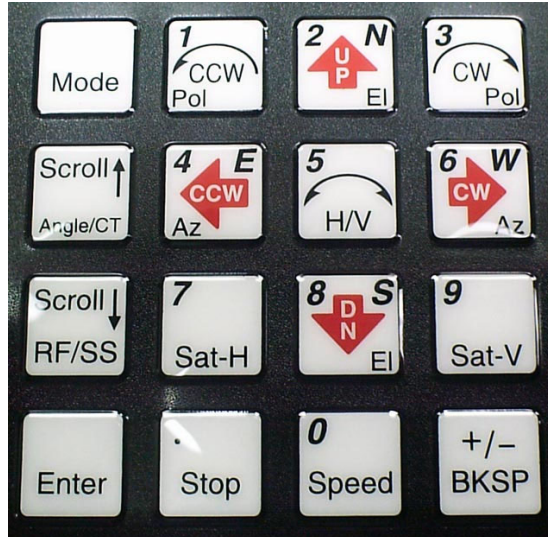
The keypad provides for both specific actions and general data input. As an example, the <2/UP/N> key initiates an antenna up movement while in MANUAL mode but also allows for the entry of the number 2 when numeric entry is required or the indication of North when entering a latitude value. The required key usage is provided in the detailed description of each mode.

The table on the following page describes both the specific action and general data entry function of each key.

	KEY LABEL	SPECIFIC FUNCTION	GENERAL FUNCTION
Mode	Mode	No specific function	Momentary push switches between modes within group. Button held for 5 seconds switches between operational and programming groups. Momentary push also exits sub-mode screens.
Scroll↑ Angle/CT	Scroll Up Angle/CT	Toggles between multiple az/el position display options in Manual Mode	Scrolls forward through lists. Provides "YES" answer to prompts.
Scroll↓ RF/SS	Scroll Dn RF/SS	Toggles between displayed signal strength sources in Manual Mode	Scrolls backward through lists. Provides "NO" answer to prompts.
Enter	Enter	Heading Fix in Manual Mode	Complete entry of data. Select entry from list. Access sub-mode in CONFIG mode.
1 CCW Pol	1 Pol CCW	Jogs polarization motor counter-clockwise when pol movement is allowed	Supplies "1" for numeric entry. Use to select option 1 from a numbered list.
2 N UP El	2 N El UP	Jogs elevation axis up when in MANUAL mode	Supplies "2" for numeric entry. Supplies NORTH for latitude entry (12°34N). Scrolls up during alphanumeric entries.
3 CW Pol	3 Pol CW	Jogs polarization motor clockwise when pol is movement allowed	Supplies "3" for numeric entry.
4 E CCW Az	4 E Az CCW	Move azimuth axis counter-clockwise in MANUAL mode	Supplies "4" for numeric entry. Supplies East for longitude entry (123°45E).
5 H/V	5 H/V	Commands Cross-Polarization movement in MANUAL mode, Store	Supplies "5" for numeric entry.

	KEY LABEL	SPECIFIC FUNCTION	GENERAL FUNCTION
	6 W Az CW	Move azimuth axis clockwise in MANUAL mode	Supplies "6" for numeric entry. Supplies West for longitude entry. (123°45W)
	7 Sat-H	Requests move to predefined Horizontal polarity position	Supplies "7" for numeric entry.
	8 S El DN	Jogs elevation axis down when in MANUAL mode	Supplies "8" for numeric entry. Supplies SOUTH for latitude entry (12°34S). Scrolls down during alphanumeric entries.
	9 Sat-V	Requests move to defined Vertical polarization	Supplies "9" for numeric entry.
	0 Speed	Toggles motor drive speed between FAST and SLOW	Supplies "0" for numeric entry.
	. (decimal point) Stop	Provides way to stop automatic movements	Provides delimiter for various data entries. Decimal point for floating point entry (2.50). Degree sign for lat/lon entry (38°56N). Colon for time entry (12:34:56). Slash for date entry (11/29/18).
	+/- BKSP	Provides way to exit out of certain conditions	Toggles sign of numeric data entry when cursor is at beginning of entry field. Backspaces one field to the left during data entry.

2.1.2.1.3   Data Entry

Many RC4080 screens request some type of user input. This section provides instructions on the entry of various types of data.

Selection from List (<0-9>SELECT)

When the user is prompted to select an action from a displayed list, pressing the numbered key corresponding to the desired action will initiate the action.

Scrolling Through List (<SCR>THRU LIST)

When the user is prompted to scroll through a list of items, pressing the <Scroll Up/Yes> key will move forward through the list and pressing the <Scroll Dn/No> key will move backward through the list. Pressing the <Enter> key when the desired item from the list is displayed will select the item.

Alphanumeric Entry (NAME:SES 3)

To manually enter the name of a satellite or location, the user scrolls through the list of characters (A-Z, 0-9 and blank) and selects the character by pressing the <6/CW/W> key. To scroll forward through the list of characters use the <2/UP/N> key and use the <8/DN/S> key to scroll backward.

To complete the entry of the alphanumeric string, press <Enter>. The user may delete through the string by using the <BKSP> key or move to the left to adjust once character by pressing the <4/CCW/E> key.

Integer Data Entry (SIZE: 80)

To enter whole numbers, use the 0-9 keys to enter the desired numeric string followed by the <Enter> key. Note that the data field will initially show the current value for the item until numeric entry is started. To terminate the entry without changing the value, the user may use the <Scroll Up/Yes> or <Scroll Dn/No> key. The <BKSP> key may be used to move back in the string to correct the input. Pressing the <Enter> key with the current value displayed will also result in no update.

Floating Point Data Entry (HEADING:180.0)

Entering floating point values is similar to entering integer values except that the decimal point is inserted by using the <Stop> key.

Degree/Decimal Latitude/Longitude Entry (LAT:38.9556N)

Entering Latitude or Longitude is the same as floating point data entry. After entering the numeric value of latitude or longitude, the user is prompted to supply W(est) or E(ast) for longitude or N(orth) or S(outh) for latitude.

Degree/Decimal Longitude Entry (SAT LON:179.0E)

This entry is similar to the degree/minute entry but allows decimal fractions of degrees. This format will be used for satellite longitude entry where the degree/minute format is standard for vehicle position entry.

Time/Date

Time is entered in HH:MM:SS format and date in MM/DD/YY format.

2.1.2.1.4 Display Layout

The following screen shows many elements common to RC4080 mode displays.

```
AZIM:  -8.4 (  -8.2)   DVB:3837 L   MANUAL
ELEV:  44.5 (  44.5)   SAT:GALAXY 28
                       SPD:FAST        UTC
<MODE>MENU <0-9>JOG ANTENNA     20:53:18
```

MODE TITLE: In the upper right corner the title of the current RC4080 mode is displayed – in this example MANUAL designates that the RC4080 is currently in manual mode.

NOTE: if the mode title is preceded by an exclamation point (!), the mode was initiated by a remote command.

DATA LABELS: Since each mode presents a unique set of data, labels describing the data must be presented. The label will typically be followed by a colon to delimit between the label and the actual data. In the example shown, AZIM: is the label for the current platform azimuth angle.

DATA VALUES: The current value of relevant data for the mode is displayed following the appropriate data label. In the example, the current platform azimuth angle (AZIM:) is -8.4. Likewise, the satellite (SAT:) is GALAXY 28.

USER PROMPTS: Since each mode requires unique (but similar) keypad inputs, prompts for relevant user action are included on the fourth line to the extent possible. In the above example, <MODE> tells the user that pushing the mode key will transition the RC4080 to MENU mode. There are several types of user data inputs as described in 2.1.2.1.3.

USER INFORMATION: When room allows, information about the current state of the RC4080 is displayed. In the above example, "SPD:FAST" describes the fact that since the RC4080 is currently configured for a jog in fast speed.

TIME: In some modes where data (such as azimuth position) may not change for long periods of time, the current time is displayed to reassure the user that the RC4080 is functioning. In the above example, the current system time (20:53:18) is displayed with the colon flashing once per second.

ALARM STATUS: While not shown in the above example, row 4 is used to display any alarm conditions the RC4080 has detected. The alarm message will alternate with the text normally on row 4. See section 3.1.2 for more description of the alarm system.

2.1.2.2   Front Panel Operating Group

Within the operating group of modes exists two high level modes – MANUAL and MENU. The MANUAL mode allows the user to manually jog the antenna while the MENU mode allows the user to select the modes that implement the RC4080's automatic movement features. While in either one of these modes, a momentary push of the Mode key will transition the RC4080 to the other mode.

2.1.2.2.1   MANUAL Mode

```
AZIM:    0.0 STOW    DVB:1576          MANUAL
ELEV:   16.0         SAT:
 POL:    0.0         SPD:FAST              UTC
<MODE>MENU <0-9>JOG ANTENNA        14:25:47
```

In MANUAL mode, the user may jog the antenna in all three axes. A momentary push of the <Mode> key will move the controller from the MANUAL mode to the MENU mode.

AZIM:/MAG:/TRUE:

The azimuth field shows a current position value of the azimuth axis. It also shows the status of azimuth limits (STOW, CCW, CW). The limits will be displayed based on the table below. It is possible for different limits to have different sources (Switch Hardware for stow and Pot Based for CCW and CW).

	Switch Hardware + Software Limits	Pot Based Hardware + Software Limits	No Hardware + Software Limits
Limit Reached			
Hardware Limit	STOW, CCW, CW	STOW, CCW, CW	n/a
Software Limit	stow, ccw, cw	stow, ccw, cw	STOW, CCW, CW

The azimuth axis may be moved by pressing the <AZ CCW> or <AZ CW> keys.

The value displayed may be changed by the <Scroll Up/Angle CT> key.   The display will rotate between showing Azimuth platform angle (AZIM), Azimuth count value (AZIM), Azimuth platform magnetic heading (MAG) and Azimuth platform true heading (TRUE) values. When first entering MANUAL mode, the field will always be initialized in the display mode selected by the Initial Azimuth Display configuration item.

The true heading platform azimuth angle is derived by taking the current heading estimate of the mount (see the LOCATE function) and adding the platform azimuth angle and the magnetic variation for the current location. If there is currently no antenna heading estimate, the field will display "********".

The magnetic platform azimuth angle is derived by taking the current heading estimate of the mount (see the LOCATE function) and adding the platform azimuth angle. If there is currently no mount heading estimate or lat/lon, the field will display "********".

ELEV:

The elevation field shows a current position value of the elevation axis. It also shows the status of elevation limits (STOW, DOWN, UP). The limits will be displayed based on the table below. It is possible for different limits to have different sources (Switch Hardware for Up and Down software for stow).

	Switch Hardware + Software Limits	No Hardware + Software Limits
Limit Reached		
Hardware Limit	STOW, DOWN, UP	n/a
Software Limit	stow, down, up	STOW, DOWN, UP

The elevation axis may be moved by pressing the <El UP> or <El DN> keys.

The value displayed may be changed by the <Scroll Up/Angle> CT key. The display will rotate between showing the inclinometer elevation angle (ELEV) or the elevation count value (ELEV).

Following a LOCATE operation, the azimuth and elevation limit fields will display the target angles in parenthesis. If a limit condition is active, the limit display will overwrite the target values.

POL:

The polarization field shows a current angular value of the polarization axis. It also shows the status of polarization limits (STOW, CCW, CW). The limits will be displayed based on the table below. It is possible for different limits to have different sources (Switch Hardware for stow and Pot Based for CCW and CW).

	Switch Hardware + Software Limits	Pot Based Hardware + Software Limits	No Hardware + Software Limits
Limit Reached			
Hardware Limit	STOW, CCW, CW	STOW, CCW, CW	n/a
Software Limit	stow, ccw, cw	stow, ccw, cw	STOW, CCW, CW

This field will also show if the polarization axis has been placed at a predefined horizontal (H) or vertical (V) position.

The value of the predefined horizontal and vertical positions depends on what mode was active prior to entering the MANUAL mode. If a LOCATE operation occurred prior to MANUAL, the H and V values will be those automatically calculated by the LOCATE mode. H and V will be defined according to the reference defined in the POL CALIBRATION screen (ie. if REF = H, H = 0 & V = 90 if REF = V, V = 0 & H = 90).

The polarization axis may be moved manually by pressing the <Pol CCW> or <Pol CW> keys. The axis may also be moved automatically to the predefined horizontal or vertical positions by pressing the <H> or <V> keys.

In the MANUAL mode, whenever the <5 H/V> key is pressed the polarization axis will automatically move 90 degrees from its current position. The target position for this automatic "cross polarization" movement considers the user defined polarization axis limits. For example, if a cross polarization movement of 90 degrees clockwise will move the axis beyond the clockwise limit, the movement will be achieved by moving 90 degrees counter-clockwise.

RF/REM/DVB:

This field shows the current signal strength sensed on the selected signal strength channel. By pressing the <Scroll Dn RF/SS> key the source of signal strength will rotate between the RF input (**RF**) and an alternate signal strength. If the controller is equipped with an optional external modem option, **REM** will also be available as a signal source. If the controller is equipped with an optional internal DVB-S2 receiver, **DVB** will also be available as a signal source.

The current signal strength will be displayed as a value between 0 and 1023 for **RF** and 0 and 4096 for **REM** or **DVB**.

If a signal lock input has been enabled associated with the observed channel, an "L" will be displayed to the right of the signal strength value whenever the signal lock condition has been satisfied.

SPD:

This field shows the selected drive speed. The speed may be toggled between FAST and SLOW by pressing the <Speed> key.

TIME DISPLAY

MANUAL mode will display the "display time" and time zone in the lower right-hand corner.

2.1.2.2.1.1   Heading Fix

After a LOCATE operation has occurred, the operator is delivered to MANUAL mode and the RC4080 has the ability to correct the antenna's true heading based on where the selected satellite is found. This HEADING FIX capability is available when all the following conditions are true:

1)   MANUAL mode was entered following a successful LOCATE
2)   The selected satellite is geostationary (inclination = 0)
3)   The mount's position has not already been saved
4)   The heading has not already been fixed (automatically or manually)

When the above conditions are present, the RC4080 will automatically "fix" the heading to be used for subsequent LOCATE operations. When the unit is powered off, the fixed heading will be cleared from memory.

2.1.2.2.2   MENU Mode

MENU mode allows the user to select one of listed modes. Pressing the Mode key will move to MANUAL mode.

```
<GREEN>LOCATE AMC 4 (67.0W)              MENU
<SCROLL>CHANGE SATELLITE
    <RED>STOW ANTENNA                      UTC
<MODE>MANUAL <BKSP>LOCATION       00:04:31
```

MENU mode displays the time and time zone in the lower right-hand corner. On the DVB version of the RC4080 the user will be able to scroll up and down using keypad to choose one of three satellites. On the OpenAMIP version of the RC4080, the user will be presented with the MENU mode screen below.

```
<GREEN>LOCATE SATELLITE                 MENU

    <RED>STOW ANTENNA                      UTC
<MODE>MANUAL <BKSP>LOCATION       00:04:31
```

The user may enter LOCATE, STOW, MANUAL, or LOCATION mode by pressing one of the corresponding buttons. On systems that are shipped without the red and green button, the <1> and <2> key on the keypad will simulate this functionality. Pressing <1> will transition to LOCATE mode and pressing <2> will transition to STOW mode.

2.1.2.2.2.1   LOCATE

The LOCATE mode performs a calculation of the pointing angle to a selected satellite based on the RC4080's estimate of where the antenna is positioned (lat/lon) and oriented (Antenna Bearing). After the calculation is performed, the user may initiate an automatic antenna movement to locate the selected satellite.

ANTENNA POSITION
————————————
LAT: 38.9556N
LON: 94.7543W
Bearing: 178.9

SATELLITE DATA
————————————
NAME: GALAXY 28
LON: 89.0W

POINTING SOLUTION CALCULATION

ANTENNA TARGETS
————————————
AZ: -8.0
EL: 44.5
H: 82.9
V: -7.1
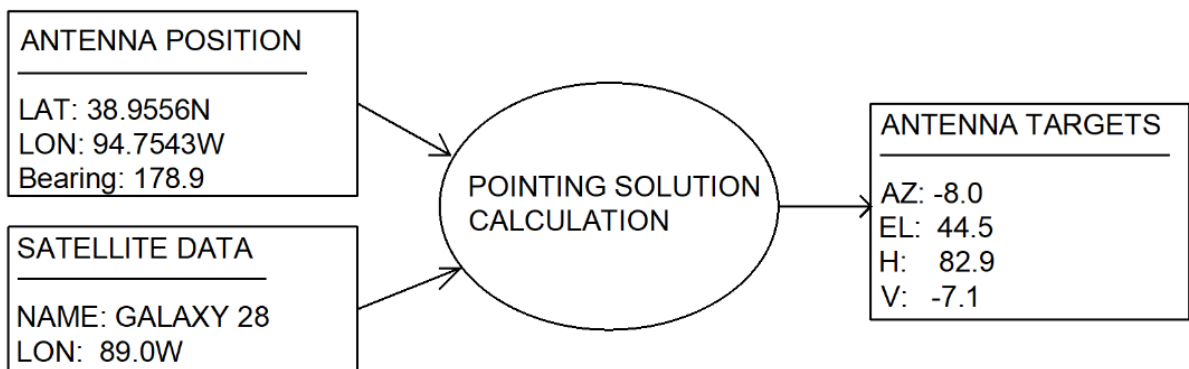
When the LOCATE mode is first entered, the RC4080 will verify that all the location data is valid. These items include Lat/Lon, Heading, and Pitch/Roll values. If any of the information is invalid, the ACU will move the antenna to the appropriate position for collecting the missing data. Once the ACU has all the necessary location data, it will proceed with the locate operation.

When locating a satellite, the RC4080 will use the information available in the satellite database to locate the selected satellite. The tree for selecting which satellite to use for a locate is shown in the flowchart on the page following the description of the satellite types.

There are 3 types of satellites defined in the locate tree. The characteristics of each type of satellite are described below.

- "Target" Satellite
    - This is the satellite that was selected in the LOCATE mode.
    - It is the end location of any locate routine.
- "Signpost" Satellite
    - This is a satellite that has a DVB or Beacon frequency set to signpost.
    - Can also be the "Target" satellite.
    - Will be used to auto fix heading.
- "Confirm" Satellite
    - This is a satellite that has a DVB or Beacon set to confirm.

```
                        ┌─────────────────────┐
                        │   Selected "Target" │
                        │ satellite a "Signpost"│
                        │      satellite?      │
                        └─────────────────────┘
            ┌──────────────┘                   └──────────────┐
         YES                                                  NO
  ┌──────────────────┐                          ┌──────────────────────┐
  │ Locate directly to│                          │  Any database satellite│
  │ "Target" satellite│                          │   a "Signpost" satellite?│
  └──────────────────┘                          └──────────────────────┘
            │                          ┌──────────┘              └──────────┐
            │                        YES                                    NO
  ┌──────────────────┐    ┌──────────────────┐          ┌──────────────────┐
  │   Azimuth Scan    │    │ Locate to "Signpost"│        │  Move to "Target"│
  │     Peak Up       │    │    satellite      │          │     satellite    │
  └──────────────────┘    └──────────────────┘          └──────────────────┘
            │                        │                             │
  ┌──────────────────┐    ┌──────────────────┐          ┌──────────────────┐
  │  Locate Complete  │    │   Azimuth Scan    │          │  Locate Complete │
  │                   │    │     Peak Up       │          │                  │
  └──────────────────┘    └──────────────────┘          └──────────────────┘
                                     │
                          ┌──────────────────┐
                          │    Fix Heading    │
                          │  Move to "Target" │
                          │    satellite      │
                          └──────────────────┘
                                     │
                          ┌──────────────────┐
                          │ "Target" satellite a│
                          │ "Confirm" satellite?│
                          └──────────────────┘
                   ┌──────────┘              └──────────┐
                 YES                                    NO
        ┌──────────────────┐                 ┌──────────────────┐
        │      Peak Up      │                 │  Locate Complete │
        └──────────────────┘                 └──────────────────┘
                 │
        ┌──────────────────┐
        │  Locate Complete  │
        └──────────────────┘
```

2.1.2.2.2.1.1   LOCATE Automatic Movement

Immediately following the satellite selection, the RC4080 will begin moving to the calculated position to continue the locate process. The progress of the movement is displayed on the following screen.

```
AZIM:    1.7 (    1.7)   DVB:2236     LOCATE
ELEV:   30.7 (   45.0)   SAT:GALAXY 28
 POL:   -7.1 (   -7.1)
MOVING  TO  START  OF  SCAN          <STOP>HALT
```

The current angular values for AZ/EL/PL are displayed along with the target position for each axis in parenthesis. The label for the current axis being moved will flash. Movement may be halted at any time by pressing the <Stop> key. Halting movement will return the controller to the MANUAL mode.

If below the down limit in elevation, the first automatic movement will be in the elevation axis to ensure that the mount is brought out of the elevation stow and down regions. If above the down limit, or after moving above the down limit the RC4080 will then make an automated move to the first point of the locate routine.

2.1.2.2.2.1.2   Azimuth Scan

The figure shows the movements made to perform an azimuth scanning operation. This operation enables the RC4080 to try to compensate for any antenna bearing errors.
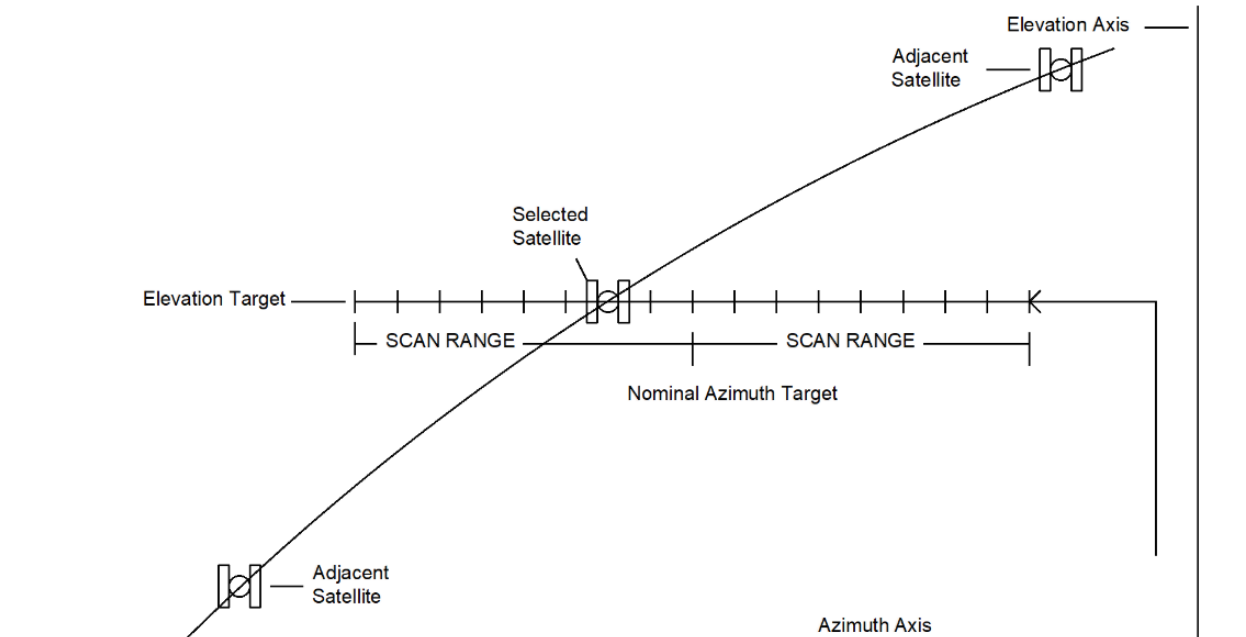
1) As part of the basic LOCATE movement, the mount will be moved to the target elevation position and the polarization axis will be moved to the correct orientation.

2) Azimuth Scan moves to the end of the "scan range" that is shortest distance away from the current azimuth position. Azimuth Scan will begin trying to detect a satellite from this position.

3) Azimuth Scan moves across the "scan range" and samples the lock signal or signal strength for the current locate source. Note that to compensate for any vehicle tilt, occasionally elevation movements are also made to stay on the target elevation. Note also that the Azimuth Scan movement may be truncated due to the limits of azimuth movement.

4) After completing the Azimuth Scan, the RC4080 will return the antenna to the "Center of Lock" or location of peak signal strength.

During the Azimuth Scan, line 4 of the display will provide information on what step of the locate is currently being performed. In the display below, the RC4080 is currently "SCANNING AZIM FOR LOCK".

```
AZIM:   -2.8 ( -23.1)   DVB:2236      LOCATE
ELEV:   44.5 (  44.5)   SAT:GALAXY 28
 POL:   -7.1 (  -7.1)
SCANNING AZIM FOR LOCK (5)      <STOP>HALT
```

The "scan range" is a receiver specific user-defined angular value that determines the range to be searched by the Azimuth Scan routine. Since the angular range is user-selectable, there are two factors to take into consideration when setting this value.

1) The scan range should be larger than the accuracy of the compass. For example, if the compass is accurate to ±5° the scan range should be at least ±5. A scan range of double the compass accuracy is usually recommended for optimum operation.

2) Always ensure that there are not multiple satellites within the "scan range" that have the same carrier. When this occurs, the RC4080 will have difficulty determining which satellite is the desired target.

Following the completion of the Azimuth Scan, the RC4080 will immediately move to performing an azimuth and elevation peak up.

2.1.2.2.2.1.3   Peak Up

The Peak Up routine will automatically begin at the end of an Azimuth Scan. If the heading has already been fixed, it will also perform this routine automatically at the end of a locate if the "TARGET PEAK" configuration item is set to option 1-3.

If the Azimuth Scan finds a lock or signal strength peak, it will return to the azimuth position where it noted the lock or peak. This position may not be the absolute peak position due to the lag of signal strength sensing during the Azimuth Scan. The Peak Up routine will next perform a "fine tune" peaking process. While executing this, line 4 will display "PERFORMING PEAKUP".

During the Peak Up, small jogs in azimuth and elevation will be made to find the local peak position. The step sizes taken will approximate a theoretical signal strength change of 0.4 dB (according to antenna size, operating band, etc.).

During the Peak Up operation, line 4 of the display shows "PERFORMING PEAK UP (***)". Where *** corresponds to the size of the current peaking step in counts. The axis that is currently moving will also flash during the Peak Up operation.

```
AZIM: 32512 (  -8.2)   DVB:3654 L   LOCATE
ELEV: 37622 (  44.5)   SAT:GALAXY 28

PERFORMING PEAK UP (53)        <STOP>HALT
```

2.1.2.2.2.2   STOW

The STOW mode automatically moves to the mount's predefined "stow" position. See Appendix B for the list of stow positions for the various mounts supported.

After initiation a sequence of movements will be performed to stow the antenna. The sequence of axis movements will be mount dependent. As each axis moves, its label (AZIM/ELEV/POL) will flash and the current position will update. The target stow positions will be displayed in parenthesis.

```
AZIM:   0.0 (   0.0)                         STOW
ELEV:  13.2 (  16.0)
 POL:   0.0 (   0.0)
MOVING  ANTENNA  TO  STOW        <STOP>HALT
```

The following describes a typical sequence of movements:

- the azimuth axis is moved to its predefined stow position (typically AZIM:0.0). After moving to this indicated position, the RC4080 will confirm the position by looking to see if the azimuth stow switch is active. If the azimuth stow switch is not recognized, the mount will be moved a short distance to either side of the current position trying to find the azimuth stow switch. If the controller fails to see the azimuth stow switch the following message will be displayed: "*CANNOT FIND AZ STOW SWITCH* <MODE>EXIT" and no further stow movements will be performed.

- if stowing of the polarization axis is enabled, the polarization axis will next move to its predefined stow position. As with the azimuth axis, if a polarization stow switch (if the mount is so equipped) is not confirmed then the message "*CANNOT FIND POL STOW SWITCH* <MODE>EXIT" will be displayed and no further stow movements will be performed.

- if the azimuth and optional polarization movements complete successfully, then the elevation axis will move to its predefined stow position. Typically, this movement ends when the elevation stow limit is encountered.

Following completion of movement to the stow position, the RC4080 will return to MANUAL mode. The automatic movement may be terminated anytime by pressing the <Stop> key.

Many mounts have unique stow sequence requirements. Check Appendix B to see if your mount has any unique stow situations. The azimuth, elevation and polarization stow positions are defined in the Stow/Deploy configuration screen. Typically, the default parameters will be correct for a particular mount.

2.1.2.2.2.3   LOCATION

The LOCATION mode allows the user to set the latitude, longitude, heading and pitch/roll of the antenna for subsequent use in calculating pointing angles to satellites. The first screen that appears shows the current mount position used in the RC4080. Also shown are the source that was used to acquire the current position data. If any field was not already populated, *** would be shown.

```
L/L:38_57N    94_45W    GPS        POSITION
ANT BEARING:181.6 COMPASS
P:  0.6 R:  0.5    AUTO
<1>LAT/LON <2>HEADING <3>TILT <MODE>MENU
```

2.1.2.2.2.3.1   LAT/LON

When the user chooses to modify latitude and longitude, a screen appears showing three options for updating the current lat/lon.

```
<1>ENTER MANUAL LOCATION          LAT/LON

<3>GET LOCATION FROM GPS
                             <MODE>EXIT
```

<1>ENTER MANUAL LOCATION

```
                                  LAT/LON
LAT:         LON:

ENTER LATITUDE <DEG.MIN>      <SCR>EXIT
```

The user is provided two fields to manually enter lat and lon. See 2.1.2.1.3 for instructions on how to enter latitude and longitude.

<3>GET LOCATION FROM GPS

```
                                  LAT/LON
GPS:38_57N       94_45W
UTC:14:20:48
                             <MODE>EXIT
```

When option 3 is selected, the RC4080 will pull in the lat/lon from the GPS. Once complete the controller will automatically move back to the main LOCATION screen. Note that if movement is required to acquire the GPS information, the following screen will be displayed so the user can confirm the movement.

```
                                  LAT/LON
     *  ANTENNA MOVEMENT REQUIRED  *
     *    TO DETERMINE LOCATION    *
<ENTER>CONFIRM MOVE           <MODE>EXIT
```

2.1.2.2.2.3.2   HEADING

When the user chooses to modify the heading, a screen appears showing three options for updating the current heading.

```
<1>ENTER MAGNETIC HEADING        HEADING
<2>ENTER TRUE HEADING
<3>GET HEADING FROM COMPASS
                                 <MODE>EXIT
```

<1>ENTER MAGNETIC HEADING

```
   MAG:                          HEADING
MAGVAR:    1.6
   TRUE:
<0-9 .>ENTER DEGREES        <SCR UP>EXIT
```

When option 1 is selected, the user is prompted to ender a magnetic heading of the antenna. After magnetic heading is entered, the RC4080 will apply the magnetic variation to generate the true heading of the mount's azimuth centerline.

<2>ENTER TRUE HEADING

```
   MAG:                          HEADING
MAGVAR:    1.6
   TRUE:
<0-9 .>ENTER DEGREES        <SCR UP>EXIT
```

When option 2 is selected, the user is prompted to enter a true heading of the antenna. After true heading is entered, the RC4080 will apply the magnetic variation to generate the magnetic heading of the mount's azimuth centerline.

<3>GET HEADING FROM COMPASS

```
CMP HDG: 180.0                   HEADING
 OFFSET:   0.0
 MAGVAR:   1.6
HEADING: 181.6                   <MODE>EXIT
```

When option 3 is selected, the RC4080 will pull in the heading from the compass. After the compass heading has been pulled in, the RC4080 will apply the offset and the magnetic variation to generate the heading of the mount's azimuth centerline. Once complete the controller will automatically move back to the main LOCATION screen. Note that if movement is required to acquire the compass information, the following screen will be displayed so the user can confirm the movement.

```
                                 HEADING
     *   ANTENNA MOVEMENT REQUIRED   *
     *       TO DETERMINE HEADING    *
<ENTER>CONFIRM MOVE              <MODE>EXIT
```

2.1.2.2.2.3.3   TILT

When the user chooses to modify the tilt, a screen appears showing two options for updating the current tilt.

```
<1>ENTER MANUAL PITCH/ROLL          TILT
<2>MOVE ANTENNA TO GET PITCH/ROLL

                          <MODE>EXIT
```

<1>ENTER MANUAL PITCH/ROLL

```
                               TILT
PITCH:            ROLL:

PLATFORM PITCH <+/-60.0 DEG>   <SCR>EXIT
```

When option 1 is selected, the user is prompted to manually enter the pitch and roll of the platform. Note that the pitch and roll is measured at the azimuth centerline and should be entered based on that position.

```
                            POSITION
PITCH:   0.5
 ROLL:   0.3
```

<2>MOVE ANTENNA TO GET PITCH/ROLL

When option 2 is selected, the RC4080 will pull in the tilt from source specified by the tilt configuration item. Once complete the controller will automatically move back to the main LOCATION screen.

```
AZIM:   40.4 (    0.0)              TILT
ELEV:   16.0 (   16.0)

MOVING TO DETERMINE TILT     <STOP>HALT
```

Note that if movement is required to acquire the pitch and roll information, the following screen will be displayed so the user can confirm the movement.

```
                            POSITION
     *  ANTENNA MOVEMENT REQUIRED  *
     *   TO DETERMINE PITCH/ROLL   *
<ENTER>CONFIRM MOVE           <MODE>EXIT
```

2.1.3   Graphical User Interface Software Overview

The Graphical User Interface to the RC4080 can be accessed by navigating to the IP address of the controller using a web browser. The default IP address of the RC4080 is 192.168.1.1

2.1.3.1   Graphical User Interface Main Page

2.1.3.1.1   Automatic

The Automatic tab allows the user to LOCATE a satellite or Pack (STOW) the antenna. On the DVB version, dropdown box will allow the user to select a satellite preset for the locate operation. On the OpenAMIP version, this dropdown will not be present and the satellite information will come from the IP connected modem.
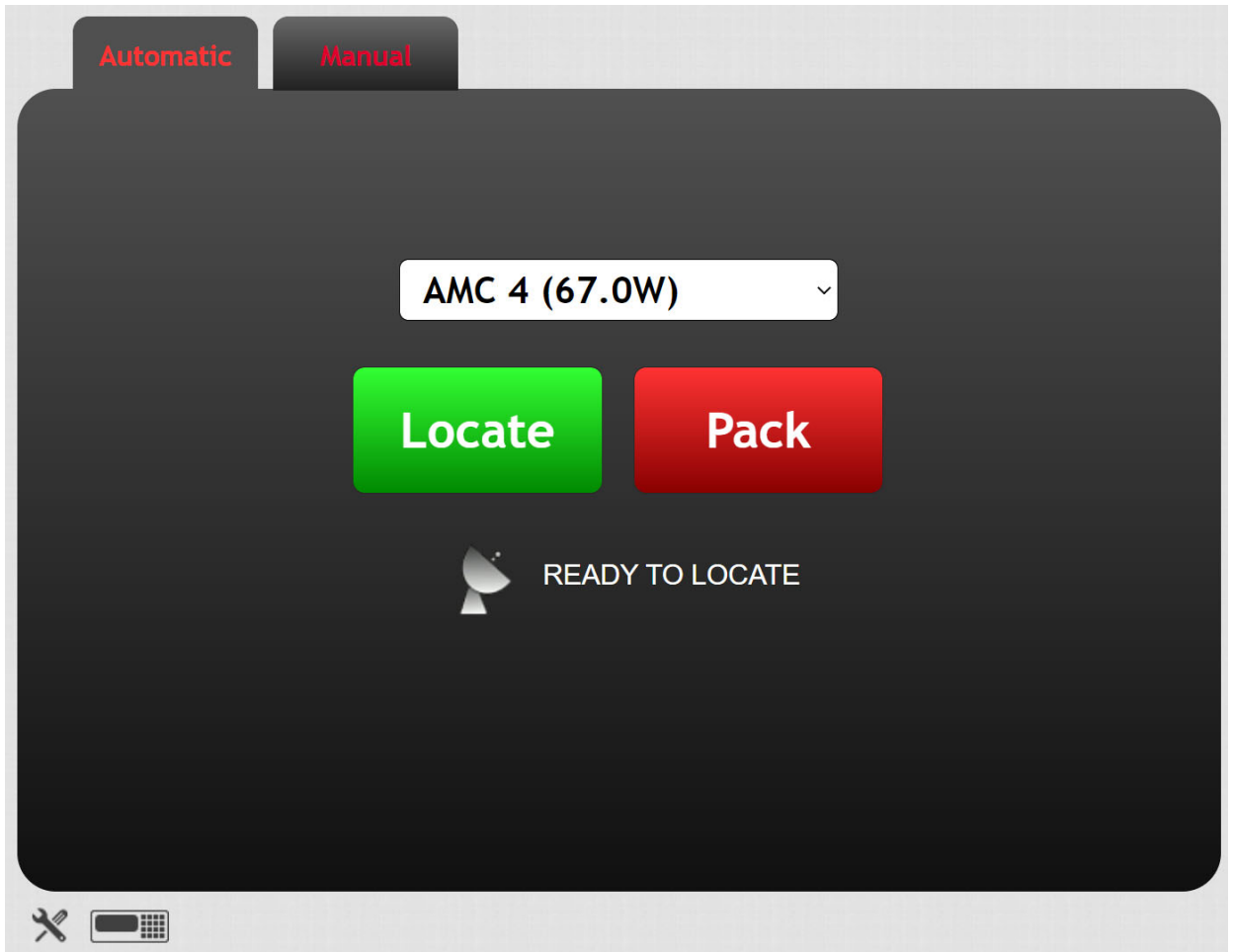

Additionally, the user is able to navigate to the /config webpage and the /rcfp webpage (2.1.2) by clicking the image of the wrench and screwdriver or the front panel respectively.

2.1.3.1.2   Manual

The Manual tab allows the user to manually jog the antenna in AZ/EL/POL in both fast and slow speed. Status windows for each axis are also shown along with the current signal strength, signal source, and signal lock status.
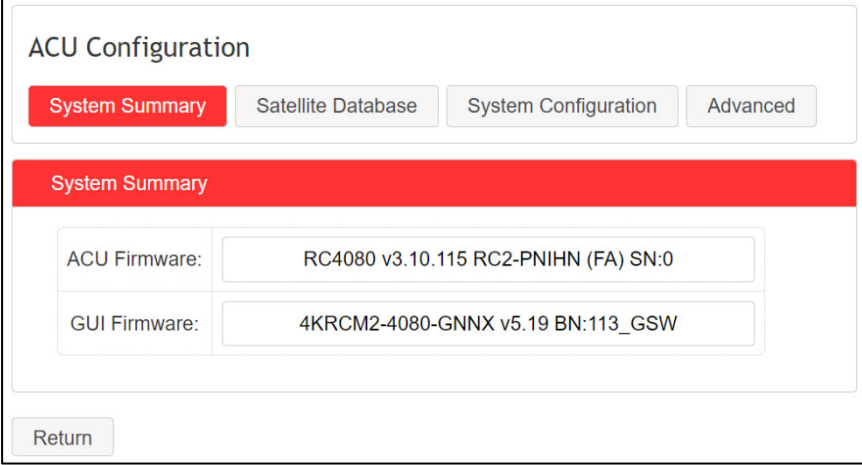

When at a limit, the limit status will overwrite the angle value for the axis as shown below.
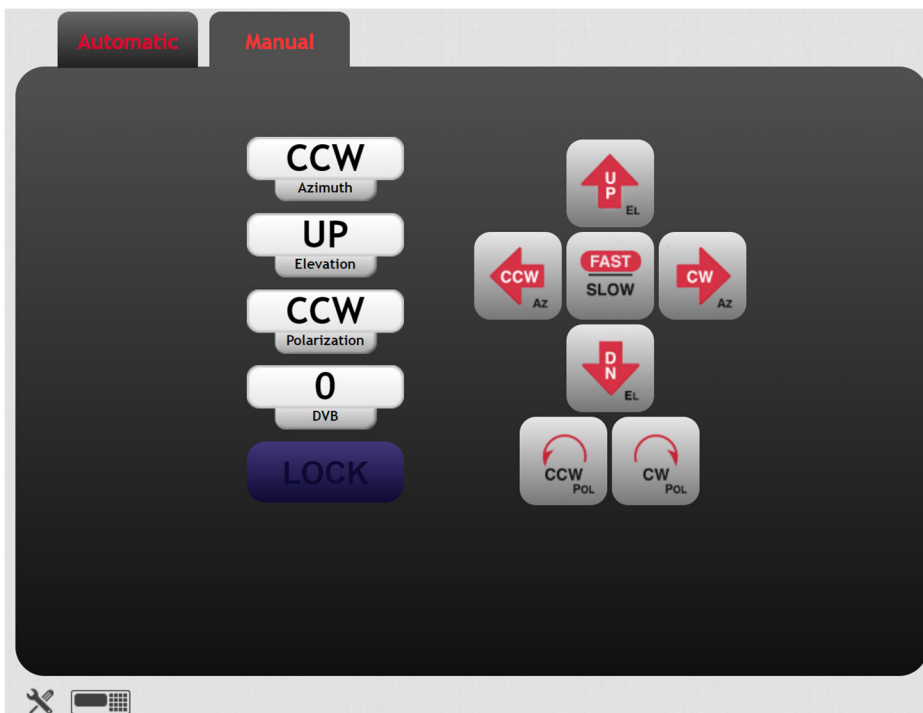
2.1.3.2   Configuration Page

The main configuration page for the RC4080 is available by navigating a web browser to the IP address of the controller /config (192.168.1.1/config). Upon entry to the configuration page, the System Summary tab is selected by default.

The System Summary tab will provide you with the current software on the RC4080, as well as the serial number for the controller. At the bottom of the window is a <Return> button. Clicking this button will always return the user to the main page of the GUI (2.1.3.1).

Three additional tabs are available in addition to the System Summary. Each of these tabs is described in detail in the sections below.

2.1.3.2.1   Satellite Database

The Satellite Database tab gives the user to edit information about the preset list of 3 satellites. Each satellite entry can be expanded individually. The following screen shows an example full satellite database list. This list will not be available on the OpenAMIP version.

ACU Configuration

| System Summary | **Satellite Database** | System Configuration | Advanced |

1 AMC 4 (67.0W)

2 GALAXY 3C (95.0W)

3 GALAXY 14 (125.0W)

| Save | Return |

At the bottom of the screen there is a <Save> button in addition to the <Return> button. The <Save> button will become active anytime the webpage detects that information about a satellite has changed. If the <Save> button is not clicked after changing the satellite information, the database will not be updated.

2.1.3.2.1.1   Satellite Configuration

Clicking on a satellite in the database will expand the satellite to show additional field. All fields in the satellite preset are editable by typing on a keyboard. Additionally, the Two-Line Element data can be copied and pasted into the window.

 # 1 AMC 4 (67.0W)

Satellite Name	Satellite Longitude	Satellite Band	Satellite Inclination	Satellite Pol Offset	Satellite Final Pol
AMC 4	67.0 ° W ⌄	Ku ⌄	0 °	0.0 °	Horz ⌄

DVB Polarization	DVB Frequency	DVB Symbol Rate	DVB FEC	DVB Standard	DVB Locate
Vert ⌄	11800 MHz	28888 kS/sec	3/4 ⌄	S1 ⌄	Disabled ⌄

After adjusting the desired parameters for the satellite preset, ensure that the <Save> button and the bottom of the page is clicked prior to any further operations.

3   SUPPORT

3.1 Troubleshooting

3.1.1   Warning Displays

3.1.1.1   General Warnings

Alarm	Description/Recommended Action
Low Battery	Battery used to backup NVRAM and Date/Time is low. Replace internal battery backup.
Invalid Date/Time	Date/Time is corrupt. Reset the Date/Time via maintenance or GPS time sync.
Limits Inactive	The software limits of the controller are currently disabled. Reactivate limits via Limits maintenance screen.
Local Jog Connected	A local jog panel or handheld remote front panel is currently connected to the ACU. Disconnect the local jog panel or handheld remote front panel.

3.1.1.2   Azimuth

Warning	Description/Recommended Action
CCW, ccw	Antenna is at the azimuth hardware limit (CCW) or azimuth software limit (ccw), move the antenna azimuth CW out of the limit.
CW, cw	Antenna is at the azimuth hardware limit (CCW) or azimuth software limit (ccw), move the antenna azimuth CCW out of the limit.
STOW, stow	Antenna is at the azimuth hardware limit (STOW) or azimuth software limit (stow), this is part of normal operation.

3.1.1.3   Elevation

Warning	Description/Recommended Action
DOWN, down	Antenna is at the elevation hardware limit (DOWN) or azimuth software limit (down), move the antenna elevation up out of the limit.
UP, up	Antenna is at the elevation hardware limit (UP) or elevation software limit (up), move the antenna elevation down out of the limit.
STOW, stow	Antenna is at the elevation hardware limit (STOW) or elevation software limit (stow), this is part of normal operation.

3.1.1.4 Polarization

Warning	Description/Recommended Action
CCW, ccw	Antenna is at the polarization hardware limit (CCW) or polarization software limit (ccw), move the antenna polarization CW out of the limit.
CW, cw	Antenna is at the polarization hardware limit (CCW) or polarization software limit (ccw), move the antenna polarization CCW out of the limit.
STOW, stow	Antenna is at the azimuth hardware limit (STOW) or azimuth software limit (stow), this is part of normal operation.

3.1.1.5 GPS

Warning	Description/Recommended Action
No GPS Present	GPS is disabled in the system definition screen
Initializing	RC4080 has sent a message to the GPS to start communication.
GPS Offline	RC4080 is not receiving information from the GPS receiver
Waiting For GPS	RC4080 is waiting for the GPS to report that it has a valid Lat/Lon

3.1.1.6 Compass

Warning	Description/Recommended Action
No Compass Present	Compass is disabled in the system definition screen
Compass Offline	RC4080 is not receiving information from the compass
Waiting for Compass	RC4080 is waiting for the compass to report that it has a valid heading

3.1.1.7 Dual Axis Inclinometer

Warning	Description/Recommended Action
No Tilt Sensor Detected	RC4080 is unable to communicate with the dual axis inclinometer
Inconsistent Sensor Data	RC4080 is receiving invalid data from the dual axis inclinometer
Waiting for Tilt	RC4080 is waiting for the dual axis inclinometer to provide pitch and roll

3.1.2   Alarm Displays

3.1.2.1   General Alarms

Alarm	Description/Recommended Action
Flash Version Mismatch	Flash Memory Structure error. Reset defaults, recalibration of controller will be required.
Flash Data Corrupt	Items in Flash Memory are corrupt. Reset defaults, recalibration of controller will be required.
NVRAM Version Mismatch	NVRAM version doesn't match Flash Memory version. Reset Defaults, recalibration of controller will be required.
NVRAM Data Corrupt	Items in NVRAM are corrupt. Reset defaults, recalibration of controller will be required.
Emergency Stop	The emergency stop input on the controller is currently open. Reset the input to clear alarm.

3.1.2.2   Azimuth

Alarm	Description/Recommended Action
Runaway	Antenna was not attempting to move the axis and the RC4080 sensed movement outside of the runaway slop configuration item range. Verify axis movement working as expected and that the runaway slop configuration item is set properly.
Jammed	Antenna was attempting to move the axis and the RC4080 did not sense the amount of movement defined by the jam slop configuration item. Verify axis movement working as expected and that the jam slop configuration item is set properly.

3.1.2.3   Elevation

Alarm	Description/Recommended Action
Runaway	Antenna was not attempting to move the axis and the RC4080 sensed movement outside of the runaway slop configuration item range. Verify axis movement working as expected and that the runaway slop configuration item is set properly.
Jammed	Antenna was attempting to move the axis and the RC4080 did not sense the amount of movement defined by the jam slop configuration item. Verify axis movement working as expected and that the jam slop configuration item is set properly.

3.1.2.4   Polarization

Alarm	Description/Recommended Action
Runaway	Antenna was not attempting to move the axis and the RC4080 sensed movement outside of the runaway slop configuration item range. Verify axis movement working as expected and that the runaway slop configuration item is set properly.
Jammed	Antenna was attempting to move the axis and the RC4080 did not sense the amount of movement defined by the jam slop configuration item. Verify axis movement working as expected and that the jam slop configuration item is set properly.