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OPERATION AND MAINTENANCE MANUAL

FOR

MODELS 7134 & 7134 AST ANTENNA CONTROL SYSTEMS

WITH

7150 DRIVE CABINET

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CAUTIONARY NOTICE

Although the manufacturer has attempted to detail in this manual all areas of possible danger to personnel in connection with the use of this equipment, personnel should use caution when installing, checking out, operating, and servicing this equipment. Care should be taken to avoid electrical shock, whether the hazard is caused by design or malfunction.

The manufacturer is specifically not liable for any damage or injury arising from the technician's failure to follow the instructions contained in this manual or his failure to exercise due care and caution in the installation, operation, checkout, and service of this equipment.

PROPRIETARY NOTICE

WARNING

THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY REGULATIONS.

PLEASE READ THE FOLLOWING PRECAUTIONS

This manual is intended as a general guide for trained and qualified personnel who are aware of the dangers of handling potentially hazardous electrical and electronic circuits. This manual is not intended to contain a complete statement of all safety precautions that should be observed by personnel in using this or other electronic equipment.

The installation, operation, maintenance, and service of this equipment involves risks both to personnel and equipment and must be performed only by qualified personnel exercising due care. Vertex Communications Corporation shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks.

During installation and operation of this equipment, local building codes and fire protection standards must be observed.

WARNING

ALWAYS DISCONNECT POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, GATES, PANELS, OR SHIELDS. ALWAYS USE GROUNDING STICKS AND SHORT OUT HIGH VOLTAGE POINTS BEFORE SERVICING. NEVER MAKE INTERNAL ADJUSTMENTS OR PERFORM MAINTENANCE OR SERVICE WHEN ALONE OR FATIGUED.

Do not remove, short-circuit, or tamper with interlock switches on access covers, doors, enclosures, gates, panels, or shields. Keep away from live circuits.

WARNING

IN CASE OF EMERGENCY BE SURE THAT POWER IS DISCONNECTED.

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1.0 INTRODUCTION

1.1 Purpose

This manual provides instructions for the installation and operation of the Model 7134 and 7134-AST Antenna Control System (ACS). Failure to follow the procedures detailed in this manual may cause improper operation and/or damage to the system. Limited information about the antenna structure, the equipment used to develop an analog tracking signal, or other equipment peripheral to the 7134 and 7134-AST ACS is included.

1.2 General Information about the 7134-AST ACS

The 7134 and 7134-AST ACS is an antenna pointing system, controlled manually or automatically, that positions the antenna to receive the peak signal from a satellite. The 2-axis and 3-axis options use azimuth (AZ) and elevation (EL) controls to position the antenna. The 3-axis option also includes polarity controls to position the antenna and feed assembly. Variable speed inverters provide 2-speed operation with continuously variable drive rates over a range of approximately 50:1.

The 7134 ACS uses the latest microprocessor technology, providing accurate antenna positioning, high reliability, and maximum system flexibility. The system has the capabilities for rapid multiple satellite access and RS-232 or RS-422 remote control communications.

The 7134 version is capable of step tracking with inclined orbit satellites.

1.2.1 System Hardware

The 7134 ACS consists of the following subsystems:

- Model 7134 Antenna Control Unit (ACU)
- Model 7134-AST Antenna Control Unit (ACU)
- Model 7150 Drive Cabinet
- Resolvers

The system interfaces with 3-phase induction motors for AZ and EL positioning and a single-phase alternating current (AC) synchronous stepping motor for polarization (POL) rotation. Limit interfaces are normally closed switches that open upon engagement.

1.2.1.1 7134 and 7134-AST ACU

These units are in a 19-inch rack-mountable unit, that can be used in a shelter or other antenna control room. The primary components of the 7134 and 7134-AST ACU are shown in Figures 1-1 and 1-2 and are described in the following list.

- Front Panel - This panel consists of momentary-contact, illuminated switches on a keypad; an 80-character, vacuum fluorescent display; and the POWER ON/OFF switch that controls the power to the circuit boards on the 7134-AST ACU. With these switches, the operator controls the movement of the antenna, edits configuration parameters, and edits the data base.

- Two Power Supplies - These power supplies provide 5, ±12, and 24 volts (V) to the ACU.

- Main Board - This board contains circuitry for resolver/digital conversion, resolver reference signal generation, analog-to-digital (A/D) conversion for external analog inputs, and the RS-232 and RS-422 serial data ports.

- Computer Board - This board, ETI15297, consists of the main system microprocessor, Read-Only Memory (ROM) containing the operating system software, Random Access Memory (RAM) for system setup data and **Target/Program Track** data bases, and a battery backup for the RAM.

- Interface Board - This board consists of command address decoding circuitry, 16 corresponding output command signal relays, and 8 input signal optoisolators that receive signals from the 7150 drive cabinet and from the external customer interface port.

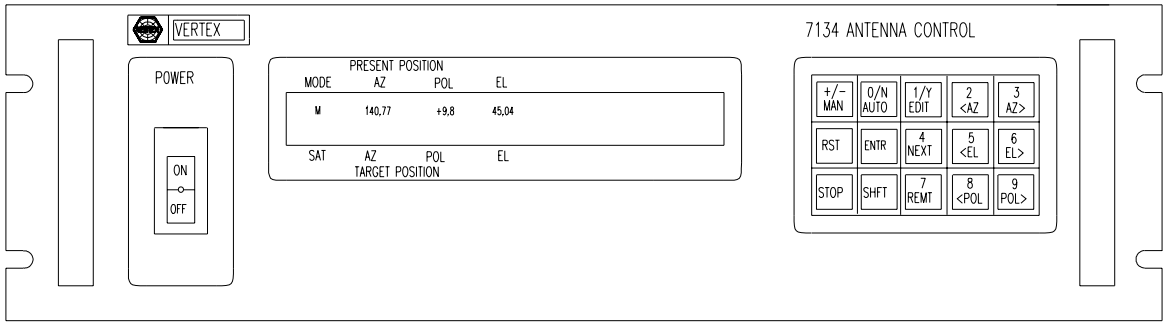

Figure 1-1 7134 and 7134-AST Antenna Control Unit (Front Panel)

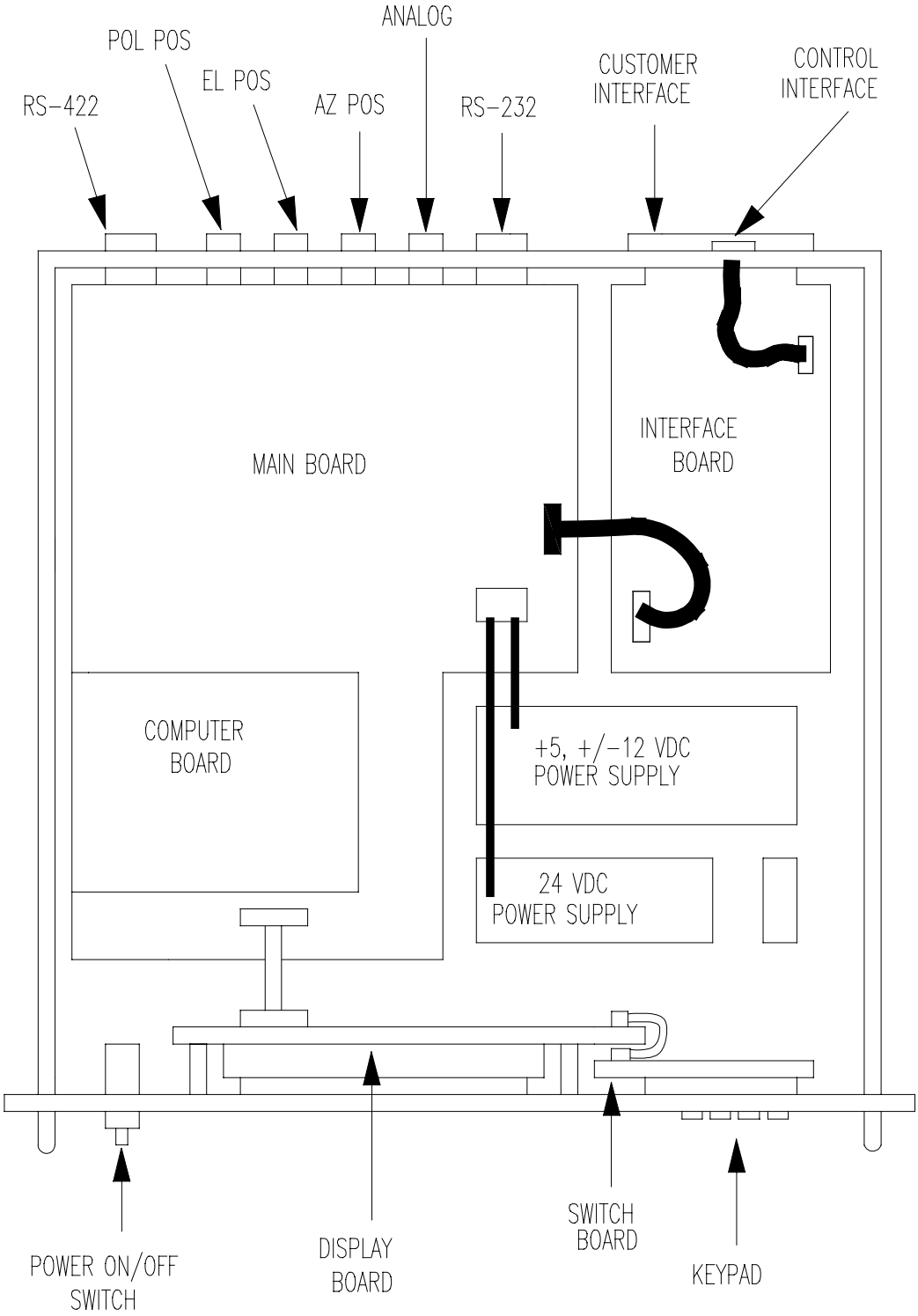

Figure 1-2 7134 and 71324-AST Antenna Control Unit (Top View)

1.2.1.2 7150 Drive Cabinet

The components of the pad-mounted drive cabinet are shown in Figure 1-3. The function of each major component is described below.

- ANTENNA DRIVE UNIT- A Portable Maintenance Control Unit (PMCU) allows the operator to control antenna movement from the proximity of the antenna and adjust the speed of the EL and AZ drives.

- DRIVE CIRCUIT BREAKER - This breaker controls the main power to the drive motors, the limit switches, and the 7150 drive cabinet. It does not provide power to the 7134 or the 7134-AST ACU.

- EMERGENCY STOP SWITCH - When pressed, this switch removes power from the drive motors.

- AZIMUTH VARIABLE SPEED AC DRIVE UNIT (inverter) and ELEVATION VARIABLE SPEED AC DRIVE UNIT (inverter) - These inverters are a sensorless flux vector type of AC drive which allow for continuous variable drive rates over a range of approximately 50:1.

- 24 volts, direct current (VDC) POWER SUPPLY - This power supply provides operating voltage to the 7150 drive cabinet antenna drive relay circuit board.

- The unit has an operational temperature rating of 0° to 55°C.

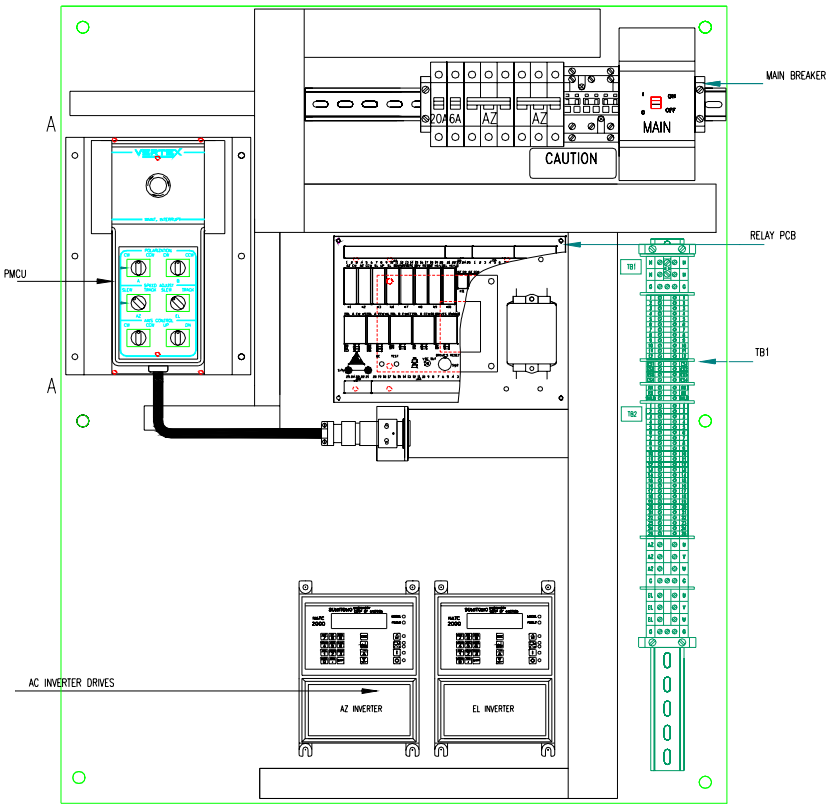

Figure 1-3 7150 Drive Cabinet

1.2.2 System Functions

When the power to the 7134 or 7134-AST ACU is turned on, the system performs a self-diagnostic test and the display indicates any detected problems. If the test finds no problems, the display indicates the current AZ, EL, and POL angles of the antenna. The AZ, EL, and POL resolvers send analog antenna position data to resolver/digital converters that provide digital antenna position data to the main processor. The processor sends this data to the front panel display.

From the 7134 or 7134-AST ACU, an operator can change the position of the antenna in three ways: manually stepping the antenna toward a desired target, entering a position to which the antenna should move, or selecting a preprogrammed target. Each method of antenna movement is described in Section 3.0 of this manual.

Four primary modes of operation, selectable from the front panel keypad, are provided by the 7134 and 7134-AST ACU.

1. **Manual** mode - The **Manual** mode provides three methods of manually moving the antenna.

   a. Low Speed Jog - When the operator presses the MAN key on the front panel, it illuminates and enables low speed manual (jog) positioning of the antenna. By pressing the AZ, EL, and POL keys, the operator causes the antenna to move in the indicated direction. This function is primarily useful for manually positioning the antenna for maximum signal strength.

   b. High Speed Jog - The operator may press the SHFT key while pressing the AZ or EL key to move the antenna at high speed. POL is single speed and is not affected by the SHFT key.

   c. **Manual Track (Jump)** mode - The operator presses the **EDIT** key on the front panel, chooses JUMP, types in a position to which the antenna should move, and the antenna can immediately be moved to that position.

2. **Auto** mode - When the operator presses the AUTO key on the front panel, it illuminates and allows the operator to select one of three automatic submodes of antenna positioning:

   7134 and 7134-AST

   a. **Target Track** - Allows automatic high-speed antenna positioning to any of 50 preprogrammed look angles, using manual keypad initiation.

   b. **Program Track** - Provides automatic, chronologically sequential positioning to as many as 99 time-tagged, preprogrammed look angles.

   7134-AST Only

   c. **Adaptive Step Track** - Provides automatic step track movement of the antenna to find the peak signal level at periodic intervals or when the signal has fallen

below a preset threshold.

3. **Edit** mode - Allows entry of the **Target Track** and **Program Track** look angle data, general system setup parameters, and position angle offsets from the keypad. In this mode, all 7134 and 7134-AST ACU and remote control antenna movement commands are disabled.

4. **Remote Communications** mode - Transfers control of the system to a remote terminal through either the RS-232 or RS-422 communications port. Entry of position angle offsets or software limits over the communications link is not allowed in this mode. All functions available through the front panel are available except the setting of offsets and configuration parameters.

1.3 Controls and Indicators

The following paragraphs describe the controls and indicators of the 7134 and 7134-AST, ACU and drive cabinet.

1.3.1 7134 and 7134-AST ACU

The 7134 and 7134-AST ACU contains the following controls and indicators (refer to Figure 1-1):

1. POWER ON/OFF illuminated circuit breaker

2. Alphanumeric display, referred to as the "display" in this manual

3. Fifteen-key illuminated keypad, referred to as the "keypad" in this manual.

1.3.1.1 POWER ON/OFF Circuit Breaker

This circuit breaker acts as a protective device for the 7134 and 7134-AST ACU and also acts as an emergency stop switch for the ACS. Setting this breaker to the OFF position commands the 7150 drive cabinet to remove power from the input terminals of the AZ and EL inverters if the 7150 drive cabinet is in the **Remote** mode; however, the 7150 drive cabinet can still be operated in the **Maintenance** mode.

1.3.1.2 Alphanumeric Display

Current position information as well as mode status, target angles, fault messages, and all edit information is provided on an 80-character (two rows of 40 character-length) alphanumeric display. Generally, the top row, Row A, displays current (real-time) pointing angles, time or signal strength, selected beacon signal, and fault information. The second row, Row B, displays **Edit** mode data, **Auto** mode data, and status condition information. Information is displayed as follows:

- Row A - The first field of Row A displays the current mode status, using a one or two character mnemonic code as defined in Table 1-1.

TABLE 1-1 MODE STATUS CODES	
MODE STATUS	**DEFINITION**
M	Manual Mode
A	Auto Mode
TT	Target Track Mode
PT	Program Track Mode
ST	Adaptive Step Track Mode **7134-AST Only**
E	Edit Mode
ET	Edit Target Track Data Base
EP	Edit Program Track Data Base
EO	Edit Position Offsets
EC	Edit Configurations
ES	Edit Adaptive Step Track **7134-AST Only**
MT	Manual Track (Jump) Mode

- The mode status code is followed by the current position angles for the AZ, EL, (2-axis systems), and POL axes (3-axis systems), except during initial power-up self-diagnostic testing.

- Immediately to the right of the EL angle display is a field dedicated to displaying current time or the analog (A/D) signal input level expressed in volts or in relative decibels (dB). If A/D is selected, the next field displays the selected beacon number (B1 - B4). Selection between time and analog level display is made using an **Edit** mode command (refer to Paragraph 3.6.2).

- The last field in Row A is dedicated to showing all system fault messages. Refer to Paragraph 3.7 of this manual for a listing of all possible fault messages and an explanation of each.

- Row B - During **Target Track** mode and **Program Track** mode operation, Row B displays the 2-digit target number in the first field, followed by the corresponding AZ, POL, and EL target angles. The field following the EL target angle shows prompt and status information, including time of next event in the **Program Track** mode.

- In **Adaptive Step Track** mode (7134-AST Only), Row B provides real-time status information, telling the user when tracking is being performed or when tracking will begin if the system is in the WAITING state.

- In **Edit** mode, Row B provides submode selection choices and user prompts, displays existing data, and reflects data input.

1.3.1.3 Keypad

The function of each key on the 7134 and 7134-AST ACU keypad is described in Table 1-2.

TABLE 1-2 7134 or 7134 ACU KEYPAD CONTROLS

7134-AST or 7134 KEY	FUNCTION
(+/-) MAN	Places the ACU in **Manual** mode. Enters plus and minus signs when entering POL data.
0/N AUTO	Places the ACU in **Auto** mode for **Program Track**, **Target Track**, or **Adaptive Step Track (7134-AST Only)**. Answers NO to a yes/no question. Enters the number 0 when entering data in **Edit** mode.
1/Y EDIT	Places the ACU in **Edit** mode. Answers YES to a yes/no question. Enters the number 1 when entering data in **Edit** mode.
2 <AZ	Jogs AZ at slow speed in counterclockwise (CCW) direction in **Manual** mode. With the SHFT key held down, moves antenna at high speed in CCW direction in **Manual** mode. Enters the number 2 when entering data in **Edit** mode.
3 AZ>	Jogs AZ at slow speed in clockwise (CW) direction in **Manual** mode. With the SHFT key held down, moves antenna at high speed in CW direction in **Manual** mode. Enters the number 3 when entering data in **Edit** mode.
RST	When the ACU is in **Standby** with no mode indicated on the display, pressing this key sends a signal to the 7150 drive cabinet to reset the AZ and EL drive modules. When the ACU is in **Manual**, **Auto**, or **Edit** mode, pressing this key exits the current mode. NOTE: This key will not exit **Program Track**, **Target Track**, or **Adaptive Step Track (7134-AST Only)** when they are running. Only the STOP key stops these modes when they are active. When the ACU is in a submenu of a mode, pressing this key returns the user to the main menu of that mode. Press the key again to exit the current mode.
ENTR	Places the data entered through the keypad into RAM while in **Edit** mode. Initializes drive commands while in **Auto** mode.
4 NEXT	Moves the cursors on the display to the next menu selection. Steps through the data tables in **Edit** mode (VIEW function only) and **Auto** modes. Enters the number 4 when entering data in **Edit** mode.
5 <EL	Jogs EL at slow speed in downward direction in **Manual** mode. With the SHFT key held down, moves antenna at high speed in downward direction in **Manual** mode. Enters the number 5 when entering data in **Edit** mode.
6 EL>	Jogs EL at slow speed in upward direction in **Manual** mode. With the SHFT key held down, moves antenna at high speed in upward direction in **Manual** mode. Enters the number 6 when entering data in **Edit** mode.
STOP	Stops movement of the antenna any time the ACU has control of the system. Exits **Program Track**, **Target Track**, or **Adaptive Step Track (7134-AST Only)** when they are running.
SHFT	When held down, permits the AZ and EL keys to move the antenna at high speed. POL is not affected by the SHFT key. When held down in **Program Track** mode, the key lights up and the display shows the next target.
7 REMT	If not illuminated when pressed, this key transfers control of the system to the remote terminal and becomes illuminated, and the front panel keypad controls are inoperative. Pressing the STOP key exits **Remote**. If illuminated when pressed, this key transfers control of the system to the ACU and is no longer illuminated. Enters the number 7 when entering data in **Edit** mode.
8 <POL	Jogs POL in CCW direction if ACU is in **Manual** mode. Enters the number 8 when entering data in **Edit** mode.
9 POL>	Jogs POL in CW direction if ACU is in **Manual** mode. Enters the number 9 when entering data in **Edit** mode.

1.3.2 7150 Drive Cabinet

2.4.2 Antenna Drive Cabinet Hardware

The standard motor drive cabinet is a freestanding, foot-mounted aluminum NEMA-4X enclosure with overall dimensions of approximately 36-inches tall by 30-inches wide by 10-inches deep. The aluminum cabinet provides outstanding corrosion protection even in the harshest of environments.

A functional block diagram of the drive cabinet is shown in Figure 1-4.

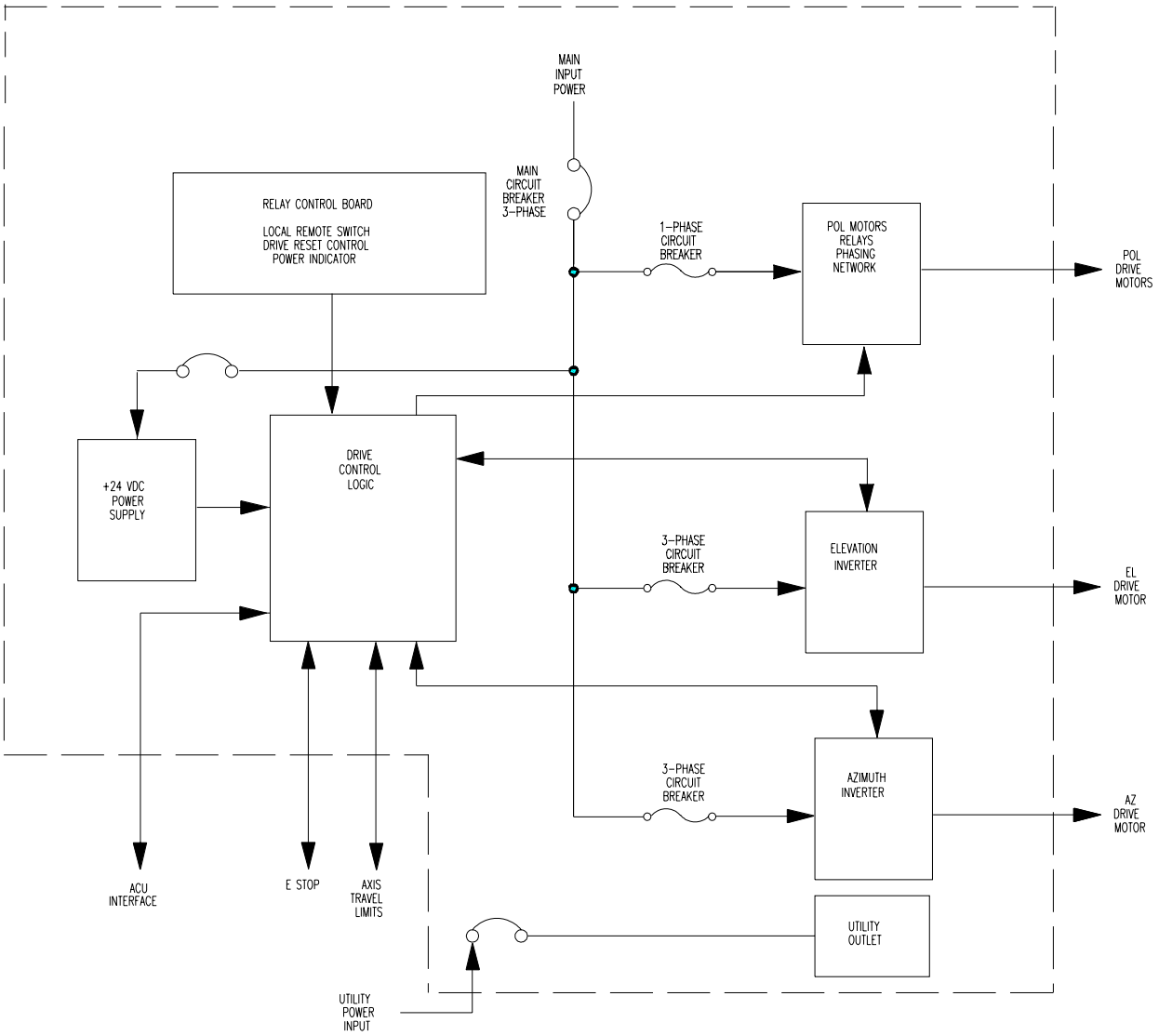

Figure 1-4 Drive Cabinet Block Diagram

The drive cabinet consists of the following major components:

- Portable Maintenance Control Unit
- Main and Inverter Drive Circuit Breakers
- EMERGENCY STOP SWITCH
- AZ variable speed AC drive unit (inverter)
- EL variable speed AC drive unit (inverter)
- 24 VDC power supply
- Control circuitry for the POL motor

Figure 1-5 shows the major components of the drive cabinet. Refer to the engineering drawings in Section 8.0.

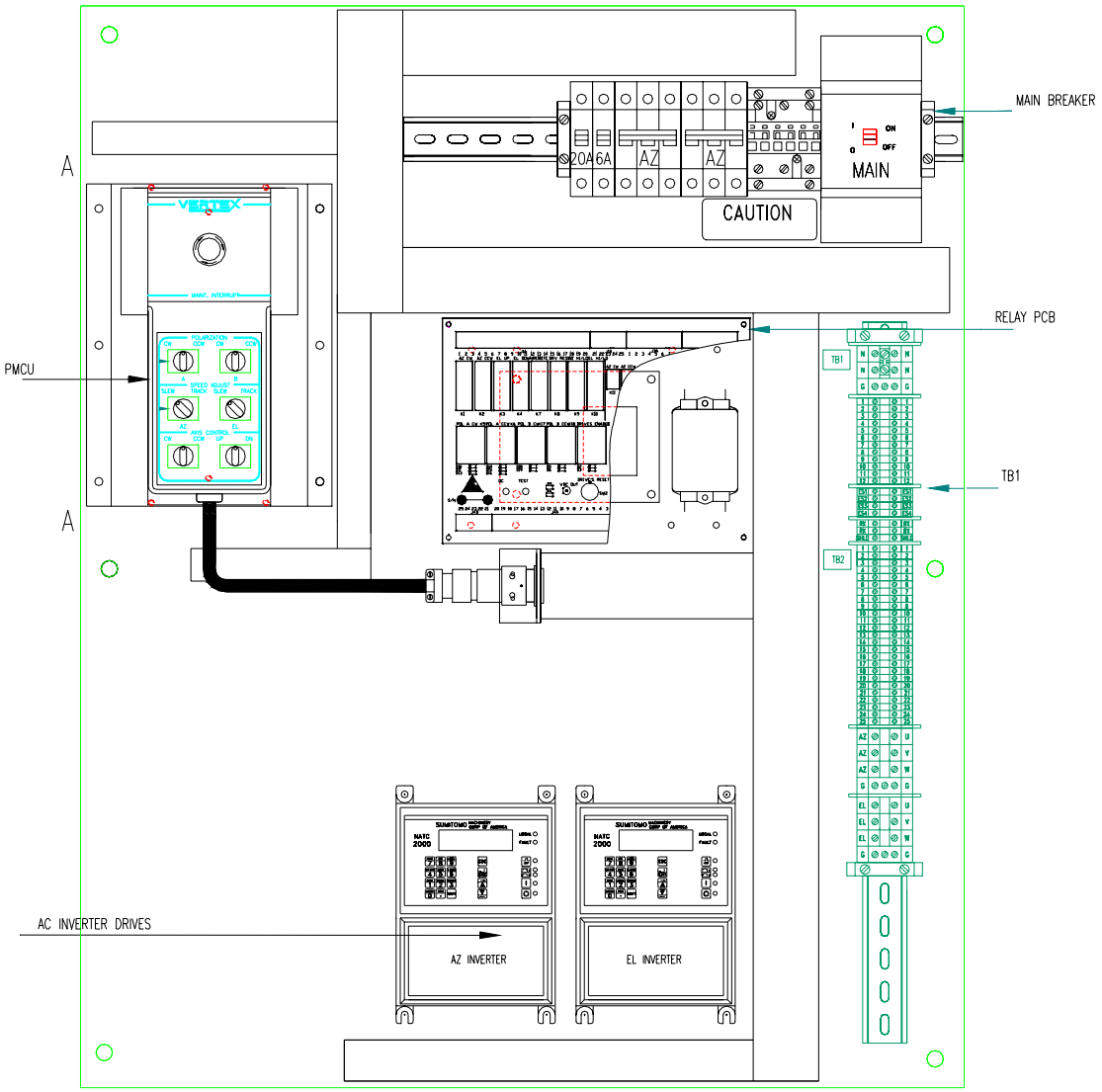

Figure 1-5 Drive Cabinet Assembly

The Portable Maintenance Control Unit (PMCU) located inside the 7150 Drive Cabinet allows the operator to control antenna movement from the proximity of the antenna.

The MAIN CIRCUIT BREAKER controls the main power to the drive motors, the limit switches, and the drive cabinet, but does not provide power to the 7134 or 7134-AST ACU. Each inverter has an individual circuit breaker for protection.

The EMERGENCY STOP switch (on the outside of the drive cabinet), when pressed, removes power from the drive motors by opening the drive enable contactor.

The AZ and EL inverters provide pulse-width-modulated motor current, allowing continuously variable drive rates over a range of up to 50 to 1.

The 24 VDC power supply provides operating voltage to the drive cabinet relay circuit board.

Relay PCB accepts all limit switch status inputs and controls the commands to the inverter drives and the POL motor.

2.4.2.1 AZ and EL Drive Inverters

One of the critical advantages of the 7134 and 7134-AST ACS over many other systems is the use of variable frequency drive inverters to control the speed of standard three-phase induction motors for AZ and EL antenna motion. This approach has several distinct advantages over the commonly used and simplistic on/off contactor control of motor power. First, inverters allow Vertex to offer two-speed control in a standard configuration without the problems associated with special dual-wound motors or clumsy clutching arrangements. Secondly, the inverters offer precision motor control by ramping motor speeds up and down in a controlled manner rather than simply switching full motor power on and off and having to contend with inertial coasting of the motor rotor and the related axis overshoot. In addition to these two distinct advantages, the inverter drives offer superior motor protection through sophisticated electronic motor overcurrent protection. Motor current is continuously monitored and compared against allowable levels for different conditions. Should the actual measured current exceed the allowable levels, the inverter trips and the drive is disabled. The inverter then has the capability to automatically reset and continue operation, provided the current remains within allowable limits.

2.4.2.2 Polarization Motor Control

The 7150 OU uses a Single-speed AC synchronous stepping motor for feed assembly rotation (POL). The POL motor is controlled and powered from the 7150 OU. Drive power to the POL motor is switched, according to the required direction of rotation, by relays located on the Relay PCB. A resistance-capacitance (RC) network in the drive cabinet provides the proper phase relationship to the motor.

2.4.2.3 Drive Cabinet Control Logic

Motor drive commands and interlock functions in the drive cabinet are performed with relay logic operating at +24 VDC, which is derived from a regulated power supply. Commands are received from the ACU, and PMCU for motor speed and direction, The Drive Reset is controlled from the Relay PC board and the Emergency stop is located on the right side of the enclosure. The drive cabinet relay logic then commands the axis drives accordingly. Likewise, limit switches mounted on the structure activate relays in the drive cabinet upon engagement to form axis interlocks and provide the appropriate fault reporting to the ACU.

2.4.2.4 Local Control

Local (Maintenance) control of the antenna drives is facilitated through a set of switches on the PMCU in the drive cabinet. A MAINT/REMOTE switch located on the Relay PCB allows the operator to select between ACU control and local drive cabinet control. With the select switch set to the MAINT position, ACU control is disabled; however, all status reporting remains fully operational at the ACU.

2.4.2.5 Drive Cabinet Overcurrent Protection

As described in paragraph 2.4.2.1, "intelligent" electronic overcurrent protection is provided for AZ and EL drive motors by the variable frequency inverters. In addition, there are several other protection devices integral to the drive cabinet. The inverter inputs are individually protected by circuit breakers essentially to offer short-circuit protection in the event of a drive inverter catastrophic failure. The +24 VDC logic power supply line input a back panel mounted circuit breaker. In a three-axis system, the POL motor circuit is individually protected by a circuit breaker. A main input power circuit breaker is also provided, which serves as an internal disconnect for the entire cabinet.

2.4.2.6 AZ and EL Drive Motors

Three-phase induction gear motor assemblies are utilized for actuation of the AZ and EL axes. The motors are sized based upon deadweight, frictional, and wind-loading requirements, as well as the required axis velocities. The standard motors can be connected for either 208 or 380 - 415 VAC three-phase input, based upon the line voltage available to the drive cabinet. The motors have sealed, permanent, synthetic grease lubricated bearings and the gearboxes are lubricated with synthetic gear oil, minimizing maintenance requirements.

2.0 INSTALLATION AND INITIAL SETUP

> ***WARNING***
>
> ***Always disconnect power before opening covers, doors, enclosures, gates, panels, or shields. Never make internal adjustments or perform maintenance or service when alone or fatigued. Main power connections and grounding should be performed by qualified personnel. Keep away from live circuits; know the equipment, and don't take chances. In case of emergency, be sure to disconnect power before touching equipment or personnel in contact with the equipment.***

This section of the manual provides the information necessary for the installation and initial setup of the 7134 and 7134-AST ACS for all modes of operation, including connection details for the remote serial interface. The remote interface protocol is provided in Appendix B.

2.1 Mechanical Installation

2.1.1 Antenna-Mounted Components

Mechanical interfaces for the antenna and motors vary with the specific equipment provided and are detailed in the drawing package supplied (separately from this manual) with each antenna. Proper and complete installation of the motors, resolvers, and limit switches is imperative for safe and accurate system operation. Refer to the mechanical drawings supplied in the drawing package for mechanical interface details. Complete this phase of installation first.

2.1.2 Installing the 7150 Drive Cabinet

Refer to Vertex foundation and conduit layout drawings for recommended locations of the 7150 drive cabinet.

Use the following procedures to install the 7150 drive cabinet.

1. Locate the 7150 drive cabinet as close as possible to the antenna without obstructing the full range of antenna movements.

2. Center the 7150 drive cabinet over any conduit stub-ups to facilitate conduit termination and wire pulling.

3. Attach the 7150 drive cabinet to the foundation using at least two 2-inch concrete anchors on each leg.

4. Using a set of conduit punches, punch conduit holes in the bottom of the 7150 drive cabinet.

2.1.3 Installing the 7134 or 7134-AST ACU

Using four No. 10 screws, mount the 7134 or 7134-AST ACU inside a standard 19-inch Electronic Industries Association (EIA) rack. No added support is necessary.

2.2 System Cabling

Figure 2-2 shows the cabling diagram for the 7134 or 7134-AST ACS. The following paragraphs describe the cabling and list the connections for the 7134 and 7134-AST ACS.

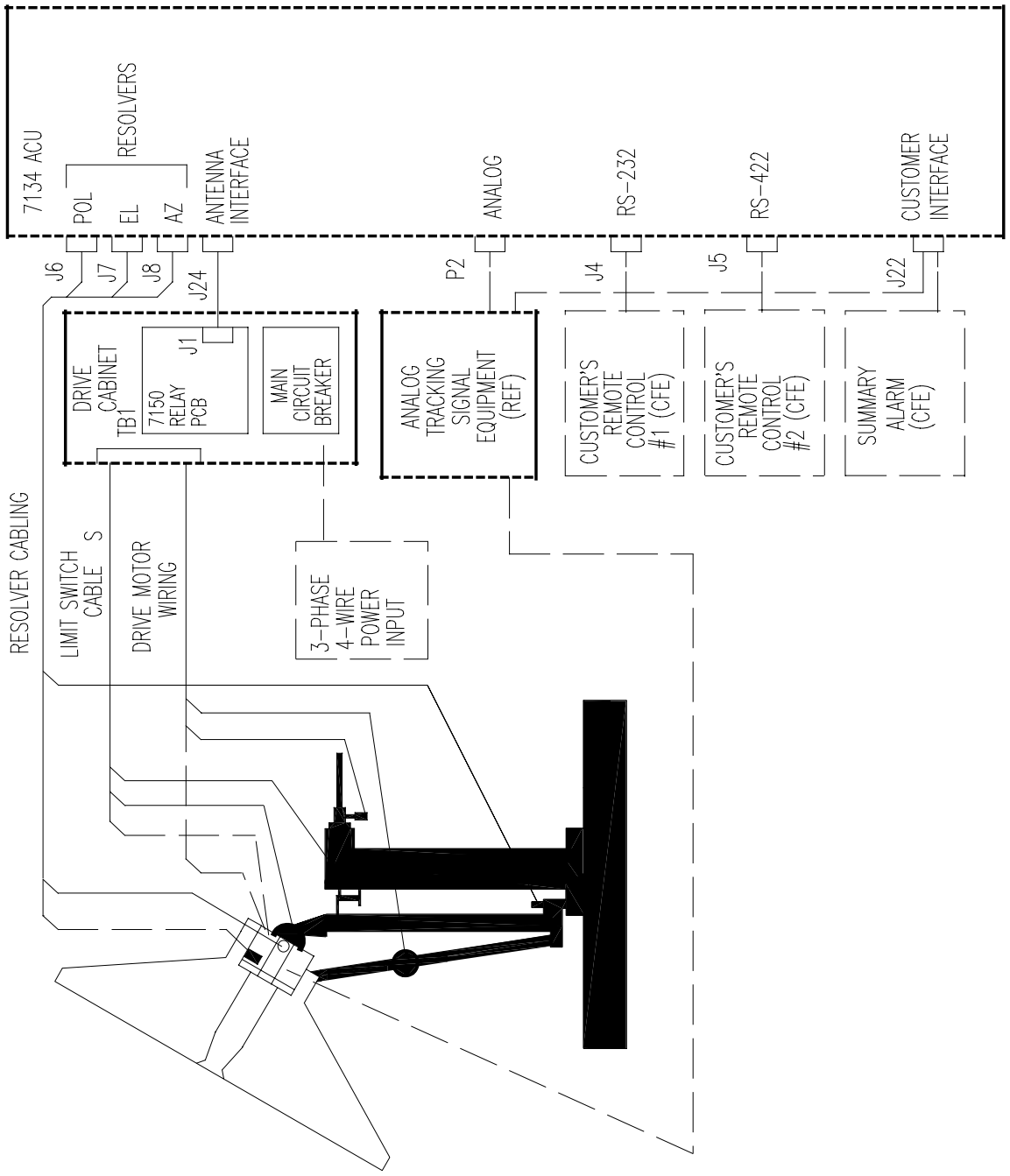

Figure 2-2 7134 and 7134-AST Antenna Control System Cabling Diagram

Cables must be connected from the antenna to the 7150 drive cabinet, from the 7150 drive cabinet to the 7134 or 7134-AST ACU, and from the antenna to the 7134 or 7134-AST ACU. Verify that the cables are connected correctly and securely. Proper functioning of the system during power-up is important for the protection of the equipment and for timely completion of the installation.

2.2.1 7150 Drive Cabinet Main Power Connection

Always follow applicable local electrical safety codes when installing wire and cables.

1. If conduit is not installed, use chase nipples with bushings or other suitable means to protect the wire and cables.

2. Check the main breaker size in the drive cabinet to determine required power conductor size for this installation.

3. If the wire from the distribution panel to the drive cabinet is long, increase wire size to keep the voltage drop to less than 5 percent of nominal.

> ***NOTE: The prime power required for the standard drive system is 3 phase WYE, 5-wire with ground. Other prime power configurations are available by special order. The neutral wire of the power system must be installed for proper operation.***

4. Connect the three-phase line leads to the line side (top) of the main circuit breaker in the upper right corner of the drive cabinet. Refer to Figure 2-3 for a drawing of the drive cabinet.

5. Tag the neutral wire with white electrical tape and connect the wire to one of the large terminals marked N on TB1 in the lower right corner of the drive cabinet.

6. Tag the ground wire with green and yellow electrical tape and connect the wire to one of the large green terminal blocks labeled with a G or a ground symbol on TB1.

7. Jumper the utility outlet circuit breaker (if available) to one of the three-phase legs on the main breaker or install a separate one-phase circuit.

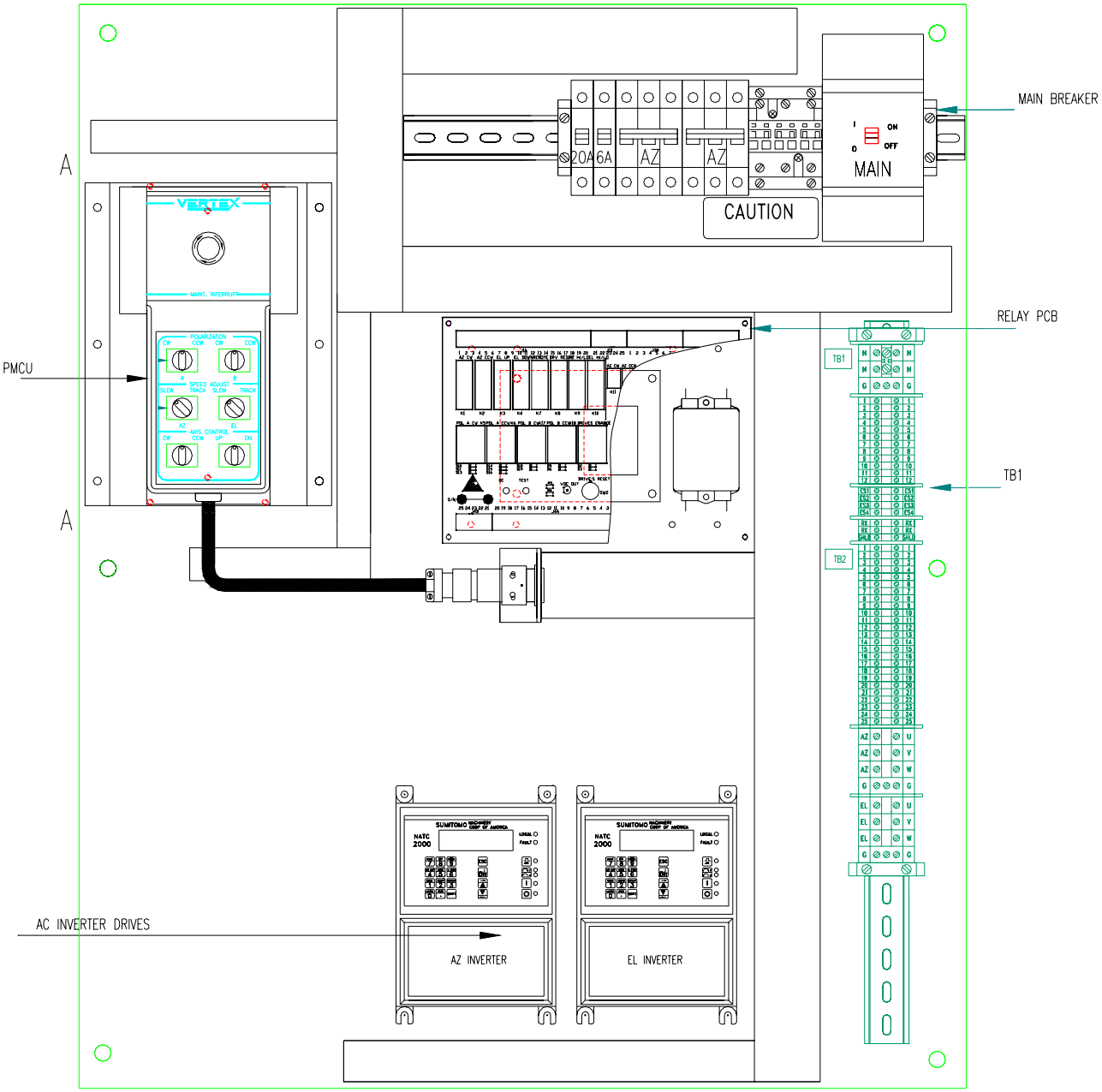

Figure 2-3 Drive Cabinet Assembly

2.2.1.1 Connecting the Drive Motors to the Drive Cabinet

To connect the drive motors to the drive cabinet, refer to Table 2-1 and use the following procedures.

NOTE: The AZ and EL motors require 3- phase conductors and a ground conductor

TABLE 2-1 MOTOR CONNECTIONS TO THE DRIVE CABINET		
DRIVE CABINET TB1	DEVICE	FUNCTION
Az-U	Az Motor	Phase 1
Az-V	Az Motor	Phase 2
Az-W	Az Motor	Phase 3
EL-U	EL Motor	Phase 1
EL-V	EL Motor	Phase 2
EL-W	EL Motor	Phase 3
POL CW	POL Motor	POL Motor CW
POL CCW	POL Motor	POL Motor CCW
N	POL Motor	POL Motor Common

1. Wire the AZ and EL motors for the appropriate system voltage by following the motor wiring diagrams inside the motor terminal box or on the motor nameplate.

2. Connect the AZ motor leads to TB1 terminals labeled Az-U, Az-V, and Az-W.

3. Connect the motor ground wire to the ground terminal.

4. Connect the EL motor leads to TB1 terminals labeled EL-U, EL-V, and EL-W.

5. Connect the motor ground wire to the ground terminal.

If 2-axis system skip steps 6-9
If 3-axis system perform steps 6-9.

6. Connect the wire from terminal 1 of the POL motor to the TB1 terminal labeled POL CW in the drive cabinet.

7. Connect the wire from terminal 3 of the POL motor to the TB1 terminal labeled POL CCW in the drive cabinet.

8. Connect the wire from terminal 2 of POL motor to TB1 terminal labeled N.

9. Connect the POL motor case ground to the ground terminal on TB1 in the drive cabinet.

2.2.2 Limit Switch Connections

Connect the limit switches to TB1-1 through TB1-9 on the drive cabinet as shown in Table 2-2. Note that normally closed (open upon limit) contacts are required.

TABLE 2-2 LIMIT SWITCH CONNECTIONS TO THE DRIVE CABINET

DRIVE CABINET TB1	DEVICE	FUNCTION
1	Az Limit Switch	Az CW Limit
2	Az Limit Switch	Az Limit Common
3	Az Limit Switch	Az CCW Limit
4	EL Limit Switch	EL Up Limit
5	EL Limit Switch	EL Limit Common
6	EL Limit Switch	EL Down Limit
7	POL Limit Switch	POL CW Limit
8	POL Limit Switch	POL Limit Common
9	POL Limit Switch	POL CCW Limit

To connect the main power to the 7150 drive cabinet, follow these steps. Be sure to follow local building codes and the National Electric Code when installing wire and cables.

1. If conduit is not installed, use chase nipples with bushings or other suitable means to protect the wire and cables.

2. Use Table 2-3 or Table 2-4 according to the input voltage to determine the feeder wire size for the 7150 drive cabinet. (If the required system configuration is not listed, check the main breaker size in the on-site 7150 drive cabinet. If the main breaker size is not available, contact Vertex Communications Corporation for the power requirements.)

TABLE 2-3 COMMON CONFIGURATIONS OF THE 7150 DRIVE CABINET 208 VAC 3 Phase		
MAIN CIRCUIT BREAKER	**AZ DRIVE**	**EL DRIVE**
30A	1 HP	1 HP
30A	2 HP	2 HP
30A	3 HP	2 HP
30A	3 HP	3 HP
30A	5 HP	3 HP
40A	5 HP	5 HP
50A	7.5 HP	5 HP
50A	7.5 HP	7.5 HP
63A	10 HP	7.5 HP
70A	10 HP	10 HP

TABLE 2-4 COMMON CONFIGURATIONS OF THE 713450 DRIVE CABINET 380-415 VAC 3 Phase		
MODELMAIN CIRCUIT BREAKER	**AZ DRIVE (FUSE)**	**EL DRIVE (FUSE)**
20A	2 HP	2 HP
20A	3 HP	2 HP
20A	3 HP	3 HP
30A	5 HP	3 HP
30A	5 HP	5 HP
30A	7.5 HP	5 HP
40A	7.5 HP	7.5 HP
40A	10 HP	7.5 HP
40A	10 HP	10 HP
50A	15 HP	10 HP
60A	15 HP	15 HP
70A	20 HP	15 HP
80A	20 HP	20 HP

3. If the wire from the distribution panel to the 7150 drive cabinet is long, increase wire size to keep the voltage drop to less than 5 percent of nominal.

NOTE: The prime power required for the standard drive system is 3-phase Y, 5-wire with ground. THE NEUTRAL WIRE OF THE POWER SYSTEM MUST BE INSTALLED FOR PROPER OPERATION.

4. Connect the 3-phase line leads to the line side of the main circuit breaker in the upper right corner of the 7150 drive cabinet.

5. Tag the neutral wire with white electrical tape and connect the wire to one of the large terminals marked N on TB1 in the lower right corner of the 7150 drive cabinet.

6. Tag the ground wire with green electrical tape and connect the wire to the grounding bar located below the vertical terminal strip.

7. Jumper the utility outlet circuit breaker to one of the 3-phase legs on the main breaker or install a separate 120 VAC, 1-phase, 20A circuit.

2.2.2 Connecting the Drive Motors to the 7150 Drive Cabinet

Table 2-5 describes the function of the limit switches and motor connections of the 7150 drive cabinet.

NOTE: The AZ and EL motors require 3-phase conductors and a ground conductor.

TABLE 2-5 LIMIT SWITCH AND MOTOR CONNECTIONS TO THE 7150 DRIVE CABINET

7150 DRIVE CABINET TB1	DEVICE	FUNCTION
1	AZ Limit Switch	AZ CW Limit
2	AZ Limit Switch	AZ Limit Common
3	AZ Limit Switch	AZ CCW Limit
4	EL Limit Switch	EL Up Limit
5	EL Limit Switch	EL Limit Common
6	EL Limit Switch	EL Down Limit
7*	POL Limit Switch	POL CW Limit
8*	POL Limit Switch	POL Limit Common
9*	POL Limit Switch	POL CCW Limit
Az-U	AZ Motor	Phase 1
Az-V	AZ Motor	Phase 2
Az-W	AZ Motor	Phase 3
EL-U	EL Motor	Phase 1
EL-V	EL Motor	Phase 2
EL-W	EL Motor	Phase 3
POL CW	POL Motor	POL Motor CW
POL CCW	POL Motor	POL Motor CCW
N	POL Motor	POL Motor Common

* For a 2-axis system, terminals should be jumpered.

To connect the drive motors to the 7150 drive cabinet, follow these steps.

1. Wire the AZ and EL motors for the appropriate system voltage by following the motor wiring diagrams inside the motor terminal box or on the motor nameplate.
2. Connect the AZ motor leads to TB1 terminals labeled AZ-U, AZ-V, and AZ-W.
3. Connect the motor ground wire to the ground bar.
4. Connect the EL motor leads to TB1 terminals labeled EL-U, EL-V, and EL-W.
5. Connect the motor ground wire to the ground bar.
6. Connect the wire from terminal 1 of the POL motor to the TB1 terminal labeled POL CW in the 7150 drive cabinet.
7. Connect the wire from terminal 3 of the POL motor to the TB1 terminal labeled POL CCW in the 7150 drive cabinet.
8. Connect the wire from terminal 2 of the POL motor to the TB1 terminal labeled N.
9. Connect the POL motor case ground to the ground bar in the 7150 drive cabinet.

2.2.3 Limit Switch Connections

To connect the limit switches, refer to the antenna drawing package and Table 2-5. Connect the limit switches to TB1-1 through TB1-9 on the 7134 drive cabinet.

2.2.4 Installing the 7134 or 7134-AST ACU Control Cable

Figure 2-3 shows the back panel layout of the 7134 and 7134-AST ACU. The pin-out and function of each conductor of the 25-conductor control cable are listed in Table 2-6.

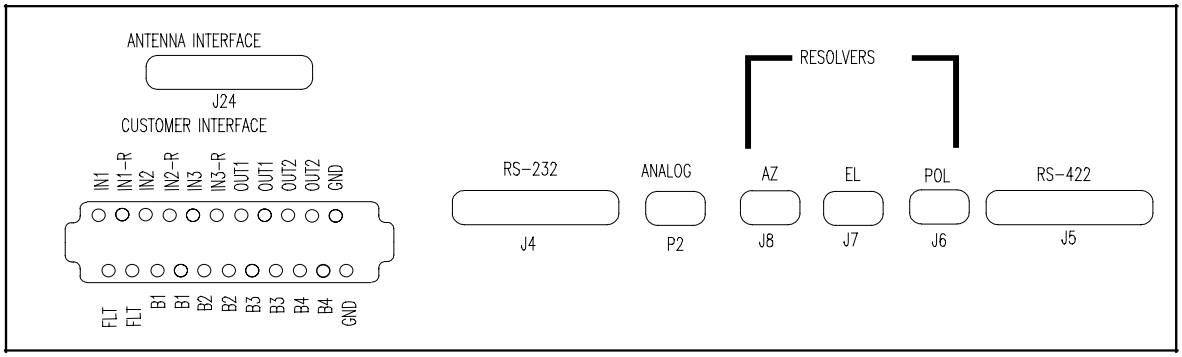

Figure 2-3 7134-AST Antenna Control Unit Back Panel Layout

TABLE 2-6 CONTROL CABLE CONNECTIONS		
7150 DRIVE CABINET J1	**7134-AST ACU J24**	**FUNCTION**
1 Black	1	AZ CW Command
2 White	2	AZ Common
3 Red	3	AZ CCW Command
4 Green	4	EL Up Command
5 Orange	5	EL Common
6 Blue	6	EL Down Command
7 Wht-Blk	7	POL CW Command
8 Red-Blk	8	POL/Drives Enable Command
9 Grn-Blk	9	POL CCW Command
10 Org-Blk	10	Summary Limit
11 Blu-Blk	11	No Connection
12 Blk-Wht	12	No Connection
13 Red-Wht	13	No Connection
14 Grn-Wht	14	AZ Fault
15 Blu-Wht	15	EL Fault
16 Blk-Red	16	E Stop Return
17 Wht-Red	17	Sum Limit, AZ Fault, EL Fault Common
18 Org-Red	18	Sum Limit, AZ Fault, EL Fault Common
19 Blu-Red	19	E Stop Command
20 Red-Grn	20	No Connection
21 Org-Grn	21	AZ Low Speed Command
22 Blk-Wht-Red	22	EL Low Speed Command
23 Wht-Blk-Red	23	Drives Enable
24 Red-Blk-Wht	24	Local Maint Status
25 Grn-Blk-Wht	25	Local Maint Status Return

To install the control cable of the 7134 or 7134-AST ACU, follow these steps.

1. Connect one end of the 25-conductor control cable (Belden 8459 or equivalent) to the 25-pin connector labeled ANTENNA INTERFACE (J24) on the back of the 7134 or 7134-AST ACU.

2. Connect the other end of the 25-conductor cable to the 25-point terminal strip (J1) on the relay board inside the 7150 drive cabinet (refer to Table 2-6).

2.2.5 Resolver Connections

The connections for each resolver are identical to those provided in Table 2-7. Connect each end of the respective cables to the AZ resolver and J8, the EL resolver and J7, and the POL resolver (if provided) and J6, following the correlation shown for each in table. Refer to Figure 2-3 for location of the connectors on the ACU.

R1 and R2, S1 and S3, S2 and S4 should be installed in twisted pairs.

TABLE 2-7 RESOLVER CONNECTIONS

7134 and 7134-AST ACU J6, J7, J8	FUNCTION	RESOLVER LEAD COLOR
2	R1	Red/White
8	R2	Yellow/White
9	S1	Red
5	S2	Yellow
4	S3	Black
3	S4	Blue
1,6,7	Shield	Not Connected at Resolver

2.2.6 Analog Input Connections

Two analog input ports are provided on the 7134 and 7134-AST ACU via P2 on the rear panel (refer to Figure 2-3). Internally, the analog inputs connect to A/D converter circuits that condition input signals for use by the main processor. Dual analog inputs and A/D circuitry provide a spare channel in case of primary channel failure or for signal input from an auxiliary source.

Each analog input has (+), (-), and GND terminals to facilitate devices with isolated or differential outputs. In most cases, the (+) output of the tracking receiver connects to the (+) analog input, and the common or (-) output of the tracking receiver connects to the (-) analog input. If the Vertex TRC-14 is used as the tracking receiver, the GND wire should be connected at the TRC-14.

The analog input voltage range is 0 - 10 VDC, and the minimum slope required for step track operation is 0.2 volts per dB of signal level change.

Refer to Table 2-8 and connect the analog inputs to P2 on the back of the 7134 and 7134-AST ACU.

TABLE 2-8 ANALOG INPUT CONNECTIONS				
7134 & 7134-AST (P2)	**DESIGNATION**	**FUNCTION**	**TRC/TRK/TRX TRACKING RECEIVERS (TB1)**	**TRL TRACKING RECEIVER (J3)**
1	GND	Signal Ground	No Connection	No Connection
2	AD1 +	Channel 1(+)	OUT +	1
3	GND	Signal Ground	No Connection	No Connection
4	AD2-	Channel 2(-)	OUT-	16
5	SPARE	No Connection	No Connection	No Connection
6	GND	Signal Ground	No Connection	No Connection
7	AD1-	Channel 1(-)	OUT-	14
8	AD2 +	Channel 2(+)	OUT +	3
9	GND	Signal Ground	No Connection	No Connection

2.2.7 Remote Communications Connections

Tables 2-9 and 2-10 provide the connections for the remote communication ports to the 7134 and 7134-AST ACU. Refer to Appendix B for information on the remote communications protocol.

TABLE 2-9 COMMUNICATION PORT CONNECTIONS (RS-232)		
J4	**DESIGNATION**	**FUNCTION**
1	PROT GND	Protective Ground
2	RS-232 XDATA	Transmit
3	RS-232 RDATA	Receive
7	SIG GND	Signal Ground

TABLE 2-10 COMMUNICATION PORT CONNECTIONS (RS-422)		
J5	**DESIGNATION**	**FUNCTION**
1	GND	Ground
2	HDX +	Half Duplex (+)
6	XDATA-	Transmit (-)
9	RDATA-	Receive (-)
15	HDX-	Half Duplex (-)
16	HDX SHIELD	Half Duplex Shield
19	XDATA +	Transmit (+)
20	XDATA SHLD	Transmit Shield
22	RDATA +	Receive (+)
23	RDATA SHLD	Receive Shield

2.2.8 Customer Interface Connections

The customer interface connector (refer to Figure 2-3) provides a summary fault output (normally closed dry contacts) and four contact closures for remote beacon selection. The FLT contacts have continuity between them under normal conditions but provide an open circuit under fault conditions. The terminals for remote beacon selection are open circuits for the respective beacon 1 - 4, unless that beacon is selected through the 7134 and 7134-AST ACS front panel. Thus, the customer interface beacon contacts for any selected beacon provide a closed circuit, allowing the flexibility of switching beacon channels and/or sources on compatible equipment. The remaining IN and OUT terminals are reserved for future use.

Refer to Table 2-11 and connect the customer interface to the connector on the back of the 7134 and 7134-AST ACU. As an example, Figure 2-4 shows the beacon select connections between a 7134 and a Vertex TRC-14 tracking receiver (if that receiver is used).

TABLE 2-11 CUSTOMER INTERFACE TERMINAL STRIP	
TERMINAL	**FUNCTION**
FLT FLT	Summary Fault Status Contacts
B1 B1	Beacon #1 Select Contacts
B2 B2	Beacon #2 Select Contacts
B3 B3	Beacon #3 Select Contacts
B4 B4	Beacon #4 Select Contacts
GND	Ground
IN1	Input #1
IN1-R	Input #1 Return
IN2	Input #2
IN2-R	Input #2 Return
IN3	Input #3
IN3-R	Input #3 Return
OUT1 OUT1	Output #1 Contact
OUT2 OUT2	Output #2 Contact
GND	Ground

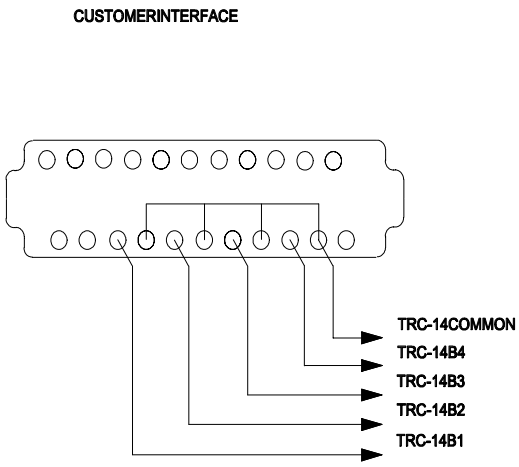

Figure 2-4 Beacon Select Connections Between 7134/7134 AST and TRC-14

2.2.9 Portable Maintenance Control Unit (PMCU) Installation

The PMCU is supplied with out a display. The display option will not function with a 7134 or a 7134-AST ACU. The PMCU is provided for local control at the antenna. It is located inside the 7150 drive cabinet.

2.2.9.1 PMCU Connections

The following table gives the terminal numbers and a description of the terminals of the PMCU terminal strip (J5) on the relay Printed Circuit Board (PCB) and the MS connector located on the back plate of the 7150 drive cabinet.

TABLE 2-12 PMCU CONNECTIONS

RELAY PCB "J" CONNECTORS & TB1 TERMINAL STRIP	DESCRIPTION	MS CONNECTOR PIN OUT
J5-1	INTERRUPT RTN	B
J5-2	MAINT. INTERRUPT	A
J5-3	AZ CW	N
J5-4	AZ/EL COMMON	E
J5-5	AZ CCW	P
J5-6	AZ SLEW	J
J5-7	EL UP	L
J5-8	EL DN	M
J5-9	EL SLEW	K
J5-10	POL CW	G
J5-11	POL COMMON	F
J5-12	POL CCW	H
J5-13	NC	C
J5-14	NO	D
J5-15	NC	
J5-16	NC	
J4-13	+24 VDC	W
J4-11	VDC COMMON	X
	NC	
	NC	R
	NC	S
	NC	T
	NC	U
	NC	V
	NC	Y
	NC	Z

2.3 Initial Turn-On and System Setup

Before proceeding with system power-up, check all system cabling and termination's for correctness and integrity. Then proceed, in the order presented, with the following items. Because the antenna may be moved from the control panel of the 7150 drive cabinet, independent of the ACU, system start-up will be initiated at the 7150 drive cabinet.

2.3.1 Initial Power-Up

1.Verify that the following conditions exist at the respective drive cabinet controls:

a. CONTROL switch set to the LOCAL position.
b. CONTROL POWER switch set to ON.
d. EMERGENCY STOP button pulled out.

2. Apply power to the drive cabinet by setting the MAIN CIRCUIT BREAKER to ON. Turn on all other breakers. The green indicator LED in the center of the CONTROL POWER circuit breaker should illuminate at this time. Also, the displays on the inverters should become active

2.3.2 Pulse-Width Modulation Inverter Drive Setup (AZ/EL Drive Modules)

The intelligent, variable speed motor control modules incorporated in the drive cabinet for AZ and EL require correct setting for a number of operational parameters. All parameters should be set correctly from the factory, but the procedures in paragraph 2.4.1.2.1 should be followed to ensure that the correct settings have been retained. Additionally, some codes may have to be altered during system installation to fine- tune system performance.

2.3.2.1 Function Parameters

NTAC-2000 AC drives are supplied with a Digital Operator Interface (DOI) attached to the front of the drive. The DOI can be used to operate the drive, change program parameters and to display drive operating conditions. Figure 2-5 shows for DOI layout and component identification. See the NTAC 2000 Drive instruction manual for detailed descriptions of these operators.

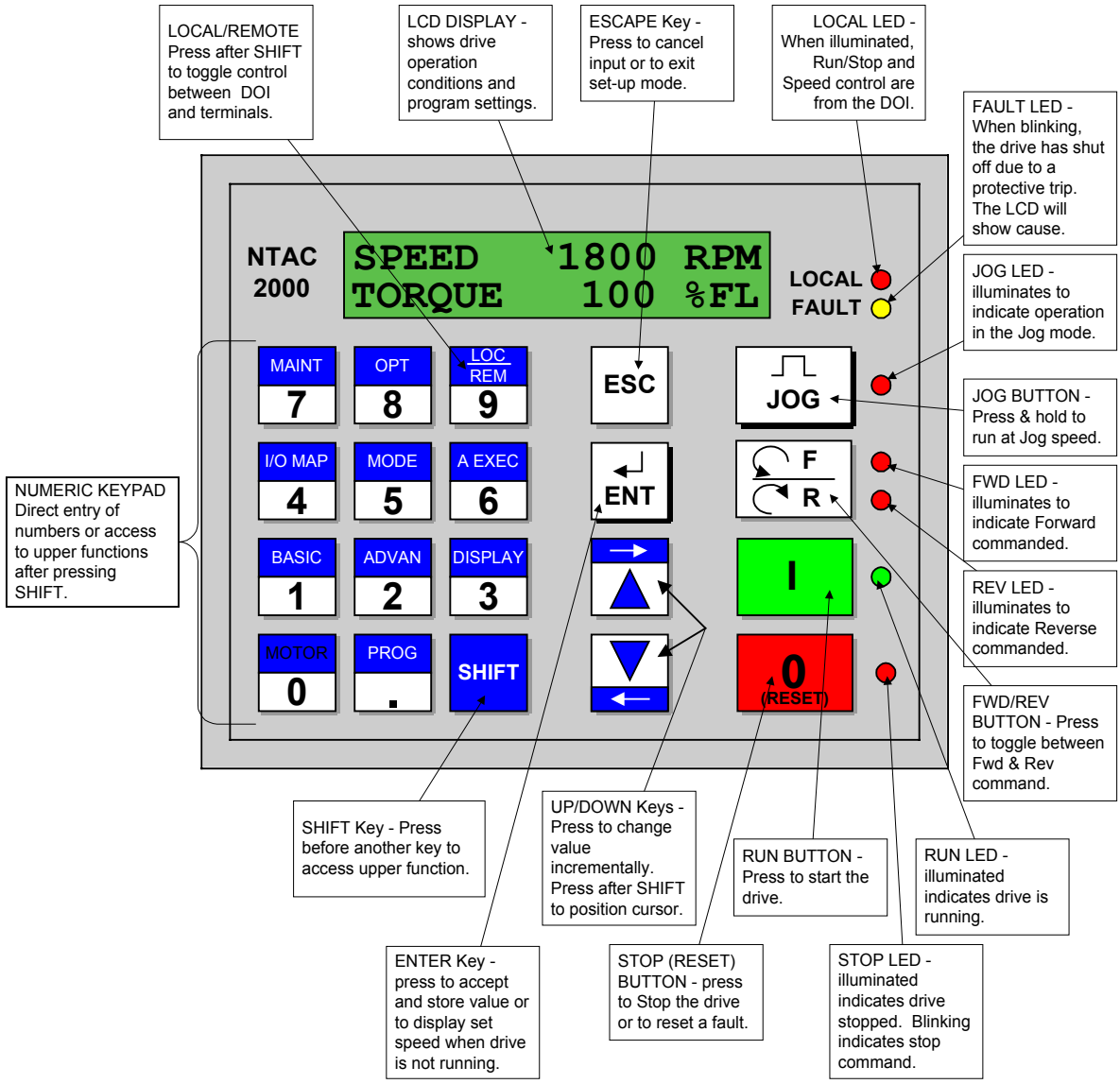

Figure 2-5 DOI Layout and Component Identification

To change Basic params 101-112:
SHIFT-1, ENT, param 101 is shown, down arrow to the desired param, ENT for change mode, enter new value, ENT to invoke change.

WARNING

DO NOT USE THE FORWARD, REVERSE OR JOB BUTTONS ON THE INVERTER DRIVES TO MOVE THE ANTENNA. THE LIMIT SWITCHES WILL NOT STOP THE ANTENNA MOVEMENT AND POSSIBLE STRUCTURAL DAMAGE TO THE ANTENNA CAN OCCUR.

2.3.2.2 NTAC 2000 Inverter Drive Setup (Function Parameters)

All parameters are set at the factory. VCSD has modified some of these parameters.

TABLE 2-13 NTAC 2000 DRIVE PARAMETERS

FUNCTION NUMBER	AZ INVERTER	EL INVERTER	FACTORY & VCSD SETTINGS
11	380 VAC	380 VAC	**Motor Voltage; Set to Nameplate rating on motor**
12	3.8 Amps	3.8 Amps	**Motor Full Load Amps Set to nameplate rating on motor**
13	2.0 HP	2.0 HP	**Motor HP Set to nameplate rating on motor**
14	60 Hz	60 Hz	**Motor rated Frequency Set to nameplate rating on motor**
15	1720 RPM	1720 RPM	**Motor rated Speed Set to nameplate rating on motor See Note 3**
16	USE ONLY THE "STANDARD AUTOTUNE FUNCTION" IT DOES NOT ROTATE THE MOTOR. ****WHEN ANY PARAMETER IS CHANGED, THE AUTOTUNE MUST BE REDONE****		
18	80 RPM	80 RPM	**"80 RPM"**
101	0.8 S	0.8 S	**"0.8S"**
102			**"0.8S"**
111	172 RPM	172 RPM	**Set to 10% of motor nameplate RPM. See Note 2**
112	1720 RPM	1720 RPM	**Set to motor nameplace RPM. See Note 1**
201	Note: These all agree with the Factory & VCSD Settings shown at right.	Note: These all agree with the Factory & VCSD Settings shown at right.	**"3"**
202			**"0.5"**
204			**"TRUE"**
205			**"FALSE"**
225			**"10"**
303			**"I OUT (A)"**
402			**"RUN FWD"**
403			**"RUN REV"**
404			**"RESET"**
414			**"0.0V"**
421			**"FAULT"**
422			**"RUN"**
423			**"AT SPD"**
502			**"REMOTE"**
503			**"REMOTE"**

NOTE: 1. *Use motor name plate speed. Example 1720 RPM (Slew Speed)*

2. *Use 10% of motor name plate speed. Example 170 RPM (Track Speed)*

3. *Minimum rated speed for 60 Hz motor is 1630 RPM. Minimun rated speed for 50 Hz motor is 1370 RPM. Failure to set these minimum values may result in* ***a MOTOR PARAMETERS FAULT*** *during autotune.*

Changed parameter #112 to 172 RPM for patterns (while using the Manual Track "Jump" mode, which switches to Slew Speed when moving to a Target).

NOTE: Do not make changes to the program function codes before contacting Vertex Control Systems. Changing these parameters could cause Drive malfunctions, incorrect tracking of the antenna, and or physical damage to the system.

All other parameters are set at factory default.

2.3.2.3 Drive Motor Phasing

Because all axis drives are bi-directional, the actual direction of antenna axis rotation should correspond to the direction commanded by the control system. The following procedures should be followed to ensure this correspondence (make all control commands at the swing-out panel).

NOTE: Prior to performing these procedures, ensure that the antenna is clear of electrical and mechanical stop limits in all axes, preferably with each axis near the center of travel.

WARNING
IF ANY AXIS DRIVE MOTOR IS PHASED INCORRECTLY, THE CORRESPONDING ELECTRICAL LIMIT SWITCH WILL NOT PREVENT OVERTRAVEL OF THE ANTENNA.

2.3.2.4 AZ Motor Phasing

1. Using the PMCU set the AZIMUTH SPEED ADJUST switch to the TRACK position.

2. Hold the AZ AXIS switch to CW for a few seconds and then to CCW for a few seconds, while observing the direction of rotation of the antenna.

3. If the direction of antenna rotation agrees with the control commands, proceed with paragraph 2.3.2.5.

4. If the direction of antenna rotation is reversed from the commanded direction, remove power from the drive cabinet, and switch the AZ motor leads connected to terminals Az-U and Az-W.

5. Restore power to the drive cabinet and recheck for proper AZ rotation.

2.3.2.5 EL Motor Phasing

1. Using the PMCU set the ELEVATION SPEED ADJUST switch to the TRACK position.

2. Hold the EL AXIS switch to UP for a few seconds and then DOWN for a few seconds, while observing the direction of rotation of the antenna.

3. If the antenna movement correlates with the commanded direction, proceed to paragraph 2.3.3.

4. If the direction of antenna rotation is reversed from the commanded direction, remove power to the drive cabinet, and switch the EL motor leads connected to terminals EL-U and EL-V.

5. Restore power to the drive cabinet and recheck for proper EL rotation.

2.3.3 POL Motor Phasing

1. Hold the POL switch to CW for a few seconds and then to CCW for a few seconds. The CW drive command should result in clockwise rotation of the feed assembly as viewed from the **rear** of the antenna structure; the CCW drive command should result in counterclockwise rotation of the feed assembly as viewed from the **rear** of the antenna structure.

2. If the drive command and axis rotation are correct, proceed to paragraph 2.3.4.

3. If the drive command and axis rotation are reversed, remove power from the drive cabinet and switch the POL motor leads connected to terminals POL CW and POL CCW located on TB1.

4. Restore power to the drive cabinet and recheck for proper POL rotation.

2.3.4 Electrical Limit Switch Tests and Preliminary Settings

CAUTION

In the following steps, jog the antenna slowly as it nears each limit to prevent possible damage to the antenna structure because of a malfunctioning or improperly adjusted limit switch. This caution is necessary only during installation in order to verify that the limit switches are functioning correctly.

1. Using the PMCU hold the AZ AXIS CONTROL switch to the CW position and drive the antenna into the AZ CW limit. Verify that the CW movement of the antenna stops and that CCW motion is allowed. If CW and CCW limits are operating backward, switch wires on TB1-1 and TB1-3.

2. Using the PMCU hold the AZ AXIS CONTROL switch in the CCW position and drive the antenna into the AZ CCW limit. Verify that the CCW movement of the antenna stops and that CW motion is allowed.

3. Using the PMCU hold the EL AXIS CONTROL switch in the UP position and drive the antenna into the EL UP limit. Verify that the upward movement of the antenna stops and that downward motion is allowed.

4. Using the PMCU hold the EL AXIS CONTROL switch in the DOWN position and drive the antenna into the EL DOWN limit. Verify that the downward movement of the antenna stops and that upward motion is allowed. If UP and DOWN limits are operating backward, switch wires on TB1-4 and TB1-6.

5. Using the PMCU hold the POL switch in the CW position and drive the feed tube into the CW limit. Verify that the CW movement of the feed tube stops and that CCW motion is allowed. If CW and CCW limits are operating backward, switch wires on TB1-7 and TB1-9.

6. Using the PMCU hold the POL switch in the CCW position and drive the feed tube into the CCW limit. Verify that the CCW movement of the feed tube stops and that CW motion is allowed.

If any of the limit switches do not operate in the manner described above in steps 1 through 4, discontinue operation of the system until the problem is cleared. Limit circuit problems can usually be traced to a wiring error between the switch and drive cabinet.

After ensuring proper operation of all limits, set the limit stops for each axis to ensure clearance of all obstructions while allowing only the necessary total antenna travel in each axis.

2.3.5 AZ and EL Speed Adjustments

Low- and high-speed drive rates for the AZ and EL axes are pre set as parameter inside each drive.

2.3.6 7134 and 7134-AST ACU Software Initialization

These paragraphs describe the procedures for the initial setup of the 7134 and 7134-AST ACU for operation. All data (configuration and tracking data bases) are stored in a nonvolatile, battery-backed RAM, so these need to be set once, when the 7134 or 7134-AST ACS is first installed. Configuration of the ACU's parameters should be done only after the entire 7134 or 7134-AST ACS is installed properly.

Although all data is stored in nonvolatile RAM, the data should also be recorded and kept in a safe place in case the battery-backed RAM fails so that it can quickly be reentered into the ACU.

At this point, if the reader is not familiar with the operation of the 7134 or 7134-AST ACU, read Section 3.0, Operation, before proceeding with installation configuration. Note, however, that while the 7134-AST ACU may not be configured properly for the intended site, the parameter and tracking data base editing functions are fully functional immediately, so the reader may try moving around the ACU's menus, editing parameters, etc., while reading the Operation section. However, **Manual** mode (accessed from **Standby** mode by pressing the MAN key), **Manual Track (Jump)** mode (accessed from **Manual** mode by pressing the EDIT key and choosing JUMP), nor **Auto** mode (accessed from **Standby** mode by pressing the AUTO key) should be entered before the ACU has been configured properly.

2.3.7 Power-Up of the 7134 or 7134-AST ACU

On the 7134 or 7134-AST ACU control panel, set the ON/OFF switch to ON. Following self-test diagnostics, the display shows the current AZ, EL, and POL angles of the antenna.

2.3.7.1 Initialization Sequence

When configuring the 7134 or 7134-AST ACU, use the following procedures. Again, refer to Section 3.0 for detailed instructions on setting parameters.

1. Set the ACU's system time). The **Program Track** does not function properly if system time is not set. Page 3-9
2. Set resolver offsets. The ACU will not read the current look angles correctly until the resolver offsets are set. Page 3-15
3. Set configuration parameters. The factory defaults for these parameters are usually adequate. However, a few of them are very installation-dependent. In particular: Page 3-10
   a. POL ENABLED? must be set properly, or POL errors will occur.
   b. AZ, EL, POL REVERSED? parameters must be set properly, or the ACU will detect motion in the wrong direction. The current position displayed will be incorrect, and **Target** and **Program** tracking will not function properly.
4. Set the **Adaptive Step Track (7134-AST Only)** parameters. Page 3-24
5. Set the 0 dB and -3 dB levels. Page 3-26

3.0 OPERATION

After the 7134 or 7134-AST ACU is powered up and completes initial self-diagnostic tests, it reverts to the **Standby** mode. From this mode, the operator can select to drive the antenna using the keypad on the 7134 and 7134-AST ACU in **Manual** mode or **Auto** mode, or from the PMCU in the drive cabinet in **Maintenance** mode. This section provides the procedures for powering up the drive cabinet, operating the ACS in these modes, and editing all user-changeable setup and tracking data in the 7134 and 7134-AST ACU.

3.1 Power-Up Procedures

To power up a 7134 or a 7134-AST ACS, use the following procedures.

1. On the drive cabinet, pull the EMERGENCY STOP switch to the out position.
2. On the drive cabinet swing-out control panel, set the CONTROL POWER circuit breaker to ON.
3. On the drive cabinet swing-out control panel, set the DRIVE CIRCUIT BREAKER to ON (up position).
4. On the drive cabinet swing-out control panel, set the MODE switch to REMOTE.
5. On the 7134 or 7134-AST ACU control panel, set the ON/OFF switch to ON. The system performs a self-diagnostic test and the display indicates any detected problems. If there are no problems, the display shows the current azimuth, polarization, and elevation angles of the antenna.

3.2 Manual Movement of the Antenna from the Drive Cabinet (PMCU)

Manual control of each axis is provided at the drive cabinet by using the PMCU, primarily to facilitate antenna maintenance. A MAINT/REMOTE switch (CONTROL) located on the Relay PCB. It is the only selection point for maintenance mode. Therefore, with this switch in the MAINT position, the ACU cannot assume control. With the switch in the REMOTE position, the ACU has control of the system and the drive cabinet switches are inoperative..

To operate the antenna from the drive cabinet, use the following procedures.

1. On the drive cabinet, set the CONTROL switch to MAINT to enable the controls on the PMCU.
2. Set the AZIMUTH SPEED ADJUST to TRACKING SPEED. The SLEW SPEED and TRACKING SPEED parameter are set in the drivers. (Slew Speed is a fast speed. Track Speed is a slow speed.)
3. Hold the momentary AZ AXIS CONTROL to the CW or CCW position. Holding the switch at CW results in clockwise motion of the antenna as observed from the **rear** of the antenna. Holding the switch at CCW results in counterclockwise motion of the antenna. When released, the switch automatically returns to the center (off) position.

4. Set the ELEVATION SPEED ADJUST to TRACKING SPEED. The SLEW SPEED and TRACKING SPEED parameter are set in the drives.

5. Hold the momentary EL AXIS CONTROL switch to the UP or DOWN position. Holding the switch at UP results in upward motion of the antenna and holding the switch at DOWN results in downward motion of the antenna. When released, the switch automatically returns to the center (off) position.

6. Hold the momentary POL switch to the CW or CCW position. Holding the switch at CW causes the feed assembly to rotate CW as observed from the **rear** of the antenna and holding the switch at CCW causes the feed assembly to rotate CCW. When released, the switch automatically returns to the center (off) position.

7. Press the RESET Button located on the Relay PCB to clear any faults detected by the motor controllers (inverters).

8. MAINT/REMOTE switch to REMOTE.

3.3 7134 and 7134-AST ACU Standby Mode

In this mode, the display shows a blank status field, followed by the current AZ, POL, and EL angles and any current or latched faults. While in this mode, if a latched fault is shown on the display, press the RST key to clear the fault message, providing the physical fault has been cleared.

The operator cannot move the antenna by using the keypad when the system is in **Standby** mode. In order to change from one active mode to another (for example, **Manual** mode to **Auto**), the system must first be in **Standby** mode and then be placed in the desired mode. To place the system in **Standby** mode, the operator must follow one of these procedures:

1. If in an **Edit** mode menu, the main **Auto** mode menu, or an **Auto** mode target selection menu, press the RST key repeatedly as required to reach **Standby** mode.

2. If in an active **Auto** mode (**Target Track**, **Adaptive Step Track (7134-AST Only)**, or **Program Track**), press the STOP key once to return the system to the **Auto** mode menu. Then press the RST key.

3. Cycling the POWER ON/OFF circuit breaker OFF and ON brings the system up in the **Standby** mode; however, this method is not the best because extra time is required for the self-diagnostic tests. If power is not turned off for more than five seconds, the ACU resumes tracking if it was tracking when power was turned off.

3.4 Manual Operation from the 7134 and 7134-AST ACU

The antenna may be moved manually in low (jog) speed or high speed in the **Manual** mode, or by using the **Manual Track (Jump)** mode. The following paragraphs provide instructions for moving the antenna using each method.

3.4.1 Low Speed Manual Operation from the 7134 and 7134-AST ACU

In **Manual** mode, the display shows the mode status, current antenna position, signal strength or the time (depending upon which of these parameters is enabled and the selected beacon number. The antenna may be moved in a clockwise, counterclockwise, upward, or downward direction. On a 3-axis system, the feed assembly may be moved in a counterclockwise or clockwise position. In this mode, the operator may also adjust the antenna for peak reception.

Follow these steps to drive the antenna manually at low speed.

1. From **Standby** mode (see paragraph 3.3), enter **Manual** mode by pressing the MAN key. The key illuminates and the display shows information similar to the following:

M 141.86 -0.1 44.94 -0.4 B1

2. Press the <AZ key to jog the antenna in a CCW direction.

3. Press the AZ> key to jog the antenna in a CW direction.

4. Press the <EL key to move the antenna elevation downward.

5. Press the EL> key to move the antenna elevation upward.

6. Press the <POL key to jog the feed assembly in a CCW direction (3-axis system only).

7. Press the POL> key to jog the feed assembly in a CW direction (3-axis system only).

8. For peak reception in the **Manual** mode, press <AZ, AZ>, <EL, EL>, <POL, POL> as required to jog the antenna until the display shows the peak signal level obtainable from the received signal.

3.4.2 High Speed Manual Operation from the 7134 and 7134-AST ACU

In this mode, the displays shows the mode status, current antenna position, the analog signal level or the time, and the selected beacon number. The antenna can be moved in a clockwise, counterclockwise, upward, or downward direction.

Follow these steps to drive the antenna manually at high speed.

1. From **Standby** mode (see paragraph 3.3), enter **Manual** mode by pressing the MAN key. The key illuminates and the display shows information similar to the following:

M 141.86 -0.1 44.94 -0.4 B1

2. Press the <AZ key and the SHFT key to move the antenna in a CCW direction.

3. Press the AZ> key and the SHFT key to move the antenna in a CW direction.

4. Press the <EL key and the SHFT key to move the antenna elevation downward.

5. Press the EL> key and the SHFT key to move the antenna elevation upward.

3.4.3 Manual Track (Jump) Mode Operation from 7134/7134-AST ACU

Use this mode for antenna patterns

In this mode, the display shows the mode status, current antenna position, the analog signal level (or the time), and the selected beacon number. The operator may change the AZ, POL, or EL angle and move (jump) the antenna immediately to the new position. Tracking in this mode may be aborted by pressing the STOP key.

NOTE: This paragraph covers only Manual Track (Jump) mode. Paragraph 3.6.7 covers the other items (CHANGE BEACON, 0 dB, and -3 dB) in this menu.

Follow these steps to drive the antenna manually in **Track** (**Jump**) mode.

1. From **Manual** mode, enter **Edit** mode by pressing the EDIT key. The key illuminates and the display shows the following:

<CHANGE BEACON> 0dB -3dB JUMP

2. Use the NEXT key to place the brackets around JUMP and press the ENTR key. The display shows information similar to the following:

MT	150.00	+30.2	35.22	-19.5	B1
	150.00"	+30.2	35.22		

NOTE: The default angles are the same as the current position.

3. A blinking cursor appears next to the azimuth angle, the polarization angle, and then the elevation angle. To change any of the three angle positions, when the blinking cursor is next to the angle to be changed, enter the new angle using the numeric keys and press the ENTR key. To accept the default value, press the ENTR key.

4. Return to the display shown in step 1 by pressing the RST key. Next, press the ENTR key to move the antenna to the position just entered. The display shows TRACKING, and the ACU drives the antenna to the target. To stop tracking, press the STOP key to abort the **Manual Track (Jump)** mode.

3.5 Automatic Operation of the 7134 and 7134-AST ACU

Three automatic submodes of operation **Target Track**, **Program Track**, and **Adaptive Step Track** (7134-AST Only) are available from the 7134 and 7134-AST ACU. Operation of these modes is discussed in the following paragraphs.

3.5.1 Operation of the Target Track Mode

Target Track commands the antenna to slew in high speed to a preprogrammed position. Up to 50 positions may be programmed into the **Target Track** data base.

> ***NOTE: This paragraph references configuration parameters. Paragraph 3.6.2 provides the parameter types, defaults, and instructions on setting the parameters. The reader will find it helpful to scan the information in paragraph 3.6.2 for those parameters referenced in the following paragraphs. Refer to paragraph 3.6.4 for instructions on programming the Target Track data base.***

In **Target Track** mode, the top line of the display shows the mode status mnemonic TT, the current antenna position, signal strength, and selected beacon (or time of day). Fault messages also appear on the first line of the display. The bottom line of the display gives the user a prompt to enter the desired target number. When the target number is entered, the bottom line echoes the selected target number, followed by the target AZ, POL, and EL angles, followed by a prompt to either move to the target (ENTR), call up the next target in the data base (NEXT), or exit the mode (RST).

The second line displays the target number, current antenna position, and the message TRACKING while the antenna is in motion. After the antenna has been positioned at the selected target (within the deadband), the ACU reverts to the previous menu, if the POSITION ACTIVE? parameter is set to NO.

If the POSITION ACTIVE? parameter is set to YES and STEP ACTIVE is set to NO (refer to paragraph 3.6.2), the second line continues to display the selected target number, followed by the associated AZ, POL, and EL angles and the message: HOLDING. In this case, the ACU continues to monitor the position loops and provides corrections for any slight antenna movements.

Adaptive Step Track Available in 71340-AST Only

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If the POSITION ACTIVE? and STEP ACTIVE? parameters are set to YES (refer to paragraph 3.6.2), the ACU checks after the target is reached to see if a tracking signal is present (above the LOW SIGNAL LEVEL) and if so, **Adaptive Step Track** (see paragraph 3.6.6) engages and peaks the antenna for maximum signal strength. In this case, **Adaptive Step Track** remains active, peaking the signal periodically as dictated by the **Adaptive Step Track** configuration settings (see paragraph 3.6.6). If the signal is less than LOW SIG or no signal is received, **Adaptive Step Track** becomes inactive and the system continues in the holding stage.

To operate the 7134-AST ACU in **Target Track** mode, use the following procedures.

1. From **Standby** mode (see paragraph 3.3), enter **Auto** mode by pressing the AUTO key. The AUTO key illuminates and the display shows a message similar to the following:

AUTO TRK: <TARGET> PROGRAM STEP

2. Use the NEXT key to place the brackets around TARGET and press the ENTR key. The display responds with information similar to the following:

TT	141.80	-40.2	44.95	-0.2	B1
01"					

4. Using the numeric keys, enter the desired target number (01 through 50) and press the ENTR key. The display responds with the top line unchanged and the bottom line showing the selected target information and a prompt, similar to that shown below:

TT	141.80	-40.2	44.95	-0.2	B1
04	195.80	+35.6	51.09	ENTR/NEXT/RST	

6. To activate tracking, press the ENTR key. To call up the next target in the data base, press the NEXT key, or to exit the mode, press the RST key. If the ENTR key is pressed, the top line of the display then shows the changes occurring in real time, while the bottom line of the display shows the target coordinates as the antenna moves toward the target, as shown below:

TT	175.74	-17.4	49.76	-0.2	B1
04	195.80	+35.6	51.09	TRACKING	

When the antenna has been positioned to within the deadband in each axis (refer to paragraph 3.6.2), the ACU either reverts to the **Auto TRK** menu (if POSITION ACTIVE is disabled) or actively holds the selected target position (if POSITION ACTIVE is enabled), and the bottom line of the display shows the following:

04	STEP:WAITING (2:34)

If POSITION ACTIVE is enabled and STEP ACTIVE is not enabled, "STEP:WAITING" does not appear on the display. If POSITION ACTIVE is disabled, STEP ACTIVE doesn't show up on the CONFIGURATION menu. If POSITION ACTIVE is enabled, pressing the STOP key reverts the ACU to the **Auto TRK** menu.

3.5.2 Operation of the Program Track Mode

Program Track mode causes the antenna to reposition automatically according to preprogrammed pointing angle and time information.

> **NOTE: Refer to paragraph 3.6.5 for instructions on programming the Program Track data base.**

In **Program Track** mode, the top line of the display shows the mode status mnemonic PT, the current antenna position, time of day (if this parameter is set to be shown), and any fault messages. The bottom line of the display shows the entry number, corresponding AZ, POL, and EL positions, time of occurrence and day of the week for the next item in the **Program Track** sequence, and the track status mnemonic (either TR for track active or WT for waiting to track).

If POSITION ACTIVE is set to 'YES', the bottom line of the display shows the line of data corresponding to the current data base entry (01, for example) rather than the next entry (02), because position (01) is being held by the ACU. When the time comes for positioning to entry (02), the second line changes to reflect entry (02) information, and this information remains on the second line of the display until the following entry (03) is due for activation, and so on.

To operate the 7134 or 7134-AST ACU in **Program Track** mode, use the following procedures.

1. From **Standby** mode (see paragraph 3.3), enter **Auto** mode by pressing the AUTO key. The AUTO key illuminates and the display shows a message similar to the following:

```
AUTO: <TARGET>    PROGRAM    STEP
```

2. Use the NEXT key to place the brackets around PROGRAM.

3. Press the ENTR key. The display responds with information similar to the following:

```
PT      141.80   -40.2     44.95     17:34:18
01      145.04   +38.3     46.32     18:00:00    Thu  WT
```

   When the time comes for tracking to entry 01 (18:00:00 hours on Thursday), the displayed time, day, and the mnemonic WT disappear and are replaced by the message "TRACKING" until the target is reached. When the antenna has been positioned to the angles for entry 01, the bottom line of the display is updated to reflect entry 02 data, unless POSITION ACTIVE is selected, as discussed above.

   With POSITION ACTIVE ON and STEP ACTIVE OFF, the display shows a message similar to the following:

```
PT      141.80        -40.2     44.95     17:34:18
        HOLDING
```

4. Press the SHFT key to see the next target.

5. To exit **Program Track** and revert to the **Auto Trk** menu, press the STOP key. Press the RST key to return to **Standby** mode.

3.5.3 Operation of the Adaptive Step Track Mode (7134-AST Only)

The **Adaptive Step Track** mode utilizes a step tracking algorithm to automatically peak the antenna relative to an analog tracking signal (proportional to signal strength) at periodic intervals.

By moving the antenna one step (5 to 10 percent of receive BW) toward or away from the peak signal, the ACU differentiates the change in power (dB) with respect to the angular motion of the antenna. This data is used with a mathematical model of the signal to determine the location of the peak. The ACU then moves the antenna to this position.

> ***NOTE: Refer to paragraph 3.6.6.1 for instructions on setting the required Adaptive Step Track parameters. Proper setting of these parameters is imperative for Adaptive Step Track operation. The azimuth and elevation low speed adjustments must be set to approximately 0.1 BW/second for proper Adaptive Step Track operation.***

To operate the 7134-AST ACU in **Adaptive Step Track** mode, use the following procedures.

1. From **Standby** mode (see paragraph 3.3), enter **Auto** mode by pressing the AUTO key. The AUTO key illuminates and the display shows a message similar to the following:

```
AUTO TRK:  <TARGET>  PROGRAM  STEP
```

2. Use the NEXT key to place the brackets around STEP.

3. Press the ENTR key. The display responds with information similar to the following:

```
      141.80     -40.2      44.95     -0.1      B1
                            STEP: TRACKING
```

   The AZ and EL jog keys illuminate to reflect the respective axis motion each time the antenna is stepped. When the antenna has been peaked, the display shows information similar to the following:

```
ST    141.83     -40.2      44.90     +0.0      B1
                            STEP: WAITING (15:00)
```

   The time remaining field (in parentheses in the lower right-hand corner of the display) provides a countdown for the next scheduled **Adaptive Step Track** cycle as determined by the configuration parameters.

4. To exit **Adaptive Step Track** and revert to the **Auto** menu, press the STOP key.

3.6 Editing the Configuration of the 7134 and 7134-AST ACS

Each antenna installation is unique and requires custom configuration; therefore, configuring the 7134 and 7134-AST ACS properly is important for efficient antenna positioning. The system Erasable Programmable Read-Only Memory (EPROM) is shipped with values that allow the 7134 and 7134-AST ACU to be operational on initial power-up, but in many cases the user needs to adjust the values for optimum performance. This portion of the manual provides the procedures for editing the configuration, entering offsets, entering data base information, and editing or deleting data stored in memory.

3.6.1 Setting the 24-Hour, 7-Day Clock

Follow these steps to set the 24-hour, 7-day clock.

1. With the system powered up, press the EDIT key. The bottom line of the display shows the following:

```
EDIT:  <TGT>  PGM  STEP  POSITION  CONFIG
```

2. Use the NEXT key to place the brackets around CONFIG. Press the ENTR key. The bottom line of the display shows the following:

```
CONFIGS:  <EDIT>  SET TIME
```

3. Use the NEXT key to place the brackets around SET TIME. Press the ENTR key. The bottom line of the display shows the following:

```
Enter Time (or RST):  00:--:--
```

4. Enter the correct hour of day by pressing the numeric keys. While holding the SHIFT key!

5. After entering the hour, press the ENTR key. The display shows the hour entered.

6. Repeat step 4 to enter the minutes and then the seconds. After keying in each part of the time, press the ENTR key to display the numbers just entered.

7. After the seconds are entered, the display shows the day of the week. If the day is not correct, press the NEXT key until the desired day is shown.

8. Press the ENTR key. The display shows the following:

```
Hit RST to Cancel
Hit ENTR to Set     hh:mm:ss:day
```

9. To cancel the changes and return the display to the CONFIGS menu, press RST.

10. To set the clock with the current data and return the display to the CONFIGS menu, press the ENTR key.

3.6.2 Configuration Parameters

The following paragraphs explain each configuration parameter and provide detailed instructions on setting the configuration parameters. From Home: EDIT, next to <CONFIG>, ENTR, <EDIT>, ENTR, next to <INSTALLATION>, ENTR

3.6.2.1 Configuration Parameters Defaults and Definitions

Table 3-1 lists each configuration parameter, its type, default value, and an explanation of each parameter.

TABLE 3-1 CONFIGURATION PARAMETERS

PARAMETER	TYPE	DEFAULT	EXPLANATION
POL ENABLED?	INSTALLATION	YES	If the default is YES, POL is enabled. If it is NO, POL is not enabled and the display does not show the POL coordinates nor will the display show the POL field for **Target** and **Program Track** data bases during **Edit** mode. During configuration editing, the display does not show POL parameters such as POL REVERSED? if POL is not enabled.
AZIMUTH REVERSED?	INSTALLATION	NO	These change the resolver count sense. If a resolver is wired backwards, the display shows the antenna going opposite to the desired direction, although the antenna is moving correctly. If this occurs, set the appropriate parameter to YES.
POL REVERSED?	INSTALLATION	NO	
EL REVERSED?	INSTALLATION	NO	
AZ LOWER LIMIT	LIMITS	232.0	These set the soft limits for the antenna. They should be set so that the soft limits are inside the limit switch.. settings on the antenna by several tenths of a degree The ACS should stop driving the antenna before it reaches the limit switches If the lower limit is higher than the upper limit, the ACU will not function properly.
AZ UPPER LIMIT	LIMITS	235.0	
EL LOWER LIMIT	LIMITS	45.0	
EL UPPER LIMIT	LIMITS	47.0	
POL LOWER LIMIT	LIMITS	+52.5	
POL UPPER LIMIT	LIMITS	+53.5	
MOTION ERROR PARAMETER	LIMITS	80.0 075?	Each unit of this parameter is 1/40 of a second. If it is set to 8, the time is 1/5 of a second. If this happens and the operator commands the antenna to move, and the antenna has not moved or moves in the wrong direction within 1/5 of a second, the program stops tracking and disables the drive. To disable this parameter, set it to 000.
RUNAWAY ERROR ANGLE	LIMITS	0.10E	If set to 0.10E and the antenna moves this many degrees without program command, the display shows RUNAWAY ERROR. To disable this parameter, set it to 000.
POSITION ACTIVE?	TRACKING	YES	When set to NO, the parameter STEP ACTIVE? is not available, and the program returns to **Standby** after moving to a target in the **Target Track** mode. In the **Program Track** mode, the program waits for the next scheduled time after moving to a target. When set to YES, the parameter STEP ACTIVE? must be set also. If POSITION ACTIVE? is set to YES and STEP ACTIVE? is set to NO, the second line of the display continues to display the selected target number and the message: HOLDING. In this case, the ACU continues to monitor the position loops and provide corrections for any slight antenna movements. In **Program Track** mode, the ACU also continuously monitors the current antenna positions and

TABLE 3-1 CONFIGURATION PARAMETERS			
PARAMETER	**TYPE**	**DEFAULT**	**EXPLANATION**
			corrects it as necessary, but the ACU moves the antenna to the next position at the scheduled time. If STEP ACTIVE? is set to YES, the ACU checks after the target is reached to see if a tracking signal is present (above the LOW SIGNAL LEVEL), and if so, **Adaptive Step Track** (7134-AST Only) engages and peaks the antenna for maximum signal strength. In this case, **Adaptive Step Track** remains active, peaking the signal periodically as dictated by the **Adaptive Step Track** configuration settings.
STEP ACTIVE?	TRACKING	YES	This parameter is only available when POSITION ACTIVE? is set to YES. If STEP ACTIVE? is set to YES, the ACU checks after the target is reached to see if a tracking signal is present (above the LOW SIGNAL LEVEL), and if so, **Adaptive Step Track** (7134-AST Only) engages and peaks the antenna for maximum signal strength. In this case, **Adaptive Step Track** remains active, peaking the signal periodically as dictated by the **Adaptive Step Track** configuration settings. If STEP ACTIVE? is set to NO, the second line of the display shows the selected target number and the message: HOLDING. The ACU continues to monitor the position loops and provide corrections for any slight antenna movement.
AZ COAST ANGLE	TRACKING	2.0E 0.5 1.0?	When tracking a target in **Target Track** or **Program Track**, the antenna moves at high speed until it comes within the coast angle of the target. The program stops the drive, and the antenna coasts to the target position. If the coast angle is set correctly, the antenna stops just before the target position.
EL COAST ANGLE	TRACKING	2.0E 0.5 1.0?	If the coast angles are set too small, the antenna overshoots the target position and must move in the opposite direction to arrive at the target coordinates. If the coast angles are set too large, the antenna stops too soon and moves in slow speed, increasing the time to arrive at the target position.
FAST COAST Time	TRACKING	2.0 SECONDS 1.0?	These reflect the coasting time for the antenna to stop moving after a drive command has been removed
SLOW COAST Time	TRACKING	1.0 SECOND	Both coast times must be long enough for the antenna to come to a complete stop after driving.
INCHING ON TIME	TRACKING	0.2 SECONDS	Inching occurs when slow coast is completed if the antenna is outside the deadband or when correcting the antenna position in POSITION ACTIVE mode. The first parameter indicates the time the motor is on during inching or fine position stepping. Was 1.0!
INCHING OFF TIME	TRACKING	0.5 SECONDS 1.0?	The second parameter indicates the time the motor is off during inching. Inching occurs in **Program Track** or **Target Track** mode after the antenna slews in fast speed to within the deadband of the target and during **Adaptive Step Track** (7134-AST Only) operation.
DEADBAND	TRACKING	0.02E	When the 7134 ACS moves the antenna to a target, the program moves the antenna closer to the position coordinate for each axis until the difference between the actual position and the programmed position is less than the deadband. For example, if the operator sets the target track to 140.00 000.0 50.00 and the deadband is set to 00.02°, the program may stop tracking when the antenna reaches 139.98 000.0 50.02. The deadband setting affects AZ and EL only. The POL deadband is set at 0.1°, and the user cannot change it. Setting of the deadband to less than 0.02° may cause the system to hunt, depending upon uncertainty of the readout system.
SECOND A/D	MISC	NO	The 7134 ACU has two independent A/D channels. Setting this

TABLE 3-1 CONFIGURATION PARAMETERS			
PARAMETER	**TYPE**	**DEFAULT**	**EXPLANATION**
CHANNEL?			parameter to YES causes the 7134 ACU to use channel 2 instead of channel 1. These are intended to be beacon receiver inputs for **Adaptive Step Track** (7134-AST Only). To use this input for other purposes, contact Vertex Communications Corporation.
DISPLAY TIME?	MISC	NO	If this parameter is set to YES, the display shows the current time. Vertex recommends that this parameter be set to NO in **Adaptive Step Track** (7134-AST Only) systems. NOTE: If both DISPLAY TIME? And DISPLAY dB? Are turned off (i.e., both parameters are set to NO), the default reading on the front panel display will be the direct input voltage for the selected A/D channel.
DISPLAY dB?	MISC	YES	If this parameter is set to YES, the display shows the dB level of the tracking signal instead of the time. NOTE: If both DISPLAY TIME? And DISPLAY dB? Are turned off (i.e., both parameters are set to NO), the default reading on the front panel display will be the direct input voltage for the selected A/D channel.

3.6.2.2 Setting Configuration Parameters

To change any of the default configuration parameters listed in Table 3-1, use the following procedures. At any time during the setting of the parameters, pressing the RST key will step the program back one step at time.

Record each change made to a parameter in the appropriate table (Tables 3-2 through 3-5) for the parameter type (e.g., INSTALLATION, LIMITS, TRACKING, MISC). These tables can be used as a reference if the values in RAM are lost because of operator error, power system problems, or loss of battery backup.

3.6.2.2.1 Setting Installation Configuration Parameters

1. On the 7134 and 7134-AST ACU control panel, press the EDIT key. The bottom line of the display shows the following:

```
EDIT:  <TGT>  PGM  STEP  POSITION  CONFIG
```

2. Use the NEXT key to place the brackets around CONFIG and press the ENTR key. The display shows the following:

```
CONFIGS:  <EDIT>  SET TIME
```

3. Press the ENTR key. The display shows the following configuration parameter types:

```
<INSTALLATION>  LIMITS  TRACKING  MISC
```

4. Use the NEXT key to place the brackets around INSTALLATION and press the ENTR key. The display shows the first INSTALLATION parameter:

POL ENABLED?: Yes (No)

5. If the desired parameter value is displayed, press the ENTR key to view the next parameter.

6. To change the parameter value, press the EDIT key to answer "YES" or press the AUTO key to answer "NO".

7. Record the new setting in Table 3-2. Press the ENTR key to store the data in memory and to view the next INSTALLATION parameter.

TABLE 3-2 CHANGES TO INSTALLATION PARAMETERS

PARAMETER	DEFAULT	NEW SETTING
POL ENABLED?	YES	
AZIMUTH REVERSED?	NO	
POL REVERSED?	NO	
ELEVATION REVERSED?	NO	

8. Repeat steps 5, 6, and 7 to view and edit the remainder of the INSTALLATION parameters.

9. If while viewing the parameters changes were made, the prompt KEEP THESE CHANGES? appears on the display. To answer "YES", press the EDIT key. To cancel the changes, press the AUTO key. Whether or not changes were made, the display returns to the CONFIGS menu.

3.6.2.2.2 Setting Limits Configuration Parameters

1. Use the NEXT key to place the brackets around LIMITS and press the ENTR key. The display shows the first LIMITS parameter:

AZ LOWER LIMIT 125.00 DEGREES

2. If the desired parameter value is displayed, press the ENTR key to view the next LIMITS parameter.

3. To change the parameter value, enter the desired limit using the numeric keys.

4. Record the new setting in Table 3-3. Press the ENTR key to store the data in memory and to view the next LIMITS parameter.

TABLE 3-3 CHANGES TO LIMITS PARAMETERS		
PARAMETER	DEFAULT	NEW SETTING
AZ LOWER LIMIT	120.0°	129.0
AZ UPPER LIMIT	230.0°	220.0
EL LOWER LIMIT	15.0°	8.50
EL UPPER LIMIT	60.0°	63.0
POL LOWER LIMIT	-95.0°	-77
POL UPPER LIMIT	+95.0°	+99
MOTION ERROR PARAM	80.0	080
RUNAWAY ERROR ANGLE	0.10°	0.10

5. Repeat steps 2, 3, and 4 to view and edit the remainder of the LIMITS parameters.

6. If while viewing the parameters changes were made, the prompt KEEP THESE CHANGES? appears on the display. To answer "Yes," press the EDIT key. To cancel the changes, press the AUTO key. Whether or not changes were made, the display returns to the CONFIGS menu.

3.6.2.2.3 Setting Tracking Configuration Parameters

1. Use the NEXT key to place the brackets around TRACKING and press the ENTR key. The display shows the first TRACKING parameter:

POSITION ACTIVE? YES

2. If the desired parameter value is displayed, press the ENTR key to view the next TRACKING parameter.

3. To change a parameter with values of "YES" or "NO", press the EDIT key to answer "YES" or press the AUTO key to answer "NO". To change a parameter with a numeric value, enter the new value by using the numeric keys.

4. Record the new setting in Table 3-4. Press the ENTR key to store the data in memory and to view the next TRACKING parameter.

TABLE 3-4 CHANGES TO TRACKING PARAMETERS		
PARAMETER	ROM DEFAULT	NEW SETTING
POSITION ACTIVE?	YES	Yes
STEP ACTIVE?	YES	Yes
AZ COAST ANGLE	02.0 DEGREES	0.5
EL COAST ANGLE	02.0 DEGREES	0.5
FAST COAST TIME	03.0 SECONDS	2.0
SLOW COAST TIME	01.0 SECONDS	1.0
INCHING ON TIME	00.2 SECONDS	0.2
INCHING OFF TIME	00.5 SECONDS	0.5
DEADBAND	00.01 DEGREES	0.01

5. Repeat steps 2, 3, and 4 to view and edit the remainder of the TRACKING parameters.

6. If while viewing the parameters changes were made, the prompt KEEP THESE CHANGES? appears on the display. To answer "Yes," press the EDIT key. To cancel the changes, press the AUTO key. Whether or not changes were made, the display returns to the CONFIGS menu.

3.6.2.2.4 Setting Miscellaneous Configuration Parameters

1. Use the NEXT key to place the brackets around MISC and press the ENTR key. The display shows the first MISC parameter:

SECOND A/D CHANNEL? Yes (No)

2. If the desired parameter value is displayed, press the ENTR key to view the next MISC parameter.

3. To change the parameter value, press the EDIT key to answer "YES" or press the AUTO key to answer "NO".

4. Record the new setting in Table 3-5. Press the ENTR key to store the data in memory and to view the next MISC parameter.

TABLE 3-5 CHANGES TO MISCELLANEOUS PARAMETERS

PARAMETER	ROM DEFAULT	CHANGES
SECOND A/D CHANNEL?	NO	
DISPLAY TIME?	NO	
DISPLAY dB?	YES	

5. Repeat steps 2, 3, and 4 to view and edit the remainder of the MISC parameters.

6. If while viewing the parameters changes were made, the prompt KEEP THESE CHANGES? appears on the display. To answer "Yes," press the EDIT key. To cancel the changes, press the AUTO key. Whether or not changes were made, the display returns to the CONFIGS menu.

3.6.3 Entering Resolver Offsets

After installing the resolvers, the display position readouts may need to be adjusted to indicate true angle position. Use the following procedures to adjust the display position readouts.

NOTE: Before starting the following procedures, refer to Section 2.0 of this manual to be sure that the resolvers are counting in the correct direction.

3.6.3.1 Viewing the Offsets

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around POSITION.
3. Press the ENTR key. The display shows the following:

<SET POSITION> SET OFFSETS DSP OFFSETS

4. Use the NEXT key to place the brackets around DSP OFFSETS.
5. Press the ENTR key and view the offsets.
6. Press the ENTR key to return to the previous menu.

3.6.3.2 Setting the Position

During the following procedures, the changes may be aborted by pressing the RST key at any time until the ENTR key is pressed in the last step.

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around POSITION.
3. Press the ENTR key. The display shows the following:

<SET POSITION> SET OFFSETS DSP OFFSETS

4. Use the NEXT key to place the brackets around SET POSITION.
5. Press the ENTR key. The display shows the following:

EO	139.99	+35.9	41.00	-20.00	B1
	139.99	+35.9	41.00		

6. Using the numeric keys, enter the desired azimuth coordinate.
7. Press the ENTR key to enter the azimuth coordinate into RAM.
8. Enter the desired polarization coordinate by using the +/- key and the numeric keys.
9. Press the ENTR key to enter the polarization coordinate into RAM.

10. Using the numeric keys, enter the desired elevation coordinate.

11. Press the ENTR key to enter the elevation coordinate into RAM. If an error occurs, a message will appear in the upper right-hand corner of the screen along with the prompt "KEEP THESE CHANGES? (Y/N)". To answer "Yes," press the EDIT key. To cancel the changes, press the AUTO key.

12. Press the ENTR key to return to the previous menu.

3.6.3.3 Setting the Offsets

During the following procedures, the changes may be aborted by pressing the RST key at any time until the ENTR key is pressed in the last step.

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around POSITION.

3. Press the ENTR key. The display shows the following:

<SET POSITION> SET OFFSETS DSP OFFSETS

4. Use the NEXT key to place the brackets around SET OFFSETS and press ENTR. The display shows the following:

140.00	+35.9	41.00	-20.00	B1
6.38"	+118.7	139.27		

5. Using the numeric keys, enter the desired azimuth offset angle, which must be entered as a positive number. For example, if the data from the resolvers indicates that the angle is 155.63 degrees and the actual angle is 155.55 degrees, enter the offset angle of 359.92. 360 -(155.63 -155.55) = 359.92
Resolver - Actual

   NOTE: Values over 360 degrees should be figured as follows: 360 - (155.45 -155.55) = 360 - (-.10) = 360.10 degrees. Enter the offset value of the number of degrees over 360. In this example, the value is 000.10 degrees.

6. Press the ENTR key to enter the azimuth offset into RAM.

   NOTE: The polarization offset angle may be entered as a positive or negative number within the range of -180.0 to +179.9.

7. Enter the desired polarization offset by using the +/- key and the numeric keys.

8. Press the ENTR key to enter the polarization offset into RAM.

9. Using the numeric keys, enter the desired elevation offset.

10. Press the ENTR key to enter the elevation offset into RAM. KEEP THESE CHANGES?(Y/N) appears on the display. To answer "Yes," press the EDIT key. To cancel the changes, press the AUTO key.

3.6.4 Editing the Target Track (TGT) Data Base

This function allows quick access to up to 50 satellite positions by editing the **Target Track** data table.

3.6.4.1 ADD/EDIT the Target Track Data Base

To change the contents of the target data base, use the following procedures.

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around TGT and press the ENTR key. The display shows the following:

TARGETS: <ADD/EDIT> VIEW DEL CLR ALL

3. Use the NEXT key to place the brackets around ADD/EDIT and press the ENTR key. The display shows the following:

01±

4. Enter the target number (01 to 50) by using the numeric keys.

5. Press the ENTR key. If the satellite number contains previously entered coordinates, they are displayed. To keep the coordinates, press the ENTR key. To change the coordinates, use the numeric keys to enter new values.

   SPECIAL FEATURE: To place the current axis positions into an empty target number, press the ENTR key. Defaults for an empty record are the current antenna position and system beacon. Press the ENTR key at each position to accept defaults.

6. Press the ENTR key to place the azimuth value into memory and to initialize the polarization entry.

7. Enter the polarization coordinate by using the +/- key and the numeric keys.

8. Press the ENTR key to place the polarization value into memory and to initialize the elevation entry.

9. Enter the elevation coordinate by using the numeric keys.

10. Press the ENTR key to place the elevation value into memory and validate the three target angles.

After El angle entry, use the NEXT key to select B2 for STEP-TRACK after acquisition.

11. To enter another satellite position, follow steps 4 through 10, or press the RST key and the display returns to the TARGETS menu.

3.6.4.2 VIEW the Target Track Data Base

To view the contents of the data base, use the following procedures.

1. Press the EDIT key. The display shows the following:

```
EDIT:  <TGT>  PGM  STEP  POSITION  CONFIG
```

2. Use the NEXT key to place the brackets around TGT and press the ENTR key. The display shows the following:

```
TARGETS:  <ADD/EDIT>  VIEW  DEL  CLR ALL
```

3. Use the NEXT key to place the brackets around VIEW.

4. Press the ENTR key. The display shows satellite number 1 with its azimuth, polarization, and elevation coordinates and beacon number.

5. Press the NEXT key to step through all target entries. Hold down the SHFT key and press the NEXT key to step through the target entries five at a time.

6. Press the RST key to return to the TARGETS menu.

3.6.4.3 DEL (Delete) Items of the Target Track Data Base

To delete portions of the data base, use the following procedures.

1. Press the EDIT key. The display shows the following:

```
EDIT:  <TGT>  PGM  STEP  POSITION  CONFIG
```

2. Use the NEXT key to place the brackets around TGT and press the ENTR key. The display shows the following:

```
TARGETS:  <ADD/EDIT>  VIEW  DEL  CLR ALL
```

3. Use the NEXT key to place the brackets around DEL.

4. Press the ENTR KEY to initialize the delete function.

5. Enter the satellite number to be deleted.

6. Press the ENTR key. The display shows the following:

02 221.09 -1.5 43.60 DELETE?(Y/N)

7. To delete that position, answer "YES" by pressing the EDIT key. To abort the deletion, answer "NO" by pressing the AUTO key.

8. Press the RST key to exit the target menu. The display shows, KEEP THESE CHANGES?

9. To enter the changes into RAM, press the EDIT key. To abort all changes and retain the original data, press the AUTO key.

3.6.4.4 CLR ALL (Clear All) Items from the Target Track Data Base

To clear the **Target Track** data base, use the following procedures.

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around TGT and press the ENTR key. The display shows the following:

TARGETS: <ADD/EDIT> VIEW DEL CLR ALL

3. Use the NEXT key to place the brackets around CLR ALL.

4. Press the ENTR key. The display shows ERASE ENTIRE DATABASE?(Y/N). To erase the entire data base, press the EDIT key, or press the AUTO key and the 7134-AST ACU then returns to the TARGETS menu.

5. Press the RST key. The display shows KEEP THESE CHANGES? (Y/N).

6. To clear the data table, press the EDIT key. To abort the change, press the AUTO key. The 7134-AST returns to the TARGETS menu.

3.6.5 Editing the Program Track (PGM) Data Base

This function allows the operator to program up to 99 satellite positions into the **Program Track** data base, providing automatic repositioning of the antenna at the time indicated.

3.6.5.1 VIEW the Program Track Data Base

To view the contents of the data base, use the following procedures.

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around PGM.

3. Press the ENTR key to initialize the **Program Track** data/time base **Edit** mode function. The display shows the following:

PGM: ADD EDIT <VIEW> DEL CLR ALL

4. Press the ENTR key to select VIEW. If the data base contains no stored values, the display shows DATABASE EMPTY. If the data base contains stored values, the display indicates location number 1 and its coordinates, time, date, and beacon number.

5. Press the NEXT key to step through the location numbers and view the contents.

6. To advance five entries at a time, hold down the SHFT key and press the NEXT key.

7. Press the RST key to exit VIEW. The 7134-AST ACU returns to the PGM menu.

3.6.5.2 ADD to the Program Track Data Base

To add satellite locations to the existing data base, use the following procedures.

NOTE: If a coordinate or number that is out of range is entered, the display shows "CHECKING TARGETS XXX OUTSIDE SOFT LM" when Program Track is run.

"04 aaa.aa OUTSIDE SOFT LM" indicates that the AZ value for the target is outside the soft limits and that the POL and EL values are inside the soft limits.

If a time that is already used on another entry is entered, the display shows "DUPLICATE TIME" and ignores the entry.

24:00:00 must be entered as 00:00:00.

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around PGM.

3. Press the ENTR key to initialize the **Program Track** data/time base **Edit** mode function. The display shows the following:

PGM: <ADD> EDIT VIEW DEL CLR ALL

4. Use the NEXT key to place the brackets around ADD.

5. Press the ENTR key. The display shows the following:

EP	139.99	+35.9	41.00	21:34:18	
	139.99±	+35.9	41.00	00:00:00	Sun B1

6. To add the current position to the data base, press the ENTR key at each of the cursor's stops. To add a new position to the data base, use the numeric keys to enter the AZ coordinate.

7. After entering the AZ, press the ENTR key. The display shows the AZ entered.

8. Repeat steps 6 and 7 to enter POL, EL, and time.

9. Repeat steps 6 and 7 to enter day and beacon. Press the NEXT key to step through the days and beacon selections.

10. Press the ENTR key. The display momentarily shows where the record was inserted in the data base and returns to the PGM menu.

11. To add another satellite location, move the cursor to ADD and repeat steps 5 through 10. To exit the **Program Track** data base menu, press the RST key.

12. When all desired data has been entered, press the RST key. The display shows KEEP THESE CHANGES? (Y/N).

13. To keep the changes, press the EDIT key to answer "YES". To abort the changes, press the AUTO key to answer "NO". The 7134-AST ACU returns to the **Edit** mode.

3.6.5.3 EDIT the Program Track Data Base

NOTE: An empty data base cannot be edited. If the data base is empty, the display will show: "DISPLAY: DATABASE EMPTY."

To edit a specific entry in the time base, use the following procedures.

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around PGM.

3. Press the ENTR key to initialize the **Program Track** data/time base **Edit** mode function. The display shows the following:

PGM: <ADD> EDIT VIEW DEL CLR ALL

4. Use the NEXT key to place the brackets around EDIT.

5. Press the ENTR key. The display shows the following:

01"

6. Press the number of the item to be edited.

7. Press the ENTR key. The display shows the full line with a flashing cursor next to the AZ coordinate.

8. To keep the current data in the data base, press the ENTR key at each of the cursor's stops. To add a new position to the data base, use the numeric keys to enter the AZ coordinate.

9. After entering the AZ, press the ENTR key. The display shows the AZ entered.

10. Repeat steps 8 and 9 to enter POL, EL, and time.

11. Repeat steps 8 and 9 to enter day and beacon. Press the NEXT key to step through the days and beacon selections.

12. Press the ENTR key. The display returns to the PGM menu.

3.6.5.4 CLR ALL (Clear All) Program Track Data Base

To erase the **Program Track** data base, use the following procedures.

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around PGM.

3. Press the ENTR key to initialize the **Program Track** data/time base **Edit** mode function. The display shows the following:

PGM: ADD EDIT VIEW DEL <CLR ALL>

4. Use the NEXT key to place the brackets around CLR ALL.

5. Press the ENTR key. The display shows the following:

ERASE ENTIRE DATA BASE?(Y/N)

6. To clear the data base, press the EDIT key to answer "YES". To abort the change, press the AUTO key to answer "NO". The 7134-AST ACU returns to the PGM menu.

7. Press the RST key. If "NO" was answered in step 6, the ACU returns to the PGM menu. If "YES" was answered in step 6, the display shows KEEP THESE CHANGES? (Y/N).

8. Press the EDIT key to answer "YES". Press the AUTO key to answer "NO".

3.6.5.5 DEL (Delete) an Item from the Program Track Data Base

To remove a target position from the data base, use the following procedures.

1. Press the EDIT key. The display shows the following:

EDIT: <TGT> PGM STEP POSITION CONFIG

2. Use the NEXT key to place the brackets around PGM.

3. Press the ENTR key to initialize the **Program Track** data/time base **Edit** mode function. The display shows the following:

PGM: ADD EDIT VIEW <DEL> CLR ALL

4. Use the NEXT key to place the brackets around DEL.

5. Press the ENTR key. The display shows the following:

01

6. Enter the number of the item to be deleted. The display shows the information for that number.

7. Press the ENTR key. The display shows the item and "Delete?(Y/N)".

8. To delete this item, press the EDIT key to answer "YES" or press the AUTO key to answer "NO".

9. The 7134-AST ACU returns to the **Program Track** data base menu. Press the RST key to exit the menu. The display shows, "KEEP THESE CHANGES? (Y/N)".

10. To keep the changes, press the EDIT key to answer "YES". To abort all changes and deletions, press the AUTO key to answer "NO".

3.6.6 Adaptive Step Track Configuration Parameters (7134-AST Only)

Table 3-6 lists each **Adaptive Step Track** configuration parameter, its default value, and an explanation of each parameter.

From Home: EDIT, next to <STEP>, ENTR

TABLE 3-6 ADAPTIVE STEP TRACK PARAMETERS

PARAMETER	DEFAULT	EXPLANATION
CYCLE TIME (0 = OFF)	15 180? MINUTES	This is the time, in minutes, between the beginning of one **Adaptive Step Track** cycle and the beginning of the next cycle. If this parameter is set to 0 when **Adaptive Step Track** is initiated, the 7134-AST will do one **Adaptive Step Track** cycle to peak up on the satellite and return to the previous menu.
LOW SIGNAL LEVEL	5dB dB	When the tracking signal falls below this value, the ACS suspends **Adaptive Step Track** and waits for the signal to rise above this level before continuing. This was 10dB
TRACK	00.00 dB	While the ACU is waiting for the cycle time to expire (to begin a new **Adaptive Step**

TABLE 3-6 ADAPTIVE STEP TRACK PARAMETERS

PARAMETER	DEFAULT	EXPLANATION
THRESHOLD	0.5dB 3dB	**Track** cycle), if the signal falls by this many dB below the most recently acquired peak, it will do an **Adaptive Step Track** cycle immediately. If the track threshold is set to 0.00, it will only do **Adaptive Step Track** cycles at intervals given by CYCLE TIME. If CYCLE TIME = 0, step tracking occurs when the signal drops below the track threshold.
PEAK ANGLE DEADBAND	00.03° 00.02	**Adaptive Step Track** moves the antenna closer to the peak signal until the difference between the actual position and the peak position is less than the deadband. As in system configuration parameters, this deadband setting affects AZ and EL only. When the antenna moves to within this deadband of the peak signal, **Adaptive Step Track** stops for that cycle. Assure that the STEP SIZE (set below) is > the Peak Angle Deadband!
MAX # ATTEMPTS	6 2?	This parameter limits the number of AZ and EL attempts the **Adaptive Step Track** algorithm makes in finding the peak signal.
STEP SIZE 6.1M = .28 deg BW	00.06° 0.03 (min)	This parameter sets the size of each step that the antenna makes as the **Adaptive Step Track** algorithm approximates a curve and samples points long that curve. The value should be set to approximately 8 percent of the -3 dB receive BW of the given antenna.
# SAMPLES	5 6?	This parameter sets the number of samples taken from the tracking signal input before and after each step. This number of measurements is then averaged.
PEAK AZ FIRST?	YES	Set to YES if the required motion for following the satellite is more AZ than EL. Otherwise, set this parameter to NO.
OVERSHOOT LIMIT	00.10 dB .25?	If moving toward the peak and the current signal level decreases by the value of the overshoot limit, the antenna stops moving, the system declares an overshoot, and another attempt is made.
DISPLAY OVERSHOOT ?	NO Yes	If set to YES, this parameter informs the operator when the antenna moves past the peak signal during an **Adaptive Step Track** peaking operation. This option can be used to fine-tune **Adaptive Step Track**. On a clear day, occasionally an overshoot will occur during **Adaptive Step Track** operations. If an overshoot occurs on each **Adaptive Step Track** operation, the -3 dB BW value should be decreased by 0.01E. If an overshoot never occurs or if the signal can be manually improved after **Adaptive Step Track** operations are complete, the -3 dB value should be increased by 0.01°. No adjustments should be made with a noisy signal that occurs, for example, during inclement weather.
-3dB BEAMWIDTH	00.82° .26 deg	This parameter is constant for a given antenna. The **Adaptive Step Track** algorithm uses the -3 dB receive BW to calculate power as a function of boresight deflection angle. Note that this WAS 00.45 !
BOX LIMIT	02.00°	If the **Adaptive Step Track** algorithm moves the antenna in one direction more than the value given by BOX LIMIT, a BOX ERR (box error) message is displayed in the message region, and **Adaptive Step Track** terminates. **Adaptive Step Track** will not function again until RST is pressed in **Standby** mode to clear the error. If the ACU is in STEP ACTIVE with **Target** or **Program Track** and a box error occurs, it returns to POSITION ACTIVE mode (maintains the antenna within the position deadbands of the current target). If **Adaptive Step Track** moved the antenna out of the deadband and then fails because of a box error, POSITION ACTIVE returns the antenna to the programmed position to which **Target Track** or **Program Track** moved before **Adaptive Step Track** began. Was 1.00
AUTO SELECT BEACON?	NO	When set to YES, if the signal drops below tracking level in **Adaptive Step Track** mode, the system searches among the four system beacons, attempting to find a signal strong enough to which to track. If more than one beacon is found to be greater than the low signal threshold, the ACU selects the one with greatest signal strength.

3.6.6.1 Editing the Adaptive Step Track Configurations (7134-AST Only)

1. Press the EDIT key. The display shows:

```
EDIT:  <TGT>  PGM  STEP  POSITION  CONFIG
```

2. Use the NEXT key to place the brackets around STEP. Press the ENTR key. The display shows the first of the **Adaptive Step Track** parameters, followed by a flashing cursor.

3. To change the value displayed, enter the new value using the numeric keys and press ENTR, or press the EDIT key to answer "YES" or the AUTO key to answer "NO". To accept the displayed value, press the ENTR key and the next parameter is displayed.

4. Repeat step 3 until all parameters have been displayed.

5. After the last parameter has been displayed and if any parameters were changed, "KEEP THESE CHANGES? (Y/N)" appears. To keep the changes, press the EDIT key to answer "YES" or the AUTO key to answer "NO". The system returns to the EDIT menu.

3.6.7 Setting the 0 dB and the -3 dB Levels

The 0 dB and -3 dB options are used to calibrate the 7134-AST ACU with respect to the tracking signal used for **Adaptive Step Track**.

For **Adaptive Step Track**, the 7134-AST assumes that the A/D input is supplied with a voltage that is proportional to signal strength in dB. By setting the 0 and -3 dB points, the 7134-AST can then compute the V/dB scale needed to decode the A/D input for **Adaptive Step Track**.

As many as four independent tracking signal sources may be selected by changing the current beacon. Each beacon has its own V/dB scale, and the 0 and -3 dB points for each must be set separately. If there is only one tracking signal source, use beacon 1 for everything for consistency.

NOTE: Although there may be four independent tracking signal sources, there is only one A/D input available for this purpose; the switching between tracking signal sources to this input is external to the 7134-AST ACU. Although the ACU has two independent A/D inputs, the current A/D input is not changed when the current beacon is changed.

The Model 7200 declares a 6-8VDC Beacon PEAK level range.
Ref. Table 5-6, pg 5-24

Also, a 7.5-8.5VDC range.
Ref. pg G-10.

By default, each beacon has the 0 dB point set at 10 VDC with a slope of 0.7 V/dB. In most cases, the 0 dB and -3 dB levels must be set to reflect actual conditions.

The differences in voltages supplied to the A/D corresponding to the 0 and -3 dB points must fall within a certain range. If they are too close together or too far apart, the display shows the error message OUT OF RANGE on the bottom line and does not make a change to the -3 dB point. The allowable range of tracking signal slopes is 0.2 to 1.0 V/dB.

NOTE: The DISPLAY ANALOG VALUE parameter in the configuration table must be set to "YES".

1. To change the beacon, select **Manual** mode and press the EDIT key to enter **Edit** mode. The key illuminates and the display shows the following:

```
M  141.86  -0.1   44.94  -0.4  B1
        <CHANGE BEACON>   0 dB   -3 dB  JUMP
```

2. Press the NEXT key to place the brackets around CHANGE BEACON and press the ENTR key until the desired beacon number shows on the display.

3. To set 0 dB, return to **Manual** mode by pressing the RST key and manually peak the antenna on a satellite. Press the EDIT key to reenter **Edit** mode. Press the NEXT key to place the brackets around 0 dB and press the ENTR key. The display shows the following:

```
KEEP THESE CHANGES? (Y/N)
```

4. To set the current input level to 0 dB, press the EDIT key to answer "YES". To abort the change, press the AUTO key to answer "NO".

5. To set -3 dB, first, follow the procedures in steps 3 and 4 to set the 0 dB. Then, either move the antenna off the peak so that the signal strength is 3 dB down from the peak signal, or place a 3 dB attenuator in-line with the line supplying signal to the RF tracking receiver. Use the cxr peak as a -3dB ref.

6. Press the EDIT key to reenter the **Edit** mode. Press the NEXT key to place the brackets around -3 dB and press the ENTR key. The display shows the following:

```
KEEP THESE CHANGES? (Y/N)
```

7. To set the current input level to -3 dB, press the EDIT key to answer "YES". To abort the change, press the AUTO key to answer "NO".

8. Press the RST key to return to **Manual** mode.

3.7 7134 and 7134-AST ACU Fault Status Reporting

The 7134 and 7134-AST ACU constantly monitors a number of system status items and provides fault detection and certain safety reactions to faults. Table 3-7 lists each fault and the condition(s) that triggers the fault.

TABLE 3-7 7134 and 7134-AST FAULTS

MESSAGE	CONDITION
RAM CORRUPTED HIT [ENTER]	One or more parameter tables failed power-up test and was loaded with default values. Tables that pass the test are not affected.
WARNING: CLOCK STOPPED HIT [ENTER]	Clock is not running and is malfunctioning. Contents of RAM have not been corrupted. The clock must be reset, and the user must press the ENTR key to continue.
WARNING: CLOCK IS DEAD HIT [ENTER]	Clock has stopped and cannot be restarted. The clock chip is not working and must be replaced.
NO POWR	Drive cabinet has no power.
SUM LIM	An electrical axis limit has tripped.
EM STOP	EMERGENCY STOP switch is pushed in.
AZ FLT	AZ inverter is tripped or has lost power.
EL FLT	EL inverter is tripped or has lost power.
MAINT	MODE switch on the drive cabinet is set to MAINT OVERRIDE.
SOFT LM	Antenna is moved past one of the positions set as a limit in the software.
LOW SIG	Signal is below the threshold necessary for **Adaptive Step Track (7134-AST Only)**.
AZ ERR/EL ERR POL ERR	AZ, EL, or POL readout system fails. Four system conditions cause these errors: (1) ACU commands the antenna to move and detects no movement feedback from the resolvers; (2) ACU detects movement feedback from the resolvers and has not commanded antenna movement; (3) resolver provides a noisy feedback to the ACU; or (4) ACU detects movement feedback from the resolvers, but the movement is the reverse of the commanded movement.
BOX ERR	During **Adaptive Step Track(7134-AST Only) t**he antenna jogs beyond the limit set by the box limit in the **Adaptive Step Track** configurations.

3.8 Drive Cabinet Motor Controller (Inverters) Fault Status Reporting

The inverters in the drive cabinet monitor status related to the motors and the inverters and provide fault detection with a display message on the inverter control panel. See the NTAC2000 Manual, Section 9 for a listing of the fault messages.

4.0 SITE ACCEPTANCE TEST PROCEDURE

4.1 Preliminary Information

This test procedure is intended to serve as the final proof of performance document for the 7134 and 7134-AST ACS, subsequent to field installation and setup. (This procedure is provided for both 2- and 3-axis systems. Ignore all references to the POL axis drive components for 2-axis systems.) Prior to the performance of these tests, the system must have been installed and adjusted as provided in Section 2.0 of this manual. All motor rotation directions should be normalized, all limit stops should be set, and the radio frequency (RF) equipment used to provide the analog tracking signal should be calibrated for proper system performance.

4.2 Drive Cabinet Line Voltage Measurements and Power-Up

Follow these steps to measure the line voltage and power up the drive cabinet.

1. Using an AC voltmeter, with the main circuit breaker OFF, measure and record the voltages on the line (upper) side of the main breaker as indicated below (record data under the appropriate heading for the main power provided for this system):

3-PHASE SYSTEMS (4-WIRE + GROUND)	
A phase to B phase	VAC
B phase to C phase	VAC
C phase to A phase	VAC
A phase to Neutral	VAC
B phase to Neutral	VAC
C phase to Neutral	VAC

SINGLE-PHASE SYSTEMS (3-WIRE 2-WIRE + GROUND)	
L1 to L2	VAC
L1 to Neutral	VAC
L2 to Neutral	VAC

SINGLE-PHASE SYSTEMS (2-WIRE + GROUND)	
Line to Neutral	VAC

2. On the drive cabinet swing-out panel, set the DRIVE CIRCUIT BREAKER to ON. _____(Check)

3. Verify that the EMERGENCY STOP button is in the out position. _____(Check)

4. Set the CONTROL POWER circuit breaker on the swing-out panel to the ON position and verify that the green LED in the center of the circuit breaker illuminates. _____(Check)

5. Verify that the MODE switch is in the MAINT OVERRIDE position. _____(Check)

4.3 Motor Phasing Tests

1. Set the AZIMUTH and ELEVATION SPEED ADJUST select switches to LOW SPEED. _____(Check)

2. Jog AZ briefly CW and then CCW, checking to see that the resulting motion corresponds to the respective switch commands. _____(Check)

3. Jog EL briefly up and then down, checking to see that the resulting motion corresponds to the respective switch commands. _____(Check)

4. Jog POL briefly CW and then CCW, checking to see that the resulting motion corresponds to the respective switch commands. _____(Check)

4.4 Limit Switch Tests

The following steps check the function and setting of the electrical limit switches on the antenna structure. Drive the antenna from the drive cabinet, which allows high speed jogging while also providing viewing access for any possible obstructions.

1. a. Drive the antenna using the JOG AZ CW switch until the limit switch stops the movement of the antenna. _____(Check)
   b. Check the 7134 or 7134-AST ACU display for a SUM LIMIT message. _____(Check)
   c. Record the AZ angle at which the limit occurred. _____(Record)
   d. Verify that the antenna will drive in the CCW direction. _____(Check)

2. a. Drive the antenna using the JOG AZ CCW switch until the limit switch stops the movement of the antenna. _____(Check)
   b. Check the 7134 or 7134-AST ACU display for a SUM LIMIT message. _____(Check)
   c. Record the AZ angle at which the limit occurred. _____(Record)
   d. Verify that the antenna will drive in the CW direction. _____(Check)

3. a. Drive the antenna using the JOG EL UP switch until the limit switch stops the movement of the antenna. _____(Check)

   b. Check the 7134 or 7134-AST ACU display for a SUM LIMIT message. _____(Check)

   c. Record the EL angle at which the limit occurred. _____(Record)

   d. Verify that the antenna will drive in the DOWN direction. _____(Check)

4. a. Drive the antenna using the JOG EL DOWN switch until the limit switch stops the movement of the antenna. _____(Check)

   b. Check the 7134 or 7134-AST ACU display for a SUM LIMIT message. _____(Check)

   c. Record the EL angle at which the limit occurred. _____(Record)

   d. Verify that the antenna will drive in the UP direction. _____(Check)

5. a. Drive the antenna using the JOG POL CW switch until the limit switch stops the movement of the antenna. _____(Check)

   b. Check the 7134 or 7134-AST ACU display for a SUM LIMIT message. _____(Check)

   c. Record the POL angle at which the limit occurred. _____(Record)

   d. Verify that the feed will drive in the CCW direction. _____(Check)

6. a. Drive the antenna using the JOG POL CCW switch until the limit switch stops the movement of the antenna. _____(Check)

   b. Check the 7134 or 7134-AST ACU display for a SUM LIMIT message. _____(Check)

   c. Record the POL angle at which the limit occurred. _____(Record)

   d. Verify that the feed will drive in the CW direction. _____(Check)

4.5 Drive Cabinet Inverter Parameters NTAC 2000

NTAC-2000 AC drives are supplied with a Digital Operator Interface (DOI) attached to the front of the drive. The DOI can be used to operate the drive, change program parameters and to display drive operating conditions. Figure 4-5 below for DOI layout and component identification. See the NTAC 2000 Drive instruction manual for detailed descriptions of these operators.

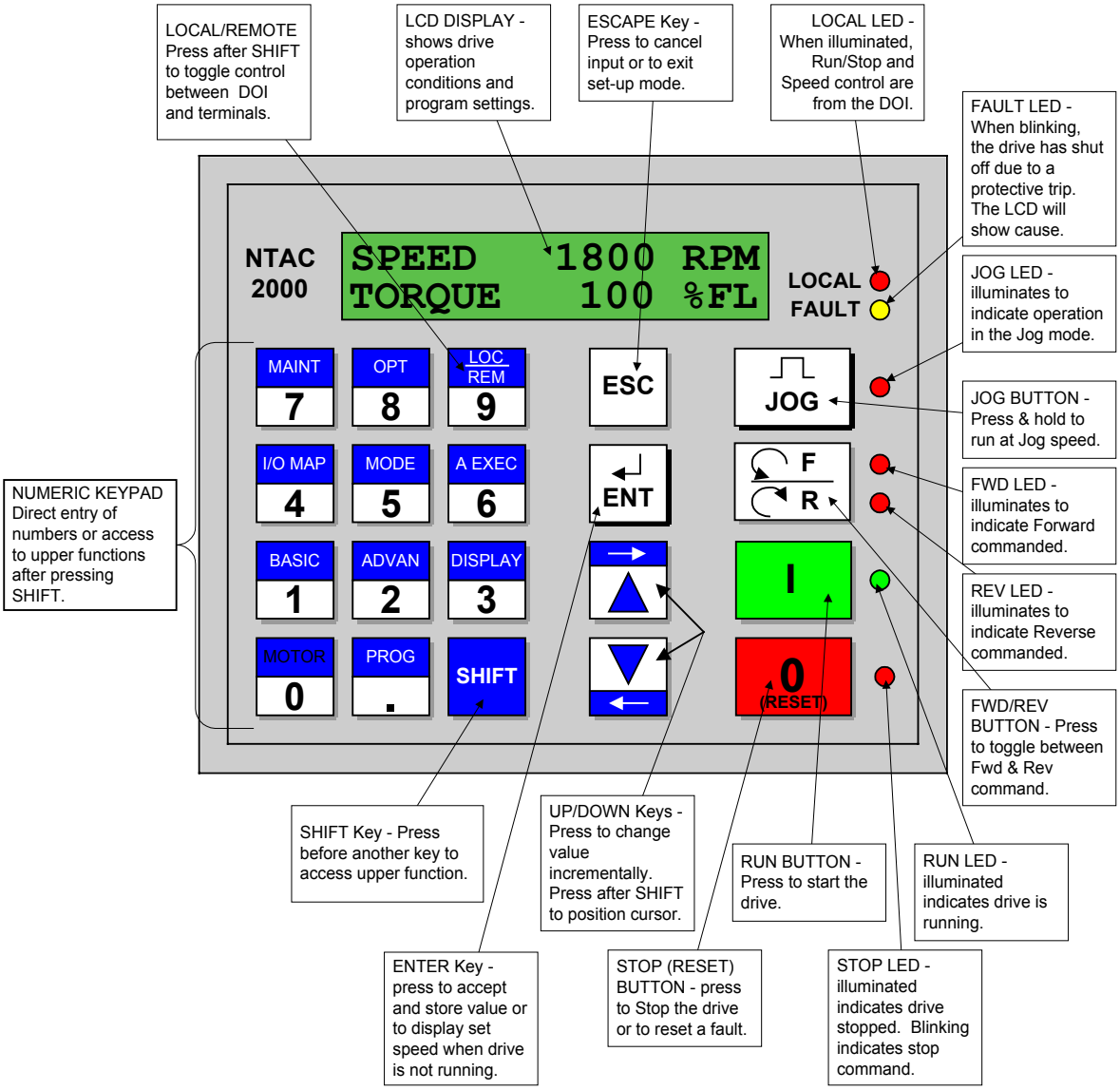

Figure 4-1 DOI Layout and Component Identification

WARNING

DO NOT USE THE FORWARD, REVERSE OR JOB BUTTONS ON THE INVERTER DRIVES TO MOVE THE ANTENNA. THE LIMIT SWITCHES WILL NOT STOP THE ANTENNA MOVEMENT AND POSSIBLE STRUCTURAL DAMAGE TO THE ANTENNA CAN OCCUR.

All parameters are set at the factory. VCSD has modified some of these parameters.

TABLE 4-1 NTAC 2000 DRIVE PARAMETERS			
FUNCTION NUMBER	**AZ INVERTER**	**EL INVERTER**	**FACTORY & VCSD SETTINGS**
11			**Motor Voltage; Set to Nameplate rating on motor**
12			**Motor Full Load Amps Set to nameplate rating on motor**
13			**Motor HP Set to nameplate rating on motor**
14			**Motor rated Frequency Set to nameplate rating on motor**
15			**Motor rated Speed Set to nameplate rating on motor See Note 3**
16	USE ONLY THE "STANDARD AUTOTUNE FUNCTION" IT DOES NOT ROTATE THE MOTOR. ****WHEN ANY PARAMETER IS CHANGED, THE AUTOTUNE MUST BE REDONE****		
18			**"80 RPM"**
101			**"0.8S"**
102			**"0.8S"**
111			**Set to 10% of motor nameplate RPM. See Note 2**
112			**Set to motor nameplace RPM. See Note 1**
201			**"3"**
202			**"0.5"**
204			**"TRUE"**
205			**"FALSE"**
225			**"10"**
303			**"I OUT (A)"**
402			**"RUN FWD"**
403			**"RUN REV"**
404			**"RESET"**
414			**"0.0V"**
421			**"FAULT"**
422			**"RUN"**
423			**"AT SPD"**
502			**"REMOTE"**
503			**"REMOTE"**

NOTE: 1. Use motor name plate speed. Example 1720 RPM (Slew Speed)

2. *Use 10% of motor name plate speed. Example 170 RPM (Track Speed)*

3. *Minimum rated speed for 60 Hz motor is 1630 RPM. Minimun rated speed for 50 Hz motor is 1370 RPM. Failure to set these minimum values may result in* ***a MOTOR PARAMETERS FAULT*** *during autotune.*

NOTE: Do not make changes to the program function codes before contacting Vertex Control Systems. Changing these parameters could cause Drive malfunctions, incorrect tracking of the antenna, and or physical damage to the system.

All other parameters are set at factory default.

4.6 7134 and 7134-AST Power-Up and Self-Diagnostics

On the 7134 and 7134-AST front panel, set the POWER ON/OFF switch to OFF for more than 5 seconds. Restore power and observe that the controller cycles through the internal self-diagnostic initialization routine.

1. Verify that during the lamp test the following conditions occur:

   a. All alphanumeric display characters illuminate. _____(Check)
   b. All key switch lamps illuminate. _____(Check)

2. Verify that the unit reverts to **Standby** mode with no error messages. _____(Check)

4.7 Setup and Configuration Parameters

In **Edit** mode (refer to paragraph 3.6.2.2 for editing procedures), review each of the configuration parameters and record the current setting in the following table:

PARAMETER	TYPE	CURRENT SETTING
POL ENABLED?	INSTALLATION	
AZIMUTH REVERSED?	INSTALLATION	
POL REVERSED?	INSTALLATION	
EL REVERSED?	INSTALLATION	
AZ LOWER LIMIT	LIMITS	
AZ UPPER LIMIT	LIMITS	
EL LOWER LIMIT	LIMITS	
EL UPPER LIMIT	LIMITS	
POL LOWER LIMIT	LIMITS	
POL UPPER LIMIT	LIMITS	
MOTION ERROR PARAMETER	LIMITS	
RUNAWAY ERROR ANGLE	LIMITS	
POSITION ACTIVE?	TRACKING	
STEP ACTIVE?	TRACKING	
AZ COAST ANGLE	TRACKING	
EL COAST ANGLE	TRACKING	
FAST COAST ANGLE	TRACKING	
SLOW COAST ANGLE	TRACKING	
INCHING ON TIME	TRACKING	
INCHING OFF TIME	TRACKING	
DEADBAND	TRACKING	
SECOND A/D CHANNEL?	MISC	
DISPLAY TIME?	MISC	
DISPLAY dB?	MISC	

4.8 Manual Mode Tests

1. Place the 7134 or 7134-AST ACU in **Manual** mode. Observe that the mode status changes to M and that the MAN key illuminates. _____(Check)
2. Jog AZ CCW and observe that the <AZ key illuminates and the AZ angle decreases. _____(Check)
3. Jog AZ CW and observe that the AZ> key illuminates and the AZ angle increases. _____(Check)

4. Jog EL DOWN and observe that the <EL key illuminates and the EL angle decreases. _____(Check)
5. Jog EL UP and observe that the EL> key illuminates and the EL angle increases. _____(Check)
6. Jog POL CCW and observe that the <POL key illuminates and the POL angle decreases. _____(Check)
7. Jog POL CW and observe that the POL> key illuminates and the POL angle increases. _____(Check)
8. Hold the SHFT key down and jog AZ CCW and observe that the <AZ key illuminates and the AZ angle decreases. _____(Check)
9. Hold the SHFT key down and jog AZ CW and observe that the AZ> key illuminates and the AZ angle increases. _____(Check)
10. Hold the SHFT key down and jog EL DOWN and observe that the <EL key illuminates and the EL angle decreases. _____(Check)
11. Hold the SHFT key down and jog EL UP and observe that the EL> key illuminates and the EL angle increases. _____(Check)

4.9 Manual Track (Jump) Mode Tests

1. Place the 7134 or 7134-AST ACU in **Manual Track (Jump)** mode. Observe that the mode status indicates MT and that the MAN and EDIT keys illuminate. _____(Check)

2. Enter a target. Verify that the antenna moves to the target angle. _____(Check)

4.10 Software Limit Tests

The software (soft) limits provide an added margin of safety when the location of the 7134 and 7134-AST ACU or the remote link causes obstructed visibility of the antenna. Test the function and setting of each soft limit by driving the antenna from the 7134 and 7134-AST ACU in **Manual** mode as follows:

1. a. Drive the antenna using the JOG AZ CW switch until the soft limit stops the movement of the antenna. _____(Check)
   b. Check the ACU display for a SOFT LIMIT message. _____(Check)
   c. Record the AZ angle at which the limit occurred. _____(Record)
   d. Verify that the antenna will drive in the CCW direction. _____(Check)

2. a. Drive the antenna using the JOG AZ CCW switch until the soft limit stops the movement of the antenna. _____(Check)
   b. Check the ACU display for a SOFT LIMIT message. _____(Check)
   c. Record the AZ angle at which the limit occurred. _____(Record)
   d. Verify that the antenna will drive in the CW direction. _____(Check)

3. a. Drive the antenna using the JOG EL UP switch until the soft limit stops the movement of the antenna. _____(Check)
   b. Check the ACU display for a SOFT LIMIT message. _____(Check)
   c. Record the EL angle at which the soft limit occurred. _____(Record)
   d. Verify that the antenna will drive in the DOWN direction. _____(Check)

4. a. Drive the antenna using the JOG EL DOWN switch until the soft limit stops the movement of the antenna. _____(Check)
   b. Check the ACU display for a SOFT LIMIT message. _____(Check)
   c. Record the EL angle at which the limit occurred. _____(Record)
   d. Verify that the antenna will drive in the UP direction. _____(Check)

5. a. Drive the antenna using the JOG POL CW switch until the soft limit stops the movement of the feed assembly. _____(Check)
   b. Check the ACU display for a SOFT LIMIT message. _____(Check)
   c. Record the POL angle at which the limit occurred. _____(Record)
   d. Verify that the feed assembly will drive in the CCW direction. _____(Check)

6. a. Drive the antenna using the JOG POL CCW switch until the soft limit stops the movement of the feed assembly. _____(Check)
   b. Check the ACU display for a SOFT LIMIT message. _____(Check)
   c. Record the POL angle at which the limit occurred. _____(Record)
   d. Verify that the feed assembly will drive in the CW direction. _____(Check)

4.11 Auto Mode Tests

4.11.1 Target Track

Enter several targets in the **Edit Target** mode. Test the **Target Track** mode operation by starting with the antenna pointed away from the sample target values and then commanding movement to the sample target. Record the resulting data in the following tables, and check to see that the final angle agrees with the commanded angle to within the value set in the configuration table, +/- 0.01 degree.

TARGET # __________			
	ACTUAL	**COMMANDED**	**ERROR**
AZ			
EZ			
POL			
ERRORS WITHIN DEADBAND ("0.01 degree)			______(Check)

TARGET # __________			
	ACTUAL	**COMMANDED**	**ERROR**
AZ			
EZ			
POL			
ERRORS WITHIN DEADBAND ("0.01 degree)			______(Check)

TARGET # __________			
	ACTUAL	**COMMANDED**	**ERROR**
AZ			
EZ			
POL			
ERRORS WITHIN DEADBAND ("0.01 degree)			______(Check)

TARGET # __________			
	ACTUAL	**COMMANDED**	**ERROR**
AZ			
EZ			
POL			
ERRORS WITHIN DEADBAND ("0.01 degree)			______(Check)

4.11.2 Program Track

Load several **Program Track** data points in **Edit Program** mode, leaving a few minutes between each entry. Then place the system in **Program Track** mode and observe that the antenna is moved sequentially to the position coordinates entered at the appropriate times. Enter the resulting values into the data tables provided below:

PROGRAM TRACK COMMANDED ANGLE DATA					
STEP	**AZ**	**POL**	**EL**	**TIME/DAY**	**BEACON**
1					
2					
3					
4					
5					

PROGRAM TRACK ACTUAL ANGLE DATA					
STEP	**AZ**	**POL**	**EL**	**TIME/DAY**	**BEACON**
1					
2					
3					
4					
5					

4.11.3 Adaptive Step Track (7134-AST Only)

4.11.3.1 Input Signal Variation

Accurate tracking is predicated on a stable reference tracking signal. Therefore, the stability of the tracking signal must be established before system tracking accuracy can be evaluated.

Observe the beacon level on the 7134-AST display with the antenna parked at beam center for at least one minute and record the signal variation below:

SIGNAL VARIATION (dB)	

If the observed variation is in excess of +/- 0.1 dB, evaluation of the system tracking accuracy will be uncertain, limited by the amount of fluctuation present.

4.11.3.2 Tracking Accuracy

For each direction listed in the following table, perform steps 1 - 3 and record the resulting data in the table.

1. In **Manual** mode, move the antenna off beam center in the direction listed in the following table until the signal level drops 2 dB.

2. Activate **Adaptive Step Track** and allow the system to repeak the antenna and record the resulting signal level from the 7134-AST ACU display in the TRACK LEVEL column.

3. Place the system in **Manual** mode and manually peak the antenna and record the resulting signal level in the MANUAL LEVEL column. Repeat steps 1-3 for each subsequent direction listed in the following table.

DIRECTION	TRACK LEVEL	MANUAL LEVEL	ERROR
AZ CCW			
AZ CW			
EL UP			
EL DOWN			

NOTE: If the level achieved in Adaptive Step Track is greater than that achieved in Manual peaking, enter a zero for the error.

4. Calculate the RMS tracking accuracy as follows:

$$RMS\ TRACKING\ ERROR = \frac{[(AZCCW)^2 + (AZCW)^2 + (ELDOWN)^2 + (ELUP)^2]^{\frac{1}{2}}}{2}$$

5. Record the RMS TRACKING ERROR (< 0.1 dB, Nominal) ____dB(Record)

4.12 Readout System Error Tests

The following tests simulate system errors or faults.

1. Disconnect the AZ resolver cable from the back of the 7134 or 7134-AST ACU. _____(Check)
2. Verify that the display shows AZ ERR. _____(Check)
3. Verify that the customer interface FLT contacts open. _____(Check)
4. Reconnect the AZ resolver cable. Disconnect the POL resolver cable. _____(Check)
5. Verify that the display shows POL ERR. _____(Check)

6. Verify that the customer interface FLT contacts open. _____(Check)
7. Reconnect the POL resolver cable. Disconnect the EL resolver cable. _____(Check)
8. Verify that the display shows EL ERR. _____(Check)
9. Verify that the customer interface FLT contacts open. _____(Check)
10. Disconnect all resolver cables. _____(Check)
11. Verify that the display scrolls AZ ERR, POL ERR, and EL ERR. _____(Check)
12. Verify that the customer interface FLT contacts open. _____(Check)
13. Reconnect all resolver cables. This concludes the resolver error tests. _____(Check)

4.12.1 Miscellaneous Error and Fault Messages

1. On the drive cabinet swing-out panel, set the DRIVE CIRCUIT BREAKER to OFF. Verify that the 7134 or 7134-AST ACU display shows NO PWR. _____(Check)
2. On the drive cabinet swing-out panel, set the DRIVE CIRCUIT BREAKER to ON. _____(Check)
3. Press the EMERGENCY STOP button on the side of the drive cabinet. Verify that the 7134 or 7134-AST ACU display shows E STOP. _____(Check)
4. Verify that the customer interface FLT contacts open. _____(Check)
5. Set the EMERGENCY STOP button to the out position. _____(Check)
6. Press the RST key. Verify that the inverters reset and that the display shows no fault messages. _____(Check)
7. Verify a closed circuit between the customer interface FLT terminals. _____(Check)

4.13 Brake Options

Perform the following steps only if this system has brake options.

4.13.1 Azimuth Brake Option

1. Verify the Brake voltage and record _____(Record)

2. Set voltmeter for proper voltage and connect across Az B1 & AZ B2. Record voltage. (Should be 0 volts) _____(Record)

3. Move Az in CW direction. _____(Check)
   Record Voltage (Should be same as in Step 1) _____(Record)

4. Move Az in CCW direction. _____(Check)
   Record Voltage (Should be same as in Step 1) _____(Record)

4.13.2 Elevation Brake Option

1. Verify the Brake voltage and record _____(Record)

2. Set voltmeter for proper voltage and connect across
   Az B1 & AZ B2. Record voltage. (Should be 0 volts) _____(Record)

3. Move El in UP direction. _____(Check)
   Record Voltage (Should be same as in Step 1) _____(Record)

4. Move El in DOWN direction. _____(Check)
   Record Voltage (Should be same as in Step 1) _____(Record)

THIS CONCLUDES THE 7134 or the 7134-AST ACU ACCEPTANCE TESTS.

SIGNATURE OF WITNESSES		
SIGNATURE	COMPANY	DATE
	VERTEX COMMUNICATIONS CORPORATION	

5.0 MAINTENANCE

There is no scheduled maintenance required for the 7134 or 7134-AST ACS.

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6.0 ENGINEERING DRAWINGS

This section includes the following engineering drawings:

200503 Relay Circuit Board Model 7150

200602 Remote Interface PMCU Model 7150

200607 Pol Motor Option, 50 Hz

200608 Pol Motor Option, 60 Hz

200693 7134 Antenna Control Front Switch P.C. Board Assembly Layout

200811 Baseline AZ/EL Assembly (208 VAC) Model 7150

200812 Baseline AZ/EL Assembly (380-415 VAC) Mod 7150

200726 Antenna Drive Unit AZ/EL W/BRK Options 7150

370219 7134 ACU Schematic Diagrams

700001 Cable Harness ASSY Power Supply Model 7134 ACU STD

700002 Model 7134 Controller DC Power Supplies Output Connections

800001 Antenna Control Unit Main PC Board Assembly Model 7134 STD

800003 Antenna Control Unit Front Display PC Board Model 7134 STD

800228 Antenna Control Unit Interface Circuit Board Model 7134 STD

800326 Antenna Control Unit Assembly & Wiring Diagram Model 7134 STD

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APPENDIX A ACRONYMS AND ABBREVIATIONS

The following is a list of acronyms and abbreviations that appear in this manual.

A	amps
AC	Alternating Current
ACS	Antenna Control System
ACU	Antenna Control Unit
A/D	analog-to-digital
AZ	azimuth
BCD	Binary Coded Decimal
BW	bandwidth
CCW	counterclockwise
CFE	customer-furnished equipment
CPU	Central Processing Unit
CW	clockwise
dB	decibels
DC	Direct Current
EIA	Electronic Industries Association
EL	elevation
EPROM	Erasable Programmable Read-Only Memory
FLT	fault
GND	ground
Hz	Hertz
LED	Light-Emitting Diode
MAINT	maintenance
N/A	not applicable
POL	polarization
POS	position
RAM	Random Access Memory
RF	Radio Frequency
ROM	Read-Only Memory
rpm	revolutions per minute
V	Volts

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APPENDIX B - TECHNICAL SUPPORT

If you have any questions or problems that are not addressed by the manual, there are several ways to contact our technical support team.

1. Phone us at (903) 295-1480.

2. Email us at ***support@vcsd.com.***

3. Make copies of the following Technical Inquiry form and fax us your questions at (903) 295-1479.

4. Contact us on our web site at ***www.vcsd.com.***

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VERTEX CONTROL SYSTEMS

Technical Inquiry **FAX (903) 295-1479**

CUSTOMER NAME:	**SITE:**	
CONTACT:	**PHONE:**	**EXT:**
FAX:	**EMAIL:**	

EQUIPMENT: ***(INCLUDE MODEL, NAME, AND SERIAL NUMBER OF ALL PERTINENT EQUIPMENT)***

S/N:

1. Model: _____

2. Model: _____

3. Model: _____

4. Model: _____

OTHER EQUIPMENT

TECHNICAL QUESTION/PROBLEM:

VCSD RESPONSE:

VCSD TROUBLESHOOTER	DATE	TIME	REF. NO.

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APPENDIX C
REMOTE COMMUNICATIONS PROTOCOL

Appendix C is provided for those operators who want to set up remote communications with the 7134 or 7134-AST ACS.

The 7134 and 7134-AST ACU has two serial communications ports. The RS-232 operates at 1200 baud, and the RS-422 operates at 9600 baud. Each port operates with 7 data bits, even parity, 1 start bit, and 1 stop bit.

The remote terminal initiates communications, and the 7134 or 7134-AST ACU makes a response. The RS-232 or the RS-422 can make requests at any time. Commands can be made only when the 7134-AST ACU is in remote mode and by only one terminal at a time.

The initial communication is a sequence of characters, terminated by a carriage return (CR). The response is similar. If a terminal is used interactively, it should be set to half-duplex mode and carriage return translated into carriage return/line feed. A line feed (LF) if sent, is ignored.

If there is no error, the response consists of the answer to the request, followed by a carriage return, followed by >>, a prompt for the next command. If there was an error, there is no answer, and the response is a character followed by the >. The character indicates the type of error condition as indicated below:

C - Communications error such as a parity error
L - Line too long (more than 64 characters)
? - Unrecognized command
X - Extra characters in the input
M - Missing fields in the input
N - Number error (if a number is expected, the number is invalid)
V - Value error (if a number is expected, the number is out of range)
U - Undefined (reference to an unused program or target
R - Command refused (occurs when the remote is not in control)
S - Syntax error
T - Transaction error
I - Illegal position in command
D - Drive reset in progress (for commands only)

Requests

After sending a request or a command, the remote computer must wait for a prompt before sending the next request/command, or the message will be ignored by the ACU.

The requests are as follows:

NOTE: Polarization coordinates are only sent or entered if polarization is enabled. All Adaptive Step Track requests are available only on a 7134-AST ACU.

RC - Request coordinates.

Response: aaa.aa ppp.pp eee.ee
- aaa.aa is azimuth
- ppp.pp is polarization, which is unsigned.
- eee.ee is elevation

- Decimal values are in hundredths of one degree.
- Polarization is omitted if not enabled.

RA - Request A/D converter value

- With pulse tracking disabled:
  response: dd.dd
  - dd.dd is in volts.
- With pulse tracking enabled:
  send: RA n ; 0 < = n < = 5
  n = 0 response: (same as RA)
  n = 1 response: dd.dd
    - A/D converter value in volts.
  n = 2 response: +ddddd
    - ddddd is the "raw" A/D converter value.
    - (+) sign immediately precedes the digits
    - ddddd represents a 12-bit integer.
  n = 3 response: -ooooo
    - ooooo is the offset. May be zero.
    - (-) sign immediately precedes the digits.
  n = 4 response: +sssss
    - sssss is the A/D scaling factor.
  - Relationship between values:
    A/D value in dB =
    (raw value + offset) * scale factor / 409,600
  - in terms of RA responses:
    A/D value in dB =
    ((RA 2) + (RA 3)) * (RA 4) / 409,600

RB - Request both coordinates and A/D value.

Response: aaa.aa ppp.pp eee.ee "dd.dd
- same syntax as for RA and RC.

RE - Request errors.

Response: (OU errors) (ACU errors) (step tracking errors)
Each error message is 2 characters long.
There may be multiple errors returned for each category; each error is space-separated from the next.

- OU errors:
  - NP: No power to OU
  - HL: Hard limit
  - AF: Azimuth fault
  - EF: Elevation fault
  - OR: Maintenance override
  - ES: Emergency stop
  - PU: Step track error
- ACU errors:
  - 2 letters: 1st is channel, 2nd is type of error.
    - Channels:
      - A: Azimuth
      - P: Polarization
      - E: Elevation
    - Errors:
      - R: Runaway
      - M: Motion (no motion)
      - B: (Moving) Backwards
      - V: Resolver error (Validity error; reading is invalid)
      - L: Soft limit
- Step tracking errors: either PU and/or BX
  - PU: Step error (i.e., signal dropout during step tracking.)
  - BX: Box error (i.e., antenna runaway during step tracking; probably due to a defective A/D converter or a similar cause.)

Example: HL AF AM EV
(Hard limit reached; azimuth fault;
azimuth motion error, elevation resolver error.)

RR - Request relay status.

Response: A[+|++|-|--] P[+|-] E[+|++|-|--] F(+|-) D(+|-)

A: Azimuth

++	: moving CW at high speed
+	: moving CW at low speed
(none)	: idle
-	: moving CCW at low speed
--	: moving CCW at high speed

P: Polarization
- `+` : moving CW
- (none) : idle
- `-` : moving CCW

E: Elevation
- `+ +` : moving up at high speed
- `+` : moving up at low speed
- (none) : idle
- `-` : moving down at low speed
- `--` : moving down at high speed

F: Fault status
- `+` : fault
- `-` : no fault

D: Drive status
- `+` : Drive enabled
- `-` : Drive disabled

Example: A + + P E + + F- D +
Azimuth moving CW at high speed; polarization is not moving; elevation is moving up at high speed; no faults; drives are enabled.

RS - Request status.

Response: (ACU state) (remote control state) (current beacon)

ACU state is one of the following:
- ID : idle
- TT : target track
- PT : program track (currently tracking)
- PW : program track (currently waiting for next time)
- MN : manual mode
- ED : editing
- JG : jog mode
- DR : drive reset
- PU : step track (when enabled)

Remote control state is one of the following.
- LOC : local control (at the 7134)
- 232 : RS-232 remote control
- 422 : RS-422 remote control
- REM : ACU is in remote mode (REMT key is illuminated on the front panel), but neither serial port has assumed control.

Current beacon: returns 2 characters: "Bn", where n = 1 through 4, inclusive.

RS n - Request status (extended); n = 0 or 1.

n = 0 response: same as RS (see above)

n = 1 response:

(primary state)[:(secondary state)] POS:(NO|MN|PU) POL(+|-) PU(-|+nnn)

RS 1 examples: PU:MN POS:PU POL+ PU+002 ID POS:NO POL+ PU+002

Primary state: this is the same as ACU state described above.

Secondary state: this field, with the leading colon (:) only appears during tracking.

WT: Waiting for the step timer and/or next program time.

PU: Actively step tracking; this includes waiting for the signal level to rise again, if it drops out.

TR: Tracking to a target.

MN: Maintaining or holding a target (position active).

POS (position active) field:

NO: Position active is disabled.

MN: Maintenance condition; locked on a target and merely correcting drift (position active).

PU: Begin step tracking at the end of normal tracking (step active).

Note: with a box error, step active is inhibited and will be replaced by position active, but the PU code will still be returned.

Polarization enabled field:

+ if polarization is enabled;

- if disabled.

Pulse enabled field:

- if step tracking is disabled.

+nnn if enabled; nnn is the step cycle time in minutes

RL n - Request Soft Limits

RV1 must be active

RL1 7 RL0 6 lower limit for each axis

RL2 7 RL1 6 upper limit for each axis

send: RL n

receive: aaa.aa ppp.pp eee.ee

RM - Request time (Military).

Response: hh:mm:ss Dd

hh : hours

mm : minutes

ss : seconds

d : day of week --

0 = Sunday, 1 = Monday, ..., 6 = Saturday

Example: 14:30:00 D1

(2:30 p.m. on Monday)

RP nn - Request Program item nn; 1 < = nn < = 99.
Response: aaa.aa ppp.pp eee.ee hh:mm:ss Dd Bb
aaa.aa : azimuth
ppp.pp : polarization
eee.ee : elevation
d : day of week (see "RM" request)
b : beacon number
Example: 185.10 022.55 075.00 21:15:00 D4 B1

RT nn - Request Target number nn; 1 < = nn < = 10.
Response: aaa.aa ppp.pp eee.ee
aaa.aa : azimuth
ppp.pp : polarization
eee.ee : elevation
- special case: nn = 00 yields current target.
Example: RT 01

RU - Request step track information
Response: aaa.aa ppp.pp eee.ee hh:mm:ss Dd
- pointing angles are the position of the peak.
- hh:mm:ss Dd are the time and day that the step tracking last found a peak.

Information returned by RU is not "initialized"; the user should assume that the 1st response is old or invalid information and wait for it to change before assuming it to be current.

RV n - Request Version
Send: RV n: n = 0 or 1
Response: none
Default is RV 0 for compatibility with previous versions.
RV1:
- RT returns beacon # and target; beacon # must be entered with target (using CR command, described later).
- RL request is enabled

RQ - Request quick

The RQ remote request sends in a compressed format the following information:
- Current antenna position
- A/D input
- Machine state (local/remote; idle, tracking, editing, etc.)
- Relay status:
  - Fault
  - Azimuth drive (direction; fast/slow)
  - Elevation drive (direction; fast/slow)
  - Polarization drive (direction; single-speed)
  - Drives enabled
- Current beacon

RQ returns a string of 13 printable ASCII characters. To extract the data, first subtract 21h (21 hex) from the ASCII value of each character. This leaves 6 bits of data per character. By concatenating the 13 6-bit fields from the string left to right (the first character returned by RQ has the most significant bits) we have 78 bits of data, divided up as follows (again left to right):

# BITS	DATA
16	AZIMUTH ANGLE
16	POLARIZATION ANGLE
16	ELEVATION ANGLE
12	A/D VALUE
4	PRIMARY MACHINE STATE
2	SECONDARY MACHINE STATE
10	RELAYS
2	BEACON
78 BITS	

Details of Bit-fields

1. Angle Decompression

RQ returns angles in the same format that the ACU uses internally: a circle from 0 to 360.00 degrees is mapped into 0 to 10000h. To translate the angles returned, use the following formula: $angle = bit\_angle * 90.00 / 4000h$ where angle is the angle in degrees, and bit_angle is the angle returned by RQ.

2. A/D Value

The A/D value returned is the same value returned by the "RA 2" remote request.

3. Machine State

a. Primary State

4 bits contain the primary machine state information:

bit 3: 0 = local; 1 = remote.
bits 0 - 2:

VALUE	STATE
0	IDLE (STANDBY)
1	TARGET TRACKING*
2	PROGRAM TRACK: WAITING
3	PROGRAM TRACK: TRACKING*
4	MANUAL
5	EDIT
6	STEP TRACKING*
*Secondary state applies; if not, ignore secondary state.	

b. Secondary State

VALUE	STATE
0	STEP ACTIVE: WAITING FOR NEXT STEP TRACKING CYCLE TO COME DUE
1	ACTIVE POSITION: STEP TRACKING
2	MOVING TO A NEW TARGET
3	POSITION ACTIVE: MAINTAINING CURRENT TARGET

4. Relays

The 10 bits of relay data are as follows (most to least significant):

BIT #	RELAY
9	FAULT
8	AZIMUTH CW
7	AZIMUTH FAST
6	AZIMUTH CCW
5	ELEVATION FAST
4	ELEVATION UP
3	ELEVATION DOWN
2	DRIVE ENABLED
1	POLARIZATION CW
0	POLARIZATION CCW

5. Beacon

The last two bits are simply the current beacon # - 1; that is:

BITS	BEACON
00	1
01	2
10	3
11	4

6. RQ Example

In this example:

- The ACU is in local (not remote) control and in manual mode.
- There are no faults.
- The antenna is being manually driven CW in azimuth and up in elevation.
- At the time RQ request is made, the antenna's current look angles are:

AZ	POL	EL
150.00	000.00	50.00

- The current beacon is beacon 1 (B1).
- The A/D values given by RA are:

RA 0 = -01.62
RA 1 = +07.00
RA 2 = +2868
RA 3 = -3308
RA 4 = +01513

CHAR #:	C	B	A	9	8	7	6	5	4	3	2	1	0
RQ RETURNS:	;	K	M	!	!	#	/	/	M	U	1	2	1

CHAR	ASCII(CHAR) [HEX]	ASCII(CHAR) -21H[HEX]	ASCII(CHAR)-21H[BINARY]
;	3B	1A	011010
K	4B	2A	101010
M	4D	2C	101100
!	21	0	000000
!	21	0	000000
#	23	2	000010
/	2F	E	001110
/	2F	E	001110
M	4D	2C	101100
U	55	34	110100
1	31	10	010000
2	32	11	010001
1	31	10	010000

NOTE: The shaded areas in the chart above correspond to the shaded areas in the chart below.

a. Split these bits up by fields:

FIELD	BITS	VALUE
AZ	0110101010101011	6AABh = 27307
POL	0000000000000000	0h = 0
EL	0010001110001110	238Eh = 9102
A/D	101100110100	B34h = 2868
PRIMARY STATE	0100	6 = MANUAL MODE
SECONDARY STATE	00	0*
RELAYS	0100010100	114h
BEACON	00	0 = B1
*In manual mode the value of secondary state has no effect		

b. Break the values down:

! Convert look angles to decimal:

! az: 6AABh(90.00/4000h) = 27307(90.00/16384) = 150.00
! pol: 0
! el: 238Eh(90.00/4000h) = 9102(90.00/16384) = 50.00

! A/D:

- ... is 12-bit; mapped 0 - 10 VDC -> 0 - 1000h (= 4096)
! To get volts from "raw" return:
2868(10/4096) = 7.00 VDC
! To get dB (formula is from the RA section of the manual):
(RA 0) = [(RA 2) + (RA 3)] (RA 4)/409,600

For our example:
(2868 - 3308) * 1513/409600 = -1.62 dB.

! Relays:

BIT #	VALU	RELAY
9	0	FAULT
8	1	AZ CW
7	0	AZ CCW
6	0	AZ FAST
5	0	EL FAST
4	1	EL UP
3	0	EL DOWN
2	1	DRIVE ENABLED
1	0	POL CW
0	0	POL CCW

! Beacon: 00 --> beacon = 1 (B1)

Commands

Commands return nothing (except the prompt for the next command). The 7134 must be polled to verify that the action was successful. If the next prompt is ">>", then the command was successfully accepted by the 7134 (i.e., it received it properly; no syntax error, etc.).

Control

CC
- Assume remote control of the 7134, if possible.
  - Must be executed before any other commands (requests do not require this).
  - If the 7134 is taken out of remote mode at any time, the remote controller must wait until the 7134 has been placed back in remote mode and execute "CC" again before executing further commands.

CQ
- Relinquishes remote control of the 7134; returns it to the "REM" state. The 7134 cannot be remotely returned to local mode.

CD
- Drive reset to outside unit (OU).

CX
- System reset: this causes the ACU to do a warm restart.
  - CX does not return a prompt upon successful execution; it does return a prompt on an error, though.
  - Leaves the 7134 in the "REM" state (see RS request); CC must be reissued before sending further commands.
  - CX does not clear program or target databases.

Antenna Positioning

CB n
- Select beacon n; 1 <= n <= 4.

CM aaa.aa ppp.pp eee.ee
- Move (antenna) to specified coordinates.

CT nn
- Target track target nn.
- Returns prompt "I>" if target nn contains values outside of the soft limits.

CP
- Program track using loaded program.
  - Returns prompt "I>" if a program entry contains values outside the current soft limits but does not indicate at the remote end the program entry that contains the erroneous coordinates.

CU
- Do step tracking.

CS
- Stop all motion.

CJ (axis)(direction)nn
- Jog antenna in specified direction (azimuth, elevation, or polarization) in + or - direction for nn tenths of one second. 1 <= nn <= 60.
  - axis is one of the following: A (azimuth), P (polarization), or E (elevation).
  - direction is "+" for up or CW; "-" for down or CCW.
  - There must be exactly 4 characters in parameter field, NOT space-separated.
  - The ACU will not jog when outside of soft limits, except in the direction that will bring the antenna back within the soft limits.

CA c
- Set position active mode.
  c is: A : Active position
  P : Step active (w/ step track option only)
  I : Idle
  - The "position active" mode reverts back to the mode previously defined in the configuration (locally on the ACU when local control is assumed or the ACU is reset.

CY nnn
- Set step cycle time.
- 0 <= nnn <= 240; nnn = 000 -> cycle time is disabled (track only on threshold)

<u>Program/Target Data Editing</u>

CF
- Start program edit transaction.
  Clears entire program; awaits CG and/or CH commands (see below).

CG nn aaa.aa ppp.pp eee.ee hh:mm:ss Dd Bb
- Append program item nn to the database.
  - Format for fields is the same as previously defined.
  - Program items must be entered in order (01,02,etc.).
  - CF must be called before starting CG transactions.
  - CG returns an error if a value is out of range.

CH (Y|N)
- End program edit transaction.
  Y : ends the transaction and updates the program track database.
  N : ends the transaction but does not update the program track database with the values entered through CG
  - CH must be called after last CG transaction before executing other commands/requests.

CR nn aaa.aa ppp.pp eee.ee
- Sets target track database item nn with azimuth, polarization, and elevation values given.
  - CR commands can be issued in any order at any time the remote has control.
  - CR returns an error if a value is out of range.

APPENDIX D - VENDOR LITERATURE

This appendix contains the O & M Manual on the NTAC2000 Inverter Drive.

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APPENDIX E - AZIMUTH AND ELEVATION BRAKE OPTION

The 7150 Drive Cabinet can be equipped with 3 different motor brake options.

1. Azimuth Only
2. Elevation Only
3. Azimuth and Elevation

The Brake Options assume that when you energize the motor, that a brake coil will be energized, this releases the brake. When the motor is turned off, the brake coil is released, which causes the brake to stop the motor.

When the inverter drive receives a "Run" command, the brake release command is also sent to the Brake Interface Relay. The output of this relay is connected to the brake coil. The brake voltage is determined by the manufacturer rating on the brake.

If a different brake system is required, contact Vertex Control Systems Division.

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