

**OPERATION AND MAINTENANCE MANUAL
FOR THE
MODELS 7134 & 7134 EMT ANTENNA CONTROL SYSTEMS
WITH
7150 SERIES III DRIVE CABINET**



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E – Rear panel J22 connector	M. Neely	9-13-05	D. Harrison	9-13-05	6050
D – Mode status codes updated	M. Neely	8-25-05	D. Harrison	8-25-05	5953
C – EMT, Intelsat updates	M. Neely	11-4-04	D. Harrison	11-4-04	5426
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NOTICES

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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.

WARNING

IN CASE OF EMERGENCY BE SURE THAT POWER IS DISCONNECTED.

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WARNING

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TABLE OF CONTENTS

1.0	INTRODUCTION.....	1-1
1.1	Purpose	1-1
1.2	General Information about the 7134-EMT ACS.....	1-1
1.3	System Hardware	1-1
1.3.1	7134 and 7134-EMT ACU	1-2
1.3.2	7150 Drive Cabinet	1-4
1.3.2.1	AZ and EL Drive Inverters	1-6
1.3.2.2	Polarization Motor Control	1-6
1.3.2.3	Drive Cabinet Control Logic	1-7
1.3.2.4	Local Control	1-7
1.3.2.5	Drive Cabinet Overcurrent Protection	1-7
1.3.2.6	AZ and EL Drive Motors	1-7
1.4	System Functions	1-8
1.5	Controls and Indicators	1-9
1.5.1	7134 and 7134-EMT ACU	1-9
1.5.1.1	POWER ON/OFF Circuit Breaker.....	1-10
1.5.1.2	Alphanumeric Display.....	1-10
1.5.1.3	Keypad	1-12
2.0	INSTALLATION AND INITIAL SETUP.....	2-1
2.1	Mechanical Installation.....	2-1
2.1.1	Antenna-Mounted Components	2-1
2.1.2	Installing the 7150 Drive Cabinet.....	2-1
2.1.3	Installing the 7134 or 7134-EMT ACU.....	2-2
2.2	System Cabling.....	2-2
2.2.1	7150 Drive Cabinet Main Power Connection	2-3
2.2.2	Connecting the Drive Motors to the Drive Cabinet.....	2-5
2.2.3	Limit Switch Connections	2-7
2.2.4	Installing the 7134 or 7134-EMT ACU Control Cable.....	2-7
2.2.5	Resolver Connections.....	2-9
2.2.6	Analog Input Connections.....	2-9
2.2.7	Remote Communications Connections	2-10
2.2.8	Customer Interface Connections	2-11
2.2.9	Portable Maintenance Control Unit (PMCU) Installation	2-13
2.2.9.1	PMCU Connections.....	2-13
2.3	Initial Turn-On and System Setup	2-14
2.3.1	Initial Power-Up.....	2-14
2.3.2	Inverter Drive Setup (AZ/EL Drive Modules).....	2-14
2.3.2.1	Function Parameters	2-14
2.3.2.2	Inverter Drive Setup (Function Parameters)	2-17
2.3.2.3	Drive Motor Phasing	2-18
2.3.2.4	AZ Motor Phasing.....	2-18
2.3.2.5	EL Motor Phasing	2-19
2.3.3	POL Motor Phasing	2-19
2.3.4	Electrical Limit Switch Tests and Preliminary Settings.....	2-19
2.3.5	AZ and EL Speed Adjustments	2-20
2.3.6	7134 and 7134-EMT ACU Software Initialization.....	2-21
2.3.7	Power-Up of the 7134 or 7134-EMT ACU	2-21
2.3.7.1	Initialization Sequence.....	2-22

3.0	OPERATION	3-1
3.1	Power-Up Procedures	3-1
3.2	Manual Movement of the Antenna from the Drive Cabinet (PMCU)	3-1
3.3	7134 and 7134-EMT ACU Standby Mode	3-2
3.4	Manual Operation from the 7134 and 7134-EMT ACU	3-3
3.4.1	Low Speed Manual Operation from the 7134 and 7134-EMT ACU	3-3
3.4.2	High Speed Manual Operation from the 7134 and 7134-EMT ACU	3-4
3.4.3	Manual Track (Jump) Mode Operation from 7134 and 7134-EMT ACU	3-4
3.5	Automatic Operation of the 7134 and 7134-EMT ACU	3-5
3.5.1	Operation of the Target Track Mode	3-5
3.5.2	Operation of the Program Track Mode	3-7
3.5.3	Operation of the Adaptive Step Track Mode (7134-EMT Only)	3-8
3.5.4	Operation of the Enhanced Memory Track Mode (7134-EMT Only)	3-10
3.5.5	Operation of the Intelsat (IESS412) Track Mode (7134-EMT Only)	3-12
3.6	Editing the Configuration of the 7134 and 7134-EMT ACS	3-13
3.6.1	Setting the Time and Date	3-13
3.6.1.1	Setting the Time	3-13
3.6.1.2	Setting the Date	3-14
3.6.2	Configuration Parameters	3-15
3.6.2.1	Configuration Parameters Defaults and Definitions	3-15
3.6.2.2	Setting Configuration Parameters	3-17
3.6.2.2.1	Setting Installation Configuration Parameters	3-18
3.6.2.2.2	Setting Limits Configuration Parameters	3-19
3.6.2.2.3	Setting Tracking Configuration Parameters	3-19
3.6.2.2.4	Setting Miscellaneous Configuration Parameters	3-20
3.6.3	Entering Resolver Offsets	3-21
3.6.3.1	Viewing the Offsets	3-22
3.6.3.2	Setting the Position	3-22
3.6.3.3	Setting the Offsets	3-23
3.6.4	Editing the Target Track (TGT) Database	3-24
3.6.4.1	ADD/EDIT the Target Track Database	3-24
3.6.4.2	VIEW the Target Track Database	3-25
3.6.4.3	DEL (Delete) Items of the Target Track Database	3-25
3.6.4.4	CLR ALL (Clear All) Items from the Target Track Database	3-26
3.6.5	Editing the Program Track (PGM) Database	3-26
3.6.5.1	VIEW the Program Track Database	3-26
3.6.5.2	ADD to the Program Track Database	3-27
3.6.5.3	EDIT the Program Track Database	3-28
3.6.5.4	CLR ALL (Clear All) Program Track Database	3-29
3.6.5.5	DEL (Delete) an Item from the Program Track Database	3-30
3.6.6	Editing the Adaptive Step Track Configuration (7134-EMT Only)	3-30
3.6.7	Setting the 0 dB and the -3 dB Levels	3-32
3.6.8	Editing the Enhanced Memory Track Configuration (7134-EMT Only)	3-34
3.6.9	Editing Intelsat Tracking Parameters (7134-EMT Only)	3-35
3.6.9.1	Editing Earth Station Parameters	3-36
3.6.9.2	Editing Intelsat Satellites	3-36
3.6.9.3	Viewing Intelsat Satellites	3-37
3.6.9.4	Deleting Intelsat Satellites	3-38
3.6.9.5	Clearing All Intelsat Satellites	3-38
3.7	7134 and 7134-EMT ACU Fault Status Reporting	3-39
3.8	Drive Cabinet Motor Controller (Inverters) Fault Status Reporting	3-39

4.0	SITE ACCEPTANCE TEST PROCEDURE	4-1
4.1	Preliminary Information	4-1
4.2	Drive Cabinet Line Voltage Measurements and Power-Up	4-1
4.3	Motor Phasing Tests.....	4-2
4.4	Limit Switch Tests	4-2
4.5	7134 and 7134-EMT Power-Up and Self-Diagnostics.....	4-3
4.6	Setup and Configuration Parameters	4-4
4.7	Manual Mode Tests	4-4
4.8	Manual Track (Jump) Mode Tests.....	4-5
4.9	Software Limit Tests	4-5
4.10	Tracking Tests.....	4-7
4.10.1	Target Track	4-7
4.10.2	Program Track	4-8
4.10.3	Adaptive Step Track (7134-EMT Only)	4-8
4.10.3.1	Input Signal Variation.....	4-8
4.10.3.2	Tracking Accuracy.....	4-9
4.11	Readout System Error Tests	4-9
4.11.1	Miscellaneous Error and Fault Messages	4-10
4.12	Brake Options	4-10
4.12.1	Azimuth Brake Option	4-10
4.12.2	Elevation Brake Option	4-11
5.0	MAINTENANCE	5-1
6.0	ENGINEERING DRAWINGS	6-1
APPENDIX A	Acronyms And Abbreviations.....	A-1
APPENDIX B	Technical Support	B-1
APPENDIX C	7134 Remote Communications Protocol.....	C-1
APPENDIX D	Vendor Literature	D-1
APPENDIX E	Azimuth and Elevation Brake Options.....	E-1

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LIST OF FIGURES

Figure 1-1	7134 and 7134-EMT Antenna Control Unit (Front Panel)	1-2
Figure 1-2	7134 and 7134-EMT Antenna Control Unit (Top View)	1-3
Figure 1-3	7150 Drive Cabinet	1-4
Figure 1-4	Drive Cabinet Block Diagram.....	1-5
Figure 2-1	7134 and 7134-EMT ACS Cabling Diagram	2-2
Figure 2-2	Drive Cabinet Assembly	2-5
Figure 2-3	7134-EMT Antenna Control Unit Back Panel Layout	2-7
Figure 2-4	Digital Operator Indicator and Key Description	2-15
Figure 2-5	Digital Operator Indicator and Key Description	2-15

LIST OF TABLES

TABLE 1-1	MODE STATUS CODES	1-10
TABLE 1-2	7134 or 7134 ACU KEYPAD CONTROLS	1-12
TABLE 2-1	COMMON CONFIGURATIONS OF THE 7150 DRIVE CABINET 208 VAC 3 Phase	2-3
TABLE 2-2	COMMON CONFIGURATIONS OF THE 7150 DRIVE CABINET 380-415 VAC 3 Phase	2-4
TABLE 2-3	MOTOR CONNECTIONS TO THE DRIVE CABINET	2-6
TABLE 2-4	LIMIT SWITCH CONNECTIONS TO THE DRIVE CABINET.....	2-7
TABLE 2-5	CONTROL CABLE CONNECTIONS	2-8
TABLE 2-6	RESOLVER CONNECTIONS	2-9
TABLE 2-7	ANALOG INPUT CONNECTIONS	2-10
TABLE 2-8	COMMUNICATION PORT CONNECTIONS (RS-232)	2-10
TABLE 2-9	COMMUNICATION PORT CONNECTIONS (RS-422)	2-11
TABLE 2-10	CUSTOMER INTERFACE TERMINAL STRIP.....	2-12
TABLE 2-11	PMCU CONNECTIONS	2-13
TABLE 2-12	DIGITAL OPERATOR LED FUNCTION DESCRIPTIONS	2-16
TABLE 2-13	GPD315 DRIVE PARAMETERS.....	2-17
TABLE 3-1	AUTOMATIC SUBMODES	3-5
TABLE 3-2	CONFIGURATION PARAMETERS.....	3-15
TABLE 3-3	CHANGES TO INSTALLATION PARAMETERS	3-18
TABLE 3-4	CHANGES TO LIMITS PARAMETERS.....	3-19
TABLE 3-5	CHANGES TO TRACKING PARAMETERS	3-20
TABLE 3-6	CHANGES TO MISCELLANEOUS PARAMETERS.....	3-21
TABLE 3-7	ADAPTIVE STEP TRACK PARAMETERS	3-30
TABLE 3-8	ENHANCED MEMORY TRACK PARAMETERS	3-34
TABLE 3-9	INTELSAT 11-ELEMENT PARAMETERS.....	3-35
TABLE 3-10	7134 and 7134-EMT FAULTS	3-39

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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-EMT (Enhanced Memory Track) 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-EMT ACS is included.

1.2 General Information about the 7134-EMT ACS

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

1.3 System Hardware

The 7134 ACS consists of the following subsystems:

- Model 7134 Antenna Control Unit (ACU) or
- Model 7134-EMT Antenna Control Unit (ACU)
- Model 7150 Drive Cabinet
- Resolvers and Limit Switches

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.

1.3.1 7134 and 7134-EMT 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-EMT 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-EMT ACU. With these switches, the operator controls the movement of the antenna, edits configuration parameters, and edits the database.
- **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 tracking databases, 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.

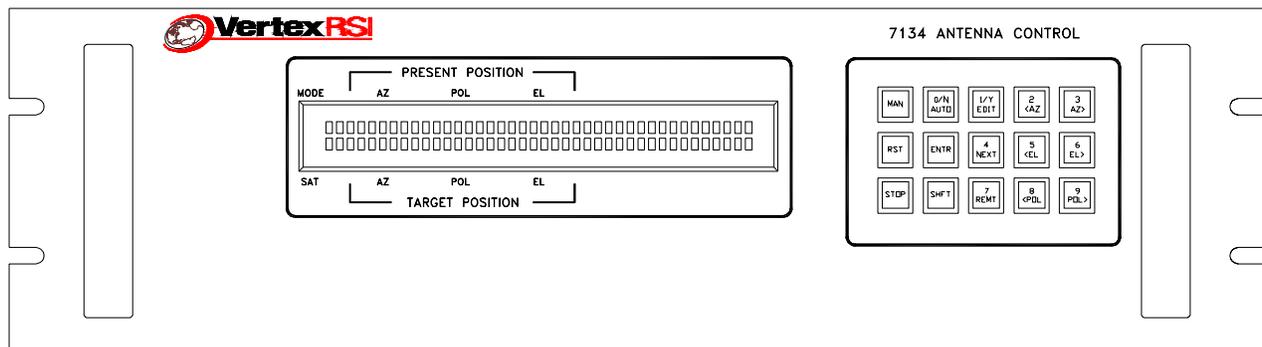


Figure 1-1 7134 and 7134-EMT Antenna Control Unit (Front Panel)

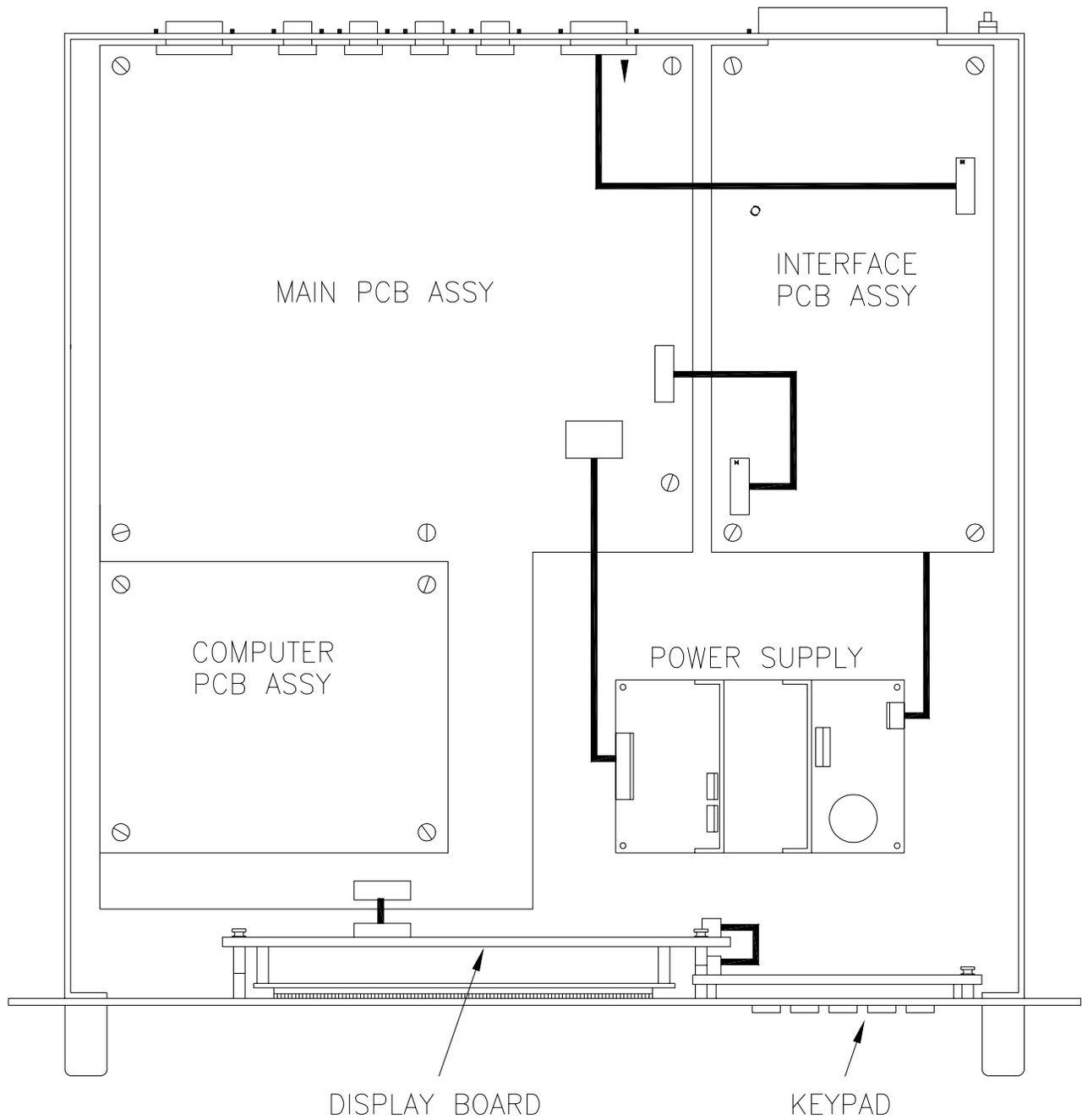


Figure 1-2 7134 and 7134-EMT Antenna Control Unit (Top View)

1.3.2 7150 Drive Cabinet

The standard pad-mounted motor drive cabinet (shown in Figure 1-3) 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.

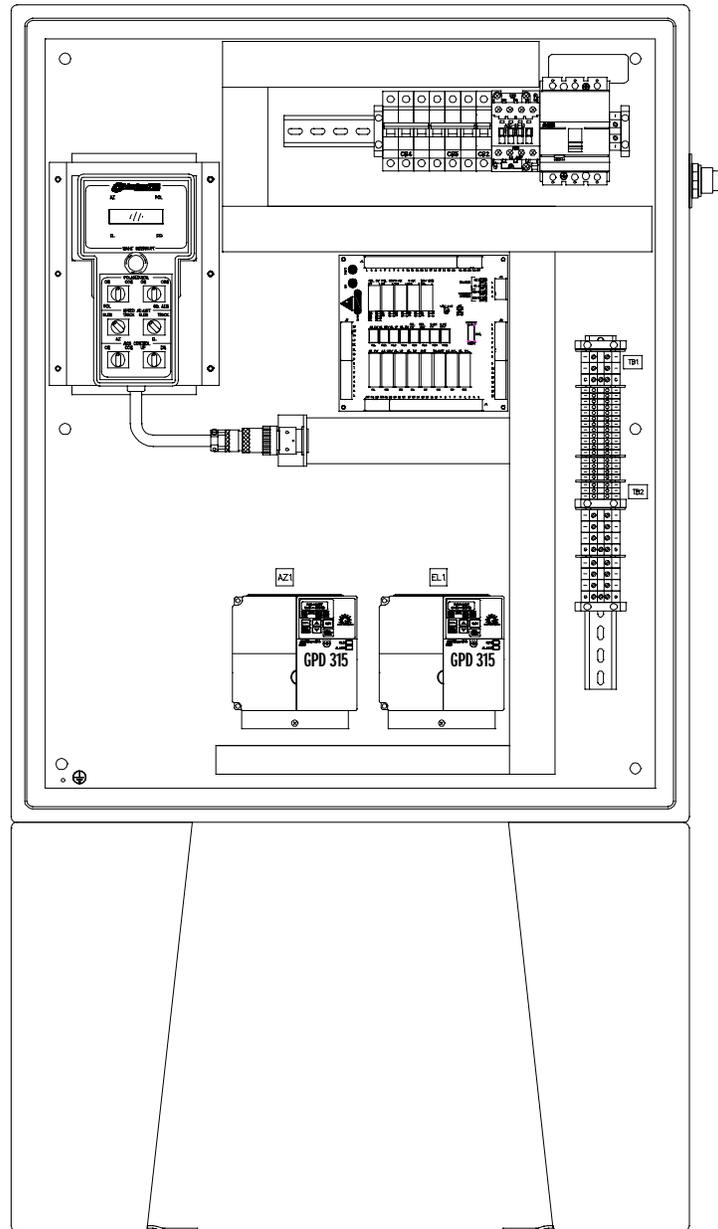


Figure 1-3 7150 Drive Cabinet

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

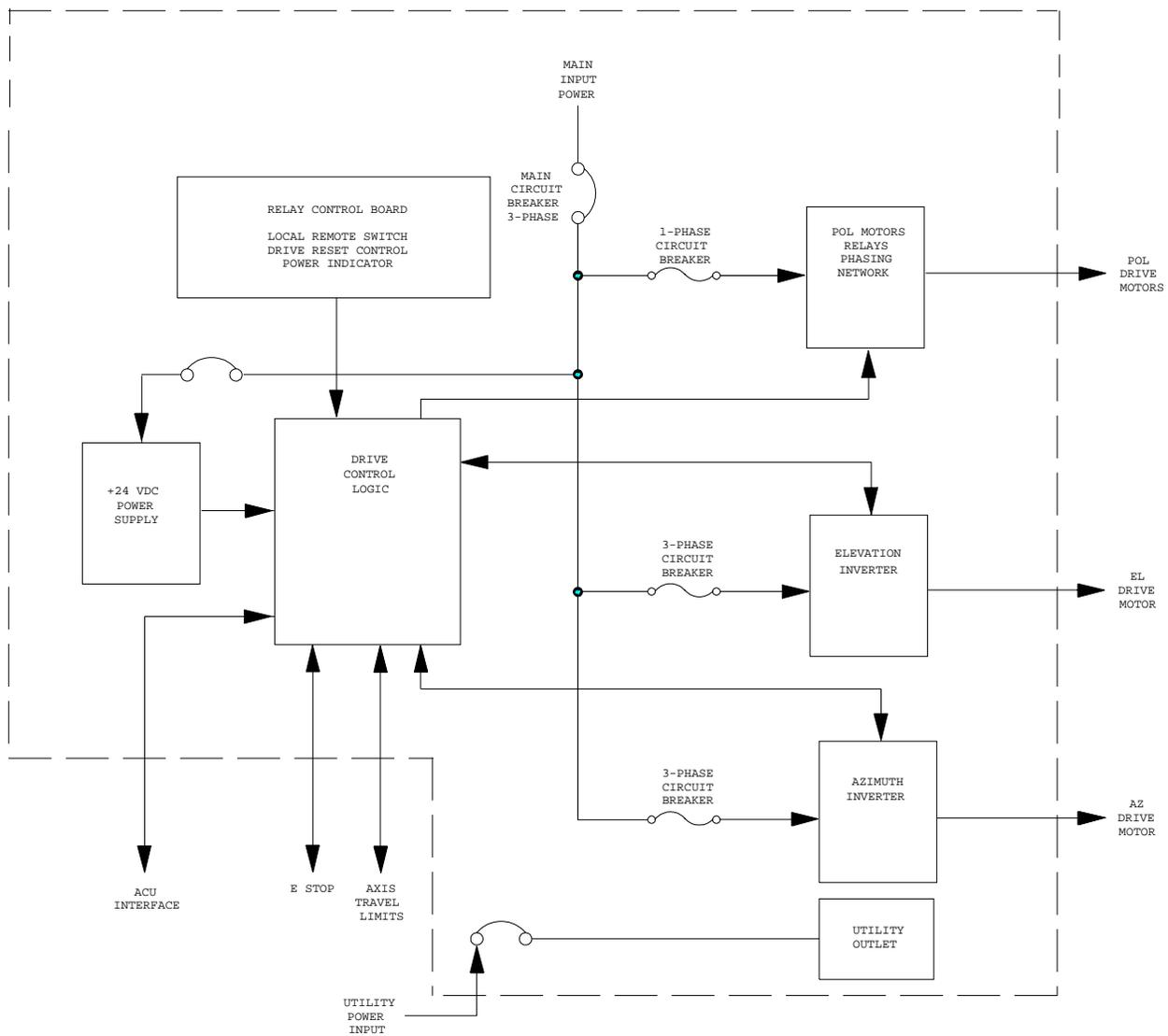


Figure 1-4 Drive Cabinet Block Diagram

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

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-EMT 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.

1.3.2.1 AZ and EL Drive Inverters

One of the critical advantages of the 7134 and 7134-EMT 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 VertexRSI 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.

1.3.2.2 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.

1.3.2.3 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.

1.3.2.4 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.

1.3.2.5 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.

1.3.2.6 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.

1.4 System Functions

When the power to the 7134 or 7134-EMT 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-EMT 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-EMT 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 several automatic submodes of antenna positioning:

7134 and 7134-EMT

- 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-EMT 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.

- d. **Enhanced Memory Track - Is Adaptive Step Track** with tracking data stored in a table for performing a curve fit to that data set which enables the 7134 EMT to continue following the satellite path when the signal level drops below the user settable low signal level parameter.
 - e. **Intelsat (IEEE412)** - The antenna is moved according to pointing data generated using the Intelsat Eleven Parameter Model. The ACU accepts element sets as distributed by Intelsat, as well as local site data, and calculates the corresponding predicted AZ and EL positions along the ephemeris. The antenna is then moved to the predicted positions with sufficient frequency to maintain pointing within a user-selectable deadband around the theoretical values. The data for a given target is maintained in a dedicated database for that target and is continually updated to provide appropriate positioning anytime the target is accessed (within time of validity constraints).
- 3. **Edit mode** - Allows entry of the **Target Track**, **Program Track**, **Adaptive Step Track (7134-EMT Only)**, **Enhanced Memory Track (7134-EMT Only)**, and **Intelsat Track (7134-EMT Only)**, and general system setup parameters, and position angle offsets from the keypad. In this mode, all 7134 and 7134-EMT 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.

1.5 Controls and Indicators

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

1.5.1 7134 and 7134-EMT ACU

The 7134 and 7134-EMT 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.

1.5.1.1 POWER ON/OFF Circuit Breaker

This circuit breaker acts as a protective device for the 7134 and 7134-EMT 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. Also see section 3.3.3.

1.5.1.2 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
	Idle
M	Manual Mode
A	Auto Mode
TT	Target Track Mode
PT	Program Track Mode
ST	Adaptive Step Track Mode*
E	Edit Mode
ET	Edit Target Track Database
EP	Edit Program Track Database
ES	Edit Adaptive Step Track*
EY	Edit Enhanced Memory Track*
EI	Edit Intelsat Track*
EO	Edit Position Offsets
EC	Edit Configurations
JG	Remote Jog
MT	Manual Track (Jump) Mode
IT	Intelsat Tracking Mode*
YI	Enhanced Memory Track*, Idle submode (e.g. no model)
YT	Enhanced Memory Tracking*
YS	Enhanced Memory Track, Step track submode*
YW	Enhanced Memory Track, Waiting submode*
YC	Enhanced Memory Track, Calculating submode*

* 7134-EMT Only

- 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**, **Enhanced Memory Track**, and **Intelsat Track** modes (7134-EMT 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.

1.5.1.3 Keypad

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

TABLE 1-2 7134 or 7134 ACU KEYPAD CONTROLS	
7134-EMT 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 , Adaptive Step Track (7134-EMT Only), Enhanced Memory Track (7134-EMT Only), and Intelsat Track (7134-EMT 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 the Auto tracking modes, Program Track , Target Track , etc. 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 , Adaptive Step Track (7134-EMT Only), Enhanced Memory Track (7134-EMT Only), or Intelsat Tracking (7134-EMT Only) when they are running. When entering Intelsat parameters this key also serves as a "." key to add the decimal place.
SHFT	When held down in Manual mode, 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.

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-EMT ACS for all modes of operation, including connection details for the remote serial interface. The remote interface protocol is provided in Appendix C.

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 VertexRSI 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-EMT ACU

Using four No. 10 screws, mount the 7134 or 7134-EMT 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-EMT ACS. The following paragraphs describe the cabling and list the connections for the 7134 and 7134-EMT ACS.

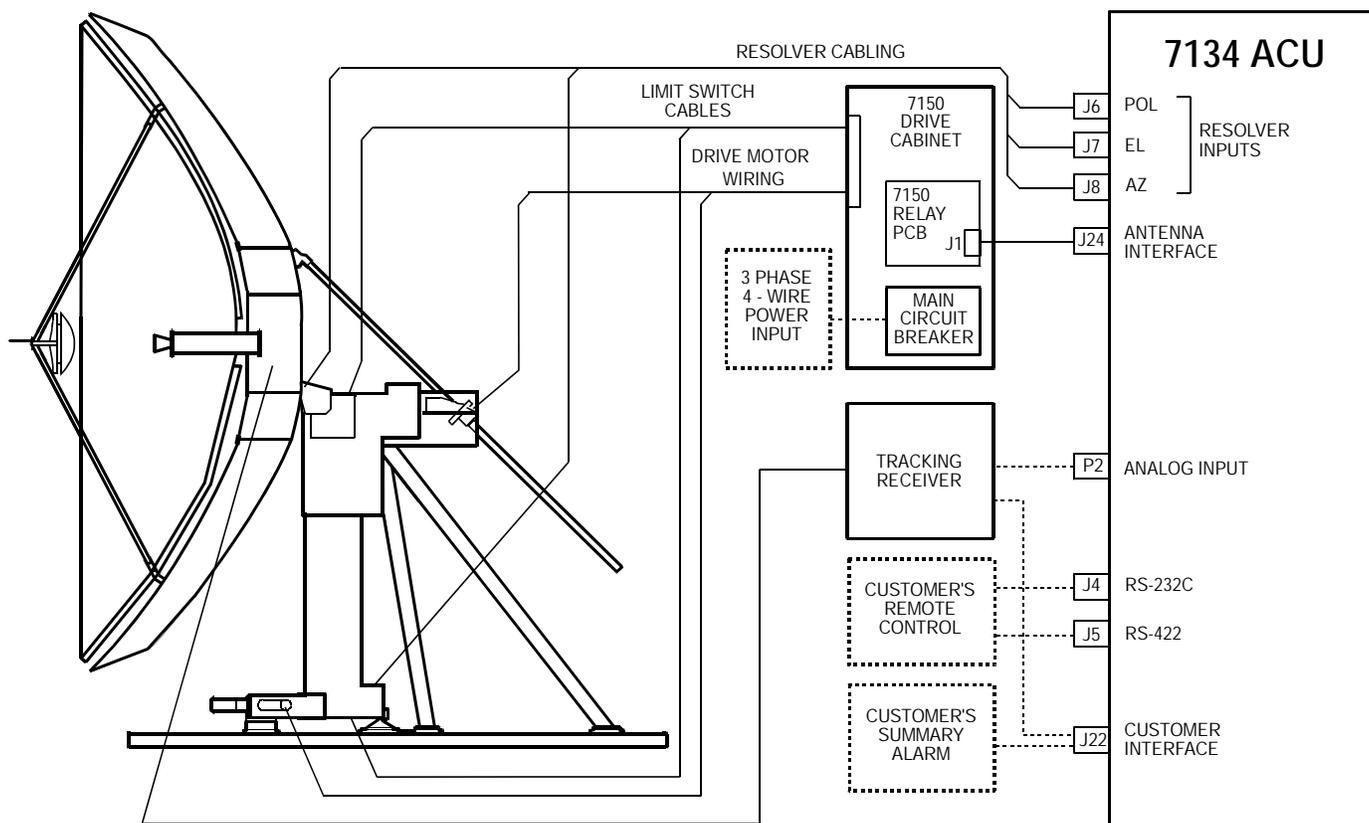


Figure 2-1 7134 and 7134-EMT ACS Cabling Diagram

Cables must be connected from the antenna to the 7150 drive cabinet, from the 7150 drive cabinet to the 7134 or 7134-EMT ACU, and from the antenna to the 7134 or 7134-EMT 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. Use Table 2-1 or Table 2-2 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 VertexRSI for the power requirements.)

TABLE 2-1 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 2-2 COMMON CONFIGURATIONS OF THE 7150 DRIVE CABINET 380-415 VAC 3 Phase		
MODEL MAIN 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 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 120 VAC 1-phase 20A circuit.

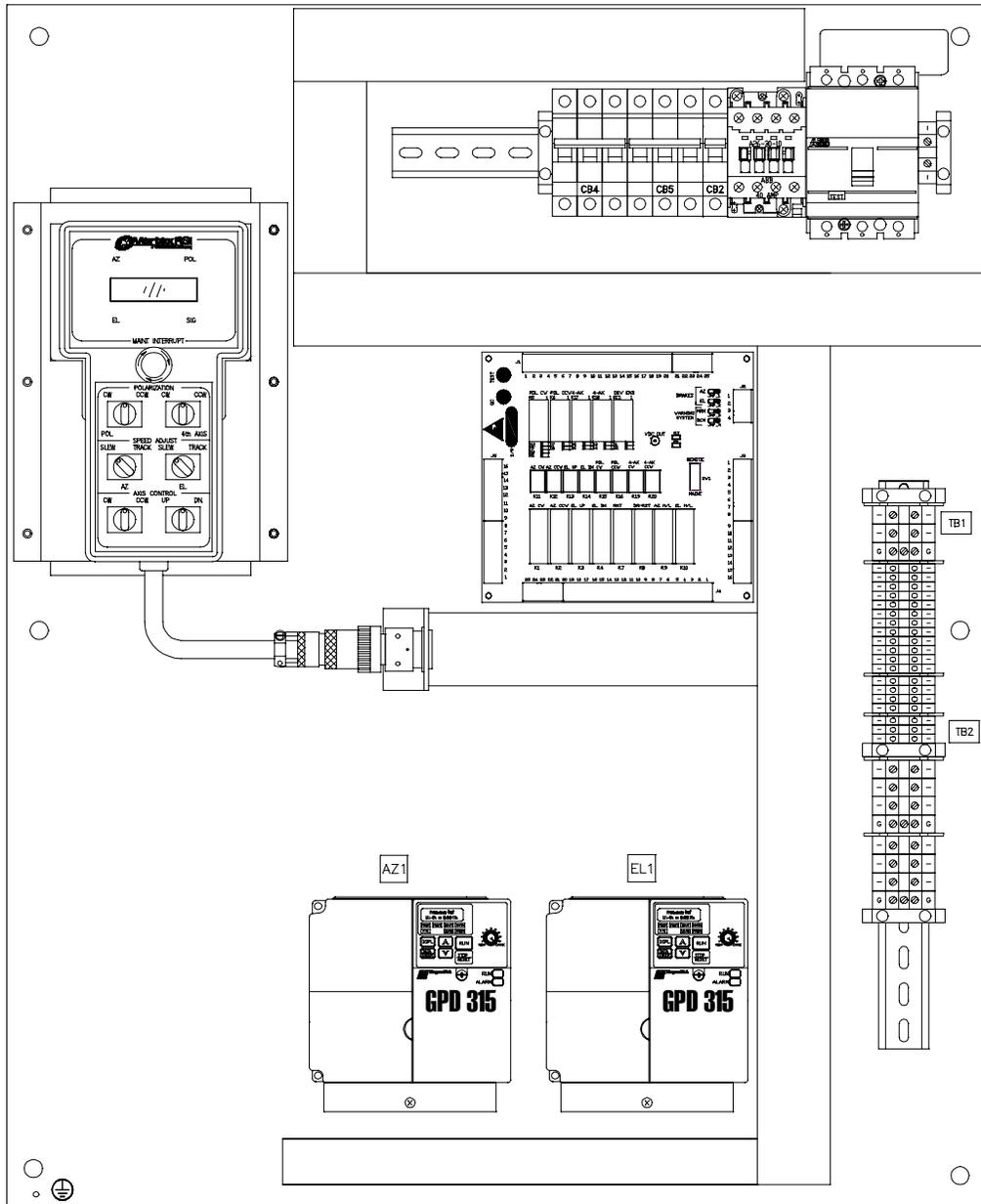


Figure 2-2 Drive Cabinet Assembly

2.2.2 Connecting the Drive Motors to the Drive Cabinet

To connect the drive motors to the drive cabinet, refer to Table 2-3 and use the following procedures.

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

TABLE 2-3 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.

2.2.3 Limit Switch Connections

Connect the limit switches to TB1-1 through TB1-9 on the drive cabinet as shown in Table 2-4. Note that normally closed (open upon limit) contacts are required.

TABLE 2-4 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

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

2.2.4 Installing the 7134 or 7134-EMT ACU Control Cable

Figure 2-3 shows the back panel layout of the 7134 and 7134-EMT ACU. The pin-out and function of each conductor of the 25-conductor control cable are listed in Table 2-5.

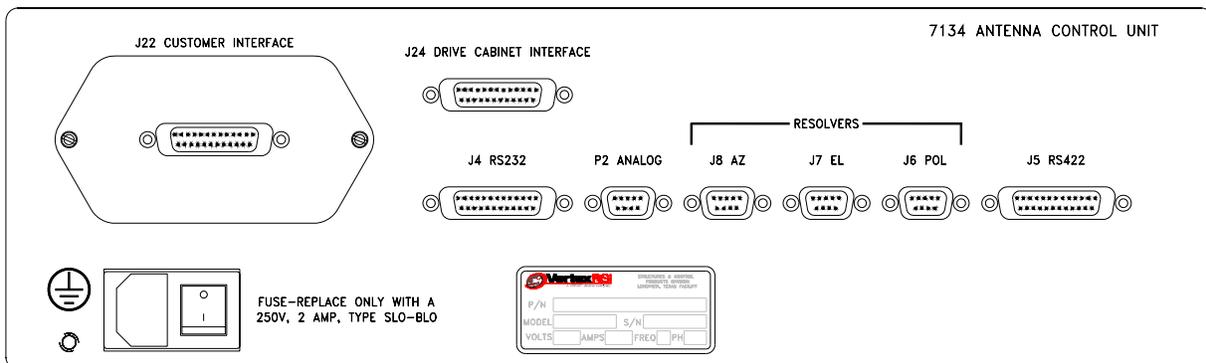


Figure 2-3 7134-EMT Antenna Control Unit Back Panel Layout

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

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

1. Connect one end of the 25-conductor control cable (Belden 8459 or equivalent) to the 25-pin connector labeled DRIVE CABINET INTERFACE (J24) on the back of the 7134 or 7134-EMT 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 2-5).

2.2.5 Resolver Connections

The connections for each resolver are identical to those provided in Table 2-6. 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 2-6 RESOLVER CONNECTIONS		
7134 and 7134-EMT 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-EMT 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 VertexRSI 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 2-7 and connect the analog inputs to P2 on the back of the 7134 and 7134-EMT ACU.

TABLE 2-7 ANALOG INPUT CONNECTIONS				
7134 & 7134-EMT (P2)	DESIGNATION	FUNCTION	TRC/TRK/TRX TRACKING RECEIVERS (TB1)	TRL (J3) OR DTR (I/O INT. #1)
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 2-8 and 2-9 provide the connections for the remote communication ports to the 7134 and 7134-EMT ACU. Refer to Appendix C for information on the remote communications protocol.

TABLE 2-8 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 2-9 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, J22, (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-EMT 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 2-10 and connect the customer interface to the connector on the back of the 7134 and 7134-EMT ACU.

TABLE 2-10 CUSTOMER INTERFACE TERMINAL CONNECTOR	
J24 PINS	DESCRIPTION
2, 4	Summary Fault Status Contacts
6, 8	Beacon #1 Select Contacts
10, 12	Beacon #2 Select Contacts
14, 16	Beacon #3 Select Contacts
18, 20	Beacon #4 Select Contacts
21, 22	Ground
1	Input #1
3	Input #1 Return
5	Input #2
7	Input #2 Return
9	Input #3
11	Input #3 Return
13, 15	Output #1 Contact
17, 19	Output #2 Contact
23, 24, 25	Unused

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-EMT 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 2-11 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 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 2.3.2.1 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

All functions of the inverter drives are accessed using the Digital Operator, shown in Figure 2-4. In addition to controlling the motor operation, the operator can enter information into the drive's memory to configure its operation. See the Vendor Manual in Appendix D for more detailed information.

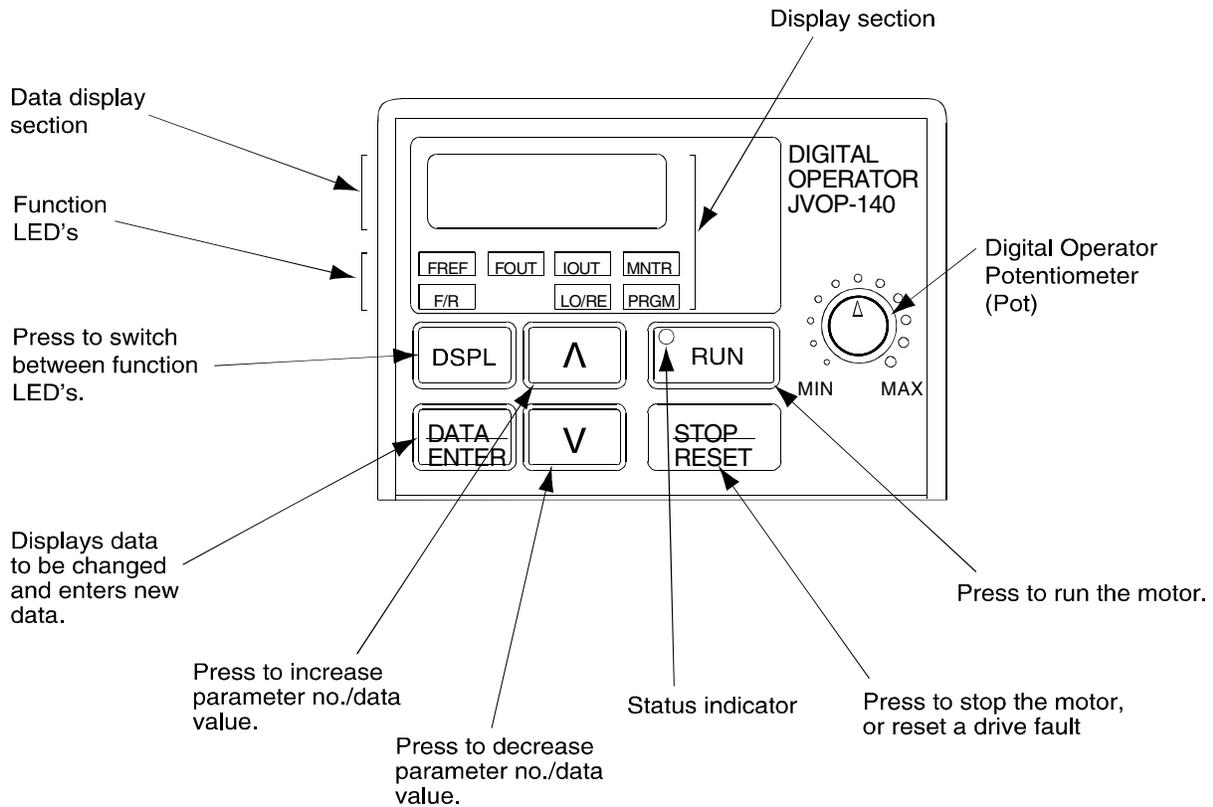


Figure 2-4 Digital Operator Indicator and Key Description

By pressing the DSPL key on the Digital Operator, the operator can step to each of the seven Function LED's and its associated display/setting function:

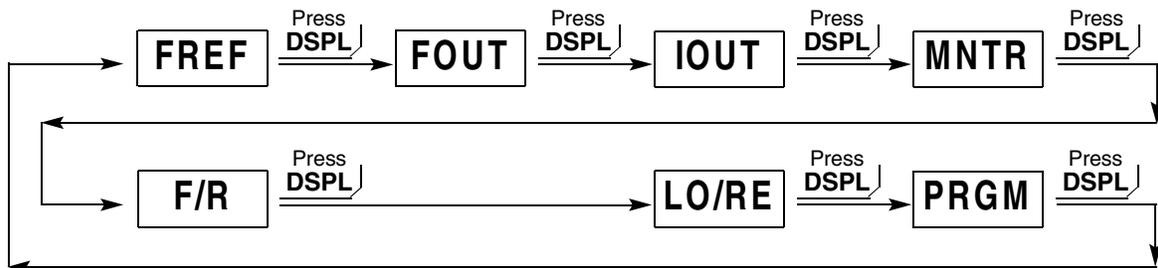


Figure 2-5 Digital Operator Indicator and Key Description

TABLE 2-12 DIGITAL OPERATOR LED FUNCTION DESCRIPTIONS	
Key	Description
FREF	Frequency Reference Setting Sets/Displays the inverter's operation speed (Hz).
FOUT	Output Frequency Monitor Displays the output frequency (Hz) at which the GPD 315 is currently operating. This is a monitor only function; the operator cannot change the displayed value by use of the keypad.
IOUT	Output Current Monitor Displays the level of the output current (Amps) that the GPD 315 is currently producing. This is a monitor only function; the operator cannot change the displayed value by use of the keypad.
MNTR	Monitor Selection Pressing ENTER allows access to the various Monitor parameters, U-01 through U-10 . These are monitor only functions; the operator cannot change the displayed value. Accessible during run command. See vendor literature for complete listing of all monitor parameters.
F/R	FWD/REV Run Selection Sets the rotation direction of the motor when a Run command is given by the Digital Operator keypad. Display of For = forward run, rEu = reverse run.
LO/RE	Local/Remote Selection This toggles between the Local (Digital Operator) and Remote (set by parameters n003 & n004) modes of operation. This affects both the start/stop functions, as well as the frequency reference. Local/Remote status cannot be changed using this LED when a multi-function input terminal is set for Local/Remote (n050 through n056 set for "17").
PRGM	Parameter Programming Selects or reads data using parameter number (nXXX). Data is displayed by pressing the ENTER key, and can be changed by pressing the "up arrow" or "down arrow" keys. Any changes can be saved by again pressing the ENTER key. Pressing the DSPL key exits the Programming mode.

2.3.2.2 Inverter Drive Setup (Function Parameters)

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

TABLE 2-13 GPD315 DRIVE PARAMETERS				
PARAMETER	DESCRIPTION	SETTING	AZ INVERTER SETTINGS	EL INVERTER SETTINGS
n002	Control Method	1		
n003	Operation Mode Selection	1		
n004	Reference Selection	1		
n008	Reference-Digital Operator	1		
n011	Motor Operating Frequency	Motor Nameplate Frequency		
n012	Motor Operating Voltage	Motor Nameplate Voltage		
n013	Maximum Frequency @ Motor Operating Voltage	Motor Nameplate Frequency		
n019*	Acceleration Time	0.8 seconds		
n020*	Deceleration Time	0.8 seconds		
n025*	Frequency Reference	Set Frequency to obtain 10% of Motor Rated Speed		
n026*	Frequency Reference	Motor Nameplate Frequency		
n036	Motor Rated Current	Enter the Motor Nameplate Current		
n050	Multi-Function Input (S1) Forward Run	1		
n051	Multi-Function Input (S2) Reverse Run	2		
n053	Multi-Function Input (S4) Fault Reset	5		
n054	Multi-function Input (S5) Speed Ref. #1	6		
n055	Multi-Function Input (S6) Speed Ref #2	7		
n057	Multi-Function Output (MA, MB)	0		
n082	Number of Auto Restarts	3		
n090	DC Injection Time at Stop	0.5		
n103**	Torque Compensation Gain	.2		

* Parameters can be changed while the inverter is running.

**This parameter may have to be adjusted depending on the motor characteristics

NOTE: Do not make changes to the program function codes before contacting VertexRSI Control & Structures Division. 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.

<p style="text-align: center;">WARNING <i>IF ANY AXIS DRIVE MOTOR IS PHASED INCORRECTLY, THE CORRESPONDING ELECTRICAL LIMIT SWITCH WILL NOT PREVENT OVERTRAVEL OF THE ANTENNA.</i></p>
--

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-EMT ACU Software Initialization

These paragraphs describe the procedures for the initial setup of the 7134 and 7134-EMT ACU for operation. All data (configuration and tracking databases) are stored in a nonvolatile, battery-backed RAM, so these need to be set once, when the 7134 or 7134-EMT ACS is first installed. Configuration of the ACU's parameters should be done only after the entire 7134 or 7134-EMT 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-EMT ACU, read Section 3.0, Operation, before proceeding with installation configuration. Note, however, that while the 7134-EMT ACU may not be configured properly for the intended site, the parameter and tracking database 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-EMT ACU

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

1. Set the ACU's system time. **Program Track**, **Enhanced Memory Track** (7134-EMT Only), and **Intelsat Track** (7134-EMT Only) do not function properly if system time is not set.
2. Set resolver offsets. The ACU will not read the current look angles correctly until the resolver offsets are set.
3. Set configuration parameters. The factory defaults for these parameters are usually adequate. However, a few of them are very installation-dependent. In particular:
 - 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 tracking modes will not function properly.
4. Set the desired tracking parameters.
5. Set the 0 dB and -3 dB levels.

3.0 OPERATION

After the 7134 or 7134-EMT 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-EMT 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-EMT ACU.

3.1 Power-Up Procedures

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

1. On the drive cabinet, pull the EMERGENCY STOP switch to the out position.
2. On the drive cabinet set the CONTROL POWER circuit breaker to ON.
3. On the drive cabinet swing-out control panel, set the MODE switch to REMOTE.
4. On the 7134 or 7134-EMT ACU control panel, set the ON/OFF switch to ON. The display first shows the 7134 software version and then performs a self-diagnostic test. The display will indicate any detected problems. If there are no problems, the display then shows the current azimuth, polarization, and elevation angles of the antenna.

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

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-EMT 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** tracking mode (**Target Track**, **Program Track**, etc.), 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 in local control and tracking when power was turned off.

3.4 Manual Operation from the 7134 and 7134-EMT 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-EMT 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-EMT 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 and 7134-EMT ACU

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:
- 2.

< CHANGE BEACON >	0 dB	-3 dB	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-EMT ACU

The following automatic submodes of operation are available from the 7134 and 7134-EMT ACU. Operation of each mode is discussed in the following paragraphs.

TABLE 3-1 AUTOMATIC SUBMODES	
7134	7134-EMT
Target Track*	Adaptive Step Track (AST)
Program Track*	Enhanced Memory Track (EMT)
*(also in 7134-EMT)	Intelsat Track

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 database.

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 database.

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 database (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 7134-EMT Only

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-EMT 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: <TGT> PGM STEP MEMRY INTSAT

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 database, 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 database.

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 database 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-EMT 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 PGM.
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-EMT 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-EMT 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: <TGT> PGM STEP MEMRY INTSAT

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.

3.5.4 Operation of the Enhanced Memory Track Mode (7134-EMT Only)

Enhanced Memory Track operates **Adaptive Step Track** as long as a beacon signal is present. The steps are taken at a user-determined interval specific to memory track, between 1 and 29 minutes inclusive. While step tracking is proceeding, the 7134 ACU stores AST cycle peak angle data points. If a low signal condition occurs, a model is constructed from the stored data points (provided there are sufficient data points as described in the paragraphs below).

At most, one AST cycle data point is stored in any ten-minute window, where the windows start at exact multiples of ten minutes. The window to which a point belongs is determined by the time at which the step-track was started, rather than the time at which it ended. So the actual time of the point may not be inside the window, but rather in the next one. A model is created by fitting the data points to a periodic curve with a period of one sidereal day. Only the last 72 hours of data is used in creating a model.

Full Model – The full model is created from a continuous 24-hour set of data with no large time gaps (>1 hour) between AST cycle data points. If this is not possible, points are merged in from previous time periods to make a model: for each 10-minute window, it is determined whether there is a point in that window in any of the three previous days. If insufficient data points exist to create a full model then the 7134 attempts to create an Extrapolated model from the data points (see below).

Extrapolated Model – An Extrapolated model is attempted if the Extrapolate Data parameter is set to yes; otherwise a "Contigs" model is attempted (see below). If there are at least 36 unique 10-minute windows with AST cycle data points, then a model is created. Having a data point at the same time two days in a row is only considered to be one AST cycle data point where the most recent point in time is used and the other is ignored. If there are less than 36 data points then the 7134 ACU attempts to create a "Contigs" model (see below).

Contigs Model – The 24-hour cycle is divided into "contigs": this is a series of almost-consecutive data points, with no more than 2 windows in a row missing, and where there are at least 9 points. If there are never more than 12 missing windows (2 hours) between contigs, then a model is created. Interpolation is performed to fill the empty data point windows.

If one or more of the time gaps between contigs is too large (> 2 hours), then the 7134 ACU will memory track as long as the data points exist to determine the commanded antenna position. When the 7134 ACU reaches a large time gap in the data it will hold the last known position until the next known data point time arrives.

Whenever a model is constructed, the program also calculates and briefly displays the "internal" rms error, between the model predictions and the points on which the model is based. If this rms error is more than a certain percentage of the beamwidth (determined by the user), the model is rejected. In that case, the actual percentage seen is displayed to the user, so that he can determine whether or not to raise the limit and thereby accept the model.

NOTE: Refer to paragraph 3.6.8 for instructions on setting the Enhanced Memory Track parameters.

To operate the 7134-EMT ACU in Enhanced Memory 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: <TGT> PGM STEP MEMRY INTSAT
```

2. Use the NEXT key to place the brackets around MEMRY.
3. Press the ENTR key. The display responds with information similar to the following:

```
MEMORY TRACK: Target A ENTR/NEXT/RST
```

- The ENTR key selects the currently displayed Target (A, B or C). Only targets that have previously been set up in the EDIT menu will be displayed.
 - The NEXT key cycles to the next target (A, B or C)
 - The RST key exits the menu.
4. Pressing ENTR begins the **Enhanced Memory Track** operation.

3.5.5 Operation of the Intelsat (IESS412) Track Mode (7134-EMT Only)

In this IESS-412 mode, the antenna is moved according to pointing data generated using the Intelsat Eleven Parameter Model. The ACU accepts element sets as distributed by Intelsat, as well as local site data and date/time, and calculates the corresponding predicted AZ and EL positions along the ephemeris. The antenna is then moved to the predicted positions with sufficient frequency to maintain pointing within a user-selectable deadband around the theoretical values. The data for a given target is maintained in a dedicated database for that target and is continually updated to provide appropriate positioning anytime the target is accessed (within time of validity constraints).

NOTE: Refer to paragraph 3.6.9 for instructions on setting the Intelsat Tracking parameters.

To operate the 7134-EMT ACU in Intelsat 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: <TGT> PGM STEP MEMRY INTSAT
```

2. Use the NEXT key to place the brackets around INTSAT.
3. Press the ENTR key. The display responds with information similar to the following:

```
1 805 304.4523 03/06/04 17:00:00
```

If the IDENT is enclosed by "X" characters (as shown below) the data set has one or more incorrectly entered parameters. Check the data and re-enter the parameters as necessary.

```
1 X805X 304.4523 03/06/04 17:00:00
```

At this point, the display can be cycled to any of the entered Intelsat parameters by pressing the NEXT key. When the desired parameter is displayed, press ENTR.

4. Intelsat Tracking will begin.

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

Each antenna installation is unique and requires custom configuration; therefore, configuring the 7134 and 7134-EMT 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-EMT 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 database information, and editing or deleting data stored in memory.

3.6.1 Setting the Time and Date

3.6.1.1 Setting the Time

Follow these steps to set the real-time clock. The system is designed to use local site time, but UTC can be used if desired.

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

```
EDIT: <TGT> PGM STEP MT IT POS CNFG
```

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

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

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. NOTE: The clock is a 24-hour clock, i.e. no a.m. or p.m.
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. The display shows the following:

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

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

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

3.6.1.2 Setting the Date

Follow these steps to set the date.

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

```
EDIT: <TGT> PGM STEP MT IT POS CNFG
```

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

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

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

```
CHANGE? Y:03 M:06 D:04 (Wed) UTC +00:00
```

4. The cursor is blinking awaiting a Y/N response. To change the date, press the "Y" key on the keypad. (Pressing "N" will exit this menu.)
5. The bottom line of the display shows the following:

```
SET Y:03 M: D: ( ) UTC
```

6. Enter the correct year by pressing the numeric keys followed by the ENTR key.
7. Enter the Month and Day as in step 6.
8. The display now shows the following:

```
SET Y:03 M:06 D:04 (Wed) UTC +00
```

Notice that the real-time clock in the 7134 has provided the correct day of the week after the date information has been entered.

9. Using the keypad, enter the number of hours the local timezone is different from Coordinated Universal Time (UTC). Use the "+/-" key to adjust for ahead or behind UTC. Press enter once after entering each hours and minutes. **Note:** users < 180° W of UTC time will enter a negative offset while those < 180° E will enter a positive offset.
10. The unit will then respond with "DO IT?". To accept the date changes, press "Y", otherwise press "N".
11. The display will briefly show "DATE CHANGED".

3.6.2 Configuration Parameters

The following paragraphs explain each configuration parameter and provide detailed instructions on setting the configuration parameters.

3.6.2.1 Configuration Parameters Defaults and Definitions

Table 3-2 lists each configuration parameter, its type, default value, and an explanation of each parameter.

TABLE 3-2 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 databases 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	120.00°	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	230.00°	
POL LOWER LIMIT	LIMITS	-95.0°	
POL UPPER LIMIT	LIMITS	+ 95.0°	
EL LOWER LIMIT	LIMITS	15.00°	
EL UPPER LIMIT	LIMITS	60.00°	
MOTION ERROR PARAMETER	LIMITS	080	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	0.10°	If set to 0.10° and the antenna moves this many degrees without program command, the display shows RUNAWAY ERROR. To disable this parameter, set it to 0.00.

TABLE 3-2 CONFIGURATION PARAMETERS			
PARAMETER	TYPE	DEFAULT	EXPLANATION
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 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-EMT 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 or Enhanced Memory 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-EMT 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 or Enhanced Memory 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	2.0°	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	2.0°	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 ANGLE	TRACKING	3.0 SECONDS	These reflect the coasting time for the antenna to stop moving after a drive command has been removed. Both coast times must be long enough for the antenna to come to a complete stop after driving.
SLOW COAST ANGLE	TRACKING	1.0 SECOND	
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. 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-EMT Only) operation.
INCHING OFF TIME	TRACKING	0.5 SECONDS	

TABLE 3-2 CONFIGURATION PARAMETERS			
PARAMETER	TYPE	DEFAULT	EXPLANATION
DEADBAND	TRACKING	0.02°	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 CHANNEL?	MISC	NO	The 7134 ACU has two independent A/D channels. Setting this 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-EMT Only). To use this input for other purposes, contact VertexRSI.
DISPLAY TIME?	MISC	NO	If this parameter is set to YES, the display shows the current time. VertexRSI recommends that this parameter be set to NO for Adaptive Step Track (7134-EMT Only). 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.
AZ. CENTERLINE	MISC	180.00°	This parameter is for mobile applications only; it may be ignored for fixed antennas. It is set to the center of the antenna's azimuth range of motion or reference heading in degrees. When set, the AZ. position/offset and AZ lower/upper soft limits are automatically rotated from their current values by the difference of the new centerline and the previous centerline. This parameter must be correct before configuring the azimuth resolver offset, AZ LOWER LIMIT, and AZ UPPER LIMIT.

3.6.2.2 Setting Configuration Parameters

To change any of the default configuration parameters listed in Table 3-3, 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 3-4 through 3-6) 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-EMT ACU control panel, press the EDIT key. The bottom line of the display shows the following:

EDIT: <TGT> PGM STEP MT IT POS CNFG

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

CONFIGS: <EDIT> SET TIME SET DATE

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 3-3. Press the ENTR key to store the data in memory and to view the next INSTALLATION parameter.

TABLE 3-3 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 3-4. Press the ENTR key to store the data in memory and to view the next LIMITS parameter.

TABLE 3-4 CHANGES TO LIMITS PARAMETERS		
PARAMETER	DEFAULT	NEW SETTING
AZ LOWER LIMIT	120.0°	
AZ UPPER LIMIT	230.0°	
EL LOWER LIMIT	15.0°	
EL UPPER LIMIT	60.0°	
POL LOWER LIMIT	-95.0°	
POL UPPER LIMIT	+ 95.0°	
MOTION ERROR PARAM	80.0	
RUNAWAY ERROR ANGLE	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 3-5. Press the ENTR key to store the data in memory and to view the next TRACKING parameter.

TABLE 3-5 CHANGES TO TRACKING PARAMETERS		
PARAMETER	ROM DEFAULT	NEW SETTING
POSITION ACTIVE?	YES	
STEP ACTIVE?	YES	
AZ COAST ANGLE	02.0 DEGREES	
EL COAST ANGLE	02.0 DEGREES	
FAST COAST TIME	03.0 SECONDS	
SLOW COAST TIME	01.0 SECONDS	
INCHING ON TIME	00.2 SECONDS	
INCHING OFF TIME	00.5 SECONDS	
DEADBAND	00.01 DEGREES	

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", press the AUTO key to answer "NO", or enter the new value using the numeric keys and press ENTR.
4. Record the new setting in Table 3-6. Press the ENTR key to store the data in memory and to view the next MISC parameter.

TABLE 3-6 CHANGES TO MISCELLANEOUS PARAMETERS		
PARAMETER	ROM DEFAULT	CHANGES
SECOND A/D CHANNEL?	NO	
DISPLAY TIME?	NO	
DISPLAY dB?	YES	
AZ. CENTERLINE	180.00	

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 MT IT POS CNFG

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 MT IT POS CNFG

2. Use the NEXT key to place the brackets around POS.
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 MT IT POS CNFG

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. $360 - (155.63 - 155.55) = 359.92$

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.

- Using the numeric keys, enter the desired elevation offset.
- 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) Database

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 Database

To change the contents of the target database, use the following procedures.

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

```
EDIT: <TGT> PGM STEP MT IT POS CNFG
```

- 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
```

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

```
01±
```

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

- Press the ENTR key to place the azimuth value into memory and to initialize the polarization entry.
- Enter the polarization coordinate by using the +/- key and the numeric keys.
- Press the ENTR key to place the polarization value into memory and to initialize the elevation entry.
- 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.
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 Database

To view the contents of the database, use the following procedures.

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

```
EDIT: <TGT> PGM STEP MT IT POS CNFG
```

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 Database

To delete portions of the database, use the following procedures.

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

```
EDIT: <TGT> PGM STEP MT IT POS CNFG
```

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.

Operation

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 Database

To clear the Target Track database, use the following procedures.

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

```
EDIT: <TGT>  PGM  STEP  MT IT POS CNFG
```

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 database, press the EDIT key, or press the AUTO key and the 7134-EMT 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-EMT returns to the TARGETS menu.

3.6.5 Editing the Program Track (PGM) Database

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

3.6.5.1 VIEW the Program Track Database

To view the contents of the database, use the following procedures.

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

```
EDIT: <TGT>  PGM  STEP  MT IT POS CNFG
```

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 database contains no stored values, the display shows DATABASE EMPTY. If the database 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-EMT ACU returns to the PGM menu.

3.6.5.2 ADD to the Program Track Database

To add satellite locations to the existing database, 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  MT  IT  POS  CNFG
```

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.

Operation

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 database, press the ENTR key at each of the cursor's stops. To add a new position to the database, 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 database 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** database 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-EMT ACU returns to the **Edit** mode.

3.6.5.3 EDIT the Program Track Database

NOTE: An empty database cannot be edited. If the database 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 MT IT POS CNFG

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 database, press the ENTR key at each of the cursor's stops. To add a new position to the database, 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 Database

To erase the Program Track database, use the following procedures.

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

```
EDIT: <TGT> PGM STEP MT IT POS CNFG
```

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 database, press the EDIT key to answer "YES". To abort the change, press the AUTO key to answer "NO". The 7134-EMT 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 Database

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

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

EDIT: <TGT> PGM STEP MT IT POS CNFG

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 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-EMT ACU returns to the **Program Track** database 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 Editing the Adaptive Step Track Configuration (7134-EMT Only)

Table 3-7 lists each **Adaptive Step Track** configuration parameter, its default value, and an explanation of each parameter.

TABLE 3-7 ADAPTIVE STEP TRACK PARAMETERS		
PARAMETER	DEFAULT	EXPLANATION
CYCLE TIME (0 = OFF)	15 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-EMT will do one Adaptive Step Track cycle to peak up on the satellite and return to the previous menu. Note: Enhanced Memory Track uses its own cycle time parameter.
LOW SIGNAL LEVEL	10.00 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.
TRACK	00.00 dB	While the ACU is waiting for the cycle time to expire (to begin a new Adaptive Step

TABLE 3-7 ADAPTIVE STEP TRACK PARAMETERS		
PARAMETER	DEFAULT	EXPLANATION
THRESHOLD		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°	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.
MAX # ATTEMPTS	6	This parameter limits the number of AZ and EL attempts the Adaptive Step Track algorithm makes in finding the peak signal.
STEP SIZE	00.06°	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	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	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	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°	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.
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.
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.

1. Press the EDIT key. The display shows:

EDIT: < TGT > PGM STEP MT IT POS CNFG

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-EMT ACU with respect to the tracking signal used for **Adaptive Step Track**.

For **Adaptive Step Track**, the 7134-EMT 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-EMT 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-EMT ACU. Although the ACU has two independent A/D inputs, the current A/D input is not changed when the current beacon is changed.

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.
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.

3.6.8 Editing the Enhanced Memory Track Configuration (7134-EMT Only)

Table 3-8 lists each Enhanced Memory Track configuration parameter, its default value, and an explanation of each parameter.

TABLE 3-8 ENHANCED MEMORY TRACK PARAMETERS		
PARAMETER	DEFAULT/ UNITS/ RANGE	EXPLANATION
MEM TRK STEPTIME	15 MINUTES 1 TO 29	This is the time, in minutes, between the beginning of one Adaptive Step Track cycle and the beginning of the next cycle. Setting this value towards the upper limit will maximum antenna jack life. Setting this value towards the lower limit will maximize the memory track table data points and allow the 7134 to track inclined orbit satellites. (The 7134-EMT in memory track mode stores a maximum of one data point in each 10 minute time slot, therefore it should be set lower than 10 minutes for highly inclined satellites).
TARGET A TARGET B TARGET C	0 (Target #) 0 to 50	A memory table is stored for the selected target # (1-50). Setting this parameter to zero sets the memory target to unused and discards any data points currently in the table. The target number does not have to belong to a valid target at the time it is entered; the target validity is checked when entering the memory track process.
MODEL TOLERANCE	20 (% Of 3dB beamwidth) 10 to 50	If the calculated model has an internal RMS error greater than the Model Tolerance parameter then the model is not used.
EXTRAPOLATE DATA	YES YES or NO	Setting this parameter to YES enables the 7134-EMT to use the memory track table data even if a full model does not exist due to a lack of enough data points spanning the full 24 hour period. Extrapolated Model memory tracking will only track when it has a corresponding historical data point; otherwise it holds at the position of the last known point until the next corresponding historical data point is encountered.

The parameters above can be entered one at a time by following the displayed menu option for each successive parameter.

The desired value must be entered with the keypad followed by the ENTR key to proceed to the next parameter.

3.6.9 Editing Intelsat Tracking Parameters (7134-EMT Only)

Table 3-9 lists each Intelsat Track configuration parameter and a description of each parameter. See section 3.6.9.2 for more detailed entry instructions.

TABLE 3-9 INTELSAT 11-ELEMENT PARAMETERS		
PARAMETER	DESCRIPTION	
IDENT	The 3-digit satellite identifier that is assigned to a satellite by Intelsat. NOTE: this field can alternatively contain other identifying characters as deemed useful by the end user.	
EPOCH	Year	Year portion of the epoch time on which the ephemeris is based; value must be the last two digits of the year (20## where ## is 01 - 99).
	Month	Month portion of the epoch time on which the ephemeris is based; input is a two-digit integer value (01 - 12).
	Day	Day portion of the epoch time on which the ephemeris is based; input is a two-digit integer value (01 - 31).
	Hour	Hour portion of the epoch time on which the ephemeris is based; input is a two-digit integer value (00 - 23).
	Minute	Minute portion of the epoch time on which the ephemeris is based; input is a two-digit integer value (00 - 59).
	Second	Second portion of the epoch time on which the ephemeris is based; input is a two-digit integer value (00 - 59).
LM0 [deg. E]	Mean longitude (degrees east of Greenwich). Labeled LMO on the 11-parameter ephemeris from Intelsat.	
LM1 [deg/day]	Mean longitude drift rate (degrees east per day).	
LM2 [deg/day/day]	Mean longitude drift acceleration (degrees east per day).	
LONC [deg. E]	Amplitude of the cosine component of the longitude oscillation (degrees east).	
LONC1 [deg/day]	Rate of change in LONC (degrees east per day).	
LONS [deg. E]	Amplitude of the sine component of the longitude oscillation (degrees east).	
LONS1 [deg/day]	Rate of change in LONS (degrees east per day).	
LATC [deg. N]	Amplitude of the cosine component of the latitude oscillation (degrees north).	
LATC1 [deg/day]	Rate of change in LATC (degrees north per day).	
LATS [deg. N]	Amplitude of the sine component of the latitude oscillation (degrees north).	
LATS1 [deg/day]	Rate of change in LATS (degrees north per day).	
LON170 [deg. E]	Satellite longitude at epoch plus 170 hours (degrees east).	
LAT170 [deg. N]	Satellite latitude at epoch plus 170 hours (degrees north).	
POL [deg]	Polarization angle used with Intelsat tracking if POL is enabled. If the ACU does not control POL, this value is irrelevant.	

3.6.9.1 Editing Earth Station Parameters

To adjust the earth station information, use the following procedures.

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

```
EDIT: <TGT> PGM STEP MT IT POS CNFG
```

2. Use the NEXT key to place the brackets around IT.
3. Press the ENTR key to initialize the **Intelsat Track** screen. The display shows the following:

```
INTELSAT: <EARTH STATION> SATELLITES
```

4. Use the NEXT key to place the brackets around EARTH STATION and press ENTR.
5. Input the Longitude, Latitude and Altitude of the earth station site using the keypad, pressing ENTR after each value is input.

The first is the longitude, in degrees E of Greenwich, of the earth station (use a negative number for degrees W of Greenwich). The second is the latitude, in degrees N of the equator. The third is the altitude, in kilometers.

NOTE: The STOP key functions as a "." (decimal point) in this mode.

6. After entering the last parameter (altitude), the display will show:

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

7. Press "Y" to keep these changes, otherwise press "N".

3.6.9.2 Editing Intelsat Satellites

To edit the intelsat satellite information, use the following procedures.

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

```
EDIT: <TGT> PGM STEP MT IT POS CNFG
```

2. Use the NEXT key to place the brackets around IT.
3. Press the ENTR key to initialize the **Intelsat Track** screen. The display shows the following:

```
INTELSAT:  EARTH STATION  < SATELLITES >
```

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

```
SAT'S: < ADD/EDIT >  VIEW  DEL  CLR ALL
```

- To add Intelsat Satellite parameters to your unit, select ADD/EDIT. Since no values have yet been input, the display will show the following:

```
1 Not Entered
```

- To edit this "empty" parameter position, press ENTR. The unit will now cycle through the parameters in Table 3-9. After all parameters have been entered, the display will show the following:

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

Press "Y" to keep these changes, otherwise press "N". The sets are error-checked at this time and a warning is displayed only if one or more of the parameters has been incorrectly entered. If no warning is displayed, the parameters have been entered correctly.

NOTE: The ADD/EDIT screen will allow cycling through all all available Intelsat Satellite positions (1-9). "Not entered" will display in those positions which no data has been entered.

3.6.9.3 Viewing Intelsat Satellites

The VIEW screen only displays the Intelsat targets that have been set up. The VIEW screen will display "NONE ENTERED" if no Intelsat targets have been entered.

3.6.9.4 Deleting Intelsat Satellites

After selecting SATELLITES from the Intelsat Track menu, use the NEXT key to place the brackets around DEL as shown below:

```
SAT'S: ADD/EDIT  VIEW  <DEL>  CLR ALL
```

1. Pressing ENTR will display a list of all Intelsat satellites that are currently in the system (much like in the VIEW screen).
2. Use the NEXT key to select the satellite to be deleted.
3. Press ENTR. The following screen will be displayed:

```
DELETE ENTRY? (Y/N)
```

4. Press "Y" to confirm the deletion, otherwise press "N".

3.6.9.5 Clearing All Intelsat Satellites

1. If all Intelsat satellites need to be deleted, use NEXT to place the brackets around CLR ALL as shown below:

```
SAT'S: ADD/EDIT  VIEW  DEL  <CLR ALL>
```

2. Pressing ENTR will display the following screen:

```
ERASE ALL ENTRIES? (Y/N)
```

3. Press "Y" to confirm the deletion, otherwise press "N".

3.7 7134 and 7134-EMT ACU Fault Status Reporting

The 7134 and 7134-EMT ACU constantly monitors a number of system status items and provides fault detection and certain safety reactions to faults. Table 3-10 lists each fault and the condition(s) that triggers the fault.

TABLE 3-10 7134 and 7134-EMT 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-EMT 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-EMT Only) the 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 Inverter Manual in Appendix D for a listing of the fault messages.

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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-EMT 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.

- 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

- On the drive cabinet swing-out panel, set the DRIVE CIRCUIT BREAKER to ON. _____(Check)
- 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-EMT 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-EMT 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-EMT 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-EMT 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-EMT 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-EMT 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 7134 and 7134-EMT Power-Up and Self-Diagnostics

On the 7134 and 7134-EMT 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)

4.6 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	
AZ. CENTERLINE	MISC	

4.7 Manual Mode Tests

1. Place the 7134 or 7134-EMT 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)

4.8 Manual Track (Jump) Mode Tests

1. Place the 7134 or 7134-EMT 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)

4.9 Software Limit Tests

The software (soft) limits provide an added margin of safety when the location of the 7134 and 7134-EMT 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-EMT 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)

Site Test

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)

4.10 Tracking Tests

4.10.1 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)

4.10.2 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					

4.10.3 Adaptive Step Track (7134-EMT Only)

4.10.3.1 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-EMT 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.

4.10.3.2 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 re-peak the antenna on beam center and record the resulting signal level from the 7134-EMT 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:

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

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

4.11 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-EMT 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)

4.11.1 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-EMT 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-EMT 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)

4.12 Brake Options

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

4.12.1 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)

4.12.2 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 EI in UP direction. _____(Check)
 Record Voltage (Should be same as in Step 1) _____(Record)
- 4. Move EI in DOWN direction. _____(Check)
 Record Voltage (Should be same as in Step 1) _____(Record)

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

SIGNATURE OF WITNESSES		
SIGNATURE	COMPANY	DATE
	VertexRSI	

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5.0 MAINTENANCE

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

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6.0 ENGINEERING DRAWINGS

This section includes the following engineering drawings:

- 200602 Remote Interface PMCU Model 7150
- 200607 Pol Motor Option, 50 Hz
- 200608 Pol Motor Option, 60 Hz
- 200726 Antenna Drive Unit AZ/EL W/BRK Options 7150
- 201157 Baseline AZ/EL Assembly (208 VAC) Model 7150 Series III
- 201158 Baseline AZ/EL Assembly (380-415 VAC) Mod 7150 Series III
- 201609 Antenna Control Unit 90-250VAC 1P 7134
- 370219 7134 ACU Schematic Diagrams
- 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

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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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 Technical Inquiry		FAX (903) 295-1479	
CUSTOMER NAME:		SITE:	
CONTACT:		PHONE:	EXT:
FAX:		EMAIL:	
EQUIPMENT: <i>(INCLUDE MODEL, NAME, AND SERIAL NUMBER OF ALL PERTINENT EQUIPMENT)</i>		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

7134 ACU

REMOTE COMMUNICATIONS PROTOCOL

Table of Contents

1.0	Introduction	1
2.0	Requests.....	3
3.0	Commands.....	21
3.1	Control.....	21
3.2	Antenna Positioning	21
3.3	Program/Target Data Editing	24

1.0 Introduction

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

The 7134 and 7134-EMT ACU each 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-EMT 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-EMT 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)

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.

Notations

- [] Square brackets indicate optional/conditional information.
- < > Angle brackets represent a required piece of information, described later if not self-explanatory.
- | Pipes separate multiple items where only one may be present.

2.0 Requests

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-EMT 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.

Example:

```
> > RC
198.36 038.56 053.42
```

See: RT

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; n = 0 or 1 (extended).

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 RLO 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 | RMO - 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)

RM1

Gives the time and date, and UTC offset. The date is given in the format yy/mm/dd.

Example for Tuesday, 2004/08/17 1pm:

>> RM 1

13:13:44 D2 04/08/17 UTC+ 00:00

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 <= 50.

Response: aaa.aa[ppp.pp] eee.ee

aaa.aa : azimuth

ppp.pp : polarization

eee.ee : elevation

- special case: nn = 00 reports the current position.

Example:

> > RT 01

198.35 038.56 053.43 B1

See: RC

RU - Request step track information (7134-EMT Only)

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

RY | RY0 - Enhanced Memory Track (7134-EMT Only)

- Gives the values of the memory-track parameters, as well as indicating which of the three possible targets was most recently used. This is the main request, and has quite a few sub-requests.

RY1, RY2 - Enhanced Memory Track Data (7134-EMT Only)

- The pair of RY1 and RY2 is a slightly nonstandard way of obtaining the information in the database. The RY1 request must be given first: this tells the user how many data points there are, and starts the procedure. After that, simply sending the space character results in displaying the next data point. They come in chronological order, from early to late; and each one tells when it was, which of the three targets it is from, and what the az/el values were. After the last valid one is obtained, the space character loses its special status.
- During the procedure, actually, any character other than a space cancels the mode. But the recommended canceling mechanism is the RY2. This also informs the user if there have been any changes to the database since the request was started. If there have been, some of the points received may no longer be valid.
- Although there are two possible serial ports, and both can be active at the same time, it is not possible for both of them to use the RY1 - space method of obtaining memory track information. If one of the remote interfaces is using this, and the other attempts to do it also, it will get a response which says "BUSY: RETRY". It is unlikely that this will ever actually happen to anybody.

RY3 - Enhanced Memory Track Datum (7134-EMT Only)

- The request RY3 simply gives the most recent data point stored, if any.

RY4 - Enhanced Memory Track Version (7134-EMT Only)

- The request RY4 gives the memory-track version in use (in case of later changes; now it is just 1.1), and the type of model in use, if any.

RI – Intelsat Tracking (7134-EMT Only)

- The request is the RI request, with a number of sub-requests.

RI0 (or simply RI) gives a one-line response telling which targets are available. It has nine fields of the form k:nnn or k:---, separated by spaces. The k is the Intelsat index number, 1 to 9, and the nnn is the corresponding identifier for that satellite, if one has been defined. If not, it is ---.

RI1 returns the earth station information: longitude, latitude, and altitude.

The other requests give the information about the Intelsat satellite with index k, k between 1 and 9. Because of space limitations, the information is split into four pieces. The request is RIkn, where k is the index and n says which line. For instance: RI50 gives the first line of information for satellite 5. Since there is no satellite 0, there is no clash with RI0 and RI1.

RIk0 gives the identification and epoch information in the form yy/mm/dd hh:mm:ss.

RIk1 gives the first group of the eleven parameters: LM0, LM1, and LM2.

RIk2 gives the second group: LONC, LONC1, LONS, LONS1.

RIk3 gives the third group: LATC, LATC1, LATS, LATS1.

RIk4 gives the fourth group: LON170, LAT170, POL.

These are all given as floating point numbers, and preceded by their designations. For example one response to RI30 might be

"IDENT = 709 03/04/05 00:00:00"

and one response to RI31 might be

"LM0 = 304.6646 LM1 = 0.0034 LM2 = -0.000759"

For technical reasons, the response can't be given if the main unit is in the process of displaying a floating-point number. In this unlikely event, the response will be "RETRY"

RQ | RQ0 - 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	4 = 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:

$$2868(10/4096) = 7.00 \text{ VDC}$$

- 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:

$$(2868 - 3308) * 1513/409600 = -1.62 \text{ dB.}$$

-Relays:

BIT #	VALUE	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)

RQ1 - Request Quick Enhanced (7134-EMT Only)

Gives more complete information for the enhanced modes (RQ can also be accessed as RQ0). The RQ1 is the same as RQ, except that the two field major/minor state, which were 4 bits and 2 bits respectively, are now major state followed by minor state, each 6 bits.

RQ returns a string of 14 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 14 6-bit fields from the string left to right (the first character returned by RQ has the most significant bits) we have 84 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
6	PRIMARY MACHINE STATE
6	SECONDARY MACHINE STATE
10	RELAYS
2	BEACON
84 BITS	

Details of Bit-fields**1. Angle Decompression**

RQ1 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

6 bits contain the primary machine state information:

bit 4: 0 = local; 1 = remote.

bits 0 - 3:

VALUE	STATE
0	IDLE (STANDBY)
1	TARGET TRACKING
2	PROGRAM TRACK: TRACKING
3	PROGRAM TRACK: WAITING
4	STEPTRACK: TRACKING
5	STEPTRACK: WAITING
6	MANUAL
7	EDIT
8	RESET
9	MEMORY TRACK: STEPPING
10	MEMORY TRACK: WAITING FOR NEXT STEP TIME
11	MEMORY TRACK: USING MODEL
12	MEMORY TRACK: IDLE (NO SIGNAL, NO MODEL)
13	MEMORY TRACK: CALCULATING MODEL
14	INTELSAT TRACK
15-63	reserved

b. Secondary State

6 bits contain the secondary machine state information:

VALUE	STATE
0	IDLE (STANDBY)
1	TARGET TRACKING
2	NOT USED
3	NOT USED
4	STEPTRACK: TRACKING
5	STEPTRACK: WAITING
6	POSITION ACTIVE: MAINTAINING CURRENT TARGET
7-63	reserved

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. RQ1 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 #:	D	C	B	A	9	8	7	6	5	4	3	2	1	0
RQ RETURNS:	;	K	M	!	!	#	/	/	M	U	'	!	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
'	27	6	000110
!	21	0	000000
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	000110	6 = MANUAL MODE
SECONDARY STATE	000000	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 #	VALUE	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)

3.0 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.).

3.1 Control

CC - Assume Remote Control

- 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

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

CD - Drive Reset

- Drive reset to outside unit (OU).

CX - System Reset

- 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.

3.2 Antenna Positioning

CB n - Select Beacon

- Select beacon n; $1 \leq n \leq 4$.

CM aaa.aa[ppp.pp] eee.ee - Move Antenna

- Move (antenna) to specified coordinates.

CT nn - Target Track

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

CP - Program Track

- 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 - Adaptive Step Track (7134-EMT Only)

- Do step tracking.

CE n - Enhanced Memory Track Target (7134-EMT Only)

- Memory track target n; $1 \leq n \leq 3$
"CE n" commands the unit to enter memory track mode. Here n is the memory-track target number, and must be 1 to 3. Further, that number must be associated with a valid entry in the target database, which must be within the soft limits. As with all other commands, the 7134 must be in remote mode and the serial port must have taken control of the unit.

CE t t1 t2 t3 tol p - Enhanced Memory Track Parameters (7134-EMT Only)

- Memory track parameters
"CE t t1 t2 t3 tol p" sets the memory track parameters. The t is the step-time, in minutes. The t1, t2, and t3 are the targets. The tol is the model tolerance, in percent. The p is either 0 or 1, and says whether it is ok to use a less-than-perfect model to make predictions (in the sense of being based on partial information).

CI1 n - Intelsat Track (7134-EMT Only)

- Starts Intelsat tracking, with target number n. Here, n is between 1 and 9, and must be a valid Intelsat target index.

CI n k- Intelsat Track Parameters (7134-EMT Only)

- The rest of the commands put information into the database. This is done as a transaction: there must be a command to start the transaction; then commands to enter data can be given; and then there must be a command to complete the transaction to finish it off:
- CI2 k starts the edit transaction on satellite with index k; k must be from 1 to 9. In the rest of the edit transactions, the value k given must agree with the one at the start.
- CI3 k id yy/mm/dd hh:mm:ss sets the identification number and epoch. The id can be any 3-digit number. The other fields must be two digits.
- CI4 k lm0 lm1 lm2 sets the relevant parameters.
- CI5 k lonc lonc1 lons lons1 sets the relevant parameters.
- CI6 k latc latc1 lats lats1 sets the relevant parameters.
- CI7 k lon170 lat170 pol sets the relevant parameters
In these, the parameters (other than k) are floating point numbers. They can have an optional sign, at most three digits before the decimal point, and at most 6 after: just as in floating point entry at the front panel.
- CI8 k ends the transaction, saving the information.
- CI9 k aborts the transaction, discarding data entered during it. The parameter k here is optional; but if given, it must match the original value.
- CI0 k zeroes out the record and marks it as invalid. This still has to be given in the context of a transaction. It can be used to initialize the data or just to delete an entry.

CS - Stop All Motion**CJ (axis)(direction)nn - Jog Antenna**

- Jog antenna in specified direction (azimuth, elevation, or polarization) in + or - direction for nn tenths of one second. $1 \leq nn \leq 60$.
- 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

- 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

- Set step cycle time.
- $0 \leq nnn \leq 240$; $nnn = 000 \rightarrow$ cycle time is disabled (track only on threshold)

3.3 Program/Target Data Editing

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

- 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 – Set Target Track Database Item

- 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 for the Inverter Drives.

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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 VertexRSI.

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