BRADSHAW
COMMUNICATION
SYSTEMS

MODEL ACU1
ANTENNA CONTROL UNIT
INSTALLATION & MAINTENANCE MANUAL

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INTRODUCTION

A. MANUAL PURPOSE

This manual contains installation and maintenance instructions for the Bradshaw Communication Systems ACU1 Antenna Control Unit. The instructions herein are provided for personnel responsible for installing and maintaining the ACU1. A nameplate label located on the rear panel of the ACU1 identifies the units' model number, part number, revision, and serial number. The serial number is used by Bradshaw Communication Systems (BCS) to identify the units' particular firmware and hardware configuration.

This manual does not provide information pertaining to the operation of the ACU1. Information pertaining to operation of the ACU1 is found only in the ACU1 Operators Manual. It is required that a installation and/or service technician have a thorough understanding of the operation of the ACU1 prior to any attempts to install or service the unit. Any required internal repairs to the ACU1 should be referred to qualified service personnel.

B. MANUAL ORGANIZATION

This manual is organized into the following four sections:

"Introduction" – This section provides manual purpose, manual organization, required installation/ setup equipment, unit specifications, and customer support information.

"ACU1 Installation" – This section provides safety precautions, typical system configuration, layout of the ACU1 rear panel, rack installation, and interface wiring information.

"ACU1 Parameter Setup" – This section provides the detailed steps to properly configure the ACU1 parameters, verify functional operation, acquire a satellite and setup the Steptrack Mode.

"ACU1 Maintenance" – This section provides information pertaining to preventative maintenance and troubleshooting of the ACU1.

C. REQUIRED INSTALLATION / SETUP TOOLS & EQUIPMENT

1 EACH	Medium Phillips Screwdriver
1 EACH	Medium Flat-blade Screwdriver
1 EACH	3dB Attenuator
1 EACH	Spectrum Analyzer (capable of measurement of the appropriate satellite freq.)
1 EACH	Multi-meter (capable of direct current voltage measurement)
MISC.	R.F. Test Cables and Multi-meter Test Leads

D. UNIT SPECIFICATIONS

Dimensions:	Rack Mount ANSI/EIA 2 Rack Height Chassis 3.5" (88.9mm) high x 19.0" (482.6mm) wide x 13.5" (342.9mm) deep
Weight:	13.5 LBS (6.12 Kg)
Power Requirements:	Universal Input 90-264VAC / 47-63Hz / 0.75 Amps Max
Environmental:	0° to 50°Celsius (32° to 122° Fahrenheit) Operational -40° to 85°Celsius (-40° to 185°Fahrenheit) Storage 0 – 90% Relative Humidity (Non-Condensing)
Tracking:	Typical Accuracy 10% of received 3dB beamwidth (RMS) or better for beamwidths $\geq$0.20° and up to 2° target inclinations. Memory Track option adds execution of interpolated trajectory data from stored data while in Steptrack mode.
Position Measurement:	4:1 Synchro Position Encoders providing absolute angular position with typical accuracy of 0.03° RMS and 0.01° position display resolution. Optional 1:1 Synchro Transmitter for polarization axis w/ 0.1° resolution.
Receiver Interface:	D.C. Output Proportional to Signal Strength ($\pm$10 V Analog 0.01 to 1.0V/dB Gradient)

E. CUSTOMER SUPPORT

Customer support, replacement parts, and repair are available 8AM – 5PM EST M-F by contacting Bradshaw Communication Systems at 770-844-9704 or by fax at 770-886-0205.

ACU1 INSTALLATION

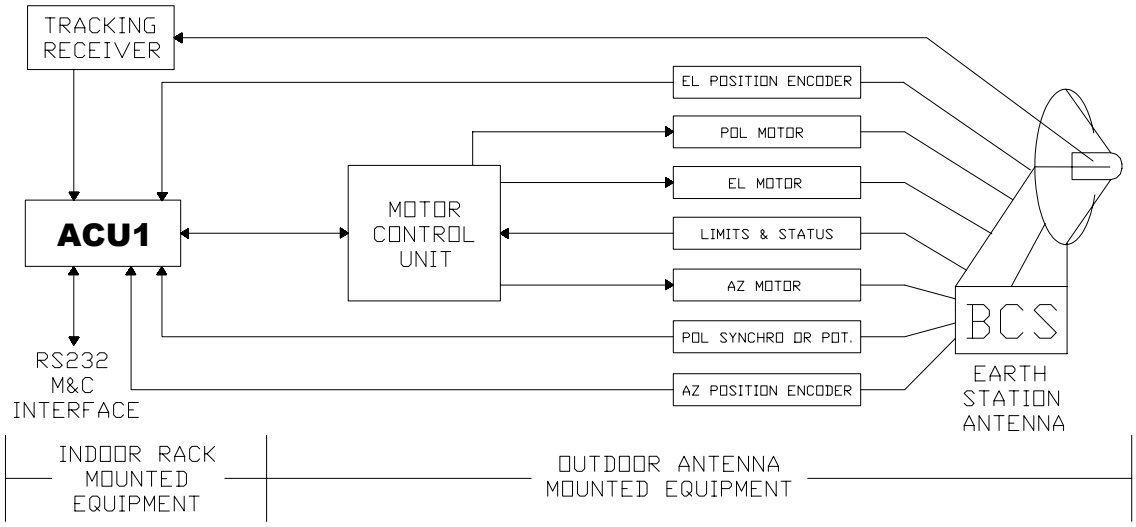
A. SAFETY PRECAUTIONS

Lethal voltages are present inside the ACU1. Emergency Stop switches and other interlocks will disable the system, but do not disconnect the ACU1 from primary power. Refer all troubleshooting and repair to qualified service personnel. The ACU1 contains no operator serviceable parts.

B. INTRODUCTION

Typical System Configuration

The ACU1 is designed to allow manual or automatic positioning of an earth station antenna from a remote location away from the antenna. Operators may select from various modes of operation providing antenna control, displaying fault and/or status information, and to adjust setup parameters. The ACU1 is only a part of the antenna control system. A typical antenna control system configuration using the ACU1 is depicted in Figure 1.



TYPICAL SYSTEM CONFIGURATION
FIGURE 1

The ACU1 is the main system component and contains the control logic electronics to generate motor drive commands. The motor control commands are produced in response to inputs from the position encoders, limit and status switches, front panel controls, and R.F. signal receiving equipment. Control may also be accomplished via the RS-232 monitor & control port.

The angular position of each axis is reported by synchro based position encoders that are mounted on their corresponding axes of the earth station antenna. The signal from these position encoders is converted in the ACU1 to provide an angular display on the front panel display as well as being used for automatic positioning modes.

For automatic satellite tracking operation (Steptrack), a D.C. signal proportional to signal strength is connected to the ACU1. This signal is then used by the ACU1 to optimize the antenna position when in Steptrack mode.

The ACU1 is connected to a motor control unit, which produces the high voltage required to start and stop the earth station antennas' motors. Each axis has a motor (or possibly two depending upon configuration) which allow electrical control of the mechanical movement of each antenna axis. In some system configurations two motors (or dual speed) motors are employed allowing two-speed control of each antenna axis. In these two-speed configurations either a single motor control unit or two separate motor control units (the second for high-speed motor control) are typically used.

If the earth station antenna being controlled by the ACU1 has a linearly polarized feed, the ACU1 polarization option is employed. This option allows the ACU1 to receive a signal from an additional position encoder (either a synchro transmitter or potentiometer depending upon configuration) and to control an additional motor. By adding the additional position encoder and motor the ACU1 can remotely control the rotation of the earth station antenna polarization feed horn.

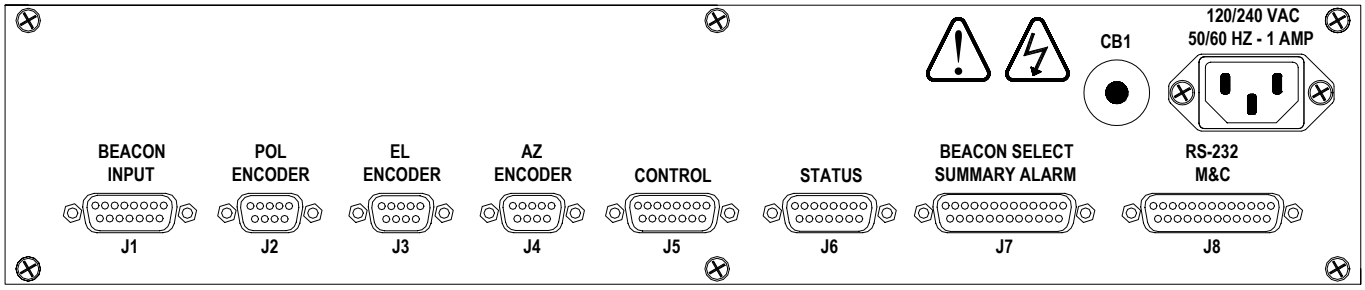
The ACU1 is generally rack mounted and located in the control room area, while the position encoders, limit switches, motor controller/s, and motors are generally located on the earth station antenna structure. The R.F. tracking equipment is generally located in the control room area as well.

Rear Panel Layout

The ACU1 Rear Panel allows access to the primary power connector, power supply circuit breaker, and socket (female) style D-Subminiature type connectors. The power supply circuit breaker is the only technician serviceable fuse device contained on the ACU1. This circuit breaker is re-settable by depressing the button in the center after a "tripped" condition occurs. If the circuit breaker continues to "trip", after being reset, refer the ACU1 to a qualified service technician for repair.

The power connector is a standard IEC style and the ACU1 is provided with a NEMA15P, 6 foot, power cord suitable for interface to this connector. The interface connectors are 9 pin, 15 pin, and 25 pin D-Subminiature type connectors and mating pin type connectors are provided in the installation kit.

The following figure shows the rear panel of the ACU1:



ACU1 Rear Panel

C. RACK INSTALLATION

The ACU1 design provides for installation in a standard, indoor, 19inch wide, equipment rack. The ACU1 will occupy two ANSI/EIA-310-D-1992 rack heights. Provision must be made to not block the top or bottom vent slots in the ACU1. A minimum of two inches clearance should be provided to allow proper convection cooling to take place. Damage to the ACU1 or degraded life expectancy will occur if proper ventilation is not provided. The ACU1 is designed to support it's own weight by means of front panel mounting. Rack slides are not provided nor required.

D. INTERFACE WIRING CHARTS

1. Termination Notes

NOTE 1: The Position Encoders may be wired to either count up or down when the input shaft is rotated in a particular direction. If a down count is required, when the input shaft is rotated Clock-Wise (looking into the Position Encoder shaft from the coupling side), use the Forward Count Wiring List. If a up count is required, use the Reverse Count Wiring List.

NOTE 2: SW1 is the top Cam Switch. SW2 is the middle Cam Switch. SW3 is the bottom Cam Switch. The bottom Cam Switch is located closest to the mounting plate.

NOTE 3: An open connection between COM and N.O. of the Summary Alarm contacts indicates a fault condition. Contacts are isolated and rated at 50 Volts at 500 Milliamps maximum.

NOTE 4: For three-wire M&C Port termination, use J8-2, J8-3, and J8-7. J8-2 is the input pin for data transmitted from the host to the ACU1. J8-3 is the output pin for data transmitted from the ACU1 to the host. J8-7 is signal ground common to both J8-2 and J8-3.

NOTE 5: The polarization synchro and/or potentiometer can be wired to provide either up or down count when the input shaft is rotated in a particular direction. To reverse the count direction of a polarization synchro, switch wires S1 and S2 at the synchro termination. To reverse the count direction of a polarization potentiometer, switch the wires POT1 and POT2.

2. ACU1 to MCU1

Status Cable

FROM ACU1 (DSUB 15 PIN TYPE)			TO MCU1 (TERMINAL BLOCK)			
TERMINATION	**TYPE**	**NOTES**	**TERMINATION**	**TYPE**	**NOTES**	**FUNCTION**
J6-1	SOLDER		TB3-18	#6 LUG		CCW Limit
J6-2	SOLDER		TB3-22	#6 LUG		UP Limit
J6-3	SOLDER		TB3-19	#6 LUG		CW Limit
J6-4	SOLDER		TB3-16	#6 LUG		System Intlk.
J6-5	SOLDER		TB3-25	#6 LUG		POL CCW Limit
J6-6						No Connection
J6-7						No Connection
J6-8						No Connection
J6-9	SOLDER		TB3-21	#6 LUG		DOWN Limit
J6-10	SOLDER		TB3-20	#6 LUG		EL Intlk.
J6-11	SOLDER		TB3-24	#6 LUG		POL CW Limit
J6-12	SOLDER		TB3-17	#6 LUG		AZ Intlk.
J6-13	SOLDER		TB3-23	#6 LUG		POL Intlk.
J6-14	SOLDER					No Connection
J6-15	SOLDER		Cable Shield			Cable Shield

Control Cable

FROM ACU1 (DSUB 15 PIN TYPE)			TO MCU1 (TERMINAL BLOCK)			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J5-1	SOLDER		TB3-12	#6 LUG		POL CW/CCW
J5-2	SOLDER		TB3-11	#6 LUG		POL Enable
J5-3	SOLDER		TB3-4	#6 LUG		AZ CW/CCW
J5-4	SOLDER		TB3-1	#6 LUG		Drive Ground
J5-5	SOLDER		TB3-10	#6 LUG		EL Brake
J5-6	SOLDER		TB3-3	#6 LUG		AZ Enable
J5-7	SOLDER		TB3-9	#6 LUG		EL High Speed
J5-8	SOLDER		TB3-5	#6 LUG		AZ High Speed
J5-9	SOLDER		TB3-13	#6 LUG		Local Ctl. Status
J5-10	SOLDER		TB3-7	#6 LUG		EL Enable
J5-11	SOLDER		TB3-2	#6 LUG		Drive Ground
J5-12						No Connection
J5-13	SOLDER		TB3-8	#6 LUG		EL UP/DOWN
J5-14	SOLDER		TB3-6	#6 LUG		AZ Brake
J5-15	SOLDER		Cable Shield			Cable Shield

3. ACU1 to Azimuth & Elevation Position Encoders

FORWARD COUNT
Azimuth Position Encoder Cable

FROM ACU1 (DSUB 9 PIN TYPE)			TO AZ POSITION ENCODER			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J4-1	SOLDER		SYNCHRO S1	#2 LUG	NOTE 1	S1
J4-2	SOLDER		SYNCHRO S2	#2 LUG	NOTE 1	S2
J4-3	SOLDER		SYNCHRO S3	#2 LUG		S3
J4-4	SOLDER		SW2-N.C.	#2 LUG	NOTE 2	Cam 2 Status
J4-5	SOLDER		SW3-N.C.	#2 LUG	NOTE 2	Cam 3 Status
J4-6	SOLDER		SYNCHRO R2	#2 LUG		Reference HIGH
J4-7	SOLDER		SYNCHRO R1	#2 LUG		Signal Ground
J4-8	SOLDER		SW1-N.O.	#2 LUG	NOTE 2	Cam 1 Status
J4-9	SOLDER		Cable Shield			Cable Shield

Elevation Position Encoder Cable

FROM ACU1 (DSUB 9 PIN TYPE)			TO EL POSITION ENCODER			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J3-1	SOLDER		SYNCHRO S1	#2 LUG	NOTE 1	S1
J3-2	SOLDER		SYNCHRO S2	#2 LUG	NOTE 1	S2
J3-3	SOLDER		SYNCHRO S3	#2 LUG		S3
J3-4	SOLDER		SW2-N.C.	#2 LUG	NOTE 2	Cam 2 Status
J3-5	SOLDER		SW3-N.C.	#2 LUG	NOTE 2	Cam 3 Status
J3-6	SOLDER		SYNCHRO R2	#2 LUG		Reference HIGH
J3-7	SOLDER		SYNCHRO R1	#2 LUG		Signal Ground
J3-8	SOLDER		SW1-N.O.	#2 LUG	NOTE 2	Cam 1 Status
J3-9	SOLDER		Cable Shield			Cable Shield

REVERSE COUNT
Azimuth Position Encoder Cable

FROM ACU1 (DSUB 9 PIN TYPE)			TO AZ POSITION ENCODER			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J4-1	SOLDER		SYNCHRO S2	#2 LUG	NOTE 1	S1
J4-2	SOLDER		SYNCHRO S1	#2 LUG	NOTE 1	S2
J4-3	SOLDER		SYNCHRO S3	#2 LUG		S3
J4-4	SOLDER		SW2-N.C.	#2 LUG	NOTE 2	Cam 2 Status
J4-5	SOLDER		SW3-N.C.	#2 LUG	NOTE 2	Cam 3 Status
J4-6	SOLDER		SYNCHRO R2	#2 LUG		Reference HIGH
J4-7	SOLDER		SYNCHRO R1	#2 LUG		Signal Ground
J4-8	SOLDER		SW1-N.C.	#2 LUG	NOTE 2	Cam 1 Status
J4-9	SOLDER		Cable Shield			Cable Shield

Elevation Position Encoder Cable

FROM ACU1 (DSUB 9 PIN TYPE)			TO EL POSITION ENCODER			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J3-1	SOLDER		SYNCHRO S2	#2 LUG	NOTE 1	S1
J3-2	SOLDER		SYNCHRO S1	#2 LUG	NOTE 1	S2
J3-3	SOLDER		SYNCHRO S3	#2 LUG		S3
J3-4	SOLDER		SW2-N.C.	#2 LUG	NOTE 2	Cam 2 Status
J3-5	SOLDER		SW3-N.C.	#2 LUG	NOTE 2	Cam 3 Status
J3-6	SOLDER		SYNCHRO R2	#2 LUG		Reference HIGH
J3-7	SOLDER		SYNCHRO R1	#2 LUG		Signal Ground
J3-8	SOLDER		SW1-N.C.	#2 LUG	NOTE 2	Cam 1 Status
J3-9	SOLDER		Cable Shield			Cable Shield

4. ACU1 to Polarization Synchro (Optional)

Polarization Synchro Cable

FROM ACU1 (DSUB 9 PIN TYPE)			TO POL SYNCHRO			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J2-1	SOLDER		SYNCHRO S1	#2 LUG	NOTE 5	S1
J2-2	SOLDER		SYNCHRO S2	#2 LUG	NOTE 5	S2
J2-3	SOLDER		SYNCHRO S3	#2 LUG		S3
J2-4						No Connection
J2-5						No Connection
J2-6	SOLDER		SYNCHRO R2	#2 LUG		Reference HIGH
J2-7	SOLDER		SYNCHRO R1	#2 LUG		Signal Ground
J2-8						No Connection
J2-9	SOLDER		Cable Shield			Cable Shield

5. ACU1 to Polarization Potentiometer (Optional)

Polarization Potentiometer Cable

FROM ACU1 (DSUB 9 PIN TYPE)			TO POL POTENTIOMETER			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J2-1						No Connection
J2-2						No Connection
J2-3						No Connection
J2-4	SOLDER		POT 1	SOLDER	NOTE 5	+15 V.D.C.
J2-5	SOLDER		POT 2	SOLDER	NOTE 5	-15 V.D.C.
J2-6						No Connection
J2-7						No Connection
J2-8	SOLDER		POT WIPER	SOLDER		POT Wiper Input
J2-9	SOLDER		Cable Shield			Cable Shield

6. ACU1 to Tracking Receiver

Tracking Receiver Cable

FROM ACU1 (DSUB 15 PIN TYPE)			TO TRACKING RECEIVER			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J1-1	SOLDER		RCVR + OUT			Signal Positive
J1-2			NOT USED			Comm. Ch. 1 -
J1-3			NOT USED			Comm. Ch. 1 +
J1-4			NOT USED			Comm. Ch. 2 -
J1-5			NOT USED			Comm. Ch. 2 +
J1-6						No Connection
J1-7	SOLDER	N.O.	FREQ. 2 SEL.			Freq. 2 Select
J1-8	SOLDER	N.C.	FREQ. 1 SEL.			Freq. 1 Select
J1-9	SOLDER		RECV - OUT			Signal Negative
J1-10						No Connection
J1-11						No Connection
J1-12						No Connection
J1-13						No Connection
J1-14	SOLDER	COM	FREQ. SEL.			Freq. Select
J1-15	SOLDER		Cable Shield			Cable Shield

7. ACU1 to Summary Alarm Form C Contacts

Summary Alarm Cable

FROM ACU1 (DSUB 25 PIN TYPE)			TO SUMMARY ALARM MONITOR (If Used)			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J7-1			NOT USED			Status 1
J7-2	SOLDER		AS REQ'D.			Signal Ground
J7-3						No Connection
J7-4			NOT USED			Driver 7
J7-5			NOT USED			Status 2
J7-6			NOT USED			Status 5
J7-7			NOT USED			Status 7
J7-8	SOLDER		AS REQ'D.			Signal Ground
J7-9	SOLDER		BEACON SEL.			Driver 5
J7-10	SOLDER		BEACON SEL.			Driver 3
J7-11	SOLDER		BEACON SEL.			Driver 1
J7-12	SOLDER		ALARM N.O.		NOTE 3	Alarm N.O.
J7-13	SOLDER		ALARM N.C.		NOTE 3	Alarm N.C.
J7-14	SOLDER		AS REQ'D.	Maximum	500Ma	+15 V.D.C.
J7-15			NOT USED			Driver 8
J7-16			NOT USED			Driver 9
J7-17			NOT USED			Status 3
J7-18			NOT USED			Status 4
J7-19			NOT USED			Status 8
J7-20			NOT USED			Status 6
J7-21			NOT USED			Driver 6
J7-22	SOLDER		BEACON SEL.			Driver 4
J7-23	SOLDER		BEACON SEL.			Driver 2
J7-24	SOLDER		ALARM COM.		NOTE 3	Alarm Common
J7-25	SOLDER		Cable Shield			Cable Shield

8. ACU1 Monitor & Control Port to Host Computer/Terminal

M&C Port Cable

FROM ACU1 (DSUB 25 PIN TYPE)			TO M&C PORT (If Used)			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
J8-1	SOLDER		SHIELD			Protective Gnd.
J8-2	SOLDER		AS REQ'D.		NOTE 4	TX Data
J8-3	SOLDER		AS REQ'D.		NOTE 4	RX Data
J8-4	SOLDER		AS REQ'D.			RTS
J8-5	SOLDER		AS REQ'D.			CTS
J8-6	SOLDER		AS REQ'D.			DSR
J8-7	SOLEDR		AS REQ'D.		NOTE 4	Signal Ground
J8-8	SOLDER		AS REQ'D.			Signal Detect
J8-9						No Connection
J8-10						No Connection
J8-11	SOLDER					DCD
J8-12						No Connection
J8-13						No Connection
J8-14						No Connection
J8-15	SOLDER		AS REQ'D.			Signal Ground
J8-16						No Connection
J8-17						No Connection
J8-18						No Connection
J8-19	SOLDER		AS REQ'D.			Signal Ground
J8-20	SOLDER		AS REQ'D.			DCD
J8-21						No Connection
J8-22						No Connection
J8-23						No Connection
J8-24	SOLDER		AS REQ'D.			Signal Ground
J8-25						No Connection

ACU1 PARAMETER SETUP

A. STARTUP

After the ACU1 is wired correctly per the ACU1 Installation Instructions and the ACU1 is plugged into a suitable power source, apply power to the ACU1 by pressing the front panel power switch to the " I " (ON) position. The ACU1 should power up in the Standby Mode (STBY).

B. PARAMETER SETTINGS

Use the following table to check and adjust the ACU1 parameters. Not all parameters are applicable to every ACU1. Any parameters not found indicate the associated option is not implemented in the particular ACU1 being installed or setup. The values shown are only nominal values and may require "fine tuning" by a technician with a thorough understanding of ACU1 operation.

Mnemonic	Range	Name	Nominal	Function
T	d=1 – 7 hh=00-23 mm=00-59 ss=00-59	Time of Day	Universal Time Constant Time	Used to set the real-time clock to the proper day, hours, minutes, and seconds
TOS	-30 to +30	Time Offset (Seconds)	0	Offset Inaccuracies in Real Time Clock
TRS	0 to 7	Tracking Signal	See Tracking Signal Calibration Section	Determines which tracking signal is to be used for Steptrack. Setting TRS to "0-1" - "0-7" places ACU1 in auto signal search mode. ACU1 searches until a signal greater than SRC is found. Set unused channels to –9.9
SG1	-9.9 to +9.9	Tracking Signal #1	See Tracking Signal Calibration	Tracking Signal #1 Gain & Offset Entry Refer to Install & Maintenance Manual
SG2	-9.9 to +9.9	Tracking Signal #2	See Tracking Signal Calibration	Tracking Signal #2 Gain & Offset Entry Refer to Install & Maintenance Manual
SG3	-9.9 to +9.9	Tracking Signal #3	See Tracking Signal Calibration	Tracking Signal #3 Gain & Offset Entry Refer to Install & Maintenance Manual
SG4	-9.9 to +9.9	Tracking Signal #4	See Tracking Signal Calibration	Tracking Signal #4 Gain & Offset Entry Refer to Install & Maintenance Manual
SG5	-9.9 to +9.9	Tracking Signal #5	See Tracking Signal Calibration	Tracking Signal #5 Gain & Offset Entry Refer to Install & Maintenance Manual
CC6	-9.9 to +9.9	Comm. Channel #6	See Tracking Signal Calibration	Tracking Signal #6 Gain & Offset Entry Refer to Install & Maintenance Manual
CC7	-9.9 to +9.9	Comm. Channel #7	See Tracking Signal Calibration	Tracking Signal #7 Gain & Offset Entry Refer to Install & Maintenance Manual
SDP	0 to 359.99	Slew Decision Point (degrees) (2speed systems only)	0.20	Distance in degrees away from commanded position where motors will be switched from high speed to low speed. (359.99 for 1 speed systems)
DBT	0 to 80	dB Threshold	5	Signal level in ±10ths of a dB away from signal level at "park" which will initiate a Steptrack cycle
SRC	0 to 80	Signal Range Control	30	Signal level in 10ths of a dB below 0.0 at which the Low Signal alarm occurs
TRG	0 to 80	Tracking Gain	12	Sets the gain of the corrective step / Tracking gain adjust parameter
RNT	0 to 255	Run Time (0.1 sec. increments)	Calculate As Required	Sets the Steptrack nominal step size. EL receive -3dB BW (degrees) / Velocity (degrees/second)

SRT	0 to 255	Signal Rate Threshold (100^{th} of dB/second)	11	Net rate of change in signal level during a Steptrack integration period that is acceptable. Greater signal rate changes will inhibit corrective steps.
SCT	0 to 255	Scan Cycle Time (minutes)	30	Sets time between Steptrack cycles.
DBD	0 to 255	AZ & EL Deadband (0.01° units)	4	Deadband about a commanded position where motors are turned off.
PDB	0 to 255	POL Deadband (0.1° units)	50	Deadband about a commanded position where POL motor is turned off.
PAA	0 to 359.99	SAT A AZ Position	User Defined	Stores SAT A AZ Command Position
PAE	0 to 359.99	SAT A EL Position	User Defined	Stores SAT A EL Command Position
PAP	0 to 359.9	SAT A POL Position	User Defined	Stores SAT A POL Command Position
PBA	0 to 359.99	SAT B AZ Position	User Defined	Stores SAT B AZ Command Position
PBE	0 to 359.99	SAT B EL Position	User Defined	Stores SAT B EL Command Position
PBP	0 to 359.9	SAT B POL Position	User Defined	Stores SAT B POL Command Position
PCA	0 to 359.99	SAT C AZ Position	User Defined	Stores SAT C AZ Command Position
PCE	0 to 359.99	SAT C EL Position	User Defined	Stores SAT C EL Command Position
PCP	0 to 359.9	SAT C POL Position	User Defined	Stores SAT C POL Command Position
AOS	0 to 359.99	Azimuth Offset	See Note 1	Used to align AZ Position Encoder
EOS	0 to 359.99	Elevation Offset	See Note 1	Used to align EL Position Encoder
POS	0 to 359.9	Polarization Offset	See Note 1	Used to align POL Position Encoder
AZD	0 to 359.99	Azimuth Difference (Program Track & Memory Track)	User Defined	Used to set acceptable limit of AZ angular distance between two contiguous valid table data points.
ELD	0 to 359.99	Elevation Difference (Program Track & Memory Track)	User Defined	Used to set acceptable limit of EL angular distance between two contiguous valid table data points.
POD	0 to 359.9	Polarization Difference (Program Track & Memory Track)	User Defined	Used to set acceptable limit of POL angular distance between two contiguous valid table data points.
PTB	0 or 1	Program Track Backup	0	When set to “1” enables Program Track to backup Steptrack
MTB	0 or 1	Memory Track Backup	0	When set to “1” enables Memory Track to backup Steptrack
APO	0 to 359.99	Azimuth Position Offset	0.00	Allows offset of the stored AZ angle in the Memory Track table
EPO	0 to 359.99	Elevation Position Offset	0.00	Allows offset of the stored EL angle in the Memory Track table
BX	0 to 5.00	Box Limit	User Defined	Stores Box Limit size value (disabled)
BXA	0 to 5.00	Box Limit Armed	User Defined	Stored Box Limit size value (enabled)

Note 1 These parameters are used to offset the displayed angular position for fine alignment. Course alignment should be done at the position encoder coupling to the antenna prior to parameter fine alignment. The value of the Offset Parameter must **NOT** be in the antenna travel area. The ACU1 will not command the antenna through the value of the Offset Parameter. This is applicable to azimuth, elevation, and polarization.

C. MANUAL JOG MODE VERIFICATION

Depending upon motor controller type associated with the antenna control system, verify the ACU/LOCAL switch is in the ACU position (MCU1) or the handheld controller is not plugged in (MCU2). Verify antenna movement in all directions of all axes matches the nomenclature of each Manual Jog button at the ACU1 front panel. If a commanded direction does not match physical antenna movement, reverse any two phases to the associated axis motor to reverse it’s direction.

CAUTION! DO NOT USE ANY AUTOMATIC POSITION MODES PRIOR TO COMPLETION OF THE MANUAL JOG MODE VERIFICATION, POSITION LOOP PHASING, AND VERIFICATION OF ALL LIMIT SWITCH FUNCTIONALITY!

D. POSITION LOOP PHASING

After the antenna physical direction matches the ACU1 front panel jog controls, verify the antenna position loop phasing. Verify that when the antenna is commanded in the UP (EL) or CW (both AZ and POL) directions, the associated ACU1 front panel angular displays are increasing in angle. If not, rewire the position encoder using the Reverse Count wiring instructions found in the ACU1Installation section.

E. AUTOMATIC POSITION MODES VERIFICATION

The automatic modes may now be used. Verify a stored angular value near the present antenna position is stored in parameters PAA, PAE, and PAP. Enter the “SAT A” Mode. Verify the antenna is moved to within +/- 0.02 degrees for azimuth and elevation and to within +/- 0.20 for polarization of the stored parameter values associated with each axis.

Inspect the motors at each axis for oscillation while in the “SAT A” mode and at position. If oscillation is detected, the Dead-Band Threshold (DBT) parameter value will need to be increased until the oscillation is no longer evident. If the DBT parameter value required is excessive, the antenna will need to be inspected for excessive backlash and/or wind-up.

Repeat this procedure for the “SAT B” and “SAT C” Modes

F. SATELLITE ACQUISITION

Due to errors associated with site surveys, satellite coordinates, angle indicator calibration and antenna alignment, a systematic method must be used to help with initial acquisition of the satellite. A spectrum analyzer (or equivalent) will be required to verify both the identity and “peak” of the satellite. The following procedure may be used as a guide to initial satellite acquisition.

1. Point the antenna to the position where the satellite is supposed to be.

2. Decrease the sensitivity of the spectrum analyzer to a point where a noise indication is established.

3. Move the azimuth axis in alternating directions until a signal indication is obtained. Continue moving the same direction and watching the amplitude until a second peak is observed.

   If the second peak is greater in amplitude, continue in the same direction.

   If the second peak is smaller in amplitude, reverse direction and scan the opposite direction through the previous peaks looking for a peak greater in amplitude than the previous.

   If the second peak is approximately equal to the first, set the azimuth position midway between the two peaks and continue with Step 4.

   Scanning should be continued until two peaks of equal amplitude or two peaks with a greater peak between them is encountered. If the two peaks are equal, position azimuth midway between the peaks. If a greater peak of the three found, position azimuth on the center peak at position of greatest amplitude.

4. Move the elevation axis in alternating directions, repeating the same sequence described for azimuth in Step 3.

5. If the main signal peak (should be 15dB or greater above all side-lobe signals) was not found, repeat Steps 3 & 4 until the main signal peak is found.

G. STEPTRACK TRACKING SIGNAL CALIBRATION

1. Verify proper connection and setup of the tracking receiver equipment.

2. Select tracking signal 1 by setting the parameter value TRS to 1.

3. Manually peak the antenna as described in the previous Satellite Acquisition section.

4. Select the Tracking Signal 1 Gain parameter, “SG1”, and depress the “ ⇑ ” value entry button once on the ACU1 front panel keyboard. This will cause the ACU1 to store the offset (0dB) point for Steptrack use.

5. Attenuate the R.F. signal 3dB by inserting a 3dB attenuator in the R.F. signal path or by positioning the antenna off peak by a measured 3dB.

6. While still at the “SG1” parameter, depress the “ ⇓ “ value entry button on the ACU1 front panel keyboard. This will cause the ACU1 to store the gain (-3dB) point for Steptrack use.

7. Select parameter “SG2”. Depress the “ ⇑ ” value entry button and then the “ ⇓ “ value entry button until the displayed parameter value for “SG2” is –9.9. This will cause the ACU1 to ignore this unused signal gain and offset entry.

   Repeat Step 7 for all remaining signal gain and offset entries (SG3, SG4, SG5, CC6, and CC7). Note not all signal gain and offset entries are available on all ACU1’s.

   If an alternate tracking signal source is available, it should be connected to the additional analog inputs per the Installation section and parameter CC6 or CC7 should be used to set the gain and offset of this alternate signal as described in Step 4 only using “CC6”

8. If more than one tracking signal source has been implemented and calibrated, set the parameter TRS to 0. This will allow the ACU1 to search through the tracking signal sources upon a “Low Signal” fault until a suitable signal source is found. If only one tracking signal source is available set TRS to 1.

H. STEPTRACK MODE VERIFICATION

After Tracking Signal Calibration, the ACU1 Steptrack Mode may be utilized. Large siganl variation may cause the ACU1 to track off the peak of the signal. If this condition occurs, Tracking Gain (TRG) parameter value may be lowered. The following parameters may need to be “fine tuned” by an experienced technician who is thoroughly familiar with the ACU1 Operating Instructions.

Parameter Mnemonic	Parameter Name
TRG	Tracking Gain
SCT	Scan Cycle Time
DBT	dB Theshold
SRC	Signal Range Control
SRT	Signal Rate Threshold

Refer to the ACU1 Operation Manual for further explanation of these parameters and the Steptrack process.

ACU1 MAINTENANCE

A. MAINTENANCE

There is no periodic maintenance required for the ACU1. Ensure proper ventilation and no blocked vent holes.

B. TROUBLESHOOTING

If no display is evident verify proper A.C. power is being supplied to the ACU1. Verify the rear panel mounted circuit breaker has not been tripped. Do not attempt reset more than once if circuit breaker trips again after a reset. Refer the ACU1 to Bradshaw Communication Systems for service.

If functionality of the ACU1 is present, with no display (or very dim display) the display unit is most likely defective. Return the ACU1 to Bradshaw Communication Systems for display replacement.

The ACU1 runs a diagnostic self-test of the Micro-I/O card each time the unit is powered on (after being off) or the Standby button is depressed. This self-test checks the RAM, ROM, Synchro to Digital Conversion circuits, and the Parameters for an out of range checksum. If any area fail the test, one of the following messages will appear.

RAM ERROR
ROM ERROR
CHK PARM
SDC ERROR
BRAM EROR
ERAM EROR

With the exception of the “CHK PARM” error message, the remaining error messages indicate a catastrophic hardware failure on the Micro-I/O board in the ACU1. This type of failure should only be serviced by an authorized Bradshaw Communication Systems repair facility. If the “CHK PARM” message appears, verify the correct parameters are stored and depress the Standby button to clear the fault message. If the parameters are corrupted, the lithium battery contained on the Micro-I/O board may need replacement. The expected life of this battery is 10 years.