OPERATION AND MAINTENANCE MANUAL

ELEVATION OVER AZIMUTH POSITIONER
AL-4017-1EBS-B

For Baron Services Radars:
XDD-350C ®
VHDD-350C ™
HDD-350C ™
HDD-250C ™
VHDD-1000C ™

BARON RADAR SERVICES, L.L.C.
4930 Research Drive
Huntsville, AL 35805
PHONE: 256.881.8811   FAX: 256.881.8283

Table of Revisions

REV	DATE	DESCRIPTION	BY
A	10/9/03	Added VHDD-1000C to front cover	CK

TABLE OF CONTENTS

LIST OF TABLE AND FIGURES

SECTION 1 DESCRIPTIONS

1.1   General Description

The Positioner AL-4017-1EBS-B is comprised of two modified ORBIT Standard AL-760's.

The modifications were performed according to Baron Service's specifications concerning speed, acceleration, antenna adapter and environmental conditions (see Table 1).

1.2   Technical Description

The AL-4017-1EBS-B Elevation-over-Azimuth Positioner has two main units: Elevation and Azimuth. All parts are submitted to high-stress tests to ensure reliability and avoid downtime.

1.3   Specifications

The specifications of the AL-4017-1EBS-B EL/AZ Positioner are listed in Table 1.

1.4   Mechanical Sub-Assemblies

1.4.1 Elevation Unit

The Elevation Unit, mounted on the turntable of the Azimuth Unit, turns the upper turntable through the vertical plane. The mechanism of the Elevation Unit is as follows: A DC motor drives a worm gear through a timing belt. The worm gear drives an internal gear, an integral part of a ball race type slewing bearing assembly, which is designed and produced according to very high standards and specifications. The internal gear is the linking element between the Azimuth and Elevation Units.

1.4.2 Azimuth Unit

The Azimuth Unit turns the Positioner through the horizontal plane. It is designed to handle vertical and radial loads. The mechanism of the Azimuth Unit is as follows: A DC motor drives a reduction worm gear through a timing belt. The pinion on the reduction gear drives an internal gear, which is an integral part of a slewing bearing assembly. The internal gear drives the turntable, which carries the Elevation unit.

1.5 *Electromechanical Sub-Assemblies*

1.5.1 Limit Switches

The limit switches are designed to coordinate the rotation of the El axis. The limit switches are of the electric rotary cam type. Each limit switch assembly has two cams, one for UP and one for DOWN. The limit switches are <u>normally open</u>.

TABLE 1. AL-4017-1EBS-B SPECIFICATIONS

PARAMETERS		UNIT	VALUE
AZIMUTH BEARING MOMENT CAPACITY		ft-lbs	3000
VERTICAL LOAD		lbs	800
DELIVERED TORQUE	Azimuth	ft-lbs	170
	Elevation	ft-lbs	170
WITHSTAND TORQUE	Azimuth	ft-lbs	500
	Elevation	ft-lbs	500
NOMINAL SPEED	Azimuth	deg/sec.	36
	Elevation	deg/sec.	36
DATA TAKE-OFF ACCURACY	Azimuth	deg.	±0.07
	Elevation	deg.	±0.07
MAXIMUM BACKLASH	Azimuth	deg.	0.05
	Elevation	deg.	0.05
ELEVATION LIMIT-TO-LIMIT TRAVEL		deg.	-2 to +182
AZIMUTH TRAVEL		deg	Continuous
OPERATING TEMPERATURE		°C	-20 to +55
WEIGHT		lbs	950

Note:

When slip rings and/or rotary joints are used, limit switches are disabled.

SECTION 2 INSTALLATION & OPERATION

2.1 General

The AL-4017-1EBS-B Elevation over Azimuth positioner is shipped as a ready-mounted unit (pedestal assembled on base riser).

Unpack the system and examine it for any damage that may have occurred in transit. Check connectors, units, the base, and the body itself. The site on which the Positioner is to be placed must be adequate to support its weight. Unless otherwise stated, Positioners are dispatched with the upper turntable in the zero position and locked on zero.

2.2 Positioner Installation

Using an adequate hoisting device and lifting eye, place the Positioner on the designed location and clamp it with 3/4" UNC bolts and torque to ≈100 ft-lbs.

2.3 Antenna Installation

CAUTION

To prevent injury to personnel and damage to equipment, always make sure that the SAFE/OPERATE switch on the connector panel is set to SAFE, prior to antenna installation on Positioner.

a. The antenna should be fastened to the upper turntable using the specially designed antenna support. When mounting the antenna it is important to consider the Positioner's bending moment rating. The weight of an antenna assembly, wind, and/or ice-formation may all subject a Positioner, located in the open, to a bending moment. When approaching the Positioner's maximum rating, caution should

be exercised since the additional moment load on the antenna from wind force may be enough to exceed the maximum load rating.

b. Inertia loading must also be considered since, during both acceleration and deceleration, the torque load on the drive train mechanism increases. Inertia overload causes slow starting and commensurate increase in motor current to compensate for the excessive drive torque required. Faltering, vibration, and exceeding of the torque rating on deceleration may all result from inertia overload, causing excessive gear wear and possible tooth breakage.

CAUTION

To avoid damage to the Positioner drive train from inertial overload, it is vital to apply speed changes slowly whenever an overload is suspected. This is because inertial torque effects are proportional to the square of the turntable speed.

2.4 Operation Instructions

CAUTION

Prior to any operation of the Positioner, make sure that no person or equipment is inside the Positioner rotation area.

a. Set the "SAFE/OPERATE" switch to "OPERATE" position.

b. Set Power Switch on the Controller to the "ON" position - "ON" lamp will illuminate. The positioner will perform a self-test by slewing in both azimuth and elevation.

c. Upon completion of the self-test, choose between "LOCAL" operation (operation by means of the Controller) or "REMOTE" operation (operation by means of the Computer) by setting the Controller to the desired mode of operation, using the LOCAL/REMOTE switch. The Positioner and System are now ready to operate.

d. To operate the System, refer to the applicable Controller Operation Manual.

WARNING

TO PREVENT INJURY TO MAINTENANCE PERSONNEL OR DAMAGE TO EQUIPMENT, ALWAYS VERIFY THAT NO EXTERNAL VOLTAGE IS SUPPLIED TO THE POSITIONER AND THAT THE SAFE/OPERATE SWITCH IS IN THE SAFE POSITION, PRIOR TO PERFORMING ANY MAINTENANCE WORK ON THE POSITIONER.

IF POWER MUST BE APPLIED FOR TEST PURPOSES, TAKE ALL THE STEPS THAT ARE NECESSARY IN ORDER TO AVOID INJURIES AS A RESULT OF ELECTRICAL SHOCKS AND MOVEMENT OF MECHANICAL UNITS.

SECTION 3 MAINTENANCE

3.1 General

This chapter provides information necessary for maintaining the AL-4017-1EBS-B Elevation-over-Azimuth Positioner series in optimal operating condition.

<u>Note</u>

When performing maintenance operations, the internal components such as motors, electrical devices, wires, connectors, and mechanical elements, should be visually inspected.

3.2 Cleaning

The Positioner should be cleaned as often as dictated by the operating conditions. It should be kept free of dust, moisture and grease. If available, use a vacuum cleaner to remove all accumulated dust from the interior and exterior of the Positioner.

3.2.1 Exterior Cleaning

Loose dust can accumulate on the exterior surface of the positioner. Remove this dust with a soft cloth or a soft bristle brush. A cloth saturated with cleaning solvent may also be used.

3.2.2 Interior Cleaning

Loose dust in the Positioner interior must be removed due to its electrical conductivity under humid conditions. The recommended method is to use a vacuum cleaner. Remove any remaining dirt with a soft bristle brush or a cloth soaked in cleaning solvent. A cotton-tipped applicator is useful for cleaning narrow spaces.

3.3 Lubrication

This section includes access information, periodicity, and lubrication procedures.

3.3.1 Periodicity

Lubrication of the Positioner should be performed periodically, per the intervals listed in Table 2.

3.3.2 2,000 Hour or 2-Month Lubrication

3.3.2.1   Slewing Bearing Lubrication

   a.   Inject 2cc of grease (see Table 2), through the grease fitting, every 60° of the Azimuth turntable rotation. For Elevation, inject grease at the end of the travel, in each direction.

   b.   When operating under very hot or dry environmental conditions, inspect and inject grease more frequently.

3.3.3 17,000 Hour or 2-year Lubrication

3.3.3.1   Ring-Gear Lubrication

   a.   Using a 5/32-inch Allen wrench, loosen the two screws fastening the primary limit switch assembly to the body.

b.   Through the limit switch hole in the body apply a thin layer of grease on the gear teeth. Then, rotate the turntable a small amount and again apply a thin layer of grease on the gear teeth. Continue this rotating and greasing process until the turntable completes one full revolution.

c.   Remount the limit switch after rotating the turntable to its previous position.

Note

To achieve the previous position, verify that the angle that is displayed on the controller's console is the same angle that was displayed before the removing of the limit switch assembly.

TABLE 2. RECOMMENDED LUBRICANTS AND LUBRICATION INTERVALS

Item	Lubricant	Type	Manufacturer	Interval
Large ring gear	Grease 165 LT	Molykote GmbH	Dow Corning	17,000 hours of operation or 2 years
Bearings	Grease	Isoflex LDS 18 Special A	Kluber	1,500 hours of operation or 2 months
Reduction gear	Grease	Shell Tivella Compound A	Shell Oil Co.	During overhaul

Note: If the required Lubricants, as described in the above table, are not available in your area; please contact your Baron Services Representative for assistance.

3.3 *Electromechanical Components*

3.3.2 General

Common components, such as encoders and limit switches, do not usually require special servicing; such components may be serviced during general overhaul. Maintenance information for the limit switches is given in the following pages.

3.3.3 Limit Switches Maintenance

The limit switches are factory adjusted prior to shipment. However, when Positioner readjustment or change of rotation limits is necessary, the limit switches must be readjusted.

CAUTION

To avoid damage to the internal cables (connecting the Azimuth Unit to the Elevation Unit), verify that the new adjusted turning range does not exceed the specified range.

3.3.4 Limit Switch Adjustment Procedure (see Figure 1)

a.   Turn Positioner axis to the desired limit angle (CW or CCW).

b.   Gain access to limit switch assembly.

c.   Using a 7/64" Allen wrench, release the appropriate limit switch cam fastening screw (S1 for CCW and S2 for CW).

d.   Rotate the appropriate switch cam until Positioner operation is inhibited in the desired direction and retighten the cam screw.

e.   Turn the Positioner in the opposite direction and then return it in the limit direction. Verify that Positioner operation is stopped at the desired angle.

11

Use a 7/64" Allen
wrench for adjusting
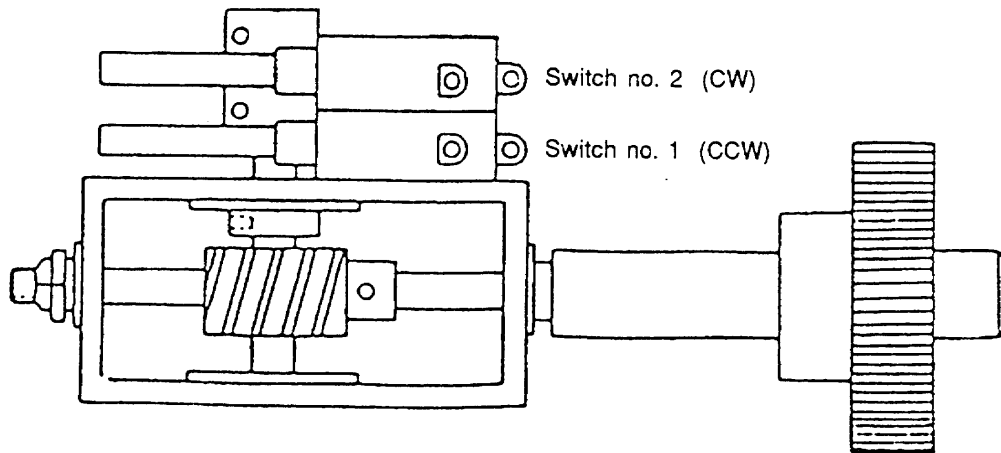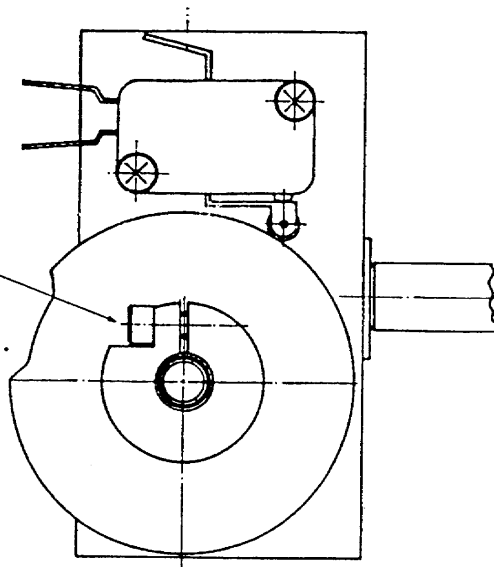cam. Refasten screw
after cam is adjusted.

Switch no. 2 (CW)

Switch no. 1 (CCW)

FIGURE 1. LIMIT SWITCH ASSEMBLY

3.4 Timing Belt Installation And Adjustment

The Timing belt should be installed with a snug fit, neither too tight nor too loose. The belt's positive grip eliminates the need for initial tension. Consequently, a belt, when installed with a snug fit (that is, not too tight), assures longer life, less wear on bearings and quieter operation. Preloading, often the cause of premature failure, is not necessary.

3.4.1 Belt Tension (refer to Figure 2)

When torque is unusually high, a loose belt, on starting, may "jump teeth". In such a case, the tension should be increased gradually until satisfactory operation is attained.

When the safety switch is in the OPERATE position, run the polarizer so that the top of the belt is slack and return the safety switch to the SAFE position. The application of a force (f) of 1.3 lbs (0.59 Kg) at the midpoint of the slack span, between the two pulleys, shall result in a deflection (d) of 0.21 inch (5.4mm).

If the force (f) required to obtain the specified deflection (d) is less than specified, the belt is too loose. If the force (f) required to obtain the specified deflection (d) is greater than that specified, the belt is too tight. Adjust the motor position until the specified force and deflection measurements are obtained.

Deflection - 1/64" per inch of span

Span Length, t

d

Force
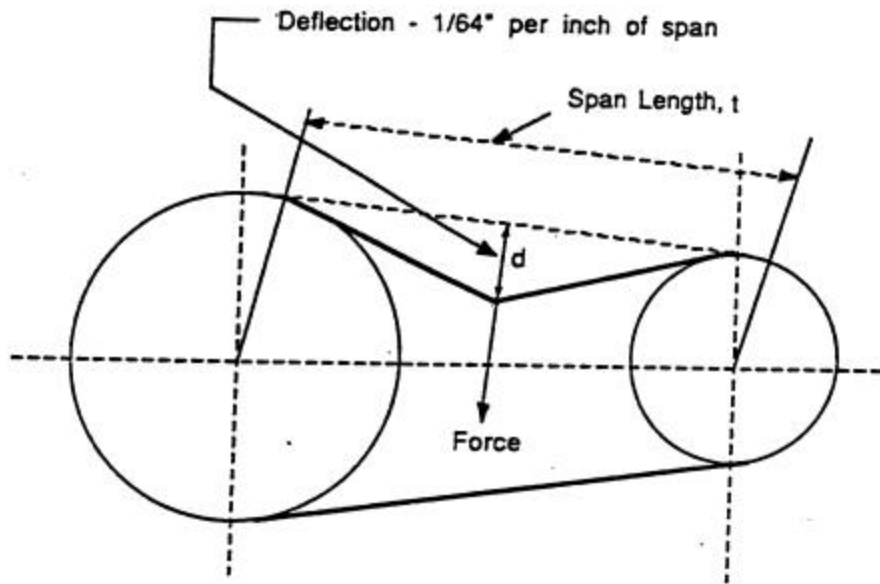
d = 0.21 inch (5.4 mm)
f = 1.3 lbs   (0.59 Kg.)

FIGURE 2: RECOMMENDED BELT TENTION

3.4.2 Sprocket Alignment

Misalignment of drive results in unequal tension and extreme edge wear. Consequently, sprocket alignment should be verified by means of a straight-edge and shafts checked to assure parallelism. On a long-center drive, due to the belt's tendency to run against one flange of the drive sprocket, it is often advisable to offset the driven sprocket slightly to compensate for this effect.

3.4.3 Belt Handling

On installation, the belt should never be forced or pried over the sprocket flange. Reduction of center distance usually permits the belt to slide into the sprocket easily. Otherwise, one or both sprockets must be removed.

3.4.4 Belt Storage

To assure smooth operation and to prevent premature failure, belts in storage should be protected against sharp bending or creasing. Avoid subjecting belts to extreme heat, low temperature or high humidity.

3.5   Replacement of Azimuth Motor Assembly

3.5.1 Removal of Azimuth Motor Assembly

Use the following procedure to remove the Azimuth Motor Assembly (Refer to Figure 3):

a.   Rotate the Elevation Axis until it is at the 90 deg. vertical position; i.e. pointing straight up.

b. Set the SAFE/OPERATE switch to the SAFE position.

c. Remove the antenna, counterweights, and the two arms located on the Elevation Axis.

d. Remove the four screws on each flange (8) and the screws (3) securing the Positioner to the base riser.

e. Detach the connectors MOL1 thru MOL4, located in the base riser.

f. Lift the Positioner off of the base riser and place it on a secure working surface; e.g. a table.

g. Support the Positioner in a level position.

h. Remove screws (6), cut the tie wraps located on the waveguide and remove the parts (7) from the Slip-Ring.

i. Remove the screws (4) securing the lower plate (5) to the Azimuth unit.

j. Separate the lower plate (5) from the Azimuth unit.

<u>Note</u>:

The length of the wiring harness between the slip-ring and the elevation unit is long enough to allow the plate (5) to be moved away from the Azimuth unit by a distance of approximately one foot.

k. Remove the four screws securing the motor bracket to the azimuth positioner body.

l. Using a "heat gun", remove the LOCKTITE No. 241 epoxy from the four screws securing the motor to the bracket.

m. Remove the four screws attaching the motor to the bracket.

n. Carefully, remove the motor from the bracket.

16

o.   Remove the pulley from the motor shaft and retain it for installation on the shaft of the new motor.

3.5.2 Installation of Azimuth Motor Assembly

For new Azimuth Motor installation, follow the removal procedure in paragraph 3.6.1 in a logical reverse sequence using the following notes:

<u>Notes</u>:

1)   When the lower plate (5) is assembled to the Azimuth unit, be sure that the extra length of the wire harness between the slip-ring and the elevation unit is inserted in part (1). Loose wiring inside the Azimuth unit should be secured to the waveguide by means of tie wraps.

2)   When assembling the positioner, verify that the waveguide and lower plate (5) O-ring gaskets are in good condition and are installed in their proper locations. Verify that all screws are securely fastened.

3)   After the installation procedure is completed, the new motor and gear sprockets must be aligned according to para. 3.5.2; and the tension of the belt between the new motor and the gear must be adjusted according to para. 3.5.1.
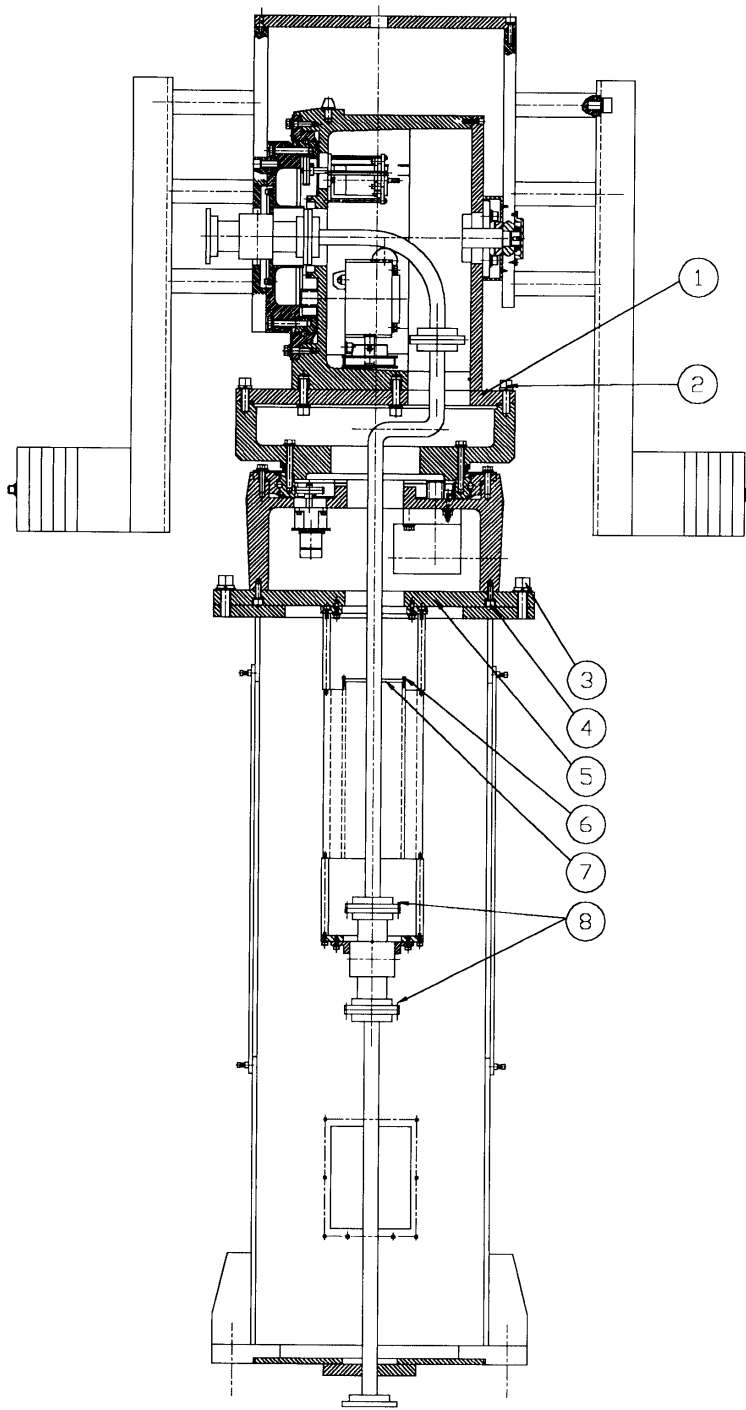
FIGURE 3. AL-4017-1EBS-B POSITIONER ASSEMBLY

SECTION 4 STORAGE AND PREPARATION FOR USE

Store the Positioner in a closed place, protected from dust and rain.
Once a month, rotate the Positioner at each axis, three times from limit to limit.
Before using the Positioner after a long storage period, re-lubricate the bearings.
Refer to lubrication instructions.

SECTION 5 REPLACEMENT PARTS

5.1 PARTS LIST

5.1.1 GENERAL

The various parts used in the AL-4017-1EBS Positioner are listed in the following parts list table. The purpose of this part list is for identification, requisition, and issuance of spare or replacement parts. For part replacement, use only part numbers specified in this parts list.

The parts list table is divided into four columns, which are described in the following paragraphs.

5.1.2 ITEM NUMBER (ITEM No.)

The first column in the parts list table contains item numbers, assigned in sequence.

5.1.3 DESCRIPTION

The second column contains brief descriptive information for each part.

5.1.4 PART NUMBER (PART No.)

The third column lists manufacturer's part numbers.

5.1.5 QUANTITY (QTY)

The fifth column lists quantity of each item used in the Positioner.

5.1.6 ORDERING INFORMATION FOR PARTS

When ordering spare or replacement parts, state the full description of part, part number, and the desired quantity.

TABLE 3. AL-4017-1EBS-B Parts List

Item No.	Description	Part No.	Qty.
1.	Az. Motor Assy.	BS-104453	1
2.	El. Motor Assy.	BS-104452	1
3.	Encoder	BS-104455	2
4.	Reduction Gear	BS-104151	2
5.	Pulley (Az/El) (Motor)	BS-104482	2
6.	Belt	BS-104456	2
7.	Pulley (Az/El) (Gear)	BS-104483	2
8.	Slewing Bearing	BS-104107	2
9.	Az Power Amp.	BS-104134	1

APPENDIX

AL-4017-1EBS-B

INTERFACE CONTROL DRAWING (ICD)	**-**	**Dwg. No. 19-0342**
WIRING DIAGRAM	**-**	**Dwg. No. 19-0361-1/2**
SYSTEM LAYOUT	**-**	**Dwg. No. 19-0589**

OPERATION AND MAINTENANCE MANUAL

AL-1642-3JB

Two-Axis Controller
With Built-In Servo Amplifier

For Baron Services Radars:
XDD-350C ™
XDD-300X ®
VHDD-350C ™
VHDD-1000C™

BARON SERVICES, INC.
4930 Research Drive
Huntsville, AL 35805
PHONE: 256.881.8811   FAX: 256.881.8283

Table of Revisions

REV	DATE	DESCRIPTION	BY
A	10/9/03	Added VHDD-1000C to front cover	CK

TABLE OF CONTENTS

1   INTRODUCTION

The AL-1642-3JB is a higher power version of the AL-1613-3JB Antenna Control Unit (ACU) for controlling a two-axis elevation-over-azimuth positioner. A front panel provides manual control of the antenna from the controller through a joystick, a set of pushbuttons, and two 8-character LED displays, one for each axis.

Two RS-232 serial links are provided. One link provides for remote control and parameter tuning. Modes of operation in remote control include Go-to-Point, Slew, Raster Scan, Go-to-Home Position, Standby, and Calibrate. The second link provides azimuth and elevation position continuously.

Go-to-Point mode includes an extrapolation algorithm designed to allow the controller to closely follow a trajectory sent over the serial link. This algorithm is used automatically when point commands are received at a sufficiently rapid rate. Most important control gains and parameters may be tuned over the serial link and stored in non-volatile memory.

The AL-1642-3JB is packaged in a 4U height 19"-wide rack-mount box which includes DC power supplies, a CPU card, an I/O card, two amplifiers for the DC motors, and the front panel card.

The CPU card, based on the Intel 80960KB RISC processor, performs closed loop control of the axis positions and manages the serial protocol and front panel. The I/O card contains inputs for encoders to read axis positions, digital inputs for limit switches, digital outputs for the drive enable and analog outputs for the current references for the motors. It also contains the serial communications chip and drivers for the RS-232 communication link. The front panel card provides interfaces for the joystick, the pushbuttons, and the 8-character displays for reading the angles.

The amplifiers provide closed loop velocity control of the motors, as well as protective functions, such as constant current limiting, peak current limiting, clockwise motion limiting, and counterclockwise motion limiting.

2   FRONT PANEL OPERATION

The front panel is shown in Figure B-3. It consists of a joystick, a fine/coarse switch, two 8-character displays, two LEDs, three pushbuttons, and an on/off power switch.

When the AL-1642-3JB is first powered on, the unit will be in REMOTE mode, permitting remote operation without access to the Controller.

2.1   *Front Panel Keypad*

The front panel contains 3 pushbuttons with functions as follows:

REM/LOC - Toggle between remote and local modes. In remote mode, the other front panel controls are inactive and all control is by commands over the serial communications link. In local mode, commands over the serial link which could move the positioner are not accepted. This includes axis mode commands and pointing commands. Position is controlled instead through the joystick and other front panel switches. The REM/LOC switch also places the controller in Standby mode whenever it is pressed, bringing the positioner to zero velocity.

CAL - This function is required because the position measurement is based on incremental encoders. It finds the mechanical zero point of the positioner and resets the angle displays accordingly.

A detailed explanation of the calibration sequence and the parameters that affect it is given in section 4.1.5 below.

OFFSET - Set azimuth offset so that the present angle will be zero. If the positioner is moving, it is first commanded to zero velocity. If the positioner is calibrated, the offset is saved to non-volatile memory.

2.2 Front Panel Joystick and Fine/Coarse Switch

The joystick is a dual axis unit with a spring return to zero. It allows controlled movement of both axes at a wide range of velocities when in MANUAL mode. Movement of the joystick UP or DOWN causes elevation motion in the CW or CCW direction respectively. Movement to the right or left causes CW or CCW azimuth motion.

The joystick is a very sensitive control unit. An excessive amount of force is not required in order to move the stick. Extreme force can cause damage to the joystick.

The velocity varies with the amount the joystick is moved from its center position. A central region of approximately ±10% of the joystick's total travel range gives zero velocity. The next ±40% gives a velocity range which increases slowly at first and then increases rapidly. The last ±50% of the travel provides a velocity which increases at a linear rate with respect to joystick position. In all ranges, a deadband of ±2.5% keeps the velocity constant until a motion of at least 2.5% of the stroke length is made.

A front panel velocity parameter, which may also be adjusted via the communications link, is the maximum velocity when the FINE/COARSE switch is set to COARSE. With the FINE/COARSE switch set to FINE, the maximum velocity is reduced by a factor of 10.

With a typical maximum velocity of 36 deg/sec., velocities of about 0.3 deg/sec. to 36 deg/sec. are possible in COARSE mode, and 0.03 deg/sec. to 3.6 deg/sec. in FINE mode.

Zero-adjust levers are provided for each axis of the joystick. If a small velocity exists, with the joystick at the center position, this may be nulled by adjusting these levers.

2.3 Front Panel Power Switch

This switch will switch the main power, which may be either 115 VAC or 230 VAC, depending on settings of rear panel switches described below. The switch will be illuminated when 230 VAC power is in use and the switch is in the ON position.

2.4   *Front Panel Display*

Azimuth and Elevation angles are displayed on the front panel using 8-character LED displays. Six of the characters provide the angle reading to a precision of 0.001 degree. The 7th character is for the sign of the angle, and the 8th character provides limit information.

A rapidly blinking display (4-Hz) indicates that the axis has not completed its calibration cycle.

A slowly blinking display (2-Hz), along with a letter in the limit character, indicates that a limit switch has been tripped, stopping the positioner motion. Motion is then permitted only in the direction away from the limit.

> L (left) indicates CCW azimuth limit (decreasing angle).
> R (right) indicates CW azimuth limit (increasing angle).
> U (up) indicates CW elevation limit, and D (down) indicates CCW
>   elevation limit.

A slowly blinking letter in the limit character, with the rest of the display not blinking, indicates that the positioner has reached the software limit maximum or minimum angle. These limit angles may be adjusted by commands over the serial communication link.

The angle display may be changed by commands CCA and CCE on the serial communications link. The precision may be set to 0.1, 0.01, or 0.001 degree. The format may be set to 0-359.999 or +/-780 degrees. If desired, the limit character may be displayed (without blinking) to indicate cable wrap (when the angle is outside the center +/-180 degree area). This cable wrap feature is particularly useful with a 0-359.999 degree display format.

3   REAR PANEL CONFIGURATION

The rear panel is shown in Figure B-4. It contains a power select area, power input, fuses, a connector for the cable to the positioner, two communications connectors, and a chassis ground connector.

3.1   *Power Selection, Input, and Fuses*

Power input is through the power connector J1.

The switch labeled "MAINS SELECT" has two positions, 115 VAC and 230 VAC.

> **The "MAINS SELECT" switch must be set to the proper input voltage. If this is not done, damage may result to the internal power supply used to provide DC current for the positioner motors and the electronic circuitry.**

Fuse F1 is for the AC input. Recommended fuses to be used are 4 Amp "slow-blow" type for 230 VAC input, 8 Amp "slow-blow" type for 115 VAC. High breaking capacity fuse (greater than 500 Amps) should be used.

3.2   *Motor Fuses*

Fuse F2 protects the azimuth motor and fuse F3 protects the elevation motor. Current limit protection already exists in the amplifiers and is set to 5 Amps continuous and 10 Amps for peaks of less than 2 seconds. This will protect the motors from thermal overheating for ambient temperatures up to about 45°C. "Slow-blow" type fuses of 10 Amps are recommended as further protection.

3.3 Positioner Connectors

The positioner connectors J3 and J5 are circular MS-type connectors which carry encoder signals, tachometer signals, limit switch signals, and power for the motors and encoders.

3.3.1 Encoder IN/OUT (J3)

For each encoder, there are 6 wires, in three sets of shielded twisted pairs. One pair is for the normal (A) pulses, one pair for the quadrature (B) pulses, and one for the index (I) pulses.

For each axis, there are two wires for a home (zero-indicating) pulse which is used during the calibration operation to find an absolute reference point.

115/230 VAC is provided as input to a power supply which provides 5 Vdc power to the encoders.

For each tachometer (azimuth and elevation), there are two wires.

3.3.2 Motor Power and Limits (J5)

Each motor has 6 wires, one group of three connected in parallel for DC power-high side and the second group of three connected in parallel for DC return.

For each axis, there are 3 limit switch wires: one for CW limit, one for CCW limit and one for common. The CW and CCW limits will shut down the motor amplifiers from moving the motors in the direction which caused the limit.

3.4   *Communication Connectors*

The communication connector J4 is a 25-pin D-type connector for RS-232, with pins 2,3, and 7 used for TXD, RXD, and COMMON, respectively per standard RS-232 configuration. The controller is configured as DCE (data communications equipment), since normally the host computer will be configured as DTE (data terminal equipment). This means that the controller receives data from the host on pin 2 (TXD) of the 25-pin connector and transmits data to the host on pin 3 of the 25-pin connector (RXD).

Connector J6 is a 25-pin D-type connector for RS-232, configured the same as J4. The azimuth and elevation status data are transmitted via connector J6.

4   REMOTE OPERATION

Remote operation is implemented by sending commands to the positioner via the serial link. The modes of operation available via remote control and the details of the serial protocol commands are described below.

4.1   *Modes of Operation*

The mode of operation for each axis is independent. The modes of operation are: MANUAL, STANDBY, POINT, HOME, SLEW, RASTER SCAN, and CALIBRATE. A mode command may be used to select all but the first via the remote link.   Following is a description of what occurs when each mode is selected.

4.1.1   Standby

Axis is brought to a stop at the maximum allowed deceleration rate, determined by the parameter MAx. When the velocity arrives at zero, the motor amplifier is shut down if bit #12 in Control Word #2 is set. This bit should be set only for positioners which have self-locking gears, or for which there is no load imbalance which would cause the positioner to move when the amplifiers are shut down.

Note that Standby may also be implemented from the Controller front panel by toggling the REMOTE/LOCAL switch.

Note that if Standby is commanded before the power-up calibration has been performed, the position readings will be relative to the position at which the unit was powered-up. The front-panel display will blink at 4 Hz. repetition rate to indicate this, and the status bit in RDS (az_calibrated or el_calibrated) will be 0.

4.1.2   **Point**

4.1.2.1   Single Point Commands

Positioner moves to the axis point reference, as sent by the PTx command, and comes to rest there. The amplifier continues to supply current as needed to hold the position against external forces.

If the positioner has been switched from LOCAL to REMOTE and no point command has been sent, the axis point reference is the place where the positioner came to rest.

When a single PTx command is send while the ACU is in Remote and Point mode, the positioner moves to the commanded point using a trapezoidal velocity profile.

If the Continuous Rotation bit (bit #5) in Control Word #1 is set, the direction of motion is the shortest route, and the user has no control over the direction. If it is not set, the direction of motion is according to the commanded values. For example, if the position is +170.000 and the user wishes to move 20 degrees CW, the commanded point must be +190.000. If he wishes to reach the same point by a 340 degree motion CCW, the commanded point must be -170.000.

The acceleration is determined by the value of the MAx parameter.

The maximum speed is determined by the step size, the MVx parameter, and the "Full-Speed Step" bit (bit #6) in Control Word #2. If "Full-Speed Step" is set, the maximum speed will be the MVx parameter for all step sizes greater than MVx^2/MAx. For smaller steps, the velocity profile will be triangular. If "Full-Speed Step" is zero, the maximum velocity will be according to the formula sqrt(step*MAx/5.0), or MVx, whichever is less. For applications where there are many small, irregular position corrections being commanded, and response time is not critical, this formula provides smoother motion with good response time.

4.1.2.2   Repeated Point Commands (Track Mode*)*

If a series of point commands are sent when in point mode, and the time delay between commands is less than the maximum update-time (UTx) parameter, the points will be interpreted as a continuous trajectory. Instead of coming to rest, the positioner extrapolates the trajectory based on the last two points

received and attempts to arrive at the point and velocity expected according to the extrapolated trajectory. This mode is entered after 3 points have been sent with the two time intervals between them less than the maximum update-time.

As long as the update time varies by less than 10%, the trajectory extrapolation is based on the assumption that the intended time interval was constant. If the time interval between points is more than this, the positioner begins to decelerate to zero velocity.

4.1.3 Home

Positioner moves to the home point (HMx) parameter specified for the axis and comes to rest there. The amplifier continues to supply current to hold the positioner at that point against external forces.

Home mode acts like a single point command, but using the HMx parameter to determine the target point instead of the PTx parameter.

4.1.4 Slew

Positioner moves at the constant velocity last commanded with a slew velocity (SVx) command. If no slew velocity command has been sent since the controller was turned on, the slew velocity is zero.

4.1.5 Calibrate

This function is required because the position measurement is based on incremental encoders. It finds the mechanical zero point of the positioner and resets the angle displays accordingly. First, the positioner moves towards the clockwise limit switch at the go-to-limit velocity until one of three events occurs:

> 1) The clockwise limit switch is tripped
> 2) The zero indicating pulse is detected
> 3) The maximum clockwise calibration distance is
>   passed

In cases 2 and 3, if required, the positioner moves clockwise an additional distance to be sure that it will accelerate to the calibrate velocity before it reaches the zero-indicating pulse.

The positioner then moves counter clockwise at the calibrate velocity until it detects the zero-indicating pulse and continues until the first index pulse on the encoder is observed.

At this point, the current angle is then set equal to the zero switch position minus the offset. The positioner then decelerates and returns to this set point.

Go-to-limit velocity, calibrate velocity, maximum clockwise calibration distance, zero switch position, and offset for each axis may all be adjusted via the serial communication link.

Notes:

1. If the zero switch position parameter is changed without performing a calibration, the current angle readout will not be changed until a calibration is actually performed.

2. Calibration is performed automatically upon power-up.

3. For a continuous rotation axis, as defined by bit 5 in control word #1, the clockwise movement in the calibration cycle is not performed. Instead, the axis is moved counterclockwise until the zero-indicating pulse is detected, continues until the first index pulse on the encoder is observed, and sets the current angle equal to the zero switch position minus the offset, as described above. It then decelerates and returns to this set point.

4.1.6   Raster Scan Mode

Positioner performs a raster scan using a rectangular angular profile. The Raster Scan mode is different from all the other modes in that the mode command for one axis (primary axis) also controls the operation of another axis (secondary axis). If the Raster Scan mode command is for the azimuth axis (i.e., "MDA 6"), the raster area is covered by scanning the azimuth axis (primary axis) followed by stepping of the elevation axis (secondary axis) at the end of each azimuth scan. If the Raster Scan mode command is for the elevation axis (i.e., "MDE 6"), the raster area is covered by scanning the elevation axis (primary axis) followed by stepping of the azimuth axis (secondary axis) at the end of each elevation scan. When a Raster Scan command has been initiated for the primary axis, mode commands for the secondary axis should not be given until the primary axis is commanded to another mode.

Seven parameters and four control bits govern the details of the raster scan performed:

RCA   Center azimuth position
RCE   Center elevation position
RRA   Azimuth range scanned at constant velocity. The azimuth range will have added to it at each end an acceleration distance of 0.5*RVA*RVA/MAA.
RRE   Elevation range scanned
RVx   Scan speed of primary axis in Raster Scan mode command
RSx   Step size of secondary axis
RTx   Time delay at end of each scan

4.1.6.1   Azimuth Raster Scan Mode

When the Azimuth Raster Scan mode is entered, the positioner moves to the initial corner of the raster profile at the maximum velocity (MVx). The initial corner is determined by the sign of the RVA and RSA parameters. If RVA is positive, the initial corner is the CCW corner in azimuth. If RSA is positive, the initial corner is CCW in elevation.

After the initial corner is reached, the positioner scans in azimuth with elevation constant until the end of the azimuth range, and decelerates to zero velocity.

If the RTA parameter is nonzero, it waits for a delay time as specified by the RTA parameter. If the bit for a single-direction raster is set (Control Word #2, bit 4), the positioner then steps in elevation an amount given by the RSA parameter and returns to the azimuth starting point, both together at maximum velocity, and the azimuth scan repeats.

If the single-direction bit is cleared, the elevation steps and the azimuth scans in reverse.

The process is repeated until the next elevation step results in exceeding the range specified in the RRE parameter. At this point, if the Non-Stop Raster bit (Control Word #2, bit 5) is set, the positioner returns to the initial corner and the process is repeated.

If Non-Stop Raster is cleared, the positioner enters Standby mode at the end of the scan.

Note that parameters may be changed in the middle of a scan, but this should be done with caution. The parameter change will normally take effect at the

end of each azimuth sweep. Changes of sign in RVA or RSA, or changes to RCx or RRx may have the effect of placing the positioner outside the scan limits, in which case it will scan until it reaches maximum position (MNx or MXx) or a limit switch. Changes in RVA or RSA without a change in sign are OK.

Two control bits which may affect scanning are the Fast Step bit (Control Word #2, bit #6) and the Continuous Rotation bit (Control Word #1, Bit #5).

If the Fast Step bit is not set, the various step motions at the end of each azimuth scan may not proceed at their maximum velocity. The user may choose, according to his preference, for fastest completion of scanning or smoother motions between azimuth scans.

If the Continuous Rotation bit is set for azimuth, all step motions at the end of azimuth scanning will be in their shortest possible direction. Therefore, in single direction scanning, the "return" motion will be in the same direction as the scan for scans greater than 180 degrees.

If it is desired to scan in azimuth only; i.e., with no elevation motion, set both the elevation step size (RSA) and range (RRE) to zero.

4.1.6.2   Elevation Raster Scan Mode

This mode is analogous to the Azimuth Raster Scan mode, with the roles of the two axes reversed; ie., the positioner scans in elevation and steps in azimuth.

When the Elevation Raster Scan mode is entered, the positioner moves to the initial corner of the raster profile at the maximum velocity (MVx). The initial corner is determined by the sign of the RVE and RSE parameters. If RVE is positive, the initial corner is the CCW corner in elevation. If RSE is positive, the initial corner is CCW in azimuth.

After the initial corner is reached, the positioner scans in elevation with azimuth constant until the end of the elevation range, and decelerates to zero velocity.

If the RTE parameter is nonzero, it waits for a delay time as specified by the RTE parameter.

If the bit for a single-direction raster is set (Control Word #2, bit 4), the positioner then steps in azimuth an amount given by the RSE

parameter and returns to the elevation starting point, both together at maximum velocity, and the elevation scan repeats.

If the single-direction bit is cleared, the azimuth steps and the elevation scans in reverse.

The process is repeated until the next azimuth step results in exceeding the range specified in the RRA parameter. At this point, if the Non-Stop Raster bit (Control Word #2, bit 5) is set, the positioner returns to the initial corner and the process is repeated.

If Non-Stop Raster is cleared, the positioner enters Standby mode at the end of the scan.

Note that parameters may be changed in the middle of a scan, but this should be done with caution. The parameter change will normally take effect at the end of each elevation sweep. Changes of sign in RVE or RSE, or changes to RCx or RRx may have the effect of placing the positioner outside the scan limits, in which case it will scan until it reaches maximum position (MNx or MXx) or a limit switch. Changes in RVE or RSE without a change in sign are OK.

Two control bits which may affect scanning are the Fast Step bit (Control Word #2, bit #6) and the Continuous Rotation bit (Control Word #1, Bit #5).

If the Fast Step bit is not set, the various step motions at the end of each elevation scan may not proceed at their maximum velocity. The user may choose, according to his preference, for fastest completion of scanning or smoother motions between elevation scans.

If the Continuous Rotation bit is set for elevation, all step motions at the end of elevation scanning will be in their shortest possible direction.

If it is desired to scan in elevation only; ie., with no azimuth motion, set both the azimuth step size (RSE) and range (RRA) to zero.

4.2   *Serial Protocol - Data Link Level*

Serial communication uses asynchronous protocol with 8-bit word length, 1 start bit, 1 stop bit, even parity, and a rate of 9600 baud. Signal levels are RS-232.

4.3 Serial Protocol - Commands from Host Computer to ACU

All commands use printable ASCII characters, plus the ASCII control codes as follows:

> **STX** (start of text, value 02 hex)
> **ETX** (end of text, value 03 hex)

Each command line sent to the controller consists of an ASCII STX character, followed by up to 80 characters of commands, two checksum characters, and an ETX character. The checksum is calculated such that the sum modulo 256 of all command line bytes (excluding the STX, ETX, and checksum bytes) will be equal to the checksum characters interpreted as ASCII-HEX.

The command line consists of a number of commands, each of which is either a read command or a write command.

A write command consists of a 3-letter command followed by a value. The value consists of a number with an optional leading sign (+ or -), up to 8 digits, and an optional decimal point. For each parameter, there is a range of legal values. Certain commands will be received only when the controller is in the remote mode.

A read command consists of a 3-letter command followed by the read-request symbol "<". Only one read request is allowed in a single command line. Any parameter may be read at any time.

Several characters, such as space, tab, new-line, carriage return, comma, and semicolon, are ignored. They may be included in the command line at any place and will have no effect, other than to add to the time required to send the command line. They are not counted in the 80 character limit. However, they must be included in the checksum. These characters may be used, if desired, to provide the meaning of a command line by adding descriptive comments.

If any error is detected in a command line, none of the commands in the line are executed.

A full list of the commands, parameters, maximum and minimum values, and conditions governing when they may be written, is provided in section 4.5.

A typical valid command line to update the azimuth and elevation point would be:

<STX>PTA20.24PTE-14.05E9<ETX>.

The calculation of the checksum E9 is given by:

```
<STX>  excluded
P      50 hex
T      54 hex
A      41 hex
2      32 hex
0      30 hex
.      2E hex
2      32 hex
4      34 hex
P      50 hex
T      54 hex
E      45 hex
-      2D hex
1      31 hex
4      34 hex
.      2E hex
0      30 hex
5      35 hex
----------------
sum    3E9 hex
```

4.4 Serial Protocol - Replies from ACU to Host

All replies use printable ASCII characters, plus the ASCII control codes as follows:

STX (start of text, value 02 hex)
ETX (end of text, value 03 hex)
ACK (acknowledge, value 06 hex)
NAK (negative acknowledge, value 15 hex)

Each complete command line received is answered. Typically the reply will start within 2.5 msec of receipt of the last character of the command.

If an error is detected in the command line, an error message will be returned with the control character NAK followed by two ASCII hex characters comprising an error code. Error codes are as follows:

(reserved)	01	
CL_PARITY	02	Parity error in byte in command line.
CL_FRAME	03	Framing error in byte in command line.
CL_OVERRUN	04	Overrun error in byte in command line.
CL_BUFOVFL	05	Receive FIFO overflow.
CL_STRLEN	06	Command line more than 80 characters.
CL_CHECKSUM	07	Command line checksum error.
CL_ILLEGAL	08	Illegal character in command line.
CL_CFORMAT	09	Illegal command format.
CL_UNKCMD	0A	Unknown 3-letter command mnemonic.
CL_DATALONG	0B	More than 10 characters in value.
CL_MLTREAD	0C	More than 1 read command in command line.
CL_DFORMAT	0D	Illegal data format.
CL_DATAULIM	0E	Data value too large.
CL_DATALLIM	0F	Data value too small.
(reserved)	10	
CL_NOTREMOTE	11	Controller not in remote and command line attempted to write to parameter which may be changed only in remote.
CL_BABBLE	12	Babbling transmitter. More than 80 characters read with no STX.
CL_READONLY	13	Read only command and attempted to write.

The large number of error messages listed above is intended to assist the user in debugging his communications code by pointing to the exact source of the problem.

If there is no error and the command line contained no read messages, the response is a single ACK character.

If there is no error and the command line contained a read message, the response is of the format:

STX <value> <checksum> ETX

where the value may be 1-10 characters including a leading sign and a decimal point and the checksum is calculated as above.

4.5   *Command codes and parameters*

4.5.1   General comments

Below is a complete description of the command codes and their parameters, for use in designing communications programs for the host computer. In the list below, most of the commands are shown with the third letter as x. The x should be replaced by A if the command is for an azimuth parameter or with E for an elevation parameter.

Certain parameters have been adjusted in the factory to work with the positioner supplied. This applies particularly to values for gear ratio, encoder pulses per revolution, and gains. These parameters should not be changed unadvisedly.

Certain parameters may be written only when the controller is in REMOTE mode. This applies to mode, offset, point, and slew-velocity commands. Other than these commands, a parameter may be written at any time. It is recommended not to change control loop gains unless the positioner is in Standby mode.

When a parameter is written with a normal write command, the change is made in RAM only. Parameter changes may be saved to EEPROM using the SAV command with value 1. Parameters have hard coded default values which will exist if the parameter has not been changed. These default values may also be restored by a SAV command with parameter 2. The values last stored in EEPROM may be restored by a SAV command with parameter 3, or by cycling power.

Note: SAV 2 command is for factory use only, since the values restored may not be appropriate to the particular positioner to which the controller is connected.

4.5.2   Parameter Limits

For each parameter there are maximum and minimum values that will be accepted over the communication link.

> For angles, these values are +/-780 degrees.
> For velocities, the values are 0 to 10000 deg/sec.
> For other parameters, the limiting values are given with the command description.

4.5.3   Alphabetical command listing

CBx
Set value of control word #1. Bits in control word #1 have the following functions:

Bit	Value	Function
0	1	0=>CW feedback from motor = CW motion of axis 1=>CCW feedback from motor = CW motion of axis
1	2	0=>Positive command for CW rotation of axis. 1=>Negative command for CW rotation of axis
2	4	Reserved (must be 0)
3	8	0=>Shutdown bit = 0 for shutdown 1=>Shutdown bit = 1 for shutdown
4	16	Reserved (Must be 0).
5	32	0=>Limited range of rotation 1=>Continuous rotation axis
6	64	0=>Normal closed-loop control 1=>Open-loop test mode. In this case, the position feedback is ignored, and the velocity command output is 10 VDC * RVx/CVx. By changing the value of RVX, a step may be produced in the velocity command output for testing the response of the velocity loop.
7	128	0=>Normal Operation 1=>Unused Axis - Always in Shutdown
8	256	0=>Normal Operation 1=>Open-loop test mode. In this case, the position feedback is ignored, and the velocity command output is a trapezoid based on the parameters RVx, FSx, MAx, and RTx. The slope of the trapezoid is controlled by MAx, the height is 10 VDC*RVx/FSx, and the time of the flat top is RTx. The direction of the trapezoid alternates each cycle. This is used for testing the response of the velocity loop.

Value must be from 0 to 511.

CCx
Set value of control word #2. Bits in control word #2 have the following functions:

Bit	Value	Function
0,1	0-2	0=>Display precision 0.1 degree 1=>Display precision 0.01 degree 2=>Display precision 0.001 degree
2	4	0=>+/-780 deg display 1=>0-359.999 or +/-180 deg display
3	8	0=>No cable wrap display 1=>L,R or U,D cable wrap display
4	16	0=>Bidirectional Raster 1=>Single Direction Raster
5	32	0=>Raster Scan Once 1=>Continuous Raster Scan
6	64	0=>Soft Step in Point Mode 1=>Step at Full Speed in Point Mode
7	128	Reserved (Should be 0)
8	256	0=>Normal Front Panel Display 1=>Front Panel Display Darkened
9	512	0=>9600 Baud on 2nd RS-232 Output 1=>19200 Baud on 2nd RS-232 Output
10	1023	0=>0-359.999 deg display if bit 2 set 1=>+/-180 deg display if bit 2 set
11	2048	0=>Full precision position on comm link 1=>Front Panel position on comm link
12	4096	0=>No shutdown in Standby mode 1=>Motor amplifiers shutdown in Standby mode

Value should be 0-8191.

CDx
CGx
CLx
CVx

During a calibrate cycle, the positioner will operate at the go-to-limit velocity (CGx) until the clockwise limit switch is activated, the zero indicating pulse is detected, or the maximum clockwise calibrate distance (CDx) is passed. It will then return at the calibrate velocity (CVx) until the zero-indicating pulse is observed and an index pulse occurs on the encoder. At that point, the angle will be set to equal the zero switch position (CLx).

CDx sets the maximum clockwise calibrate distance in degrees.

CGx sets the go-to-limit velocity, in degrees/sec.

CLx sets the calibrate zero switch position, in degrees.

EPx
Motor encoder pulses per revolution of motor. Value must be from 1 to 1000000, with no decimal point. Default is 8000.

FSx
Full scale axis velocity. This is the velocity that would be achieved with 10 VDC velocity command to the amplifier (assuming no limitations due to back-EMF). It is used for converting velocity command outputs from degrees/sec to volts.

FVx
Front panel slew velocity from maximum joystick motion in coarse mode. Value between 0 and 10000 deg/sec. Value should be about 10-20% greater than the actual maximum velocity desired.

GDx
GNx
The gear ratio of each axis is specified as a numerator and a denominator. GNx sets the numerator, GDx sets the denominator. Values must be from 1 to 1000000 for the numerator and 1 to 10000 for the denominator, with no decimal point.

HMx
Home position. Value from -720 to +720 degrees. This is the position that the axis goes to when it is placed in home mode.

ILx

Integral limit.   Upper limit of velocity command from the integral error term in the PI position control loop. Integral error is defined as:

$$Ki * \int angle\ error\ dt$$

Where Ki is the parameter specified below under KIx and angle error is the difference between actual and target angles.   Units are in deg/sec. Value from 0 to 50. Lower limit of integral error is the same value with opposite sign. Note that the integral error term should be small relative the maximum velocity of the system.   It serves primarily to correct for any zero offsets in analog components and is updated only when the position command and the position feedback are stable and when the closed loop error is within the integral window.

IWx

Integral window.   The integral error term is updated by the integral gain only when the absolute value of the closed loop error is less than this parameter. Units are in degrees.

KDx

Feedforward gain in PI position control loop.   The feedforward term provides a velocity command output equal to the derivative of the position command times the feedforward gain.   Feedforward gain is a pure number.   Normally, it is set close to 1. Value is from 0 to 2

KLx

Lock gain in PI loop. Units are in 1/sec. When the positioner has arrived at its target position, within the range of the lock window, as specified by the parameter LWx, the gain is increased linearly from KPx to KLx as the error closes to 0. Value is from 0 to 20, and should normally be greater or equal to KPx.

KPx

Proportional gain in PI loop. Units are in 1/sec. Value is from 0 to 20

KIx

Integral gain in PI loop. Units are in 1/sec/sec Value is from 0 to 20.

LWx

Lock window for use of lock gain (KLx) in place of proportional gain (KPx). Units are in degrees.

MAx

Maximum acceleration/deceleration. Units are in deg/sec/sec. Value is from 0.16 to 10,000.0.

MDx

Set operation mode. Value is as follows:

> 0 - Manual (not allowed)
> 1 - Standby
> 2 - Go to Point
> 3 - Go to Home
> 4 - Slew (Continuous Velocity)
> 5 - Calibrate
> 6 - Raster Scan

This command is accepted only when the ACU is in REMOTE mode.

MNx

Set minimum position. Units are in degrees.
Value is from -720 to + 720 degrees.

MOx

Set maximum output from D/A chip. Units are fraction of full scale
Value is from 0 to 1.0

MVx

Set maximum velocity. Units are deg/sec.
Value is 0 to 10,000 deg/sec.

MXx

Set maximum position. Units are in degrees. Value is from -720 to + 720 degrees. Note that for a continuous rotation axis, the minimum and maximum position should be set to less than -190 and greater than +190, respectively.

OFx

Set offset. Units are in degrees. Value is from -720 to +720 degrees. ACU must be in REMOTE mode to write offset. If positioner is moving, the velocity is first commanded to zero, and when the positioner stops, the offset is entered.

Note: Offset for the azimuth may be also be set by the front-panel OFFSET pushbutton. In this case, a save to all parameters is performed.

PTx

Set pointing angle. This is the angle which will be used at the target in point mode. Units are in degrees. Value is from -720 to +720 degrees. This command is accepted only when the ACU is switched to REMOTE mode.

RCx

Raster scan center point in degrees.

RDx

Read command only. Read current angle. Value is in degrees.

RDS

Read status word. Value returned is 0 to 2^{23}-1; ie, 0-8388607, consisting of a sum of 23 status bits. Bits in the status word have the following values and meanings (refer to next page):

Bit#	Value	Meaning
0	1	Azimuth CW Limit Switch Active
1	2	Azimuth CCW Limit Switch Active
2	4	Azimuth Zero Limit Switch Active
3	8	Azimuth Calibrated (see sec 2.1, CAL function)
4	16	Azimuth Stuck (Full current, no motion)
5	32	Azimuth Software CW Limit Active
6	64	Azimuth Software CCW Limit Active
7	128	Azimuth Encoder Fault
8	256	Elevation CW Limit Switch Active
9	512	Elevation CCW Limit Switch Active
10	1024	Elevation Zero Limit Switch Active
11	2048	Elevation Calibrated
12	4096	Elevation Stuck (Full current, no motion)
13	8192	Elevation Software CW Limit Active
14	16384	Elevation Software CCW Limit Active
15	32768	Elevation Encoder Fault
16	65536	Front Panel Switch Flickering
17	131072	EEPROM Memory Fault Detected
18	262144	Remote Mode
19	524288	Azimuth Joystick A/D Fault
20	1048576	Elevation Joystick A/D Fault
21	2097152	Azimuth Calibration Done
22	4194304	Elevation Calibration Done
23-31	Unused	

RRx

Raster scan range in degrees

RTx

RTA is the Raster Scan time delay at end of each azimuth scan in seconds. If bit #8 in control word #1 is set, RTx is the duration of the flat top of the trapezoidal open-loop velocity command output.

RVx

RVx is the Raster Scan velocity in deg/sec. If bit #6 or bit #8 in control word #1 is set, RVx is the open loop velocity command output (bit #6) or the open loop velocity command output during the flat top of the trapezoid (bit #8).

SAV

Save/Restore commands. All other commands perform reads and writes on parameters in static RAM. Any changes made in this way will be lost when power is turned off unless they are saved to the EEPROM non-volatile memory.

On powerup, if values exist in EEPROM they are used. If the EEPROM has never had values stored in it, or if a checksum error is found, the hard-coded default values are used.

A SAV command with a value of 1 causes present values in RAM to be saved to EEPROM.

A SAV command with a value of 2 causes default values to be restored to RAM. Note that any changes made and not yet saved to EEPROM are now lost. However, any values in EEPROM are still there and will be used next time power is cycled. Note that default values may be stored to EEPROM by a SAV 2 followed by a SAV 1 command.

A SAV command with a value of 3 causes EEPROM values to be restored to RAM.

STI

Interval between status outputs on J6. Units are 1=2.5 msec. For example, for a status interval of 200 msec, STI parameter should be set to 80.

SVx

Slew velocity command. This sets the velocity in degrees/sec which will be used when Slew Mode is selected. This command is accepted only when the ACU is in REMOTE.

UTx

Maximum update time command. Sets time interval, in seconds, used to activate the extrapolation algorithm for following a trajectory. If two consecutive time intervals are less than the maximum update time, the extrapolation algorithm is activated. Value must be between 0 and 10 seconds.

5   TROUBLESHOOTING

Problem: **No display, no LEDs, no motion on powerup**

Check: •   Is Fuse F1 OK?

                              •   Is Mains Select Switch in proper
                                          position?

                              •   Is AC Power Cord connected well?

Problem: **Display OK but neither axis operates**

Check: •   Is Safe/Operate switch on positioner in OPERATE
                              mode?

                  •   Are cables W1 and W2 connected properly to the
                              controller and the positioner?

Problem: **Azimuth axis does not operate**

Check: •   Is Fuse F2 OK?

Problem: **Elevation axis does not operate**

Check: •   Is Fuse F3 OK?

Problem: **Front Panel does not operate**

Check: •   Is Red Local LED lit? If not, press
                              REMOTE/LOCAL switch to place in LOCAL mode.
                              Red LED should light and Green LED should be
                              turned off.

Problem: **Positioner motion is very slow**

Check: • FINE/COARSE switch should be in COARSE position for rapid motion.

Problem: **Azimuth position reading is not correct after calibrate**

Check: • After calibrate, place the controller in LOCAL mode by pressing the LOCAL/REMOTE button, point the Positioner in the azimuth direction where a reading of 0 is desired and press the offset button.

Problem: **Azimuth axis creeps when Joystick is in zero position**

Solution: • Adjust small zeroing lever in the horizontal direction until no creep occurs.

Problem: **Elevation axis creeps when Joystick is in zero position**

Solution: • Adjust small zeroing lever in the vertical direction until no creep occurs.

6 MAINTENANCE

6.1 *Amplifier Adjustment*

Verify the following settings:

- T1 is at the maximum CW position.
- T2 is at the midpoint of the potentiometer range.

6.2 *Voltage Tests*

With respect to GND (TB1, pin 7), verify the following DC voltages:

-12V +/- 0.3V	at	TB1 (6)
+5V +/- 0.25V	at	TB1 (5)
+12V +/- 0.3V	at	TB1 (4)

With respect to GND (TB1, pin 8), verify the following DC voltages:

130V +/- 5V	at	TB1 (9)

APPENDIX A

AL-1642-3JB
Host Software User's Guide

1. SOFTWARE

The AL-1642-3JB Host Software is provided on an "as is basis", as an aid for the user, with no expressed or implied warrantees or guarantees of any kind.
The following four files comprise the host software:

1) EGAVGA.BGI
Loadable graphics interface file for VGA graphics routines.

2) KBRG.CF_
Configuration file for the host software.

3) KBRG.ST_
Configuration file for the host software.

4) HOST.EXE
Executable code for the host software.

2. INSTALLATION

1) Copy the above four files into a directory on the hard disk (any name for the directory is acceptable).

2) Use the following procedure to run the software:

> 1) If COM1 is configured for communications, type HOST 1 and press ENTER key.
>
> 2) If COM2 is configured for communications, type HOST 2 and press ENTER key.

3) The Main Screen will be accessed (refer to Figure A-1)

> Note: The software has been run on a range of computers; from a 386DX operating at 33 MHz, without floating point coprocessor, running under DOS 5.0 to a Pentium II operating at 400 MHz running in a DOS window under Windows 95. Minimum computer requirements have not been established, but most likely a PC-XT or a lower compatible computer will not be capable of running the software.

3. **MAIN SCREEN** (Refer to Figure A-1)

The Main Screen is divided into three sections:
1) Axes Numerical Display
2) Status Flag Display
3) Function Key Titles.

The Axes Numerical Display section shows four parameters for each axis:
Point Command, Slew Velocity Command, Mode Command and Position Received. The
displayed field shows the last command sent for each of these parameters, as received from
the positioner.

The Status Flag section of the main screen shows which flags are set from the RDS command
to the AL-1642-3JB, along with titles to show their meaning.

The Function Keys permit entry to the azimuth and elevation configuration screens (F1, F2;
respectively), setting of positioner azimuth and elevation modes (F3, F4; respectively),
updating target point for point mode and slew velocity for slew mode (F7), and exiting from
the program (F8).

Before entering azimuth or elevation go-to-point mode, using F3 or F4, respectively; F7
should be utilized to introduce a target point, since otherwise the value of the target point will
depend on the previous mode and last operation performed in this mode, and will not
necessarily be that displayed on the screen under Azim-Point-Command or Elev-Point-
Command.

When azimuth mode or elevation mode CALIBRATION is selected, using F3 or F4,
respectively; the above sequence is begun again each time the command to enter the
calibration mode is initiated.

Figure A-1: Main Screen

```
Azim        Azim        Azim        Azim        Elev        Elev        Elev        Elev
Point       Slew        Mode        Position    Point       Slew        Mode        Position
Command     Command     Command     Received    Command     Command     Command     Received

0.000       0.000       POINT       0.000       0.000       0.000       POINT       0.000
```

```
   STATUS FLAGS
   AZ_CW_LIM   = 0  AZ_STUCK      = 0    EL_CW_LIM   = 0  EL_STUCK      = 0
   AZ_CCW_LIM  = 0  AZ_CW_SLIM    = 0    EL_CCW_LIM  = 0  EL_CW_SLIM    = 0
   AZ_ZERO_LIM = 0  AZ_CCW_SLIM   = 0    EL_ZERO_LIM = 0  EL_CCW_SLIM   = 0
   AZ_CALIBR'D = 1  AZ_ENC_FAULT  = 0    EL_CALIBR'D = 1  EL_ENC_FAULT  = 0


   SWTCHFLT=0 EEPRMFLT=0 AZADCFLT=0 ELADCFLT=0 REMOTE=1 AZCALDONE=1 ELCALDONE=1
```

| 1 AZIM CONFIG | 2 ELEV CONFIG | 3 AZIM MODE | 4 ELEV MODE | 5 | 6 | 7 SETPOINT SLEW VEL | 8 PROGRAM EXIT |

4. **CONFIGURATION SCREENS** (Refer to Figures A-2, A-3 and A-4)

Each axis (azimuth or elevation) has its own set of configuration parameters. For a system that has never been configured, a set of default parameters are coded into the controller software. In addition, an EEPROM exists which allows the user to save the parameters he has configured. If parameters have been saved, they will be read from the EEPROM at powerup and used instead of the default parameters. Note that azimuth and elevation parameters are saved together; i.e., it is not possible to save the parameters for one axis only.

To configure azimuth parameters, press the function key F1. The azimuth configuration screen will be loaded (refer to Figure A-2). Parameters are configured by entering the item number to the left of the parameter, and then entering the desired value. Values that are too large, too small, or of incorrect format will be rejected with an error message displayed, and the parameter will retain its previous value.

To save the new parameter values, enter 55 from the keyboard. The software then initiates a command SAV1 and waits until the controller has reset the SAV parameter to zero, at which time a message "Save Confirmed" is displayed.

To restore the default configuration values for the parameters, enter 66. The software initiates a command SAV2 and then displays the default values of the parameters. Note that the parameter default configuration is now restored to active use, but this does not affect the configurations that are stored in EEPROM. Also note that the default configuration may not be suitable for the positioner and load presently interfaced with the controller. (Therefore, care should be exercised when using the "66" command).

To restore the parameter configuration held in the EEPROM, enter 77. The software then initiates the command SAV3 which restores the parameters to their last saved values.

To exit the Configuration screen and return to the main screen, enter 88.

To configure the Elevation parameters, press function key F2 on the main screen.   A screen that is identical to the azimuth configuration screen, except for the title, is accessed (refer to Figure A-3).

Figure A-4 shows the parameters on the azimuth or elevation configuration screen, correlated with the software remote command codes (refer to paragraph 4.5 in the main section of this manual). The lower case 'x' is to be replaced by either A or E for azimuth or elevation axis, respectively.

Figure A-2: Azimuth Configuration Screen – *Default Parameter Values*

```
Azim Pedestal Parameters              Azim Control Parameters
  1. Gear Ratio Numerator...        36   21. Maximum Acceleration.. 12.000
  2. Gear Ratio Denominator.         1   22. Maximum Velocity...... 36.000
  3. Encoder Pulses/Rev.....      8000   23. Go-to-Limit Velocity.. 18.000
  4. Control Bits Word #1...        32   24. Calibrate Velocity.... 18.000
  5. Control Bits Word #2...      2149   25. Front Panel Velocity.. 36.000
  6. Maximum Angle.......... +380.000   26. Low Kp-Proport Gain...  0.997
  7. Minimum Angle.......... -380.000   27. High Kp-Lock Gain.....  3.966
  8. Home Position..........    0.000   28. High Kp Window........  0.050
  9. Zero Switch Position...    0.000   29. Kd-Differential Gain..  1.000
 10. Offset................    0.000   30. Ki-Integral Gain......  0.244
 11. Special Sts Interval...       80   31. Integral Limit........  5.000
 12. Full Scale Velocity....   42.000   32. Integral Gain Window. 500.000
 13. Maximum D/A Chip Output   1.000   33. Maximum Update time...  0.000
 14. Max CW Cal Movement....  380.000   34. Raster Center......... 50.000
 55. SAVE CONFIG TO EEPROM            35. Raster Range.......... 80.000
 66. RESTORE DEFAULT CONFIG           36. Raster Vel............ 18.000
 77. RESTORE EEPROM CONFIG            37. Raster Step...........  0.000
 88. EXIT                             38. Raster Scan Delay.....  0.000
```

Figure A-3: Elevation Configuration Screen – *Default Parameter Values*

```
ELEV Pedestal ParamS                  ELEV Control Parameters
  1. Gear Ratio Numerator....       36   21. Maximum Acceleration.. 12.000
  2. Gear Ratio Denominator..        1   22. Maximum Velocity...... 18.000
  3. Encoder Pulses/Rev......     8000   23. Go-to-Limit Velocity..  3.000
  4. Control Bits Word #1....        0   24. Calibrate Velocity.... 10.000
  5. Control Bits Word #2....     2145   25. Front Panel Velocity.. 18.000
  6. Maximum Angle...........  182.000   26. Low Kp-Proport Gain...  0.997
  7. Minimum Angle........... -2.000   27. High Kp-Lock Gain.....  4.000
  8. Home Position...........    0.000   28. High Kp Window........  0.050
  9. Zero Switch Position....    0.000   29. Kd-Differential Gain..  1.000
 10. Offset................    0.000   30. Ki-Integral Gain......  0.244
 11. Special Sts Interval....       80   31. Integral Limit........  5.000
 12. Full Scale Velocity.....   69.000   32. Integral Gain Window  500.000
 13. Maximum D/A Chip Output.   0.700   33. Maximum Update time...  0.000
 14. Max CW Cal Movement.....   20.000   34. Raster Center......... 20.000
 55. SAVE CONFIG TO EEPROM            35. Raster Range.......... 40.000
 66. RESTORE DEFAULT CONFIG           36. Raster Vel............ 18.000
 77. RESTORE EEPROM CONFIG            37. Raster Step...........  5.000
 88. EXIT                             38. Raster Scan Delay.....  0.000
```

Note:

The above configuration screens list the DEFAULT values of the pedestal and control parameters for the Azimuth and Elevation Axes. Do not use these parameter values, since they may not be suitable for the positioner. Refer to the following "Installation and Calibration Procedure" configuration screens (Figures A-5 thru A-8) to determine which pedestal and control parameter values need to be adjusted.

Figure A-4: Azimuth/Elevation Configuration Screen correlated with remote command codes

```
  Azim/Elev Pedestal Parameters          Azim/Elev Control Parameters
 ┌─────────────────────────────────────────────────────────────────────┐
 │  1. Gear Ratio Numerator....   GNx    21. Maximum Acceleration..MAx   │
 │  2. Gear Ratio Denominator..   GDx    22. Maximum Velocity......MVx   │
 │  3. Encoder Pulses/Rev......   EPx    23. Go-to-Limit Velocity..CGx   │
 │  4. Control Bits Word #1....   CBx    24. Calibrate Velocity....CVx   │
 │  5. Control Bits Word #2....   CCx    25. Front Panel Velocity..FVx   │
 │  6. Maximum Angle...........   MXx    26. Low Kp-Proport Gain...KPx   │
 │  7. Minimum Angle...........   MNx    27. High Kp-Lock Gain..   KLx   │
 │  8. Home Position...........   HMx    28. High Kp Window........LWx   │
 │  9. Zero Switch Position....   CLx    29. Kd Differential Gain..KDx   │
 │ 10. Offset..................   OFx    30. Ki-Integral Gain......KIx   │
 │ 11. Special Sts Interval....   STI    31. Integral Limit........ILx   │
 │ 12. Full Scale Velocity.....   FSx    32. Integral Gain Window..IWx   │
 │ 13. Maximum D/A chip Output.   MOx    33. Maximum Update time.  UTx   │
 │ 14. Max CW Cal Movement.....   CDx    34. Raster Center........RCx    │
 │ 55. SAVE CONFIG TO EEPROM      SAV1   35. Raster Range.........RRx     │
 │ 66. RESTORE DEFAULT CONFIG     SAV2   36. Raster Vel...........RVx     │
 │ 77. RESTORE EEPROM CONFIG      SAV3   37. Raster Step..........RSx     │
 │ 88. EXIT                              38. Raster Scan Delay.....RTx   │
 └─────────────────────────────────────────────────────────────────────┘
```

5. **INSTALLATIONS AND CALIBRATION PROCEDURE**
   (Refer to Figures A-5 thru A-8)

   1) Install the positioner in an indoor environment.

   2) Before connecting the controller to the positioner, use the Host computer program to verify that the configuration parameters installed in the controller memory are as listed in the applicable figure A5 thru A-8.

   3) Connect the cables between the controller and the positioner.

   4) Before installing the antenna and the counterweights, turn on the controller and verify that the positioner is moving smoothly and is completing the calibration procedure. Then, use the manual joystick to check the elevation software limits. (The down limit should be –2 degrees, and the upper limit should be 110 degrees).

   5) Manually point the elevation axis to 90 degrees.

   6) Install the arms on the positioner.

   7) Install the correct number of counter weights on the back of the antenna arms as previously determined for the antenna unit.

   8) Install the antenna on the positioner.

   9) Point the antenna to 0 degree.

   10) Connect a dc current probe on the F3 wire, and measure the current. The current should be between 0 +/-0.5 amps. If the current exceeds this value, correct the antenna balance by adjusting the counterweights (adding or removing counterweights).

   After completing steps 1 through 10, you can operate the positioner under load.

CAUTION
You must observe positioner movement for both axes and verify that the operation is smooth, with no oscillations or jerking. In case of un-smooth movement, stop the positioner operation IMMEDIATELY and recheck the applicable configuration parameters and the antenna balance.

11) Rotate the elevation axis between 0 degrees and 180 degrees. Verify that the current on the F3 wire does not exceed 1.0 amp. (When changing the rotation direction, more current may be present for a short duration of time).

12) Rotate the azimuth axis in continuous rotation. Verify that the current on the F2 wire does not exceed 1.0 Amp.

13) Operate the azimuth and elevation axes in POINT mode. Verify that both axes arrive at the desired position, with smooth deceleration and no overshoot. If overshoot occurs, configuration parameter 12 (Full Scale Velocity) may be increased or decreased up to 5 percent of the value.

CAUTION

Do not exceed the +/-5% tolerance for the values stated in Step 13.

6. **AL-4017-1EBS-B Positioner Configuration Parameters**

Note:
The following parameters are listed as they appear on the computer screen.

Figure A-7: Azimuth Configuration Screen for AL-4017-1EBS-B Positioner

```
Azim Pedestal Parameters                Azim Control Parameters
  1. Gear Ratio Numerator...        36  21. Maximum Acceleration.. 12.000
  2. Gear Ratio Denominator.         1  22. Maximum Velocity...... 36.000
  3. Encoder Pulses/Rev.....      8000  23. Go-to-Limit Velocity.. 18.000
  4. Control Bits Word #1...        32  24. Calibrate Velocity.... 18.000
  5. Control Bits Word #2...      2149  25. Front Panel Velocity.. 36.000
  6. Maximum Angle.........   +380.000  26. Low Kp-Proport Gain...  0.997
  7. Minimum Angle.........   -380.000  27. High Kp-Lock Gain.....  3.966
  8. Home Position.........      0.000  28. High Kp Window........  0.050
  9. Zero Switch Position...      0.000  29. Kd-Differential Gain..  1.000
 10. Offset................      0.000  30. Ki-Integral Gain......  0.244
 11. Special Sts Interval...        80  31. Integral Limit........  5.000
 12. Full Scale Velocity....   42.000*  32. Integral Gain Window. 500.000
 13. Maximum D/A Chip Output    1.000  33. Maximum Update time...  0.000
 14. Max CW Cal Movement....   380.000  34. Raster Center......... 50.000
 55. SAVE CONFIG TO EEPROM           35. Raster Range.......... 80.000
 66. RESTORE DEFAULT CONFIG          36. Raster Vel............ 18.000
 77. RESTORE EEPROM CONFIG           37. Raster Step...........  0.000
 88. EXIT                            38. Raster Scan Delay.....  0.000
```

* This number may vary by +/-5%, depending on the tacho voltage level.

CAUTION

Do not exceed the +/-5% tolerance for the value stated in Parameter No. 12 (Full Scale Velocity).
Oscillation may result from exceeding the 5% tolerance.

Figure A-8: Elevation Configuration Screen for AL-4017-1EBS-B Positioner

```
ELEV Pedestal ParamS                ELEV Control Parameters
 1. Gear Ratio Numerator....      36   21. Maximum Acceleration.. 12.000
 2. Gear Ratio Denominator..       1   22. Maximum Velocity...... 18.000
 3. Encoder Pulses/Rev......    8000   23. Go-to-Limit Velocity..  3.000
 4. Control Bits Word #1....       0   24. Calibrate Velocity.... 10.000
 5. Control Bits Word #2....    2145   25. Front Panel Velocity.. 18.000
 6. Maximum Angle........... 182.000   26. Low Kp-Proport Gain...  0.997
 7. Minimum Angle........... .-2.000   27. High Kp-Lock Gain.....  4.000
 8. Home Position...........   0.000   28. High Kp Window........  0.050
 9. Zero Switch Position....   0.000   29. Kd-Differential Gain..  1.000
10. Offset..................   0.000   30. Ki-Integral Gain......  0.244
11. Special Sts Interval....      80   31. Integral Limit........  5.000
12. Full Scale Velocity.....  69.000*  32. Integral Gain Window  500.000
13. Maximum D/A Chip Output.   0.700   33. Maximum Update time...  0.000
14. Max CW Cal Movement.....  20.000   34. Raster Center......... 20.000
55. SAVE CONFIG TO EEPROM               35. Raster Range.......... 40.000
66. RESTORE DEFAULT CONFIG              36. Raster Vel............ 18.000
77. RESTORE EEPROM CONFIG               37. Raster Step...........  5.000
88. EXIT                                38. Raster Scan Delay.....  0.000
```

* This number may vary by +/-5%, depending on the tacho voltage level.

CAUTION

Do not exceed the +/-5% tolerance for the value stated in Parameter No. 12 (Full Scale Velocity). Oscillation may result from exceeding the 5% tolerance.

APPENDIX B

AL-1642-3JB (BS-104435) CONTROLLER DRAWINGS:

<u>**DRAWINGS**</u>

Figure B-1:   WIRING DIAGRAM   -   Dwg. No. BS-104435-1

Figure B-2:   TOP ASSEMBLY   -   Dwg. No. BS-104435-2

Figure B-3:   FRONT PANEL   -   Dwg. No. BS-104435-3

Figure B-4:   REAR PANEL   -   Dwg. No. BS-104435-4

Figure B-5:   BLOCK DIAGRAM   -   Dwg. No. BS-104435-5

Figure B-1:   WIRING DIAGRAM   - Dwg. No. 19-0350

Figure B-2:   TOP ASSEMBLY   -   Dwg. No. 19-0354-9/2

Figure B-3:   FRONT PANEL   -   Dwg. No. 19-0351-9/2

Figure B-4:   REAR PANEL   -   Dwg. No. 19-0352-9
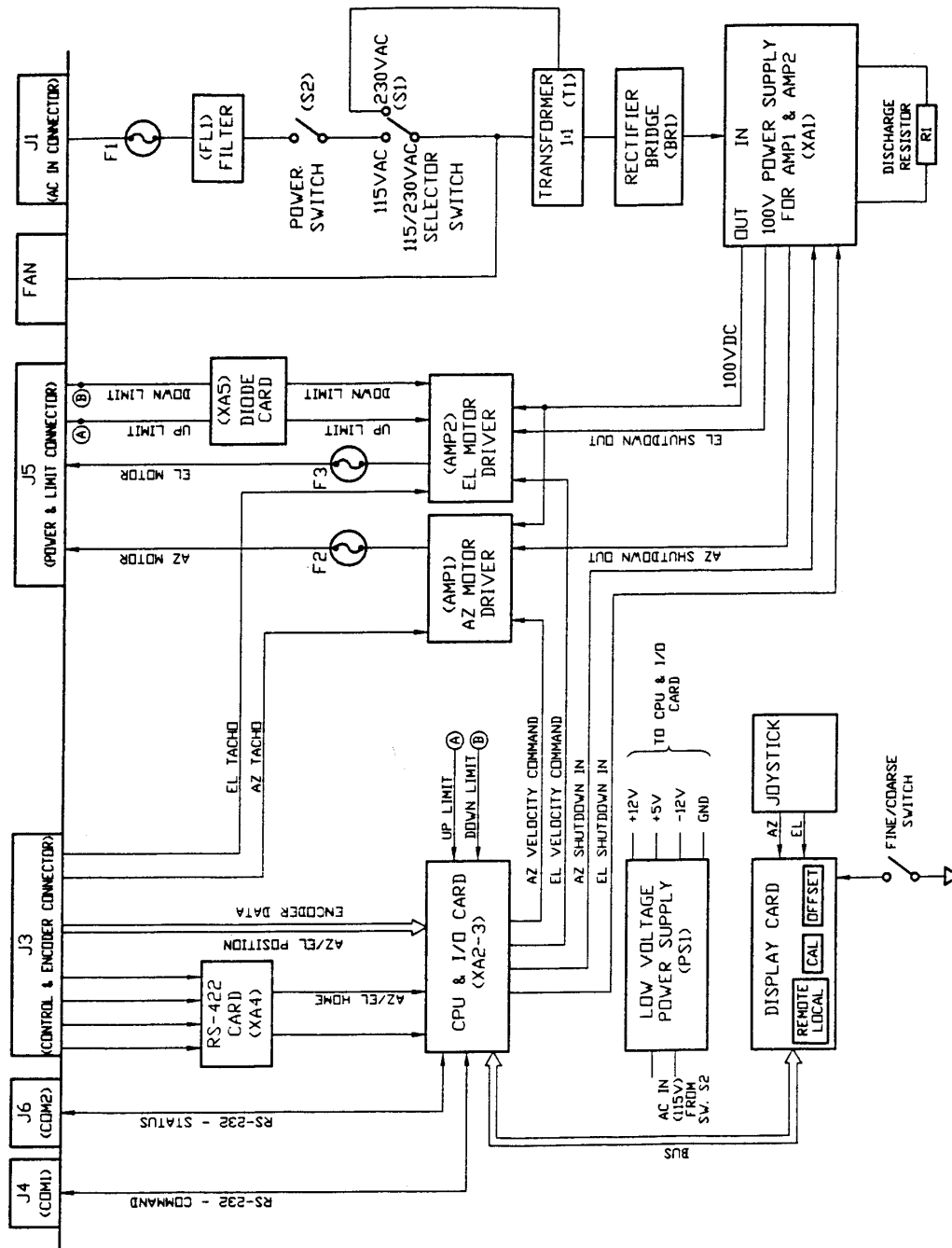
Figure B-5: BLOCK DIAGRAM - Dwg. No. 20-0094

Table of Contents

<u>*Preface*</u>

This manual describes the operating procedures for Baron Service's RDACS software program that is delivered with the Neighborhood Radars™

Document Organization

The information in this manual is organized as follows:

- ❑ Section 1 describes the RDACS Terminal Window, which acts as the radar system's log and provides a few controls.
- ❑ Section 2 describes the RDACS Config utility, which lets you perform a limited number of system controls from the Radar Control dialog box.
- ❑ Section 3 is a step-by-step procedure for accessing RDACS controls while operating FasTrac.
- ❑ Section 4 describes the installation instructions for RDACS.

Related Documentation

The following manual provides in-depth information about RVPtty:

RVP7™ Digital IF Receiver and Doppler Signal Processor User's Manual.

Describes the operating and troubleshooting procedures for SIGMET, Inc's. RVP7 Doppler Signal Processor.

Type Faces

Italic: Indicates a document title, the first occurrence of a new term, a directory or file name, or a system response that explains what the system is doing. For Example: The monitor displays current parameters.

Bold: Indicates an item in the graphical interface, such as the **OK** button or a command button.

`Courier:` Indicates information you type. For example: Set the signal processor parameters by typing: SOPRM

Symbols

The following document conventions are used throughout this manual:

Information that is not critical to system operation but describes useful procedures or information that will optimize system operation.

Very important about a command or a procedure.

Critical instructions that must be followed to prevent injury or loss of data.

Keyboard Conventions

ALT	Alternate key. For example, ALT+x means hold down the Alternate key and press x.
CTRL	Control key. For example. CTRL+c means hold down the Control key and press c.
DEL	Delete key.
Enter	Return/enter key.
ESC	Escape key.
SHIFT	Shift key.
TAB	Tab key.

Terminology

Click	To position the pointer on the screen, and then to press and quickly release the left mouse button.
Double Click	To quickly press and release a mouse button twice without moving the mouse. This action is used as a shortcut for common actions, such as activating an icon, opening a file, or selecting a word or a graphic element.
Drag	To press and hold a mouse while moving the mouse. This action is used to identify a range of objects, to move objects, or to resize objects.
Enter	To input information by typing or by using the mouse.
Identify	To locate an element on the screen either by clicking it or by typing the name.
Press and hold	To press and hold down a mouse button to perform an action, such as resizing a window.
Scroll	To move through text or graphics
Select	To click a button, a text box, an item in a list, or some other item on a dialog box, menu, or window.
Type	To key in data. To complete this action, you may also need to click **OK**, press ENTER, or press TAB.

What to Expect from this Document

This document describes how to install, start, and run the RDACS program.

1. Introduction

This manual describes the Radar Acquisition and Control System (RDACS), which gives users remote control over many radar system operations. The remainder of this manual is comprised of four main sections:

1. The RDACS terminal window, which is accessed by **Start** ➡ **BSI** ➡ **RDACS**.

2. The Radar Control dialog box, which is accessed by **Start** ➡ **BSI** ➡ **Config RDACS**.

3. The RDACS window that is installed in FasTrac.

4. The RDACS installation instructions.

2. RDACS Terminal Window

The RDACS terminal window acts as the radar system's log and provides few controls. The main display lists the time and type of radar system commands. The commands can be issued from Config RDACS or from FasTrac real-time operations. The following window displays when you select **Start** ➡ **BSI** ➡ **RDACS**. (Start is located next to the taskbar on bottom of your terminal screen.)
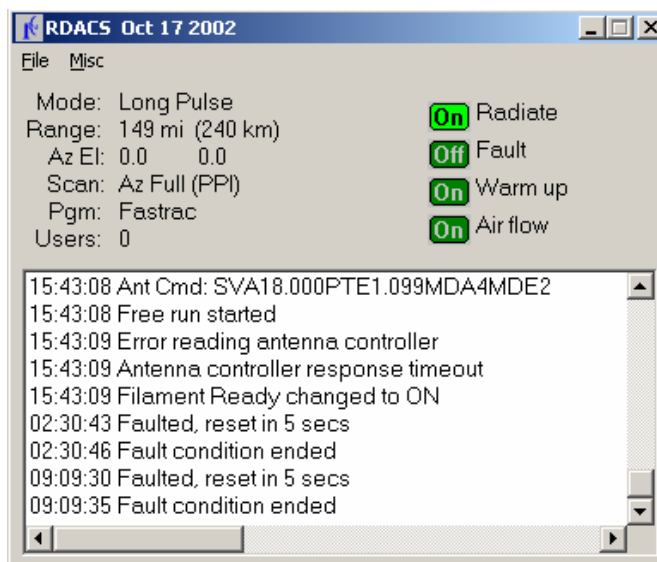

The **File** menu has only one subcommand, **Exit**.
The **Misc** menu has three subcommands: **Gparm, Log scans,** and **List users.**

1. **Gparm** accesses the status information for the radar system.
2. **Log scans** displays information about a complete antenna scan similar to the following: *Scan complete: 39 seconds, 361 rays, 0 too big, small 1.0, large 1.0*
3. **List users** displays the following information about users who are remotely logged into your system's RDACS: ID, State, User name, Address, Log-In time, and Log-Out time.

3. RDACS Config

The RDACS Config utility lets you perform a limited number of system controls from the Radar Control dialog box, which is accessed by selecting **Start** ➡ **BSI** ➡ **Config RDACS.**
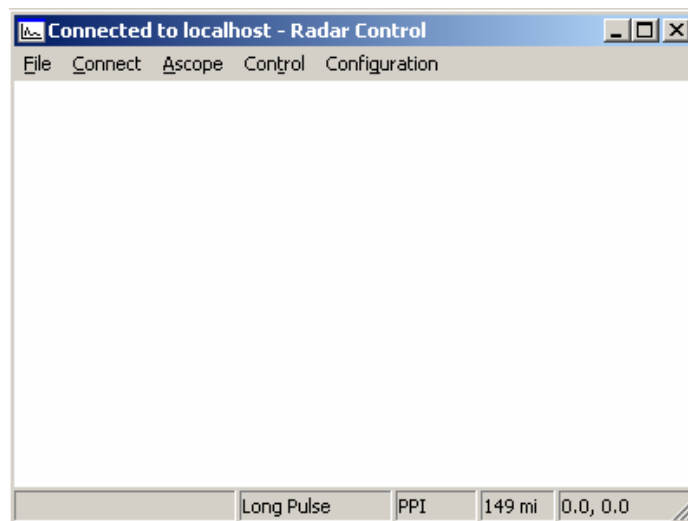
3.1 File Pull-Down Menu

The File pull-down menu has only two options: **About** and **Exit**. Select **File** ➡ **About** to open a message box that indicates the name of the software package, the version number, and the copyright date. Click **OK** to dismiss the message box.

Select **File** ➡ **Exit** to terminate the RDACS Config session.

3.2 Connect Commands

The **Connect** commands let you remotely view and control another site's RDACS. Select **Connect** ➡ **Disconnect** to end remote control mode.

A connect to RDACS dialog box, similar to the one shown below, displays when you select **Connect** ➡ **Connect.** You must know the server name or address, your user name, your password, and the port designator to connect remotely to RDACS. See your System Administrator for the required inputs.
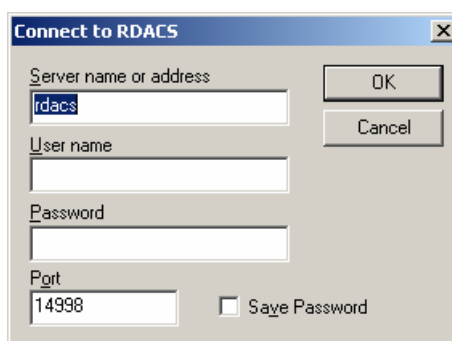
A Connect to RDACS dialog box, similar to the one shown below, displays when you select **Connect** ➡ **Auto connect.** This dialog box lets you log onto the specified server to remotely view and control RDACS. The controls on this dialog box are similar to the Connect to RDACS dialog box, except you automatically are connected to the specified server when you start up RDACS and you cannot save your password.
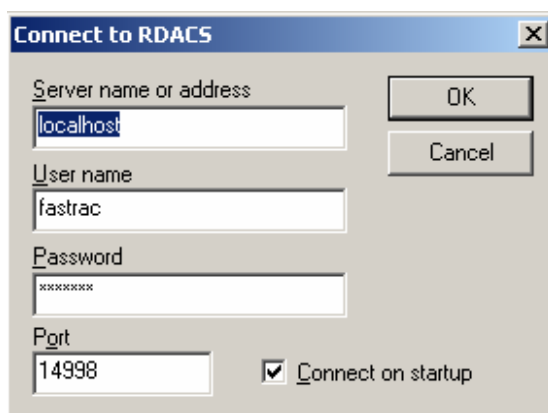
3.3 A-Scope Commands

The A-Scope commands let you configure the A-Scope presentation of return data, in signal strength and in either distance or in time. You can use the A-Scope commands to display three types of radar data (reflectivity, velocity, and spectrum width) and to set the display limits.

3.3.1 A-Scope Settings

The A-Scope displays the radar data, where the horizontal axis (X) displays time and the vertical axis (Y) displays signal strength. The A-Scope Settings command lets you configure the display shown when you select **A-Scope** ➡ **Enable.**

The following, double-tabbed dialog box displays when you select **Oscilloscope** ➡ **Settings:**
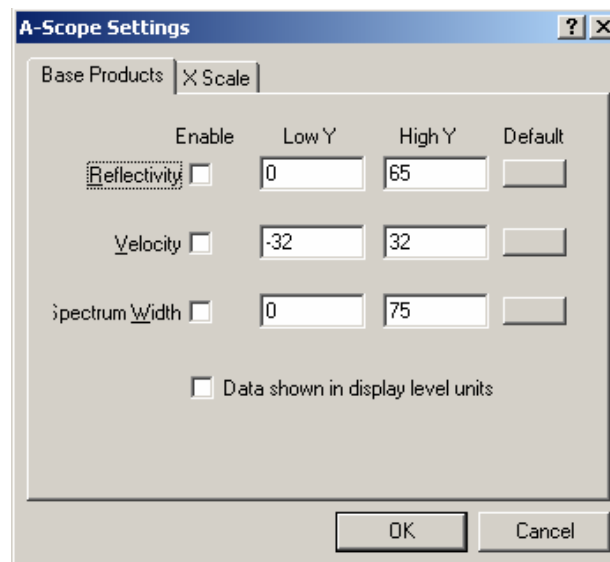
This **Base Products** section of this dialog box lets you select which radar products will be shown on the A-Scope display. When you select a radar product, you must either select the **Data shown in display level units'** option to enable the default values or key in the **Low Y and High Y** values.

| Control	Description
Reflectivity	Enables the computer algorithms that measure the linear radar reflectivity factor (z) in m^6/m^3.
Velocity	Enables the computer algorithms that measure the winds in the atmosphere.
Spectrum Width	Enables the computer algorithms that transform time-series data into the frequency domain. In other words, it determines the average frequency as well as the distribution of frequencies, thus providing data about storm turbulence.
Data shown in display level units	You must select this option to enable **Default** option.
OK	Accepts your changes, and returns you to the main RDACS dialog box.
Cancel	Ignores any changes, and returns you to the main RDACS dialog box.

The **X Scale** portion of the dialog box controls the A-Scope's horizontal display. You must either select the **Auto Scale** option or specify the **Low X** and **High X** values.
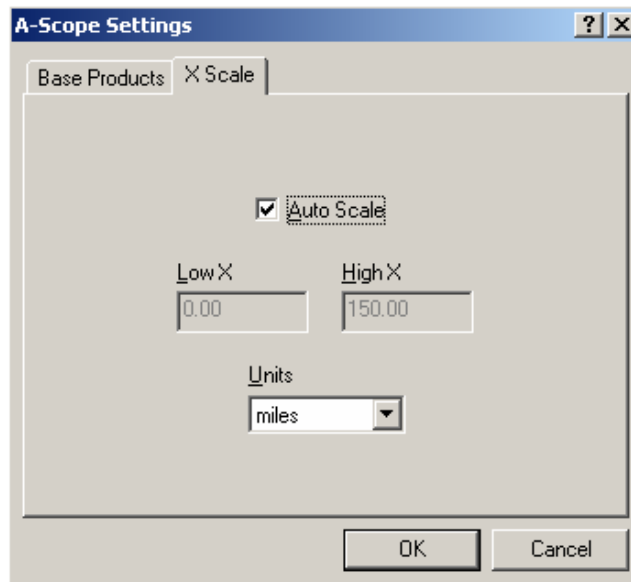
Control	Description
Auto Scale	Automatically controls the low and high range for the horizontal axis. When selected, the **Low X** and **High X** fields are disabled.
Low X	Specifies the lowest range for the horizontal axis.
High X	Specifies the highest range for the horizontal axis.
Units	Specifies the unit for the horizontal axis measurements: miles, nautical miles, kilometers, or microseconds.
OK	Accepts your changes, and returns you to the main RDACS dialog box.
Cancel	Ignores any changes, and returns you to the main RDACS dialog box.

3.3.2 A-Scope Display

An A-Scope Display, similar to the one pictured below, appears when you select **A-Scope ➡ Enable.** It is a real-time display, reflecting the parameters you set under **A-Scope Settings.** Select **A-Scope ➡ Disable** to remove the display and to return to the main Radar Control dialog box.
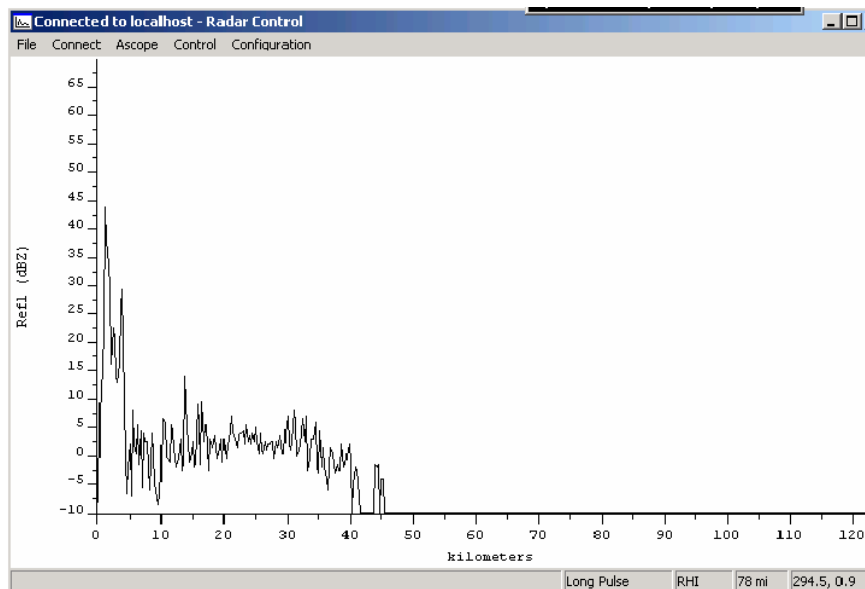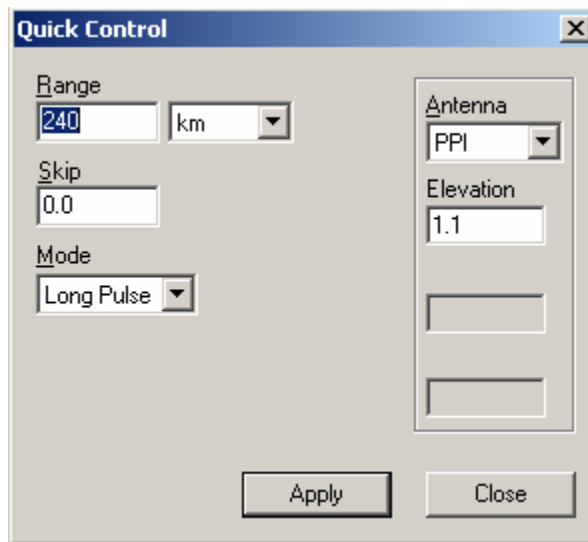

3.4 Control Commands

The Control Commands let you set most of the radar's controlling parameters, as described in the following subsections. Remember, some of the controls can also be changed by:

1. Editing the *rdacs.ini* file.
2. Performing real-time system manipulations in the FasTrac program.

In either case, the last issue change is the one under which the radar system operates.

3.4.1 Quick Control

A Quick Control dialog box, similar to the one shown below, displays when you select **Control ➡ Quick.** Observe the RDACS display when you issue commands form this dialog box, and verify that the system is operating as expected.

Control	Description
Range	Defines the maximum distance from the radar antenna to the target. You may specify the range measurement in miles, kilometers, or nautical, miles. If you have a single or double-pulse Doppler radar, range is usually 75 miles. If your system is in Log mode, range is usually 300 miles. Remember, the lower the range, the higher the resolution for closer targets. If you set a range that is greater than the maximum allowed for your radar type, RDACS uses the maximum valid range and displays the correct value.

Control	Description
Skip	Sets the radar sampling skip distance in miles. For example, a value of 2.5 means that data sampling begins 2.5 miles from the radar. Use this option to remove the display of the strong signal that is received just after the radar pulse is transmitted. A typical value for Skip lies between 0.5 to 5.0 miles (the default value is 1.0).
Mode	Controls the system mode as selected from the pull-down menu: Not all modes are available for all radars. Only the available modes are displayed. **Power Down** turns off the radar electronics. It may take several minutes before the radar cools and the power is removed. **Standby** turns off the transmitter (it no longer radiates), while the radar electronics remain on. **Log** places the radar in long-pulse mode, which is up to 300 miles in range and provides no velocity product. **Log + Turb** places the radar in log mode, and the system displays turbulence from the receiver data. **Long Pulse** places the radar in long pulse mode, which is up to 300 miles in range. **Single PRF** places the system in single-pulse Doppler mode. Range is set to 75 miles and the pulse tolerance is set to +/- 16 µs. **VHD** places the system in Very High Definition (dual-pulse) Doppler mode. Range is set to 49 miles, and pulse tolerance is set to +/- 38 µs. **Dual PRF** places the system in dual-pulse Doppler mode. Range is set to 75 miles, and the pulse tolerance is set to +/- 32 µs. **No Radiate** turns off your radar system. It may take several minutes before the transmitter cools and power is removed.

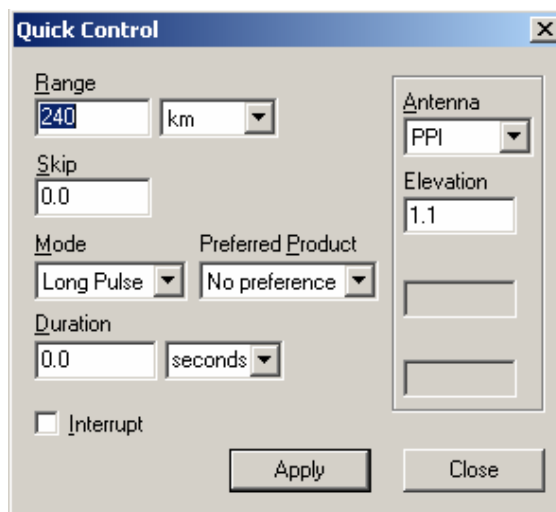| Control	Description
Antenna	Defines the antenna Scan mode: **PPI, Stop, Sector, or RHI. PPI** (plan position indicator) mode displays a 360-degree sweep in azimuth at the specified elevation angle. (This is the normal operating modes) **Stop** scans weather only within the specified azimuth and elevation levels. This mode is useful for investigating a particular storm cell. **RHI** (range-height indicator) shows the distance from the radar at the specified azimuth angle and displays the height above the radar on the vertical axis, from El 1 to El 2. (Note that RHI exaggerates the vertical size of an echo, giving a distorted impression of the actual storm. The angular resolution of the radar increases as the beamwidth decreases, so the narrower the beam, the lesser the size of the echo.) **Sector** performs a pie-shaped track at the set azimuth, within the specified span, at the set elevation level.
Apply	Puts the new specifications into operations, and returns you to the main Radar Control window.
Close	Ignores any changes you have made, and returns you to the Main Control window.

3.4.2 Extended Control

The Extended Control dialog box is similar to the Quick Control dialog box described in Section 1.4.1 except you have two additional options: **Preferred Product** and **Duration.**

Preferred Product lets you specify which algorithms the computer applies to the decluttered, dealiased, and range-unfolded return data to produce the selected product. You can select the following items from the pull-down menu: **No preference, Log intensity, Linear intensity, Velocity,** or **Turbulence.**

1. **No preference** indicates that clean, quality-checked return data will be displayed.

2. **Log Intensity** measures reflectivity in logarithmic values. Z is the logarithmic reflectivity factor measured in units of dBZ (decibels relative to a reflectivity 1 mm^6/m^3)

3. This is a convenient method for compressing reflectivity measurements to numbers that are more convenient than the larger values of the corresponding linear intensity measurements.

4. **Linear intensity** measures the linear radar reflectivity factor (z) in m^6/m^3.

5. **Velocity** measures the winds in the atmosphere.

6. **Turbulence** measures velocity variances that exceed set thresholds. The higher the variance, the greater the turbulence.

7. **Duration** specifies the transmitter's pulse duration measured in the specified units: seconds or cycles.

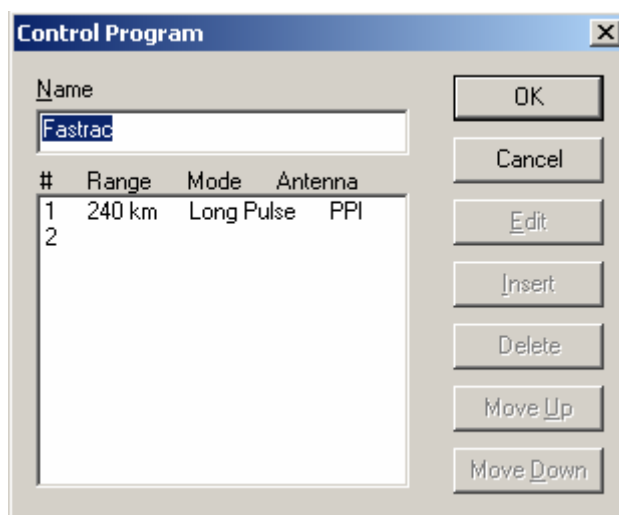A dialog box similar to the one shown below, displays when you select **Control** ➡
Extended:

3.4.3 Program Control

A dialog box similar to the one shown below, displays when you select **Control** ➡
Program:

Control	Description
Program List	Displays saved programs
OK	Accepts your changes, and returns you to the main RDACS dialog box.
Cancel	Ignores any changes, and returns you to the main RDACS dialog box.
Edit	Lets you modify program parameters.
Insert	Lets you introduce a new program.
Delete	Deletes the selected program.
Move Up	Moves you up through the program list.
Move Down	Moves you down through the program list.

3.4.4 Inputs and Outputs

The Input/Output control combines several functions:

1. The **User Defined** options let you test the Digital Signal Processor's input and output buses. If everything is working correctly, the **Fault** indicator will remain unlit.

2. The **Radiate** command lets you turn on the transmitter.

3. The **Fault, Filament ready,** and **Airflow Good** indicators let you monitor system status. These indicators do not change dynamically after you open the Input/Output dialog box. You must press the **Refresh Status** button to update the status indicators.

4. The **Reset Modulator** sends a reset pulse to the modulator circuitry. This normally clears any system fault interlock logic. (If the fault condition persists, the fault interlock logic may cause a new fault again.)

A dialog box, similar to the one shown below, displays when you select **Control** ➡ **Input/Output:**
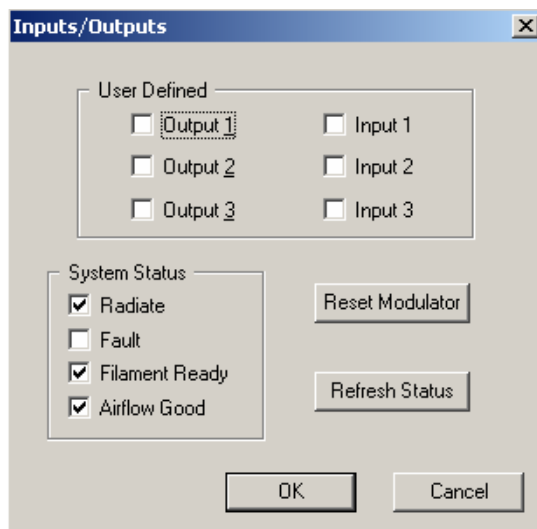
3.4.5 Resample Noise

There are two types of input signals to the receiver: the signal from a particular target and the signal generated by the radar system, which is referred to as *noise.* The Resample Noise command measures the receiver noise so it can be subtracted from subsequent measurements. During the resampling process, the internal trigger generator is temporarily set to a special noise rate that is usually much lower than the operating rate. You must verify that no returned power is present within the sampling interval. You may have to raise the antenna during resampling to avoid thermal noise from the ground or from weather targets.

After power-up, you should issue this command at least once before the system begins to receive and process data. You should also occasionally issue the command to compensate for drift, both in the radio frequency system and in the analog-to-digital converter system. Finally, you must reissue the Resample Noise command when you change the rate or range.

When you issue the Resample Noise command, lines similar to the ones shown below appear on the RDACS terminal display.

```
Free run stopped
SNOISE: Noise=1609 DiagA=0000 DaigB=0000 Imm1=42A0 Imm2=0301
Latch=0000
Free run started
```

The following list describes each word in the listing:

Parameter	Description
Noise	Indicates the log of the measured noise level.
DiagA	Indicates the measured DC offset for the I channel.
DaigB	Indicates the measured DC offset for the Q channel.
Imm1	
Imm2	
Latch	Indicates if failures were detected during noise sampling. Check command to verify that everything is working correctly.

If failures are detected during the noise measurement, status bits will be set in the Latch word.

3.4.6 Status

A current status listing, similar to the one shown below, displays when you select

Control ➡ Status. The displayed data are accessed from the Digital Signal Processor

(the RVP7) and are described in the "Get Processor Parameters" section in the *RVP7*

Digital IF Receiver User's Manual.
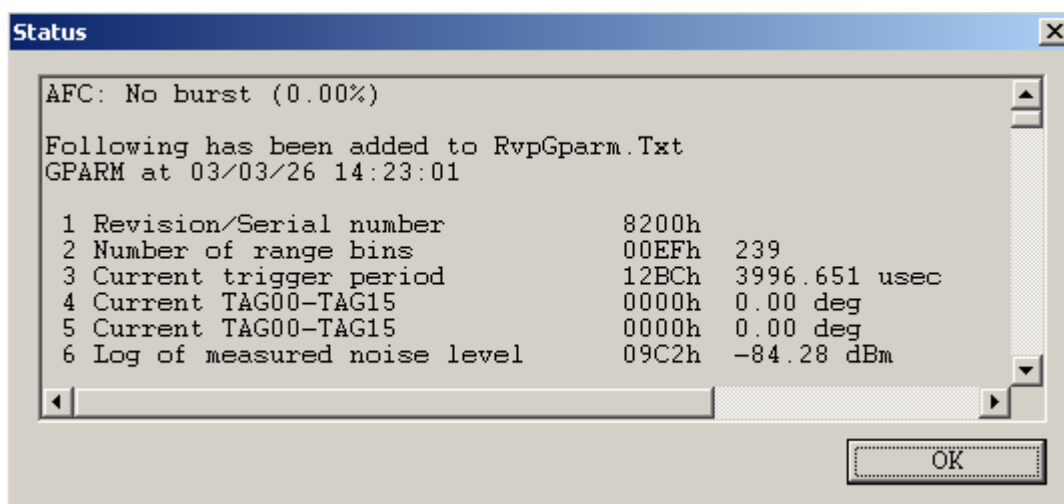
3.5   Configuration Commands

The Configuration commands let you specify the site parameters, control the antenna,

and edit the RDACS.ini file.

3.5.1 Configuration Site Parameters

The following dialog box displays when you select **Configuration** ➡ **Sites:**

While most of the dialog box controls are user-definable, the fields are set during system configuration and should not be changed. The parameters correspond to the Site section of the radacs.ini file. The bottom three fields, **Radar Type, Version,** and **Protocol,** are read-only parameters that are set by the software. Review the site parameters, and click **OK** to dismiss the dialog box.

3.5.2 Antenna Control Settings

The Antenna Control Settings dialog box controls the speed and direction of the radar antenna, as well as the data sample interval and offset rates. The following dialog box displays when you select **Configuration** ➡ **Antenna:**
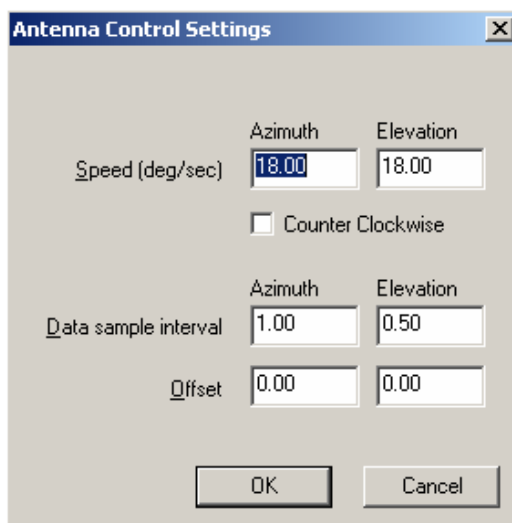
The controls are self-explanatory. When you click OK to accept your changes, note that an Antenna command is reflected in the RDACS display. The commands input from the Antenna Control Settings dialog box correlate to the Antenna section in the *rdacs.ini* file, as shown below.
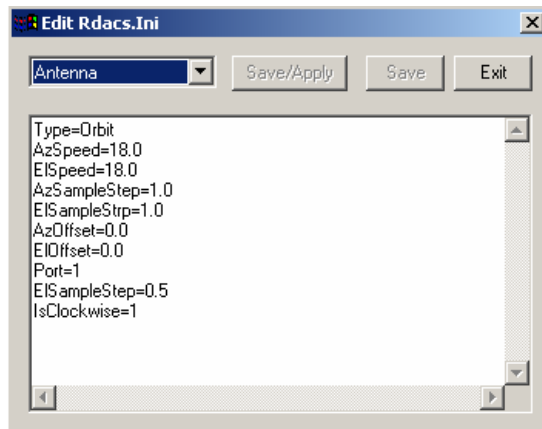
3.5.3 Editing the rdacs.ini File

The Edit Rdacs.Ini dialog box displays when you select **Configuration ➡ RDACS.Ini.**
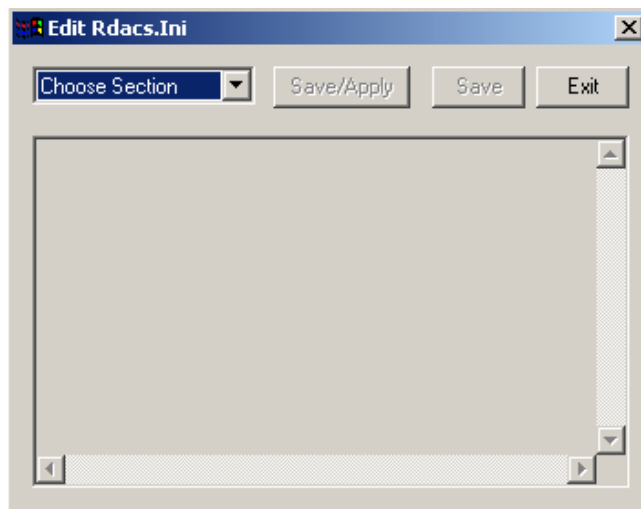
The top leftmost drop-down menu lets you select a section in the *rdacs.ini* file, which you can then view and edit, as required. The *rdacs.ini* file has several sections: Startup, Master, Site, RadPgm0, RadPgmAntennaStuck, CrossRefTables, six Mode tables, ModeDefault, five Level tables, Antenna, and AntennaCmds. Regardless of which section you choose to edit, there are three controls: **Save/Apply, Save,** and **Exit. Save/Apply** saves your edits and puts them into operation immediately. **Save** saves your edits, but they will not become effective until the next time you enter RDACS. **Exit** ignores your edits, asks if you want to save your edits, terminates the editing session, and returns you to the Radar Control dialog box.

Section lines beginning with the # character are notes that provide important information about parts of the *rdacs.ini file*. The following paragraphs describe each section of the *radacs.ini* file. While most parameter values are not specified, important values that should be included in the *rdacs.ini* file are specified.

Startup Section

```
NumUsers=
```

WatchDogType= *Set to any value from 0 to 20 (0 disables WatchDog). When Watchdog detects that the I/O interface between the Digital IF Receiver and the RDACS computer is malfunctioning for the specified time (in seconds), the system performs a complete reset operation.*

```
TcpNoDelayUsers=
AntennaMoveTimeout=
#DIOPort=O
#DIOPort=0x02a8
DIOPort=
Logscans=
AutoFaultResetDelay=
```

Master Section

```
CfgVersion=
```

 # do not change the next three while rdacs runningNumModes

```
NumLevels=
NumRadPgmS
```

 # do not change the next three while rdacs running

```
RangeResolution0=
RangeResolution1=
RangeResolution2=
RangeResolution3=
```

 # always set to 1

```
SepNoiseLevels=l
```

 # if 1, use defaults in rvp

```
NoNoiseCmds=
```

Site Section

The Site section of the *rdacs.ini* file contains many of the parameters described in Section 2.5.1, *Configuring Site Parameters.* These items, which are either set at system installation or are set by the software, should not be changed.

```
Edit Rdacs.Ini                                          [x]

Site           [v]    Save/Apply    Save      Exit

VersionNum=102                                      [^]
ProtocolNum=200
#Station call in next
SiteName=WAAA
RadarName=BSI Digital Doppler
RadarType=10
Capabilities=0
#Lat Lon in decimal degrees
Latitude=35.0
Longitude=-86.0
Altitude_AAT=10
Altitude_ASL=100
Angle360=16384                                      [v]
[<]                                            [>]
```
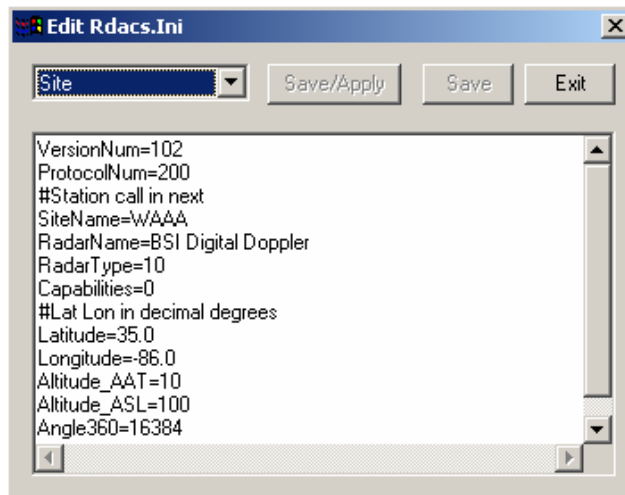
RadPgm0 Section

 # the mode on startup

Title=

NumSteps=

AntOp0=

 # this is the RdpModeNum

Mode0=0xl

Range0=

Skip0=

Duration0=

Az0=

E10=

EndPt0=

RadPgmAntennaStuck Section

```
Title=Antenna Stuck
NumSteps=
AntOp0=
```

 # this is the RdpModeNum

```
Mode0=0xO
Range0=
Skip0=
Duration0=
Az0=
E1O=
EndPt0=
```

CrossRef Tables Section

 # this section notes the mode to rdpmode xref

 # it is not used by rdacs

mode0=rdpmode4 powerdown

mode1 =rdpmode0 standby

mode2=rdpmode1 long pulse

mode3=rdpmode2 single prf

mode4=rdpmode3 dual prf

mode5=rdpmode5 clear air

 # level tables:

level0=reflectivity 5-75 dBZ

level1=speed for width,

level2=speed for single prf +/- 20 kts

level3=speed for dual prf +/- 99 kts

level4=reflectivity for clear air -28 to 28 dBZ

Mode0 Section

```
RdpModeNum=4
Name ="PowerDown"
Radiate=
PowerUp=
```

Mode1 Section

```
RdpModeNum=0
Name="Standby"
Radiate=0
```
#force reset forces a modulator reset when

 # mode is entered
```
ForceReset=l
```

Mode2 Section

```
LogThreshold=Sets the upper limit for reflectivity values.
Reflectivity values below this number may be discarded. This
value is always positive.
CalRef1=
RdpModenUM=1
Name=LongPulse
Radiate=
RAvail=
VAvail=
WAvail=
PRF=
Pulselndes=
Unfold=
# #
FilterRange0=
Filterlndex0=
FilterRange1=
FilterIndex1=
FilterRange2 =
Filterlndex2=
FilterRange3=
Filterlndex3=
SampleSize=Specify from 1 to 256 pulses.
CMS=usedefault
Lsr=usedefault
Dsr=usedefault
Ccorthreshold=usedefault
SqiThreshold=usedefault
SigThreshold=usedefault
ThCt1Uncorr=usedefault
ThCt1Corr=usedefault
ThCt1Vel=usedefault
ThCt1Width=usedefault
```

Mode3 Section

```
RdpModeNum=2
Name="Single PRF"
Radiate=
Vlevel=
RAvail=
VAvail=
WAvail=
PPF=
PulseIndex=
Unfold=
# #
FllterRange0=
FilterIndex0=
FilterRanqe1=
FilterIndex1=
FilterRange2=
FilterIndex2=
FilterRanqe3 =
FilterIndex3=
SampleSize=Specify 1 to 256 pulses.
CMS =
Lsr=
Dsr=
LogThreshold=
CcorThreshold=usedefault
SqiThreshold=usedefault
SigThreshold=usedefault
CalRef1=usedefault
ThCt1Uncorr=usedefault
ThCt1Corr=usedefault
ThCt1Vel=usedefault
ThCt1Width=usedefault
```

Mode4 Section

```
RdpModeNum=3
Name="Dual PRF"
Radiate
VLevel=
RAvail=
VAvail=
WAvail=
PRF=
PulseIndex=
Unfold=
```

# #

```
FilterRange0=usedefault
FilterIndex0=usedefault
FilterRange1=usedefault
FilterIndex1=usedefault
FilterRange2=usedefault
FilterIndex2=usedefault
FilterRanqe3=usedefault
FilterIndex3=usedefault
SampleSize=usedefault
CMS=usedefault
Lsr=usedefault
Dsr=usedefault
LogThreshold=
CcorThreshold=usedefault
SqiThreshold=usedefault
SigThreshold=usedefault
CalRef1=
ThCt1Uncorr=usedefault
ThCt1Corr=usedefault
ThCt1Vel=usedefault
ThCt1Width=usedefault
```

Mode5 Section

```
LogThreshold=
CalRef1=
RdpModeNum=5
Name="NoRadiate"
Radiate=
RAvail =
VAvail =
WAvail=
PRF=
PulseIndex=
Unfold=
# #
FilterRange0=
FilterlndexO=
FilterRange1=
Filterlndex1=
FilterRange2=
Filterlndex2=
FilterRange3=
Filterlndex3=
SampleSize= Specify 1 to 256 pulses.
CMS=usedefault
Lsr=usedefault
Dsr=usedefault
CcorThreshold=usedefault
SqiThreshold=usedefault
SigThreshold=usedefault
ThCt1Uncorr=usedefault
ThCt1Corr=usedefault
ThCt1Vel=usedefault
ThCt1Width=usedefault
```

ModeDefault Section

```
# O=standby l=log 2=singleprf 3=dual 4=powerdown 5=user...
RdpModeNum=
# mode name in fastrac and config menus
Name="Default"
# set if mode should radiate
Radiate=
PowerUp=
# leveln table to use for color levels
# R, V, W=reflectivity, velocity, and width
RLevel=
VLevel=
WLevel=
# what products are available
RAvail=
VAvail=
WAvail=
# pulse width code, typ: O=2µs l=.8µs 2=user 3=user
PulseIndex=
# trigger frequency
PRF=
# maximum number of range bins
ReqNumBins=
# number of bins to average to product final bin
SamplesPerBin=
# up to 4 filters, range is in km. Index is 0 for # off, or 1 to
7 for increasing filtering. Lower # numbered filters should have
lower ranges
FilterRange0=
IndexRange0=
FilterRange1=
IndexRange1=
FilterRange2=
IndexRange2=
FilterRange3=
IndexRange3=
# procmode=1 sync command mode, =2 dynamic angle sync
# normally set to 2
ProcMode =
# unfold 0=none, 1=2:3, 2=3:4, and 3=4:5
Unfold=
```

ModeDefault Section

 # number of pulses to average

SampleSize= *Specify 1 to 256 pulses.*

 # 0=horiz, 1=vert, 2=alternate

Polar=

 # clutter microsupprresion

CMS=

 # use three lag algorithms for width, signal power, and clutter correction

R2=

 # pulse end ray

End=

 # reflectivity speckle removal

Lsr=

 # doppler speckle removal

Dsr=

rangle normalization and enables gas attenuation correction

Rnv=

logslope typ=0.03

LogSlope=003

 # logthreshold (must be >=0)

LogThreshold=

 # clutter correction threshold

CcorThreshold=

 # signal quality index threshold

SqiThreshold=

 # signal power threshold

SigThreshold=

 # calibration reflectivity

CalRef1=

 # see SOPRM input 10 doc

ModeDefault Section

TopMode=*Specifies the processing mode, where 0000 Pulse Pair Processing; 0001 = FFT Processing; and 0010 Random Phase Processing.*

AGCNumPulses=Specifies *the number of pulses during one AGC integration period.*

Window=*Specifies the type of window that is applied to time series data where 0 Rectangle; 1=Hamming; and 2=Blackman.*

ZER=*Set to 1 to zero the clutter filter's internal state variables before the delay time has elapsed.*

FilterStabDly=*Specifies time delay before processing the next data ray. Used when dual-PRF velocity is enabled or when RVP7 has been reconfigured by user commands.*

 # typ thctl vals: ffff = all pass, 0000 = all fail
 # AAAA=log 8888=log & ccor AOAO=log & sqi
 # weights sig: 8 sqi: 4 ccor: 2 log: 1
ThCt1Uncorr=
ThCt1Corr=
ThCt1Vel=
ThCt1Width=
ThCt1ZdrRefl=
 # normally leave tag inverts 0
InvTagLow= 0
InvTagHigh= 0
 # gas atten
GasAtten=Specifies *the value for atmospheric attenuation, measured in dB/kin. When the water vapor is higher than this value, attenuation will be higher.*
 # zdr cal
ZdrCalOff set = *Specifies reflectivity depolarization ratio.*
 # radar wavelength
Wave length=Specifies *the distance that the radar wave within one cycle.*
 # use uncorrected (no range correction) ref1
productRUseUncorr=

Level0 Section

```
# types 0=refl 1=speed
Type = 0
Name=Log
Units = dBZ
1=5
2=10
3=15
4=20
5=25
6=30
7=35
8=40
9=45
10=50
11=55
12=60
13=65
14=70
15=75
```

Level1 Section

```
Type = 1
Name=Width
Units=knots
1=2
2=4
3=6
4=8
5=10
6=12
7=14
8=16
9=18
10=20
11=24
12=26
13=28
14=30
15=32
```

Level 2 Section

```
Type = 1
Name=Single PRF Vel
Units=knots
1=-20
2=-17
3=-14
4=-11
5=-8
6=-5
7=-2
8=0
9=2
10=5
11=8
12=11
13=14
14 =17
15=20
```

Level3 Section

```
Type=1
Name=Dual PRF Vel
Units=knots
1=-99
2=-64
3=-5O
4=-36
5=-26
6=-20
7=-1O
8=0
9=10
10=20
11=26
12=36
13=50
14=64
15=99
```

Level4 Section

```
Type= 0
Name=Clear Air
Units =dBZ
1=-28
2=-24
3=-20
4=-16
5=-12
6=-8
7=-4
8=0
9=4
10=8
11=12
12=16
13=20
14=24
15=28
```

Antenna Section

```
Type=Orbit
AzSpeed=45.0
ElSpeed=6.0
AzSampleStep=1.0
AzOffset=90.0
ElOffset=0.0
Port=1
ElSampleStep=0.5
IsClockwise=1
```

AntennaCmds Section
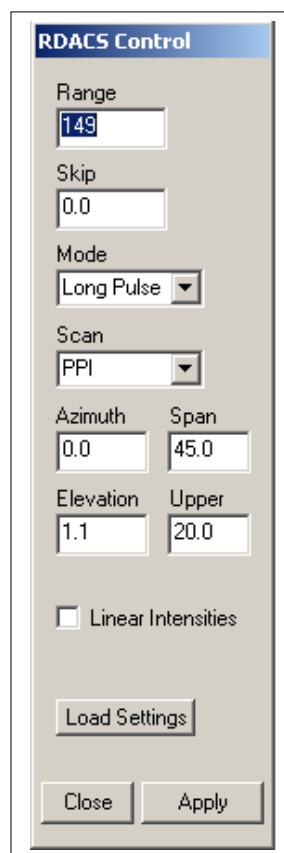
```
InitCmd1=C [500d]
#xCP vel4 acc3 boost2 prop3 inte3 diff3 zero1
#InitCmd2=ACPOO4O/200/05/006/000/350/0[r] [500d]
#InitCmd3=ECPOO4O/200/05/030/005/350/0[r] [500d]
InitCmd2=ACPOO4O/100/05/030/040/350/0[r] [500d]
InitCmd3=ECPOO2O/100/05/055/125/350/0 [r] [5OOd]
#xCL offlset5 dowrn-ccw5 up-cw5 zero1
InitCmd4=ACL [azoff] /00000/00000/000[r] [500d]
InitCmd5=ECL [eloff] /35800/09500/000[r] [500d]
AzFullCmd=G1V00000 [el] [cw] [azvel] 00000000000 [r]
StopCmd=GOV[r] [1500d] DDD [az] [el] [r]
#StopCmd=DDDO900001000 [r]
#AzSectorCmd=GCE [el] 00000 [cw] [elvel] 00000000000 [r] [1500d]
G1A [azcen] [azspn] [cw] [azvel] 00000000000 [r]
#ElSectorCmd=GCA [az] 00000 [cw] [azvel] 00000000000 [r] [1500d]
G1E [elcen] [elspn] [cw] [elvel] 00000000000 [r]
AzSectorCmd=G0 [r] [l000d] G1A [azcen] [azspn] [cw] [azvel] [el]
000000 [r]
ElSectorCmd=G0[r] [l000d] G1E [elcen] [elspn] [cw] [elvel] [az]
000000 [r]
```

4. RDACS Control from FasTrac

This section provides a step-by-step procedure for accessing RDACS control while operating FasTrac.

1. Start the FasTrac program.

2. From the leftmost Select Panel area, select Views to open the View Main panel.

3. Under the More Settings area on the bottom of the View Main panel, select Data to open the View Data panel.

Under the **More Radar Settings** area in the middle of the **View Data** panel, select **Radar Control** to open the **RDACS Control** panel.

This menu is similar to that explained in the previous sections except you have two additional options-**Linear Intensities** and **Load Settings.**

1. Linear Intensities determines which format of reflectivity data the radar uses when it is one of the Doppler modes. If you do not select this option, the radar uses Log reflectivity data.

    a. The use of the Linear Intensities option depends on which version of the RDACS controller executable is installed. If you have the early file, HDDE.EXE, both linear reflectivity and log reflectivity are available. Since log reflectivity data usually provides higher quality data, do not select this option. If you have a later version of the RDACS controller executable, H250S.EXE, you have access only to linear data and you must select this option.

2. Load Settings accesses a saved RDACS configuration. You can use the RDACS control program to create and save up to 10 configurations (numbers 0 through 9). Configuration 0 is loaded when you restart RDACS. You can set other configurations to your personal preferences and needs. For example, you can use a different color table to implement a clear-air mode in Configuration 1. Configurations 8 and 9 are temporary saves of the test configuration.

After configuring the RDACS, select **Load Settings** to open the Load RDACS dialog box.
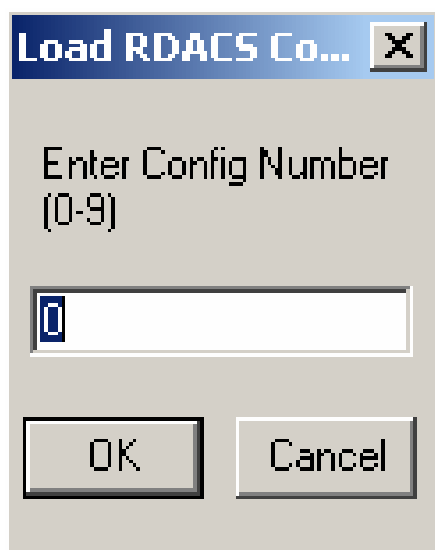
Specify the configuration number, and click **OK** to return to the View Data panel.

OR

Click Cancel to dismiss the dialog box and to return to the RDACS Control panel.

5. Installing RDACS

RDACS is normally set up when your system is delivered. The following instructions are provided in case your system crashes, a new version is delivered, or some other unusual circumstance occurs.

There is no separate installation program. Copying the executable file to its destination and setting up shortcuts are manual operations.

The rdacs directory or folder must be created before you install RvpTty. The steps below outline one possible way to set up the shortcuts to the program. Those familiar with Microsoft Windows can use their preferred technique.

1. Copy the *rdacs.exe* file to your *\rdacs* directory.

2. RDACS will create the *rdacs.ini* file when it is needed.

3. Run Windows Explorer, navigate to the *C. \ Windows\Start Menu\BSI folder*, and select File ➡ New ➡ **Shortcut** to open the Create Shortcut dialog box. Note you may have to create the *BSI* folder.

4. Use the Browse function or key in the complete pathname for the *\rdacs\rdacs.exe* file in the Command Line text box.

5. Click **Next**, name the shortcut, and click **Finish.**

6. Select **Start** ➡ **BSI,** and verify that the new shortcut is displayed.

7. Right click on the desktop; then select New ➡ **Shortcut** from the popup menu.

8. Use the Browse function or key in the complete pathname for the *\rdacs\rdacs.exe* file in the Command Line text box.

9. Click **Next**, name the shortcut, and click **Finish.** A shortcut to RDACS will appear on the desktop.

6.   The radacs.ini Configuration File

The *rdacs.ini* configuration file contains configuration parameters for RDACS. It is in text format; therefore, you can use Notepad or any equivalent text editor to view and edit the file contents.

The file is organized into sections. Section headings are on a line by themselves and appear as a bracketed keyword, as shown in the following example:

```
[Startup]
NumUsers=10
WatchDogType=0
TcpNoDelayUsers=ndfastrac ndlocal wbay
AntennaMoveTimeout=0
#DIOPort=0
#DIOPort=0x02a8
DIOPort=PC17250
LogScans=0
AutoFaultResetDelaly=60

[Master]
CfgVersion=100
#Do   not   change   the   next   three   while   RDACS   is   running
NumModes=60
NumLevels=5
NumRadPgms=1
# If next are changed, RVP7 must be configured
RangeResolution0=125.0
RangeResolution1=125.0
RangeResolution2+125.0
```

For example, in our example file, **[Startup]** is the first section and [**Master**] is the second section. Each section lists its associated variables and the current variable values separated by equal (j signs. (For example, WatchDogType=1 enables the WatchDog timer feature). Depending on the context, the value may be a real number, an integer, a hexadecimal integer, a Boolean expression, or an alphanumeric string.

Note that variable names may or may not be case sensitive, depending on the context. To ensure correct interpretation, use the variable names are they are specified in this document.

There are three ways to change the configuration file, listed in order of preference:

- ❐ By menu commands and dialog boxes in the RDACS Config program;

- ❐ By using the **Configuration** ➡ **Edit RDACS.ini** menu command in the RDACS Config program; and

- ❐ By editing *rdacs.ini* with Notepad or an equivalent text editor.

For example, most of the variables in the **Antenna** section can be edited indirectly via the **Configuration** ➡ **Antenna** command in RDACS Config. However, the **Port** variable in that section must be edited through Notepad. In the ensuing descriptions, each variable may include information on the best way to change it. If none is specified, open RDACS Config and use the **Configuration** ➡ **Edit RDACS.ini** command to edit the file. If this document discusses a variable that is not listed in your *radacs.ini* file, it will have the default value.

The order of section variables discussed in this document is not important. In general, variables are discussed in the order in which they are processed; sometimes, variable descriptions are logically grouped.

The following table lists the major configuration sections:

Section Title	Description
Startup	System startup information
Master	Global configuration variables
Site	Site-specific configuration
RadPgm*N*	Saved scan programs
RadPgmAntennaStuck	Scan program used if antenna fails to rotate
Antenna	Antenna configuration
Level*N*	Color/display level translate tables
Mode*N*	Radar operational modes
ModeDefault	Default settings for radar operational modes
AntennaCmds	Optional section when a TSA antenna system is used

Other sections may also appear. For example, the system may make a section called **RebootRadPgm.** The section and variable names are not case-sensitive; the order in which sections and variables appear is also not important.

Note that sections ending in *N* indicate multiple sections ending in a number. In most cases, the first number used is 0. For example, *radacs.ini* includes the **Mode0** and **Mode1** sections. M and X are also be used to reference numbered sections and variables.

The subparagraphs describing each variable list the following items for each variable.

Item	Description
Value Type	Real, Integer, Hexadecimal Integer, Boolean, and/or String.
Range/Units	Valid ranges of values/units of values, where applicable.
Default Value	Value used if the variable is missing from rdacs.ini
Change Dynamically	Specifies where there are any restrictions on changing the variable value while RDACS is running
RVP7User'sGuide Reference	Optional reference to RVP7 program commands (typically this is only in the **Mode*N*** section).

The following are the various Value Types:

- ❒ **Real-**Specifies a real number, optionally with a decimal point. The number may be signed, depending on context. Any reasonable number of digits after the decimal point is allowed; however, the value may be rounded to a fixed number of significant digits.

- ❒ **Integer-** Specifies a whole number; no decimal point is allowed. The number may be signed, depending on context.

- ❒ **Hexadecimal Integer-**Specifies a whole number in Base 16, with a *Ox* prefix.

- ❒ **Boolean-**Specifies a numeric 1 or 0 representing true or false, respectively.

- ❒ **String-**Specifies a sequence of printable characters. Spaces may be allowed, depending on context.

In some cases, more than one value type is accepted. For example, a particular

configuration item may allow either an integer or the "none" string.

The remainder of this document describes each section and each variable within that

section.

6.1 Startup Section

This section contains configuration variables that are related to system startup and user options.

TcpNoDelayUsers [Startup]

> *Value Type:* One or more user name strings, separated by spaces.
>
> *Range/Units:* User names that are listed in the *users.txt* file.
>
> *Default Value:* Empty.
>
> *Change Dynamically?* Yes.

RDACS communicates with its users via TCP/IP, a networking protocol. When RDACS turns the radar data into packets of data to send to the users, TCP/IP may bundle several small packets of data into one larger packet. This packetizing process can increase networking efficiency but it can cause the data to lose its real-time look, especially in the case where the data is visualized as a real-time sweep, as in FasTrac. However, TCP/IP has an option to turn this bundling off on a connection-by-connection basis. When a user logs on with a name contained in the TcpNoDelayUsers list, RDACS instructs TCP/IP not to bundle packets for that user. The tradeoff is that more bandwidth is consumed on the network, so this should only be used as needed. User login names for applications that do not display real-time data, such as RdacCap, should not appear in the list.

Changes to this variable while RDACS is running only affect new connections.

RebootOnScsiError [Startup]

> *Value Type:* Boolean.
> *Range/Units:* 0 (disabled) or 1 (enabled).
> *Default Value:* 1.
> *Change Dynamically?* Yes.

If the RebootOnScsiError variable is enabled (set to 1) and if (a) a fatal error occurs on the SCSI to the RVP7 or if (b) the RVP7 does not seem to be responding, the RDACS computer restarts. This allows the system to reset the SCSI hardware, and the RVP7 will issue an internal reset when it detects that the SCSI interface is being initialized.

This option can be considered a watchdog on the RDACS/RVP7 interface, and it normally should be enabled. If one of the described errors occurs, an entity is made in the *RDACSLog.txt* file.

For this to be used in an unattended environment, the RDACS computer must be configured to start RDACS (and any other desired applications) upon system boot. Also, the RVP7 configuration item **Respond to SCSI Reset** (the RVPtty **Mc** command) should be set to **YES**.

Before initiating reboot, RDACS creates the **RebootRadPgm** section in the *rdacs.ini* file. This section contains the currently running scan program. It also contains the **Active=1** variable, which lets RDACS know that it should run the scan program in the **RebootRadPgm** section rather than the scan program in the **RadPgm0** section.

DIOPort [Startup]

> *Value Type:* Integer, hexadecimal integer, or string.
> *Range/Units:* 0, 1, 2, 3, 4, I/O port address, or the string "PC17250'.
> *Default Value:* Empty.
> *Change Dynamically?* No, RDACS must be stopped.

This variable defines the type of interface to the radar transmitter and status. There are three types of interfaces: (1) an ISA bus I/O card, (2) a PCI bus I/O card model PCI-7250, or (3) the RRC1 interface board integrated in the transmitter (serial interface).

❑ To select (1), the ISA bus I/O card, enter the port address. For example, enter **DIOPort=0x260**.

❑ To select (2), the PCI bus I/O card, use **DIOPort=PCI7250.**

❑ To select (3), the RRC1 interface, use 1, 2, 3, or 4 to select the COM1, COM2, COM3, or COM4 serial port interface.

A value of 0 can also be used. In this case, there will be no transmitter control (the transmitter can be operated in local mode and the status will be ignored).

AntennaMoveTimeout [Startup]

Value Type: Integer.
Range/Units: Timeout; enter 0 to disable or enter number of seconds.
Default Value: 300.
Change Dynamically? No, RDACS must be stopped.

If this variable is not 0, this variable specifies the timeout for taking action if antenna motion is not detected. Typically, the action is to stop radiating. The actual scan program that executes when the timeout occurs is specified in the **RadPgmAntennaStuck** section.

AutoFaultResetDelay [Startup]

> *Value Type:* Integer.
>
> *Range/Units:* Time between consecutive faults; enter 0 to disable or enter the number of seconds.
>
> *Default Value:* 0.
>
> *Change Dynamically?* No, RDACS must be stopped.

This variable is used to configure automatic attempts to radiate if the radiate operation is shut down due to a fault. When a fault is first detected, a transmitter reset is attempted in five seconds. If another fault is detected, the number of seconds specified in the **AutoFaultResetDelay** variable must elapse before RDACS resends the Reset signal.

LogScans [Startup]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 (disabled) or 1 (enabled).
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes (use the RADACS Terminal window's **Misc** ➡ **Log scans** command).

When this variable is set, a message displays in the log window every time the antenna passes through 0 degrees. The number of samples and the largest and smallest angles sampled are displayed.

This can be useful to confirm correct antenna operation. Most of the time, it should be disabled because it quickly fills up the log file (the log file is self-maintaining but other useful information scrolls away faster).

NumUsers [Startup]

> *Value Type:* Integer.
>
> *Range/Units:* 1 to 10 users.
>
> *Default Value: 5.*
>
> *Change Dynamically?* No, RDACS must be stopped.

Set the number of concurrent users supported by RDACS. A typical installation could have the FasTrac, RadarNet Server, RdacCap, IRIS, and RDACS Config applications. There is no harm in just setting the maximum, 10.

Consult Baron Services if more concurrent users are required.

WatchDogType [Startup]

> *Value Type:* Integer.
>
> *Range/Units:* 0 (disabled), 1, or 2.
>
> *Default Value:* 0.
>
> *Change Dynamically?* No, RDACS must be stopped.

This setting enables using the Watchdog timer feature available on some motherboards.

If the variable is set to 1, the system periodically inputs a byte on port 0x443 to enable the Watchdog timer. It is disabled by inputting a byte on port 0x43.

If the variable is set to 2, the Watchdog timer is periodically enabled by outputting a (byte) 5 on port 0x443. It is disabled by outputting a (byte) 5 on port 0x441.

If Watchdog is enabled and RDACS hangs for some reason, the computer will be reset by the Watchdog hardware logic.

6.2 Master Section

This section contains several global configuration variables. Two important variables are **NumModes** and **NumLevels**. These must match the number of **Mode*N*** and **Level*N*** sections, respectively. In general, variables in this section should not be changed while RDACS is running.

CfgVersion [Master]

> *Value Type:* Integer.
> *Range/Units:* 100.
> *Default Value:* 100.
> *Change Dynamically?* No, RDACS must be stopped.

Cfg Version specifies a software version tracking number that should not be changed.

NumModes [Master]

> *Value Type:* Integer.
> *Range/Units:* The number of mode sections defined.
> *Default Value:* Empty.
> *Change Dynamically?* No, RDACS must be stopped.

NumModes specifies the number of mode (**Mode*N***) sections defined in the *rdacs.ini* file. Each mode section specifies a particular operational configuration. By convention, the first five mode sections are Powerdown, Standby, Long Pulse, Single PRF Doppler, and Dual PRF Doppler.

NumLevels [Master]

  Value Type: Integer.

  Range/Units: The number of level tables defined.

  Default Value: Empty.

  Change Dynamically? No, RDACS must be stopped.

NumLevels specifies the number of level conversion tables (the **Level***N* sections) in the *rdacs.ini* file. These tables are used to convert engineering units (e.g., dBZ or m/s) to color levels. By convention, four tables are defined: **Level0** through **Level3**. Normally, **Level0** is for reflectivity, **Level1** is for spectrum width, **Level2** is for single PRF velocities, and **Level3** is for dual PRF velocities.

RangeResolution*N (N* = 0, 1, 2, or 3) [Master]

  Value Type: Real.

  Range/Un its: Selected values from 50.0 to 133.3/meters.

  Default Value: 125.0.

  Change Dynamically? No, RDACS must be stopped.

This variable specifies the range resolution for the four pulse-width configurations supported by RVP7. The specified value must agree with that configured by the *Range Resolution* option of the **Mt<n>** command of the RVP7. Valid values are 50.0, 58.3, 66.7, 75.0, 83.3 91.7, 100.0, 108.3, 116.7, 125.0, and 133.3.

SepNoiseLevels [Master]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 or 1.
>
> *Default Value:* 1.
>
> *Change Dynamically?* No, RDACS must be stopped.

SepNoiseLevels determines if separate noise commands should be issued for each of the four possible pulse-width configurations. Normally, this should agree with the *Maintain separate noise levels for each PW* item of the **Mp** command of the RVP7. The recommended setting is 1.

NoNoiseCmds [Master]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 or 1.
>
> *Default Value:* 0.
>
> *Change Dynamically?* No, RDACS must be stopped.

Setting this variable to 1 inhibits automatic noise sampling when a pulse-width configuration is selected for the first time. The recommended setting is 0. If set to 1, the noise variables within the RVP7 must be set in Interactive Setup mode. Note that when **NoNoiseCmds** is set to 1, noise commands are not performed, even when explicitly commanded.

6.3 Site Section

This section is used to configure site-specific parameters, such as the radar location. Although these can be changed by editing the *rdacs.ini* file, RDACS Config supports changing most of these parameters via the RDACS Config menu command Configuration ✚ Site.

VersionNum [Site]

> *Value Type:* Integer.
> *Range/Units:* 102.
> *Default Value:* 102.
> *Change Dynamically?* Do not change.

This variable specifies the software version tracking number and should not be changed.

ProtocolNum [Site]

> *Value Type:* Integer.
> *Range/Units:* 200.
> *Default Value:* 200.
> *Change Dynamically?* Do not change.

This variable specifies the protocol number and should not be changed.

SiteName [Site]

> *Value Type:* String.
> *Range/Units:* Up to 31 characters.
> *Default Value.* Test Site.
> *Change Dynamically?* Yes (use the **RDACS Config Configuration ✚ Site** command).

SiteName can be any string that identifies the site

RadarName [Site]

> *Value Type:* String.
>
> *Range/Units:* Up to 31 characters.
>
> *Default Value:* BSI Digital Doppler.
>
> *Change Dynamically?* Yes.

RadarName specifies the name of the radar system. Normally, it should not be changed.

RadarType [Site]

> *Value Type:* Integer.
>
> *Range/Units:* 10.
>
> *Default Value:* 10.
>
> *Change Dynamically?* Do not change.

RadarType specifies the numeric identifier of the radar type. Do not change this number.

Capabilities [Site]

> *Value Type:* Hexadecimal integer.
>
> *Range/Units:* Bit pattern.
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes.

Not currently used; reserved for future expansion.

Latitude [Site]

> *Value Type:* Real.
>
> *Range/Units:* Valid latitude in decimal degrees; positive for north.
>
> *Default Value:* 35.0
>
> *Change Dynamically?* Yes (use the RDACS Config **Configuration ➜ Site** command).

This variable specifies the latitude of the radar antenna in decimal degrees. For example, 35.25 in decimal degrees is equivalent to 35:15:00 in D: M: S format.

Longitude [Site]

> *Value Type:* Real.
>
> *Range/Units:* Valid longitude in decimal degrees; negative for west.
>
> *Default Value:* -86.0.
>
> *Change Dynamically?* Yes (use the **RDACS Config Configuration ➜ Site** command).

This variable specifies the longitude of the radar antenna in decimal degrees. Note that western longitudes are negative.

Altitude_AAT [Site]

> *Value Type:* Integer.
>
> *Range/Units:* Signed number/meters.
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes (use the **RDACS Config Configuration ➜ Site** command).

Altitude_AAT specifies the antenna's height, in meters, above the average terrain. This value is not used by RDACS but is passed to other programs upon request.

Altitude_ASL [Site]

> *Value Type:* Integer.
> *Range/Units:* Signed number/meters.
> *Default Value:* 0.
> *Change Dynamically?* Yes (use the RADACS Config **Configuration** ➡ **Site** command).

Altitude_ASL specifies the antenna's height above sea level, in meters. This value is not used by RDACS but is passed to other programs upon request.

Angle36O [Site]

> *Value Type:* Integer.
> *Range/Units:* 16384/counts.
> *Default Value:* 16384.
> *Change Dynamically?* Do not change.

This variable specifies the number *of counts* in 360 degrees. This is a legacy value passed to other programs and should not be changed.

6.4 *RadPgm*N *Section*

RDACS continually runs a *scan* program... (A scan program is a series of steps.) In each step, you can specify the radiate mode and data acquisition options, the antenna operation mode, and the duration of the step. When a step is completed, the next step in the scan program executes. When the last step is completed, RDACS loops back to the first step.

Many programs consist of only one step that executes forever. However, to perform volume scanning or to acquire data with different data acquisition options, you must create a multi-step program.

Up to ten prepared scan programs **(RadPgm0** to **RadPgm9)** are kept in the *rdacs.ini* file. These programs are best created by using the RDACS Config **Control ➡ Load Program and Control ➡ Save Program** commands in RDACS. **RadPgm0** is the program executed upon system startup.

The **RadPgmAntennaStuck** section also contains a scan program. If enabled in the Startup section, this program is executed if the antenna quits turning. Typically, it is a one-step program that puts the system in Standby mode.

If the system attempts to reboot to correct a fatal I/O error (if so enabled), the **RebootRadPgm** temporary section is created to hold the currently executing program so it can be restarted. It has the same variables as **RadPgm***N* and includes the **Active** variable, which is set to 0 or 1, as needed.

Note that the currently executing program is not necessarily contained in the *rdacs.ini* file. A program, such as FasTrac, can download its own program to be executed, and it will not be saved. These programs are typically one-step operations and continuously execute.

To create and manage programs, use the RDACS Config **Control** commands. Use **Control** ➡ **Quick** to create a simple one-step scan program; use **Control** ➡ **Program** to create or edit a multi-step program.

Title [RadPgmN]

> *Value Type:* String.
>
> *Range/Units:* Up to 39 characters.
>
> *Default Value:* "None".
>
> *Change Dynamically?* Yes (use the RDACS Config Control commands).

Title defines the scan program's name. Some programs (in particular *rdaccap.exe)* may derive information about the scan program from the title.

NumSteps [RadPgmN]

> *Value Type:* Integer.
>
> *Range/Units:* 1 to 30/number of steps in scan program.
>
> *Default Value:* 1.
>
> *Change Dynamically?* Yes (use RDACS Config **Control** commands).

NumSteps specifies the number of steps in the scan program. For a one-step program, the following variables should also be present: **AntOp0, Mode0, Range0, Skip0, Duration0, Az0, E10, and EndPt0.** For a two-step program, the variables **AntOp1, Mode1…EndPt1** should be present, and so on up to a maximum of 30 steps.

AntOp*M* [RadPgmN]

> *Value Type:* Integer or hexadecimal integer.
>
> *Range/Units.* 0 to 3 (with possible modifier of +16 or +32).
>
> *Default Value:* 1.
>
> *Change Dynamically?* Yes (use RDACS Config **Control** commands).

This variable defines the antenna mode or operation for step *M.* Valid modes are:

> 0 - Point or stop.
>
> 1 - PPI (full azimuth revolution with fixed elevation).
>
> 2 - Azimuth sector scan with fixed elevation.
>
> 3 - RHI (elevation scan with fixed azimuth).

If **AntOp*M*** is 1, then 16 or 32 may be added to the value to force CW or CCW rotation direction. If **AntOp*M*** is 2, then 32 may be added to the value to force the scan to take the "long path" when scanning from **Az*M*** to **EndPt*M***. If **AntOp*M*** is 2 or 3, then 16 may be added to the value to force the scan to always start at either **Az*M*** or **El*M***. (Otherwise, the scan may start at **EndPt*M*** if it is closer when the step is started.)

Mode*M* [RadPgmN]

> *Value Type:* Integer or hexadecimal integer.
>
> *Range/Units:* 0 to highest mode number.
>
> *Default Value:* 1.
>
> *Change Dynamically?* Yes (use RDACS Config **Control** commands).

Mode*M* defines the basic radar operational mode. The value is used to find a **Mode*X*** section that has the **RdpModeNum** variable equal to the *M* value.

> **HOT**
>
> **Note that this number does not point directly to a *ModeX* section. All the *ModeX* sections are searched to find a section containing a matching *RdpModeNum* value. When searching, the preferred data modifiers described below are ignored.**

By convention, the following values are used: **Mode0** = Standby, **Mode1** = Long Pulse, **Mode2** = Single PRF Doppler, **Mode3** = Dual PRF Doppler and **Mode4** = PowerDown. Again, this convention may be altered by changing the **RdpModeNum** variable in the **Mode*X*** sections; however, it is best to keep this order for legacy programs.

A *preferred data* modifier may be added to this value: this modifier can suggest, to a display program, what to visualize when the step *S* is in effect. The modifiers are 16 = Log Reflectivity, 32 = Linear Reflectivity, 48 = Velocity, and 64 = Width. This field is obsolete, and no other programs currently use this information.

Range*M* [RadPgmN]

>   *Value Type:* Real.
>   *Range/Units:* Total range, in kilometers.
>   *Default Value:* 120.
>   *Change Dynamically?* Yes (use **Control** menu command in RDACS Config).

This variable specifies the radar range. In older systems with a limited number of range bins, this field was useful in shortening the range and, thus, increasing range resolution. However, with systems that have a large number of range bins, this field can be set to the maximum allowable range (constrained by PRF).

Skip*M* [RadPgmN]

> *Value Type:* Real.
> *Range/Units:* Skip zone range, in kilometers.
> *Default Value:* 1.61.
> *Change Dynamically?* Yes (use RDACS Config **Control** commands).

This variable specifies a skip zone. Data near the radar will be blanked. This can be used to not show strong clutter areas adjacent to the radar site. Set to 0 for no skip zone.

Duration*M* [RadPgmN]

> *Value Type:* Integer or hexadecimal integer.
> *Range/Units:* Time in seconds or loop count.
> *Default Value:* 0.
> *Change Dynamically?* Yes (use RDACS Config **Control** commands).

This variable can be used two ways: (1) as a counter or (2) as a timer. To use as a counter, add 32768 (0x8000) to the value. This determines how long a step will execute before moving to the next step of the scan program (or to return to the first step if the current step is the last). A value of 0 means forever and 0 is normally used in single-step scan programs.

The meaning of the loop count depends on the antenna mode defined in **AntOp*M***. If **AntOp*M*** is 0 (point), loop count mode should not be used. For 1 (PPI), each count is one-fourth of a revolution. For example, a value of 4 gives one revolution before proceeding to the next step. For 2 or 3 (azimuth and elevation sector scans), each traversal of the scan region in either direction is one count.

AzM [RadPgmN]

> *Value Type:* Real.
> *Range/Units:* 0 to 359.99/degrees.
> *Default Value:* 0.0.
> *Change Dynamically?* Yes (use RDACS Config **Control** commands).

This variable contains the azimuth associated with the antenna mode defined in *AntOpM.* If **AntOpM** is 0 (point), **AzM** defines the azimuth at which the antenna will stop. For 1 (PPI), this is not used. If **AntOpM** is 2 (azimuth sector scan), **AzM** defines one endpoint of the sector scan - the other endpoint is defined by **EndPtM**. If **AntOpM** is 3, **AzM** defines the fixed azimuth for the elevation scan.

EIM [RadPgmN]

> *Value Type:* Real.
> *Range/Units:* -2 to 88/degrees.
> *Default Value:* 0.0.
> *Change Dynamically?* Yes (use RDACS Config **Control** commands).

This variable defines the elevation associated with the antenna mode defined in **AntOpM.** If **AntOpM** is 0 (point), **EIM** defines the elevation at which the antenna will stop. If **AntOpM** is 1 or 2 (PPI or azimuth sector scan), **EIM** defines the fixed elevation for the step. If **AntOpM** is 3 (RHI), **EIM** defines one endpoint of the elevation sector scan - the other endpoint is set by **EndPtM.**

EndPt*M* [RadPgmN]

> *Value Type:* Real.
> *Range/Units:* 0 to 359.99/degrees.
> *Default Value:* 0.0.
> *Change Dynamically?* Yes (use RDACS Config **Control** commands).

This variable defines the endpoint when the antenna mode is a sector scan. If **AntOp*M*** is 2 (azimuth sector scan), **EndPt*M*** defines the second azimuth. If **AntOp*M*** is 3 (elevation sector scan or RHI), **EndPt*M*** defines the second elevation. It is not used for other **AntOp*M*** values.

6.5 Antenna Section

This section contains settings affecting the antenna operation. The type of antenna and the serial port to be used can be set in this section, as well as the antenna speed, sampling angle, and offset corrections.

Other than the **Type** and **Port** variables, the recommended way to change these variables is to use the RDACS Config **Configuration** ➡ **Antenna** command.

Type [Antenna]

> *Value Type:* String.
> *Range/Units:* Either "None", "TSA", or "Orbit".
> *Default Value:* TSA.
> *Change Dynamically?* No, RDACS must be stopped.

This variable defines the type of antenna. Type selects the command set used to communicate with the antenna controller. If "None" is selected, no antenna control command will be issued.

Port [Antenna]

> *Value Type:* Integer.
>
> *Range/Units:* 0, 1, 2, 3, or 4/COM port number.
>
> *Default Value:* 2.
>
> *Change Dynamically?* No, RDACS must be stopped.

This variable defines the COM port (serial port) used to communicate with the antenna controller. If 0 is selected, no antenna control command will be issued.

AzSpeed [Antenna]

> *Value Type:* Real.
>
> *Range/Units:* 1 to 36/degrees/second.
>
> *Default Value:* 6.0.
>
> *Change Dynamically?* Yes (use RDACS Config **Configuration ➡ Antenna** command).

This variable defines the azimuth speed used in PPI and azimuth sector scan modes. Depending on the controller, it may or may not also affect the speed used to slew to a fixed azimuth.

ElSpeed [Antenna]

> *Value Type:* Real.
>
> *Range/Units:* 1 to 36/degrees/second.
>
> *Default Value:* 6.0.
>
> *Change Dynamically?* Yes (use RDACS Config **Configuration ➡ Antenna** command).

This variable defines the elevation speed used in RI-IT scan modes. Depending on the controller, it may or may not also affect the speed used to slew to a fixed elevation.

AzSampleStep [Antenna]

> *Value Type:* Real.
>
> *Range/Units:* 0.1 to 2/degrees.
>
> *Default Value.* 1.0.
>
> *Change Dynamically?* Yes (use RDACS **Config Configuration ➡ Antenna** command).

This variable defines the angular width of a sampled radial of radar data for azimuth scan modes (PPI and azimuth sector scan). For example, if the value is 1.0 degree and the antenna mode is PPI, 360 radials will be produced for each antenna revolution. This variable can be set to a smaller value, but if the network link between RDACS and its users is slow and the antenna speed is fast, the bandwidth must be considered. Other factors include the number of range bins and the processing speed capabilities of RDACS users.

ElSampleStep [Antenna]

> *Value Type:* Real.
>
> *Range/Units:* 0.1 to 2/degrees.
>
> *Default Value:* 1.0
>
> *Change Dynamically?* Yes (use RDACS Config **Configuration ➡ Antenna** command).

This variable defines the angular width of a sampled radial of radar data for the elevation scan mode (RHI). For example, if the low elevation is 0.0 degrees, the upper elevation is 40 degrees, the **ElSampleStep** is 0.5 degrees, and the antenna mode is RHI, 80 radials will be produced for each scan cycle. When lowering this number, factors to consider include the network link speed between RDACS and its users, the antenna speed, the number of range bins, and the processing speed capabilities of RDACS users.

AzOffset [Antenna]

Value Type: Real.

Range/Units: -359.9 to 359.9/degrees.

Default Value: 0.0.

Change Dynamically? Yes (use RDACS Config **Configuration** ➡ **Antenna** command).

This variable is used to correct for the difference between the antenna pedestal's azimuth "zero" point and 0 degrees (0 degrees is north and 90 degrees is east). For example, if the antenna is pointing at 0 degrees, the displays indicate 10 degrees, and the current **AzOffset** is 6, **AzOffset** should be changed to -4.

ElOffset [Antenna]

Value Type: Real.

Range/Units: -359.9 to 359.9/degrees.

Default Value: 0.0.

Change Dynamically? Yes (use RDACS Config **Configuration** ➡ **Antenna** command).

This variable is used to correct for the difference between the antenna pedestal's elevation "zero" point and 0 degrees (0 degrees is on the horizon and 90 degrees is up). For example, if the antenna is pointing at 0 degrees, the displays indicate 2 degrees, and the current **ElOffset** is 0, **ElOffset** should be changed to -2.

IsClockwise [Antenna]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 (CCW) or 1 (CW).
>
> *Default Value:* 1.
>
> *Change Dynamically?* Yes (use RDACS Config **Configuration** ➡ **Antenna** command).

This variable sets the default antenna direction when the antenna scan mode is PPI.

6.6 *Level*N Section

This section is repeated multiple times (for example**, Level0, Level1...Level**n). Each instance is a conversion table that translates engineering units to display, or color, levels. There are three types of products emanating from the RVP7: (1) R - reflectivity, (2) V - velocity, and (3) W - spectrum width. At least three **Level** table sections should be created, one for each product table. In practice, additional tables can be created with different thresholds to better match the range of values encountered in a particular mode. For example, if two different modes acquire velocities at different PRFs, the range of unambiguous velocities will be different and it may be desirable to map these into different display levels.

For a given mode, which is specified in the **Mode***M* section, the desired **Level***N* section is selected by the **RLevel, VLevel,** and **WLevel** variables. For example, if in **Mode3** and **VLevel=2**, the threshold values in Level2 are used for velocities in **Mode3.**

> *The total number of level tables is recorded in the **NumLevels** variable in the **Master** section. If you add or remove a section, be sure to update **NumLevels**.*

Type [Level*N*]

> *Value Type:* Integer.
>
> *Range/Units:* 0 (reflectivity) or 1 (velocity).
>
> *Default Value:* 0.
>
> *Change Dynamically?* No, RDACS must be stopped.

Type defines whether the level table is used for reflectivities or velocities. Set **Type** to 0 for a reflectivity level table or set to 1 for a velocities table. Set **Type** to 1 for both velocity and width products.

Name [Level*N*]

> *Value Type:* String.
>
> *Range/Units:* Up to 31 characters.
>
> *Default Value:* "None".
>
> *Change Dynamically?* No, RDACS must be stopped.

Name provides an arbitrary string describing the table (for example, **Name=Single PRF Velocity**).

Units [Level*N*]

> *Value Type:* String.
>
> *Range/Units:* One of the strings described below.
>
> *Default Value:* dBZ or m/s, depending on **Type** setting.
>
> *Change Dynamically?* No, RDACS must be stopped.

The translate values in a level table can be in one of several different units. **Units** define the units for these values. If **Type=0**, then this maybe one of the following values: "dBZ", "mm/hr", or "in/hr". If **Type=1**, the following values are allowed: "m/s", "km/hr", "mph", or "knots". The spelling and spacing of these strings are critical. For example, do not add spaces around the "/"in "m/s".

The *native* units used by the signal processor are dBZ and m/s. When these units are specified, no conversion of the threshold values in the **1, 2 ... 15** variables takes place. Otherwise, the threshold values are converted from the appropriate units before they are used.

To convert from dBZ to rate (mm/hr), the following is used: rate = pow (10.0, (dbz/10 – log10 (200.0)) /1.6).

1, 2... 15[LevelN]

> *Value Type:* Real.
> *Range/Units:* Varies.
> *Default Value:* None.
> *Change Dynamically?* Yes.

These variables contain the threshold values for the level table. For example, if you want **Level1** section to represent 5 to 10 dBZ and the **Units** variable is "dBx ", set variable **1** to 5 and set variable **2** to 10.

6.7 ModeN Section

This section contains all of the variables used to define an operational mode except for antenna scan mode and range. Multiple sections (**Mode0, Mode1 … Mode*N***) may be used. The total number of modes is defined by the **NumModes** variable in the **Master** section.

The parameters contained in the **Mode*N*** section include radar products collected, radiate on/off, pulse width, PRF, and filter options. Many, but not all, parameters flow directly to the RVP7.

A **Mode*N*** section is referenced from the currently executing scan program. From the user's point of view, the modes are named (see the Name variable). By convention, the following relationships are established for the first five modes:

- ❐ **Mode0**-Powerdown.
- ❐ **Mode1**-Standby.
- ❐ **Mode2**-Long Pulse.
- ❐ **Mode3**-Single PRF Doppler.
- ❐ **Mode4**-Dual PRF Doppler.

In the first two modes, radiate is off. **Mode2** is characterized by a long pulse width at a low PRF; therefore, no velocities are acquired. **Mode3** and **Mode4** use a narrow pulse width at a higher PRF and the full suite of products (R, V, and W) is acquired.

> **Note**: The total number of mode sections is recorded in the **NumModes** variable in the **Master** section. If you add or remove a section, be sure to update **NumModes**.

New mode sections cannot be created while RDACS is running. However, every setting can be modified in an existing mode. To add a new mode, stop RDACS and edit the *radacs.ini* file. Use Copy and Paste to copy the **Mode*N*** section most like the one you will be creating to a new section. Update the mode number in the new section, and update **NumModes** in the **Master** section. You can now change the rest of the variables, or you can restart RDACS and use RDACS Config to change the variables.

If a variable is not defined in a **Mode*N*** section, the **ModeDefault** section is searched for the same variable. Further, all variables in a **Mode*N*** section can have the *usedefault* value. This also forces the system to search the **ModeDefault** section for the actual value to use.

Name [Mode*N*]

> *Value Type:* String.
> *Range/Units:* Up to 39 characters.
> *Default Value:* "NoName".
> *Change Dynamically?* Yes (connected users must reconnect to see change).

This variable names the mode. It is not used internally except for status display. It is passed to user applications so that it can be presented to the operator in the list of available modes (e.g., see the RDACS Config **Control ➡ Quick** command).

RdpModeNum [Mode*N*]

Value Type: Integer.

Range/Units: See text.

Default Value: 0.

Change Dynamically? Yes (connected users must reconnect to see change).

When a scan program is defined, it contains a mode number that does not directly refer to a **Mode*N*** section. Instead, it refers to a **Mode*N*** section with a matching **RdpModeNum** variable. The reason for this extra layer of indirection is that some older legacy programs have the following hard coded modes: 0=Standby, 1 Long Pulse, 2 Single PRF Doppler, 3 = Dual PRF Doppler and 4 = PowerDown. The following table lists the resulting **RdpModeNum** value when following all conventions:

Section	*Name*	*RdpModeNum*
Mode0	Powerdown	4
Mode1	Standby	0
Mode2	Long Pulse	1
Mode3	Single PRF Doppler	2
Mode4	Dual PRF Doppler	3

For example, if you are adding a new mode, **Mode5,** you can establish a one-to-one relationship between the mode section number and the **RdpModeNum** variable (older programs cannot access the new modes).

Radiate [Mode*N*}

> *Value Type:* Boolean.
>
> *Range/Units:* 0 (no) or 1 (radiate).
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes.

This variable defines whether the transmitter is enabled for the mode. Typically, set to 1 unless a Powerdown or Standby mode is being defined.

PowerUp [Mode*N*]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 (powerdown) or 1 (powerup).
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes.

This variable determines whether system power is supplied to all circuits (including filament voltage). If **PowerUp** is set to 0, some circuits are powered down (if the system supports Powerdown). Note that exiting a Powerdown mode may require waiting for filament warm-up.

AutoReset [Mode*N*]

> *Value Type:* Boolean.
>
> *Range/Un its:* 0 (no) or 1 (yes).
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes.

If **AutoReset** is set to 1 and a fault condition exists, a Reset command is issued to the transmitter. This is only done once, when the mode is first selected. To reiterate the Reset operation, see **AutoFaultResetDelay** in the **Startup** section.

ForceReset [Mode*N*]

      Value Type: Boolean.

      Range/Units: 0 (no) or 1 (yes).

      Default Value: 0.

      Change Dynamically? Yes.

If **ForceReset** is set to 1, a Reset command is issued to the transmitter when the mode is first selected. For repeated attempts to reset faults, see **AutoFaultResetDelay** in the **Startup** section.

RLevel, VLevel, and WLevel [Mode*N*]

      Value Type: Integer.

      Range/Units: 0 to Number **of Level*N*** sections.

      Default Value: 0.

      Change Dynamically? Yes.

These variables select which level translate table is used for R, V, and W products respectively. For example, if **VLevel=2**, the **Level2** section will be used to convert velocities from engineering units to display levels.

RAvail, VAvail, and WAvail [Mode*N*]

      Value Type: Boolean.

      Range/Units: 0 (not available) or 1 (available).

      Default Value: 0.

      Change Dynamically? Yes.

      RVP7 User's Guide Reference: Bits 11-14 in the PROC command.

These variables specify which of the R, V, and W products should be processed for delivery to user applications. Normally, for a low PRF where the unambiguous velocity is low, only **RAvail** is set. For a higher PRF, all three variables should be set to 1.

RUseUncorr [Mode*N*]

    Value Type: Boolean.

    Range/Units: 0 (use corrected) or 1 (use uncorrected).

    Default Value: 0.

    Change Dynamically? Yes.

    RVP7 User's Guide Reference: Bits 13-14 in the PROC command.

Normally, RVP7 delivers corrected reflectivity, for which all processing is applied. Set this variable to 1 to deliver uncorrected reflectivity.

ReqNumBins [Mode*N*]

    Value Type: Integer.

    Range/Units: 0 - 2000.

    Default Value: 500.

    Change Dynamically? Yes.

    RVP7 User's Guide Reference: LRMSK command.

This variable defines the approximate number of range bins that will be used for delivered products. The actual number used will be a few bins smaller than requested, depending on the skip zone range, the bin resolution, and the **SamplesPerBin** variable.

SamplesPerBin [Mode*N*]

> *Value Type:* Integer.
>
> *Range/Units:* 1 to 256.
>
> *Default Value:* 1.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* LRMSK command.

This variable defines the number of adjacent bins to be averaged. A value of 1 specifies no averaging: the number of bins requested will be the same number delivered.

PulseIndex [Mode*N*]

> *Value Type:* Integer.
>
> *Range/Units:* 0 to 3/index to RVP7 pulse-width tables
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SETPWF command, Bits 8-9.

This variable selects one of four pulse-width configurations stored at the RVP7. By convention, a value of 0 selects long pulse and 1 selects short pulse. The remaining entries can be used for other pulse widths.

PRF [Mode*N*]

> *Value Type:* Integer.
>
> *Range/Units:* 0 to several thousand/Hertz.
>
> *Default Value:* 500.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference*: SETPWF command, Input 1.

FilterRange*M* (*M* = 0 to 3)

FilterIndex*M* (*M* = 0 to 3) [Mode*N*]

> *Value Type:* Real (range) and Integer (index).
>
> *Range/Units:* km (range) and index.
>
> *Default Value:* 0.0 and 0.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* LFILT command.

Use these variables to configure clutter filters. Up to four filters may be defined, with arbitrary range. The **FilterIndex*M*** variables define which filter is selected. A value of 0 is off, while 1 to 7 selects progressively more rejective filters. The range of successive **FilterRange*M*** variables should increase; set to 0 if the filter is not used.

For example, to use a highly rejective filter for the first 15 km, a moderate filter for the next 30 km, and no filter for the remainder, the variables would be:

> **FilterRange0=1 5.0**
>
> **FilterIndex0=6**
>
> **FilterRange1=45.0**
>
> **FilterIndex0=2**
>
> **FilterRange2=0**
>
> **FilterIndex2=0**
>
> **FilterRange3=0**
>
> **FilterIndex3=0**

Unfold [Mode*N*]

> *Value Type:* Integer.
>
> *Range/Units:* 0 to 3.
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* PROC command, Bits 8-9.

This variable enables dual-PRF unfolding based on the set value from the following table:

Unfold	Meaning
0	No unfolding
1	Ratio of 2:3
2	Ratio of 3:4
3	Ratio of 4:5

ProcMode [Mode*N*]

> *Value Type:* Integer.
>
> *Range/Units:* 1 (synchronous) or 2 (free running).
>
> *Default Value:* 2.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* PROC command, Bits 5-6.

This variable specifies whether the synchronous mode or the free running mode should be used (see *RVP7 User's Guide).* In almost all cases, you should set **ProcMode** to 2.

SampleSize [Mode*N*]

> *Value Type:* Integer.
>
> *Range/Units:* 1-256.
>
> *Default Value.* 25.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 1.

This variable specifies the number of pulses to be averaged.

Rnv [Mode*N*]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 (off) or 1 (on).
>
> *Default Value:* 1.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 2, Bit 0.

This variable enables range correction of reflectivity data. It also enables intervening gas attenuation correction.

Dsr [Mode*N*]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 (off) or 1 (on).
>
> *Default Value:* 1.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 2, Bit 1.

This variable enables the Doppler speckle remover. When **Dsr=1,** speckles in velocity and width data are removed.

Lsr [Mode*N*]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 (off) or 1 (on).
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 2, Bit 2.

This variable enables the reflectivity speckle remover. When **Lsr=1,** speckles in corrected and uncorrected reflectivity data are removed.

End [ModeN]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 (off) or 1 (on).
>
> *Default Value:* 1.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SQPRM command, Input 2, Bit 3.

When **End** is set to 1, the ENDRAY_ output is pulsed at the end of each ray. This is not used by RDACS.

R2 [Mode*N*]

> *Value Type:* Boolean.
>
> *Range/Units:* 0 (off) or 1 (on).
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 2, Bit 7.

When R2=1, the system uses three lag algorithms (R0, R1, and R2) for width, signal power, and clutter correction.

CMS [Mode*N*]

    Value Type: Boolean.

    Range/Units: 0 (off) or 1 (on).

    Default Value: 0.

    Change Dynamically? Yes.

    RVP7 User's Guide Reference: SOPRM command, Input 2, Bit 8.

This variable enables clutter microsupprresion prior to being averaged together in range. (Clutter microsupprresion is the rejection of individual range bins based on excessive clutter.)

Polar [Mode*N*]

    Value Type: Integer.

    Range/Units: 0 to 2.

    Default Value: 0.

    Change Dynamically? Yes.

    RVP7 User's Guide Reference: SOPRM command, Input 2, Bits 12-13.

This variable specifies polarization: 0 = horizontal, 1 = vertical or 2 = alternating.

LogSlope [Mode*N*]

    Value Type: Real.

    Range/Units: N/A.

    Default Value: 0.03.

    Change Dynamically? Yes.

RVP7 User's Guide Reference: SOPRM command, Input 3.

This variable specifies the multiplicative constant used to covert signal power in dB to units of the time-series outputs (which are not used by RDACS). Also, one-fourth of this value is used to generate the *Log of Measured Noise Level* output from RVP7's GPARM command. The recommended value is 0.03.

LogThreshold [Mode*N*]

      Value Type: Real.

      Range/Units: >=0/dB.

      Default Value: 0.5.

      Change Dynamically? Yes.

      RVP7 User's Guide Reference: SOPRM command, Input 4.

This variable sets the LOG threshold for reflectivity values. This is only used if enabled in the **ThCtlxxx** variables.

CcorThreshold [Mode*N*]

      Value Type: Real.

      Range/Units: <0/dB.

      Default Value: -25.0.

      Change Dynamically? Yes.

      RVP7 User's Guide Reference: SOPRM command, Input 5.

This variable sets the clutter correction threshold. Any correction that is more negative than this value results in thresholding of data if enabled via the **ThCtlxxx** variables.

SqiThreshold [Mode*N*]

> *Value Type:* Real.
> *Range/Units:* 0 to 1.
> *Default Value:* 0.5.
> *Change Dynamically?* Yes.
> *RVP7 User's Guide Reference:* SOPRM command, Input 6.

This variable sets the signal quality index (SQI) threshold. Any SQI that is less than this value results in thresholding of data if it has been enabled via the **ThCtlxxx** variables.

SigThreshold [Mode*N*]

> *Value Type:* Real.
> *Range/Units:* dB.
> *Default Value:* 10.0.
> *Change Dynamically?* Yes.
> *RVP7 User's Guide Reference:* SOPRM command, Input 7.

When the estimate of the signal-to-noise ratio (SIG) falls below this value, data will be thresholded if enabled via the **ThCtlxxx** variables.

CalRefl [Mode*N*]

> *Value Type:* Real.
> *Range/Units:* < 0.
> *Default Value:* -22.0.
> *Change Dynamically?* Yes.
> *RVP7 User's Guide Reference:* SOPRM command, Input 8.

This variable sets the calibration reflectivity, which is referenced to 1.0 km. Changes in this variable result in a one-to-one change in the output reflectivity data levels. For example, if the reflectivity level tables specify 5 dBZ levels, a 5 dB change in this will be reflected as a shift of one level.

AGCNumPulses [Mode*N*]

> *Value Type:* Integer.
> *Range/Units:* 1 to 255.
> *Default Value:* 8.
> *Change Dynamically?* Yes.
> *RVP7 User's Guide Reference:* SOPRM command, Input 9, Bits 0-7.

This variable specifies the number of AGC pulses averaged.

TopMode [Mode*N*]

> *Value Type:* Integer.
> *Range/Units:* 0 to 2.
> *Default Value:* 0.
> *Change Dynamically?* Yes.
> *R VP7 User's Guide Reference:* SQPRM command, Input 9, Bits 8-11.

This variable specifies the signal processing mode used by the RVP7: 0 = pulse pair processing, 1 FFT processing, and 2 random phase processing.

FilterStabDly [Mode*N*]

> *Value Type:* Integer.
> *Range/Units:* Pulses.
> *Default Value:* 10.
> *Change Dynamically?* Yes.
> *RVP7 User's Guide Reference:* SOPRM command, Input 10, Bits 0-7.

This variable specifies a delay introduced prior to processing the next radial of data whenever dual PRF velocity unfolding is enabled or when the RVP7 has been reconfigured. The delay permits clutter filter transients to settle down following PRF and gain changes.

ZER [Mode*N*]

> *Value Type:* Boolean.
> *Range/Units:* 0 (off) or 1 (on).
> *Default Value:* 0.
> *Change Dynamically?* Yes.
> *RVP7 User's Guide Reference:* SOPRM command, Input 10, Bit 8.

If **ZER1,** digital clutter filters' internal state variables are reset to 0 prior to waiting the time specified in **FilterStabDly.**

Window [Mode*N*]

> *Value Type:* Integer.
>
> *Range/Units:* 0 to 2.
>
> *Default Value:* 1.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 10, Bits 9-10.

This variable specifies the type of window that is applied to time-series data prior to computing power spectra via a digital Fourier transform. The values are 0 = rectangular, 1 = Hamming, and 2 = Blackman window.

ThCtlUncorr [Mode*N*]

> *Value Type:* Integer or hexadecimal integer.
>
> *Range/Units:* Bit pattern (16 bits).
>
> *Default Value:* 0xAAAA.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 11.

This variable specifies threshold control for uncorrected reflectivity. The following steps describe how the bit patterns in the **ThCtlxxx** variables are used:

1. After a radial has been acquired, compute value x as follows:

   - ❑ Add 1to x if data passes LOG threshold.
   - ❑ Add 2 to x if data passes CCOR threshold.
   - ❑ Add 4 to x if data passes SQI threshold.
   - ❑ Add 8 to x if data passes SIG threshold.

2. Now x will have the value 0 to 15. It will be 0 if the data was below all thresholds; it will be 15 if it was above them all.

3. Use x to index into the bit pattern, and select one bit. If that bit is set, pass or keep the range data. If the bit is clear, then fail or discard the data.

The following table lists values of the **ThCtlxxx** variable for selected combinations of acceptance criteria:

Value (Hex)	Criteria
FFFF	All pass (threshold disabled)
0000	All fail
AAAA	LOG
8888	LOG and CCOR
A0A0	LOG and SQI
F0F0	SQI
FAFA	LOG or SQI
C0C0	CCOR and SQI
F000	SQI and SIG
C000	CCOR and SQI and SIG
FFF0	SQI or SIG
CCC0	CCOR and (SQI or SIG)

ThCtlCorr [Mode*N*]

> *Value Type:* Integer or hexadecimal integer.
>
> *Range/Units:* Bit pattern (16 bits).
>
> *Default Value:* 0x8888.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 12.

This variable specifies threshold control for uncorrected reflectivity. See **ThCtlUncorr** for the meaning of this value.

ThCtlVel [Mode*N*]

>   *Value Type:* integer or hexadecimal integer.
>   *Range/Units:* Bit pattern (16 bits).
>   *Default Value:* 0xC0C0.
>   *Change Dynamically?* Yes.
>   *RVP7 User's Guide Reference:* SOPRM command, Input 13.

This variable specifies the threshold control for velocity. See **ThCtlUncorr** for the meaning of this value.

ThCtlWidth [Mode*N*]

>   *Value Type:* Integer or hexadecimal integer.
>   *Range/Units:* Bit pattern (16 bits).
>   *Default Value:* 0xC000.
>   *Change Dynamically?* Yes.
>   *RVP7 User's Guide Reference:* SOPRM command, Input 14.

This variable specifies threshold control for width. See **ThCtlUncorr** for the meaning of this value.

InvTagLow
InvTagHigh [Mode*N*]

>   *Value Type:* Integer or hexadecimal integer.
>   *Range/Units:* Bit pattern (16 bits).
>   *Default Value:* 0.
>   *Change Dynamically?* Yes.
>   *RVP7 User's Guide Reference:* SOPRM command, Inputs 15 and 16.

This variable specifies whether selected TAG inputs to the RVP7 should be inverted. All current hardware requires that both these values be 0.

GasAtten [Mode*N*]

>*Value Type:* Real.
>*Range/Units:* dB.
>*Default Value:* 0.016.
>*Change Dynamically?* Yes.
>*RVP7 User's Guide Reference:* SOPRM command, Input 17.

This variable specifies the compensation for beam losses due to absorption by atmospheric gases. Set to 0 to disable. This value is used only if the **Rnv** variable is also set.

ThCtlZdrRefl [Mode*N*]

>*Value Type:* Integer or hexadecimal integer.
>*Range/Units:* Bit pattern (16 bits).
>*Default Value:* 0xAAAA.
>*Change Dynamically?* Yes.
>*RVP7 User's Guide Reference:* SOPRM command, Input 18.

This variable specifies the threshold control for differential reflectivity. See **ThCtlUncorr** for the meaning of this value.

ZdrCalOffset [Mode*N*]

> *Value Type:* Real.
>
> *Range/Units:* signed/dB.
>
> *Default Value:* 0.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 19.

This variable specifies the offset to be added to all reflectivity polarization ratio (ZDR) measurements.

Wavelength [Mode*N*]

> *Value Type:* Real.
>
> *Range/Units:* cm.
>
> *Default Value.* 5.3.
>
> *Change Dynamically?* Yes.
>
> *RVP7 User's Guide Reference:* SOPRM command, Input 20.

This variable specifies the radar's wavelength, in centimeters.

6.8 AntennaCmds Section

This section is only used for the TSA antenna system (the **Type** variable in the **Antenna** section must be set to TSA). The variables in this section hold script-like strings with replaceable parameters that are used to construct the command strings sent via the serial port to the TSA antenna.

HOT

Firmware evolution in the ISA antenna controller has rendered the default values obsolete. Consult Baron Services or the ISA documentation before changing this section.

In the script-like strings, replaceable parameters are denoted by a keyword in brackets. The keywords are listed and described in the table below. In all cases where a numeric quantity is created, it is 0 padded on the left to create the specified number of digits.

Keyword	*No. of Digits*	*Meaning*
az	5	Target azimuth * 100
azvel	4	Azimuth speed
azvel2	2	Azimuth speed
azv100	4	Azimuth speed * 10
azcen	5	Target azimuth center * 100
azspn	5	Target azimuth span * 100
el	5	Target elevation * 100
elvel	4	Elevation speed
elvel2	2	Elevation speed
elv100	4	Elevation speed * 100
cw	1	1 if clockwise rotation; else 0
*x*d	N/A	Delay *x* milliseconds
r	N/A	Add end of line codes
azoff	5	Azimuth offset
eloff	5	Elevation offset

InitCmd*M* (*M* = 1 to 9; TSA antenna only) [AntennaCmds]

> *Value Type:* String.
>
> *Range/Units:* Up to 150 characters.
>
> *Default Value:* C [r] [30d] C[r] [30d].
>
> *Change Dynamically?* Yes.

This command can be used to specify up to nine initialization command strings. These strings are sent to the antenna controller on startup and when a variable is changed in the **Antenna** section of the *rdacs.ini* file.

AzFullCmd [AntennaCmds]

> *Value Type:* String.
>
> *Range/Units:* Up to 150 characters.
>
> *Default Value:* G 1 V00000 [el] [cw] [azvel] 00000000000[r] [30d] G 1 V[r] [30d].
>
> *Change Dynamically?* Yes.

This variable is used to build the antenna controller command string to enable continuous rotation in azimuth.

StopCmd (TSA antenna only) [AntennaCmds]

> *Value Type:* String.
>
> *Range/Units:* Up to 150 characters.
>
> *Default Value:* G0[r] [30d] DDD [az] [el] [r] [30d].
>
> *Change Dynamically?* Yes.

This variable is used to build the antenna controller command string to enable pointing at a fixed azimuth and elevation.

AzSectorCmd (ISA antenna only) [AntennaCmds]

> *Value Type:* String.
>
> *Range/Units:* Up to 150 characters.
>
> *Default Value:* GCE [el] 00000[cw] [elvel] [r] [30d] G1A [azcen] [azspn] [cw] [azvel] [r] [30d] G1A[r] [30d].
>
> *Change Dynamically?* Yes.

This variable is used to build the antenna controller command string to enable azimuth sector scan.

ElSectorCmd (TSA antenna only) [AntennaCmds]

> *Value Type:* String.
>
> *Range/Units:* Up to 150 characters.
>
> *Default Value:* GCA [az] 00000[cw] [azvel] [r] [30d] G1E [elcen] [elspn] [cw] [elvel] [r] [30d] G1E[r] [30d].
>
> *Change Dynamically?* Yes.

This variable is used to build the antenna controller command string to enable elevation sector scan
(RHI).