RC2500 Interface Specifications

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1.0 RC2500 Overview

The RC2500 is an antenna controller designed to control antennas equipped with discreet limit switches and resolver type position sensors. The RC2500 can be controlled remotely via an SA Bus compatible RS-422 serial interface.

A number of options can be specified when the controller is ordered …

1. Inclined Orbit Tracking … Inclined orbit satellite tracking (via step track and memory track algorithms) is supported by the RC2500B antenna controller. RC2500A models do not support inclined orbit satellite tracking. For a description of the tracking algorithms employed by the RC2500B please refer to the white paper entitled 'Research Concepts Inclined Orbit Tracking Satellite Antenna Controllers'. This paper is available on our web site (www.researchconcepts.com). Signal strength information is supplied via an analog input. AGC input specifications are discussed in the 'Signal Strength Information for Inclined Orbit Satellite Tracking' section of this document.

   Antenna Interface Unit (AIU) – The RC2500 usually interfaces to the antenna drive motors and limit switches via an AIU located next to the antenna mount. The unit is plug compatible with the Vertex 7134 antenna controller and the Harris 9135 antenna controller. The RC2500 can be ordered with three unique I/O configurations …

   i) Vertex 7134 I/O with a summary limit indication (this is plug compatible with the Vertex 7134 Antenna controller).

   ii) Vertex 7134 with individual limit indications.

   iii) Harris 9135 I/O.

   The controller has also been retrofitted into applications which originally employed SA8840 and RSI4020 antenna controllers.

2. Polarization Potentiometer – The RC2500 can also optionally interface with potentiometer based polarization position sensors. Feeds manufactured by Seavey Engineering often use a potentiometer for polarization position sensing.

3. Input Power – The RC2500 can be configured in the field to work with either 115 or 230 VAC (50/60 Hz) input power. When the controller is ordered please specify the desired input voltage.

4. Satellite List – The controller's EPROM memory contains a list satellites to facilitate controller setup. Three satellite lists are available: West, East, and Pacific. The West list includes satellites that are visible from the Americas. The East list includes satellites that are visible for Europe, Africa, and Western Asia. The Pacific list includes satellites that are visible from be seen from East Asia and Australia.

2.0 RC2500 I/O

The controller contains two circuit boards. The digital board includes the microprocessor, non-volatile memory, and agc signal processing circuits. The other board is referred to as the analog board. It contains the circuitry that generates the AIU control outputs and processes limit switch inputs. All versions of the controller employ the same digital board. Two versions of the analog board are available. One board implements a Vertex 7134 type interface to the AIU. The other implements a Harris 9135 type interface to the AIU.

2.1 Vertex 7134 I/O

The Vertex 7134 analog board is labeled '2_5KI_O1'. It supports the following optically isolated, open collector (pull down) type control outputs (27 VDC, 700 ma max): Az Cw, Az Ccw, El Up, El Down, Pol Cw, Pol Ccw, Az Fast, El Fast, and Drive Enable. All outputs are active low. For the Az/El Fast control circuits, the open collector circuit conducts when the controller specifies fast speed movement. The return current associated with these outputs flows out the Drive Common terminal of connector J7.

The Vertex 7134 analog board also supports optically isolated input circuits. Each input circuit consists of an input terminal, a return terminal (that may be shared with other inputs), and a photo diode in series with two 2.2 K ohm resistors. The input circuits are designed to accept 24 VDC or 0 VDC inputs (referenced to the return terminal of that circuit). The logic of the circuit is such that an open circuit usually indicates the 'safest' state for the input.

The Vertex 7134 analog board supports the following input circuits …

Summary Limit and Summary Limit Return. To the RC2500, current flow implies summary limit is not active.

Azimuth Drive Fault, return current flows out of the Summary Limit Return terminal. To the controller, current flow indicates that the fault is not active.

Elevation Drive Fault, return current flows out of the Summary Limit Return terminal. To the controller, current flow indicates that the fault is not active.

Maintenance Status and Maintenance Status Return. To the controller, current flow indicates that the RC2500 has control of the antenna. No current flow indicates that antenna control is disabled at the antenna. The Maintenance Status input also supplies current for the open collector drivers (return current flows via the Drive Common terminals on J7).

Emergency Stop, Emergency Stop Return. Current flow indicates that an emergency stop is not active. An emergency stop function should be supported by the AIU.

Azimuth Cw Limit, Azimuth Cw Limit Return. To the controller, current flow indicates that the antenna is not at the Azimuth Cw limit.

Azimuth Ccw Limit, Azimuth Ccw Limit Return. To the controller, current flow indicates that the antenna is not at the Azimuth Ccw limit. The Azimuth Ccw limit circuit is the same as the Summary limit input circuit. Software determines whether the input is interpreted as Summary limit or Azimuth Ccw limit.

Elevation Up Limit, Elevation Up Limit Return. To the controller, current flow indicates that the antenna is not at the Elevation Up limit.

Elevation Down Limit, Elevation Down Limit Return. To the controller, current flow indicates that the antenna is not at the Elevation Down limit.

Polarization Cw Limit, Polarization Cw Limit Return. To the controller, current flow indicates that the antenna is not at the Polarization Cw limit.

Polarization Ccw Limit, Polarization Ccw Limit Return. To the controller, current flow indicates that the antenna is not at the Polarization Ccw limit.

For more information please refer to the Addendum of this document. The Addendum is an excerpt from the manual (section 3.3) that covers electrical installation of the controller.

2.2 Harris 9135 I/O

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2.3 RC2500 I/O Hardware/Software Configuration

The previous sections describe the RC2500 I/O options. The RC2500 can be ordered with either of the two analog boards described above. Three I/O configurations are supported.

2.3.1 Vertex 7134 Plug Compatible

The Vertex 7134 controller supports a single Summary limit input. An RC2500 that is plug compatible with the Vertex 7134 employs the Vertex 7134 I/O board and runs software that only processes the single summary limit input.

2.3.2 Vertex 7134 I/O with Individual Limits

The RC2500 can be ordered with the Vertex 7134 I/O board with software that supports individual azimuth, elevation, and polarization limits. This controller is identical with the controller described in section 2.3.1 with the exception that the software processes azimuth cw, azimuth ccw, elevation up, elevation down, polarization cw, and polarization ccw limits.

As stated in the Overview section of this document, the RC2500 can be supplied in two basic models. The RC2500A does not support inclined orbit tracking. The RC2500B does support inclined orbit tracking. Any RC2500 can be ordered with or without support

2.3.3 Harris 9135 Compatibility

For Harris 9135 compatibility, the RC2500 is equipped with the Harris 9135 I/O board.

2.4 Replacing Other Controllers

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2.4.1 SA 8840

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2.4.2 RSI 4020

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3.0 AIU Interface/Design Guidelines

For applications where an AIU is to be designed and constructed the RC2500 is usually ordered with 7134 I/O and support for individual limit switches. Figure 3.3 in the Addendum to this document outlines a possible AIU azimuth cw drive control output - limit switch input circuit. This circuit could be replicated to achieve movement in both directions about the antenna azimuth, elevation, and polarization axis.

3.1 Az/El/Pol Control Outputs and Limit Switch Inputs

The circuit outlined in Figure 3.3 of the Addendum assumes that when the relay coil associated with the ‘Azimuth CW Contact Closure’ is energized the contact closes and the antenna moves clockwise about the azimuth axis.

Here is a description of each of the elements of the circuit …

The Estop switch can control the application of the 24 VDC control voltage to azimuth, elevation, and polarization control circuits. When the Estop switch is open the relay coil cannot be energized.

The Az CW Limit switch opens when the antenna reaches the azimuth CW limit. When the limit switch is open current cannot flow through the relay coil.

The purpose of the diode in parallel with the relay coil is to prevent an inductive ‘kick’ when the relay coil is de-energized. This diode is referred to as a ‘buck diode’. If this diode was not present the voltage applied to the RC2500’s open collector drivers could exceed the device’s maximum voltage rating.

The 'Local/Remote Lockout' is an optional contact closure that prevents the RC2500 from energizing the relay coil when the antenna is jogged from a 'local' control panel at the antenna. Note that this circuit does not show how a local jog control would be implemented. If a local jog control were implemented the circuit should be designed so that the antenna limits are not exceeded. It is not clear how this would be accomplished with the circuit depicted in figure 3.3.

The 'CCW Motion Lockout' contact closure is present to insure that azimuth ccw and azimuth cw movement cannot be commanded to occur simultaneously. Note that this can be implemented with a NC (normally closed) contact that may be present on the azimuth ccw relay. Under normal operating conditions, the RC2500 will not command simultaneous azimuth cw and azimuth ccw movement to occur. If simultaneous application of the azimuth cw and azimuth ccw control signals will damage the AIU or motor drives some provision should be made to insure that it will not occur.

The opto-isolated, open collector, output circuit depicted in section 3.3 is contained in the RC2500. When azimuth cw movement is commanded to occur the open collector output will conduct.

Azimuth CW limit switch status information is input to the controller via the optically isolated input circuit depicted in Figure 3.3. Current flow in the opto-isolator circuit indicates to the controller that the antenna is not at the azimuth CW limit position.

3.2 Other Controller Outputs

The Az and El fast speed output circuits can be used to convey speed information to the azimuth and elevation drive devices. Return current for these open collector outputs flows out the Drive Common terminal. Contactor based drives operate at a single speed and these outputs are not used. Variable speed AC and DC drives often have a 'follow pot' speed input. With this scheme the motor speed is a function of an input voltage presented to the drive. For these drives the az and el speed control outputs can be used to activate a relay that causes the voltage applied to the drive's speed input to vary.

The controller's Drive Enable output is designed to be used to enable and reset the drives. When the drive is enabled this open collector conducts. When the drives are reset (via the controller's RESET mode) the output will be released for a few seconds and then reactivated. This output can be used with relays to reset the drive. If the drives do not support a reset feature this output can remain unused.

3.3 Other Inputs

An RC2500 which is configured for Vertex 7134 I/O supports a number of inputs which may not be required for every application. Unused inputs (with the exception of the Summary Limit input) on the J7 connector must be tied high to suppress controller generated warning and/or alarm messages and to insure proper operation of the AIU. With the Vertex 7134 I/O analog board an open input circuit (no current flow) generally indicates an alarm condition.

Here is a description of the inputs and the warning messages associated with each …

1) Azimuth and Elevation Drive Fault inputs indicate the status of the azimuth and elevation drives. The controller interprets a lack of current flow in these circuits as an indication of a drive fault. When the controller detects a drive fault an alarm message is displayed on the bottom row of the display and movement about that axis is disabled. The fault can be cleared via the controller's RESET mode.

   If the drives do not generate a drive fault output these inputs should be tied to the power supply (usually 24 VDC) that powers the limit switches. The limit switch power supply must be used because the return path for these inputs is the Summary Limit return. The Summary Limit return terminal is internally connected to the Azimuth CCW return pin on connector J6. If the azimuth ccw limit return terminal is not tied to the limit switch power supply ground the summary limit return terminal of J7 should be tied to the limit switch power supply ground.

2) If current in the Emergency Stop input circuit is disrupted the controller assumes that an Emergency Stop switch at the antenna has been activated. Movement about all axis is disabled and an alarm is displayed on the bottom row of the controller's LCD. If the AIU does not support an emergency stop function the Emergency Stop input should be tied to the control loop/limit switch power supply and Emergency Stop input return should be tied to the power supply return terminal.

3) Power must always be supplied to the Maintenance status input terminal. This terminal supplies current to a 15 volt DC linear regulator that powers the isolated side of the controller's output circuits (isolated relative to the controller's internal power supply). The common terminal of this regulator is tied to the Drive Common terminal of connector J7.

For the controller's open collector outputs to function the Maintenance input must be tied to the AIU control loop power supply and the Drive Common terminal must be tied to the return terminal of the AIU control loop power supply.

The Maintenance input circuit is an optically isolated and is designed to be powered by 24 volts DC. Current flows into the Maintenance Status input terminal of connector J7 and flows out of the Maintenance Status input return terminal of connector J7. When current flow is not detected in this circuit the controller assumes that the AIU is in a Maintenance mode and displays a message on the bottom row of the LCD.

Many AIU's are equipped with a Local/Remote switch. In the Remote position the RC2500 controls all antenna movements. In the Local position antenna movements occur in response to user manipulation of switches on a jog control panel included as part of the AIU. If the AIU Local/Remote switch controls the current applied to the Maintenance input the controller will detect the state of that switch and the controller open collector outputs will be disabled when the switch is in the Local position.

Alternatively, if …

i) the RC2500's Drive Common terminals (on connector J7) are tied to the Maintenance Status input return terminal at the controller,

and

ii) the Drive Common terminals of the RC2500 are connected to the AIU's 24 VDC Loop Power Supply Return through the Local/Remote switch (switch function is such that the Drive Common is disconnected from the supply return when the switch is in the Local position) …

… the controller will detect the state of the switch and the controller's open collector outputs will be disabled because the open collector drivers are not powered when the switch is in the Local position.

3.4 Controller – AIU Cabling

If the RC2500 is equipped with a Vertex 7134 type I/O board and the controller is running a version of the software that recognizes individual limits for each direction associated with each axis (rather than the summary limit indication supported by the Vertex 7134 controller) the RC2500's J6 and J7 connectors are used to interface the antenna to the AIU. J7 on the controller is a D25 male connector and J6 is a D25 female connector.

With this RC2500 configuration the J7 connector supplies antenna stimulus signals (via open collector outputs) and provides connections to input circuits for non-limit related antenna status information. The J6 connector provides connections to the input circuits that process antenna limit information.

The current required for the input circuits is typically around 0.5 ma for 24 volt circuits. The open collector drivers that supply the antenna stimulus signals are capable of sinking around 700 ma. The actual current required for the antenna stimulus signals is dependent on the AIU design. For many designs the antenna stimulus current is less than 100 ma per channel.

Shielded cable equipped with a bare drain wire should be used for the conductors that interface the AIU to both the J7 and J6 connectors. The bare drain wire (and the return terminal of the loop power supply) would normally be connected to earth ground at the AIU. The shield would be insulated at the antenna controller. Heat shrink tubing can be employed to insulate the shield at the controller end of the cables.

A 22 AWG stranded conductor (7 x 30) has a DC resistance of about 15 ohm per 1000 feet. Remember that for a 100 foot separation between the AIU and the controller a signal has to propagate through 200 feet of cable. Belden 9947 is a 15 conductor, 22 AWG, shielded cable with a bare drain wire. Belden 9948 is a 25 conductor, 22 AWG, shielded cable with a bare drain wire.

4.0 Position Sensors

The RC2500 is designed to interface with antennas equipped with resolver type position sensors on all axis. The controller can optionally be ordered with an interface to a potentiometer based polarization position sensor.

The RC2500 is designed to interface to Litton/Clifton Precision (ph: 800 336 2112) type 11-BHW-48F/F662 brushless resolvers. A data sheet for the resolver is included in the Addendum. The resolver is equipped with 12 inch flying leads

that exit the body of the resolver. The resolver should be equipped with a rubber boot or fitted with heat shrink tubing to keep moisture out of the resolver. The resolver can be interfaced to the controller with Belden 87777 cable (three 22 AWG individually shielded pairs with a bare drain wire). The drain wire should be connected at the controller. The drain wire and the shield should not be allowed to come in contact with earth ground at the antenna.

The optional potentiometer based polarization position sensor can interface to any potentiometer with a resistance of 1000 ohms or more. The Contelec PD22xx series (xx = 03, 05, or 10) 3 turn, 5 turn, and 10 turn (respectively) potentiometers have performed well in outdoor applications. The US representative for Contelec is Novotechnik (www.novotechnik.com, ph: 508 485-2244). Belden 8772 shielded cable (three 20 AWG conductors plus a bare drain wire) can be used to interface the controller to the potentiometer. As with the resolver cabling the shield of the cable should only be connected at the RC2500 – it should not be allowed to come in contact with ground at the antenna.

5.0 Limit Switches

In a typical satellite antenna application, limit switches perform two functions. One, they provide an indication to the controller that a limit has been reached. Two, they should be used by the AIU to positively disable movement beyond a limit. Limit switches such as the Telemecanique ZCKJ4104 and ZCKJ404 are often employed on satellite antennas. Similar switches are available from Honeywell. These lever operated limit switches have a neutral position and employ four sets of contacts(two normally open and two normally closed). Two sets of contacts (one NO and one NC) are associated with CW deflection of the lever from the neutral position. The other two pairs of contacts are activated by CCW deflection of the lever from the neutral position.

These limit switches are threaded to accept standard ½ inch electrical conduit fittings (1/2 inch NPT thread). The cables that interface the limit switch to the AIU can be inclosed in metel reinforced, liquid tight, flexible conduit. Telemecanique is a division of Square D (www.squared.com). Data on the switches is available in the On Line Digest that can be accessed via the Square D web page (XCKJ family of industrial limit switches).

6.0 Signal Strength Information for Inclined Orbit Satellite Tracking

The RC2500B antenna controllers can track inclined orbit satellites. Received signal strength information is required to implement the inclined orbit satellite tracking algorithms. The RC2500B can accept an analog input that is proportional (or inversely proportional) to the received signal strength. The range of values of the analog input is –10 volts to +10 volts. The controller contains scaling and offset circuits that can either compress or expand the analog signal to match the controller's microprocessor A/D converter input range (0 to 5 volts). These circuits are configured via gain and offset pots are accessible through the back panel of the controller.

The automatic gain control (AGC) circuits employed in most analog receivers generate an output voltage that is proportional to (or at least varies monotonically with) signal strength. This output voltage is often available at a pair of terminals on the receiver which may be labeled 'AGC', 'SS', or 'Tuning Meter'. Most modems also internally generate an AGC voltage. In some cases this voltage is available to the user – check with the modem manufacturer.

Beacon receivers accurately measure the strength of a received satellite signal and often produce an analog voltage proportional to signal strength. Manufacturers of beacon receivers include Satellite Systems Corporation (ph: 757-463-3553), Apogee (ph: 301-527-9200), and Vertex Controls Division (ph: 903-295-1480).

Addendum

Contents

- Section 3.3.2 of the RC2500 operator's manual that covers installation of the controller.
- Data on the Clifton Precision 11-BHW-48F resolver with the F662 modification (2 pages).

Section 3.3.2 - Antenna Interface Connections (from RC2500 Operator's Manual)

The RC2500 is designed to operate with an Antenna Interface Unit (A.I.U.) sometimes referred to as an "outdoor box". The A.I.U. contains the drive modules or contactors that switch power to the motors of the antenna mount. It also supports wiring from antenna mounted limit switches which, when actuated, shut down the motor drive for that axis/direction combination. Often the A.I.U. will have local jog controls that allow service personnel to move the antenna

at the pedestal. An emergency disconnect should always be provided at the antenna pad for operating safety. This function may also be integrated into the A.I.U.

The antenna interface connections are made through DB-25 connectors. The low impedance nature of these connections make them relatively immune to outside interference. To further increase the interface's immunity and to reduce possible emissions, a 25 conductor cable with an overall shield should be used. A cable such as Belden 9948 or equivalent (RCI p/n CBL-25_22) is recommended.

The RC2500 communicates with the A.I.U. through the use of open-collector relay drivers. These low-side drivers are designed to operate with 24VDC relays that have one side tied to the +24V loop supply originating in the outdoor box. These relays should always have locally mounted back EMF or "buck" diodes across the coil. Figure 3.3 illustrates typical interconnects for the Azimuth CW move command line. The relay drivers of the RC2500 are optically isolated, have internal current limits and are protected from over-voltage by metal oxide varistors.

In the version of the RC2500 that operates with the Harris 9135 A.I.U., 2 100mA high-side drivers are used to transmit a PWM waveform that controls the speed of the azimuth and elevation motors.

The A.I.U. transmits status information back to the RC2500 through low impedance current loops. These current loops drive the LED portion of opto-isolators in the RC2500. 5 to 10mA is the normal loop current for these circuits. They will, however reliably operate at 1 mA. An open-circuit will indicate a limit has been reached for most cases. This, combined with the opto-isolated drivers described above, allows the A.I.U. and RC2500 to have 5000V of isolation.

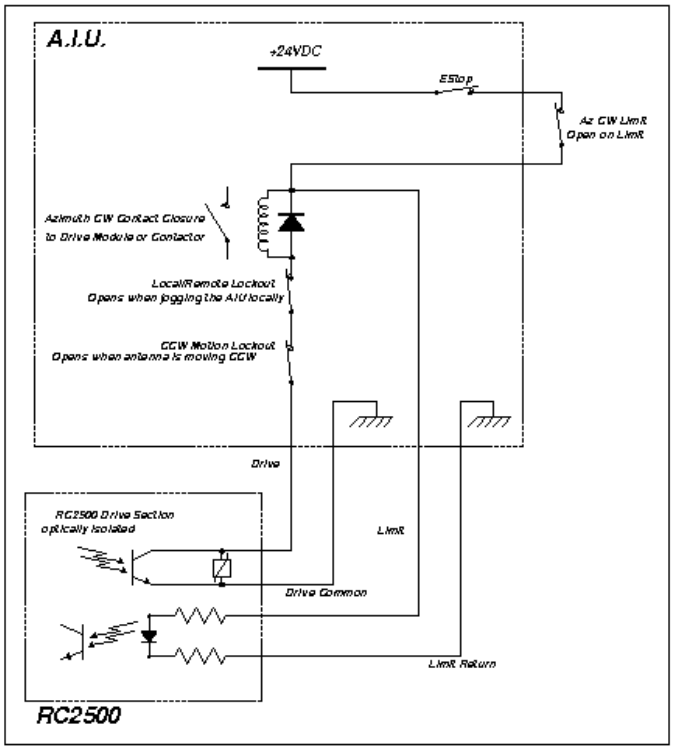

Figure 3.3 Typical Antenna Interface Unit Limit Switch/ Relay-Drive Wiring

The different RC2500 versions will have different pin definitions for connectors **J7** and **J6**. In the case of the 7134 summary limit version and the 9135 version, only **J7** is required to make connection to the A.I.U. For the case of the 7134 individual limits version, both **J7** and **J6** connections are required.

3.3.2.1 7134 Summary and Individual Limits Versions Connections

Antenna I/O Connector

J7, located to the right of J4, is a DB-25 plug identified as the Antenna I/O connector. This connector acts as the antenna motion control port of the RC2500. The port consists of 9 solid-state low-side relay drivers rated at 700mA sink each.

Max voltage is +27VDC on these drivers. Current is returned to the A.I.U. via the Drive Common line (pins 2,5, and 8). In addition to the drivers, this port supports three 24 VDC, low current, status inputs with isolated returns. The individual pin definitions are shown in the table below. J7 is the only required connection between the RC2500 and the Vertex 7134 Summary limit A.I.U.

Pin #	Description
1	Azimuth CW command, pull-down drive, 700mA max sink. (0.4V = move CW)
2	Drive Common (return path for AZ, EL, & POL drive command lines)
3	Azimuth CCW command, pull-down drive, 700mA max sink. (0.4V = move CCW)
4	Elevation UP command, pull-down drive, 700mA max sink. (0.4V = move UP)
5	Drive Common (return path for AZ, EL, & POL drive command lines)
6	Elevation DOWN command, pull-down drive, 700mA max sink. (0.4V = move Down)
7	Polarization CW command, pull-down drive, 700mA max sink. (0.4V = move CW)
8	Drive Common (return path for AZ, EL, & POL drive command lines)
9	Polarization CCW command, pull-down drive, 700mA max sink. (0.4V = move CCW)
10	Summary Limit input, 24 VDC low current.(same as AZ CCW limit of J7-16)
11	Nc
12	Nc
13	Nc
14	Azimuth Drive Fault input, 24 VDC low current. (0V = drive fault)
15	Elevation Drive Fault input, 24 VDC low current. (0V = drive fault)
16	Emergency Stop status return
17	Summary Limit & AZ/EL Drive Fault return (same as AZ CCW Limit return of J7, pin 4)
18	Summary Limit & AZ/EL Drive Fault return (same as AZ CCW Limit return of J7, pin 4)
19	Emergency Stop status input, 24 VDC low current. (0V = Emergency STOP)
20	Nc
21	Azimuth Fast command, solid state drive, 700mA max sink. (0.4V = AZ Fast)
22	Elevation Fast command, solid state drive, 700mA max sink. (0.4V = EL Fast)
23	Drive Enable command, solid state drive, 700mA max sink. (0.4V = Drive Enable)
24	Maintenance status input, 24 VDC low current. (0V = Maintenance – pedestal jogging)
25	Maintenance status return.

In addition to a Maintenance status indication, the Voltage on pin 24 is used to power the electronic components that reside on the A.I.U.-side of the opto-isolation barrier. When no Remote/Manual switch is present at the A.I.U., this pin must still be powered by between +15 and +28V (and its return line connected to "-") in order for the RC2500 drive system to function.

Auxiliary I/O Connection

J6, located directly above J7, is the Auxiliary I/O connector. This port, based on a DB-25 receptacle, supports isolated, axis-specific limit inputs as well as contact closures for summary faults and peripheral equipment control. A +5 VDC regulated output (200mA max), a +24 VDC unregulated output (1 Amp max), and an analog voltage input, all referenced to the RC2500 ground, are also available The individual pin definitions are shown in the table below. Both J6 and J7 are required when operating with a Vertex 7134 A.I.U. that support separate limits.

Pin #	Description
1	Summary Fault dry contact COM, (3A @ 125VAC or 3A @ 30VDC).
2	Summary Fault dry contact NO, (3A @ 125VAC or 3A @ 30VDC).
3	Azimuth CW Limit return.
4	Azimuth CCW Limit return(same as Summary Limit-AZ/EL Drive Fault return,J7-17&-18)
5	Elevation Down Limit return.

6 Elevation Up Limit return
7 Polarization CW Limit return.
8 Polarization CCW Limit return.
9 Drive Common (return path, same as J6, pins 2,5,8)
10 PC0 output dry contact NC, (3A @ 125VAC or 3A @ 30VDC).
11 P0.2 Auxiliary analog/digital input 0 - +5 VDC.
12 Ground (for digital/analog I/O).
13 Ground for system bus voltages.
14 Summary Fault dry contact NC, (3A @ 125VAC or 3A @ 30VDC).
15 Azimuth CW Limit input, 24 VDC low current. (0V = CW Limit reached)
16 Azimuth CCW Limit input, 24VDC (0V = CCW Limit reached) (same as J7-10).
17 Elevation Down Limit input, 24 VDC low current. (0V = Down Limit reached)
18 Elevation UP Limit input, 24 VDC low current. (0V = Up Limit reached)
19 Polarization CW Limit input, 24 VDC low current. (0V = CW Limit reached)
20 Polarization CCW Limit input, 24 VDC low current. (0V = CCW Limit reached)
21 PC1 Relay Driver, 700mA max sink. (0.4V = Relay On)
22 PC0 output dry contact COM, (3A @ 125VAC or 3A @ 30VDC).
23 PC0 output dry contact NC, (3A @ 125VAC or 3A @ 30VDC).
24 +5 Volts DC digital power, 200mA max.
25 Unregulated +24 VDC bus voltage, 1 Amp max..

Once the above connections have been made, verify that antenna motion in the appropriate direction can be affected from the front panel in MANUAL mode.

3.3.2.2 9135 Version Connections

Antenna I/O Connector

J7, located to the right of J4, is a DB-25 plug that acts as the Antenna I/O connector. This connector acts as the antenna motion control port of the RC2500 when connected to the Harris 9135 A.I.U.

The port consists of six solid-state low-side relay drivers rated at 700mA sink each. The maximum allowable voltage is +27VDC on these drivers. A single set of dry relay contacts control the application of 24V the loop supply (INTEST). Two modest-current, high-side drivers are used to transmit the PWM source voltage to PWM drive output lines that become speed signals to the Azimuth and Elevation drives. In addition to the aforementioned drivers, this port supports eleven 24 VDC, low current, status inputs with a common return path. The individual pin definitions are shown in the table below.

Pin #	Description
1	Azimuth CW limit input, 24VDC low current, (0V = CW Limit reached)
2	Polarization CW limit input, 24VDC low current, (0V = CW Limit reached)
3	Elevation Down limit input, 24VDC low current, (0V = Down Limit reached)
4	Remote Status input, 24VDC low current, (0V=RC2500 is disabled)
5	Azimuth Drive Fault input, 24VDC low current, (0V= Drive Fault)
6	Azimuth PWM Drive Source, 24VDC high current
7	Azimuth PWM Drive output, 24VDC high current (High duty cycle = Fast AZ Speed)
8	Elevation PWM Drive output, 24VDC high current
9	Elevation PWM Drive Source, 24VDC high current (High duty cycle = Fast EL Speed)
10	INTEST input, 24VDC high current, from A.I.U.
11	Polarization CW Drive output, open collector, 700mA sink. (0.4V = move CW)
12	Elevation Direction output, open collector, 700mA sink. (0.4V = Direction Down)

13 Elevation Drive Reset output, open collector, 700mA sink. (0.4V = EL Drive Reset)
14 Polarization CCW limit input, 24VDC low current, (0V= CCW limit reached)
15 Elevation Up limit input, 24VDC low current, (0V=UP limit reached)
16 Azimuth CCW limit, 24VDC low current, (0V=CCW limit reached)
17 Low Temperature Alarm input, 24VDC low current, (0V=cold temp point reached)
18 Elevation Drive Fault input, 24VDC low current, (0V= Drive Fault)
19 Intercom, not used
20 Power Supply Common, (Referenced to the A.I.U. Loop Supply)
21 Azimuth Drive Reset output, open collector, 700mA sink. (0.4V = AZ Drive Reset)
22 Spare, not used
23 INTEST Return path output, 24VDC high current dry contact closure
24 Polarization CCW Drive output, open collector 700mA sink. (0.4V = move CCW)
25 Azimuth Direction output, open collector, 700mA sink. (0.4V = Direction CW)

In addition to providing power to A.I.U. circuitry, the Voltage on pin 23 is used to power the electronic components that reside on the A.I.U.-side of the opto-isolation barrier. When no power is present at Intest (which is passed to Intest return when the controller is in a non-error condition), this pin must still be powered by between +15 and +28V (and its return line connected to "-") in order for the RC2500 drive system to function.

Auxiliary I/O Connection

J6, located directly above J7, is the Auxiliary I/O connector. This port, based on a DB-25 receptacle, supports a single isolated input, contact closures for summary faults and peripheral equipment control as well as two open collector relay drivers similar to those found in J7. The INTEST, INTEST Return and Power Supply Common connections of J6 are duplicated here for convenience. A +24 VDC unregulated output (1 Amp max) referenced to the RC2500 ground is also available. The individual pin definitions are shown in the table below.

Pin #	Description
1	Summary Fault dry contact COM, (3A @ 125VAC or 3A @ 30VDC).
2	Summary Fault dry contact NO, (3A @ 125VAC or 3A @ 30VDC).
3	PC0 dry contact COM, (3A @ 125VAC or 3A @ 30VDC).
4	PC0 dry contact NC, (3A @ 125VAC or 3A @ 30VDC).
5	PC0 dry contact NO, (3A @ 125VAC or 3A @ 30VDC).
6	Unregulated +24 VDC bus voltage, 1 Amp max.
7	Unregulated +24 VDC bus voltage, 1 Amp max.
8	Aux. Relay Drive 1, open collector relay driver, 700mA sink, (0.4V = Relay On)
9	Aux. Relay Drive 2, open collector relay driver, 700mA sink, (0.4V = Relay On)
10	INTEST (see J7 pin 10), 24VDC high current from A.I.U.
11	INTEST (see J7 pin 10), 24VDC high current from A.I.U.
12	INTEST Return (see J7 pin 23), 24VDC high current dry contact closure
13	INTEST Return (see J7 pin 23), 24VDC high current dry contact closure
14	Summary Fault dry contact NC, (3A @ 125VAC or 3A @ 30VDC).
15	Unregulated +24 VDC return, (RC2500 ground)
16	Unregulated +24 VDC return, (RC2500 ground)
17	Unregulated +24 VDC return, (RC2500 ground)
18	Unregulated +24 VDC return, (RC2500 ground)
19	Unregulated +24 VDC return, (RC2500 ground)
20	Unregulated +24 VDC return, (RC2500 ground)
21	Unregulated +24 VDC return, (RC2500 ground)
22	Auxiliary Input 1, 24VDC low current.

23 Auxiliary Input 1 Return, 24VDC low current.

24 Power Supply Common, (Referenced to the A.I.U. Loop Supply)

25 Power Supply Common, (Referenced to the A.I.U. Loop Supply)

Once the above connections have been made, verify that antenna motion in the appropriate direction can be affected from the front panel in MANUAL mode.