Antenna Rotator System

Setup & Hardware Reference Manual

May/2002 **Rev 2.1c**

Introduction

Thank you for purchasing the ARS interface.

ARS is the most powerful, high performance and low cost *universal rotator interface* available in the world today. It can be connected to any rotator, and three different ADC resolutions are supported: 8, 10 & 12 bits.

It works with any “azimuth rotator” or “azimuth & elevation rotator”, and many programs are supported.

It will convert your rotator into the latest technology rotator.

- ***It’s very important*** that you read the manual carefully because you could damage your rotator or the RCI circuit due to incorrect wiring. Remember that some time spent now reading the manual could save you much time or money later due to improper set up. If you are unsure how to proceed or have any questions after reading the manual, contact **EA4TX**.

The ARS has been developed to operate with most rotators available on the market. If your rotator is not included in the list of supported rotators you should consult EA4TX to check the possible differences. However, you can be sure it will not be necessary to make changes to the RCI circuit.

The RCI Board must be connected to a free LPT port on the computer. Remember that a computer can support up to 4 LPT ports simultaneously, so if you want to use the printer and the RCI Board you can install a second LPT port for less than $10. The RCI does not use any IRQ so you can disable the IRQ for the LPT port where the RCI Board is connected. Also you can use a manual port switch, allowing just one LPT port to be used for both a printer and the RCI.

You will find several ARS software versions on the CD-ROM:

- ***ARS for DOS.***
- ***ARSWIN for*** Windows9x, Windows NT, 2000 & XP.

About this manual

The manual is divided into 3 parts: **RCI Board Setup, RCI-EL Board Setup and Installation Guide**. Also some **Appendices** are included.

Part 1, **Installation of the RCI Circuit**, describes the wiring to the rotator. Normally this is carried out between the control unit and the cable attached to the rotator. In some cases the RCI board can be installed inside the rotator control unit if there is enough room, but it is recommended to check and adjust the unit outside. The interface requires a power supply providing 12-14 VDC.

Part 2, **Installation of the RCI-EL Circuit**, describes how to install the optional Elevation Board. You need to read this chapter only if you have ordered this model.

Part 3 is a quick guide to installing the RCI Board on some rotators.

In the **Appendices** you will find the specifications and troubleshooting guide.

Please read the manual carefully before installing the Board. There is no need to feel frustrated; if you have any questions contact EA4TX at:

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RCI circuit Setup

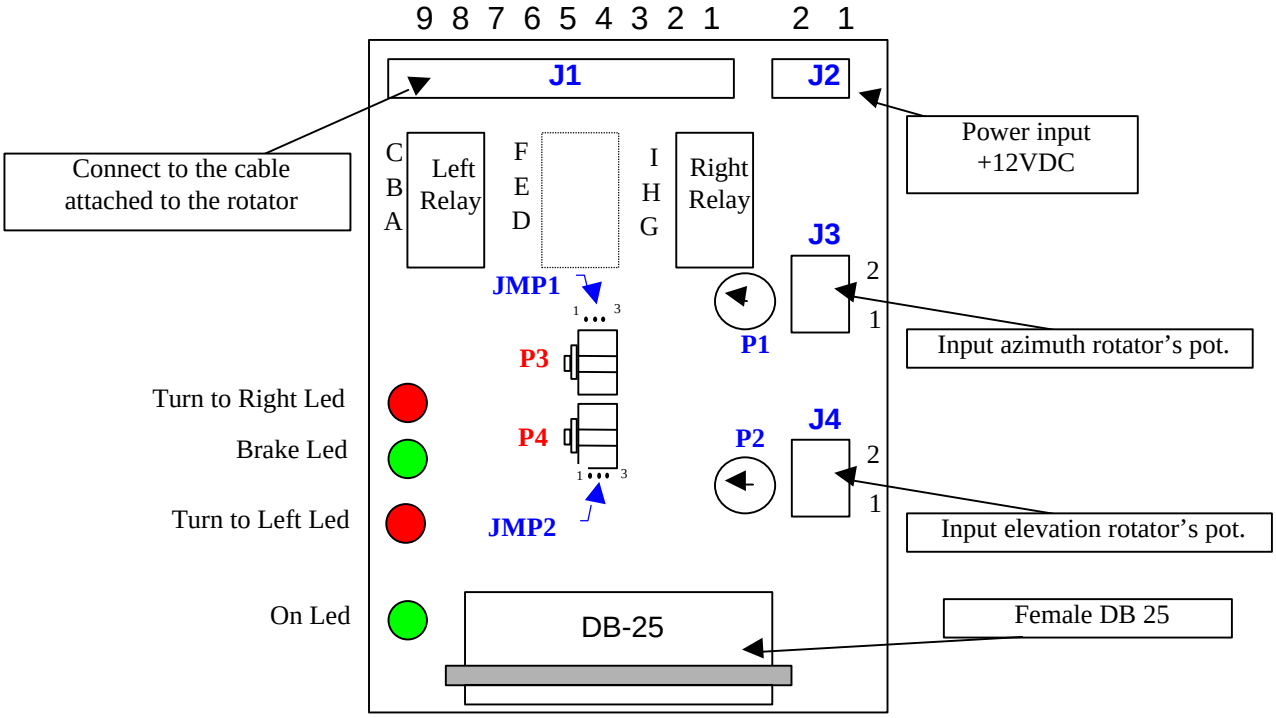
The RCI circuit facilitates the following objectives:

- Read the current antenna position by means of the incorporated A/D converter
- Control the turn (right or CW and left or CCW) by means of relays.

The RCI has the following connectors:

- **J1**: The antenna rotation is controlled by means of this connector. It is attached to 3 relays on the RCI Board. One of the relays (AUX) is able to control a brake or speed control if it is applied.
- **J2**: Power input. Requires a power supply providing 12 - 14 VDC.
- **J3**: Input to the A/D converter for the azimuth rotator. This input is used to read the antenna position. This point will be connected in parallel with the wires attached to the rotator's potentiometer allowing antenna position readout.
- **J4**: Input to the A/D converter for the elevation rotator.
- **DB-25**: Female DB25 connector to be attached to the parallel port on your computer.

The following drawing is the RCI circuit layout for easy location of the different connectors:



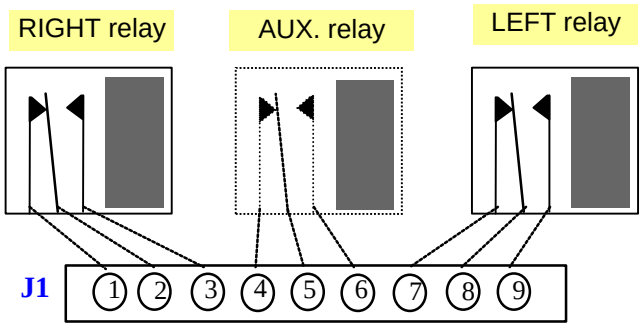
Note: P3 & P4 are not mounted on latest hardware revisions

1.1 Connector J1: Relay connections

The RCI Board has two relays to control the rotation: right (CW) and left (CCW). An optional relay (AUX), located between them, could be used to control a brake in those rotators that require it or as a speed control for those Control Units that support this feature.

These relays are 2 position and 2 circuit switches (double pole double throw). Each circuit supports 5A at 220V.

One of the two circuits of each relay is already wired and attached to this connector in accordance with the following drawing:



Throughout this manual, the 9 terminals of this connector will be referred to as:

J1-1, J1-2, J1-3, J1-4, J1-5, J1-6, J1-7, J1-8 and J1-9.

In de-energized position, J1-2 is switched to J1-1. When it's activated, J1-2 is switched to J1-3.
In de-energized position, J1-5 is switched to J1-4. When it's activated, J1-5 is switched to J1-6.
In de-energized position, J1-8 is switched to J1-7. When it's activated, J1-8 is switched to J1-9.

This first circuit of each relay (available at J1) will be used to control the turn to the right or to the left. If it is necessary, the second circuit of the relays can be used to activate a second circuit on the rotator. The connections to the second relay circuits are silk-screen printed on the board, next to the relays, with the following references:

A B C D E F G H I

Switching is similar to J1. The following are connected in de-energized position:

- B to A
- E to D
- H to G

When it's energized, the following connections are made:

- B to C
- E to F
- H to I

There are several possibilities to connect **J1** to the control unit-rotator set. Although Part 3 of this manual explains in detail how to carry out the installation on several rotator models, the general procedure is as follows:

- From the cable that connects the rotator to the control unit, locate the wire that makes the turn to right active and remove it (from the control unit).
- Attach it to J1-2, connecting J1-1 to the same point where you removed the wire. This way, when the relay is de-energized, J1-2 is connected to J1-1, allowing normal operation of the control unit.
- A similar operation will be carried out on the wire that makes the turn to left active. Remove it from the control unit and attach it to J1-8.
- Connect J1-7 to the control unit where you just removed the wire.
- You will have to attach points J1-3 and J1-9 to the voltage supplied by the control unit when it is switched on. So, open the control unit and, with aid of the circuit diagram and a voltmeter, locate (at the direction switches) the voltage that allows the rotation. Normally, this voltage is about 24V.

⌖ This is the most delicate operation in the installation and it must be made with special care. If your rotator is listed in Part 3, verify all the connections indicated. In case of doubt, or if any special modification or aid is necessary, remember to contact EA4TX.

- Remember that if your rotator has a double circuit to switch, you should carry out a similar operation using the second circuit of the RCI, by means of the points marked as: A, B, C, D, E, F, G, H, I.

- If your rotator is equipped with a brake system, you can activate it by means of the Aux Relay that is connected to J1-4, J1-5 & J1-6. Normally the two wires connected to the brake switch will be connected in parallel with J1-5 and J1-6.

1.2 Connector J2: Power input

The RCI Board must be connected to a source of 12 VDC.

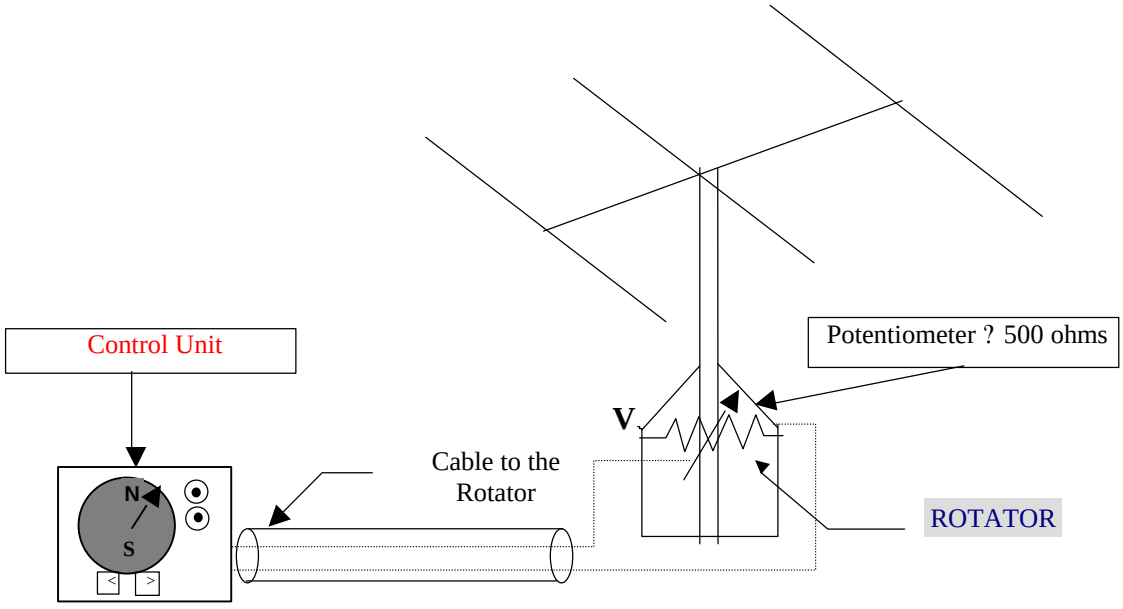
- Pay Attention to the polarity

J2-1 is the negative terminal and
J2-2 is the positive terminal.

1.3 Connectors J3 and J4: Operation of the ADC

By means of the Analog-to-Digital converter (ADC) information on where the antenna is pointing can be input to the computer. So it is necessary to connect the two wires attached to the azimuth rotator's potentiometer to J3.

Most rotators use a similar system to read the position in the control unit. The drawing below offers an overview of this operation:



Inside the rotator there is a potentiometer engaged with the antenna mast axis. The voltage feedback changes when the antenna is turned. So you get a voltage that will change between the existing voltage at both ends: normally 0V at one end (CCW) and the maximum value that will be called "***V***". This value depends on each model of rotator and each manufacturer chooses what it considers better. A 500 ohm linear potentiometer is normally used.
As a reference, this voltage "***V"*** in a HAM-IV rotator is 12V, in the Kenpro KR-600RC or YAESU G-2000 is -3.6V, some models use 5V, etc.

- It is very important to know the voltage ***"V"*** provided by your rotator in order to properly set JMP1 (or JMP2 in case of elevation rotator), as well as to adjust the potentiometer P1 (or P2 for elevation). This voltage ***V*** is not reflected in the manufacturer's documentation so you should check it with a voltmeter.

Since the RCI must get the voltage feedback from the external Pot, you have to attach the two wires that connect the control unit to the rotator (the one from the center arm of the potentiometer and the other from the ground) in **parallel** with the J3 terminals. Remember that J4 is only used in elevation rotators. Therefore the RCI, by means of its circuits, can read the voltage and calculate the beam direction.

The A/D converter has 8 bits resolution (or 10 or 12 bits). This means 256 possible values are available (8 bits). Supposing that the maximum turn is 360 degrees you get a resolution of 1.4 degrees. This performance will be enough for most applications.

Unfortunately, not all the rotators have a standard voltage ***V.*** As the A/D converter accepts 5V as maximum voltage, this giving the maximum digital output level, either you will have to attenuate the signal given by the rotator or amplify the signal. Following with the previous example, a HAM-IV or T2X rotator gives 12V when it is fully turned clockwise (CW limit); therefore you will have to attenuate the signal by means of P1 to just get 5V. In other cases, like the Kenpro KR-600RC or YAESU G-2000 rotator, the maximum voltage is negative (-3.6V); therefore you will have to amplify the signal in order to avoid losing resolution in the converter as well as change the polarity. By means of P1 you adjust the gain and by means of JMP1 you change the polarity.

The RCI has one potentiometer for each input to carry out all these adjustments:

Azimuthal input:

- P1 adjusts the Gain/Attenuation between 3-24V.
- JMP1 selects whether you want to change the input signal polarity.

This is especially useful on those models where the value ***V*** is negative. A jumper between 1-2 does not change the polarity, while a jumper between 2-3 changes the polarity. If the jumper is removed, the A/D converter input is disabled.

Elevation input:

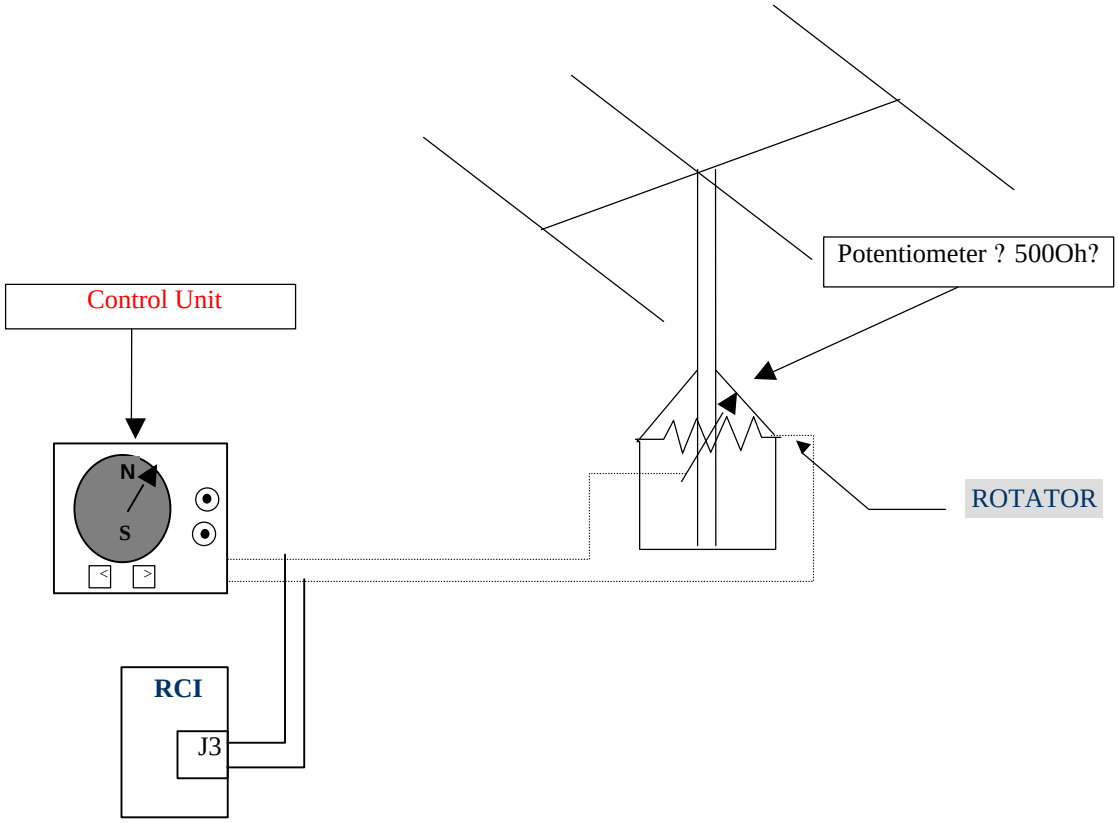
- P2 adjusts the Gain/Attenuation between 3-24V.
- JMP2 selects whether you want to change the input signal polarity.

This is especially useful on those models where the value ***V*** is negative. A jumper between 1-2 does not change the polarity, while a jumper between 2-3 changes the polarity. If the jumper is removed, the A/D converter input is disabled.

Even if your rotator appears in Part 3 of this manual, it is highly recommended you check that the data matches with your own rotator. Use a voltmeter to check the voltage in your rotator.

- The insertion of the RCI in parallel between the **Rotator** and the **Control Unit** should not cause any error or modification in the readout of the original instrument. The RCI Circuit presents high impedance at the J3 input.

The following drawing shows the correct Rotator + Control Unit + RCI wiring:



You can easily find the two wires by looking at the circuit diagram included with the rotator.
Be very careful with the polarity! J3-1 is the ground connection and J3-2 is the arm of the potentiometer. You can easily check with a voltmeter that the selected points are correct, by turning the antenna from one end to the other and writing down the readings at both ends. You should observe at the same time how the voltage increases or decreases between its upper and lower limits while you are turning the antenna. One end will correspond to 0V and the other to the maximum voltage ***"V"***.

Azimuth Calibration:
Move the Azimuth rotator to the CW limit (right limit). Check the voltage at **U2 pin 2**. This is the ADC analog input. Adjust P1 until you read 5V. When P1 is turned CW the signal input will be attenuated. When it is turned CCW the input signal will be amplified.

Elevation Calibration:
Similar to azimuth calibration, but for elevation the point to be checked will be at **U1 pin 2.**

Instead of using a voltmeter and pin 2 of U1 or U2, you can use the software for making the P1 or P2 adjustment.

RCI-EL circuit Setup

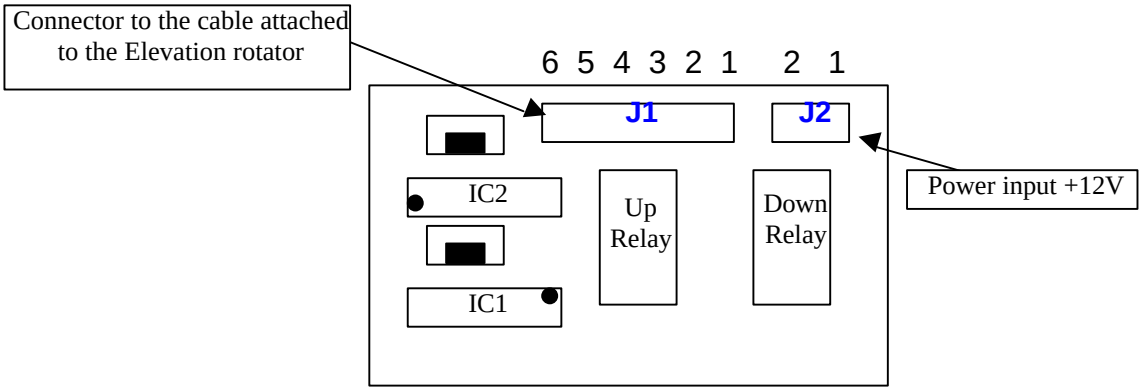
To install this kit, you must remove IC 3, (designated U3) and plug in the connector supplied with the Kit. This is a 20 pin connector. Remember to turn off the power before proceeding.

Observe the correct position of this connector when you insert it.

The RCI-EL Board has the following connectors:

- **J1**: The rotation of the antenna Elevation is controlled by means of this connector. This connector is wired to 2 relays.
- **J2**: Power input. Requires a power supply providing 12-14 VDC.

The following drawing is the RCI-EL circuit layout for easy location of the different connectors:

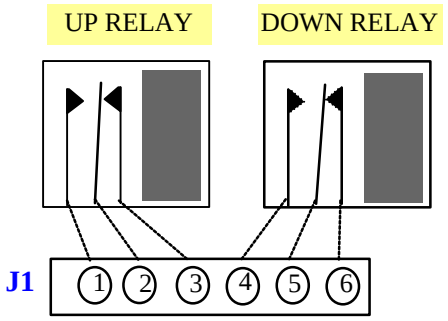


2.1 Connector J1: Relay connections

The RCI-EL has two relays to control the movement Up/Down.

These relays are 2 position and 2 circuit switches (double pole double throw). Each circuit supports 5A at 220V.

One of the two circuits of each relay is already wired and attached to this connector in accordance with the following drawing:



Throughout this manual, the 6 terminals of this connector will be referred to as:

- J1-1, J1-2, J1-3, J1-4, J1-5 and J1-6.

In de-energized position, J1-2 is switched to J1-3. When it's powered (Up), J1-2 is switched to J1-1.
In de-energized position, J1-5 is switched to J1-6. When it's powered (Down), J1-5 is switched to J1-4.

2.2 Connector J2: Power input

The RCI Board must be powered by 12 VDC.

- Pay Attention to the polarity

J2-1 is the negative terminal and
J2-2 is the positive terminal.

Installation Guide

Create RC5x-3P

This computer-compatible antenna rotator provides as standard a computer output for the RCI Board.
You need to set switch S3 (located on the rear panel of the Create Indicator Control Unit) in its lower position. This way every control will be made through connector J1 on the rear panel.
To connect the CREATE to the RCI unit, you must wire it as follows:

J1 - Relay Connector
J1-1: not used
J1-2: to pin 2 of J1 on the RC5x-3P (CW)
J1-3: to connector case, for grounding at J1 on the RC5x-3P

J1-7: not used
J1-8: to pin 5 of J1 on the RC5x-3P (CCW)
J1-9: to connector case, for grounding at J1 on the RC5x-3P

J3 - A/D input
J3-1: to connector case, for grounding at J1 on the RC5x-3P
J3-2: to pin 1 of J1 on the RC5x-3P (positioning Input pin)

J2 – Power supply (note*)
J3-1: to connector case, for grounding at J1 on the RC5x-3P
J3-2: to pin 4 of J1 on the RC5x-3P (DC Power Supply Output)

*** NOTE**: I have not tested the DC Power Supply Output. This output must supply 12V-16VDC to work properly with the RCI Unit.

Create RC5-1

Between TB1-6 and TB1-4 there is around 14V. When the Antenna is at its CCW limit (Left) the voltage at TB1-5 = 0 Volts and when the antenna is located at its CW Limit (Right) this voltage will be around 14V. So TB1-5 is the Voltage reference that will be connected to the RCI Board J3-2 (ADC input). By means of Potentiometer P1 located on the RCI you must adjust until the ADC = 254 or 255 (using the Software Calibration set up) or by means of a Voltmeter located at U2 pin 2 (ADC input – adjust for 5V). TB1-4 is the ground reference so it will be connected to J3-1.
Switch S2 (CW and CCW movements) is a double circuit but only S2A is operational:

Pins S2-1, S2-2, S2-3

Those points will be connected to the relays located on the RCI Board.

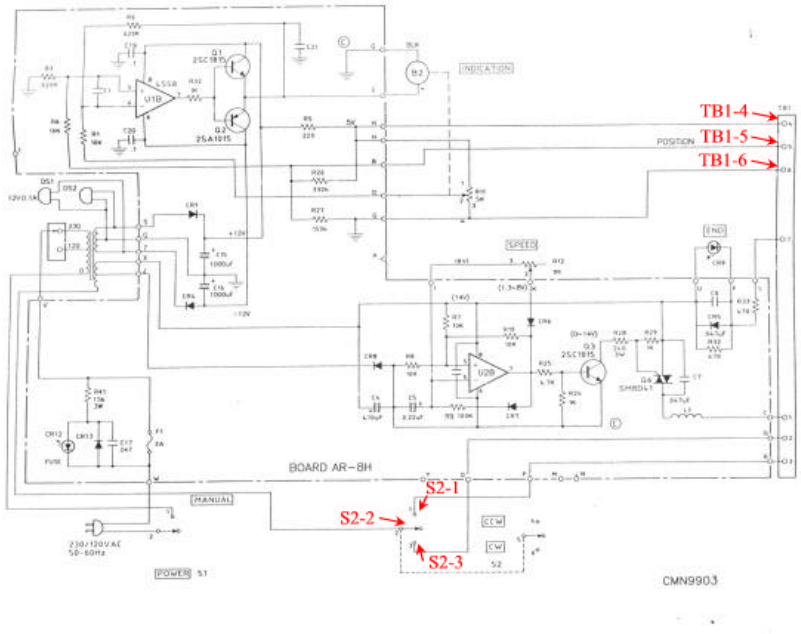


Figure 6-2. RC5-1 Indicator Control, Schematic Diagram

J1 - Relay Connector

J1-1: not used
J1-2: switch S2 Pin 2
J1-3: switch S2 Pin 3 (CW)
J1-7: not used
J1-8: switch S2 Pin 2
J1-9: switch S2 Pin 1 (CCW)

J3 - A/D input

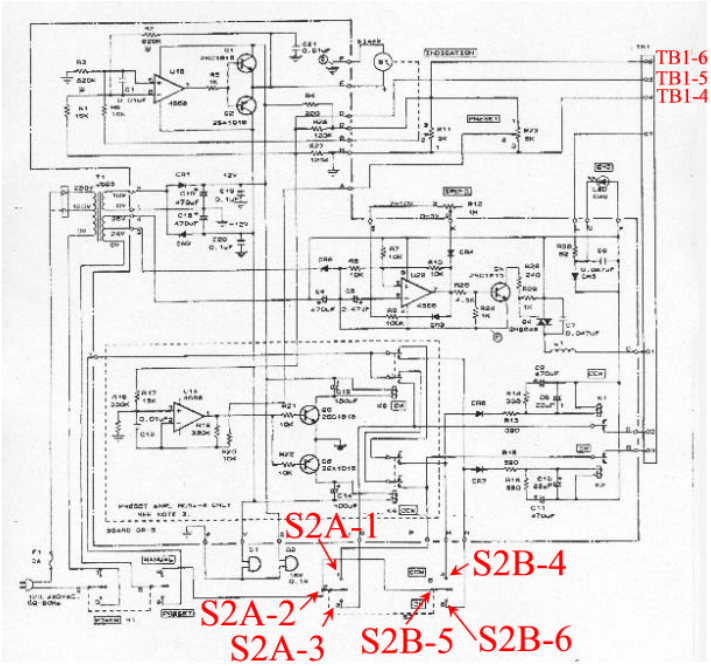
J3-1: TB1-6
J3-2: TB1-5

Create RC5-x series

Between TB1-6 and TB1-4 there is around 9.8V. When the Antenna is at its CCW limit (Left) the voltage at TB1-5 = 0 Volts and when the antenna is located at its CW Limit (Right) this voltage will be around 9.8V. So TB1-5 is the Voltage reference that will be connected to the RCI Board J3-2 (ADC input). By means of Potentiometer P1 located on the RCI you must adjust until the ADC = 254 or 255 (using the Software Calibration set up) or by means of a Voltmeter located at U2 pin 2 (ADC input – adjust for 5V). TB1-4 is the ground reference so it will be connected to J3-1.
The switch S2 (CW and CCW movements) is a double circuit:

Pins S2A-1, S2A-2, S2A-3 and S2B-4, S2B-5, S2B-6

Those points will be connected to the relays located at the RCI Board.



J1 - Relay Connector

J1-1: not used	J1-7: not used
J1-2: S2B-5	J1-8: S2B-5
J1-3: S2B-6	J1-9: S2B-4

B-C & H-I Terminals

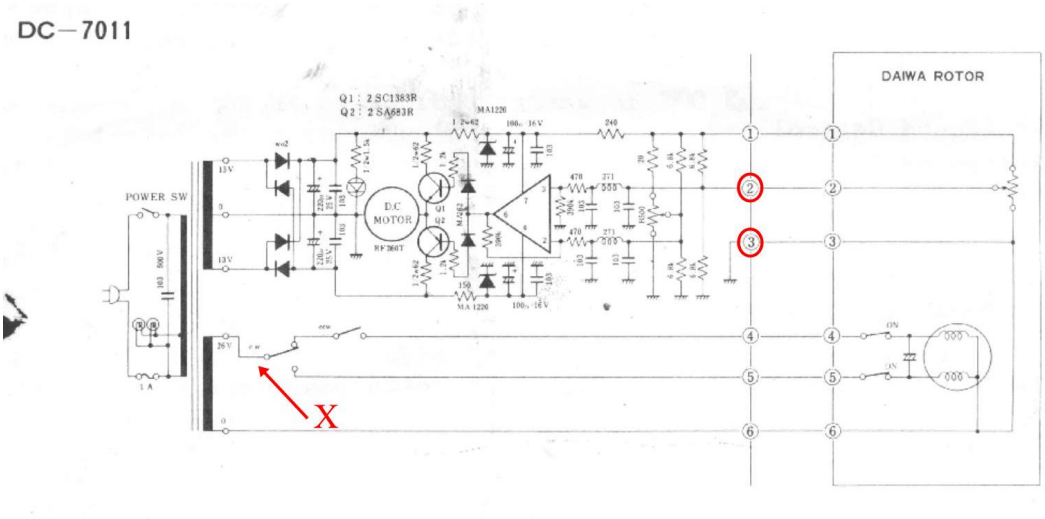
A: not used	G: not used
B: S2A-2	H: S2A-2
C: S2A-1	I: S2A-3

J3 - A/D input

J3-1: TB1-4
J3-2: TB1-5

Daiwa DR7500R/X & DR7600R/X

Both rotors have a similar wiring and connection.



From the point marked X you will get 24-26V provided by the transformer. This will go to terminals J1-3 and J1-9. This voltage will be applied to the rotator when you want to turn the antenna from the ARS.
Because the voltage at point 2 (in the diagram above you can see that this point belongs to the arm of the potentiometer) is slightly greater than the 5V needed by the RCI to work properly, attenuate the input signal by means of P1 until you get 5V at U2 pin 2.

The complete wiring is as follows:

J1 - Relay Connector
J1-1: not used
J1-2: to point 5-5'
J1-3: to point X

J1-7: not used
J1-8: to point 4-4'
J1-9: to point X

J3 - A/D input
J3-1: to point 3
J3-2: to point 2

Emoto 1200 FXX

This unit includes a DIN-5 socket connector that provides all features for connection to the RCI Board.

Pin 1 is a Data output. Output is a voltage that changes with antenna position. This pin will be wired into the RCI Azimuth Input: J3-2.

Pin 2 is the Right Control. When this pin is connected to ground, the rotator will turn towards the Right direction.

The External Shield of this connector is the Ground Reference. This point will be named in this guide as "**Gnd"**

Note: Pin 4 is +8Vcc, 0.35A. This is not a good power supply for the RCI Board. The RCI Board must be powered by +12V.

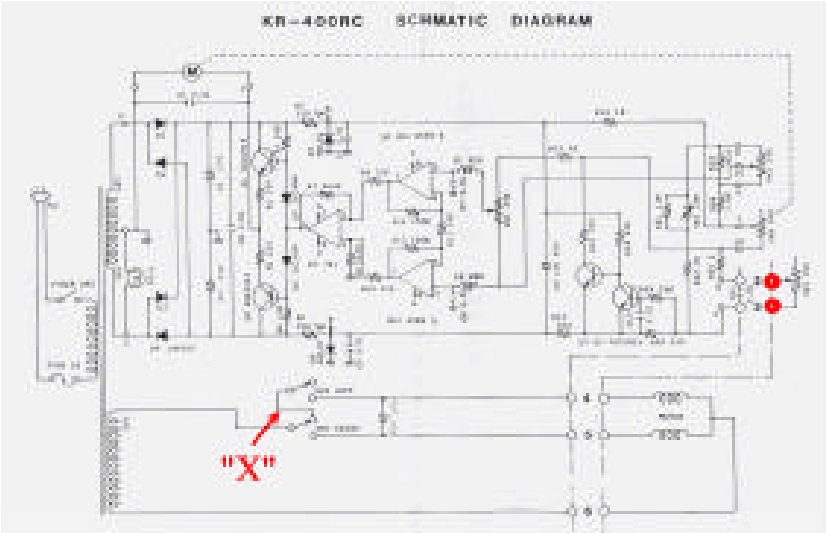
J1 - Relay Connector

J1-1: not used	J1-7: not used
J1-2: Gnd	J1-8: Gnd
J1-3: Pin 2	J1-9: Pin 5

J3 - A/D input

J3-1: Gnd
J3-2: Pin 1

Kenpro KR-400RC



From the point marked X you will get the 24-26V provided by the transformer. This voltage will be applied to the rotator when you want to turn the antenna from the ARS.
Because the voltage at point 2 (in the diagram above you can see that this point belongs to the arm of the potentiometer) is slightly greater than the 5V needed by the RCI to work properly, attenuate the input signal by means of P1 until you get 5V at U2 pin 2.

The complete wiring is as follows:

J1 - Relay Connector
J1-1: not used
J1-2: to point 5-5'
J1-3: to point X

J1-7: not used
J1-8: to point 4-4'
J1-9: to point X

J3 - A/D input
J3-1: to point 3
J3-2: to point 2

Kenpro KR-450XL & KR-650XL

These units will be wired exactly like the KR-400RC Units.

The complete wiring is as follows:

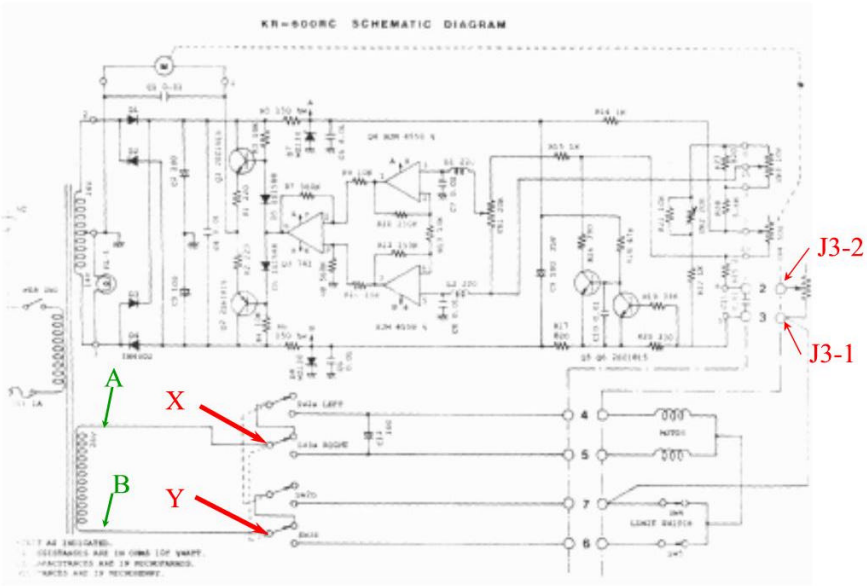
J1 - Relay Connector
J1-1: not used
J1-2: to point 5-5'
J1-3: to point X

J1-7: not used
J1-8: to point 4-4'
J1-9: to point X

J3 - A/D input
J3-1: to point 3
J3-2: to point 2

Kenpro KR-600RC

This rotator provides -3.6V at its 360° position and in addition to switching 24V for turning to right or to left, it also switches the ground as shown in the following diagram:



When a direction switch is pressed, it switches two circuits: the +24V circuit (X switch) and the rotator ground (Y switch).
The complete wiring between J1, J3 and the control unit, numbered from 2 to 7, has to be made in the following way:
Points 2, 3, 4, 5, 6 and 7 belong to the control unit terminals and points 2', 3', 4', 5', 6' and 7' belong to the cable attached to the rotator. Point X is the 24V transformer positive terminal and point Y is the negative terminal.

J1 - Relay Connector

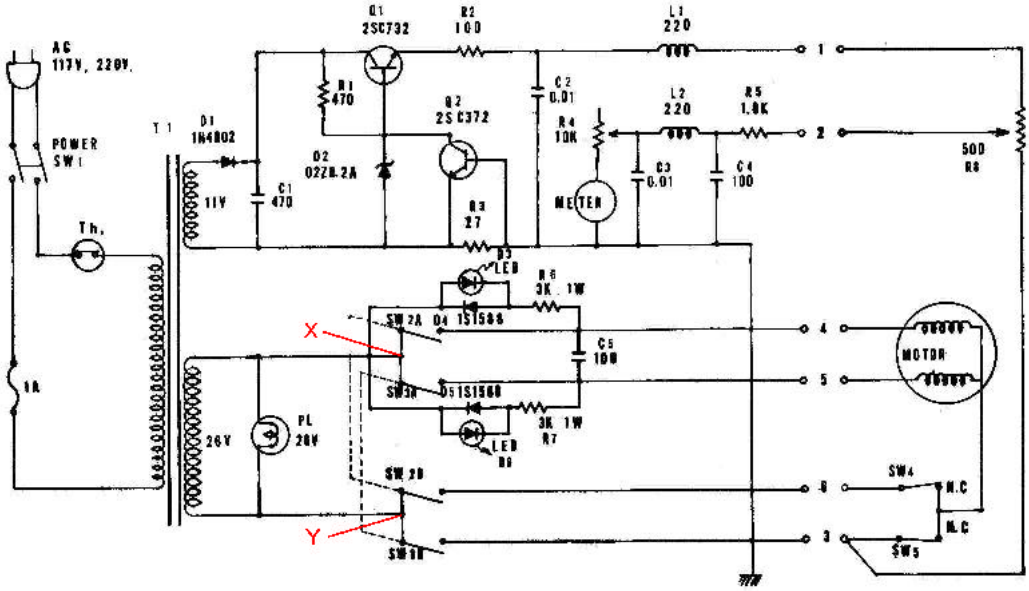
J1-1: not used	A: not used
J1-2: to point 5-5'	B: to point 7-7'
J1-3: to point X	C: to point Y
J1-7: not used	G: not used
J1-8: to point 4-4'	H: to point 6-6'
J1-9: to point X	I: to point Y

J3 - A/D input

J3-1: to point 3-3'
J3-2: to point 2-2'

Kenpro KR-600S

This rotator provides 6V at its 360° position and in addition to switching 24V for turning to right or to left, it also switches the ground as shown in the following diagram:



When the direction switch is pressed, it switches two circuits: the +26V circuit and the rotator ground.
The complete wiring between J1 (relays), J3 (antenna position) and the control unit, numbered from 1 to 6, has to be made in the following way: Points 1, 2, 3, 4, 5 and 6 belong to the control unit terminals and points 1', 2', 3', 4', 5' and 6' belong to the cable attached to the rotator. Point X is the 24V transformer positive terminal and point Y is the negative terminal.

J1 - Relay Connector

J1-1: not used
J1-2: to point 5-5' (CW)
J1-3: to point X
J1-7: not used
J1-8: to point 4-4' (CCW)
J1-9: to point X

G: not used
H: to point 3-3'
I: to point Y
A: not used
B: to point 6-6'
C: to point Y

J3 - A/D input

J3-1: to point 3-3'
J3-2: to point 2-2'

Kenpro KR-800 & KR-1000

These two rotators have the same circuit and the same wiring. The existing voltage between points 1 and 3 (potentiometer's terminals) is approximately 3.6V, therefore when the antenna is fully turned clockwise the same voltage appears at point 2-2'.

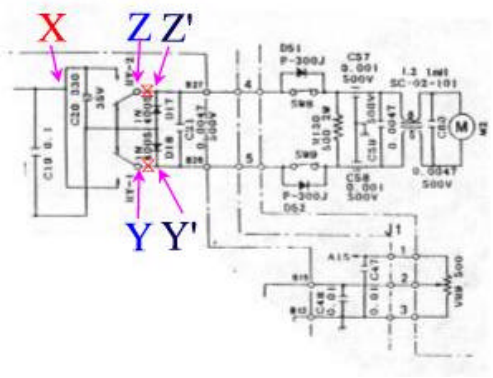


Fig 1

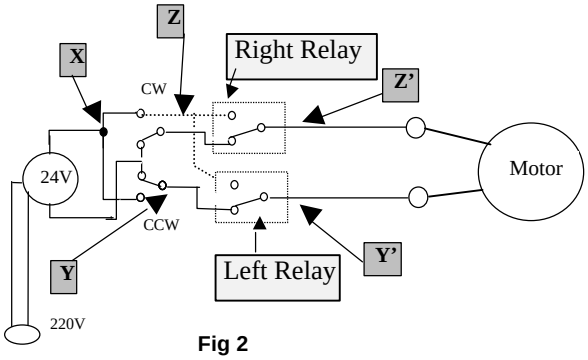
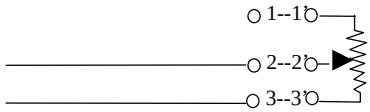


Fig 2



J1 - Relay Connector

J1-1: to point Z
J1-2: to point Z'
J1-3: to point X
J1-7: to point Y
J1-8: to point Y'
J1-9: to point X

J3 - A/D input

J3-1: to point 3-3'
J3-2: to point 2-2'

Notice the points marked as X, Y, Y' and Z, Z' in the figure.
X is the point where we'll get the +Voltage for activation of the Motor.
It's not necessary to get the –Voltage from the board, because when the CW (Right) or CCW (Left) keys are not pressed, those switches are grounded.
Y is the central position of the Left Switch (RY-1). Y' is the cable connected to this central switch (Y)
We should disconnect this Y' cable from Y and connect them through the RCI relays as Fig 2 shows.
Z and Z' are similar to Y with the Right switch (CW)
We must disconnect the cable Y' from the central switch at Y and reconnect them thought the RCI Relays.

Procedure:

This model has a special feature. Because it works under DC (direct current) it cannot be wired the same as similar models. Unsolder the common wire from each direction switch (turn to right and to left), marked in the diagram above as Z and Y. Respectively attach them to J1-1 and J1-7 (doing this allows normal operation of the control unit when you do not use the ARS). The terminals J1-2 and J1-8 from the Relay connector (J1) will be attached where you remove the two wires, that is to say, Z' and Y' respectively. 24V will be applied to terminals J1-3 and J1-9 (get it from point X) and they will be used to turn the antenna when the RCI circuit is made active.

Kenpro KR-5400 & KR-5600

These models are similar to the Yaesu G-5400 & G-5600. So read that section and proceed as described.

Pro.Sis.Tel Models

All Pro Sis Tel models can be connected in the same way. You will need the Control Box “B” model. This control box includes a DB-9 connector with all signals necessary to read the Pot feedback and the movement activations.

The complete wiring is as follows:

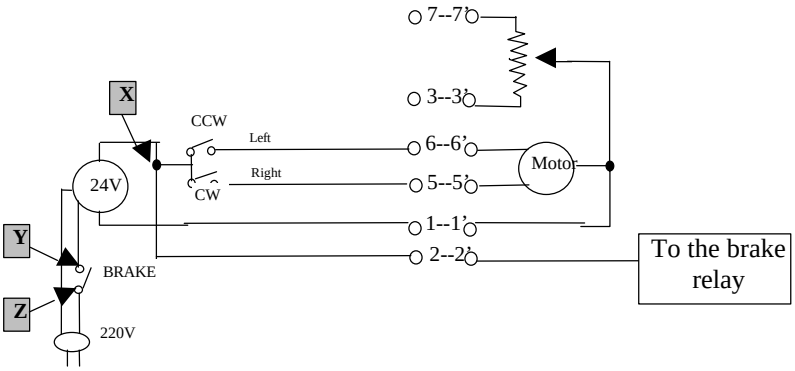
J1 - Relay Connector
J1-1: not used
J1-2: to pin 8 of the DB9 Connector (CW)
J1-3: to pin 6 of the DB9 Connector (Ground)

J1-7: not used
J1-8: to pin 9 of the DB9 Connector (CCW)
J1-9: to pin 6 of the DB9 Connector (Ground)

J3 - A/D input
J3-1: to pin 6 of the DB9 Connector (Ground)
J3-2: to pin 7 of the DB9 Connector

Telex/Hy-Gain HAM IV

The HAM IV rotator is equipped with a mechanical brake, controlled by means of a solenoid when the brake switch is pressed. The 24V that powers the motor to turn right or left only appears at the direction switches when the brake switch is pressed (points Y-Z). In fact, the brake switch closes the primary circuit of the transformer, providing the 24V used not only to make the brake relay active, but also to provide voltage to the direction switches (point X).
To read the antenna position, the HAM IV has a voltmeter that reads 13V when the antenna is turned fully clockwise. The voltmeter is calibrated in degrees in order to make it easy to read. Set the potentiometer P1 as well as the jumper JMP1 (it must be set between pins 1-2), before installing the RCI because the input signal has to be attenuated to work with the A/D converter of the RCI.
The RCI can be installed either inside the control unit or outside. If you install it inside you do not need to attach additional cables to the control unit, except the power cable and the DB25 that connects the RCI to the parallel port of your PC. This is always an advantage! You can also install the LED's on the front panel, making the set up much more ergonomic and attractive.



J1 - Relay Connector

J1-1: not used	J1-7 not used	J1-4: not used
J1-2: to point 5-5	J1-8: to point 6-6'	J1-5: to point Y
J1-3: to point X	J1-9: to point X	J1-6: to point Z

J3 - A/D input

J3-1: to point 1-1'
J3-2: to point 3-3'

Telex/Hy-Gain T^{2}X

The T^{2}X has the same circuit and control unit as the HAMIV. This means the wiring will be made in the same way. The diagram below shows the T^{2}X circuit diagram. Just observe that the points marked as 1, 2, 3, 4, 5, 6, 7, 8 belong to the control unit terminals and those marked as 1', 2', 3', 4', 5', 6', 7', 8' belong to the cable attached to the rotator.

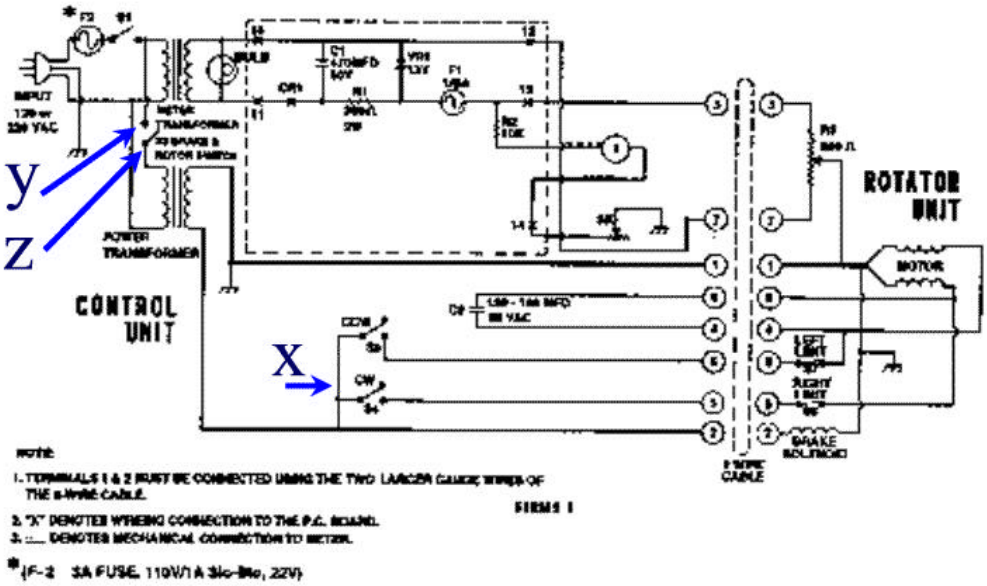


Figure 9
Wiring Schematic

J1 - Relay Connector

J1-1: not used
J1-2: to point 5-5'
J1-3: to point X
J1-4: not used
J1-5: to point Y
J1-6: to point Z
J1-7: not used
J1-8: to point 6-6'
J1-9: to point X

J3 - A/D input

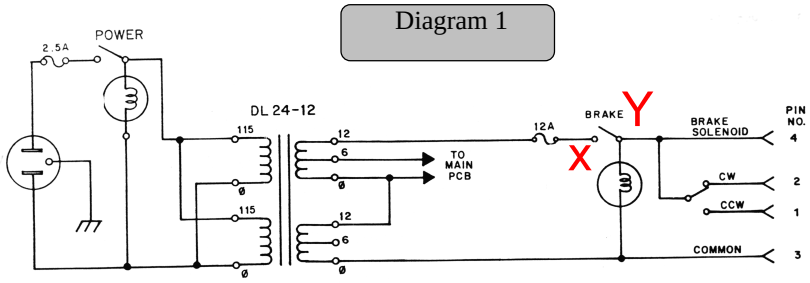
J3-1: to point 1-1'
J3-2: to point 3-3'

The points marked Y and Z are taken from the brake switch. In case of doubt, see the HAM IV circuit diagram.

Telex/Hy-gain HDR-300

This high performance rotator is equipped with a mechanical brake. When the brake switch is pressed, 24V appears at terminal 4, which is connected to the solenoid. You have to bring out two additional wires from inside the control unit, taken from the points marked X and Y, so that the RCI can control the brake. Both wires will be attached to the Auxiliary relay (the middle relay) on the RCI through J1-5 and J1-6. Order is not important. When the ARS needs to make the rotator turn, it will perform two simultaneous operations: it will make the solenoid active and it will get 24V at terminal 4, which will be used to turn right or left by means of the direction relays.

Diagram 1



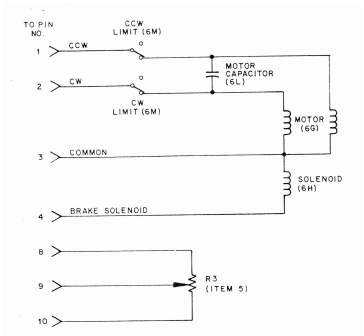


Diagram 2

Because this rotator has an internal A/D converter, the 5V needed by the RCI is already present at the potentiometer. But you should check the adjustment of P1 to be sure you get 5V at U2 pin 2 when the antenna is turned fully to the right (CW).

J1 - Relay Connector

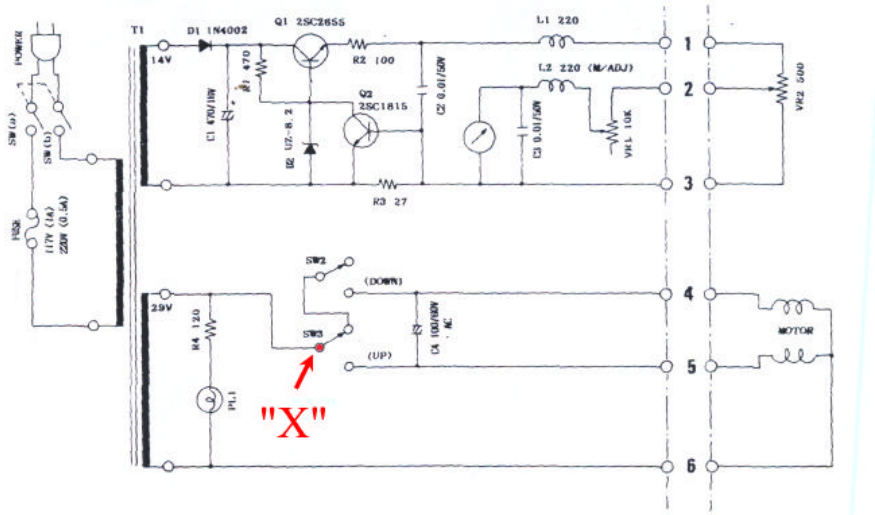
J1-1 not used	J1-7: not used	J1-4: not used
J1-2: to Pin-2 (CW)	J1-8: to Pin-1 (CCW)	J1-5: to point **X**
J1-3: to point Y or Pin-4	J1-9: to point Y or Pin-4	J1-6: to point **Y**

J3 - A/D input

J3-1: to point 10 (in parallel with the factory wires)
J3-2: to point 9 (in parallel with the factory wires)

Yaesu G-400

This model works with approximately 6.3V at the ends of the potentiometer (between points 1 and 3 in accordance with the diagram below). At the arm of the potentiometer you will get 0 and 6.3V for the counter clockwise and clockwise positions, respectively. Because there is no brake, the Aux. relay is not used.



From the point marked X you will get the 24-26V provided by the transformer to connect to terminals J1-3 and J1-9. This voltage will be applied to the rotator when you want to turn the antenna from the ARS.
Because the voltage at point 2 (the arm of the potentiometer) is slightly greater than the 5V needed by the RCI to work properly, attenuate the input signal by means of P1 until you get 5V at U2 pin 2.

The complete wiring is as follows:

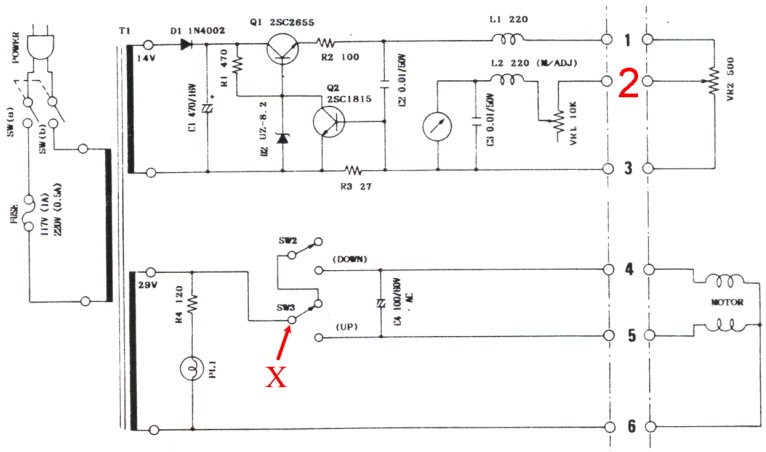
J1 - Relay Connector
J1-1: not used
J1-2: to point 5-5'
J1-3: to point X

J1-7: not used
J1-8: to point 4-4'
J1-9: to point X

J3 - A/D input
J3-1: to point 3
J3-2: to point 2

Yaesu G-500 & G-500A

This elevation rotator works similar to the G400. However, the relay connectors will be connected to the daughter board: RCI-EL



From the point marked X you will get the 24-26V provided by the transformer to connect to terminals J1-1 and J1-4 on the RCI-EL. This voltage will be applied to the rotator when you want to turn the antenna Up/Down from the ARS.
The position is displayed by means of the Voltage that is read from Pin 2. This voltage will be applied to the ADC input on the RCI-EL.

The complete wiring is as follows:

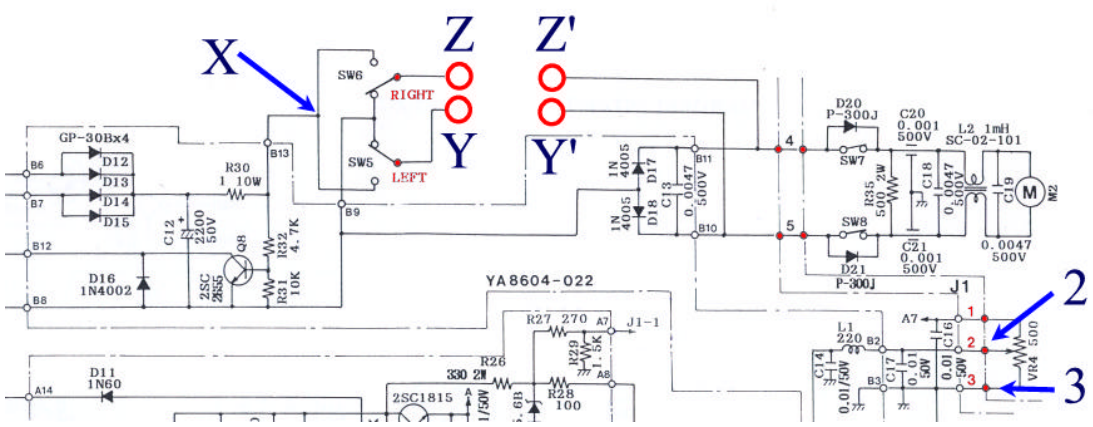
J1 - Relay Connector at RCI-EL Board
J1-1: to point X
J1-2: to point 5-5'
J1-3: not used

J1-4: to point X
J1-5: to point 4-4'
J1-6: not used

J4 - A/D input
J4-1: to point 3
J4-2: to point 2

Yaesu G-800S & G-1000S

These two rotators have the same circuit and the same wiring. The Pot feedback voltage between points 1 and 3 (potentiometer's terminals) is approximately 3.6V.



J1 - Relay Connector

J1-1: to point **Z** J1-7: to point **Y**
J1-2: to point **Z'** J1-8: to point **Y'**
J1-3: to point **X** J1-9: to point **X**

J3 - A/D input

J3-1: to point **3**
J3-2: to point **2**

You must unsolder each direction control wire and then attach those wires to J1-2 and J1-8 respectively. Then connect J1-1 and J1-7 to the place you removed the controller wires. Finally you must connect the +Vdc (point X) to J1-3 and J1-9.

To read the antenna position, 2 wires will be connected to point 2 (+V) and to point 3 (Ground), located on the back panel of the Control Unit.

Yaesu G-800SDX & G-1000SDX

Those two models have the advantage that it is not necessary to open the Control Unit. On the back panel they have a special connector with 8 pins.

The connection is as follows:

SDX series	RCI Board
Pin 1	J1-2 (right movement)
Pin 2	J1-8 (left movement)
Pin 5	J1-3 (ground)
Pin 5	J1-9 (ground)
Pin 4	J3-2 (Position Potentiometer)
Pin 5	J3-1 (ground)
Pin 8	+5V

NOTE 1:
The original Control Unit presents 5V at pin 8. I suggest replacing the 78L05 with a 7812 so the RCI Board can be powered directly form this terminal.

NOTE 2:
Kenpro **SDX** Series rotators have a similar connector called XHP-8. These instructions are also valid for that rotator.

NOTE 3:
Some users have detected that their SDX units must be wired backwards.
Instead of:

- Pin1 => J1-2
- Pin2 => J1-8

It should be:

- Pin1 => J1-8
- Pin2 => J1-2

Yaesu G-800DXA, G-1000DXA & G-2800DXA

These models include a mini-DIN connector with the following pin assignments:

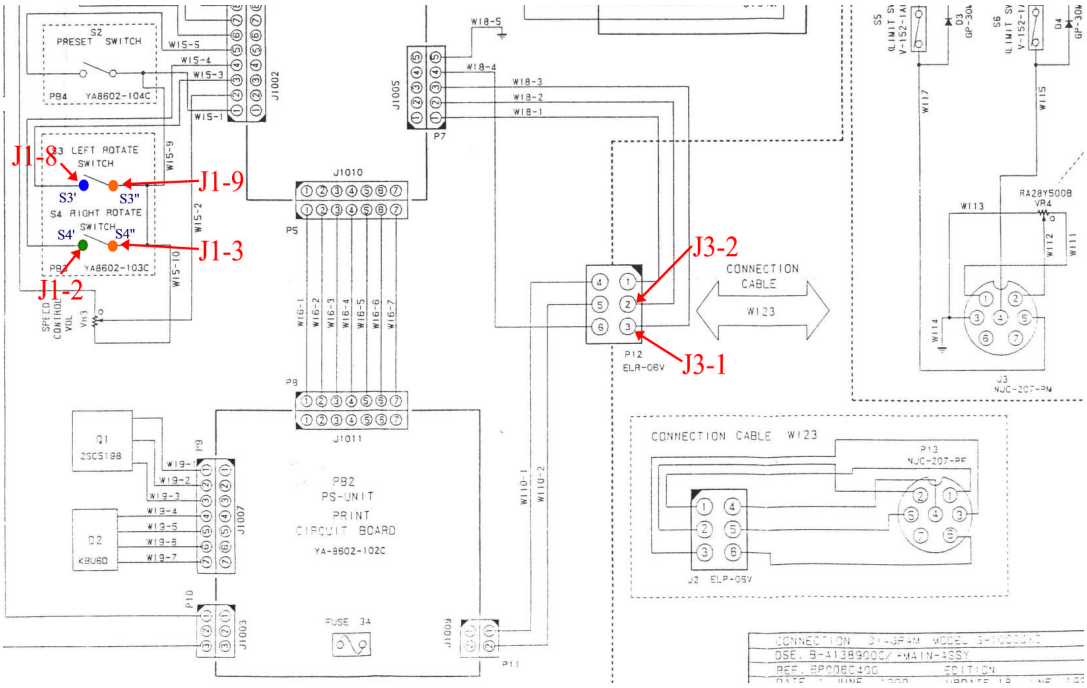
Mini-DIN	Meaning
Pin 1:	Right movement (CW)
Pin 2:	Left movement (CCW)
Pin 3:	Speed Control
Pin 4:	A/D or Potentiometer feedback
Pin 5:	Earth or Ground
Pin 6:	Vd
Pin 7:	Earth or Ground

The connection is as follows:

DXA series	RCI Board
Pin 1	J1-2 (right movement)
Pin 2	J1-8 (left movement)
Pin 5	J1-3 (ground)
Pin 5	J1-9 (ground)
Pin 4	J3-2 (Position Potentiometer)
Pin 5	J3-1 (ground)

Yaesu G-1000DXC

This rotator must be wired as follows:



J1 - Relay Connector

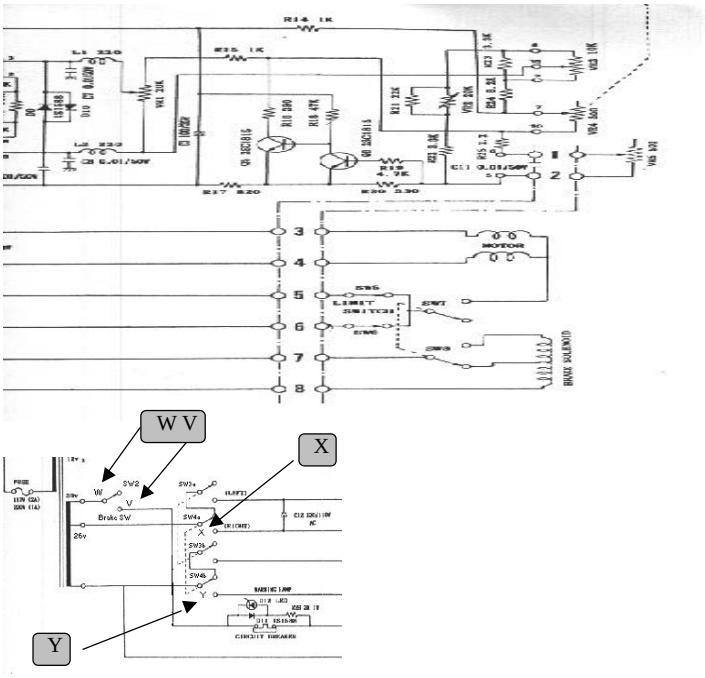
J1-1: not used J1-7: not used
J1-2: to S4' J1-8: to S3'
J1-3: to S4'' J1-9: to S3''

J3 - A/D input

J3-1: to point **3 of connector P12**
J3-2: to point **2 of connector P12**

Yaesu G-2000RC

The G-2000 provides -3.24V (negative) between terminals 1 and 2 of the control unit when the antenna is turned fully clockwise. This means it is necessary to invert this voltage by means of JMP1, by placing a jumper between pins 2-3. Also, because this voltage is less than 5V, adjust P1 until you get 5V at U2 pin 2. This rotator also incorporates a solenoid that is used as a mechanical brake, so you have to extend the wires from the brake switch (SW2) to the Auxiliary relay, passing them through J1-5 and J1-6. The direction switches SW3 (a-b) and SW4 (a-b) are a two circuit type. Therefore the main circuit (J1-1, J1-2, J1-3; J1-7, J1-8, J1-9) and the auxiliary circuit (A, B, C and G, H, I) of the RCI relays will be used.



The complete wiring is as follows:

J1 - Relay Connector (*)

J1-1: to point 4	J1-7: to point 3	J1-4: not used
J1-2: to point 4'	J1-8: to point 3'	J1-5: to point W (a SW2 terminal)
J1-3: to point X	J1-9: to point X	J1-6: to point V (the other SW2 terminal)
A: to point 5	G: to point 6	
B: to point 5'	H: to point 6'	
C: to point Y	G: to point Y	

J3 - A/D Input

J3-1: to point 3-3'
J3-2: to point 2-2'

*** NOTE:** The points marked 3, 4, 5 and 6 belong to the control unit terminals and the points marked with the apostrophe symbol (') (e.g. 3', 4') belong to the cable attached to the rotator.

Yaesu G-5400 & G-5600

Both models, including the G-5500 or the Kenpro variant, have a DIN-8 connector in the back panel that allows interfacing it to the RCI/RCI-EL Board.

The DIN-8 connector has the following pin assignments and their connection to the RCI board is as follows:

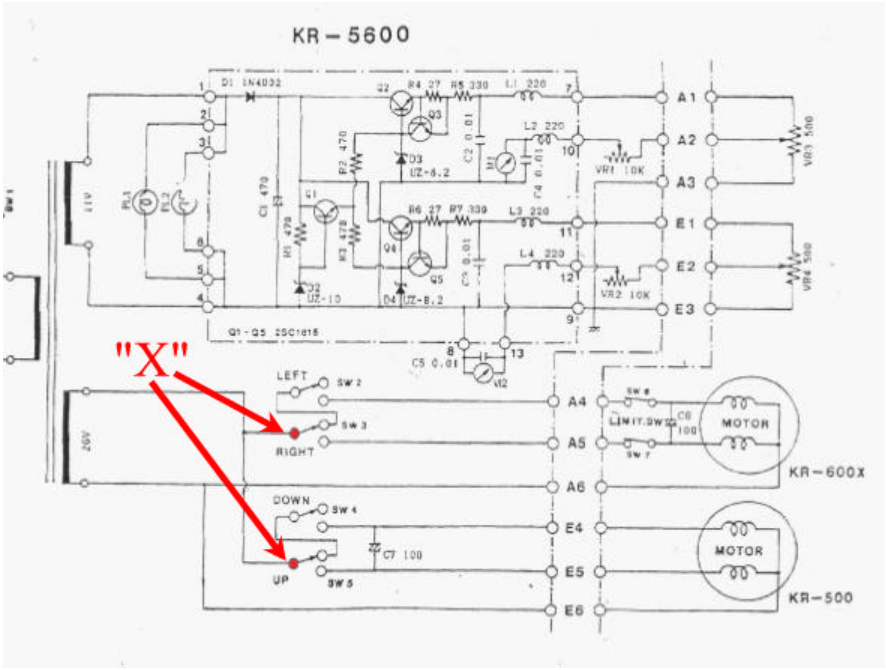
Pin Nr:	Function/Meaning	RCI/RCI-EL connection
1	Elevation position detector	J4-2 (RCI Board)
6	Azimuth position detector	J3-2 (RCI Board)
4	Left turn control	J1-9 (RCI Board)
2	Right turn control	J1-3 (RCI Board)
3	Up turn control	J1-2 (RCI-EL Board))
5	Down turn control	J1-5 (RCI-EL Board))
8	Ground	J1-8 & J1-2 (RCI B.)) + J3-1 & J4-1 (RCI B.) + J1-1 & J1-4 (RCI-EL)
7	This pin has 6 to 13V (not regulated) with a maximum current of 100mA. It is not used by the RCI Board.	

Pin 8 of the DIN-8 connector is the ground reference. So this pin will be connected to the ADC ground input (J3-1 & J4-1 on the RCI Board) and to J1-8 and J1-2 on the RCI Board (Azimuth movements) and to J1-1 & J1-4 on the elevation board (RCI-EL).

Since this Control Unit has several potentiometers that allow calibration of those inputs, fine tuning will be done by those Pots instead of the ones located on the RCI Board.

Yaesu G-5400 & G-5600 w/o DIN connector

The Yaesu or Kenpro 5400/5600 rotators without the DIN connector on the back panel of the Control Unit are wired similar to the G400 and G500. So it's necessary to read the guide for those models.
Note that the Control Unit has A1 through A6, and E1 through E6.
"A" means Azimuth and **"E"** means Elevation rotator



J1 - Relay Connector (Main Board)
J1-1: not used
J1-2: to point A5
J1-3: to point X

J1-7: not used
J1-8: to point A4
J1-9: to point X

J3 - A/D input
J3-1: to point A3
J3-2: to point A2

J1 - Relay Connector (RCI-EL Board)
J1-1: to point X
J1-2: to point E5
J1-3: not used

J1-4: to point X
J1-5: to point E4
J1-6: not used

J4 - A/D input
J4-1: to point E3
J4-2: to point E2

Yaesu G-5500

This model has the same wiring and connection as the Yaesu G5400 or G5600. So read that section and proceed accordingly.

Troubleshooting

1.- “ON LED” does not light.

- Verify that your power supply provides 12V and check the connection to J2.
- Check and/or change the LED.
- Check and/or change the 7805 voltage regulator (U3).

2.- The RCI has power, the ON LED lights but it does not read the antenna position and the relays do not operate.

- Verify that the DB25 cable is correctly attached between the RCI Board and the computer.
- You are using an incorrectly wired cable. Some wire is missing or inverted.
- Verify that the parallel port address indicated in Setup is correct.
- Enter into your computer’s BIOS Setup, and verify that the LPT Port is:
    - Enabled and configured as 0x378 or 0x278
    - Configured as Standard parallel Port

3.- Beam direction seems to work but the relays do not operate.

- Verify that the DB25 cable is correctly attached between the RCI Board and the computer.
- You are using an incorrectly wired cable. Some wire is missing or inverted.
- U5 failure.
- Power supply provides less than 12V.

4.- The relays are operating properly but the beam direction is wrong and when it’s calibrated the “A/D converter” is always 0.

- Verify that the Pot feedback is correctly attached to J3 (polarity).
- To eliminate any problem in the wiring between the RCI and the rotator, check to see if you get any voltage on JMP1 pin 2.
- Verify that a jumper is placed between pins 1-2 or 2-3 on JMP1 in accordance with the V value of the rotator.

5.- Difference between the ARS reading and the control unit reading.

- Readjust P1.
- Possible failure of operational amplifier U4 or A/D converter U2.
- Possible failure of diodes D4, D5.

6.- Although the rotator reaches its full clockwise position, this point is not reached in the ARS.

- Run SETUP and calibrate the ARS.
- Adjust P1 (or P2 if it is an elevation rotator) properly.

7.- Reading changes in the ARS when transmitting and the rotator stops.

- Radio frequency interference problem (RFI). Insert a 0.01?F capacitor at the RCI input, between terminals J3-1 and J3-2.

Specifications

J1: RELAY CONNECTOR

Relays: 2 circuits, 5A at 220V.

J2: POWER CONNECTOR

Input voltage:	12-14V
Power consumption (Standby):	<60mA.
Power consumption with relays activated:	<200mA.

J3 and J4 INPUTS

J3 is the azimuth rotator feedback input. It is adjusted by means of P1.
JMP1 selects either positive or negative voltage.
J4 is the elevation rotator feedback input. It is adjusted by means of P2.
JMP2 selects either positive or negative voltage.

Input signals between +/-3 to +/-24V can be regulated by means of P1 or P2.
.

DB-25 CONNECTOR:

Pins used: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,16,17,25 (Ground)

The parallel port of your PC has to be connected pin to pin with this connector by means of a male-male DB25 cable. If the cable has all 25 wires connected, this does not affect the normal operation of the RC interface.

CIRCUIT DIMENSIONS

12,5cm x 8cm x 3,5cm	(Deep, Wide, High)
4.7inches x 3.1inches x 1.3inches	(Deep, Wide, High)

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