



# M2 Antenna Systems, Inc.

## Model No: RC2800PRKX2SU



### SPECIFICATIONS

MODEL NUMBER .....	RC2800PRKX2SUMC
POWER REQUIREMENTS.....	115 / 230 VAC @ 6.7A / 5.0
ENCLOSURE SIZE .....	W=19" / H=5.25" / D=10"
COLOR.....	Clear Anodized / Black & Rear Black Anodized
POINTING ACCURACY.....	<0.3°
READOUT ACCURACY .....	<0.1°
MINIMUM COMMANDED MOTION .....	>0.25°
DIGIT SIZE.....	0.5" Heading / .375" Mode / Speed
CONTROL SWITCHES.....	Tactile 0.5" Diameter
MICROPROCESSOR TYPE.....	"Microchip" PIC18F2520-I/SP
CONTROLS .....	Power Switch, ON / OFF Speed Buttons, Increments 1-9 Clockwise & Counterclockwise Buttons Up & Down Mode Buttons
MODES .....	(3) Operational Run Modes / (10) Presets
STANDARD OUTPUT VOLTAGE .....	AZ / EL = 48 VDC 6.7 AMP
COMPUTER INTERFACE .....	RS232 (X2) or USB (X2)

### FEATURES

The **M2 RC2800PRKX2SUMC** is our Mid Grade rack-mount controller. The **RC2800PRKX2SUMC** was developed for "Commercial Grade" AZ/EL Pedestal Models (AE1000, AE1000CB and AE1000CBW)\*Also available for a (3) Axis System.

The **M2 RC2800PRKX2SUMC** uses a Microchip PIC18F2520-I/SP for Micro processing user commands, M2 software and EEprom for memory. User modes include: (3) Operational / Run Modes and (10) programmable presets.

The **M2 RC2800PRKX2SUMC** uses a Meanwell switching power supply so 115VAC or 230VAC can be used for the main power input with no switching needed.

The **M2 RC2800PRKX2SUMC** uses **PWM** (Pulse Width Modulation) for speed control, allowing for full torque at the slowest input speed. Location heading from the motor assembly is supplied via an Open Loop Circuit to the controllers' microprocessor.

The **M2 RC2800PRKX2SUMC** software was developed for a commercial customer. A full **GUI** software for setup and run modes and a Interface Control Document (**ICD**) is supplied with the **RC2800PRKX2SUMC**.

Computer interface to the **RC2800PRKX2SU** is via (2) individual RS232 ports or as an option (2) USB ports.

Controller Overview

Connections / Start UP

Advanced Operations

Trouble Shooting

# FRONT PANEL CONTROL OVERVIEW



## ON/OFF (POWER)

This button controls AC power to the control unit.

## DIGITAL DISPLAY & DIGITS

#1: (full left) shows the selected **MODE** for operation or programming.

#2: Indicates the Positioner travel **SPEED** in relative numbers from 0 to 9.

#3: Indicates an “. Or -” for a limit zone or a digit when programming in a high gear ratio.

#4,5,6,7: Indicates **HEADINGS**, Azimuth / Elevation / Polarity, in degrees and programming data.

## “MODE” BUTTONS

The **MODE** buttons are used to cycle through and select among (5) operational or **RUN** modes and 10 **PRESETS**. See **RUN MODES** and **PROGRAM MODE** details following this section.

## “SPEED” BUTTONS

The **SPEED** buttons control the positioner’s rate of speed in relative increments. “1” is the slowest speed, “9” is the fastest. The top button increases the speed, the lower button decreases the speed. The lowest speed available **DEFAULTS** to “1”, but can be set to any number between “1” and “9” in the supplied M2 Setup Utility Software. Speeds can be altered for travel in any of the run modes.

## “CONTROL” BUTTONS

The “**CW**” and “**CCW**” or “**UP**” or “**DOWN**” buttons, activate the positioners’ direction in **MODE “0”**, **MODE “1”** and **MODE “2”**. These buttons are also used for “**Auto Cal**” and “**Initial Cal Heading.**”

# REAR PANEL OVERVIEW



## “AC IN”

The supplied (3) prong AC cord plugs into this socket. Connect to a reliable 115 or 230 VAC source. The unit is supplied with switching power supplies that operate from 86VAC to 240VAC.

## “MOTOR PROTECTION FUSE”

This fuse provides electrical protection to the positioner. Replace this fuse with a 125VAC 5A fuse.

## “RS232” INTERFACE PORT

This is a standard (9) pin female (DB9) connector for linking to a computer for automated control. **Do not use a null modem cable for this application.**

This particular unit, has (2) individual RS232 ports for separate positioner operations.

## “TERMINAL STRIP”

The (12) position terminal strip, serves as your multi-conductor cable interface to the positioner unit. The cable supplies power and data from the positioner. Your ground connection is terminal #12. **DISCONNECT THE AC POWER CORD WHEN CONNECTING CABLE LEADS.**

## RC2800PRKX2SUMC UNITS WITH HEATER:

If your RC2800PRKX2SUMC control unit has the add on power supply, please see wiring designations on Terminals 6 & 7. The Heater power supply is powered on at all times. \*Note, the heater is thermostatically controlled.

## (12) POSITION TERMINAL STRIP ASSIGNMENTS

TERMINAL NUMBER	FUNCTION	SUGGESTED COLOR	MINIMUM WIRE GAUGE
#1	MOTOR	BLACK	16 AWG
#2	MOTOR	WHITE	16 AWG
#3	(NOT USED)		
#4	(NOT USED)		
#5	(NOT USED)		
#6	HEATER (+) LEAD	RED (IF SUPPLIED)	16 AWG
#7	HEATER (-) LEAD	BLACK (IF SUPPLIED)	16 AWG
#8	(NOT USED)		
#9	(NOT USED)		
#10	REED SWITCH DC +	ORANGE	24 AWG
#11	REED SWITCH RETURN	BLUE	24 AWG
#12	CASE GROUND	BARE	NA

# BASIC OPERATIONS / RUN MODE DESCRIPTIONS

## RUN MODES:

Modes 0, 1 and 2 are all run modes capable of activating the positioner in both the CCW / DWN and CW / UP direction.

### MODE 0 = MANUAL OPERATION MODE:

Pushing the CCW button activates the positioner in the Counter Clockwise direction, and the Heading count will go down. Pushing the CW button activates the positioner in the Clockwise direction, and the Heading count will go up. Pressing the UP button activates a specific positioner in the Upward direction and the Heading count will go up. Pressing the DWN button activates the positioner in the Downward direction and the Heading count will go down. The positioner runs while CCW / DWN or CW / UP button is depressed, ramping up from minimum programmed speed to the maximum (9) and then again ramping down to speed (1). **When reversing direction, there is a 2-3 second delay before the positioner is activated.** This delay reduces stress on your antenna and positioner. ***\*This Mode can also be initiated from the M2 Setup Utility Software. \*See the M2 Setup Utility usage page for more details.***

### NOTE:

Rotation direction, *i.e.*, CCW / DWN or CW / UP is defined as if you are looking down on the positioner / antenna from above.

### MODE 1 = SERVICE / MAINTENANCE MODE:

When the Service / Maintenance Mode is initiated, the controller will not respond to any computer commands. This allows service or maintenance issues to be addressed without the danger of the service technician being injured. While in Mode 1, the controller can be commanded with both the CCW/DWN or CW/UP buttons to put the positioner or positioners' into a stowed position for service or repair. When service is completed, the control unit must be placed back into MODE 0 (from controller panel) for computer commands.

### MODE 2 = PRESET MODE:

Preset mode is another Service / Maintenance oriented mode. When the Preset Mode is initiated, the controller will not respond to any computer commands. Again this allows service or maintenance issues to be addressed without injury. The user can program up to (10) Presets per Axis for use in stowing or rotating the positioner or positioners' to a known heading for service or repair. Preset headings are programmed into the controller with the use of the supplied M2 Setup Utility Software. Once the presets are programmed, the user selects with the CCW / DWN and CW / UP buttons. Motion is initiated to the displayed preset heading after selecting the preset and NOT pressing any button for 3 seconds. When service is completed, the control unit must be placed back into MODE 0 (from controller panel) for computer commands.

## USER DEFINED PRESETS

ELEVATION "PRESET" HEADINGS		AZIMUTH "PRESET" HEADINGS		POLARITY "PRESET" HEADINGS	
20		20		20	
21		21		21	
22		22		22	
23		23		23	
24		24		24	
25		25		25	
26		26		26	
27		27		27	
28		28		28	
29		29		29	

# M2 SETUP UTILITY INSTALLATION & OVERVIEW

## MINIMUM COMPUTER REQUIREMENTS AND HARDWARE:

500 MHz Intel Pentium II or equivalent Computer (Preferably a Laptop)  
256 MB of RAM / 1MB of Disk Space  
Windows 98 / XP / Straight through DB9 RS232 Serial Cable

## INSTALLING THE M2 SETUP UTILITY SOFTWARE:

Insert the CD into your CD-ROM drive. Follow the simple onscreen instructions. The software will walk you through each step of the installation.

Start the M2 Setup Utility by double clicking the desktop Icon. To get familiar with your software take a moment to look over the utility overview.

## M2 SETUP UTILITY OVERVIEW:

**Rotator Type:** Set Azimuth to either (S--center) or (N--center), Elevation to either (90°) or (180°).

**Pulse Divisor:** Sets the divide ratio if needed to change from the defaults. This will require a calibration of the system if this is changed.

**Set Heading:** Used to manually set the heading to the current known physical location.

**Auto Cal:** Used to automatically calibrate the heading by moving the positioner to either the CCW / DWN or CW / UP limit switch location. **Note:** During Auto Cal the positioner **WILL** bypass the electronic limit to find either the CCW / DWN or CW / UP limit switch.

**Rotator Location / Port:** Selects the COM port to use for connection to the controller. Press the CONNECT button to connect.

## MOTOR SETTINGS:

**Motor Timeout:** If the controller does not sense that the positioner has moved "1" degree in this time, an Error (E1) will be generated.

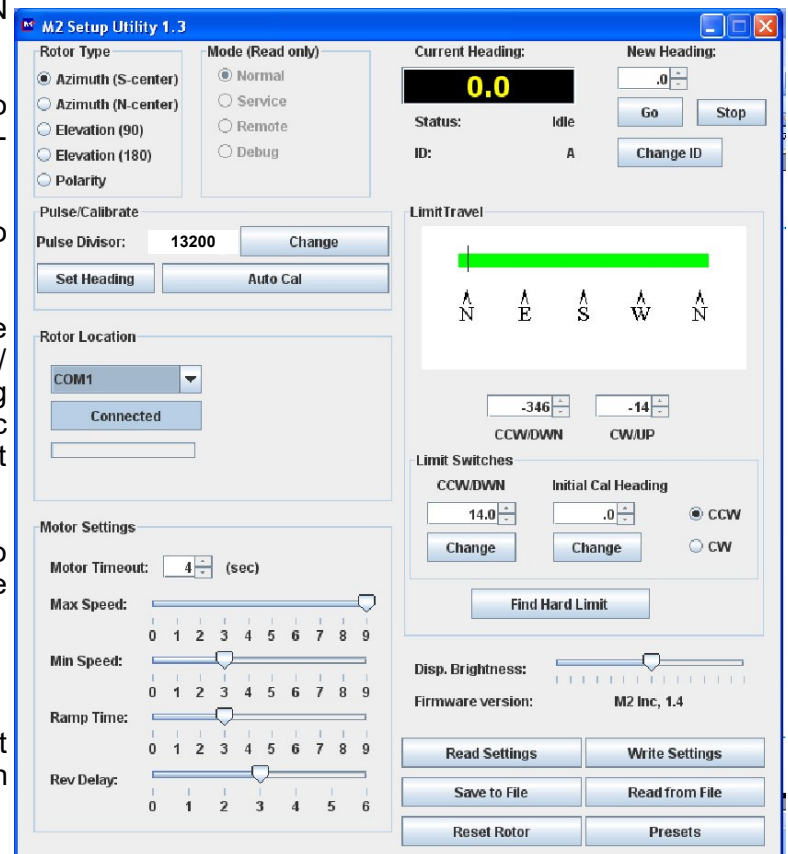
**Max Speed:** The motor will ramp up to this speed as its maximum. The speed is in 10% increments of PWM at 1.2 KHz.

**Min Speed:** The motor will start at, and ramp down to this speed. The Min speed **MUST** be set high enough to keep the motor running to provide "1" degree motion with the MOTOR TIMEOUT value.

**Ramp Time:** The amount of time spent in each speed increment as it ramps up and down.

**Rev Delay:** The number of seconds that the controller will force between a reversal from the front panel.

**Current Heading:** This display is the result of the Poll command response. The heading values are sent from the controller along with the Status and ID bytes.





# M2 SETUP UTILITY OVERVIEW CONTINUED...

**New Heading:** Change or type the desired heading value and click on “Go.” The “Stop” command will immediately stop the current motion.

**Change ID:** Changes the ID Byte as stored in the controller. This can be used to identify a specific controller board and controller based upon your usage.

**Limit Travel:** A graphical representation of allowable range of the motion as defined by the current positioner type and the Soft Limits set in the Limit Travel spinners located just below the graphic.

**Limit Switches:** CCW / DWN or CW / UP defines the number of degrees and tenths that the CCW / DWN or CW / UP limit switch is physically located from the known start heading.

**Initial Cal Heading:** This defines the known starting location in degrees. Normally a fixed location within your standard travel pattern.

**Find Hard Limit:** Once the determined hard limit is chosen, whether it be CCW / DWN or CW / UP, pressing the Find Hard Limit will run the positioner at the slowest speed until it trips the limit switch. The measured CCW / DWN or CW / UP limit switch value will then be saved in the controller for use by the **Auto Cal** Function.

**Display Brightness:** Changes the brightness level of the LED Display.

**Firmware Version:** Displays the current firmware from the controller when connected.

**Read Settings:** Button that will read the settings from the controller and re-populate the SETUP window.

**Write Settings:** Writes any changes made to values in the SETUP Utility window that do **NOT** have their own “Change Button.” All values are re-read after a Write Settings.

**Save to File:** Saves the current settings into a file for later recall and writing to a controller. This is a backup mechanism so that you may save each controller’s settings into separately named files and recall them for later use should the controller need to be replaced, or otherwise restored.

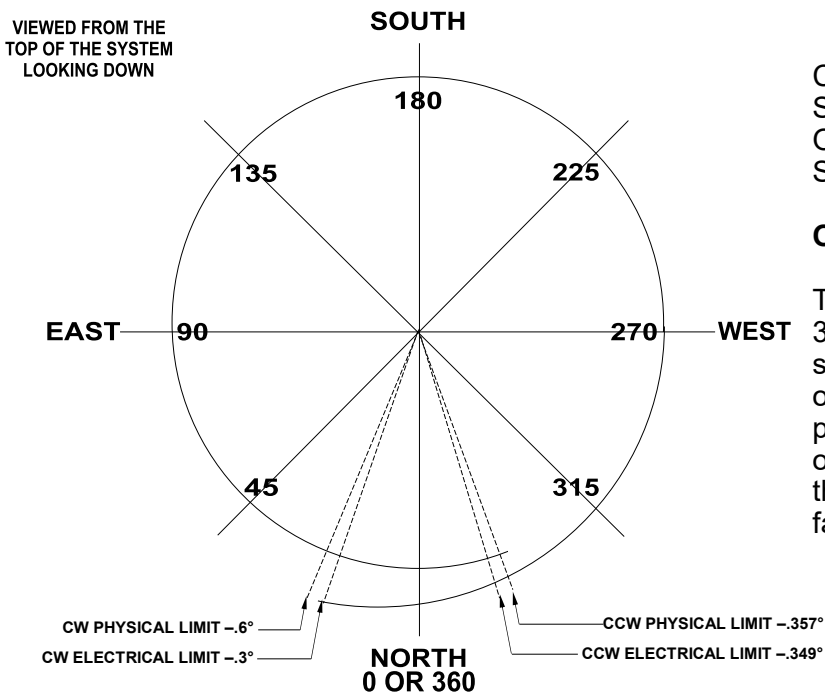
**Read from File:** Reads the saved values from the specified file. Use Write Settings after a read in order to restore the values back into a controller.

**Reset from File:** Reads the saved values from the specified file. Use Write Settings after a read in order to restore the values back into a controller.

**Presets:** Reads the (10) current presets from the controller and displays them for change. You may change only one preset at a time with the Preset Window.

# AZIMUTH SYSTEM CONFIGURATION

Each Axis of the **RC2800PRKX2SU** needs to be configured for a spectrum of use and position of limits. The programmable limits in the **RC2800PRKX2SU** control, give the ability to specify the amount of travel around a spectrum of use. The AZ and EL 2 axis positioner has physical limits CCW / DWN and CW / UP. The limits provide physical stops for safety due to control box failure. The CCW / DWN or CW / UP limits also create a reference return for each axis when using the "Auto cal" feature during Remote/computer or manual control. Below we have provided a visual explanation of some common axis configurations complete with suggested electrical and physical limits and spectrum of use.

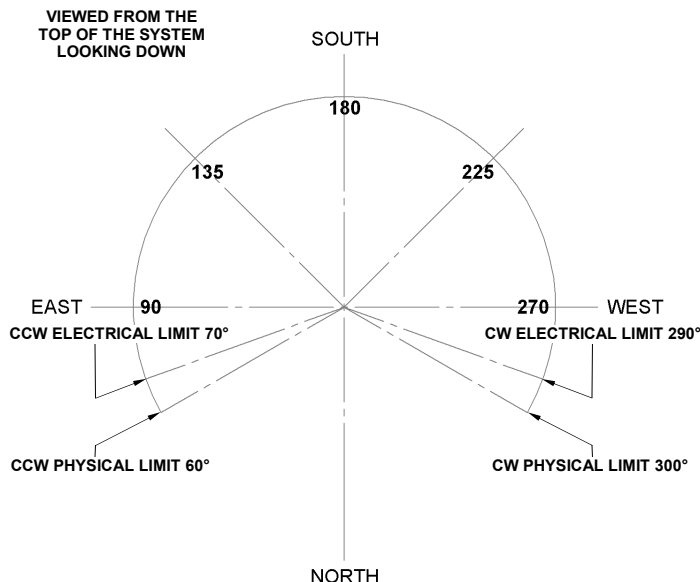


## AZIMUTH AXIS OPTION #1

Characteristics: Azimuth (S-Center)  
Spectrum of use:  $+360^\circ$   
Over travel amount:  $12^\circ$   
SU Designation: Azimuth (S-center)

### OVERVIEW:

This azimuth configuration may be used when  $360^\circ$  of travel is necessary with primarily a southern exposor and avoids limits where most of the operations are being performed. Note the position of the Physical limit switches, they are on the outside of the electrical limits. Ultimately, this provides safety when and if a control box fails.



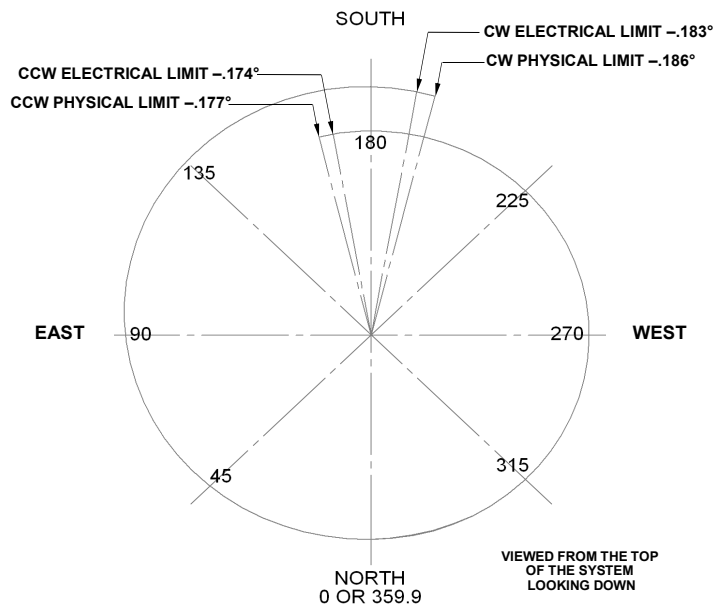
## AZIMUTH AXIS OPTION #2

Characteristics  
Spectrum of use:  $240^\circ$   
Over travel amount:  $20^\circ$   
SU Designation: Azimuth (S-center)

### OVERVIEW:

This azimuth configuration may be used when less than  $360^\circ$  of travel is necessary with a southern exposure and avoids limits where most of the operations are being performed. Note the position of the Physical limit switches, they are on the outside of the electrical limits. Again, this provides safety when and if a control box fails.

# AZIMUTH SYSTEM CONFIGURATION CONTINUED...



## AZIMUTH AXIS OPTION #3

### Characteristics

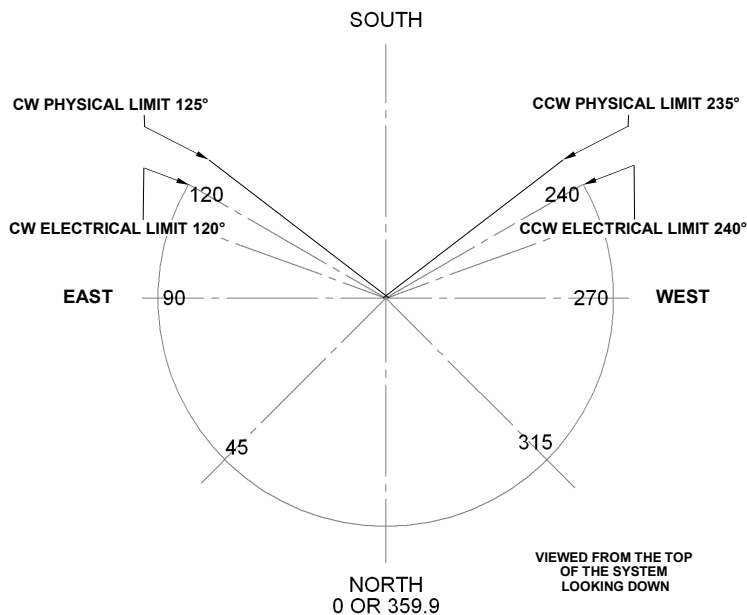
Spectrum of use: + 360°

Over travel amount: 12°

SU Designation: Azimuth (N-Center)

### OVERVIEW:

This azimuth configuration may be used when 360° of travel is necessary with primarily a northern exposure and avoids limits where most of the operations are being performed. Note the position of the Physical limit switches, they are on the outside of the electrical limits. Ultimately, this provides safety when and if a control box fails.



## AZIMUTH AXIS OPTION #4

### Characteristics

Spectrum of use: + 240°

Over travel amount: 10°

SU Designation: Azimuth (N-Center)

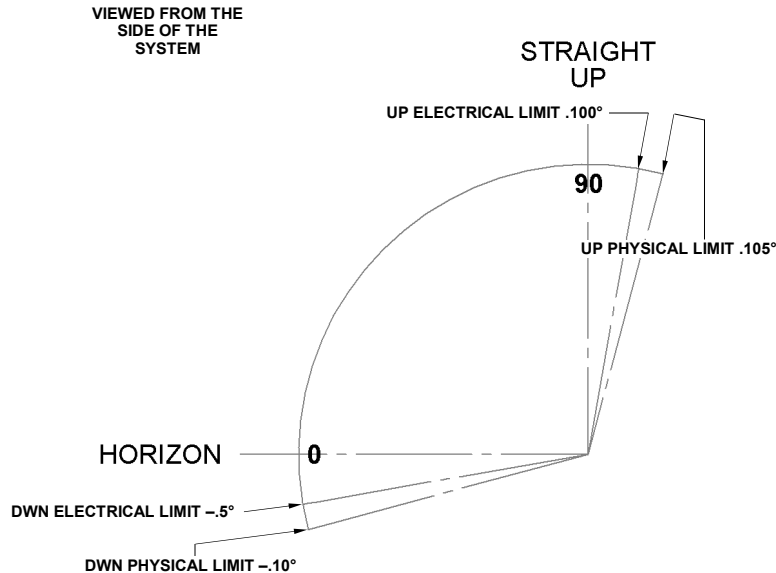
### OVERVIEW:

This azimuth configuration may be used when 240° of travel is necessary with primarily a northern exposure and avoids limits where most of the operations are being performed. Note the position of the Physical limit switches, they are on the outside of the electrical limits. Ultimately, this provides safety when and if a control box fails.



# ELEVATION SYSTEM CONFIGURATION

## ELEVATION AXIS OPTION #1



### Characteristics

Spectrum of use: 0° to 90° plus

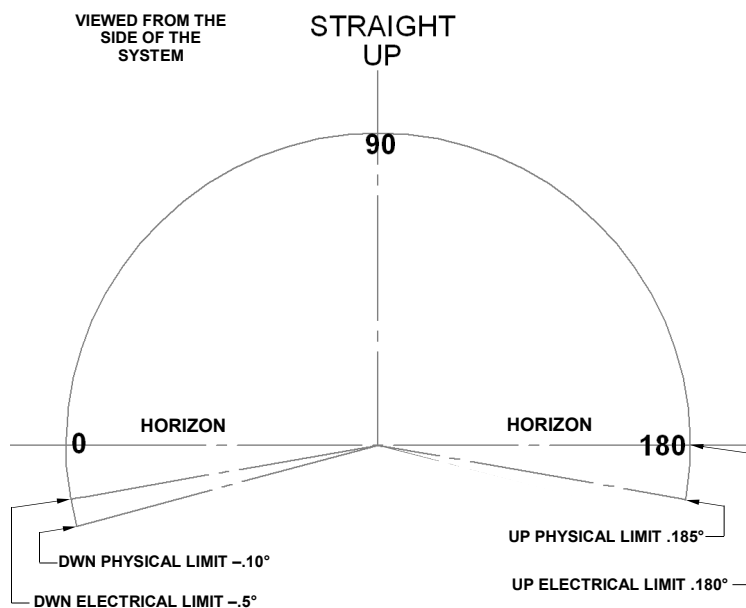
Over travel amount: 10°

SU Designation: Elevation 90°

### OVERVIEW:

This Elevation configuration is used as standard throughout the industry and may be used when 0° to 90° of travel is necessary. Note the position of the Physical limit switches, they are on the outside of the electrical limits. Ultimately this provides safety when and if a control box may fail.

## ELEVATION AXIS OPTION #1



### Characteristics

Spectrum of use: 0° to 180° plus

Over travel amount: 10°

SU Designation: Elevation 180°

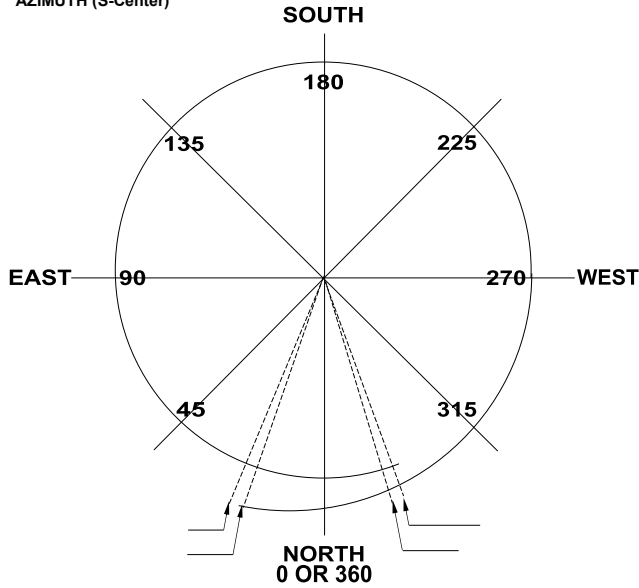
### OVERVIEW:

This Elevation configuration is used as standard throughout the industry and may be used when 0° to 180° of travel is necessary. Note the position of the Physical limit switches, they are on the outside of the electrical limits. Ultimately this provides safety when and if a control box may fail.

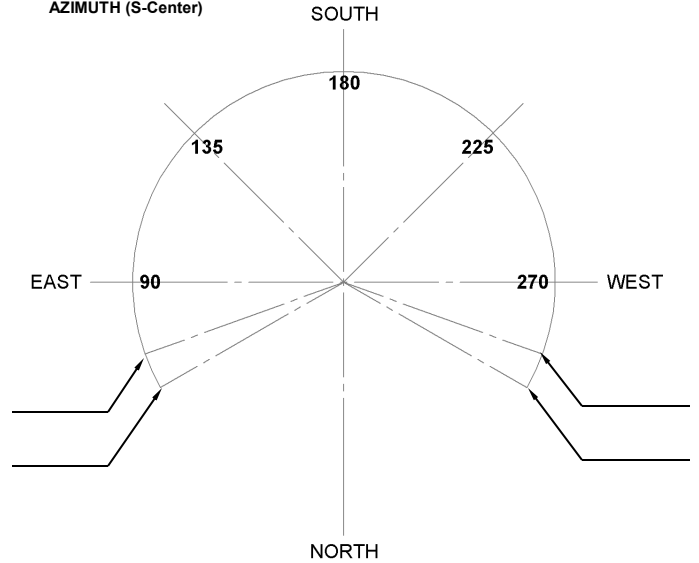
\*Note due to your dish or antenna size, there may be limitations of the overall range above 125°.

# AZIMUTH AXIS CONFIGURATION WORK SHEET

AZIMUTH OPTION #1  
AZIMUTH (S-Center)

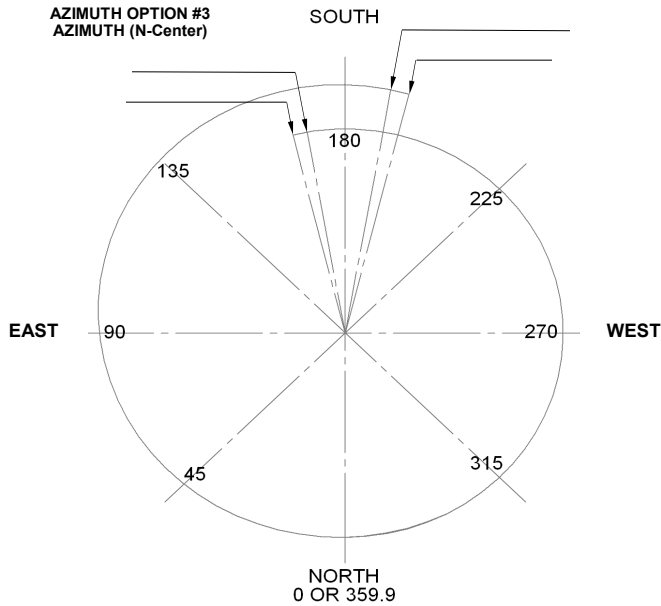


AZIMUTH OPTION #2  
AZIMUTH (S-Center)

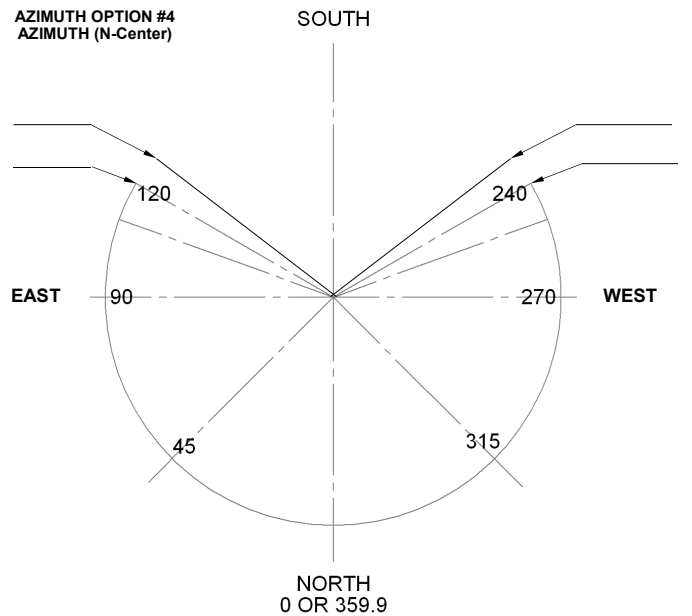


NOTES

AZIMUTH OPTION #3  
AZIMUTH (N-Center)



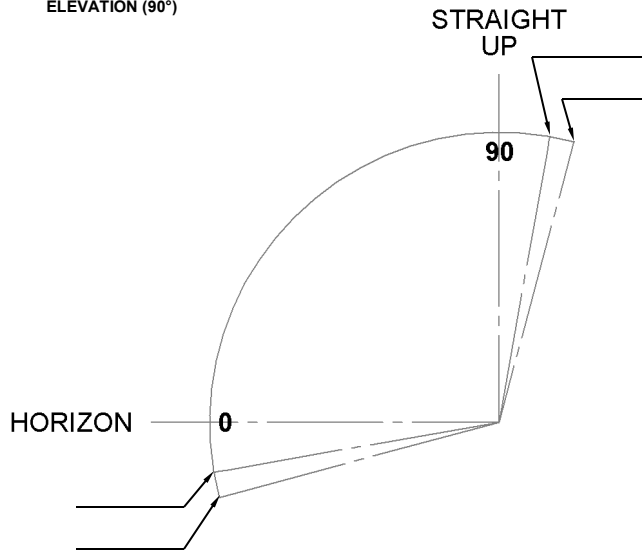
AZIMUTH OPTION #4  
AZIMUTH (N-Center)



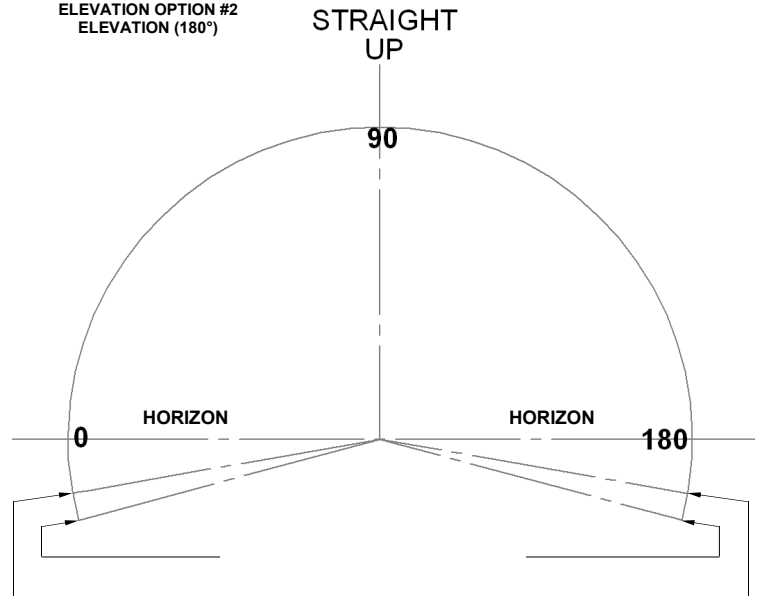
NOTES

# ELEVATION AXIS CONFIGURATION WORK

ELEVATION OPTION #1  
ELEVATION (90°)



ELEVATION OPTION #2  
ELEVATION (180°)



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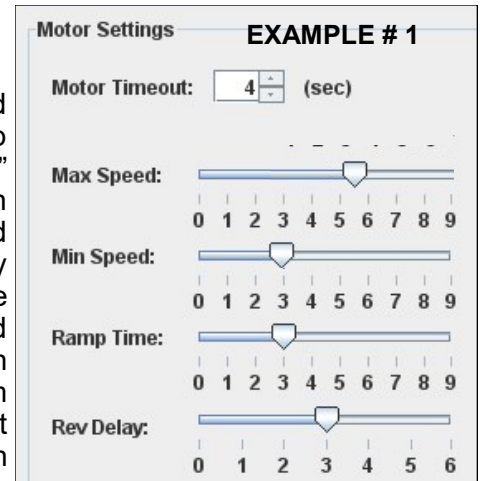
# UNDERSTANDING MIN / MAX SPEEDS & RAMPS

## SPEEDS AND RAMP OVERVIEW:

Depending upon your particular system needs, you may find it necessary to adjust minimum to maximum speeds and ramp time durations.

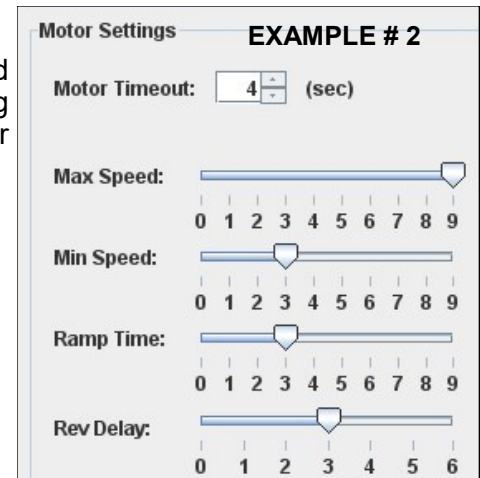
### EXAMPLE # 1:

If your system is a very large Dish or Phased Array with a lot of weight, wind area and inertia, it may be necessary to increase your maximum ramp up and ramp down duration. This can be adjusted by using the "Ramp Time" slide bar in the setup utility. The "Ramp Time" is the amount of time spent in each speed increment as it ramps up and down. It may also be suggested that your maximum speed be lowered to (5) or (6). This can be adjusted by using the "Max Speed" slide bar in the setup utility. The "Max Speed" is the maximum speed achieved during rotation. The suggested minimum speed for a very large array would be (3). You can adjust this by using the "Min Speed" slide bar in the setup utility. The "Min Speed" is the minimum starting speed. However, please keep in mind, The "Min Speed" must be set high enough to keep the motor running to provide at least "1" degree motion with the "Motor Timeout" value.



### EXAMPLE # 2:

A system that has minimal weight and wind area, does not necessarily need the longer ramp up and ramp down duration. There is not as much starting and stopping torque on motors and bearings. However, it is always your choice to setup your axis system based upon your particular needs.



## STANDARD FACTORY SETTINGS:

These settings have been pre-programmed at the factory.

### Elevation Axis:

Min Speed = 3 Max Speed = 9 Ramp Time = 3 Rev Delay = 3

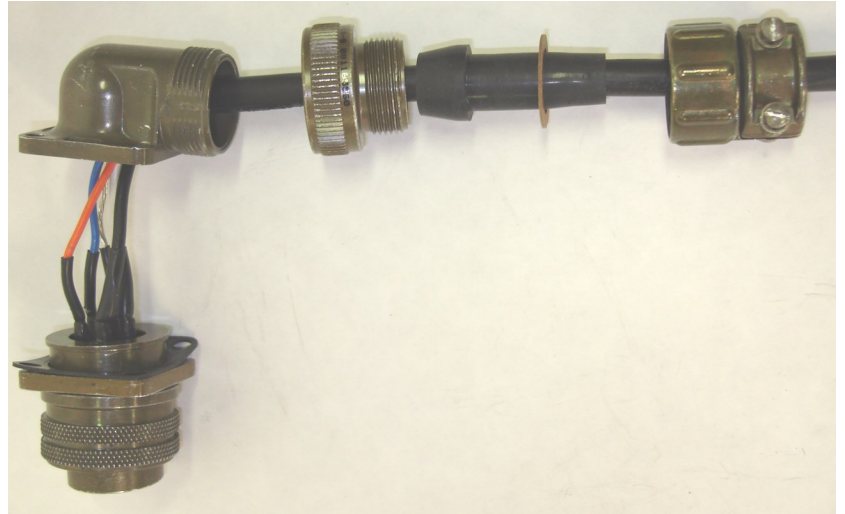
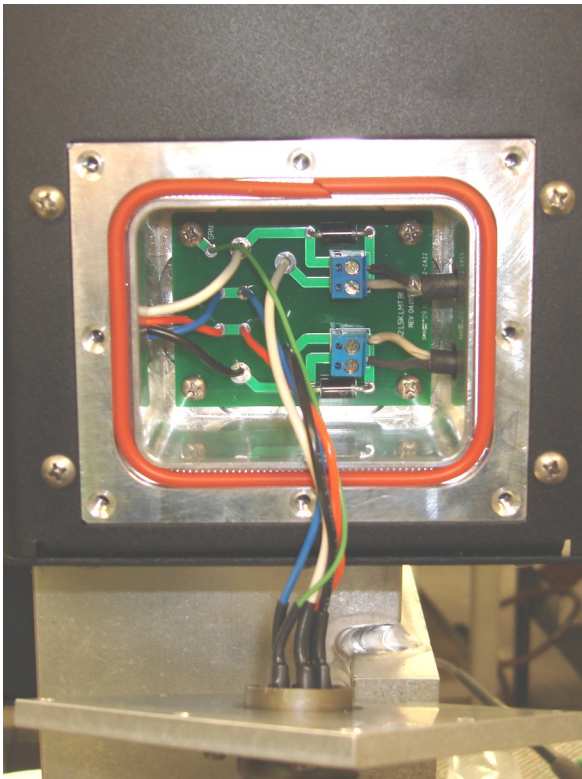
### Azimuth Axis:

Min Speed = 3 Max Speed = 9 Ramp Time = 3 Rev Delay = 3

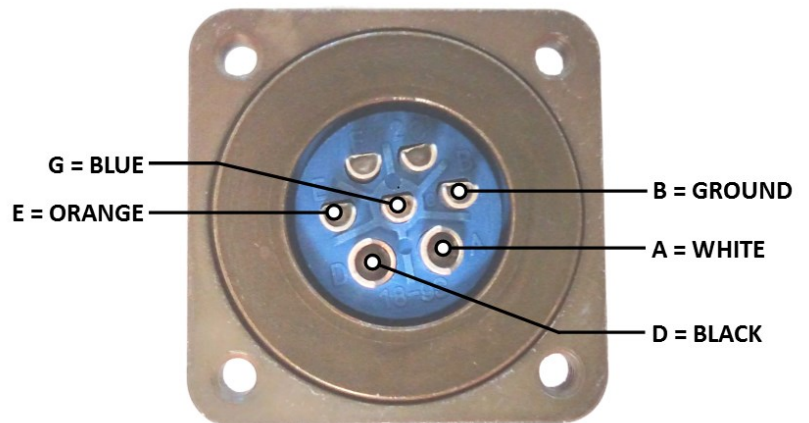
Please keep in mind, a little experimentation can help you understand each of these settings and how they interact within each other.

# AZ/EL JUNCTION BOX CONNECTIONS

The pictures on this page shows the standard wiring in the junction boxes (with switch reversing diodes) & 5 pin female right angle connector assembly. The system works the following way: Current is constant through the limit switches and through to the positioner. When the limit switch is activated, it breaks the contact and stops the current from continuing. Reversing the positioner in the opposite direction, incorporates directional diodes. Because this is a standard wiring system, there may be variations to this system that may be changed by your specific orientation of each Axis.



**7 PIN RIGHT ANGLE FEMALE CONNECTOR WIRING**





# CONNECTIONS AND START UP



## CONNECTIONS:

Once the Azimuth and Elevation units have been wired up at the motor end, start the process of wiring the correct color wires to the rear of the control unit. Use the table below for proper wire color and terminal number. Each individual (12) position terminal strip, has been clearly marked to help with proper connection points.

## (12) POSITION TERMINAL STRIP ASSIGNMENTS

TERMINAL NUMBER	FUNCTION	SUGGESTED COLOR	MINIMUM WIRE GAUGE
#1	MOTOR	BLACK	16 AWG
#2	MOTOR	WHITE	16 AWG
#3	(NOT USED)		
#4	(NOT USED)		
#5	(NOT USED)		
#6	HEATER (+) LEAD	RED	16 AWG
#7	HEATER (-) LEAD	BLACK	16 AWG
#8	(NOT USED)		
#9	(NOT USED)		
#10	REED SWITCH DC +	ORANGE	24 AWG
#11	REED SWITCH RETURN	BLUE	24 AWG
#12	CASE GROUND	BARE	NA

Unwrap the AC power cord and plug it into the AC plug on the rear of the control unit. Plug the AC cord into a reliable 115 VAC or 230 VAC source. Switching power supplies are used that can operate from 86VAC to 240VAC.

## CUSTOMER NOTE AREA:

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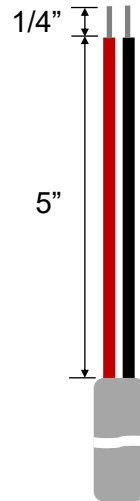
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# HEATER UNIT CONNECTIONS

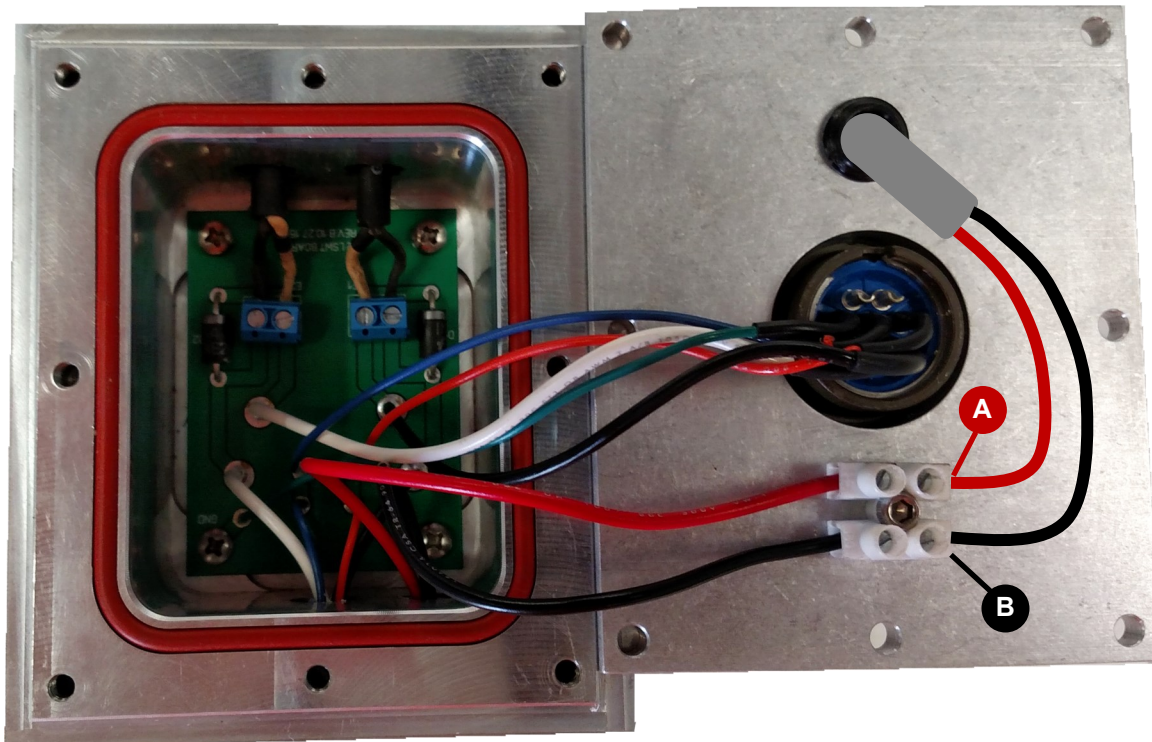


Remove the (8) 8-32 screws from the front limit switch panel.



Prepare the provided 2-Conductor Red & Black 16AWG wire. Remove (5-1/4") of the outer grey jacket. Strip (1/4") of insulation from both the Red & Black wires as shown.

Slide the prepared 2-Conductor Red & Black 16AWG wire through the cord grip from the front of the panel. Route the Red wire to position "A" as shown below. Then route the Black wire to position "B" as shown below. Tighten small flathead screws on the terminal strip. Place the front panel onto the LSK enclosure and reinstall the (8) 8-32 screws. Tighten the cord grip nut on the front of the panel.



# AZ/EL PHYSICAL LIMIT SWITCH PRE TEST

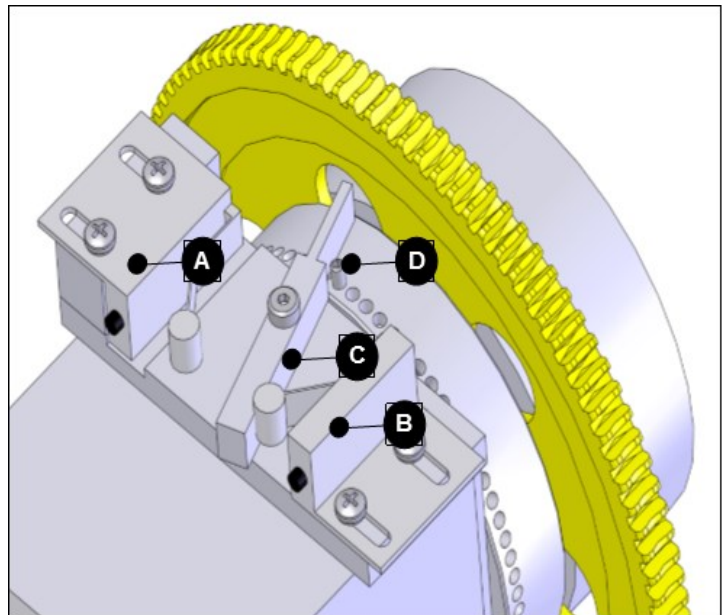
## LSK-1000 OVERVIEW:

The **LSK-1000** limit switch kit is a physical hard backup limit. The standard control unit supplied with our AZ or EL has “**Electronic Limits**”, but the **LSK-1000** limit switch kit, has been designed as a physical backup system in the event of a control unit failure. The factory has pre-installed the **LSK-1000** limit switch kit into the AZ and EL units for you. Typically the **LSK-1000** limit switches only need to be setup once, but can be adjusted when necessary.

## LSK-1000 MANUAL LIMIT SWITCH PRE-TEST:

Remove one half of the black enclosure from the positioner unit that **DOES NOT** have cord grips or wires running into it. You will see the limit switches (**A,B**) the limit arm (**C**), and limit screw (**D**) as pictured to the right. **We have not installed the limit screw due to unknown customer orientation.** Move the supplied **RC2800PRKX2SU** control unit near the positioner for proper limit switch testing. With the positioner wired to the control unit, turn the control unit on. Be sure to test the proper direction of each positioner before moving forward. Once you have determined the correct direction of rotation from the control units’ “Control Buttons,” determine which limit switch will be activated by the rotation of the main gear and limit screw. Press a known direction using the “Control Buttons,” and manually activate the limit switch. At this point the positioner should stop its travel. Continue holding the limit switch and reverse the direction using the “Control Buttons.” The motor should move away from the engaged limit switch. This confirms proper wiring and operation of the limit switch. Repeat this procedure for the other direction and limit switch. We suggest, completing each axis (ie Azimuth and Elevation) prior to moving onto the final setup.

## AZ/ EL-1000 LIMIT SWITCH ARRANGEMENT



## FINAL SETUP OF THE LIMIT SET SCREWS:

We have included (2) limit screws, one for each limit switch. The limit screws can be setup at any position based upon the orientation of your choice. On Azimuth and Elevation use the supplied 8-32 x 1/2" set screws and 5/64 allen wrench. **DO NOT INSTALL AT THIS TIME.** You can always make slight adjustments to the limit screw if necessary. We have provided adjustment holes at every 5°. We suggest leaving the cover off of the unit until you have completed your testing.

# AZIMUTH AXIS SETUP AND CALIBRATION

## AZIMUTH SETUP AND CALIBRATION:

1. Connect a straight through DB9 RS232 serial cable to the rear of the **RC2800PRKX2SUMC** controllers' "Azimuth" port. Now connect the RS232 serial cable to your laptop or desktop computer being used for setup.
2. Under programs , start the M2 Setup Utility program. Select COM1 in the setup utility under "Rotor Location." Click "Connect" and once the azimuth control board has been verified, the word "Connected" will appear.
3. Confirm that the either the Azimuth (N-Center) or Azimuth (S-Center) rotator type is selected and that this is the same port that the serial cable is plugged into on the rear of the control unit. Then verify that the "Pulse Divisor" is set to the correct value for Azimuth (13200).
4. Using the CCW / DWN or CW / UP buttons on the front of the controller, rotate the Azimuth unit to a known fixed heading position. This can be any known heading within your specified limit travel area. Note, the actual digital display heading may not be the actual physical heading of your Azimuth unit at this time, due to your orientation. Once you are confident that you are physically pointed at your known heading, click the "Set Heading" button in the setup utility. Enter in the known heading in degrees and then click OK to calibrate your heading.

## USING YOUR AZIMUTH CONFIGURATION WORKSHEET:

5. Using your Axis configuration worksheet, insert both the CCW and CW electronic limits into the setup utility. To finish this process, click the "Write Settings" button located at the bottom of the utility. At this time, it would be good to determine the largest sweep of rotation. This is important as you have the choice of setting up either the CCW or CW hard limit as your "Auto Cal" location. If most of your travel happens to be closer to the CW hard limit, choose this in the setup utility. If not, we suggest using the CCW hard limit.
6. Based upon your choice from above, press either the CCW or CW button to rotate the azimuth axis until the motor stops. This will either be your CCW or CW desired electronic limit.

## POSITIONING EITHER THE CCW OR CW PHYSICAL LIMIT SCREW:

7. Visually inspect the physical limit switches and limit arm. Activate the limit arm into the limit switch, noting the location in which the limit arm contacts the wheel of the limit switch. At this point, insert the supplied 8-32 x 1/2" limit set screw into the hole just outside of the limit arm. This will give you some room between the CCW or CW electronic limit and the CCW or CW physical limit. This position is not critical other than to give you a reference point. The controller will calculate absolute distance automatically.

## FIND CCW OR CW PHYSICAL LIMIT:

8. Press the "Find Hard Limit" button on the setup utility to start the automatic calibration process. During this process, the azimuth axis will rotate in either the CCW or CW direction (based upon your initial setup) until it touches either the CCW or CW physical limit. **Note**, the azimuth unit will drive through either the CCW or CW electronic limit, disregarding it during this process. The control box will then calculate the absolute distance between these two points. This information will automatically be updated in your CCW/DWN or CW/UP limit switch location.

At this point, you have now establish your reference return point for this axis. The "Auto Cal" can now be used from either the setup utility, hyper terminal or your own communication software.



# ELEVATION AXIS SETUP AND CALIBRATION

## ELEVATION AXIS SETUP AND CALIBRATION:

1. Move the RS232 serial cable to the Elevation port on the back of the controller. Under "Rotor Location." Click "Connect" and once the elevation control board has been verified, the word "Connected" will appear.
2. Confirm that either the Elevation (90) or Elevation (180) rotator type is selected and that this is the same port that the serial cable is plugged into on the rear of the control unit. Then verify that the "Pulse Divisor" is set to the correct value for Elevation (13200).

## USING YOUR ELEVATION CONFIGURATION WORKSHEET:

3. Using your Axis configuration worksheet, insert both the DWN and UP electronic limits into the setup utility. To finish this process, click the "Write Settings" button located at the bottom of the utility.
4. At this point, refer to the Azimuth procedures for setup and calibration of your Elevation axis. As both the Azimuth and Elevation units are very similar regarding setup other than actual degree headings.



# ADVANCED OPERATIONS / SOFTWARE COMMANDS

## CONNECTIONS TO COMPUTER:

Connect the appropriate cable from your computer to the Control Unit's DB9 connector on the rear panel. (A standard RS232 cable is sufficient to run the controller. Do not use a null cable.)

All computers have a "**Hyper Terminal**" or equivalent capability for "**Talking**" to the control unit. To setup the "**Hyper Terminal**" do the following: Click start, programs, accessories, communications and then "**Hyper Terminal**."

The next screen you will see is called "**Connection Description**." It will ask you to enter a name (IE. positioner) and choose an icon, then click OK.

The next screen will read "**Connect To**." Scroll to the last box and click on "**Connect Using**." Choose direct to **Com 1** (or whatever Com port you have available) and then click OK.

The final screen will have standard Port Settings. Change the port settings to the following and press OK.

Baud Rate	Bits	Stop Bits	Parity	Handshake
9600	8	1	None	Present, not used

## COMPUTER SOFTWARE CLARIFICATIONS:

Commands are one letter or two letter, one number codes followed by a digit. (n)

In many commands, the (n) may be any numeric and must be a "0" (zero) where specified in the Command.

All commands and responses MUST terminate with ; (semi-colon), Commands are in **bold** for clarity. Parts enclosed in ( ) are optional.

There are no inter-character timeouts, sending ; alone will:

- A. Stop Controller command motion
- B. Clear the RX buffer

There are no controller initiated transmissions.

## STANDARD USER PROGRAM COMMANDS:

**Bin ;** = Poll controller for Status / Heading

(Response = "ID\_Byte, Status\_Byte, Heading;" ID-BYTES=ASCII Char 0-9 or A-Z STATUS\_BYTE=)

- S = Stopped / Idle
- R = Running (motor in motion)
- C = Calibration in Process
- O = Offline (Controller NOT in MODE 0)
- E = Error

Heading in form of (-)xxx.y;

**Stn; or ;** Stops a computer or preset command.

**APn(-)xxx(.y)<cr>;** Sends controller to (-)xxx.y degrees if in Mode 0.

**C1n;** Recalibrate controller at the desired Limit Switch (either CCW/DWN or CW/UP) known location.

# ADVANCED OPERATION / SOFTWARE COMMANDS

**Awn(-)xxx(.Y);** Writes new calibration heading.

**C0n; (C, Zero,n)** = Find Limit Switch (CCW/DWN or CW/UP) from the specified "Initial Cal Heading" and store limit switch location for subsequent recalibrate commands. Controller MUST NOT be in MODE = 1 (Service)

**R1n;** Returns Version ID of controller software.

**W00; (Zero, Zero)** Restores controller to Azimuth Option and all default settings.

**PRn;** Reads all 10 Preset values from controller.  
(Response is **#<soh>(-)xxx.y<cr>** for 10 locations followed by ;

**P#n(-)xxx.y;** Writes preset # (0 to 9) into controller memory.

**RXn;** Reads EE stored value for **X**  
(Response is **X<soh>yyy;**

**WXnyyy;** Writes EE value yyy into **X** location.

The EE locations for **X**

**A** = Limit Switch (Tenths of degrees from "Initial Cal Heading" that trips desired limit switch

**B** = Initial Cal Heading (Heading to use as Limit Switch reference)

AZ-S = 0.0 to 360.0

AZ-N = 180 to 179.9 (one more tenth CW is "-180")

EL = 0.0 to 90.0

EL = 0.0 to 180.0

**E** = Reversal Delay in Seconds

**F** = Minimum Speed (1 to 10)

**G** = Maximum Speed (1 to 10)

**H** = CCW / DWN Soft Limit (Heading)

**I** = CW / UP Soft Limit (Heading)

**J** = Option:

0 Azimuth S Center

1 Elevation 90

3 Azimuth N Center

4 Elevation 180

**K** = Pulse Divider (0 to 50,000)

**L** = Limit Switch to use (for calibration) (0=CW, 1=CCW)

**M** = Mode (Read Only)

0 Normal

1 Service

2 Presets

3 Auto Cal

4 Find Limit

**N** = Ramp (0 to 9)

**O** = Brightness (0 to 9)

**P** = No Motion Timeout in Seconds

**R** = ID Byte

# TROUBLE SHOOTING / ERROR CODES

## ERROR CODES:

**E1** = No Motion. The controller has not sensed a movement of at least "1" degree within the Motor Timeout Value (which is defaulted to "4" seconds)

**E2** = Range Error. This means that the controller is too close to the most CCW / DWN heading allowed by the software. This is more than "45" degrees CCW / DWN from zero (-90) when the pulse divider is at it's max of 50,000. We allow >90 degrees with the pulse divider that you are using now.

**E3** = Backup No Motion. The "PO" or "P1" has been running for ~ 8 seconds with no movement from the heading indicator.

**E5** = Reserved

**E6** = Illegal CPU Chip. The software can only run if it's installed in a chip that was programmed with a boot loader from M2 Facility.

# TROUBLE SHOOTING

## **SYMPTOM:**

**When a positioner is wired to RC2800PRKX2SUMC, the positioner runs just for a second and then stops. And 'E' will appear in the mode column of the display. To reset, hit either mode key.**

Why does this happen? Most commonly, The microprocessor will not let the motor run more than a second if the micro sees no pulses coming in from the reed switch in the positioner. If the positioner moves slightly, it means your motor and motor wires are probably OK.

## **POSSIBLE CAUSES:**

This usually means that the control unit is not getting pulses back from the positioner. First remove the pulse wires from terminal #10 and #11 from the back of the control unit. Using a digital volt meter or equivalent, measure the voltage that is present between terminal #10 and #11 for about 1 second when you command the unit to go. You should have 11.3 VDC. If this voltage does not appear briefly, turn off the control unit and measure the resistance between terminal #10 and #11. If the resistance is less than 5000 Ohms, it means the protective MOV across terminal #10 and #11 inside the control unit is leaky or shorted. If the MOV is damaged it means it took a voltage spike over about 25 volts. It failed but protected the internal circuitry. Unplug the control unit, remove the cover, and using diagonal cutters, cut one lead of the red MOV on the rear pc board terminal #10 and #11.

Now turn on the control unit and check for the 11.3 VDC between terminals #10 and #11. If the voltage is present, turn off the control unit, replace the cover and reattach the wires to terminal #10 and #11. Turn on the control unit and press CCW or CW to see if the positioner now operates properly. If so, use the "Auto Cal" feature and recalibrate the unit as described at the beginning of this manual. Call M2 and order a new MOV. The system can be operated without the MOV, but during this time you have no voltage spike protection. When all else fails, call M2 at 559 432 8873 and we will help you trouble shoot the system.

**If the above appears OK, then the missing pulses maybe caused by a control cable problem or a damaged Positioner.** Again, turn off the control unit and remove the wires from terminal #10 and #11. Attach your meter in the resistance mode across the two leads just removed. Two states can exist. Your reading will either be a total open 10 meg Ohms or more OR a total short measuring only the resistance of the wires running to the positioner. Now with the meter leads still connected and measuring Ohms, turn on the control unit and press CCW or CW and make the rotator move. Watch the meter to see the state of the reed switch changes. Each motor revolution will open and close the reed switch twice so you should see the meter change from open to shorted. This may take a few tries as the reed switch is open normally about 60% of the time. If you see no change of state, you either are not on the reed wires, or there is a break in the wires between the positioner and the control unit or you have a faulty reed switch. The second of the two is very unlikely. **Most of the time this problem is due to a wiring or connection problem somewhere between the positioner and the control unit.** Use common sense trouble shooting your wiring.

## **SYMPTOM:**

**Positioner operates, but readout is erratic or consistently reads higher or lower than where the antenna system is actually pointing.**

## **POSSIBLE CAUSES:**

This is also an indication of a wiring problem. Long runs of cable that have a cut in the jacket can fill with water and significantly increase the inter-wire capacity. This can allow motor spikes to be picked up by the pulse (reed switch lines) and add extra pulses to the count. It can also cause such distortion of the square wave from the reed switch, that the microprocessor can't read the actual pulse count. Replace the cable or run a separate RG-58U or equivalent line for the reed switch. This is not usually an indication that the reed switch itself is faulty. Don't remove the positioner until you are absolutely sure the problem is in the positioner.

# TROUBLE SHOOTING CONTINUED

## TROUBLE SHOOTING CONTINUED.....

**SYMPTOM:** Positioner runs immediately after control unit is turned on:

**POSSIBLE CAUSES:**

This can mean that one of your motor control wires on terminal #1 or #2 are grounded. When one of your motor wires is grounded it completes the path to one side of the power supply. The microprocessor normally turns on the motor drive chip that in turn, turns on the hexfet that closes the circuit to ground and powers the motor. To test this, remove the motor wire from terminal #1. Using your ohm meter, see if this wire is shorted to ground. If not, then the problem may be in the control unit. The hexfet could be shorted or the motor drive chip could have failed, allowing 10 volts to appear on the gate of the hexfet, turning it on all the time. To confirm that the control unit is faulty, remove the motor wires. Using your volt meter, measure from terminal #1 to #2. 35 to 45 VDC will be present on Azimuth and Elevation units while, 24 to 28 VDC will be present on the Polarity Unit. If the control unit is faulty, ***Place a call to M2 for an RA (Return Authorization) number so we can be ready for your unit when it arrives.***

Send it to:

***M2 Antenna Systems Inc.  
4402 N. Selland Ave  
Fresno, CA 93722***



# WARRANTY INFO

## 12 Month Limited Warranty



This warranty gives you specific legal rights. You may also have other rights which will vary from state to state or province to province.

**M2** warrants the **RC2800PRKX2SUMC** two Axis Controller unit against defects in material and workmanship for a **period of 12 months** from date of purchase. During the warranty period, **M2** will, at its option, either repair or replace products or components which prove to be defective. The warranty shall not apply to defects or damage resulting from:

- Improper or inadequate maintenance by user
- Improperly prepared installation site
- Unauthorized modifications or misuse
- Accident, abuse, or misapplication
- Normal wear

**M2** specifically does not warrant this product for any direct, indirect, consequential, or incidental damages arising from the use or inability to use the product. Some states or provinces do not allow the exclusion or limitation of liability for consequential or incidental damages so the above limitation may not apply.

In the event repair or replacement are necessary, purchaser shall contact M2 for return authorization. In many cases this contact can simplify and expedite the repair / replacement process and help reduce costs and downtime.

The purchaser shall be responsible for packing the product properly for return and for charges to ship the product to **M2**. Always include with the shipment, a statement detailing the problem / failure and any other pertinent observations. Insuring the product for shipment is recommended. Use the original packing materials whenever possible. **M2** is responsible for charges **(in the United States)** to return the repaired / replacement product only where warranty service is involved.

**M2 Antenna Systems, Inc. 4402 N. Selland Ave. Fresno, CA 93722**  
**(559) 432-8873 Fax (559) 432-3059 Web: [www.m2inc.com](http://www.m2inc.com)**