Warranty

All products sold by Portable Rotation Inc. are warranted against defects in material and workmanship for a period of one (1) year from the date of shipment within North America, and for a period of one (1) year from the date of shipment to outside of North America. If you believe this product you have purchased has a defect in material or workmanship or has failed during normal use within the warranty period, please contact Portable Rotation Inc. for assistance at the contact information listed below. If product repair or replacement is necessary, the Customer will be solely responsible for all shipping charges, freight, insurance and proper packaging to prevent breakage in transit, whether or not the product is covered by this warranty. All shipments of repaired or replaced products by Portable Rotation will be F.O.B. from Roseville, California, USA.

This warranty does not apply to defects resulting from any Customer actions, such as mishandling, improper interfacing, operation outside of design limits, misapplication, improper repair, or unauthorized modification; breaking the Warranty Seal voids all stated warranties. No other warranties are expressed or implied. Portable Rotation liability shall be limited to the actual purchase price of any defective unit to which a claim is made, and shall in no event include the Customer’s manufacturing costs, lost profits, goodwill, and any other direct, indirect, special, incidental or consequential damages whether based on contract, tort or other legal theory. Portable Rotation is not responsible for any Damage to or caused by the installed Antenna in any use case.

Contact Information

For Sales Inquiries: 1-800-366-9216
http://www.sales@portablerotation.com

For Support: 1-800-366-9216
http://www.support@portablerotation.com

Shipping Address:
Portable Rotation, Inc.
4010 Foothills Blvd. Ste 103, #118
Roseville, CA  95747

Website:  http://www.portablerotation.com
Introduction

Thank you for the purchase of the Portable Rotation 12 Volt Dual Axis Portable Rotator system, Model 12PRSAT.

This system is designed with a simple to use user interface allowing easy operation while still offering advanced features like ‘Auto Turn,’ ‘Any-Direction Calibration’ and Remote Computer Control.

The 12PRSAT is a 12 volt portable dual axis rotor system designed for portable satellite operations. The system is designed to support a dual antenna (VHF / UHF) installation; one antenna on each arm for a total load of 10 pounds.

Key Features and Specifications

- Nominal Az/El rotation speed of 1RPM, or 6 degrees/Second
- 3 button user interface with backlight 2x8 character LCD and 2 Notification LEDs on the Hand Held Controller
- Full +/- 540 degree Azimuth rotation with 1 Degree minimum movement / resolution
- 180 degree Elevation movement – Limited from 0 to 180 degree. 1 Degree minimum movement / resolution
- PWM motor control with two user controlled turning speeds
- 3 Modes of operation:
  - Manual antenna movement
  - Automatic antenna movement
  - Remote computer controlled movement
- User programmable Vanity Display message
- ‘Any-Direction Calibration’ offering easy antenna system deployment
- Antenna Rotation Jam detection with auto stop
- 4 Conductor Shielded Rotor Cable (50 foot length provided)
- USB Computer interface supporting the GS232A Az/El Rotator Control Protocol.
- 150mA idle current, less than 500mA normal turning current at 12.5 Volts, both axis – Heavy Turning Loads over 1 Amp
- 12VDC 200ma Accessory power out on Rotor Unit
- Optional GPS Receiver for field portable location reporting
- Optional Auto-calibration feature
Specifications

- 12.0 Volt to 14 Volt DC Operation (13.0 Volt Nominal)
- 150ma idle current
- Maximum Antenna load of 10 LBS
- Rotor Head weight, including 18 inch arms: 7.5 lbs
- Controller Weight: 8 Ounces
- 4 conductor rotor cable – Minimum Gauge Size of 18 – Max Length supported – 100 Feet

Limitations

The 12PRSAT Az/El Rotor unit is not designed for permanent outside installation. The system is designed to be used for portable operations with antennas like what is sold by companies like Arrow, Elk Antennas. Non portable antennas like those offered by M2 can also be used as long as the maximum weight limitation is not reached. Exceeding the specified maximum antenna weight may damage the Rotor Unit and will void all expressed or implied warranties. Using oversized antennas will cause tracking failures. It is not designed to withstand long term harsh and extremely wet winter conditions.

Don’t:
- Install Antennas Heavier than 8 pounds
- Operate with off center loading; make sure the antenna is balanced at the rotor mounting points
- Leave Rotor in extreme wet environments for extended times or in high wind conditions
- Manually force the movement of the antenna system, you will damage the mechanical system

Included Items

The following items are included as part of the Portable Rotator system:

- 1 - 12PRSAT Portable Antenna Az/El Rotor Controller
- 1 - 12PRSAT Portable Antenna Az and El Rotor Mast Units
- ‘U’ Bolt hardware to attach Rotor Unit to antenna mast
- 2 – 18 inch long fiberglass cross bars
- 1 - 50 Ft - 4 conductor shielded cable with screw type connectors
- 4 – 6 inch Velcro cable ties
- 1 - 6 Foot Pigtail Power cable (2.1mm x 5.5mm, Center Pin Positive)
- 1 - 3 Foot USB Cable
- 1 - Small Magnetic Compass
- 1 - Extra Set of water seals (in small bag)
- 1 - User’s Manual

Before First Use

Inspect the contents of the box and verify that the contents of the box match the above list.

Rotor System Power

You will need to attach a 12 Volt power source to the ends of the provided cable. The cable ships with a 15Amp Anderson Power Pole connector already installed. If you are going to make your own power cable the Positive lead on the provided power cable has the White Stripe.

Note: The controller electronics will work at a voltage as low as 9 Volts, but that is not enough Voltage to operate the Rotor’s DC motors. The controller senses the power supply voltage and will not operate below 11.5 VDC or over 14.2 VDC.

The Rotor System power connections are reverse polarity protected and include a thermal resetting fuse. The 12 Volt accessory port is not reverse polarity protected but includes a 200ma thermal resetting fuse.

Rotor System Assembly

The Rotor System is shipped disassembled to keep the shipping size as small as possible. Assembly is straight forward:

- Place the Elevation Unit on a table or other surface with the mounting plate and set screws facing up (unit upside down).
- Place the Elevation unit on top of the Elevation unit aligning the set screws with the notches in the drive shaft.
- Make sure water seal is seated properly.
- Pressing down with light pressure tighten the set screws
- Attach the 18 inch arms in a similar manner with slight pressure on the arms towards the Rotor Housing
- DO NOT Over tighten the set screws.

**Installation**

Installing the Rotor system for portable Use is not difficult.

Before starting the installation **VERIFY** that the site is in a safe location to erect an antenna system of the size you are using. **Make sure there are no overhead power wires nearby.** Also make sure there are no buildings, structures, or trees that the turning antenna could strike causing potential damage.

Eye protection should be worn when installing the antennas. Large antennas with crossing elements can be an eye danger especially when installing them at eye level.

Even though this is a low power 12 volt device, the high gear ratio of the mechanism could cause damage if rotating your antenna into a fixed objects.

Use the provided Velcro strips to attach the feed line Coax and Rotor Cable to the tripod or mast in a few locations to keep the cables from dragging on the ground or moving in the wind. It is recommended to attach the cables to the mast in the opposite general direction of the satellite to be tracked, reducing the amount of cable wrap for your feed line. Remember to include a service loop in the Coax to allow for the rotation.

There are multiple connections on the Azimuth or lower rotor unit. Each connector has a different pin count so it is not possible to make the wrong connection. Connect the Elevation or Top Rotor unit to the Azimuth unit with the 6 conductor cable. Once the antenna(s)/tripod/mast is erected, connect the 4 conductor rotor cable to the Rotor Controller and connect 12 Volts to the Hand Controller using the provided power cable.

Once the controller is turned on, the following start up messages are displayed with the final display showing the user configurable 8 character top line and the last known antenna heading:

![Portable Rotation](Model 12PRSAT) → [InitComs to Rotor] → [PTBL RTN A000E000]

**New Deployment Configuration**

After erecting your portable antenna system (including Tripod, Rotor Head, Antennas, Feed Line and Rotor Cable) you will need to calibrate the antenna Azimuth and Elevation, and make any changes to the 8 characters of user programmable message.

With the ‘Any-Direction’ Calibration feature of this controller, you can erect the antenna system and not worry about the antenna heading at that time. This saves time and the effort of trying to align the antenna to its proper azimuth and elevation by adjusting U-Bolts and clamps.

Using the provided compass, smart phone application or other device, make note of the current heading of the antenna. Again, you do not need to have the physical antenna heading set to North when first erecting the antenna system; you will set the initial heading of the antenna into the controller during the power on initialization process. Make sure to position your feed lines such that you minimize antenna mast wrapping.

**Set the Initial Heading and Azimuth**

A compass points to Magnetic North. Due to the varying magnetic fields of the Earth, ‘Magnetic’ North and ‘True’ North are not always the same. When tracking satellites, true North is used. You will need to adjust your Heading entry based on both the Magnetic North reading and the Declination for your area. There is a lot of information on the web that can be referenced to further understand Magnetic Declination.

Next go to the controller and turn the system on, when the Initial “Portable Rotation” messages is displayed holding down the Mode button [Middle Button]. Continue holding the button until the “Select / Az Bt El” message is displayed. Release the button.

You can now choose to set the Initial Azimuth, Elevation or both. Press the CCW button to select Azimuth, MORDE button to set both or the CW Button to set the initial Elevation value.
Notice the 100’s place value has an underline cursor to identify the active location to change. Use the CCW [Counts Up] and CW [Counts Down] buttons to count up or down to set this value. You are allowed the value 0 through 3 in this location for Azimuth and 0 or 1 for Elevation. When the first value is set, press the Mode button, the cursor moves to the next location; the 10’s place. Using the same procedure as before; select the value with the CCW and CW buttons and then press the Mode button when the correct number is displayed. The 1’s place value is now selected; select the value and press the “Mode” button. The current heading is now saved to memory and the new heading is displayed. If you make an error, just redo the process by Power Cycling the controller.

Configuration Options
There are 3 Power-On Configuration Options:
- Antenna Configuration
- Calibrate System
- Set Baud Rate

To change any of the 3 Power-On Configuration values, press and hold the “CCW” button and turn on the controller. A menu choice will be displayed. Press the button that corresponds to the function for which you wish to make a change.

Antenna Configuration
The Rotor controller will stop the rotation on the degree position requested when turning in the Automatic Mode and the Remote Control Mode. It you notice turn inaccuracies you can adjust the system response by setting the Antenna calibration to 1 of 3 different timing modes. Small turning errors can occur due the nature of a small, low power system. Differences in the antenna systems mass and cabling load can cause motor stop and start times to vary. These errors are less than 1/10 of a degree, but over time errors of a degree or more can be seen based on external environmental influences.

To set the Controller to one of the 2 optional timing modes, do the following; turn on the controller and when the “Portable Rotation” message is displayed, hold down the CW button [right button]. Continue holding the button until the “Config / AC CS BR” message is displayed then release the buttons.

Then press the CCW button to select the Antenna Calibration option. The 3 choices displayed are:
- “DF” – Default and overall best fit
- “01” – Slightly smaller timing delays for smaller antennas
- “02” – Slightly longer timing delays for larger antennas

Select the timing option by pressing the corresponding button. The Controller will display your choice for a few seconds, then return to the previous operating mode prior to the power cycle.

Magnetometer Declination (Optional)
The power on Magnetic Declination function is used to set the magnetic declination for the location of the installation. The data is stored in memory between power cycles and only needs to be set when using the optional Magnetometer module and large distance changes between operating sites. Using the chart provided in the optional Magnetometer kit, locate the closest declination line to your location and enter the value. Remember to set the ‘+’ or ‘-’ value along with the declination. Use the same method as setting the initial heading to set the declination. The controller will make the adjustment to true North automatically.

Set Baud Rate
The default USB to serial configuration is 9600/1/N. The controller supports 2 optional baud rates; 4800, and 19,200 baud. To change the power on default, while pressing
the CCW button, turn on the controller. Release the button after the power on messages are displayed.

<table>
<thead>
<tr>
<th>Config</th>
<th>COM Rate</th>
<th>Ent AC al</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC CS BR</td>
<td>48 96 19</td>
<td>4800 BD</td>
</tr>
</tbody>
</table>

Turn On while Holding the CCW Button
Set baud rate to host Default is 9600. press CCW for 4800 baud
Selected 48 so "4800 BD" is displayed for 2 seconds

Select the "BR" choice by pressing the “CW” button. The 3 baud rates are displayed; 48 = 4,800 baud, 96 – 9,600 baud, and 19, for 19,200 baud. Press the button that corresponds to the needed baud rate. The new baud rate will be displayed for a few seconds then the controller enters its previous operating mode. The new value is saved in memory and is persistent over power cycles.

Setting your Call Sign / Vanity Text

The 12PRSAT Rotor Controller allows you to set and will display during idle time where the controller is not turning the antenna, 8 Characters of your choice on the top line of the display. This can be your call sign, antenna information, or any other message you want displayed. This information can be changed as often as you like.

The process of setting the text message is similar to setting the initial antenna heading. Turn on the controller and when the “Portable Rotation” message is displayed, holding down the CCW button [left Button] turn On the Controller. Continue holding the button until the “Ent Call” message is displayed, then Release the button. The bottom line will now display the current message text and the first character position will show that it is ready for input as it will be underlined. Use the CCW and CW buttons to go forward or backward through the Letters and Numbers, pressing the MODE button after the correct character is selected. You must do this operation for all 8 character positions. If no change is needed, just press the MODE button to move to the next character.

Ent Call N7IPY
Enter new Text for each of 8 character positions for a new message
SatTrack A123E045

After entering all 8 characters the display will refresh showing the new user selected text on the top display row and the current antenna heading on the bottom.

Normal Operations

Once the initial configuration is complete, the 12PRSAT Az/El Rotor system is ready to manage your antenna azimuth and elevation movements. As with most portable VHF/UHF beam type antennas that this system is designed to work with, exact degree accuracy is not really needed as the antennas are not that exact. The system design is accurate to 1 degree with a minimum of 1 degree increments.

A simple to use menu system is provided to select the turning mode and to control the system.

There are three modes of operation:

- **Manual Turn Mode** – Used to make manual changes in azimuth or elevation. Not a practical solution for satellite tracking
- **Automatic Turn Mode** – Used to make a turn by entering the azimuth and/or elevation and letting the controller manage the movement of the antenna.
- **Remote Control Mode** – Standard mode of operation using an external computer system with tracking software.

Manual Turn Mode

To use this mode of operation, press and hold the “Mode” button for 1 second. A menu of 3 choices is then displayed, “Az AT El”. The 3 controller buttons correspond to the 3 menu choices. Pressing the “CW” button selects the Manual Turn mode for the Azimuth motor. Pressing the “CW” button selects the manual turn mode for the Elevation motor, and pressing the middle or “Mode” button selects the Auto Turn mode. When using the Manual turning mode the bottom display line shows both the Azimuth and Elevation position. To indicate which axis is selected for manual turn control, the leading letter, ‘A’ for Azimuth or ‘E’ for Elevation is shown capitalized before the degrees value. The non-selected axis is shown with a lower case letter. If an Azimuth move was selected, the letter ‘A’ is shown as upper case, and the letter ‘e’ is shown in lower case. If an Elevation move was selected, the lower case letter ‘a’ is displayed before the degrees of turn and the upper case ‘E’ is shown before the degrees of elevation.

After selecting the Az or El turning option, pressing the CCW (Counter Clockwise) button or the CW (Clockwise) button until the heading on the LCD display shows the heading you want. This will cause a slow speed turn. Dynamic breaking is used to stop accurately on heading. You can do a full speed turn by pressing the mode button and holding it while pressing the CW or CCW button. Releasing the Mode button will return to slow speed movement. During any turn operation the GREEN LED is on, indicating that a turn is in progress.

The controller limits the Elevation motion between 0 and 180 degrees, Azimuth rotation is limited to +/- 540 degrees from North.

As a turn is in process, the new heading value is saved to memory. When finished with your turn, to save on battery power until the next time you want to turn the antenna,
you can turn off the Controller to conserve station power. Turning the power off does not cause a USB connection to be lost as the USB interface is powered by the attached USB master (the PC).

**Automatic Turn Mode**

This mode for turning to a new heading is useful when you need to make a large antenna heading or elevation change; As an Example: Turn from 010 degrees to 170 degrees, (60 degrees). You can either hold the “CW” button down for the duration of the turn or you can enter the Auto Turn Mode, input the new heading and/or elevation and let the controller manage the turn for you.

To enter the Auto Turn Mode, with the control unit on, press and hold the MODE button for 1 second. When you see the message “Az AT El” in the display, release the button. Press the “Mode” button to select Auto Turn. Enter the new heading followed by elevation as explained below.

On the first line of the display the message “Enter Az:” is displayed and on the second line of the display the message “Az:000.” Notice the 100’s place heading value has an underline cursor to identify the active location to change. Use the CCW [Counts Up] and CW [Counts Down] keys to scroll up or down to set this value. You are allowed 0 through 3 in this location. When the first value is set, press the Mode button, the cursor moves to the next location; the 10’s place. Using the same procedure as before; select the value with the CCW and CW buttons and then press the Mode button when the correct number is displayed. The 1’s place value is now selected; select the value and press the Mode button. Using the same process, enter the Elevation values.

If no change is needed for either Az or El, press the Mode button to step over and keep the current value.

The ‘Auto-Turn’ process will start and the controller will automatically turn the antenna to the new heading and/or elevation.

When the turn is completed, the new heading and/or elevation value is saved to memory and you can turn off the controller to save on battery power until the next time you want to turn the antenna.

The current antenna heading and azimuth are displayed during the turn.

**Aborting an Auto Turn Operation**

At any time during the Auto Turn process, you can abort the turn by pressing the MODE (Middle button). The turn will stop immediately saving the current heading to memory.

**Remote Control Mode**

As explained in more detail starting on page 19, this mode is the intended primary mode of operation. This is the mode used for automatic Satellite tracking when connected to a host computer.

**Operational Features**

There are three additional operational features built into the 12PRSAT dual axis Rotor System. They include:

- GPS Data Capture from optional GPS receiver
- Built in Voltage monitor
- Manual System Calibration with optional Auto Calibrate Feature

**GPS Data**

If the optional GPS unit is installed on the Motor unit, the GPS position is captured along with elevation and the current Fix time.

If the GPS unit is not installed, a message is displayed and the system returns to the Normal Operating mode. If the GPS is installed but it does not have a valid position Fix, you will be notified with a “No Fix” message.

Press the CCW button to view the GPS data. You are given a choice to view the Latitude or Longitude.

**Voltage Monitor**

Selecting this option will display the current power supply input voltage. Voltage accuracy is 10mV and the data is constantly updated.
Calibration

The calibration option will cause the rotor unit to re-zero and turn to 000 degrees Azimuth and Elevation. Internal program variables are reset.

If the optional sensor is installed and detected, two additional choices are then displayed: CM for "Calibrate Magnetometer" and AC for Auto-Calibrate.

CalibSys CM AC

When optional sensor is installed two choices are given; CM for Calibrate Magnetometer and AC for Auto-Calibrate

The ‘Calibrate Magnetometer option’ is used to calibrate the magnetometer after installation. Calibration data is stored in the controller for future use. This operation is only needed if the operating environment changes.

The Auto-Calibrate function causes the Motor Controller to perform as Auto-Calibration operation and realign to True North (based on detected magnetic orientation and your previously entered Declination value, and return the elevation to 000 degrees.

Rotational Stoppage – Antenna Jam

In the event that during the rotation of the Antenna, it comes into contact with a structure, tree, or other unmovable object that stalls the turn for more than 1 second, the Controller will detect that the turn has stopped and will turn off the motor, display the message “Turn Fail / FAULT” on the LCD and turn on the RED led with a constant ON condition.

If a Rotational Jam does occur, stop any further attempts at antenna movement and inspect the antenna site. The drive motor is relatively small but has a very high gear reduction, and when operating from a 12 volt source can produce enough torque to damage a light duty antenna.

To clear the condition after you have resolved the physical condition causing the Antenna Jam, using the Rotor Controller in Manual mode, rotate the antenna in the opposite direction that caused the JAM or power-cycle the Controller. Never force a movement by hand.

Power-On RESET Options

There are two choices to Resetting the 12PRSAT System; Reset all saved data to the default out of box settings, clearing all user entered settings and resetting all internal stored states and Resetting as above minus the Vanity Call, Declination and Magnetometer Calibration data. To reset the Controller, turn on the unit while holding down all 3 buttons until the sign on messages are displayed. The Firmware Version will be displayed and you will be asked if you want to Reset the Memory. Press the ‘CCW’ button to Reset All, or the ‘MODE’ button to do a partial Reset. Press the ‘CW’ button for No. If yes, the controller then returns to normal operation, with factory defaults, if no, the Reset is aborted. If the controller is experiencing erratic operations in heading reporting or other operations, perform one of the two Reset operation.

Voltage and Temperature Monitor

The Az/El Rotor system is designed to operate on ’12 Volts’ DC. In general the term ’12 Volts’ can mean some voltage around 12 volts. Lead Acid and Gel Cell batteries do not produce an exact 12 Volts and most power supplies operate above 12 Volts. The 12PRSAT will operate properly at voltages between 11.8 and 14 volts. If the voltage varies outside of the operating voltage margins, a message will be displayed warning the operator the voltage is low or high.

If the voltage goes beyond the maximum or minimum safe operating voltage, the system will fault and stop motor movement and halt operations with the error message; “Halting / Hi Volts” or “Halting / LowVolts” To clear the condition, adjust the power to within specification and power cycle the system.

The Rotor Unit will monitor its operating temperature reporting the data to the Hand Controller. If the operating temperature reaches 65 degrees C a warning message is displayed. If the temperature reaches 70 and above the system will stop operating and require a power cycle to restart normal operations. This is designed to protect the electronics when operating in extreme hot environments.

Remote Control

The Az/El Rotor Controller primary use mode is to be attached to a computer system using the USB Type-B jack found on the front of the Controller. The controller supports the Yaesu® GS232A Rotator Control Protocol. Default serial parameters supported are: 9600 baud, 1 Start, 1 Stop, No Parity, No Handshake.

To enter the Remote Control mode of operation, with the controller on, press and hold both the CW and CCW buttons. The display will show the following message:
While in the Remote Control Mode, manual control of Az/El movement along with all other user operations are disabled. You must exit the Remote Control Mode to make any manual azimuth or elevation changes; do not force by hand any antenna position changes.

To exit the Remote Control mode, Press both CW and CCW buttons at the same time. This button combination toggles between Manual operations and Remote Control Mode.

Note 1 - Yaesu is the registered trademark of Yaesu Munsen CO, LTD and or Yaesu USA

3rd Party Rotor Control Software
There are a number of applications on the market that can be used to Remotely Control the 12PRSAT Portable Dual Axis Rotor system to track satellites. One such program is called ‘PstRotator’ and is sold by YO3DMU. It is a full featured Windows compatible application that will run as a stand alone or as an interface between other applications.

Website: http://www.qsl.net/yo3dmu/index_Page346.htm

PSTRotator fully supports the 12PRSAT Az/El Rotor System including the optional GPS receiver for Location and Elevation setting. Us the following instructions to configure PSTRotator for the 12PRSAT Rotor System. After installing the software and entering your registration code, you must configure the software by setting the COM Port, Controller Type and other operational settings.

Note: On a Microsoft Windows based platform, you may need to install the FTDI Virtual COM Port driver. This driver is available on the FTDI Web Site at the following URL: http://www.ftdichip.com/Drivers/VCP.htm

From this location select the driver based on your Operating System and install as instructed by FTDI.

Under the ‘Communications’ Tab – Select ‘AZ/EL COM Port’ and select the USB Port to which the Controller is attached.

Under the ‘Setup’ Tab:
- Select ‘El / Az+EL Controller’ then select ‘Portable Rotation PR12SAT’
- Select ‘Refresh Rate’ and set to 1 Sec
- Select ‘Start in Manual Mode’
- Select ‘Satellite Tracking’
- Select ‘Satellite Tracking Setup -> set ‘Pos Change” to 5 Degrees or more
- Select ‘3db Beam Width’ and enter a value for your antennas. Example for antennas this unit is designed to support – set to 30 degrees.
- Select ‘My Location’ and enter your current position manually or if using the Optional GPS Module, click the ‘Use GPS’ box and your position will auto populate. When the fields are populated, click ‘Set Location’ and ‘Save’

There are many other settings that can be set based on user needs. Those listed are the minimum needed to enable this software for this controller.

The USB Port is powered by the Host PC so you can turn off the Controller and the USB port will not be dropped by the attached host computer.

Error Messages
In the event of operational errors, the Controller will display Error messages to help in system troubleshooting. In most error cases, the problem will be traced down to a bad connection between the handheld controller and the motor controller or an antenna movement issue. For all ComErr0x errors, check the interconnecting cable.

- ComErr01 FAULT! This is a fatal error at startup time. The Rotor Controller did not respond to a status request. No communications between units detected.
- RTR Fail FAULT! This is a fatal error at startup time. The Rotor Controller reported bad data at initialization.
- FW Match FAULT! Hand Controller and Motor Controller Firmware are not compatible.
- ComErr01 NStatACK Rotor unit failed to respond to a Calibrate command.
- ComErr02 No ACK Rotor unit failed to respond to an Az/EL Move Command
- ComErr03 No ACK Rotor unit failed to respond to a Stop command
**ComErr04 No ACK**
Rotor unit failed to respond to a Set AZ or El position command

**ComErr05 No ACK**
Rotor unit failed to respond to a Get AZ or El position command

**ComErr06 No ACK**
Rotor unit failed to respond to a Get Status command

**HALTING! LowVolts**
Input voltage is below minimum operating range of 11.50 VDC. System has stopped motor operations and is now faulted. Turn off the system and resolve under voltage problem.

**HALTING! Hi Volts**
Input voltage is above maximum operating range of 14.00 VDC. System has stopped motor operations and is now faulted. Turn off the system and resolve over voltage problem.

**Warning! Hi Volts**
Input voltage is above recommended operating range of 13.75 VDC. The controller will continue to work, but the Rotor Unit may not be able to accurately move the antennas causing tracking errors.

**Warning! LowVolts**
Input voltage is below recommended operating range of 11.90 VDC. The controller will continue to work, but the Rotor Unit may not be able to accurately move the antennas causing tracking errors.

**Turn Out Of Range**
New Turn command will cause a turn greater than 540 Degrees.

**FAULT! TurnFail**
Turn failed – Make sure there is nothing blocking the antenna path; check connection between rotor units. Power cycle unit.

**Warning! HighTemp**
Rotor Unit reporting high operating temperature of 65° C inside the Az enclosure.

**FAULT! HighTemp**
Rotor Unit reporting high operating temperature of 75° C inside the Az enclosure.

In most cases, ComErr01 through ComErr06 will clear with an automatic system restart. These Communication Errors are usually caused by a cabling issue; recheck cable connections between the Elevation and Azimuth units and the hand controller.

**Interconnect Information**

**Connector Details**

5-Pin Connector For Optional Auto Calibration Hardware

2-Pin Connector For User Provided Receiver Preamp or other low current Hardware

6-Pin Connector from Elevation Unit

4-Pin Connector to The Control Unit

Cable Connection Details. Note the Optional 3-Pin GPS Connector is on the front side of the Az enclosure

**50 Foot Cable Details**
The rotor cable is a 4 conductor, 18 Gauge, 7 strand cable using female connectors at each end.

- Pin 1 to Pin 1 – Power out to Rotor (12VDC)
- Pin 2 to Pin 2 – Ground
- Pin 3 to Pin 3 – RS485 Serial Data (+)
Pin 4 to Pin 4 – RS485 Serial Data (-)

Required Cable Connector: 4-Pin Female connector:
Philco P61605

An extension cable will require one 4-Pin male and one 4-Pin female connector. Cable lengths over 100 feet are **not** supported. An optional 50 Ft extension cable can be purchased from Portable Rotation.

**Caution** should be used if making your own cables as connecting the power pins to the data communications pins will **damage** one or both of the controllers and require replacement of the either or both the Controller and the Rotor Unit voiding the warranty.

### Serial Communications Commands

Below are the supported Yaesu GS232A protocol commands:

- **Start Left Turn:** ‘L’ Command
- **Start Right Turn:** ‘R’ Command
- **Start Up Movement:** ‘U’ Command
- **Start Down Movement:** ‘D’ command
- **Stop Az Turn:** ‘A’ Command
- **Stop El Turn:** ‘E’ Command
- **Stop All Turn:** ‘S’ Command
- **Auto Turn to new Az Heading:** ‘WXXX’ Command
- **Auto Turn to new Az/El Heading:**‘WXXX YYY’ Command
- **Report Current Az Heading:** ‘C’ Command
  - Responds with: ‘AZ=XXX<CR>’
- **Report Current Az/El position:** ‘C2’ command
  - Responds with: ‘AZ=XXX EL=YYY<CR>

**Additional Command to read GPS data from the Controller**

- **Report GPS Latitude, Longitude and Elevation**
  - ‘G’ Command
  - Responds: G=ddd.nnnnnX ddd.nnnnnnY hhhh
  - Where:
    - First Data Set is Latitude, Second Data Set is Longitude and hhhh = height in meters
  - Response: G=---.-------- ---.-------- ----
  - If no GPS module was detected

---

Response: G=000.0000000 000.0000000 0000
If no valid GPS data is available, No Fix

Commands are terminated with a 0x13 – CR character

### Technical Description

The system is built around a microcontroller based hand held controller that manages the user interface and the remote host computer connection and a second microcontroller system located in the main Rotor enclosure that manages motor control and position tracking.

The controllers communicate over an RS485 2 wire interface using a proprietary command protocol. The primary system control is intended to be by a user provided host computer with satellite tracking software. Any program that supports the standard Yaesu GS232A protocol should work with this system.

The two microcontrollers function in a master/slave configuration with the Hand Controller being the Master. Communications between the two controllers is simplex with the master controller as the initiator. All communications require an acknowledgment from the slave controller.

The electronics between the two controllers are similar, using the same microcontroller and power circuits. The Hand Controller has a flash memory component that is used to store operating state data between power cycles. At power on, data such as current heading and elevation is sent to the motor controller. Data is updated at each degree change in heading and elevation.

The Motor Controller interfaces to the optional GPS receiver and Optional 6-axis Magnetometer/Accelerometer. The Motor Controller has two 2-Amp Motor Drivers and manages motor movement by monitoring optical sensors on both motor systems. Mechanically, the Heading and elevation outputs are driven through a 30:1 Worm Gear, both Worm and Worm Wheel are machined from Brass for strength and ware resistance.

Both controllers use ‘Watch-Dog’ timers to reset the system in the event of an operational failure; the Motor Controller is set at 30 seconds and the Hand Controller is set for 60 seconds. If a watch-dog timer event happens, in most
cases the operator will not notice it. The system will reset and continue from where it was prior to the failure. In most cases, a watch-dog timeout is caused by a communications issue between controllers. This is not a common event.

**Minimum / Maximum Turn Explanation**

The PR12SAT Rotor System allows for a Maximum Turn of 540 Degrees (1½ turns in both directions) from the center heading of 000 Degrees True North. The system is designed not to allow more than this amount of turn so that cable-wrap is minimized. Turning past the 1½ turn limit would cause damage to the interconnecting cables.

The system will turn to a new heading using the shortest turn direction so as to accomplish the turn the fastest. As an example, if you continually do clockwise turns from 000 degrees, you will reach 000 degrees again, but the cables will have 1 full turn on them. Continuing to turn clockwise an additional 180 degrees the controller will display A180Exxx on the display and to the host computer but internally the controller knows that the turn count is 540 degrees. The next clockwise turn would cause a turn past the 540 degrees limit. At that point the turn is stopped at the 180 degree point. The controller will respond to the host computer that it has reached the commanded turn position even though the turn was stopped at the max turn position of 180 degrees plus 360.

The next commanded azimuth turn will cause a turn to the new location in the direction needed to unwind the cables and to return the physical system to +/- 180 degrees from the heading of 000 degrees. At Min/Max turn location (540 degrees of turn clockwise or counter clockwise) a commanded turn to 000 degrees will also cause a cable unwrap operation to be performed.

When the Antenna Auto Calibration option installed, a turn from any position to 000 degrees will cause the controller to adjust if necessary the azimuth and elevation to 000/000 degrees.

A fail safe is built into the software that will cause the Rotor Controller to reset, causing the Hand Controller to reset if the Min or Max turn count goes 5 degrees beyond 540 degrees from home position.

**Quick User Reference**

- **USB Computer Control Port**
  - 4 Conductor Rotor Cable Connection
  - On/Off Switch
  - 12VDC Power

- **Multifunction Buttons**
  - Press CCW and CW to set values using MODE Button.
  - Step through 100s, to 10s, to 1s. After entering 1s value, auto turn starts.
  - Press and hold for 1 Second Then select:
    - Manual Turn Azimuth
    - Manual Turn Elevation
    - Enter AutoTurn Mode

- **Backlighted 2x8 LCD with User Programmable Top Line**
  - Press all 3 buttons with power on to read Power supply Voltage, GPS position, or force an Auto Calibrate operation if options are installed

- **Fault LED**
  - Turns on if Rotation is blocked. Will flash when sending data in Remote Mode

- **Turn LED**
  - Turns on during any Turn operation

- **Press to Turn Counter Clockwise**
  - While Pressing CCW or CW in Manual turn Mode, press to turn at full turn rate

- **Press to Turn Clockwise or Up**
  - USB Computer Control Port