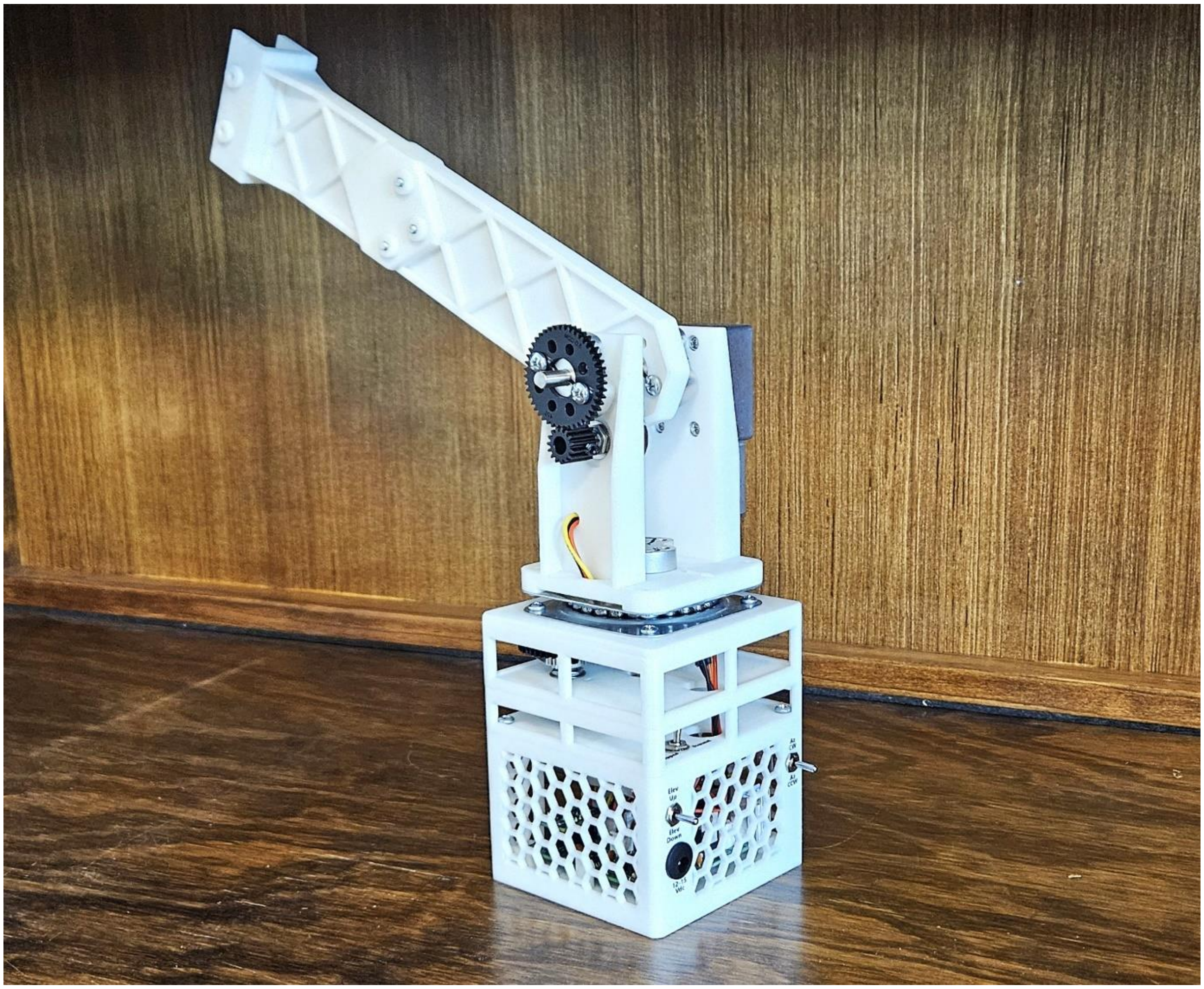

OPERATION MANUAL

PSR-100 Portable Satellite Antenna Rotor

WA4MCMkits

Don Friend – WA4MCM

Revision History

Revision Number	Date	Description	Notes
1.0	4/24/2025	• Initial publishing of the operation manual	Prior to beta testing
1.1	5/3/2025	• Minor edits to correct grammar and spelling errors	
1.2	717/2025	• Added section on how to interface with the CSN Technologies S.A.T. box	
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		•	
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CONTENTS

INTRODUCTION

Thank you for purchasing this Portable Lightweight Satellite Antenna Rotor Kit. Every effort has been made to design a product that will provide years of service and will enhance your ability to track and communicate through the many satellites available to the Radio Amateur.

I made this a kit in an effort to bring back some of the kit building nostalgia that was prevalent in the early days of Amateur Radio as well as add to the growing Maker Movement. A decision was made to use all through-hole components on the circuit board to make the kit attractive to beginners.

Finally, to keep cost and complexity to a minimum, I specifically designed the rotor for lightweight antennas such as the standard arrow antennas. I also made it with a bare-bones enclosure to reduce weight as well as cost, so the unit is not weatherproof and should only be used during fair weather (or under cover).

73,

Don – WA4MCM

FEATURES

- **Easy to Operate** – The PSR-100 requires no special skills or knowledge to operate once it has been properly installed according to the instructions provided in this document.
- **Portable** – In order to support portable satellite operations, the PSR-100 has been designed to be a lightweight and small as possible. With this in mind, it is not suitable for being permanently installed since it is susceptible to the weather.
- **Computer Interface** – Comes with a WiFi to USB "dongle" which provides a private WiFi access point (AP) to which the rotor's Microcontroller Unit (MCU) automatically connects. MS Windows will recognize the dongle and assign it a virtual Com port.
- **Satellite Tracking Software Interface** - The rotor accepts standard Azimuth and Elevation commands via the virtual Com port from most of the satellite tracking software currently on the market.
- **Mounting Bracket for Arrow Antenna (antenna not included)** – The PSR-100 comes with a removable mounting bracket that has been specifically sized to accommodate the standard Arrow antenna with a ¾" square boom. If your antenna's boom is different, you will need to fabricate a suitable adapter.
- **Mounts on a Standard Camera Tripod (not included)** – The base of the meter's enclosure has a ¼-20 threaded brass insert that will mate with the mounting bolt on most camera tripods.
- **"Flipped" Mode** – In order to allow uninterrupted tracking of satellites that pass through North (i.e., from 359° to 0°), the PSR-100 comes with a "flipped" mode that moves the physical stop to 180°. Flipped mode in invoked by a toggle switch located on the rotor itself.

SPECIFICATIONS

- Operating Voltage: 12V – 15V DC @ 300mA (a 12VDC 1A wall adapter is provided)
- Accuracy: ± 3 degrees for both azimuth and elevation
- Computer Interface: WiFi Dongle: Standard USB – Drivers available for most operating systems

- Rotor Dimensions: 3 1/2" W x 3 1/2" D x 8 1/2" H (w/o elevation arm)
  3 1/2" W x 3 1/2" D x 18" H (with elevation arm)
- WiFi Dongle Dimensions: 2 1/4" W x 1 1/8" D x 3/8" H

OVERVIEW

The PSR-100 is a lightweight unit designed to provide the Radio Amateur interested in getting started with working the various Amateur Radio satellites without "breaking the bank". It is easy to set up and take down and can point lightweight antennas by accepting azimuth and elevation movement commands from most of the satellite tracking software available. It has been designed to specifically replace one's arm as the pointing device.

In order to remove the need for additional cables besides the required coaxial feedlines, the rotor will connect wirelessly to the supplied private WiFi Access Point (AP). As long as the rotor remains within about 40-50 feet of the access point, the satellite tracking software will be able to send the movement commands. Of course, this assumes a clear line-of-sight between the rotor and the AP.

The rotor's current draw is about 150mA at idle and about 300mA when moving under load. This means the rotor is perfectly suited to being powered by a small rechargeable battery. This would even further reduce the need for additional cables. A 3AH LifePo4 battery was used during the R&D phase of the rotor's development and provided many days of testing before needing to be recharged

The rotor comes with a mounting bracket designed to accommodate the standard Arrow antenna (not included), but it can easily be adapted to other lightweight antennas – even homebrew.

Finally, to further make this a truly portable antenna rotor, it has been designed to be mounted on a standard camera tripod for ease of placement. The tripod is not included but inexpensively available from most eCommerce sites such as Amazon and eBay.

ROTOR CONTROLS

There are only a few controls available on the rotor itself since it will be mostly used in conjunction with satellite tracking software. There are toggle switches for manually moving the rotor's azimuth clockwise or counterclockwise as well as for moving the rotor's elevation arm up (increasing angle) and down (decreasing angle). There is also a toggle switch for placing the rotor into "Flipped" mode to accommodate North-passing satellites.

MANUAL ELEVATION SWITCH

The manual elevation toggle switch is located on the upper left face of layer one of the rotor's main body. The switch is spring-loaded, so you must maintain pressure in order to keep the elevation arm in motion.

Pressing the toggle up will cause the rotor's elevation arm to move towards its horizontal position which would equate to the antenna being moved towards the 90° angle (straight up).

Pressing the toggle down will cause the rotor's elevation arm to move towards its vertical position which would equate to the antenna being moved towards the 0° angle (horizontal).

Note: The initial couple of seconds of movement is slowed down to allow for more precise angle selection during the rotor's calibration process. Once this time has passed, the elevation arm will move more rapidly.

MANUAL AZIMUTH SWITCH

The manual azimuth toggle switch is located on the upper right face of layer one of the rotor's main body. The switch is spring-loaded, so you must maintain pressure in order to keep the elevation arm in motion.

Pressing the toggle up will cause the rotor to move the antenna in a clockwise direction which would equate to the antenna's azimuth angle being increased.

Pressing the toggle down will cause the rotor to move the antenna in a counterclockwise direction which would equate to the antenna's azimuth angle being decreased.

Note: The initial couple of seconds of movement is slowed down to allow for more precise angle selection during the rotor's calibration process. Once this time has passed, the elevation arm will move more rapidly.

FLIP SWITCH

The flip switch is located inside the front left corner of layer two of the rotor's main body. Refer to the image below for its exact location:

The operator should be able to activate the switch using their finger. If not, then a narrow probe such as a pen or pencil may be used.

Moving the toggle towards the "Flipped" side will cause the rotor to rotate clockwise 180°. The rotor's firmware will continue to consider this position the azimuth angle at which the rotor was positioned prior to the flip switch's activation. For instance, if the rotor was pointing at 45° (NE) in normal mode, as far as the rotor's firmware is concerned, it is still at 45° regardless of its new physical position.

Important Note: Care must be taken to be aware of the selected mode so that the operator may adjust the rotor's physical orientation with respect to North. Therefore, it is best to manually move the rotor to 0° (North)

while in normal mode, only then select flipped mode. Once the rotor has stopped its movement to the “flipped” position, the operator can then physically turn the entire rotor so that the antenna is once again pointing north. Using the camera tripod’s swivel feature makes this easy. Also, please don’t forget to move the rotor’s orientation back to its original position when returning to normal mode.

INSTALLATION

MOUNTING THE ROTOR

The PSR-100 is designed to be mounted on a standard camera tripod. The base of the rotor has a ¼-20 threaded brass insert meant to mate with the mounting bolt on the tripod.

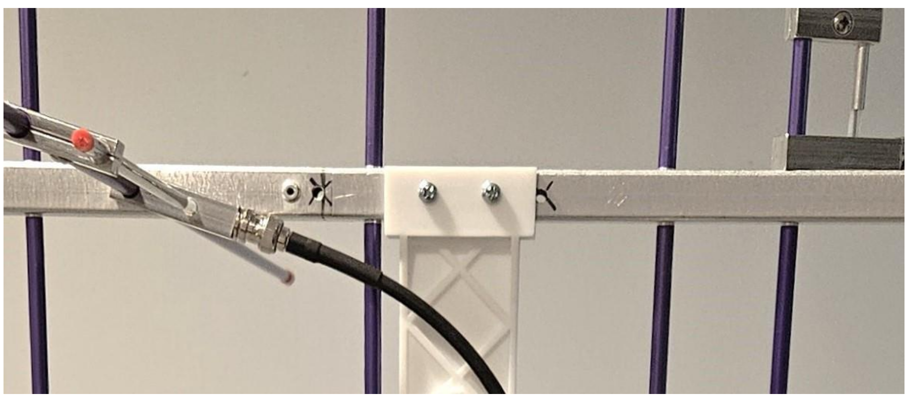
Here is a link to a typical inexpensive lightweight camera tripod that has the added feature of a small hook for holding a small battery pack as described later in the *Power Connection* section:

https://www.amazon.com/dp/B0B1HJ2YSH?ref=ppx_yo2ov_dt_b_fed_asin_title

Note: In order to make it easier to get close to the tripod/rotor assembly, It is advisable to mount the rotor to the tripod BEFORE mounting the antenna to the rotor's elevation arm. The elevation arm has been separated into two pieces – the lower arm which is permanently mounted to the elevation motor, and the upper arm which can be permanently mounted to the antenna's boom.

ATTACHING THE ANTENNA

The PSR-100's upper elevation arm has a square channel mounting bracket designed to accommodate a standard Arrow antenna. You will have to mark and drill corresponding holes in the boom of you antenna in order to



accommodate the **M4x0.7x30mm** mounting screws. One side of the mounting bracket is threaded, so no nuts are needed to secure the antenna to the bracket.

Using the standard Arrow antenna as an example, refer to the image below for the antenna booms mounting location just behind the second UHF director (kindly ignore the aborted holes with the X's):

The mounting bracket has been designed for antennas with ¾" square booms. If your antenna's boom is different, you will need to fabricate a suitable adapter.

Once the antenna has been mounted to the upper elevation arm's bracket, slide the upper elevation arm onto the end of the lower elevation arm and align the three mounting holes. Use three **M4x0.7x20mm** screws to secure the two pieces of the elevation arm.

Important: Be sure that you have the antenna pointing in the correct direction – i.e., the front of the antenna aligned with the rotor's front as indicated by the raised arrow on the base of the elevation bracket.

COAXIAL CABLE ROUTING

Proper routing of the antenna's coaxial cable feedline(s) is crucial to prevent hindering the free movement of the rotor's transition – both elevation and azimuth. Please refer to the following paragraphs and images for guidance.

Best practice suggests securing the antenna feedline(s) in two locations:

- The elevation bracket to help remove any added load on the elevation motor
- The rotor's main body so that the cables can be pre-wrapped to prevent binding the azimuth movement of the rotor

ELEVATION BRACKET

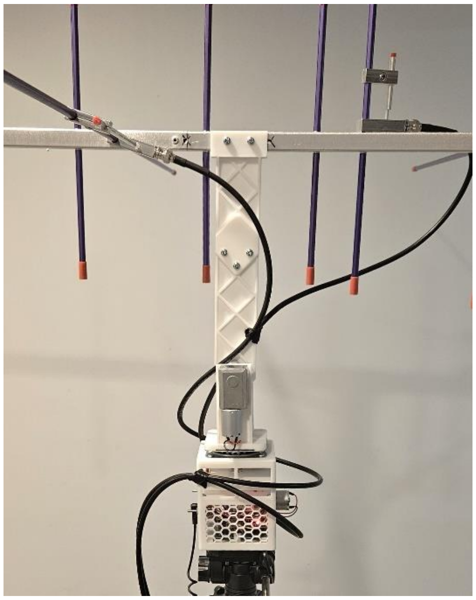
Please refer to the right-hand image below for an example of how to secure two coaxial cables to the lower elevation arm.

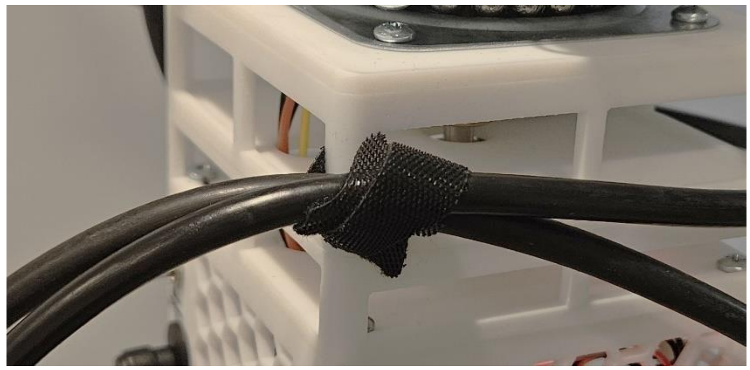
Prepare the arm by drilling a hole as shown in the left-hand image below to accommodate a tie-wrap to be used to secure the cables. The hole should be sized appropriately depending on the type of tie-wrap used – this particular example uses a ¼" hole for a small Velcro tie-wrap.

Pass the tie-wrap through the hole and wrap it snuggly around the cables to prevent them from: a) adding dead weight to the end of the elevation arm, and b) becoming snagged in the elevation position indicating gear train.

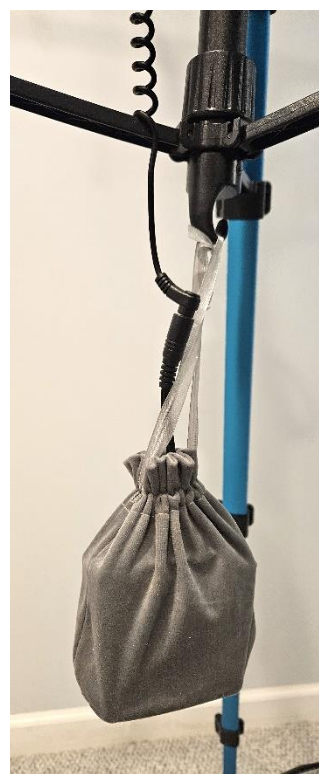
MAIN BODY

In order to prevent the need to "Drag" the feedline cables through the rotational path of the antenna while actively tracking a satellite, it is best to pre-wrap and secure them to the main body of the rotor. Please refer to the images below for an example:





POWER CONNECTION



The PSR-100 comes with a 12 VDC wall adapter whose plug will fit the power receptacle located under the manual elevation toggle switch. However, the unit will accept any 12 - 15 VDC wall adapter with a 5.5mm x 2.1mm plug.

Since the rotor has been designed for portable use, WA4MCMkits recommends the purchase of a small 12-15VDC rechargeable battery such as a 3AH LifePo4 or similar battery pack. This will not only provide the needed power required to operate the rotor for many satellite passes before needing to be recharged but will also remove the need for 120VAC to power the wall adapter.

Here is a link to the Bioenno battery model used at WA4MCMkits during the initial field testing of the rotor with very good results:

https://powerwerx.com/bioenno-blf-1203w-12v-3ah-lithium-iron-pvc

Link to the appropriate charger:

https://powerwerx.com/bioenno-power-bpc-1502dc-2a-dc-plug

Link to the power extension cable from Amazon:

https://www.amazon.com/dp/B0BN2YX895?ref=ppx_yo2ov_dt_b_fed_asin_title

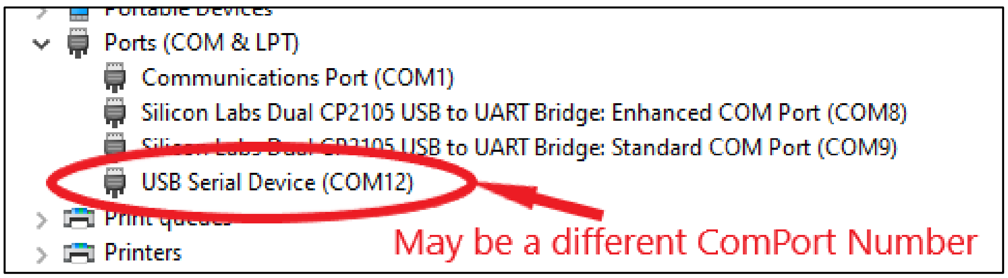
The battery is small enough to fit into a small drawstring bag that can be suspended from the camera tripod as shown in the image to the right:

WIFI HOT SPOT

The PSR-100 comes with a private WiFi hot spot designed to be plugged into a computer's USB port. This hot spot receives rotor movement commands from the satellite tracking software and then retransmits them wirelessly to the PSR-100 using the UDP protocol.

VIRTUAL SERIAL PORT DRIVER INSTALLATION

The ESP32-S3-WROOM microcontroller used by the PSR-100 WiFi Dongle uses an integrated USB Serial/JTAG Controller. On MS Windows 10 or newer PCs, the drivers should be installed automatically when you plug in the module for the first time. Once this is complete, you can identify the ComPort assigned to the module by reviewing the Windows Device Manager as shown below:



If there is more than one ***USB Serial Device*** entry, you can easily identify the one associated with the meter's USB controller by unplugging it and observing which entry disappears from the Device Manager listing.

COMPANION WINDOWS APPLICATION

The PSR-100 requires the Windows companion application for initial setup and calibration. The application is also very handy for manually testing the rotor's operation.

At this time, the application has only been written for the Windows operating system. There are currently no plans to port it to other operating systems such as Linux or Apple, but that may change if enough interest is received by WA4MCMkits.

If you are the original builder of the PSR-100 kit, then you have already downloaded and used the companion application to perform pre-assembly checks of the rotor's electronics as well as the initial angle calibration procedure, so the following paragraphs will be a somewhat recognizable. For new users, please refer to the following sections for instructions on how to download, install and use the PSR-100 Windows companion application.

DOWNLOAD AND INSTALLATION

You may download the PSR-100 Windows companion application from the WA4MCMkits website at the following URL:

https://wa4mcmkits.com/wp-content/uploads/2025/05/PSR-100-Remote-Control-v1.0.1.zip

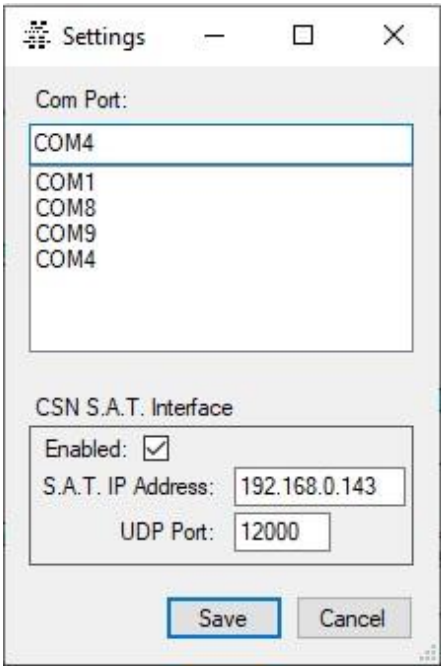
The download package contains a ***ReadMeFirst.txt*** file which contains the simple installation instructions. Follow the instructions to complete the installation of the application then refer to the next section to set the Com port.

CHOOSING A COM PORT

Start the PSR-100 companion application. When starting the application for the first time, you may get a Com Port error as shown below:

Just click the "Ok" button, and the main application window will appear.

Click on the "Settings" option on the top menu to bring up the Settings dialog box. Click on the Com Port that you identified in the previous step and click the "Save" button.



SATELLITE ROTOR OPERATION

The following sections provide instructions and/or procedures needed to successfully use your PSR-100 for Amateur satellite operations.

INITIAL SETUP

The following initial setup steps are performed using the PSR-100 Windows Companion application. Please ensure that the PSR-100 WiFi Access Point dongle has been inserted into a USB port on the computer being used and that the companion application is running.

Note: You will need to close any satellite tracking software while the companion application is running due to Com port contention. Likewise, you must close the companion application prior to launching the satellite tracking software.

CALIBRATION (IF NEEDED)

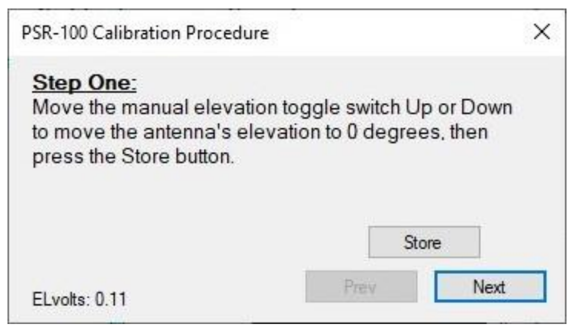
Normally, the calibration parameters that were determined during the rotor's initial assembly are saved in the rotor's non-volatile memory and shouldn't need to be redone. However, events may occur that would cause the angle transmitting potentiometers to be mis-positioned which would require the calibration process to redone.

Rotor Calibration Steps

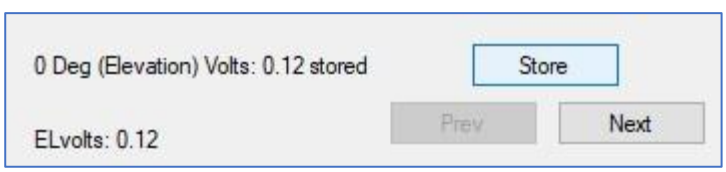
- Open the companion application's calibration procedure by selecting "Calibrate" from the top menu.

  The calibration dialog box as shown in the image to the right will appear.

  The calibration procedure is a guided, step-by-step process that will ensure that both the elevation and azimuth gear trains provide the most accurate angle measurements.



- Use the manual elevation toggle switch to rotate antenna to zero degrees elevation as instructed in step one of the guided calibration procedure.
- Click the **Store** button and ensure the stored message similar to the one shown below is displayed.



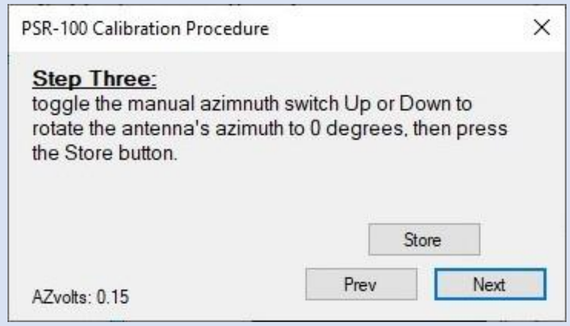
  Once you receive the message, click the **Next** button to move to step two of the guided calibration process.

- As instructed in the step two text, use the manual elevation toggle switch to move the antenna so that it is at 90 degrees (pointing straight up).
- Click the **Store** button to store the 90 degree **ELvolts** reading.

The 90 Deg stored message should appear shortly after clicking the **Store** button.

Once you receive the message, click the **Next** button to move to the azimuth portion of the guided calibration process.

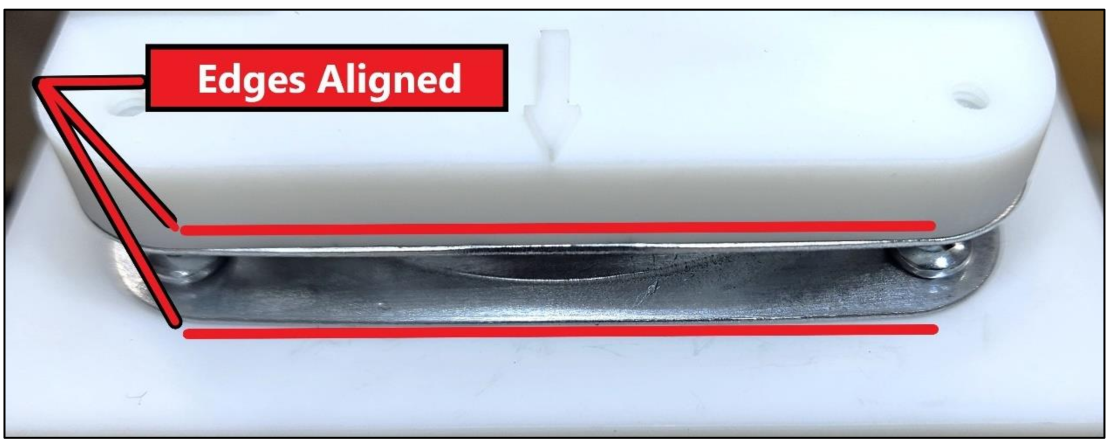
- The calibration procedure dialog box should now be at step three as shown in the image to the right:



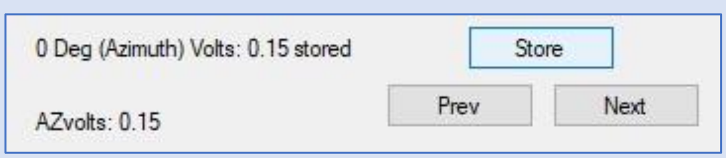
- As instructed in the step three text, use the manual azimuth toggle switch to rotate the **Elevation Motor Mounting Bracket** so that it is at 0 degrees.

  Note: 0 degrees is when the raised arrow is pointing towards the rotor's main body face containing the manual movement toggle switches as well as the DC power receptacle.

  Tip: To easily judge the 0, 90, 180, 270 and 360 degree positions, use the CW and CCW positions of the manual azimuth toggle switch to line up the edges of the upper and lower parts of the turntable as shown in the image below.



- Click the **Store** button and ensure the stored message similar to the one shown below is displayed.



  Once you receive the message, click the **Next** button to move to step four of the guided calibration process.

- As instructed in the step four text, use the manual azimuth toggle switch to rotate the **Elevation Motor Mounting Bracket** so that it is at 90 degrees.

- Click the **Store** button to store the 90 degree **AZvolts** reading.

  The 90 Deg stored message should appear shortly after clicking the **Store** button.

  Once you receive the message, click the **Next** button to move to step five of the guided calibration process.

- As instructed in the step five text, use the manual azimuth toggle switch to rotate the **Elevation Motor Mounting Bracket** so that it is at 180 degrees.

- Click the **Store** button to store the 180 degree **AZvolts** reading.

  The 180 Deg stored message should appear shortly after clicking the **Store** button.

  Once you receive the message, click the **Next** button to move to step six of the guided calibration process.

- As instructed in the step six text, use the manual azimuth toggle switch to rotate the **Elevation Motor Mounting Bracket** so that it is at 270 degrees.

- Click the **Store** button to store the 270 degree **AZvolts** reading.

  The 270 Deg stored message should appear shortly after clicking the **Store** button.

  Once you receive the message, click the **Next** button to move to step seven of the guided calibration process.

- As instructed in the step seven text, use the manual azimuth toggle switch to rotate the **Elevation Motor Mounting Bracket** so that it is at 360 degrees.

- Click the **Store** button to store the 360 degree **AZvolts** reading.

  The 360 Deg stored message should appear shortly after clicking the **Store** button.

  Once you receive the message, click the **Next** button to move to the last step of the guided calibration process.

- Click the Done button to complete the PSR-100 calibration process.

SET TO NORTH

Before using the rotor, it must be pointed so that the 0° position is pointing towards true north. This can be accomplished by following these steps:

- Using a map, compass, GPS, or other method to identify a landmark that is north of the rotor's operating position.
- Use the PSR-100 companion application to move the rotor and antenna to 0° azimuth and 0° Elevation.
- Sight down the length of the antenna's boom and physically move the tripod (or, if the tripod is so equipped, its mounting plate) so that the boom is pointing at the landmark identified in the first step.

WHEN TO USE FLIP MODE

The PSR-100 is only capable of rotating between 0° and 359°. Therefore, if a satellite passes to the north of the operator's location, the rotor will have to stop and rotate a full circle in the counterclockwise direction before transitioning from 359° to 0° (when moving from west to east), or a full circle clockwise when transitioning from 0 to 359 (when moving from east to west).

In order to prevent this wasted movement (and time), the PSR-100's firmware recognizes a "Flipped" mode where the rotor's north direction is virtually moved to the center of its physical azimuth boundaries. The firmware handles all angle calculations so that the rotor can seamlessly transition between 0° and 359° (and vice-versa).

Please refer to the following image for an example of a north satellite pass (the ISS from West to East):

TRACKING SOFTWARE CONFIGURATION

It is beyond the scope of this document to provide comprehensive instructions on the utilization of the following applications. The information contained in this section only pertains to the setup parameters needed to successfully interface the application with the PSR-100 Satellite Antenna Rotor.

As of this writing, I only have information for two applications: SatPC32 and PstRotator. I will add others as the information becomes available. I am always grateful for any input from my customers, and will incorporate any info you can send my via don.friend@wa4mcmkits.com.

SATPC32

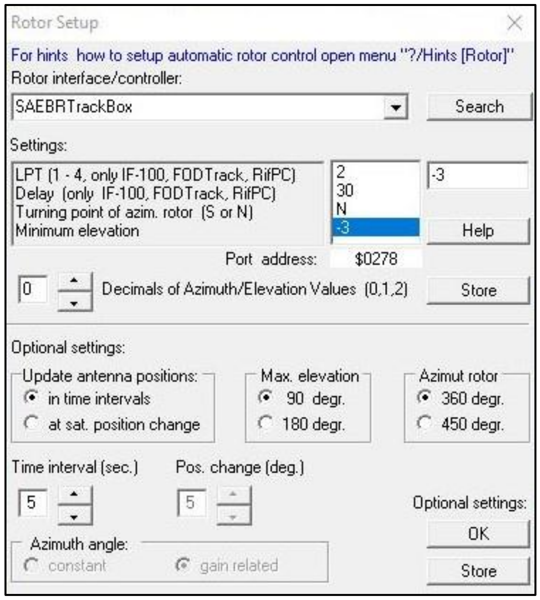
The SatPC32 satellite tracking software package may be purchased and downloaded from the AMSAT website at the following URL:

https://www.amsat.org/product/satpc32-by-electronic-download/

The price includes a license key that will unlock all of the application's features. For more information, please visit DK1TB's website (https://www.dk1tb.de/indexeng.htm) where you can also download a free version of the application.

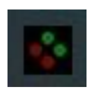
Please refer to the following steps for information on how to configure SatPC32 for the PSR-100 Rotor:

1. Select Setup/Rotor Setup from the application's top menu. This will display the dialog box shown in the image below:

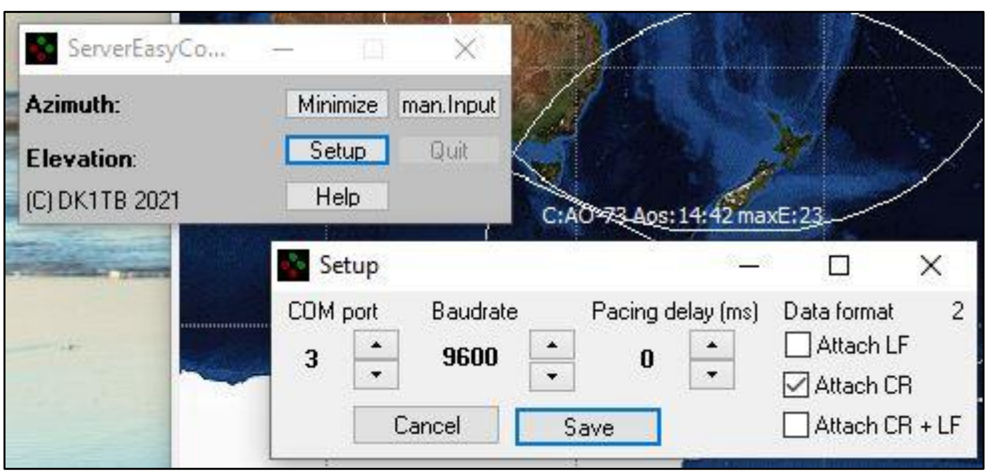


2. Choose the settings shown in the image and click the two **Store** buttons. You will need to restart the application.

3. After the application has restarted, you should see an icon in the Windows system tray that looks like:



4. Click the icon to maximize the ServerEasyComm1 applet provided by the SatPC32 author. Click its **Setup** button and select the Com port for the PSR-100's WiFi hot spot dongle. Set the other parameters as shown in the image below, then click the **Save** button.



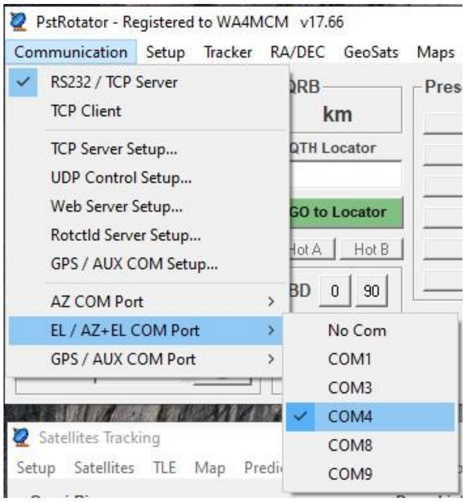
PSTROTATOR

PstRotator can be purchased and downloaded from YO3DMU's web site at the following URL:

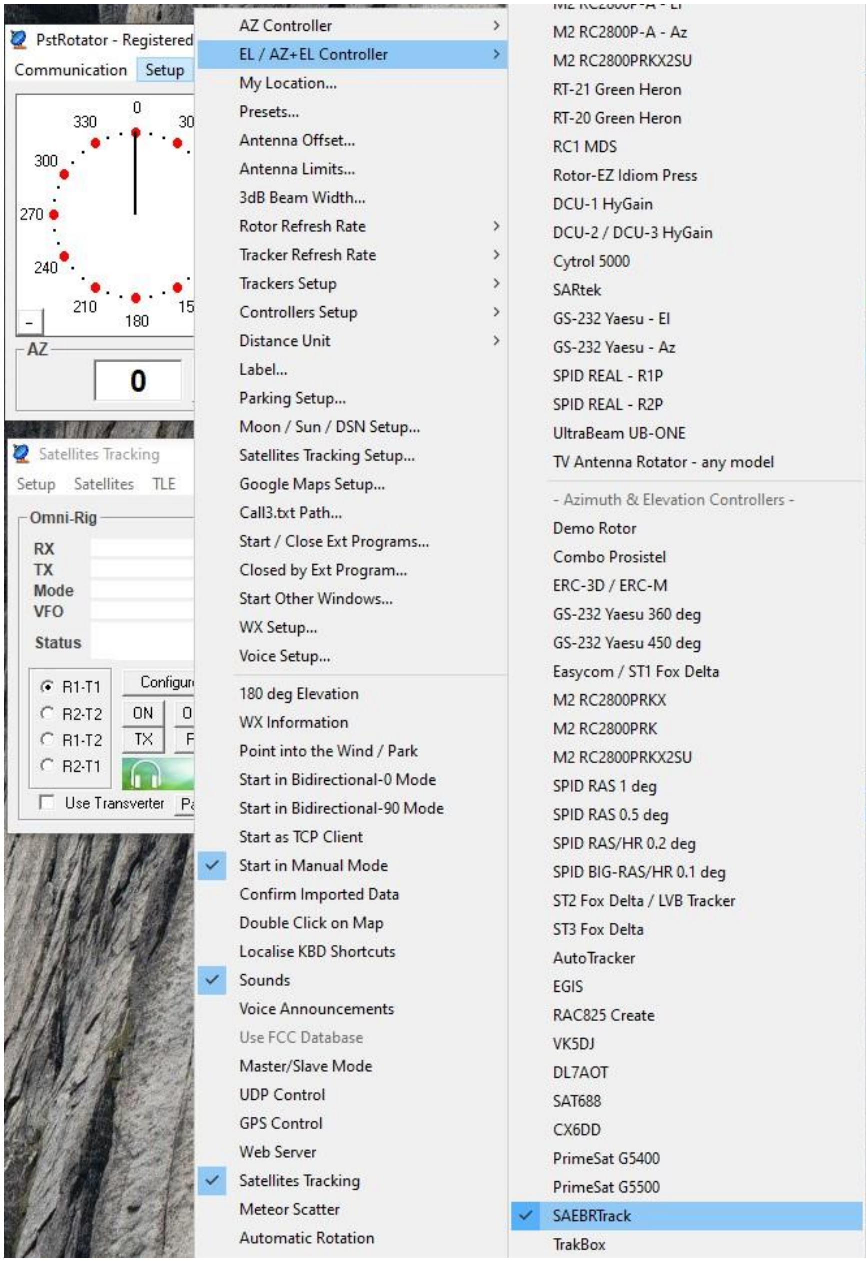
https://www.qsl.net/yo3dmu/index_Page346.htm

Please refer to the following steps for information on how to configure PstRotator for the PSR-100 Rotor:

1. Open the **Communications** top-level menu and click the **RS232 / TCP Server** option such that there is a check mark to its left.
2. From this menu, open the **EL / AZ+EL COM Port** sub-menu and select the PSR-100 WiFi Dongle's Com port. Refer to the image below for guidance:



3. Open the Setup top-level menu and expand the EL / AZ+EL Controller sub-menu. Select **SAEBRTrack** from the **- Azimuth and Elevation Controllers -** section of this sub-menu. Please refer to the following image for guidance:



OTHERS

For tracking software not addressed in the previous sections, use the following information to assist you with interfacing the PSR-100:

- Select a rotor model that uses a COM port for communications – such as the SAEBRTrack referenced in the previous sections.

- The rotor recognizes the azimuth and elevation commands in the following format: AZxxx.xELxx.x

  It doesn't really matter how many decimal places are used. The rotor's firmware will truncate to the nearest integer value. The only requirement is that the azimuth value precedes the elevation value and that there are no other fields between the azimuth and elevation values.

CSN TECHONOLOGIES S.A.T. BOX

The CSN S.A.T. is a fully self-contained satellite tracking device that can simultaneously control an antenna rotator and adjust the tuning of an Icom transceiver to compensate for doppler shift. It is accessed over WiFi using a standard web browser. It is available for sale from the CSN Technologies web site:

http://www.csntechnologies.net/purchase

as well as most Ham Radio equipment outlets such as:

https://www.dxengineering.com/search/product-line/csn-technologies-s-a-t-self-contained-antenna-trackers/part-type/network-devices?fr=part-type

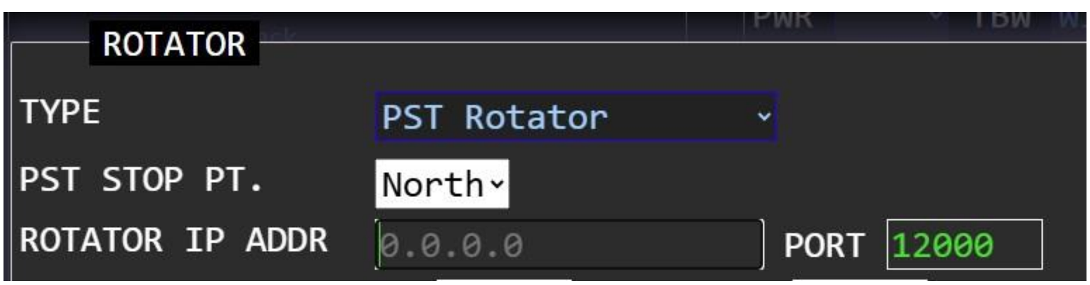
https://www.hamradio.com/detail.cfm?pid=H0-018576

The PSR-100 can interface with the S.A.T by using its Windows companion application as a "middleman" as described in the following paragraphs.

NOTE: In order to interface with the CSN S.A.T, the Windows companion application must be version 1.1.0, or later. Also, the PSR-100 firmware version must be 1.0.3 or later for all control features to be available.

S.A.T. TRACKER ROTOR SETTINGS

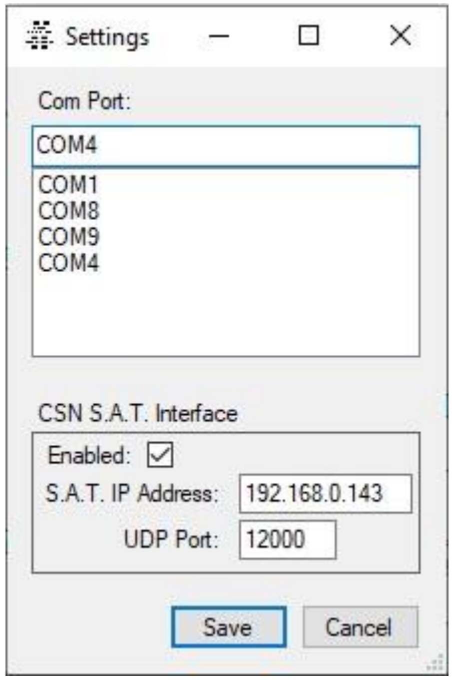
1. At the bottom of the S.A.T. Tracker's web interface, click on the "ROTATOR" button. The ROTATOR settings window will appear – the top portion is shown below:



2. Select PST Rotator as the TYPE
3. Set the ROTATOR IP ADDR to the IP address of the computer that will be running the PSR-100 Windows companion application.
4. Set the PORT to 12000

PSR-100 WINDOWS COMPANION APPLICATION SETTINGS

1. Open the application's settings window by clicking the top menu "Settings" option. The window shown below will appear:



2. Click the "Enabled" check box.
3. Enter the IP Address for the S.A.T. Tracker box. This can be found on the tracker's front display, or on the NETWORK settings screen in the web interface.
4. Set the UDP Port to 12000.
5. Click the "Save" button.

APPENDICES

TROUBLESHOOTING

For detailed troubleshooting steps, please refer to the assembly manual's troubleshooting section. For any operational issues, please refer to Table 1 below.

Table 1 - Troubleshooting Matrix

Symptom	Possible Solution
TBD	
TBD	

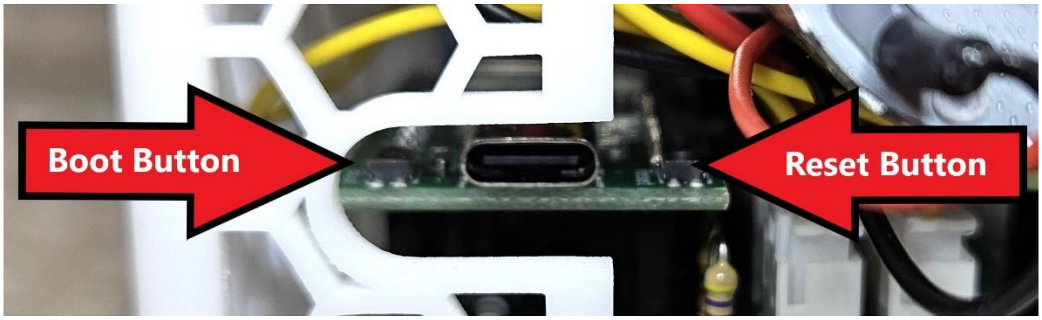
UPGRADING THE ROTOR'S FIRMWARE

Periodically, WA4MCMkits may release updates to the rotor's firmware. This could be to fix bugs or provide enhancements. Firmware updates may easily be accomplished using the existing USB computer interface by executing the following steps:

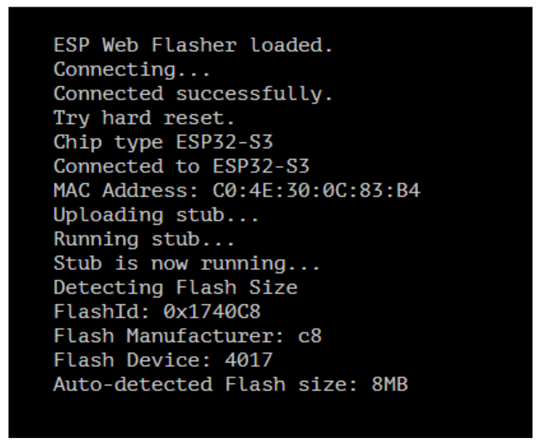
Caution: Unless you follow these steps exactly, there is a possibility that you may "brick" your PSR-100. Especially if you enter the wrong hexadecimal installation address. Please double-check your work before clicking the "Program" button. If you do end up bricking your rotor, please contact WA4MCMkits @ don.friend@wa4mcmkits.com for assistance.

1. Go to https://wa4mcmkits.com/support-files/ and download the latest firmware .zip file to a location on your computer's hard drive where it will be easy to find. Right-click on the .zip file and choose "extract All…". Note the location of the extracted files – the file with the **.bin** file extension is the actual firmware image.
2. Plug a suitable USB-C cable into the MCU board's USB connector which is accessible via the cutout located below and to the left of the azimuth motor. Plug the other end of the cable into an available USB port on your computer.
3. Please refer to the image below for guidance in performing this next step. Use a small straight-slot screwdriver to press and **hold** the "boot" button to the left of the USB connector on the end of the rotor's MCU board. While still holding the "boot" button, use a second screwdriver (or appropriate probe) to press and release the "reset" button to the right of the USB connector. This will put the MCU board in a

mode for uploading a new firmware image. It will also temporarily change the virtual serial port number being used by the meter while in this mode.



4. Go to the following web site: https://adafruit.github.io/Adafruit_WebSerial_ESPTool/
5. Click the "Connect" button in the upper-right corner of the page, and then select the serial port that is labeled "USB JTAG/serial debug unit" and click connect. Please note that this will be a different virtual serial port than what has normally been used for your rotor.
6. Refer to the image for a sample response from the flasher tool – the MAC address you see will be different. The results text should show that you've connected successfully. Once this happens, you'll be able to set up the image file for programming.



7. Set the top file offset to 0x10000 (four zeros!) – you can leave the other 3 at 0x0 since you'll only be selecting one file.
8. Click the top "Choose a file…" button and navigate to and select the firmware file that you downloaded and extracted in step one above.
9. **Double-check the file offset address!**
10. Click the "Program" button and observe the progress bar until it's done.
11. Press the reset button on the rotor's MCU board. Confirm the new firmware version number by observing it on the PSR-100 companion application's main screen.