PSR-100 Mk2 Portable Satellite Antenna Rotor Kit

Operation Manual

WA4MCMkits

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Revision History

Revision	Date	Description	Notes
2.0	5/1/2026	**Major firmware update:** • Eliminated Windows Companion Application • Added integrated web interface • Web-based calibration wizard • Software flip toggle (no physical switch) • Park position functionality • Multi-protocol support (GS-232, EasyComm II, CSN S.A.T.) • Direct UDP communication	Beta release
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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 Mk2 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 Mk2 has been designed to be lightweight and as small as possible. It is not suitable for being permanently installed since it is susceptible to the weather.
- **Integrated Web Interface** — The PSR-100 Mk2 features a complete web-based control interface accessible via WiFi. No companion software required!
- **Direct UDP Communication** — The rotor communicates directly with tracking software via UDP, supporting multiple protocols including GS-232, SAEBRTrackBox (EasyComm II format), and CSN S.A.T.
- **Web-Based Calibration** — Easy step-by-step calibration wizard accessible through the web interface. No Windows software is required.
- **Software Flip Mode** — For North-passing satellites, flip mode is now controlled via the web interface with a simple toggle button. Physical flip switch has been eliminated.
- **Park Position** — Set and save a custom park position for your antenna. One-click return to park.
- **Real-Time Position Display** — View current azimuth and elevation on interactive polar graphs with compass rose indicators.
- **Mounting Bracket for Either and Arrow II or Elk Antenna** — The PSR-100 Mk2 comes with a removable mounting bracket that has been specifically sized to accommodate the standard Arrow II antenna with a ¾" square boom, or an Elk log periodic antenna.
- **Standard Camera Tripod Mount** — The base of the enclosure has a ¼-20 threaded brass insert that will mate with the mounting bolt on most camera tripods.

SPECIFICATIONS

- Operating Voltage: 12V - 15V DC @ 300mA (12VDC 1A adapter provided)
- WiFi: 2.4GHz 802.11 b/g/n, WPA/WPA2 security
- Azimuth Range: 0° - 360° continuous rotation
- Elevation Range: 0° - 90°
- Position Accuracy: ±3°
- Supported Protocols: GS-232, SAEBRTrackBox (EasyComm II), CSN S.A.T.
- Communication Method: UDP over WiFi
- Web Interface Port: 8080 (HTTP)
- Maximum Antenna Weight: 2 lbs (0.9 kg)
- Maximum Recommended Transmitter Power: 10 Watts
- Approximate Dimensions: 4" × 4" × 18" (10.2cm × 10.2cm × 45.7cm)
- Weight (without antenna): Approximately 2.5 lbs (1.1 kg)
- Microcontroller: ESP32-S3 with integrated WiFi

OVERVIEW

The PSR-100 Mk2 represents a complete redesign of the control system. The Windows companion application has been eliminated in favor of an integrated web interface that runs directly on the rotor's microcontroller. The rotor now operates entirely standalone, communicating directly with your tracking software via UDP over WiFi.

KEY CHANGES IN VERSION 2.0:

- **No Windows Software Required** — Everything is accessed through a web browser on any device (phone, tablet, laptop).
- **Direct UDP Communication** — No virtual serial port needed. Tracking software can send commands directly to the rotor via UDP if it's capable of doing so.
- **WiFi Dongle Has Been Repurposed** – The Version 1.0 WiFi dongle has been repurposed as a Serial-to-UDP bridge so that you may continue to use computer-based tracking software that is not capable of communicating with the rotor via UDP (e.g., SatPC32, etc.).
- **Web-Based Calibration Wizard** — Step-by-step calibration process with on-screen instructions and real-time voltage display.
- **Software Flip Toggle** — Physical flip switch eliminated. Flip mode is now controlled via web interface toggle button.
- **Configurable Park Position** — Save a custom park position and return with one click.
- **Real-Time Position Display** — Interactive polar graphs show current azimuth and elevation with compass rose indicators.
- **Multi-Protocol Support** — Built-in support for GS-232B, EasyComm II (SAEBRTrackBox), and CSN S.A.T. protocols with independent port configuration for each.

SYSTEM ARCHITECTURE

The PSR-100 Mk2 creates or connects to a WiFi network and hosts a web server on port 8080. Users access the control interface by navigating to the rotor's IP address in any web browser.

Tracking software communicates with the rotor via either UDP packets sent directly to the rotor's ip address (e.g, CSN S.A.T. Box), or via the PSR-100 Mk2 Serial-to-UDP Bridge (e.g., SatPC32, Ham Radio Deluxe, MacDoppler, PstRotator, etc.)

On first power-up, if no WiFi credentials are configured, the rotor automatically creates an Access Point (AP) called "PSR100-Rotor-Config" where you can configure it to connect to your WiFi network. Once configured, the rotor will connect to your network, and the Access Point remains available as a fallback for troubleshooting if the network connection fails.

HARDWARE OVERVIEW

The PSR-100 Mk2 rotor consists of several main physical components:

PHYSICAL COMPONENTS

- **Elevation Bracket** — The U-shaped bracket that holds the antenna and rotates in the vertical plane (0° to 90°). Features a North arrow indicator for azimuth calibration.
- **Azimuth Motor Housing** — Contains the azimuth motor that rotates the entire elevation assembly. Provides 360° continuous rotation.
- **Main Body** — The base enclosure containing the ESP32 microcontroller, motor drivers, and power electronics.
- **Power Connector** — 5.5mm x 2.1mm barrel jack for 12-15V DC input.
- **Antenna Mounting Bracket** — Removable bracket specifically sized for either the Arrow II antenna with ¾" square boom, or the Elk log periodic antenna. Can be replaced with custom brackets for other antennas.
- **Tripod Mount** — ¼-20 threaded brass insert on the base for standard camera tripod mounting.
- **USB-C Programming Port** — Located below and to the left of the azimuth motor, accessible via cutout. Used only for firmware updates.

Note on Removed Hardware

The PSR-100 Mk2 has eliminated the following hardware components that were present in Version 1.x:

- Physical flip switch (now web controlled)
- Manual azimuth CW/CCW switches (now web controlled)
- Manual elevation UP/DOWN switches (now web controlled)

CONTROLS

Physical controls on the rotor have been eliminated:

All controls (positioning, calibration, flip mode, park position) are accessed through the web interface.

POSITION SENSORS

The PSR-100 Mk2 uses analog voltage feedback from potentiometers connected to both the azimuth and elevation mechanisms. These voltages are read by an ADS1115 16-bit analog-to-digital converter, providing high-precision position sensing. The calibration process maps these voltage readings to specific angles.

MOTORS

Both azimuth and elevation axes use 12vdc 2rpm high-torque motors with PWM speed control. The motors support two speed modes:

- **Slow Mode** — Used for initial movement and precise positioning
- **Fast Mode** — Automatically engages after 3 seconds of continuous movement for quicker slewing

INSTALLATION

This section covers the physical installation of the PSR-100 Mk2 rotor, including mounting, antenna attachment, and power connection.

MOUNTING THE ROTOR

The PSR-100 Mk2 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:

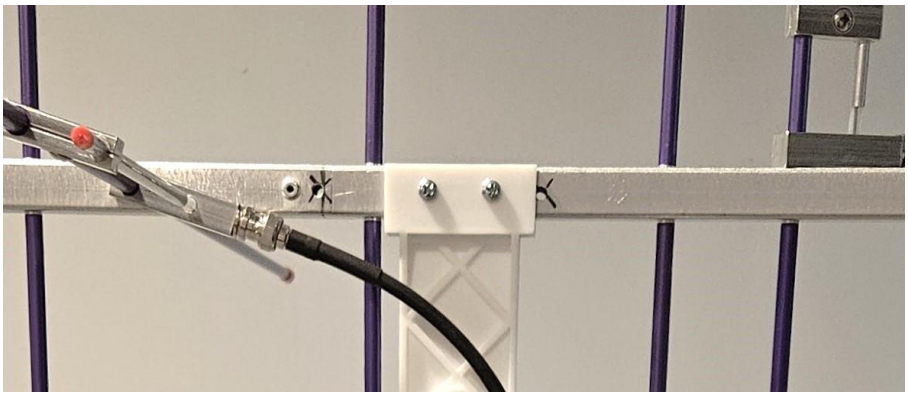
https://www.amazon.com/dp/B0B1HJ2YSH?ref=ppx_yo2ov_dt_b_fed_asin_title

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 Mk2'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.

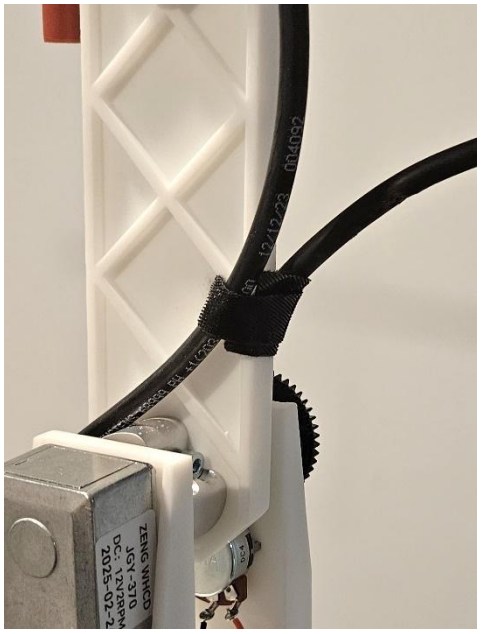
Best practice suggests securing the antenna feedline(s) in two locations:

- 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.

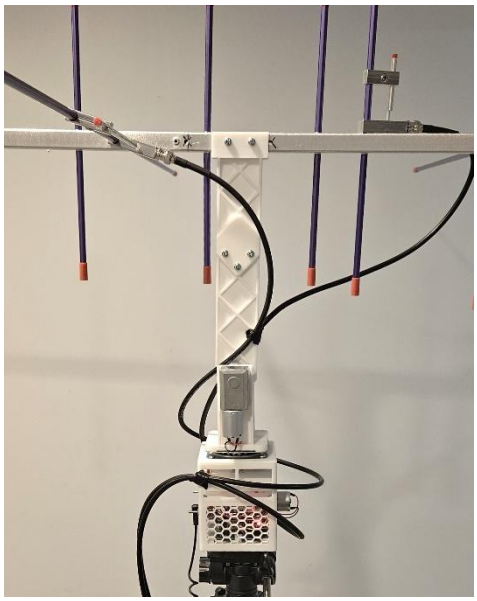
Prepare the arm by drilling a hole as shown in the left-hand image below to accommodate a tie-wrap to be used to secure the cables. The hole should be sized appropriately depending on the type of tie-wrap used – this particular example uses a ¼" hole for a small Velcro tie-wrap.

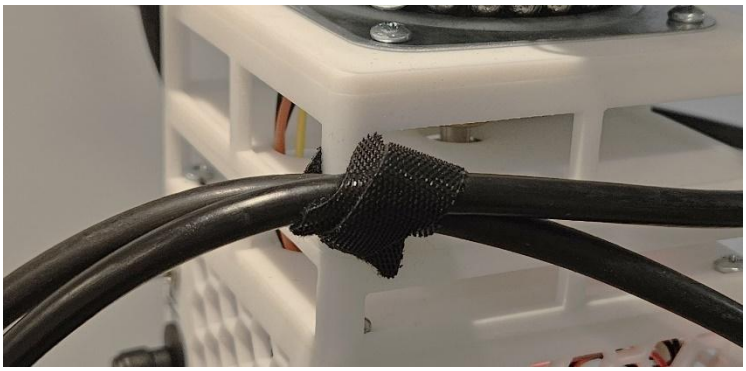


Pass the tie-wrap through the hole and wrap it snuggly around the cables to prevent them from: a) adding dead weight to the end of the elevation arm, and b) becoming snagged in the elevation position indicating gear train.

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 Mk2 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:

INITIAL WIFI SETUP

The PSR-100 Mk2 must be configured to connect to your WiFi network before normal operation. This is a one-time setup process.

The PSR-100 Mk2's WiFi service can save up to three different sets of network credentials. Upon being powered up, the rotor will attempt to connect to each network in the order of their stored priority until a connection is successful. This allows for a "Home" network as well as a portable network (such as a phone's hot spot).

Finally, the saved networks are posted on the WiFi configuration page as links to make it easy to manually connect to the desired network.

FIRST POWER-ON

When the PSR-100 Mk2 is powered on for the first time (or if WiFi credentials are not configured), the ESP32 microcontroller automatically creates a WiFi Access Point.

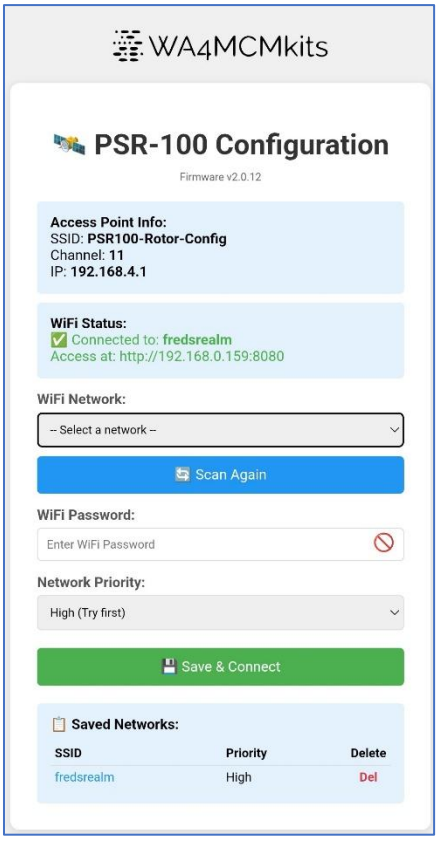
- **Access Point SSID:** PSR100-Rotor-Config
- Password: 12345678
- Configuration URL: http://192.168.4.1

NOTE: The Access Point remains available as a fallback even after WiFi is configured. If the rotor cannot connect to your WiFi network, it will automatically enable the Access Point for troubleshooting.

CONNECTING TO THE ACCESS POINT

Use any WiFi-capable device (smartphone, tablet, or laptop) to configure the rotor.

- Apply power to the PSR-100 Mk2.
- Wait approximately 10-15 seconds for the ESP32 to boot and create the Access Point.
- On your device, open WiFi settings and scan for available networks.
- Select the network named "PSR100-Rotor-Config".
- Enter the password: 12345678
- Wait for your device to connect. You may see a warning that says, "This network has no internet access". This is normal and expected.



WIFI CONFIGURATION PAGE

Once connected to the Access Point, you can access the WiFi configuration page.

- Open a web browser on the connected device.
- Navigate to: http://192.168.4.1

- The WiFi configuration page will load, displaying available networks.
- Click the "Scan Networks" button if needed to refresh the list.
- Select your WiFi network from the dropdown list.
- Enter your WiFi password in the password field.
- Choose the network's connection priority (High, Medium, Low)
- Click the "Save & Connect" button.
- The rotor will attempt to connect to your network. This takes approximately 10-15 seconds.
- If successful, a confirmation message will appear showing the assigned IP address.

NOTE: If you have networks showing in the ***Saved Networks*** pane at the bottom of the page, you may simply click on the network's SSID to automatically connect to that network.

IMPORTANT: Write down the IP address displayed after successful connection. You will need this to access the rotor's web interface.

ACCESSING AFTER CONFIGURATION

After WiFi configuration is complete, the rotor will connect to your network automatically on every power-up.

- Disconnect your WiFi-capable device from the PSR100-Rotor-Config Access Point.
- Reconnect your WiFi-capable device to the same WiFi network to which the rotor has just been connected.
- Open a web browser and navigate to http://**[IP-ADDRESS]**:8080
- Replace **[IP-ADDRESS]** with the IP address noted during configuration.
- The PSR-100 Mk2's Home page will load.

TIP: If you forget the IP address, you can always reconnect to the PSR100-Rotor-Config Access Point and check the configuration page. The Access Point is always available as a backup access method.

TROUBLESHOOTING WIFI CONNECTION

If the rotor fails to connect to your WiFi network:

- Verify the WiFi password was entered correctly (passwords are case-sensitive).
- Ensure your WiFi network uses 2.4GHz (the ESP32 does not support 5GHz networks).
- Check that your router has DHCP enabled and can assign IP addresses.
- Verify your WiFi network is within range and has adequate signal strength.
- Power cycle the rotor and try the configuration process again.

WEB INTERFACE OVERVIEW

The PSR-100 Mk2 web interface consists of three main pages accessible via navigation buttons at the top of each page. The interface works on any modern web browser including mobile devices.

NAVIGATION

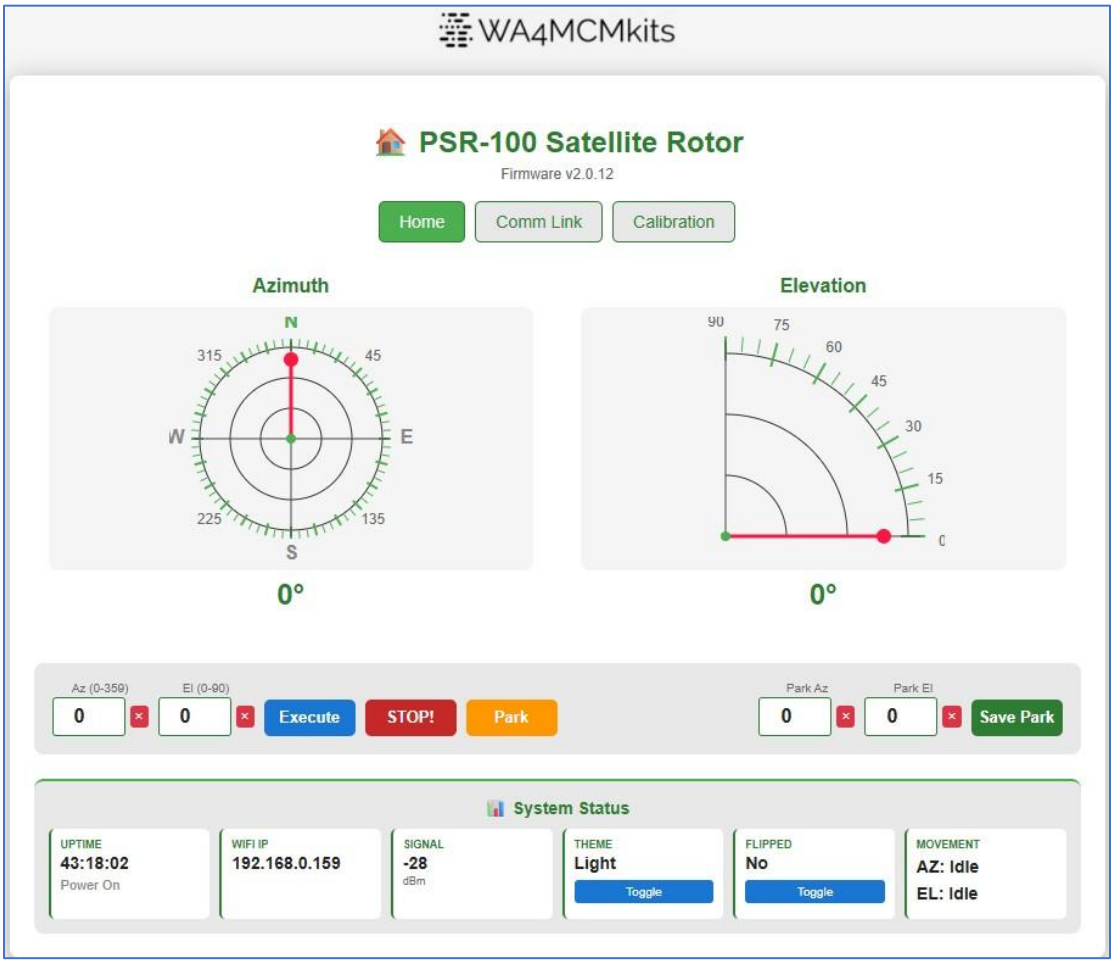
Three navigation buttons appear on every page:

- **Home** — Main control interface with position display and manual controls
- **Comm Link** — Protocol configuration and communication logging
- **Calibration** — Step-by-step calibration wizard

The active page is highlighted in the navigation bar. The firmware version is displayed below the page title on the Home page.

HOME PAGE

The Home page is the primary control interface for normal operation. It displays real-time position information and provides manual control of the rotor.



POSITION DISPLAY

Two interactive polar graphs show current antenna position:

- **Azimuth Graph** — Compass rose showing 0-359° with cardinal directions (N, E, S, W). Current azimuth indicated by red pointer and numeric display.
- **Elevation Graph** — Quarter-circle showing 0-90° range. Current elevation indicated by red arc and numeric display.

Position displays update in real-time as the rotor moves.

MANUAL MOVEMENT CONTROLS

Go To Position

- Enter desired azimuth (0-359°) in the Az field. (Click the "**X**" button to reset the value to 0°)
- Enter desired elevation (0-90°) in the El field. (Click the "**X**" button to reset the value to 0°)
- Click the "Execute" button.

The rotor will move to the commanded position.

Park Button

Clicking on the "Park" button will command the rotor to move to the azimuth and elevation angles defined in the "Park Az" and "Park El" data entry field to the right of the "Go To Position" fields and buttons.

NOTE: The "STOP!" button provides emergency stop functionality that immediately halts all motor movement.

PARK POSITION

The park position feature allows you to save a preferred antenna orientation and return to it with one click.

Setting Park Position:

- Enter the desired "park" values in the Park Az and Park El fields on the right side of the controls.
- Click "Save Park".

The park position is saved to non-volatile memory and persists after power cycles.

Returning to Park:

Click the "Park" button at any time to move the rotor to the saved park position.

SYSTEM STATUS

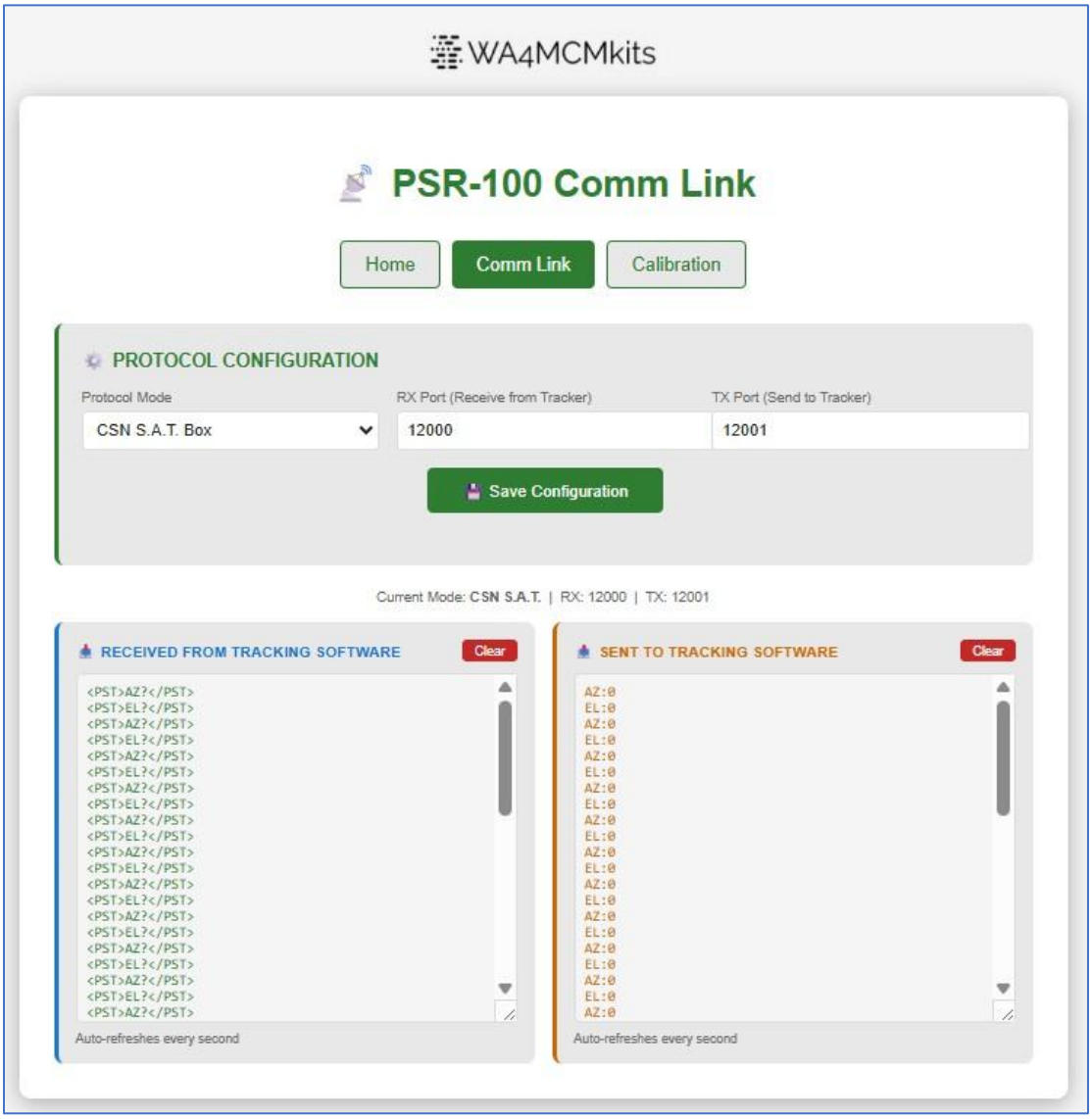
The bottom section of the Home page displays system status information in five compact cards:

- **Uptime** — Time since last power-on or reset (days, hours, minutes, seconds). This also displays the reason for the last rotor restart (used only for troubleshooting purposes)
- **WiFi IP** — Current IP address on your WiFi network
- **Signal** — WiFi signal strength in dBm (closer to 0 is better, typically -30 to -90 dBm)

- **Theme** – Current color scheme for the web pages with a toggle button to switch between the Light and Dark themes
- **Flipped** — Current flip mode status with toggle button (see Flip Mode section)
- **Movement** — Shows the direction of movement for both azimuth and elevation, or “Idle” if not moving.

COMM LINK PAGE

The Comm Link page configures communication protocols and displays real-time message logging for troubleshooting.



PROTOCOL SELECTION

The PSR-100 Mk2 currently supports three communication protocols:

- **GS-232B** — Compatible with HRD, Gpredict and other GS-232 software
- **EasyComm II** (SAEBRTrackBox) — compatible with SatPC32, PstRotator, and others
- **CSN S.A.T.** — Compatible with CSN Technologies S.A.T. tracker

To configure protocol:

- Select the protocol from the dropdown menu.

- Set the RX Port (port where rotor receives commands from tracking software).
- Set the TX Port (port where rotor sends position updates to tracking software).

Click "Save" to apply the configuration.

NOTE: Each protocol maintains independent port settings. Switching between protocols automatically loads the saved ports for that protocol.

Default port configurations:

Protocol	Default RX Port	Default TX Port
GS-232B	2390	2391
SAEBRTrackBox	2390	2391
CSN S.A.T.	12000	12001

COMMUNICATION LOGS

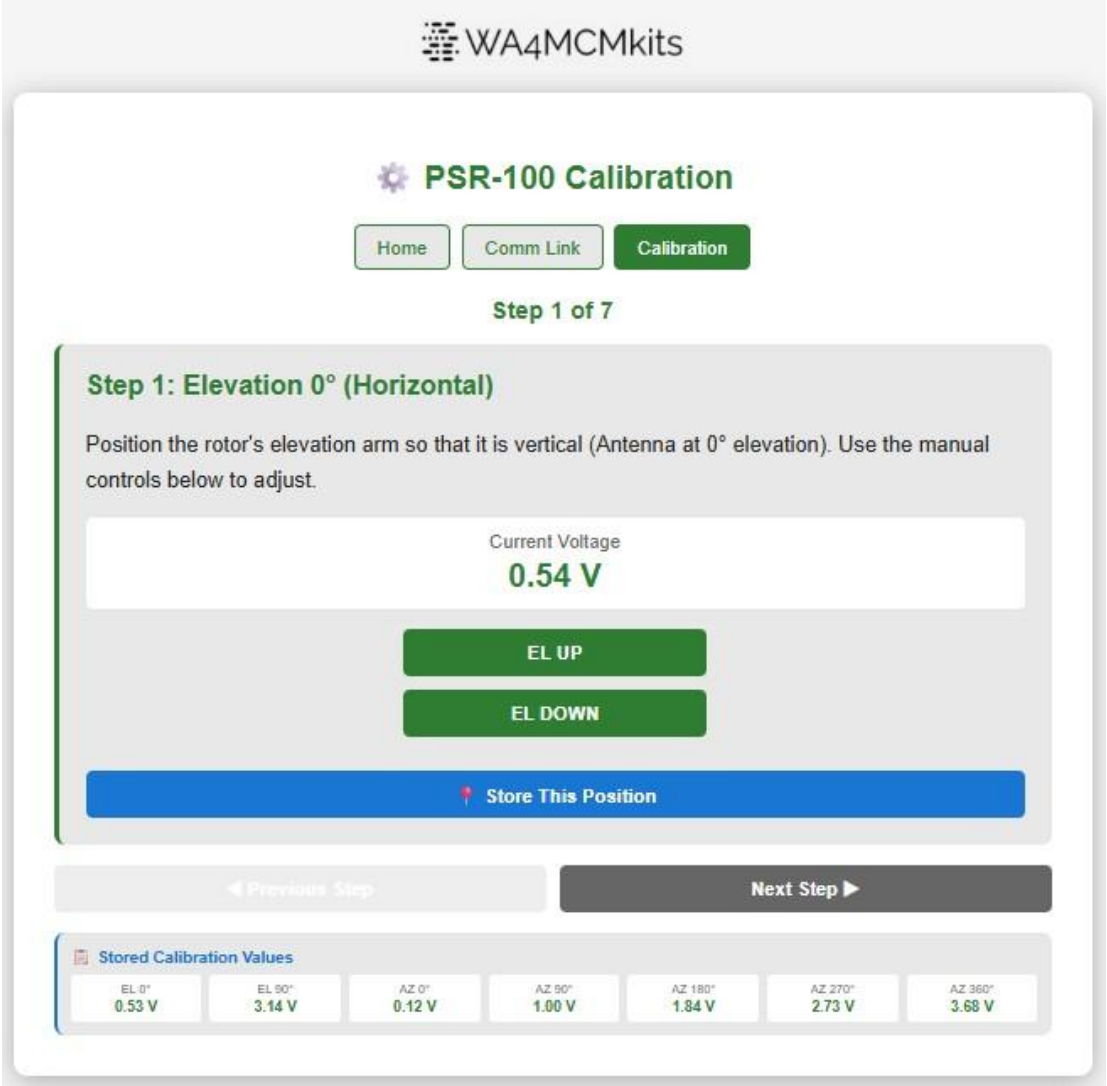
The Comm Link page displays real-time message logs to help troubleshoot communication with tracking software:

- **Received Messages** — Commands received from tracking software on the RX port
- **Sent Messages** — Position updates sent to tracking software on the TX port

Each log displays the most recent messages at the top of the list. Use the "Clear" buttons to reset the logs. Logs update automatically in real-time as messages are exchanged.

CALIBRATION PAGE

The Calibration page provides a step-by-step wizard for calibrating the rotor's position sensors. Detailed calibration procedures are covered in the Calibration section of this manual.



The page consists of:

- **Step Indicator** — Shows current step (e.g., "Step 1 of 7")
- **Instructions Panel** — Displays specific positioning instructions for the current step
- **Current Voltage** — Real-time voltage reading from the position sensor
- **Movement Controls** — Context-sensitive buttons (Azimuth CW/CCW or Elevation UP/DOWN depending on step)
- **Store Button** — Saves the current voltage reading for the calibration point
- **Navigation Buttons** — Previous Step and Next Step buttons
- **Stored Values Panel** — Displays all 7 stored calibration voltages at the bottom of the page

CALIBRATION

The PSR-100 Mk2 uses analog voltage sensors to determine azimuth and elevation positions. Calibration maps these voltage readings to specific angles, ensuring accurate position reporting and tracking.

WHEN CALIBRATION IS NEEDED

Calibration should be performed:

- During initial setup after assembly
- After any physical impact or jarring of the rotor
- If position accuracy degrades over time

NOTE: Calibration only needs to be performed once unless the rotor is jarred to the point that the azimuth or elevation gear trains may have slipped. The calibration values are stored in non-volatile memory and persist after power cycles.

ACCESSING CALIBRATION

- Navigate to the rotor's web interface (http://[rotor-ip]:8080)
- Click the "Calibration" button in the navigation bar
- The calibration wizard will load, showing Step 1 of 7

Calibration mode is always active in firmware version 2.0 and later. There is no need to enable or disable calibration mode — simply access the page and begin.

CALIBRATION WIZARD OVERVIEW

The calibration wizard guides you through seven calibration points:

- Two elevation points (0° and 90°)
- Five azimuth points (0°, 90°, 180°, 270°, and 360°)

Each step displays:

- **Step number and title** — Shows which calibration point you're working on
- **Positioning instructions** — Detailed description of where to position the rotor
- **Current voltage display** — Real-time voltage reading (updates every 500ms)
- **Movement controls** — Context-sensitive buttons for the current axis (AZ CW/CCW or EL UP/DOWN)
- **Store button** — Saves the current voltage reading for this calibration point
- **Previous/Next navigation** — Move between calibration steps

At the bottom of the page, the Stored Calibration Values panel displays all seven voltage readings after they've been saved.

CALIBRATION STEPS

Follow these steps for each calibration point. The procedure is the same for all seven steps, only the positioning instructions change.

STEP 1: ELEVATION 0° (HORIZONTAL)

Position: Position the rotor's elevation arm so that it is vertical (Antenna at 0° elevation).

1. Click and hold the "EL DOWN" or “EL UP” button until the elevation arm until it is vertical.

Note: The “EL DOWN” button moves the elevation towards the vertical while the “EL UP” button moves the elevation arm towards the horizontal. This is counterintuitive, but the actual antenna will be mounted at a right angle to elevation arm.

2. The motor will start slowly, then accelerate to fast speed after about 3 seconds.
3. Release the button when the arm is vertical. Use the movement buttons for fine adjustment as needed.
4. Observe the current voltage display. It should be between 0.15V and 0.25V.
5. Click " 📍 Store This Position" to save the voltage reading.
6. A success message will appear, and the voltage will be displayed in the Stored Calibration Values panel.
7. Click "Next Step ▶" to proceed to Step 2.

Very Important! – Don’t forget to click the "Next Step ▶" button!

STEP 2: ELEVATION 90° (VERTICAL)

Position: Position the rotor's elevation arm so that it is horizontal (Antenna at 90° elevation).

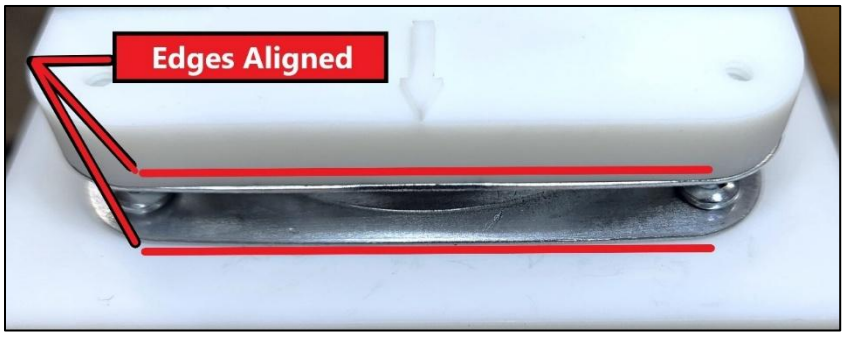
1. Click and hold the "EL DOWN" or “EL UP” button until the elevation arm is horizontal.
2. Release the button when the arm horizontal. Use the movement buttons for fine adjustment as needed.
3. Verify the voltage reading is different from Step 1 (should be approximately 2.6V higher).
4. Click " 📍 Store This Position".
5. Click "Next Step ▶" to proceed to step 3, the start of the azimuth calibration.

Very Important! – Don’t forget to click the "Next Step ▶" button!

STEP 3: AZIMUTH 0° (NORTH)

Position: Rotate the azimuth so the North arrow on the elevation bracket is parallel with the side of the main body opposite the azimuth motor.

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



1. Use the "AZ CCW" or "AZ CW" buttons to rotate the rotor.
2. Align the North arrow parallel with the main body side opposite the azimuth motor.
3. Click " 📍 Store This Position".
4. Click "Next Step ▶".

Very Important! – Don't forget to click the "Next Step ▶" button!

STEP 4: AZIMUTH 90° (EAST)

Position: Rotate clockwise 90° so the North arrow is parallel with the right side of the main body (when facing the side with the azimuth motor).

1. Click and hold "AZ CW" to rotate clockwise.
2. Stop when the North arrow is parallel with the right side of the main body.
3. Click " 📍 Store This Position"
4. Click "Next Step ▶"

Very Important! – Don't forget to click the "Next Step ▶" button!

STEP 5: AZIMUTH 180° (SOUTH)

Position: Continue rotating clockwise so the North arrow is parallel with the azimuth motor side of the main body.

1. Click and hold "AZ CW" to continue rotating clockwise.
2. Stop when the North arrow is parallel with the azimuth motor side.
3. Click " 📍 Store This Position".
4. Click "Next Step ▶".

Very Important! – Don't forget to click the "Next Step ▶" button!

STEP 6: AZIMUTH 270° (WEST)

Position: Continue rotating clockwise so the North arrow is parallel with the left side of the main body (when facing the side with the azimuth motor).

1. Click and hold "AZ CW" to continue rotating clockwise.
2. Stop when the North arrow is parallel with the left side of the main body.
3. Click " 📍 Store This Position".
4. Click "Next Step ▶".

Very Important! – Don't forget to click the "Next Step ▶" button!

STEP 7: AZIMUTH 360° (NORTH AGAIN)

Position: Complete the rotation back to North. The North arrow should again be parallel with the side opposite the azimuth motor (same as Step 3).

1. Click and hold "AZ CW" to complete the final 90° rotation.
2. Stop when the North arrow returns to the North position (same orientation as Step 3).
3. Click " 📍 Store This Position".
4. Calibration is complete! The "Next Step" button will be disabled.

AFTER CALIBRATION

Review the Stored Calibration Values panel to verify all seven voltages that have been recorded.

- Verify that all voltages are between 0.15V and 4.08V.
- Verify that elevation voltages differ by approximately 2.6V.
- Verify that azimuth voltages progress in order (each should be between 0.8V and 0.9V higher than the previous).
- Click "Home" in the navigation bar to return to the main page.
- Test positioning accuracy by commanding the rotor to known positions and verifying that the display matches.

Please refer to the following image of the Stored Calibration Values panel to see typical voltage values for the 7 angles. Please be aware that your values may vary plus or minus depending on where you set the 0° starting points for both the azimuth and elevation gear trains.

TIP: If any voltage readings look incorrect, you can navigate back to that step using the "Previous Step" button and re-store the value. Calibration values are saved immediately when you click the Store button.

OPERATION

This section describes normal operation of the PSR-100 Mk2 rotor for satellite tracking and manual positioning.

WIFI NETWORK OPTIONS

The PSR-100 Mk2 depends on being able to connect to the same WiFi network on which the tracking software can communicate – whether it's the CSN S.A.T box, or a computer-based tracking application such as Gpredict. Please refer to the following table for the standard WiFi configurations depending on your selected satellite tracking option:

Satellite Tracking Option	Devices to Connect to WiFi	WiFi Options
Computing device-based tracking software that requires a serial port to communicate such as HRD Rotator, Gpredict, SatPC32, SkyRoof, etc.	• PSR-100 Rotor • PSR-100 UDP/Bridge Dongle • Computing device that will be running the browser used to manage the PSR-100 devices	• Any available WiFi (Home network, Phone's Hot Spot, Starbucks, etc.)
Computing device-based tracking software capable of communicating with the rotor via UDP packets (need examples)	• PSR-100 Rotor • Computing device that hosts the tracking software (PC, Mac, iPad, Cell Phone, Raspberry Pi, etc.) • Computing device that will be running the browser used to manage the PSR-100 rotor (probably the same device as above, but doesn't have to be)	• Any available WiFi (Home network, Phone's Hot Spot, Starbucks, etc.)
CSN S.A.T. Box	• PSR-100 Rotor • CSN S.A.T. Box • Computing device that will be running the browser used to manage the PSR-100 devices	• Any available WiFi (Home network, National/State Park, Starbucks, etc.) • Phone's Hot Spot (if available) • PSR-100 UDP/Bridge Access Point (SSID: **PSR-100-Bridge-Config;** Password: **12345678**)

SETTING UP FOR A SATELLITE PASS

1. Power on the rotor using the power switch on the rear of the enclosure.
2. Wait approximately 15 seconds for the ESP32 to boot and connect to WiFi.
3. Open a web browser and navigate to http://[rotor-ip]:8080
4. Verify the position display shows accurate current angles.
5. Verify WiFi signal strength is adequate (check System Status section).
6. Start your tracking software and configure it to send commands to the rotor (see Tracking Software Configuration section).

MANUAL POSITIONING

The rotor can be manually positioned using the manual movement feature on the Home page.

USING THE MANUAL MOVEMENT FEATURE

1. Enter the desired azimuth (0-359°) in the Az field.
2. Enter the desired elevation (0-90°) in the El field.
3. Click the "Execute" button.
4. The rotor will move to the commanded position.
5. Watch the position display update in real-time as the rotor moves.

NOTE: If you enter invalid values (Az > 359 or El > 90), an error message will appear, and the rotor will not move.

EMERGENCY STOP

The red "**STOP!**" button (located to the right of the “Execute” button) immediately halts all motor movement. Use this if:

- The rotor is moving in an unexpected direction
- A cable is binding or creating resistance
- You need to immediately stop movement for any reason

After using the emergency stop, you can resume operation normally by issuing new position commands.

USING PARK POSITION

The park position feature allows you to save a preferred antenna orientation (typically pointed downward or in a safe direction) and return to it quickly.

SETTING PARK POSITION

1. Position the antenna where you want it to be parked (using Manual Positioning).
2. Note the current azimuth and elevation values from the position display.
3. Enter these values in the Park Az and Park El fields (located on the right side of the controls section).
4. Click the "Save Park" button.
5. The park position is now saved to non-volatile memory and will persist after power cycles.

TIP: A common park position is Az: 0°, El: 0° which points the antenna in a position that minimizes wind loading and cable strain.

RETURNING TO PARK

- Click the "Park" button at any time to move the rotor to the saved park position.
- The rotor will immediately move to the saved Az and El coordinates.
- This is useful after a satellite pass to quickly stow the antenna.

FLIP MODE

Flip mode allows the rotor to track satellites that pass through North (crossing from 359° to 0° azimuth, or vice-versa) without reversing a full 360° rotation taking time away from the satellite pass.

WHAT IS FLIP MODE?

The rotor's azimuth angle potentiometer has physical stops at each end of its rotation. 0° azimuth is calibrated to be at one end of the rotation while 360° azimuth is calibrated at the other end. Flip mode simply causes the rotor to "think" that 0° and 360° are now in the center of the azimuth potentiometer's rotational travel.

Therefore, when in flip mode, the rotor will seamlessly transition from 1° to 359° without the need for a complete 360° reverse rotation.

WHEN TO USE FLIP MODE

Use flip mode when tracking satellites that pass through North (azimuth transitions from 359° to 0°, or vice-versa)

ACTIVATING FLIP MODE

1. Use the Manual Positioning feature on the Home page to set the rotor's azimuth angle to 0°.
2. Locate the "Flipped" card in the System Status section at the bottom of the Home page.
3. The card shows current flip status: "No" (normal mode) or "Yes" (flip mode).
4. Click the "Toggle" button to change flip mode.
5. The rotor will immediately rotate 180° in azimuth to implement the flip.
6. Physically rotate the entire rotor (or tripod) 180° to accommodate the "new" North.
7. The position display will always show the new logical angles.
8. The flip status is saved to non-volatile memory and persists after power cycles.

NOTE: The rotor automatically adjusts all position reporting to tracking software. You do not need to change any settings in your tracking software when using flip mode.

DEACTIVATING FLIP MODE

1. Click the "Toggle" button again to return to normal mode.
2. The rotor will rotate 180° back to the normal orientation.
3. Physically rotate the entire rotor (or tripod) 180° back to its original orientation.

Note: It is recommended to deactivate flip mode when not needed to avoid confusion.

AUTOMATIC TRACKING

Once the rotor is configured and your tracking software is set up (see next section), the rotor will automatically follow satellite position commands sent via UDP.

- Configure your tracking software in accordance with the instructions contained in the next chapter: ***Tracking Software Configuration***
- Select the satellite to track in your software.
- Start tracking mode in the software.
- The rotor will automatically move to track the satellite based on commands from the software.
- Monitor the position display on the Home page to verify tracking accuracy.
- Check the Comm Link page to view real-time command and position update messages.

TIP: Keep the web interface open during tracking to monitor position and verify communication. The position display updates in real-time, providing immediate feedback on tracking performance.

TRACKING SOFTWARE CONFIGURATION

The PSR-100 Mk2 communicates with tracking software via UDP packets over WiFi. This section provides configuration instructions for popular satellite tracking programs.

GENERAL CONFIGURATION REQUIREMENTS

Regardless of which tracking software you use, you will need:

- **Rotor IP Address:** The IP address assigned to your PSR-100 Mk2 on your WiFi network
- **UDP Ports:** RX and TX port numbers from the Comm Link page
- **Protocol:** The protocol selected on the Comm Link page (must match the rotor type selected in your tracking software)

Configuration Steps:

1. Open the PSR-100 Mk2 web interface and navigate to the Comm Link page.
2. Select the appropriate protocol for your tracking software.
3. Note the RX Port and TX Port values (or configure custom ports if needed).
4. Click the "💾 Save Configuration" button to save the protocol configuration.
5. Configure your tracking software using the instructions below for your specific program.

NOTE: The PSR-100 Mk2 must be on the same WiFi network as the computer (or device) running your tracking software. Direct UDP communication requires network connectivity between the devices.

IMPORTANT: Some tracking software (such as SatPC32 and PstRotator) only supports serial (COM port) communication and **cannot** send UDP packets directly. For these programs, you must use the **PSR-100 Mk2 Serial-to-UDP Bridge** dongle. The bridge acts as a transparent translator, converting serial commands from the tracking software into UDP packets for the PSR-100 Mk2.

Which software requires the bridge?

- **SatPC32** — Talks directly to the bridge
- **PstRotator** — Talks directly to the bridge
- **Ham Radio Deluxe** – Talks directly to the bridge
- **Gpredict** — Requires hamlib's rotctld to be running in the background
- **SkyRoof** — Requires hamlib's rotctld to be running in the background

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).

IMPORTANT: SatPC32 only supports serial (COM port) rotor control and **cannot** communicate via UDP. You **must** use the PSR-100 Mk2 **Serial-to-UDP Bridge dongle** with this software.

Before proceeding with SatPC32 configuration:

- Set up the Serial-to-UDP Bridge following the instructions in the **Serial-to-UDP Bridge Dongle** section
- Verify the bridge is connected to your WiFi network and note its COM port number
- Configure the bridge to point to your PSR-100 Mk2's IP address and UDP port 2390

Once the bridge is configured and running, continue with the steps below.

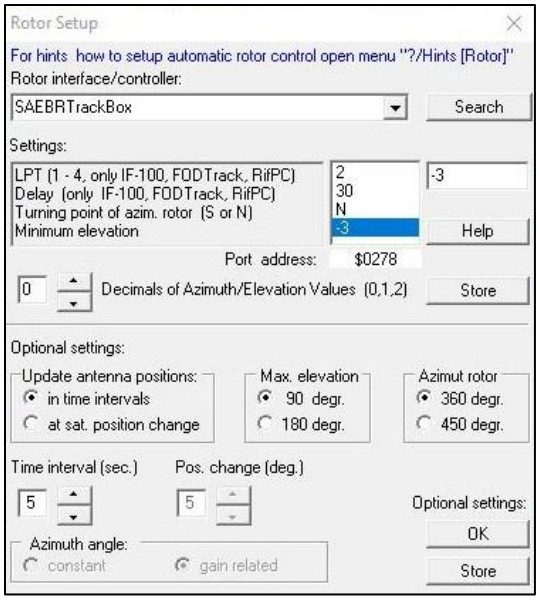
Please refer to the following steps for information on how to configure SatPC32 for the PSR-100 Mk2 Rotor:

PSR-100 MK2 CONFIGURATION

1. Navigate to the Comm Link page in the PSR-100 Mk2 web interface.
2. Select ***EasyComm II (SAEBRTrackBox)*** from the protocol dropdown.
3. Note the RX Port (default: 2390) and TX Port (default: 2391).
4. Click the "Save Configuration" button.
5. Ensure that the PSR-100 Serial-to-UDP Bridge Dongle is plugged into a USB port on the PC hosting SatPC32.

SATPC32 CONFIGURATION

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 of the **Serial-to-UDP Bridge dongle** (check Windows Device Manager if unsure). Set the Baud Rate to 19200 and configure 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

IMPORTANT: PstRotator only supports serial (COM port) rotor control and **cannot** communicate via UDP. You **must** use the PSR-100 Mk2 **Serial-to-UDP Bridge dongle** with this software.

Before proceeding with PstRotator configuration:

- Set up the Serial-to-UDP Bridge following the instructions in the **Serial-to-UDP Bridge Dongle** section
- Verify the bridge is connected to your WiFi network and note its COM port number
- Configure the bridge to point to your PSR-100 Mk2's IP address and UDP port 2390

Once the bridge is configured and running, continue with the steps below.

PSR-100 MK2 CONFIGURATION

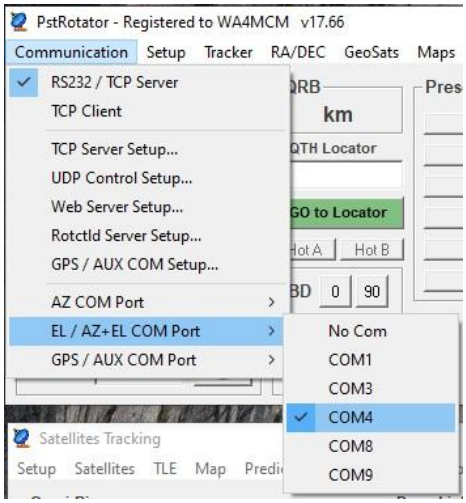
1. Navigate to the Comm Link page in the PSR-100 Mk2 web interface.
2. Select ***EasyComm II (SAEBRTrackBox)*** from the protocol dropdown.
3. Note the RX Port (default: 2390) and TX Port (default: 2391).
4. Click the "💾 Save Configuration" button.

5. Ensure that the PSR-100 Serial-to-UDP Bridge Dongle is plugged into a USB port on the PC hosting PstRotator.

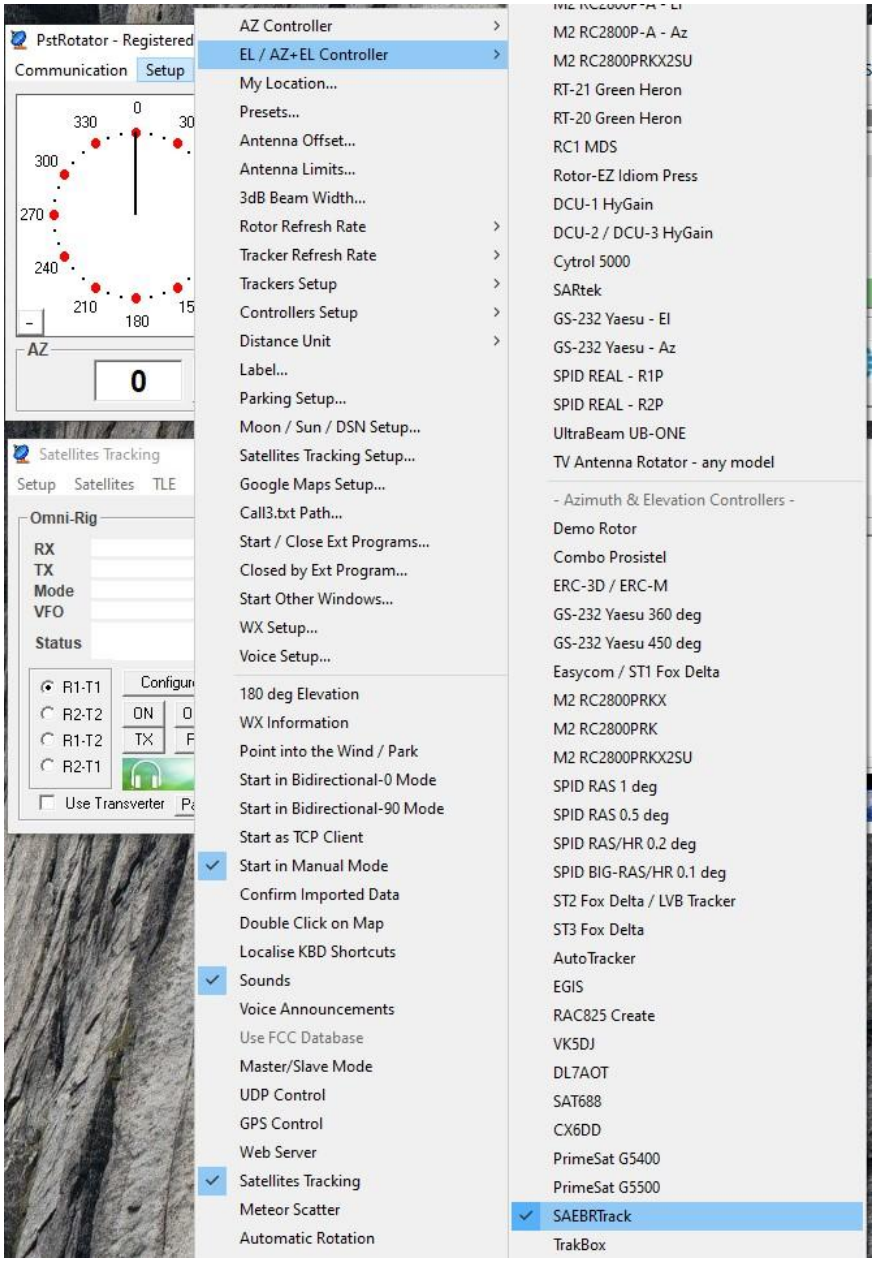
PSTROTATOR CONFIGURATION

Please refer to the following steps for information on how to configure PstRotator for the PSR-100 Mk2 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 COM port of the Serial-to-UDP Bridge dongle (check Windows Device Manager → Ports (COM & LPT) if you're unsure which port it is). The port will typically appear as "USB Serial Device (COMx)" where x is the port number. 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:



HAM RADIO DELUXE (HRD)

Ham Radio Deluxe is a widely used station control suite of applications that includes rotator control (HRDRotator) and satellite tracking (HRDSatTrack) modules. Ham Radio Deluxe is available for purchase and download at the following URL:

https://www.hamradiodeluxe.com/

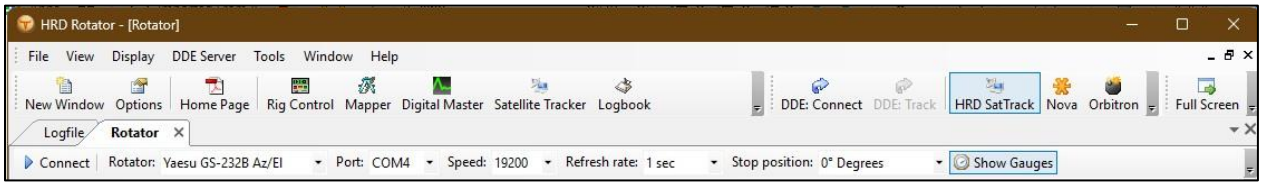
PSR-100 MK2 CONFIGURATION

1. Navigate to the Comm Link page in the PSR-100 Mk2 web interface.
2. Select ***GS-232B*** from the protocol dropdown.
3. Note the RX Port (default: 2390) and TX Port (default: 2391).
4. Click the "Save Configuration" button.
5. Ensure that the PSR-100 Serial-to-UDP Bridge Dongle is plugged into a USB port on the PC hosting Ham Radio Deluxe

HAM RADIO DELUXE CONFIGURATION

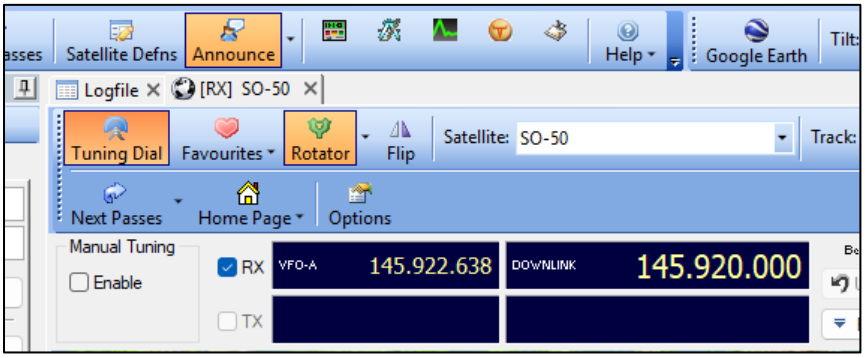
Please refer to the following steps for information on how to configure Ham Radio Deluxe for use with the PSR-100 Mk2.

1. On HRDRotator's Rotator tab (also see image below):
   - Rotator – Yaesu GS-232B Az/El
   - Port – select the virtual com port created by the ***PSR-100 Mk2 Serial-to-UDP Bridge dongle***
   - Speed – 19200
   - Refresh Rate – 1 sec
   - Stop Position – 0° Degrees



2. Click the ***Connect*** button.
3. If it's not already running, click the ***Satellite tracker*** icon on the main menu ribbon to launch the ***HRD Satellite Tracking*** module.

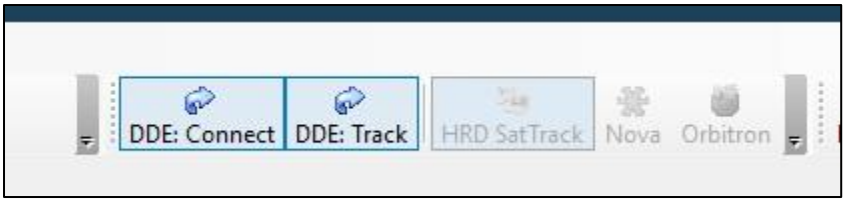
Refer to the following image below for guidance for steps 4-5:



4. Click the Rotator button to activate the rotator link.
5. Select the desired satellite from the Satellite drop down menu.
6. Click the Tuning Dial button to turn on the manual tuning controls.

7. Click the RX check box so that the box is checked

Refer to the following image below for guidance for steps 8-10:



8. Note that the ***HRD SatTrack*** Button is highlighted
9. Click ***DDE: Connect***
10. Click ***DDE: Track***

SKYROOF

SkyRoof is a relatively new satellite tracking application for Windows by **Alex Shovkoplyas, VE3NEA**. It is very feature-rich and integrates with the hamlib rig and rotor control utilities in order to control both doppler-shift as well as rotor positioning.

Download SkyRoof at: https://ve3nea.github.io/SkyRoof/

A BIG thumbs-up for this application!

PSR-100 MK2 CONFIGURATION

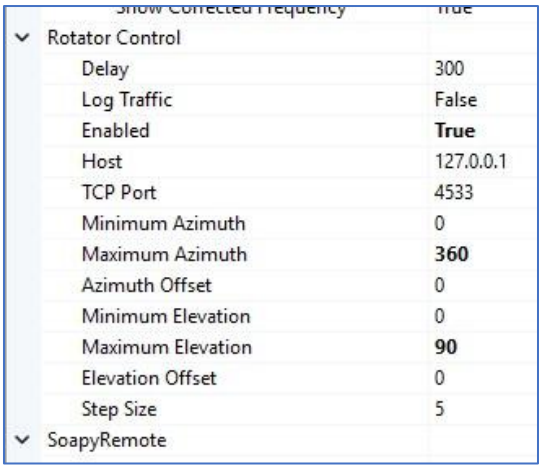
1. Navigate to the Comm Link page in the PSR-100 Mk2 web interface.
2. Select ***GS-232B*** from the protocol dropdown.
3. Note the RX Port (default: 2390) and TX Port (default: 2391).
4. Click the "Save Configuration" button.
5. Ensure that the PSR-100 Serial-to-UDP Bridge Dongle is plugged into a USB port on the PC hosting SkyRoof.

SKYROOF CONFIGURATION

1. Launch the hamlib rotctld program.

Note: Please refer to Appendix E for guidance on how to download and configure rotctld.

2. You shouldn't need to change any of the default rotator settings. To check these settings, open the Tools/Settings window. Please refer to the image on the right for the correct settings:
3. Select the satellite you wish to track and click the ***Track*** checkbox next to the Azimuth and Elevation angle readouts in the upper right-hand corner of the SkyRoof window.



GPREDICT

Gpredict is a free, multi-platform satellite tracking application by Alexandru Csete – OZ9AEC. The Windows version can be downloaded at:

https://sourceforge.net/projects/gpredict/

PSR-100 MK2 CONFIGURATION

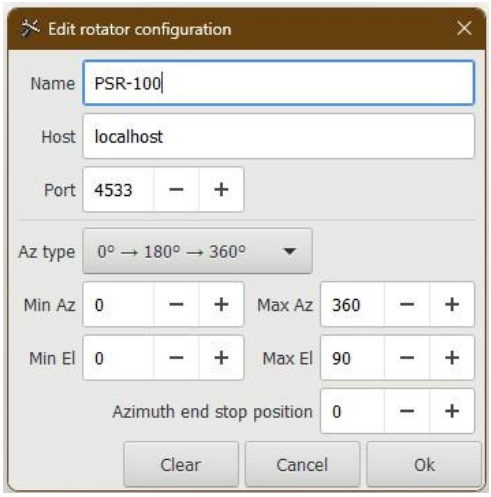
1. Navigate to the Comm Link page in the PSR-100 Mk2 web interface.
2. Select ***GS-232B*** from the protocol dropdown.
3. Note the RX Port (default: 2390) and TX Port (default: 2391).
4. Click the "💾 Save Configuration" button.
5. Ensure that the PSR-100 Serial-to-UDP Bridge Dongle is plugged into a USB port on the PC hosting Gpredict.

GPREDICT CONFIGURATION

1. Launch the hamlib rotctld program.

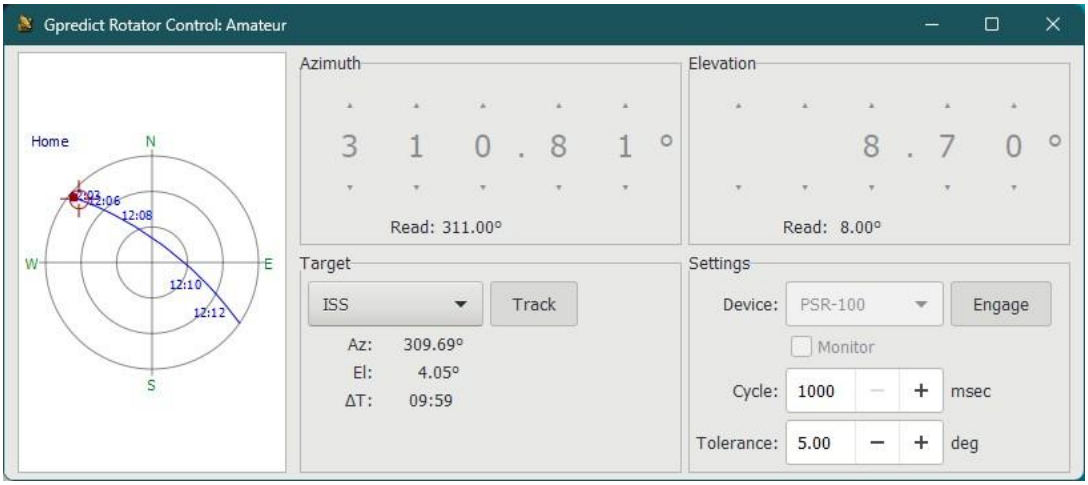
Note: Please refer to Appendix E for guidance on how to download and configure rotctld.

2. If not already configured, add the PSR-100 Mk2 rotator by navigating to ***Edit/Preferences*** and clicking on the ***Interfaces*** icon. Select the Rotators tab and click the ***Add New*** button at the bottom of the window. The new rotator widow shown in the image to the right will appear. Enter the appropriate information as shown in the image.



3. Open the Rotator Control Window by selecting it from the module's drop-down menu (activated by clicking on the small down-arrow in the upper right corner of the module's window).
4. Select the target satellite you wish to track, then click the Track button.

5. To enable commands to be sent to the PSR-100 Mk2, click the Engage button in the Settings portion of the window. Please refer to the image below for details:



CSN TECHNOLOGIES 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

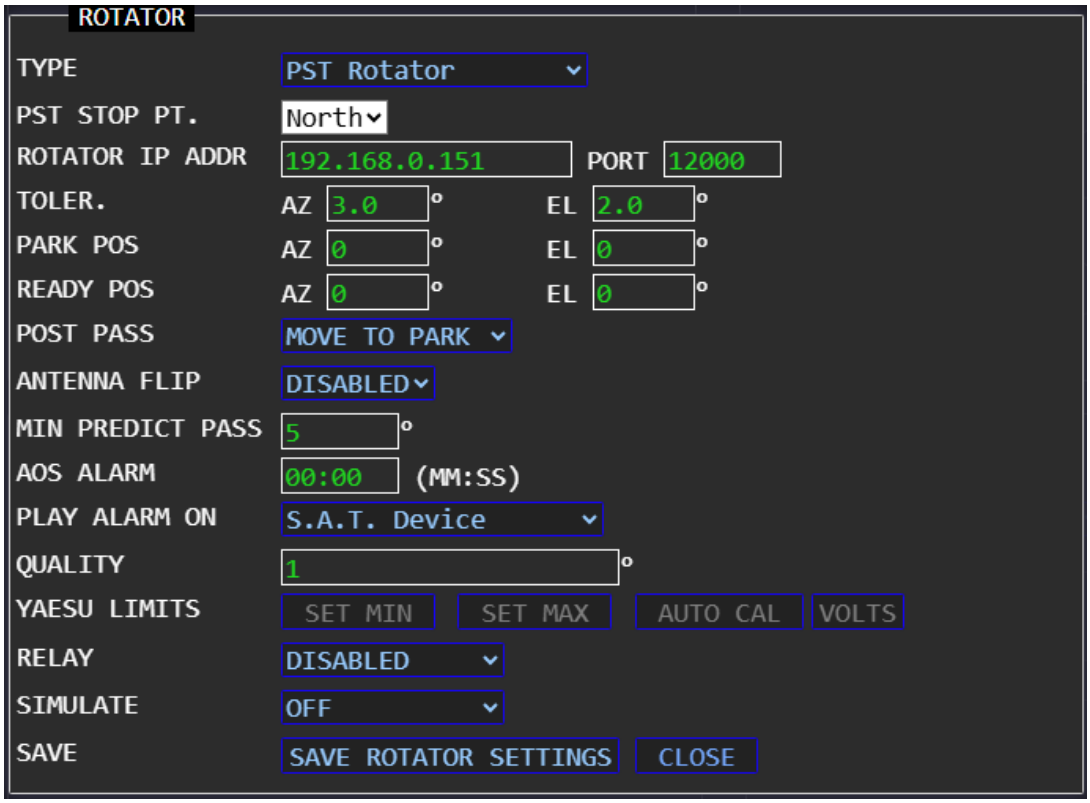
https://www.hamradio.com/detail.cfm?pid=H0-018576

PSR-100 MK2 CONFIGURATION

1. Navigate to the Comm Link page in the PSR-100 Mk2 web interface.
2. Select "CSN S.A.T." from the protocol dropdown.
3. Note the RX Port (default: 12000) and TX Port (default: 12001).
4. Click the “ 💾 Save Configuration” button.

S.A.T. TRACKER ROTATOR 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 as shown below:



2. Select **PST Rotator** as the TYPE
3. Set the ROTATOR IP ADDR to the IP address of the PSR-100 Mk2 Rotor. This can be found at the bottom of the Home page in the Wifi IP System Status Pane.
4. Set the PORT to 12000
5. Ensure ANTENNA FLIP is DISABLED
6. Click the SAVE ROTATOR SETTINGS button to save and exit the window

TESTING THE CONNECTION

After configuring your tracking software, verify communication is working:

1. Navigate to the PSR-100 Mk2 Comm Link page.
2. Start tracking in your software or manually command a position change.
3. Watch the "Received Messages" log on the Comm Link page. You should see position commands arriving.
4. Watch the "Sent Messages" log. You should see position updates being transmitted if the tracking software supports it.
5. Verify the rotor moves to the commanded position by checking the Home page position display.
6. If messages are not appearing, check the Troubleshooting section below.

TROUBLESHOOTING

This section provides solutions to common problems encountered with the PSR-100 Mk2.

WIFI ISSUES

CANNOT CONNECT TO ACCESS POINT

Symptoms: Cannot find or connect to PSR100-Rotor-Config WiFi network.

Solutions:

- Verify rotor is powered on and has been running for at least 15 seconds.
- Verify SSID is exactly "PSR100-Rotor-Config" (case-sensitive).
- Verify password is "12345678" (no spaces).
- Check that your device's WiFi is enabled and in range.
- Power cycle the rotor and wait 15 seconds.
- Try a different device (phone, tablet, laptop).

ROTOR NOT CONNECTING TO WIFI NETWORK

Symptoms: Access Point configuration seems successful, but rotor doesn't connect to your network.

Solutions:

- Verify network credentials were entered correctly (passwords are case-sensitive).
- Ensure your WiFi network uses 2.4GHz (ESP32 does not support 5GHz).
- Verify your router has DHCP enabled.
- Check router settings for MAC address filtering or access restrictions.
- Move rotor closer to WiFi access point to improve signal strength.
- Try reconfiguring via the Access Point (always available as fallback).

LOST ROTOR IP ADDRESS

Symptoms: Cannot remember or find the rotor's IP address on your network.

Solutions:

- Reconnect to PSR100-Rotor-Config Access Point and check configuration page.
- Check your router's DHCP client list or connected devices page.
- Use a network scanning tool (like Fing or Advanced IP Scanner) to find devices on your network.
- Configure your router to assign a static/reserved IP address to the rotor's MAC address.

WEB INTERFACE ISSUES

CANNOT ACCESS WEB INTERFACE

Symptoms: Browser cannot load the rotor's web interface.

Solutions:

- Verify you're using the correct IP address.
- Ensure you include port 8080 in the URL: http://[IP]:8080
- Verify your device is connected to the same WiFi network as the rotor.
- Try a different web browser.
- Clear browser cache and try again.
- Disable VPN or proxy if active.
- Check firewall settings on your device.

PAGE LOADS BUT CONTROLS DON'T WORK

Symptoms: Web interface loads but buttons don't respond or position doesn't update.

Solutions:

- Perform a hard refresh: Press Ctrl+F5 (Windows) or Cmd+Shift+R (Mac).
- Check browser console for JavaScript errors (F12 → Console tab).
- Try a different browser.
- Verify firmware version is 2.0.0 or later (shown below page title).
- Power cycle the rotor.

POSITIONING ISSUES

POSITION DISPLAY SHOWS WRONG ANGLES

Symptoms: Displayed azimuth or elevation doesn't match actual physical position.

Solutions:

- Perform calibration (see Calibration section).
- Verify flip mode status matches physical orientation (check System Status).
- Check stored calibration values on Calibration page for errors.
- Recalibrate if rotor was moved, jarred, or transported.

ROTOR DOESN'T MOVE

Symptoms: Commands are sent but motors don't respond.

Solutions:

- Verify power is connected.
- Check that 12V power supply is functioning (use multimeter).
- Test the manual movement controls on Home page.
- Verify no mechanical binding or obstructions.
- Check motor connections inside enclosure (advanced troubleshooting).

POSITION JUMPS OR JITTERS

Symptoms: Position display shows erratic values or jumps around.

Solutions:

- Check power supply voltage (should be stable 12-15V).
- Verify power supply current capacity (minimum 500mA, 1A recommended).
- Check for loose connections.
- Recalibrate to establish clean voltage readings.
- Check potentiometer connections (advanced troubleshooting).

TRACKING SOFTWARE ISSUES

SOFTWARE CAN'T CONNECT TO ROTOR

Symptoms: Tracking software reports connection error or rotor not responding.

Solutions:

- Verify rotor IP address is correct in software configuration.
- Verify port numbers match those on Comm Link page.
- Verify protocol selection matches for both the rotor and software.
- Ensure computer and rotor are on same WiFi network.
- Check firewall settings on computer (may need to allow UDP traffic on configured ports).
- Test connection by checking Comm Link page logs for received messages.

ROTOR DOESN'T RESPOND TO COMMANDS

Symptoms: Software shows connected but rotor doesn't move.

Solutions:

- Check the Comm Link page ***Received Messages*** log. If empty, commands aren't arriving.
- Verify command format matches selected protocol (check Comm Link logs).
- Test the manual movement controls on Home page to verify motors work.
- Try different protocol selection if current one isn't working.
- Power cycle both rotor and tracking software.

CALIBRATION ISSUES

CANNOT STORE CALIBRATION POINT

Symptoms: Clicking "Store This Position" doesn't save the value.

Solutions:

- Verify voltage display is updating (should change every 500ms).
- Try a different web browser.

- Check browser console for errors.
- Power cycle rotor and try again.

STORED VALUES LOOK WRONG

Symptoms: Calibration voltages seem incorrect or out of range.

Solutions:

- Verify all voltages are between 0.10V and 4.08V. Values outside this range indicate sensor problems.
- Verify elevation voltages differ by approximately 3.5-4.0V.
- Verify azimuth voltages progress in order (each higher than previous).
- If any value is clearly wrong, navigate back to that step and re-store.
- Start calibration from Step 1 if multiple values seem incorrect.
- Check sensor connections if readings are consistently out of range (advanced troubleshooting).

FIRMWARE UPDATES

WA4MCMkits may periodically release firmware updates to fix bugs, improve performance, or add new features. Firmware updates can be installed using the ESP32's built-in bootloader via USB connection. Each PSR-100 device (the Rotor itself and the Serial-to-UDP Bridge Dongle) are updated separately.

CHECKING CURRENT FIRMWARE VERSION

- **PSR-100 Rotor** - The firmware version is displayed on the Home page below the page title.
- **PSR-100 Serial to UDP Bridge** – The firmware version is displayed in the ***Device Info*** pane

WHEN TO UPDATE

Update firmware when:

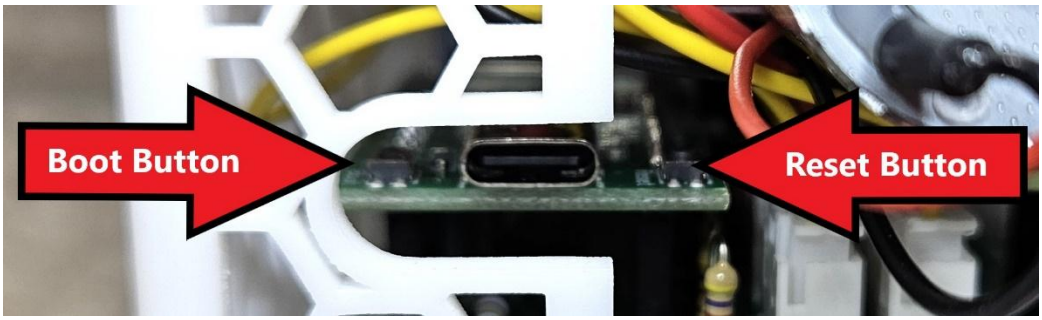
- WA4MCMkits announces a new firmware release via email or website.
- Bug fixes are available for issues you're experiencing.
- New features are added that you want to use.

NOTE: Firmware updates do not erase calibration data or WiFi credentials. Your settings will be preserved across updates.

PSR-100 ROTOR UPDATE PROCEDURE

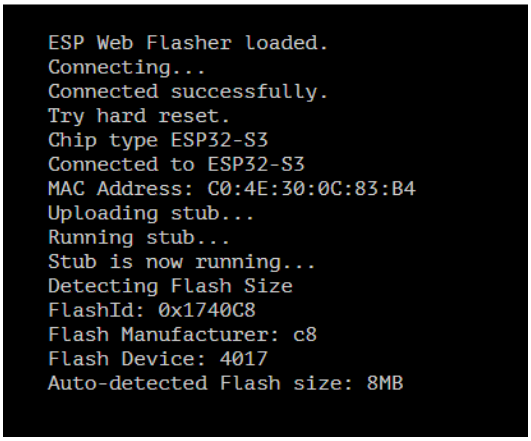
Caution: Unless you follow these steps exactly, there is a possibility that you may "brick" your PSR-100 Mk2. Especially if you enter the wrong hexadecimal installation address. Please double-check your work before clicking the "Program" button. If you do end up bricking your rotor, please contact WA4MCMkits @ 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. Be sure to read the firmware update log.
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 into 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.



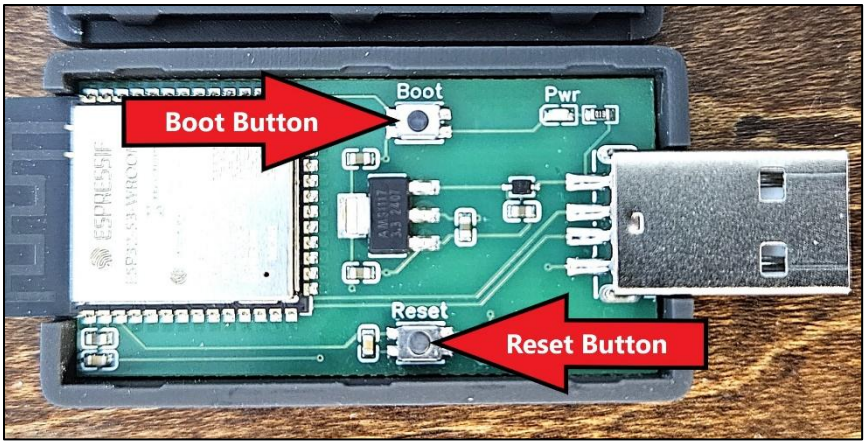
7. Leave the top file offset to 0x0. **Note: the "0x" is already entered for you by the web page**.
8. Click the top "Choose a file…" button and navigate to and select the firmware file (**PSR-100 Firmware Merged vX.X.X.bin**) that is contained in the same .zip file as these instructions (the "X's" will vary based on the current version number).
9. Click the "Program" button and observe the progress bar until it's done.
10. Press the reset button on the rotor's MCU board. Confirm the new firmware version number by observing it on the PSR-100 Mk2 web site's Home Page.

PSR-100 SERIAL TO UDP BRIDGE DONGLE FIRMWARE UPDATES

Caution: Unless you follow these steps exactly, there is a possibility that you may "brick" your Serial to UDP Bridge Dongle. 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 the WiFi Dongle, 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. Be sure to read the firmware change log.
2. Pry the lid off of the dongle's case using a small screwdriver, then plug the dongle into a USB port on a computer with Internet access.

3. Please refer to the image below for the locations of the boot and reset buttons on the Dongle's circuit board:



Press and **hold** the "boot" button on the Dongle's circuit board. While still holding down the "boot" button, press and release the "reset" button. This will put the microcontroller module in a mode for uploading a new firmware image. It will also temporarily change the virtual serial port number being used by the rotor 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.

```
ESP Web Flasher loaded.
Connecting...
Connected successfully.
Try hard reset.
Chip type ESP32-S3
Connected to ESP32-S3
MAC Address: C0:4E:30:0C:83:B4
Uploading stub...
Running stub...
Stub is now running...
Detecting Flash Size
FlashId: 0x1740C8
Flash Manufacturer: c8
Flash Device: 4017
Auto-detected Flash size: 8MB
```

7. Leave the top file offset at 0x0. **Note: the "0x" is already entered for you by the web page**.
8. Click the top "Choose a file…" button and navigate to and select the firmware file (**PSR-100 Bridge Dongle Merged vX.X.X.bin**) that is contained in the same .zip file as these instructions (the "X's" will vary based on the current version number).
9. Click the "Program" button and observe the progress bar until it's done.
10. Press the reset button on the dongle's microcontroller module.
11. Replace the Dongle's lid.

TROUBLESHOOTING FIRMWARE UPDATES

CANNOT ENTER BOOTLOADER MODE

- Ensure USB cable is fully inserted.
- Try a different USB cable (must be data-capable, not charge-only).
- Repeat the BOOT + RESET button sequence carefully.

- Try a different USB port on your computer.

PROGRAMMING FAILS

- Verify file offset is exactly 0x10000 (four zeros).
- Ensure correct .bin file is selected.
- Check USB cable connection.
- Re-enter bootloader mode and try again.
- Try a different web browser (Chrome, Edge, Opera recommended).

ROTOR DOESN'T BOOT AFTER UPDATE

- Power cycle the rotor (turn off, wait 5 seconds, turn on).
- Press RESET button on ESP32 board.
- If still not working, re-program with correct firmware file and offset.
- **If rotor is bricked:** Contact WA4MCMkits at don.friend@wa4mcmkits.com for assistance.

APPENDICES

APPENDIX A: QUICK REFERENCE

This appendix provides at-a-glance reference information for common settings and parameters.

WIFI ACCESS POINT (FALLBACK MODE)

Parameter	Value
SSID	PSR100-Rotor-Config
Password	12345678
Configuration URL	http://192.168.4.1

WEB INTERFACE

Parameter	Value
Port	8080 (HTTP)
URL Format	http://[rotor-ip]:8080
Pages	Home, Comm Link, Calibration

DEFAULT UDP PORTS

Protocol	RX Port	TX Port
GS-232	2390	2391
SAEBRTrackBox	2390	2391
CSN S.A.T.	12000	12001

POSITION RANGES

Axis	Range
Azimuth	0° - 359° (continuous rotation)
Elevation	0° - 90°

CALIBRATION VOLTAGE RANGE

Parameter	Value
Valid Range	0.15V - 4.08V
Display Precision	2 decimal places (X.XX V)

APPENDIX B: PROTOCOL COMMAND FORMATS

This appendix documents the command formats used by each supported protocol.

Azimuth angle values are denoted by x's

Elevation angle values are denoted by y's

GS-232B PROTOCOL

Movement Command Format: Wxxx yyy

- **Example:** W180 045

Rotor Position Request: C2

- **Response Format:** AZ=xxx EL=yyy
- **Example:** AZ=180 EL=045

Stop Command: S

Notes:

- Integer values only (no decimals)
- Space separates azimuth and elevation
- Compatible with any tracking software that can control the Yaesu GS-232B controller

EASYCOMM II (SAEBRTRACKBOX) PROTOCOL

Movement Command Format: AZxxx.x ELxx.x

- **Example:** AZ180.5 EL45.2

Rotor Position Request: AZ -or- EL -or- AZ EL

- **Response Format:** AZxxx.x -or- ELxx.x -or AZxxx.x ELxx.x
- **Example:** AZ180.0 -or- EL45.0 -or- AZ180.0 EL45.0

Stop Command: SA SE

Notes:

- Supports decimal values (truncated to nearest integer by rotor)
- Space separates azimuth and elevation
- Compatible with any tracking software that can control the EasyComm II or SAEBRTrackBox controller

CSN S.A.T. PROTOCOL

Note: The CSN S.A.T. Box sends its commands via XML documents.

Movement Command Format: <PST><AZIMUTH>xxx</AZIMUTH><ELEVATION>yy</ELEVATION></PST>

- **Example:** <PST><AZIMUTH>180</AZIMUTH><ELEVATION>45</ELEVATION></PST>

Rotor Position Request: <PST>AZ?</PST> -or- <PST>EL?</PST>

- **Response Format:** AZ:xxx -or- EL:xx
- **Example:** AZ:180 -or- EL:45

Stop Command: <PST><STOP>1</STOP></PST>

Notes:

- Query-only mode (S.A.T. box polls rotor for position)
- No continuous position updates sent
- Compatible with CSN Technologies S.A.T. tracker

APPENDIX C: TECHNICAL SPECIFICATIONS

Detailed technical information for advanced users.

MICROCONTROLLER

- **Model:** ESP32-S3-WROOM-1-N8
- **CPU:** Dual-core Xtensa LX7, up to 240MHz
- **RAM:** 512KB SRAM
- **Flash:** 8MB
- **WiFi:** 802.11 b/g/n, 2.4GHz only

POSITION SENSORS

- **Type:** Analog potentiometers
- **ADC:** ADS1115 16-bit I2C analog-to-digital converter
- **Resolution:** 16-bit (65,536 counts)
- **Voltage Range:** 0.10V - 4.08V (usable calibration range)

MOTORS

- **Type:** Stepper motors
- **Control:** PWM speed control with two-speed operation
- **Slow Speed:** PWM value 75 (initial movement and positioning)
- **Fast Speed:** PWM value 255 (after 3 seconds of continuous movement)

COMMUNICATION

- **Method:** UDP over WiFi
- **Web Server:** Built-in HTTP server on port 8080
- **Update Rate:** Position updates every 500ms (2 Hz)
- **Protocols:** GS-232, SAEBRTrackBox (EasyComm II), CSN S.A.T.

POWER REQUIREMENTS

- **Voltage:** 12-15V DC
- **Current:** 300mA typical, 500mA recommended
- **Polarity:** Center-positive barrel jack
- **Included Adapter:** 12V DC 1A wall adapter

APPENDIX D: SERIAL-TO-UDP BRIDGE DONGLE

OVERVIEW

The PSR-100 Mk2 Serial-to-UDP Bridge is an included accessory that enables legacy satellite tracking software (such as SatPC32 and PstRotator) to control the PSR-100 Mk2 rotor. These programs were designed to communicate via RS-232 serial ports, which are not natively supported by the PSR-100 Mk2's WiFi-based architecture. The bridge dongle acts as a transparent translator, converting serial commands from your PC into UDP packets that the PSR-100 Mk2 can process over WiFi.

WHEN DO YOU NEED THE BRIDGE?

- **You DO need the bridge** if you're using SatPC32, PstRotator, or any other tracking software that only supports serial (COM port) rotor control
- **You DO NOT need the bridge** if you're using tracking software with native UDP/network support (such as CSN S.A.T. or modern versions of Gpredict configured for network control)

The bridge dongle is built around an ESP32-S3 microcontroller and provides:

- **Bidirectional serial-to-UDP translation** — Commands from your PC are forwarded to the PSR-100 Mk2, and position reports from the PSR-100 Mk2 are sent back to your tracking software
- **WiFi provisioning** — Easy setup via a web-based configuration page
- **Persistent settings** — Network credentials and rotor IP address are saved across power cycles
- **Dual-network operation** — The dongle maintains its own configuration access point while connected to your network, allowing you to check connection status and rotor IP at any time

PHYSICAL DESCRIPTION

The Serial-to-UDP Bridge is a compact USB dongle approximately 2 inches long. It features:

- **USB-A connector** for power and serial communication (appears as a virtual COM port on your PC)
- **No external controls** — All configuration is done via the web interface

INITIAL SETUP

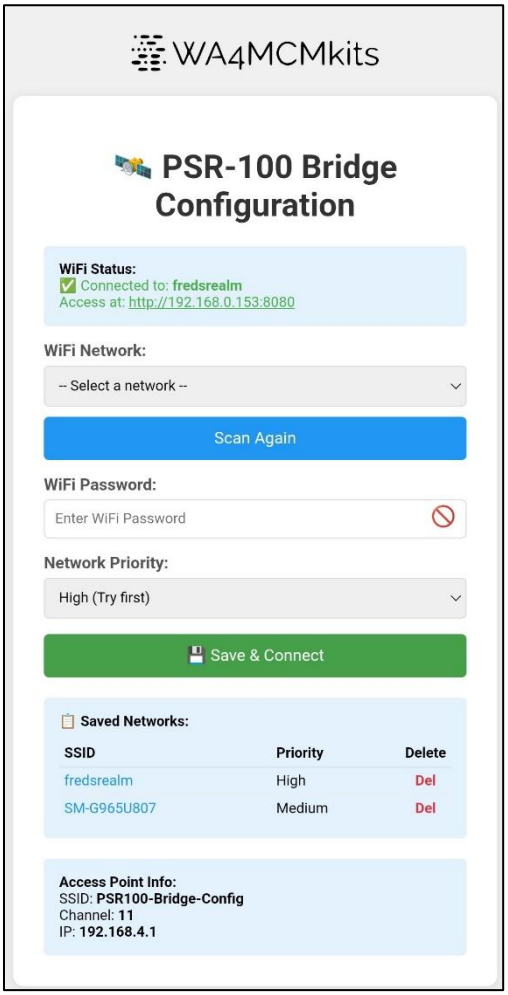
Step 1: Connect the Dongle

1. Plug the Serial-to-UDP Bridge into an available USB port on your computer
2. Windows will automatically install the necessary USB CDC drivers (no additional drivers required on Windows 10/11, macOS, or Linux)
3. Note the COM port number assigned to the dongle:
    - **Windows:** Open Device Manager → Ports (COM & LPT) → Look for "USB Serial Device" or "ESP32-S3"
    - **macOS:** The device will appear as /dev/cu.usbmodem* in Terminal
    - **Linux:** The device will appear as /dev/ttyACM* or /dev/ttyUSB*

Step 2: Connect to the Configuration Access Point

On first power-up (or after a WiFi reset), the dongle creates its own WiFi access point for configuration:

1. On your phone, tablet, or laptop, open the WiFi settings
2. Look for a network named **PSR100-Bridge-Config**
3. Connect to this network using the password: **12345678**
4. Once connected, open a web browser and navigate to: **http://192.168.4.1**



The configuration page will load automatically.

Step 3: Configure Your WiFi Network

The web page displays:

- **Station IP:** Shows "Not connected" until the dongle joins your WiFi network (refreshes every 3 seconds)
- **WiFi Network dropdown:** A list of detected networks (press "Scan Again" to refresh)
- **Password field:** Enter the password for your selected network
- **Hidden network option:** If your network is hidden, select "Other (hidden network)" and manually enter the SSID

To configure:

1. If needed, Press **Scan Again** to populate the network list
2. Select your WiFi network from the dropdown (the one your PSR-100 Mk2 is connected to)
3. Enter the WiFi password
4. Select the Network Priority (High, Medium, Low) from the drop-down list.
5. Press **Save & Connect**

The dongle will:

- Save your credentials to persistent storage
- Attempt to connect to the network
- Display a status page showing connection progress

NOTE: If you have networks showing in the ***Saved Networks*** pane at the bottom of the page, you may simply click on the network's SSID to automatically connect to that network.

Connection success: When the "Station IP" field displays an IP address (e.g., 192.168.1.45:8080), the dongle has successfully joined your network. **Write down this IP address** — you'll need it for PSR-100 Mk2 configuration.

Connection failed: If the dongle fails to connect after 60 seconds, the status page will display an error. Common causes:

- Incorrect password

- Network is 5 GHz (the ESP32-S3 only supports 2.4 GHz WiFi)
- Network out of range

Press "Try Again" to return to the configuration page and re-enter your credentials.

Step 4: Configure the PSR-100 Mk2 Target

After the dongle successfully connects to your WiFi:

1. **Reconnect your phone/laptop to your normal WiFi network** (disconnect from PSR100-Bridge-Config)
2. Open a web browser and navigate to the IP address you wrote down in Step 3 (e.g., http://192.168.1.45:8080)
3. The **PSR-100 Mk2 Serial/UDP Bridge** control panel will load

On this page, you'll see:

- **Device Info card:**
    - IP Address (this device)
    - Firmware Version
    - UDP RX Port (from PSR-100 Mk2)
- **PSR-100 Mk2 Target card:**
    - PSR-100 Mk2 IP Address field
    - UDP TX Port field (the port the PSR-100 Mk2 listens on)
    - Save button
    - Forget WiFi Network button (clears credentials and returns to setup mode)

To configure the PSR-100 Mk2 target:

1. Find your PSR-100 Mk2's IP address:
    - Open the PSR-100 Mk2 web interface
    - Navigate to the **Home** page
    - Look for the **WiFi IP** field in the System Status section (e.g., 192.168.1.100)
2. Enter this IP address in the **PSR-100 Mk2 IP Address** field on the bridge control panel
3. Enter the **UDP TX Port** — this must match the PSR-100 Mk2's configured **RX Port** on the Comm Link page:
    - For **SAEBRTrackBox** protocol (SatPC32, PstRotator): Use port **2390**
    - For other protocols: Check the PSR-100 Mk2 Comm Link page for the RX Port value
4. Press **Save**

The bridge will confirm the settings and begin forwarding serial commands from your tracking software to the PSR-100 Mk2.

USAGE

Once configured, the bridge operates transparently:

- **Serial commands** from your tracking software (via the COM port) are automatically converted to UDP packets and sent to the PSR-100 Mk2

- **Position reports** from the PSR-100 Mk2 are converted to serial data and sent back to your tracking software
- **No manual intervention required** — the bridge runs continuously as long as it has USB power

Live monitoring:

The bridge control panel (accessible at http://<bridge-ip>:8080) displays two real-time log boxes:

- **Received from PSR-100 Mk2:** Shows UDP packets arriving from the rotor (updates every 2 seconds)
- **Sent to PSR-100 Mk2:** Shows serial commands forwarded from your tracking software (updates every 2 seconds)

These logs are useful for troubleshooting communication issues. Press **Clear** to empty a log (this clears both the browser display and the internal buffer on the ESP32).

Checking Connection Status

The bridge maintains its configuration access point **PSR100-Bridge-Config** even while connected to your network. This allows you to check the current network IP address at any time:

1. Connect your phone/laptop to **PSR100-Bridge-Config** (password: **12345678**)
2. Navigate to **http://192.168.4.1**
3. The configuration page will display:
    - **AP IP:** 192.168.4.1 (always)
    - **Station IP:** The current network IP (e.g., 192.168.1.45:8080) — or "Not connected" if the WiFi connection failed

This is particularly useful when using the PSR-100 Mk2 with a mobile phone hotspot, as the IP address may change when you move to a different location.

Note: Your phone cannot reach the bridge's control panel (port 8080) while connected to the PSR100-Bridge-Config network, as they are on separate network segments. Use the AP page only to **view** the current Station IP, then reconnect to your normal WiFi to access the control panel.

Reconfiguring the WiFi Network

If you need to connect the bridge to a different WiFi network (for example, when moving from home to a field site):

1. Open the bridge control panel at http://<bridge-ip>:8080
2. Press the **Forget WiFi Network** button
3. Confirm the action when prompted
4. The bridge will clear the saved credentials and reboot
5. Follow the Initial Setup procedure (Step 2 onwards) to configure the new network

Troubleshooting

Bridge not appearing as a COM port

Cause: USB driver not installed or USB cable issue

Solution:

- **Windows 10/11, macOS, Linux:** Drivers should install automatically. If not, try a different USB cable (some cables are power-only and do not carry data)

- Verify the cable supports both power and data by testing it with another USB device
- Try a different USB port on your computer

Cannot connect to PSR100-Bridge-Config access point

Cause: Access point not active, or incorrect password

Solution:

- Verify the dongle has power (USB LED should be lit if equipped)
- Wait 10–15 seconds after plugging in for the access point to start
- Ensure you're entering the password correctly: **12345678** (8 digits, all lowercase)
- If the access point still doesn't appear, the dongle may have already connected to a saved network. Press **Forget WiFi Network** on the control panel to force it back to AP mode

Bridge connects to WiFi but tracking software doesn't receive position reports

Cause: Incorrect PSR-100 Mk2 IP address or UDP port configuration

Solution:

- Verify the PSR-100 Mk2 IP address is correct (check the PSR-100 Mk2 Home page → WiFi IP)
- Verify the UDP TX port on the bridge matches the PSR-100 Mk2 RX port (Comm Link page)
- Check the live logs on the bridge control panel (http://<bridge-ip>:8080):
    - **Sent to PSR-100** Mk2 should show outgoing commands when you move the rotor in your tracking software
    - **Received from PSR-100** Mk2 should show position reports coming back
- If neither log shows activity, the bridge is not receiving serial data from your PC — verify the correct COM port is selected in your tracking software

Tracking software reports "Rotor not responding"

Cause: COM port mismatch, baud rate mismatch, or PSR-100 Mk2 protocol mismatch

Solution:

- **COM port:** Verify your tracking software is using the correct COM port (Device Manager on Windows)
- **Baud rate:** The bridge uses **115200 baud** — this is fixed and cannot be changed. Most tracking software auto-detects the baud rate, but if yours allows manual configuration, set it to 115200
- **Protocol:** Verify the PSR-100 Mk2 Comm Link page is set to the correct protocol for your tracking software:
    - SatPC32 / PstRotator → **SAEBRTrackBox**
    - Other software → Check the software's documentation for the correct protocol

Station IP shows "Not connected" on the AP configuration page

Cause: WiFi connection failed or credentials incorrect

Solution:

- Reconnect to PSR100-Bridge-Config and check the configuration page
- Press **Scan Again** and verify your network appears in the list

- Re-enter the WiFi password (make sure it's correct)
- Ensure your network is 2.4 GHz (the ESP32-S3 does not support 5 GHz)
- Move the dongle closer to the WiFi access point to improve signal strength

TECHNICAL SPECIFICATIONS

Parameter	Value
Microcontroller	ESP32-S3-WROOM-1-N8
WiFi	802.11 b/g/n, 2.4 GHz only
Serial Interface	USB CDC (virtual COM port)
Serial Baud Rate	115200 (fixed)
UDP Ports	Configurable (default TX: 2390, RX: 2391)
Power	5V via USB-A, ~150 mA typical
Firmware Version	Displayed on control panel
Configuration Storage	Non-volatile (survives power cycles)

Firmware Updates

Firmware updates for the Serial-to-UDP Bridge will be released periodically to add features or fix bugs. Update instructions and firmware files will be available on the WA4MCM Kits website:

https://wa4mcmkits.com/support-files/support-files

Check the **Firmware Version** field on the bridge control panel to determine your current version.

Summary

The Serial-to-UDP Bridge enables you to use legacy serial-based tracking software with the WiFi-enabled PSR-100 Mk2 rotor. Setup takes just a few minutes:

1. Plug in the dongle and note the COM port
2. Connect to **PSR100-Bridge-Config** WiFi (password: **12345678**)
3. Configure your WiFi network at **http://192.168.4.1**
4. Write down the Station IP address
5. Reconnect to your normal WiFi and navigate to **http://<station-ip>:8080**
6. Enter the PSR-100 Mk2 IP address and UDP port, then press Save
7. Configure your tracking software to use the bridge's COM port

The bridge will automatically forward commands between your tracking software and the PSR-100 Mk2, with no manual intervention required.

APPENDIX E: HAMLIB ROTCTLD

The hamlib utilities (Ham Radio Control Libraries) are open-source C-based API's that provides a consistent interface for software to control amateur radio transceivers and rotators. We will be focusing on rotctld (**rot**ator **c**on**t**ro**l** **d**aemon).

A full set of download and installation instructions is out of scope of this manual. However, I will provide what I have found to be a workable configuration on a Windows PC.

Regardless of the platform you use to host your satellite tracking software, be sure to configure the rotctld to start with the command line parameters shown in step 3 below, only with the **-r** argument pointing to the appropriate serial port using nomenclature unique to the platform.

CREATE A DESKTOP SHORTCUT

For ease of starting rotctld, I create a desktop shortcut. Please follow these steps to create the shortcut:

1. Right-click on your Windows desktop and select ***New/Shortcut*** from the context menu that appears.
2. On the resulting ***Create Shortcut*** window, click the ***Browse*** button and navigate to the folder where the Hamlib files have been installed – usually ***C:\Program Files\Hamlib\hamlib-w64-4.6.3\bin*** and double-click on the ***rotctld.exe*** file.
3. Add the following command line arguments to the string that is currently shown in the text field:

   -m 603 -r COMX **-s 115200 --set-conf=dtr_state=ON --set-conf=rts_state=ON --set-conf=timeout=1000**

   Where the **X** is replaced with the comm port created by the Serial-to-UDP Bridge Dongle.
4. Ensure that the full path to the **rotctld.exe** file with the additional command line arguments is shown in the text field exactly as shown below (quotation marks as well):

   "C:\Program Files\Hamlib\hamlib-w64-4.6.3\bin\rotctld.exe" -m 603 -r COM4 -s 115200 --set-conf=dtr_state=ON --set-conf=rts_state=ON --set-conf=timeout=1000

   then click the ***Next*** button to continue.
5. Add a name for the shortcut. I recommend: **Hamlib Rotor Ctrl GS-232**
6. Click the ***Finish*** button to complete the creation of the desktop shortcut.