SARCTRAC
Satellite **A**ntenna **R**otator **C**ontroller & **TRAC**ker
SCHOOL AMATEUR RADIO CLUB NETWORK
www.sarcnet.org

SARCTRAC Mk2 Quick Start Guide

REGULATORY COMPLIANCE

SARCTRAC is essentially an embedded Raspberry Pi 3B+ (RPi) computer. The declarations of conformity, including local and regional approval certificates for the RPi can be found at:
https://www.raspberrypi.org/documentation/hardware/raspberrypi/conformity.md. This covers: USA, Argentina, Australia, Bolivia, Brazil, Canada, Chile, China, Colombia, Costa Rica, Dominican Republic, Ethiopia, Ecuador, Guatemala, Hong Kong, India, Israel, Japan, Kenya, Malaysia, Mexico, New Zealand, Nicaragua, Panama, Peru, Philippines, Russia, Rwanda, Serbia, Singapore, South Africa, South Korea, Taiwan, Tanzania, Thailand, Turkey, Uganda, Uruguay and Venezuela.

SARCTRAC has a technical folder, which indicates it comprises an RPi together with additional electronic components and assemblies such as small motors, drivers, sensors and USB devices.

SARCTRAC operates on 12-15VDC @ 1A and complies with Separated Extra Low Voltage (SELV) device requirements.

SARCTRAC has been assembled with lead-free components and solder and complies with Restriction of Hazardous Substances (RoHS) requirements.

SARCTRAC uses an RPi, which has been tested to meet international RFI/EMC requirements. SARCTRAC uses additional sensors, drivers and motors, which due to their nature and operating conditions would not affect this base RFI/EMC qualification. In fact, the reduction of RFI to nearby receivers and EMC with nearby transmitters, to levels well below international standards, was a key design requirement of this product. Note: You must set your country code in the network.txt file for compliance.
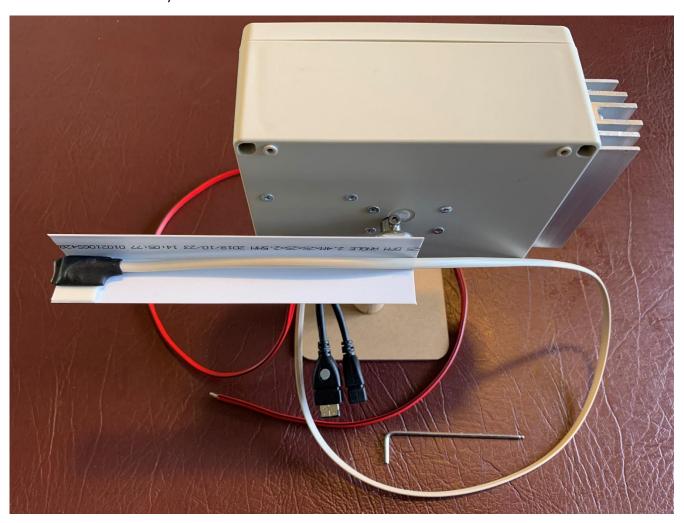

SARCTRAC introduces additional safety risks, which have been fully identified below. The safety risks have been reduced, by design, to as low as is reasonably practicable. Some operational safety testing has been carried out to qualify these safety risks as minor.

SAFETY

Please read the following very carefully. We accept no responsibility or liability for the following:

- This is partly a DIY construction project for the experience builder. We are not responsible for your time, costs, tools, availability or substitution of parts.
- Beware of moving parts - Unit may move at any time without warning. Do not stand or permit anyone to stand in the vicinity of the operating unit.
- Beware of eye hazard - Moving satellite antennas are prickly. Eye protection is recommended.
- Beware of pinch hazard - Keep fingers away from moving parts.
- Beware of electromagnetic radiation hazard - Do not use with high power transmitters. Recommend: 10 Watts maximum.
- Beware of electrocution hazard - Do not use near power lines.
- Beware of lightning hazard - Do not use in thunderstorms, rainy or windy conditions.
- Beware of burn hazard - The heatsink temperature may exceed 50 degrees. Do not touch it. Read the warning.
- Not suitable for unattended operation.
- Not suitable for fixed or permanent outdoor operation.
- Automatically connects to the Internet: Adult permission and charges may apply.
- Constant adult supervision of the operation is required to prevent injury, especially around children.
- Constant adult supervision of the operation is required to prevent damage to the unit, anything attached to the unit or anything in the vicinity of the unit.
- Constant adult supervision of the operation of radio transmitters is required at all times. You must check your licence conditions and operating frequency.
- Antenna, tripod, lift-arm, mountings, cables or anything in the vicinity of the unit may be damaged under normal operation or due to software malfunction.
- The motors are light-duty: Do not force them or drop or bump the tripod to avoid striping the metal gears.
- Installation of a safety DC cut-off switch is recommended.

SARCTRAC Mk2 Getting Started

1. Unpack the SARCTRAC box and dispose of the packaging responsibly. Check the contents first:
   a. [ ]SARCTRAC Main Unit
   b. [ ]SARCTRAC USB Disk
   c. [ ] SARCTRAC Test Stand
   d. [ ] SARCTRAC Test Lift-Arm with SARCTRAC 3D Sensor
   e. [ ]3mm Hex Wrench
2. Log into your WiFi router using the administrator password on a PC. Check it will accept new WiFi connections.
3. Open the router configuration page, which shows the hostname and IP address of the connected WiFi stations.
4. Plug the SARCTRAC USB Disk into the USB port on a PC. Open the root folder of the SARCTRAC USB Disk.
5. Use a basic text editor like Notepad, not Word, to edit the network.txt[1] file.
6. Insert your own country code, and your WiFi router SSID and Password in between the double quotes.
7. Save the network.txt file and eject the SARCTRAC USB Disk from the PC.
8. Insert the SARCTRAC USB Disk into the SARCTRAC USB Socket with the silver dot.
9. Assemble the SARCTRAC Test System (pictured) for testing and practice prior to tripod/antenna installation.
10. Place the SARCTRAC Unit on the SARCTRAC Test Stand and lightly tighten the screws using the Hex Wrench.
11. Bend the two USB Cables so they don't touch the table underneath the SARCTRAC Test Stand.
12. Attach the SARCTRAC Test Lift-Arm to the SARCTRAC Unit and lightly tighten the screws using the Hex Wrench.
13. Place the SARCTRAC Test System on a horizontal, non-magnetic, surface outside with a clear view of the sky.
14. Connect the SARCTRAC power cable (black-negative) to a 12V, 2A, regulated DC power supply and turn it on.
15. Wait up to 2 minutes for SARCTRAC to boot up and beep the first time. Remove the SARCTRAC USB Disk.
16. Check the WiFi router page again, which shows the hostname and IP address of the connected WiFi stations.
17. Record the IP Address of the station with hostname "SARCTRAC" and/or MAC Address starting with B8:27:EB.
18. Open a WiFi enabled Web Browser on a PC or Mobile Device and browse to the IP Address of SARCTRAC[2].
19. Verify that the SARCTRAC SELECTION Page is displayed with your correct name and call sign.
20. Check the Online (Internet) status and your Location. Refresh the page until there is a good GPS fix[3].
21. Under USER CONTROLS: Select the Local UTC Offset (hours) at your location and press SET. Check the Time.
22. Under SATELLITE SELECTION: Press NONE to deselect all satellites.
23. Press START. The Lift-Arm should rotate to True North and Horizontal.
24. Under SATELLITE SELECTION: Press ALL to select all satellites.
25. Press TRACKING. Note: This web page updates every 5 seconds.
26. SARCTRAC should beep and position the SARCTRAC Test Lift-Arm to the next satellite's position.
27. SARCTRAC should display some FUTURE PASSES. Press MORE or LESS to display more or less passes.
28. When satellites appear in the VISIBLE PASSES section, SARCTRAC should track the first selected satellite.
29. Under USER CONTROLS: Select your radio type(s) and baudrate. Press SET.
30. Power up your radio(s) and connect the CAT cable(s) to the SARCTRAC USB port(s).
31. Under SYSTEM STATUS: Check the RX, TX, or TR Ports for Not Used, Not Connected, Connected and Online.
32. SARCTRAC will control the Doppler frequency of the radio(s) when a tracked satellite name is prefixed with *.
33. Press HOME to return the SARCTRAC Test Lift-Arm to North. Press STOP to stop the motors.
34. Always press SHUTDOWN prior to disconnecting the power.
35. Insert the SARCTRAC USB Disk, with updated files in the root folder, and press RESTART to install them.
36. Copy and save the contents of the SARCTRAC USB Disk on a PC to preserve any backup files.
37. Download and read the SARCTRAC Mk2 User Manual prior to tripod/antenna assembly for portable operation.
38. The SARCTRAC manual and any future updates will be published at: www.sarcnet.org/sarctrac.
39. Review our SARCTRAC Project page and Forum at: www.sarcnet.org/sarctrac.html and www.sarcnet.org/blog/

Notes:

1. If "show file extensions" is off, the filename may be displayed only as "network". Do not add ".txt".
2. On an Apple device supporting the Bonjour protocol, simply browse to "sarctrac.local".
3. A good GPS fix would be indicated by your correct street address and a GPS error of under 5 metres.

SARCTRAC Operations

1. Antenna Connection
   a. Design and build a counterbalanced lift-arm for your hand-help satellite antenna.
   b. Mount the elevation hub near the balance point on the counterbalanced lift-arm.
   c. Mount the antenna/lift-arm assembly on the elevation shaft.
   d. Attach the SARCTRAC 3D Sensor with the flat side against the top side of the antenna boom.
2. Radio Connection
   a. SARCTRAC has two USB ports: USB0 (with silver dot) or USB1.
   b. Connect separate Receiver and Transmitter USB CAT cables to USB0 and USB1; or
   c. Connect a single Transceiver USB CAT cable to USB0.
   d. Check the radio is setup for CAT control and note the serial baudrate to be used.
3. SARCTRAC Controls
   a. Press START/STOP to start and stop motors.
   b. Press RESTART to reboot SARCTRAC. Press SHUTDOWN before powering off SARCTRAC.
   c. Press SELECTION/TRACKING/TUNING to select SARCTRAC web pages.
4. SELECTION Page
   a. User Controls
      i. Only track passes above the Local Radio Horizon, 0-20 degrees.
      ii. Only track passes that reach a Maximum Pass Elevation 0-45 degrees.
      iii. Set Receiver and Transmitter or Transceiver Type and Baudrate.
      iv. Set the ratio of RX VFO to TX VFO messages. E.g. 2:1 = RX, RX, TX, RX, RX, TX.
      v. Set the Radio Update Rate in milliseconds.
      vi. Press SET to save.
   b. Satellite Selection
      i. Select ALL, NONE or individual satellites.
      ii. Satellite names prefixed with * have associated radio tuning information
   c. Orbital Element Library List
      i. Add the URL of a text file containing one or more Two Line Elements.
      ii. Press PURGE to delete all downloaded/user libraries and UPDATE to download new libraries.
   d. Reject Satellite List
      i. Enter a partial match to any satellite names to be rejected.
      ii. Press REJECT to save.
   e. 3D Sensor Calibration
      i. Press BEGIN to start, ABORT to cancel and SAVE to store.
      ii. See calibration video at: https://www.youtube.com/watch?v=oJnpO5Nj7Gc
   f. System Start-Up Log
      i. Check for tracking history and any start-up errors
5. TRACKING Page
   a. INFORMATION messages include: AZIMUTH STALL, ELEVATION STALL and ANTI-WINDUP.
   b. VISIBLE PASSES include all currently visible passes. Only the first selected pass will be tracked.
   c. FUTURE PASSES include AOS-LOS times, AOS Azimuth and MAX Elevation.
   d. FUTURE PASSES are automatically selected, but may be individually deselected.
   e. Satellite names prefixed with * have associated radio tuning information.
   f. Press MORE or LESS to display more or less passes.
   g. Press HOME to deselect all passes and return rotator to the home position.
6. TUNING Page
   a. Only for satellites with names prefixed with *.
   b. Select Satellite, Receiver and Transmitter MODE.
   c. Select an incremental tuning step. Press TUNE repeatedly to increment.
   d. Remember to reset the tuning step to 0Hz if just changing MODE.
   e. Press TUNE to save.