Device-Specific Setup Guides

- Heltec V3 Setup Guide
- Heltec V4 Setup Guide
- LilyGo T-Echo Setup Guide
- LilyGo T-Beam Setup Guide
- LilyGo T-Deck Setup Guide
- LilyGo T-Deck Plus Setup Guide
- Station G2 Setup Guide
- Seeed Wio Tracker Setup Guide
- Nano G2 Ultra Setup Guide

Heltec V3 Setup Guide

⚠ **ANTENNA SAFETY - ALL DEVICES:** Always connect a proper 915 MHz antenna (or a 50-ohm dummy load) **before** transmitting on any LoRa device. Operating without an antenna creates a severe impedance mismatch. The SX1262 in this board clamps its power amplifier to protect itself, so a brief unkeyed power-on is unlikely to destroy it — but repeated or prolonged keying into no antenna stresses the front end and is bad practice. High-power boards with an external PA/front-end module (Station G2, Heltec V4, amplifier builds) are at **real risk of permanent damage** and must never transmit without a load.

Heltec V3 (WiFi LoRa 32 V3) - Setup Guide

The Heltec V3 is widely regarded as the best beginner board in the LoRa mesh ecosystem. It combines an ESP32-S3 MCU with an SX1262 radio and a built-in OLED display, making it easy to monitor status at a glance without a phone.

Specifications

Attribute	Value
MCU	ESP32-S3
Radio	SX1262
Max TX Power	21 dBm (~125 mW). This is the radio's conducted output; total radiated power depends on your antenna gain — keep EIRP within FCC limits (see the Antennas & RF / EIRP guidance).
Display	0.96" OLED
USB	USB-C
Battery	LiPo connector (battery not included)
Price	$20 - 30 (as of 2026-06-08; prices vary by seller and tariff)
Strengths	Best beginner board, OLED status display, widely supported
Weaknesses	Higher power draw than nRF52 boards; no GPS

⚠ **BATTERY SAFETY:** If you connect a LiPo, use a protected cell, verify connector polarity before plugging it in (a reversed or shorted LiPo can catch fire), do not charge below 0°C or above ~45°C, and replace any swollen cell.

Driver Installation

The Heltec V3 uses a **CP2102 USB-to-UART bridge** (a Silicon Labs CP210x device).

- **Windows:** Download the CP210x driver from the Silicon Labs website (silabs.com). Install and reboot if prompted. The device will appear as a COM port in Device Manager.
- **macOS & Linux:** Driver is built in - no installation required. The device appears automatically as a serial port (`/dev/ttyUSB0` or `/dev/cu.usbserial-*`).

Entering Bootloader / DFU Mode

You must place the device into bootloader mode before the web flasher can program it.

Method 1 - From powered-off state (recommended):

1. Unplug the USB cable.
2. Hold the **BOOT** button.
3. Plug in the USB cable while continuing to hold BOOT.
4. Hold for 1 - 2 seconds after the cable is connected, then release BOOT.

Method 2 - From powered-on state:

1. Hold the **BOOT** button.
2. While holding BOOT, briefly press and release the **RST** button.
3. Release the BOOT button.

The OLED will go blank when the device is in bootloader mode. This is normal.

Firmware Flashing

Use a Chromium-based browser (Chrome or Edge) - Firefox does not support WebSerial.

1. Enter bootloader mode (see above).
2. Navigate to your preferred flasher:
   - **MeshCore:** flasher.meshcore.io
   - **Meshtastic:** flasher.meshtastic.org

3. Select **Heltec WiFi LoRa 32 V3** from the device list.
4. Select your desired firmware variant.
5. Click **Flash** and grant the browser permission to access the serial port when prompted.
6. Wait for the flash to complete - do not disconnect during this process.
7. The device will reboot automatically when flashing is done.

Post-Flash Configuration

1. Connect to the device via the Bluetooth app (MeshCore or Meshtastic app on your phone).
2. Set your **region to US** (required for legal operation on 915 MHz).
3. **MeshCore:** Select the *USA/Canada* channel preset.
4. **Meshtastic:** Set region to *US* in the Radio Config → LoRa section.
5. Set your node name and any other desired settings.

Known Quirks & Fixes

> **Bluetooth Antenna Issue:** The stock PCB Bluetooth antenna can cause Bluetooth dropouts at range. **Optional fix (only if you actually have BLE range problems):** replace it with a 31 mm bare wire antenna soldered directly to the BT antenna pad on the PCB. **Note:** this is a precision SMD soldering job on a small pad — it requires a fine-tip iron and good soldering skill, can void any warranty, and a slip with the iron can short adjacent components or damage the board. If you are not confident soldering fine-pitch work, leave it stock.

Heltec V4 Setup Guide

⚠ **ANTENNA SAFETY:** Always connect a proper 915 MHz antenna (or a 50-ohm dummy load) **before** transmitting. The V4 has a high-power front-end module (PA/FEM) that **can be permanently damaged** by transmitting into no antenna or a bad impedance mismatch — never key this board without a load. (On plain SX1262 boards without a PA the radio clamps its own power and is more tolerant, but on the V4 the front-end module is genuinely at risk.)

Heltec V4 (WiFi LoRa 32 V4) - Setup Guide

The Heltec V4 offers higher TX power than the V3 (the high-power variant is rated ~28 dBm vs the V3's 21 dBm; a low-power 22 dBm variant also exists) and includes a built-in solar charging interface, making it well-suited for permanent outdoor installations. *Note: the "Heltec V4" (WiFi LoRa 32 V4) is a distinct product from the Heltec Vision Master series (e.g. T190) — they share the ESP32-S3 + SX1262 platform but are different boards with different form factors and separate flasher entries. This page covers the WiFi LoRa 32 V4 only.*

Specifications

Attribute	Value
MCU	ESP32-S3
Radio	SX1262
Max TX Power	~28 dBm conducted (~630 mW) on the high-power variant, via the onboard front-end module (PA); a low-power variant is ~22 dBm. The SX1262 itself is +22 dBm max — the extra gain comes from the FEM, so actual output and EIRP must account for the FEM plus any filter/coax loss.
Solar	Built-in solar charging interface
USB	USB-C (native ESP32-S3 USB)
Price	$25 - 35 (as of 2026-06-08; prices vary by seller and tariff)
Strengths	Higher TX power than V3, solar interface, good for permanent installs

⚠ **FCC / RF EXPOSURE:** 28 dBm conducted is within the FCC Part 15 limit (30 dBm / 1 W max conducted). But if you pair the V4 with an antenna above 6 dBi, you must reduce TX power 1 dB for each dB of antenna gain above 6 dBi to stay within the EIRP limit (36 dBm EIRP ceiling). On a higher-power board feeding an external gain antenna on a rooftop or mast, also maintain an RF-exposure keep-away distance from people. For battery/solar use, fit a charge controller with a low-temperature charge cutoff and never charge lithium below 0°C.

Driver Installation

The Heltec V4 **removed the external USB-serial bridge chip** (the CP2102 used on the V3 is gone). It uses the ESP32-S3's **native USB CDC**, so it generally needs **no separate USB-serial driver** on any modern operating system.

- **Windows:** Modern Windows enumerates the V4's native USB CDC automatically and assigns a COM port — no CH340/CP210x driver download is required.
- **macOS:** Native USB CDC enumerates automatically; no WCH/CH34x or CP210x driver needed.
- **Linux:** The kernel enumerates the V4's native USB CDC automatically — no driver needed.

⚠ **If the device does not appear:** Because the V4 uses native USB CDC, a missing serial-bridge driver is not the cause. Try a different (data-capable) USB-C cable, a different USB port, and confirm the board enters bootloader mode (see below) before flashing.

Entering Bootloader / DFU Mode

Method 1 - From powered-off state (recommended):

1. Disconnect the USB cable.
2. Hold the **BOOT** button.
3. Connect the USB cable while continuing to hold BOOT.
4. Hold for 1 - 2 seconds after connecting, then release BOOT.

Method 2 - From powered-on state:

1. Hold the **BOOT** button.
2. Briefly press and release the **RST** button while holding BOOT.
3. Release the BOOT button.

Firmware Flashing

1. Enter bootloader mode (see above).
2. Open Chrome or Edge and navigate to:
   - **MeshCore:** flasher.meshcore.io
   - **Meshtastic:** flasher.meshtastic.org
3. Select the **Heltec V4** variant from the device list.
4. Click **Flash** and grant serial port access when prompted.
5. Wait for completion. Device reboots automatically.

Post-Flash Configuration

1. Connect via Bluetooth app.
2. Set **region to US**.
3. Select the appropriate channel preset (MeshCore: USA/Canada; Meshtastic: US region).
4. Configure solar charging settings if using a solar panel.

Known Quirks & Fixes

FEM (Front End Module) Self-Interference: The V4's high-power front end module can cause RF self-interference. Recommended mitigations:

- **Do not wrap the PCB in aluminum foil.** An ungrounded foil wrap is not a Faraday shield — it can detune the antenna matching and the BLE/Wi-Fi antennas, short exposed pads or pins, and parasitically couple into the front end, often making self-interference worse. Proper shielding uses a grounded board-level shield can soldered over the RF section only, keeping the antenna connector and feed clear.
- Add a 915 MHz bandpass filter (JMT or Baymesh) on the antenna line — this is usually the most effective single fix.

> **rxgain on V4.3 (MeshCore, as of 2026-06-08):** On some MeshCore firmware versions (reported around v1.15.0), `rxgain` is enabled by default on V4.3 hardware. This improves receive sensitivity but adds ~0.5 mA idle draw. If the device is power-critical (e.g., solar with a limited panel), you can disable it via serial or Bluetooth. Verify the exact command and the default behavior against your firmware version's MeshCore release notes before relying on it — syntax can change between versions:
> `set radio.rxgain off`

LilyGo T-Echo Setup Guide

⚠ **ANTENNA SAFETY - ALL DEVICES:** Always connect an antenna **before** powering on or transmitting with any LoRa device. Transmitting without an antenna reflects power back into the radio and is poor practice that can stress the RF front end over time. The T-Echo's SX1262 has on-chip PA clamping that protects the die against a brief antenna-mismatch event, so a momentary no-antenna transmission is unlikely to cause documented permanent damage — but make it a firm habit anyway, and treat the "permanent damage" risk as real for boards with an external PA/FEM stage.

LilyGo T-Echo - Setup Guide

The T-Echo is a premium portable node with an e-ink display, built-in GPS, NFC, and exceptional battery life. For many users it is the best overall portable node - readable in direct sunlight, fitting in a shirt pocket, and running 7 - 14 days per charge.

Specifications

Attribute	Value
MCU	nRF52840
Radio	SX1262
Display	E-ink (sunlight-readable)
Battery	~850 mAh internal
Battery Life	7 - 14 days typical (varies with role/config; vendor claims run up to ~1 month)
GPS	Built-in
NFC	Built-in
Price	$50 - 65 (as of 2026-06-08; verify a current Rokland/LilyGO listing)
Strengths	Sunlight-readable display, excellent battery life, GPS, NFC, compact
Weaknesses	E-ink refresh is slow; not suitable for fast-changing displays

Driver Installation

No driver installation required on any operating system. The nRF52840 MCU presents itself as a USB mass storage device (like a USB thumb drive). It will appear automatically on Windows, macOS, and Linux when connected via USB.

Entering Bootloader / DFU Mode

The T-Echo uses a double-tap reset method to enter DFU mode:

1. Connect the device via USB-C.
2. **Quickly double-tap the reset button** (both taps must occur within ~500 ms).
3. The device will appear as a USB drive labeled **"TECHOBOOT"** (it may also appear as **"NRF52BOOT"**).
4. In DFU/bootloader mode the indicator LED **fades/pulses green** (Adafruit nRF52 bootloader behavior) to confirm the bootloader is active. (The blue LED on the T-Echo is the Bluetooth activity indicator, not a DFU indicator.)

If the drive does not appear, try again - the timing of the double-tap is important. A slow double-tap will simply reset the device rather than entering DFU mode.

Firmware Flashing

Method A - Drag and Drop (simplest):

1. Download the `.uf2` firmware file for the T-Echo from the MeshCore or Meshtastic release page.
2. Enter DFU mode (double-tap reset as above).
3. Drag and drop the `.uf2` file onto the USB drive that appeared.
4. The device will automatically reboot and apply the firmware.

Method B - Web Flasher:

1. Enter DFU mode.
2. Open Chrome or Edge and navigate to:
   - **MeshCore:** flasher.meshcore.co.uk
   - **Meshtastic:** flasher.meshtastic.org
3. Select **T-Echo** from the device list.
4. Click **Flash** and follow prompts.

Post-Flash Configuration

1. Connect via Bluetooth app (MeshCore or Meshtastic).
2. Set **region to US**.

3. GPS will acquire satellites automatically - allow a few minutes outdoors for first fix.
4. Configure node name and any desired settings.

Known Quirks

- E-ink display refreshes slowly by design. This is normal and not a malfunction.
- GPS first fix may take several minutes. Subsequent fixes are faster.
- Double-tap reset timing can take a few tries to get right on first attempt.

LilyGo T-Beam Setup Guide

⚠ **ANTENNA SAFETY - ALL DEVICES:** Always connect an antenna **before** powering on or transmitting with any LoRa device - this is good practice on every board. On the T-Beam's **SX1262**, the radio has improved antenna-mismatch tolerance, so a brief transmission without an antenna is less likely to cause instant damage than on older PA/front-end boards; nonetheless, transmitting without an antenna can still stress the radio, so make antenna-before-power a firm habit. (The "permanent damage from a brief TX" risk is most acute on PA/FEM-equipped boards.)

LilyGo T-Beam - Setup Guide

The T-Beam is a compact ESP32-based node with built-in GPS and a holder for a standard 18650 lithium cell. It is important to verify the radio variant (SX1262 vs SX1276) before purchasing, as this affects firmware compatibility.

Specifications

Attribute	Value
MCU	ESP32
Radio	SX1262 on the current T-Beam v1.1 / v1.2 (US/EU); some older revisions shipped the SX1276. Read the radio chip off your board and confirm against LILYGO's product page before flashing. (The T-Beam Supreme uses the SX1262; the SX1268 is the ~470 MHz China-band part.)
GPS	Built-in
Battery	18650 holder (cell not included)
Power Management	AXP192 or AXP2101 chip
Price	$35 - 45 (volatile; confirm against a current LILYGO/Rokland listing, as of 2026-06-08)
Strengths	Compact with GPS, familiar form factor, replaceable 18650

⚠ **CRITICAL - Verify Radio Variant Before Purchasing:**
The T-Beam is sold with two different radio chips:

- **SX1262** - Current standard. Full firmware support for both MeshCore and Meshtastic. Preferred for new builds.
- **SX1276** - The legacy radio. Still supported in Meshtastic/MeshCore, but being phased out, so the SX1262 is preferred for new purchases.

Selecting the wrong firmware variant during flashing will result in a blank/non-functional screen. Confirm your hardware version before flashing.

Driver Installation

- **Windows:** The required driver depends on your board's USB-to-UART chip. Recent T-Beams ship a **CH9102F** chip, which needs the **CH9102/CH34x driver**; older boards use a **CP2102**, which needs the **CP210x driver** from Silicon Labs. Check Device Manager (or the chip marking on the board) to confirm which one you have.
- **macOS & Linux:** Built-in - no driver needed.

Entering Bootloader / DFU Mode

Method 1 - From powered-off state:

1. Hold the **BOOT** button (labeled "IO0" on some hardware versions).
2. Plug in the USB cable while holding BOOT.
3. Release BOOT after ~2 seconds.

Method 2 - From powered-on state:

1. Hold the **BOOT** button.
2. Briefly press and release the **RST** button.
3. Release the BOOT button.

Firmware Flashing

1. Enter bootloader mode.
2. Open Chrome or Edge and navigate to:
   - **MeshCore:** flasher.meshcore.io (the canonical MeshCore web flasher)
   - **Meshtastic:** flasher.meshtastic.org
3. Select the T-Beam variant that matches your radio chip:
   - **T-Beam (SX1262)** for current hardware
   - **T-Beam (SX1276)** for older hardware
4. Click **Flash**. Do not disconnect during the process.

Post-Flash Configuration

1. GPS initializes and begins acquiring satellites automatically.
2. Set **region to US** via the Bluetooth app.
3. The AXP192/AXP2101 power management chip handles battery charging automatically and provides charge/discharge protection.
4. **Use good-quality flat-top (unprotected) 18650 cells.** The T-Beam holder is sized for **unprotected flat-top** cells - protected cells are longer and generally will not fit, and may also trip on transmit current spikes. The board's AXP PMIC provides charge/discharge protection. Buy quality cells from a reputable brand, and in cold deployments never charge any lithium cell below 0 °C (32 °F).

Known Quirks

- **SX1262 vs SX1276 variant selection is critical** - the wrong radio firmware leaves a blank/non-functional screen. (Distinct from a wrong-PMIC mismatch, where the board may appear to boot but the battery will not charge.)
- On some hardware versions the GPS antenna is located under the screen - avoid placing metal objects directly on the display area.
- The BOOT button may be labeled "IO0" on older PCB revisions.

LilyGo T-Deck Setup Guide

⚠ **ANTENNA SAFETY - GOOD PRACTICE:** Always connect an antenna **before** powering on or transmitting with any LoRa device. The T-Deck uses the SX1262, which has improved tolerance to antenna mismatch, so a brief accidental transmit without an antenna is unlikely to instantly destroy it - but operating without a proper antenna load is still bad practice and can stress the radio over time. Reserve "permanent damage from a brief transmit" concerns for PA/FEM-equipped boards (high-power front-end designs and amplifier builds). Connect the antenna first regardless.

LilyGo T-Deck - Setup Guide

The T-Deck is a standalone LoRa communicator with a 2.8" touchscreen, physical QWERTY keyboard, trackball, speaker, and microphone - enabling full mesh network operation without a phone. Note that the base T-Deck does not include GPS; see the T-Deck Plus for GPS functionality.

Specifications

Attribute	Value
MCU	ESP32-S3
Radio	SX1262
Display	2.8" touchscreen
Input	QWERTY keyboard + trackball
Audio	Speaker + microphone
GPS	Not included (requires T-Deck Plus)
Price	~$50 - $53 (the base T-Deck typically retails around $52 and up; as of 2026-06-08)
Strengths	Full standalone keyboard operation, touchscreen, speaker for alerts
Weaknesses	No GPS; higher power draw

Driver Installation

- **Windows:** A USB-serial driver (CP210x) may be required depending on the board's USB interface. If the board does not enumerate, install the CP210x driver from the Silicon Labs website; see the Meshtastic serial-driver docs (meshtastic.org/docs/getting-started/serial-drivers/) for guidance.
- **macOS & Linux:** Built-in - no driver needed.

Entering Bootloader / DFU Mode - UNIQUE METHOD

> **Note:** The T-Deck uses a unique bootloader entry method using the trackball, not a traditional BOOT button. This power-switch method below is the authoritative T-Deck DFU procedure; if a flasher page gives an abbreviated "depress trackball while connecting USB" instruction, follow the power-switch steps here instead.

Primary Method (Trackball):

1. Flip the power switch to **OFF**.
2. Press and hold the **trackball** (physically depress it - it clicks).
3. While holding the trackball, flip the power switch to **ON**.
4. Continue holding the trackball for 2 - 3 seconds, then release.
5. **Confirmation:** The screen stays blank with the backlight off. Because a blank screen also looks like a powered-off or failed-to-boot device, confirm DFU mode the reliable way: the device should appear as a serial/USB device in your flasher's "Connect" / device-picker dialog (or in Device Manager on Windows). If it appears there, you are in DFU mode; if not, repeat the steps.

Alternative Method (Side Reset):

1. With the device powered on, press and hold the trackball.
2. While holding, press the side reset button briefly.
3. Release both. The screen goes blank with the backlight off; confirm by checking that the device shows up in the flasher's device picker / Device Manager rather than relying on the blank screen alone.

Firmware Flashing

1. Enter DFU mode (see above).
2. Connect via USB-C to your computer.
3. Open Chrome or Edge and navigate to:
   - **MeshCore:** flasher.meshcore.io
   - **Meshtastic:** flasher.meshtastic.org

4. Select **T-Deck** from the device list.
5. Click **Flash** and grant serial port access.
6. Wait for completion. Device reboots automatically.

Post-Flash Configuration

1. Set **region to US** via Bluetooth app or directly on the keyboard interface.
2. Both MeshCore and Meshtastic support standalone keyboard operation on this device.
3. Configure node name, channel settings, and alert preferences.

Known Quirks

- Bootloader entry using the trackball can be unintuitive at first - ensure you press the trackball *before* turning on power.
- Higher power draw than simpler boards; plan battery capacity accordingly.
- For GPS functionality, the T-Deck Plus is required.

LilyGo T-Deck Plus Setup Guide

⚠ **ANTENNA SAFETY - ALL DEVICES:** As good practice, always connect an antenna **before** powering on or transmitting with any LoRa device. Transmitting into a severe antenna mismatch is hard on the radio, though the SX1262 used here has improved mismatch tolerance and generally clamps to protect itself from a brief unintended transmission. Reserve "permanent damage from a brief TX" expectations for boards with an external PA/front-end module (FEM) rather than a bare SX1262.

LilyGo T-Deck Plus - Setup Guide

The T-Deck Plus adds GPS and a larger 2000 mAh battery to the T-Deck platform, making it the best all-around standalone LoRa device for users who want full communication capability without a phone. **MeshOS** — a standalone on-device user interface available for the MeshCore firmware (selectable in the MeshCore flasher) — provides an excellent new-user experience for operating the device without a companion phone.

Specifications

Attribute	Value
MCU	ESP32-S3
Radio	SX1262
Display	2.8" touchscreen
Input	QWERTY keyboard + trackball
GPS	Built-in
Battery	2000 mAh
Price	~$65 - 85 (approximate; verify against a current retailer listing, as of 2026-06-08)
Strengths	Best all-around standalone device - GPS, keyboard, touchscreen, 2000 mAh, no phone needed

Driver Installation

- **Windows:** The T-Deck Plus uses the ESP32-S3's native USB (USB-CDC), so no serial-bridge driver is normally required on current Windows. If the device is not detected, confirm the cable carries data and see the Meshtastic serial-driver documentation; only older or bridge-equipped units need a Silicon Labs CP210x driver.
- **macOS & Linux:** Built-in - no driver needed.

Entering Bootloader / DFU Mode

Primary Method (Trackball):

1. Flip the power switch to **OFF**.
2. Press and hold the **trackball** (depress until it clicks).
3. While holding the trackball, flip the power switch to **ON**.
4. Maintain hold for 2 - 3 seconds, then release.
5. **Confirmation:** Black screen with backlight disabled = DFU mode successful.

Alternative Method:

1. Hold the trackball.
2. Press the side RST button while holding.
3. Release both simultaneously.

Firmware Flashing

1. Enter DFU mode (see above).
2. Open Chrome or Edge and navigate to:
   - **MeshCore:** flasher.meshcore.io (the canonical MeshCore web flasher run by the MeshCore core team)
   - **Meshtastic:** flasher.meshtastic.org
3. Select **T-Deck Plus** from the device list.
4. Click **Flash** and follow prompts.
5. Device reboots automatically on completion.

Post-Flash Configuration

1. GPS begins satellite acquisition automatically after boot.
2. Set **region to US** via Bluetooth app or the device's keyboard interface.

3. MeshOS (the standalone MeshCore on-device interface introduced above) provides a streamlined experience - recommended for new users.
4. Configure node name, channel presets, and contact list.

Known Quirks

- Bootloader entry is identical to the base T-Deck - trackball must be held before power-on.
- GPS first fix may take several minutes outdoors. Subsequent locks are faster.
- The 2000 mAh battery provides solid runtime but recharge time is proportionally longer than smaller cells.

Station G2 Setup Guide

⚠ **ANTENNA SAFETY - ALL DEVICES:** Always connect a properly matched antenna **before** powering on any LoRa device. Never transmit without a properly matched antenna connected. On a high-power PA board like the Station G2, an antenna mismatch during transmission can cause **permanent damage** to the RF amplifier, so this precaution matters even more here than on a bare SX1262 board.

⚠ **FCC COMPLIANCE WARNING - READ BEFORE OPERATING**

The Station G2's maximum **36.5 dBm (4.46 W)** output **EXCEEDS the FCC Part 15 conducted limit of 1 W (30 dBm)** for unlicensed 902-928 MHz operation by roughly 6.5 dB - about 4.5× the legal limit. You may **NOT** operate it above 30 dBm conducted on unlicensed 915 MHz.

Compliance is governed by the **conducted** (radio) output limit FIRST, before antenna gain or EIRP. A low-gain antenna does **NOT** make full power legal. For unlicensed Part 15 use you must set conducted TX power to **no more than 30 dBm (1 W)**, and reduce it further dB-for-dB for any antenna with gain above 6 dBi (36 dBm EIRP is the derived ceiling).

Higher power is only lawful under an amateur (**Part 97**) license - and Part 97 **prohibits encryption** (so Meshtastic/MeshCore default AES must be disabled) and **requires station ID by callsign**. See 47 CFR 15.247.

Station G2 - Setup Guide

The Station G2 is a purpose-built fixed base station with a very high TX power capability for a LoRa node (36.5 dBm / 4.46 W conducted) and an integrated LNA for excellent receive sensitivity. **This output level is for licensed (Part 97) or other-region use only - it is NOT a legal unlicensed selling point in the US, where conducted output must be capped at 30 dBm (see the FCC compliance warning above).** It is designed for hilltop, tower, and infrastructure deployments - not personal portable use.

⚠ **RF EXPOSURE (MPE, FCC §1.1310):** At up to 4.46 W into a gain antenna, this station can produce RF-exposure levels exceeding human-safety limits close to the antenna. Perform an

RF-exposure evaluation, mount the antenna where people cannot approach within the computed compliance distance while transmitting, and keep workers out of the main beam during installation and service.

Specifications

Attribute	Value
MCU	ESP32-S3
Radio	SX1262 + power amplifier (PA) + LNA
Max TX Power (conducted)	36.5 dBm (4.46 W, US915 per uniteng spec) - **exceeds the US Part 15 limit; cap at 30 dBm for unlicensed use**
Price	$109 (as of 2026-06-08; confirm current price at shop.uniteng.com / official Tindie store)
Strengths	High TX power for licensed/other-region use, integrated LNA, purpose-built for fixed infrastructure
Weaknesses	Expensive; requires high-voltage power; overkill for personal use; full power is illegal for unlicensed US operation

⚡ **CRITICAL POWER REQUIREMENT:**

The Station G2 **requires 15V USB-C Power Delivery (PD) or 9 - 19V external DC** (5.5×2.1 mm barrel jack, center-positive) for full RF power. The high-power amplifier needs this higher voltage to reach full TX power.

Standard 5V USB powers the ESP32 (enough to flash and configure the device) but will NOT enable the high-power amplifier. For full TX power, use 15V USB-C PD or 9 - 19V external DC.

Use one of:

- A USB-C charger that supports Power Delivery (PD) and can negotiate 15V - verify PD capability and that it offers the 15V profile before purchasing
- A 9 - 19V DC supply via the 5.5×2.1 mm barrel jack (12V is a common choice; observe center-positive polarity)

Connecting only 5V will let the device power on and enumerate for flashing/config, but the RF amplifier will not reach full output.

Driver Installation

- **Windows:** The ESP32-S3 can present native USB. If a USB-serial bridge driver is needed for your unit, install the matching driver (CP210x from Silicon Labs, or CH34x/CH9102, depending on the onboard USB chip) only if the device is not detected. Confirm the chip on your board before installing a driver.
- **macOS & Linux:** Built-in - no driver needed.

Entering Bootloader / DFU Mode

Method 1 - From powered-off state:

1. Disconnect power.
2. Hold the **BOOT** button.
3. Connect USB while holding BOOT.
4. Release BOOT after ~2 seconds.

Method 2 - From powered-on state:

1. Hold **BOOT**.
2. Briefly press and release **RST**.
3. Release BOOT.

Firmware Flashing

1. Enter bootloader mode.
2. Open Chrome or Edge and navigate to:
   - **MeshCore:** flasher.meshcore.io
   - **Meshtastic:** flasher.meshtastic.org
3. Select **Station G2** from the device list.
4. Click **Flash**. Do not disconnect during flashing.

Post-Flash Configuration

MeshCore:

1. Configure via Bluetooth or serial connection.
2. Set **region to US**. Selecting the US region caps firmware TX power to the legal 30 dBm. Do NOT override the region power cap or enable any high-power/boost mode that pushes conducted output above 30 dBm on unlicensed 915 MHz.
3. **The Station G2 can output up to 4.46 W, which is illegal under Part 15.** Set conducted TX power to no more than 30 dBm (1 W) for unlicensed use, AND reduce it further dB-for-dB for any antenna gain above 6 dBi. Conducted power is a separate, hard limit from EIRP - a low-gain antenna does NOT make full power legal.

4. For most infrastructure deployments: use an external directional or high-gain antenna (and remember high-gain antennas require additional conducted-power reduction).

Meshtastic:

1. Set **role to Router** in the app for infrastructure deployment.
2. Configure power settings and region. Selecting US region caps TX power to the legal 30 dBm - do not override it for unlicensed operation.
3. Independent of antenna gain, the conducted (radio) output must not exceed 30 dBm / 1 W for unlicensed Part 15 use. The Station G2 must be turned **DOWN** to 30 dBm or less - reducing TX power is mandatory, not optional, for legal unlicensed operation.

Known Quirks & Deployment Notes

- Power supply verification is essential - confirm PD output voltage before connecting.
- At full TX power (up to 4.46 W, per the uniteng Station G2 US915 spec), antenna quality and coax loss matter significantly. Use low-loss coax and quality connectors. Remember that for unlicensed US use you must operate at 30 dBm or below.
- Conducted power is the first, hard limit: cap conducted output at 30 dBm / 1 W for unlicensed Part 15 use. The derived EIRP ceiling is ~36 dBm (47 CFR 15.247) - for any antenna with gain above 6 dBi you must reduce conducted TX power dB-for-dB. Example: with a 9 dBi antenna (3 dB over the 6 dBi reference), set conducted power no higher than 27 dBm so EIRP stays at the 36 dBm ceiling.
- **Tower, water-tower, and rooftop installation is elevated, high-voltage-adjacent work** - use fall protection / working-at-height precautions, maintain the full fall-radius clearance from overhead power lines, ground and surge-protect the antenna feedline, and bond the antenna ground rod to the building grounding electrode system (NEC 810.21/250). See *Mounting Outdoor Nodes*.
- Ideal placement: hilltop, water tower, or rooftop with clear line-of-sight horizon (keeping people clear of the RF-exposure compliance distance while transmitting).

Seeed Wio Tracker Setup Guide

⚠ **ANTENNA SAFETY - ALL DEVICES:** Always connect an antenna **before** powering on or transmitting with any LoRa device. Transmitting without an antenna can damage the radio. SX1262-based boards (like the Wio Tracker) are relatively low-power and tolerate brief antenna mismatches better than older parts, and simply powering the board on without transmitting is generally harmless - but never deliberately transmit without an antenna connected.

Seeed Wio Tracker L1 - Setup Guide

The Seeed **Wio Tracker L1** is an nRF52840-based Meshtastic node with an SX1262 LoRa radio, an L76K multi-GNSS (GPS) module, and a 1.3" OLED display. The **L1 Pro** variant adds an enclosure and an integrated battery - strongly recommended for field deployment over the bare L1 board.

A note on naming, since Seeed's lineup is easy to confuse: the **Wio Tracker L1** is the bare board used for this build; the **L1 Pro** is the L1 plus an enclosure and integrated battery. These are distinct from the separate **Wio Tracker 1110**, which is a different LR1110-based development board - it is **not** the same product as the L1, so match the exact name to the store listing before you buy.

Specifications

Attribute	Value
MCU	nRF52840
Radio	SX1262
Display	1.3" OLED
GPS	L76K multi-GNSS module

Price (L1)	$32.99 (bare board, no enclosure, no battery) - Seeed store, as of 2026-06-08; prices drift, verify before buying
Price (L1 Pro)	$46.99 (enclosure + integrated battery) - Seeed store, as of 2026-06-08; prices drift, verify before buying
Strengths	nRF52840 efficiency, GPS, OLED, ready-to-use battery + enclosure on L1 Pro

L1 vs L1 Pro - Which to Buy: The bare L1 board has no enclosure and no battery. Most users deploying in the field should choose the **L1 Pro**, which ships as a ready-to-use node with an enclosure and an integrated battery.

Driver Installation

No driver installation required on any operating system. The nRF52840 presents as a USB mass storage device. It appears automatically on Windows, macOS, and Linux.

Entering Bootloader / DFU Mode

1. Connect the device via USB.
2. Locate the **RESET button** (may be recessed - use a SIM card ejector pin, toothpick, or similar small tool).
3. **Double-tap the RESET button** quickly.
4. The device will appear as a USB drive.

If the USB drive does not appear, retry the double-tap - timing sensitivity is similar to the T-Echo.

Firmware Flashing

Method A - Web Flasher (recommended):

1. Enter DFU mode (double-tap RESET).
2. Open Chrome or Edge and navigate to:
   - **MeshCore:** flasher.meshcore.io
   - **Meshtastic:** flasher.meshtastic.org
3. Select the **Wio Tracker L1** variant from the device list.
4. Click **Flash**.

Method B - Drag and Drop:

1. Download the `.uf2` firmware file.
2. Enter DFU mode.

3. Drag and drop the `.uf2` file onto the USB drive.
4. Device reboots automatically.

Post-Flash Configuration

1. GPS begins acquiring satellites automatically after boot.
2. Connect via Bluetooth app and set **region to US**.
3. Configure node name and channel settings.

Known Quirks

- The RESET button may be recessed - have a SIM pin or similar tool available.
- GPS first fix may take several minutes on a fresh boot outdoors.
- L1 bare board requires an external battery and enclosure for practical field use.

Nano G2 Ultra Setup Guide

⚠ **ANTENNA SAFETY - ALL DEVICES:** Always connect an antenna (or a 50-ohm dummy load) **before** transmitting on any LoRa device, to avoid stressing the power amplifier. Transmitting without an antenna stresses the PA and risks damage, especially at higher power. The Nano G2 Ultra's SX1262 has improved tolerance to antenna mismatch (per its datasheet), so a brief unloaded transmit is less likely to destroy it than on older PA/FEM boards - but do not rely on that; attach an antenna or dummy load first.

Nano G2 Ultra - Setup Guide

The Nano G2 Ultra is a premium nRF52840-based node whose board is matched and filtered for roughly 815 - 940 MHz, with a 1.3" OLED display and approximately 3.5 days of battery life (figures per the manufacturer; price as of 2026-06-08). Its tuning range covers the 868 MHz and 915 MHz bands, so the same hardware can be configured for different regional frequency plans. It is not usable on 433 MHz - that is outside the board's 815 - 940 MHz matching network, even though the SX1262 chip itself tunes wider.

⚠ **US legal band:** In the United States, only **902 - 928 MHz** is authorized for unlicensed Part 15 operation. The 868 MHz (EU) setting and any other out-of-band frequency this hardware can tune to are illegal to transmit on in the US. Set region to US and do not transmit outside 902 - 928 MHz domestically. Only transmit on frequencies authorized in your country/region.

Specifications

Attribute	Value
MCU	nRF52840
Radio	SX1262 (the chip tunes ~150-960 MHz; this board is matched/filtered for ~815-940 MHz)
Board frequency range	~815 - 940 MHz matched (covers 868 & 915 MHz bands; US-legal portion is 902-928 MHz only)
Display	1.3" OLED
Battery Life	~3.5 days typical (manufacturer figure)
Price	$85 - 90 (as of 2026-06-08)

Strengths	Wideband-capable radio, ~3.5-day battery, premium build, 1.3" OLED

Wideband Note: The Nano G2 Ultra's board is matched for roughly 815 - 940 MHz, so the same hardware can be configured for 868 MHz (Europe) or 915 MHz (US/Canada) frequency plans. This makes it useful for multi-region hardware, but you must always operate only on a band that is legal in your region (902 - 928 MHz in the US/Canada). Configuring it onto a band not authorized where you are is illegal and can interfere with other services.

Driver Installation

No driver installation required on any operating system. The nRF52840 presents as a USB mass storage device, visible automatically on Windows, macOS, and Linux.

Entering Bootloader / DFU Mode

1. Connect the device via USB-C.
2. **Rapidly double-tap the RESET button.**
3. The device appears as a USB drive in your file manager/Finder/Explorer.

Firmware Flashing

Method A - Web Flasher:

1. Enter DFU mode (double-tap RESET).
2. Open Chrome or Edge and navigate to:
   - **MeshCore:** flasher.meshcore.io
   - **Meshtastic:** flasher.meshtastic.org
3. Select **Nano G2 Ultra** from the device list.
4. Click **Flash**.

Method B - Drag and Drop:

1. Download the `.uf2` firmware file for Nano G2 Ultra.
2. Enter DFU mode.
3. Drag and drop the `.uf2` onto the USB drive.
4. Device reboots and applies firmware automatically.

Post-Flash Configuration

1. Set **region to US** (selects 915 MHz frequency plan; keeps you within the legal 902-928 MHz band).
2. For other regions, select the appropriate region code in the app - only choose a region whose band is legal where you operate.
3. Configure node name and channel settings via Bluetooth app.

Known Quirks

- Wideband hardware does not automatically configure for all bands - region must be set correctly in firmware, and only to a band legal in your country.
- The board is matched for ~815-940 MHz; despite the SX1262's wider chip-level tuning range, 433 MHz operation is not supported on this board.
- Double-tap reset timing is similar to other nRF52840 devices - may take a couple of attempts.