Hardware

Power systems, enclosures, and hardware considerations.

- Hardware Considerations
- Power and Solar Systems

Hardware Considerations

A MeshCore repeater needs three things: a LoRa radio running repeater firmware, an antenna, and reliable power. How you combine these depends on your deployment location and budget.

The LoRa radio

Any MeshCore-compatible LoRa device can be flashed with repeater firmware. The radio is rarely the performance bottleneck - location and antenna matter far more. Key requirements:

- **915 MHz band** - required for US/Canada. Beyond interoperability, the band choice is a legal one: 902-928 MHz is the FCC-authorized license-free ISM band in the US/Canada (47 CFR 15.247). The EU 868 MHz band is *not* authorized for this use in the US, so 868 MHz hardware (common in European product listings) should not be transmitted on here regardless of network compatibility — and it would not interoperate with the US network anyway.
- **External antenna connector** - essential for connecting a quality external antenna. Devices with only a PCB trace antenna are not suitable for fixed outdoor deployment.
- **MeshCore firmware compatibility** - verify against the MeshCore compatibility list before purchasing.

Purpose-built outdoor units vs. DIY

Purpose-built solar repeater units

Several manufacturers produce all-in-one weatherproof units with integrated solar panels, batteries, and LoRa radios. These are the simplest path to a permanent outdoor installation - they arrive ready to mount and flash.

Advantages: weatherproof from the factory, integrated power system, no enclosure engineering required.
Disadvantages: higher cost, limited hardware customization.

DIY builds

A builder can assemble a repeater from individual components: a LoRa board, weatherproof enclosure, solar panel, charge controller, and battery. The main challenges are reliable weatherproofing and correctly sized cable penetrations.

Advantages: full customization, potentially lower cost, complete control over every component.
Disadvantages: requires time and skill; waterproofing failure is a leading cause of field failures.

Enclosures

Electronics exposed to outdoor conditions should live in a weatherproof enclosure rated IP65 or higher. Note that the IP rating only holds if *every* penetration is sealed with a rated cable gland — drilling unsealed holes voids the rating. Key considerations:

- Proper cable glands on all penetrations (antenna, power, USB)
- Desiccant packs inside to absorb residual moisture
- UV-resistant material for sun exposure
- Thermal management - a sealed enclosure in direct sun can reach internal temperatures that exceed electronics and battery ratings (typically around 60 °C) without ventilation or shading. Shade the box or use a light-colored, UV-resistant material to reduce solar heating.

Power and Solar Systems

A repeater that runs out of power disappears from the network. Power system design is as critical as radio configuration for a reliable long-term deployment.

Why solar works for repeaters

MeshCore repeater firmware is designed for low power consumption. A repeater draws very little power when idle and slightly more when forwarding packets. This makes solar deployment practical even with modest hardware.

Sizing your power system

The goal: enough battery to run through several consecutive cloudy days, and a panel large enough to fully recharge on a typical sunny day.

- **Solar panel:** A 5 - 20W panel is reasonable example sizing for a low-draw repeater, but the right wattage depends on your load and your site's worst-month sun-hours. Mount it south-facing (in North America) and angle it roughly to match your latitude for best year-round output; if cloudy-season uptime is critical, tilt toward latitude +10-15 degrees to favor winter sun.
- **Battery chemistry:** LiFePO4 (lithium iron phosphate) is strongly recommended for outdoor use. It tolerates cold *discharge* well, has a much longer cycle life than LiPo, and is significantly safer. **However, LiFePO4 (like any lithium chemistry) must NOT be charged below 0 °C / 32 °F** - charging when frozen causes permanent lithium plating, reduced cycle life, and a fire risk. For cold climates, use a pack with a low-temperature charge cutoff in its BMS, or add a low-temp charge disconnect. Size for several days of runtime without any solar input - 3 - 5 days is a common minimum starting point; increase it for cloudy climates or critical links. For emergency-grade deployments, size the battery for your worst-case multi-day low-solar period (often longer than 3 - 5 days in winter) and validate it with a no-charge runtime test before relying on the node.
- **Charge controller:** Required between panel and battery. MPPT (Maximum Power Point Tracking) controllers are more efficient than PWM, especially in cold/temperate climates and on larger arrays. On very small systems the efficiency gain is modest, and a simple PWM controller is often sufficient and cheaper.
- **Fuse the battery.** Install an inline fuse in the battery positive lead close to the battery, sized per your controller and wiring. A LiFePO4 cell can deliver very high fault current; an

unfused short can start a fire. Wire in order: battery → charge controller → panel.

Mains power

For rooftop installations with building power access, mains power plus a battery backup is more reliable than solar alone. Use a quality regulated supply and consider a small UPS to ride out brief power interruptions.

Power optimization

- Disable unused features: display backlight, Bluetooth, WiFi (if present on the board)
- Set a long **flood** advertisement interval for fixed infrastructure - the MeshCore default is commonly 12 hours, set via `set flood.advert.interval {hours}` (range ~3-168; verify in your firmware version). Note this is separate from the zero-hop `advert.interval` (default 0/off). More frequent ads increase power draw with minimal benefit.
- Do not set TX power higher than needed for your coverage goals - the power amplifier is the largest current draw during transmission. On a low-traffic repeater that spends most of its time receiving, idle/RX current may dominate total energy use, so also minimize wake/advertise frequency. TX power is also legally capped: 47 CFR 15.247 limits conducted power to 1 W (30 dBm) in 902-928 MHz, reduced dB-for-dB for antennas above 6 dBi.