

Assembly Guide

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This guide assumes you have all parts from the Parts List & Overview page and have already flashed MeshCore Repeater firmware onto the node.

Step 1: Test Before Sealing

Before putting anything in the enclosure, bench-test the complete power chain:

1. Connect the charge controller to a bench power supply set to the panel's operating voltage - ~6V simulates a 6V solar panel; use a higher voltage for a 12V system. **No bench supply?** Use the actual solar panel outdoors in direct sun, or a 5V USB source, to simulate the input.
2. Connect a battery to the charge controller output.
3. Power the node from the battery via the appropriate connector (JST or 18650 contacts).
4. Verify the node boots, joins the mesh, and can be configured. Fix any issues now before sealing.

Step 2: Prepare the Enclosure

1. Drill or punch holes for cable glands. Typical layout: one PG9 gland for the antenna pigtail, one PG7 gland for the solar wires. PG7 fits 3-6.5 mm cable; PG9 fits 4-8 mm cable - confirm your actual cable diameters fall in range before buying, and see the Cable Glands & Penetrations page for the full sizing table. Use the same PG gland convention across all build pages so parts lists stay consistent. Place glands on the bottom or sides of the enclosure - never on top where water can pool.
2. Thread cable glands into holes. Wrap the gland threads with PTFE tape (not thread-sealant compound), then tighten finger-tight plus a quarter turn with a wrench. Do not overtighten or you will crack the enclosure.
3. Route the antenna coax pigtail through a PG9 gland. Leave enough slack inside to connect to the node. Tighten the gland around the cable until it grips firmly.
4. Route solar panel wires through a PG7 gland.

Step 3: Wire the Power System

Wiring order: Solar panel → Charge controller input → Charge controller battery output → Battery → Charge controller load output → Node.

1. Connect the solar panel positive and negative wires to the IN+ and IN - terminals of the CN3791 or TP4056 charge controller. **Double-check polarity:** reversing the solar or battery leads on these boards destroys them, and a reversed LiPo can overheat and vent. On unlabeled clone boards, identify the IN/BAT/OUT pads from a known-good photo or the seller's pinout before connecting.
2. Connect the battery to the BAT+ and BAT - terminals. **Fuse the battery positive lead** with an inline fuse at the battery terminal (sized to the wire) before energizing the power chain - this protects against a short in the enclosure.
3. The node is powered from the charge controller load output (OUT+ / OUT -). Note: bare TP4056 modules often have no separate load output - the battery and load share the OUT/BAT pads, so the node connects in parallel with the cell. The CN3791 and TP4056-with-protection boards provide a dedicated OUT. If using the Heltec V4 with its built-in solar input, connect the solar panel directly to the solar input and skip the external charge controller - the V4 handles charging internally.
4. Use appropriately rated wire. 24 AWG is adequate for the current levels involved (under 500mA).
5. **Battery chemistry warning:** the TP4056 and CN3791 are 4.2V Li-ion/LiPo chargers only. Do NOT charge a LiFePO4 cell with them - LiFePO4 is full at ~3.6V, and a 4.2V charger will overcharge it. If you swap to LiFePO4 for cold weather, use a LiFePO4-appropriate charger (3.6V/cell) that also has a low-temp charge cutoff. Never charge any lithium chemistry - including LiFePO4 - below 0°C (32°F); the cells discharge fine in the cold but charging below freezing causes permanent damage.
6. Insulate all connections with heat shrink. Exposed connections inside an enclosure can still short against the metal walls of a die-cast box.

Step 4: Mount Components Inside the Enclosure

1. Use double-sided foam tape or small cable ties through holes in the enclosure wall to secure the charge controller and node. Hot glue is acceptable but makes future servicing harder.
2. Place the desiccant pack in a corner of the enclosure where it will not interfere with components or lid closure.
3. Ensure the node's USB port is accessible from the enclosure lid or a gland - you may need to access it for firmware updates.

Step 5: Seal and Close

1. Apply a thin bead of silicone sealant around the inside edge of each cable gland nut where the cable exits. This is belt-and-suspenders weatherproofing on top of the gland's O-ring.
2. Verify the enclosure lid gasket is seated properly. Close and latch the lid.
3. Check that no wires are pinched by the lid.

Step 6: Mount the Enclosure

Working-at-height safety: rooftop, tree, and tower mounting all expose you to fall hazards. OSHA requires fall protection at 6 ft (construction) and 4 ft (general industry). Use proper ladder technique and fall-arrest equipment where applicable, keep the mast and your full fall-radius clear of overhead power lines, and never climb roofs or trees in wet, icy, or windy conditions. Ground the installation and bond the antenna ground rod to the building grounding electrode system (NEC 810.21/250). For anything beyond a low, easily reached mount, consider hiring a professional. See the Mounting Outdoor Nodes page for full mounting, grounding, and clearance guidance.

1. Mount at the highest practical point that you can reach safely, with clear line of sight to the mesh coverage area. For most community nodes: rooftop, eave, fence post, or tree mount - observe the working-at-height and power-line cautions above.
2. Orient the antenna vertically. A vertical omni antenna radiates strongest toward the horizon - its pattern is donut-shaped, with a null straight up and down. For same-elevation peer nodes keep it vertical; tilting shifts the lobe and helps only when reaching a node well above or below your elevation.
3. Mount the solar panel facing south (northern hemisphere). For true year-round yield at northern US/Canada latitudes ($\sim 45\text{-}49^\circ$), set the tilt roughly equal to your latitude ($\sim 45\text{-}49^\circ$ from horizontal). Bias steeper, toward $55\text{-}60^\circ$, only to prioritize winter (worst-case) production for an always-on node, at the cost of some summer output. A shallower angle ($30\text{-}45^\circ$) favours summer production.
4. Route solar panel wires so water cannot follow them into the enclosure. A drip loop - a downward U in the wire before it enters the gland - prevents capillary wicking.

Step 7: Verify Operation

1. In the MeshCore app, confirm the repeater appears in the node list and is relaying messages.
2. Check battery voltage via the app or CLI. A full 18650 (Li-ion) reads $\sim 4.2\text{V}$; the CN3791/TP4056 will stop charging at 4.2V. (A LiFePO4 cell on its proper charger reads $\sim 3.6\text{V}$ full - do not expect 4.2V from LiFePO4.)
3. During daylight, verify solar charging is active (charge controller LED or app telemetry).