ThunderBank

Operation Manual

LIGHTNIN SUPPORT · 24/7

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Leave voicemail or text if no immediate response. Numbers listed in priority order.

Read alongside: the *ThunderBank Emergency Action Plan* and the two laminated quick-reference cards (Production Crew + Fire Department). This manual covers normal operation; the EAP covers what to do when something goes wrong.

Lightnin Production Rentals · ThunderBank 270 kWh BESS
Revision 1 · Effective 2026-06-13

SECTION 1

Overview & Specs

The ThunderBank is a mobile lithium battery energy storage system housed in a truck box. It stores energy from multiple charge sources (3-phase shore, single-phase trickle, truck alternator, rooftop solar, and ThunderBolt export) and delivers up to 90 kVA of 208 V 3-phase AC power to the fleet. The ThunderBank can carry a production and dramatically reduce or eliminate Basecamp Generator (BG) runtime by harnessing excess solar from ThunderBolt Solar Trailers and rapid recharging.

For Cabling and Operation, Follow Industry Safety Guidelines.

Quick facts

CAPACITY **270 kWh total** 243 kWh usable (90% DoD)	BATTERY CHEMISTRY **LiFePO4**
INVERTERS **90 kVA** 72 kW max continuous (24 kW/leg)	OUTPUT CURRENT **250 A/leg · 750 A total** 200 A/leg continuous · 600 A total
DC BUS **48 V nominal**	AC OUTPUT **208 / 120 V 3-phase**
ROOFTOP SOLAR **~2,900 W**	3-PHASE AC INPUT **30–275 A/leg, 208 V** controlled by orange dial
MAX BATTERY CHARGE **168 A/phase · ~60.5 kW** excluding trickle charger	EV CHARGING **Grizzl-E Ultimate 80 A Level 2** stowed in front-right jockey box
COMPONENT CERTS **UL 1741 · UL 1973 · UL 9540A*** * or equivalent — IEC 62619/62620 · UN 38.3	BATTERY RANGE **100% → 11%** shutdown 10% · inverting resumes at 12%
LEG BALANCE **Legs don't have to be balanced** each must stay within 24 kW continuous	

SECTION 2

Components & where to find them

A walk-around reference. Memorize these locations before show start — the EAP and the laminated cards depend on you being able to find each item without searching.

COMPONENT	LOCATION
EMERGENCY STOP button	Exterior, rear-right corner of the truck box, right of the AC Output panel. Red/white decal, latches when pressed.
Control panel (screen, orange dial, 3-position switch)	Exterior, rear-right corner of the truck box, in the unlocked grey Polycase. Primary operator interface — live SOC, power flow, alarms, and all daily operating controls.
AC Output panel	"Waterfall" panel, right side of the rear wall (exterior). Camlocks G/W/R/Bl/Bk.
AC Input panel	Exterior, front-right of truck box, labeled **"Input Only"**. 3-phase camlocks vertical; single-phase camlocks horizontal, directly below the 3-phase set.
External PV breakers	Exterior, shielded breaker box at the rear-left corner of the truck box, near the ABC extinguisher. Three breakers for additional solar panel inputs (customer-added or Lightnin-supplied panels). Onboard rooftop solar is also isolatable via internal breakers, but those are not field-accessible.
Alternator switch	In the truck cab, left of the steering wheel. Engine-driven DC charging source. Leave the switch in the ON position unless the fault light illuminates.
Level 2 EV charger	Stored in a black jockey box on the front-right of the truck box (Grizzl-E Ultimate 80 A). Customer deploys to charge EVs from the bank's AC output.
ABC fire extinguisher	Mounted on the bumper at the rear-left of the truck.
Personnel door	Combination-locked. Driver does not have the combo — intended for maintenance or emergency only. Combo is held by Lightnin and can be given over the phone.

SECTION 3

The Control Panel

The control panel sits in the unlocked grey Polycase at the rear-right corner of the truck box. It has three things you need to know: the **Main Control Screen**, the **orange dial**, and the **3-position switch**. Almost every operational decision flows through this panel.

The 3-position switch

The switch sits at three clock positions: **10 o'clock = Off**, **12 o'clock = Charge**, **2 o'clock = On**. **Move the switch slowly — pause ~3 seconds at Charge when transitioning between Off and On.** Slow movement lets the inverters settle and avoids fault states.

10 O'CLOCK

Off

- Main inverters off
- AC output and input dead
- EV off
- **Trickle charger still works**

12 O'CLOCK

Charge

- **Pause position** — move switch slowly through here
- **Treat AC output as live**
- If no AC outputs are plugged in, this is the most efficient charging position
- **3-phase and trickle charging live**

2 O'CLOCK

On

- **AC output live**
- **3-phase and trickle charging live**
- EV charger enabled
- **ThunderBolts can export power**

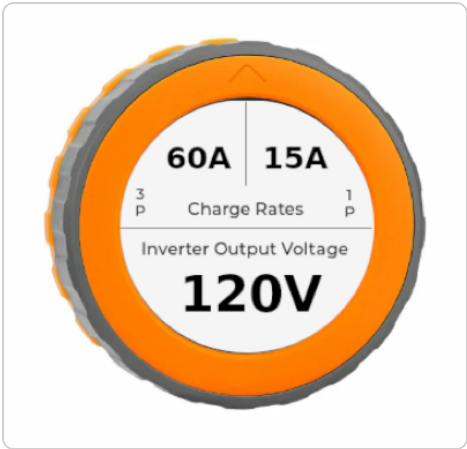
Air conditioning and trickle charger are always on. Both are wired in a way that keeps them active in every switch position — only the **EMERGENCY STOP** takes them down. The air conditioning can still use the battery in the Off position; this is rarely a concern given the bank's size, but plan accordingly for weeks-long idle periods or units sitting at low SOC.

At 160°F panel temperature, the ThunderBank automatically triggers EMERGENCY STOP. The 150°F VRM alert is the warning threshold; 160°F is the auto-shutdown threshold. See the Troubleshooting section for the 150°F response procedure.

When ThunderBolts are exporting to the bank, set them to **On / No Export** or **Off** (or unplug them) ***before*** moving the ThunderBank 3-position switch. Skipping this trips an overcurrent alarm on the inverters, requiring a reset cycle to clear.

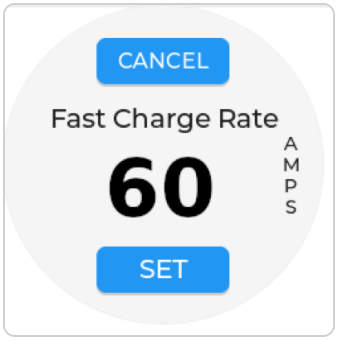
The orange dial

The orange dial does three related jobs, each shown as one of the three fields on the dial face. Push the dial to wake the display, then **tap a field** to bring up its setter, change the value, and tap **SET** to confirm (or **CANCEL** to back out without changing it).

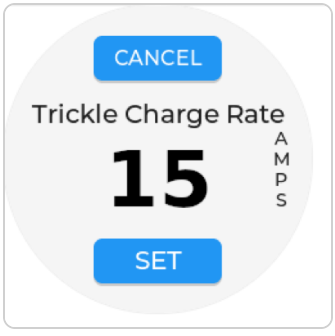


Home view. Top row: **3-phase charge rate** (left, labeled **3P**) and **trickle charge rate** (right, labeled **1P**). Bottom: **Inverter Output Voltage**. The values shown here (60 A / 15 A / 120 V) are the post-power-loss defaults.

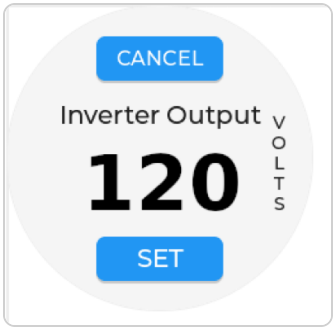
- **3-phase AC input current limit (3P)** — sets how much current the bank will draw per leg from the 3-phase shore connection. Range is **30 A to 275 A per leg**. The bank may require a minimum of 55 A under some conditions.
- **Trickle charger current limit (1P)** — sets the per-leg AC input limit for the trickle chargers, **10 A to 50 A**. Adjusting it changes **both** trickle legs at the same time; you can still plug in one leg or both as needed.
- **Inverter Output Voltage** — trims the inverter output voltage. Useful for long AC output cable runs where voltage drops along the cable; increasing it lifts the inverter output so the voltage at the far end of the cable run is in the desired range. Reads line-to-neutral (~120 V) and controls all three hot legs simultaneously.



3P tap → Fast Charge Rate. Spin to set per-leg amps, then **SET**.



1P tap → Trickle Charge Rate. Sets both trickle legs at once.



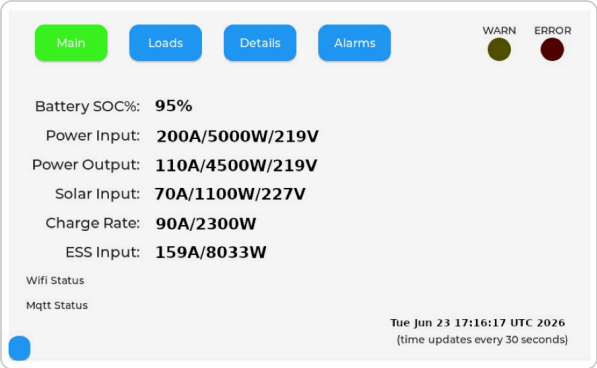
Voltage tap → Inverter Output. Trims all three hot legs together.

> **Dial auto-resets on AC power loss.** After any loss of AC power, the dial behavior resets to **60 A (3-phase)** / **15 A (trickle)**. Ramp the 3-phase dial up incrementally — **30–50 A per step** — until your target rate is reached. Gentle ramping is easier on the equipment and reduces the chance of inverter faults.

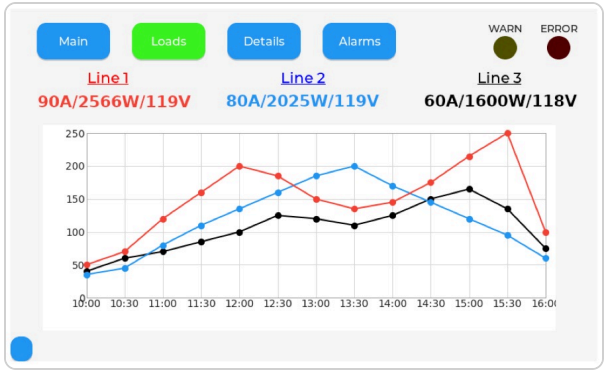
Main Control Screen

The screen shows live SOC, power flow, and alarms, including **individual leg amps, volts, and watts** on the 3-phase AC input. The screen retains a **24-hour history**; for any longer date range, use the VRM app or VRM portal. In VRM, the **Dashboard** covers basic information and the **Advanced** tab provides in-depth analysis.

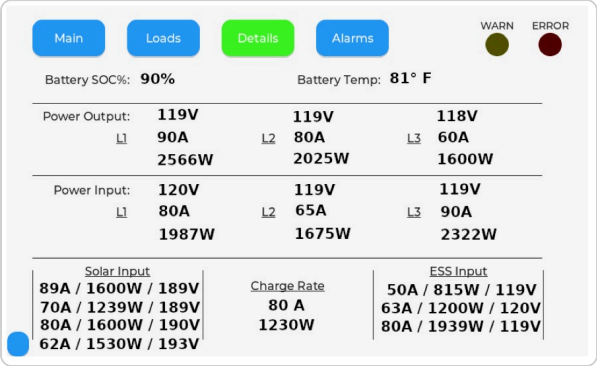
Four tabs across the top — **Main**, **Loads**, **Details**, **Alarms** — switch between views. The active tab turns green. The two indicators in the upper-right (**WARN** and **ERROR**) light up when the system raises an alarm; tap **Alarms** to see what tripped.



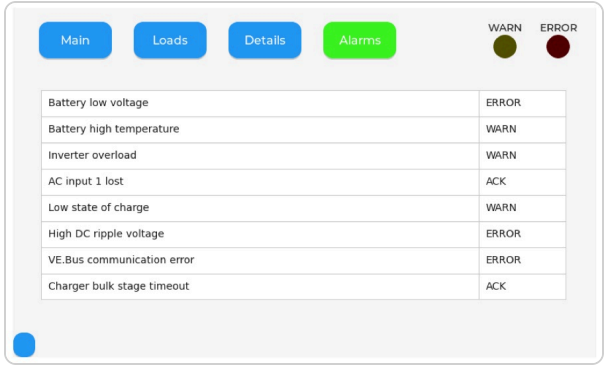
Main — the at-a-glance view. Battery SOC, then five aggregate rows: **Power Input** (3-phase shore draw), **Power Output** (AC loads), **Solar Input**, **Charge Rate** (net into the battery), and **ESS Input**. **WiFi** / **Mqtt Status** at the lower-left confirm the unit is talking to VRM; system time bottom-right updates every 30 s.



Loads — per-leg AC output, live and recent. The three header rows show current draw on **Line 1**, **Line 2**, and **Line 3** in A / W / V. The chart underneath plots each leg's amps over the last ~6 hours — useful for spotting leg imbalance or load spikes against a calm baseline.



Details — the full diagnostic view. Top half: per-leg **Power Output** and **Power Input** (V / A / W on L1, L2, L3). Bottom half: four **Solar Input** strings, the current **Charge Rate**, and per-leg **ESS Input** from any ThunderBolts. Battery temperature is shown top-right.



Alarms — what's currently wrong. Each row is an active alarm with a status badge: **ERROR** (red — needs attention now), **WARN** (yellow — watch it), or **ACK** (acknowledged but unresolved). Cross-reference these with the Troubleshooting section before calling Lightnin.

The **blue dot in the lower-left corner** of the screen resets the display if there are any glitches or malfunctions. **Resetting the screen does not affect power input or output in any way** — only the display restarts.

Remote monitoring — VRM app and portal

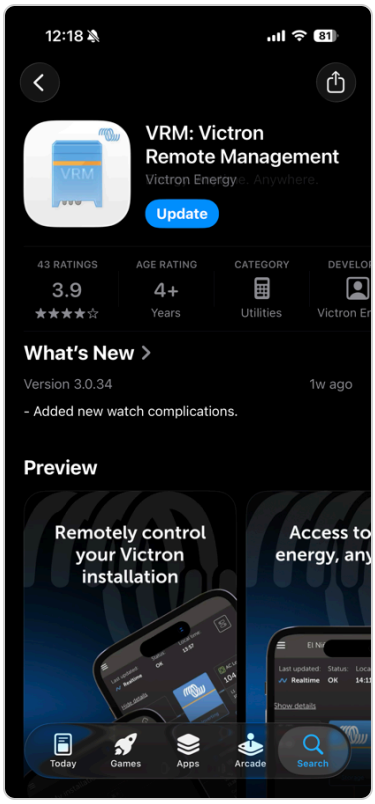
Every ThunderBank reports live to Victron Remote Management (VRM). You can monitor the same data the on-board control screen shows, plus full historical logs, from anywhere with an internet connection.

Getting access to VRM: Call Lightnin and we'll add you to your unit. You have two options:

- **Use your own VRM login** — create a free account at **vrm.victronenergy.com/register**, tell us the email you used, and we'll grant that login access to your unit.
- **Use a temporary login from Lightnin** — if you don't want to make your own account, we can issue you a temporary login to sign in with.

On a phone or tablet, install the **VRM: Victron Remote Management** app from the App Store or Google Play; on a computer, sign in at **vrm.victronenergy.com**.

Lightnin Portal (separate from VRM): **portal.lightnin.com** hosts our in-house tools — VRM data views, sustainability reporting, and remote control capability for units. Access is granted separately from VRM; contact Lightnin if you need it.

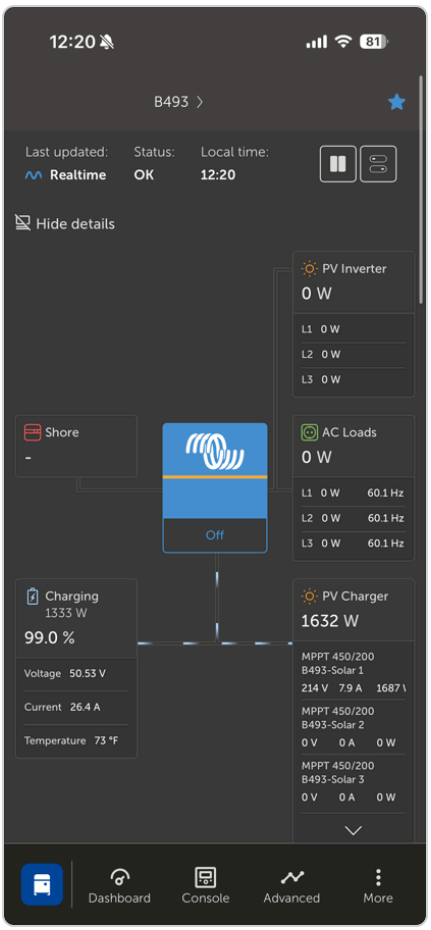


Install this app — VRM: Victron Remote Management by Victron Energy. The icon and name shown here are the only correct match; other Victron apps in the store are for different products and will not connect to your bank.

Reading the dashboard

After signing in, tap your unit (for example, **B493**) to open its dashboard. The view mirrors the on-board control screen: state of charge, shore draw, PV input, AC loads, and per-leg power on the 3-phase side.

Realtime = live data. Anything else means the feed is stale →



← Per-leg watts and frequency for **L1 / L2 / L3**

Tap the **blue icon** bottom-left to **switch to another unit** you have access to →

← Tap anywhere on the screen to bring up the **bottom menu bar**

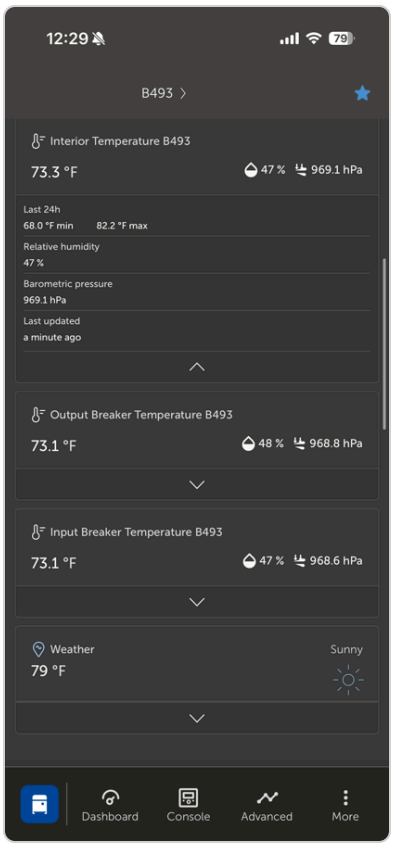
← **Advanced** is the most useful tab — covered below

Dashboard view for B493. The bottom navigation bar appears when you tap the screen. **Dashboard** is this live view, **Console** is the remote control panel, **Advanced** opens the full historical data browser, and **More** contains settings and unit info.

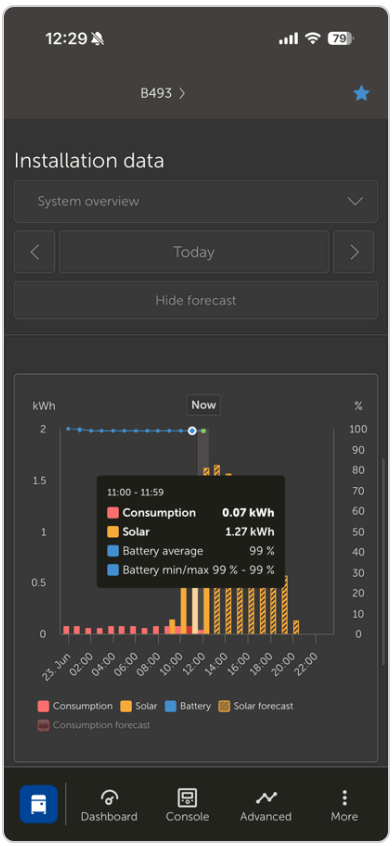
> **Tip:** If a number on the dashboard ever looks off, check that the status reads **Realtime**. If it reads anything else, the connection is slow and the data is stale. When the data is stale, use the on-board control screen as authoritative — it operates regardless of cell signal.

Scroll down the dashboard for sensors and quick history

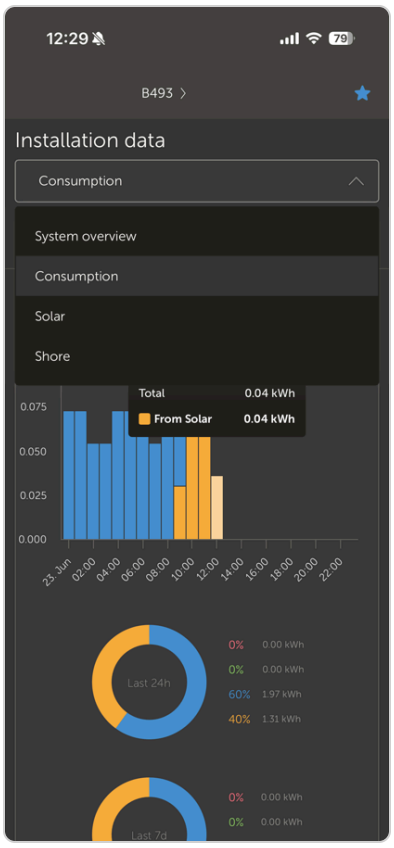
The dashboard view is longer than the screen. Scroll down and you'll find on-board sensor readings and a quick historical chart — useful for at-a-glance answers without opening the Advanced tab.



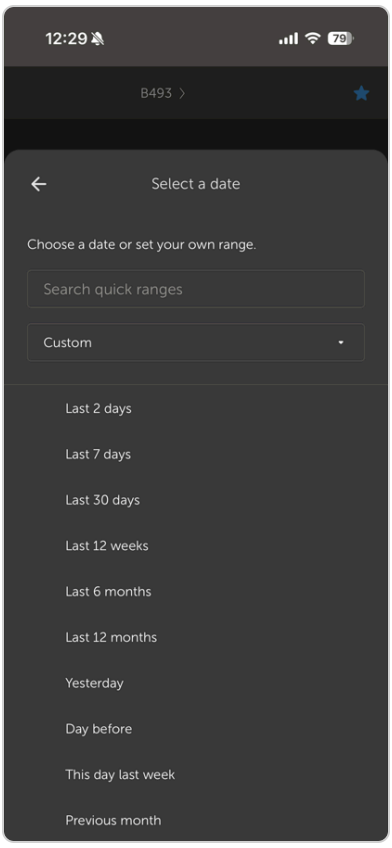
On-board temperature sensors. Interior, output breaker, input breaker, plus humidity, barometric pressure, and outside weather. Tap any tile to expand for **last-24h min/max**.



Installation data chart. Stacked bars show **consumption** (red), **solar** (orange), and **battery SOC** (blue line). Tap a bar to see exact kWh and battery min/max for that hour.



Source selector. The dropdown at the top of the chart switches between **System overview**, **Consumption**, **Solar**, and **Shore** — same chart, different signal.



Date range picker. Tap the date label to jump to **Last 2 days**, **Last 7 days**, **Last 30 days**, etc., or set a custom range.

> **Dashboard vs. Advanced:** The dashboard charts are the fastest way to answer "how did yesterday look?" The **Advanced** tab (next subsection) is where the per-leg, per-MPPT, high-resolution data lives.

The Advanced tab — where the real data lives

The dashboard only shows the current moment. The **Advanced** tab is where you can go back in time and see exactly what each leg, each MPPT, and the battery were doing across any date range you choose.

- **Pick a date range** at the top — last 24 hours, last week, custom range, etc.
- Scroll through the available widgets — **AC Input** (per-leg amps, volts, watts), **Battery** (SOC, voltage, current, temperature), **Solar** (per-MPPT yield), **AC Loads**, and more.
- Each chart is zoom- and pan-capable. Tap a point to see the exact value and timestamp.
- This is the right place to answer questions like "was one leg pulling harder than the others last night?" or "how much solar did we actually get on day 3?"

Site selection

- **Coordinate parking location nearby the external power source** (Basecamp Generator or grid power) to minimize cable runs. This is the first thing to plan.
- Leave enough room for access and egress around the truck box (personnel door, rear-left ABC extinguisher, and FD vehicle access)
- Confirm AHJ requirements per the EAP pre-show check list (Section B in the EAP)
- Inspect that the ABC fire extinguisher tag is current and the cylinder is in place

SECTION 4

Operation and Microgrid

This section covers how to use the ThunderBank to operate the loads of your basecamp and the unique interaction with ThunderBolt trailers to form a microgrid. The ThunderBolts will increase the runtime of the ThunderBank by exporting excess solar power to charge the bank or offset loads.

For Cabling and Operation, Follow Industry Safety Guidelines.

ThunderBank — Turning ON

1. 3-position switch slowly to **On** — pause at **Charge** for ~3 seconds
2. Verify AC Output live and stay within limits (24 kW/leg)

Load shedding — managing the fleet when walking away

Before leaving the bank to run unattended overnight, over a weekend, or during any extended idle:

1. Leave the **ThunderBank On**.
2. Keep ThunderBolts in **On/Export** — excess power helps the ThunderBank run longer.
3. For units that are still needed, load-shed nonessentials — especially air conditioners on customer loads.
4. Turn off or unplug non-ThunderBolt units that aren't needed.

Idle ThunderBolts: If a ThunderBolt isn't planning to be used, leave it in **On/Export** and shed its loads — it can still provide power to the ThunderBank or other units.

No-solar conditions: If solar will be 0 (overnight, indoors, snow-covered panels), ThunderBolts can be turned off too — there likely won't be enough power to export.

> **In normal operation, also pay careful consideration to load shedding.** The same principle from *"a penny saved is a penny earned"* applies — every watt saved can be spent later, extending time before a recharge is needed.

ThunderBank — Turning OFF (Moving Locations or Long Term Storage)

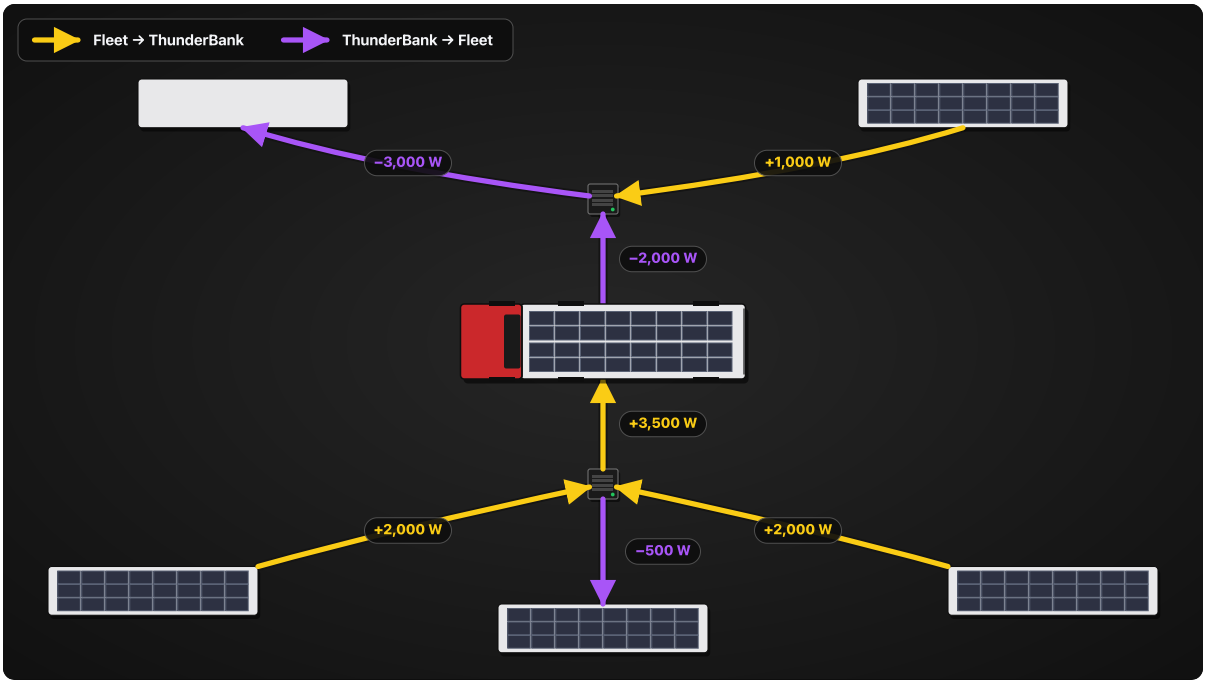
> **When turning the ThunderBank Off for any reason, move ThunderBolts to On / No Export or Off first.**

1. **Unplug or turn off exporting ThunderBolts first** — set to **On/No Export** or **Off**, or unplug
2. 3-position switch slowly through **Charge** (pause ~3 s) to **Off**

Single Cable System

Basecamp cabling and setup can be done the same way it's always been done. ThunderBolts and solar trailers can be placed anywhere in the basecamp cabling package.

The intent is for your ThunderBolt trailers to be operated in **On/Export** when cabled to the ThunderBank. In this condition, the ThunderBolts will send excess solar energy to the ThunderBank on the same cable they may receive power from. This is done automatically and without any interruption in power. The diagram below shows a sample setup and what the ThunderBank might see.



Sample basecamp with 5 ThunderBolts and one ThunderBank. **Yellow** = excess solar flowing to ThunderBank; **purple** = ThunderBank supplying a draw. Labels show example net flow on each leg (+ exporting, − drawing).

Connecting ThunderBolts

ThunderBolts have a 3-position switch located by the ThunderBolt Charge Plug:

10 O'CLOCK

Off

- ThunderBolt off
- No export
- **Solar charging still live**

12 O'CLOCK

On / No Export

- **Required when cabling directly to grid or generator**
- ThunderBolt powered on
- Won't export

2 O'CLOCK

On / Export

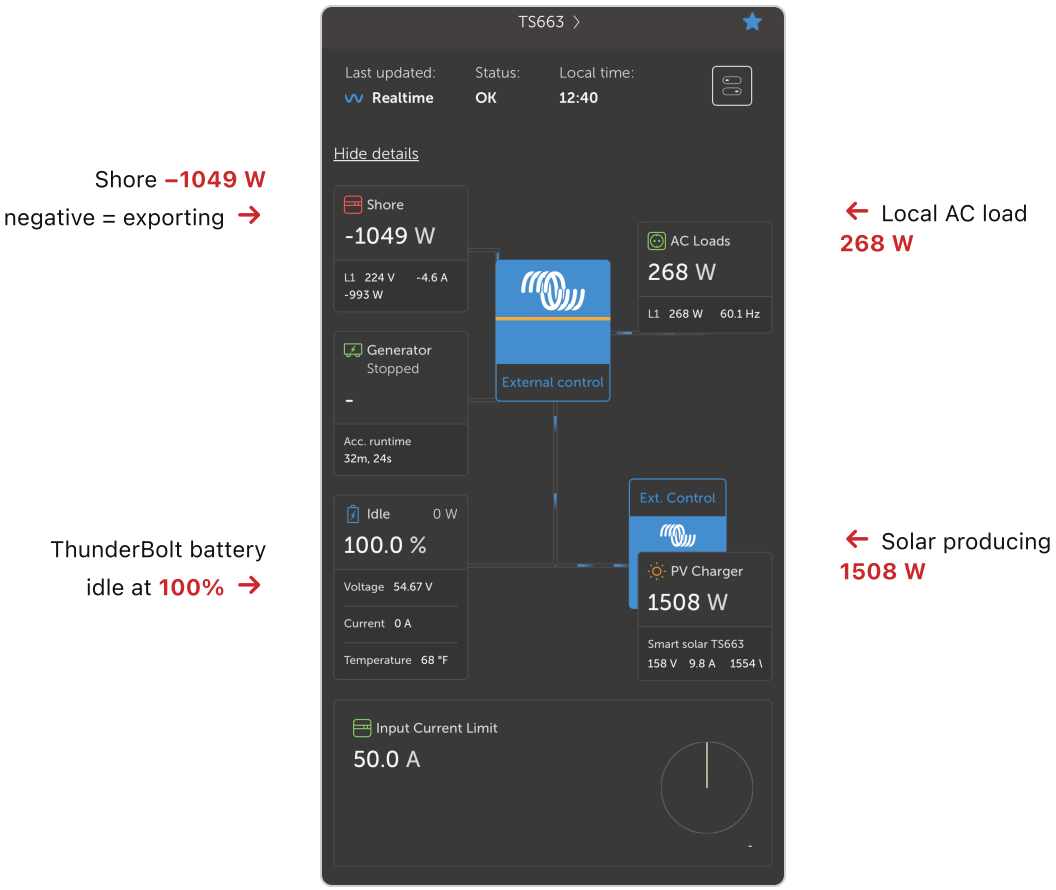
- **Default for ThunderBank operation**
- ThunderBolt powered on
- Exports automatically when above Min Battery SOC

If connected to a ThunderBank, leave ThunderBolts in **On / Export** — they export power automatically when above Min Battery SOC. When cabling ThunderBolts directly to grid or generator power, they **must** be in **On / No Export**. ThunderBolts temporarily stop exporting while the ThunderBank has another 3-phase charge source, and will resume automatically.

> **Best practice: bring ThunderBolts online one at a time.** Move ThunderBolts to **On / Export** one at a time so each unit's safety checks happen at slightly different moments, even if only seconds apart. One way to accomplish this: leave ThunderBolts in **On / No Export** while you run cables to the ThunderBank, then move switches to **On / Export** one by one. **When turning the ThunderBank Off for any reason, move ThunderBolts to On / No Export or Off first.**

Detailed behavior:

- ThunderBolts take a few minutes of automatic safety checks before they begin exporting at their normal rate
- Exporting appears as a **negative AC Input number** on the ThunderBolt's dashboard (e.g. –1049 W). On the ThunderBank, the same power shows as **PV Inverter** in VRM and **ESS Charging** on the Control Screen.
- If a ThunderBolt should be exporting but isn't, **unplug that ThunderBolt and plug it back in** to restart its safety checks. If it still does not export after that, call Lightnin to diagnose.
- If a ThunderBolt is exporting and shouldn't be, move the ThunderBolt switch to **On / No Export** or unplug it.
- Power exported to the ThunderBank may be consumed by other loads before it reaches the bank — in that case the energy goes to work but does not register as charge.
- **Safe to disconnect a ThunderBolt while it is exporting** — ThunderBolts carry anti-islanding technology that drops their output when the connection is broken.



ThunderBolt TS663 exporting to the bank. The negative shore number is the verification signal — this ThunderBolt is exporting through the shore line, not receiving from it.

SECTION 5

Charging Operations

This section describes how to charge the ThunderBank with 3-phase or single-phase power, and includes charge rate tables for planning fill time.

Key principle. 3-phase charging disables ThunderBolt export and runs the ThunderBolts independently. **Do not leave a 3-phase power source plugged in (or with live voltage)** from a generator or shore power — 3-phase is only meant for active recharging periods. Single-phase trickle chargers, by contrast, can be left plugged in at any time.

The orange dial sets your charge rate. It resets to a safe minimum — **60 A for 3-phase** and **10 A for single-phase** — each time. You must turn the dial up to your selected charge rate, choosing a setting that is safe for the cable and power source you are using.

Switch positions — what charges in each

Charging behavior depends on the 3-position switch. **3-phase charging is only available in the On or Charge positions; single-phase (trickle) charging works in any switch position**, including Off. The cards below summarize what each position does while charging.

10 O'CLOCK

Off

- No 3-phase charging
- **Single-phase trickle charging still works**
- AC output dead

12 O'CLOCK

Charge

- **Charge-Only state** — most users treat this as **Pause**
- **3-phase and trickle charging live**
- Provides **pass-through power** to anything plugged into the AC Outputs
- **Treat the AC Output panel as HOT**
- Most efficient charging position when nothing is plugged into AC Outputs

2 O'CLOCK

On

- **AC output live**
- **3-phase and trickle charging live**
- All loads run; charging occurs at the Orange Dial rate
- If charge rate < load, the battery still discharges to meet the load

The **Charge** position puts the inverters into a **Charge-Only state**. Most users will reach for it as a Pause, but it does more than pause: it still allows 3-phase charging, and if anything is plugged into the AC Outputs it will supply **pass-through power** to those loads. That is why **the AC Output panel must still be treated as HOT in the Charge position.**

> **In Charge, load must stay under the charge rate.** Because the inverters are in a Charge-Only state, if the load ever exceeds the charge rate set on the orange dial, the unit will **stop supplying loads** for insufficient power. Set the dial above any pass-through load you expect to draw.

> **Charge is the most efficient position for charging** when nothing is plugged into the AC Outputs. With no loads, the inverters consume no power and the batteries will not deplete if the unit is left in this position.

In the **On** position, all loads run and charging occurs at the rate selected on the orange dial. **If the charge rate is less than your load, the battery will still discharge to meet the load** — choose a dial setting above your running load if you want net charging while the unit is On.

Connecting 3-phase shore power

1. Connect 208 V 3-phase shore power at the AC Input panel (front-right, "Input Only"). 3-phase camlocks are mounted vertically. Match colors: Green / White / Red / Blue / Black. Cables can be connected in any switch position, but charging will only work in **On** or **Charge**.
2. Move the 3-position switch slowly to **On** (charging while running AC output loads) or **Charge** (charging with no AC output loads — most efficient). **Pause ~3 seconds at Charge** when transitioning between Off and On to let the inverters settle.
3. Verify on the exterior display or VRM that AC Input current is rising.
4. Confirm the orange dial is at the auto-reset baseline (**60 A** for 3-phase) and ramp up incrementally — **30–50 A per step** — to your target rate (up to 275 A/leg). Use the **Charge Time** calculator in the Lightnin Portal to plan how long the fill will take.
5. **At 95% SOC, charging is complete.** Turn off any generator to avoid wasting fuel, and **unplug the 3-phase charge source** so ThunderBolts begin exporting again. **Do not leave the unit plugged into a 3-phase charge source after charging completes** — 3-phase shore presence disables ThunderBolt export, so you would lose the solar contribution from the fleet. Once disconnected, ThunderBolts resume exporting automatically. The Charge Time calculator gives the estimated fill time — or quick math: **(100 × kW) ÷ 270 = Charge % per hour**.

Quick reference — charge rate vs. fill time with and without load

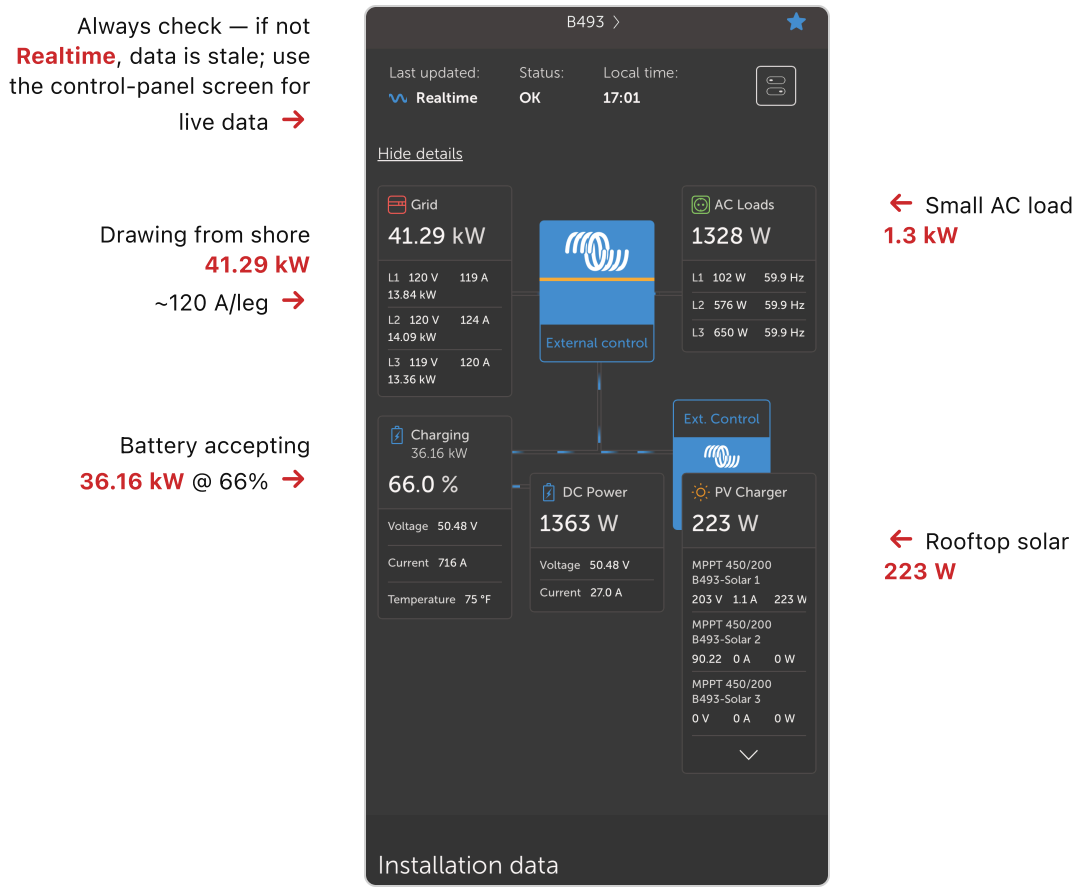
The table below shows fill time (industry-standard **20% → 100% SOC** = 216 kWh) at each dial position, for four different load scenarios.

Net battery charging = AC input – AC output load

The maximum power the batteries can charge with is **60.5 kW**.

DIAL (A/LEG)	AC IN (KW)	FILL TIME NO LOAD	FILL TIME + 10 KW LOAD	FILL TIME + 20 KW LOAD	FILL TIME + 30 KW LOAD
75 A/leg · 225 A total	27.0	8 hr	12 hr 42 min	30 hr 51 min	discharging
100 A/leg · 300 A total	36.0	6 hr	8 hr 18 min	13 hr 30 min	36 hr
125 A/leg · 375 A total	45.0	4 hr 48 min	6 hr 10 min	8 hr 38 min	14 hr 24 min
150 A/leg · 450 A total	54.0	4 hr	4 hr 55 min	6 hr 21 min	9 hr
168 A/leg · 504 A total	60.5	**3 hr 34 min**	4 hr 17 min	5 hr 20 min	7 hr 5 min
200 A/leg · 600 A total	72.0	**3 hr 34 min**	**3 hr 34 min**	4 hr 9 min	5 hr 9 min
225 A/leg · 675 A total	81.0	**3 hr 34 min**	**3 hr 34 min**	**3 hr 34 min**	4 hr 14 min
250 A/leg · 750 A total	90.1	**3 hr 34 min**	**3 hr 34 min**	**3 hr 34 min**	**3 hr 36 min**
275 A/leg · 825 A total	99.0	**3 hr 34 min**	**3 hr 34 min**	**3 hr 34 min**	**3 hr 34 min**

The 168 A/leg row is where the bank starts capping battery charging at 60.5 kW (its DC ceiling). At 200 and 275 A/leg the surplus AC capacity stays available to absorb concurrent loads — which is why those rows show the same fill time as long as the load fits in the surplus. At lower dial settings combined with significant loads, the bank breaks even or actively discharges; plan the dial around your expected load. For other start/end SOC ranges or load profiles, use the Charge Time and Runtime calculators in the Lightnin Portal.



B493 charging from 3-phase shore. Matches the 100 A/leg row of the table above (with a small concurrent load). For the math formula above, the kW value to use is the **36.16 kW Battery accepting** number — the net charge at the battery, not the 41.29 kW the shore is delivering.

> **3-phase charging only begins below 85% SOC** and the bank auto-ignores the input at 95% SOC. If you plug in above 85%, the bank may refuse to charge until SOC drifts down.

> **Charging behavior between 88–100%.** Batteries sometimes charge at unexpected rates between 88–100%. The batteries are still accepting charge, even if the percentage moves slower or faster than expected. At the upper end of charging, the voltage may rise quicker than the battery percentage. Don't be alarmed — this is normal and the batteries are working properly.

Connecting single-phase trickle chargers

Trickle chargers charge the bank regardless of the 3-position switch position, including Off. Each trickle charger needs its own single-phase hot leg; **ground and neutral are always required** on every trickle connection.

- **One hot leg** — plug into **Red**. One trickle charger active, ~3.4 kW into the bank
- **Two hot legs** — plug into **Red and Blue**. Both trickle chargers active, ~6.7 kW combined

- Single-phase camlocks are mounted horizontally on the AC Input panel, directly below the 3-phase set
- Trickle input current is controlled with the **orange dial**, set between **10 – 50 A**. The dial changes both legs at the same time

> **Trickle input is flexible** and works with **120 V or 240 V**, so you can use anything from a standard wall socket to a 50 A RV output.

Using a Basecamp Generator (BG) to charge

- A BG is a valid 3-phase source — deliver 208 V 3-phase at your chosen input limit
- Use the **Charge Time calculator** in the Lightnin Portal (Tools → Power → ThunderBank Charge Time) to estimate how long the fill will take at your selected amps
- Plan to shut the BG off when the bank reaches your target SOC, or when the bank auto-ignores the input at 95%. Idling a BG past 95% wastes fuel
- If you are unsure when to shut it off, the calculator will give you the fill time at your chosen input amps

Running 3-phase and trickle chargers at the same time

The 3-phase shore and single-phase trickle chargers can run simultaneously. The trickle charger's power source can be the same as the 3-phase source or completely different. Some examples:

- One BG feeding both the 3-phase input and the trickle charger(s)
- A BG running the 3-phase input while a separate grid panel runs the trickle charger(s)
- 3-phase shore from grid while the truck alternator and rooftop solar also contribute

This flexibility lets you put together a charging setup based on what power is available at the site.

Which charge path does what

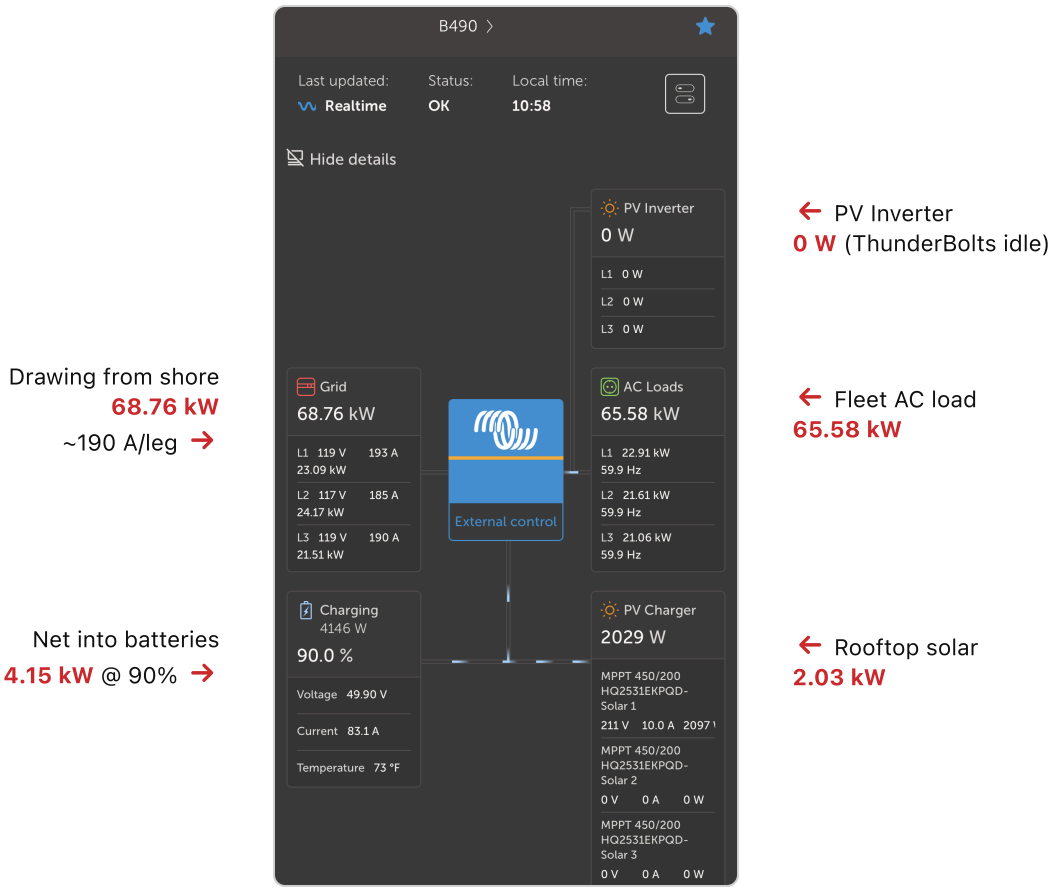
SOURCE	BEHAVIOR
3-phase shore (208 V)	Fastest path. Up to 275 A/leg AC in / 168 A per phase DC into the bank. Auto-ignores input at 95% SOC. Only begins below 85% SOC. Disables ThunderBolt export while running.
Single-phase trickle (1 or 2 chargers)	~3.4 kW DC per charger. Works in any switch position, including Off. Does NOT disable ThunderBolt export.
Truck engine alternator	DC charging while the truck engine is running. Switch is in the cab, left of the steering wheel. Leave the switch in the ON position unless the fault light illuminates.
Rooftop solar (~2,900 W)	Continuous in daylight. Adds to whatever else is charging. Onboard MPPT (Victron 450/200) handles regulation automatically.
ThunderBolt export	Auto-starts once switch is in On and any AC charge source is removed. Disabled during 3-phase charging.

Cabling and charge rate

- **2/0 or 4/0 cable** recommended when running at the max AC input rate. For lower charge rates and shorter runs you can size cable appropriately — pick what matches your chosen input limit and distance
- The orange dial's voltage adjust is for the **AC output** side (not input). On long AC output cable runs the voltage drops across the cable; turning the dial up raises the inverter output so the voltage at the far end of the run is in the desired range

> **(100 × kW) ÷ 270 = Charge % per hour**
>
> Easy math to estimate how long the battery has left or how long until it is full. Same formula works for discharge — just use a negative kW.
>
> **Use the *net charge/discharge rate at the battery*** — not the AC input or AC load. On the screen this is the “Charging” or “Discharging” kW value, not the Grid or AC Loads number.

> **When the bank is connected to a charging source, the AC output load is primary.** Load is served first, and whatever AC input is left over flows into the batteries. The batteries can absorb up to **168 A per phase** (~60.5 kW DC); any input beyond load + 168 A simply isn't drawn from the charging source. So if you want to charge at max AND run loads simultaneously, set the orange dial high enough to cover the load *plus* 168 A/leg of charging headroom.



Drawing from shore
68.76 kW
~190 A/leg →

Net into batteries
4.15 kW @ 90% →

← PV Inverter
0 W (ThunderBolts idle)

← Fleet AC load
65.58 kW

← Rooftop solar
2.03 kW

What happens when the dial is set too low for the load. 190 A/leg only delivers 68.8 kW, and the 65.6 kW of fleet load consumes nearly all of it — only 4 kW makes it into the batteries. To keep batteries charging at the full 60.5 kW DC ceiling while carrying this load, the dial would need to be set higher.

SECTION 6

Other Capabilities

Level 2 EV charging

- The Grizzl-E Ultimate 80 A Level 2 charger is stored in a black jockey box on the front-right of the truck box. Customer deploys it to charge an EV from the bank's AC output
- The **EV itself determines the charging rate** in most cases — the ThunderBank is set to a maximum of 80 A unless the customer requests otherwise
- EV charging is only enabled when the 3-position switch is in **On**

> **EV charging is a large load and will significantly reduce ThunderBank runtime.** A Level 2 charge can pull **8 – 19 kW** depending on the vehicle — that is a substantial draw on the bank. Coordinate with the production and prioritize what matters: EV charging can usually be done elsewhere (an off-set EV charger, a public charger, the EV's home charger), while many production loads cannot.

For Cabling and Operation, Follow Industry Safety Guidelines.

Monitoring

- **Exterior display** — the unlocked grey Polycase at the rear-right corner. Live SOC, power flow, alarms, and per-leg amps/volts/watts. Best place for quick on-site checks
- **Lightnin Portal** — web-based monitoring and remote controls for both the ThunderBank and the ThunderBolt fleet. Shows the latest snapshot of readings (refreshed on demand, not continuously streaming), plus historical data, alarm history, sustainability metrics, and the Tools-tab calculators (Power, Charge Time, Runtime). For continuously updating values, use the on-board screen or VRM
- **VRM** — Victron's underlying telemetry portal. Useful for low-level diagnostics Lightnin tech may walk you through over the phone

Air conditioning

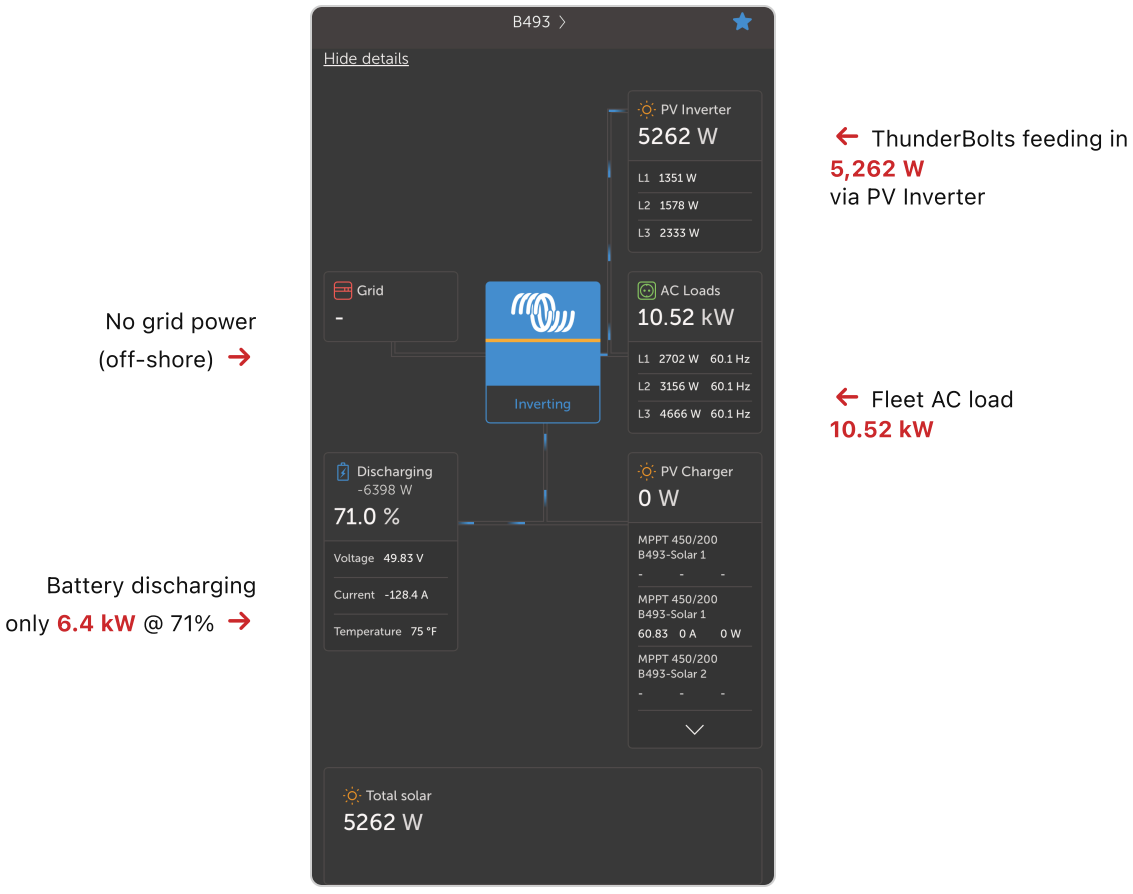
- The interior is air-conditioned to **80°F or less**
- The air conditioning is wired to the MultiPlus and is **always on** regardless of the 3-position switch — it stays running even in **Off** or **Charge**. The only thing that takes the air conditioning down is the **EMERGENCY STOP**. The air conditioning can still use the battery in the Off position; this is rarely a concern given the bank's size, but plan accordingly for weeks-long idle periods or units sitting at low SOC

- Compartment temperature sensors are reliable to **±5°F**. If a sensor stops reporting to VRM, its battery has failed — call Lightnin to coordinate replacement
- **100–120°F compartment temps** usually mean the air conditioning is failing or struggling, not a thermal event. Call Lightnin to diagnose
- **150°F+ panel temps** are an early-fire alert — follow the EAP, not this manual. Hit EMERGENCY STOP and call Lightnin. **At 160°F the ThunderBank automatically triggers EMERGENCY STOP.**

Solar contribution

Rooftop solar runs continuously in daylight. Additional solar panels can be connected to the external PV breakers located near the fire extinguisher. **You must have the breakers in the OFF position before connecting or disconnecting cables to solar panels.** Solar offsets load and charges the bank; you do not need to do anything to "use" it — it just contributes automatically.

The main solar contribution comes from the fleet of ThunderBolt Solar Trailers feeding the ThunderBank, which together form a microgrid. Long run times are only possible when there is additional energy flowing into the ThunderBank — from the ThunderBolts or from a solar farm on the external PV breakers.



The microgrid in action. ThunderBolts are feeding ~5.3 kW back to the bank, so the bank only has to discharge ~6.4 kW to cover the 10.5 kW of load. Without the ThunderBolt support the bank would be discharging at over 10 kW.

Connecting additional solar panels

Up to three additional PV strings can be connected through the external PV breakers (shielded box at the rear-left corner, near the ABC extinguisher).

- Lightnin can supply panels that can be used in **strings of 4 – 10 panels per breaker**
- If the customer is supplying their own panels, confirm with Lightnin that the string's short-circuit current rating is within spec before connecting
- **Breakers must be OFF before connecting or disconnecting panels**
- Once panels are connected, flip the corresponding external PV breaker to ON. Confirm on the exterior display that solar contribution rises

Truck alternator

- The alternator charges the bank while the truck engine is running. The switch is in the cab, left of the steering wheel
- Leave the switch in the **ON** position by default — the alternator only contributes when the engine is running, so there's no penalty for leaving it on the rest of the time
- If the switch's indicator light is illuminated, the alternator has faulted. Move the switch to **OFF** and call Lightnin

SECTION 7

Pack-Up & Shutdown

> **Set ThunderBolts to On/No Export or Off before moving the ThunderBank switch.** Turning the ThunderBank Off while ThunderBolts are still in Export will trip an overcurrent alarm on the inverters and force a reset cycle to clear.

1. Set ThunderBolts to **On / No Export** or **Off** (or unplug them).
2. Move the ThunderBank 3-position switch slowly to **Off** — pause at **Charge** for ~3 seconds to let the inverters settle.
3. Disconnect everything from the unit:
    - 4. AC output camlocks at the rear wall ("waterfall" panel)
    - 5. ThunderBolt feeds
    - 6. 3-phase shore at the AC Input panel
    - 7. Single-phase trickle chargers
    - 8. Additional solar; confirm the three external PV breakers are OFF
9. Stow all camlocks; secure cable bundles for transport.
10. Stow the Level 2 EV charger in the black jockey box on the front-right.

SECTION 8

Troubleshooting

Overcurrent while turning the ThunderBank Off

The most common cause of an overcurrent alarm is **turning the ThunderBank Off while ThunderBolts are still in Export** — this is **not recommended**, because repeated alarms cause unnecessary wear and risk damage to the equipment.

Best practice: set ThunderBolts to **On / No Export** or **Off** first, then move the ThunderBank switch.

If the alarm does fire, a reset cycle is the recommended resolution:

1. Confirm ThunderBolt export has stopped (set to On/No Export, Off, or unplug).
2. Cycle the 3-position switch **Off → On → Off**, then move it to your desired state.

Overcurrent or inverter fault at any other time

Do not reset — call Lightnin. A blind reset can mask a real problem. Investigate first: read the alarm description on the Alarms tab (4th blue tab at the top of the screen), check shore cable seating, polarity, and color order, then call Lightnin if the cause isn't obvious.

Common real causes Victron may be reacting to:

- Too high a load on one or multiple legs
- Bad voltage from a bad cable or a reversed cable
- Loose camlock connection
- Shore source voltage drifting out of acceptable range

Victron's fault logic: disconnect → wait ~30 seconds → retry 3–5 times → then either disconnect from the fault source **for 30 minutes** or ignore the AC inputs entirely.

ThunderBolt should be exporting but isn't

1. Confirm the ThunderBank switch is in **On** and no 3-phase shore is active (3-phase blocks export).
2. Confirm the ThunderBolt switch is in **On / Export**.
3. If conditions look right for export, **unplug the ThunderBolt and plug it back in** to restart the ThunderBolt's safety checks.
4. If the ThunderBolt still does not export after that, call Lightnin to diagnose.

ThunderBolt is exporting and shouldn't be

Move the ThunderBolt switch to **On / No Export** or unplug it.

Note: ThunderBolts in **On / No Export** may routinely draw a small amount of watts and briefly (less than a second) show readings of **–50 W to 0 W**. This is part of a "handshake" between the trailer and the power source and won't cause any harm. The setpoint is below what utility companies define as backfeed.

Screen glitches on the control panel

If the control-panel screen freezes, shows artifacts, or otherwise misbehaves, there is a **small blue dot in the lower-left corner of the display**. Press it to reset the screen. Resetting the screen does not affect the inverters or the bank — it only restarts the display.

If the blue dot is not visible, there are **two thumb screws on the control panel**. Unscrew them to allow the control panel door to swing open. Unplug the cable that goes into the back of the screen, and plug it back in.

Any glitches to the screen don't affect operation of the ThunderBank — this is a reference screen only. Loads and charging will continue to function. **VRM is the primary overview tool.**

Air conditioning struggling (compartment 100–120°F)

Not a fire indicator. Likely a refrigerant or compressor issue. Call Lightnin to coordinate service. The 150°F early-fire alert threshold is well above this range — you have time.

Control screen is throttling or showing partial data

Confirm **EMERGENCY STOP** hasn't been pressed. Use VRM as the primary reference guide.

Sensor not reporting in VRM

The temperature sensors have user-replaceable batteries. If a sensor drops off VRM, its battery has died. Call Lightnin to coordinate replacement.

When to call Lightnin vs. just continue

- Overcurrent from turning the ThunderBank Off while ThunderBolts were exporting → reset cycle is OK (see Troubleshooting). If it persists after one cycle, **call Lightnin**
- Any **other** overcurrent or inverter fault → **don't reset — call Lightnin.** A blind reset can mask a real problem
- Any thermal indicator (150°F panel alert, vapor, odor) → **follow the EAP, not this manual**
- Any alternator fault indicator → **leave OFF and call Lightnin**

- ThunderBolt that still is not exporting after an unplug-and-replug attempt → **call Lightnin**

SECTION 9

Maintenance & Inspection

6-month bolt re-torque

Lightnin handles the 6-month bolt re-torque internally. Loose connections are the most common preventable cause of electrical fires; the re-torque catches them before they become a problem. **If the inspection comes due during a rental, call Lightnin to schedule a good time for a tech to come out and perform the maintenance.**

ABC fire extinguisher inspection

- Inspect the tag date before every show. If the tag is past due, notify Lightnin
- Confirm the cylinder is in its bracket on the bumper at the rear-left of the truck
- Confirm the gauge needle is in the green band

Battery Depth of Discharge

- The batteries have a **90% Depth of Discharge**.
- Do not plan a load profile that takes the bank below 11% — running deeper degrades cell life over time
- **At 10% SOC the bank performs an automatic shutdown.** Once shut down, the bank can still accept a charge in the **On** or **Charge** switch position. Inverting (AC output) only resumes once SOC reaches **12%** or higher
- Use the **Runtime calculator** to plan how long a given load can run before reaching the cutoff

Pre-show checklist (quick version)

- ABC extinguisher tag current, cylinder in bracket
- EAP and laminated cards present and current
- 6-month inspection up to date (Lightnin tracks)

- Point person identified to handle emergency planning per EAP Section B

Post-show checklist (quick version)

- Pack-up sequence completed in order (Section 7)
- All camlocks stowed, no loose cables
- Level 2 EV charger stowed in jockey box
- Alternator switch OFF
- External PV breakers OFF
- Any alarms or unusual events logged for Lightnin debrief

APPENDIX

Quick Reference

A. Specs sheet

Capacity	270 kWh total / 243 kWh usable
Battery chemistry	LiFePO4
Inverters	90 kVA 72 kW max continuous (24 kW/leg)
AC output current	250 A/leg peak (750 A total) 200 A/leg continuous (600 A total)
DC bus nominal	48 V
AC output	208 / 120 V 3-phase, 90 kVA
3-phase AC input range	30 – 275 A/leg (sometimes 55 A minimum)
Max battery charge current	168 A/phase (AC input above 168 A flows through to AC loads)
Trickle charger contribution	~3.4 kW per charger, ~6.7 kW combined (2 chargers); set 10 – 50 A with the orange dial (both legs)
Rooftop solar	~2,900 W
Additional solar inputs	3 external PV breakers; 4 – 10 panels per string
EV charger	Grizzl-E Ultimate 80 A Level 2
Air conditioning setpoint	80°F (sensors ±5°F)
Early-fire alert threshold	150°F panel sensor
Operating SOC range	100% → 11% (auto-shutdown at 10%)
3-phase charging window	Available below 85% SOC, auto-ignores input at 95%
Recommended cable for max charge	2/0 or 4/0

B. Portal tools

- **Power Calculator** — convert amps ↔ kW for 3-phase or single-phase circuits. Lightnin Portal → Tools → Power → Power Calculator.
- **Charge Time** — estimate fill time for a given amp/kW input. Lightnin Portal → Tools → Power → ThunderBank Charge Time.
- **Runtime** — estimate how long the bank will run a given load (with optional solar offset or trailer-count solar contribution). Lightnin Portal → Tools → Power → ThunderBank Runtime.

C. Cross-reference

- **ThunderBank Emergency Action Plan** — what to do when something goes wrong
- **Production Crew Emergency Card** — laminated quick-ref for crew, kept near the unit
- **Fire Department Quick Reference Card** — laminated quick-ref handed to first responders