THE 12 VOLT SHOP

LOW VOLTAGE SPECIALISTS

12VS LITHIUM BATTERY USER MANUAL

Introduction

Thank you for purchasing a 12VS Smart Lithium Battery.

This LiFePO4 (Lithium Iron Phosphate) battery is a robust, safe, and high-performance deep-cycle energy storage solution engineered for the demanding environments of Western Australia and beyond. Whether powering a 4WD canopy, a marine house bank, or a remote off-grid station, the 12VS range provides the reliability required for mission-critical power.

Built with premium Grade-A+ cells and high-grade components, the 12VS features an advanced dual-layer management system: an integrated, next-generation Daly JHB Smart BMS paired with a dedicated 5A Heltec Active Balancer. While standard lithium batteries rely exclusively on low-current passive BMS balancing, our dedicated active balancer ensures your cells remain perfectly aligned even under high-load conditions, significantly extending the functional lifespan of your battery bank.

⚠ **SAFETY FIRST: Please ensure you read the Warnings and Safety Instructions section of this Manual in full before installing, connecting, or charging your battery.**

Key Features

- Advanced Chemistry: Premium LiFePO4 cells for maximum safety, thermal stability, and an industry-leading cycle life.
- Dual-Layer Balancing: The combination of a Daly JHB Smart BMS and a dedicated 5A Heltec Active Balancer provides superior cell health that far exceeds standard lithium offerings.
- Comprehensive Protection: Automatic hardware safeguards against over-voltage, under-voltage, over-current, over-temperature, and short circuits.
- Inbuilt Parallel Protection: Powered by the Daly JHB architecture, the battery features integrated current-limiting and pre-charge protection. This allows safe expansion for Parallel connection (up to 16 units) or Series connection (up to 48V / 4 units) without requiring external parallel control modules.
- Real-Time Monitoring: Integrated Bluetooth allows you to monitor State of Charge (SoC), Voltage, Current, and individual Cell health via the official DALY BMS App

Applications

- Caravan, Motor-home, and 4WD Dual-Battery Systems
- Marine Leisure and House Power Banks (Strictly deep-cycle; not rated for engine starting applications)
- Off-Grid Renewable Energy and Solar Storage Emergency Backup and Telecommunications

Initial Setup Note: Your 12VS battery is shipped at approximately 30–50% State of Charge (SoC) to comply with transport regulations. A full charge using a dedicated LiFePO4 charger is required prior to first use. This initial top-charge synchronizes the BMS capacity indicator and allows the 5A Heltec balancer to complete its first full cell calibration at the top of the charge curve.

CONTENTS

1. IMPORTANT SAFETY INFORMATION

1.1 WARNING AND SAFETY INSTRUCTIONS

GENERAL SAFETY & LIABILITY

- PLEASE READ CAREFULLY BEFORE USE
  Failure to follow these instructions may result in fire, explosion, electric shock, or permanent damage to the battery and your equipment.
- Not a “Drop-In” Replacement: While LiFePO4 offers superior performance, it is not a direct “drop-in” replacement for Lead Acid/AGM/Gel batteries. You must ensure your charging system (Solar, DC-DC, or AC) is configured with a specific LiFePO4 profile.
- Limitations of Use: Do not use this battery in connection with life-support systems or critical medical equipment.
- Children: Ensure children are supervised to ensure they do not play with or around the battery.
- Disclaimer: The 12 Volt Shop (AUST) Pty Ltd assumes no responsibility for errors, omissions, or damage caused by improper installation.

OPERATIONAL WARNINGS:

- No Cranking: DO NOT use this battery for engine cranking or high-surge starting. This is a deep-cycle battery designed for sustained power storage only.
- Low-Temperature Hazard: NEVER charge the battery if the internal temperature is below 0°C. Charging in sub-freezing temperatures causes “Lithium Plating,” leading to permanent cell damage and fire risk.
- Terminal Torque: Ensure all cable lugs are tightened to 9–12 Nm. Loose connections are the leading cause of heat-related failure and fire.
- Cleaning: Use only a dry or damp cloth. DO NOT use oils, alcohols, solvents, or high-pressure washers.

ELECTRICAL & INSTALLATION SAFETY

- Short Circuit: Do not short-circuit the battery terminals. Use only insulated tools. Always install the provided terminal boots.
- Cabling & Fusing: Use only the cable and fuse sizes recommended in this guide. The installer is responsible for ensuring the system meets local electrical standards.
- Series & Parallel Strings: Do NOT mix lithium batteries with different chemistries, brands, capacities, or ages. All batteries in a string must be of the same model and state of charge.
- Do NOT alter, open, or disassemble the battery. Unauthorized tampering will immediately void the warranty and poses a significant safety risk.

ENVIRONMENTAL HAZARDS:

- Fire & Sparks: Never smoke or allow a spark or flame near the battery. Keep away from flammable materials and major heat sources (e.g., engine manifolds).
- Physical Damage: Do not drop, crush, or puncture the battery. If the casing is compromised, stop use immediately.
- Moisture: This battery is not waterproof. Do not submerge the battery or install it where standing water may accumulate.

1.2 INTEGRATED PROTECTION SYSTEM

Your 12VS Smart Lithium Battery features an internal Daly JHB Smart BMS and a separate 5A Heltec Active Balancer.

The Daly JHB BMS acts as the digital guardian, protecting against over-charge, over-discharge, over-current, short circuits, and extreme temperatures.

The 5A Active Balancer transfers energy from the highest cells to the lowest cells continuously at a high 5A rate. This ensures cell voltages remain equalized even under heavy current draws, maximizing the usable capacity and life of the pack.

Note on Initial Balancing: During your first few charges, the BMS may briefly trip “Cell Over-Voltage” protection. This is normal. The 5A Active Balancer is simply aligning the cells. If your charger errors out, reset the charger or disconnect the battery for 20 minutes to allow the balancer to level the cells, then resume charging. For detailed recovery steps, see Section X: Troubleshooting.

1.3 INITIAL SETUP REQUIREMENT

IMPORTANT: Your battery is shipped at 30–50% State of Charge (SoC) to comply with transport regulations. A full charge is mandatory prior to the first use. If installing multiple batteries in a bank, each battery must be charged individually to 100% before they are connected together. This ensures the bank starts in a perfectly balanced state.

1.4 TECHNICAL WARNING SYMBOLS & DEFINITIONS

- Refer to Instruction Manual: Mandatory to read the manual before operation.
- General Warning: Risk of danger or damage if instructions are ignored.
- Warning; Electricity: Risk of high-current electrical shock or short-circuit.
- Warning; Low Temperature: Risk of permanent cell damage from charging in freezing conditions..
- No Open Flame: Fire, open ignition sources, and smoking are strictly prohibited near the asset..
- Do Not Extinguish With Water: In the extreme event of a lithium battery fire, use a Class D metal fire extinguisher, CO2, or dry chemical powder. Do not use small amounts of water.
- General Prohibition: Do not open or tamper with the internal components.

2. INSTALLATION & MOUNTING

To ensure the safety and longevity of your 12VS LiFePO4 battery, proper placement and secure mounting are critical. Unlike traditional lead-acid batteries, LiFePO4 units can be installed in various orientations, but thermal management and vibration resistance remain the highest priorities for long-term reliability.

2.1 LOCATION & ENVIRONMENT

Selecting the correct environment is the first step in protecting your investment and ensuring structural safety. For all transportable structures, caravans, motor-homes, and camper trailers, the installation location must strictly comply with AS/NZS 3001.2:2022 Clause 5.4.12.2 (Lithium-ion battery location requirements)

AS/NZS 3001.2:2022 Clause 5.4.12.2 Mandates:

Lithium-ion batteries installed within a connectable electrical installation or recreational vehicle shall:

- Be installed externally — defined by the standard as being behind a structural wall, dedicated compartment, or robust barrier that completely prevents the egress of gases or vapors into the habitable living area.
- Not enter the habitable area of the transportable structure under any operating or fault condition.
- Be installed to operate within the manufacturer’s defined operating temperatures, including matching the appropriate environmental IP rating.

Practical Compliance Layouts for 12VS Footprints:

- Internal Cavities (Under-Bed, Cupboards, or Lounge Seating): If a 12VS battery is mounted inside an internal caravan cavity, the entire enclosure or hatch framework must be completely sealed off from the habitable living cabin. The compartment must utilize compressed gaskets, rubber seals, and airtight cable glands for all exiting conductors. Crucially, the compartment must be vented directly through the vehicle floor or wall to the external ambient atmosphere to ensure any localized out-gassing is exhausted safely outside the RV.
- Access Restrictions: If a battery box or custom compartment opens into the habitable living space, the access panel must be securely fastened into position. It must require a specialized tool or screws to remove. A permanent safety warning label must be applied to the hatch stating: “WARNING: This panel must remain sealed and securely fastened into position to comply with AS/NZS 3001.2:2022 Clause 5.4.12.2.”
- Chassis & Tunnel Boot Mounts: Installing the battery inside an external tool box, chassis-mounted tray, or a dedicated tunnel boot compartment completely isolated from the main cabin is highly recommended, as it naturally satisfies the external isolation standard

Additional Environmental Rules:

- Temperature Control & BMS Thermal Profiles: Your Daly JHB BMS monitors internal cell temperatures in real time. It will trigger a Level 1 Warning at 55°C, and will execute a full Safety Charge Cut-off if internal temperatures reach 65°C. For optimal lifespan, aim for an ambient operating environment below 45°C.
- Environmental Protection: Avoid locations exposed to direct sunlight, high-pressure water spray, salt spray, or heavy road debris.

- Thermal Isolation & Fuel Lines: Do not install the battery adjacent to high-heat sources such as exhaust systems, turbochargers, or diesel heaters without appropriate structural heat shielding. Additionally, per AS/NZS 3001.2, the battery must maintain a minimum 300mm clearance from any gas cylinders, diesel tanks, or fuel lines.

2.2 MOUNTING ORIENTATION

The internal construction of the 12VS range allows for flexible mounting options to suit tight spaces in 4WDs, caravans, and boats.

Upright (Recommended):

The standard and preferred orientation for optimal heat dissipation.

On-Side (Allowed):

The 12VS can be safely mounted on its long side or back if required by space constraints, as long as the terminals are not facing downward.

Upside Down (Prohibited):

DO NOT mount the battery upside down (terminals facing the ground) or on its short side with the terminals at the bottom. This places unnecessary mechanical stress on internal cell connections and prevents the BMS from dissipating heat correctly.

2.3 MOUNTING OPTIONS

Securing the battery is vital, especially in high-vibration environments like Off-Road 4WDing or Marine applications.

Mounting Method	Recommendation	Best For
12VS Stainless Steel Tray	Highly Recommended	4WD Canopies, Chassis mounts, and high-vibration environments.
Standard Battery Box	Recommended	Portable setups, internal van storage, or leisure use.
Heavy-Duty Straps	Minimum Requirement	Temporary setups where a fixed tray is not feasible.

Pro Tip: Our custom 12VS Stainless Steel Mounting Trays are specifically engineered for this battery range. They feature a 5mm Neoprene rubber base, which provides critical high-frequency vibration damping and acts as a thermal barrier to prevent heat-soak from the vehicle's metal surfaces to the battery cells.

2.4 BLUETOOTH SIGNAL & THE “FARADAY CAGE” EFFECT

Since your 12VS battery uses integrated Bluetooth for the DALY BMS App, the mounting location affects signal range.

Metal Enclosures: If the battery is installed inside a fully sealed metal canopy, aluminum toolbox, or thick steel battery box, the metal acts as a Faraday Cage, significantly blocking the Bluetooth signal.

Range Optimization: Depending on your specific 12VS model layout within our premium ABS casing, the BMS and its integrated Bluetooth antenna are positioned either directly at the terminal end panel or directly under the top lid cover. If you experience a weak wireless connection, ensure this specific face of the battery has a clear “line of sight” to a non-metallic window, canvas section, or gap..

2.5 MOUNTING BEST PRACTICES

Airflow Clearance:

Maintain at least 10mm of space around all sides of the battery. Airflow is essential for the BMS to stay cool during high-current discharge (e.g., running an air fryer or coffee machine).

Structural Fastening:

If utilizing our stainless steel tray, ensure it is bolted to a flat, load-bearing structural surface using high-tensile fasteners and large backing washers underneath the vehicle floor or canopy lining

Terminal Access:

Position the battery so the terminals remain easily accessible for routine torque maintenance and inspection. Ensure all heavy-gauge cables have enough structural “slack” so that chassis flex or vehicle movement does not pull on the battery terminal posts.

Weight Distribution:

While LiFePO4 is significantly lighter than lead-acid, large multi-battery banks accumulate weight quickly. Ensure your mounting platform or canopy sub-frame is safely rated for the total weight of the completed battery bank.

3. WIRING, CABLE SIZING & FUSING

High-performance lithium batteries can deliver massive amounts of current almost instantaneously. To ensure your system remains highly efficient and operating safely, the electrical “highway” (your cabling, terminals, and over-current protection) must be engineered to the highest local standards.

3.1 CABLE SELECTION & GAUGE GUIDE

To minimize voltage drop and hazardous heat generation, always utilize high-quality, multi-strand, oxygen-free copper cabling. For high-current applications - such as large multi-kilowatt inverters - running two smaller cables in parallel can provide equivalent current-carrying capacity while being significantly easier to mechanically bend and route in tight canopy or marine structural spaces.

CABLE SELECTION & GAUGE TABLE

Load Current (Amps)	Single Cable Area (mm²)	Nearest B&S/AWG Size	Parallel Dual-Cable Equivalent Run
<50A	8-10mm²	8 B&S / AWG	-
60-80A	13-25mm²	6 / 4 / 3 B&S / AWG	-
100-150A	35-50mm²	2 / 0 B&S / AWG	2 x 4 B&S / AWG
175-225A	70mm²	00 B&S / AWG	2 x 2 B&S / AWG
250-300A	95mm²	000 B&S / AWG	2 x 0 B&S / AWG
>325A	120mm²	0000 B&S / AWG	2 x 00 B&S / AWG

- **Insulation Standard:** All cables used must feature a minimum rating of V90 or TPE (105°C) flame-retardant insulation profiles to ensure safety under sustained high-load conditions.
- **Cable Length Compensation:** For total cable runs exceeding 3 meters (round trip), the installer must increase the cable cross-sectional area by one standard gauge size to combat voltage drop. Aim to keep voltage drop below a strict 3% threshold across the system footprint.
- **Dual Run Requirements:** When deploying parallel dual cables, both lines must be the exact same length, gauge, and termination style. Mismatched lengths introduce unequal resistance pathing, causing one cable to bottleneck, overheat, and prematurely trip the BMS over-current threshold.
- **Termination & Crimp Quality:** All battery cable lugs must be terminated using a professional, high-pressure industrial hex-crimping tool. DIY "hammer-indented" or soldered lugs leave internal micro-air pockets which deteriorate under vibration, creating localized resistance points that cause systemic heat failure and fire risks.

3.2 TERMINAL CONNECTION & TORQUE SETTINGS

The 12VS battery range utilizes high-conductivity internal connections terminating in rugged structural terminal posts matching our custom footprint configurations.

Achieving the precise mechanical torque specification is a critical factor in preventing high-resistance localized heating events and terminal failure. Over-tightening will permanently strip the internal threads, while under-tightening creates an electrical bottleneck and a severe fire hazard.

TORQUE SETTINGS TABLE

Terminal Thread Size	Recommended Mechanical Torque (Nm)	Engineering Application Notes & Footprints
M6	4 - 5 Nm	Deployed on our compact 105Ah custom casing footprint (223 x 150 x 180mm).
M8	7 - 9 Nm	Standard high-current terminal post used across our 50Ah, 105Ah, 163Ah, 304Ah, and 608Ah configurations.
M10	10 - 13 Nm	Ultra-heavy-duty high-current posts deployed on specialized 304Ah and 628Ah extreme capacity configurations.

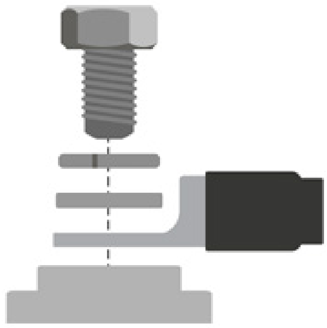
Routine Maintenance Protocol: Due to the severe structural cyclic vibrations encountered on corrugated off-road tracks or high-frequency marine hull slamming, you must re-torque all battery terminal fasteners after the first 10 hours of initial operation, and subsequently audit the torque values every 3 to 6 months.

3.3 THE HARDWARE STACK (ASSEMBLY ORDER)

The precise mechanical layout of the fastener stack dictates the efficiency of the electrical boundary layer. To minimize contact resistance, the high-current cable lug must always be clamped directly and flush against the flat battery terminal pad surface.

The Certified Stack Profile (Bottom to Top):

- **Base Layer:** Flat Battery Terminal Casing Face
- **Primary Layer:** Cable Lug (Direct, uninterrupted metal-to-metal contact is mandatory)
- **Secondary Layer:** Stainless Steel Flat Washer (Distributes the clamping force evenly)
- **Tertiary Layer:** Stainless Steel Split-Spring Lock Washer (Exerts continuous tension to prevent backing off)
- **Top Layer:** High-Tensile Terminal Bolt or Flanged Nut



⚠ **CRITICAL SAFETY WARNING:** ⚠

NEVER place a flat washer, spring washer, or fuse mounting tab between the structural battery terminal face and the cable lug. Placing any medium between these two surfaces increases electrical resistance, generating concentrated heat under load that will melt the ABS casing, destroy the internal connections, and cause an electrical fire.

3.4 FUSING & OVER-CURRENT PROTECTION ENGINEERING

Over-current safety in high-performance lithium systems is non-negotiable. Fusing architecture within the 12VS platform is strictly divided into three distinct functional categories: Branch Load Fusing, Main Battery Protection, and Parallel Bank Protection.

While a fuse's primary engineering objective is to protect downstream cabling from thermal breakdown, the fuse must also possess an adequate Ampere Interrupting Capacity (AIC). The AIC is the maximum fault current a fuse can safely interrupt without physically rupturing, shattering, or forming a sustained conductive plasma arc across its blown elements. Because our premium EV-Grade cells feature ultra-low internal resistance, a dead short will release thousands of Amps instantaneously. Traditional automotive blade or glass fuses must never be used

BRANCH LOAD FUSING (DEVICE PROTECTION)

Fusing for individual consumer circuits (e.g., refrigerators, water pumps, lighting circuits, DC-DC chargers) is dictated solely by the current draw of the appliance and the cross-sectional area of the supply cable.

- **Purpose:** To isolate a single faulted appliance and prevent the downstream cable from melting or causing a structural vehicle fire.
- **Sizing Principle:** The fuse rating must be higher than the maximum peak draw of the device, but strictly lower than the maximum safe current-carrying capacity of the cable.
- **Approved Types:** Blade, MIDI, MEGA, ANL, MRBF, Class T or high-quality thermal-magnetic circuit breakers from certified manufacturers (such as Blue Sea Systems, Bussmann, Littelfuse, PEC, Adler or Mechanical Products)

3.4.2 MAIN BATTERY PROTECTION (SYSTEM SAFETY)

This acts as the catastrophic fail-safe protection layer and must be positioned on the primary positive line as close as physically possible to the battery terminal. Unlike individual branch fuses, the main system fuse is sized based on the total collective continuous load of your entire distribution network (e.g., matching the maximum DC intake of a large inverter).

Fuse Type	True Certified AIC (Interrupting Capacity)	Maximum DC Voltage Rating	Engineered System Application
MIDI	5000A @ 16V DC 2000A @ 32V DC 1000A @ 58V DC	58V DC	Small branch loads and isolated DC-DC charger inputs up to 125A
MEGA	2,500A @ 70V DC	70V DC	Medium system loads and primary protection for independent batteries up to 300A
ANL	6,000A @ 80V DC	80V DC	Large inverter supply lines and heavy-duty common positive distribution bars.
MRBF	10,000A @ 14V DC 5,000A @ 32V DC 2,000A @ 58V DC	58V DC	Terminal-mounted main system protection for single battery banks up to 300A
Class T	20,000A @ 125V DC	125V DC	Mandatory for heavy multi-battery parallel arrays and large off-grid systems.

PARALLEL PROTECTION & BANK SEGREGATION

When linking multiple 12VS lithium batteries in parallel to increase capacity, their individual prospective short-circuit currents add together mathematically $(\mathrm{I}_{\text{total}} = \mathrm{I}_{\text{sc1}} + \mathrm{I}_{\text{sc2}} + \mathrm{I}_{\text{sc3}} + \ldots.)$.

If a short-circuit fault occurs internally within one of the cells or battery casings, all other parallel units in the bank will dump their combined energy into the faulted unit.

To comply with AS/NZS 3001.2 and prevent catastrophic case rupture, each individual battery within a parallel array must be independently fused before tying into a common parallel Busbar.

```
[ Battery 1 + ] ===> [ Individual MRBF / Class T Fuse ] ---+
                                                           |===> [ COMMON BUSBAR ]
[ Battery 2 + ] ===> [ Individual MRBF / Class T Fuse ] ---+
```

- **Why Class T is Mandatory for Large Banks:** Marine Rated Battery Fuses (MRBF) are highly efficient, space-saving options providing 10,000A AIC at 14V nominal. This is perfectly suited for small setups. However, once you parallel large, high-capacity automotive-grade packs, the prospective fault current easily scales beyond 10,000A.
- **Arc Quenching:** Class T fuses are the only readily available consumer fuses containing specialized internal granular silica sand element packaging. When the fuse blows under a massive short, the sand instantly melts into non-conductive glass, snapping the electrical arc shut instantly and safely containing the energy.

If your main system fuse works out to be 300A, each individual battery must have a 300A fuse (or closer to its individual maximum capability) and matching heavy-gauge cabling to the Busbar.

Below is the reason why each battery needs a higher rated fuse, rather than dividing the main fuse by the number of batteries like you would on a load output using multiple positive/negative cables:

THE PHYSICS OF CURRENT SHARING

Why 3 x 100A Fuses Fail: While a 3-battery parallel bank theoretically splits a 300A load perfectly into 100A per battery, in the real world, current never shares exactly 33.3% across lithium banks due to tiny micro-ohm resistance differences in cable lengths, lugs, or cell states of charge.

More importantly, if one battery's internal BMS trips or disconnects for any reason (e.g., cell balancing calibration, a transient temperature spike, or a cell over-voltage warning), the remaining two operational batteries must immediately shoulder the entire 300A load. If they are fused at 100A each, those fuses will instantly blow in a cascading fashion, completely shutting down the vehicle's electrical network and leaving the user stranded.

Cable Sizing and Safety Rules: The engineering rule for sizing parallel battery leg protection is straightforward. The individual cable running from each battery to the Busbar must be rated to handle the full capacity of that individual battery's fuse.

If you use a 300A Class T fuse on each battery output, the cable between that battery and the parallel Busbar must be sized to handle 300A cleanly (e.g., 95mm^2 or dual 50mm^2) as per the cable chart).

Alternatively, if your individual battery is physically limited to a maximum continuous output of 150A by its internal BMS, you can fuse that specific battery stalk at 175A/200A to match its independent output ceiling, sizing the cable to match.

3.5 OVER-CURRENT PROTECTION & FAULT CURRENT ANALYSIS

SYSTEM PROSPECTIVE SHORT-CIRCUIT CURRENT $(\mathrm{I_{cp}})$ REFERENCE MATRIX

To satisfy strict compliance under Australian installation standards (AS/NZS 3001.2), the matrix below outlines the calculated Prospective Short-Circuit Current $(\mathrm{I_{cp}})$ for each custom footprint model in the 12VS lineup.

These metrics dictate the absolute peak instantaneous fault current a battery container will deliver if a zero-resistance dead short is applied directly across the external casing terminals at a 100% State of Charge (SoC).

```
            [ External Casing Short-Circuit Fault ]
                              ||
                   +-------------+-------------+
                   |                           |
       [ Cell Matrix ACIR ]     [ BalanceBMS On-Resistance ]
                   |                           |
                   +-------------+-------------+
                                 |
            [ Internal Busbar & Stud Resistance ]
```

THE SHORT-CIRCUIT PHYSICS FORMULA:

$$I_{cp} = \frac{V_{max\_pack}}{R_{cells\_total} + R_{BMS} + R_{internal\_connections}}$$

Where:

- v_{max_pack} = The absolute upper voltage boundary of the series string at full absorption charge floor
  $$N_{series} + 3.65v$$
- R_{cells_total} = The collective internal AC Impedance (IR) of the cells, calculated as:
  $$\frac{N_{series} \times R_{cell\_impedance}}{N_{parallel}}$$
- R_{BMS} = Main circuit on-resistance specified by the BalanceBMS hardware datasheet (<20 μΩ or 0.00002Ω)
- $R_{internal\_connections}$ = [Factory Engineering Estimate] The combined structural resistance of the factory laser-welded M6/M8 threaded studs paired with premium internal aluminium linking busbars.

SYSTEM PROSPECTIVE SHORT-CIRCUIT CURRENT (I_{cp}) REFERENCE TABLE

Pack Profile	Cell Model & Internal Layout	Factory Cell ACIR Specification	System Upper Voltage (V_max)	Standalone Short Current (I_cp)	Max Parallel Units per single Busbar (MRBF)	Max Parallel Units per single Busbar (Class T)
12V 105Ah	EVE LF105 (4S1P)	≤0.50mΩ	14.6V	5,910.93 A	Max 2 Units	Max 4 Units
12V 163Ah	CALB L173F163 (4S1P)	≤0.50mΩ	14.6V	5,910.93 A	Max 2 Units	Max 4 Units
12V 304Ah	EVE LF304 (4S1P)	≤0.50mΩ	14.6V	5,910.93 A	Max 2 Units	Max 4 Units
12V 608Ah	EVE LF304 (4S2P)	≤0.250mΩ (parallel)	14.6V	9,229.36 A	PROHIBITED	Max 3 Units
12V 628Ah	EVE MB56 (4S1P)	≤0.10mΩ	14.6V	17,804.88 A	PROHIBITED	Max 2 Units
24V 50Ah	EVE LF50K (8S1P)	≤0.70mΩ	29.2V	4,657.10 A	Max 2 Units	Max 5 Units
24V 163Ah	CALB L173F163 (8S1P)	≤0.50mΩ	29.2V	6,252.68 A	PROHIBITED	Max 4 Units
24V 304Ah	EVE LF304 (8S1P)	≤0.50mΩ	29.2V	6,252.68 A	PROHIBITED	Max 4 Units
36V 105Ah	EVE LF105 (12S1P)	≤0.50mΩ	43.8V	6,375.55 A	PROHIBITED	Max 4 Units
48V 105Ah	EVE LF105 (16S1P)	≤0.50mΩ	58.4V	6,438.81 A	PROHIBITED	Max 4 Units

TECHNICAL INSIGHT: WHY CAPACITY (AH) DOES NOT DICTATE SHORT-CIRCUIT CURRENT

A common misconception is that a battery's storage capacity (Ah) is the primary metric driving its short-circuit output capacity. This is incorrect.

- Capacity (Ah): Dictates the volumetric runtime of the energy reservoir (how long the battery can sustain power over hours).
- Internal Resistance (IR): Actively restricts the immediate flow of power (how fast the battery can dump its complete chemical energy in a fraction of a second).

When a dead short circuit drops electrical resistance down to zero ohms, the battery chemistry attempts to discharge an infinite volume of current. The only factor in the physical universe preventing this spike from hitting infinity is the combined internal micro-ohm (μΩ) or milliohm (mΩ) structural limits of the internal pack.

Because Ohm's Law states (I = V/R), if a 105Ah pack, a 163Ah pack, and a 304Ah pack all share a matching nominal voltage framework (14.6V) peak) and match on maximum internal cell factory resistance limits (≤0.5mΩ), their initial peak prospective short-circuit surge must mathematically map identically, regardless of the energy capacity held in the respective containers.

MANDATORY PARALLEL BANK SAFETY RULES & INDIVIDUAL BATTERY LINE FUSING

When coupling multiple 12VS lithium batteries in parallel to scale up your storage network capacity, you MUST isolate and independently protect every single container using a dedicated Individual Battery Fuse before the lines link into a common parallel Busbar.

```
[ 12VS Battery Pack 1 ] ===> [ Individual Battery Fuse ] ---+
                                                            |===> [ COMMON SYSTEM BUSBAR ]
[ 12VS Battery Pack 2 ] ===> [ Individual Battery Fuse ] ---+
```

The N-1 Fault Safety Law:

If an internal structural insulator breaks or a component failures causes a dead short inside one specific battery case, all other parallel batteries connected to that same Busbar will instantly discharge their complete available energy down into that single fault point. Therefore, the Individual Battery Fuse on that faulted line must safely handle the combined fault load of all remaining companion packs combined $\mathrm{I}_{\text{fault\_load}} = [\mathrm{N} - 1] \times \mathrm{I}_{\text{cp}}$

Individual Battery Line Sizing Principle:

Do NOT divide the main system distribution fuse rating by the total number of parallel batteries (e.g., placing 100A fuses on three parallel batteries to feed a 300A main trunk line). If a single battery BalanceBMS executes a temporary cell-balancing calibration or safety temperature disconnect, the remaining operational fuses will instantly face cascading over-current failures. Every Individual Battery Fuse must be sized to handle the independent maximum peak continuous output capacity of its own internal BalanceBMS framework.

Cable to Fuse Matching:

The electrical delivery cabling feeding from each individual battery terminal post to the parallel Busbar (the individual battery line) must feature a continuous current cross-sectional area that safely matches or exceeds the continuous capability of that Individual Battery Fuse.

Voltage and Material Exclusions:

12V & 24V Systems: Marine Rated Battery Fuses (MRBF) are permitted on individual battery lines, provided the collective fault current calculation of your bank size does not violate the strict de-rated boundaries shown in table 3.5.1.36V & 48V Systems: MRBF profiles are completely prohibited due to structural high-voltage boundaries. Class T fuses (rated for 125V DC) are mandatory on every battery line.

THE CRITICAL DIFFERENCE: ELEMENT ENGINEERING & ARC QUENCHING

As shown in our reference matrix, the maximum number of parallel batteries allowed per single Busbar shifts dramatically based on whether you install an MRBF terminal fuse or an industrial Class T fuse. This is governed by how these two safety devices physically extinguish a massive Direct Current (DC) plasma arc flash.

Marine Rated Battery Fuses (MRBF) — Open-Air Interrupting

An MRBF contains an open metal alloy link encapsulated inside a tiny clear plastic housing. When thousands of fault Amps flow through the link, the metal vaporizes instantly.

However, because the chamber is hollow and filled with air, the vaporized metal forms a super-heated, highly conductive ionized gas cloud. The intense continuous DC voltage tries to bridge the gap, forming a sustained plasma arc flash. If the prospective current scales near or past the fuse's testing limit (10,000A at 12V, or de-rated to 5,000A at 24V), the pressure can explode the plastic body, failing to break the circuit.

Industrial Class T Fuses (Bussmann JJN / Littelfuse JLLN) — Sand-Quenched Interrupting

Class T fuses are engineered inside a heavy-duty, high-temperature structural ceramic chassis. The internal metal element pathway is entirely embedded in highly pure, tightly compacted granular silica sand.

The exact microsecond a short circuit occurs and the element vaporizes, the surrounding silica sand instantly absorbs the immense thermal energy of the fault. The sand immediately melts and fuses into a solid bar of non-conductive glass right across the break zone. This action physically starves the plasma arc of energy, snapping the circuit shut instantly and containing the explosion safely inside the ceramic casing.

Because Class T fuses are designed with this advanced sand-quenched architecture, their certified 20,000A DC safety rating is highly stable, making them required to maintain AS/NZS 3001.2 compliance as your parallel battery bank expands.

Scaling Beyond Single Busbar Limits (Up to 16 Parallel Units)If you are building an ultra-capacity system reaching our maximum design ceiling of 16 parallel units, you cannot bolt all 16 batteries onto a single Busbar pair. The collective fault potential will destroy the fuses. Installers must deploy a Modular or Fused Sub-Bank Topology (utilizing heavy-duty modular hardware like the Victron Lynx Class T system). Split your 16 batteries into isolated sub-clusters of 2 to 4 units (depending on your specific model limits in table 3.5.1). Each cluster must possess its own main sub-bank fuse before routing into the primary distribution network.

AUSTRALIAN REGULATORY COMPLIANCE STANDARDS

The engineering parameters, fusing requirements, and parallel distribution rules outlined throughout Section 3.5 are designed to meet or exceed the statutory safety requirements of AS/NZS 3001.2:2022 (Electrical installations — Transportable structures and vehicles including their site supplies).

Installers must ensure the completed battery bank deployment complies with the following mandatory regulatory foundations:

- **AS/NZS 3001.2 Clause 5.4 —** Installation of Extra-Low Voltage (ELV) Storage Batteries: Dictates the structural protection, venting, and isolation requirements for lithium battery banks installed within transportable structures and vehicles.
- **AS/NZS 3001.2 Clause 5.4.2 —** Over-current Protection: Explicitly mandates that every independent battery circuit must incorporate over-current protection (fusing or circuit breakers) sized strictly to protect the connected conductor pathways against both prolonged over-current events and catastrophic short-circuit faults.
- **AS/NZS 3001.2 Clause 5.4.5 —** Parallel and Series Connections: Requires that all interconnected battery banks use identical chemistries, capacities, and states of charge, and that the wiring geometry must provide equal resistance pathing to prevent uneven current loading.

Compliance Mandate: Under West Australian law, all high-current DC installations within caravans, motor-homes, commercial vessels, and off-grid platforms must be audited and executed by a qualified auto electrician or certified electrical contractor. Failure to comply with AS/NZS 3001.2 wiring rules immediately voids your 12VS manufacturer warranty and may invalidate your comprehensive vehicle or marine insurance policy.

4. MULTI-BATTERY CONNECTIONS: SERIES & PARALLEL CONFIGURATIONS

Expanding your energy storage footprint requires precise wiring geometry to ensure long-term balance, safety, and systemic cell health. Mismatched resistance pathways within multi-battery banks will cause uneven current sharing, forcing individual packs to overheat, bottleneck, and suffer accelerated capacity degradation.

4.1 PRE-CONNECTION MANAGEMENT & SYNCHRONIZATION

Before physically connecting two or more 12VS batteries together in any series or parallel arrangement, installers should check that the packs are normal and operational via the DALY BMS app.

Unlike legacy lithium batteries that require strict pre-balancing protocols, narrow millivolt alignment windows, and identical model capacities to prevent dangerous cross-pack current surges, your 12VS Smart Lithium Battery is engineered for simplified hot-swapping and flexible system scaling

Integrated JHB Parallel Current-Limiting Modules:

Your integrated DALY JHB Smart Active Balance BMS is manufactured with an onboard intelligent parallel current-limiting module. When multiple 12VS batteries are connected together to form a common bank, the JHB hardware automatically detects any state-of-charge or voltage differences between the packs. If a voltage delta exists, the BMS instantly engages its inline current-throttling circuitry, safely capping the cross-pack current transfer to a pre-set internal limit while the batteries smoothly align themselves automatically.

Cross-Capacity Paralleling Permitted:

Because of this advanced inline current regulation, the traditional engineering rule restricting parallel setups to identical capacities is completely eliminated.

- The Capability: You can safely mix and match different battery capacities within the 12VS parallel lineup (e.g., connecting a 12V 105Ah battery in parallel with a 12V 304Ah battery on the same single Busbar) providing they have the same series BMS
- How it works: The internal parallel modules dynamically throttle and balance current distribution based on each battery's individual capability, ensuring the larger pack safely shoulders a proportionally larger share of the system load while the smaller pack is protected from over-stress.

Synchronization Protocol: Because of this integrated balancing control, you do not need to manually top-balance the individual packs to a matching voltage before assembly. Simply bolt the batteries straight into your desired bank topology. The DALY JHB framework will handle the energy synchronization safely in the background. For optimal efficiency, it is still recommended to charge all units to roughly the same approximate charge level where practical.

4.2 PARALLEL CONFIGURATIONS: TOPOLOGIES FOR EXPANDING CAPACITY

Connecting multiple 12VS batteries in parallel combines their capacity (Ah) while keeping the system voltage identical to a single battery profile. To comply with AS/NZS 3001.2 Clause 5.4.5, parallel conductors must be configured to provide equal resistance pathing across the entire bank array.

Based on the engineering frameworks outlined in the Victron Energy Wiring Unlimited manual, installers must adhere strictly to the following configuration hierarchy:

CRITICAL PROHIBITION: SAME-END TERMINAL CONNECTION

🚫You **MUST NEVER** connect both the main system positive and the main system negative distribution cables to the same battery terminals at one end of a parallel chain.

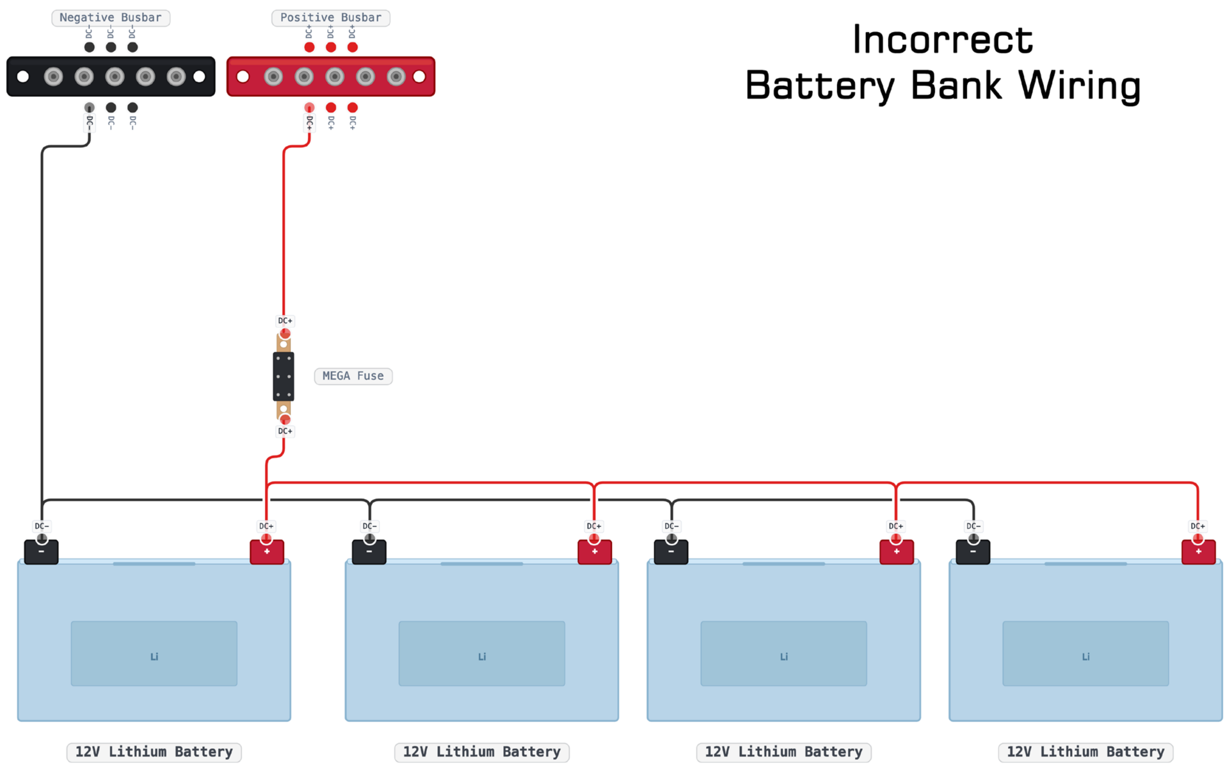
It matters how a battery bank is wired into the system. When wiring a battery bank, it is easy to make a mistake. One of the most common mistakes is to parallel all the batteries together and then connect one side of the parallel battery bank to the electrical installation. As indicated in the image above.

The Operational Danger:

Because electricity follows the path of least resistance, the battery closest to the main cable take-offs (Battery 1) will be forced to shoulder the vast majority of the collective system charge and discharge current. The companion packs further down the chain will remain severely underutilized due to cumulative cable resistance.

This creates an aggressive thermal imbalance, overloads the primary battery's BMS, and will prematurely destroy the entire bank.

The correct way of connecting multiple batteries in parallel is to ensure that the total path of the current in and out of each battery is equal.



TOPOLOGY A: COMMON BUSBAR ARCHITECTURE

Every individual battery within the parallel bank runs its own dedicated positive and negative conductor cables straight to heavy-duty, centrally mounted common positive and common negative busbars.

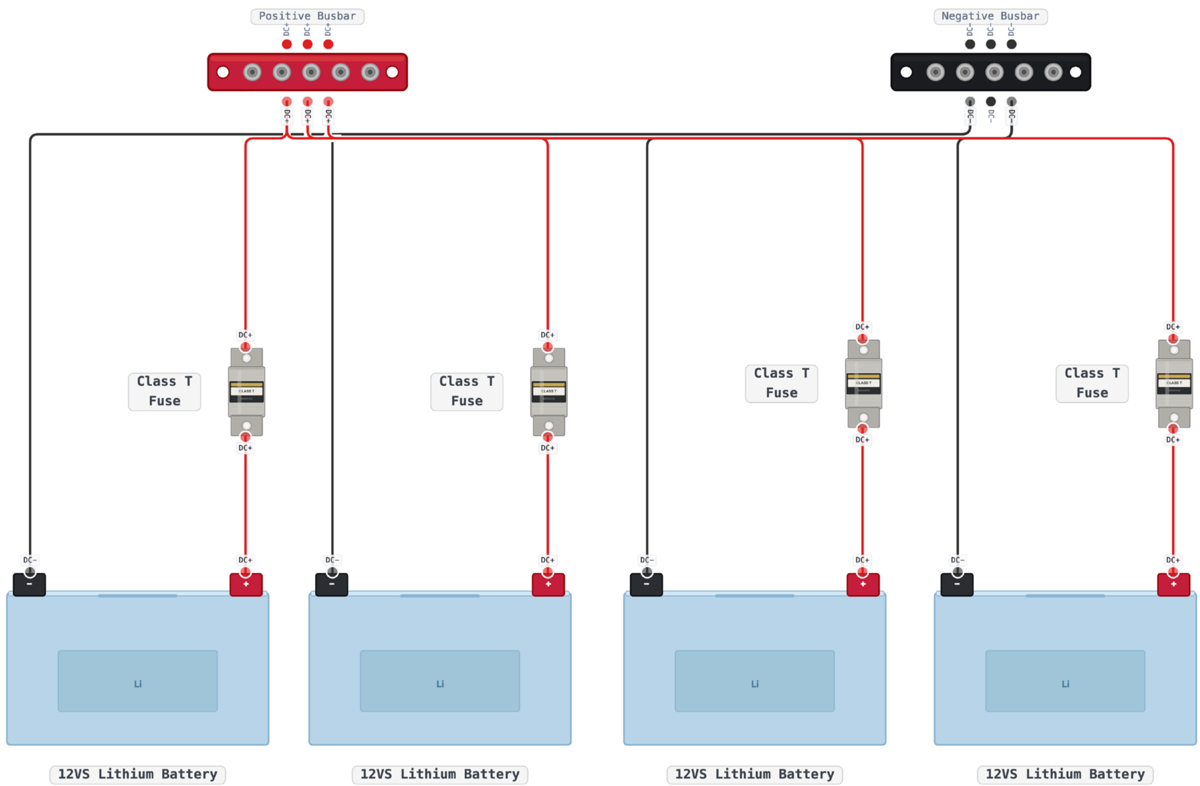
Engineering Requirement:

Every independent conductor pathway running from the battery posts to the common busbars must feature the exact same thickness (gauge) and the exact same physical length.

Fusing Advantage:

This represents the ultimate safety layout because it allows an Individual Battery Fuse (MRBF or Class T) to be mounted on each individual battery line prior to joining the common Busbar junction, fully matching the requirements established in Section 3.5.

Correct Battery Bank Wiring with Class T Parallel Fusing

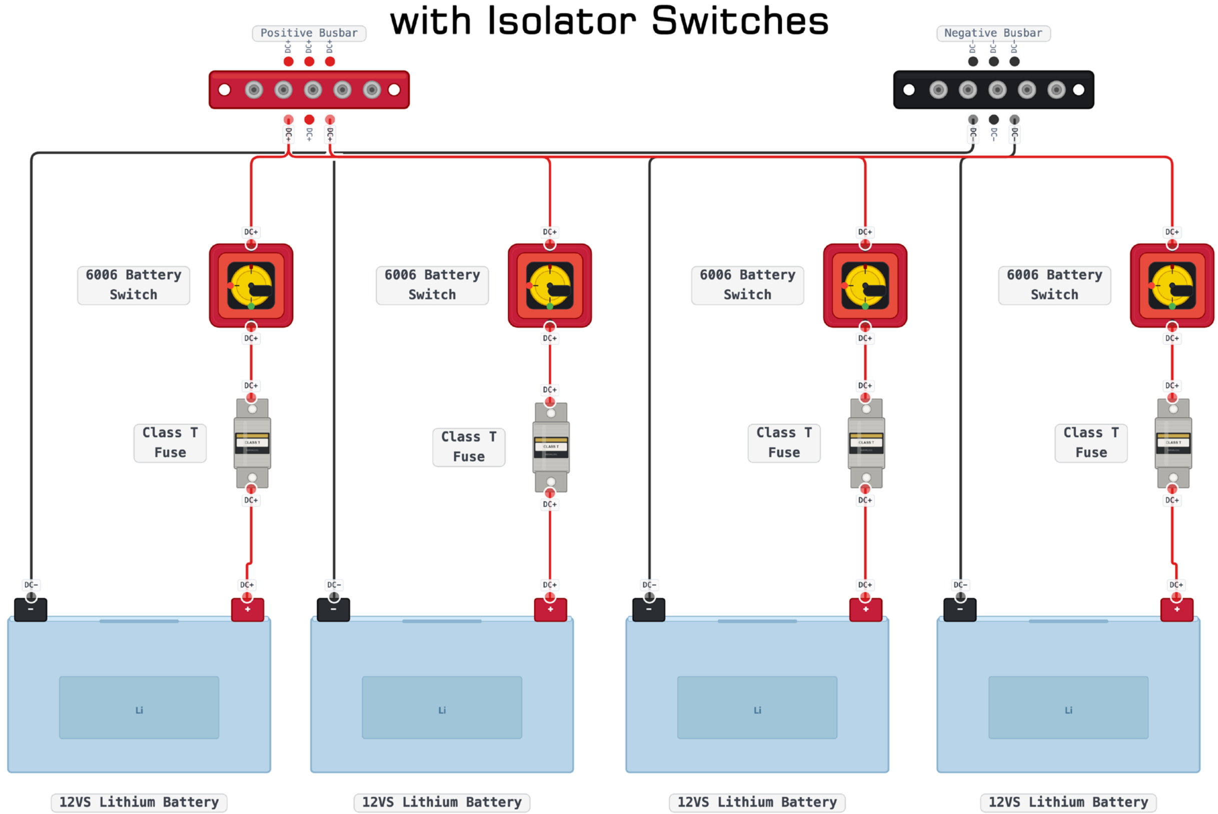


TOPOLOGY B: COMMON BUSBAR ARCHITECTURE WITH ISOLATOR SWITCH

Every individual battery within the parallel bank runs its own dedicated positive and negative conductor cables straight to heavy-duty, centrally mounted common positive and common negative busbars, along with isolators on each parallel lead.

This allows you to isolate a single battery in a parallel system and have the remaining still run the system.

Correct Battery Bank Wiring with Class T Parallel Fusing with Isolator Switches



TOPOLOGY C: CROSS-DIAGONAL POST-TO-POST LINK (ACCEPTABLE FOR SMALL BANKS)

Batteries are physically arrayed in a row and linked terminal-to-terminal using heavy copper links or equal-length jumper cables. The primary positive feed to your vehicle's electrical system is taken from the first battery in the chain, while the primary negative feed is taken from the last battery in the chain.

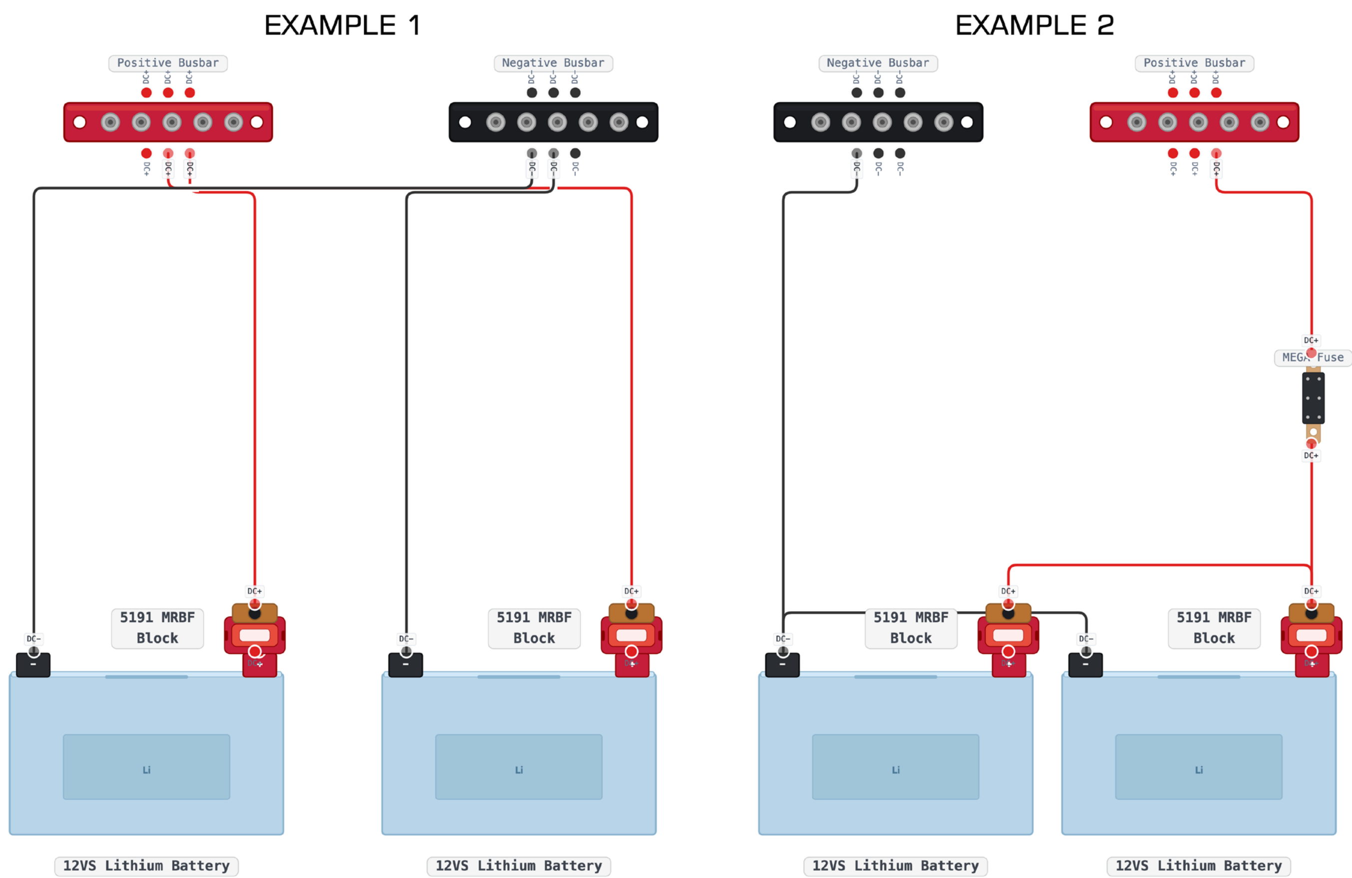
The Balancing Effect:

This diagonal configuration forces the current to travel through an equal length of interconnecting cable regardless of which cell container it flows through, effectively normalizing the voltage drop across the bank.

Fusing Constraint:

If utilizing this layout, the batteries must be individually protected using terminal-mounted MRBF fuses on each battery post, and the bank must remain within the strict single Busbar capacity limits mapped in Section 3.5.1.

Correct Battery Bank Wiring with MRBF Parallel Fusing



5. CHARGING PARAMETER & ALGORITHM CONFIGURATION

Lithium Iron Phosphate (LiFePO4) chemistry requires a fundamentally different charging architecture than traditional lead-acid, AGM, or Gel batteries. To maximize the operational lifespan and ensure complete cell-capacity utilization, you must utilize a charging system—including AC Mains Chargers, DC-DC In-Vehicle Chargers, and Solar MPPT Regulators—featuring a dedicated, native LiFePO4 profile.

We highly recommend utilizing commercial-grade charging hardware from Victron Energy, Enerdrive, Projecta or Redarc to guarantee precise voltage regulation and superior top-balancing performance.

5.1 CHARGE PROFILE SETTINGS & VOLTAGE PARAMETERS

Charge Stage	Recommended Target Settings (12V Nominal)	Absolute Maximum Limit (12V Nominal)	Operational Engineering Protocol
Bulk	14.2 V - 14.4 V	14.6 V	Constant Current (CC) stage. The charger outputs its maximum rated current while voltage climbs. If utilizing a fixed-profile charger, the default pre-programmed 14.6V Lithium Profile is acceptable.
Absorption	30 - 60 Minutes (Total Bank)	2 Hours	Constant Voltage (CV) stage. The charger holds the voltage flat while the current tapers down, allowing the active balancer to execute cell calibration. Do NOT multiply absorption time by the number of parallel batteries.
Float	13.5 V	13.6 V	Constant Voltage (CV) stage. Maintains the pack at 100% capacity without inducing internal chemical cell stress.
Equalization	DISABLED / OFF	PROHIBITED	CRITICAL: Equalization forces high-voltage pulses designed to de-sulfate lead-acid plates. This will permanently destroy lithium cells and void your warranty.
Temp. Compensation	DISABLED / OFF	PROHIBITED	Lithium chemistry does not require voltage drift relative to ambient tracking. Disable to prevent hazardous voltage inflation.

Proportional Charging Current Rule:

For optimal cell longevity, the continuous charging current should be regulated to approximately 30% of the total battery bank capacity (0.3C rate). While your integrated cells are fully rated to tolerate higher maximum intake profiles during rapid-charge scenarios, sticking to the 30% baseline minimizes internal thermal buildup and extends cycle lifespans.

Bank Sizing Adjustments:

To ensure a stable window for top-balancing, configure your fixed absorption timers relative to the total size of your completed battery network:

- Small Banks (1 to 2 Batteries): Set to exactly 30 Minutes total absorption duration.
- Large Banks (3 to 16 Batteries): Set to exactly 60 Minutes total absorption duration.

VICTRON ENERGY OPTIMIZATION PROTOCOL:

If you are configuring a Victron Energy charger (such as a SmartSolar MPPT, Blue Smart AC Charger, or Orion DC-DC) via the VictronConnect App, you must change the absorption setting from “Adaptive” to “Fixed”.

Why this is mandatory:

Victron’s default Adaptive profile calculates absorption time based on lead-acid chemical behaviors, which will over-saturate a large lithium bank and potentially trip the BalanceBMS into high-voltage protection mode. Manually adjust the app parameters to Fixed Absorption and set the duration timer to 30 minutes for single/twin packs, or 60 minutes for multi-battery arrays. This locks the holding window to the exact duration required for the integrated active balancers to execute top-calibration safely.

DECONSTRUCTING THE THREE-STAGE CHARGING LIFECYCLE

CC (Constant Current) Stage:

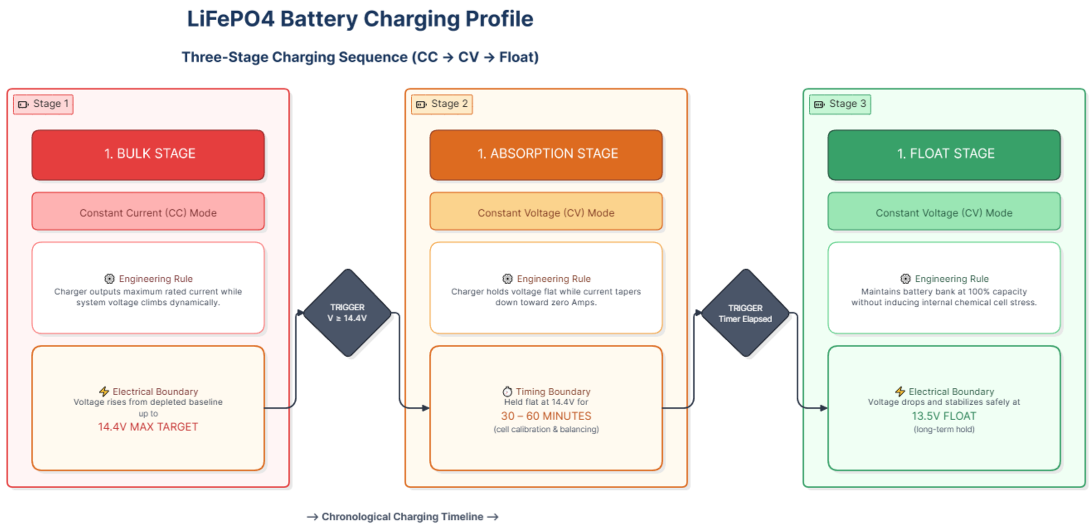
This is the Bulk stage. The charger forces its maximum current (Amps) into the battery, causing the system voltage to climb steadily until it hits your target absorption ceiling (14.2V - 14.4V). This phase bulk-loads approximately 95% of the total capacity back into the cells at maximum speed.

CV (Constant Voltage) Stage:

This is the Absorption stage. The moment the voltage hits that (14.2V - 14.4V) target, the charger locks the voltage completely flat and holds it constant. The current (Amps) then naturally begins to taper down toward zero as the internal resistance of the cells fills up completely and the active balancers top-balance the pack.

Float Stage:

This is the Maintenance stage. Once the absorption timer expires or the current tapers down to zero, the charger drops its voltage output down to a resting state (13.5V - 13.6V). This holds the battery fully charged safely and powers any ongoing vehicle loads (such as fridges or lights) directly from the charger, removing all chemical stress from the lithium cells.



5.2 ENVIRONMENTAL TEMPERATURE CONSTRAINTS

Your 12VS Smart Lithium Battery monitors real-world internal temperatures via integrated thermal sensors embedded directly into the cell packs.

- Safe Charging Temperature Floor: 0°C to 45°C
- Safe Discharging Temperature Floor: -20°C to 60°C

⚠ CRITICAL LOW-TEMPERATURE WARNING: NEVER force charging current into a LiFePO4 battery if the internal cell core temperature has dropped below 0°C Charging in sub-freezing environments forces the lithium ions to accumulate on the surface of the carbon anodes instead of embedding inside them. This creates permanent "Lithium Plating", inducing irreversible internal micro-short circuits, structural case destruction, and catastrophic fire hazards.

- Integrated Automated Safety: Your next-generation 100Balance JHB BMS features integrated low-temperature charge protection. If your vehicle or vessel is operating in extreme sub-freezing regions, the BMS will automatically execute a hardware block on all incoming charge currents if the internal cells hit 0°C while still safely permitting downstream loads to draw discharge current down to -20°C

5.3 HARDWARE COMPATIBILITY, NON-LITHIUM, & VSR WARNINGS

Smart Alternator & Vehicle Integration (No VSRs)

You MUST NEVER connect a 12VS lithium battery directly to a vehicle starting battery using a legacy Voltage Sensitive Relay (VSR) or standard smart-solenoid dual-battery isolator.

Because lithium batteries maintain a high, flat resting voltage curve (typically >13.3V) even when partially discharged), their resting potential will trick a legacy VSR into remaining continuously latched "ON". This creates an uninterrupted circuit that will continuously drain your high-capacity lithium bank backward straight into the vehicle starting battery, completely flattening your starting cell or overloading the vehicle's alternator wiring. All vehicle alternator charging installations must run exclusively through a dedicated, current-limiting DC-DC Battery Charger featuring an orange-wire profile or digital lithium mapping (such as a REDARC BCDC or Victron Orion).

Non-Lithium Smart AC Chargers

While emergency charging via a traditional lead-acid AC smart charger is technically possible under strict, constant human supervision, it is heavily discouraged

Traditional automotive chargers lack the necessary voltage cutoff parameters required for lithium profiles. They may attempt to initiate high-voltage "reconditioning" stages, desulfation cycles, or pulse-charge algorithms that will confuse the 100Balance BMS, cause extreme localized terminal heating, and permanently void your manufacturer product warranty

5.4 UNDERSTANDING STATE OF CHARGE (SOC) DRIFT & SYNCHRONIZATION PROTOCOLS

State of Charge (SoC) tracking inside the DALY BMS App and physical External Battery Shunts relies on an automated mathematical process called Coulomb Counting (measuring the volume of current entering or leaving the cells over a timeline). Because LiFePO4 cells maintain a highly stable, flat voltage profile across their operational runway, smart sensors cannot determine remaining capacity by voltage tracking alone.

THE CAUSE OF SOC DRIFT

All digital current sensors are subject to minute measurement tolerances. If a battery bank undergoes continuous shallow discharge cycles (e.g., repeatedly drawing down by only 10% to 20% before recharging, which is highly common in solar-focused or canopy standby builds) or spends months resting in long-term seasonal storage, these minor tracking variances begin to accumulate.

This tracking error is known as SoC Drift. Over an extended period without a full reset event, the app or shunt display might report a calculated capacity reading that deviates significantly from the actual, physical chemical capacity of the cell matrix.

THE 100% RE-SYNCHRONIZATION PROTOCOL

To clear out cumulative sensor inaccuracies and reset your tracking baselines to a true 100% reference baseline, the battery bank must undergo a Full Saturation Reset.

THE RECALIBRATION WINDOW:

For systems in continuous daily service or undergoing shallow cycles, you must force a complete 100% charge saturation once every 14 to 30 days. For systems waking up from long-term off-season storage, this protocol must be executed immediately prior to putting the vehicle or vessel back into active service.

HOW TO SYNC THE DALY BMS APP:

Connect your primary multi-stage charger. Force the system to pass completely through the Constant Current (Bulk) stage until it hits the target Constant Voltage (CV) Absorption ceiling (14.2V–14.4V). The charger must hold the battery at this target voltage for a fixed 30 to 60 minutes total.

Once the cell internal resistance rises and the current tapers down to zero (tail current threshold), the internal DALY BMS microchip will automatically snap its internal software register back to a calibrated, absolute 100% SoC mark.

HOW TO RECALIBRATE EXTERNAL SHUNTS (VICTRON SMARTSHUNT / BMV):

While your individual battery app resets itself automatically via voltage saturation, an external physical network shunt (such as a Victron SmartShunt or BMV-712) tracks the whole bank and can require manual alignment.

If your shunt fails to automatically re-synchronize after the battery bank spends a full hour in the absorption stage, open your VictronConnect App and navigate to your shunt device. Go to the battery configuration settings page and manually tap the button labeled “Sync SoC to 100%”. This locks the shunt back into a perfect zero-point calibration matching the true status of your 12VS battery bank.

6. BLUETOOTH APP & REAL-TIME MONITORING

Your 12VS battery is equipped with integrated Bluetooth connectivity, linking directly to its internal monitoring network. This allows you to audit individual cell health, verify operational safety margins, and track live power throughput straight from your smartphone.

6.1 DOWNLOADING THE OFFICIAL "DALY BMS" APP

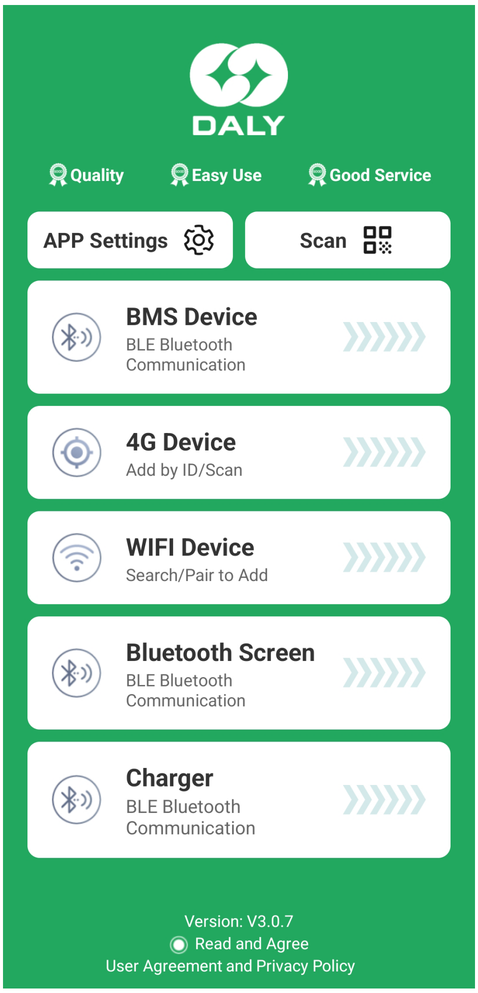
To communicate with your battery, download the official "DALY BMS" application developed By DalyBMS from your mobile app store.

IOS Devices: Search for "DALY BMS" in the Apple App Store. Or CLICK HERE

Android Devices: Search for "DALY BMS" in the Google Play Store. Or CLICK HERE

6.2 INITIAL LANDING PAGE & DEVICE SELECTION

When you first open the software application on your mobile device, you will be presented with the primary application landing screen ("Main Welcome Interface").



System Permissions: Prior to connection, verify that your smartphone's Bluetooth and Location Services (GPS) are both toggled to ON. Note: Mobile operating systems strictly require location permission to allow Bluetooth Low Energy (BLE) peripheral scanning.

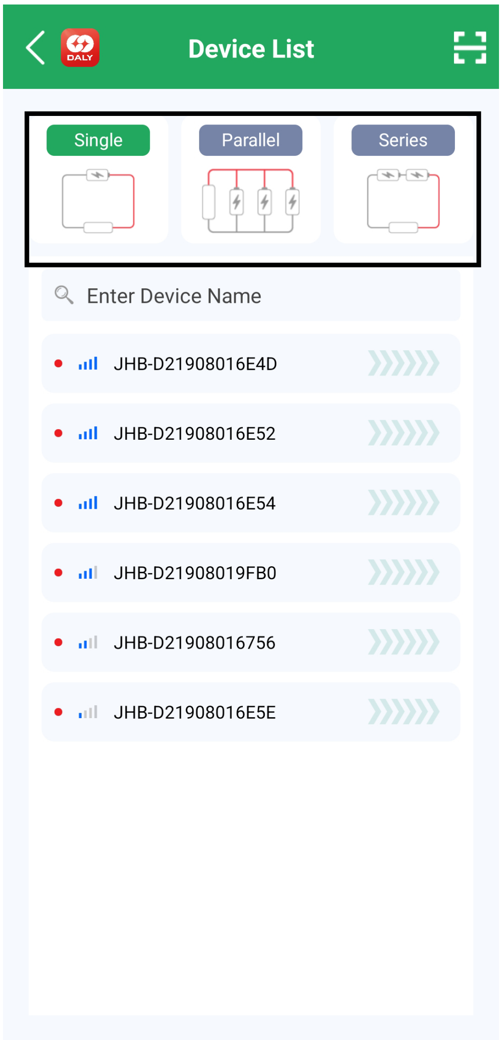
Accept Terms: Check the circular radio button at the bottom of the interface to acknowledge and agree to the User Agreement and Privacy Policy.

BMS Discovery: Tap the top white module block labeled "BMS Device". This will route you directly to the peripheral scanning workspace.

NOTE: In APP Settings, you can change the APP theme (background colour). There are 4 colours to choose from, Red (Default), Green, Black & Blue

6.3 NAVIGATING THE DEVICE LIST SCREEN HUB

Tapping “BMS Device” opens the central Device List page. This is the central hub where you control how the app connects to your hardware, depending on your physical battery installation topology.

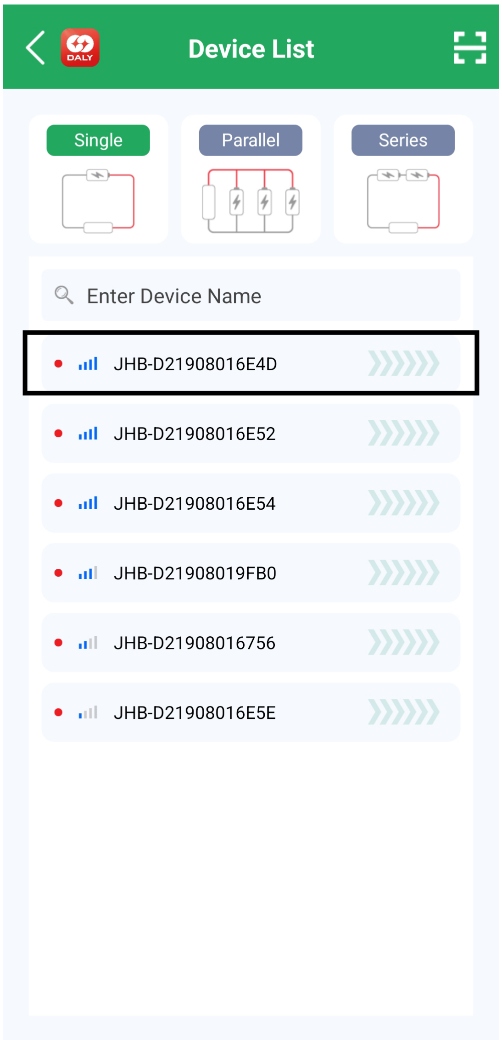


At the top of the interface, you are presented with three distinct system circuit buttons:

Single: Select this tab when you are running, troubleshooting, or deep-diving into one independent battery container.

Parallel: Select this tab when you have multiple individual batteries physically bolted to a single common Busbar network to expand your total capacity (Ah).

Series: Select this tab when you have multiple individual batteries chained post-to-post to increase your overall system operating voltage (e.g., 24V, 36V, or 48V banks).

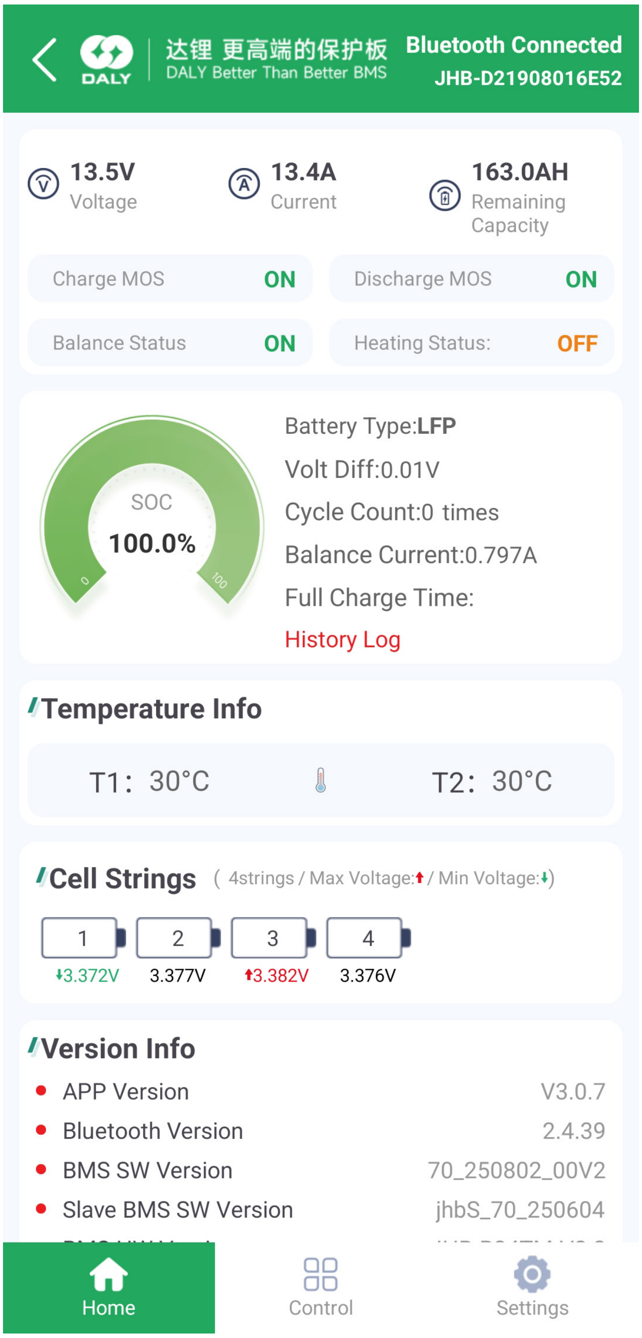


To execute deep cell diagnostics, inspect millivolt balances, check individual internal temperature probes, or view active protection alarm logs, you must select the “Single” tab on the Device List page and tap directly on a specific battery serial string.

This loads the primary Single Battery Dashboard (Home Screen) interface

6.4 THE SINGLE BATTERY DASHBOARD (HOME SCREEN)

DASHBOARD TELEMETRY BREAKDOWN:



Core Metrics: Displays a live, high-resolution State of Charge percentage (SoC %) visual gauge alongside total independent package voltage, real-time current throughput, and exact remaining capacity.

Model Recognition: Displays the configured continuous chemistry type (e.g., Battery Type: LFP).

MOSFET Control Status Blocks: Displays the functional switching state of your internal protection circuits:

- **Charge MOS (ON):** Incoming charging current paths are normal and active.
- **Discharge MOS (ON):** Downstream load delivery paths are normal and active.
- **Balance Status (ON):** The active equalizer network is actively processing internal delta alignments.
- **Heating Status (OFF):** There is no internal heating function installed.

Temperature Info Sub-Index: Displays real-time temperatures from internal probes embedded directly inside the cell matrices (T1 and T2).

Cell Strings Voltage Matrix: Displays the exact, real-time voltage of each internal cell to three decimal places. The app automatically flags tracking boundaries using localized color-coded arrow symbols:

Red Up Arrow (▲): Highlights the cell container currently registering the highest independent voltage in the series string.

Green Down Arrow (▼): Highlights the cell container registering the lowest independent voltage in the series string.

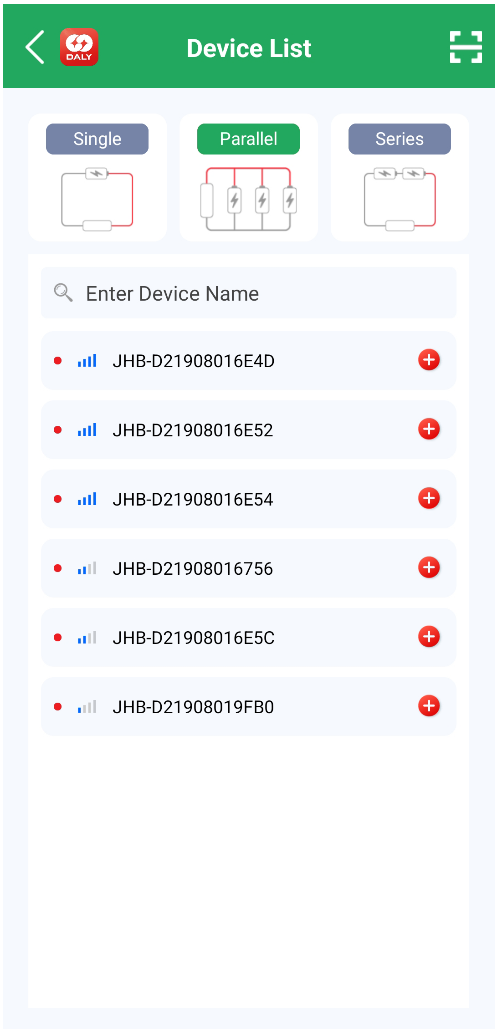
Volt Diff: Displays the live millivolt delta spacing between the highest and lowest cells (e.g., 0.01V).

Active Equalizer Feedback: Displays the live balancing rate (e.g., Balance Current: 0.797A) moving active energy between mismatching cell strings.

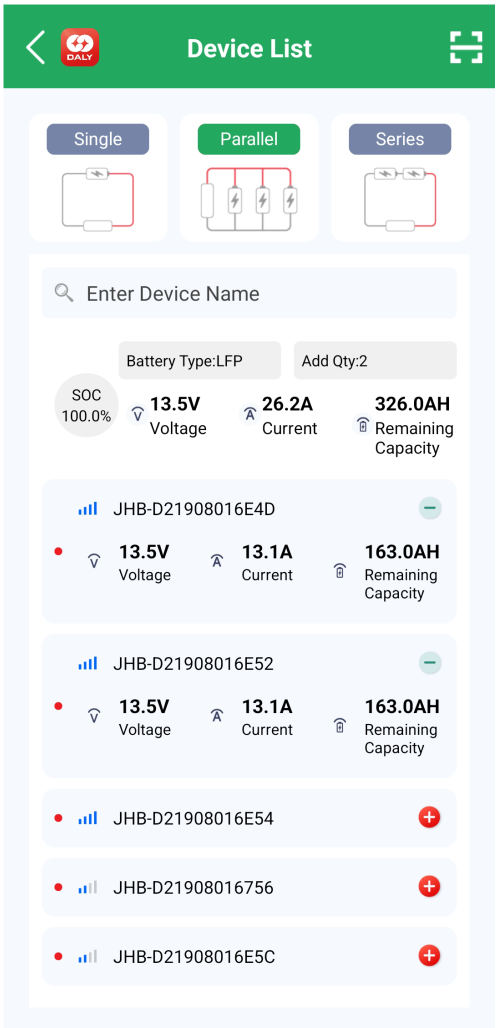
6.5 MULTI-BATTERY BANK GROUP SELECTION & AGGREGATION

When batteries are configured into multi-pack networks, the app does not automatically blend the signals. You must use the integrated pairing array to group them manually.

GROUPING PARALLEL BANKS (CAPACITY EXPANSION)



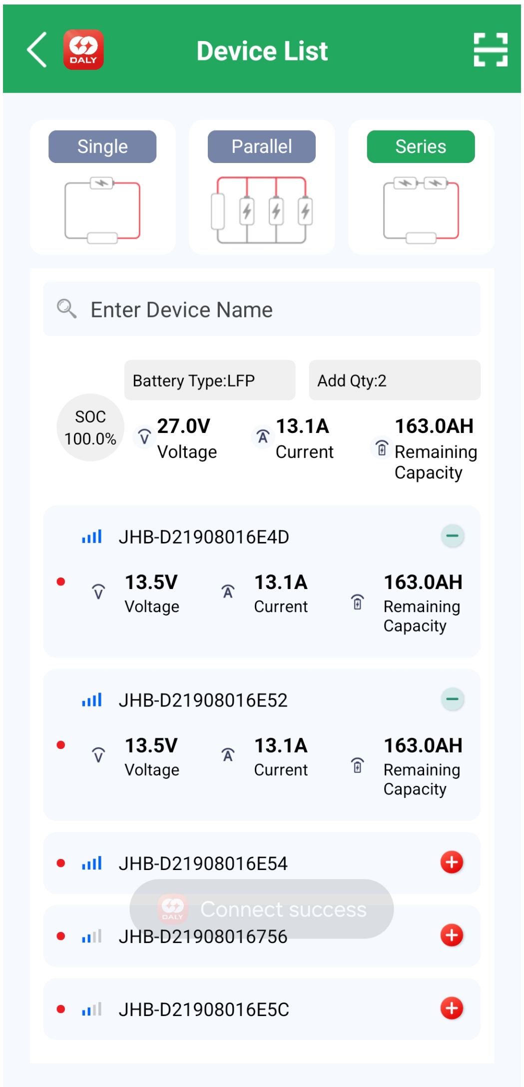
- Navigate to the Device List page and tap the green “Parallel” layout tab at the top.
- The application directory will update, displaying a circular red “+” (Plus) icon next to every discovered battery ID matching your physical serial codes (e.g., JHB-D2...).
- Tap the red “+” icon next to each specific battery that belongs to your parallel bank. The icon will immediately change to a green “-” (Minus) icon, verifying that the pack has been locked into the collective calculation loop.
- The app header will instantly display your Cumulative Parallel Matrix Data alongside each battery’s individual real-time contribution row.



DECONSTRUCTING THE PARALLEL SUMMARY CARD:

- **Cumulative Header Data:** Bundles your network together mathematically. For example, if you connect two 12V 163Ah batteries, it will display a total unified capacity of 326.0Ah, a shared Busbar voltage of 13.5V, and a combined total current discharge draw of 26.2A.
- **Individual Strings Data Rows:** Displays the exact work sharing between the cases. You can verify that each battery is contributing equally to the load (e.g., both lines showing a balanced split of 13.1A each).

GROUPING SERIES BANKS (VOLTAGE EXPANSION)



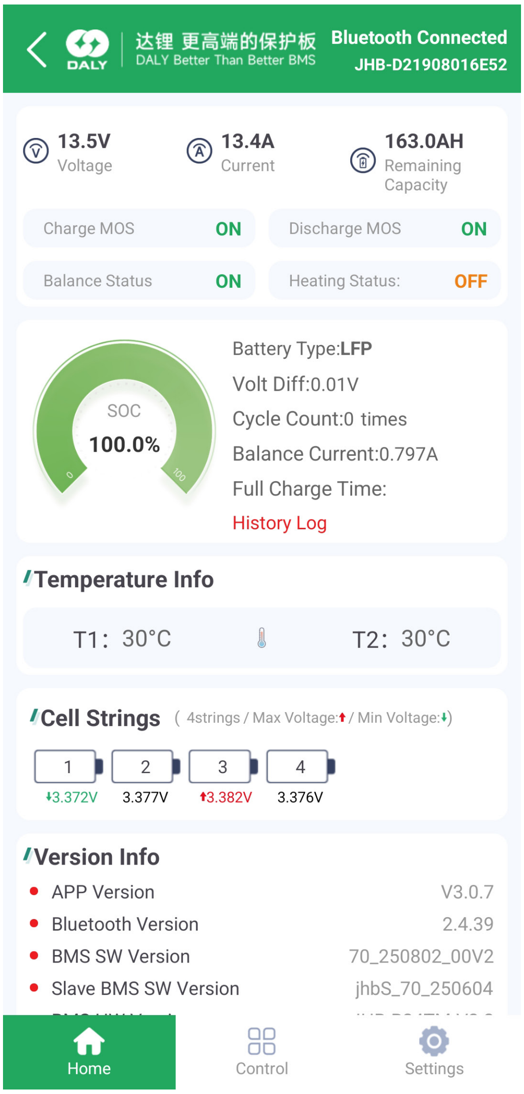
Navigate to the Device List page and tap the green "Series" layout tab at the top of the screen ("Image: Series Connection Array").Tap the red "+" icon next to each independent battery that forms your high-voltage series string.

Cumulative Series Matrix Behavior: The application header will automatically stack the system voltage additively while keeping the capacity bounded by a single pack profile. For example, linking two 12V 163Ah batteries (13.5V each) in series will display a combined string voltage of 27.0V, while the capacity correctly remains at 163.0Ah. The current remains uniform across the series string line at 13.1A.

6.6 ADVANCED PROTECTION & PARAMETER SETTINGS PROFILES

By selecting the gear icon tab labeled "Settings" at the bottom-right corner of the interface screen, users can audit the hard-coded firmware safety thresholds of the battery pack.

CRITICAL USER SECURITY MANDATE: The 12VS firmware parameter matrix is factory-locked to protect your system. While the screens display green "Settings" modification tabs, you are strictly prohibited from altering any voltage ceilings, current thresholds, temperature limits, or active balancing triggers. Unauthorized field adjustments immediately create a severe fire hazard and permanently void your manufacturer warranty.



VOLTAGE & CURRENT PROTECTION LIMITS

This page governs the hard electronic cut-off ceilings that protect the cells from catastrophic over-stress:

Cell Over-volt Protect (3.65V): The absolute safety ceiling per individual cell. If a battery charger forces any cell to 3.65V, the BMS immediately blocks incoming charge current.

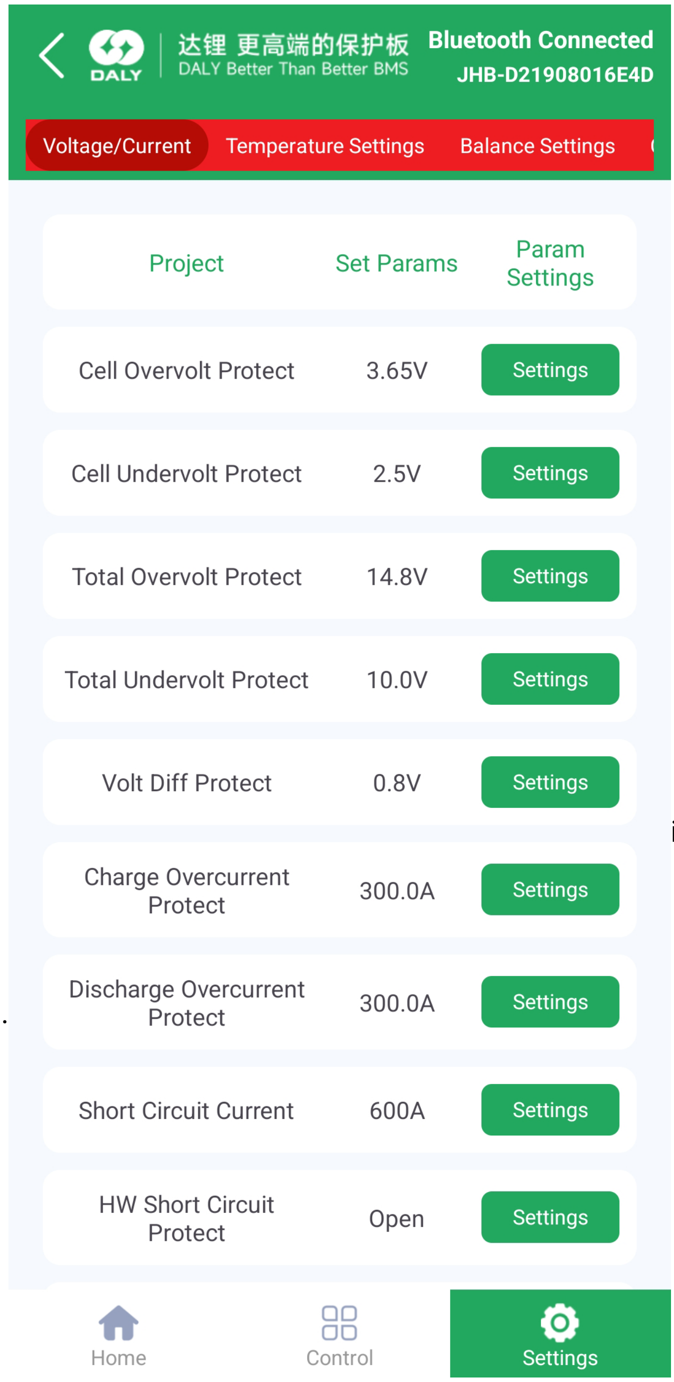
Cell Under-volt Protect (2.5V): The absolute low cutoff floor. Protects cells from destructive over-discharge by isolating the terminals.

Total Over-volt (14.8V) & Total Under-volt (10.0V): Pack-level backup safety parameters.

Volt Diff Protect (0.8V): Pack-level protection boundary if individual strings experience severe alignment deviation.

Charge & Discharge Over-current Protect: The safety current limit. Triggers a full shut-down if external system demands exceed safe continuous ratings.

Short Circuit Current: The catastrophic fault threshold. If external loads bridge the terminals and current spikes, the BMS cuts power within microseconds to prevent an arc flash explosion.



TEMPERATURE PROTECTION PROFILES

This page governs how the system reacts to environmental and thermal shifts:

Charge High Temp: Blocks all incoming charging current if internal cell temperatures reach 65°C to prevent thermal runaway.

Charge Low Temp: Direct safety enforcement of the 0°C Freeze Charge Rule established in Section 5.2. Automatically blocks all charge inputs if cells hit freezing point to prevent lithium plating.

Discharge High & Discharge Low Temp: The absolute boundaries for safe power delivery.

Fan Start Temp: Automatically engages the active cooling fan system when heavy work loads drive internal temperatures up (only certain models).

ACTIVE BALANCING CONFIGURATIONS

This page defines the parameters governing the internal high-efficiency equalization system:

Balance Start Voltage: The BMS active balancer remains completely dormant during low or resting states to save power. It only wakes up and begins balancing once cells rise past 3.3V during a charge cycle. Prior to this the Heltec Balancer is working from 2.7V upwards

Balance Stop Voltage: The absolute termination upper limit for balancing operations.

Balance Start Volt Diff: The sensitivity trigger. Equalization is activated the exact microsecond any cell pair drifts apart by more than 10mV (0.01V), ensuring the cells stay perfectly balanced at the top of the charging curve.

Balance Start Current: Establishes the initial threshold logic parameters for active hardware optimization runs.

Voltage/Current | Temperature Settings | Balance Settings

Project	Set Params	Param Settings
Charge High Temp Protect	65°C	Settings
Charge Low Temp Protect	0°C	Settings
Discharge High Temp Protect	70°C	Settings
Discharge Low Temp Protect	-20°C	Settings
Temp Diff Protect	15°C	Settings
Fan Start Temp	47°C	Settings
Heating Start Temp	0°C	Settings
Heating Stop Temp	0°C	Settings
Temp Ctrl Qty	2	Settings

Temperature Settings | Balance Settings | Cell Parameters

Active Balance	Set Params	Param Settings
Balance Start Voltage	3.3V	Settings
Balance Stop Voltage	3.8V	Settings
Balance Start Volt Diff	0.01V	Settings
Balance Start Current	1.0A	Settings
Active Balance Switch	Open	Settings

7. MAINTENANCE & STORAGE

While your 12VS Smart Lithium Battery is fundamentally a zero-maintenance power station, regular mechanical auditing and correct off-season storage chemistry are vital. Adhering to these preventative guidelines ensures maximum systemic cell health, maintains comprehensive warranty compliance, and prevents premature capacity fade.

7.1 ROUTINE MAINTENANCE & TERMINAL TENSION

FASTENER TENSION AUDITS

High-current Direct Current (DC) power systems are subject to continuous vehicle vibration and structural thermal expansion/contraction cycles. Loose connections introduce high localized electrical resistance, causing extreme heat generation, terminal deformation, and intermittent BMS power cut-offs.

Inspection Interval: Every 3 to 6 months, visually inspect all terminal junctions and re-verify thread tightening torques.

Torque Compliance: Utilize a calibrated hand torque wrench to re-verify all casing connection posts match our factory boundaries:

- M6 Threaded Studs: 5 - 7Nm
- M8 Threaded Studs: 9 - 12Nm
- M10 Threaded Studs: 15 - 20Nm

ENVIRONMENTAL CLEANLINESS

Accumulated carbon dust, dynamic road grime, and ambient salt-spray moisture can form an invisible, low-resistance bridging film across the battery lid casing. This creates a pathway for parasitic tracking current, resulting in a slow, continuous self-discharge of the internal cells. Clean the upper casing periodically using a clean, dry microfiber cloth. Do NOT use aggressive solvent chemicals, liquid detergents, or high-pressure sprays.

AUTOMATED UNDER-VOLTAGE BMS RESET & RECOVERY

If an unmanaged load drains the pack completely, the internal DALY JHB BMS will trip into its low-voltage hardware protection lock to preserve cell integrity. The battery will read 0 Volts at the external posts. To reactivate the internal switches:

Primary Recovery Method: Apply an smart AC or DC-DC charging source featuring a dedicated “Lithium Wake-up”, “BMS Reset”, or “0V Activation” hardware profile. These profiles pulse a wake-up voltage to the terminals, prompting the BMS micro-controller to close its discharge gates.

Secondary Emergency Jump Method: If your vehicle charging hardware lacks a low-voltage recovery pulse, you must apply a brief external power source using a 12V portable jump-starter pack or a healthy starting battery:

- Turn off all vehicle or vessel branch accessories and isolate the common busbars.
- Connect the positive (+) jumper clamp to your 12VS positive terminal.
- Connect the negative (-) jumper clamp to your 12VS negative terminal.
- Turn on the jump-starter pack or run the companion vehicle for 30 to 60 seconds to feed a stable baseline threshold voltage straight into the DALY JHB board.
- Once the BMS registers the input and wakes up, remove the jumper clamps and immediately connect your primary LiFePO4 battery charger to top-up the pack.

7.2 LONG-TERM STORAGE (SOC & ISOLATION)

If you are parking your 4WD caravan, recreational vehicle, or marine vessel for an off-season layup or extended garaged storage period, you must configure the internal cell chemistry for dynamic hibernation.

- 100% SoC (Full) ===> HIGH CHEMICAL STRESS (Accelerates Capacity Decay)
- 50% - 80% SoC ===> STABLE STORAGE WINDOW (Preserves Cell Longevity)
- 0% SoC (Empty) ===> CRITICAL UNDER-VOLTAGE HAZARD (Permanent Cell Damage)

OPTIMAL STATE OF CHARGE (SOC) BOUNDARIES

The Target Window: Store the battery strictly between 50% and 80% State of Charge.

Why this is mandatory: Storing a lithium battery at a 100% full charge for months forces the internal cathode material to live under high chemical oxidation stress, accelerating internal gas generation and reducing permanent capacity. Conversely, storing a battery at 0% empty leaves the cell voltage resting near its critical crash line. Normal background BMS power consumption will slowly drain the cells below 2.0V, causing permanent copper shunting and destroying the cells.

COMPLETE GALVANIC ELECTRICAL ISOLATION

You must physically separate the battery from the vehicle network during storage. Even when all master control panels are toggled “OFF”, background electronic devices (such as stereo memory retainers, digital clocks, proximity sensors, or smart inverter standby sensors) continue to pull microscopic current. Over 3–6 months, these parasitic tracking loads will completely drain your bank.

Protocol: Turn off your primary high-current battery isolator switch, or physically unbolt and disconnect the Main Negative Distribution Cable straight from the battery post.

SEASONAL TOP-UP AUDITS

Check your battery bank status once every 3 to 6 months via the DALY BMS App.

If the resting total pack voltage drops beneath 13.1V (or individual cells drift close to 3.2V), apply a short top-up charge to bring the system back into the stable 50% - 80% storage safety envelope.

7.3 BMS SLEEP MODE & AUTO-WAKE FUNCTIONS

To preserve internal core cell balances during periods of extended storage or vehicle inactivity, the DALY JHB BMS incorporates an automated, low-overhead micro-power firmware framework.

Trigger Parameters:

The BMS will automatically transition its operational software states into Sleep Mode if it detects no continuous charge or discharge current (<500mA) for an uninterrupted block of 15 hours, or if the system drops to a low-power warning ceiling.

The Operational Benefit:

Once active, Sleep Mode shuts down all non-essential internal computing pipelines, BLE broadcasting antennas, and active balancers, dropping background control power draw down to microscopic levels (μA). This effectively eliminates internal battery self-drain while your vehicle is parked up in a depot or warehouse.

HOW TO WAKE THE SYSTEM:

Automated Auto-Wake:

The JHB framework continuously listens for hardware voltage shifts across its external terminal posts. The exact millisecond you connect a valid charging input (such as your vehicle starting up and feeding current via a DC-DC charger, or your solar panels waking up at sunrise) or draw an external current load, the BMS detects the electrical vector change and wakes up automatically within milliseconds.

Manual Recovery:

If the battery has transitioned into a low-voltage protection lock-down state rather than standard idle sleep, it cannot auto-wake. Installers must execute the Automated Under-Voltage BMS Reset protocols outlined in Section 7.1.

8. DISCHARGE & REAL-WORLD USAGE

Managing how your 12VS Smart Lithium Battery delivers power under dynamic loads is essential for system reliability. Unlike lead-acid variants, $LiFePO_4$ chemistry provides highly stable, sustained voltage throughput under extreme electrical stress. However, operating within safe continuous current ceilings and understanding state-of-charge tracking are critical to avoiding unexpected protection shutdowns.

8.1 DEPTH OF DISCHARGE (DOD) VS. CYCLE LIFE

The physical lifespan of an EV-Grade Lithium Iron Phosphate cell is directly dictated by its depth of discharge per cycle.

Recommended DoD Ceiling (80%):

Restricting daily usage to 80% of total capacity (e.g., drawing 130Ah out of a 163Ah pack) represents the ultimate engineering sweet spot for your system. Adhering to this operational envelope yields an exceptional 5,000+ complete cycles before the cell pack experiences nominal capacity decay.

Maximum Allowable DoD (100%):

Pulling the full 100% capacity out of the container is fully supported. The integrated Daly JHB BMS features a hard electronic protection floor that safely isolates the external posts before the chemistry suffers irreversible under-voltage damage. However, continuously discharging the battery to empty reduces total long-term cycle expectancy down to 3,500 cycles.

8.2 CONTINUOUS & PEAK DISCHARGE CURRENT LIMITS

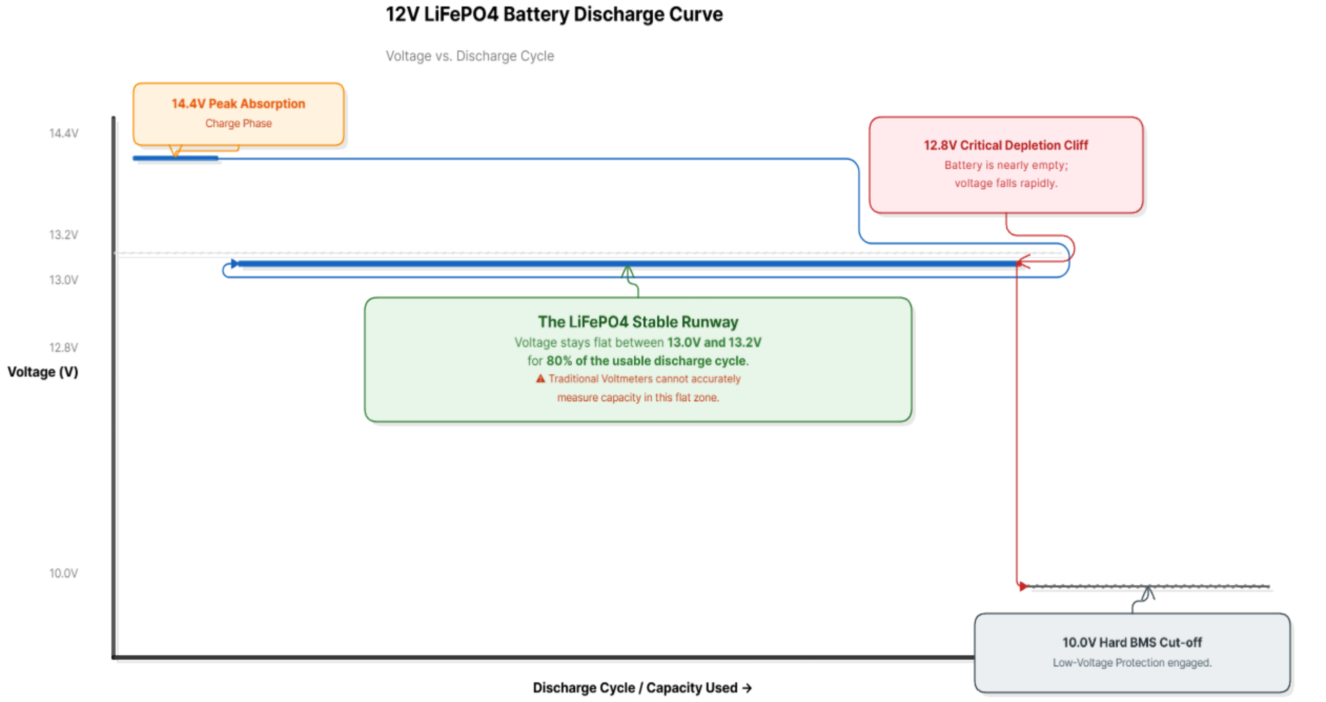
Exceeding the continuous current delivery limit of your specific model configuration causes immediate thermal buildup across the internal cell interconnects and will trigger a firmware protection trip.

Load Classification	Consumer Appliance Examples	Operational Engineering Protocol
Low Load	LED Internals, Water Pumps, USB Outlets	Ideal for extended off-grid endurance. Minimal thermal signature.
Medium Load	12V Compressor Fridges, Diesel Heaters, Fans	Standard system operation. Flat, highly efficient current draw.
High Load	AC Inverters, Coffee Machines, Induction Cook-tops	Heavy current draw. Ensure your individual battery's BMS continuous rating safely matches the inverter's maximum DC draw.

PRO INVERTER DESIGN TIP: High-power 2,000W to 3,000W pure sine wave inverters running on a 12V system pull an incredible 180A to 270A of continuous DC current from the battery bank. To prevent overloading a single integrated control board, you should deploy a multi-battery **Parallel Setup per single Busbar (Topology A, Section 4.2)**. This design geometry divides the high-current inverter demand equally across multiple parallel modules, reducing thermal stress and ensuring seamless power delivery.

8.3 DECODING THE LIFEPO4 DISCHARGE CURVE & STATE-OF-CHARGE TRACKING

LiFePO4 chemistry features an exceptionally "flat" voltage discharge curve. During 80% of the battery's discharge cycle, the overall pack terminal voltage remains locked tightly between 13.0V and 13.2V.



The Cliff Drop-Off:

Because the voltage curve is so flat, the battery will display 13.1V whether it is 80% full or 30% full. However, once the cells reach a critical state of depletion, the voltage hits a steep "cliff" at 12.8V and begins to drop rapidly toward empty.

The Voltmeter Limitation:

Because of this unique chemical profile, a traditional LED voltage panel or cigarette-socket voltmeter is completely useless for judging remaining capacity. It will read 13.1V right up until the system is minutes away from shutting down.

Tracking with Multiple Batteries:

While the official DALY BMS App provides an excellent, aggregated summary for parallel or series arrays using the "+" selection tool (as shown in Section 6.4), it relies on wireless Bluetooth data strings. For permanent, hard-wired, and completely accurate cabin monitoring across multi-battery installations, you should install a physical, **Shunt-Based Battery Monitor** (such as a Victron SmartShunt, BMV-712, ePro, or Simarine unit). A shunt acts as an electrical toll booth on your main negative trunk line, continuously counting every single milliamp of current entering or leaving the complete bank to provide an airtight capacity tracking reading.

8.4 SAFE OPERATING LIMITS & AUTOMATED BMS CUT-OFFS

To protect the internal cell matrices from catastrophic damage during operational faults, the factory-locked firmware parameters will automatically isolate the battery via the internal MOSFET gates if any of the following boundaries are breached:

Low-Voltage Cut-off:

The BMS closes the discharge gates the exact millisecond the collective pack voltage drops to 10.0V (or if any individual internal cell string drops to 2.5V). To recover the battery, follow the Automated Under-Voltage BMS Reset instructions detailed in Section 7.1.

Short-Circuit Protection:

If an external short circuit bridges the positive and negative lines, current instantly spikes past the critical threshold. The BMS executes an ultra-fast hardware shutdown within microseconds to choke out the arc flash. Installers must locate and completely remove the physical wiring fault before applying an active charge source to wake the system.

High-Temperature Discharge Protection:

If sustained heavy inverter loads combine with high ambient outback environments to drive internal cell core probes up to 70°C, the BMS will immediately shut down all output power. The system will remain locked out until the cells naturally cool down into safe thermal boundaries.

9. INVERTER USAGE & HIGH-LOAD ENGINEERING

Powering high-voltage alternating current (240V AC) induction appliances—such as coffee machines, travel kettles, microwaves, air fryers, and air conditioners—via a pure sine wave inverter requires precise power matching. Because inverters pull immense direct current (DC) from the battery bank, the system architecture must be designed to withstand heavy continuous loads without triggering thermal or electronic protection shutdowns.

9.1 MATCHING INVERTER CAPACITY TO 12VS MODEL FLEET

To protect the internal cells and the integrated BalanceBMS, you must ensure that your battery's continuous discharge limit safely accommodates your inverter's full current draw. Furthermore, your total battery capacity (Ah) must be sized to support the continuous duration of the load.

For example, a 3,000W inverter on a 12V system draws roughly 250A of DC current. While a single 12VS 304Ah battery features a 300A BMS and can physically power that 3,000W load, running it continuously for 1 hour would drop the battery's State of Charge down into its critical 20% depletion zone. For extended high-power loads, scaling your overall capacity via parallel banks is required.

OFFICIAL MODEL-TO-INVERTER SIZING REFERENCE MATRIX

The matrix below defines the absolute maximum pure sine wave inverter size permitted per independent battery unit across the 12VS fleet:

12VS Factory Model Identifier	Nominal Pack Voltage	Integrated BMS Rating	Maximum Independent Inverter Limit
BAT105M-G2	12.8V	100A	1200W
BAT105S-G2 / BAT105SL-G2	12.8V	200A	2500W
BAT163S-G2 / 163SL-G2 / 163SSL-CAN	12.8V	200A	2500W
BAT304-CAN / BAT304SSL-CAN	12.8V	300A	3800W
BAT608-CAN / BAT628SSL	12.8V	500A	6400W
BAT50S-24	25.2V	100A	2500W
BAT163-24CAN	25.2V	200A	5100W
BAT304-24CAN	25.2V	300A	7600W
BAT105-36	38.4V	150A	5700W
BAT105-48CAN	51.2V	200A	10000W

The 12VS Engineering Advantage:

Oversized BMS Integration Standard 100Ah lithium batteries available on the Australian market typically feature a matching 100A BMS. Attempting to run a standard 2,000W inverter (which pulls roughly 170A) under full load) off a single competitor's 100Ah battery will cause the system to instantly trigger a High-Current Over-current shutdown.

To solve this limitation, we purposefully engineer our 100Ah/105Ah batteries with an oversized 200A BalanceBMS. This upgrade allows you to seamlessly run a full 2,000W inverter from a single 100Ah container to power high-draw, short-runtime appliances (e.g., boiling a camp kettle, running a coffee pod machine, or heating a microwave for 2 to 5 minutes).

⚠ **IMPORTANT RUNTIME DIRECTION:** If your installation requires running heavy appliances for continuous, extended periods (such as induction cook-tops, air fryers, or caravan air conditioning units for more than 5 minutes), you must scale up your total battery bank capacity. This ensures you can comfortably run your gear without prematurely exhausting your power storage.

9.2 INVERTER EFFICIENCY & TERMINAL VOLTAGE SAG

One of the primary advantages of our premium 12VS LiFePO4 cells is their ability to maintain stable terminal voltage under extreme current demands.

The Lead-Acid Deficit: Traditional AGM or lead-acid batteries suffer heavy internal resistance drops. When a large inverter activates, a lead-acid bank will immediately "sag" down to 11.5V or lower, frequently triggering premature "Low Voltage Alarms" on the inverter itself and causing it to shut off.

The 12VS Stability Advantage: Your 12VS battery bank maintains an incredibly flat discharge runway. Under heavy current draws, it typically stays comfortably above 12.5V. This allows your inverter to operate at its absolute peak conversion efficiency while preventing unexpected low-voltage cut-offs.

9.3 HIGH-CURRENT HEAT MANAGEMENT & CONNECTION INTEGRITY

Continuous high-power usage (such as extended induction cooking or running a roof-mounted air

Conditioner) forces maximum current through your wiring, generating significant thermal energy across the terminals and internal BMS pathways. Managing this heat is vital to system longevity.

Cable & Lug Integrity: All high-current battery leads must be terminated using professionally crimped heavy-gauge copper lugs. A poor or loose crimp creates high localized resistance, which can generate localized hot-spots hot enough to melt terminal protectors, damage cable insulation, or distort the battery casing.

The Torque Verification Mandate: Hand-tightening terminal connections is strictly prohibited for inverter installations. As established in Section 3.2, you must tighten all terminal connections to their exact factory torque specifications using a manual torque wrench:

- M6 Threaded Studs: 5 - 7Nm
- M8 Threaded Studs: 9 - 12Nm
- M10 Threaded Studs: 15 - 20Nm

Settling Check: Always re-check the torque tightness of your terminal fasteners after the first few uses of a high-power inverter to account for any initial copper or thread settling.

9.4 INVERTER STANDBY CURRENT & STARTUP SURGE LOADS

MANAGING STANDBY CURRENT DRAIN

Even when there are no 240V appliances actively plugged in or running, an inverter that is left turned "ON" consumes a continuous background current just to keep its internal monitoring electronics and cooling fans active.

The Self-Discharge Hazard: A typical pure sine wave inverter draws between 1A and 2A continuously while idling. Left unchecked overnight, this idle background draw will drain 12Ah to 24Ah of usable capacity out of your battery bank while your vehicle is parked.

Protocol: Always turn the inverter completely "OFF" via its remote switch or a dedicated heavy-duty isolator when 240V power is not actively required to prevent slow, unintended battery depletion over several days.

MANAGING INDUCTIVE STARTUP SURGE LOADS

Appliances with integrated electric motors or compressors (such as older power tools, portable fridges, or air conditioning units) require a massive burst of initial current to start up. This is known as an inductive surge load, and it can easily reach 3 to 5 times the appliance's normal running watts.

- **The BMS Peak Window:** Your 12VS battery is engineered to handle these brief, transient surges. The BalanceBMS includes an integrated Short-Circuit Protection delay that allows the battery to tolerate high startup currents for up to 600A for microseconds before executing a safety lock-down.
- **Sizing Safety Buffer:** If an appliance's initial startup surge exceeds the certified peak surge rating of your inverter or your battery's BMS ceiling, the system will instantly trip into over-current protection mode. Always verify the peak surge rating of your motor-driven appliances before attempting to power them via the inverter.

10. ADVANCED COMMUNICATIONS & SYSTEM INTEGRATION

When combining multiple 12VS Smart Lithium Batteries into a single parallel bank, data synchronization is required to allow a central Victron GX device (such as a Cerbo GX, Cerbo GX MK2, or Ekrano GX) to monitor the entire system. Establishing an internal communication network allows individual internal management systems to combine their data, reporting a single aggregated storage bank with accurate State of Charge (SoC), unified capacity (Ah), and dynamic charge/discharge current boundaries.

10.1 WNT BOARD ADDRESSING TOPOLOGIES

All 12VS Smart Lithium WNT communication profiles are pre-programmed and locked to the Victron CAN-bus protocol at the factory. No software adjustments or PC-based protocol selections are required by the end-user. Depending on your production build tier, addressing is executed via physical hardware switches or auto-negotiating digital logic.

OPTION A: DIP SWITCH BOARDS (HARDWARE-BASED ADDRESSING)

These boards utilize a block of physical binary switches to define each independent battery container's position within the parallel bank network.

The Sizing Rule: Before connecting any interconnecting data cables, you must configure the physical DIP switches on each battery's WNT board according to the specific master/slave directory table included with your footprint documentation.

The Safety Mandate: Do NOT attempt to override or adjust battery ID allocations inside the mobile app or PC-based diagnostic software; doing so will conflict with the hardwired logic.

Series Constraints: For high-voltage series configurations (24V, 36V, 48V) using physical DIP switch boards, the WNT architectures must be pre-programmed and locked at the warehouse prior to shipping. Hardware addressing for series configurations cannot be modified in the field.

OPTION B: NON-DIP SWITCH BOARDS (AUTO-ADDRESSING MODULES)

The next-generation WNT control boards utilize self-negotiating logic. There is no distinction between Master and Slave units during mechanical installation.

Automatic ID Assignment: The WNT boards automatically negotiate and assign unique network node IDs the exact moment the parallel network is turned on. The internal CAN-bus manages cross-pack balancing parameters while simultaneously broadcasting an aggregated signal externally to the Victron ecosystem.

Prohibition Warning: Do NOT use the smartphone app or PC diagnostic portals to assign manual IDs to an auto-addressing board.

Single Bank Logic: The Victron GX hub reads the network as a single instance of DC storage, hiding individual cell complexities from the primary user interface while maintaining safe system tracking.

DIP SWITCH CONFIGURATION

Pack	DIP Switch 1	DIP Switch 2	DIP Switch 3	DIP Switch 4
1	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	OFF
3	OFF	ON	OFF	OFF
4	ON	ON	OFF	OFF
5	OFF	OFF	ON	OFF
6	ON	OFF	ON	OFF
7	OFF	ON	ON	OFF
8	ON	ON	ON	OFF
9	OFF	OFF	OFF	ON
10	ON	OFF	OFF	ON
11	OFF	ON	OFF	ON
12	ON	ON	OFF	ON
13	OFF	OFF	ON	ON
14	ON	OFF	ON	ON
15	OFF	ON	ON	ON
16	ON	ON	ON	ON

10.2 12VS PROPRIETARY CAN-BMS CABLES (TYPE A VS. TYPE B)

Reliable data communication between the battery management network and the Victron GX device acts as the central nervous system of your off-grid power plant. Utilizing the correct cable prevents "BMS Lost" connection drops and keeps the charging system operating inside Managed (DVCC) safety mode.

⚠ **CRITICAL COMPLIANCE WARNING**: All 12VS Smart Lithium Batteries utilize a custom pin-out designed specifically for our factory WNT board interfaces. You must never use standard off-the-shelf Victron Type A or Type B retail data cables; their standard retail pin mapping is incompatible and will block communications entirely.

12VS TYPE A COMMUNICATION CABLE (DIP SWITCH VARIANT)

Visual Identification: Manufactured with a Blue RJ45 Plug on the Victron GX end and a Green RJ45 Plug on the battery communication port end.

Application: Used exclusively for 12VS models equipped with physical hardware DIP Switch Boards.

Part Numbers: BATCAN-A-2 (2-Meter Length) | BATCAN-A-5 (5-Meter Length)

12VS TYPE B COMMUNICATION CABLE (AUTO-ADDRESSING VARIANT)

Visual Identification: Manufactured with a Blue RJ45 Plug on the Victron GX end and a Yellow RJ45 Socket on the battery communication port end.

Application: Used exclusively for the latest generation 12VS auto-addressing WNT boards (no physical DIP switches).

Part Numbers: BATCAN-B-2 (2-Meter Length) | BATCAN-B-5 (5-Meter Length)

10.3 INTERNAL PARALLEL RS485 BRIDGING

To interlink multiple independent battery enclosures within a common parallel bank, you must establish an internal data bridge between the RS485 ports on each WNT board.

Cable Requirement: Standard RJ45 UTP (Unshielded Twisted Pair) patch data leads.

Quality Specification: High-quality CAT5e is the minimum engineering standard permitted for all parallel communication bridges to minimize data corruption caused by high-current DC cables.

Operational Function: This jumper network allows the individual BMS units to share raw, microsecond data (including cell voltages, SoC calculations, and live temperatures) and combine their maximum current limits (Charge Current Limit / Discharge Current Limit) before sending a single unified "Master" data pack to the Cerbo or Ekrano hub.

10.4 CABLE CONSTRUCTION, SIGNAL INTEGRITY & TERMINATION LOOPS

MANAGING SIGNAL INTEGRITY

The physical construction of your communication lines is critical for data bus stability, especially in compact engine bays, tunnel boots, or marine lockers where data cables run close to high-current DC cabling.

Twisted Pair Requirement: Data signals (CAN High and CAN Low) are carried on a single internal Twisted Pair within the CAT5e cable (typically matching the Blue and Blue/White internal core pair). This twisting filters out electromagnetic interference (EMI), keeping the data bus stable when routed alongside heavy 12V inverter cables.

UTP (Unshielded Twisted Pair) Mandate: You must strictly use unshielded twisted pair cables. This aligns with Victron Energy's grounding layout, preventing the formation of hazardous ground loop paths that can occur if shielded cables are grounded at multiple separate points in a complex DC system.

THE TERMINATION LOOP

A CAN-bus network is a sequential "daisy-chain line," not a radial "star" layout. For the digital signal to be read correctly by the micro-controllers, it must be terminated at both physical ends of the line to prevent data corruption caused by signal bounce or "echoes."

The GX Hub Termination: Insert a standard Blue Victron VE.Can Terminator into the empty, remaining RJ45 VE.Can port on the Cerbo GX or Ekrano GX.

The Battery Termination: Insert a dedicated terminator into the empty, remaining CAN RJ45 port of the final battery container in the data chain.

PRO INSTALLER INSIGHT: Without proper terminal loop resistor termination, a CAN-bus network may pass basic diagnostic checks at low idle loads but will drop connections or experience "Check Sum Errors" the exact second a high-power inverter begins drawing heavy current. Always verify both terminators are physically clicked into position.

10.5 VICTRON GX DEVICE CONFIGURATION (CERBO/ EKRANO & DVCC)

Once the physical data cables, intermediate RS485 jumpers, and terminators are installed, follow these steps to commission the smart network:

- Prevent Sleep Mode Drops: Prior to finishing the installation, open your mobile app interface and log into each battery using Single Mode (as detailed in Section 6.5). Navigate to advanced configurations and adjust the "Sleep Time" parameter to maximum: 65,535. This ensures the internal BMS never enters a deep hibernation state while connected to an external hub, maintaining a constant, uninterrupted heartbeat data packet with the vehicle's GX device.
- Access the Interface: Power up your Victron Cerbo or Ekrano GX device and open the primary remote console menu screen.
- Navigate to DVCC: Go to Settings > DVCC.
- Toggle Status: Toggle DVCC to ON.
- Verify Shared Telemetry: Ensure that both Shared Voltage Sense (SVS) and Shared Temperature Sense (STS) are actively engaged.
- Audit Combined Limits: Exit to the main menu and go to Device List > [Your Custom 12VS Battery Name] > Parameters.
- Confirm Aggregation: Verify that the Charge Current Limit (CCL) and Discharge Current Limit (DCL) accurately reflect the combined capacity of all connected units. For example, if two batteries featuring 500A discharge boards are linked in parallel, the combined system DCL must display a unified continuous ceiling of 1,000A.

11. TROUBLESHOOTING & BMS FIELD DIAGNOSTICS

Every 12VS Smart Lithium Battery is managed by an advanced internal 100Balance JHB Smart Active Balance BMS network. Think of this module as the operational safety brain of the enclosure. It continuously audits the thermodynamic and electrical health of the internal cells. If an external wiring fault, aggressive inverter overload, or charging abnormality breaches safe operating parameters, the BMS will instantly isolate the cells from the external terminal posts to prevent permanent damage.

11.1 BMS PROTECTION DIAGNOSTIC MATRIX (FIRMWARE TRIGGERS & RECOVERY ACTIONS)

If your battery suddenly stops delivering output power or refuses to accept an incoming charge, connect your smartphone to the DALY BMS App (as detailed in Section 6) and review the primary alarms page.

The table below outlines the factory-locked firmware trip parameters and their mandatory field recovery procedures:

Protection Identifier	Firmware Alarm Trigger Threshold	Primary Trigger Cause	Automated / Manual Recovery Action
Cell Over-Voltage	≥ 3.65V per Cell (Or 14.8V (Pack)	Charging source voltage set too high; charger failed to transition to Float stage.	Disconnect all charging sources. Apply a small DC load (e.g., turn on vehicle lighting) to pull cell voltage back down into normal bounds.
Cell Under-Voltage	≤ 2.50V per Cell (Or 10.0V (Pack)	Battery bank has been drawn down to 0% empty. Parasitic loads left unmanaged	The BMS locks out the terminals. Apply a lithium-specific wake-up charge source immediately (see Section 11.3).
Discharge Over-Current	Exceeds continuous rating [Varies by BMS size tier]	Downstream consumer loads or inverter demands exceed the BMS continuous hardware rating.	Completely isolate the load. The BMS will execute an automated reset attempt; reduce overall system appliance demands before re-engaging power.
Catastrophic Short-Circuit	Catastrophic Current Spike [Varies by BMS size tier]	Positive and negative distribution wires or copper links have physically touched.	CRITICAL FAULT: Disconnect the system immediately. Locate and repair the physical wiring dead short. Apply an active charge pulse to wake the BMS.
Thermal High-Temp Limit	≥ 65°C (Charge) or ≥ 70°C (Discharge)	Heavy continuous high-load inverter operations combined with harsh outback engine-bay heat.	Shut down all operations. Allow the battery casing to cool down naturally beneath 45°C. The BMS will re-engage switches automatically.
Thermal Low-Temp Limit	≤ 0°C (Charge Over-ride Cut-off)	Vehicle operating in alpine or freezing climates.	Direct enforcement of the 0°C Freeze Charge Rule. The BMS blocks incoming charging current to prevent lithium plating while keeping discharge open. Warm the enclosure space

11.2 COMMON SYSTEM SYMPTOMS AND FIELD SOLUTIONS

Real-World Symptom	Potential Root Physical Cause	Recommended Field Investigation & Solution
Absolute 0V Readout at External Posts	Internal BMS has entered a low-voltage protection lock-down or short-circuit isolation state.	Measure terminal voltage. If reading 0V to 5V, execute the automated or manual BMS Wake-Up Procedures detailed in Section 11.3.
Inverter Suddenly Shuts Off / Low Voltage Alarm	Excessive high-current terminal voltage sag or high continuous current overload trip.	Reduce consumer AC appliance loads. Verify your delivery conductor cables match the heavy gauges specified in Section 9.3 to prevent voltage drop.
Battery Will Not Accept Charging Current	Cells are out-of-balance, fully saturated, or thermal safety probes are active (0°C or 65°C)	Check the DALY BMS App diagnostics. Ensure the ambient enclosure temperature is within the safe 0°C) to 45°C charging envelope. Check charger profiles.
Extreme Heat Buildup at External Battery Posts	Loose terminal thread tension, cross-threaded bolts, or a poorly crimped copper conductor lug.	STOP ALL INVERTER OPERATIONS IMMEDIATELY. Allow components to cool. Clean terminal surfaces. Re-torque all fasteners to factory spec using a manual torque wrench (see Section 11.6). Replace substandard lugs.

11.3 HOW TO "WAKE UP" A TRIPPED BMS

When the battery enters a low-voltage or short-circuit lock-down state, a standard digital multimeter will register 0V or an erratic floating voltage (e.g., 2V to 5V) across the external casing terminals. To wake up the internal micro-controller and close the MOSFET gates, you must present a stable voltage source to the posts:

Lithium-Specific Pulse Charger:

Connect an AC mains charger or in-vehicle DC-DC charger featuring an integrated "LiFePO4 Reset", "BMS Wake-up", or "0V Activation" hardware profile (such as premium Victron Energy, REDARC, or Enerdrive systems). These chargers pulse a small voltage signal to the posts, prompting the BMS to re-engage.

Automated Solar Regulation Reset:

If your MPPT solar regulator is wired directly to the battery terminals, certain advanced smart controllers will automatically push an automated wake-up pulse once sunlight hits the photovoltaic array, re-initializing the internal circuit.

The Parallel Jumper Jump Start:

If your charging hardware cannot execute a low-voltage reset pulse, you can manually override the safety gate using a 12V portable jump-starter pack or a healthy secondary battery:

- Turn off all vehicle branch accessories and isolate the main busbars.
- Secure the positive (+) jumper clamp to the 12VS positive post.
- Secure the negative (-) jumper clamp to the 12VS negative post.
- Initiate the jump-starter pack or run the companion vehicle for 30 to 60 seconds to hold a stable baseline voltage across the DALY JHB board.
- Once the BMS wakes up and registers normal states, remove the jumper clamps and immediately connect your primary charger to replenish the pack.

11.4 ADVANCED RECOVERY: DIRECT-TO-CELL RECOVERY

⚠ DANGER: CLASS 1 ELECTRICAL HAZARD — PROFESSIONAL USE ONLY ⚠

Opening the sealed structural casing lid of a high-capacity lithium battery exposes live, un-fused cell matrix terminals capable of delivering massive energy. Executing an accidental short-circuit fault during this procedure introduces an immediate risk of arc flash explosion and catastrophic fire.

This advanced procedure **MUST EXCLUSIVELY** be conducted by a certified auto electrician, battery technician, or authorized electrical engineer. Consumer attempts to open the casing or bypass internal safety boards immediately and completely void your product warranty and liability protection.

[HIGH-VOLTAGE DIRECT RECOVERY PATH]
||
[Charger Pos (+)] ===> Connects directly to Casing Positive Terminal Post
[Charger Neg (-)] ===> Connects directly to internal BMS “B-” Terminal Pad (Bypassing BMS Board)

If an extreme over-discharge event locks down the cells so deeply that standard external terminal wake-up pulses fail to initialize the board, a certified technician may execute a direct bypass recovery:

1. Workspace Safety: Ensure the battery is fully isolated from all vehicle loads, chargers, and parallel busbars on a static, non-conductive workbench.

2. Casing Disassembly Protocol: Access methods to the internal active balancing core space vary depending on the physical 12VS generation chassis style:

- **Screw-Fastened Lids:** Carefully unbolt and remove the perimeter retaining screws from the upper lid. Store the fasteners safely and lift the top panel straight up to clear the internal balancing array.
- **Factory-Glued Lids:** Use a specialized non-marring trim tool or scoring blade to carefully separate the factory bond line around the upper lip. Take extreme care not to plunge tools deeply into the container to avoid puncturing the internal balancing cells, thermal probes, or wiring paths.

3. Charger Grounding Configuration: Connect the positive (+) lead of a regulated, variable DC laboratory power supply or an unmanaged 12V charger directly to the main positive terminal post of the battery container.

4. The Bypass Link: Connect the negative (-) lead of the charger directly to the internal BMS B- Terminal Pad (the main board path linking straight to the cells, bypassing the MOSFET switches entirely).

5. Recovery Sizing Boundaries: Set the variable DC laboratory power supply to a low, safe continuous current (e.g., 2A to 5A maximum). Note: Because the BMS is currently locked down, its Bluetooth transmitter is completely dead and the DALY app will not be visible on your smartphone. The technician must track the live recovery progress by monitoring the real-world voltage climb directly on the DC bench power supply digital display screen, or via an external handheld digital multimeter clipped straight across the cell matrix.

6. Alarm Clearance: As soon as the internal cells rise safely back above 2.8V per cell (hitting roughly 11.2V) total across the internal 4S cluster), the BMS micro-controller will instantly wake up, re-initialize its firmware, and power up its Bluetooth radio. The DALY BMS app will now snap back to life on your phone screen, showing a clear, cleared alarm log.

7. Immediate Reconnection: The exact microsecond the board clears its fault, turn off the charger. Disconnect the negative charge lead from the internal B- pad. Attach your negative charger lead back onto the main external negative terminal post to resume standard, managed charging through the BMS to 100% full capacity.

8. Mandatory Case Resealing & IP Protection: To preserve moisture barriers and ensure environmental protection compliance under AS/NZS 3001.2, the casing lid must be structurally restored to factory seal requirements before the pack is reinstalled:

- **Screw-Fastened Lids:** Inspect the primary rubber perimeter gasket for alignment or pinching. Replace the cover and tighten all retaining screws evenly in a cross-diagonal sequence to compress the gasket.
- **Glued Lids:** Clean any loose residue from the mating channels. Apply a continuous bead of high-grade, neutral-cure structural silicone adhesive along the internal joint track. Seat the lid firmly into position and apply uniform mechanical clamping pressure around the perimeter for a full 24-48 hours to allow the silicone to cure completely.

11.5 TROUBLESHOOTING PARALLEL COMMUNICATIONS & CAN-BUS ERRORS

Observed Network Error	Probable Localized Cause	Precise Engineering Resolution
Victron Cerbo / Ekrano GX Device Does Not See Battery	Incompatible data cable pin-out architecture or incorrect model choice.	Ensure you are utilizing our proprietary cables: 12VS Type A (Blue/Green) for physical DIP switch boards, or 12VS Type B (Blue/Yellow) for Auto-Addressing modules. Standard off-the-shelf Victron retail cables are wired differently and will drop communication.
System Current Limits (CCL/DCL) Do Not Stack/Double	The cross-pack communication bridge has failed or is disconnected.	Inspect your intermediate RS485 Bridge jumper patches linking the batteries. Ensure the CAT5e UTP cables are plugged securely into the dedicated RS485 RJ45 ports, not into the CAN network ports.
Communication Sync Drops Intermittently via the Bus	The individual BMS micro-controllers are transitioning into Power Conservation mode.	Connect your smartphone via Single Mode to each battery. Open advanced configurations and change the "Sleep Time" parameter to 65,535 to maintain a constant data bus heartbeat.
"BMS Lost" or Check-Sum Packet Errors on the Console Screen	The CAN data transmission bus lines are un-terminated, causing signal bounce.	Ensure a standard Blue VE.Can Terminator is firmly seated in the remaining open VE.Can port on the Cerbo/Ekrano GX. Next, insert a terminator into the remaining open CAN port of the specific gateway battery that links directly to the Victron device via the CAN cable (see Section 10.4.2).
Network Node ID Conflicts / Multi-Pack Errors	Automated address pathways have been overwritten by manual app settings.	NEVER attempt to input manual node addresses via the PC software or mobile application. For DIP switch boards, rely strictly on physical hardware binary switches. For auto-addressing variants, allow the system to self-negotiate. If IDs are manually corrupted, the WNT network requires a full factory reset via a PC interface at our workshop.

11.6 THREE-STEP FIELD DIAGNOSTICS FLOWCHART

If your 12VS battery bank is under-performing or behaving unexpectedly in the field, execute the following three diagnostics steps in strict sequential order before requesting service:

Step 1: Physical Structural Audit

Inspect the physical casing. Are all terminal fasteners tight?

Re-verify tightness using a manual torque wrench to ensure threads match factory specifications

- M6: 5-7Nm
- M8: 9-12Nm
- M10: 15-20Nm.
- Check for any visual signs of melting, copper discoloration, or cable distortion.

Critical Danger Warning:

If the battery casing is visibly swollen, emitting an unusual chemical odor, or feels hot to the touch while sitting completely at rest, do not attempt to charge or wake the BMS. Isolate the battery immediately in a safe, non-combustible outdoor location and contact The 12 Volt Shop technical support team for immediate engineering guidance.

Step 2: Open-Circuit Terminal Voltage Evaluation

Isolate the battery from all external busbars and consumer accessories. Measure the resting voltage directly across the terminal posts using a trusted digital multimeter:

- If Voltage is >10.0V: The battery is healthy but resting in a low State of Charge. Connect your LiFePO4 multi-stage charger to replenish the bank normally.
- If Voltage is 0V to 5V: The internal BMS safety matrix is locked in protection mode. Execute the BMS Wake-Up Procedures detailed in Section 11.3.

Step 3: Branch Circuit Load Validation

If the battery wakes up successfully and displays a perfect 13.2V open-circuit profile, but instantly trips back into a complete safety lock-down the exact second a specific vehicle load is engaged, the appliance (such as an oversized inverter or induction cook-top startup surge) is drawing more current than your battery's integrated BMS rating can support.

Review the continuous load sizing rules detailed in Section 9.1 to match your inverter demands to your model tier correctly.

12. WARRANTY & TECHNICAL SUPPORT

At The 12 Volt Shop, we back the engineering and materials that go into every 12VS Smart Lithium Battery. This comprehensive warranty outline defines your legal rights, establishes our 5-Year Limited Warranty boundaries, and sets the mandatory testing protocols required for rapid repair or replacement under Australian law.

12.1 AUSTRALIAN CONSUMER LAW MANDATORY STATEMENT

Our goods come with guarantees that cannot be excluded under the Australian Consumer Law (ACL). You are entitled to a replacement or refund for a major failure and compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure. The benefits provided under this manufacturing warranty sit completely in addition to other consumer rights and remedies available to you under the statutory framework of local Australian states and territories.

12.2 5-YEAR LIMITED WARRANTY PERIOD & OPERATIONAL EXCLUSIONS

The 12VS Custom Lithium Battery fleet is backed by a 5-Year Limited Warranty valid strictly from the initial verified date of purchase. This coverage applies strictly to the original retail buyer and is non-transferable unless authorized in writing by the manufacturer.

Strict Warranty Exclusion Boundaries

This warranty strictly covers inherent manufacturing defects, internal component anomalies, and materials structural failure. It does not cover systemic degradation, damage, or premature cell capacity collapse resulting from any of the following operational violations:

- Improper Charger Settings: Charging via legacy non-lithium profiles or holding bulk/absorption targets continuously outside the factory-locked 14.2V - 14.4V optimal range (excluding unmanaged fixed-profile chargers capped at 14.6V.
- Deep Discharge Inactivity: Leaving the battery container sitting in a flat, fully depleted state at 0% State of Charge (SoC) for an uninterrupted period exceeding 14 consecutive days.
- Thermal & Environmental Abuse: Forcing current into the pack when internal core temperatures drop below 0°C (violating the 0°C Freeze Charge Rule), or exposing the container to operating environments exceeding 65°C.
- Mechanical & Physical Alterations: Dropped casings, fractured terminal assemblies, casing submersion, or un-authorized field modifications (such as splitting glued lids or bypassing internal boards by consumers, as detailed in Section 11.4).
- Defective Field Installation: Melted terminal posts caused by loose thread tension (failing to match the factory M6, M8, or M10 torque metrics), upside-down mechanical mounting orientations, or installations inside unshielded combustion engine bays.

- Under-Sizing Engineering Faults: Intentionally connecting a high-draw appliance (such as an oversized 3,000W inverter platform) to an under-rated battery module, causing repetitive over-current protection trips.

12.3 HOW TO INITIATE A COMMERCIAL WARRANTY CLAIM

If your system displays an irregular diagnostic readout or you suspect an internal hardware fault, you must adhere strictly to the following corporate claim progression:

- Initial Tech Validation: Contact our Welshpool engineering support division immediately via the channels listed below.
- Telemetry Verification Data: Have your DALY BMS App real-time data ready for inspection. You must provide clear screenshots of the Single Battery Dashboard Home Screen showing live cell voltages and active alarm logs to assist our technicians with remote troubleshooting.
- Return for Authorized Laboratory Assessment: If remote diagnostics cannot resolve the state, the battery must be physically returned to our Western Australian service hub for formal capacity testing. Our technicians will connect the module to a calibrated industrial DC laboratory load-bank to log precise charge/discharge curve behaviors.
- Logistics Responsibility: In strict alignment with Australian Consumer Law guidelines, the consumer is responsible for any freight, transport, or shipping costs associated with delivering the goods to our service centre for assessment. If a manufacturing component defect is verified by our laboratory, The 12 Volt Shop will reimburse documented baseline domestic return freight costs.

12.4 TECHNICAL SUPPORT & SERVICE HUB CONTACT DETAILS

For all firmware configuration inquiries, component validations, or warranty auditing, contact our centrally operated Western Australian design headquarters directly:

- Physical Workshop Address: Unit 4 / 12 Kewdale Road, Welshpool, WA, 6106, Australia
- Mailing Address: PO Box 119, Welshpool DC, WA, 6986, Australia
- Landline Phone: (08) 9458 1212
- Corporate Email: sales@12volt.com.au
- Online Portal: www.12volt.com.au
- Australian Business Number (ABN): 51 106 172 785