LIONENERGY™

# Sanctuary™ 3 Energy Storage System (AC ESS)

Sanctuary 3 Inverter / Sanctuary 3 Battery 14.3kWh

# Installation Guide & Manual

Updated 6/26/25

# READ THIS INSTALLATION GUIDE & MANUAL IN ITS ENTIRETY BEFORE OPERATING THE UNIT.

This unit provides safe, quiet, and renewable electric power. It is very important to carefully read this Installation Guide before using the product. Keep this guide for future reference.

Carefully read and comply with all safety directives before installing and using the Sanctuary 3 System. Otherwise, personal bodily injury or death may result.

### Symbols Used:

**WARNING:** Indicates a hazardous situation which, if not avoided, could result in injury or death.

**CAUTION:** Indicates a hazardous situation which, if not avoided, could result in minor injury or damage to the equipment.

**NOTE:** Indicates an important step or tip that leads to best results, but is not safety or damage related.

## Follow these directives for safe use:

**System Integrity:** The inverter and all system components must not be disassembled or altered by unauthorized personnel. Unauthorized modifications can compromise system safety, void warranties, and result in serious injury or death.

**Electrical Hazard:** Always disconnect all power sources, including the AC and DC terminals, before performing any maintenance or cleaning. Use lockout/tagout procedures to ensure the system remains de-energized during maintenance.

**Grounding Requirements:** Proper grounding is essential for safe operation. Ensure that the system is connected to a permanent, grounded wiring system, and comply with all applicable grounding and bonding requirements.

**Load Calculations:** Ensure all connections follow the specifications outlined in the Installation Guide and comply with the National Electric Code (NEC). Using incorrect wire sizes, breaker ratings, or failing to properly balance loads can lead to system malfunction or pose safety hazards. Always verify that all load connections meet both installation and code requirements.

**Heavy Equipment:** This system includes heavy equipment. Use lifting assistance during installation to prevent injury.

**Compliance with Regulations:** All installation and maintenance activities must comply with local, state, and national electrical codes and standards, including but not limited to UL 9540 and UL 1973. Adherence to these standards is mandatory to ensure safety and compliance.

**Final Continuity Check:** Do not power on the system until a final continuity check is performed to ensure all connections are secure and correctly installed.

**Battery Handling:** Strictly follow the manufacturer's instructions for handling and installation of batteries. Failure to do so may result in fire, explosion, or electric shock.

**Tool Usage:** Exercise caution when using metal tools around batteries and electrical components. Dropping tools can cause short circuits, leading to potential explosions or fires.

**Ventilation:** The installation location must provide adequate ventilation to prevent overheating of the system components. Ensure that the unit is installed in a well-ventilated area according to the manufacturer's recommendations.

**Weatherproofing – IP65 Compliance:** When installing the Sanctuary system outdoors, it is critical to maintain IP65 and NEMA 3R protection to ensure long-term performance and safety.

- Any holes made in the wire box for conduit or wiring must be sealed using the appropiate fittings and components.
- Improper sealing may lead to water or dust ingress, which can cause equipment damage, corrosion, or electrical faults.
- Always use the appropiate conduit connectors, grommets, and glands to maintain enclosure integrity.
- It is the installer's responsibility to ensure that the final installation meets the appropiate standards for outdoor use.

**Qualified Personnel Only:** Installation, service, and maintenance of this Sanctuary system must be performed by qualified personnel/technicians. Only certified professionals with the appropriate training should install or service the unit, with or without a battery. For questions on how to become certified for installing the Lion Energy Sanctuary, please contact the Lion Energy ESS Support team.

## General Safety Guidelines

**Emergency Procedures:** In case of fire, evacuate the area and contact emergency services immediately.

**Handling of Damaged Equipment:** If the unit or any of its components are damaged, do not operate the system. Contact a qualified technician, or Lion Energy's ESS Support Team for inspection and repair.

# Table of Contents

# Lion Sanctuary Introduction

Congratulations on your purchase of the Lion Energy Sanctuary ESS (Energy Storage System)! You're taking a major step toward energy independence, efficiency, and cost savings. The Sanctuary is not just a backup system—it's a smart energy solution that integrates with solar, generators, and advanced energy management tools to optimize your power usage.

**Reliable Power & Seamless Backup**
Stay powered during outages, storms, or grid failures with automatic backup. Unlike noisy fuel-powered generators, Sanctuary provides safe, quiet, and maintenance-free energy with lithium iron phosphate batteries.

**Smart Energy Management & Cost Savings**
Sanctuary's intelligent system helps you reduce energy costs by storing power when it's cheapest and using it when rates are high. Time-of-use (TOU) and peak demand management allow you to optimize your energy consumption for maximum savings. Monitor and control your energy using in real-time using the mobile or PC app.

**Solar & Generator Integration**
Easily integrate with solar panels and a generator to extend your backup power. Sanctuary stores excess solar energy for later use, reducing reliance on the grid and ensuring power availability at all times.

**Scalable & Customizable for Your Needs**
Whether you need to back up essential appliances or your entire home, Sanctuary is fully expandable. You can add more batteries and inverters for extended runtime and greater energy security.

**Maximize Savings with Clean Energy Incentives**
Take advantage of federal tax credits and financing options to make clean energy more affordable. With incentives available, Sanctuary helps you save money while contributing to a sustainable future.

**For additional details and support, please contact Lion Energy per the contact information on the last page of this manual.**

**Thank you for choosing Lion Energy—your trusted partner in smart, reliable, and sustainable energy solutions!**

# Commonly Used Terms

**AC-Coupled Solar:** The Sanctuary system is compatible with AC-coupled solar setups. In these systems, solar panels generate DC power that is converted to AC power by a separate inverter or microinverters. This AC power can be used to run home appliances, charge the Sanctuary battery, or be exported to the grid.

**Bypass:** Bypass occurs when essential or backup loads are powered by the grid rather than the Sanctuary system. It serves as a temporary state during system maintenance, similar to taking a detour in a construction zone. A bypass switch allows homeowners or installers to temporarily bypass the Sanctuary system for servicing or troubleshooting while still maintaining power.

**C (in relation to battery charge/discharge rate):** The C rate for batteries is related to the Amp-hour capacity. For example, if a battery capacity is rated at 280Ah, then one C rate is 280 Amps, and 0.1C is 28A.

**Consumption:** Consumption refers to the power used by electrical loads or the entire home. CTs track consumption patterns, providing insights into energy usage.

**CT (Current Transformer):** CTs are devices used to measure the current flow in another circuit. In the Lion Energy System, external CTs are installed according to specified guidelines to accurately monitor current flow.

**DC:** DC refers to direct current, such as solar power and battery output.

**DC-Coupled Solar:** Solar panels output DC power directly to the Sanctuary, which then can either store that energy in its battery or convert it to AC power for usage in the home or exporting back to grid.

**Grid:** The grid refers to the power supply from the utility company. Energy meters installed by utility companies measure the amount of power consumed by a home, typically billed monthly.

**Load:** A load is any electrical device that draws power from your electric utility service.

**MPPT:** Maximum power point tracking. This is a type of power converter that is able to extract the maximum solar power available.

**PV (Photovoltaic):** PV refers to solar energy generation using photovoltaic cells. PV systems convert sunlight into electricity, contributing to sustainable power sources. The Sanctuary system works in conjunction with PV systems to store and distribute solar power efficiently.

# Sanctuary ESS Overview

The Sanctuary is a multi-functional Energy Storage System (ESS) that incorporates the functions of an inverter, solar charger, battery charger, generator (not included), and lithium iron phosphate battery. The Sanctuary is commissioned and monitored through the Lion Energy App, available on smartphones and PCs.

The Sanctuary ESS can be considered your personal power plant. Whether you are covering essential loads or powering your entire home, correct system sizing is key to ensuring reliable performance.

To size your system, start by identifying the loads you want the Sanctuary to support. Common essential loads include refrigeration, lighting, internet, and garage doors. Review your existing load center and breaker sizes, and use the appropriate load calculation method per your local jurisdiction to determine your total continuous power requirement.

Sanctuary inverters are designed to meet a wide range of power needs. For higher demand systems, multiple inverters can be configured in parallel. If your total load exceeds the capacity of a single inverter, additional inverters may be needed to ensure proper coverage.

The Sanctuary is sold as a complete system, including both the inverter and battery—both are required for full functionality. DC-Coupled Solar can be added for clean energy generation.

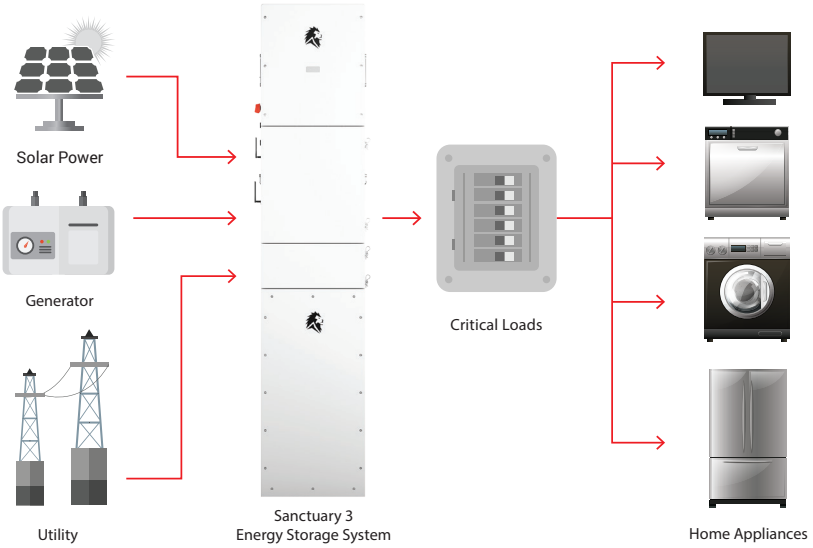
Depending on your goals, the system can be sized to support either essential (critical) loads or a full home backup.

# Critical Loads Diagram

A Critical Loads Backup system is designed to supply power only to essential circuits during an outage. This setup connects the Sanctuary Inverter to a dedicated critical loads panel, ensuring necessary devices remain powered, such as refrigeration, lighting, internet, and medical devices.

## Key Features:

- Powers essentials such as fridge, lights, WiFi, and medical devices.
- Requires fewer inverters and batteries by focusing on critical loads.
- Cost-effective backup that keeps priority devices running during outages.
- Smaller system size improves efficiency and saves space.
- Prioritizes essential loads to extend battery life.
- Compatible with solar, generator, and grid input (for all system types).

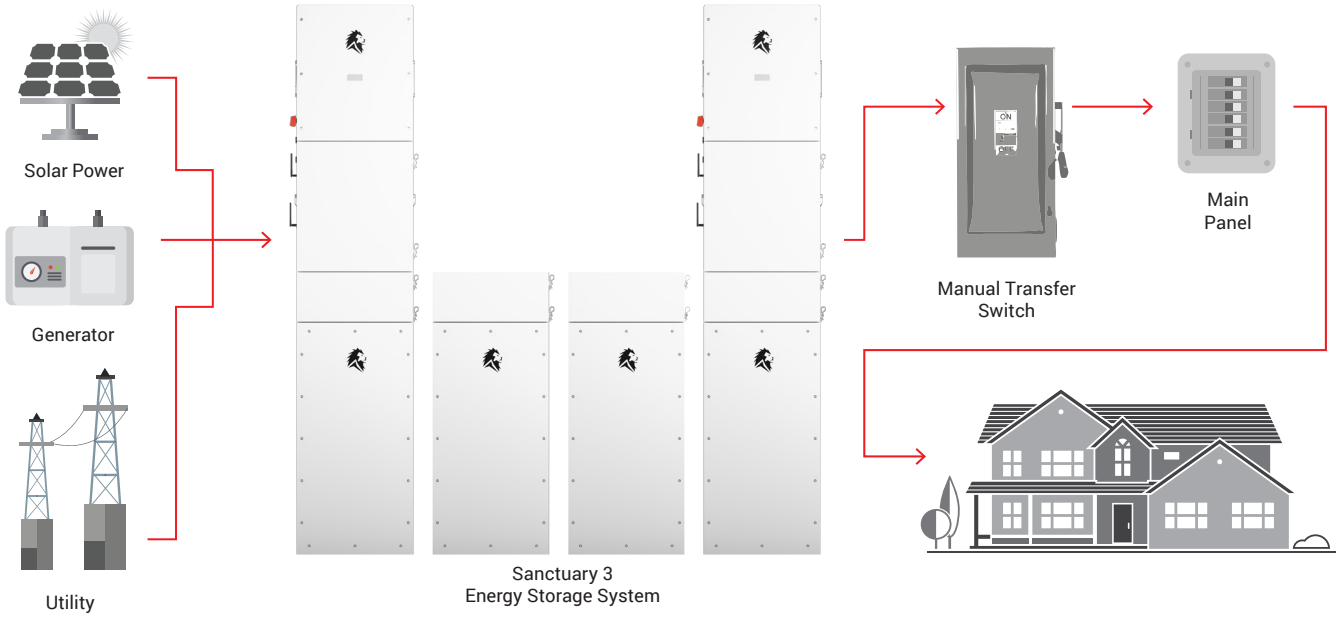


# Whole Home Backup Diagram

A Whole Home Backup system powers an entire home during an outage, ensuring all appliances function as if grid power were available. The Sanctuary 3 Inverter and multiple Sanctuary 3 Batteries (14.3kWh each) work together to provide seamless energy supply.

## Key Features:

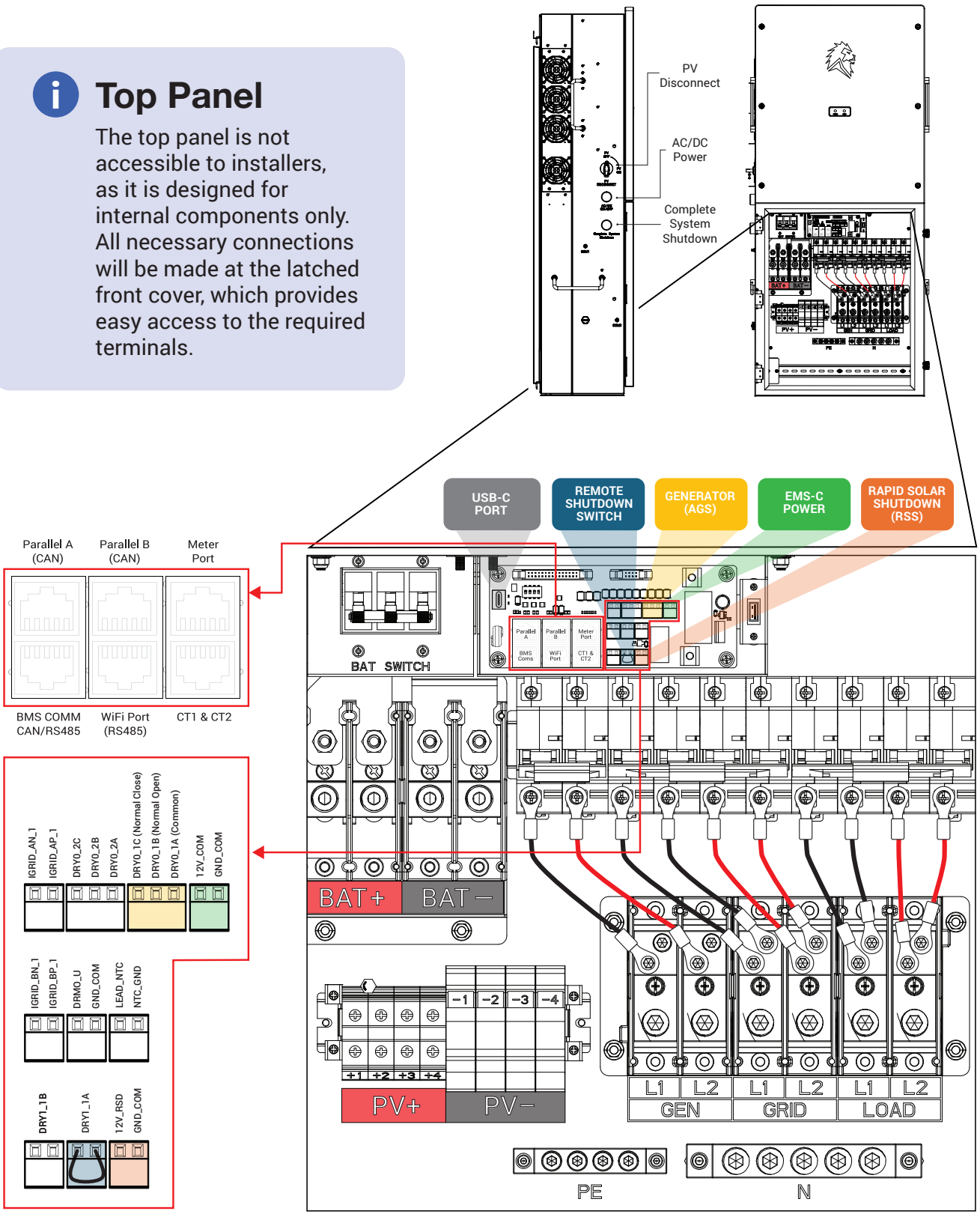
- Maintains whole-home power during grid outages, eliminating the need to select specific backed-up loads.
- Reports total home load and grid usage every 5 minutes through the Lion Energy Smart App.
- Reduces installation complexity by removing the need for a dedicated critical loads panel.
- Minimizes changes to existing electrical wiring in the home



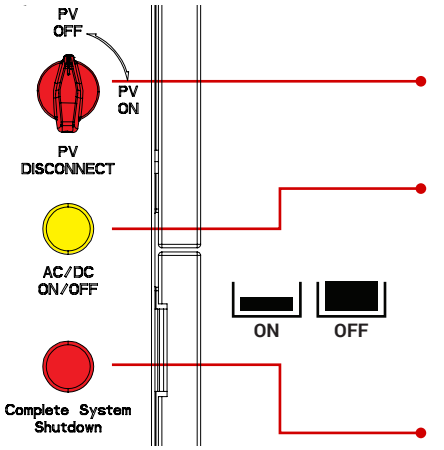
# Inverter Overview

## Top Panel

The top panel is not accessible to installers, as it is designed for internal components only. All necessary connections will be made at the latched front cover, which provides easy access to the required terminals.



# Inverter Side Controls




**PV Disconnect:** Enables or disables solar power input to the inverter.

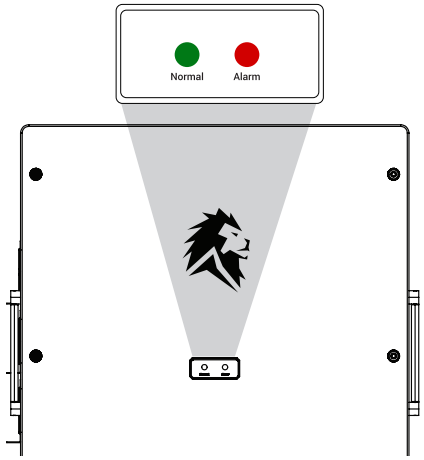
**AC/DC Power:** When on, the inverter operates normally. When off, PV power is not used, and inverter loads are powered down. However, the controller remains active and can still communicate and receive firmware updates unless a complete system shutdown occurs.

**Complete System Shutdown:** Turns off all inverter components.

## Solar RSS

Both AC/DC Power and Complete System Shutdown activate the Solar RSS if installed as described later in this manual.

# External Indicators (Lights) on System




**Green Light Solid:** No alarms; system is functioning normally.

**Green Light Blinking:** Indicates an alarm state, such as a low battery charge. Some inverter functions may be limited.

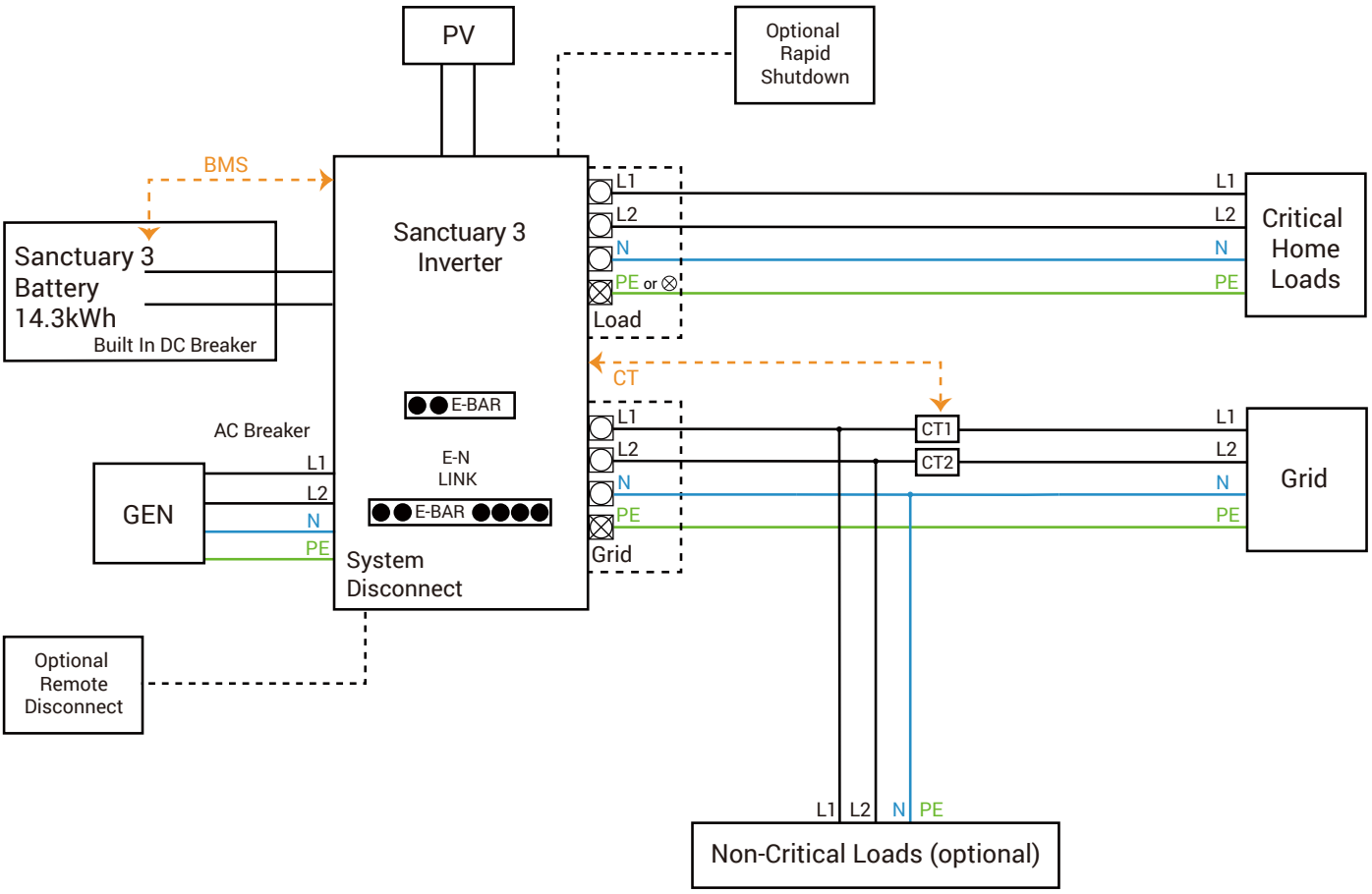
**Red Light:** The inverter shuts down for protection. If the fault persists or recurs, contact your installer.

**No Lights:** The system is off

## Indicator Notes

Alarms can be cleared automatically and may occur during times when the system is not yet fully commissioned. Some alarms or faults may need intervention to operate again. If a light is blinking, check the Lion Energy App to identify the alarm. If the alarm indicates a problem or the light does not turn on when the button is pressed, contact your installer for assistance.

# Basic Wiring Diagram



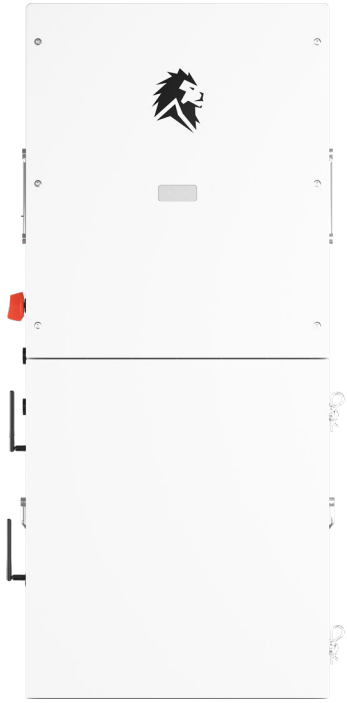

## Professional Wiring Required

All wiring must be completed by a licensed electrician, and installation must be performed by a Lion-Certified Installer.

## Residential Circuit Protection

External circuit protection not shown. Refer to NEC for guidelines on proper residential circuit protection.

# Inverter Parts and Components



**Sanctuary 3 Inverter**

**1 Per Inverter**

**Wi-Fi/Bluetooth Antenna**
(#90000557)

**1 Per Inverter**

**Cellular Antenna**
(#90000194)

**1 Per Inverter**

**CT Pair 200 Amp 2/1**
(#90000622)

**1 Per Inverter**

**Inverter Bracket**
(#90000185)

**2 Per Inverter**

**Cat5 Cable (10')**
(#90000136)

**2 Per Inverter**

(Pre-installed)

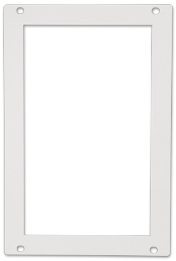
**Inverter to Busbar Cable- Black, 32"**
(#90000168)

**2 Per Inverter**

(Pre-installed)

**Inverter to Busbar Cable - Red, 32"**
(#90000169)

**1 Per Inverter**



**Mounting Spacer**
(#90000184)

**6 Per Inverter**

**Safety Clips**
(#90000671)

**1 Per Inverter**

**Inverter Wire Box**
Pre-installed in the inverter
(#90000186)

**1 Per Inverter**

(Pre-mounted)

**Busbar Distribution Block - Red 500A**
(#90000167)

**1 Per Inverter**

(Pre-mounted)

**Busbar Distribution Block - Black 500A**
(#90000166)

**8 Per Inverter**

**Hex Zinc Plated Lag Screw 3/8" x 2"**
(#90000623)

**1 Per Inverter**

**4mm Allen Drive**
(#90000670)

# Battery Parts and Components

**Sanctuary 3 Battery 14.3kWh**

**1 Per Battery**

**Battery Bracket**
(#90000188)

**1 Per Battery**

**Battery Wire Box**
(#90000187)

**8 Per Battery**

**Hex Zinc Plated Lag Screw 3/8" x 2"**
(#90000623)

**1 Per Battery**

**3' CAT5 (Ethernet) Cable**
(#90000653)

**1 Per Battery**

**AWG2 Battery Cable Red (55")**
(#90000501)

**1 Per Battery**

**AWG2 Battery Cable Black (55")**
(#90000500)

**2 Per Battery**

**Safety Clips**
(#90000671)

# Sanctuary Installation Guidelines

The Sanctuary System is designed for indoor and outdoor installations when environmental conditions are met. Install in a location with ambient temperatures between -4°F and 131°F for optimal performance.

**Clearance & Placement**

- Ensure at least 20 inches of clearance to the sides of the inverter and 12 inches above it for airflow and wiring.
- Avoid installation in living spaces due to operational noise (~60dB).
- Installing on a noncombustible wall is recommended but not required.

**Indoor Installations**

- Install in a climate-controlled area (garage, utility room, or storage room).
- Ensure the location is free from:
  - » Humidity exceeding 95%, highly flammable materials, or explosive environments.
  - » Direct airflow from HVAC or cooling systems to prevent temperature fluctuations.

**Outdoor Installations**

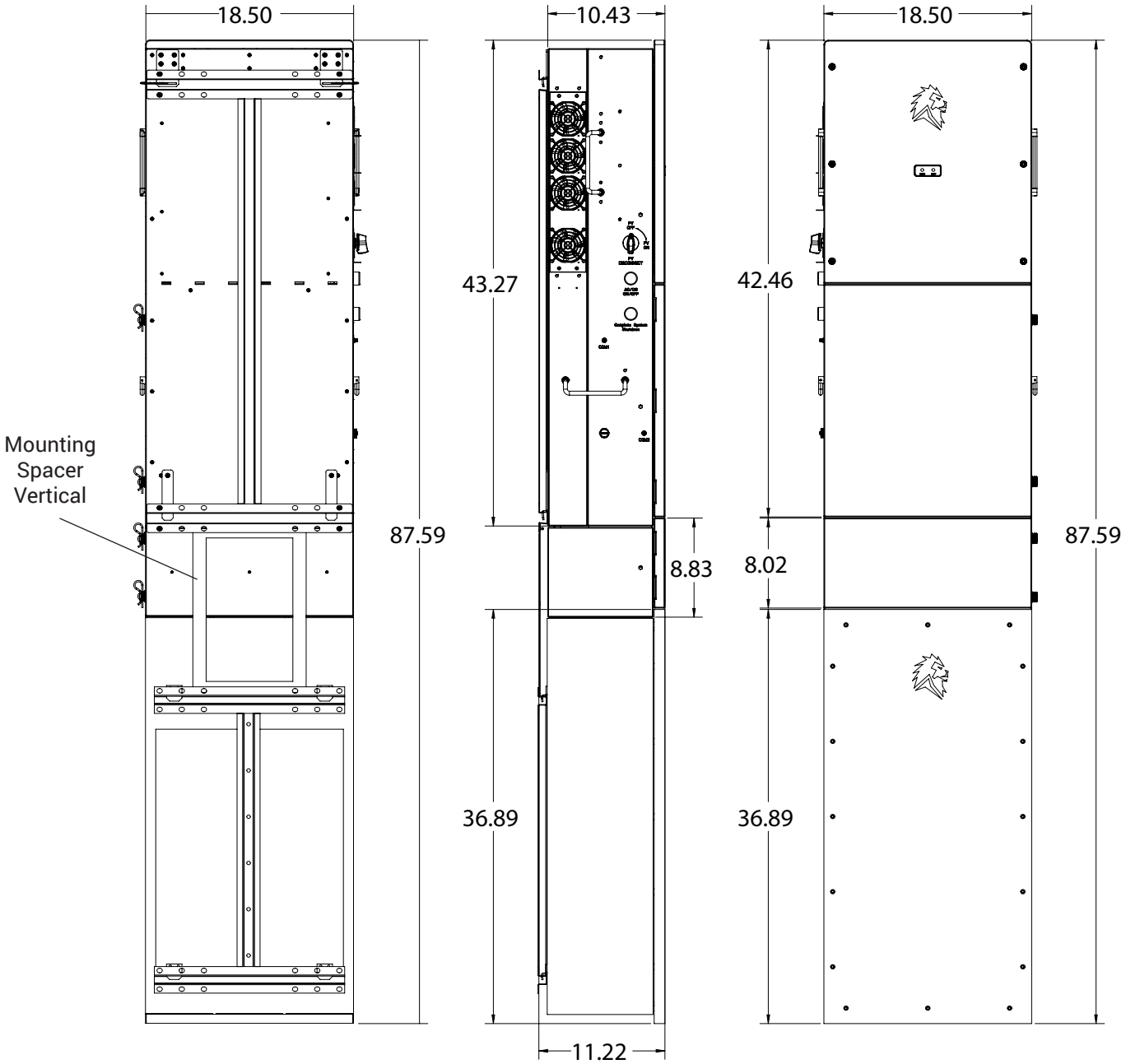
- It's recommended to install the system in an area protected from direct sunlight, rain, and snow.
- Use shading structures or enclosures to protect from extreme weather conditions.
- Ensure that the system's mounting wall meets all local structural and building codes and is capable of withstanding outdoor environmental stressors.
- The system will automatically derate in high and low temperatures and low temperatures temperatures to protect the inverter and battery. During these periods, energy production from the Sanctuary will be limited.


## Outdoor Installations (Reminder)

Outdoor installation is permitted for the Lion Energy system when appropriate environmental protections are in place. As a reminder, ensure the system is shielded from direct sunlight, rain, and extreme temperatures. In high ambient conditions, the system may derate automatically to prevent overheating.

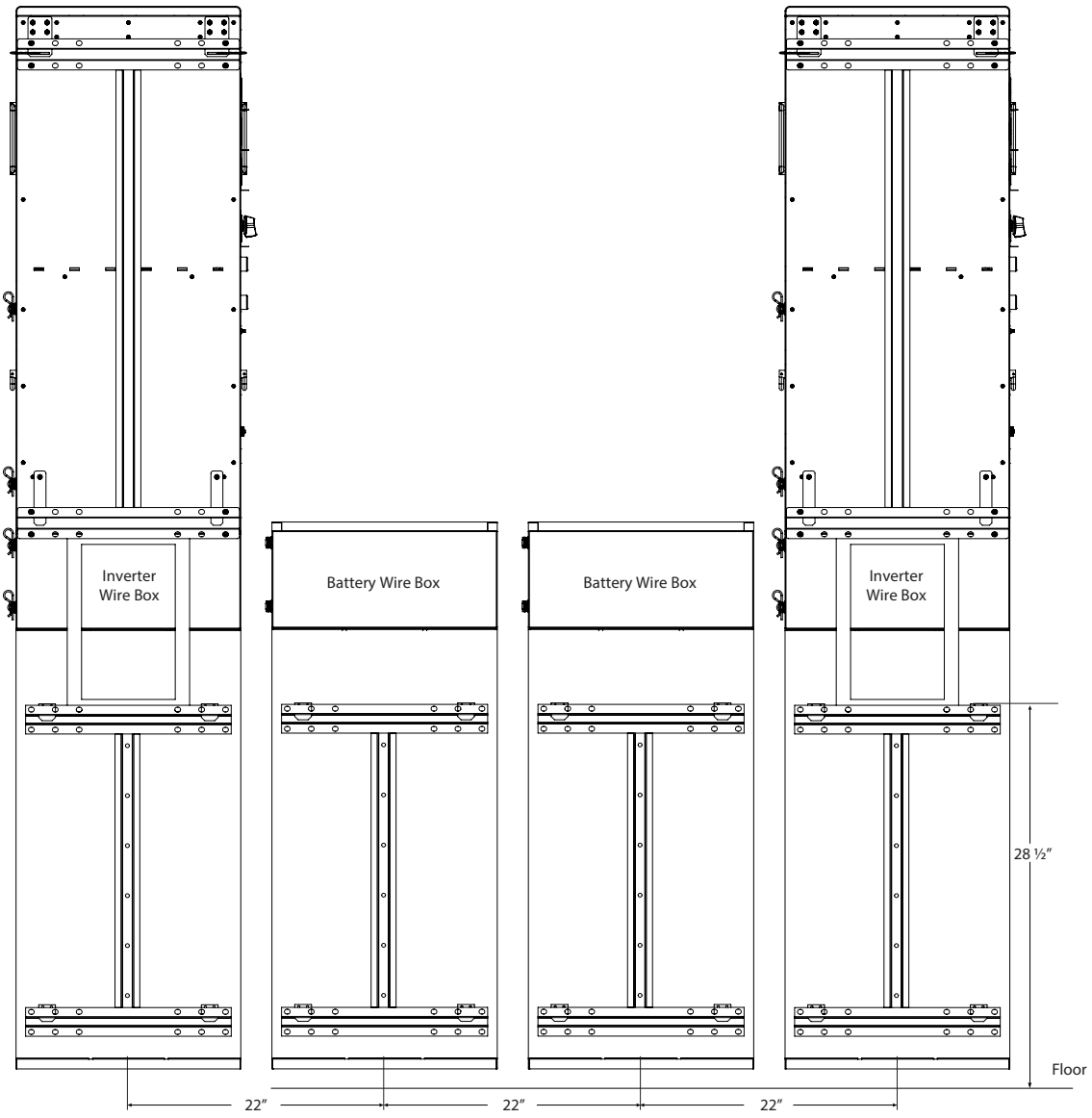
## Ignition Hazard

Do not install the system in an environment with flammable vapors, such as gasoline, as sparks from relays may ignite vapors




Sanctuary 3 system dimensions

*The wire box is a required accessory for installation.




**Installation Requirements:**

**Minimum Battery Mounting Height:**

The battery must be at least 0.5″ off the ground when installed. To meet this height, measure 28.5″ from the top of the battery bracket to the floor.

**Minimum Side-to-Side Spacing:**

- **Battery:** 2.6″ on each side for access to open and close the latching wirebox; 1″ minimum on the non-latch side (wall or barrier).
- **Inverter:** 20″ clearance on both sides for proper airflow to the cooling fans.

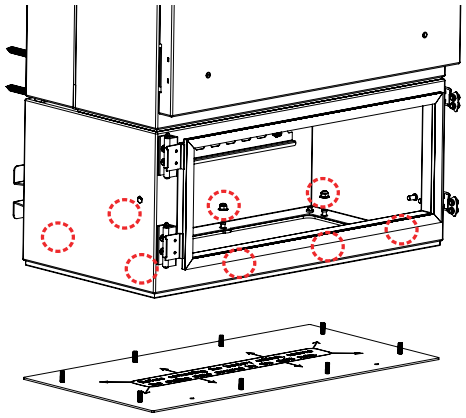
For multiple inverter systems, we recommend mounting inverters over non-adjacent batteries to maintain required spacing.

# Wire Box Installation Instructions

**The Sanctuary 3 System includes two wire boxes:**

1. Inverter Wire Box (pre-installed on the inverter)
2. Battery Wire Box (included inside the battery packaging)

In some cases, the battery wire box may not be needed. Below are the instructions for proper installation and when to use or discard the battery wire box.



**Step 1:** Inverter Wire Box Setup (Mandatory)

- The inverter wire box is pre-attached to the inverter and must remain installed.
  - » It is secured to the inverter with a removable bottom plate.
- To detach the bottom plate:
- Unscrew the 8 bolts securing it.
- Remove the plate to allow mounting onto the battery.

**Step 2:** Determining Whether to Use the Battery Wire Box

- For a single inverter and single battery setup:
  - » The inverter wire box is sufficient, and the battery wire box is not required.
- For systems with multiple batteries (e.g., 1 inverter, 2 batteries):
  - » The battery wire box must be installed on top of the battery.
  - » This ensures proper sealing and environmental protection (water, dust, debris).

**Step 3:** Installing the Wire Box on the Battery (If Required)

- If a battery does not have an inverter mounted directly above it, install the wire box included with the battery on top of that unit.
- Secure the wire box to the battery using the provided nuts on the bolts sticking out of the battery.
- Ensure all necessary conduit holes are pre-drilled prior to installation.

**Step 4:** Finalizing Installation

- Secure the wire box with its latches for easy access.
- Install any needed conduit between wire boxes for proper wire routing.

**Alternative Installation Option**

If the inverter is not placed on top of the battery, the bottom plate does not need to be removed. However, in this case, conduit must be installed to connect the inverter wire box to the battery wire box.

## Battery Wire Box Disposal

If the battery wire box is not needed, it can be safely discarded or recycled after installation is complete. Each battery includes its own wire box, so keeping extras is not necessary for future expansions. If you prefer not to discard the unused wire box, please contact Lion Energy to inquire about return or recycling options.

# Conduit Installation Between Wire Boxes

To ensure proper cable routing between two or more wire boxes, drill passthrough holes for conduit based on project-specific requirements. When installing multiple inverters or batteries in a row, complete all drilling before mounting to maintain alignment and ease of access. Take care to preserve seal integrity and follow mechanical safety best practices throughout the process.

**Step 1:** Mark and Drill Conduit Holes

- There are no pre-marked knockouts on the wire boxes; installers must manually measure and mark hole locations.
- Suggested hole diameter: 2.00 inches
- This is a recommended size for typical conduit applications, but not mandatory. Installers should determine the final hole size based on conduit type, wire gauge, and fill requirements, ensuring code compliance.

**Step 2:** Maintain IP65 Environmental Rating

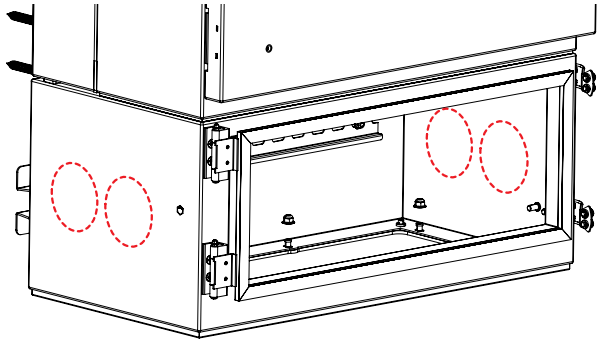
- Use rated conduit fittings (IP65 or better) that ensure a watertight and dust-tight seal.
- Apply appropriate gaskets or sealing rings with all conduit connectors.
- Avoid over-drilling or distorting the enclosure, which could compromise its IP65 protection.

**Step 3:** Drill with Care

- Use a hole saw or step drill bit appropriate for metal enclosures.
- Secure the enclosure before drilling to prevent movement.
- Drill slowly and cleanly to avoid paint damage or deformation.
- Deburr and clean all holes thoroughly to prevent cable damage.

**Step 4:** Install Conduit and Secure

- Fit the conduit with IP-rated compression or sealing connectors.
- Ensure the conduit does not obstruct access to serviceable components or interfere with hinges, latches, or mounting surfaces.



## Single Inverter & Battery Systems

To maintain IP65 rating for single Inverter & Battery systems drill only as many holes as are needed for your load and grid cables.

## Multiple Inverter & Battery Setup

Reference page 20 for details on spacing requirements for multiple battery and/or inverter systems.

# Mount Brackets & Sanctuary

Before starting, determine your system configuration and install all battery, spacer, and inverter brackets before placing any equipment. Refer to page 20 for spacing guidelines if installing multiple inverters or batteries.

**Step 1:** Position the battery bracket against the wall, mark the location, and secure it using the provided lag bolts.

**Step 2:** Align the mounting spacer vertically above the battery bracket and fasten it to the wall with the included lag bolts.

**Step 3:** Mount the inverter bracket by aligning it with the top of the spacer and securing it to the wall.

Repeat steps 1–3 for all additional units before continuing to the next stage.

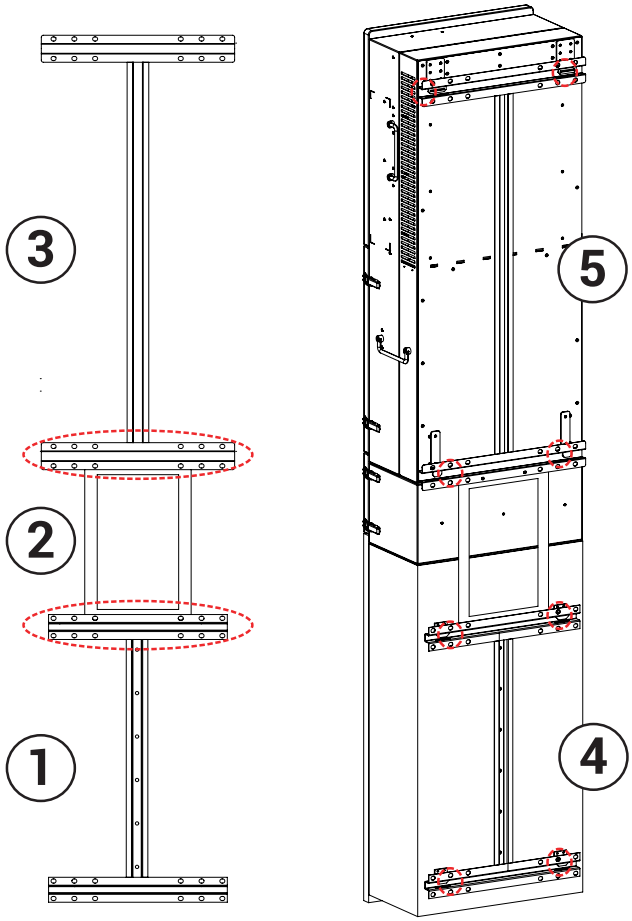
**Step 4:** Using a dolly, carefully lift the battery and lower it into the bracket until it clicks and locks in place.

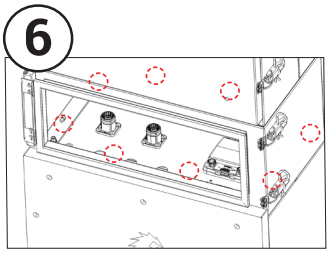
**Step 5:** Place the inverter on top of the battery, aligning the pre-installed wire box with the battery studs and the slots on the inverter bracket. Use the lower handle to help with placement.

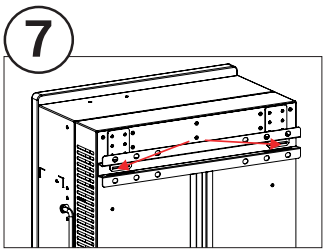
**Step 6:** Secure the inverter wire box to the battery studs using the provided nuts and a 5/16" socket. If the threads are not fully visible, press down gently on the wire box to compress the gasket.

**Step 7:** Lock the inverter in place using the safety clips provided in the inverter box.

If installing multiple units, pre-drill all necessary conduit passthrough holes in the wire boxes before mounting the additional batteries or inverters.



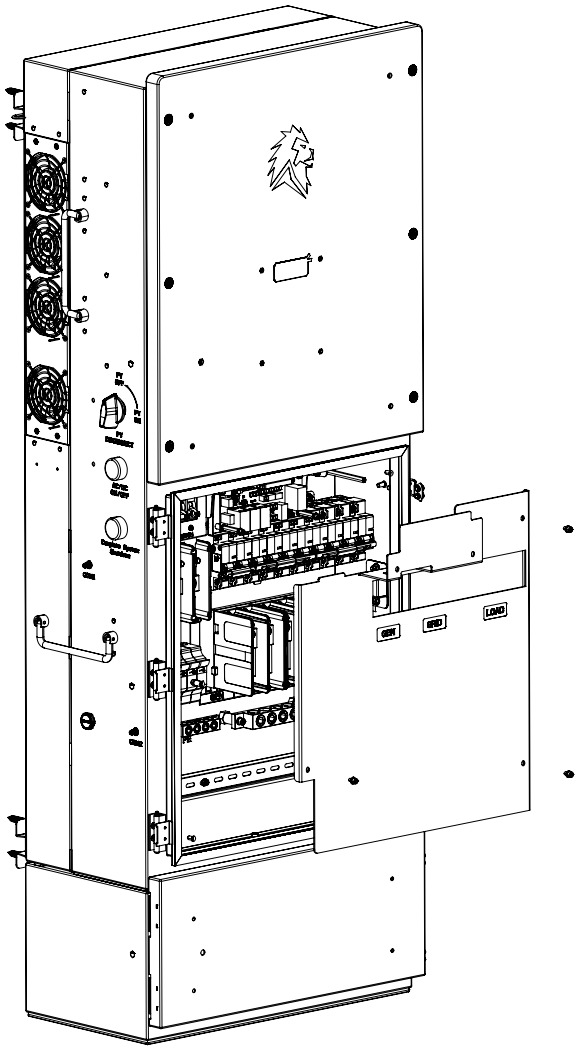

## Heavy Equipment – Lift with Caution

These units are heavy and require careful handling. **Inverter: ~194 lbs, Battery: ~290 lbs.** To avoid injury or damage:

- Always use 2–3 people when lifting or moving
- Lift with proper form—keep your back straight and lift with your legs
- Use a dolly, lift straps, or other equipment if needed
- Make sure the area is clear and stable before moving the units

# Accessing Internal Inverter Components

To access the internal components of the Sanctuary Inverter, follow these steps:



**Step 1.** Locate the two latches on the lower right side of the inverter.

**Step 2.** Open the inverter door.

**Step 3.** Remove the clear protective cover by unscrewing the five screws with a phillips screwdriver. Set aside for reinstallation.

**Step 4.** Once installation and wiring are complete, Step securely reattach the clear protective cover before closing the inverter door.

## Grounding Requirements

**Risk of electric shock.** When installing, the inverter must be grounded **first**. When dismantling, the grounding wire must be removed **last**.

## Reinstall Protective Cover

The protective cover must be reinstalled after completing the installation to ensure safety.

# EMS Compact Overview

The EMS-Compact is Lion Energy's proprietary Energy Management System for the Sanctuary System. It operates as the primary communications and command gateway between the inverter, battery, and solar-conversion components, while also providing a secure interface for the end user.

## Function Details

### Core Role

- Collects operating data from the inverter, battery, and PV modules.
- Maintains optimal and safe system operation through continuous health monitoring.
  Communications
- Bluetooth for local diagnostics and commissioning.
- SIM card included that provides continuous cloud connectivity.
- Remote monitoring, firmware updates, and analytics.

### Backup Power

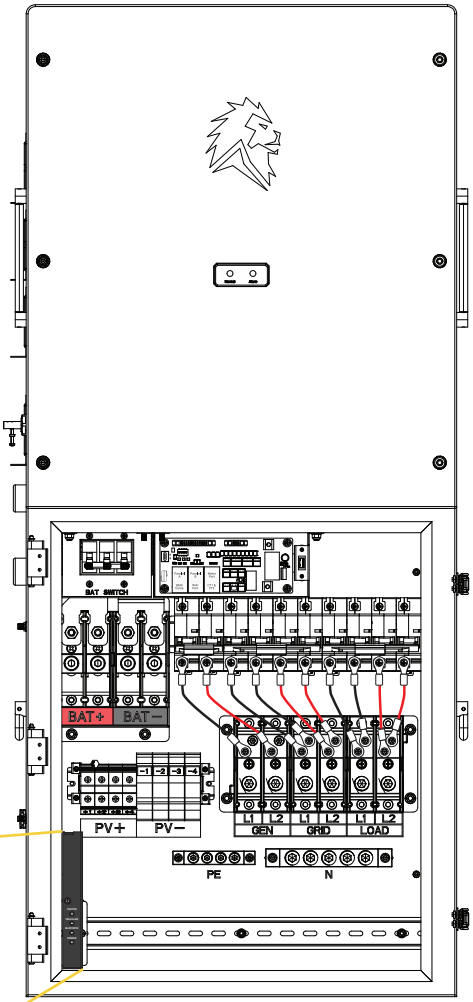
- Integrated backup battery supports data logging and status reporting during site-wide outages.

### Utility Integration

- SunSpec 2030.5 CSIP Certified

### Certification

- PTCRB certified – tested and approved to meet North-American cellular network standards.



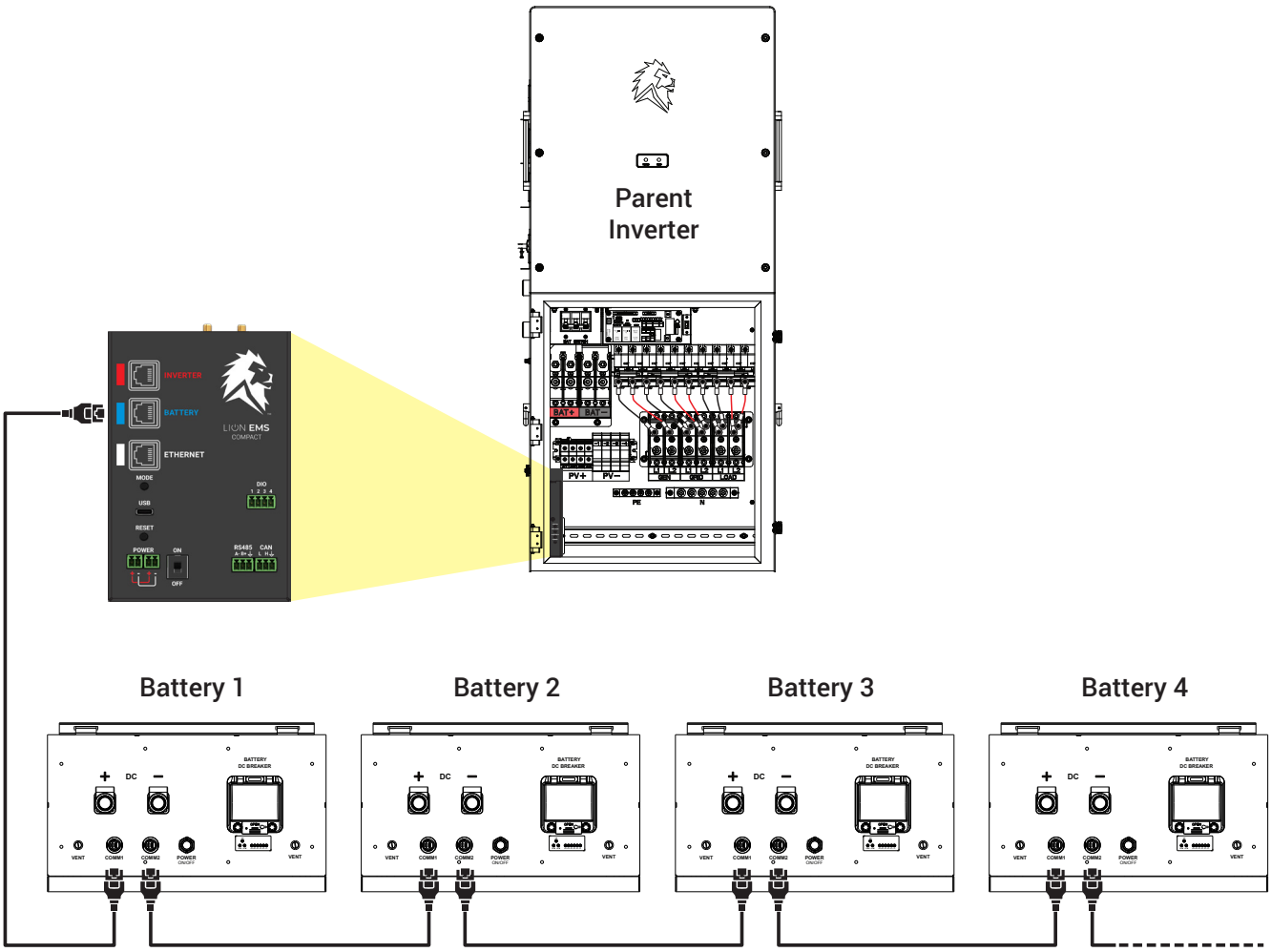


(EMS Compact, side view)

### EMS-Compact Guidance

For systems with multiple inverters, a single EMS-Compact should be used in the designated parent inverter. Refer to the commissioning instructions for detailed setup procedures.

# BMS Communication Cable Wiring



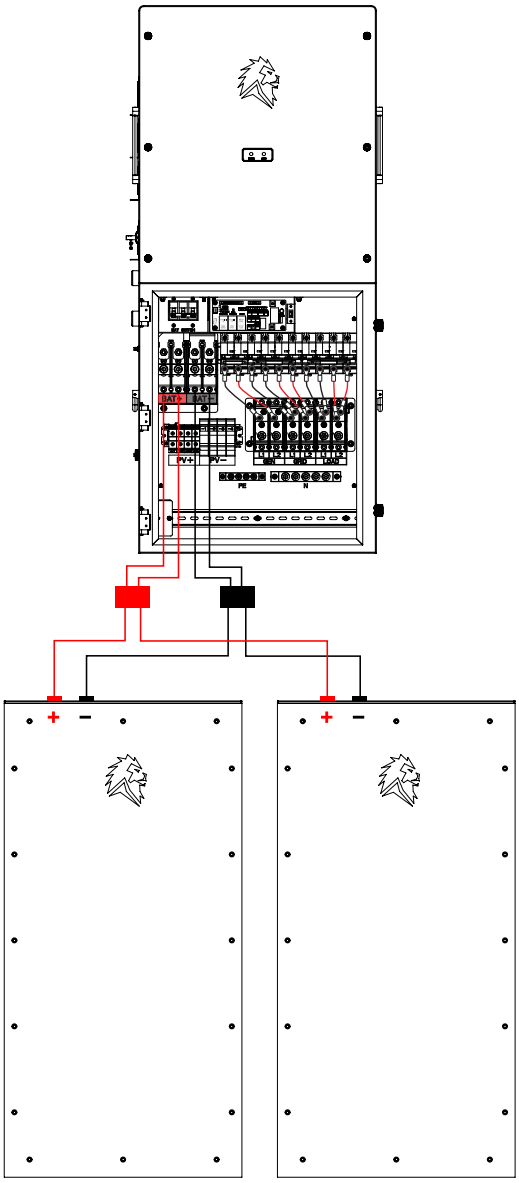

Each Battery includes one 3’ ethernet cable, which is required for the following steps. For a full list of Battery Parts and Components refer to page 14.

**Step 1:** Connect Parallel Batteries and Inverters (if applicable)

- Daisy-chain batteries using Ethernet cables:
  - » COMM1 (Battery 1) → “BATTERY” port in the EMS Compact
  - » COMM2 (Battery 1) → COMM1 (Battery 2)
  - » COMM2 (Battery 2) → COMM1 (Battery 3)
  - » Continue this pattern for additional batteries as needed.

  If additional inverters are present, the inverters should be connected together on their parallel ports. Additional inverters should not be connected to the battery communication chain.

# Low Voltage DC Wiring: 1 Inverter




**Step 1: Confirm Pre-Installed Components & Connect Inverter to Busbar**

- Busbars and inverter-to-busbar cables (32” red and black) are pre-installed. Confirm they are securely mounted and routed correctly.
- The black cable connects the inverter’s negative terminal (M8) to the negative (black) busbar (M10).
- The red cable connects the inverter’s positive terminal (M8) to the positive (red) busbar (M10).
- Always connect negative (–) first, then positive (+).

**Step 2: Connect the Batteries to the Busbar**

- Route black 50mm cables (55”) from M8 eyelets to the negative busbar; plug the 230A connectors into the negative (–) battery terminals.
- Route red 50mm cables (55”) from M8 eyelets to the positive busbar; plug the 230A connectors into the positive (+) battery terminals.
- Confirm all cables are installed according to layout. If prewired, verify their presence before continuing.

**Step 3: Verify Connections**

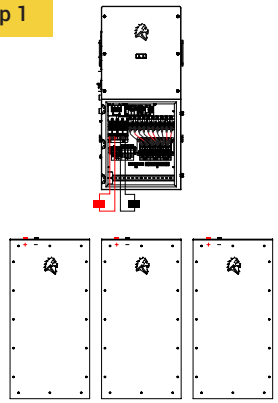
- Ensure all red cables go from positive (+) to positive (+), and all black cables from negative (–) to negative (–).
- Torque all connections to spec and check for secure attachment.

**Step 4: Power On the System**

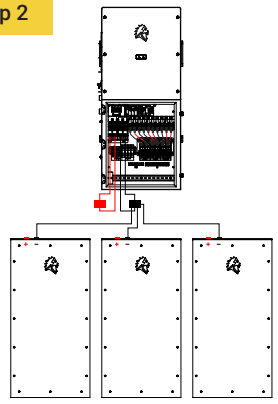
- Turn on each battery using the power button.
- Once all batteries are on, power up the inverter.
- Confirm the system starts without faults or LED alerts.

# Low Voltage DC Wiring: 1 Inverter (cont.)

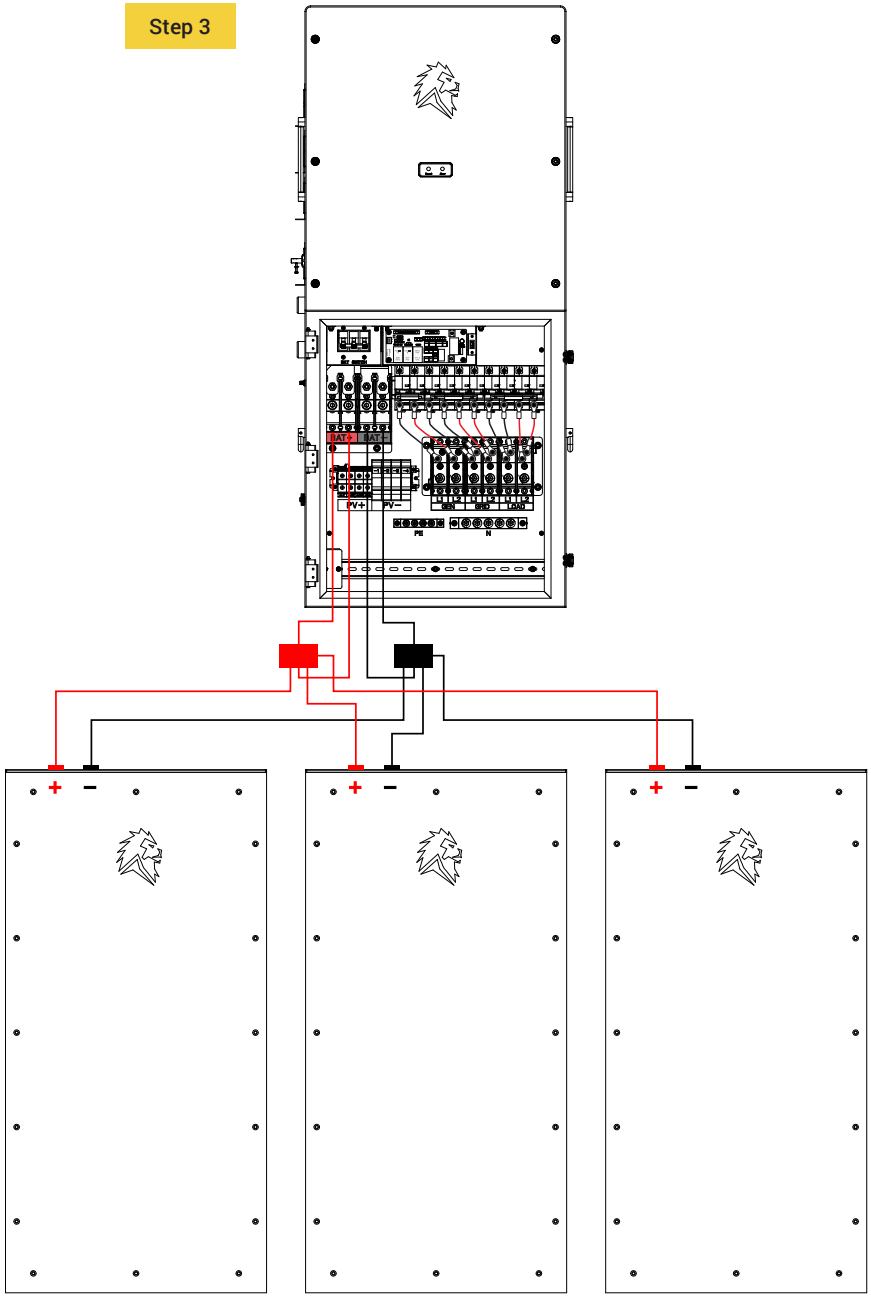
Step 1



Step 2



Step 3



# Low Voltage DC Wiring: Multiple Inverter

## (3 Inverters, 6 Batteries)

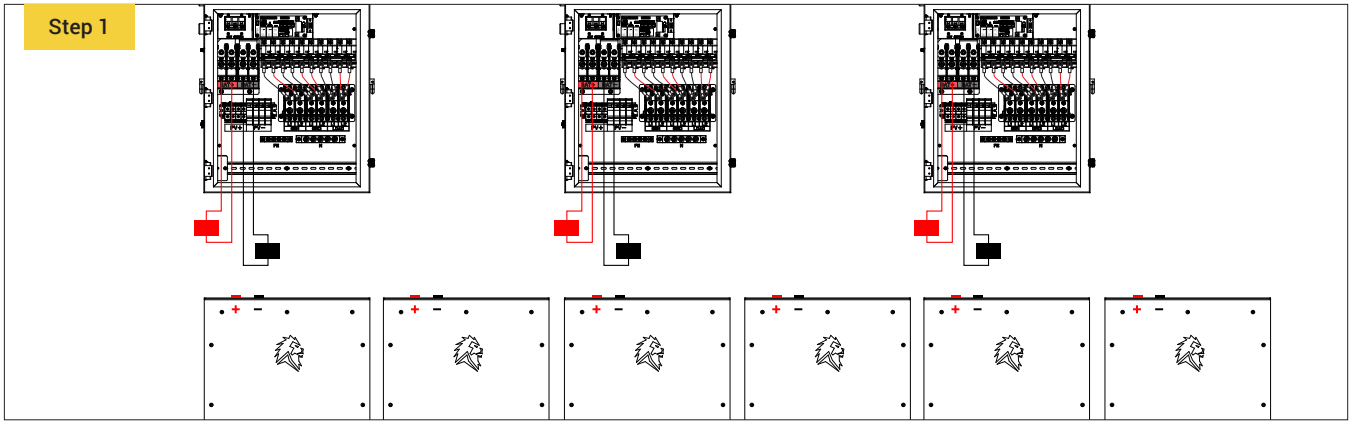
**Step 1.** Ensure the busbar is premounted, and verify if the inverter-to-busbar connection has been pre-wired.

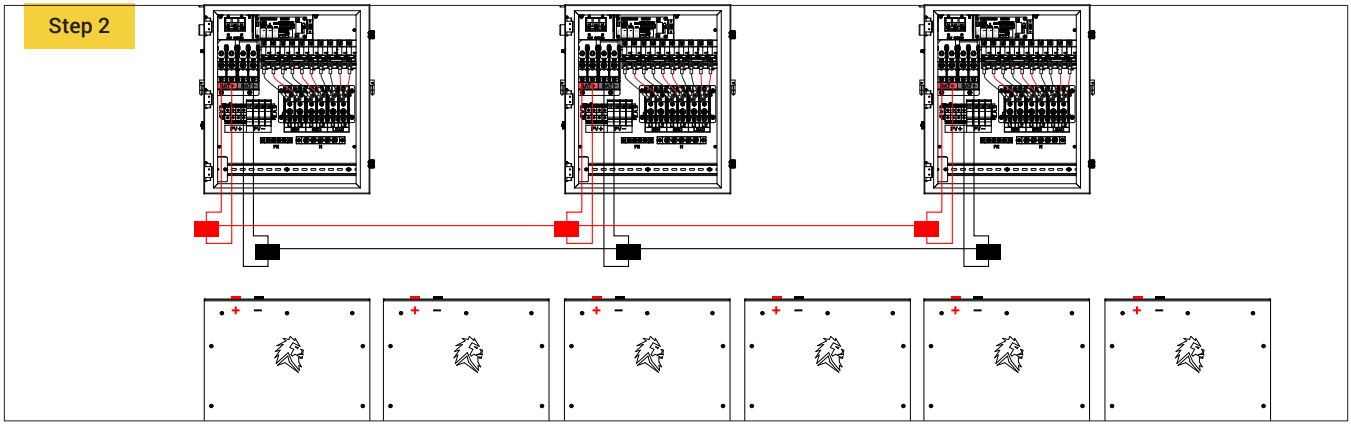
**Step 2.** Use an M8 busbar-to-busbar cable to connect one busbar to another, ensuring proper (+ and -) connections.This cable is included in the Lion Parallel Kit (sold separately) or can be custom-made with an M8 eyelet.

**Step 3.** Use the black cable with a 230A plug and M8 eyelet to connect the negative terminal of each battery to the negative busbar.

**Step 4.** Use the red cable with a 230A plug and M8 eyelet to connect the positive terminal of each battery to the positive busbar.

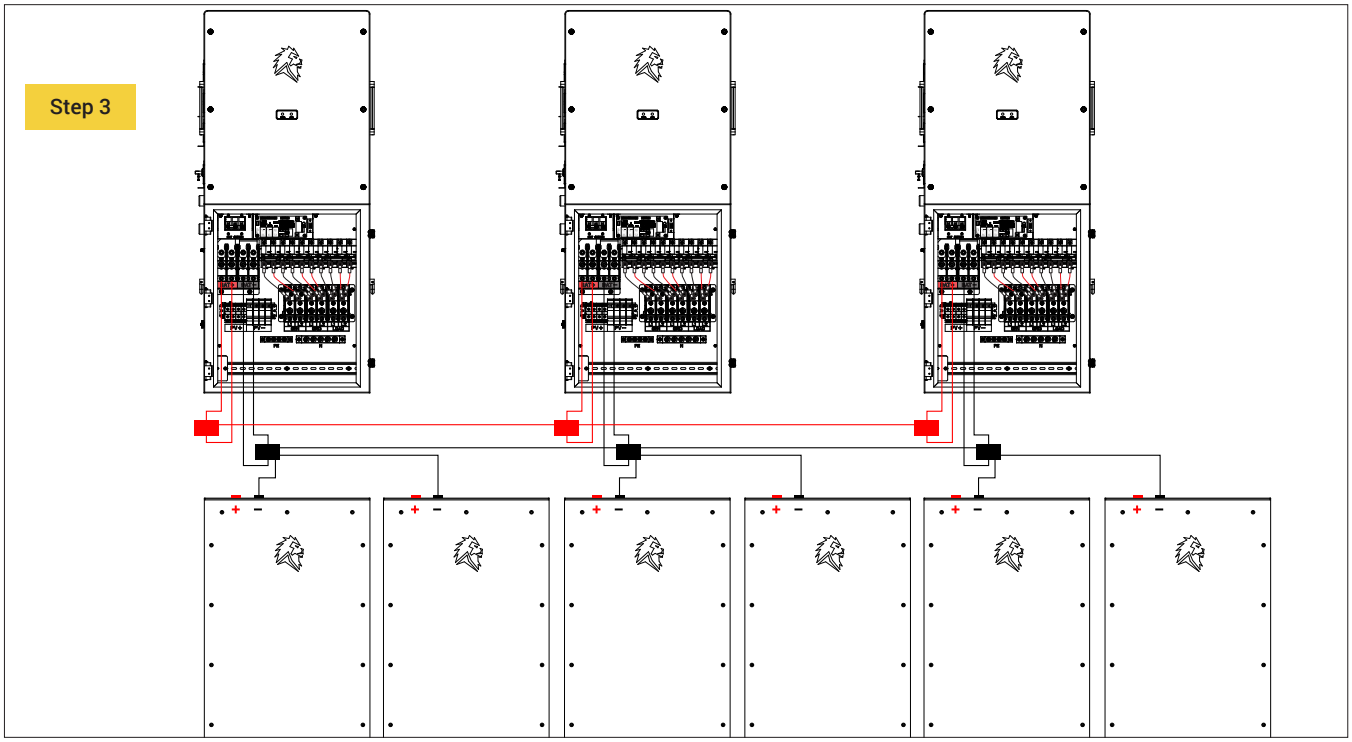
**Step 5.** Ensure all connections are secure.



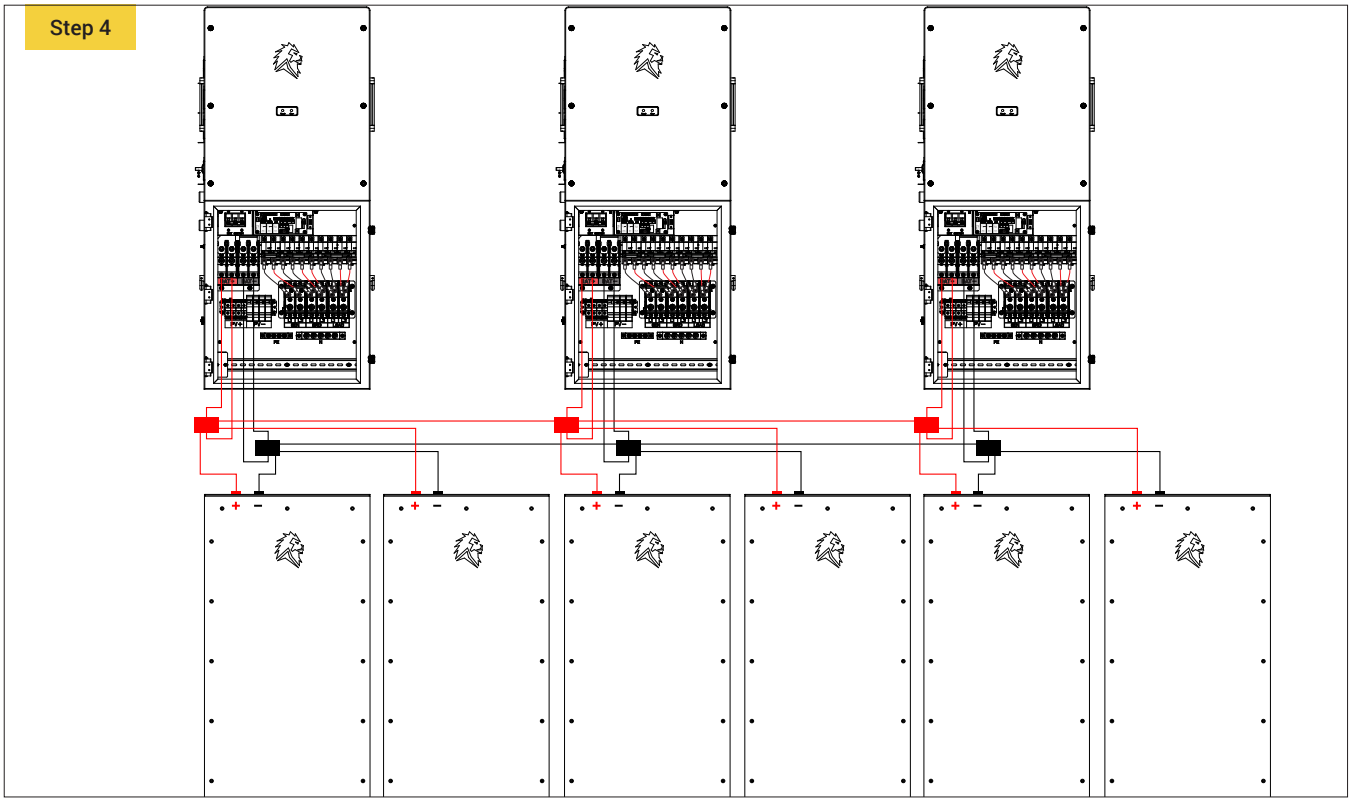



# Low Voltage DC Wiring: Multiple Inverter (cont.)

Step 3



Step 4



# Solar Input DC Wiring

The Sanctuary inverter includes 4 MPPTs, each capable of handling a specific solar input capacity. Depending on the model, the system can support a total solar input within a specified range.

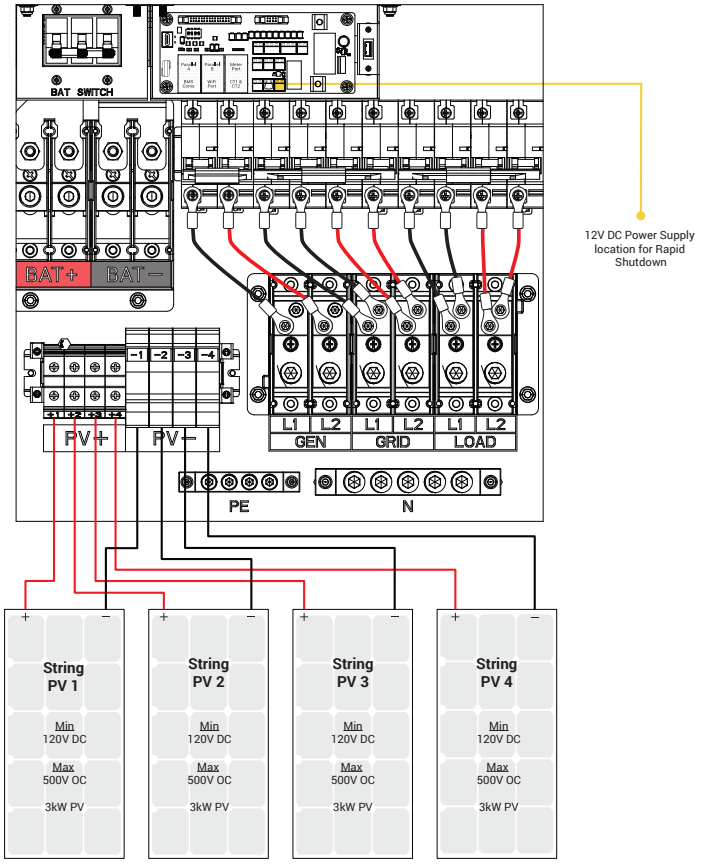
Usable voltage range: 120V to 500V
Maximum PV ISC rating: 22A

For higher wattage PV strings, MPPTs can be paired to increase capacity, allowing for greater power input per MPPT. Proper pairing and configuration help maximize system efficiency and prevent overloading individual MPPTs.

### PV Installation Considerations:

Before connecting solar panels, confirm that the total open circuit voltage (Voc) of the PV string does not exceed 500V by checking the solar panel specification sheet.

Calculate string sizes based on the inverter's voltage range and MPPT limits. Incorrect string sizing can lead to reduced performance or system faults.




## Properly Connect Positive and Negative

Before making the final DC connection or turning on the high-voltage DC switch/disconnect, ensure that the positive (+) is connected to positive (+) and the negative (-) is connected to negative (-). Incorrect wiring may cause damage or safety hazards.

## High Voltage - Handle with Caution

Always make connections while the unit is powered off. The PV (-) terminals can reach approximately -240V DC during operation. Failure to follow proper procedures may result in electric shock or equipment damage.

# PV Module Wire Connection

Verify correct polarity of all wire connections for the PV modules and PV input connectors. Insert the wires and connect the positive pole (+) of the connection wire to the positive pole (+) of the PV input connector. Connect the negative pole (-) of the connection wire to the negative pole (-) of the PV input connector.

## Use surge protection

It is recommended to install a surge protection device on PV lines to prevent damage from lightning strikes or electrical surges, which could impact system performance.

## PV Grounding Guidelines, Do Not Ground PV(-)

The inverter system includes fuses for protection, but PV(-) must remain ungrounded for proper system operation. If PV(-) is grounded, the fuse on the affected line will blow and need to be replaced. Before replacing the fuse, check for grounding issues to prevent it from happening again.

## Check for Current Leakage

Avoid using PV modules with known ground leakage, as this can lead to performance issues. Verify there is no continuity between PV(-) and ground before connecting to the inverter.

## Diagnosing PV to GND Leakage

Even though voltage differences between PV(+) and PV(-) are expected, there should be no continuity between PV(+) or PV(-) and ground. If there is continuity, it may indicate a wiring issue or a faulty module. Follow these steps to check for leakage:

1. Turn the PV Disconnect switch off.
2. Measure the voltage between PV(-) and ground. It should read approximately 0V. If continuity is detected, the circuit should be open.
3. Measure the voltage between PV(+) and ground. It should also read 0V. If continuity is detected, verify that the PV module wiring is correct.
4. If using Module Level Power Electronics (MLPE), note that this test may not detect leakage paths if the Rapid Shutdown System (RSS) is not activating the PV panels properly.

# Rapid Shutdown

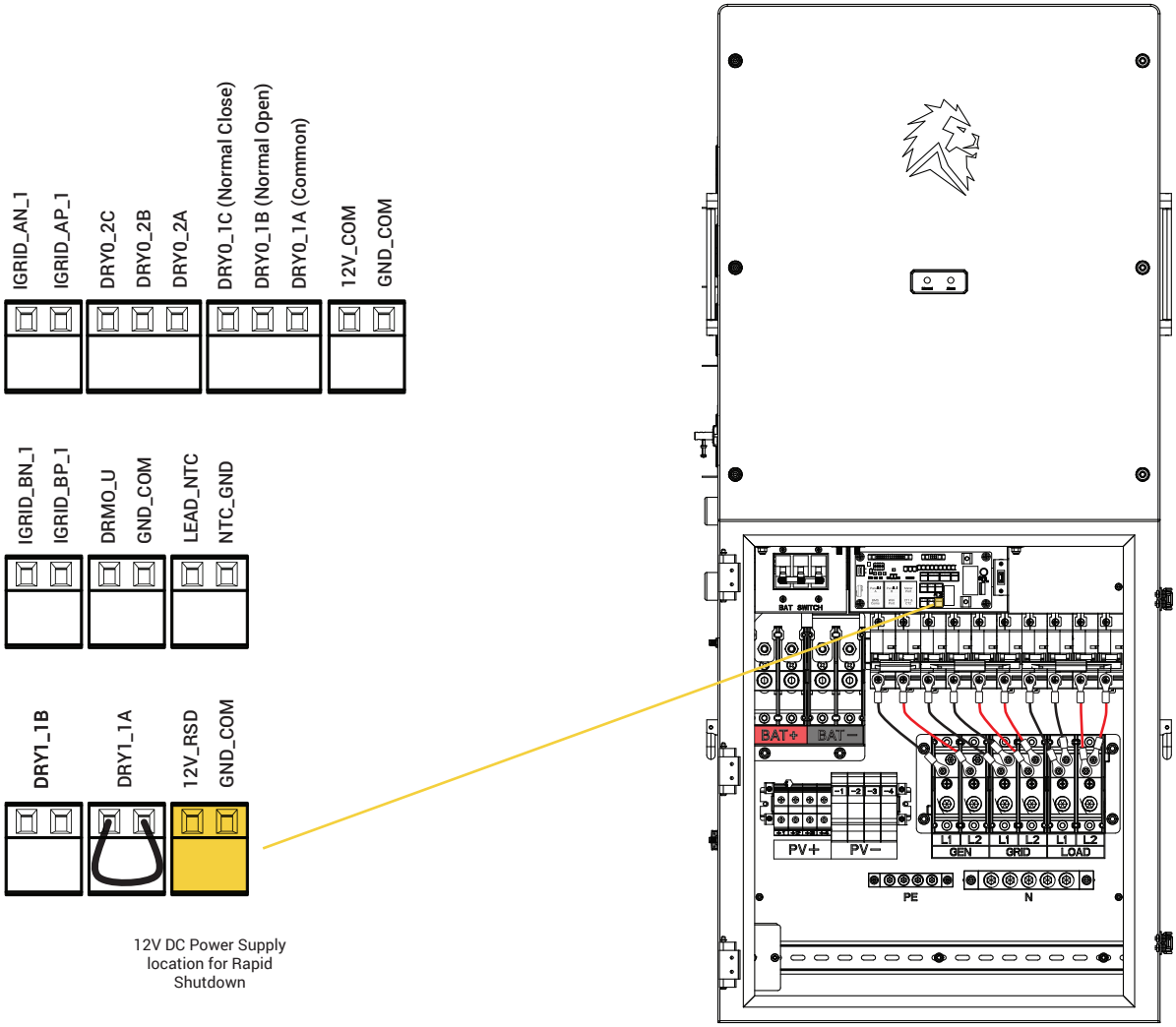
The National Electric Code (NEC) requires PV systems on buildings to have a rapid shutdown system (RSD) for first responder safety during rooftop ventilation or rescue operations. For more details, see NEC Section 690.12.

The Sanctuary inverter includes a built-in 12V DC, 1A power supply for a rapid shutdown (RS) transmitter. This transmitter is polarity-sensitive and must be wired correctly.

The 12V supply is available on the pins labeled 12V_RSD and GND_COM, as shown in the diagram below.

If the remote shutdown switch is activated (open circuit), or if either of the two power buttons on the inverter is turned off, the inverter and the 12V power source will shut down.

See the page 33 for remote shutdown switch installation instructions.



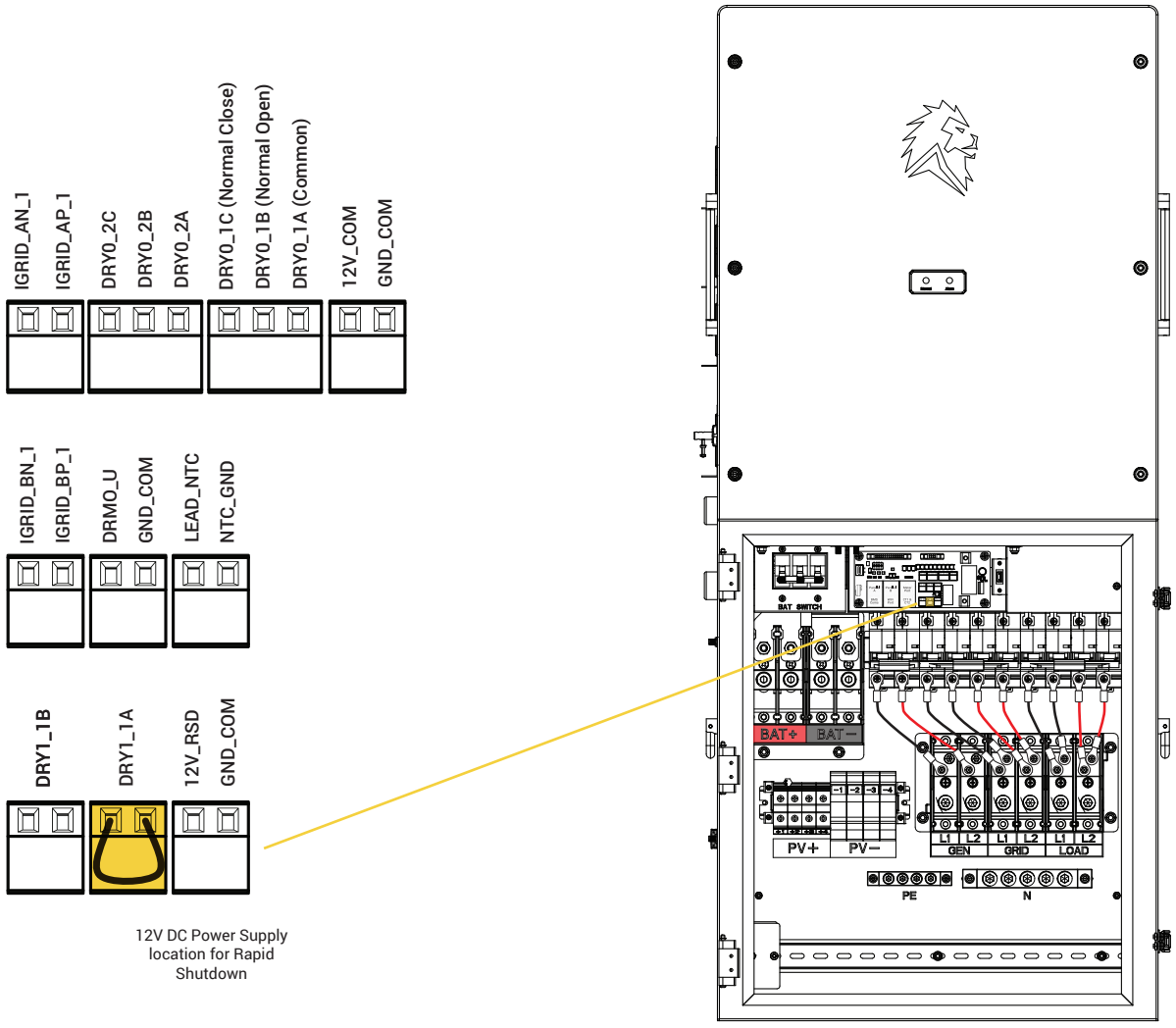

12V DC Power Supply location for Rapid Shutdown

# Remote Shutdown Switch

To install a remote shutdown switch, first unplug the connector with the black wire loop (highlighted in yellow in the image below). Remove the wire loop and connect the remote shutdown switch in its place.

The remote shutdown switch must be wired in the normally closed position for the inverters to remain on. When the switch is activated to shut down the system, it will open the circuit, turning off the inverters.

If the remote shutdown switch is activated (open circuit), or if the AC/DC Power button on the inverter is turned off, the inverter and the 12V power source will shut down.




12V DC Power Supply location for Rapid Shutdown

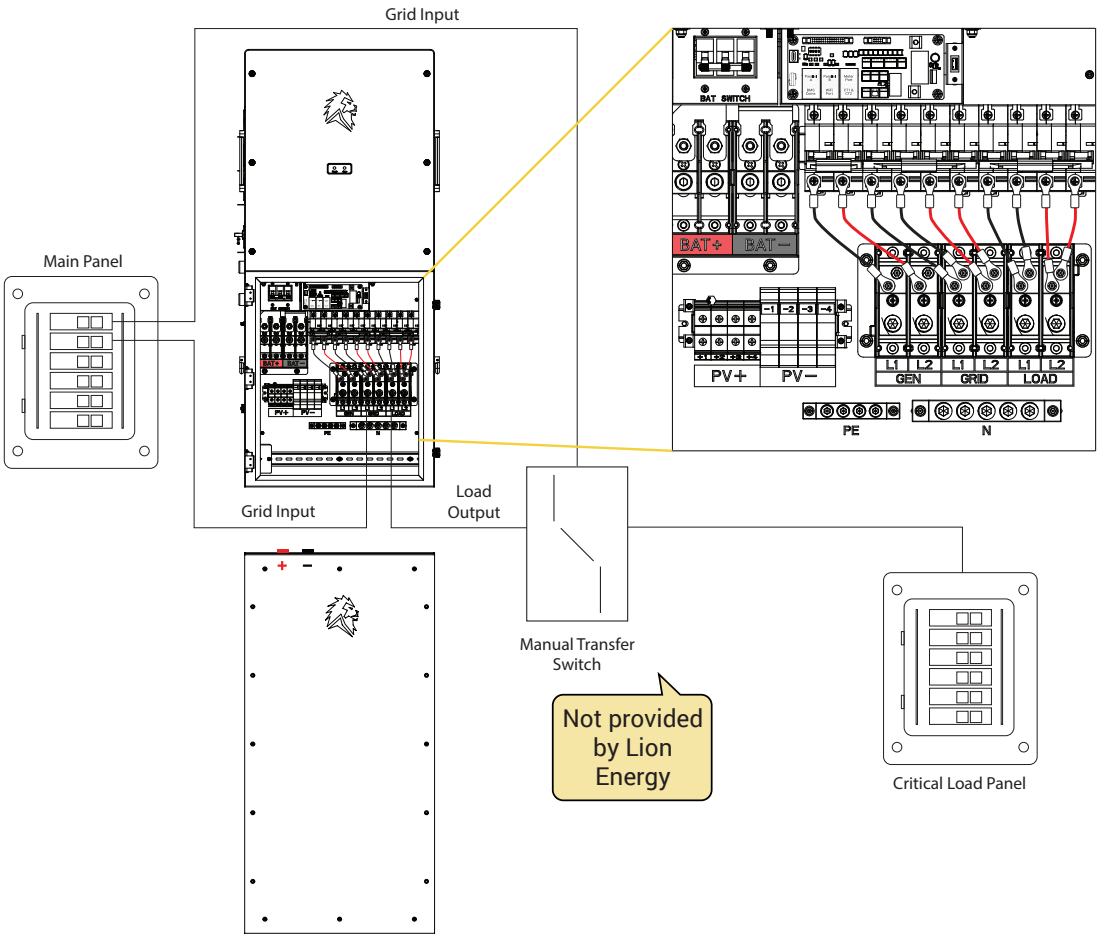
# AC Wiring: 1 Critical Loads Backup

For grid-tied installations, the Sanctuary 3 inverter supports up to 200A grid-supplied pass-through. The grid input must be connected to an appropriately sized 200A circuit breaker. For 200A residential installations, 4/0 SER cable must be used to ensure proper current handling and safety.

**Step 1.** Install two breakers in the Main Panel—one for the Sanctuary inverter's grid input and another connecting to a 3-position manual transfer switch.

**Step 2.** Connect the Sanctuary inverter by wiring its load output to the 3-position manual transfer switch.

**Step 3.** Wire the Critical Loads Panel by connecting it directly to the manual transfer switch.




## Note

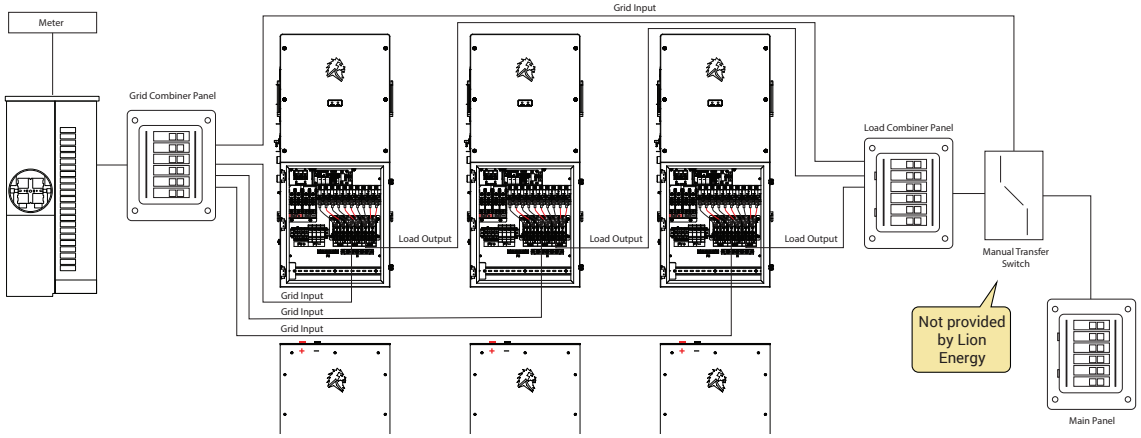
- A 3-position manual transfer switch is recommended but not required for this installation.
- This example shows a single inverter installation. However, multiple inverters can also be configured for critical loads backup by using combiner panels on the load outputs before connecting to the critical loads panel.

# AC Wiring: Whole Home Backup

For grid-tied installations, each Sanctuary inverter supports up to 200A grid-supplied pass-through. This allows the Sanctuary to provide whole home backup using a single inverter, or with additional inverters to maximum grid down power and energy The grid input power must be connected using an appropriately sized circuit breaker, up to 200A per inverter.

**3 Inverters for example shown**

To connect the inverters' load outputs, install a combiner panel with breakers—one for each inverter. These breakers must be wired to the load outputs of the Sanctuary inverters. The combiner panel connects to a manual transfer switch, which then connects to a grid breaker and also routes back to the grid combiner panel to enable system bypass The output of the manual transfer switch is wired to the essential loads panel.




## Manual Transfer Switch

- A 3-position manual transfer switch is recommended but not required.
- Before powering up multiple inverters, perform a continuity test to ensure all phases match across all units.

## L1 L2 PHASING

It is critical that the grid input and load output phases match across all inverters. If a phase is crossed, it can cause a short circuit between L1 and L2. Incorrect phasing can damage the equipment. Perform a continuity test before powering up to confirm correct phase alignment. See page 36-37.

## Breaker Sizing

The three breakers supplying power from the main panel to the Sanctuary inverters must be rated equally, with a maximum of 200A each. This ensures balanced and safe operation across all units. The fourth breaker, which feeds the manual bypass switch, must be rated equal to the supply-side breaker of the panel. This maintains consistency and ensures safe pass-through during bypass conditions.

# Continuity Testing: Multiple Inverters

When installing multiple Sanctuary inverters, do not cross phases—Line 1 must remain Line 1, and Line 2 must remain Line 2 on Grid Input and Load Output for all inverters. Neutral must also stay consistent. Phases can be accidentally crossed due to wiring, service panel bussing, or breaker misalignment, so a continuity test is required for grid input, generator input, and load output terminals.

## Grid Input Continuity Testing

**If there is no AC disconnect above the inverter grid breakers, use extreme caution when measuring live circuits. Do not measure continuity if there is live voltage.**

**Step 1.** Turn off the AC power button on each inverter

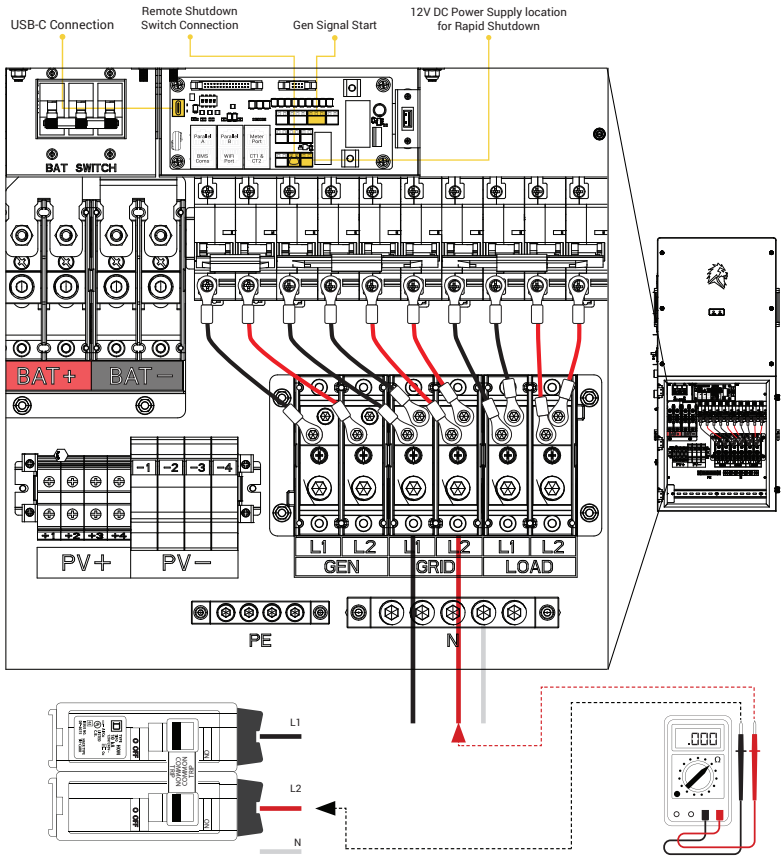
**Step 2.** Turn off load breakers in the load combiner panel.

**Step 3.** Turn off grid power feeding the inverters but leave inverter grid breakers ON (if no disconnect is present, measurements will be on live wires).

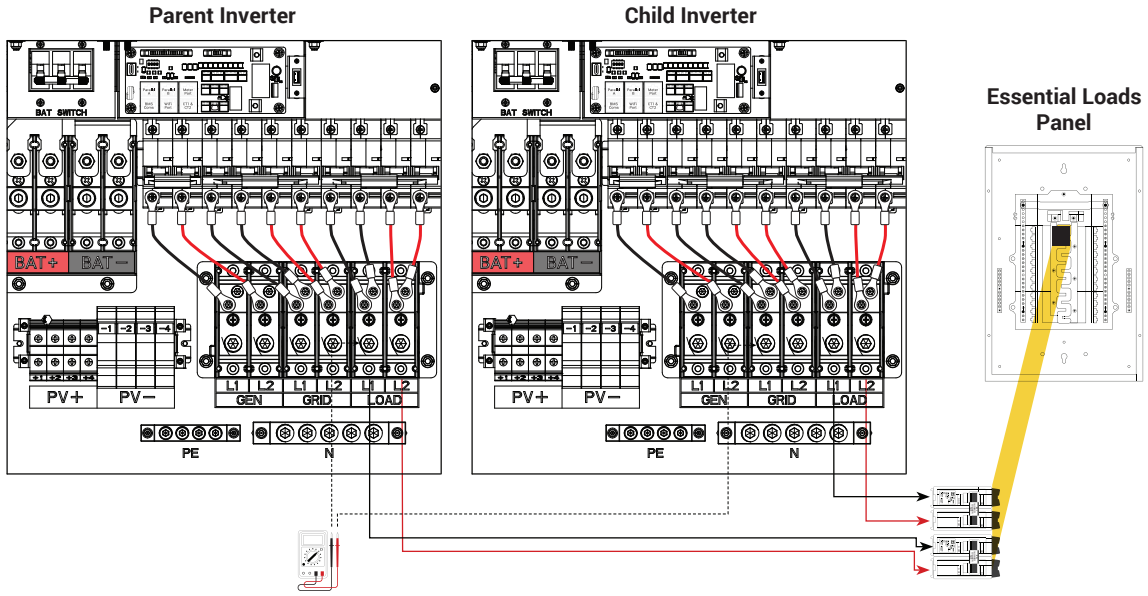
**Step 4.** Measure voltage and continuity:

- If grid power is live, confirm that L1 to L2 reads 240V. DO NOT measure continuity when voltage is live.
- If grid power is off, confirm that L1 to L2 reads 0V. At this point, it is safe to measure continuity.
- There should be no continuity between L1 and L2 under any condition.
- Multiple Inverter Voltage and Continuity Testing
  - » L1 Voltage/Continuity: Measure between Grid L1 of the parent inverter and Grid L1 of the next inverter—it should read 0V and close to zero ohms.
  - » L2 Voltage/Continuity: Measure between Grid L2 of the parent inverter and Grid L2 of the next inverter—it should read 0V and close to zero ohms.
  - » Repeat for all inverters in the system.

**Step 5.** Measure neutral to ground on each inverter. It should read 0V and be close to 0 ohms, due to neutral-to-ground bonding in the first panel after the utility meter.



## Load Output Continuity Testing




**Load Output Continuity Testing**
Before testing, confirm that all inverters are powered off and that there is no voltage at the grid input, generator input, or load output terminals.

**Step 1:** Verify there is no live voltage by checking the essential loads panel to ensure it is not receiving power from another source. If a manual bypass switch is installed, set it to the grid power position to disconnect the inverter load breakers. If no bypass switch is present, turn off the essential loads panel breakers for the test.

**Step 2:** With inverters still off, turn on their load output breakers to close the circuit between inverters. This allows continuity testing between load outputs.

**Step 3:** L1 Continuity: Measure between Load L1 of the parent inverter and Load L1 of the next inverter—it should read close to zero ohms. L2 Continuity: Measure between Load L2 of the parent inverter and Load L2 of the next inverter—it should read close to zero ohms.

**Step 3:** Confirm that voltage from Load L1 to Load L2 is 0V before performing a continuity check. If the voltage is 240 turn off the inverter. Check for short circuits by measuring continuity from Load L1 to Load L2 on each inverter—this should always be an open circuit.

**If any test fails, check for incorrect wiring, such as:**

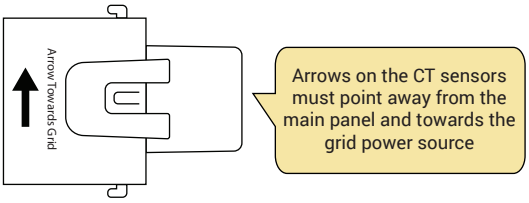
- Crossed phases
- Load breakers turned off
- Essential loads panel incorrectly connected

### AC Output Breakers

After commissioning, you will be prompted to reconnect and verify AC output breakers.

# CT Installation

The inverter requires correctly installed CTs (Current Transformers) to measure power flow and direction. Improper installation can cause system malfunctions.

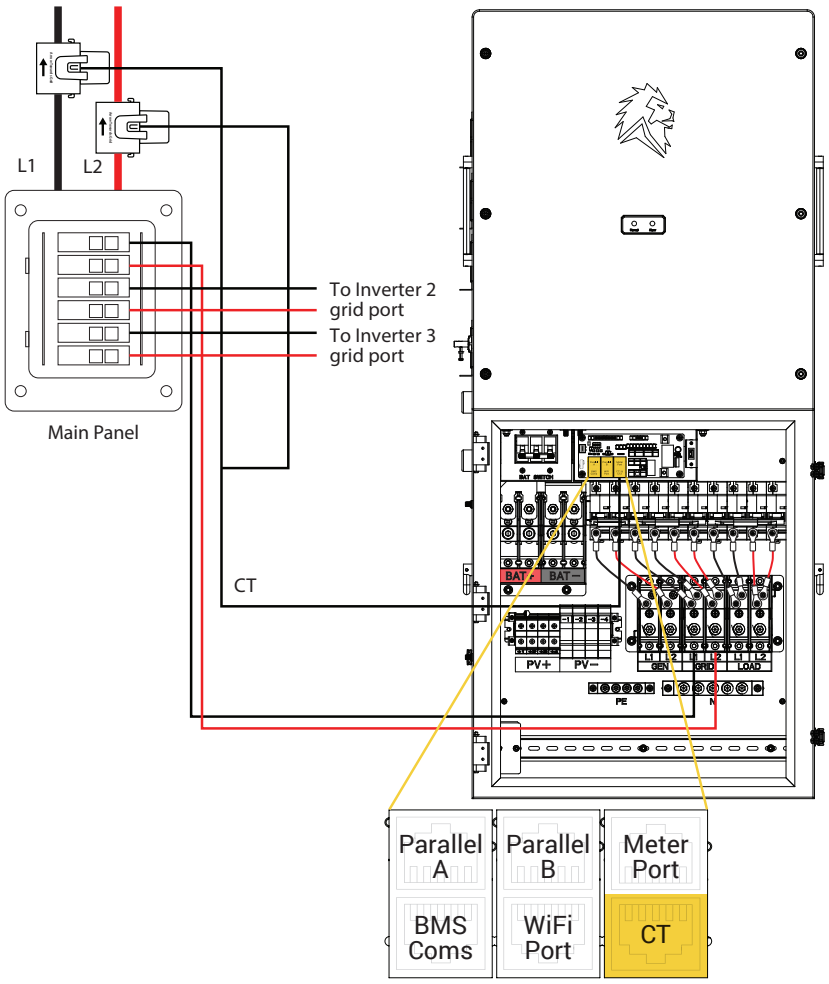



**How to Install CTs Correctly**

**Step 1:** Clamp the CT labeled “Line 1” around Line 1 feeding the main panel.

**Step 2:** Clamp the CT labeled “Line 2” around Line 2 feeding the main panel.

**Step 3:** Ensure the arrows on the CT sensors point away from the main panel and toward the grid power source




**IMPORTANT**

**Incorrect CT installation may cause:**

1. Unintended battery charging from the grid.
2. Continuous battery discharge back into the grid.

For multiple inverter systems, only the main inverter (parent inverter) should have CTs installed as shown in the diagram.

## CT Lines and Direction

The CTs must be placed on the correct lines and in the right direction for the system to work properly.

## Warning

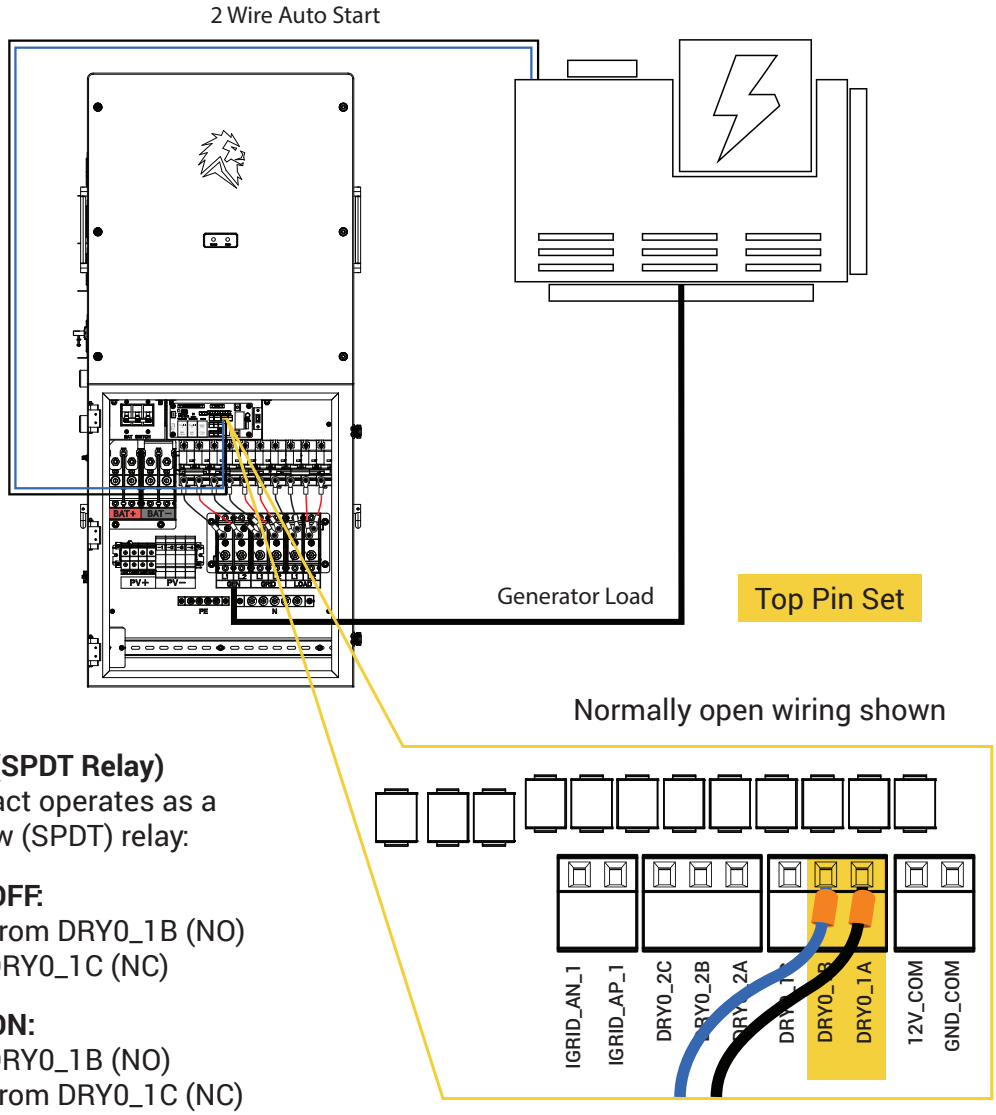
Incorrect CT installation can cause system issues, including unwanted battery charging and discharging. Follow these steps carefully to avoid problems.

# Generator Wiring: 1 Inverter

The Sanctuary ESS is compatible with 240V split-phase home backup generators. It supports both manual and automatic start features and can accept up to 12kW of input power through the generator input to supply loads and charge batteries.

**Wiring a Generator to the Sanctuary Inverter**
If the system is grid-tied, the generator must be connected directly to the Gen input on the inverter.
If the system is off-grid, the generator can be connected to either the Gen input or the Grid input.

**Two-Wire Auto Start Configuration**
If the generator has a two-wire auto start feature:
1. Connect one control line to DRY0_1A (Common).
2. The second control line should be connected based on the generator's auto start type:
2.1 If the generator start is normally open (NO)  Connect to DRY0_1B
2.2 If the generator start is normally closed (NC)  Connect to DRY0_1C




**Generator Dry Contact (SPDT Relay)**
The generator dry contact operates as a single-pole double-throw (SPDT) relay:

**When the generator is OFF:**
DRY0_1A disconnects from DRY0_1B (NO)
DRY0_1A connects to DRY0_1C (NC)

**When the generator is ON:**
DRY0_1A connects to DRY0_1B (NO)
DRY0_1A disconnects from DRY0_1C (NC)

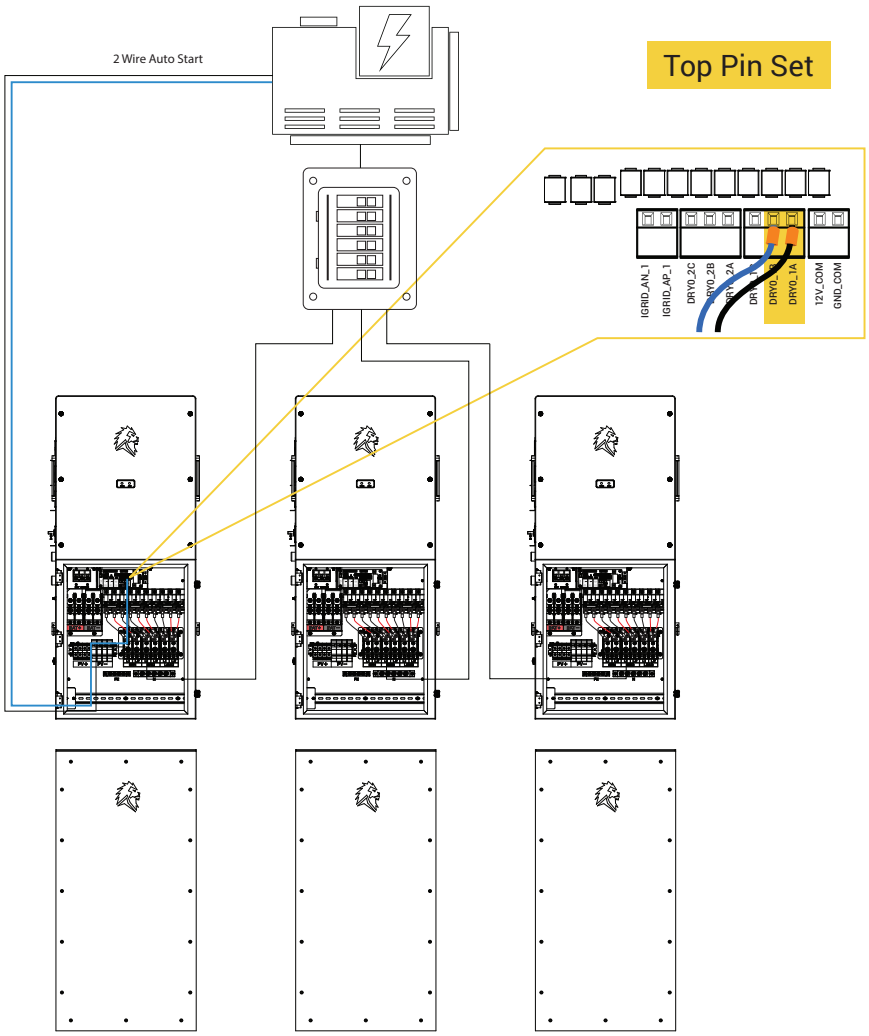
# Generator Wiring: Multiple Inverter

## L1 L2 PHASING

- The generator input phases must match across all inverters. Incorrect phasing may result in a short circuit between L1 and L2, causing damage to the generator and equipment.
- Perform a generator input continuity test before powering up to verify proper phase alignment. See page 41.

Each inverter can handle up to 12kW of input power from the generator to supply loads and charge batteries. The generator function is only available when the grid is not present.

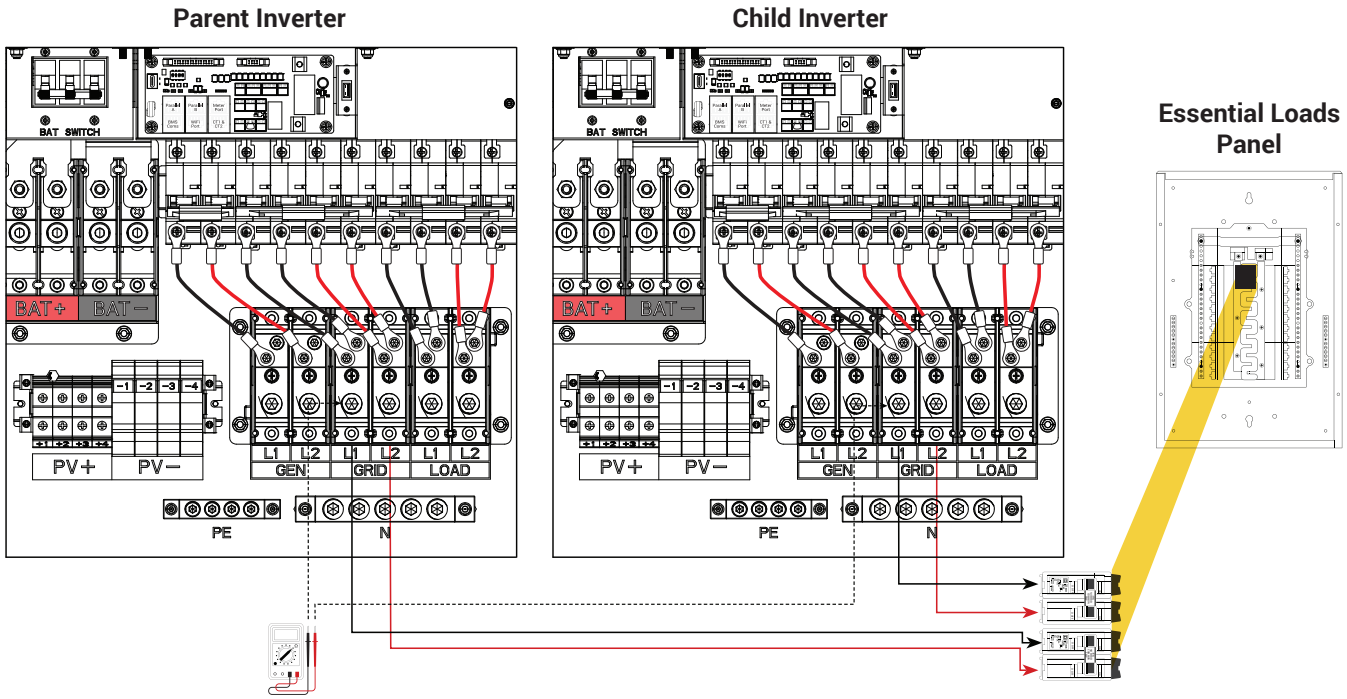
For multiple inverters, the generator's AC output must be wired to a combiner panel. From the combiner panel, dedicated lines must be run to each Sanctuary inverter's Gen input. If the generator has a two-wire auto start feature, these control lines should be connected to the parent inverter's DRY0_1A (Common) and either DRY0_1B (NO) or DRY0_1C (NC), depending on the generator's start configuration.




## Breaker Sizing

The three breakers feeding the sanctuary system from the generator combiner panel need to be the same amp rating with a maximum of 50A each.

## Generator Input Continuity Testing




**Step 1.** Ensure the generator is off. If using AC solar, turn off the AC power button on each inverter. If the inverters are powered on with AC solar enabled, the generator port will be connected to grid power through internal relays.

**Step 2.** Leave the generator (or AC solar) combiner breakers in the on position.

**Step 3.** Verify the generator power is off by measuring voltage between L1 and L2 on each inverter's generator port.

**Step 4.** Measure continuity between generator L1 terminals:

L1 on the first inverter → L1 on the second inverter → Should be close to zero ohms

L1 on the second inverter → L1 on the third inverter → Should be close to zero ohms

**Step 5.** Measure continuity between generator L2 terminals:

L2 on the first inverter → L2 on the second inverter → Should be close to zero ohms

L2 on the second inverter → L2 on the third inverter → Should be close to zero ohms

**Step 6.** Turn off the generator breaker. Measure continuity between generator L1 and generator L2 ports on each inverter. These should be open circuit.

# AC Solar

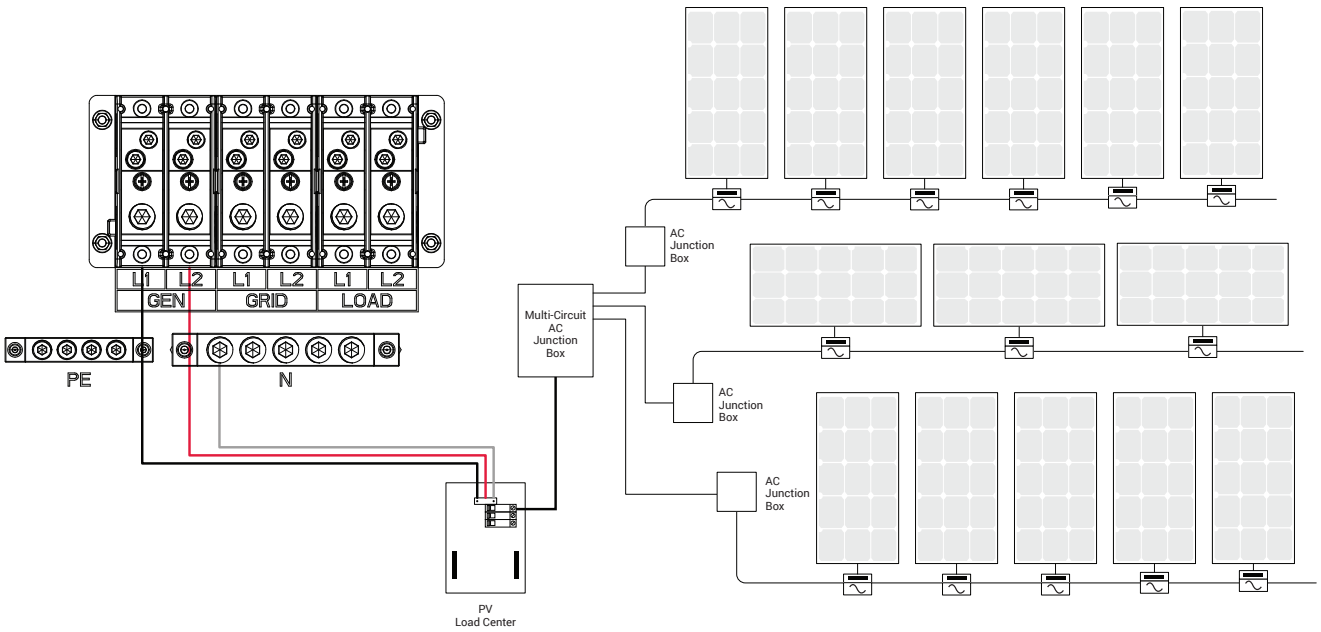
The Sanctuary ESS supports AC-coupled solar and provides battery backup for existing grid-tied solar systems. The inverter will use excess solar power to charge the battery. The generator port can be used for either AC solar or a generator, depending on the system setup.

### System Capability

- The system supports up to 12kW of AC solar or a generator, regardless of the inverter model.
- For a single inverter setup, connect up to 12kW of AC solar or a generator to the generator port.
- For multiple inverters, use a combiner panel to distribute AC solar or generator power to each inverter.

### Installation Guidelines

- Do not cross phases in the AC solar or generator wiring. If a phase is crossed on one of the generator ports, it will short L1 to L2, potentially damaging the equipment.
- Follow the procedure outlined in generator input continuity testing for proper installation.




## AC Solar Considerations

- The diagram provided is for illustrative purposes only. Actual system configuration may vary based on installation requirements.
- In a multiple inverter setup, only one input type—either generator or AC solar—may be used across all inverters; mixing the two is not supported.

# First-Time Power-Up

Before turning on the grid breakers to any inverters, it is critical to go through the first-time power-up sequence. This checks the PV wiring for ground leakage. There can be no continuity between PV(-) and ground or PV(+) and ground.

**Step 1.** Make sure grid breakers are turned off to all inverters. Make sure the load combiner breakers are turned off for all inverters (applies to parallel systems only).

**Step 2.** Make sure batteries are connected to the inverters.

**Step 3.** Turn on the bottom power switch labeled “Complete System Shutdown” on all inverters so that the control board has power. Leave the middle button (AC/DC) off.

**Step 4.** Commission the System.

**Step 5.** After commissioning the system, turn on the load combiner breakers.

**Step 6.** On all inverters, turn the PV DISCONNECT switch on. You should be getting voltage from the PV panels to the inverters now.

**Step 7.** Wait at least two minutes. After a minute, the inverter should start the PV insulation check test. You might be able to hear the relay clicking. If the front panel LED turns on orange or red, it failed the test. Do not proceed powering up until the PV wiring has been corrected so that there is no path from PV(+) to GND or PV(-) to GND. If the test failed, the inverter must be completely powered down.

**Step 8.** On all inverters, turn the AC/DC switches on and wait two minutes. The load will power on within about 30 seconds. If the red light comes on, power off all the inverters (turn off all three buttons) and fix the PV wiring. Do NOT turn on any grid breakers until the PV wiring is fixed. Otherwise, catastrophic equipment failure may occur.

**Step 9.** Turn on on the grid breakers to all inverters.

## Notes:

## Notes:

LIONENERGY™

385.375.8191
Monday - Friday
9:00 AM - 5:00 PM MST

735 S. Auto Mall Drive Suite 200
American Fork, Utah
84003

info@lionenergy.com
www.lionenergy.com
@lionenergy