



**BigBattery**  
— Your Source For Power

# **RHINO 2 USER MANUAL**



Version 1.1



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# 1. Definition of Terms

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- AWG – American Wire Gauge
- A – Amp(s)
- Ah – Amp hour(s)
- AC – Alternating Current
- Battery Module – Single battery
- Battery System – Two or more battery modules connected to a controller box
- BMS – Battery Management System
- Capacity – Measure of stored energy, typically in Ah or mAh
- Cell Balancing – Process of ensuring uniform charge among cells in a battery
- Cycle Life – Total charge-discharge cycles before capacity decline
- C-rating – Charging/discharging rate relative to battery capacity
- DC – Direct Current
- DOD – Depth of Discharge
- ESS – Energy Storage System
- kW – Kilowatt
- kWh – Kilowatt-hour
- LFP – Lithium Iron Phosphate or LiFePO<sub>4</sub>
- mm – Millimeter(s)
- mV – Millivolt(s)
- Overcharge – Charging beyond recommended voltage limits
- PPE – Personal Protective Equipment
- PV – Photovoltaic
- Self-Discharge – Natural battery discharge over time
- State of Charge (SOC) – Battery's remaining charge as a percentage
- State of Health (SOH) – Overall battery condition and performance
- Thermal Runaway – Dangerous overheating with potential battery damage
- V – Volt(s)

## 2. Safety Instructions











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Before you start working, make sure to read and follow all safety instructions for handling the battery. When installing it, be sure to meet all the rules and regulations in your area. Ask your local authority for the right permits and approvals before you install it.




















Lithium Iron Phosphate (LiFePO<sub>4</sub>) batteries are an inherently safe chemistry. However, safety measures should always be taken as consideration before, during, and after installation and during ongoing use and maintenance. The following safety notices are crucial for both the installer and end users when operating this product normally.

**Improper installation could result in harm to the installer, the operator, or others, as well as damage to the battery or connected equipment.**

### WARNING:

-  Do not make any connections or disconnections to the system when the batteries are in operation. Working with active batteries can lead to system component damage or pose a risk of electrical shock.
-  Do not charge with a charge voltage above 58.4V.
-  Do not charge nor discharge battery when ambient temperature is above **55 °C (131 °F)**.
-  Do not install battery where it may contact conductive materials, water, seawater, strong oxidizers, nor strong acids.
-  Do not install battery in a location exposed to direct sun, hot surfaces, nor hot locations. Do not install batteries in a tight clearance compartment, overheating may result.
-  Keep any flammable/combustible material (e.g. paper, cloth, plastic, etc.) that may be ignited by heat, sparks, flames, or any other heat source at a minimum distance of two feet away from the batteries.
-  Disconnect batteries immediately if, during operation or charging, they emit an unusual smell, develop heat, or behave abnormally.
-  Have a Class ABC or Class BC fire extinguisher on the premises.
-  Never short-circuit DC inputs: may result in a risk of electric shock or fire.
-  Do not disassemble the battery: Contact BigBattery for proper handling instructions. Incorrect servicing or re-assembly may result in a risk of electric shock or fire and voiding the warranty

## PRECAUTION:

-  Qualified personnel must handle all product work to reduce the risk of electric shock.
-  Follow local and national electrical standards for installation and confirm utility provider and local authorities requirements before grid connection.
-  Maintain visibility of warning labels and nameplates.
-  Choose battery placement with future user safety in mind.
-  Keep children away from the battery and systems.
-  Use team lift technique due to battery weight.
-  Use batteries as directed; do not open or modify.
-  Avoid inserting foreign objects into battery terminals.
-  Handle batteries and/or battery-powered devices cautiously when using metal tools or when around the system. Risk of electrical arcs or short-circuits can cause serious harm, death, and equipment damage.
-  Do not charge or discharge battery if ambient temperature is below **-20 °C** (-4 °F)
-  Beware of the battery current: Please ensure that the battery is “off” before
-  installing or working on the battery. Use a voltmeter to confirm there is no voltage present.  
Always wear protective gear when handling batteries (PPE).
-  Handle batteries carefully to prevent damage; avoid pulling, dragging, or mishandling.
-  Inspect batteries before use; don't use damaged or swollen ones; contact BigBattery immediately.
-  Don't paint any part of the batteries, inside or out.
-  Make sure all cable connections are properly tightened and secured, and to prevent any accident caused by improper installation.
-  Install and remove batteries using the handles provided.
-  Do not place any objects on top of batteries.
-  Before storing battery for more than 6 months, fully charge the battery and disconnect batteries from your system.

### **Disclaimer:**

*BigBattery, Inc has the authority to modify the content here without prior notice. To access the latest manual version, please visit our website at [www.bigbattery.com](http://www.bigbattery.com).*

## 3. Introduction

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Introducing BigBattery's Rhino 2! These revolutionary wall mountable on-grid lithium battery systems designed to push the boundaries of efficiency, flexibility, and reliability in energy management are the BEST Batteries Money can Buy. The Rhino 2 represents a leap forward in energy storage technology, offering a compact and scalable solution for seamlessly integrating renewable energy sources into your home or business. With its cutting-edge features and intelligent design, this advanced lithium battery system promises to empower individuals and organizations to take control of their energy usage like never before. Equipped with one of our Rhino 2 battery systems from BigBattery, you'll stay powered and prepared!

This User Manual is designed to provide you with an understanding of the specs, features, capabilities, and installation of these batteries. Read and take note of all safety information prior to installing or operating your battery. This document applies to every Rhino 2 battery system.

### 3.1 Product Description

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The 48V 14.3 kWh Rhino 2 wall mountable battery systems are ideal for low-voltage residential and for your grid-tied homes, solar systems, off-grid power systems, emergency power supplies, and more. Each battery is 51.2V 280Ah and its advanced communication capabilities allow over 18 Rhino 2 batteries to be paralleled together. These batteries utilize lithium iron phosphate (LiFePO<sub>4</sub> or LFP) cells, renowned for their top-notch safety.

They are equipped with an intelligent Battery Management System (BMS) that continuously monitors and records cell voltage, along with real-time data on current, voltage, and temperature for the module. The BMS features a passive balance function and an advanced battery control method, which collectively enhance battery pack performance. Furthermore, the battery includes built-in fire-extinguishing modules for added safety. The battery utilizes standardized Amphenol UL ESS Connector, which easily and safely secures power to your battery unit. Designed to endure, the Rhino 2 has a lifespan of over 10 years and is engineered to withstand more than 4000 - 8000 cycles at 80% Depth of Discharge (DOD) at a rate of 0.5C°.

You can always monitor your battery's health and performance from the LED interface located on the controller box. The display will show the word protection during an Alert or fault. BMS status codes can only be seen through computer connection and BMS tools.



## 3.2 Features & Applications

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### Applications:

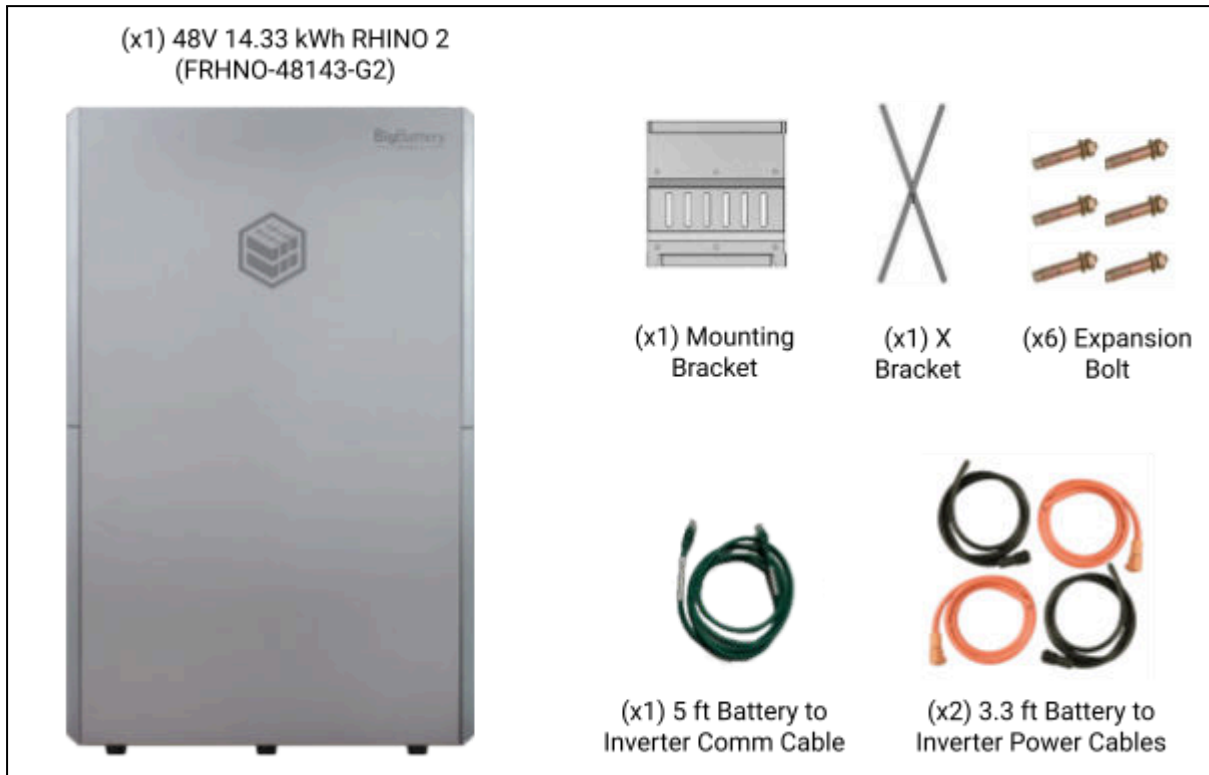
- **Residential**
- **Commercial**
- **Grid-Tied Homes**
- **Cabin Off-Grid**
- **ESS**
- **Backup Power**

### Features:

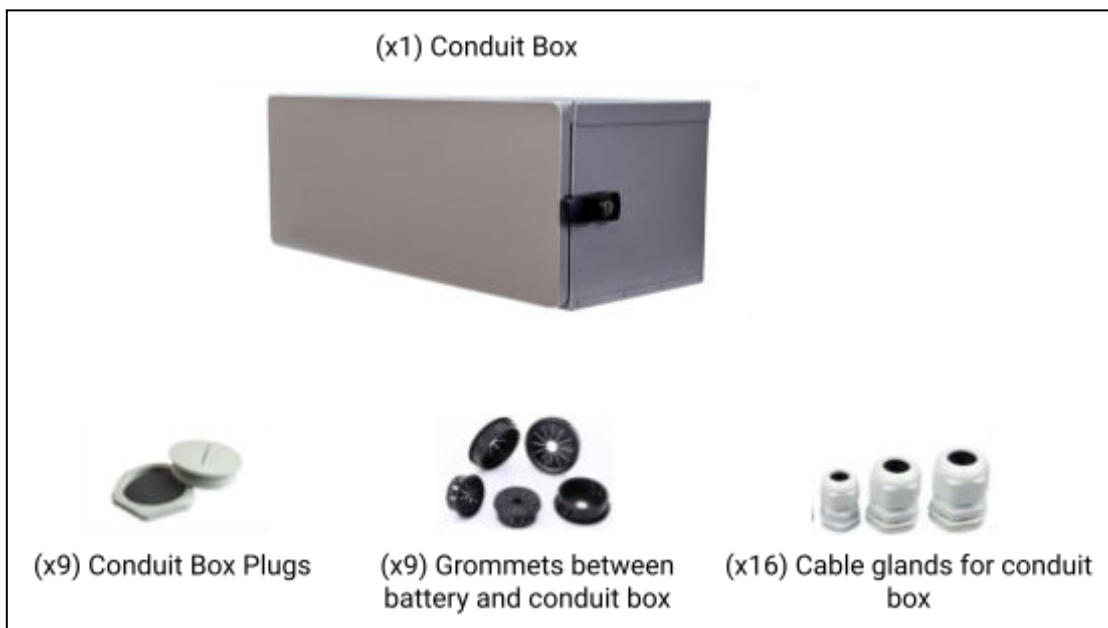
- Advanced BMS (Battery Management System) to protect the battery from operating in abnormal conditions.
- Lithium-Ion LiFePO4/LFP Chemistry
- Easy connection to a larger power system
- Multiple layers of safety and battery protection
- Built-in fire suppression system
- Good insulation performance
- Utilizes standardized plug&play Amphenol UL ESS Connector.
- LCD Smart Monitor Display (voltage, current, temperature, SOC)
- Maintenance free battery pack
- Smart cell's balancing
- Parallel and Communicate Multiple Batteries using a 600A Internal BusBar and the Comm ports
- 8000 cycles at 80%DOD at 0.5C
- CAN bus and RS-485 communication with different inverters.
- RJ-45 ports
- Wall mountable
- IP65 all-weather rated
- Self-heating in freezing temperatures
- UL9540A and UL1973 certifications
- Integrated E-stop circuit

## 4. Packed Components

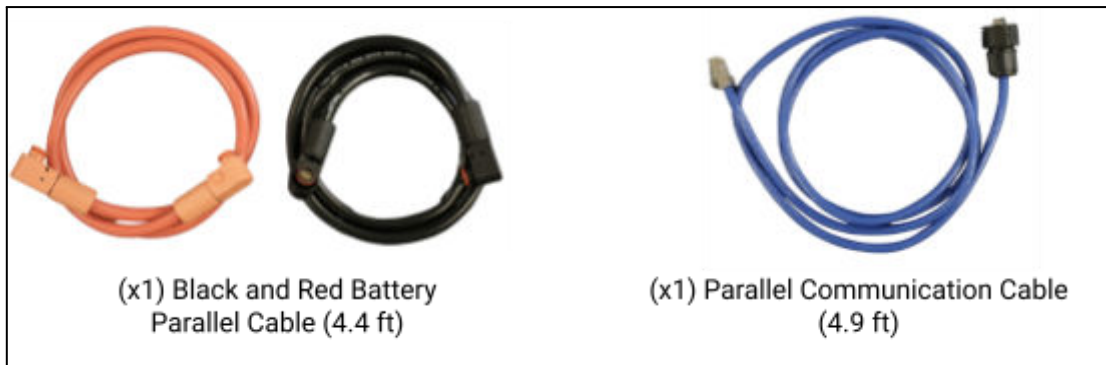
### 4.1 Rhino 2 Included Components



### 4.2 Rhino 2 Conduit Box Kit



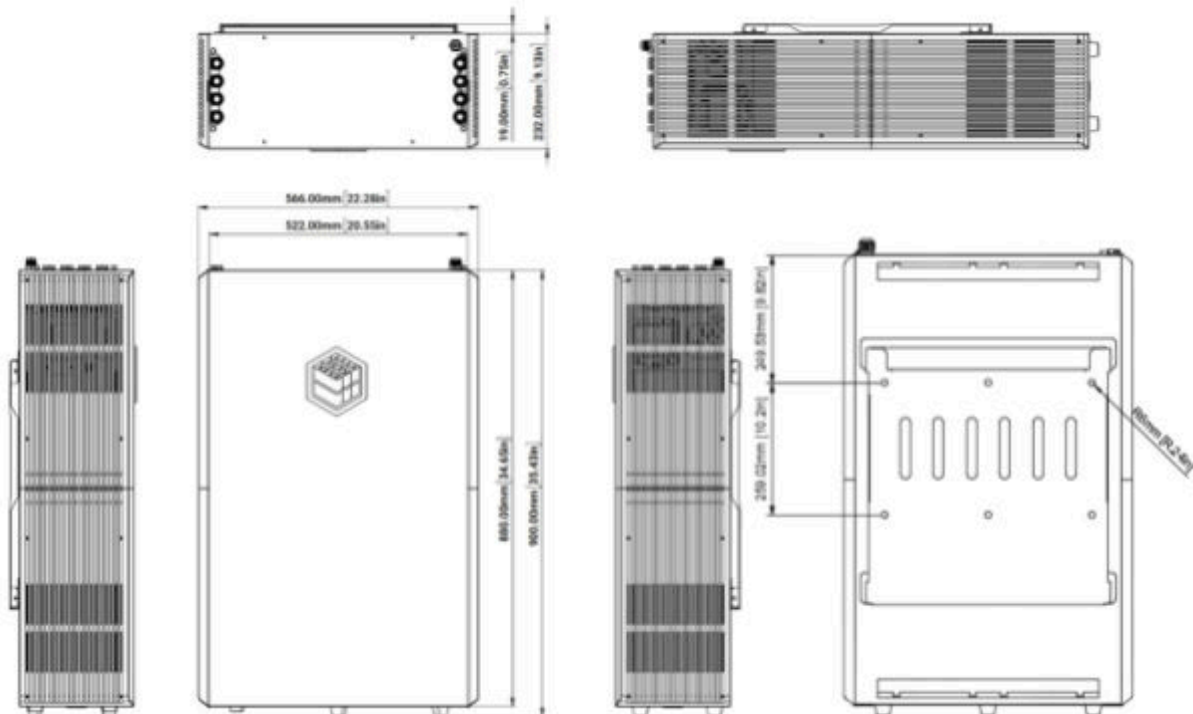
## 4.3 Rhino 2 Parallel Kit



# 5. Product Specifications

## 5.1 Rhino 2 Overview

**Figure 1: Rhino 2 Battery Overview**



*Before handling the battery, always switch it off and verify there is no voltage with a voltmeter to prevent accidental contact with live terminals. Failure to do so could lead to severe injury or fatality.*

## 5.2 Rhino 2 System Specs

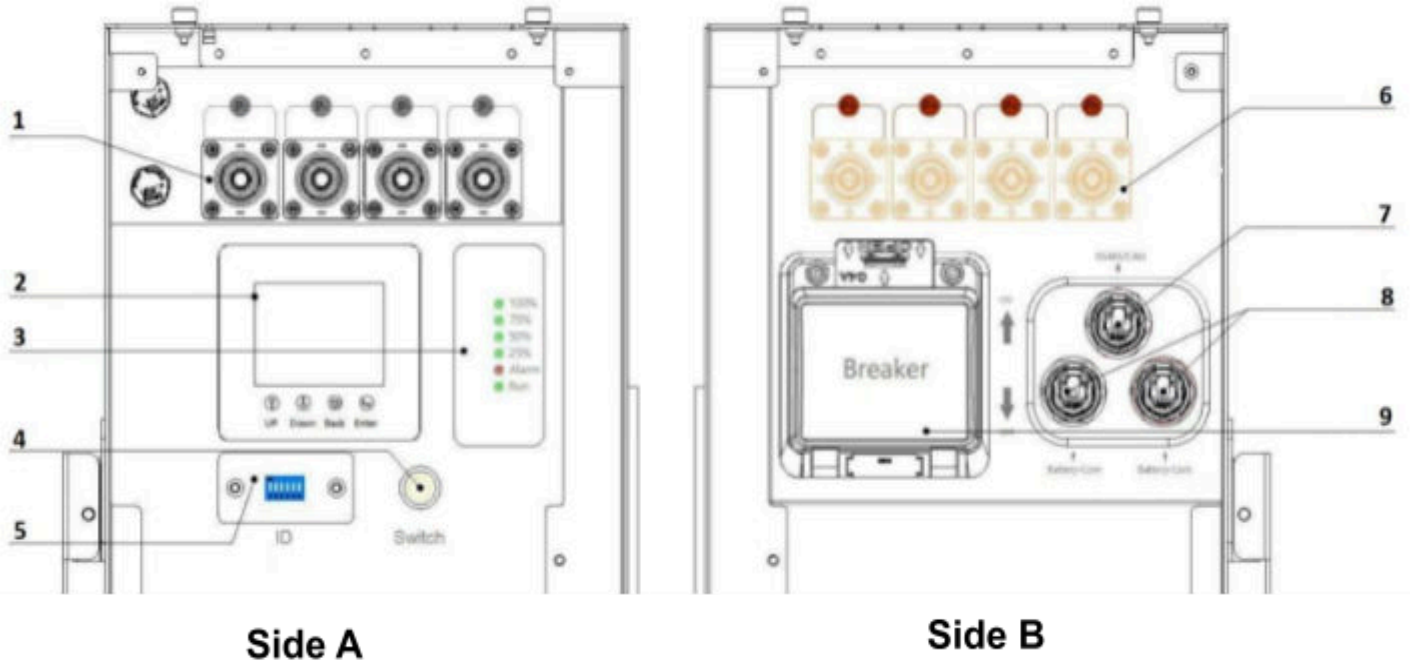
### BATTERY SPECIFICATIONS



SKU	FRHNO-48143-G2
System Voltage	48V
Nominal Voltage	51.2V
Chemistry	LiFePO4
kWh Capacity	14.34 kWh
Ah Capacity	280 Ah
Charging Voltage Range	55.6V - 57V
Max Charge Voltage	57V
Operating Voltage Range	48V - 57V
Suggested Low Voltage Cutoff	48V - 50.8V
Cell Configuration	16S
Max Continuous Discharge Current	200A
Max Continuous Power	10240W
Max Discharge Peak Current	300A (Max 5 seconds)
Max Charge Current	200A
Charge Temperature Range	-4°F - 113°F (-20°C - 45°C)
Discharge Temperature Range	-4°F - 122°F (-20°C - 50°C)
Optimal Discharge Temperature Range	59°F - 95°F (15°C - 35°C)
Storage Temperature Range (SoC >50%)	-4°F - 113°F (-20°C - 45°C) (Max 6 months)
Dimensions (DxWxH)	9.1 x 22.3 x 34.6 in (231 x 566.5 x 879 mm)
Weight	308.6 lbs (140 kg)
Max Connections	Up to (3) parallel connections per (1) inverter
Communications	CANBus / RS485
Protection Rating	IP65
Certifications	UL9540, UL9540a, UL1973, & UN38.3

## 5.3 Rhino 2 Diagram

**Figure 2: Rhino 2 Battery Diagram**

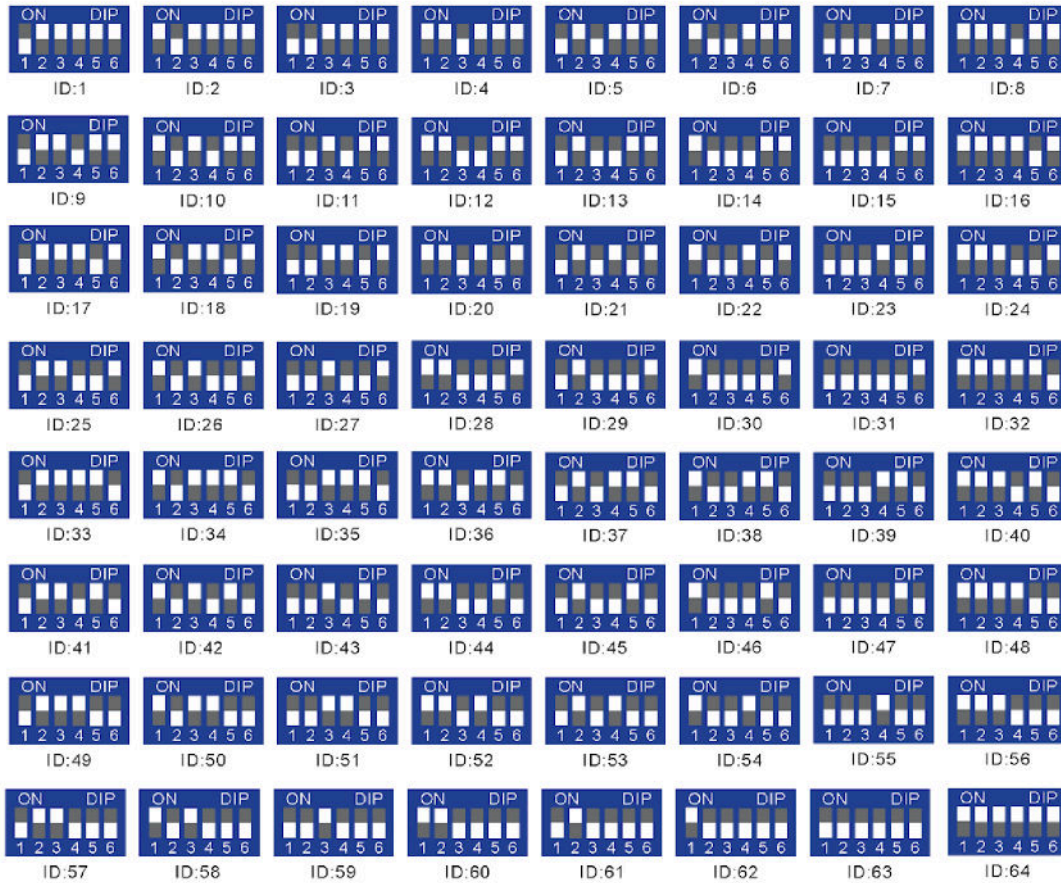


Item	Name	Description	Details
1	Negative Terminals	Connects to negative terminal of Inverter and/or paralleled battery	
2	LCD Screen	Shows battery information	
3	SOC/Alarm	State of Charge LED and Alarm LED	4 LEDES On = 100% 3 LEDES On = 75% 2 LEDES On = 50% 1 LED On = 25%
4	Power Switch	Turns BMS on/off	
5	ID	Battery Communication ID	Dip-Switch
6	Positive Terminals	Connects to positive terminal of Inverter and/or paralleled battery	
7	RS485/CAN Port	RS485/CAN Communication Interface	
8	Battery-Comm	Parallel battery Communication Port	
9	Battery Disconnect Breaker	Turns power supply on/off	

**Note:** The side covers need to be removed in order to access the ETHOS Terminals.

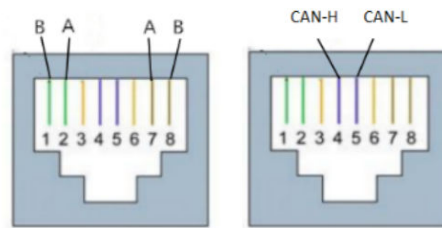
## 5.4 ID Addresses Description

**Figure 5: Rhino 2 Battery ID Description**



*ID code bits correspond to binary digits, down represents "ON", up represents "OFF", the right side of the code bit is the low bit, the left side is the high bit, the code range is 0~63, and the communication mode can support up to 64 modules in parallel.*

## 5.5 Communication Ports Description



Pin	Description	Pin	Details
1	RS485 B-( T/R-)	5	CAN-L
2	RS485 A+( T/R+)	6	-
3	-	7	RS485 A+( T/R+)
4	CAN-H	8	RS485 B-( T/R-)

**Note:** Both RJ45 Communication Port can be used for RS485 or CAN protocols.

## 5.6 Battery LED Indicators


Each battery module has an SOC light that will tell you the current state of charge of that module according to the table below.

Status	Operation	RUN *	Alarm *	SOC ****	Notes
Shutdown / Sleep		OFF	OFF	OFF	
Stand by	Normal	ON	OFF	4 LEDS On = 100% 3 LEDS On = 75% 2 LEDS On = 50% 1 LED On = 25%	According to the state before standby
	Alarm	ON	Flash		
Charge	Normal	Short flash	OFF		
	Alarm	Short flash	Short flash		
	End-off Voltage	OFF	ON		
	Over-Temp Protection	OFF	Short flash		
	Over-current transfer limit -current	Short flash	Short flash/OFF		Over-current flash, limit-current OFF
Discharge	Normal	Long Flash	OFF		
	Alarm	Long Flash	Long Flash		
	End-off Voltage	OFF	OFF	Go to sleep	
	Over-Temp/Over-current Protection	OFF	ON		
BMS Fault		OFF	Flash	All OFF	

*Shutdown: All LED lights are off; Power on: RUN light is always on; System failure: ALM light is always on; each SOC light represents 25% capacity; Long flash: flash once every 2.4 seconds; Short flash: flash once every 1.2 seconds.*

## 6. Installation

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 **WARNING:** Before installing, make sure to review all warnings and precautions in Section 2, as well as the installation safety guidelines in Section 6.1 below.

### 6.1 Installation Safety Guidelines

- Inspect batteries upon receipt for any signs of damage before use. In case of battery damage, reach out to BigBattery for repair or replacement. Avoid using a defective battery as it may result in incorrect battery voltage that could potentially ruin your appliances. Damaged batteries have the potential to cause fire hazards.
- Check to ensure that all cables are in good condition.
- Be sure your battery packs are powered “**OFF**” before making/removing any connections.
- It is crucial to never create a short circuit on the external battery terminals. When attaching the battery, ensure that each cable is properly connected to the correct terminal. There should be no conductive material between the terminals that could cause a short circuit.
- Use a screwdriver with a rubber coated handle.
- **Do not put the Rhino 2 batteries in series.** The BMS and internal components are not designed to handle this setup, which could cause the modules to fail.
- Always mount the battery in an upright position.

### 6.2 Installation Requirements

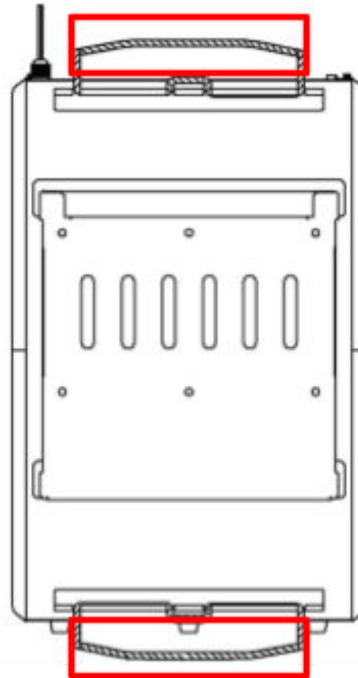
The battery’s placement significantly affects safety, longevity, and performance. It should allow for convenient system wiring, maintenance, and operation, while avoiding high-temperature, high-humidity environments. Ensure there's enough space and strong support for the battery. Use cable specifications that match the equipment's maximum current needs. Arrange the power equipment and batteries logically. Keep the wiring neat, moisture-proof, and corrosion-resistant. During installation, wear an anti-static wristband and have at least two people present.

- The Rhino 2 is substantial in weight. It’s recommended to use lifting equipment or other aids for transportation and handling. The Rhino 2 can be set up either on a flat surface or mounted on a wall. If it’s placed on the ground, make sure the surrounding area has adequate drainage to preserve the module’s integrity over time. If it’s wall-mounted, leave at least a 12-inch gap on each side of the unit to ensure sufficient airflow and smooth operation.
- Choose a location for the wall mount bracket that is safe from potential flood damage.



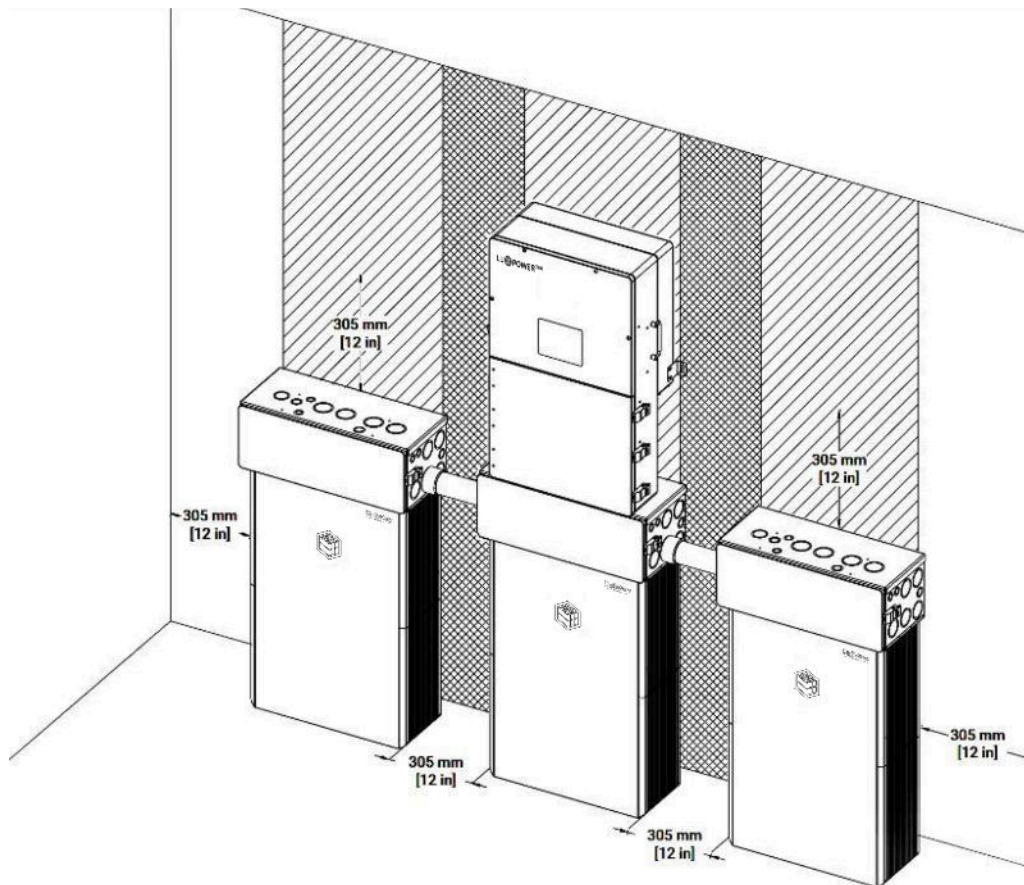
- Please note, the battery will be delivered with temporary handles to assist in unpacking. Refer to figure 7 for more details.
- BigBattery advises removing these handles prior to connecting any wires to the battery.

**Figure 7: Rhino 2 temporary handles**



- The Rhino 2 requires sufficient clearance on all sides - left, right, top, bottom, and front - for ease of installation and safe operation.
- When installing multiple Rhino 2 batteries or other devices, maintain a minimum distance of 12 inches between them, unless they are part of an inverter kit that includes a LUXPower 12K Hybrid Inverter with the conduit box. In such a setup, the conduit box is directly attached to both the battery and inverter, as shown in figure 8.
- Adherence to NEC and local codes is crucial during the installation process.

**Figure 8: Rhino 2 inverter system with clearance**



The RHINO2 battery can be installed in different configurations:

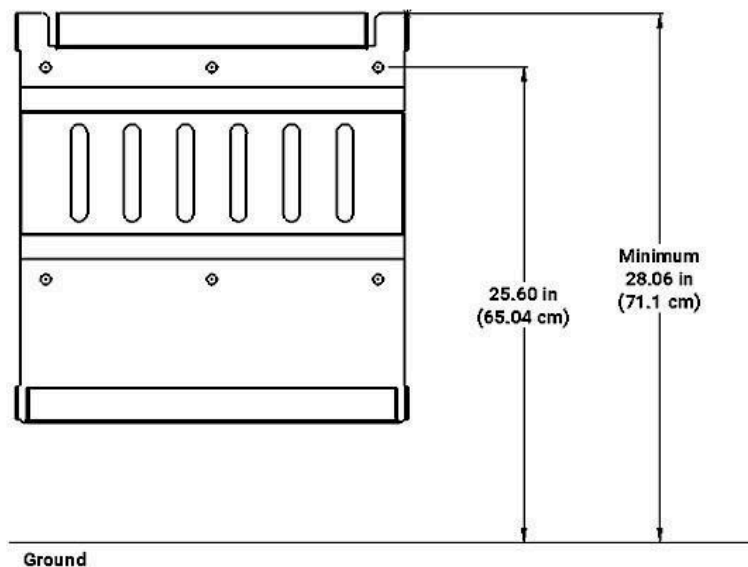
- 6.3 Without a Conduit Box
- 6.4 With a Conduit Box
- 6.5 With the LUXPower 12K Hybrid Inverter

## 6.3 Rhino 2 Battery Installation (Battery only)

①

Position the mounting bracket on the wall at least 28.0625 inches from the ground (if you don't want the battery to sit on the ground then mount the bracket higher), see figure 9 for the ground clearance. Use a level to ensure the bracket is straight, and mark the locations for the mounting holes. Drill holes to fit the mounting hardware you're using.

**Figure 9: Mounting bracket ground clearance (front view)**



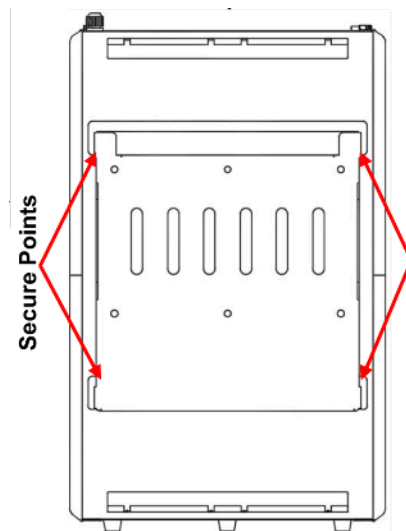
②

Secure the mounting bracket to the wall using the provided expansion bolts (for concrete/brick walls) or the necessary hardware for your specific mounting surface.

③

Attach the Rhino 2 onto the mounting bracket. To do this, lift the battery and align the flange at the back of the battery with the flange at the front of the mounting bracket. Once aligned, hook the battery onto the bracket. Ensure the battery is firmly attached to the mounting bracket using the 4 side screws provided. See figure 10 for the secure points.

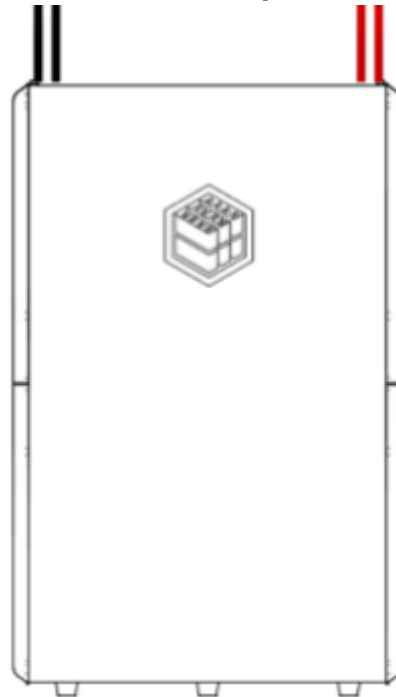
**Figure 10: Rhino 2 secure points**



④

Lastly, ensure the battery is adequately grounded by connecting a grounding conductor to the M6 grounding screw located on top of the battery and connecting it to the Equipment Grounding System as shown on figure 11.

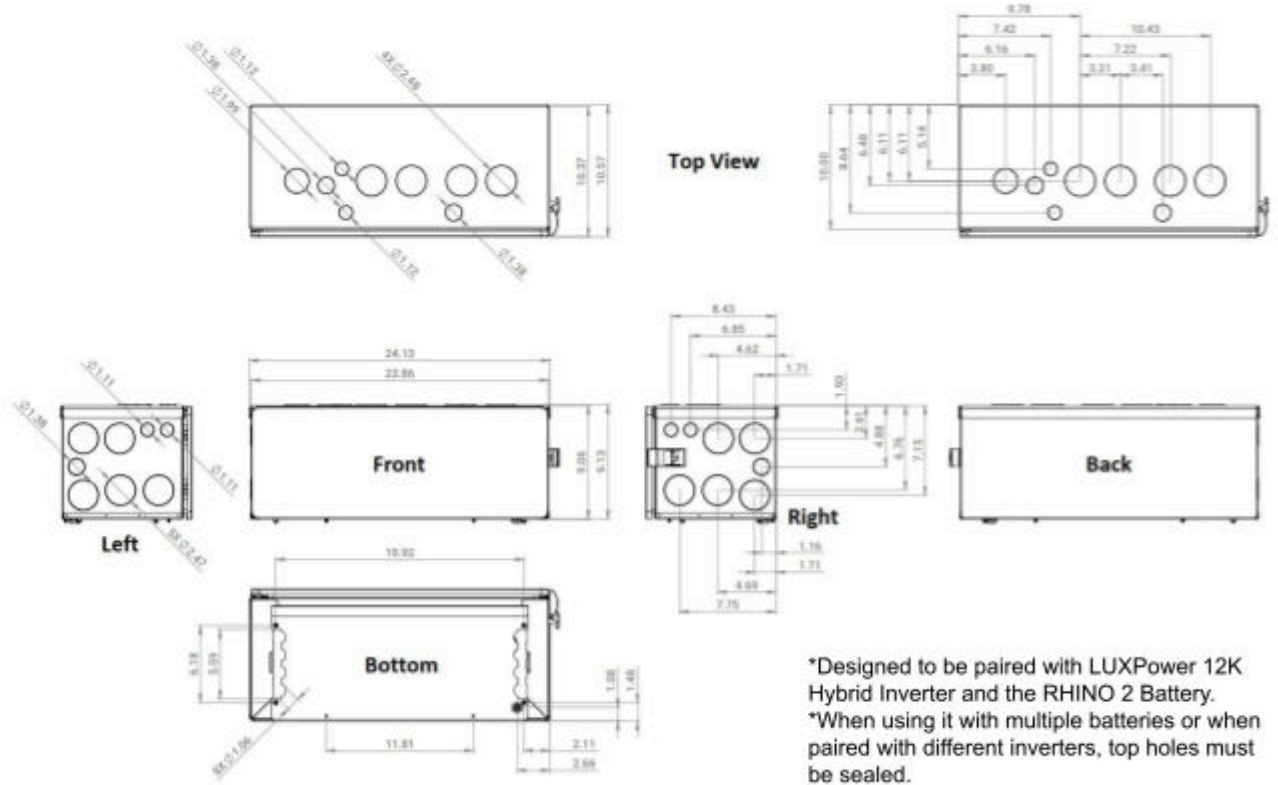
**Figure 11: Rhino 2 Complete Installation**



## 6.4 Conduit Box Installation\* (sold separately)

The conduit box is an included accessory in the RHINO ESS UL LUXPower 12K Hybrid Inverter kit designed to hold both the conduits and wires that are running between the inverter and the battery. A cross sectional view is shown in figure 12.

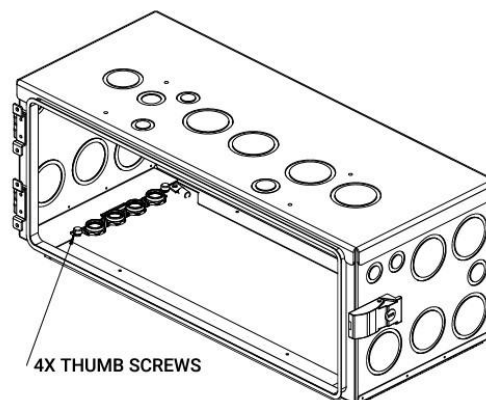
**Figure 12: Cross sectional view of conduit box (dimensions in inches)**



①

Locate the four screw positions that are used to secure the battery, as shown in figure 13. Position the conduit box on the battery's top and utilize the included thumb screws to fasten the conduit box to the battery.

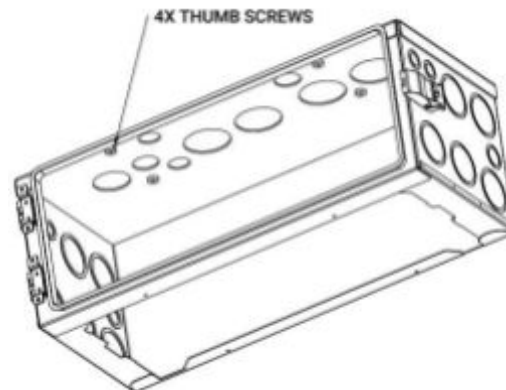
**Figure 13: Conduit box with bottom thumb screws**



②

When installing the Rhino 2 with the LUXPower 12K Hybrid Inverter, the remaining 4 thumb screws are used to connect the top side of the conduit box to the inverter, as shown in figure 14.

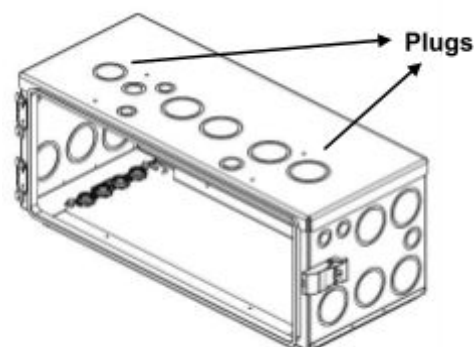
**Figure 14: Conduit box with top thumb screws**



③

If you're setting up the Rhino 2 as an extra battery or in conjunction with a non-LUXPower 12K Hybrid Inverter, make sure to use the provided plugs to seal the upper openings on the conduit box. See figure 15 for reference.

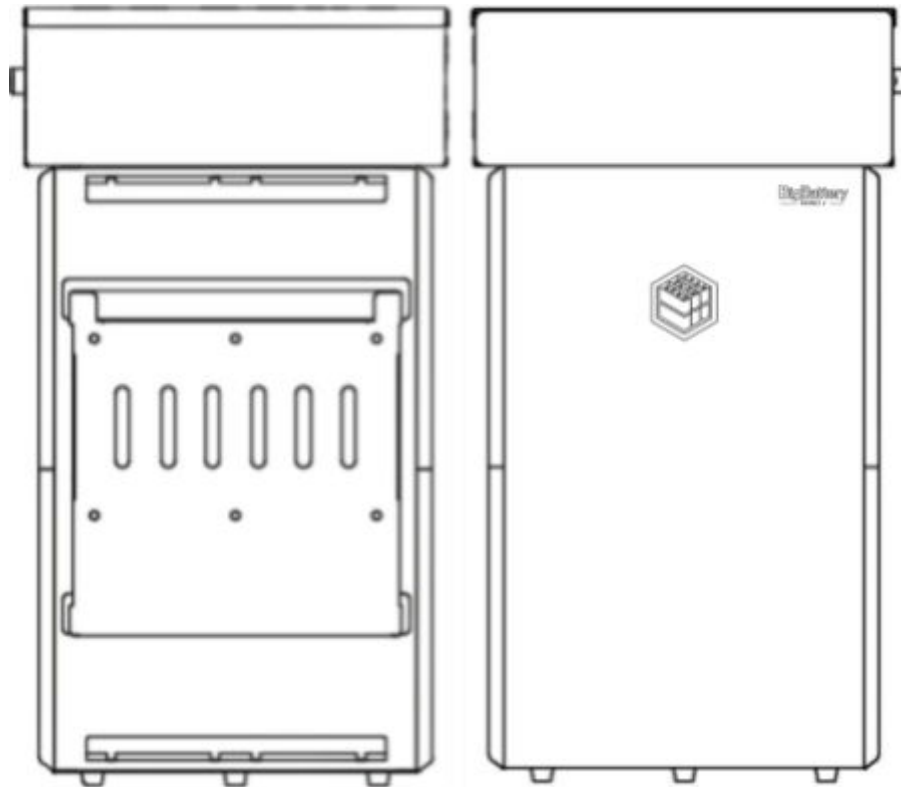
**Figure 15: Conduit box top plugs**



④

Attach the conduit box to the top of the battery. See figure 16 for a final view of the back and front after installation of the conduit box.

**Figure 16: Rhino 2 completed install with conduit box**



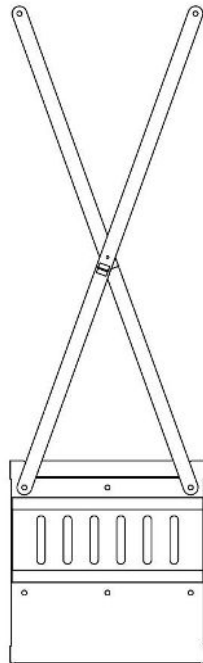
⑤

Finally, ensure the battery is correctly grounded. This can be done by connecting a grounding conductor to the M6 grounding screw located on top of the battery, and then attaching it to the Equipment Grounding System.

## 6.5 Rhino 2 + LuxPower 12K Inverter Installation

- ① Position the mounting bracket on the wall at least 28.0625 inches from the ground (if you don't want the battery to sit on the ground then mount the bracket higher), see figure 9 for the ground clearance. Use a level to ensure the bracket is straight, and mark the locations for the mounting holes.
- ② Position the supplied X-bracket in alignment with the holes on the mounting bracket, as shown in figure 17. Secure both the X-bracket and the mounting bracket to the wall using the provided expansion bolts (for concrete/brick walls) or the suitable hardware for your specific mounting surface. The X-bracket should be placed behind the mounting plate, directly against the wall.

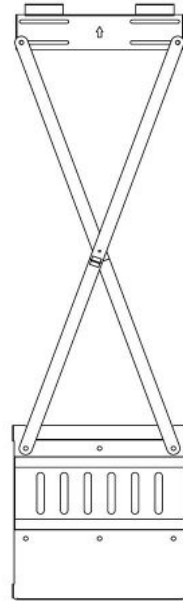
**Figure 17: Mounting bracket with X-Bracket (back view)**



- ③ With the X-bracket as your guide, secure the LUXPower 12K Hybrid Inverter mounting bracket to the mounting surface using suitable hardware. See figure 18 for reference.



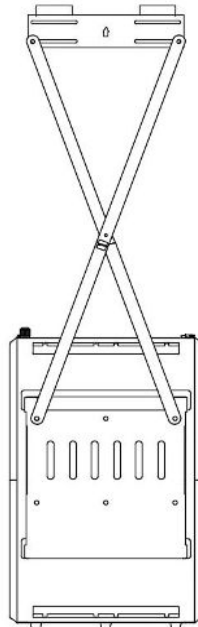
**Figure 18: Mounting bracket with inverter bracket (back view)**



④

Attach the Rhino 2 battery onto the mounting bracket. To do this, lift the battery and align the flange at the back of the battery with the flange at the front of the mounting bracket. Once aligned, hook the battery onto the bracket. Ensure the battery is firmly attached to the mounting bracket using the 4 side screws provided. See figure 19 for reference.

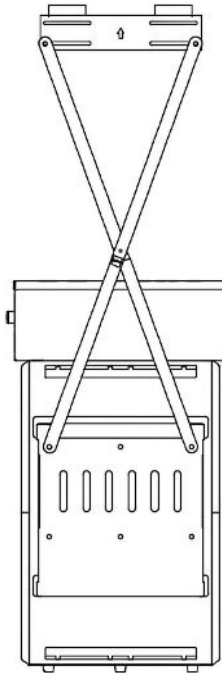
**Figure 19: Battery attached to mounting bracket (back view)**



⑤

Attach the conduit box to the top of the battery as in figure 16. See figure 20 for reference.

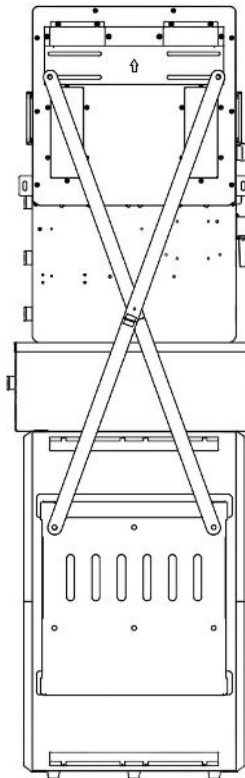
**Figure 20: Conduit box attached to battery (back view)**



⑥

Secure the LUXPower 12K Hybrid Inverter to the inverter mounting bracket, ensuring that the inverter's holes align with those on the conduit box. Use the provided hardware to fasten them together. See figure 21 for the final view of the installation.

**Figure 21: Final installation (back view)**



⑦

Finally, ensure the battery is correctly grounded. This can be done by connecting a grounding conductor to the M6 grounding screw located on top of the battery, and then attaching it to the Equipment Grounding System.

## 6.6 Rhino 2 Communication Cable Connections

①

Ensure all battery breakers and BMS are OFF.

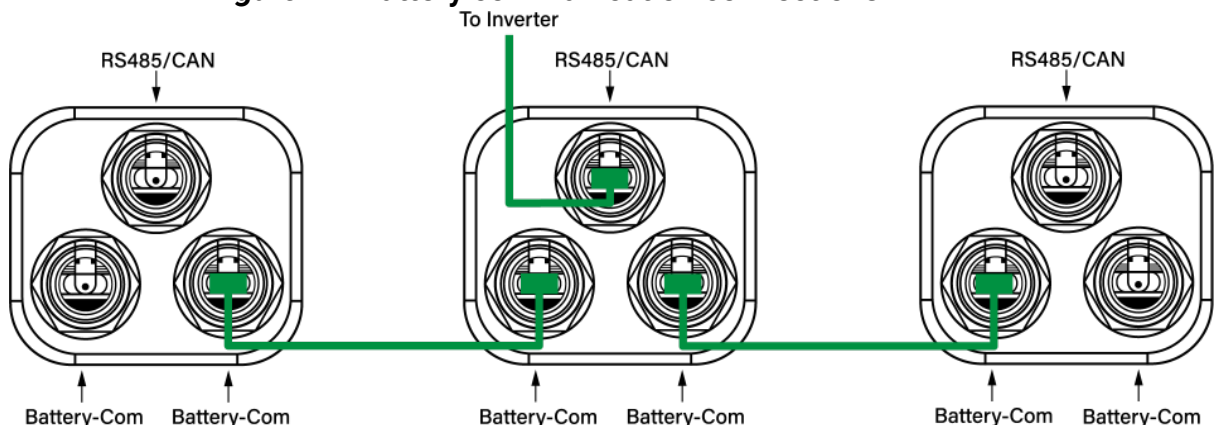
②

Adjust the address code for each battery as per the DIP Switch ID Table in section 5.4, ensuring that no two addresses are the same. The master battery should be set to ID 1.

③

Establish communication between the batteries using the “Battery-Comm” ports found on each battery. Utilize the communication cable from the paralleling kit to link all the batteries in the bank that are paralleled. See figure 22 for reference.

**Figure 22: Battery communication connections**



④

The battery that has the DIP Switch ID 1, also known as the master battery, is connected to the inverter using a communication cable that is correctly pinned (this depends on the inverter). This connection is made through the RS485/CAN port.

⑤

Connect the battery paralleling cables between the batteries. For examples of how to connect the battery cables, please refer to Section 6.7 titled “Rhino 2 Battery Power Cable Connections”.

⑥

After all the cable connections are in place and the system is prepared for commissioning, activate each battery breaker and the BMS ON/OFF switch sequentially, starting with the master battery.

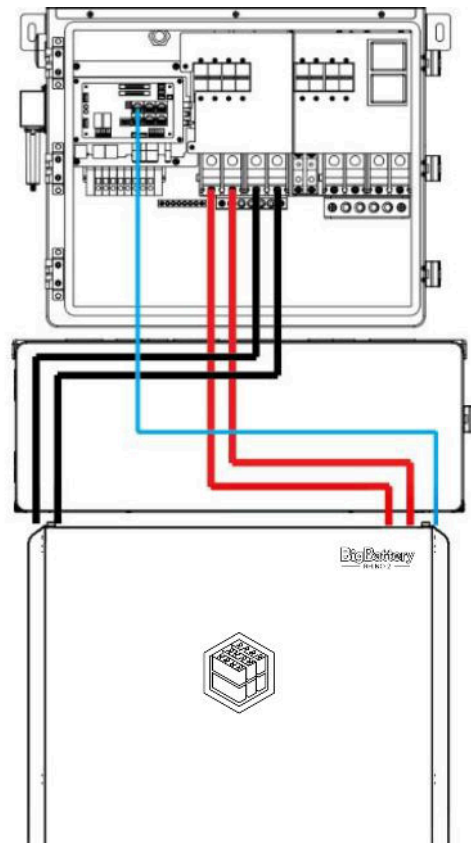
## 6.7 Rhino 2 Battery Power Cable Connections

The diagrams provided for battery cable connections serve as examples of how to use the internal busbars to parallel the batteries and connect the inverter(s) to the batteries. When using the internal integrated busbars, you can support up to 3 batteries in parallel when connected to a single inverter, 4 batteries in parallel when connected to 2 inverters, or up to 5 batteries in parallel when connected to 3 inverters.

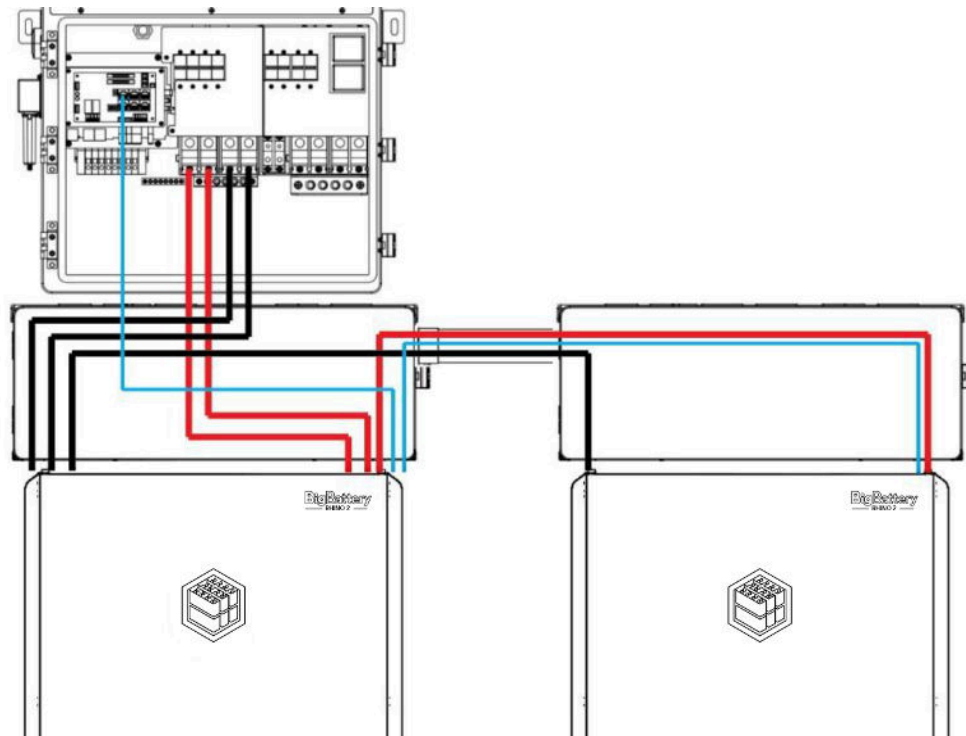
For systems with more batteries than these configurations, an external fused positive busbar and an unfused negative busbar rated at a minimum of 200A per battery are required. Each fuse should not exceed 250A. Alternatively, larger systems could utilize the LuxPower 12K inverter's ability to draw from different battery packs while still paralleling inverters, instead of using external busbars.

The maximum recommended number of paralleled LuxPower 12K inverters is 6. If this approach is used, it is recommended to maintain a ratio of 3 batteries per pack controlled by each LuxPower 12K inverter. Separating packs is only advised if the average SOC of each pack is monitored over time and does not diverge by more than 10%. While common busbars are superior to separating battery packs, sourcing fused positive busbars rated to greater than 1800 Amps may be challenging. This implies that packs larger than 9 batteries should be separated. Please refer to NEC code and your local authorities for exact requirements.

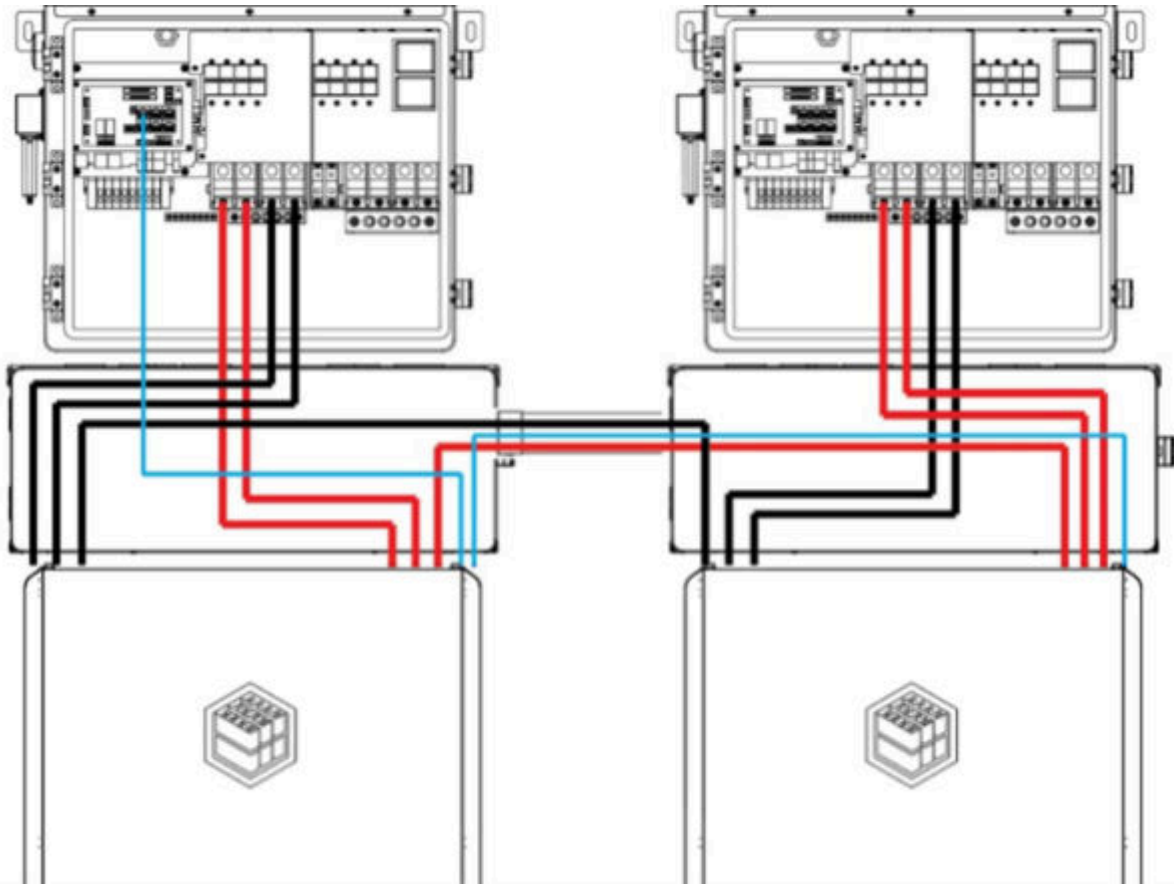
**Figure 23: (x1) LuxPower 12K inverter w/ (x1) Rhino 2 Battery**



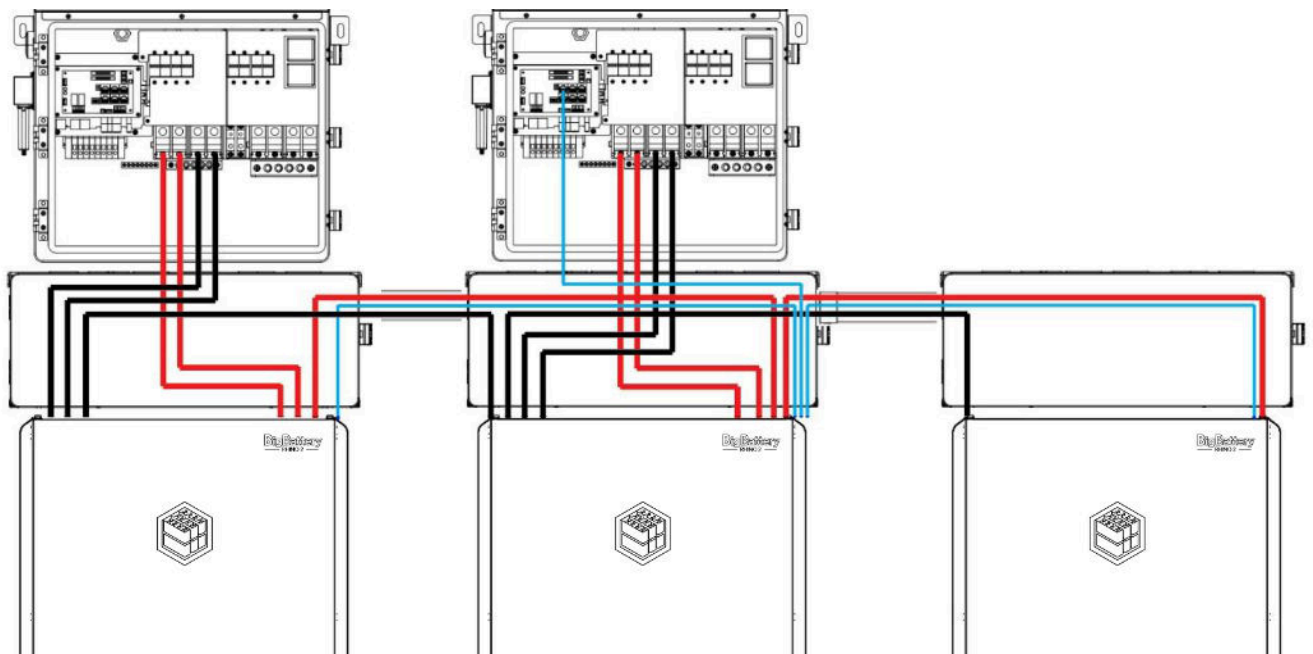
**Figure 24: (x1) LuxPower 12K inverter w/ (x2) Rhino 2 Batteries**



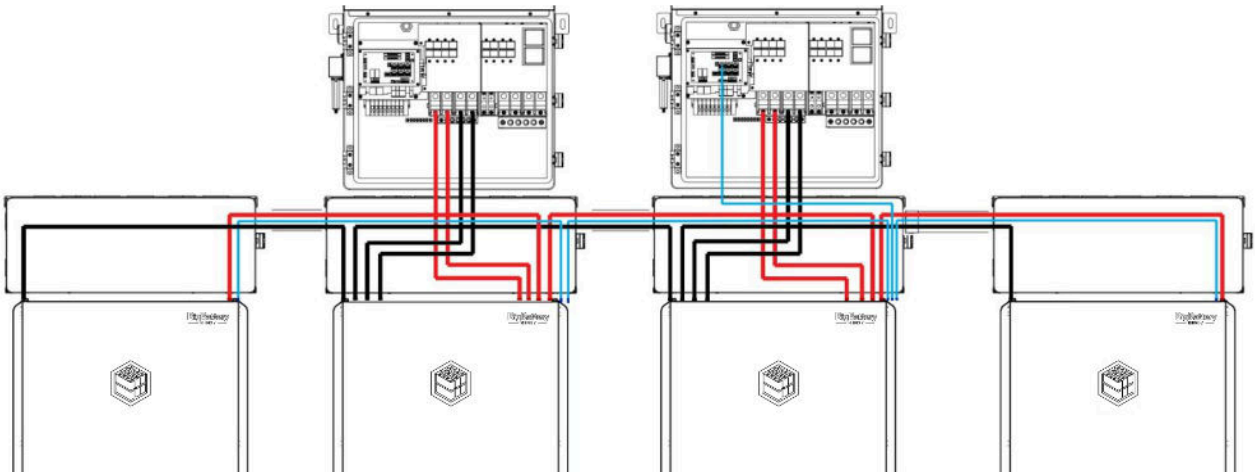
**Figure 25: (x2) LuxPower 12K inverter w/ (x2) Rhino 2 Batteries**



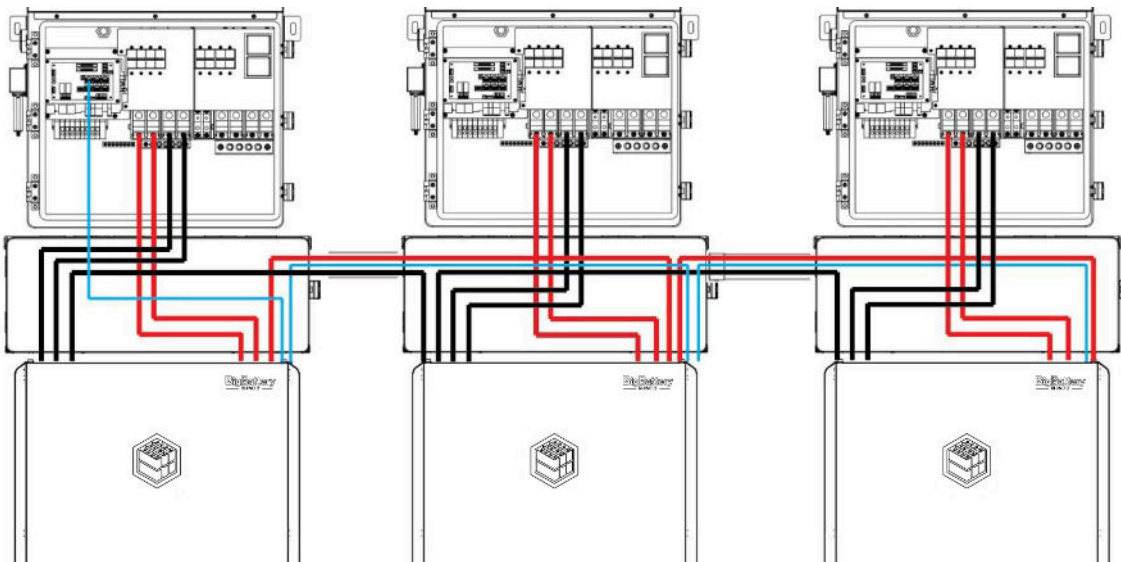
**Figure 26: (x2) LuxPower 12K inverter w/ (x3) Rhino 2 Batteries**



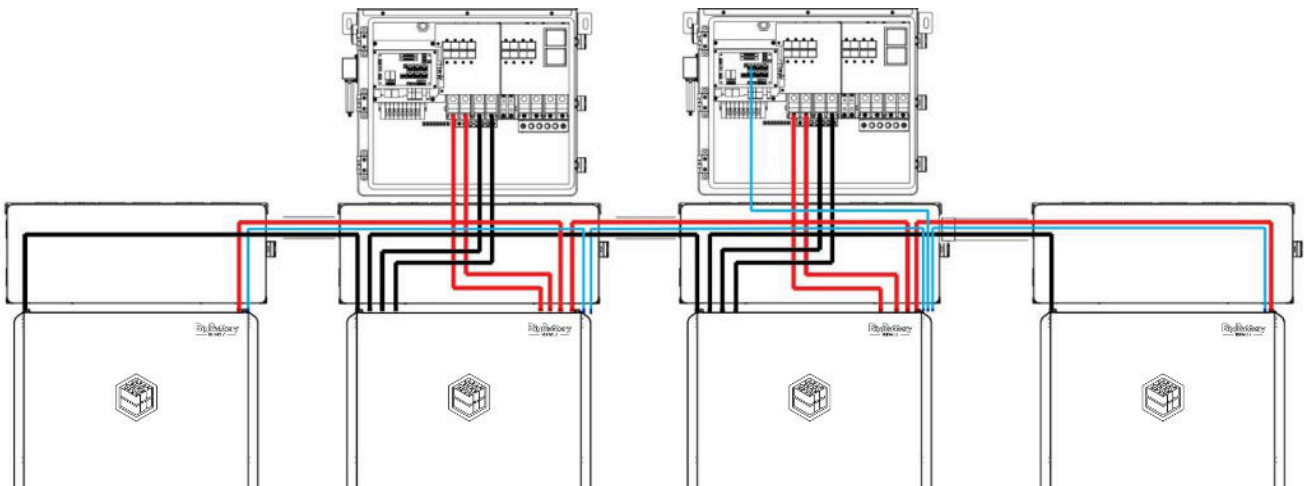
**Figure 27: (x2) LuxPower 12K inverter w/ (x4) Rhino 2 Batteries**



**Figure 28: (x3) LuxPower 12K inverter w/ (x3) Rhino 2 Batteries**



**Figure 29: (x3) LuxPower 12K inverter w/ (x3) Rhino 2 Batteries**



## 7. Battery Commissioning

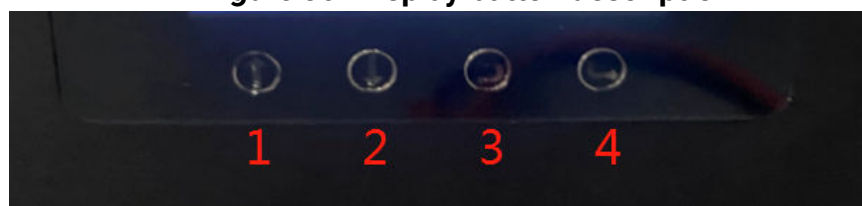
If the Rhino 2 battery is connected to an inverter and you want the battery to communicate with the inverter, the battery address and protocol need to be configured through the screen on the controller box. If communication is not needed, the battery can be directly connected to the inverter and you would select the Lead-Acid or user-defined configuration on the inverter.

### 7.1 Screen navigation and protocol selection

The LCD display is embedded on the Rhino 2, it's used to display information about the battery system, such as voltage, SOC, cell information, running status, etc. It is also used to configure the battery to communicate with a supported inverter.

There are 4 function buttons below the display with detailed descriptions shown in figure 30.

**Figure 30: Display button description**



No.	Item	Description
1	Up	Page up
2	Down	Page down
3	Back	Return
4	Enter	Confirm

Press any button to wake up the screen, you should see the BigBattery splash screen for a few seconds and then the home screen shown in figure 31.

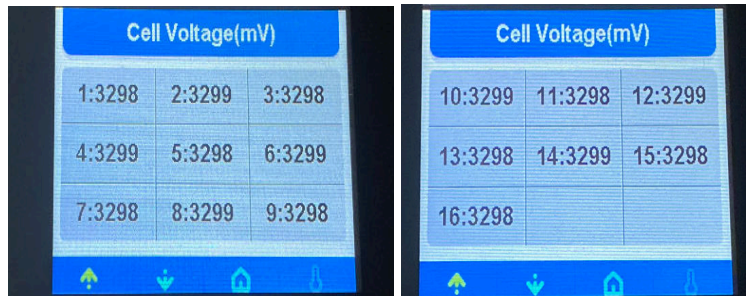
**Figure 31: Rhino 2 home screen**



Press the "Enter" button to check the cell information shown in figure 32, there are 2 pages, press "Up" and "Down" to change the page. Page 1 is for cell 01- cell 9, page 2 is for cell 10 - cell 16.



**Figure 32: Rhino 2 cell information**



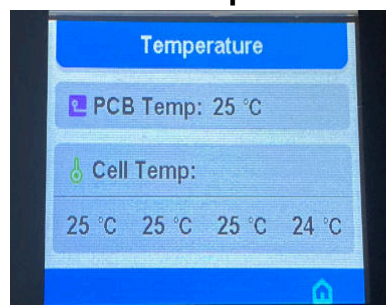
Cell Voltage(mV)		
1:3298	2:3299	3:3298
4:3299	5:3298	6:3299
7:3298	8:3299	9:3298

Cell Voltage(mV)		
10:3299	11:3298	12:3299
13:3298	14:3299	15:3298
16:3298		

From the cell information screen, press "Enter" to view cell and PCB temperature information shown in figure 33.

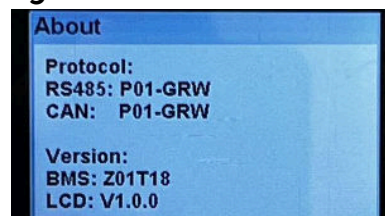
**Figure 33: Rhino 2 temperature information**



Temperature			
PCB Temp: 25 °C			
Cell Temp:			
25 °C	25 °C	25 °C	24 °C

Press the "Back" button to access the "About" screen, shown in figure 34, which will display the currently selected RS485/CAN protocol along with the current BMS and screen firmware version. Press "Enter" to return to the home screen.

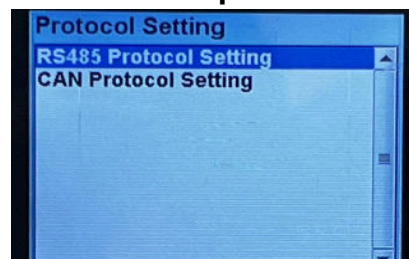
**Figure 34: Rhino 2 about screen**



About
Protocol:
RS485: P01-GRW
CAN: P01-GRW
Version:
BMS: Z01T18
LCD: V1.0.0

Hold the "Back" button for five seconds and release it to enter the "Protocol Setting" menu, shown in figure 35.

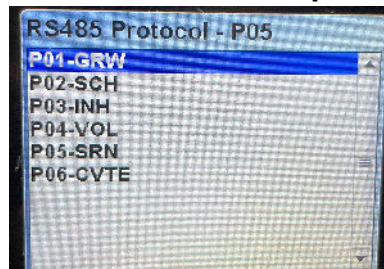
**Figure 35: Rhino 2 protocol setting menu**



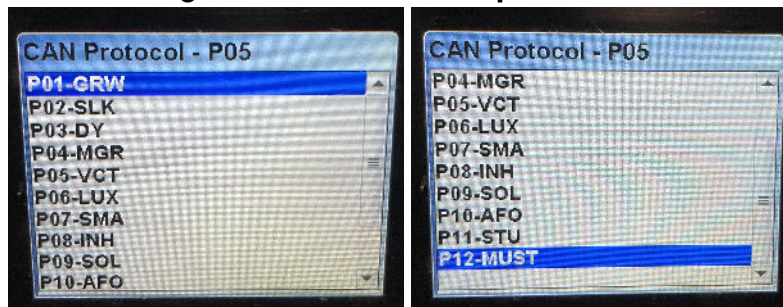
Protocol Setting
RS485 Protocol Setting
CAN Protocol Setting

Use the “Up” and “Down” buttons to navigate the “Protocol Setting” menu and press “Enter” to enter either the RS485 or CAN protocol menu, shown in figures 36 and 37.

**Figure 36: Rhino 2 RS485 protocol menu**



**Figure 37: Rhino 2 CAN protocol menu**




**Follow these steps to change the communication protocol:**

- ① Turn off all battery DC breakers and BMS power buttons.
- ② Change the address on the master battery to 64 (all switched on). After adjusting the dip switch, restart the battery using only the BMS power button for the changes to take effect.
- ③ On the master battery, press and hold the “Back” key for 5 seconds and release it to access the “Protocol Setting” menu. Choose the appropriate RS485 program or CAN program, and press “Enter” then press “Back” to return to the main interface. See section 7.2. for a list of supported inverters and their associated address.
- ④ Change the master DIP switch address back to address 1 and power cycle the master battery, and the BMS will correspond to the selected protocol.

## 7.2 Supported Inverters

P0	RS485	P0	CAN
1	Growatt	1	Growatt
2	Schneider	2	Sol-Ark
3	Inhenergy	3	Deye
4	Voltronic	4	Megarevo
5	Srne	5	Victron
6	Cvte	6	Luxpower
		7	SMA
		8	Inhenergy
		9	Solis
		10	Afore
		11	Studer
		12	Must

## 8. Battery Operation Guide

 **WARNING:** Before installing, make sure to review all the parameters listed on chapter 5.2.

### 8.1 Charging

- During the initial charging, monitor the battery's charge voltage to ensure it is within appropriate voltage limits.
- Only use the battery charger provided by BigBattery, or the inverter charging settings listed on section 5.2. Using non-recommended chargers may cause improper charging and damage the battery's capacity.
- The battery can be charged in freezing temperatures (-20 °C / -4 °F) thanks to a heating element. When charging is detected, the heating will start until the battery temperature is above 0°C / 32°F and then the charging will start.
- Use LiFePO4 batteries for "opportunity charging." Charge them whenever you can but do it with small amounts of energy. It's better to do this than using fast chargers. Fast charging can make the battery's life shorter.

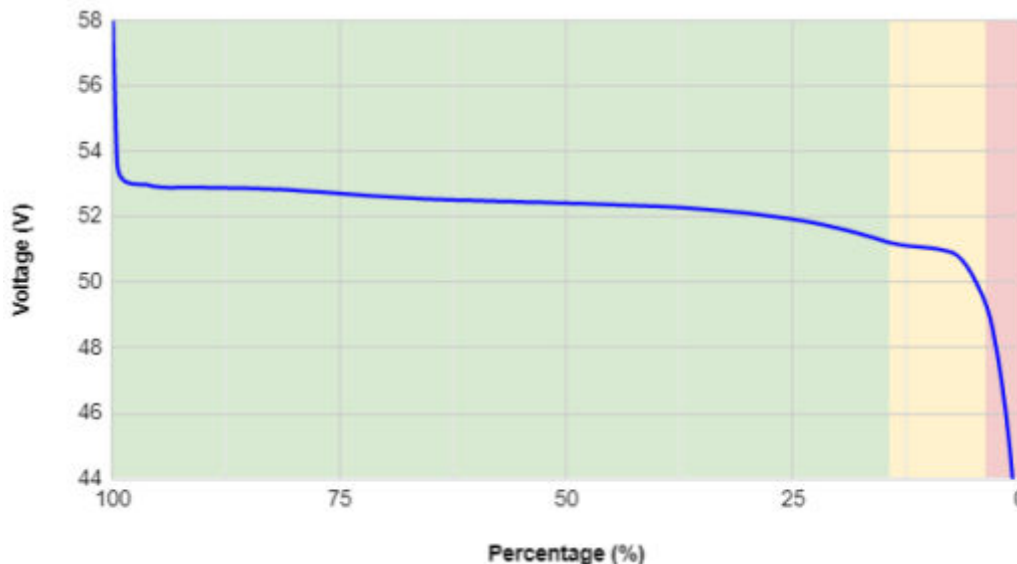
- It is suggested to charge the battery when it has a minimum of 10-20% SOC. Deep discharge won't harm the battery's health, but the BMS requires some voltage to function properly.
- The Bulk/Absorb Voltage of an LFP battery is the same as the charging voltage. BigBattery products do not need Float Voltage, Equalize voltage or absorption time.

## 8.2 Discharging

- The battery can be fully discharged. Unlike lead-acid batteries, the Voltage of a lithium battery stays very constant during discharge, delivering the same amount of power and energy from 100% to 0% SOC.
- LFP batteries handle discharging to 0% safely, but shallower cycles offer benefits. Opting for 20% SOC, instead of 0%, extends the battery's lifespan to more than 6000 cycles.
- Do not discharge if the temperature is above 55 °C / 131 °F.
- You will see an apparent loss of capacity when discharging at below-freezing temperatures that reverses when the battery gets above freezing.
- The BMS will automatically shut down when the battery reaches a low voltage, so there's no need for manual intervention. Avoid over discharging by removing the load when the battery's discharge is done.

## 8.3 State of Charge

This is the Depth of Discharge of the Rhino 2 battery:



	Cycling in this zone will ensure a reasonable life expectancy
	Ocasionally this zone is OK
	Dropping into this zone can lock the battery. Could reduce lifespan.

## 8.4 Storage

- LFP batteries have an extremely low self-discharge rate, which makes long-term storage convenient. Storing a lithium battery for up to a year is not an issue, as long as it has some charge remaining before being placed in storage.
- Before storing lithium-ion batteries, charge them to at least 50% charging level. Do not store batteries that are fully discharged. In the case of a fully charged battery, it should be discharged to 80% before it is stored.
- If you need to store batteries for longer periods, be sure to simply disconnect all wires from them. That way there can not be any stray loads that slowly discharge the batteries.
- Make sure that you store the battery within the temperatures listed on section 5.2. Storing them at low temperatures is certainly much better than storage at high temperatures. The electrolyte in LiFePO4 cells does not contain any water, so even when it freezes it does not expand, and does not damage the cells. Just let the battery warm up a bit before you start discharging it again, which is OK at -4 °F (-20 °C).

This is the storage temperature that the batteries should be stored, and the charging intervals and methods to do so.

Storage Temperature	Charging Interval	Charging Method
≤20°C	Once / 9M	56V 30A CC/CV Charging to 56V, cut-off current: 5A
20°C~30°C	Once / 6M	
30°C~40°C	Once / 3M	

## 8.5 Extend the life of your Battery

The Rhino 2 Battery is designed 10 years or more when used correctly. To ensure a proper battery operation, you must follow the previous listed instructions and battery parameters. In order to extend the lifespan of your battery, follow these recommendations.

- Avoid discharging the battery more than 80% Depth of Discharge (DOD) unless it is truly necessary.
- Keep the battery temperature under 95 °F (35 °C) and above 59 °F (15 °C)
- Keep battery charge and discharge current under 0.5 of the Capacity (C-rating)

- Never disassemble the battery, unless our tech support guides you. If the battery has any problems, contact us for assistance.
- Keep the battery away from excessive physical shocks or vibration. These can damage the battery's internal structure and hamper its operation.
- Dirty battery terminals can lead to improper flow of current during operation. Therefore, it is recommended that you clean the terminals while installing the battery pack.

## 9. Service

### 9.1 Troubleshooting

No.	Error	Description	Solution
1	Communication failure with inverter	Communication port connection error or battery ID setting error	Check connection. Refer Chapter 7. Battery Commissioning
2	No DC output	Battery is off or low voltage	Turn ON or charge the battery
3	Power supply time is too short	Battery capacity lack or not fully charged	Fully Charge the battery. Maintenance or replacement
4	Battery can't be charged fully	Power system DC output voltage falls below the minimum charge voltage	Change the DC output voltage of the power supply to a suitable charging voltage for the battery
6	ALM LED always on	Short circuit	Disconnect the power cable and check all cables.
7	The battery output voltage is unstable.	Battery management system does not operate normally.	Press the reset button to reset the battery, then reboot the system.
8	ALM LED flashes 20 times with SOC1 LED on.	Unbalanced voltage within a cell	Deep discharge the battery bank (<20% SOC), then charge the battery bank fully.
9	ALM LED flashes 20 times with SOC2 LED on.	Unbalanced temperature	Contact the distributor.
10	ALM LED flashes 20 times with SOC 3/4 LED on.	BMS damaged	Contact the distributor.
11	Different SOC value of batteries in parallel operation.	No issue	Deep discharge the battery bank (<20% SOC), then fully charge the battery

12	Low voltage protection with no LED on	BMS is in low voltage protection, and is in sleep mode	Contact the distributor.
13	Deeply discharged with "RUN" LED on	The battery voltage is too low to start BMS.	Contact the distributor.

## 9.2 Maintenance

Item	Maintenance	Maintenance Intervals
Power Cables	Check whether there is mechanical damage to the power cable and whether the terminal insulation sleeve has fallen off; if there is such a phenomenon, please turn off the machine and carry out maintenance or replacement	Once every 6 months
	check whether the power cable is loose; if there is any sign of looseness, please use a standard torque wrench to tighten it	
	check the system for loose screws or discoloration of the copper bus bar; if the screws are loose, please tighten them with a standard torque wrench; if the copper bus bar is discolored, please contact the manufacturer for after-sales replacement	
Comm Cables	check whether the parallel communication cable terminal is loose, if it is loose, re-tighten it	Once a year
	check whether the color of the communication cable has obvious discoloration, if discoloration, please shut down the machine to replace the communication cable	
Cabinet	Check the cleanliness of the front door, back door and battery module inside the cabinet, if there is obvious dust, please clean up in time.	Once 6-12 months
System Running Status	check if all parameters are normal when the system is running (voltage, current, temperature, etc.)	Once every 6 months
	check whether the main core components of the system are normal, including system switches, contactors, etc. are normal	
	check whether the system air inlet and outlet, air ducts are normal, if there is blockage and congestion, need to clean up in time	
Charge and Discharge Maintenance	Use light load and shallow charge/discharge to check whether the SOC, SOH status of the battery is normal (using the upper computer software to read); it is recommended that the depth of discharge and charge/discharge power should not exceed 20% of the rated value	Once every 6 months

## 9.3 Monitoring software

In order to view real-time detail of the BMS, see historical data, and view/change parameters you can use the provided battery monitoring software and follow the steps below.

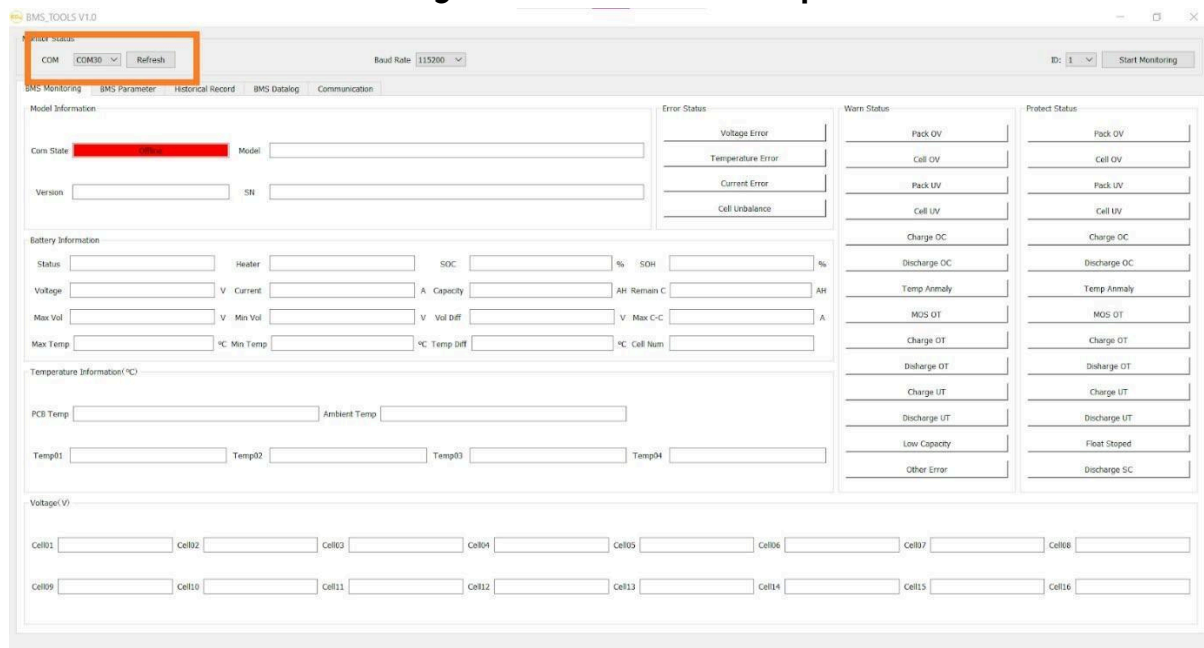
### You will need the following items:

1. (1) Laptop with a USB interface
2. (1) USB to RJ45 communication cable wired according to section 5.5
3. BMS monitoring software (BMS\_TOOLS)

### How to connect to the battery:

- ① Download the BMS-TOOLS folder onto the laptop.
- ② Turn off the battery that you want to monitor and set the ID to 64 (all switched on). Once set, turn the battery on.
- ③ Connect the RJ45 end of the communication cable to the RS-485 port of the battery you want to monitor, and connect the USB end to your laptop. Check your laptop's device manager to validate that the COM port is detected.
- ④ Open up the BMS\_TOOLS application and confirm the correct COM port is chosen, as shown in figure 38.

**Figure 38: BMS Tools COM port**

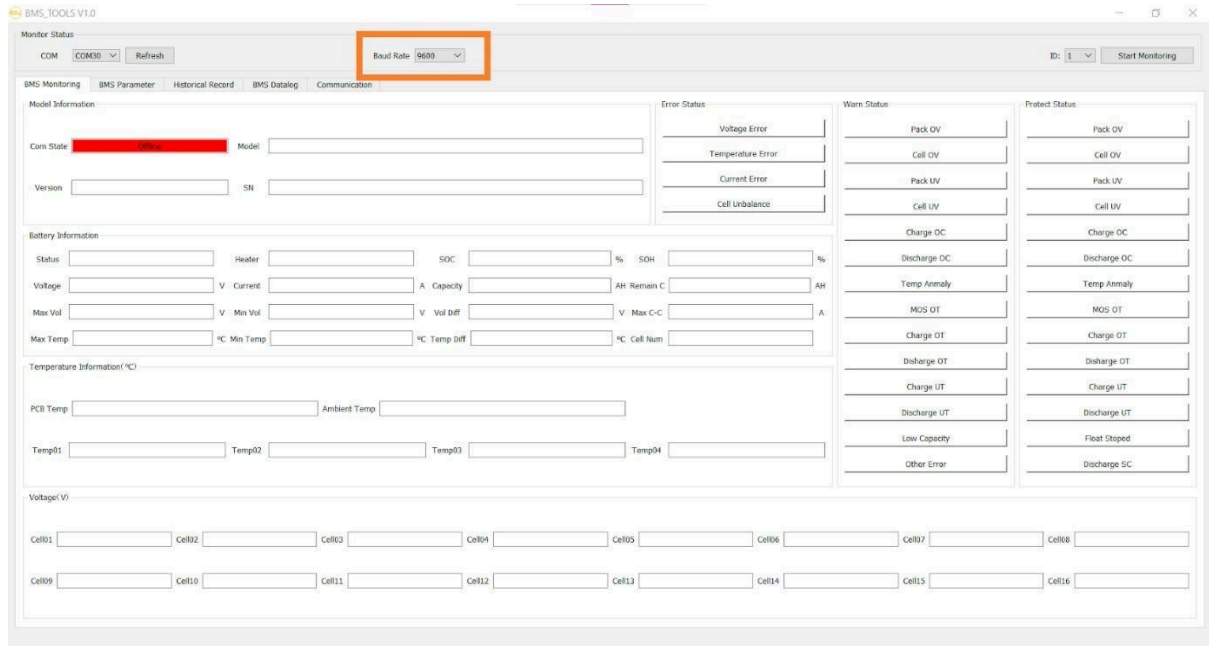




5

Change the Baud Rate to 9600, as shown in figure 39.

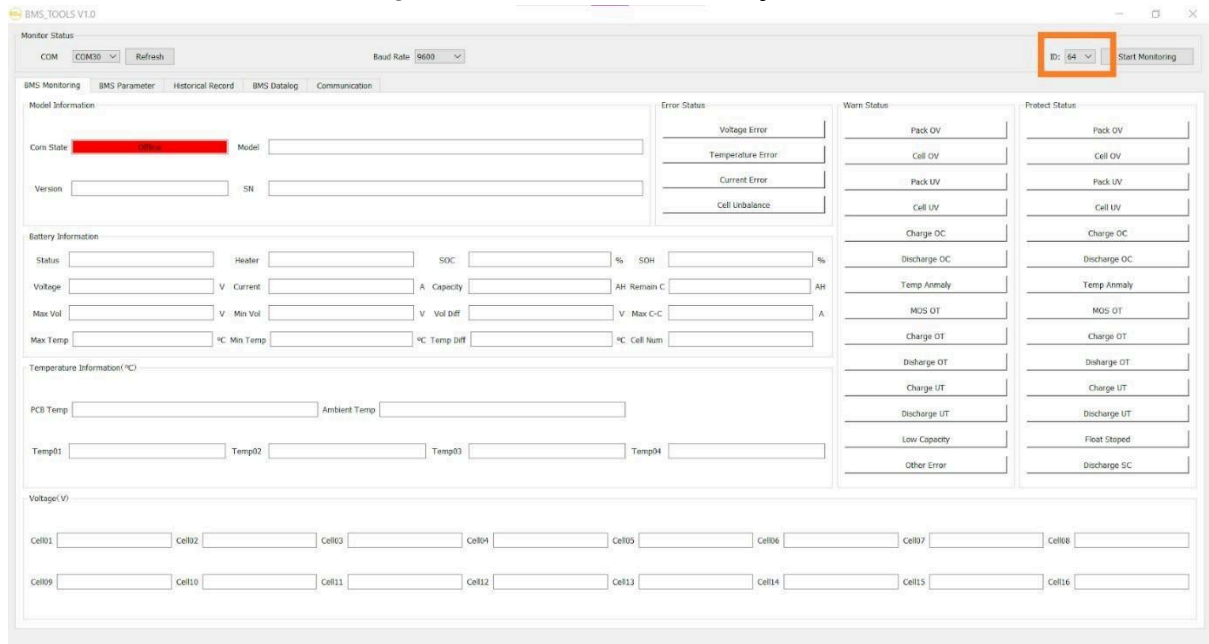
**Figure 39: BMS Tools baud rate**



6

Change the "ID" to 64, as shown in figure 40.

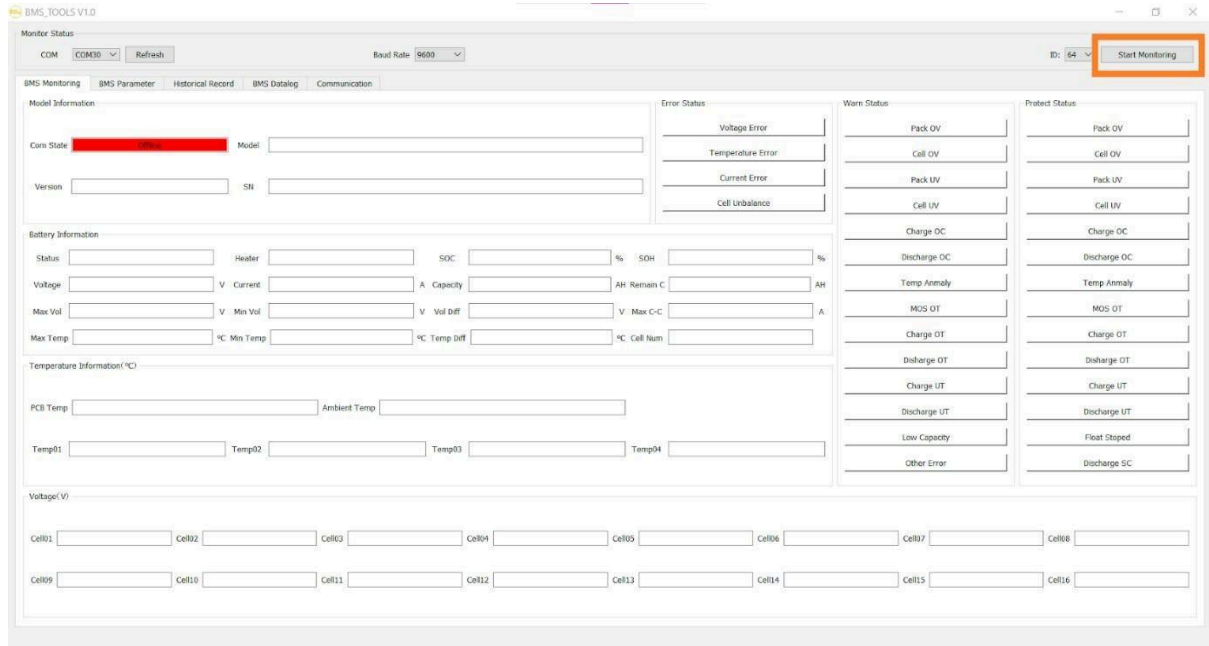
**Figure 40: BMS tools battery ID**



7

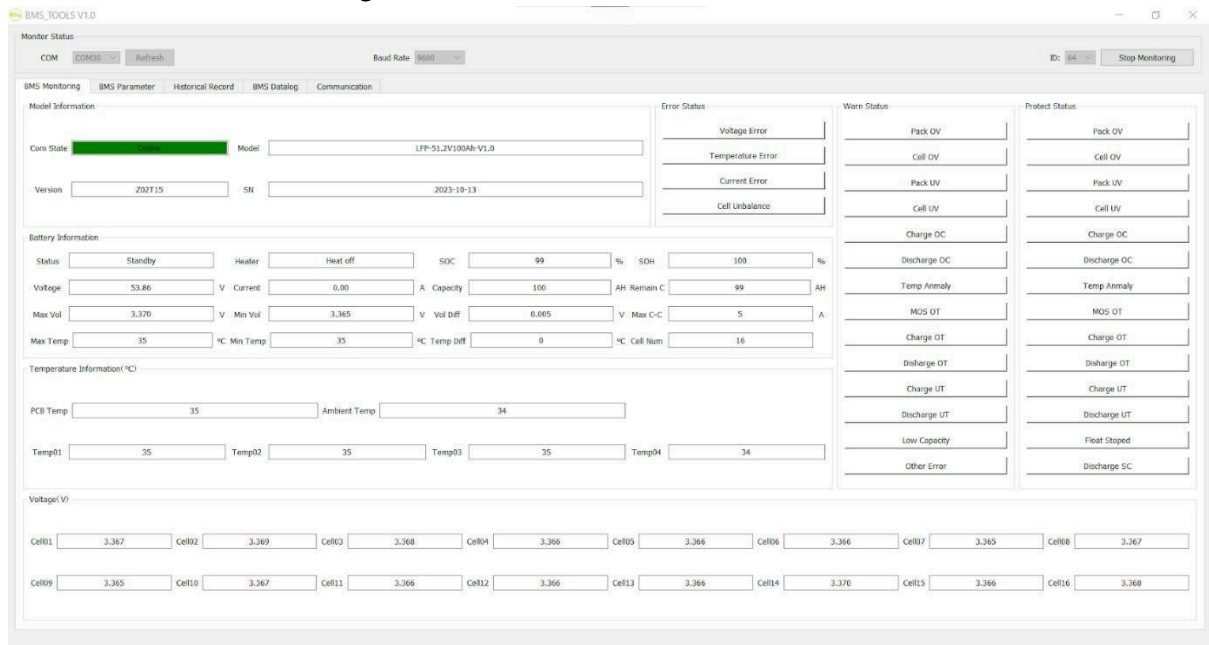
Select, "Start Monitoring", as shown in figure 41.

**Figure 41: BMS Tools Start Monitoring**



The BMS data will now populate as shown in figure 42. From this point you can see real time data from your BMS and view historical data.

**Figure 42: BMS Tools connected screen**



## 10. Recycling

Lithium iron phosphate batteries are potentially dangerous and shouldn't be tossed in the trash. Many websites and organizations can recycle them for free. If you're in the U.S. or anywhere globally, search for "Lithium Battery Disposal Near Me" online. Numerous places can safely dispose of these batteries. Make sure to call first to confirm they're open.

If you can't find a safe disposal option, contact our customer service team instead of improperly disposing of the battery. We can take care of recycling your batteries for you.

## 11. Warranty & Returns

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In the unlikely event you are having an issue with one of our batteries we have developed a straightforward warranty & return policy which includes the following:

- For all returns or warranty claims contact [support@bigbattery.com](mailto:support@bigbattery.com).
- 30-day money back guarantee. Returns of undamaged batteries unrelated to warranty claims may be issued full refunds less a 20% restocking fee.
- We have a 10-year warranty on all new batteries. For more information, visit the Policies page at BigBattery.com.
- We offer a 30-day warranty on all cells, accessories & complimentary products (Anderson connectors, wires, chargers, etc.).
- Warranty only applies to original owner (non-transferable).
- Warranties can be used for an exchange of a component only once per component.
- Operating the battery outside of acceptable parameters, according to our listed battery specs (ref. Section 5.2) will void your warranty.
  - Example: Using an incorrect charger may exceed max. charging voltage specifications.
  - WARNING: Make sure to use the appropriate charger for your battery.
- Customer pays return shipping on returns or warranted component inspections initiated after the first 30 days of ownership. Please note some battery returns may require special documentation and packaging, and these instances will encounter extra fees. This is to correctly comply with lithium battery shipping regulations.
- If you have a quality issue with a product, please contact our support team to help properly diagnose the problem. If the product you receive does not meet our rigorous quality standards, then we will issue you a replacement component or fix the original at no additional cost. Replacement batteries or components will only be sent after we have received your returned battery or component and finished an inspection to determine the cause of any problems. BigBattery is not responsible for return shipping.
- DIY modifications or damage due to gross negligence or abuse are not covered by the warranty.

Please visit [www.bigbattery.com](http://www.bigbattery.com) to review the latest policy.

For all returns, please mail your package in a traceable method to the address below. Include a note with your name, your order number and describing your situation and/or request.

**BigBattery Inc.**  
**Technical Support Team**  
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(818) 280-3091, ext. 1005  
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Chatsworth, California 91311