BigBattery

Your Source For Power

48V HUSKY 2
USER MANUAL

VERSION 1.3 | INFORMATION SUBJECT TO CHANGE WITHOUT NOTICE

SCAN QR CODE TO VIEW LATEST VERSION

MODEL SKUS: FHSKY-48051-G2

VERSION HISTORY

Version	Date	Chapters	Reason For Change
1.1	12/26/2023	All	Manual development
1.2	2/29/2024	5.2	Spec updates
1.3	9/4/2024	All	Formatting updates

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1. Definition of Terms

- **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 control box
- **BMS** - Battery Management System
- **Capacity** - Measure of stored energy, typically in Ah or mAh
- **Control Box** - Master BMS unit
- **Cell Balancing** - Process of ensuring uniform charging among battery cells
- **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 LiFePO4
- **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

Note: Read and follow all safety instructions for handling the battery prior to installation.

Lithium Iron Phosphate (LiFePO4) batteries are an inherently safe chemistry. However, safety measures should always be taken into 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.

WARNINGS:

- ⚠ 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 that specified in Section 5.2.
- ⚠ 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, or strong acids.
- ⚠ Do not install battery in a location exposed to direct sun, hot surfaces, or hot locations. Do not install batteries in a tight clearance compartment, as 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. This 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, fire, or voiding of the warranty.

PRECAUTIONS:

- ⚠ Qualified personnel must handle all product work to reduce risk of electric shock.
- ⚠ Follow local and national electrical standards for installation and confirm utility provider and local authority 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 lifting techniques 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 the battery if ambient temperature is below -20°C (-4°F).
- ⚠ Beware of the battery current. 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 (PPE) when handling batteries.
- ⚠ Handle batteries carefully to prevent damage. Avoid pulling, dragging, or mishandling.
- ⚠ Inspect batteries before use. Don’t use damaged or swollen batteries. Contact BigBattery immediately if damage or swelling is present.
- ⚠ Don’t paint any part of the batteries, inside or out.
- ⚠ Make sure all cable connections are properly tightened and secured, in order 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.

3. Introduction

Introducing BigBattery's 48V HUSKY 2! These revolutionary lithium batteries, designed to push the boundaries of efficiency, flexibility, and reliability in energy management, are the best batteries money can buy. The 48V HUSKY 2 represents a leap forward in energy storage technology, offering a compact and scalable solution for mobile, industrial, and off-grid applications. With its cutting-edge features and intelligent design, this advanced lithium battery promises to empower individuals and organizations to take control of their energy usage like never before. Equipped with one of our HUSKY 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 48V HUSKY 2 (FHSKY-48051-G2) battery systems.

3.1 Product Description

The 48V 5.12kWh HUSKY 2 battery is ideal for low-voltage applications such as your golf carts, RVs, off-grid power systems, emergency power supplies, and more. Each single battery module is 5.12kWh and it can be expanded up to 80kWh when connecting in parallel. These batteries utilize lithium iron phosphate (LiFePO4, or LFP) cells, renowned for their top-notch safety.

They are water resistant and 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 of the module. The BMS features a passive balancing 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. Plus, it has internal heating pads so the battery can be charged in freezing environments and temperatures.The battery utilizes a standard M8 bolt connection, which easily and safely secures power to your battery unit. Designed to endure, the HUSKY 2 has a lifespan of over 10 years and is engineered to withstand more than 4000 - 6000 cycles at 80% Depth of Discharge (DOD) at a rate of 0.5C.

Keep in mind, you can always monitor the battery's capacity with the State of Charge meter or check the battery's health and performance from your phone with the bluetooth BigBattery app, which will display information of the condition of your battery.

3.2 Features & Applications

Applications:

- Golf Carts
- Utility Carts
- 48V UTVs & LSVs
- Tiny Homes
- Family Homes
- Cabins
- Homesteads
- Off-Grid Systems
- Solar Systems
- Emergency Backup
- Class A, B, & C RVs
- Camper Vans
- Tow-Behind Trailers
- Sailboats & Yachts
- Scissor Lifts
- Pallet Jacks
- Light Towers & Digital Signs
- Industrial Equipment

Features:

- Advanced BMS with automatic cell balancing
- Lithium-ion chemistry (LiFePO4/LFP)
- Simple connection to a larger power system
- Expandable system with easy parallel connections
- Multiple layers of safety and battery protections
- Internal self-heating system
- Built-in fire suppression system
- Impact & vibration resistant
- IP65 protection rating
- Good insulation performance
- Durable ABS construction
- Standardized M8 bolt terminals for cable connections
- CANBus & RS485 parallel communications
- LED SoC meter
- RJ-45 ports
- Mobile monitoring app

4. Packed Components

Included In Box		
		
	(x2) Battery Handles	(x1) Ring Terminal Covers
	Add-Ons	
		
(x1) 48V 5.12kWh HUSKY 2 (FHSKY-48051-G2)	(x1) SoC Battery Meter (MTR108)	(x1) 4AWG +/- Ring Terminal Cables [3 ft.] (CBL015)

5. Product Specifications

5.1 Battery Overview

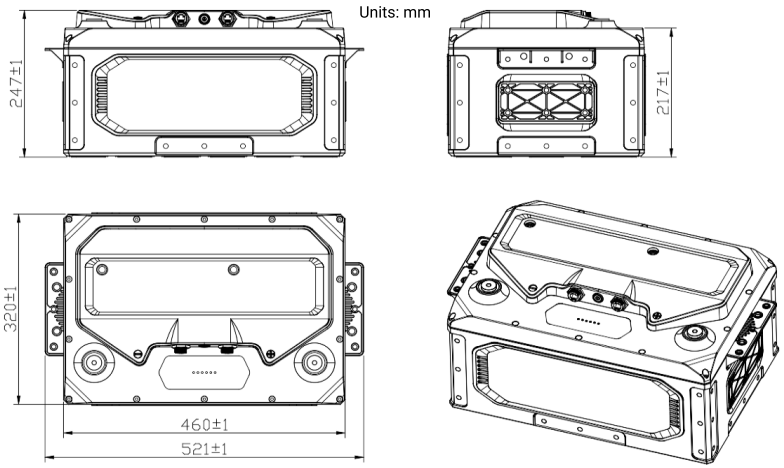


Figure 1: HUSKY 2 Battery Overview

Before handling, turn off the battery & verify that no voltage is present in order to prevent accidental contact with live terminals, as this could lead to severe injury or fatality.

5.2 Battery Specs

SKU	FHSKY-48051-G2
System Voltage	48V
Nominal Voltage	51.2V
Chemistry	LiFePO4
kWh Capacity	5.12 kWh
Ah Capacity	100
Charging Voltage Range	55.6V - 57V
Max Charge Voltage	58.8V
Operating Voltage Range	48V - 57V
Suggested Low Voltage Cutoff	48V - 50.8V
BMS Cutoff Range	42V - 47V
Cell Configuration	16S
Max Cont. Discharge Current	100A
Max Continuous Power	5120W
Max Discharge Peak Current	150A (Max 5 sec.)
Max Charge Current	100A
Charge Temperature Range	-4°F - 113°F (-20°C - 45°C)
Discharge Temperature Range	-4°F - 122°F (-20°C - 50°C)
Optimal Discharge Temp. Range	59°F - 95°F (15°C - 35°C)
Storage Temp. Range (SOC >50%)	-4°F - 122°F (-20°C - 50°C) (Max 6 months)
Dimensions (DxWxH)	12.6 x 18.1 x 9.8 in (320 x 460 x 247 mm)
Weight	100 lbs (45.4 kg)
Max Connections	Up to (16) Parallel
Protection Rating	IP65
Communications	CANBus / RS485
Heating Function	Yes

5.3 Battery Diagram

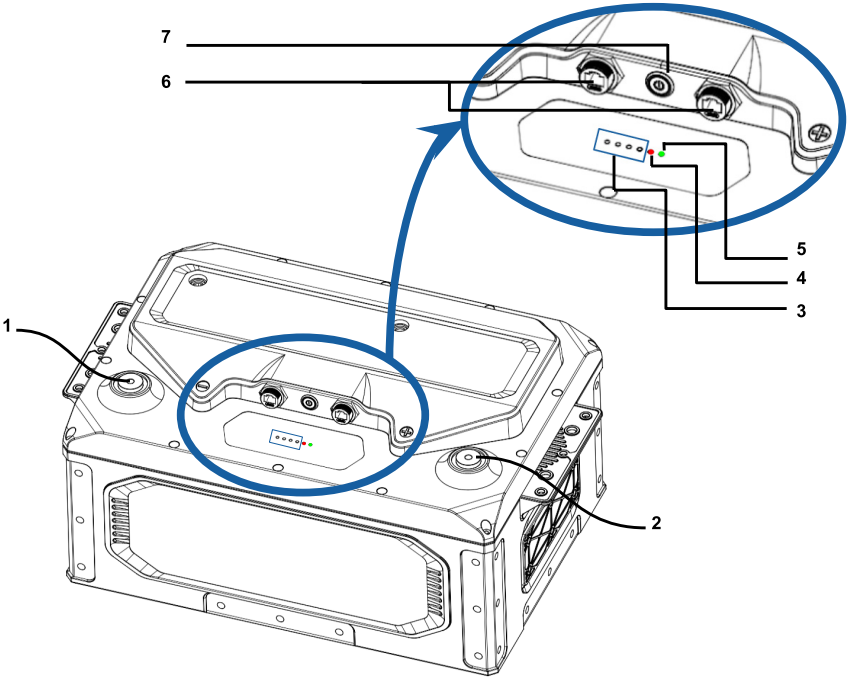
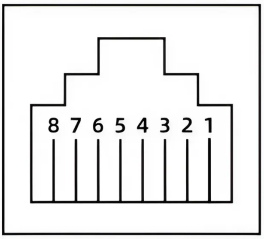


Figure 2: HUSKY 2 Battery Diagram

Item	Name	Description	Details
1	BAT-	Negative battery terminal	M8 screw
2	BAT+	Positive battery terminal	M8 screw
3	SoC	LED state of charge indicators	4 LEDs on = 100% 3 LEDs on = 75% 2 LEDs on = 50% 1 LEDs on = 25%
4	Alarm	LED alarm indicator	
5	On	LED on/operating indicator	
6	RS485/CAN	RJ-45 communication port	RS485/CANBus
7	On/Off Button	Switches BMS on/off	

5.4 Battery Communication Ports



Pin	Details	Pin	Details
1	CAN-H	5	WARK
2	CAN-L	6	12V
3	GND	7	RS485 A+ (T/R+)
4	LIN	8	RS485 B- (T/R-)

Note: Both RJ-45 communication ports can use RS485 or CANBus protocols for parallel communications.

5.5 Battery LED Indicators

Status	Operation	On	Alarm	SoC	Details
Shutdown / Sleep		Off	Off	Off	
Standby	Normal	On	Off	4 LEDs on = 100% 3 LEDs on = 75% 2 LEDs on = 50% 1 LEDs on = 25%	
Charge	Normal	Flash 1	Off		Flash 1 Off: 1 second On: 1 second
	Alarm	Flash 1	Off		
	End-Off Voltage	On	Off		
	Over Temperature / Over Current Protection	Off	On		
Discharge	Normal	Flash 2	Off		Flash 2 Off: 0.5 seconds On: 0.5 seconds
	Alarm	Flash 2	Off		
	End-Off Voltage	Off	On		
	Over Temperature / Over Current Protection	Off	On		

6. Installation

⚠ 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 installing 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 HUSKY 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 Battery Installation

1. Place the battery on a flat floor or shelf.
2. The L-shaped metal brackets on the case can be removed and used to securely mount the battery to the floor with an electric drill. If the battery is placed on its side, the metal brackets can be used to securely mount the battery to the wall with an electric drill, as shown in Figure 3 on the following page.

Figure 3: HUSKY 2 Mounting Installation

3. When connecting several batteries in parallel, you can use the flat metal plates on the sides of the case as connectors, and secure the batteries together using an electric wrench, as shown in Figure 4.

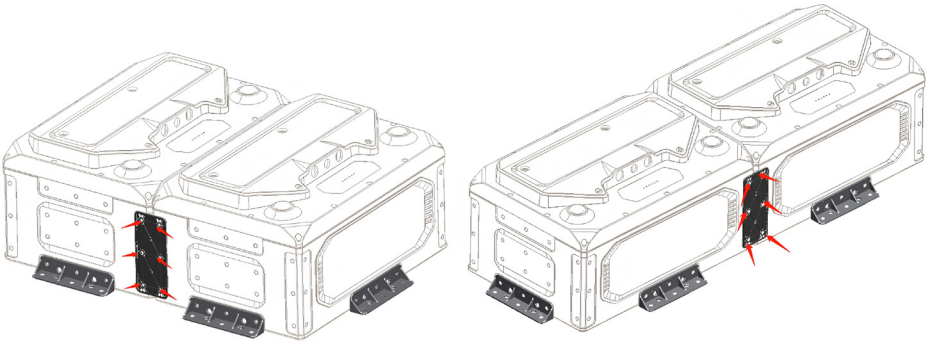


Figure 4: HUSKY 2 Parallel Mounting Installation

4. When using a single battery, connect it directly to the SoC Meter using Address No. 1. If there are multiple batteries in parallel, designate battery No.1 as the master, connecting it to the SoC Meter. The remaining slave batteries should interconnect their communication ports in a daisy chain sequence using a communication network cable (UTP), as shown in Figure 5 on the following page. It's essential to ensure that the addresses of the slave batteries are distinct from one another.

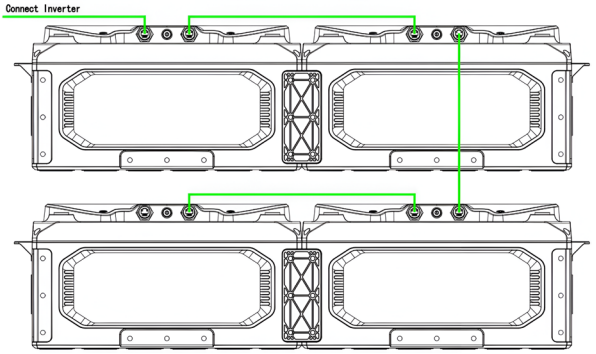


Figure 5: HUSKY 2 Communication Cable Connection Diagram

5. Connect the batteries in parallel using the 4AWG +/- Ring Terminal Cables. Ensure that all positive terminals are connected to each other, and all negative terminals are connected to each other, as shown in Figure 6.

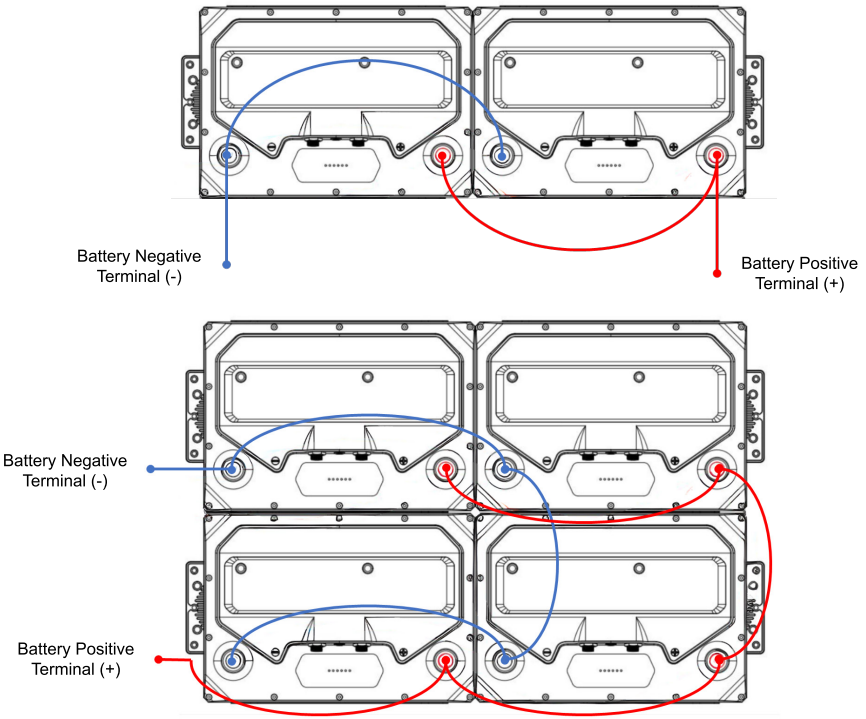


Figure 6: HUSKY 2 Power Cable Connection Diagram

6. Connect the batteries' remaining positive and negative terminals to the main positive and negative terminals on your system or vehicle.

7. Battery Commissioning

In order for the batteries to communicate with each other, they need to have their ID addresses set using the mobile monitoring app.

7.1 Battery Configuration

1. Search for BatteryMonitorBL in the Apple App Store or in the Google Play Store and download it, as shown in Figure 7.

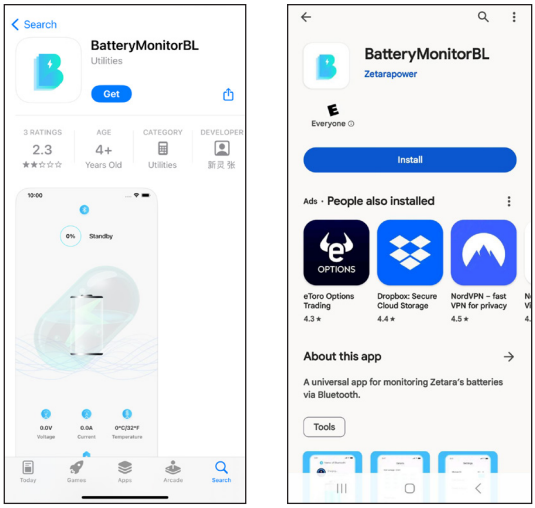


Figure 7: App Store & Play Store Download

2. Open the BatteryMonitorBL app and turn on the HUSKY 2 battery.
3. Connect the HUSKY 2 battery and the BatteryMonitorBL app using Bluetooth. Search for the batteries and connect them according to the battery's Bluetooth label (located on the left side of the battery). The app will then display the battery's information, as shown in Figure 8 on the following page.

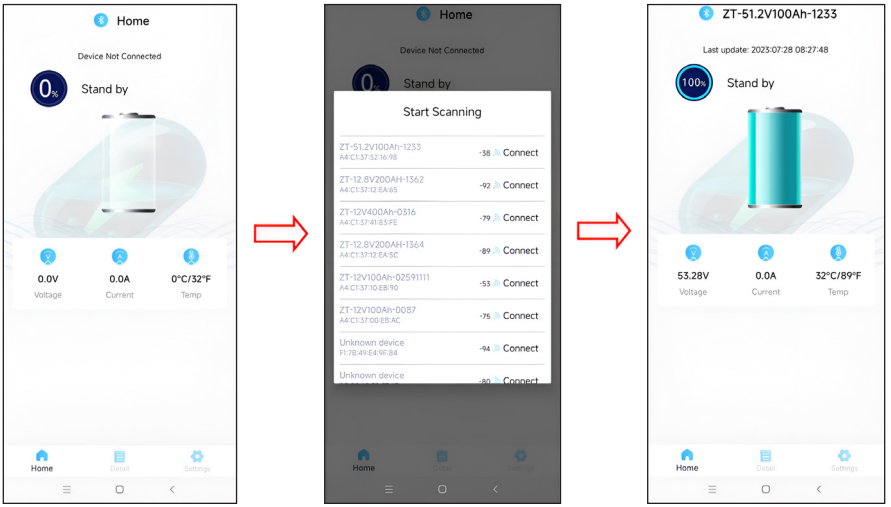


Figure 8: Connecting HUSKY 2 Batteries & Monitoring App

4. Select the ID address. Enter the 'Settings' interface. Click on 'Module ID' and select the appropriate ID, as shown in Figure 9. The default selection is ID1. The master battery that connects to the meter must be set to ID1. The next battery in the daisy chain should be set to ID2, and so on. All batteries need to have a unique ID adress in order for them to properly communicate with each other. Reset the battery after any changes made in the app.

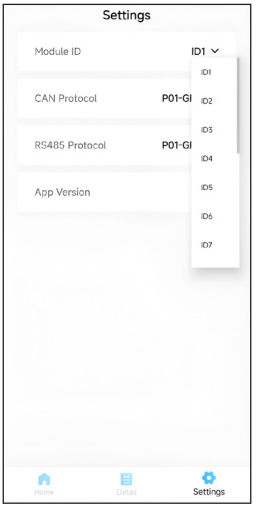


Figure 9: ID Address Configuration

8. Battery Operation Guide

⚠ WARNING: Before installing, be sure to review all parameters listed in Section 5.2.

8.1 Charging

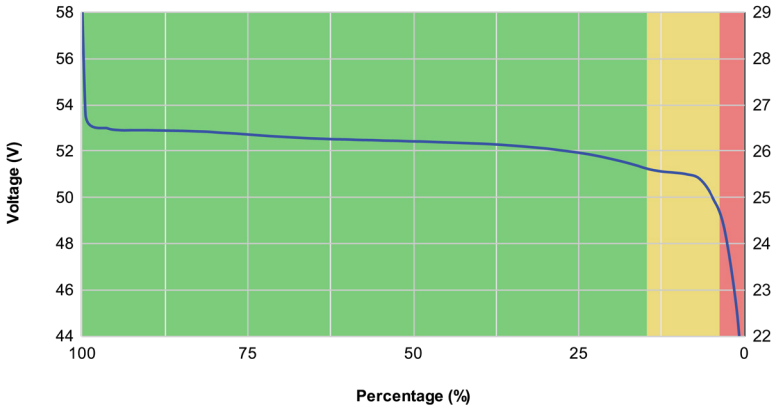
- During initial charging, monitor the battery's charge voltage to ensure it is within appropriate voltage limits.
- Only use the battery charger provided by BigBattery, or the inverter charging settings listed in Section 5.2. Using non-recommended chargers may cause improper charging and damage the battery's capacity.
- The battery can be charged in freezing temperatures (-20°C / -4°F) thanks to an automatic self-heating function. When charging is detected, heating will start until the battery temperature is above 0°C (32°F) and then charging will start.
- Use LiFePO4 batteries for "opportunity charging." Charge them whenever you can with small amounts of energy, but do it with BigBattery chargers. It's better to do this than using fast chargers. Fast charging can make the battery's lifespan shorter.
- It is recommended to charge the battery when it has a minimum of 10% - 20% SoC. Deep discharging 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 down to 0% safely, but shallower cycles offer benefits. Staying above 20% SoC 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 temperature rises 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 curve of the HUSKY 2 batteries.



	Cycling in this zone will ensure a reasonable life expectancy.
	Occasionally this zone is okay.
	Dropping into this zone can lock the battery and 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% SoC. Do not store batteries that are fully discharged. In the case of a fully charged battery, it should be discharged to 80% SoC before it is stored.
- If you need to store batteries for longer periods, be sure to disconnect all wires from them. This ensures that there will not be any stray loads that slowly discharge the batteries.
- Make sure that you store the battery within the temperatures listed in Section 5.2. Storing them at lower temperatures is better than storage at higher 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. Be sure to let the battery warm up before you start discharging it again, which is acceptable at -20°C (-4°F).

The table on the following page provides the storage temperature that the batteries should be stored at, as well as the charging intervals and methods to do so.

Storage Temperature	Charging Interval	Charging Method	Model
≤20°C	Once / 9 months	56V 30A CC/CV Charging to 56V Cut-Off Current: 5A	48V HUSKY 2
20°C ~ 30°C	Once / 6 months		
30°C ~ 40°C	Once / 3 months		

8.5 Extending Battery Life

The HUSKY 2 battery is designed for a lifespan of 10 years or more when used correctly. To ensure proper operation, adhere to the previously listed instructions and battery parameters. In order to extend the lifespan of the battery, follow the recommendations below.

- Avoid discharging the battery beyond an 80% Depth of Discharge (DoD) unless it is truly necessary.
- Keep the battery temperature under 35°C (95°F) and above 15°C (59°F).
- Keep battery charge and discharge current under a 0.5 C-rating.
- Never disassemble the battery, unless BigBattery Tech Support guides you. If the battery has any problems, contact BigBattery 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. It is recommended that you clean the terminals while installing the battery pack.

9. Service

9.1 Troubleshooting

No.	Error	Description	Solution
1	No DC output	Battery is off or low voltage	Turn on or charge the battery
2	Power supply time is too short	Battery is not fully charged or capacity is reduced	Fully charge the battery; Maintenance or replacement
3	Battery can't be charged fully	Power system DC output voltage falls below the minimum charge voltage	Regulate DC output voltage of power supply to suitable battery charging voltage
4	Alarm LED is always ON	Power line connection short circuit	Disconnect the power cable and check all cables

5	Battery output voltage is unstable	BMS does not operate normally	Press the on/off button to restart the battery
6	Charge and discharge capacity is insufficient	Unbalanced cell voltages	Examine/balance the cells
7	Unable to charge and discharge	BMS or cell/temperature sensor is damaged	Maintenance or replacement
8	Different SoC values of batteries in parallel	Normal occurence	No action needed
9	Alarm LED is ON	Over current protection	Charging or discharging current is too high and needs to be reduced
10	Alarm LED is ON	Over temperature protection	Turn off the battery and cool down the location however possible
11	Alarm LED is ON	End-off voltage	Charge the battery

9.2 Maintenance

Item	Maintenance	Maintenance Intervals
Power Cables	Check whether there is mechanical damage to the power cables and whether the terminal insulation sleeve has fallen off. If there is such an occurence, please turn off the battery 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, tighten them with a standard torque wrench. If the copper bus bar is discolored, contact the manufacturer for replacement.	
Communication Cables	Check whether the parallel communication cable terminal is loose. If it is loose, tighten it.	Once a year
	Check whether the communication cable has obvious discoloration. If discolored, shut down the battery and 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, clean up in a timely manner.	Once every 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 primary components of the system are normal, including system switches, contactors, etc.	
	Check whether the system air inlet, outlet, and air ducts are normal. If there is blockage and congestion, clean up in a timely manner.	
Charge & Discharge Maintenance	Use a light load and shallow charging/discharging to check whether the SoC and SoH status of the battery is normal (using the monitoring app). It is recommended that the depth of discharge and charge/discharge power should not exceed 20% of the rated value.	Once every 6 months

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 the BigBattery Customer Service team instead of improperly disposing of the battery. BigBattery can take care of recycling your batteries for you.

11. Warranty & Returns

In the unlikely event you are having an issue with one of our batteries, we have developed a straightforward Warranty & Return Policy which is detailed in the following link: https://bigbattery.com/policies/

For more information and support, please visit our website or reach us at:

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21314 Lassen St.
Chatsworth, California 91311

NOTES