RENOGY

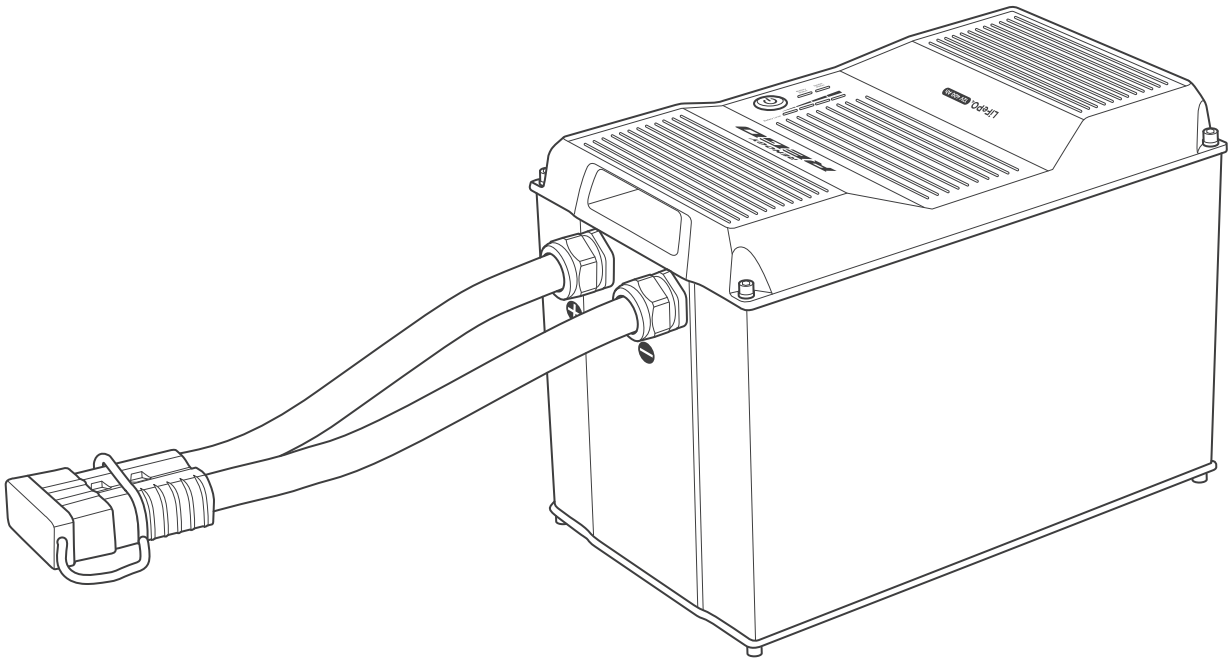
Find Your Energy Freedom™

REGO

Lithium Iron Phosphate Battery

12V | 400Ah

VERSION A0



USER MANUAL

Applicability

The user manual applies to the following product:

- REGO 12V 400Ah Lithium Iron Phosphate Battery (RBT12400LFPL-SHBT)

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Date and Revision

June 2022, Revision A0

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Symbols Used | General Safety Information

The User Manual provides important installation, operation, and maintenance instructions for REGO 12V 400Ah Lithium Iron Phosphate Battery. Please read the User Manual carefully before installation and operation and save it for future reference. Failure to observe the instructions or precautions in the User Manual can result in electrical shock, serious injury, or death, or can damage the battery, potentially rendering it inoperable.

Symbols Used

The following symbols are used throughout the User Manual to highlight important information:

WARNING	Indicates a potentially dangerous condition which could result in injury or death.
CAUTION	Indicates a critical procedure for safe and proper installation and operation.
NOTE	Indicates an important step or tip for optimal performance.
INFO	Indicates that more information is available in other documents relating to the subject.

General Safety Information

WARNING

- DO NOT puncture, drop, crush, penetrate, shake, strike, or step on the battery.
- DO NOT open, dismantle, repair, tamper with, or modify the battery.
- DO NOT touch the connector contacts of the battery.
- Please remove all connections and turn the battery off before maintenance or cleaning.
- Please install the battery in accordance with the regulations at the site of installation.
- DO NOT expose the battery to direct flame.
- Please keep the battery away from flammable or combustible materials.
- DO NOT expose the battery to harsh chemicals or vapors.
- Please keep the battery away from heating equipment.
- DO NOT touch the exposed electrolyte or powder if the battery is damaged.
- DO NOT use the battery with life support equipment or other medical equipment.
- Please keep the battery out of the reach of young children and animals.
- Please use insulated tools when working on or around the battery.
- DO NOT wear jewelry or other metal objects when working on or around the battery.
- Please wear proper protective equipment when working on or around the battery.

Important Safety Information

CAUTION

- Ensure adequate and secure mounting of the battery.
- DO NOT expose the battery to strong electrostatic fields, strong magnetic fields, or radiation.
- Please use suitable handling equipment for safe transportation of the battery.
- Ensure that no water sources are above or near the battery, including downspouts, sprinklers, or faucets.
- Ensure that snow does not accumulate around the battery.
- DO NOT lean on, stack anything on top of, or hang anything from the battery or from cables leading to the battery.

Introduction

Introduction

Meet the next era of energy storage system with Renogy 12V 400Ah REGO Lithium Iron Phosphate Battery. With a large capacity of more than 5KWh, the battery is designed to run loads for extended periods of time. Manufactured with top grade cells, the battery provides an exceptional lifespan of more than 3800 cycles (80% DOD), a continuous discharge current up to 350A for heavy loads, and a continuous charge current up to 300A for 1.5-hour fast charging. The integrated battery cables and Anderson connector significantly simplify the wiring, reduce the risk of short circuit, misconnection, and connection failure, and allow for quick connection and disconnection. The sophisticated battery management system (BMS) offers up to 60 types of warnings and protections, enables precise cell balancing, and stores up to 150 event records. The built-in heater operates automatically at low temperatures to keep the battery charging. The straightforward LED indicators visualize the battery level, battery status, and heater status. The on-board Bluetooth module ensures real-time monitoring on DC Home app and compatible monitoring devices. The RV-C protocol compatibility allows for complete system integration, featuring better charging experience, safer operation, and more customizable settings to extend the lifespan of the battery. The waterproof die cast aluminum housing and stringent road load tests ensure that the battery can deliver extreme performance even under the harshest conditions including wet environments and mechanical vibrations.

Key Features

- **Large Capacity**

Runs loads for extended periods of time with a capacity of more than 5KWh.

- **Uncompromising Quality**

Provides an exceptional lifespan of more than 3800 cycles (80% DOD), a continuous discharge current up to 350A, and a continuous charge current up to 300A.

- **Easy Installation**

Makes wiring simple and safe with the integrated battery cables and Anderson connector.

- **Advanced BMS**

Offers comprehensive protection, precise balancing, and event logging capability with the state-of-the-art battery management system (BMS).

- **Built-In Heater**

Warms the battery up automatically at low temperatures for continuous charging with the built-in heater.

- **Visualized Status**

Visualizes the battery level, battery status, and heater status with the straightforward LED indicators.

- **Remote Monitoring**

Ensures real-time monitoring on DC Home app and compatible monitoring devices with the on-board Bluetooth module.

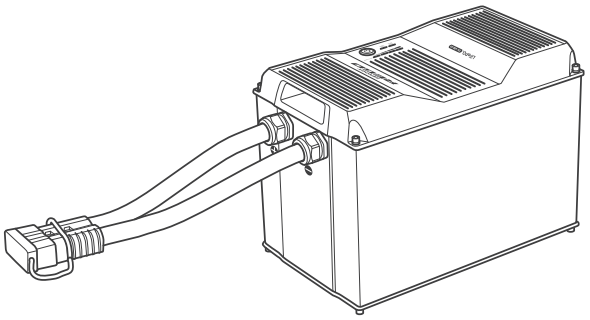
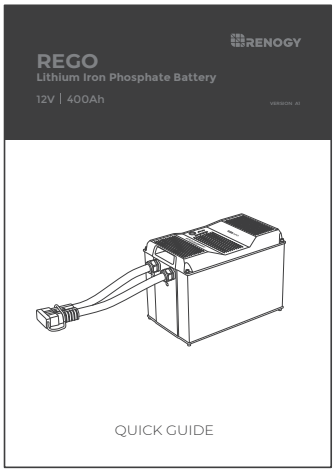
- **RV-C Compatible**

Allows for complete system integration for better charging experience, safer operation, and more customizable settings with the RV-C protocol compatibility.

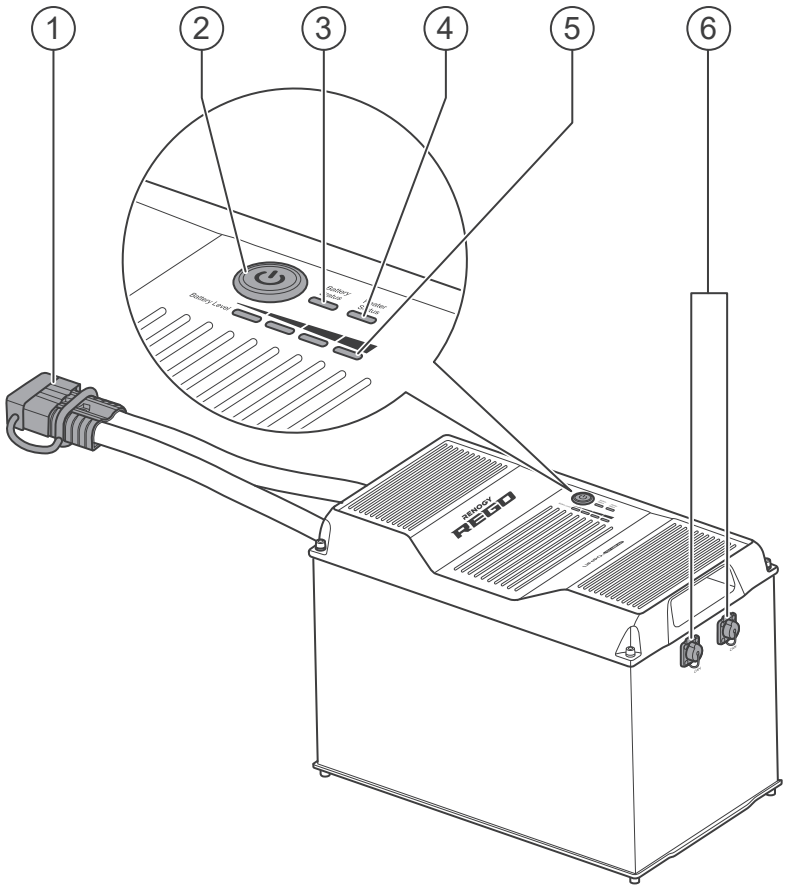
- **Reliable Design**

Delivers extreme performance even under the harshest conditions with the waterproof die cast aluminum housing.

Package Contents

12V 400Ah REGO Lithium Iron Phosphate Battery × 1	Quick Guide × 1
	

Product Overview

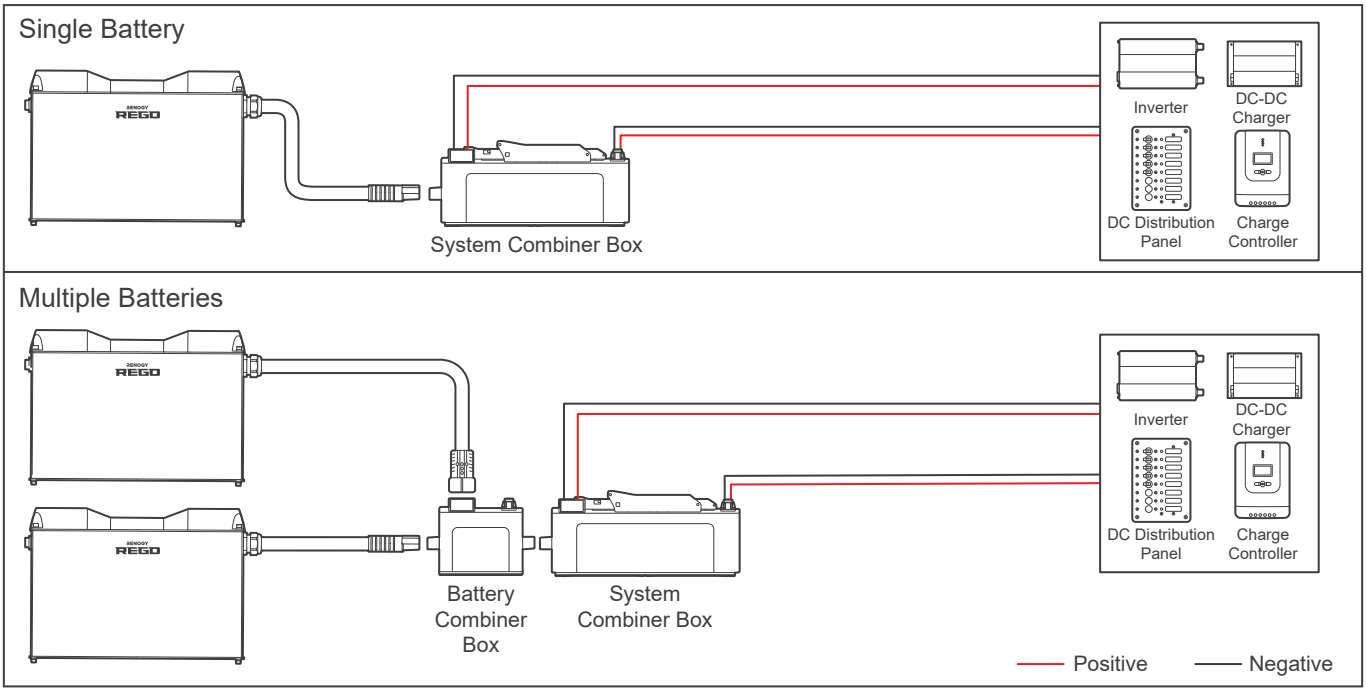


No.	Part	No.	Part
1	Gray Anderson 350 Connector (with Dust Cover)	4	Heater Status Indicator
2	Power Button	5	Battery Level Indicator
3	Battery Status Indicator	6	CAN Communication Ports

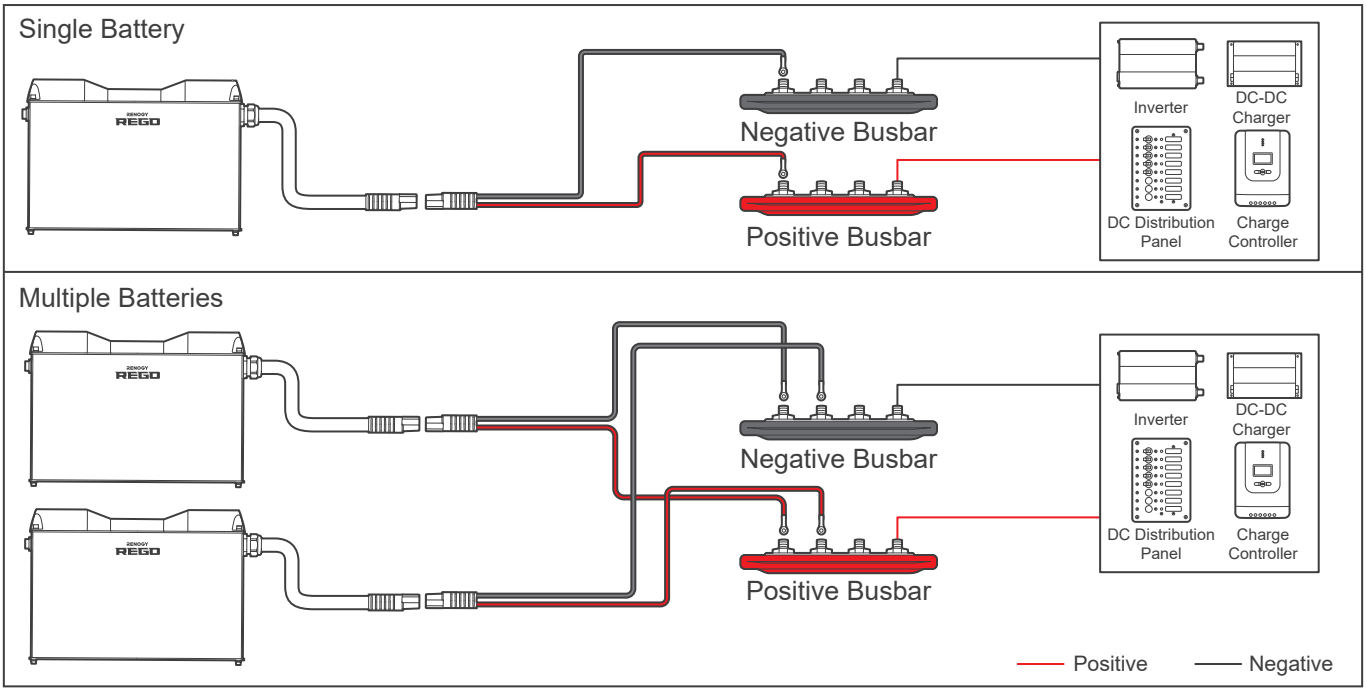
Wiring Diagram

Using Combiner Boxes | Using Busbars

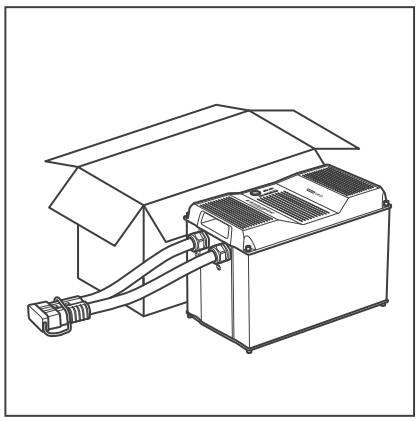
Using Combiner Boxes



Using Busbars



Inspection



Inspect the battery for any visible damages including cracks, dents, deformation, and other visible abnormalities before installation. The connector contacts shall be dry, clean, and free of any dirt and corrosion.

WARNING

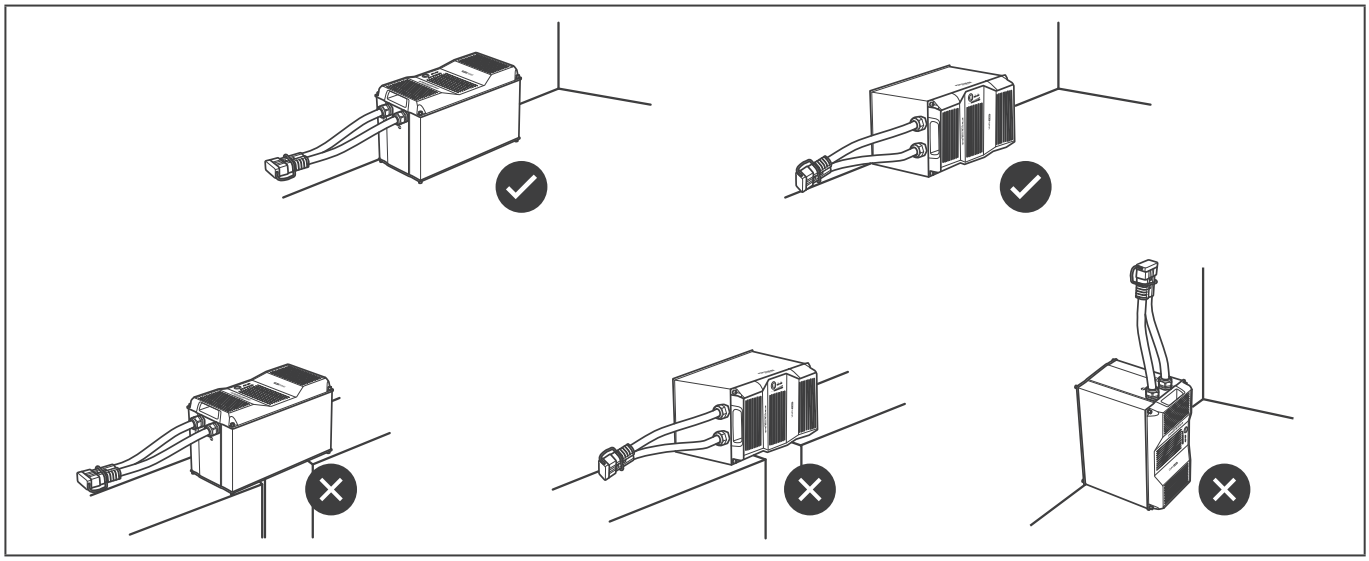
- DO NOT use the battery if it appears damaged.

Environment

Ensure that the installation environment is clean, cool, and well-ventilated. Keep the battery away from oil and dirt. The accumulation of these substances can cause current leakage, resulting in self-discharge and a possible short circuit. Avoid restricting airflow by tightly packing batteries together. Allow at least 0.5 inches (12.7 mm) of space between the batteries for efficient heat dissipation and minimal battery temperature variations. Safe operation requires environment temperatures between -4°F (-20°C) and 122°F (50°C). The recommended operating environment temperature range is 59°F (15°C) and 86°F (30°C).

Placement

Place the battery upright or horizontally on the long side.

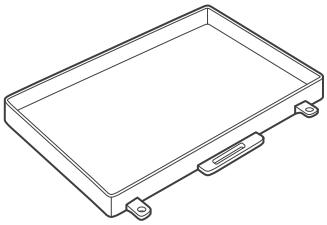
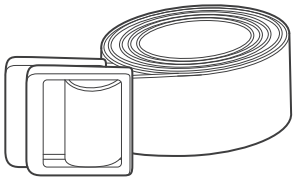
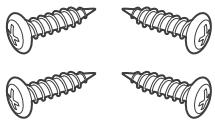


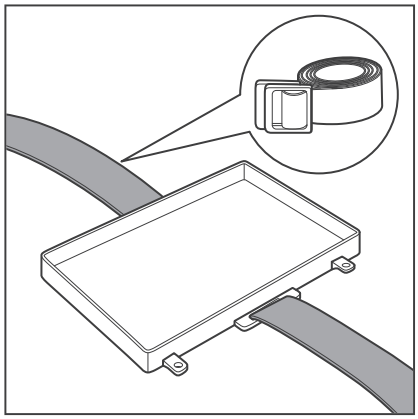
CAUTION

- DO NOT place the battery upside down or horizontally on the short side.
- Ensure that the battery is fully supported.

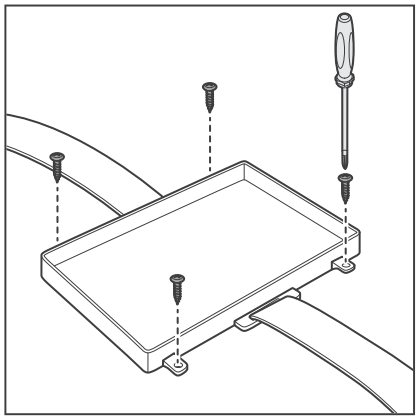
Mounting

Recommended Tool and Accessories

Phillips Screwdriver	Battery Tray
	
Tie Down Strap	**Mounting Screws**
	



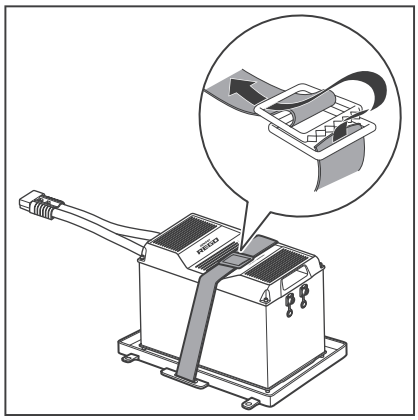
1. Thread the Tie Down Strap through the strap anchors on the Battery Tray.



2. Secure the Battery Tray on a flat mounting surface with the Mounting Screws. Tighten the Mounting Screws with the Philips Screwdriver.

NOTE

- It is recommended to pre-drill holes on the mounting surface with a drill and a drill bit before mounting the Battery Tray.



3. Place the battery into the Battery Tray. Buckle the Tie Down Strap over the battery.

NOTE

- Alternative mounting methods are allowed to meet the requirements of specific applications.

Power Connection

Using Combiner Boxes | Using Busbars

The batteries can be connected in parallel and to the system with either combiner boxes or busbars. Parallel connection is intended to increase the battery bank capacity while keeping the battery bank voltage the same.

WARNING

- DO NOT short the contacts of the Anderson Connector. Short circuits can damage the battery.
- DO NOT connect batteries in series. Series connection can damage the batteries.
- DO NOT mix battery brands, models, chemistries, nominal voltages, and rated capacities.

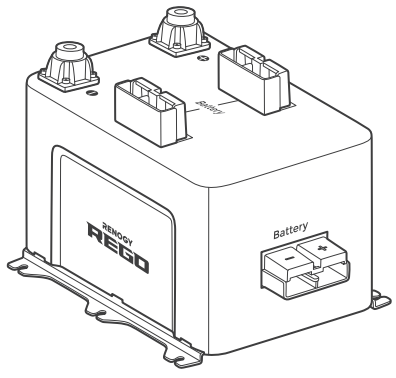
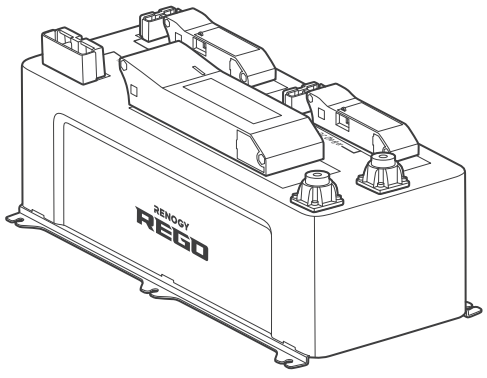
CAUTION

- Please check the polarity before connecting the cables. Reverse polarity can damage the battery and connected devices.
- The Anderson Connectors are color coded. DO NOT mate the Anderson Connectors with different colors together.
- DO NOT connect more than 8 batteries in parallel.
- Please avoid large voltage difference between batteries connected in parallel.

Using Combiner Boxes

Connecting the batteries in parallel and to the system using the Battery Combiner Box and the System Combiner Box significantly reduces the risk of short circuit, misconnection, or connection failure and allows for quick connection and disconnection.

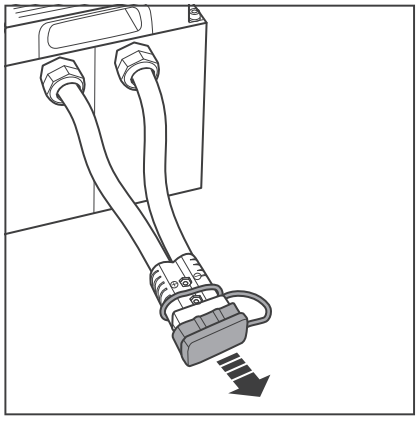
Required Accessories

REGO 3 Ports 400A Battery Combiner Box(es)	REGO 4 Ports 400A System Combiner Box
	

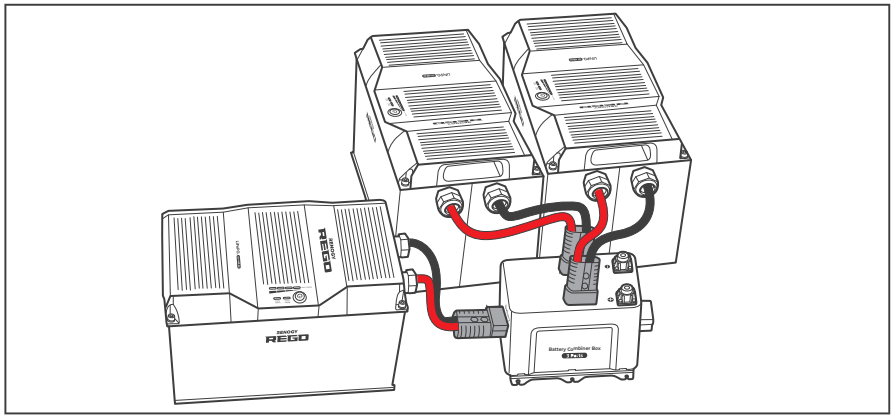
INFO

- Please read the user manual of REGO 3 Ports 400A Battery Combiner Box and REGO 4 Ports 400A System Combiner Box at renogy.com before the connection.

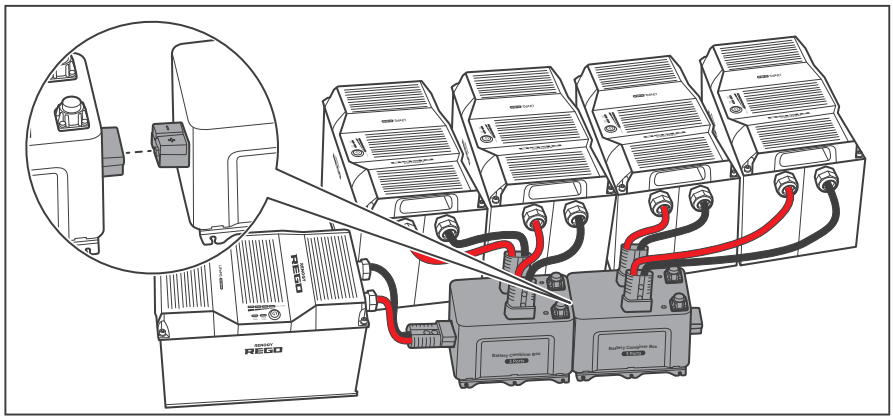
Power Connection



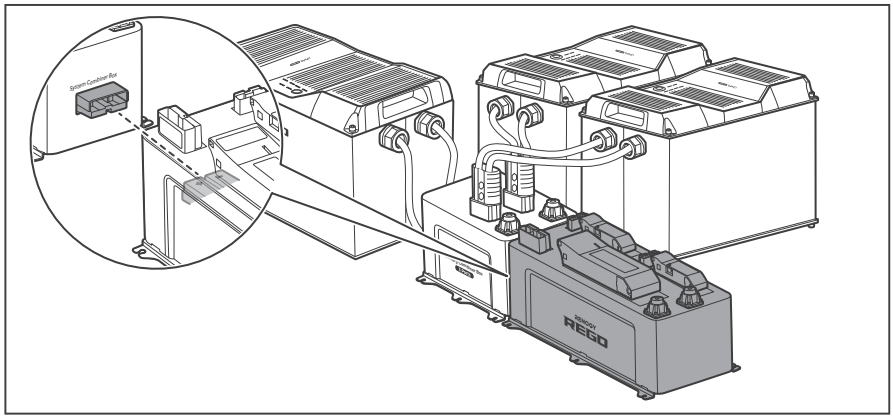
1. Remove the Dust Covers from the Anderson Connectors. If multiple batteries are to be connected in parallel, refer to step 2 to step 4. If only one battery is used, refer to step 5.



2. If multiple batteries are to be connected in parallel, plug the Anderson Connectors of the batteries to the Battery Combiner Box (sold separately).

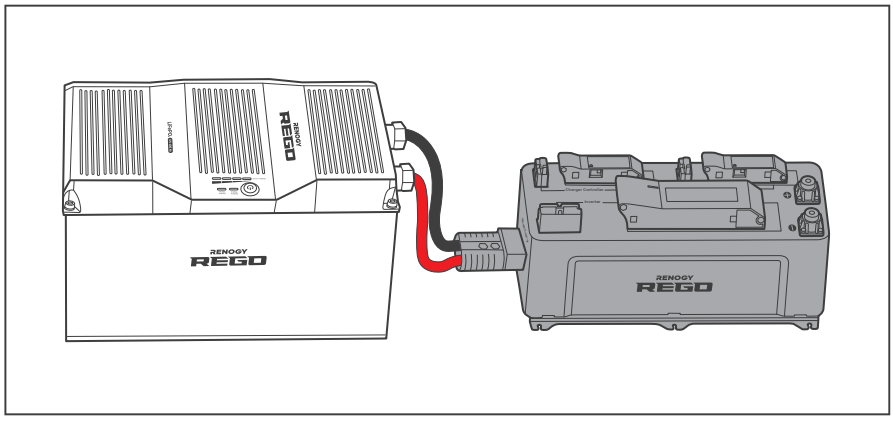


3. If necessary, connect multiple Battery Combiner Boxes together to accept more batteries in parallel.

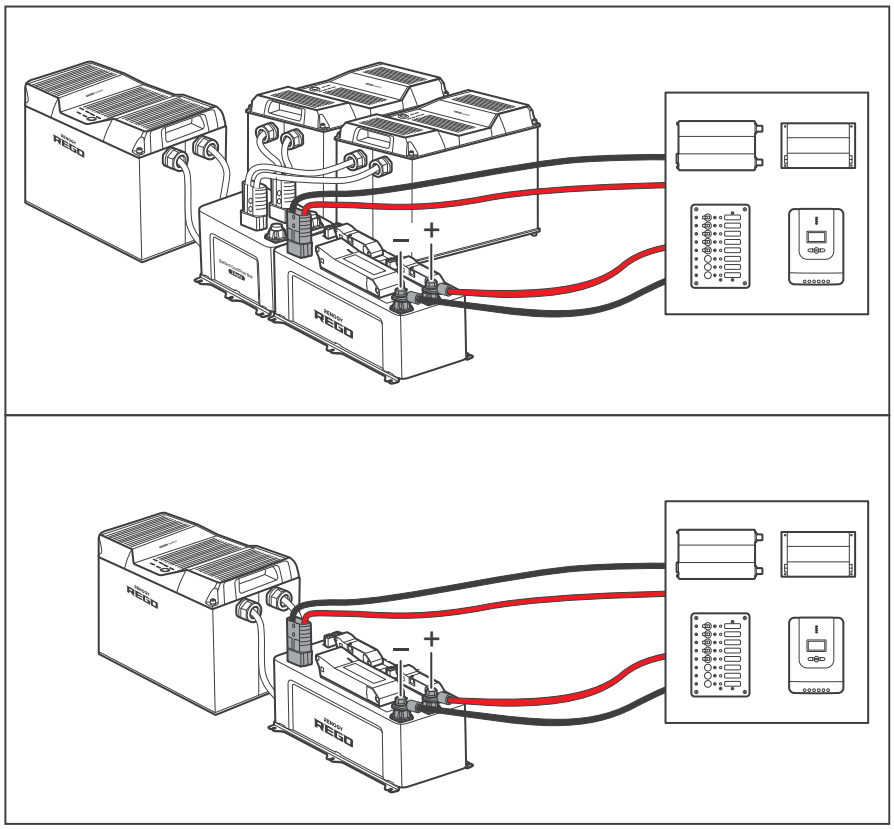


4. Connect the Battery Combiner Box and the System Combiner Box (sold separately) using the Anderson connectors on their sides.

Power Connection



5. If only one battery is used, connect the battery directly to the Anderson connector on the side of the System Combiner Box.



6. Connect the devices to the corresponding Anderson connectors or insert terminals on the top of the System Combiner Box.

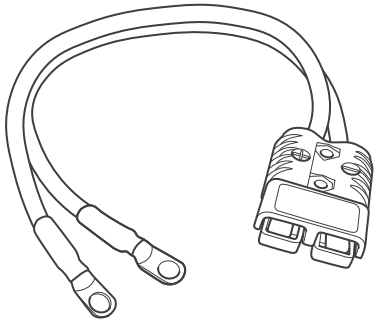
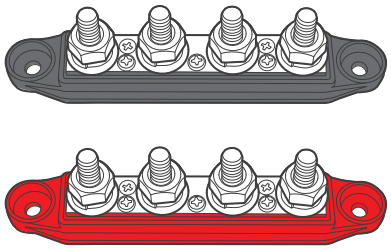
WARNING

- Please size the device cables appropriately to handle the expected current. Refer to the user manuals of the connected devices for more instructions.
- If the devices are connected to the Anderson connectors of the System Combiner Box, please install appropriately sized NH fuses (sold separately) in the System Combiner Box to protect connected devices and circuit wires. Refer to the user manual of the REGO 4 Ports 400A System Combiner Box for more instructions.
- If the devices are connected to the insert terminals of the System Combiner Box, please install appropriately sized fuses or circuit breakers in the branch circuits to protect connected devices and circuit wires. Refer to the user manuals of the connected devices for more instructions.
- Please ensure that the Anderson Connectors are fully seated and/or the ring terminals are

secured to the proper specification.

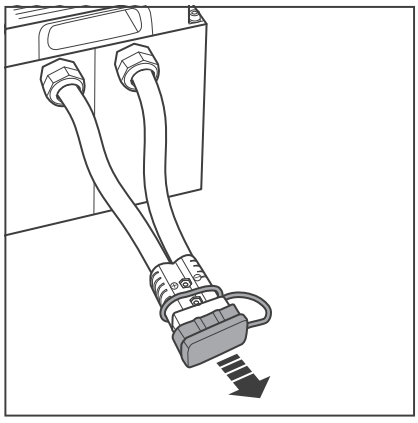
Using Busbars

Required Accessories

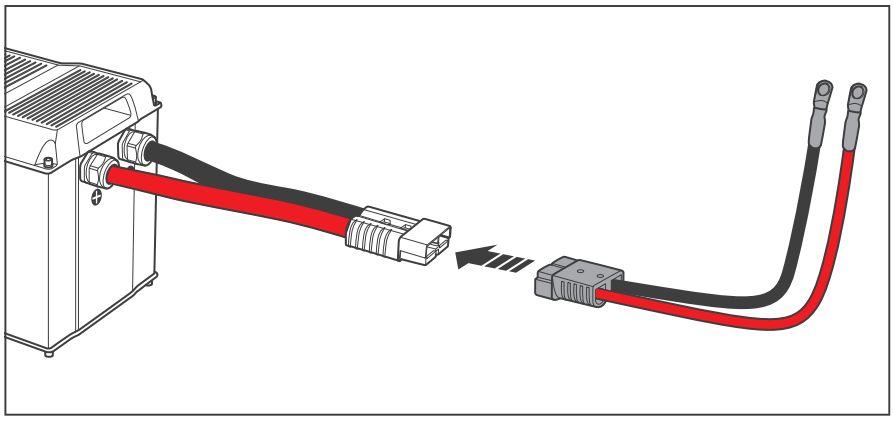
Gray Anderson 350 Connector to Ring Terminal Adapter Cable(s)	Positive/Negative Busbars
	

WARNING

- DO NOT short the positive and negative ring terminals of the Adapter Cable(s). Short circuits can damage the battery.



1. Remove the Dust Cover(s) from the Anderson Connector(s).



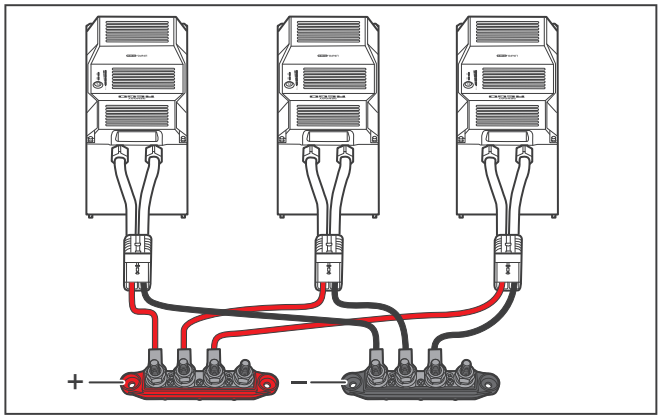
2. Connect the Anderson Connector(s) of the battery(ies) to the Adapter Cable(s) (sold separately).

WARNING

- Please size the Adapter Cable(s) appropriately to handle the expected current. Refer to Appendix for more instructions.

CAUTION

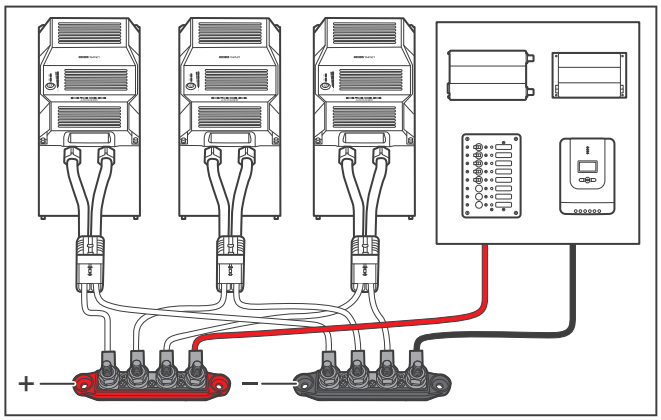
- If multiple batteries are to be connected in parallel, please ensure equal length of the Adapter Cables to make the batteries operate equally together.



3. Connect the positive and negative ring terminals of the Adapter Cable(s) to the Positive and Negative Busbars (not included) respectively.

WARNING

- Please size the Busbars appropriately to handle the expected current. Refer to Appendix for more instructions.



4. Connect the devices to the Positive and Negative Busbars.

WARNING

- Please size the device cables appropriately to handle the expected current. Refer to the user manuals of the connected devices for more instructions.
- Please install appropriately sized fuses or circuit breakers in the branch circuits to protect connected devices and circuit wires. Refer to the user manuals of the connected devices for more instructions.
- Please ensure that the Anderson Connector(s) is fully seated and/or the ring terminals are secured to the proper specification.

The communication connection is optional. It allows the battery to communicate with other REGO devices and monitoring devices, enabling safe operation, smart control, remote monitoring, and programmable settings.

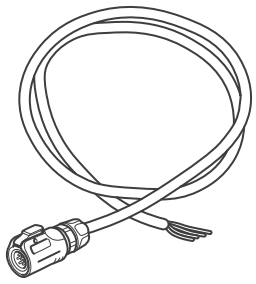
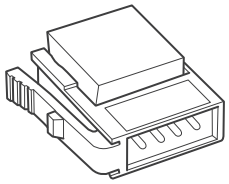
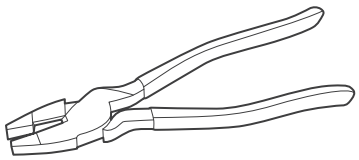
Inter-Device Communication

Depending on the installation condition, the communication connections between the battery and other REGO devices can be established with backbone or daisy chain topology. The inter-device communication allows the battery to dynamically adjust the charging profile for an optimal and safe charge.

Backbone Topology

If an RV-C bus is pre-installed in the RV, follow the backbone topology for the inter-device communication connections.

Required Accessories

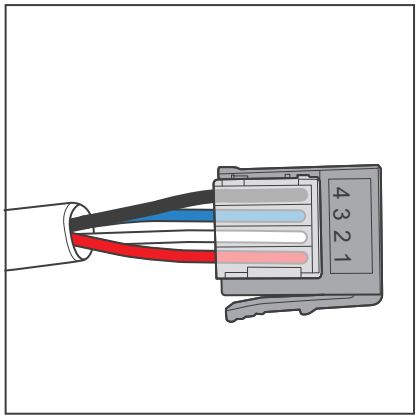
LP16 Plug (7-Pin) to Bare Wires Drop Cables	Drop Plugs	Split Joint Pliers
		

CAUTION

- The lengths of the Drop Cables shall not exceed 19.6 feet (6 m), and the total length shall not exceed 98.4 feet (30 m).

NOTE

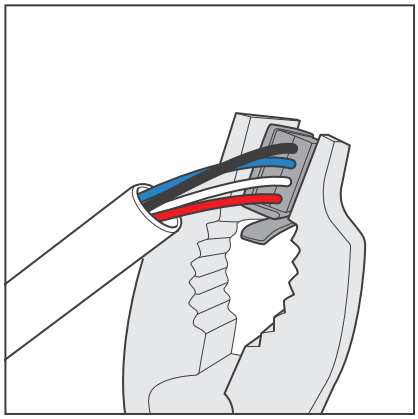
- Please check the network wiring diagram provided by the RV manufacturer before connection.



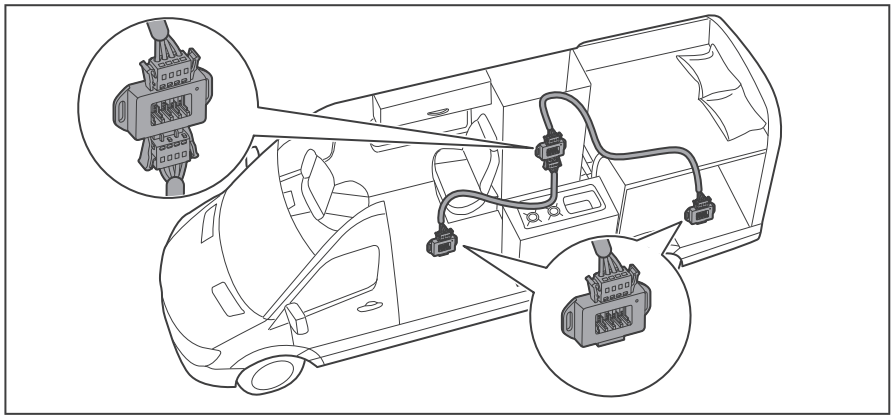
1. Insert the bare wires of the Drop Cables (sold separately) all the way into the wire ports of the Drop Plugs (not included) following the Drop Plug pinout. The red PS+ wires go to pin 1, the white CAN_H wires go to pin 2, the blue CAN_L wires go to pin 3, and the black PS- wires go to pin 4.

NOTE

- Different drop sockets are used on the RV-C bus by different RV manufacturers. Please select the Drop Plugs that match the drop sockets for the inter-device communication connections. If unsure about the Drop Plug selection, please check with the RV manufacturer. This User Manual takes the Mini-Clamp II plug (4-pin) as an example.
- Different Drop Plugs follow different pinouts. Please crimp the Drop Plugs on the Drop Cables following the correct pinout. If unsure about the Drop Plug pinout, please check with the RV manufacturer. This User Manual takes the pinout of the Mini-Clamp II plug (4-Pin) as an example.



2. Squeeze the crimp areas of the Drop Plugs with the Split Joint Pliers.



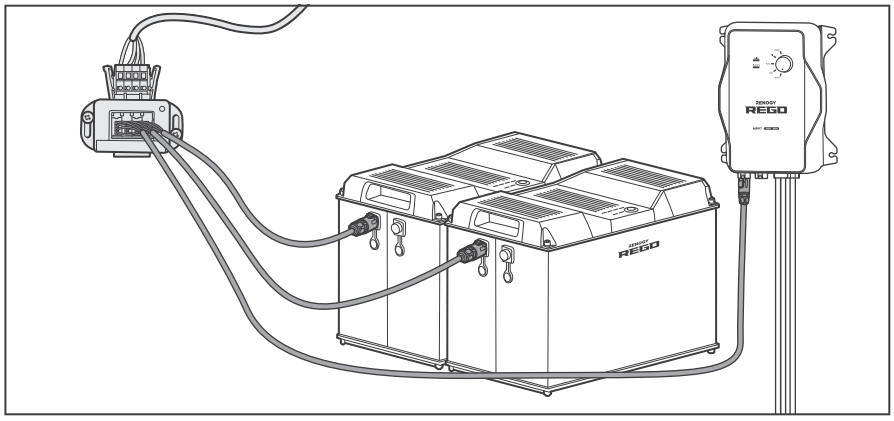
3. Locate the drop tap (not included) on the RV-C bus that is the closest to the battery installation location. The drop taps are usually located above the entry door, in the bathroom, or under the bed in the RV.

CAUTION

- Please ensure that the drop taps at both ends of the RV-C bus are properly terminated with built-in 120Ω resistors.

NOTE

- Different drop taps are used on the RV-C bus by different RV manufacturers. This User Manual takes the 4-socket drop tap as an example.
- If unable to locate the drop taps, please contact the RV manufacturer for help.

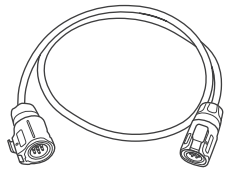
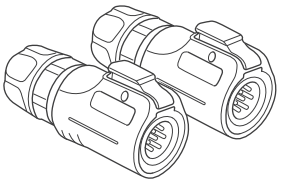


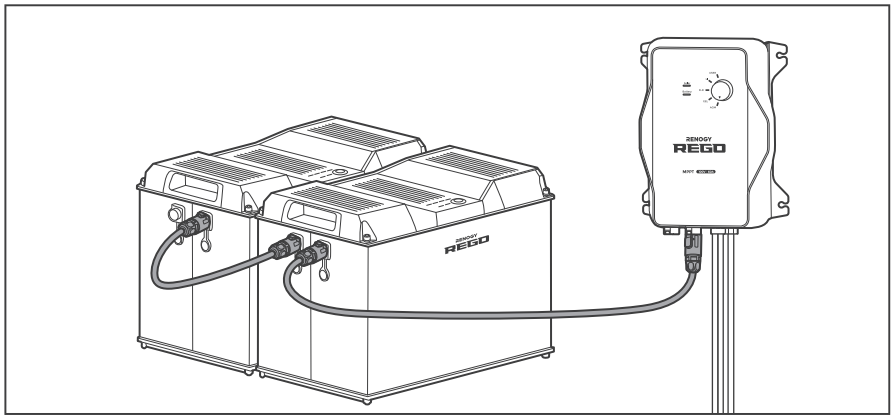
4. Connect either of the CAN Communication Ports of the battery and other REGO devices to the drop sockets on the drop tap with the Drop Cables.

Daisy Chain topology

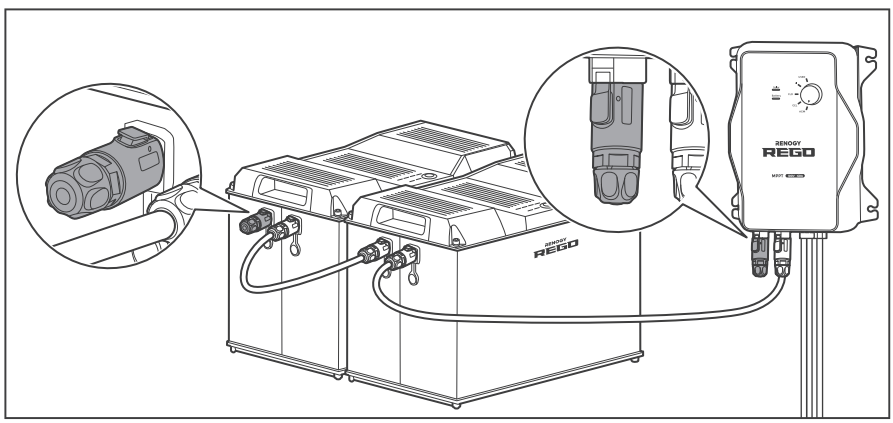
If the RV-C bus is not available, follow the daisy chain topology for the inter-device communication connections.

Recommended Accessories

LP16 Plug (7-Pin) Communication Cable(s)	LP16 Terminator Plugs (7-Pin)
	



1. Connect REGO devices in series through either of the CAN Communication Ports with the Communication Cable(s) (sold separately).



2. Plug the Termionator Plugs (sold separately) into the free CAN Communication Ports on the first and last REGO devices.

Monitoring Device Communication

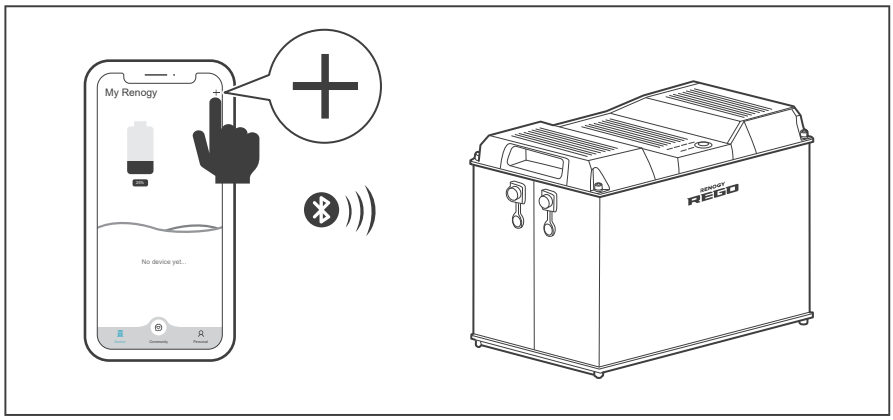
Depending on the application, the short-range or long-range communication connections can be established between the battery and the monitoring devices. The monitoring device communication allows for the monitoring and programming of the battery or even the complete system.

NOTE

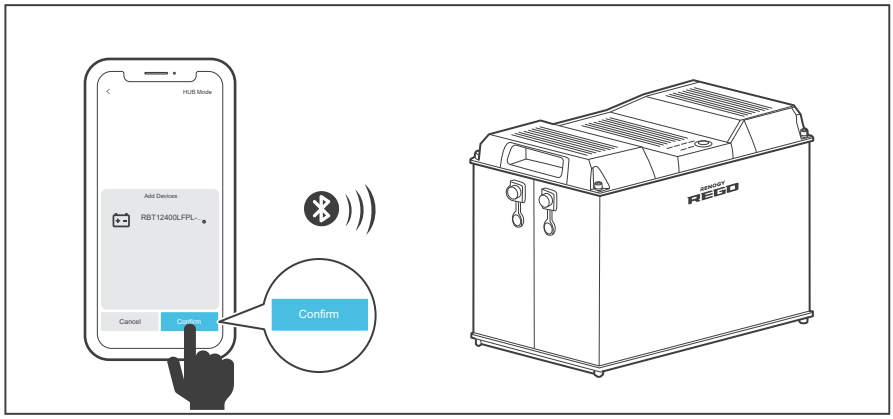
- Please scan the QR code on the last page of the User Manual to download the DC Home app.
- Please make sure that the battery is turned on before the connection. Refer to the Turning On section for more instructions.

Short-Range Monitoring

If only short-range monitoring is required, connect the battery to the DC Home app directly through Bluetooth.



1. Open the DC Home app. Turn on the Bluetooth on the phone or tablet. Tap “+” on the top right corner to search for the battery. Wait for a few minutes until the battery is found.



2. Tap “Confirm” on the pop-up menu to add the battery to the device list. Monitor the battery on the device page.

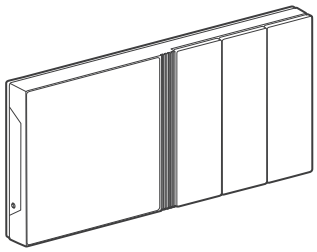
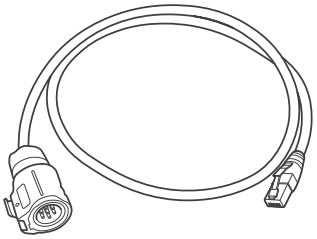
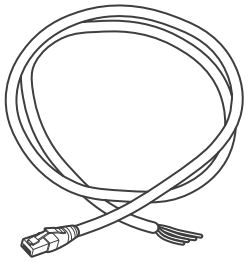
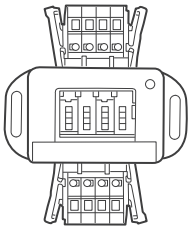
NOTE

- Please keep the phone or tablet within 10 feet (3 m) of the battery.

Long-Range Monitoring

If long-range communication and programming are required, connect the battery to Renogy ONE through Bluetooth or hard wire, and Renogy ONE to the DC Home app through WiFi.

Required Tool and Accessories

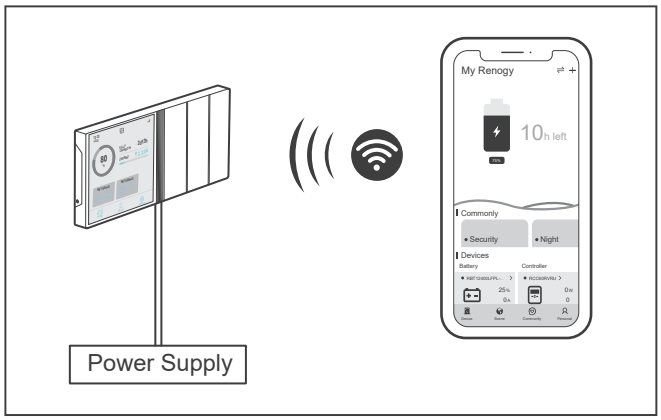
Renogy ONE	LP16 Plug (7-Pin) to RJ45 Communication Adapter Cable
	
RJ45 Plug to Bare Wires Drop Cable	**Common Drop Tap**
	

NOTE

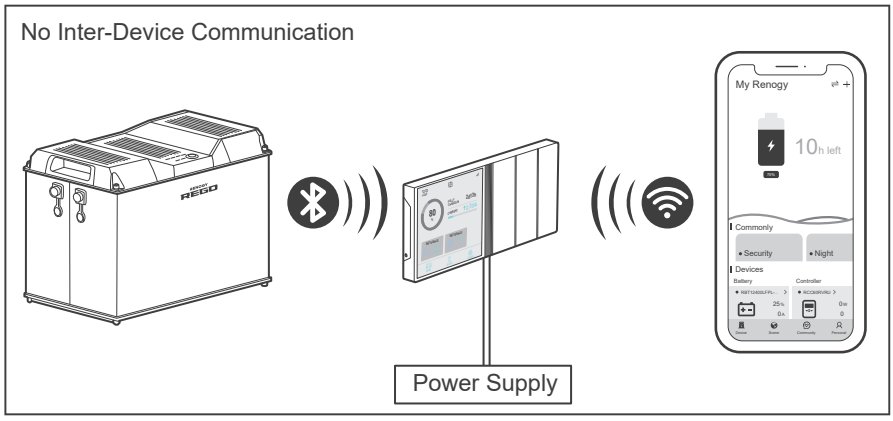
- Please make sure Renogy ONE is powered on before the connection.

INFO

- Please read the user manual of Renogy ONE at renogy.com before the connection.



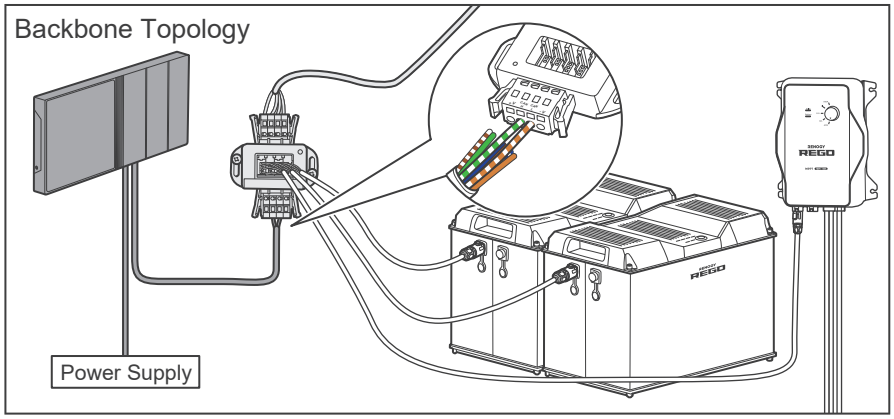
1. Pair Renogy ONE (sold separately) with the DC Home app through WiFi. If the inter-device communication is not established, refer to step 2. If the inter-device communication is established with the backbone topology, refer to step 3 to step 4. If the inter-device communication is established with the daisy chain topology, refer to step 5 to step 6.



2. If the inter-device communication is not established, connect the battery to Renogy ONE through Bluetooth. Monitor the battery on Renogy ONE or the DC Home app.

NOTE

- Please keep Renogy ONE within 10 feet (3 m) of the battery.

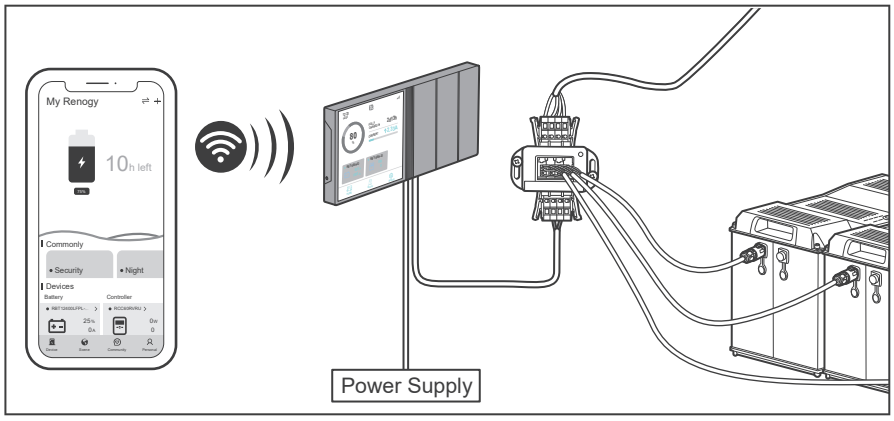


3. If the inter-device communication is established with the backbone topology, replace the terminated drop tap at either end of the RV-C bus with the Common Drop Tap (not included). Secure the bare wires of the Drop Cable (not included) onto the terminal block plug of the Common Drop Tap following the terminal block plug pinout. Plug the Drop Cable to the RJ45 port of Renogy ONE.

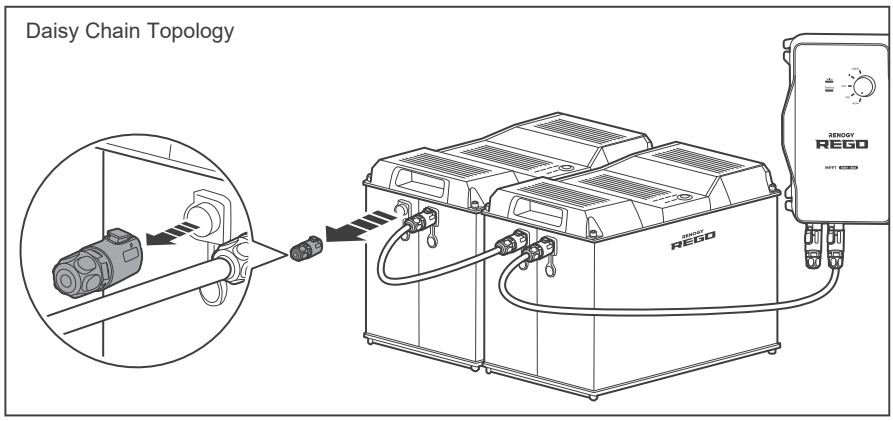
NOTE

- Different terminal block plugs are used on different Common Drop Taps and follow different pinouts. Please connect the Drop Cable to the terminal block plug of the Common Drop Tap following the correct pinout. If unsure about the terminal block plug pinout, please check with the RV manufacturer. This User Manual takes the pinout of the MCS MIDI Classic terminal block plug (4-Pin) as an example.
- Please refer to the Backbone Topology section for more instructions.

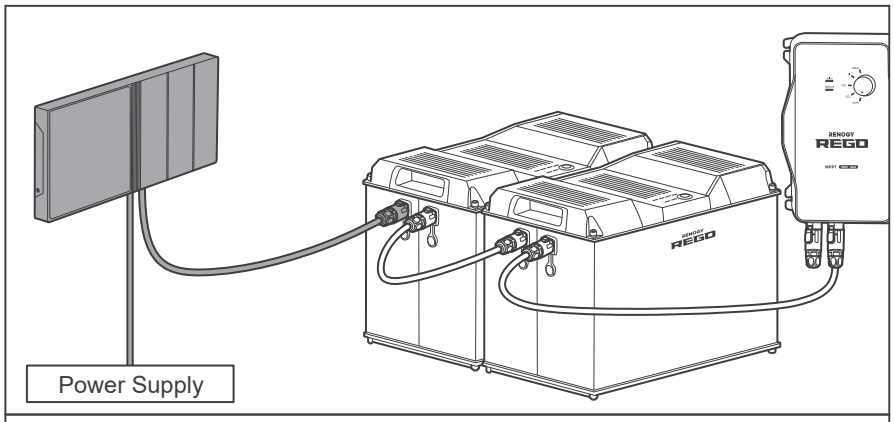
Communication



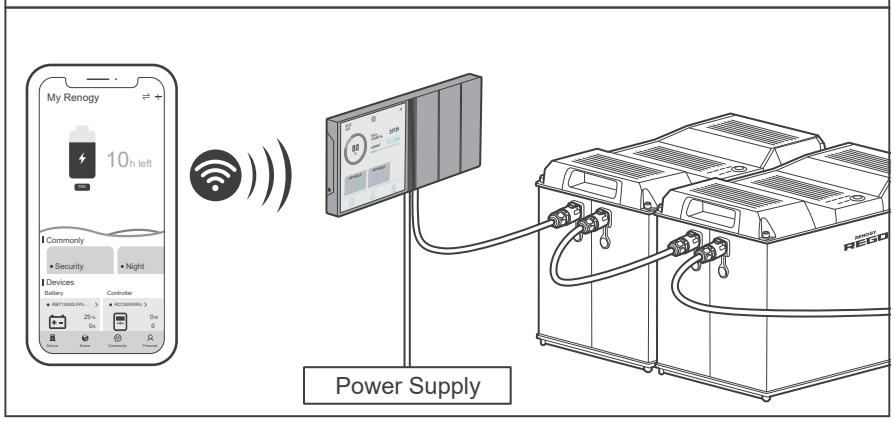
4. Monitor and program the complete system on Renogy ONE or the DC Home app.



5. If the inter-device communication is established with the daisy chain topology, remove the Terminator Plug from the REGO device at either end of the daisy chain.



6. Connect Renogy ONE to the free CAN Communication Port on the REGO device with the Communication Adapter Cable (sold separately). Monitor and program the complete system on Renogy ONE or the DC Home app.



Indicator Pattern

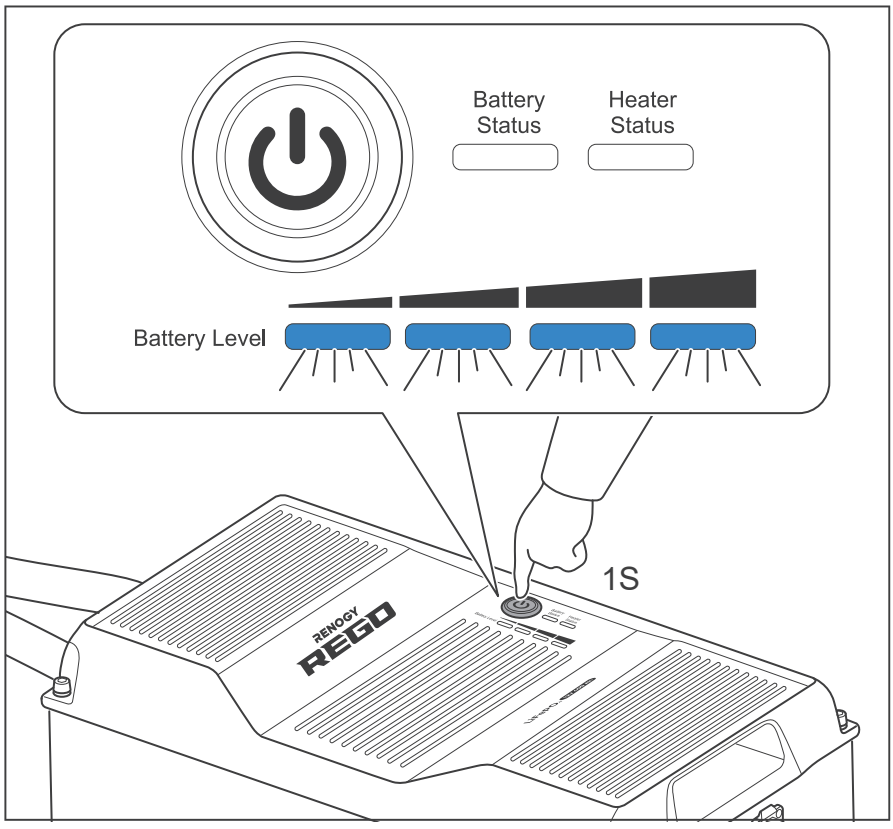
Indicator Pattern	1 Second	1 Second
Solid		
Slow Flash		
Fast Flash		
Double Flash		
Strobe		

Turning On

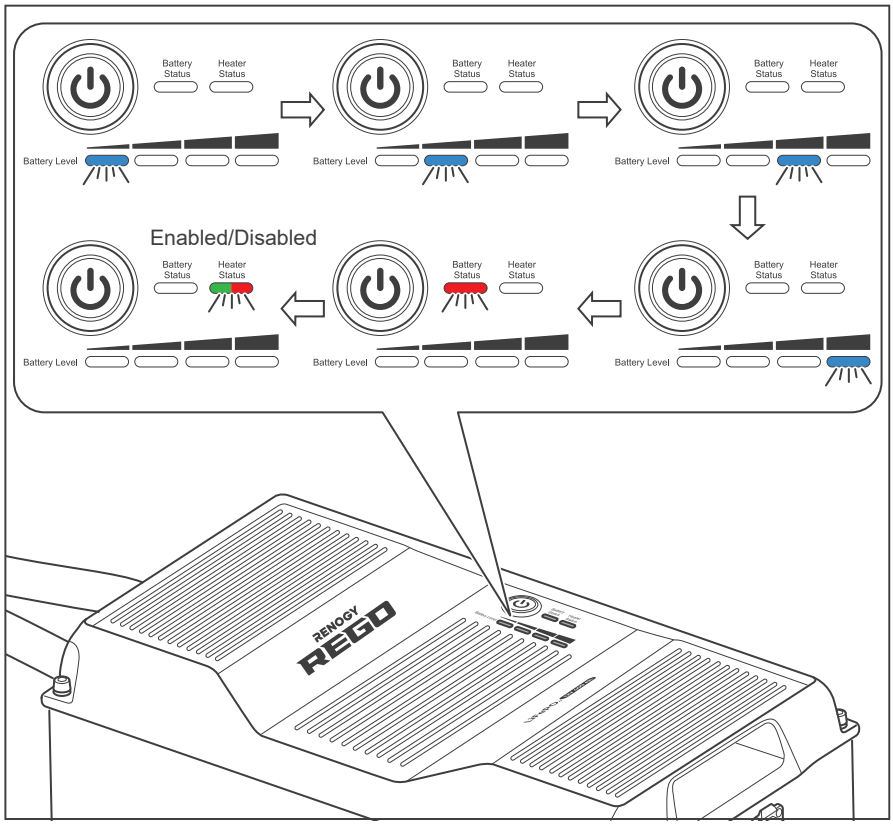
The battery is off when it leaves the factory. Please turn the battery on after connecting it to the system for the first time.

CAUTION

- DO NOT turn the battery on until completing and securing the power connection. Connecting a turned on battery to the system can trigger the short circuit or overcurrent protection of the battery.



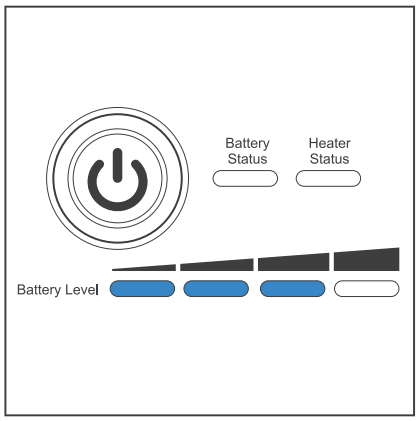
1. Long press the Power Button for 1 second or charge the battery to turn the battery on. The Battery Level Indicators fast flash blue simultaneously to indicate that the battery is turning on.



2. The Battery Level Indicators, Battery Status Indicator, and Heater Status Indicator flash in sequence once to indicate that the battery has been turned on. The color of the flashing Heater Status Indicator indicates the current heater setting.

NOTE

- Please refer to the Changing Heater Setting section for more information about the heater settings.



3. The Battery Level Indicators light up blue to indicate the current battery level.

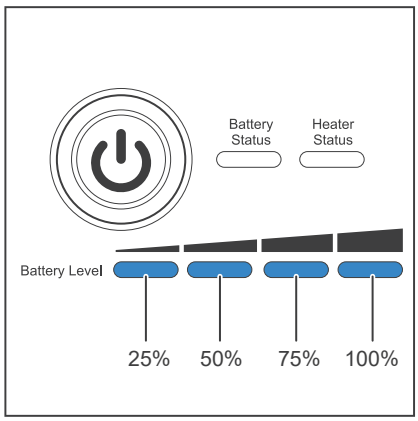
CAUTION

- If the battery is unable to be turned on, please refer to the Troubleshooting section for troubleshooting instructions.

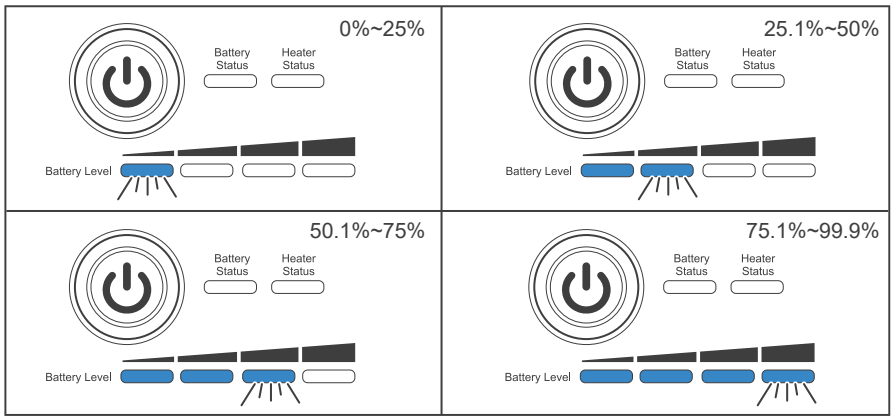
NOTE

- To turn on batteries connected in parallel simultaneously, please long press the Power Button on any battery for 1 second or charge the battery bank.

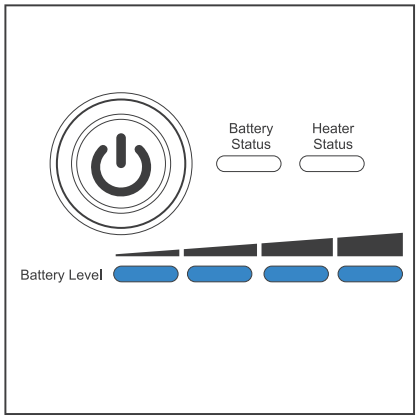
Checking Battery Level



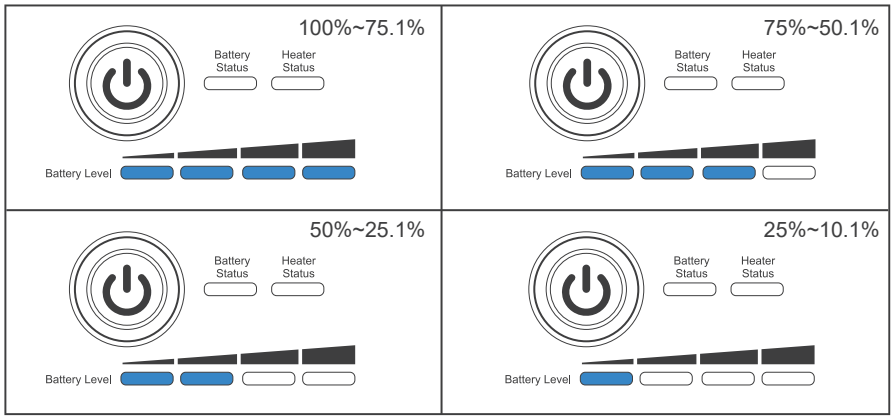
1. The four Battery Level Indicators respectively indicate 25%, 50%, 75%, and 100% battery level.



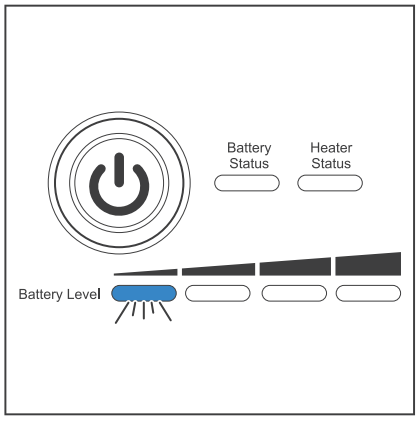
2. As the battery charges, the Battery Level Indicators light up blue one by one, and the rightmost Battery Level Indicator fast flashes blue to indicate the current battery level.



3. Once the battery is fully charged, all the Battery Level Indicators light up blue and remain solid.



4. As the battery discharges, the Battery Level Indicators go out one by one.

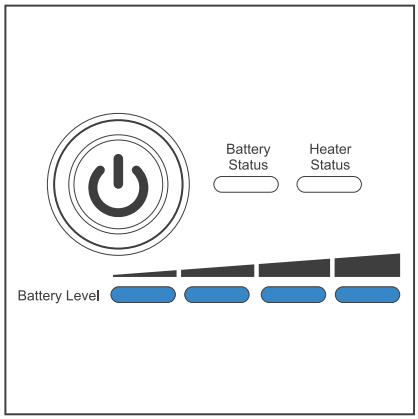


5. The last Battery Level Indicator slow flashes blue when the battery level drops below 10%.

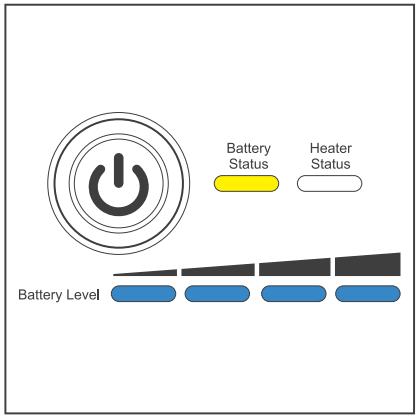
NOTE

- The Battery Level Indicators go out when the battery is in the heater setting mode or permanent failure mode. Please refer to the Changing Heater Setting and Checking Battery Status sections for more information.

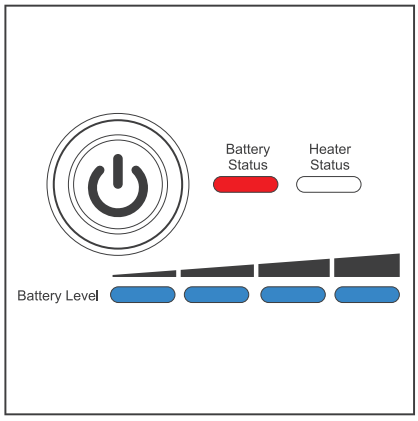
Checking Battery Status



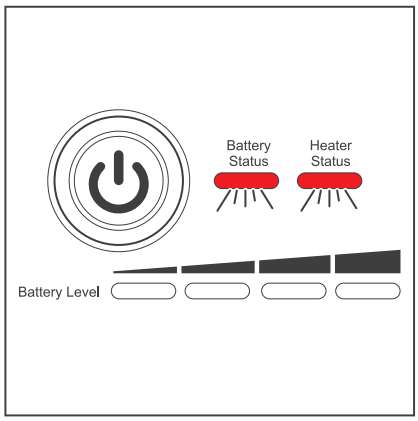
1. The Battery Status Indicator remains off when the battery is operating properly.



2. The Battery Status Indicator lights up/flashes yellow when the battery is in the warning mode.



3. The Battery Status Indicator lights up/flashes red when the battery is in the protection mode.

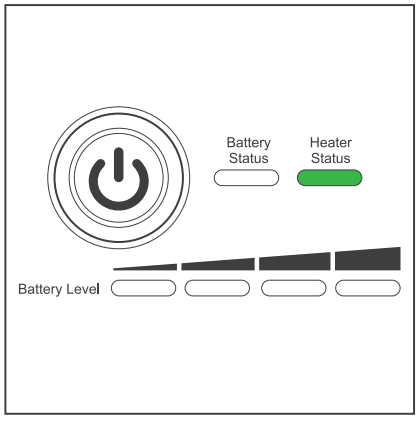


4. The Battery Status Indicator and Heater Status Indicator flash red simultaneously when the battery is in the permanent failure mode.

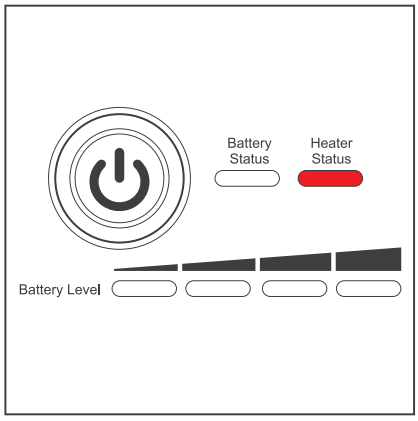
NOTE

- Please refer to the Troubleshooting section for the lighting/flashing pattern of the Battery Status Indicator and Heater Status Indicator and troubleshooting instructions under different warnings, protections, and permanent failures.
- The warnings do not affect the normal operation of the battery, but it is recommended to pay closer attention to the battery to prevent triggering the protections and/or permanent failures.

Checking Heater Status



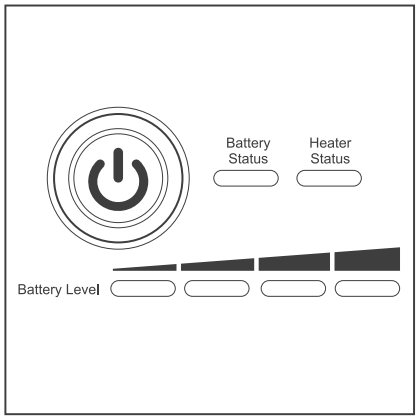
1. When the battery temperature drops below 41°F (5°C), and the charge current is stable and greater than 15A, the heater starts operating automatically, and the Heater Status Indicator lights up green.



2. When the battery temperature drops below 41°F (5°C), but the charge current is unstable or less than 15A, or the heater malfunctions, the heater is unable to operate properly, and the Heater Status Indicator lights up red.

NOTE

- Please refer to the Troubleshooting section for troubleshooting instructions.



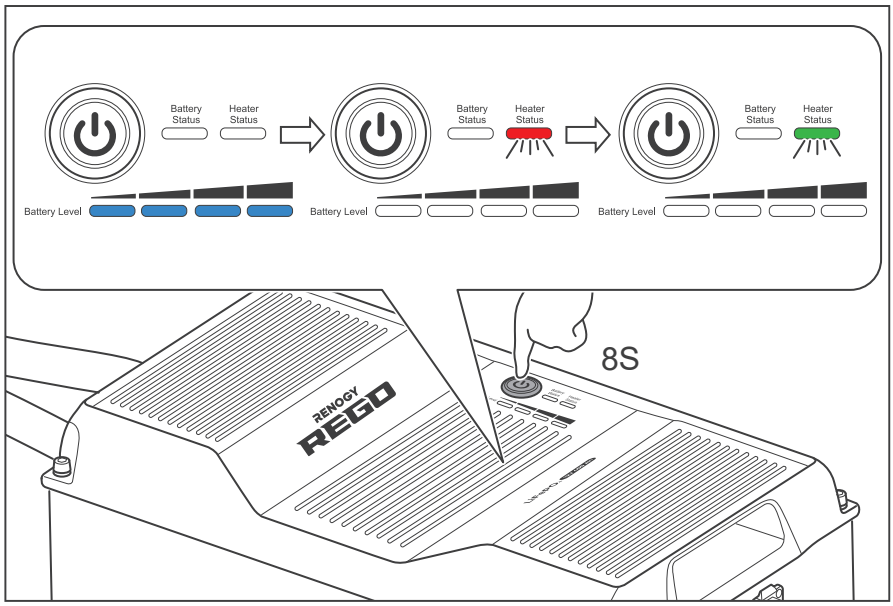
3. When the battery temperature rises above 50°F (10°C), or the charge current ceases, the heater stops operating automatically and the Heater Status Indicator goes out.

NOTE

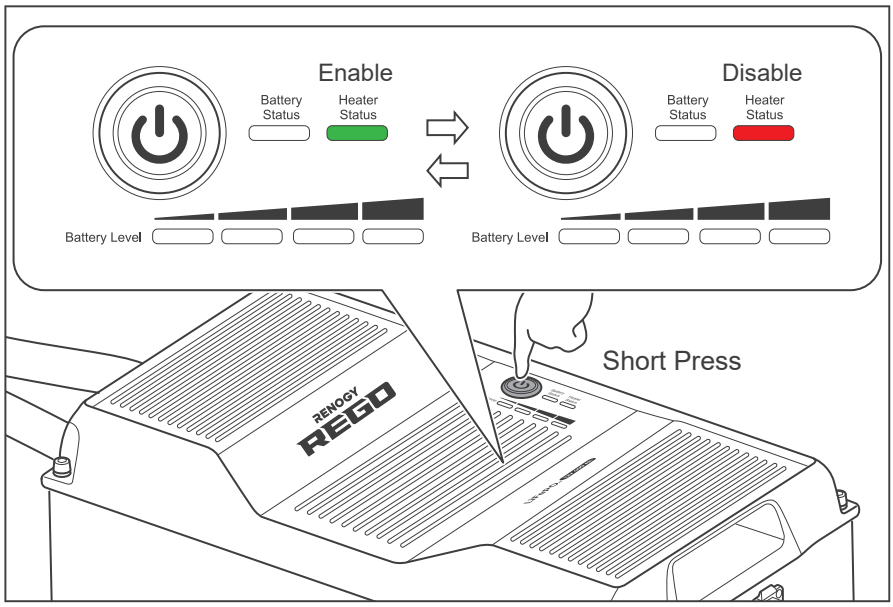
- The heater does not operate if the battery temperature drops below -4°F (-20°C).
- For batteries connected in parallel, each battery requires a stable charge current greater than 15A for the proper operation of the heater.

Changing Heater Settings

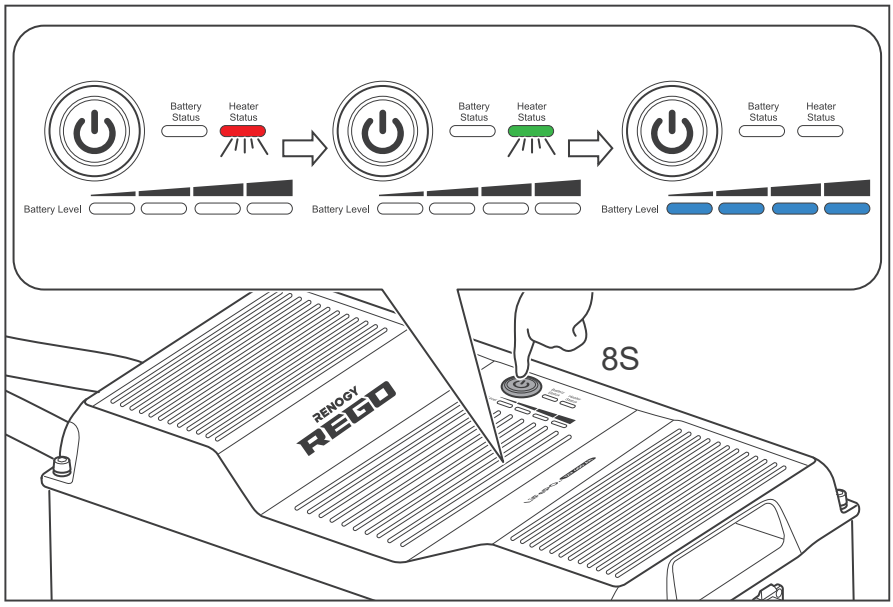
The battery leaves the factory with the heater enabled. The heater can be enabled or disabled with the Power Button.



1. Long press the Power Button for 8 seconds to enter the heater setting mode. The Heater Status Indicator flashes red and green once.



2. Short press the Power Button to enable or disable the heater. The Heater Status Indicator turns green to indicate that the heater is enabled or turns red to indicate that the heater is disabled.



3. Long press the Power Button for 8 seconds to exit the heater setting mode and save the current setting. The Heater Status Indicator flashes red and green once.

NOTE

- The battery automatically exits the heater setting mode and saves the current setting 10 minutes after entering the heater setting mode if it is not done manually.
- To enable or disable the heaters of batteries connected in parallel simultaneously, please establish the inter-battery communication connection and enable or disable the heater of any battery with the Power Button. If the inter-battery communication connection is not established, please enable or disable the heater of each battery individually. The heater setting MUST be uniform across the batteries.
- The heater is unable to operate properly at low temperatures with PWM charge controllers or low current chargers. It is recommended to disable the heater to prevent it from turning on and off repeatedly and draining the battery.

Charging

During the standard charging process, the battery is first charged at a constant current of 80A until the battery voltage reaches 14.4V. Then, the battery is charged at a constant voltage of 14.4V while tapering the charge current. The standard charging process is considered complete when the charge current is less than 20A for 10 seconds. However, leaving the battery on float can help balance the cells and does not damage the battery. The standard charging process normally takes 5.5 hours.

WARNING

- DO NOT charge the battery at high temperatures above 131°F (55°C) or low temperatures above -4°F (-20°C). If the heater is disabled or unable to operate properly, charging the battery at low temperatures below 32°F (0°C) is NOT recommended.

CAUTION

- DO NOT overcharge the battery.
- DO NOT exceed the maximum continuous charge current of the battery.
- Please charge the battery with the chargers (not included) that are compatible with the lithium iron phosphate battery and the charge voltage set at 14.4V.
- DO NOT charge the battery immediately after a long heavy run.
- Please charge the battery immediately when the battery level drops below 10% to prevent overdischarge.

NOTE

- Please fully charge the battery prior to first use.

Discharging

WARNING

- DO NOT discharge the battery at high temperatures above 140°F (60°C) or low temperatures above -4°F (-20°C).

CAUTION

- DO NOT overdischarge the battery.
- DO NOT exceed the maximum continuous discharge current of the battery.
- DO NOT connect high power loads to the battery when it is running low.

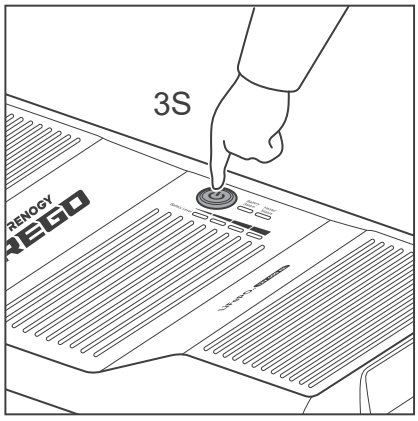
During the standard discharging process, the battery is first discharged at a constant current of 80A until the lowest cell voltage reaches 2.5V. Then, the battery enters protection mode and cuts off all the loads to prevent the battery from overdischarge.

NOTE

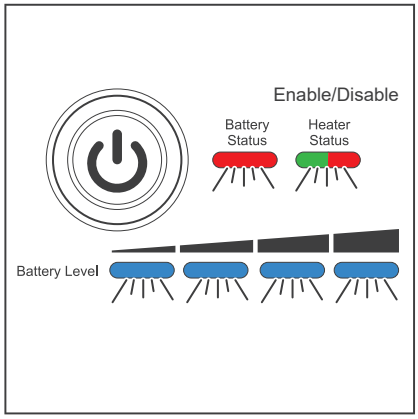
- Partial discharges reduce battery stress and prolong battery cycle life. It is recommended to keep the depth of discharge below 80%.
- It is recommended to use the battery with loads featuring low voltage disconnect.

Turning Off

Prior to long periods of storage, please disconnect the battery from the system and turn it off. With the low self-discharge rate when turned off, the battery can hold the charge for a long period of time.



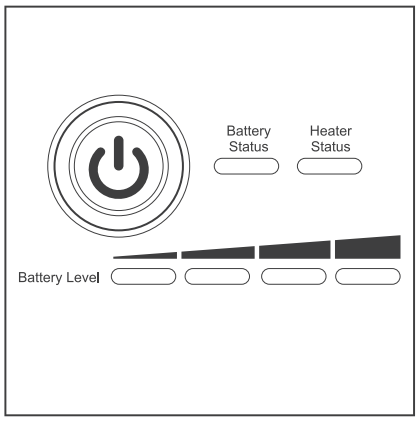
1. Long press the Power Button for 3 seconds.



2. The Battery Level Indicators, Battery Status Indicator, and Heater Status Indicator fast flash simultaneously to indicate that the battery is turning off. The color of the flashing Heater Status Indicator indicates the current heater setting.

NOTE

- Please refer to the Changing Heater Setting section for more information about the heater settings.



3. All the indicators go out to indicate that the battery has been turned off.

NOTE

- The battery is unable to be turned off if the Battery Level Indicators, Battery Status Indicator, and Heater Status Indicator keep fast flashing. Please check if the battery has been disconnected from the system.
- To turn off batteries connected in parallel simultaneously, please establish the communication connection and long press the Power Button on any battery for 3 seconds. If the communication connection is not established, please disconnect batteries connected in parallel and turn off each battery individually.

Maintenance

Inspection | Cleaning | Storage

Inspection

Please perform regular inspections following the steps below.

- Examine the external appearance of the battery. The housing and connector contacts of the battery shall be clean, dry, and free of corrosion.
- Check the battery cables and connections. Replace any damaged cables and tighten any loose connections.

NOTE

- In some applications, corrosion can form around the contacts internal to the Anderson Connector. The corrosion can cause loosening of spring retention force and increase of mated contact resistance, leading to premature failure of the connection. Please apply dielectric grease onto each connector contact at regular intervals. Dielectric grease can repel moisture and protect the connector contact against corrosion.

Cleaning

Please clean battery at regular intervals following the steps below.

- Disconnect the battery from the system.
- Turn the battery off with the Power Button.
- Clear the leaves and debris from the battery.
- Clean the battery with a soft, lint-free cloth. The cloth can be dampened with water or mild soap and water if the battery is extremely dirty.
- Dry the battery with a soft, lint-free cloth.
- Keep the area around the battery clean.
- Turn the battery back on with the Power Button.
- Reconnect the battery to the system.

Storage

Please follow the tips below to ensure that the battery emerges from storage in a good condition.

- Charge the battery to 30%-50%.
- Disconnect the battery from the system.
- Turn the battery off with the Power Button.
- Store the battery in a well-ventilated, dry, clean area with temperatures between -4°F (-20°C) and 113°F (45°C).
- Handle the battery carefully to avoid sharp impacts or extreme pressure on the battery housing.
- Charge the battery at least once every 3 months to prevent it from overdischarge.
- Fully charge the battery when it is taken out of storage.

Maintenance

CAUTION

- DO NOT expose the battery to extreme temperatures above 140°F (60°C).
- DO NOT expose the battery to heat sources.
- DO NOT expose the battery to direct sunlight, moisture, or precipitation.

Battery Management System

Warning/Protection/Permanent Failure

Battery Status	Trigger								Release		Comment
	Threshold		Sampling Time	Delay Time	Charge MOSFET	Discharge MOSFET	Communication Power Supply	Bluetooth Power Supply	BMS Power Supply	Threshold	Sampling Time	
Cell Overvoltage Warning	Highest Cell Voltage > 3.6V		3 Seconds	0 Second	Connect	Connect	On	On	On	Highest Cell Voltage < 3.45V/ Discharge Current ≥ 3A	1 Second	
Cell Overvoltage Protection	Highest Cell Voltage > 3.7V		5 Seconds	3 Seconds	Disconnect	Connect	On	On	On	Highest Cell Voltage < 3.45V/ Discharge Current ≥ 3A	1 Second	
Cell Overvoltage Permanent Failure	Highest Cell Voltage > 4.0V		10 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Unrecoverable	/	
Cell Undervoltage Warning	Lowest Cell Voltage < 3.0V		3 Seconds	0 Second	Connect	Connect	On	On	On	Lowest Cell Voltage > 3.1V/ Charge Current ≥ 1A	1 Second	
Cell Undervoltage Protection	Lowest Cell Voltage < 2.5V		5 Seconds	3 Seconds	Connect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Lowest Cell Voltage > 3.1V/ Charge Current ≥ 1A for 4 Minutes	1 Second	
Cell Undervoltage Permanent Failure	Lowest Cell Voltage < 2.0V		10 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Unrecoverable	/	
Battery Overvoltage Warning	Battery Voltage > 14.4V		3 Seconds	0 Second	Connect	Connect	On	On	On	Battery Voltage < 13.8V/ Discharge Current ≥ 3A	1 Second	
Battery Overvoltage Protection	Battery Voltage > 14.8V		5 Seconds	3 Seconds	Disconnect	Connect	On	On	On	Battery Voltage < 13.8V/ Discharge Current ≥ 3A	1 Second	
Battery Undervoltage Warning	Battery Voltage < 12V		3 Seconds	0 Second	Connect	Connect	On	On	On	Battery Voltage > 12.4V/ Charge Current ≥ 1A	1 Second	
Battery Undervoltage Protection	Battery Voltage < 10V		5 Seconds	3 Seconds	Connect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Battery Voltage > 12.4V/ Charge Current ≥ 1A for 4 Minutes	1 Second	
Cell Charge High Temperature Warning	Highest Cell Temperature > 50°C (122°F)		3 Seconds	0 Second	Connect	Connect	On	On	On	Highest Cell Temperature < 45°C (113°F)	1 Second	
Cell Charge High Temperature Protection	Highest Cell Temperature > 55°C (131°F)		5 Seconds	3 Seconds	Disconnect	Connect	On	On	On	Highest Cell Temperature < 50°C (122°F)	1 Second	
Cell Discharge/Idle High Temperature Warning	Highest Cell Temperature > 55°C (131°F)		3 Seconds	0 Second	Connect	Connect	On	On	On	Highest Cell Temperature < 50°C (122°F)	1 Second	
Cell Discharge/Idle High Temperature Protection	Highest Cell Temperature > 60°C (140°F)		5 Seconds	3 Seconds	Connect	Disconnect	On	On	On	Highest Cell Temperature < 55°C (131°F)	1 Second	
Cell High Temperature Permanent Failure	Highest Cell Temperature > 70°C (158°F)		10 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Unrecoverable	/	
Cell Charge Low Temperature Warning	Lowest Cell Temperature < 3°C (37.4°F)		3 Seconds	0 Second	Connect	Connect	On	On	On	Lowest Cell Temperature > 6°C (42.8°F)	1 Second	
Cell Charge Low Temperature Protection	Charge Current < 23.6A	Lowest Cell Temperature < -20°C (-4°F)	5 Seconds	3 Seconds	Disconnect	Connect	On	On	On	Lowest Cell Temperature > -17°C (1.4°F)	1 Second	
	Charge Current ≥ 23.6A	Lowest Cell Temperature < 0°C (32°F)								Lowest Cell Temperature > 3°C (37.4°F)		
Cell Discharge/Idle Low Temperature Warning	Lowest Cell Temperature < -17°C (1.4°F)		3 Seconds	0 Second	Connect	Connect	On	On	On	Lowest Cell Temperature > -14°C (6.8°F)	1 Second	
Cell Discharge/Idle Low Temperature Protection	Lowest Cell Temperature < -20°C (-4°F)		5 Seconds	3 Seconds	Connect	Disconnect	On	On	On	Lowest Cell Temperature > -17°C (1.4°F)	1 Second	
Environment High Temperature Warning	Battery Interior Environment Temperature > 75°C (167°F)		3 Seconds	0 Second	Connect	Connect	On	On	On	Battery Interior Environment Temperature < 65°C (149°F)	1 Second	
Environment High Temperature Protection	Battery Interior Environment Temperature > 80°C (176°F)		5 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Battery Interior Environment Temperature < 65°C (149°F)	1 Second	
Environment Low Temperature Warning	Battery Interior Environment Temperature < -30°C (-22°F)		3 Seconds	0 Second	Connect	Connect	On	On	On	Battery Interior Environment Temperature > -25°C (-13°F)	1 Second	
Environment Low Temperature Protection	Battery Interior Environment Temperature < -35°C (-31°F)		5 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Battery Interior Environment Temperature > -25°C (-13°F)	1 Second	
Cell Imbalance Warning	Cell Voltage Difference > 600mV		3 Seconds	0 Second	Connect	Connect	On	On	On	Cell Voltage Difference < 200mV	1 Second	
Cell Imbalance Protection	Cell Voltage Difference > 1000mV		5 Seconds	3 Seconds	Disconnect	Disconnect	On	On	On	Cell Voltage Difference < 200mV	1 Second	

Battery Management System

Warning/Protection/Permanent Failure | Charge Current Request | Cell Voltage Balancing

Battery Status	Trigger									Release		Comment
	Threshold		Sampling Time	Delay Time	Charge MOSFET	Discharge MOSFET	Communication Power Supply	Bluetooth Power Supply	BMS Power Supply	Threshold	Sampling Time	
Charge Overcurrent Warning	Cell Temperature ≤ 15°C (59°F)	Charge Current > 220A	3 Seconds	0 Second	Connect	Connect	On	On	On	Charge Current < 200A	1 Second	
	15°C (59°F) < Cell Temperature < 50°C(131°F)	Charge Current > 330A								Charge Current < 300A		
	Cell Temperature ≥ 55°C (131°F)	Charge Current > 220A								Charge Current < 200A		
Charge Overcurrent Primary Protection	Cell Temperature ≤ 15°C (59°F)	Charge Current > 230A	15 Seconds	3 Seconds	Disconnect	Connect	On	On	On	Charge Current < 200A/ Discharge Current ≥ 3A	1 Second	The battery automatically attempts to recover 1 minute after the protection. The interval between each attempt is 1 minute. If the battery fails 3 consecutive attempts, the protection can only be released with a discharge current greater than 3A.
	15°C (59°F) < Cell Temperature < 50°C(131°F)	Charge Current > 345A								Charge Current < 300A/ Discharge Current ≥ 3A		
	Cell Temperature ≥ 55°C (131°F)	Charge Current > 230A								Charge Current < 200A/ Discharge Current ≥ 3A		
Charge Overcurrent Secondary Protection	Cell Temperature ≤ 15°C (59°F)	Charge Current > 236A	5 Seconds	3 Seconds	Disconnect	Connect	On	On	On	Charge Current < 200A/ Discharge Current ≥ 3A	1 Second	
	15°C (59°F) < Cell Temperature < 50°C(131°F)	Charge Current > 354A								Charge Current < 300A/ Discharge Current ≥ 3A		
	Cell Temperature ≥ 55°C (131°F)	Charge Current > 236A								Charge Current < 200A/ Discharge Current ≥ 3A		
Discharge Overcurrent Warning	Discharge Current > 385A		3 Seconds	0 Second	Connect	Connect	On	On	On	Discharge Current < 350A	1 Second	
Discharge Overcurrent Primary Protection	Discharge Current > 402.5A		15 Seconds	3 Seconds	Connect	Disconnect	On	On	On	Discharge Current < 350A/ Charge Current ≥ 1A	1 Second	The battery automatically attempts to recover 1 minute after the protection. The interval between each attempt is 1 minute. If the battery fails 3 consecutive attempts, the protection can only be released with a charge current greater than 1A.
Discharge Overcurrent Secondary Protection	Discharge Current > 413A		5 Seconds	3 Seconds	Connect	Disconnect	On	On	On	Discharge Current < 350A/ Charge Current ≥ 1A	1 Second	
Discharge Overcurrent Hardware Protection	Discharge Current > 700A		100 Microseconds	0 Second	Disconnect	Disconnect	On	On	On	Discharge Current < 350A/ Charge Current ≥ 1A	100 Microseconds	
Low SOH Warning	SOH < 55%		3 Seconds	0 Second	Connect	Connect	On	On	On	SOH > 56%	1 Second	
Low SOH Permanent Failure	SOH < 50%		5 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Unrecoverable	/	
Low SOC Warning	SOC ≤ 2%		3 Seconds	0 Second	Connect	Connect	On	On	On	SOC > 4%/ Charge Current ≥ 1A	1 Second	
CAN Communication Error Warning	Unable to Receive CAN Messages for 1 Minute		1 Minute	0 Second	Connect	Connect	On	On	On	Receives CAN Messages	0 Second	
Short Circuit Protection	Short Circuit Current > 800A		1 Millisecond	0 Second	Connect	Disconnect	On	On	On	Remove Short Circuit/ Charge Current ≥ 1A	1 Second	The battery automatically attempts to recover 1 minute after the protection. The interval between each attempt is 1 minute. If the battery fails 3 consecutive attempts, the protection can only be released with a charge current greater than 1A.
Reverse Polarity Protection	Connection Polarity Reverse		0 Second	0 Second	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Connection Polarity Correct	0 Second	
Pre-Charge Failure Protection	Voltage Difference Across Pre-Charge MOSFETE > 4V		0 Second	0 Second	Disconnect	Disconnect	On	On	On	Voltage Difference Across Pre-Charge MOSFETE < 1V	0 Second	The battery automatically attempts to recover 1 minute after the protection. The interval between each attempt is 1 minute. If the battery fails 3 consecutive attempts, the protection can only be released with a restart.
Battery Source Address Conflict Warning	Source Address Conflict between Devices		0 Second	0 Second	Connect	Connect	On	On	On	Finds Unclaimed Source Address	0 Second	
AFE Communication Error Protection	Unable to Receive AFE Messages for 10 Seconds		10 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Receives AFE Messages	0 Second	
Memory Communication Error Warning	Communication Between EEPROM and Flash Memory Fails 3 Times		0 Second	0 Second	Connect	Connect	On	On	On	Communication Between EEPROM and Flash Memory Succeeds	0 Second	

Battery Management System

Warning/Protection/Permanent Failure | Charge Current Request | Cell Voltage Balancing

Battery Status	Trigger								Release		Comment
	Threshold	Sampling Time	Delay Time	Charge MOSFET	Discharge MOSFET	Communication Power Supply	Bluetooth Power Supply	BMS Power Supply	Threshold	Sampling Time	
MOSFET High Temperature Warning	MOSFET Temperature > 85°C (185°F)	3 Seconds	0 Second	Connect	Connect	On	On	On	MOSFET Temperature < 80°C (176°F)	1 Second	
MOSFET High Temperature Protection	MOSFET Temperature > 105°C (221°F)	5 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	MOSFET Temperature < 90°C (194°F□	1 Second	
Balancing Circuit High Temperature Warning	Balancing Circuit > 85°C (185°F)	3 Seconds	0 Second	Connect	Connect	On	On	On	Balancing Circuit < 80°C (176°F)	1 Second	
Balancing Circuit High Temperature Protection	Balancing Circuit > 105°C (221°F)	5 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Balancing Circuit < 85°C (185°F)	1 Second	
Temperature Sampling Error Protection	Unable to Detect Temperature Sampling Signal	3 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Detects Temperature Sampling Signal	0 Second	
Charge MOSFET Permanent Failure	Charge Current ≥ 3A When Disconnecting Charge MOSFET is Required/ Unable To Connect Charge MOSFET When Required	0 Second	3 Seconds	Disconnect	Disconnect	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Unrecoverable	/	
Discharge MOSFET Permanent Failure	Discharge Current ≥ 3A When Disconnecting Discharge MOSFET is Required/ Unable To Connect Discharge MOSFET When Required	0 Second	3 Seconds	Disconnect	Disconnect	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Unrecoverable	/	
Voltage Sampling Error Protection	Difference Between Voltages Sampled by MCU and AFE > 1V	3 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Difference Between Voltages Sampled by MCU and AFE < 0.5V	1 Second	
Communication Power Supply Malfunction Warning	Communication Power Supply Voltage ≤ 10V/ Communication Power Supply Voltage ≥ 14.8V	5 Seconds	0 Second	Connect	Connect	Off (Delay 5 Seconds)	On	On	10V < Communication Power Supply Voltage < 14.8V	1 Second	
RTC Error Warning	Unable to Receive RTC Messages for 10 Seconds	10 Seconds	0 Second	Connect	Connect	On	On	On	Receives RTC Messages	0 Second	
Heater High Temperature Warning	Heater Temperature > 75°C (167°F)	3 Seconds	0 Second	Connect	Connect	On	On	On	Heater Temperature < 50°C (122°F)	1 Second	
Heater High Temperature Protection	Heater Temperature > 85°C (185°F)	5 Seconds	3 Seconds	Disconnect	Disconnect	On	On	On	Heater Temperature < 70°C (158°F)	1 Second	
Heater High Temperature Hardware Protection	Heater Temperature > 90°C (194°F)	10 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Heater Temperature < 65°C (149°F)	Restart	The heater fuse blows when the protection is triggered. The heater is unable to operate anymore even the protection is released.
Heater Malfunction Warning	Unable to Heat Battery Up When Heater is On	5 Seconds	0 Second	Connect	Connect	On	On	On	Heats Battery Up When Heater is On	0 Second	
Fuse Permanent Failure	Voltage Difference Across > 5V	3 Seconds	3 Seconds	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Unrecoverable	/	
AFE Overvoltage Protection	AFE Sampled Cell Voltage > 3.9V	0 Second	0 Second	Disconnect	Disconnect	On	On	On	AFE Sampled Cell Voltage < 3.9V	Restart	
AFE Undervoltage Protection	AFE Sampled Cell Voltage < 2V	0 Second	0 Second	Disconnect	Disconnect	Off (Delay 1 Minute)	Off (Delay 1 Minute)	Off (Delay 1 Minute)	AFE Sampled Cell Voltage > 2V	Restart	
BMS Power Supply Malfunction Protection	BMS Power Supply Voltage ≤ 13.2V/ BMS Power Supply Voltage ≥ 10.8V	5 Seconds	3 Seconds (BMS Power Supply Undamaged)	Disconnect	Disconnect	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	Off (Delay 5 Minutes)	10.8V < BMS Power Supply Voltage < 13.2V	5 Seconds	
AFE High Temperature Protection	AFE Sampled Cell Temperature > 65°C (149°F)	0 Second	3 Seconds	Disconnect	Disconnect	On	On	On	AFE Sampled Cell Temperature < 60°C (140°F)	1 Second	
AFE Low Temperature Protection	AFE Sampled Cell Temperature < -25°C (-13°F)	0 Second	3 Seconds	Disconnect	Disconnect	On	On	On	AFE Sampled Cell Temperature > -20°C (-4°F)	1 Second	

Battery Management System

Charge Current Request

With the communication connections established between the battery and chargers, the battery management system can automatically request appropriate charge current from the chargers based on the cell voltage and temperature to prolong battery cycle life.

Cell Temperature / Highest Cell Voltage	Desired Charge Current									
	<-19°C (-2.2°F)	-19°C ~ 0°C (-2.2°F ~ 32°F)	0°C ~ 1°C (32°F ~ 33.8°F)	1°C ~ 15°C (33.8°F ~ 59°F)	15°C ~ 16°C (59°F ~ 60.8°F)	16°C ~ 49°C (60.8°F ~ 120.2°F)	49°C ~ 50°C (120.2°F ~ 122°F)	50°C ~ 53°C (122°F ~ 127.4°F)	53°C ~ 54°C (127.4°F ~ 129.2°F)	> 54°C (129.2°F)
Cell Undervoltage Permanent Failure	0A	0A	0A	0A	0A	0A	0A	0A	0A	0A
Cell Undervoltage Permanent Failure~2.5V	0A	5A	5A → 40A	40A	40A	40A	40A	40A	40A → 20A	0A
2.5V~3.5V	0A	5A	5A → 200A	200A	200A → 300A	300A	300A → 100A	100A	100A → 20A	0A
3.5V~3.54V	0A	5A	↓	↓	↓	↓	↓	↓	↓	0A
3.54V~Full	0A	5A	5A	5A	15A	15	15	15	15	0A
Full	0A	0A	0A	0A	0A	0A	0A	0A	0A	0A

NOTE

- After a full charge, the battery stops requesting charge current until the battery level drops below 95%.

Cell Voltage Balancing

The battery management system is equipped with a passive balancing circuit to balance the cell voltages. Each series connected cell is connected to a bypass resistor and a switch. During the charging process, the battery management system turns on the switch for the cell whose voltage is significantly higher than other cells and shunts the charge current through its bypass resistor until the voltage difference between cells gets small enough. To avoid excessive energy loss, the cell voltage balancing is only performed during the charging process.

Troubleshooting

Phenomenon		Possible Causes	Solutions
Battery Status Indicator	**Heater Status Indicator**		
Solid Yellow	Lights up / Flashes According to the Heater Status	Charge Overcurrent Warning	• Reduce the charge current immediately.
		Discharge Overcurrent Warning	• Reduce the discharge current immediately.
Slow Flash Yellow		Cell Overvoltage Warning	• Ensure that the chargers are comptaible with the lithium iron phosphate battery. • Ensure that the battery type is set to lithium iron phosphate and the charge voltage is set to 14.4V on the chargers. Slightly reduce the charge voltage or connect voltage sensors to the chargers to compensate for the voltage drops across the charging cables if necessary. • The charging can be continued if the chargers are compatible with the lithium iron phosphat battery and the battery type and charge voltage are set properly on the chargers.
		Battery Overvoltage Warning	• Ensure that the chargers are comptaible with the lithium iron phosphate battery. • Ensure that the battery type is set to lithium iron phosphate and the charge voltage is set to 14.4V on the chargers. Slightly reduce the charge voltage or connect voltage sensors to the chargers to compensate for the voltage drops across the charging cables if necessary. • The charging can be continued if the chargers are compatible with the lithium iron phosphat battery and the battery type and charge voltage are set properly on the chargers.
		Cell Undervoltage Warning	• Charge the battery immediately.
		Battery Undervoltage Warning	• Charge the battery immediately.
		Low SOC Warning	• Charge the battery immediately.

Troubleshooting

Phenomenon		Possible Causes	Solutions
Battery Status Indicator	**Heater Status Indicator**		
Slow Flash Yellow	Lights up / Flashes According to the Heater Status	Cell Voltage Imbalance Warning	• Disconnect the battery from the system. • Leave the battery reseting for 24 hours. • Contact us for help if the warning persists
Fast Flash Yellow		CAN Communication Error Warning	• Ensure that the inter-device communication connections are solid. • Restart the battery if no inter-device communication connection is established.
		Battery Source Address Conflict Warning	• Restart the battery. • Contact us for help if the warning persists.
		Memory Communication Error Warning	• Restart the battery. • The memory connection might have been loose if the warning persists. Contact us for help.
		RTC Error Warning	• Restart the battery. • The RTC connection might have been loose if the warning persists. Contact us for help.
		Communication Power Supply Malfunction Warning	• Restart the battery. • The communication power supply might have been damaged if the warning persists. Contact us for help.
Strobe Yellow		Cell Charge High Temperature Warning	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary. • Reduce the charge current to avoid internal heat buildup.
		Cell Discharge/ Idle High Temperature Warning	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary. • Reduce the discharge current to avoid internal heat buildup.

Troubleshooting

Phenomenon		Possible Causes	Solutions
Battery Status Indicator	Heater Status Indicator		
Strobe Yellow	Lights up / Flashes According to the Heater Status	Cell Charge Low Temperature Warning	• Insulate the battery from cold weather. • Ensure that the heater is enabled and operating properly.
		Cell Discharge/ Idle Low Temperature Warning	• Insulate the battery from cold weather. • Warm up the battery with external heat sources.
		Environment High Temperature Warning	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary. • Reduce the charge/discharge current to avoid internal heat buildup if the battery is charging/discharging.
		Environment Low Temperature Warning	• Insulate the battery from cold weather. • Warm up the battery with the heater or external heat sources.
		MOSFET High Temperature Warning	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary. • Reduce the charge/discharge current to avoid internal heat buildup.
		Balancing Circuit High Temperature Warning	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary. • Reduce the charge/discharge current to avoid internal heat buildup.
		Heater High Temperature Warning	• Restart the battery. • The heater MOSFET might have been damaged if the warning persists. Contact us for help.

Troubleshooting

Phenomenon		Possible Causes	Solutions
Battery Status Indicator	**Heater Status Indicator**		
Double Flash Yellow	Lights up / Flashes According to the Heater Status	Low SOH Warning	• Restart the battery. • The battery is near the end of life if the warning persists. Replace the battery if necessary.
		Battery Voltage Imbalance Warning	• Disassemble the battery bank. • Charge the batteries individually to bring the voltages to the same level. • Reconnect the batteries in parallel.
Solid Red		Charge Primary/ Secondary Overcurrent Protection	• Reduce the charge current immediately. • Discharge or restart the battery if the protection is not released automatically after 1 minute.
		Discharge Primary/ Secondary Overcurrent Protection	• Reduce the discharge current immediately. • Charge or restart the battery if the protection is not released automatically after 1 minute.
		Short Circuit Protection	• Locate and repair the short circuits immediately. • Charge or restart the battery if the protection is not released automatically after 1 minute.
		Reverse Polarity Protection	• Check and correct the connection polarity.
		Pre-Charge Failure Protection	• Reduce initial DC load. • Restart the battery if the protection is not released automatically after 1 minute.

Troubleshooting

Phenomenon		Possible Causes	Solutions
Battery Status Indicator	Heater Status Indicator		
Slow Flash Red	Lights up / Flashes According to the Heater Status	Cell Overvoltage Protection	• Ensure that the chargers are comptaible with the lithium iron phosphate battery. • Ensure that the battery type is set to lithium iron phosphate and the charge voltage is set to 14.4V on the chargers. Slightly reduce the charge voltage or connect voltage sensors to the chargers to compensate for the voltage drops across the charging cables if necessary. • The cell overvoltage protection might be triggered near the end of the charging process due to cell voltage divergence. No risk of damage is present if the chargers are compatible with the lithium iron phosphat battery and the battery type and charge voltage are set properly on the chargers.
		Battery Overvoltage Protection	• Ensure that the chargers are comptaible with the lithium iron phosphate battery. • Ensure that the battery type is set to lithium iron phosphate and the charge voltage is set to 14.4V on the chargers. Slightly reduce the charge voltage or connect voltage sensors to the chargers to compensate for the voltage drops across the charging cables if necessary.
		Cell Undervoltage Protection	• Charge the battery immediately.
		Battery Undervoltage Protection	• Charge the battery immediately.
		Cell Voltage Imbalance Protection	• Disconnect the battery from the system. • Leave the battery resting for 24 hours. • Contact us for help if the protection persists

Troubleshooting

Phenomenon		Possible Causes	Solutions
Battery Status Indicator	**Heater Status Indicator**		
Slow Flash Red	Lights up / Flashes According to the Heater Status	AFE Overvoltage Protection	• Ensure that the chargers are comptaible with the lithium iron phosphate battery. • Ensure that the battery type is set to lithium iron phosphate and the charge voltage is set to 14.4V on the chargers. Slightly reduce the charge voltage or connect voltage sensors to the chargers to compensate for the voltage drops across the charging cables if necessary.
		AFE Undervoltage Protection	• Charge the battery immediately.
		Voltage Sampling Error Protection	• Restart the battery. • The voltage sensor connection might have been loose if the protection persists. Contact us for help.
Fast Flash Red		AFE Communication Error Protection	• Restart the battery. • The AFE connection might have been loose if the protection persists. Contact us for help.
		BMS Power Supply Malfunction Protection	• Restart the battery. • The BMS power supply might have been damaged if the warning persists. Contact us for help.
Strobe Red		Cell Charge High Temperature Protection	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary.
		Cell Discharge/ Idle High Temperature Protection	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary.
		Cell Charge Low Temperature Protection	• Insulate the battery from cold weather. • Ensure that the heater is enabled and operating properly.
		Cell Discharge/ Idle Low Temperature Protection	• Insulate the battery from cold weather. • Warm up the battery with external heat sources.

Troubleshooting

Phenomenon		Possible Causes	Solutions
Battery Status Indicator	Heater Status Indicator		
Strobe Red	Lights up / Flashes According to the Heater Status	Environment High Temperature Protection	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary.
		Environment Low Temperature Protection	• Insulate the battery from cold weather. • Warm up the battery with the heater or external heat sources.
		MOSFET High Temperature Protection	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary.
		Balancing Circuit High Temperature Protection	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary.
		Heater High Temperature Protection	• Restart the battery. • The heater MOSFET might have been damaged if the portection persists. Contact us for help.
		Heater High Temperature Hardware Protection	• Restart the battery. • The heater fuse has blown and the heater is no longer operable. But the battery can continue charging and discharging.
		AFE High Temperature Protection	• Increase the airflow for efficient heat dessipation. • Insulate the battery from hot weather if necessary.
		AFE Low Temperature Protection	• Insulate the battery from cold weather. • Warm up the battery with the heater or external heat sources.
		Temperature Sampling Error Protection	• Restart the battery. • The temperature sensor connection might have been loose if the protection persists. Contact us for help.

Troubleshooting

Phenomenon		Possible Causes	Solutions
Battery Status Indicator	**Heater Status Indicator**		
Slow Flash Red	Slow Flash Red	Fuse Permanent Failure	• Restart the battery. • The fuse has blown due to inrush currents if the permanent failure persists. Contact us for help.
Fast Flash Red	Fast Flash Red	Charge MOSFET Permanent Failure	• Restart the battery. • The charge MOSFET has been damaged due to voltage spikes if the permanent failure persists. Contact us for help.
		Discharge MOSFET Permanent Failure	• Restart the battery. • The discharge MOSFET has been damaged due to voltage spikes if the permanent failure persists. Contact us for help.
Strobe Red	Strobe Red	Cell Overvoltage Permanent Failure	• Restart the battery. • The battery has been severely overcharged and is no longer usable if the permanent failure persists. Replace the battery.
		Cell Undervoltage Permanent Failure	• Restart the battery. • The battery has been severely overdischarged and is no longer usable if the permanent failure persists. Replace the battery.
		Cell High Temperature Permanent Failure	• Restart the battery. • The battery has been severely overheated and is no longer usable if the permanent failure persists. Replace the battery.
Double Flash Red	Double Flash Red	Low SOH Permanent Failure	• Restart the battery. • The battery reaches the end of life if the permanent failure persists. Replace the battery.

Troubleshooting

Phenomenon		Possible Causes	Solutions
Battery Status Indicator	**Heater Status Indicator**		
Lights up/ Flashes According to the Battery Status	Solid Red	Heater Malfunction Warning	• Restart the battery. • The heater might have fell off due to vibration if the warning persists. Contact us for help.
		Heater Turns on and off Repeatedly	• Ensure that the chargers are able to deliver a charge current greater than 15A to each battery in the battery bank. The heater is unable to operate properly with low current chargers. • Ensure that the chargers are able to deliver a stable charge current. The heater is unable to operate properly with PWM charge controllers.
Unable to Turn on Battery		Cell Undervoltage Permanent Failure	• The battery has been severely overdischarged and is no longer usable. Replace the battery.

Emergency Responses

Fire | Flooding | Smell

In the event of any threat to health or safety, always begin with the steps below before addressing other suggestions.

- Immediately contact the fire department or other relevant emergency response team.
- Notify all people who might be affected and ensure that they can evacuate the area.

WARNING

- ONLY perform the suggested actions below if it is safe to do so.

Fire

1. Disconnect the battery from the system.
2. Turn the battery off.
3. Put out the fire with a fire extinguisher. Acceptable fire extinguishers include water, CO_2, and ABC.

WARNING

- DO NOT use type D (flammable metal) fire extinguishers.

Flooding

1. Stay out of the water if any part of the battery or cable is submerged.
2. Disconnect the battery from the system.
3. Turn the battery off.
4. Protect the battery by finding and stopping the source of the water and pumping water away if possible.

Smell

1. Disconnect the battery from the system.
2. Turn the battery off.
3. Ensure that nothing is in contact with the battery.
4. Ventilate the installation space.

Technical Support

For additional support, contact the Renogy technical support team through renogy.com/contact-us. Have the following information available when contacting Renogy.

- Owner name
- Contact information
- Order number
- Purchase channel
- Serial number
- Brief description of the issue

Renogy offers premium services worldwide:

North America	US	www.renogy.com	CA	ca.renogy.com
Asia	CN	www.renogy.cn	JP	renogy.jp
	KR	kr.renogy.com		
Oceania	AU	au.renogy.com		
Europe	FR	fr.renogy.com	DE	de.renogy.com
	ES	es.renogy.com	UK	uk.renogy.com

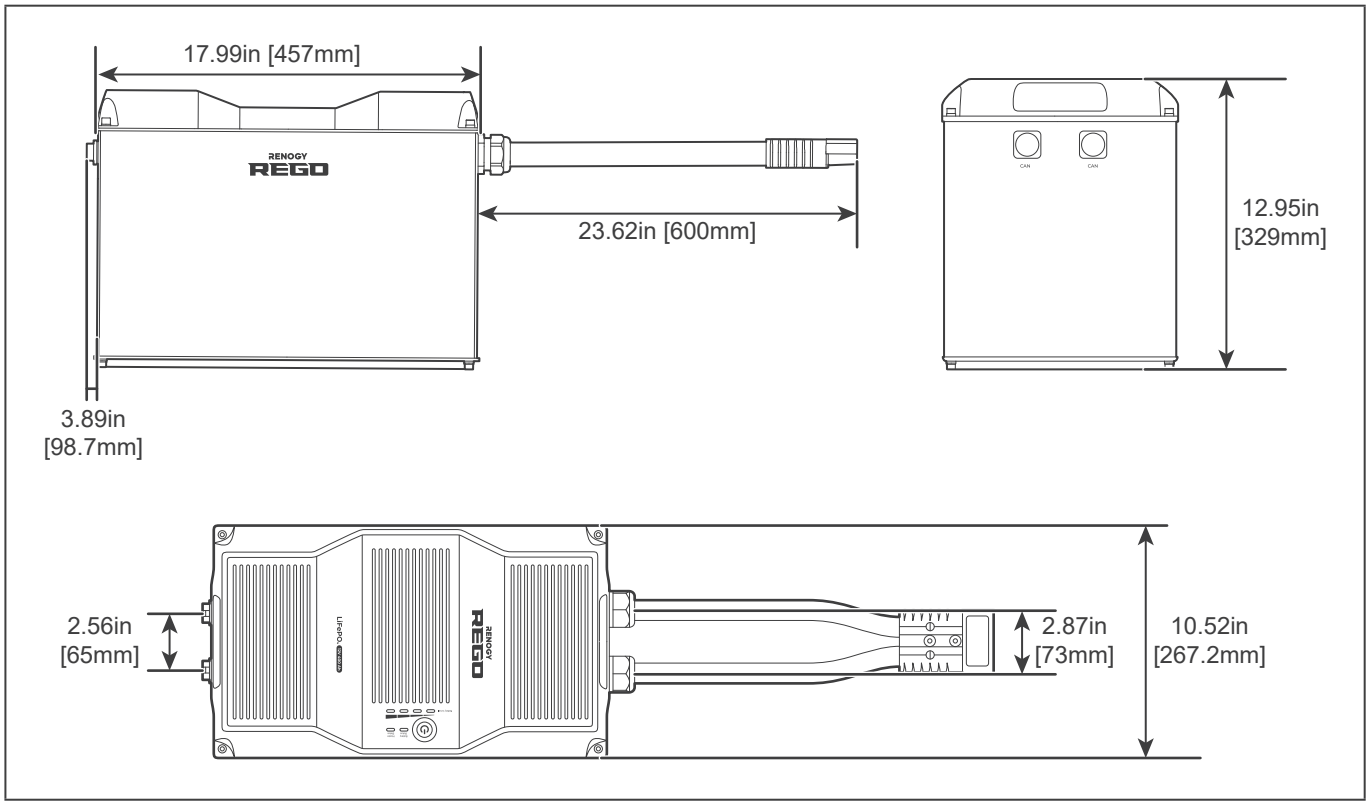
Technical Specifications

General	
Dimension	17.99 x 12.95 x 10.52 inch / 457.0 x 329.0 x 267.2 mm (Exclude Cable Glands and Integrated Cables)
Weight	112.44 lbs. / 51.0 kg
Operating Environment Temperature	59°F to 86°F / 15°C to 30°C (Recommended) -4°F to 122°F / -20°C to 50°C (Extreme)
Operating Relative Humidity	5% to 95%
Operating Altitude	<9842.5 ft. / <3000 m
Charge Temperature	-4°F to 122°F / -20°C to 50°C
Discharge Temperature	-4°F to 140°F / -20°C to 60°C
Storage Temperature	-4°F to 113°F / -20°C to 45°C
Storage Relative Humidity	5% to 95%
Input/Output Connector	Gray Anderson 350 Connector
Integrated Cable Size	4/0 AWG /107 mm^2
Integrated Cable Length	23.62 inch / 600 mm (Include AndersonConnector and Cable Glands)
Communication Interface	LP16 Port (7-Pin), Bluetooth Module
Communication Protocol	RV-C (LP16 Port), MODBUS (Bluetooth Module)
Housing Material	Aluminum
Protection Rating	IP65
Cooling Method	Passive Cooling
Electrical	
Battery Type	Lithium Iron Phosphate
Nominal Voltage	12.8V
Rated Capacity	400Ah (0.2C, 77°F / 25°C)
Rated Energy	5.12KWh (0.2C, 77°F / 25°C)
Maximum Continuous Charge Current	5A (-4°F to 32°F / -20°C to 0°C) 200A (32°F to 59°F / 122°F to 131°F / 0°C to 15°C / 50°C to 55°C) 300A (59°F to 122°F / 15°C to 50°C)
Maximum Continuous DischargeCurrent	350A (-4°F to 140°F / -20°C to 60°C)
Cycle Life	3800 Cycles (80% DOD, 80% EOL, 0.2C, 77°F / 25°C)
Internal Resistance	<10mΩ

Technical Specifications

Connection Method	Parallel (Up to 8)
Self-Discharge Rate	≤18%/Month (Turned On) ≤1.5%/Month (Turned Off)
Charger Setting	
Boost Voltage	14.4V
Float Voltage	14.4V / Disable
Equalization Voltage	3500W
Tail Current	20A
Peukert Exponent	1.01
Heater	
Heater Operating Temperature	> -4°F / > -20°C
Heater Power Rating	200W
Heater Heating Rate	9°F/h / 5°C/h

Dimensions



NOTE

- Dimension tolerance: ±0.2 in (0.5 mm)

Sizing Adapter Cable

1. Determine the maximum charge/discharge current of each device connected to the battery bank. Please refer to the formulas below.

Maximum Charge Current of Charge Controller (A) = Rated Output Current of Charge Controller (A)

Maximum Charge Current of DC-DC Charger (A) = Rated Output Current of DC-DC Charger (A)

Maximum Charge Current of Converter (A) = Rated Output Current of Converter (A)

$$\text{Maximum Discharge Current of Inverter (A)} = \frac{\text{Rated Output Power of Inverter (W)}}{\text{Cutoff Voltage of Inverter (V)}}$$

Maximum Discharge Current of DC Load (A) = Current Rating of DC Load (A)

2. Determine the maximum current of the battery bank. The maximum current is the greater of the total maximum charge current or the total maximum discharge current.
3. Determine the minimum ampacity of the adapter cable. The minimum ampacity is 125% of the maximum current.
4. Based on the installation condition and temperature rating of the adapter cable, determine the size of the adapter cable by minimum ampacity. Please refer to the table below.

Size	Allowable Ampacity (A)					
	In Raceway, Conduit, or Earth			In Free Air		
	140°F (60°C)	167°F (75°C)	194°F (90°C)	140°F (60°C)	167°F (75°C)	194°F (90°C)
18 AWG (0.82 mm²)	—	—	14	—	—	18
16 AWG (1.31 mm²)	—	—	18	—	—	24
14 AWG (2.08 mm²)	15	20	25	25	30	35
12 AWG (3.31 mm²)	20	25	30	30	35	40
10 AWG (5.25 mm²)	30	35	40	40	50	55
8 AWG (8.36 mm²)	40	50	55	60	70	80
6 AWG (13.3 mm²)	55	65	75	80	95	105
4 AWG (21.1 mm²)	70	85	95	105	125	140
3 AWG (26.7 mm²)	85	100	115	120	145	165
2 AWG (33.6 mm²)	95	115	130	140	170	190
1 AWG (42.4 mm²)	110	130	145	165	195	220
1/0 AWG (53.5 mm²)	125	150	170	195	230	260
2/0 AWG (67.4 mm²)	145	175	195	225	265	300
3/0 AWG (85.0 mm²)	165	200	225	260	310	350
4/0 AWG (107.2 mm²)	195	230	260	300	360	405

NOTE

- The above allowable ampacities are from NEC Tale 310.15(B)(16) and 310.15(B)(17) for copper cables operating at an ambient temperature no higher than 86°F (30°C). Adapter cables made of aluminum conductors or operating at higher ambient temperatures might require larger sizes.

5. Based on the and temperature rating of the adapter cable, determine the size of the adapter cable by voltage drop limit. The voltage drop limit is 3% of the battery discharge cutoff voltage. Please refer to the formula and table below.

$$\text{Voltage Drop (V)} = \frac{\text{Maximum Current of Battery Bank (A)} \times \text{Resistance (Ω/1000 feet)} \times \text{Length of Adapter Cable (foot)}}{500}$$

Size	Resistance (Ω/1000 feet)		
	140°F (60°C)	167°F (75°C)	194°F (90°C)
18 AWG (0.82 mm²)	8.04	8.45	8.86
16 AWG (1.31 mm²)	5.03	5.29	5.55
14 AWG (2.08 mm²)	3.10	3.26	3.42
12 AWG (3.31 mm²)	1.95	2.05	2.15
10 AWG (5.25 mm²)	1.23	1.29	1.35
8 AWG (8.36 mm²)	0.770	0.809	0.848
6 AWG (13.3 mm²)	0.485	0.510	0.535
4 AWG (21.1 mm²)	0.305	0.321	0.337
3 AWG (26.7 mm²)	0.242	0.254	0.266
2 AWG (33.6 mm²)	0.191	0.201	0.211
1 AWG (42.4 mm²)	0.152	0.160	0.168
1/0 AWG (53.5 mm²)	0.121	0.127	0.133
2/0 AWG (67.4 mm²)	0.096	0.101	0.106
3/0 AWG (85.0 mm²)	0.0758	0.0797	0.0836
4/0 AWG (107.2 mm²)	0.0596	0.0626	0.0656

NOTE

- The above resistances are from NEC Chapter 9 Table 8 for copper cables with coated conductors and standard number of strands.

6. Determine the size of the adapter cable. The size is the greater of the size by minimum ampacity and the size by voltage drop limit.

Sizing Busbar

1. Determine the maximum charge/discharge current of each branch circuit. Please refer to the formulas below.

Maximum Charge Current of Charge Controller Circuit (A) = Rated Output Current of Charge Controller (A)

Maximum Charge Current of DC-DC Charger Circuit (A) = Rated Output Current of DC-DC Charger (A)

Maximum Charge Current of Converter Circuit (A) = Rated Output Current of Converter (A)

$$\text{Maximum Discharge Current of Inverter Circuit (A)} = \frac{\text{Rated Output Power of Inverter (W)}}{\text{Cutoff Voltage of Inverter (V)}}$$

Maximum Discharge Current of DC Load Circuit (A) = Current Rating of DC Load (A)

2. Determine the current rating of the fuse or circuit breaker for each branch circuit. The current rating is no less than 125% of the maximum charge/discharge current of the branch circuit.
3. Determine the size of the busbar. The size is no less than the sum of the current ratings of all the fuses or circuit breaker.

FCC Statement

This device complies with Part 15 of the FCC Rules. FCC ID：2ANPBRSMLP4-G2. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

(1) Orient or relocate the receiving antenna.

(2) Increase the separation between the equipment and receiver.

(3) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

(4) Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Visit renogy.com to find relevant documentation or get more support via "Contact Us".
Renogy reserves the right to change the contents of this manual without notice.

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