THE POWER OF REDARC®

POWERED BY SUPER B lithium batteries

LBAT12150-SB

REDARC Lithium Battery
Powered by Super B

LBAT12150-SB

REDARC Lithium Battery powered by Super B

The REDARC Lithium Battery is a self-protected Lithium Iron Phosphate rechargeable Battery. The Battery operates as a 12 V energy source in power systems, making it suitable for recreational and commercial vehicles, leisure boats, commercial vessels and stationary applications.

Built with state-of-the art technology, the Lithium Battery is a robust, safe and easy to use energy storage solution. With its integrated Battery Management System (BMS) the Lithium Battery is protected from deep discharging, overcharging and overheating. Eliminating the need for an external safety relay means the Lithium Battery is very easy to install.

The Lithium Battery also has integrated battery monitoring which provides details about its status such as voltage, current, temperature, state of charge and remaining runtime. Real-time monitoring is possible via the REDARC Lithium Battery App, CI-bus, external monitoring devices and LED indicators to inform you the status of your Lithium Battery.

CONTENTS

WARNINGS AND SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS — This manual contains important safety instructions. Do not operate the LBAT12150-SB Lithium Battery unless you have read and understood this manual. REDARC recommends that the LBAT12150-SB Lithium Battery referenced in this manual be installed by a suitably qualified person.

Disclaimer: REDARC accepts no liability for any injury, loss of property damage which may occur from the improper or unsafe installation or use of its products.

SAFETY MESSAGE CONVENTIONS

Safety messages in this manual include a signal word to indicate the level of the hazard as follows:

⚠ **WARNING:** Indicates a potentially hazardous situation which could result in death or serious injury to the operator or to bystanders.

⚠ **CAUTION:** Indicates a potentially hazardous situation which may result in moderate or minor injury to the operator or to bystanders.

NOTICE: Indicates a situation that may cause equipment damage.

⚠ WARNING

RISK OF FIRE, EXPLOSION AND BURNS.
Avoid eye and skin contact with electrolyte. If contact has been made, wash the affected area with water and seek medical advice.

⚠ CAUTION

- Do not dismantle, crush, puncture, open or shred the Lithium Battery.
- Do not install multiple batteries in series.
- Do not heat above 60°C (140°F) or incinerate.
- Do not connect Battery in reverse polarity.
- Do not short Battery terminals.
- Do not expose the Lithium Battery to heat or fire. Avoid exposure to direct sunlight.
- Always use a charger which is designed for use with a Lithium Iron Phosphate battery (LiFePO4).
- Do not mix batteries of different manufacturer, capacity, size, type or age within a system.
- Keep the Lithium Battery clean and dry. Keep away from water, dust and contamination.
- Do not leave the Lithium Battery on prolonged charge when not in use.

NOTICE

- Do not operate Battery beyond published maximum specifications.
- This product can store fault conditions internally, like excessive charge current or deep discharge situations. REDARC may use this information in the warranty process.
- Place the Battery in well ventilated areas.
- Do not remove the Battery from its original packaging until required for use.
- After extended periods of storage, it may be necessary to charge and discharge the Battery several times to obtain maximum performance.
- During long periods of storage, periodic charging is needed to prevent excessive self discharge.
- Disconnect the Lithium Battery from the equipment when not in use.
- Observe the positive (+) and negative (–) marks on the Lithium Battery and equipment to ensure correct use.

DISPOSAL

Dispose the Lithium Battery in accordance with local, state and federal laws and regulations. Do not mix with other (industrial) waste.

⚠ **THE BATTERY MUST BE CHARGED BEFORE FIRST USE. WHEN THE BATTERY IS AT 0% CHARGE IMMEDIATELY.**

PRODUCT DESCRIPTION

PRODUCT FEATURES

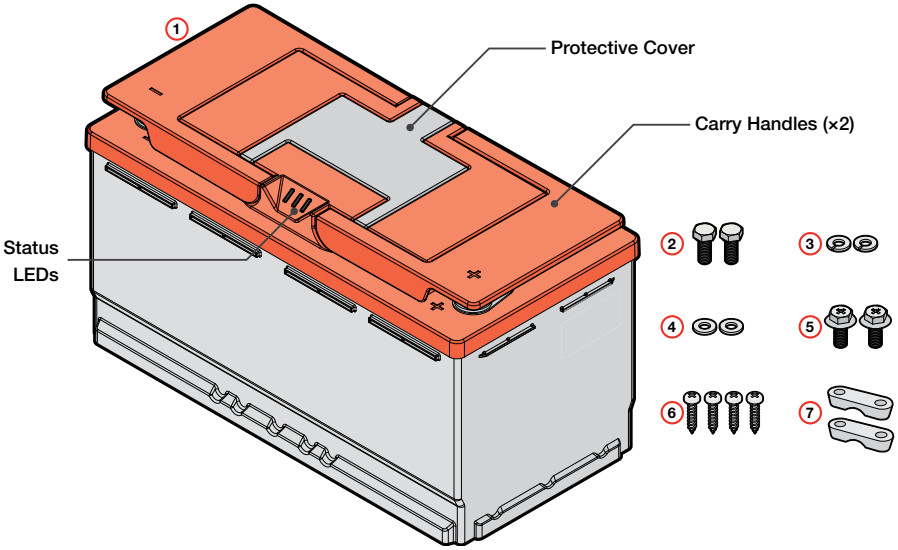
- Operates as a 12 V energy source in power systems.
- Suitable for recreational vehicles, commercial vehicles, leisure boats, commercial vessels and stationary applications.
- A-grade prismatic cells for highest possible energy density and quality.
- Integrated short circuit protection.
- Integrated protection device for maximum protection and safety.
- Integrated BMS (Battery Management System).
- Integrated cell heating to allow safe charging below 0°C (32°F) (with autonomous operation).
- Adaptive cell balancing.
- Robust casing made from environmentally friendly materials.
- Overheating protection on Battery terminals in case of poorly connected cables.
- Communication interface: Bluetooth® (wireless), CAN Bus (wired) and LIN Bus (wired).
- Monitoring via REDARC Lithium app (iOS and Android).
- Configurable general purpose inputs / outputs to control external devices (chargers for example).
- Separate power output connection for powering accessories. Analog SoC output.
- Multi-connectable coated aluminium terminals, including temperature sensors for protection.

ENVIRONMENTAL CONDITIONS

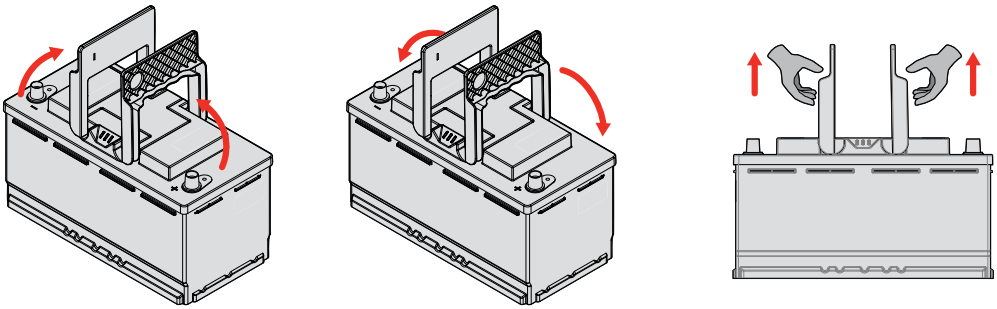
⚠ **WARNING:** The LBAT12150-SB Lithium Battery may only be used in conditions specified in this manual. Exposing the Lithium Battery to conditions outside the specified boundaries may lead to serious damage to the product, user and/or environment.

⚠ **CAUTION:** Use the LBAT12150-SB Lithium Battery in a dry, clean, dust free, and well ventilated space. Do not expose the Lithium Battery to fire, water, solvents or excessive heat.

KIT CONTENTS



Ref.	Part Description	QTY
1	Lithium Battery	1
2	M8 Hex Head Bolt	2
3	M8 Spring Washer	2
4	M8 Washer	2
5	M6 Terminal Bolt	2
6	Phillips Head Screw	4
7	Cable Clamp	2



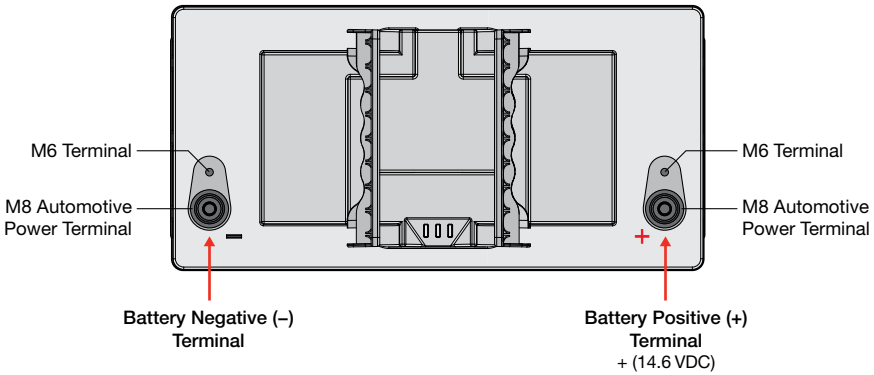
OPERATION


REDARC
SUPER B
LITHIUM ALPHA150
12V 150AH LITHIUM BATTERY
WARNING

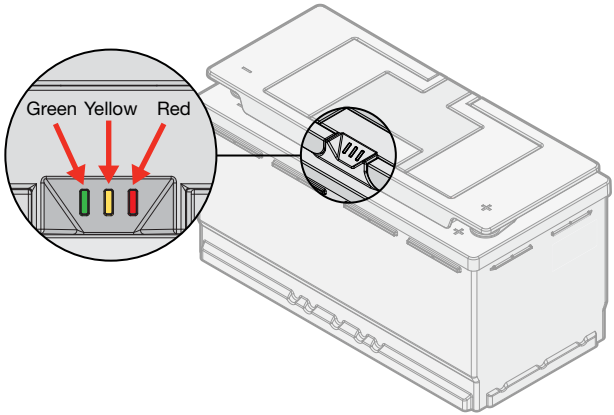
TERMINALS

Connect up to 95 mm^2 (3/0 AWG) cables to the M8 Terminals.

M6 Terminals are provided for connecting low-current devices.



STATUS LEDS

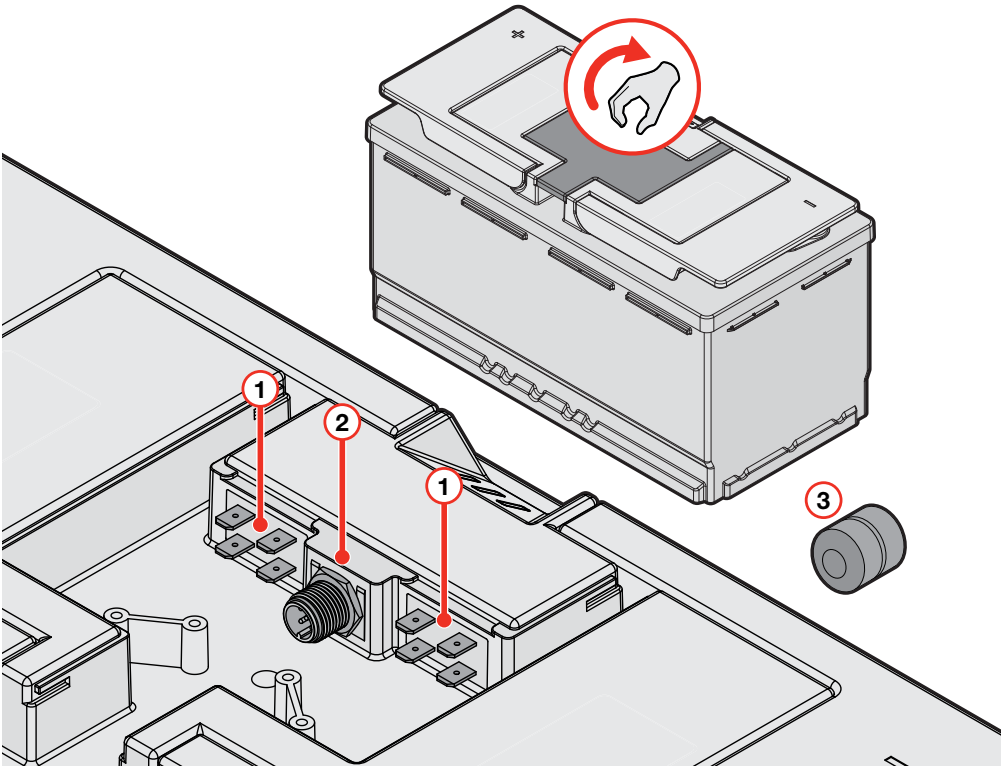


LED Indication	Mode
Green	Operational Mode
Yellow	Warning Mode
—	Empty / Deep-Discharged Mode
Red	Error Mode

When the Lithium Battery is in Operational Mode (not charging or discharging), the LED indicator flashes green every 3 seconds (see "Troubleshooting" on page 31 for more information).

SIGNAL INTERFACES

The Signal Interfaces are located underneath the Protective Cover.



1. FASTON Connections

Located underneath the protective cover. See page 10 for more information.

2. J1 CAN Bus Interface (for future use)

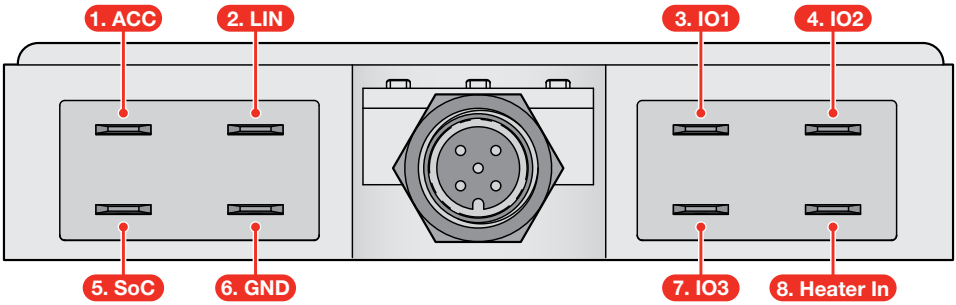
The CAN Bus Interface of the Lithium Battery is not galvanically isolated.

The CAN Bus ground pin is fused with respect to the negative (–) terminal with a 200 mA resettable fuse.

3. Protective Cap (M12)

⚠ **CAUTION:** Always use the supplied protective M12 Cap when the CAN Bus Connection is not used. Otherwise, ingress protection is not guaranteed and water/moisture may enter the Lithium Battery casing, which may cause serious damage.

FASTON CONNECTIONS



FASTON No.	Description	Function
1. ACC	Accessory Power Output	Connection for power to accessories (fused internally, resettable).
2. LIN	LIN Bus Connection (for future use)	LIN Bus communication channel (CI-Bus support).
3. IO1	IO1 Connection	Input or output 1 (configurable).
4. IO2	IO2 Connection	Input or output 2 (configurable).
5. SoC	SoC Output (analogue)	Analogue SoC output (0–10 V) (load must be higher than 100 kOhms).
6. GND	GND Connection	GND connection (fused internally, resettable).
7. IO3	IO3 Connection (for future use)	Input or output 3 (configurable).
8. Heater In	Heater Power Supply Input	External power supply for heater (12–14 V) (120 W / 10 A maximum).

MODES OF OPERATION

The LBAT12150-SB Lithium Battery has two modes: Operational and Non-Operational.

OPERATIONAL MODE

The LBAT12150-SB Lithium Battery has 3 states in Operational Mode:

Normal State: The metrics that the Lithium Battery monitors (voltage, current and temperature) are within the operational level of the cells and other components in the Lithium Battery.

Warning State: The metrics that the Lithium Battery monitors are threatened to go beyond the operational level of cells or other internal components. The Battery's protective disconnect device will allow charging and discharging.

Alarm State: The metrics that the Lithium Battery monitors are beyond the operational level of cells or other internal components. The Battery's protective disconnect device will disconnect the cells from the terminals and the Lithium Battery. This means that either charging, discharging or both are disabled.

OPERATION STATES DEPENDENCIES

TABLE 1

State	Protective Disconnect Device	Communication	BMS
Normal State	Conducting	Yes	Active
Warning State	Conducting	Yes	Active
Alarm State	One current direction conducting or non-conducting	Yes	Active

CHARGING DISABLED CAUSES

Charging is disabled under any of the following conditions:

- Over-current during charging, the charge current is too high.
- Over-voltage due to charging, the charger voltage is too high or the Battery cells are out of balance.
- The temperature is outside the allowable range for charging.
- The protective disconnect device is too hot.

DISCHARGING DISABLED CAUSES

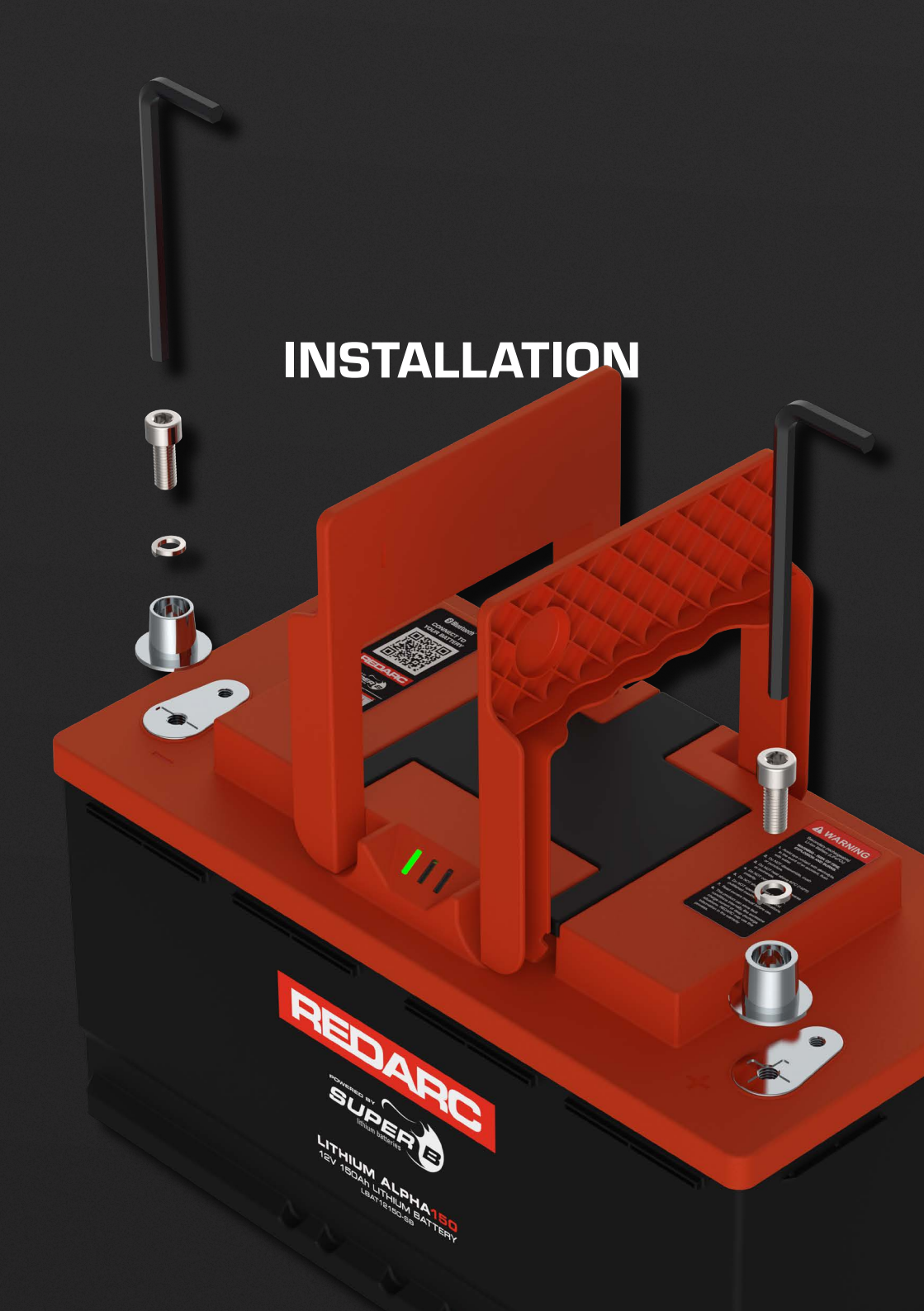
Discharging is disabled under any of the following conditions:

- Over-current during discharging, the load current is too high.
- Under-voltage due to discharging, the Lithium Battery is flat or the load current is too high for the Battery's SoC.
- The SoC 'off' level has been reached.
- The temperature is outside the allowable range for discharging.
- The protective disconnect device is too hot.

NON-OPERATIONAL MODE

When in Non-Operational Mode, the LBAT12150-SB Lithium Battery will not function/operate and cannot be used. This can happen if the BMS detects a malfunction in the Battery's monitoring and control, or when a deep-discharge has caused cell damage. A deep-discharge occurs when one of the cells is at 1.5 V or lower. This is even possible when the Lithium Battery is at 10 V. The Lithium Battery will store the state internally and becomes unusable. The Battery's protective disconnect device is non-conducting.

INSTALLATION



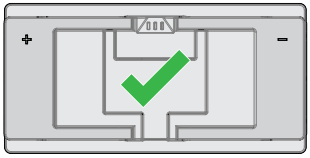
UNPACKING

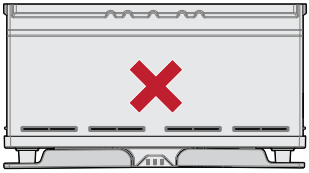
> ⚠ **THE BATTERY MUST BE CHARGED BEFORE FIRST USE. WHEN THE BATTERY IS AT 0% CHARGE IMMEDIATELY, SEE** page 21 **FOR CHARGING INSTRUCTIONS.**

Check the Lithium Battery for damage after unpacking. If the Lithium Battery is damaged, contact your reseller or REDARC Tech Support. **DO NOT install or use the Lithium Battery if it is damaged.**

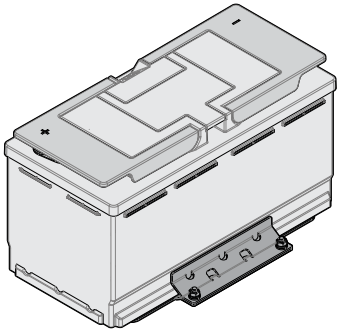
MOUNTING THE BATTERY

Before use, the Lithium Battery must be fastened in such a way that it will not move during use. The Lithium Battery may be placed on its long or short side, **do not mount upside down**. Use appropriate fastening brackets and fixtures for mounting.





A mounting bracket is available for purchase to securely mount the Lithium Battery.



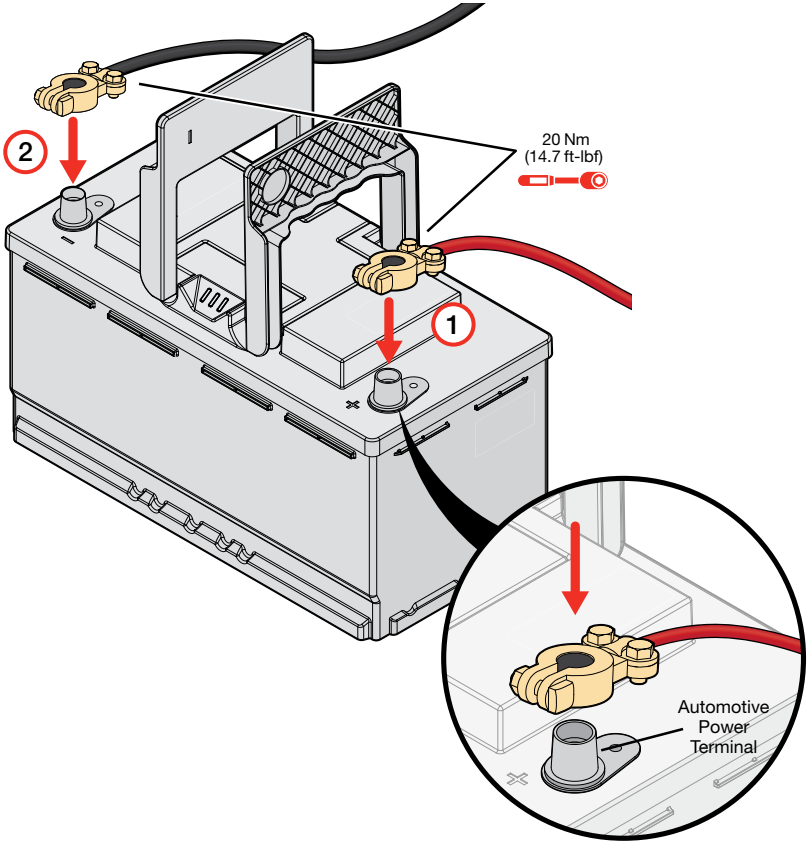
CONNECTION WIRES

> ⚠ **CAUTION:**
>
> - Batteries are capable of supplying very large currents. Fuses must be placed as close as possible to the battery's positive (+) terminal to protect the cable from damaging currents — Failure to do so could cause fire or personal injury.
> - When using more Lithium Batteries in parallel the wiring should be sized and specified according to the maximum current the parallel bank can deliver. See page 22 for more information.

Use suitably rated cables, fuses and cable lugs which meet the requirements for your installation. Refer to your devices (charger or load) installation requirements for further information. Always use the correct crimp tools to crimp the cable lugs and follow the instructions provided by the cable lug manufacturer.

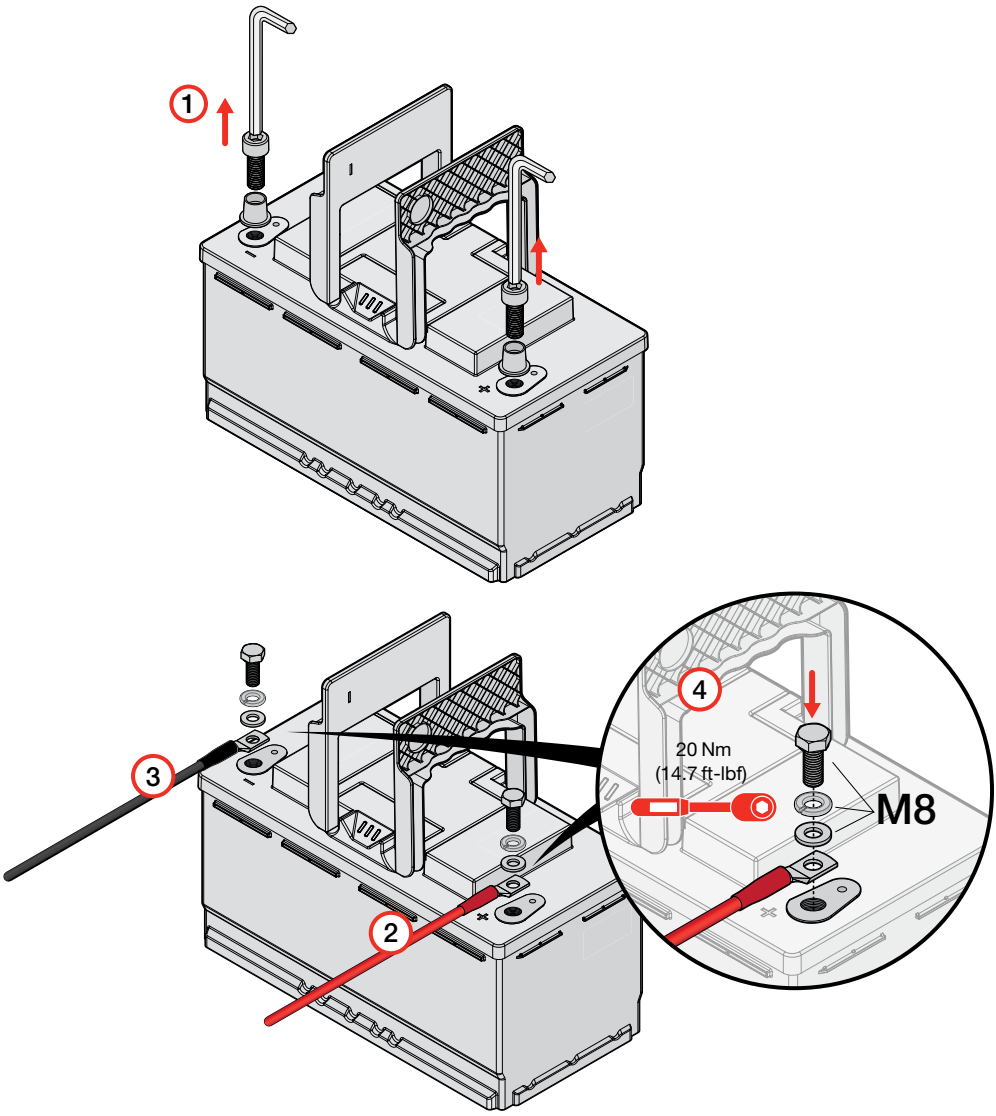
CONNECTING POWER CABLES WITH AUTOMOTIVE POWER TERMINALS

1. Connect the load or charger to the positive (+) terminal of the Lithium Battery, then torque to 20 Nm (14.7 ft-lbf).
2. Connect the load or charger to the negative (–) terminal of the Lithium Battery, then torque to 20 Nm (14.7 ft-lbf).



CONNECTING POWER CABLES WITH CABLE LUGS

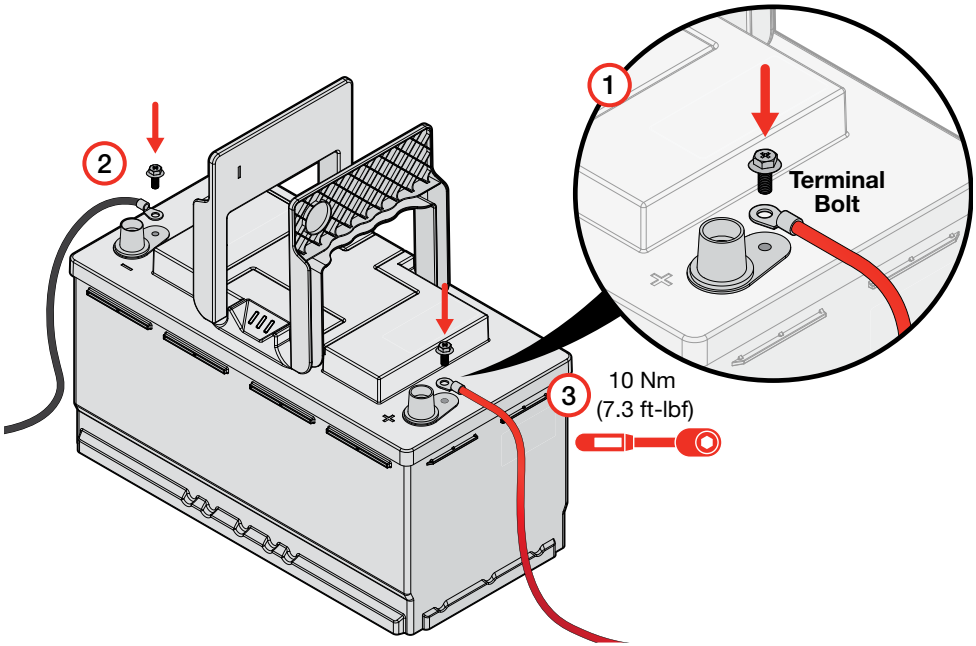
1. Remove the automotive power terminals, with hex head bolt and spring washer using an appropriate hex head tool (#6).
2. Connect the load/s or charger to the positive (+) terminal of the Lithium Battery and fasten using the supplied M8 Bolt, Spring Washer and Washer.
3. Connect the load/s or ground to the negative (–) terminal of the Lithium Battery and fasten using the supplied M8 Bolt, Spring Washer and Washer.
4. Torque both M8 Bolts to 20 Nm (14.7 ft-lbf).



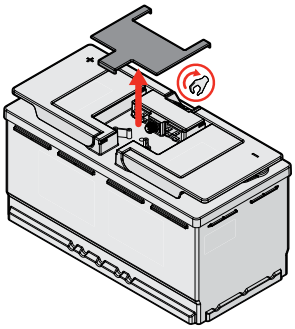
CONNECTING LOW CURRENT DEVICES TO THE TERMINALS

The Lithium Battery has a M6 thread on both terminals that is intended to supply power to low current devices. This is not the accessory power (FASTON 1) underneath the Protective Cover (see page 9).

1. Connect the positive input cable of the low current device to the positive (+) terminal of the Lithium Battery and fasten using the supplied M6 Bolt.
2. Connect the negative input cable of the low current device to the negative (–) terminal of the Lithium Battery and fasten using the supplied M6 Bolt.
3. Torque both M6 Bolts to 10 Nm (7.3 ft-lbf).



COMMUNICATION AND FASTON CONNECTIONS



PROTECTIVE COVER REMOVAL

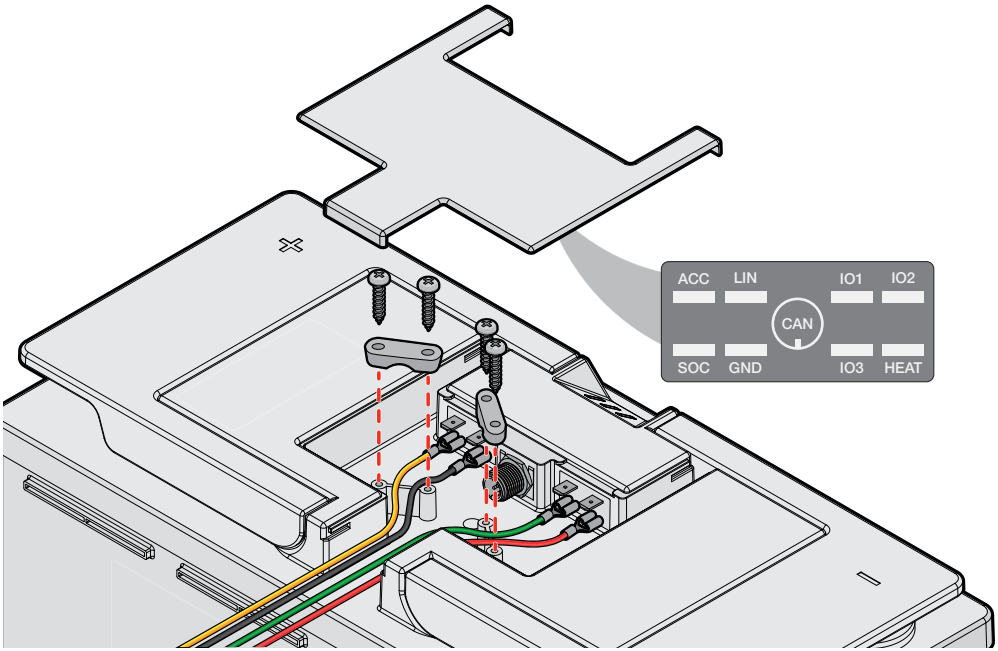
All FASTON connections can be made in one central place under the Protective Cover. The cover can be easily removed with light force and then re-fitted on when finished installing.

CONNECTING THE COMMUNICATION AND FASTON CONNECTIONS

⚠ **CAUTION:** Never use the cabling to lift the Lithium Battery, even when the cable clamps are holding it in place.

The FASTON connection inputs are marked on the inside of the protective cover. The connections can be made using standard 4.75 mm (0.2") wide automotive FASTON crimp terminals.

Once all FASTON cable connections are made, use the supplied cable clamps and Phillips head screws to secure cables into the integrated cable strain relief. Do not feed the CAN Bus cable through the integrated strain relief as this may damage the cable.



CONNECTING TO THE CAN BUS INTERFACE (FOR FUTURE USE)

IMPORTANT: The CAN Bus Interface is not compatible with REDARC R-Bus devices.

CONNECTING THE DATA CABLES

The wired communication interface must be used in a bus network topology (see Table 2). Do not use a ring– or a star topology. The wired communication interface specifications restrict the Bus length / Bus speed.

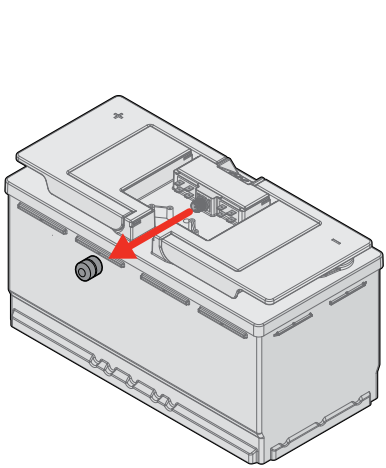
TABLE 2

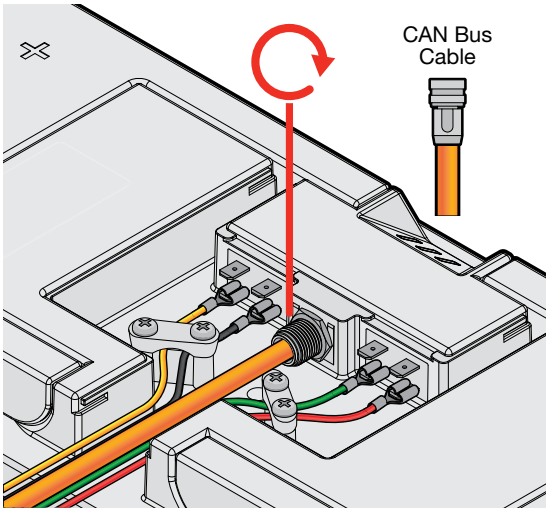
Bus Lengths (L)	Maximum Stub Length (S)	Accumulated Stub Length
250 m (820')	11 m (36')	55 m (180.5')

CAN BUS CABLES

⚠ **CAUTION:** The supplied Protective Cap must be fitted whenever the CAN Bus Interface is not in use. Without it, water/moisture may enter the socket which may cause serious damage.

The connection to the CAN Bus can be made using standard CAN Bus cable wiring and accessories. A Y-split CAN Bus cable and inline CAN Bus terminator cable is recommended for an easy installation and connection to other Lithium Batteries.





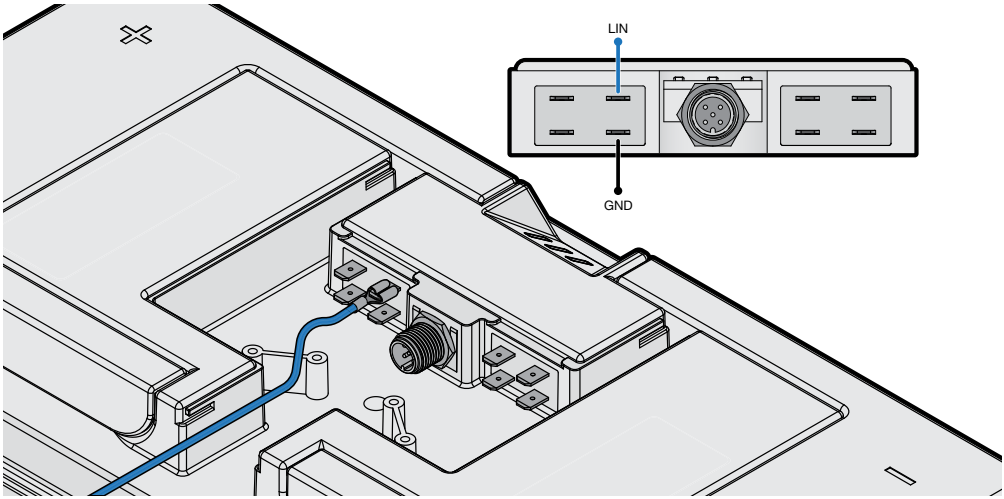
TERMINATING RESISTORS

Use terminating resistors or the inline CAN Bus terminator cable at the end nodes to maximise signal integrity. The value of this resistor should be nominally 120 Ω.

CONNECTING TO THE LIN BUS INTERFACE (FOR FUTURE USE)

The Lithium Battery includes a LIN Bus interface (Local Interconnect Network) which is accessible on FASTON 2 (LIN) under the Protective Cover (see page 9). The LIN Bus interface can be used to connect to a LIN Bus master which are often present in (recreational) vehicles or caravans.

The LIN Bus interface provides the LIN Bus master with information about the Lithium Battery like SoC and other data. Depending on the electrical installation, the LIN Bus ground can be either the negative (–) terminal or the FASTON GND. Make sure no ground loops are made when using the FASTON GND.



CI-BUS PROTOCOL

To support easy integration within the RV / caravanning industry the LIN Bus protocol is configurable. One of the protocols which can be selected is the CI-BUS protocol. When enabled, the LIN Bus provides all information necessary for the system using the CI-BUS protocol.

OTHER PROTOCOLS

The LIN Bus in the Lithium Battery can also support protocols defined by other manufacturers, this support is extended on a regular basis and prone to change. Please email REDARC to gather information about the supported protocols on the LIN Bus.

Please contact REDARC at power@redarc.com.au

IO FASTON CONNECTION AND FUNCTIONALITY

The Lithium Battery has three electrical input or output interfaces accessible by FASTON 3 (IO1), FASTON 4 (IO4) and FASTON 7 (IO3). These interfaces can be used for different purposes, and are configurable using the REDARC Lithium App.

TABLE 3

FASTON	IO Functionality	SoC Status		
		Active	OFF	Hysteresis
IO1 Output	Generator Control	Below 20%	100%	80%
IO2 Output	Inverter Control	Above 21%	Below 10%	11%
IO3 (for future use)	Reserved	Reserved for future use		

The list of supported functionalities will grow in the future and will be available by updating the REDARC Lithium App.

The I/O port can service as an input and output feature:

Input: When used, the input can measure a digital level between 0 V and 12 V (typical value). When there is 12 V on the input means that the input is made active, 0 V means input not active.

Output: When configured as such, the output acts as an “open drain” output. Open drain means that the output is pulled to 0 V when active and is floating when not active.

All I/O ports are fused with an internal re-settable fuse. When overloaded, the output will stop delivering current while the overload or short-circuit condition exists. The fuse will automatically reset when the overload or short-circuit condition is no longer active and the output will work as normal.

CHARGING THE BATTERY

Charge the Lithium Battery immediately in case of an under-voltage shutdown or if the state of charge drops below 20% to preserve the lifespan of the Lithium Battery.

CAUTION:

- Never charge the Lithium Battery with a charging current higher than mentioned in the specifications (see "Specifications" on page 33).
- Stop charging if the Lithium Battery enters error mode.
- Disconnect the charger from the Lithium Battery if it is not used for a long time.

CHARGING RATE

The Lithium Battery can be charged from empty to 100% in approximately 1 hour and 15 minutes. Always use the indicated charge current and end of charge voltage during charging.

Charging times for the Lithium Battery at different charge currents.

	Time	Charge Current
Maximum	±1 hour 15 minutes	135 A
Charge Current for Rated Cycles	Approximately 3 hours	50 A (0.3 C)

CHARGING USING A BATTERY CHARGER

IMPORTANT: Complete all previous installation steps described before connecting the Lithium Battery to a battery charger. Connect the REDARC Lithium Battery to a battery charger in accordance with the battery chargers installation instructions.

REDARC's Battery Charger ranges are compatible with LBAT12150-SB:

- BCDC Classic
- BCDC Core
- Manager
- Smart Battery Charger

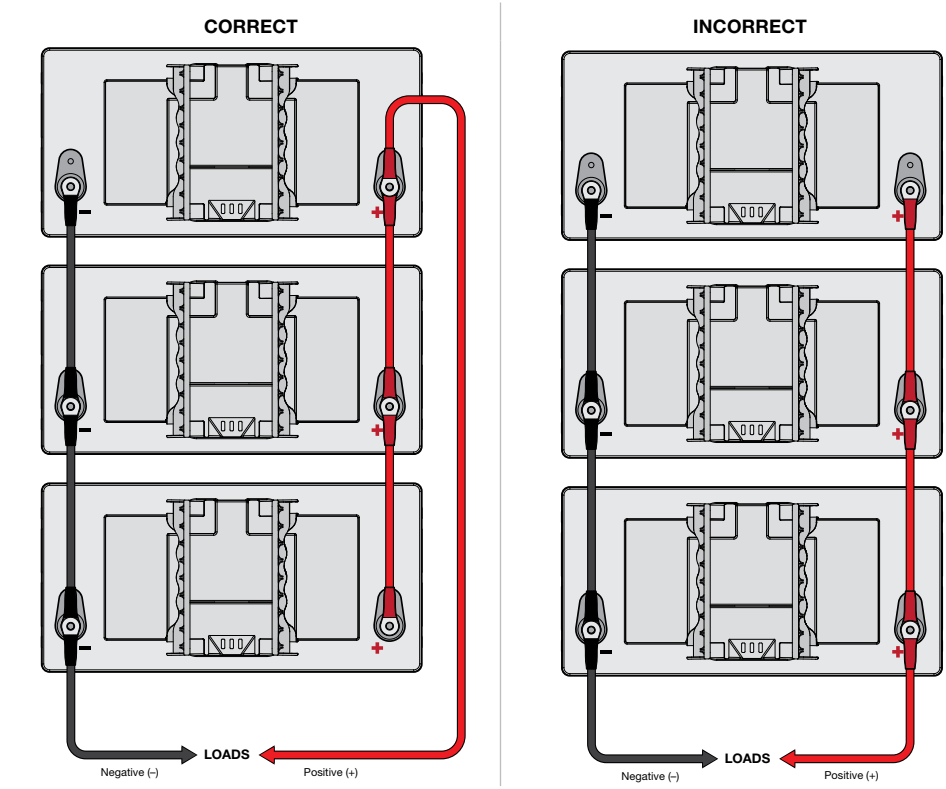
CONNECTING LITHIUM BATTERIES IN PARALLEL

⚠ CAUTION: 12 V systems only. Never install multiple LBAT12150-SB Lithium Batteries in series, never install or use a damaged Lithium Battery and; do not reverse connect the power cables (polarity).

NOTICE: Always connect batteries of the same type/capacity and age in a parallel setup.

A maximum of eight batteries can be used when connecting LBAT12150-SB Lithium Batteries in parallel. To divide the current equally amongst batteries, use the schematic bellow:

FIGURE 1



Correct Parallel Connection:

- Current equally divided.
- All batteries contribute equally to the current into the load.

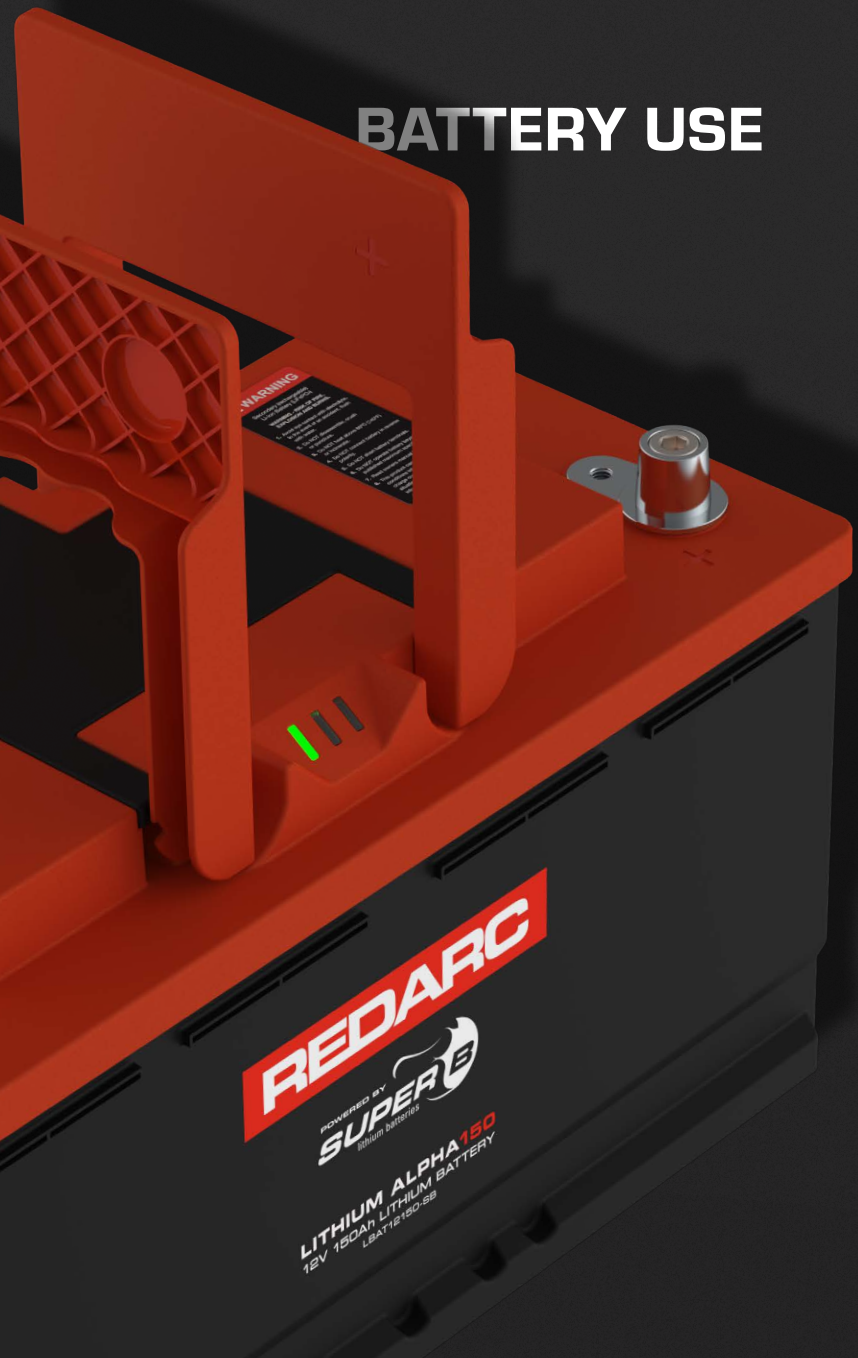
Incorrect Parallel Connection:

- Current not equally divided.
- Batteries closest to load will have the highest contribution to the current into the load.
- Batteries further away from load will have lesser current contribution.
- Wear and tear will be higher on the Lithium Battery close to the load. **Never connect the setup like this.**

DISCONNECTING THE LITHIUM BATTERY

1. Turn off any device or charger the Lithium Battery is connected to.
2. Disconnect the negative wire and accessories connection from the negative (–) terminal of the Lithium Battery.
3. Disconnect the positive wire and accessories connection from the positive (+) terminal of the Lithium Battery.
4. Disconnect all other connections like the FASTON and communication interface connection which are located under the protective cover.

BATTERY USE


WARNING
REDARC
POWERED BY
SUPER B
lithium batteries
LITHIUM ALPHA150
12V 150Ah LITHIUM BATTERY
LBAT12150-SB

GENERAL INFORMATION

⚠ **CAUTION:** Do not operate the Lithium Battery beyond its maximum specifications. Charging at deep discharge conditions can lead to venting, excessive heat or thermal runaway of the cells.

NOTICE: This product can store fault conditions internally, like excessive charge current or deep discharge situations. REDARC may use this information in the warranty process.

HEATER FUNCTIONALITY

The Lithium Battery has functionality to heat up the cells and make charging possible if the temperature of the cells is below acceptable charging temperature levels (charging LiFePO4 cells is only allowed if they are above 0°C (32°F)). The heater for this purpose is internally located in the Lithium Battery and is controlled by the BMS firmware. Multiple heating methods can be selected for the battery. Additional information can be found in the sections below. Heater Power Source

⚠ **CAUTION:** The FASTON GND is fused at a lower rate than the heater consumes. Do not connect the ground for the heaters at the FASTON GND connection.

The internal heater can be powered in two different ways:

1. Power is supplied by the Lithium Battery itself and can be aided or fully supplied by a charger connected to the positive (+) and negative (–) terminals.
2. Power is supplied by an external source via FASTON Heater power supply input and the Battery negative (–) terminal.

When an external heat source is connected, it is automatically used to heat the Lithium Battery cells. The BMS detects whether power is available at the FASTON Heater power supply input. If the user wants to use external power only, heating from terminal power must be disabled, method one or two must be used (see below). This is to prevent the energy from the Lithium Battery being used when the external source is not present (e.g. a grid power failure).

HEATING METHODS

There are three heating methods that can be used (or heating can be disabled):

1. **Method 1:** Heat up before charging (default).
2. **Method 2:** Keep at charge temperature by external source.
3. **Method 3:** Keep at charge temperature source independent.
4. **Method 4:** No heating.

Only one heating method can be used at a time and can be selected using the REDARC Lithium App.

METHOD ONE: HEAT UP BEFORE CHARGING

If one or more cells in the Lithium Battery are below 0°C (32°F) and a charge current is detected, the BMS will prevent the Lithium Battery from being charged. The BMS will then re-direct the power supplied by the charger through the Lithium Battery terminals to power the heater to heat the cells. As long as there is charging current, the heater will remain on to keep the cells above 0°C (32°F). Once the cells are above 0°C (32°F) the Lithium Battery will begin to accept charge from the charger.

NOTE: If power is detected on the FASTON HEATER power input, the BMS will prioritise this power input to heat up the cells to 0°C (32°F) before charging. If external power (FASTON HEATER power input) is being used to power the heater, method two or three are more appropriate configurations (refer below).

METHOD TWO: KEEP AT CHARGE TEMPERATURE BY EXTERNAL SOURCE

Method two keeps the Lithium Battery's cells above 0°C (32°F) using power from the FASTON Heater power input. If there is no external source available and charging is detected with cells below 0°C (32°F), the Lithium Battery will behave as per method one.

METHOD THREE: KEEP AT CHARGE TEMPERATURE SOURCE INDEPENDENT

Method three keeps the Lithium Battery's cells above 0°C (32°F) using an external source (FASTON Heater power input) or the Lithium Batteries internal energy. The Lithium Battery will prioritise heating using an external source if available. If an external source is not available, energy from the Lithium Battery will be used. If the Lithium Batteries internal energy is used for heating, the cells will be kept at 0°C (32°F) until the SoC drops below a configurable level (see Table 4). If that level is reached, the heaters will stop to prevent further discharging of the Lithium Battery.

TABLE 4

SoC	Minimum	Maximum	Default
SoC Heater Off	20%	80%	50%

Behaviour when there is no external source available:

- When the SoC is below the 'SoC Heater OFF' setting, the heating feature will fall back to Method One: Heat Up Before Charging.
- When the external power source is connected/detected again, the Lithium Battery will start heating if needed, independent of the SoC.

Behaviour when there is external source available and the Battery is drained:

If the Lithium Battery is drained due to non-heating use and therefore the SoC level drops below 'SoC Heater Off', and the external power source is used to maintain the Lithium Battery at CAT (Charge Accept Temperature) level, the heaters will continue to be powered by the external source.

BATTERY BALANCING

The BMS automatically balances the cells if necessary. The Lithium Battery can be used normally during balancing. Balancing ensures all cells are at the same voltage level and enhances usable Battery capacity.

REDARC LITHIUM APP

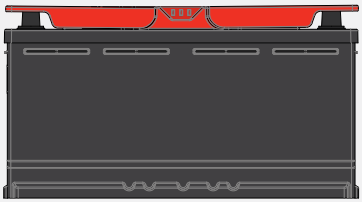
CONNECT THE LITHIUM BATTERY TO YOUR SMARTPHONE

Download the free REDARC Lithium Battery App to connect your Lithium Battery to your smartphone via Bluetooth®.

Scan the QR code below or search for 'REDARC' on your devices App store.

The app allows you to manage and view the voltage and current levels, warnings, errors and state of charge information, giving you full power of the Lithium Battery in the palm of your hands.

Lithium
Battery App



The REDARC Lithium Battery app and its interactions with the Lithium Battery have not been tested on all smartphone models. Visit the application pages within each App store to view compatibility details.

NOTICE: When updating the Battery firmware the Battery might become unresponsive and can disable the output voltage on the terminals for up to several minutes. Please be aware of this happening in your application and make sure this firmware update can be carried out safely.

BLUETOOTH®

NOTICE: Bluetooth® range is strongly dependent on the environment and how the Lithium Battery is positioned. Metal parts such as battery boxes, covers and cabling can affect the Bluetooth® range and can lead to reduced range. The mentioned range only applies to an "open field situation", and can be less or more depending on the situation.

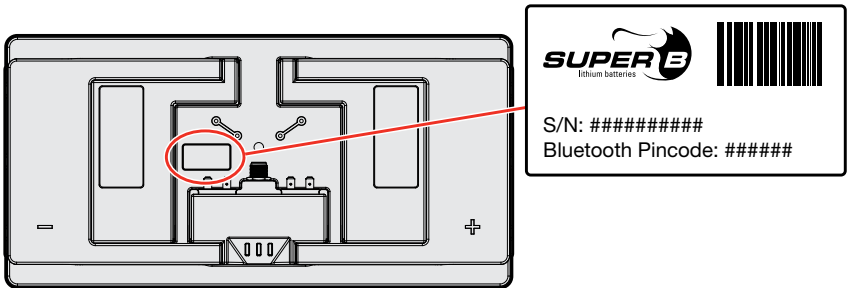
TABLE 5

Service Description	Type of Signal	Range
Bluetooth® Low Energy	Communication	10 m to 25 m (32.8' to 82') (typically)

BLUETOOTH® PAIRING (PIN CODE)

For security reasons the LBAT12150-SB Bluetooth® connection is protected with a PIN code. This PIN code is needed when pairing to the Lithium Battery and can be found on the label under the protective cover (see Figure 2). It is advisable to write down this PIN code before installation of the Lithium Battery.

FIGURE 2



READING THE BATTERY'S STATE OF CHARGE (SoC)

The Lithium Battery is equipped with an analogue SoC output, this output provides a voltage between 0 V and 10 V which reflects the 0–100% state of charge value. The state of charge can also be viewed via the REDARC Lithium App and via the LIN Bus (CI-BUS protocol).

READING THE BATTERY'S STATE OF HEALTH (SoH)

The Lithium Battery keeps track of its health using algorithms. These algorithms determine the remaining capacity at that specific moment in the Battery life, relative to the initial capacity (as new).

Example: A state of health of 95% for a LBAT12150-SB, means that the actual remaining usable capacity in the Lithium Battery is 142.5 Ah.

MAINTENANCE

⚠ **WARNING:** Never attempt to open or dismantle the Lithium Battery. The inside of the Lithium Battery does not contain serviceable parts.

NOTICE:

- Disconnect the Lithium Battery from all loads and charging devices before performing cleaning and maintenance activities.
- Before cleaning and maintenance activities fit the supplied protective caps over the terminals, put the M12 Protective Cap back in place as well as the protective cover.

INSPECTION

1. Periodically, inspect for loose and/or damaged wiring and contacts, cracks, deformations, leakage or damage of any other kind. If damaged, discontinue use immediately and replace the battery. Do not attempt to charge or use a damaged Lithium Battery. Do not touch the liquid from a ruptured Lithium Battery.
2. Routinely check the Lithium Battery's SoC. Lithium Iron Phosphate batteries continue to slowly self-discharge (< 3% per month) when not in use. Topping up the charge level periodically may be required to maintain the battery within the recommended range of 40% and 70%.
3. Consider replacing the Lithium Battery with a new one if you note either of the following conditions:
    - The run time drops below approximately 80% of the original run time.
    - The charge time increases significantly.

CLEANING

If necessary, clean the Lithium Battery with a soft, dry cloth. Never use liquids, solvents, or abrasives to clean the Lithium Battery.

STORAGE

Follow the storage instructions to optimise the life-span of the Lithium Battery during storage. If these instructions are not followed and the Lithium Battery has no charge remaining when it is checked, consider it to be damaged . Do not attempt to recharge or use it. Replace it with a new Lithium Battery.

See "Specifications" on page 33 for storage temperature conditions.

The self-discharge of the Lithium Battery is <3% per month.

1. Charge the Lithium Battery to 80% of its capacity before storage.
2. Disconnect the Lithium Battery from all loads and, if present, the charging device.
3. Place the terminal covers over the Lithium Battery's terminals during storage.
4. Charge the Lithium Battery to at least 80% of its capacity every year.

TRANSPORTATION

Check all applicable local, national, and international regulations before transporting a $LiFePO_4$ battery. Transporting an end-of-life, damaged, or recalled lithium battery may be specifically limited or prohibited.

The transport of the lithium battery falls under hazard class UN3480, Class 9. For transport over water and land, the Lithium Battery falls within packaging group PI965 Section II.

DISPOSAL AND RECYCLING

⚠ WARNING:

- Do not incinerate or dispose of in fire.
- Do not attempt to remove the internal batteries from the unit for disposal.

Fully discharge the Lithium Battery before disposal. Use electrical tape to cover over all terminals, interfaces and contacts to prevent short circuits.

$LiFePO_4$ batteries must be disposed of in accordance with local laws. Never dispose of a $LiFePO_4$ in household or general waste.

Contact your local battery recycling facility for direction on the safe disposal of the Battery.

TROUBLESHOOTING

THE LITHIUM BATTERY CANNOT BE DISCHARGED

Possible Situation	Solution
Lithium Battery is in Operational Mode (Green LED is on or flashing), but no current can be drawn from the Battery.	Check the installation of the Lithium Battery. Check main switches/fuses or other external disconnect devices. Check the Battery voltage at the terminals.
All LED's are OFF (Lithium Battery voltage < 8 V)	Battery is Deep-Discharged and has ceased all operation. Do not attempt to charge or discharge. Contact REDARC's Technical Support.
Red LED is flashing: alarm mode is active. The discharge currents or internal temperature is too high. Internal disconnect device is open.	Check the maximum current which the connection installation can draw from the Battery. Let the Battery cool down and wait for the state to reset (this can take a while). If the LED flashes red after cooling down, the BMS might still detect an issue. Check the information on REDARC Lithium App for more details on errors.
Red LED is flashing: alarm mode is active. The Battery is drained and an under-voltage has occurred. Internal disconnect device is open.	Recharge the Battery to 100%.

THE LITHIUM BATTERY CANNOT BE CHARGED

Possible Situation	Solution
Lithium Battery is in Operational Mode. Green LED is lit or flashing.	Check the installation of the Lithium Battery. Check all main switches/fuses and other external disconnect devices. Check the Battery voltage at the terminals.
Lithium Battery is in alarm mode because the charging voltage is too high. Red LED is lit or flashing.	Verify that the charging voltage is within the Lithium Battery specifications. Discharge the Lithium Battery.
Lithium Battery is in alarm mode because of high temperature. Red LED is lit or flashing.	Disconnect the Lithium Battery from load/charger and wait for it to cool down.
Lithium Battery is in alarm mode because of too high charge current. Red LED is lit or flashing.	Discharge the Lithium Battery, lower charge current.

THE CAPACITY OF THE LITHIUM BATTERY HAS DECREASED

Possible Situation	Solution
The cells within the Lithium Battery are not properly balanced or is worn out.	Perform one full charge (100% SoC) cycle to balance the cells.

THE HEATER NOT WORKING

Possible Situation	Solution
Lithium Battery is in Operational Mode but temperature is within normal cell specifications. No need to heat up the cells.	Heater is not broken, when the temperature drops below 0°C (32°F) it will turn on when the settings are correct.
Lithium Battery is in Operational Mode, temperature is below 0°C (32°F) and there is a need to charge.	Check settings for the heaters. Check if external power is active and can deliver enough power to supply the heaters.

BLUETOOTH® ERRORS / CONNECTION PROBLEMS

Possible Situation	Solution
Connection rejected.	Remove Bluetooth® pairing from device settings. Verify no other device is using the Bluetooth® connection. Re-pair again and use correct PIN code supplied with the Lithium Battery.
Connection cannot be made or battery cannot be found.	Check if the smartphone and Lithium Battery are within range. Make sure the Lithium Battery has a working LED Indication. Check if no other devices are connected to the Lithium Battery. Switch off/on Bluetooth® on your smartphone and retry.

SPECIFICATIONS

GLOSSARY OF TERMINOLOGY

BMS	Battery Management System
Charge Cycle	A period of use from fully charged, to fully discharged and fully recharged again.
Endurance Life-cycle	The products maximum life-span, achieved by following the guidelines presented in this manual.
$LiFePO_4$	Lithium Iron Phosphate
SoC	State of Charge
SoH	State of Health
CCCV	Constant Current, Constant Voltage
DoD	Depth of Discharge
I/O	Inputs and Outputs

GENERAL PRODUCT SPECIFICATIONS

Battery Designation	IFpP / 27 / 148 / 135 [3p4s] M / –20 +60 / 95
Cycle Life	> 5000 (0.3 C Charge / Discharge, DoD 100%)* > 3500 (0.9 C Charge/ Discharge, DoD 100%)*

*The cycle life value given above is an indication at 23°C (73.4°F). The Lithium Battery cycle life depends strongly on temperature and the applied charging and discharging loads.

ELECTRICAL SPECIFICATIONS

Nominal Capacity	150 Ah
Energy	1920 Wh
Nominal Voltage	12.8 V
Open Circuit Voltage	13.2 V
Self Discharge	< 3% per month

MECHANICAL SPECIFICATIONS

Dimensions (L × W × H)	353 × 175 × 190 mm (13.9" × 6.9" × 7.5")
Weight	16 kg (35 lbs)
Case Material	PC / ABS
Ingress Protection	IP56
Cell Type / Chemistry	Prismatic — $LiFePO_4$

FASTON CONNECTION ELECTRICAL SPECIFICATIONS

	Description	Value
I/O Connection 1–3	Input Voltage Range	0 V – 15 V
	Input Impedance	> 100 kOhm
	Input High Level	> 8.4 V
	Input Low Level	< 6.8 V
	Output Current Sink (open drain output type)	0.5 A
SoC Output	Output Voltage Range	0.01 V – 10 V
	Output Impedance	< 1 Ohm
Heater Input	Input Voltage Range	12 V – 15 V
	Power Rating	120 W

CHARGE AND DISCHARGE SPECIFICATIONS

Charge Method	CCCV
Charge Voltage	14.3 V – 14.6 V
Max Charge Current	135 A
End of Discharge Voltage	8 V
Discharge Current Continuous Maximum	200 A
Discharge Pulse Current (10 sec)	350 A

TEMPERATURE SPECIFICATIONS

Charge Temperature (heating off)	0°C to 45°C (32°F to 113°F)
Charge Temperature (heating on)	–30°C to 45°C (–22°F to 113°F)
Discharging Temperature	–20°C to 60°C (–4°F to 140°F)
Storage Temperature Short Term (<1 month)	–20°C to 45°C (–4°F to 113°F)
Storage Temperature Long Term (>1 month)	18°C to 28°C (64°F to 82°F)
Relative Humidity*	10 – 90%

*Charging from –30°C (–22°F) is only possible with an external power source to power the heaters, the correct settings should be used. Long term exposure to temperatures >35°C (>95°F) might affect the Battery's capacity and cycle life.

J1 CAN BUS (FOR FUTURE USE)

Pin	Signal	Description
1	CAN_SHLD	Optional CAN Bus Shield
2	NC	Not in use
3	CAN_GND	Ground / OV
4	CAN_H	CAN_H Bus Line (Dominant High)
5	CAN_L	CAN_L Bus Line (Dominant Low)

NOTE: CAN Bus is not galvanically isolated.

COMPLIANCE SPECIFICATIONS

Certifications	RCM, FCC, UN 38.3, UN ECE R10.06, UL1642 (Cells), CAN ICES-003 (B) / NMB-003 (B)
Shipping Classification	UN3480

Note: 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:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm (7.9") between the radiator and your body.

This device complies with Industry Canada (IC) license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes.

1. L'appareil ne doit pas produire de brouillage.
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillardest susceptible d'en compromettre le fonctionnement.

This device contains:

FCC: Y82-DA14531MOD
IC: 9576A-DA14531MOD”

WARRANTY

LIMITED WARRANTY

For full warranty terms and conditions, visit the Warranty page of the REDARC website:
www.redarcelectronics.com/warranty

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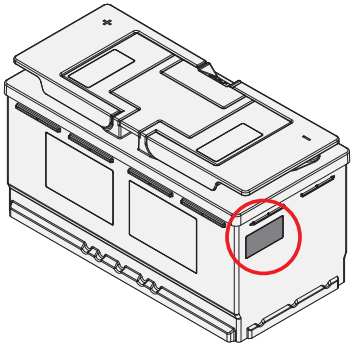
CHECKING THE PRODUCT SERIAL NUMBER

The product Serial Number is located on the Lithium Battery and on the product packaging.



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