Installation & User Guide

High Power (HP) Batteries

Medium Size

Models:

LBS-12150-HP-REG
LBS-12150-HP-BIC
LBS-12200-HP-REG
LBS-12200-HP-BIC
LBS-12225-HP-REG
LBS-12225-HP-BIC
LBS-12300-HP-REG
LBS-12300-HP-BIC
LBS-2475-HP-REG
LBS-2475-HP-BIC
LBS-24110-HP-REG
LBS-24110-HP-BIC
LBS-24150-HP-REG
LBS-24150-HP-BIC
LBS-3675-HP-REG
LBS-3675-HP-BIC
LBS-4875-HP-REG
LBS-4875-HP-BIC

Due to continuing improvements, the product you have purchased may differ slightly from the products described herein.

Contents

1.0 Acronyms & Abbreviations

BIC	Built-In-Controllers
BMS	Battery Management System
HP	High Power
LBS	Lithium Battery Systems
REG	Regular
DCS	Direct Current charging for Smart alternators

2.0 Introduction

Congratulations! You have purchased a state-of-the-art lithium battery and we hope you enjoy many years of trouble-free life. This Installation and User Guide describes how to connect and safely operate the High Power (HP) range of Medium Size batteries.

The regular (REG) models (Figure 2b) contain no internal controllers. The BIC models (Figure 2a) contain a built-in solar controller which can take direct solar panel input, and a DC Charge controller that controls charging current from a vehicle alternator / start battery. (The BIC-DCS model, not covered in this user guide, contains a further DC-DC charger to regulate charging from a vehicle with a smart alternator.)

In the context of this guide, the term High Power (HP) refers to the BMS charge and discharge current capability. In most models the BMS allows charging at up to 150A and discharge at 200A continuous / 500A surge.

Figure 2a
LBS-*****-HP-BIC

Figure 2b
LBS-*****-HP-REG

As with all batteries, you should consider the mechanical and environmental conditions that you intend to operate the battery in to maximise overall performance and achieve the longest battery life. LBS offer these general guidelines; however, you should seek LBS advice or that of a qualified electrical tradesperson if you are in doubt.

3.0 Do's and Don'ts

This battery contains lithium iron phosphate (LFP) cells. While LFP cells are the safest Li-Ion chemistry, the stored chemical energy represents a risk of fire, burns or explosion if misused.

Avoid injury to yourself and others, adhere to the warnings in this Guide.

- **Do NOT connect batteries in series (parallel is OK).**
- Avoid mechanical shock
- Do not expose to fire
- Do not pierce battery
- Do not disassemble
- Do not drill into enclosure
- Do not short the terminals
- Do not allow water to enter
- Do not charge battery below 0°C
- Do not store battery below -20°C or above 60°C

2.1 Ensure the battery is physically secure

Even though lithium batteries are light weight in comparison to lead acid, they can still become a dangerous projectile in a moving vehicle, RV, cart or boat if not secured. Ensure the battery is safely secured before travel. If in doubt seek LBS advice and consider making use of LBS mounting brackets to safely secure the battery.

2.2 Do not penetrate the battery enclosure

You may be tempted to drill into the aluminium enclosure to secure mounting brackets. Doing so may inadvertently penetrate one of the cells which could cause thermal runaway and vapour emissions. Do not under any circumstances drill or penetrate into the enclosure. Use only existing mounting holes in the battery and short screw lengths no greater than 13mm.

We strongly recommend the LBS mounting kit with screws and brackets that are designed to safely attach to the battery; alternatively use strapping and clamping to secure the battery in place.

2.3 Maintain an acceptable temperature range

Like all batteries, LBS batteries operate and perform the best, as well as last the longest, in a cool and stable temperature environment of between 10°C and 25°C. The maximum window of acceptable operation is 0-45°C.

If you regularly operate outside of this suggested range, you should consider changing the battery location or actively cool or heat the environment in order to preserve battery life. If the ambient temperature that the battery operates in is greater than 60°C you should cease use immediately. Operating outside of these guidelines diminishes the life and performance of the battery and voids the warranty.

2.4 Avoid repeated shock and vibration

Whilst the battery is robustly constructed and protected in an aluminium enclosure, it is not designed to operate continuously in high shock or high vibration environments. Normal use in a 4WD environment is acceptable and the battery has been designed in accordance with these expected conditions. However, dropping the battery or exposing the battery to a high number of excessive vibrations may lead to a fault or failure of the battery.

2.5 Avoid exposure to water or salt spray

Whilst the battery is mechanically protected, the enclosure is only IP20 equivalent and is not designed for a wet environment. Do not submerge the battery in water or expose the battery to direct water spray. If it is likely that a water will be on the floor where the battery is located, ensure the battery is facing upwards with the terminals (and electronics) on the top, so that any water that gets into the bottom can drain out again without touching the electronics.

Avoid exposing the battery long term to salty water spray such as in a marine environment to avoid corrosion. Salt laden air may also cause corrosion in the long term; therefore, minimise exposure by installing the battery in a protected hatch or compartment.

2.6 Do not short circuit the battery

Whilst the BMS will protect the internal cells from short circuit, it is highly recommended to avoid short circuiting the battery. Appropriately sized external fuses should be used where possible.

Pay attention when using metallic tools in the vicinity of the terminals, as accidentally contacting the positive and negative terminal with a metallic object like a spanner will cause a short circuit and spark. Always keep the plastic caps screwed on when not using the terminals.

Always perform work on passive wiring first and connect the live battery as the last connection. If you have to, when working on live circuits, exercise due care and use insulated tools where possible. If you are unsure how to install the battery, seek advice from LBS or a suitably qualified electrical tradesperson.

2.7 Mounting orientation

The typical operating orientation is with the terminals facing upwards and should be the first option if possible. Having the battery terminals facing forwards is also an acceptable orientation. The battery uses the aluminium lid as a heat sink, the function of which can be hampered by an upside-down orientation; therefore, mounting upside down is not recommended. If in doubt, contact LBS or a suitable tradesperson for advice.

IF THE SUPPLIED MOUNTING BRACKETS ARE NOT SUITABLE, USE EXTERNALLY SUPPORTED STRAPPING OR BRACKETS. DO NOT DRILL INTO THE BATTERY ENCLOSURE OR REMOVE RIVETS FROM THE BATTERY ENCLOSURE. IF METAL SHAVINGS OR PIECES OF METAL FROM REMOVED RIVETS FALL INTO THE ELECTRONICS, THIS WILL CAUSE DAMAGE AND VOID THE BATTERY WARRANTY.

4.0 Longevity & Depth of Discharge

One of the advantages of lithium batteries over lead-acid batteries is longevity. If you want to realise the long life potential out of your lithium battery, then consideration must be given to depth of discharge.

The electronics inside the battery enclosure is designed to monitor the charge – if you connect a solar panel to your battery for the purpose of maintaining 100% charge, this will be switched on when needed. You do not have to keep a constant watch on the screen display – a constant green LED on the battery display panel means that the battery is charging. The internal electronics are working to protect the battery from being overcharged, as well as when the battery is close to empty.

When the battery is supplying current to a connected device such as an inverter, the green LED on the battery display marked 'STAT' will continuously flash on and off every second.

For example, if you have solar panels continuously connected to your battery, the electronics will not allow the battery to remain at a maximum charge level. Keeping your battery at a maximum is not as important as it is for lead acid batteries.

A battery lifespan is rated by the number of cycles before the original capacity has reduced by a certain amount; a cycle is defined as discharging from fully charged, to a percentage Depth of Discharge (DOD), and then charging back to full again. So, DOD describes what percentage of the battery capacity is being used each time.

Note: DOD is different to State of Charge (SOC, also known as Charge Level); in fact, they add together to 100%. So, 80% DOD equates to 20% SOC.

The less DOD you use each cycle, the longer the battery will last.

This fact should be considered when choosing the battery Amp hour capacity. You will have a higher return on battery investment if there is enough capacity at hand such that you are not heavily discharging the battery on every cycle. Extra capacity ensures lower DOD, extended life and a higher financial return on your investment.

LBS batteries have a lifespan of:

- 5,000 cycles if you use 50% DOD, or
- 2,000 cycles if you use 80% DOD.

4.1 Discharge Curve

Note that unlike lead acid batteries, lithium batteries hold their voltage over the cycle, dropping off only when the battery is about 90% discharged, as indicated in Figure 4-1 for illustrative purposes.

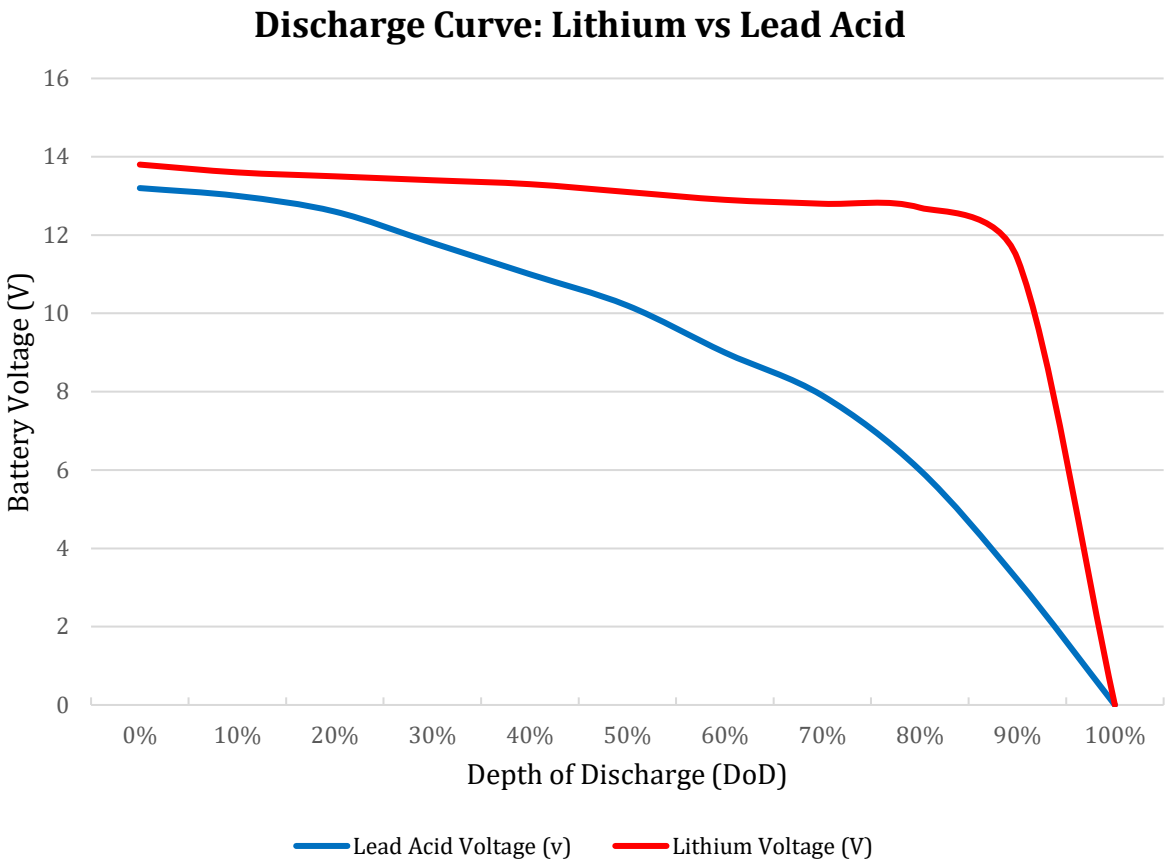


Figure 4-1 – Volt Curve Lead Acid vs Lithium

5.0 Installation

5.1 Securing the Battery

It is strongly recommended to use the LBS purpose-made mounting brackets and screws to secure the battery in its permanent location. The battery enclosure has been specifically designed with pre-drilled holes to locate aluminium angle brackets at various points to suit different compartments, locations and battery orientation (terminals facing up or terminals facing to the side).

Figure 5-1: Battery Mounting Bracket Options

Unsecured batteries in moving vehicles represent a projectile hazard in the event of an accident. Refer to the specific battery model datasheet for mounting bracket options. As mentioned earlier in section 2, do not remove rivets or penetrate the enclosure in any way – drilling holes into the enclosure or removing rivets to mount brackets will cause metal shavings to interfere with the electronics inside.

Mounting orientation

The typical operating orientation is with the terminals facing upwards and should be the first option if possible. Having the battery terminals facing forwards is also an acceptable orientation. The battery uses the aluminium lid as a heat sink, the function of which can be hampered by an upside-down orientation; therefore, mounting upside down is not recommended. If in doubt, contact LBS or a suitable tradesperson for advice.

5.2 Connecting the battery

All HP Medium batteries contains a red positive and black negative M10 terminal post. This is the main connection point for all loads. Wiring for these should be connected in the order described below.

Additional input options are available via Anderson plugs for the BIC and BIC-DCS models. The BIC-DCS has an additional DC-DC charger option inside the enclosure and is not described in this user guide.

Figure 5-2: High Power REG Battery

Figure 5-3: High Power BIC Battery

Batteries OFF

Firstly, ensure that all batteries are turned OFF. The LED backlight of the blue power switch will be off, showing that charge and load has been disconnected.

Connect Wiring

Connect the positive terminal of the battery first and immediately replace the terminal cap, then connect the negative terminal and immediately replace the terminal cap. Connect the ring terminals over the terminal post and add the washer and nut and tighten securely (10Nm). EXCESSIVE FORCE WILL DAMAGE THE TERMINAL MOUNTS. Replace each terminal cap so that it locks tight with the nut. The red and black terminal caps are there for safety protection and to prevent accidental shorting of the terminals from a metal object such as a spanner. TAKE CARE NOT TO SHORT CIRCUIT THE BATTERY DIRECTLY BETWEEN THE POSITIVE AND NEGATIVE TERMINAL POSTS, OR THE POSITIVE POST TO ANY METALLIC OBJECT!!!!

Connect Isolators

Turn ON / connect any isolation switches / circuit breakers / fuses to the inverter / motor controller.

We recommend not to use isolation switches or circuit breaker between the batteries and inverter/motor controller, as this can cause issues with inrush currents into capacitors if the inverter is connected when the battery is already on; this is detected by the BMS as a short circuit condition, which may trip overload protection. Alternatively, if there is an isolator switch / circuit breaker / fuse between the battery and inverter, it should be connected **before** the battery is turned ON.

The batteries limit inrush current by using a soft-start function during the first few seconds after the battery is turned on. However, this relies on the inverter already being connected.

Other DC loads that draw current as soon as they are turned on may interfere with this soft-start function; if possible, they may need to be disconnected when the battery is first turned on.

Batteries ON

TURN ON THE BATTERY. This is the square **blue** POWER pushbutton inside the protective cover. If the blue backlight behind the button is on, the battery is on as shown in Figure 5-1. If not, push the button to turn the battery on. You can reset the battery by pressing the power button off and on again. Resetting the battery is sometimes necessary when using 'smart chargers.

WHEN THE BATTERY IS INITIALLY TURNED ON, ALL THE GREEN LEDS WILL FLASH FOR A FEW SECONDS. ONLY ONE LED WILL FLASH CONTINUOUSLY ON THE LEFT-HAND SIDE OF THE BATTERY DISPLAY SCREEN. IF YOU SEE A RED FLASHING LED, THEN THERE IS A FAULT WITH THE BATTERY AND YOU NEED TO REFER TO THE TABLE 6-1.

Once turned on, a single green LED will be on constantly while being charged. The square blue button also remains illuminated.

When in a dormant state with no active load, a single green LED will flash every 5 seconds. The square blue button also remains illuminated.

Loads ON

Large loads such as inverters and motor controllers can now be turned ON.

5.3 Anderson Plugs – BIC Version Only

On the left-hand side of BIC batteries there are four Anderson plug connections (grey, black, red and blue). Black, blue, red plugs have overcurrent protection that will either restrict current to less than 45A, or trip an error if current exceeds 45A.

The uses for these additional inputs are summarised below:

Grey: Directly connected to the main terminals to allow additional temporary loads and charging sources to be connected to the battery when the terminal posts are already occupied – e.g., another inverter (max 600W) or a folding solar panel with integrated charge controller. Max current 50A in or out.

Black: Monitoring of **external** physically separate charger – could be:

- AC/mains charger
- Solar charger / charge controller / charge regulator
- DC-DC charger

Red: 12V (nominal) solar panels in **parallel**: max V_{oc} ~24V (without a charge controller);

i.e., unregulated solar

Blue: DC charging from a 12V alternator / start battery, as long as the voltage remains above that of the lithium battery, and also above 12.8V.

NB: Please ensure that the battery is turned **ON** if you intend to charge your battery. Charging from solar panels or chargers will not occur when the battery is switched off because the BMS disconnects the battery in the OFF state.

With respect to DC charging from a 12V alternator, the BMS is programmed to block charge when the cells are completely full, and continue to block charge until all cells are BELOW 3.35V.

This is done for 2 reasons:

- Cell lifespan is better when cells are not held at 100% for long periods, i.e., they last longer at 80% SOC. (In this way they are opposite to lead acid/AGM etc cells)
- To avoid high charge and discharge currents repeatedly turning on and off – this is not good for charger electronics etc.

For example, if you notice that your lithium battery is not charging, put a load on this battery, or wait a little longer. The max cell voltage will drop below 3.35V – this will reset the charge blocking and allow charging again.

5.4 Voltmeters

Voltmeters are connected directly to the Anderson plugs they are next to, for diagnostic purposes. Therefore, they show the voltage of whatever is plugged into that Anderson plug. They may also be connected to the battery; in which case they will show the battery voltage. To check what voltage is coming from a solar panel / vehicle alternator, etc. - just turn off the battery with the charging source connected and read the voltmeter value.

6.0 Battery User Guide

6.1 Battery Management System

Your battery comes with a Battery Management System (BMS) mounted internally.

The BMS is an electronic solid-state circuit board which manages the cells and protects the battery across a range of scenarios which primarily includes over charge and over discharge protection. Unlike lead acid batteries, over charging or over discharging a lithium battery may lead to a hazardous scenario. Therefore, the BMS is the heart and soul of a lithium battery.

The HP battery BMS is a highly reliable and functional solid-state device which is primarily designed to keep the cells safe and the overall pack from being damaged by excessive voltage or excessive discharge event.

In the context of this guide, the term High Power (HP) refers to the BMS charge and discharge current capability. The BMS allows charging at up to 150A and discharge at 200A continuous or 500A surge for <1 second.

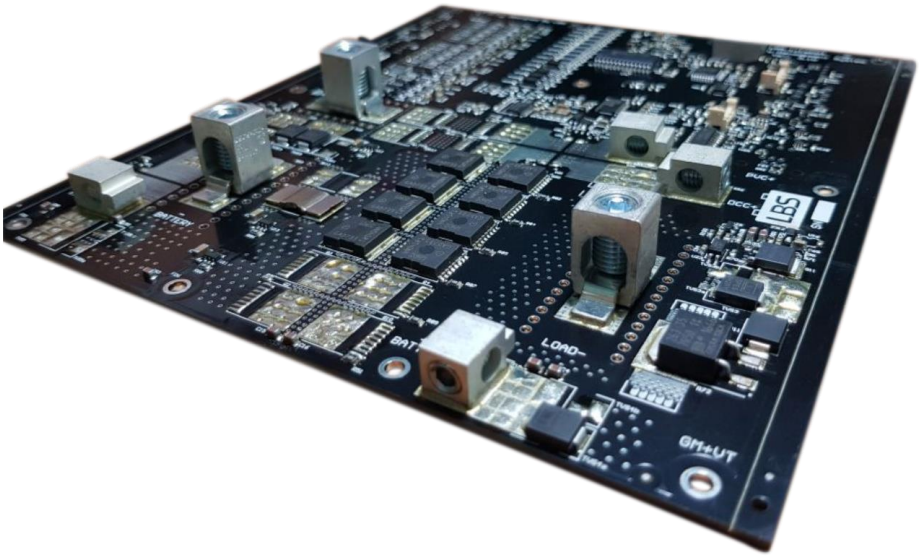


Figure 6-1 HP BMS

6.2 BMS User Interface

The BMS user interface on the REG, BIC and BIC-DCS models is the same, and located as shown in Figure 6-2. A clear plastic protective cover over the interface helps to protect from ingress of dust, dirt, debris and any water.

Figure 6-2 BMS User Interface Location

A detailed view of the interface is illustrated in Figure 6-3 and shows a close-up of the Comms port, Status LED, Shutdown Button, Start Button, Power button and BIC 1, 2, 3 LED status light which are discussed below.

Figure 6-3 HP BMS User Interface

STATUS LED

Green solid = net charging,

green fast flashing = net discharging

green flash every 5 seconds = battery on, but no net current

If the STATUS LED is flashing RED, this means the BMS has disconnected the battery because of some Protection/issue and has gone into one of the following error states shown in Table 5-1 on page 16.

The issue is shown by the number # of flashes of the RED LED on the battery as follows (and described on the remote Monitoring Screen).

# Flashes of red LED	Description of Protection	Result	Action Required
0	Normal State	-	None
2	Low Voltage Disconnect (LVD) CUV: Cell Under Voltage Battery empty	Loads Disconnected	Connect charger; Screen: Enter button, or Battery: Power Button
3	BMS too hot	Loads & Charge Disconnected	Reduce temperature; wait to recover
4	Battery too cold (UTD: Under Temperature Discharge.)	Loads Disconnected	Increase/Reduce Temperature; wait to recover
5	Battery too hot (OTD: Over Temperature Discharge.)		
6	Short Circuit (Load current > 1000A for 70µs)	Loads Disconnected	Screen: Enter button, or Battery: Power Button
7	Surge Overload (Load current > 500A for 1 second)		
8	Over Current		
9	Communications issue	Screen readings incorrect	Battery: Shutdown, then Start button
10	Voltage Reading Mismatch (cells vs pack)	Loads & Charge Disconnected	Battery: Shutdown, then Start button

Table 6-1 BMS Status Light Diagnostics

Apply the appropriate remedy as above – usually by pressing the power button off and on again, or by pressing Enter on the Monitoring Screen.

Low Voltage Disconnect

The most common situation is #2 where the battery has been drained to empty and the Low Voltage Disconnect (LVD) has occurred – in this case you should do the following:

1) Turn off all major loads (e.g., inverters, pumps etc.). Small loads such as lights and fridges are OK to remain connected – provided that they draw less current than what the charger can supply. However, all connected loads will draw current from the charger and so will reduce the rate at which the battery charges.
2) Connect your charger(s) – maximum input current should be limited to 45 Amps.
3) If you have an LBS AC charger (or solar panels/alternator into an LBS BIC battery), this will automatically charge the battery up to an acceptable level, after which the battery will connect again. (Just check your AC mains/shore power is connected and switched on!)
4) If you have another brand of charger, it may not charge automatically until it can "see" the battery, which means you may need to reset the battery before your charger will begin charging. You can reset the battery by pressing the power button off and on again, or by pressing Enter on the Monitoring Screen. This will allow 1 minute for the charger to start up and start charging.
5) You may also need to reset your charger (after resetting the battery), by turning the charger switch OFF and ON again, or disconnecting and reconnecting the AC mains/shore power.

It is worth noting that LVD is based only on voltage; i.e., the Level / SOC % does not affect this. Therefore, the Level could be 0% well before the disconnection occurs (this is intentional – similar to the reserve fuel tank of a vehicle). Conversely the Level reading may have lost track slightly and predict that more capacity is left that there actually is, so the LVD may happen earlier than expected. This is OK, as the Level reading will reset after an LVD event.

Short Circuit & Surge Overload

Protection 6 or 7 may occur when an inverter or motor controller is connected to the battery – such loads have very high inrush currents into their capacitors, and this is detected by the BMS as a short circuit or overload condition, even though it happens far too quickly to trip a circuit breaker or blow a fuse.

The BMS has a built-in Pre-Discharge circuit to avoid this issue by limiting the inrush current into such loads during the first few seconds; however, this only operates when the BMS turns on or recovers from reset.

Therefore:

1. Always connect capacitive loads with the battery OFF, and the load (inverter / motor controller) OFF.
2. When turning ON the battery, or resetting a Protection, always ensure the inverter / motor controller is OFF.
3. Wait at least 5 seconds after turning on or resetting the battery before turning ON the inverter / motor controller and powering an appliance or motor.

Comms reset:

If there is ever an issue with communications from a battery, this can be resolved by resetting the battery:

Press **Shutdown** (little black pushbutton near blue backlight power button on top of battery)

On some buttons, this will also restart the battery, and the LED lights will flash during startup. If this does not happen, press **Start** (another little black pushbutton near blue backlight power button on top of battery). *OLD VERSION ONLY*: The buttons only need to be pressed quickly and lightly; if they are pressed too hard, they can "stick" and remain depressed – this needs a wiggle with a fingernail so they spring back to their unpressed state (the latest battery version uses different hardware that does not do this).

Repetitive Tripping

In some cases, the inverter's capacitors do not successfully charge up during the Pre-Discharge phase, and so will cause a trip (6: Short Circuit or 7: Surge Overload) after a few seconds every time the battery is reset / turned off and on again. This is usually due to other 12V loads sucking current that is intended for the inverter.

If your battery keeps tripping after reset / turning on, you may need to turn off / disconnect all other 12V loads until the battery remains ON when connected to the inverter without tripping. Then you can turn on other 12V loads as normal.

Reset from Display Screen

You can press the Enter (right hand) button on the display screen to reset the battery. This is the same button that cycles through the information screens on the Display when there is no Protection state.

Reset from Battery

You can also press the power button OFF and ON again.

START Button - Hibernation / Shutdown

If the battery stays in the LVD for a long time, the power draw of the BMS, LEDs, monitoring screen etc will eventually flatten the battery further to a state where the BMS will shut down completely to prevent damage to the battery.

If the battery has been left in state #2 (empty) for a long time, the voltage will eventually get so low that the entire BMS will shut itself down to conserve power and go into a hibernation mode.

In this state the power switch and reset button will have no effect, and no Status/Protection LED will be shown. The Battery Charge Level / State of Charge (SOC) value will also be forgotten.

To "wake up" the battery from this Hibernation mode you will need to connect a charger, then press the START button. After "waking up" you have 30 seconds to bring the voltage of the battery back up to an acceptable range, or the battery will shut down into hibernation again.

SHUTDOWN Button

Acts like a reset button to revert back to the factory default settings.

Some older models of LBS batteries require pressing the Start button to wake up again.

BIC 1, 2, 3 LEDs

The BIC 1, 2 and 3 LED lights relate to corresponding BIC voltmeter. A solid green BIC LED means that the correspond BIC port is charging; a green flashing LED means that port is discharging

COMMS Port

The COMMS (or communications) port is where the remote monitoring screen is connected via a RJ12 plug (like old telephone cables). The remote monitoring screen is discussed in the next section.

7.0 Remote Monitoring Screen

The LBS remote Monitoring Screen shown below can be used to monitor and control the battery remotely, such as in the cabin of an RV. It is designed with an LCD display and 2 push buttons to display diagnostic information about the batteries connected to the system.

The remote Monitoring Display has 2 buttons on the front cover as shown below.

From left to right:

- SETTINGS (cog shaped icon)
- ENTER (arrow)

SETTINGS Button

Please do not touch unless instructed by supplier/auth service agent.

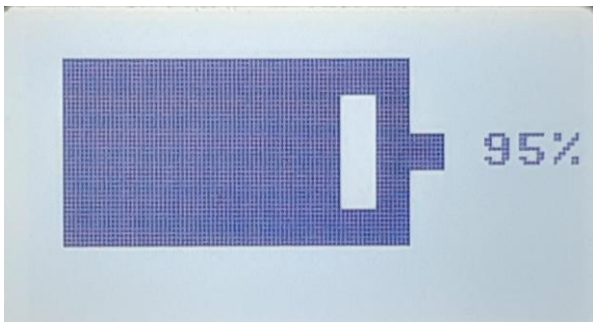
ENTER Button

Depressing the ENTER button cycles through the screen pages once takes you to the first screen which shows state of charge Level %, number of batteries in the system, battery voltage (V) and net amps in/out (A).

Screen Pages

This is the scan screen which appears after the battery is turned on. The software will search for all batteries connected to the system, regardless of if there is one battery or more. This should take about 20 seconds:

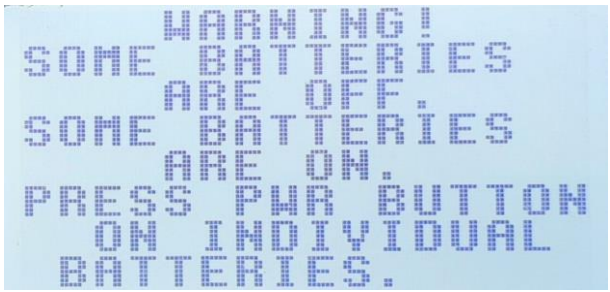
This screen indicates the battery level. If more than one battery is connected in parallel within the 12V system, this screen indicates the overall system level (SOC - state of charge):



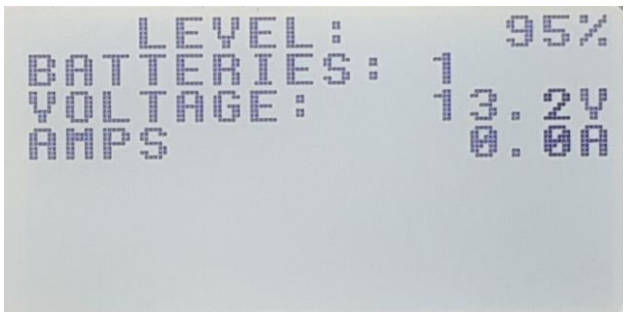
One minute after being turned on, this screen will automatically appear to show that the screen is checking for additional batteries that were connected after the screen first turned on. Disconnecting and reconnecting a battery will cause the system to scan again.

Once the software has finished scanning for extra batteries connected to the system, a summary page and a diagnostics page for each battery will displayed when the menu select key on the screen is pressed (the right-hand button with the arrow).

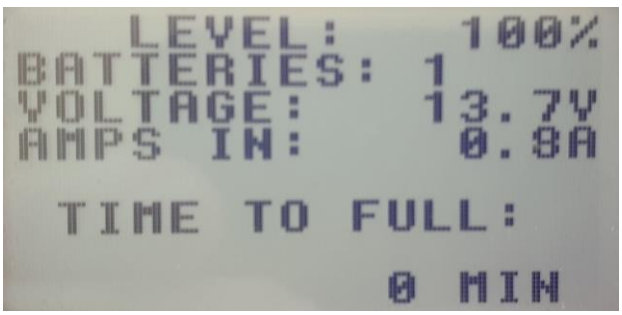
If you have more than one battery connected, switching off one or more of the batteries will show this screen page below. Turning the battery back on will remove this screen and return to the battery level page. If you have an assortment of new and older BIC and REG batteries and you are not seeing all of the connected batteries, ***turn on all batteries individually (via blue power button) before connecting the remote screen.*** This ensures that when the screen first powers on, it finds all batteries connected to the network:



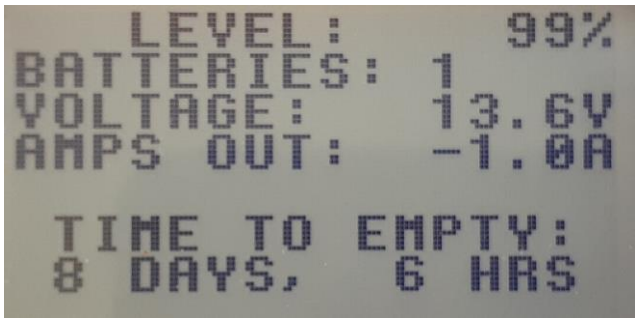
Below is a summary page that indicates the battery charge level, the number of batteries connected to the system, the battery voltage and the current supplied or drawn. For a single stand-alone battery without a connected load or charger, the display reads as below:



If discharging, it shows the Amps out and the time to empty – a continuously flashing green LED will be seen on the battery display (not this screen). If charging, it shows the charge current in Amps and the time to reach full charge - a constant green LED will show on the battery display.



For example, if you only have an inverter connected directly to the terminal posts of the battery, the display will indicate the Amps being drawn (a negative number):



If you were to have only a charger connected directly to the terminal posts of the battery, the display will indicate the Amps being supplied (a positive number):

If you are not seeing all of the connected batteries; i.e., the number on the summary page is less than the number of batteries in your system, do the following:

1) Firstly, unplug the RJ12 cable from the back of the screen (or the other end of the cable at the batteries) and plug it in again – this will power cycle the screen and thus rescan the battery network, and find any batteries that were connected/turned on after the screen turned on.
2) Perform a comms reset (page 17) on the batteries that are not found.

This is the diagnostics screen for each battery in the network, which shows cell voltage (V), cell temperature (°C), BMS temperature (°C) and previous error:

Max, Min are for each of the battery cells – should be very similar, unless full or empty;

Prev E: is previous error code – ref earlier to the Protection/warning in table 6-1;

Prev W: is previous warning code;

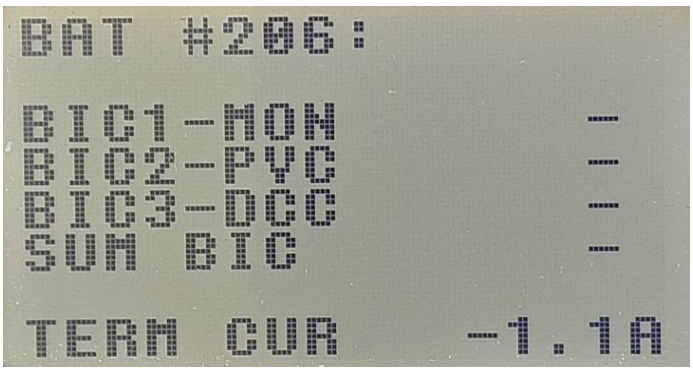
T: how many times max temperature has been reached;

S: shows if settings have been changed.

# denotes battery number for a network of batteries, BIC and REG models may be combined.

The home and summary screens relate to all batteries connected to the system; all other screens displayed are specific to each battery in the network.

This is the BIC screen. This shows the charging and discharging currents of the black, red and blue connections on the side of each battery connected to the system. Below is the display when the battery is not connected to any load or charging inputs:



The TERM CUR value indicates the amount of current into or out of the grey Anderson connector and the battery terminals, which are both connected in parallel. Low readings of ±0.3 Amps can be taken as a zero-value due to the response of the electronics to small changes in measurement.

For example, if you had an AC charger connected to the black Anderson connector, the diagnostic screen will show the input current for BIC1-MON: