Installation & User Guide

Slimline (SL) Range

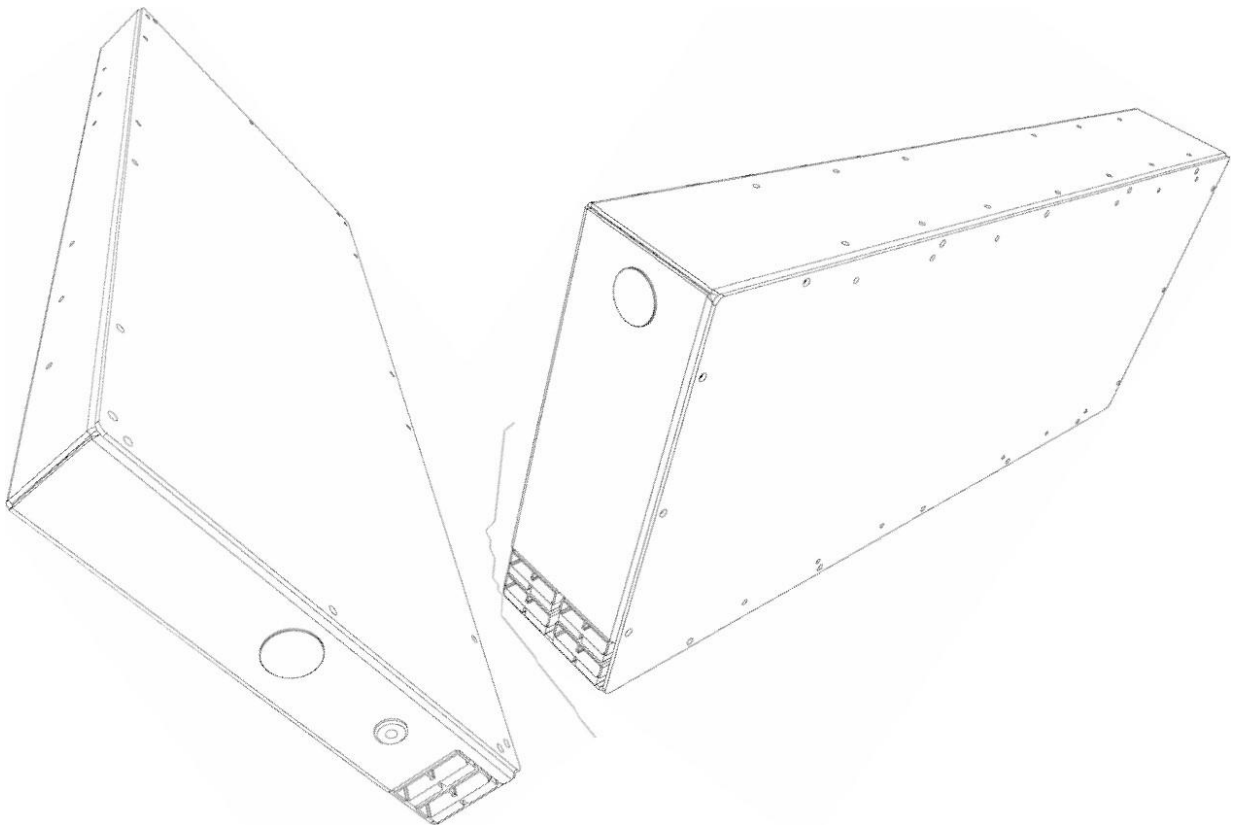
Models:

LFP12-110SL

LFP12-110SLDC20

LFP12-150SL

LFP12- 150SLDC40



Contents

1. 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 Slimline range of 12V batteries.

This User Guide covers the LFP-12V Slim line battery range.

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. We offer these general guidelines; however, you should seek our further advice or that of a qualified electrical tradesperson if you are in doubt.

Figure 1: LFP12-150SL Battery

2. 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.

- 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
- Keep away from water
- Avoid direct sunlight
- Do not charge battery below O ^{O}C or above 45 ^{0}C
- Do not store battery below -20^{0}C or above 60^{0}C

To ensure a long and safe life from your battery, please ensure you consider the following:

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 LFP 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 the enclosure. Use only existing mounting holes in the battery and short screw lengths no greater than 13mm.

We strongly recommend the LFP 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, LFP batteries operate and perform the best, as well as last the longest, in a cool and stable temperature environment between 10^{O}C and 25^{0}C. The maximum window of full operation is 0-45^{0}C. Do not attempt to charge the battery below O^{O} C or above 45 ^{0} C.

If you regularly discharge 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^{0}C, you should cease use immediately. Avoid direct sunlight — the internal temperature of the enclosure can rise quickly due radiation from the sun.

Operating outside of these guidelines diminishes the life and performance of the battery and voids the warranty.

2. Do's and Don'ts cont…

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. 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

Do not short circuit the battery. 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 perform work on passive wiring first and connect the live battery as the last connection. If you must work on live circuits, exercise due care, and use insulated tools where possible. If you are unsure how to install the battery, seek advice from LFP or a suitably qualified electrical tradesperson.

Check to ensure the connecting Anderson plugs are correctly wired (positive and negative) and do not attempt to mismatch Anderson colours when connecting.

3. 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.

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 (S oc, 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. A capacity 'overhead' ensures lower DOD, extended life and therefore a higher financial return on your investment.

LFP Lithium Iron Phosphate (LFP) batteries have a cycle life of 5,000 cycles at 50% DOD and 2,000 cycles at 80% DOD.

4. Battery Management System

Your battery comes with an integrated Battery Management System (BMS).

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 Slimline battery BMS is a highly reliable 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.

It has the following features:

- Cell over-voltage protection
- Cell under-voltage protection
- Over current protection
- In-rush current protection
- Short circuit protection
- Transient voltage protection and fusing, with fail -safe monitoring of the fuse
- Fail-safe operation if connection to any cell is lost
- Blocking charge above 45 ^{0}C (with automatic recovery)
- Blocking discharge (all loads disconnect) above 60^{0} C (with automatic recovery)
- Smart passive cell balancing

5. Installation

5.1 Stowage

The Slimline battery is likely to be stowed in a car, RV or 4WD or used as a portable battery for camping. An important part of the battery installation is securely fixing it down or safely stowing it away during transport so that it does not become a projectile in an accident.

Figure 2, Figure 3 & Figure 4 illustrate some handy stowage solutions (Battery Colour: Hammertone Blue). The primary benefit of the Slimline battery is that it can tuck away behind a seat in a vehicle. Too often space is at a premium and the slim shape and design of the battery means it can be hidden away easily.

Figure 2: Behind a seat

Figure 3: Back of a 4x4

Figure 4: Strapped at the back of a 4x4

5. Installation cont…

5.2 Mounting orientation

The Slimline battery is best mounted on its side with the Anderson terminals at the bottom. Do not mount on its side with the Anderson plugs at the top. In this configuration the internal cells are upside down which is against the cell manufacturer's recommendations. Please refer to the figures below.

Figure 5: Recommended orientation for LFP batteries.

Figure 6: Do not install the battery in the above orientation.

Figure 7: Recommended orientation for LFP batteries.

Figure 8: Do not install the battery in the above orientation.

5. Installation cont…

5.3 Connecting DC loads and chargers

Always follow the "Battery Charge Range" described in the specification table in Section 7 below. **Do not** attempt to plug in chargers with a voltage higher than 14.6V. Doing so may lead to **permanent** damage of your battery.

5.3.1 LFP12-110SL

The LFP12-110SL models are equipped with two (2) convenient grey Anderson plug connectors, accessible from the side of the battery as shown in Figure 9. Both can be used as input and outputs for charging and running loads. Please see section 5.3.5 below for current limits per Anderson connector.

Figure 9: Dual grey Anderson Plugs

5.3.2 LFP12-150SL

The LFP12-150 models are equipped with two studs; red (positive) and black (negative) for charging and load connections.

Red and Black Studs

5. Installation cont…

5.3.3 LFP12-110SLDC20

This model feature one (1) grey Anderson plug and one (1) blue Anderson plug as shown in Figure 10. The single grey Anderson can be used as an input/output for charging or running loads. The blue Anderson connector is reserved for a IOV to 16V DC input, to make use of the internal DC-DC charger. See section 5.4 below for more information on the DC-DC charger fitted in DCS models. Please see section 5.3.5 below for current limits per Anderson connector.

Figure 10: DC models, featuring Grey and Blue Anderson connectors

5.3.4 Regulated Charge Sources

Charge sources that can be connected to the grey connector(s) could include:

- External AC-DC charger with grey Anderson connector;
- External (regulated) solar charger with grey Anderson connector; or
- External DC-DC charger with grey Anderson connector.

For connected chargers and devices, a grey Anderson plug must be used. Check to ensure the Anderson is correctly wired (positive and negative) and do not attempt to use any coloured Anderson other than grey.

5.3.5 Current Limits

Please consider the following current limits when connecting charging devices and loads.

Parameter	12-110SL	12-110SLDC20	12-150SL	12150SLDC40
Max. Current per Grey Anderson Input or Output	100 A		50 A	
Max. Total Current Output (Discharge)	100 A (200 A surge)			200 A (400 A Surge)
Max. Total Current Input (Charge)	70 A	100A		140 A

Table 1: Slimline Grey Anderson specifications

5. Installation cont…

5.4 Connecting to the integrated DC-DC charger (DCS models only)

5.4.1 Configuring the DC-DC Charger

As you look at the 20A DC-DC charger, there is an LED and 2 rotary switches on the side face of the battery.

1. Green LED which will illuminate when the DC-DC charger is ready to charge.
2. Rotary Switch 1 nearest the LED is called Voltage Switch.
3. Rotary Switch 2 furthest from the LED is called the Time Delay/Ignition Trigger switch

Figure 11: DC-DC Charger switches

The DC-DC charger is factory set at setting 0-6 for smart alternators using an ignition trigger. If you want to use your DC-DC charger in a different mode, then you need to turn the two rotary switches to the correct position. After connecting the DC source via the blue Anderson plug, the vehicle engine can be started. The green LED status light should illuminate if the battery is charging. The rotary switches will require adjusting depending on the alternator type.

Do not attempt to plug in a DC source higher than 16V. Doing so may lead to permanent damage to your battery.

Table 2 below indicates the voltage rotary switch position and corresponding voltage on and off level.

	VOLTAGE	
VOLTAGE SWITCH POSITION	**ON LEVEL**	**OFF LEVEL**
0	11.0v	10.0v
1	12.0v	11.0v
2	13.0v	12.0v
3	13.3v	12.3v
4	13.5v	12.5v
5	13.7v	12.7v
6	14.0v	13.0v

Table 2: Voltage Switch Positions

5. Installation cont…

Table 3 below indicates the time delay rotary switch position and corresponding delay off time.

DELAY SWITCH POSITION	OFF DELAY TIME
0	0
1	30 SECONDS
2	1 MIN
3	1.5 MIN
4	3 MIN
5	5 MIN
6	IGNITION SIGNAL

Table 3: Time Delay/Ignition Trigger Switch Positions

Example: If you select 'O' for the Voltage Switch Position, then the source battery will stop delivering charge once it drops to 10.0V. So that the source battery voltage does not get too low, its best to select a higher voltage shut off point, such as '4' — 12.5V. For Smart Alternator installations, its recommended to use the Ignition Trigger; Select 'O' on the Voltage Switch Position and '6' on the Delay Switch Position. If installation is without an Ignition Trigger, then it's recommended to select '4' on the Voltage Switch Position and 'O' on the Delay Switch Position — this configuration is best suited to traditional alternators (non-smart).

5.4.2 Ignition Trigger Input

The Ignition Trigger Input, a red/blue plug on the front face of the battery (Figure 12), can be used to only charge the Slimline when an ignition feed is live. This will ensure that the starter battery doesn't drain unnecessarily when the vehicle is not in use. Please consult your auto electrician to discuss a suitable place to connect an ignition trigger input to in your vehicle. The Ignition Trigger requires only a single 12V positive signal and uses the common ground of the battery. The rotary switches will need to be configured to ignition trigger mode. Please see section 5.4.1 above.

Figure 12: Ignition Trigger Input

If you are unsure of the correct setting for your vehicle alternator , then you should contact an auto electrician for guidance.

6. User Guide

Once the battery is securely installed and electrically connected it will automatically be available for use. The internal BMS will actively ensure the battery is always protected and operating safely. The battery requires no user interface or intervention under normal conditions.

The Slimline lithium battery voltage can be monitored by installing an external display, such as our remote voltage monitor shown right.

Note that unlike lead acid batteries, lithium batteries hold their voltage over the cycle, dropping off only when the battery is [N]90% discharged, as indicated in Figure 13 for illustrative purposes.

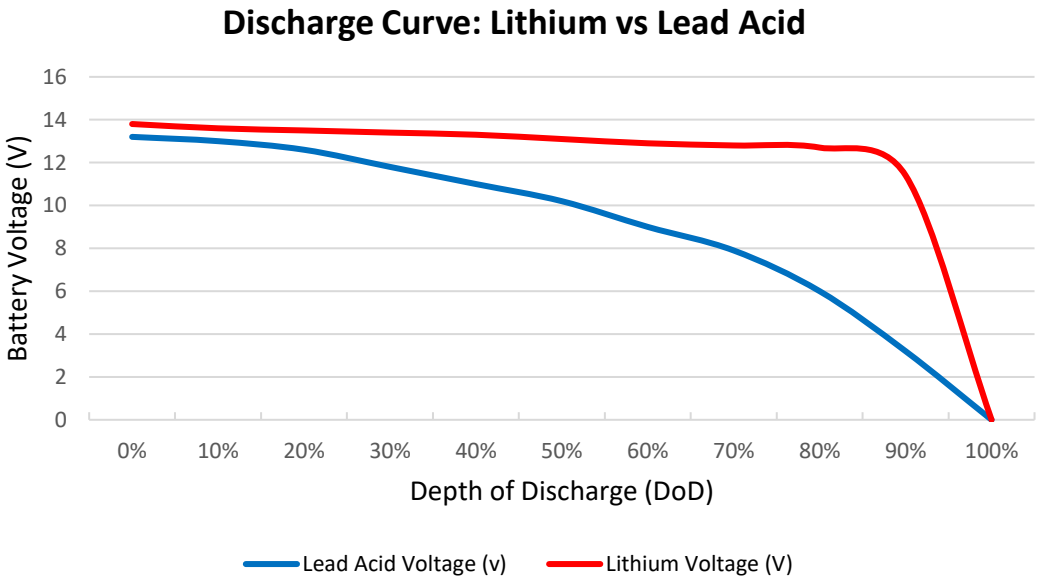


Figure 13: Voltage Curve Lead Acid vs Lithium

The Slimline battery voltages below are a useful guide:

1. A normal full battery open circuit voltage (Voc) with no load rests at 13.3V to 13.8V;
2. Depending on the load, voltage may dip 0.5V below the Voc;
3. Below 13V Voc the battery is low and should be charged to promote a long lifespan.
4. Below 12V Voc the battery is close to empty, and should be charged straight away;
5. Low Voltage Disconnect (LVD) is set at [N]IO.5V.

Do not attempt to charge the battery with a voltage higher than 14.6V. Doing so may lead to permanent damage of your battery.

7. Specifications

	LFP12-110SL
Battery Voltage	12 v
Battery Charge Range	13.8- 14.6 v
Capacity	110 Ah
Max discharge rate	120 A (240A surge)
Max charge rate	120 A
DC Charger (-DCS Models only)	lov-16V in, 20 A output with ignition trigger feed
Dimensions (L x W x D)	636 x 256 x 50 mm
Weight	12.9 kg
Operating Temperature (Discharge)	-20 ^{0}C to 60^{0}C
Operating Temperature (Charge)	O^{O}C to 45 ^{0}C
	LFP12-150SL
Battery Voltage	12 v
Battery Charge Range	13.8- 14.6 v
Capacity	150 Ah
Max discharge rate	140 A (280A surge)
Max charge rate	140 A
Dimensions (L x W x D)	560 x 235 x 85 mm
Weight	16.7 kg
Operating Temperature (Discharge)	-20 ^{0}C to 60^{0}C
Operating Temperature (Charge)	0 ^{O}C to 45 ^{0}C

Table 4: Slimline Specifications