



Installation and User's Manual

12V LiFePO4 Battery Range

Manufactured By Freedom Won (Pty) Ltd

Unit 23

Ruimsig Shopping Centre

Muriel Road

Amorosa

Gauteng Province

1732

South Africa

www.freedomwon.co.za

Technical and Installation Assistance – Contact:

Please contact your Freedom Won Distributor or Reseller Installer for technical and installation support. A directory of Distributors and Reseller Installers is available at www.freedomwon.co.za.

Revision 1 – 13 July 2019

1. Introduction

This manual is intended to provide assistance to an installer or user for the installation, commissioning and operation of the range of **Freedom Won** lithium iron phosphate (LiFePO₄) 12V lead replacement batteries.

This manual does not attempt to cover all the details pertaining to the setup of third party equipment in relation to setup and operation with the 12V battery. Assistance is available at the contact details mentioned on page one to provide direct support where necessary for supported third party brands.

2. Product Description

Freedom Won offers the following ranges in the LiFePO₄ technology:

1. **12V (includes General Purpose and Starter models)**
2. Lite Mini (note this range is only available for volume orders in specific countries, please enquire with Freedom Won Sales)
3. Lite Home and Business
4. Lite HV Home and Business
5. Lite Marine
6. Lite Mobility (golf carts, forklifts etc)
7. Lite Commercial
8. Lite Industrial

This manual covers the 12V range. Please refer to the manuals specific to the other ranges where required.

The Freedom Won 12V batteries are available in various standard sizes to meet most 12V applications, ranging from 7.5Ah up to 200Ah for the General Purpose models, and 8Ah, 30Ah and 50Ah for the Starter models.

Table 2.1 provides an overview of the Freedom Won 12V General Purpose range and Table 2.2 for the Starter range.

An image showing the General Purpose range is provided in Figure 2.1 and of a 30Ah Starter battery in Figure 2.2.

Please refer to the detailed specification sheets specific to each model available on the Freedom Won website for more detailed information pertaining to each model.

The maximum discharge and charge current for each model is governed by the rating of the built-in protection electronics. It is important to note the maximum current durations in the table. **The current ratings must not be exceeded. The maximum charge voltage value must also not be exceeded.**

Figure 2.1 Image of the Freedom Won 12V General Purpose range



Figure 2.2 Image of 30Ah 12V Starter Battery (50Ah model is identical in appearance)



All models operate at a nominal voltage of 12,8V, which suits the most commonly available residential battery inverters and is also matched to vehicle alternators.

The absolute maximum voltage when fully charged is 14.6V, however a more typical setting is 14,2V for a single unit and 14V each for series connected units. The battery will protect itself from exceeding 14,6V, however it is not desirable to have this protection enforced because it will cut out the entire DC circuit.

The voltage normally used as the minimum cut off is 11V, however this will not typically be reached if operating down to 90% Depth of Discharge (DoD) – the recommended maximum DoD, which equates to about 11,5V. The battery will protect itself from under voltage at about 10V.

The weight of each model is given in the tables. The weights are about a quarter of the equivalent lead acid battery.

Table 2.1 Freedom Won 12V General Purpose Range

Model	FW-12-7.5	FW-12-10	FW-12-20	FW-12-40	FW-12-60	FW-12-100	FW-12-200
Max Energy [Wh]	96	128	256	512	768	1280	2560
Current Capacity [Ah]	7.5	10	20	40	60	100	200
Standard Charge Current [A]	1.5	2	4	9	12	20	40
Max Charge Current [A]	7.5	10	20	20	30	50	50
Max Pulse Discharge Current [A]	15A (<3s)	20A (<3s)	40A (<3s)	80A (<3s)	120A (<3s)	150A (<3s)	150A (<3s)
Max Continuous Discharge Current [A]	7.5	10	20	40	60	80	80
Nominal Voltage [V]	12,8V (suitable for 12V alternators)						
Charge Voltage [V]	13,8V to 14,4V						
Weight [kg]	1,1	1,6	2,75	5,75	9,0	13,6	29,6
Dimensions Length x Width x Height [mm]	151x65x99	151x98x101	181x77x167	197x165x170	259x168x214	342x173x220	484x170x211
Enclosure	Plastic						
Terminals	T2 Spade Female	T2 Spade Female	M5	M6	M6	M6	M8
Protection	Internal Overcurrent, Overtemperature, Overvoltage and Undervoltage protection with cell balancing						
Warranty	5 years unlimited usage						
Service Life	>15 years (or 5 500 cycles) expected life at 70% DoD, 20 years (>7 000 cycles) at 50% DoD (for 70% End of Life capacity). 0.3C discharge and charge current.						

Table 2.2 Freedom Won 12V Starter Range

Model	FW-12-8-S	FW-12-30-S	FW-12-50-S
Max Energy [Wh]	90	360	600
Current Capacity [Ah]	8	30	50
Standard Charge Current [A]	8	30	30
Max Charge Current [A]	16	90	90
Max Pulse Discharge Current [A]	400	900	900
Max Continuous Discharge Current [A]	80	180	180
Nominal Voltage [V]	12,8V (suitable for 12V alternators)		
Charge Voltage [V]	13,8V to 14,4V		
Weight [kg]	1.5	5	8
Dimensions Length x Width x Height [mm]	160x75x110	241x175x190	241x175x190
Enclosure	Plastic		
Terminals	M6	Automotive	Automotive
Protection	Cell balancing only, no over or under voltage protection	Internal Overcurrent, Overtemperature, Overvoltage and Undervoltage protection	
Warranty	5 years unlimited usage		
Service Life	As starter battery: >15 years As cycling battery: >15 years (or 5 500 cycles) expected life at 70% DoD, 20 years (>7 000 cycles) at 50% DoD (for 70% End of Life capacity). Cycling at 0,3C charge and discharge		

3. Packaging and Transport

The Freedom Lite units are packaged in cardboard boxes with protective foam inside. The batteries are typically shipped at 20% State of Charge.

4. Connecting the 12V Batteries

When connecting the General Purpose 12V batteries it is important to observe the minimum cable sizes for each model provided in Table 4.1 below. Proper connectors or lugs must be used for connecting to the battery terminals and the connection bolts where

applicable must be tightened properly with a flat washer and spring washer included. Multistrand welding or panel cable must be used. For connecting the starter batteries the original vehicle connectors are used.

Table 4.1 Freedom Won 12V General Purpose Range – Minimum Connection Cable Sizes

Model	FW-12-7.5	FW-12-10	FW-12-20	FW-12-40	FW-12-60	FW-12-100	FW-12-200
Minimum Cable Connection Size [mm ²]	4	4	6	10	25	35	35

5. Operating Configuration

The Freedom Won 12V battery ranges are intended for use in a standalone configuration only i.e. only one battery should be connected in any one system.

Parallel Operation

Should more capacity be required than any given model offers then a larger capacity model must be selected instead of connecting multiple units in parallel. Should the largest model (200Ah) not provide sufficient capacity, Freedom Won suggests considering the Freedom Won Marine range of batteries to offer the required capacity – starting from 5kWh and extending up to 40kWh, and available in 13V, 26V and 52V nominal to suit 12V, 24V and 48V systems respectively. Should it however be necessary to connect the batteries in parallel it should be noted that **this use application is not covered by the Freedom Won warranty**, but can offer satisfactory results if installed and operated appropriately – as follows:

1. Each battery must be charged to 14.2V before being placed in parallel
2. The maximum current values should not exceed the limits given for a single unit.
3. All units must be the same model and of a similar age.
4. The cables connecting each battery to the next must not be shorter than 200mm to reduce heat transfer from one terminal to another. The interconnecting cables must all be the same size and length and the size must comply with Table 4.1 above.
5. The max charge voltage is to be set as for a standalone unit.

Series Operation

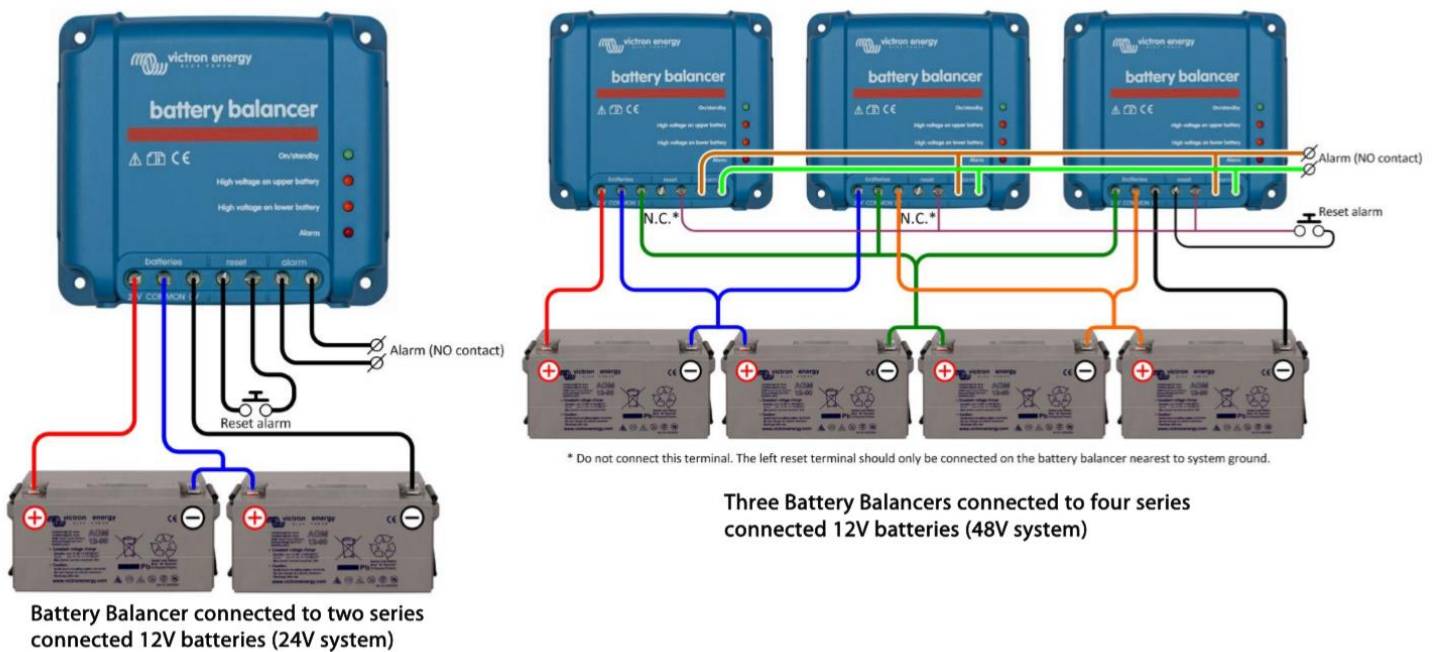
Should a 24V or 48V system be required it is possible to connect the 12V units in series (up to four), **however this application is not covered by the Freedom Won warranty** owing to too much reliance on third parties for proper installation and operation.

Should the user at his discretion decide to connect these batteries in series the following is essential for proper operation:

1. Each battery **must** be charged separately up to exactly 14.2V on the same day prior to being connected in series to ensure that they are equally charged (balanced) prior to use.

2. The cables connecting each battery to the next must not be shorter than 200mm to reduce heat transfer from one terminal to another. The interconnecting cables must all be the same size and length and the size must comply with Table 4.1 above.
3. These batteries **must** be fitted with a battery balancer (or three as in below 4 series example) when connected in series.
4. When operated in series the maximum current values provided in the specification sheet must be de-rated to 70% to cater for series connection dynamics between the batteries e.g. Different battery internal resistance values.
5. The max charge voltage setpoints must be set correctly to ensure that none of the batteries reach its maximum cut out voltage:
 - 5.1 Two in series – 28V maximum charge voltage
 - 5.2 Three in series – 42V maximum charge voltage
 - 5.3 Four in series – 56V maximum charge voltage

Figure 5.1 Example of Battery Balancer Configuration



6. Connected Equipment

The 12V battery range is protected internally using solid state electronics. These electronics will not resist extreme operation or abuse outside of the limits given in this document. It is thus important to connect these batteries to suitable equipment. The following points are of primary relevance:

1. The connected equipment must not cause excessive inrush current when connected to the battery – should excessive inrush current (from inverter capacitors for

example) be suspected, the DC bus must be pre-charged using a 50-100 Ohm 100W resistor before connecting the battery onto the DC bus

2. The inverter or other load(s) must not be capable of exceeding the current ratings in the specification sheet for discharge, and must be set correctly for the maximum charge current, which is possible in most devices. For chargers where it is not possible to limit the charge current the model selected must not be capable of delivering a current higher than the standard charge current given in the specification table.
3. It is imperative that the correct nominal DC voltage is selected on the connected equipment i.e. 12V, 24V, 36V or 48V.
4. **Please note: The General Purpose range is not designed for, or capable of, starting internal combustion engines. The cranking current demands are far too high. For this application select a starter battery option.**
5. **Note: The 8Ah starter battery does not include overvoltage protection and therefore must only be charged with a charge source that is guaranteed not to exceed 14,2V. Likewise there is no under voltage protection, which means care should be taken not to discharge this unit below 10V ideally but with an absolute minimum of 8V).**
6. **Note: These batteries must never be connected with other brands and must all be of the same size when connected in parallel or series.**

7. Application Notes

The General Purpose range is suitable for low to medium current (power) applications only such as for the following:

1. Auxiliary batteries in holiday vehicles, caravans and Recreational Vehicles (RV's)
2. Auxiliary batteries in boats (not for starting boat motors)
3. Bass fishing trolling motors and small boat electric motors
4. Gate motor and alarm backup batteries
5. Small residential backup systems
6. Mobile power supplies
7. Golf Caddies and other small traction applications

A very high cycle life and long calendar life make these batteries far superior than any other technology. Standing unused for months or years will not result in degradation or loss in performance.

The Starter battery range is suitable for starting most petrol and diesel engines that operate with 12V starter batteries. With a battery balancer these units can also be connected in series to provide 24V nominal output. Examples include:

1. Motor car starting – typical 30Ah application but the 50Ah can be used if cycling capacity is needed for an on-board fridge for example.
2. Generator starting – 8Ah for small generators up to 10kVA and 30Ah for generators up to 250kVA. 50Ah for generators up to 500kVA.
3. Petrol golf cart and lawnmower starting – 8Ah.

4. Truck and heavy machinery starting – 50Ah connected two in series with battery balancer can start large diesel engines.
5. Boat engine starting – outboard and inboard.
6. High power output mobile power packs

8. Operating Instructions

The General Purpose range requires no specific operating instructions that are not covered elsewhere.

The Starter battery (30Ah and 50Ah models), however requires the user to be aware of the “Jump Start” feature. There is a button located on the top of the battery that when pressed offers two functions:

1. A State of Charge display lights up beside the button.

9. Operating Environment

Both the General Purpose and the Starter models are suitable for use in the following environments:

1. Vibration – vibration experienced on vehicles driving on poor dirt roads will not damage the battery provided it is securely fastened to the vehicle.
2. Temperature – the batteries are designed for operation up to a maximum of 60°C and a minimum of -20°C. Please note the following regarding ambient temperatures:
 - Charging:
 - General Purpose Range: Charging above the standard charge current is not recommended for ambient temperatures above 45°C. Charging at amperage values below the standard charge current is permissible for short durations at ambient temperature up to 60°C
 - Starter Range: Charging permitted from 0°C to 60°C with no special restrictions on charging current within this temperature range
 - Any charging while the battery temperature is below 0°C is not permitted. For cold environments the battery should be installed inside the vehicle and not under the bonnet (General Purpose range) to prevent the battery temperature from dropping below 0°C during the night when parked outside. The Starter battery range, if installed under the bonnet, is not suitable for use in vehicles where the vehicle must be used directly after being parked in a place where the ambient temperature has dropped below 0°C - unless a heating blanket can be installed to ensure that the battery remains above 0°C.
 - Discharging:
 - Discharging has not special limitations outside of the general temperature range of -20°C to +60°C.
 - NOTE: It is possible that under bonnet temperature can exceed 60°C shortly after a petrol or diesel driven vehicle has stopped after a long run on a hot day. In such an instance it is possible that the thermal protection inside the battery may cause an internal disconnection for several minutes until the under-bonnet temperature has reduced. This is more likely to occur on the General Purpose range – hence it is always favourable to place the battery in an alternative location in the vehicle.

3. Moisture – all Freedom Won 12V batteries are protected from water splash and low-pressure spray, however application of a high pressure water spray onto the batteries is not permitted. Special precaution is required to ensure that a high-pressure sprayer is not used on under-bonnet units. **The batteries must never be submerged in a liquid/water** as liquid ingestion may occur.
4. Corrosion Resistance – these batteries have a moderate resistance to corrosion and may be used in an environment where there is airborne sea (salt) moisture present provided that they are rinsed off lightly with fresh water after exposure. **NOTE: prolonged direct exposure to sea spray or sea water is not recommended.** Special care is required to protect the battery terminals from corrosion when operated in a marine environment.

10. Long Term Storage

The Freedom Won 12V ranges should be charged to 14,2V before being placed in storage. They should be recharged to 14,2V every 6-12 months or if the voltage drops below 12V.

The storage area temperature should ideally be within 0°C to 30°C, however storage temperatures up to 40°C ambient will not cause significant shelf degradation. If storage temperature exceeds 40°C there will be a slow degradation in battery performance and capacity over time.

11. Accessories

Freedom Won offers the following accessories for the 12V batteries:

Table 7.1 List of Accessories

Item	Description
Cable Connection Kits	Available for all models specified for standalone, two, three or four series connection. Includes cable with lugs or spade connection as applicable. Requirements to be specified with order.

12. Warranty

For the detailed warranty information please refer to the separate Freedom Won 12V LiFePO4 battery warranty document.

In summary, the 12V batteries are guaranteed for 5 years of unlimited cycles provided that the battery is operated within the specifications and guidelines provided in this manual.