



Installation and User's Manual

12V LiFePO4 Battery Range

Manufactured By Freedom Won (Pty) Ltd

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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.

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1. Introduction

This manual is intended to aid an installer or user with the installation, commissioning and operation of the range of **Freedom Won** lithium iron phosphate (LiFePO₄) 12V General Purpose “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 General Purpose**
2. eTower 52V
3. Lite Home and Business 52V
4. Lite HV Home and Business HV
5. Lite Marine
6. Lite Mobility (golf carts, forklifts etc)
7. Lite Commercial 52V
8. Lite Commercial HV and HV+
9. Lite Industrial HV and HV+

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

The Freedom Won 12V General Purpose batteries are available in various standard sizes to meet most 12V applications, ranging from 7.5Ah up to 200Ah.

Table 2.1 provides an overview of the Freedom Won 12V General Purpose range.

An image showing the General-Purpose range is provided in Figure 2.1.

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.**

Note that these batteries are not suitable for starting internal combustion engines – the current requirement for this application is much higher than the capability of the 12V General Purpose range.

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



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 12V 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 table. 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-12-100	FW-12-200
Max Energy [Wh]	96	128	256	512	1280	2560
Current Capacity [Ah]	7.5	10	20	40	100	200
Standard Charge Current [A]	1.5	2	4	9	20	40
Max Charge Current [A]	7.5	10	20	20	50	50
Max Pulse Discharge Current [A]	15A (<3s)	20A (<3s)	40A (<3s)	80A (<3s)	150A (<3s)	150A (<3s)
Max Continuous Discharge Current [A]	7.5	10	20	40	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	13,6	29,6
Dimensions Length x Width x Height [mm]	151x65x99	151x98x101	181x77x167	197x165x170	342x173x220	484x170x211
Enclosure	Plastic					
Terminals	T2 Spade Female	T2 Spade Female	M5	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.					

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. The batteries should be kept dry and away from direct sunlight and other extreme heat sources.

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.

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-12-100	FW-12-200
Minimum Cable Connection Size [mm ²]	4	4	6	10	35	35

5. Operating Configuration

The Freedom Won 12V General Purpose battery range is primarily intended for use in a standalone configuration only i.e. where only one battery is connected in any one system. However parallel and series operation is permissible.

Parallel Operation

Should more capacity be required than any given model offers then a larger capacity model should ideally 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 the user however decide to connect these batteries in parallel, the following is essential for proper operation:

1. Each battery must be at the same voltage (within $\pm 0.2V$) before being placed in parallel
2. The total maximum current experienced by the combined batteries should not exceed the limits given for a single unit.
3. All units must be the same model and of a similar age (less than 3 years apart).
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, typically 14.2V.

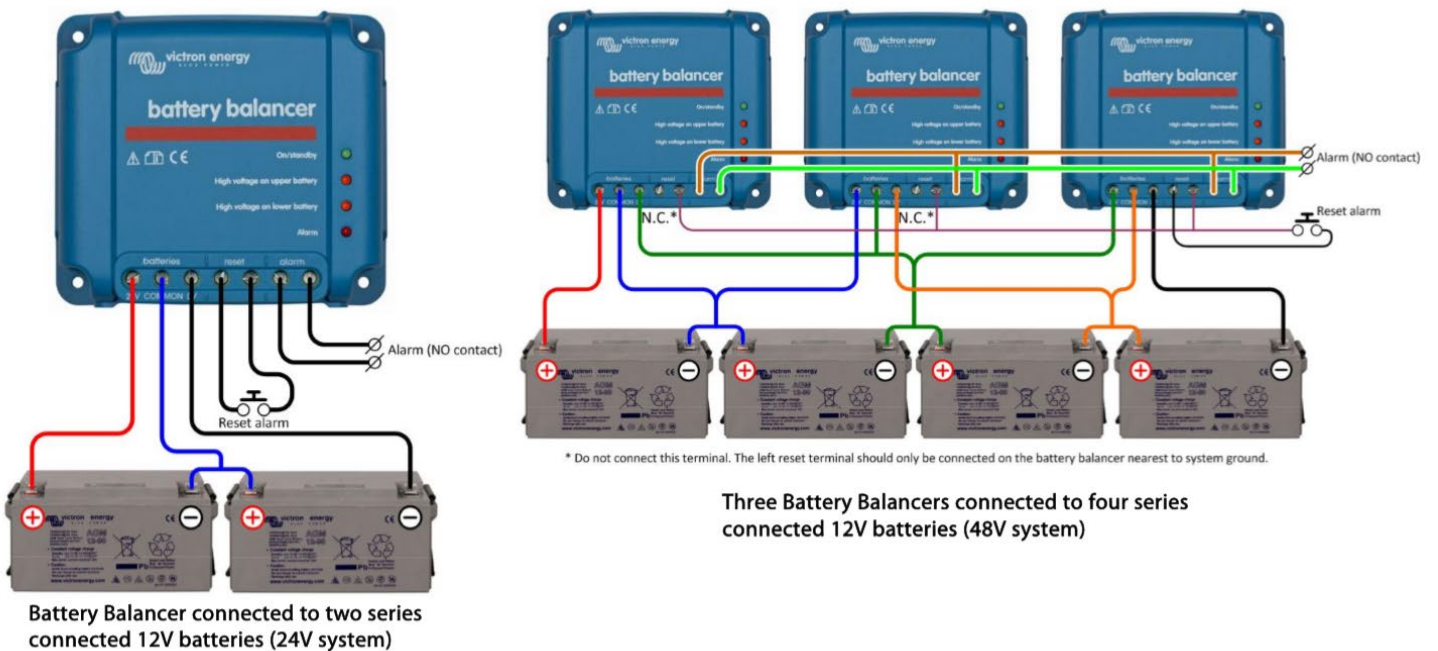
Series Operation

Should a 24V, 36V, or 48V system be required it is possible to connect the 12V units in series (up to four. Should it however be necessary to connect the batteries in series, it is necessary to install a battery balancer in this application as to not void the warranty (please see below examples of battery balancer configurations).

Should the user wish 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 reaches 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 Victron Battery Balancer Configuration



6. Connected Equipment

The 12V General Purpose 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.**
5. **Note: These batteries may never be connected with other brands and must all be of the same size (model) when connected in parallel or series.**

6. 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 to any other technology. Standing unused for months or years will not result in degradation or loss in performance provided that one discharge recharge cycle is performed per year at most, or preferable every 6 months.

7. Operating Instructions

The 12V General-Purpose range requires no specific operating instructions that are not covered elsewhere.

8. Operating Environment and Orientation

The 12V General Purpose batteries 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:
 - Charging above the standard charge current is not recommended for ambient temperatures above 40°C. Charging at amperage values below the standard charge current is permissible for short durations at ambient temperature up to 60°C
 - 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 to prevent the battery temperature from dropping below 0°C during the night when parked outside.
- Discharging:
 - Discharging has no 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. 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 recommended. 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.
- 5. Orientation – all the batteries covered in this manual may be orientated on their sides. Fitment of the battery in an upside-down position is not recommended.

9. Long Term Storage

The Freedom Won 12V batteries should be charged to 14,2V before being placed in storage. They should be discharged to 11.5V and 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 25°C, however storage temperatures up to 35°C ambient will not cause significant shelf degradation. If storage temperature exceeds 35°C there will be a slow degradation in battery performance and capacity over time.

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.

10. 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.