



Installation Manual

Freedom Lite Home and Business HV

Range of Lithium Iron Phosphate Battery Modules

Manufactured by Freedom Won (Pty) Ltd

Kimbult Industrial Park, Unit C3 & C4

9 Zeiss Road

Laser Park, Honeydew

2040

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.

For advanced support please contact support@freedomwon.co.za.

Update Record:

Revision Number	Update Summary	Updated By	Date of Issue
0	First Release	Antony English	June 2015
1	Incorporated New HV+ models	Antony English	08 November 2020
2	Updated CAN Bus Cable Pin Configuration	Antony English	22 November 2020

1. Introduction

This manual is intended to provide assistance to an installer for the installation and commissioning of the range of **Freedom Lite Home and Business HV and HV+** lithium iron phosphate (LiFePO₄) energy storage modules. This document is not intended to provide detailed information of the inner workings of Freedom Lite that is not relevant to a person that is performing the installation and final commissioning. Supplementary information relating to programming of the built-in battery management system for specific applications is available to approved integrators directly from Freedom Won.

This manual does not attempt to cover all the details pertaining to the setup of third-party equipment in relation to the interface and necessary functionality to work with the Lite. Freedom Won however is available at the contact details on page one to provide direct support where necessary for supported third party brands.

2. Product Description

The Freedom Lite technology is available in various standard sizes to meet all residential, commercial, and industrial applications, ranging in models from 5kWh up to 2500kWh. Larger systems are provided by Freedom Won based on specific project requirements by installing multiple units of the same model battery in parallel.

Freedom Won offers the following ranges in the LiFePO₄ technology:

1. Lite 12V
2. Lite Home and Business
- 3. Lite Home and Business HV**
4. Lite Marine
5. Lite Mobility (golf carts, forklifts etc)
6. Lite Commercial (including Lite Commercial HV and HV+)
7. Lite Industrial

This manual covers the standard voltage models of the **Lite Home and Business HV and HV+** range from 15kWh up to 80kWh. Please refer to the manuals specific to the other ranges for assistance with other models.

The Lite Home and Business HV and HV+ models vary in voltage from 153V nominal up to 614V nominal. The Freedom Lite HV and HV+ range is designed for specific **Higher Voltage** inverters. The acceptable voltage ranges for the various HV inverters vary quite substantially so it is important to check the inverter specifications and make sure that you select the correct Freedom Lite HV battery voltage. Contact Freedom Won for assistance if there is any doubt. A list of supported HV inverters is available in [Section 5.3](#). The nominal voltage options are presented in Table 2.1. If none of these options is suitable for your preferred inverter, please contact Freedom Won for assistance with the right solution for your needs.

Table 2.1 provides an overview of the Freedom Lite Home and Business HV and HV+ range. There are six primary, as included in the table, but some models are available in two voltages as distinguished by the suffixes HV and HV+ on the model name. The models are classified in terms of energy capacity.

An image with numbered labels pertaining to the following paragraphs is provided in Figure 2.1. The model number denotes with the first number [1] the total energy storage capacity in kWh of each model. The second number [2] denotes the average amount of energy in kWh that should be withdrawn per cycle (on average) in order to optimise the life of the lithium cells. This equates to 80% of the total for each model i.e. 80% depth of discharge (DoD). **Note that all Freedom Lite batteries offer a maximum of 90% DoD as standard.**

The range is designed with a tall and slim profile with the “Home” models intended to be wall mounted (floor mounting is also possible – all models are supplied standard with plastic feet). The larger “Business” range is floor standing with plastic feet for the 40/32 and aluminium feet with plastic pads on the underside for the 60/48 and 80/64. The aluminium feet on the latter two models have a height of 100mm and allow for shifting the battery once upright using a pallet trolley.

The Ah capacity is not provided in the table because this varies depending on the voltage option, instead use the kWh capacity rating for sizing information.

The maximum current for each model is governed by the rating of the built-in circuit breaker [3], which has been sized below the maximum current capability of the lithium cells to ensure their protection. There is no noticeable cell temperature rise during operation and no active cooling of the cells is required. The time limit for operation at the maximum current is 2 minutes in a 10-minute cycle. To ensure that the circuit breaker does not trip in normal operation it is advised that the design of the system aims to remain at or below the continuous current value.

The maximum operating voltage of each battery model is 112% of the nominal voltage and the minimum operating voltage is 88% of the nominal voltage.

The BMS will command the connected inverter with the CAN Bus interface to stop discharging the battery at 10% SoC (90% DoD), which roughly equates to 88% of the nominal voltage). Under high load the voltage may drop lower whilst still above 10% SoC. The battery breaker will eventually trip the battery at around 80% of the nominal voltage to protect the cells from undervoltage.

Figure 2.1 Labelled Image of the Freedom Lite Home 20/16HV (Labelling corresponds with the text)



1. *Gross Capacity*
2. *80% Capacity recommended for daily cycling (max available is 90%)*
3. *Breaker*
4. *Power Cables*
5. *Model Specification Label*
6. *CAN Bus Sockets x 2 (RJ45) (one socket must contain a termination resistor if end of line)*
7. *USB Programming Port (not visible in photo). Note that older models had a DB9 plug instead.*
8. *Reset Button (not visible in photo)*
9. *State of Charge Display*
10. *Error Lite*

11. *On Button*
12. *Off Button*
13. *Lifting Eye Bolt Hard Point position*
14. *Safety Retaining Tab position for Floor Mount Option (included on the 30/24 model and larger)*
15. *Plastic Feet (60/48 and 80/64 models have aluminium feet)*

The weight of each model is given in the tables. The Freedom Lite Home 15/12HV and 20/16HV models can be manually lifted by four people and maneuvered by two. The larger units typically require lifting equipment of varying degrees for handling and installation as explained later in this document.

The dimensions given are for the principle outlines of the aluminium housing and exclude items that protrude such as the DC cable glands and the circuit breaker handle.

The DC cables exit the unit through glands [4] located on the **top right-hand side** of the casing. For this range all models have one positive and one negative cable. The sizes and lengths are provided in Table 2.1. The correct cable lugs for connecting these leads to the inverter must be in hand when doing an installation. If there are several inverters and charge controllers that need to be connected to the battery it is advisable to install a DC connector box to use as a junction point from which to branch out to all the battery connected equipment.

Note the model specifications label and serial number on the label shown by label [5].

Table 2.1 Freedom Lite Range Overview

Freedom Lite	Home 15/12 HV	Home 20/16 HV	Home 30/24 HV [HV+]	Business 40/32 HV [HV+]	Business 60/48 HV [HV+]	Business 80/64 HV
Max Energy [kWh]	15	20	30	40	60	80
Energy, 90% DoD [kWh] (1)	13.5	18	27	36	54	72
Energy, 80% DoD [kWh] (1)	12	16	24	32	48	64
Nominal Voltage [V](2)	153	204	153 [307]	204 [410]	307 [614]	410
Max/Cont Discharge Current [A]	150/80	150/80	250/150 [150/100]	250/200 [150/100]	250/200 [150/100]	250/200
Max/Cont Discharge Power [kW]	20/12	30/16	38/23 [46/30]	51/40 [61/40]	76/61 [92/60]	102/80
Max and Cont Charge Current [A]	100	100	200 [100]	200 [100]	200 [100]	200
Weight [kg]	130	173	260	346	519	692
Dimensions on or against wall - Height x Width x Depth [mm]	745x 490x290	745x 640x290	1260x 490x290	1260x 640x290	1260x 490x565	1260x 640x565
DC Connection – Fly Leads, [no. per electrode] (3)	1 x 16mm ²	1 x 16mm ²	1 x 25mm ²	1 x 50mm ²	1 x 50mm ²	1 x 50mm ²
External Interfacing	CAN Bus					
Enclosure	Aluminium – powder coated white, IP54 enclosure rating, Home – wall or floor mount, Business – floor mount					
Protection	Shunt Trip Circuit Breaker sized to suit max current, can be tripped by BMS if critical fault incl. overcurrent, cell under and over voltage, temperature, weak cell detection, minimum SOC control, manual reset					
Human Interface	State of Charge Display (0 to 100%), Error light, Error Reset Button, USB Plug for Programming					
Service Life [4]	10 year (or 4000 cycles) warranty for 80% average DoD, 13-15 yrs (>5 500 cycles) expected life at 70% DoD, 15-20 years at 50% DoD (>7 000 cycles)					

- 1) DoD = Depth of Discharge, recommended up to average daily 80% DoD for extended life, 50% average DoD for extra-long life. Max allowable DoD is 90%.
- 2) Voltage suitable for various high DC voltage inverters. Please enquire with Freedom Won for pairing support. Some models available in two voltages i.e. HV and HV+
- 3) Fly Leads 1,8m long, power cable Red = Positive, Black = Negative, conductors in table refer to one electrode i.e. per positive and negative connections. Longer cables available on request.
- 4) End of Life (EoL) defined as cell dropping to 60% of Beginning of Life (BoL) capacity for expected life and as 70% of BoL capacity for warranty.

Two RJ45 sockets [6] are provided, one for connecting the CAN interface from the battery to the system controller or directly to the inverter depending on the brand, and another for connecting the battery to another battery or for a termination resistor (more detail later in manual).

A USB Serial Connector [7 - concealed] is fitted to the upper left-hand side of the housing for use by technicians for programming the required profile onto the BMS or updating firmware. The required profile is typically loaded by Freedom Won prior to delivery but installers are advised to keep a USB “printer” cable handy during commissioning to allow Freedom Won or the distributor to program batteries remotely on behalf of the installer via the installer’s Windows laptop if necessary. A USB cable is provided with each battery.

An error reset button [8 - concealed] is positioned adjacent to the DB9 plug.

Freedom Lite is also fitted with a State of Charge (SoC) display [9], which includes a red LED error indicator [10] and below it a “reduced power” indicator.

Figure 2.2 USB “printer” Cable for Programming all Freedom Lite models produced after May 2020



The ON button [11] and OFF button [12] are located beside the SoC display.

The Lite Home HV range can be wall mounted, but if a sturdy wall is not available floor mounting is an option. The models 30/24 and upwards are supplied with a securing tab at the top in the middle as part of the rear cover to secure the battery against the wall to prevent it from tipping over [13]. **Note:** this tab must not be used to support the weight of the Lite, only to ensure it does not topple over when mounted on the floor. This tab is not suitable for securing the Lite in a moving vehicle where vibration could occur.

All Lite’s have feet as standard, whether needed or not [15].

A hard point is supplied on the top for the 15/12HV and 20/16HV models [14] for inserting an eye bolt that can be used for hoisting the battery onto the wall mountings. The Lite 30/21 and above are supplied with permanently installed eye bolt(s).

3. DC Bus Design Notes

The Lite range includes an integrated battery DC breaker/isolator that breaks the positive cable continuity inside the battery. This breaker, on all Home and Business models, is rated for a 36kA fault (short circuit) current. The system therefore does not require another DC isolator or breaker except where required in relation to conformance with the Clean Energy Council of Australia battery design Best Practice Guide, which states that, should the internal battery isolator not offer isolation of BOTH the positive and negative terminals of the battery, an external isolator is required that can isolate both the positive and negative cables/terminals of the battery.

The approximate short circuit current values of each battery model are provided in the table below:

Table 3.1 Short Circuit Current for Lite Home and Business Models

Freedom Lite	Home 15/12HV	Home 20/16HV	Home 30/24HV [30/24HV+]	Business 40/32HV [40/32HV+]	Business 60/48HV [60/48HV+]	Business 80/64HV
Short Circuit Current [A]	3100	3600	4700	5100	5800	6200

The external isolating device required for installations in Australia should be designed to withstand these fault levels (short circuit currents).

4. Transport, Handling and Mounting

The Freedom Lite units are packaged in protective layering and fastened into a wooden crate with pallet type feet, which allow lifting with a forklift or a pallet jack. The 15/11HV and 20/14HV models may be manually handled by four people but are best handled by a pallet jack or forklift if available. The 30/21HV, 40/28HV, 60/42HV and 80/56HV models must be handled with care by a forklift or pallet jack of the required lifting capacity rating.

If it is necessary to transport the larger units (typically 40/28 and larger) up or down multiple stairs in order to get them to the point of installation in the premises it may be preferable to deliver the unit with the lithium cells separate and then Freedom Won will fit them into the unit on site. This must be arranged with Freedom Won at the time of order placement and will attract a nominal fee for labour plus transport and accommodation where applicable. This service is not available in all countries. Please enquire with Freedom Won Sales.

The “Home” series is designed for wall mounting in order to preserve room and floor space and offer a convenient obstruction free and aesthetically pleasing solution. Each model is fitted to the wall using two Rawl Bolts. The Rawl Bolts are inserted into correct diameter pre-drilled holes in the wall. **The bolts must first be tightened substantially so that the internals of the Rawl Bolt have gripped tightly into the wall, and then the bolt must be turned out slightly with the head protruding so that about 5mm of the bolt shank is**

visible. This pre-tightening prevents the bolt from being pushed into the wall when mounting the Lite. The Freedom Lite has two keyhole shaped holes on the back, which are shaped to fit over the bolt heads and then a narrowed section secures around the bolt shank as the unit is lowered into its final position. The 15/11HV and 20/14HV models are hung using M8 bolts whilst the 30/21 model is hung on M10 bolts. The larger models are not equipped with keyholes and must be mounted upright on the floor. The centre to centre spacing of these bolts must be applicable to the model being installed. It is critical that these bolts are mounted within 1mm of the correct dimension and must be **perfectly level**.

Figure 4.1 Bolt Mounting Keyhole on Rear of Lite Casing – floor mount retaining tab and fitted eye bolt also visible



Eye bolts fixed to the top of the battery can be used for hoisting the unit up to the required height for fitting to the wall. The eye bolt on the models up to the Lite 20/14 can be removed after installation. Ensure that you have one M12 x 1,75 thread eye bolt rated for 450kg or more for the models that are not supplied with permanently fixed eye bolts.

Lifting the batteries by the eye bolts should be performed using a mobile gantry crane or a high lift pallet jack.

Figure 4.2 Eye bolt Example



Figure 4.3 Eye bolt Installation on a Lite 15/12HV model (remove after installation)



The units can alternatively be lifted to the right height and onto the hanging bolts using a high-lift pallet jack such as shown in Figure 4.4. A site assembled gantry with electric winch is shown in Figure 4.5. This gantry is available from Freedom Won as an accessory and is available with various gantry widths and lifting capacities.

Figure 4.4 High Lift Pallet Jack



Models up to Lite Home 20/16 are fitted with lifting or manoeuvring handles to make placement easier. See Fig 5.1.

Fig 4.5 Site Assembled Gantry with Electric Hoist



Caution:

1. Great care must be taken to ensure that the Rawl Bolt has properly located into the narrowed section of the mounting hole before removing the support.
2. Handle the Freedom Lite with great care when lifting and manoeuvring. It should remain either lying flat on its back, on a long side, or vertically upright (it should not be placed upside down or on its front face. When manoeuvring through a doorway on its long side be certain to pack spacing foam to prevent damage to the plugs and glands.
3. Do not allow the pallet jack to over centre if it is a model with forks longer than the lower arms
4. Take care not to knock any of the protruding items against obstacles during handling such as the DC cabling and plugs and the circuit breaker handle.
5. Take care not to scratch the Lite during handling. Packaging foam should be used to protect the paint when being handled on a trolley or pallet jack.
6. Always ensure that lifting equipment and slings are adequately rated for the lifting weight.
7. Ensure that the eye bolts are fully screwed into the hard point thread on the top of the unit before lifting.
8. Wear personal protective equipment such as safety shoes and gloves while handling and mounting the Freedom Lite

9. Always ensure that you have enough people on hand to perform the operation safely, i.e. at least one person to guide and stabilise and one person to hoist or handle the pallet jack or gantry.
10. The gantry can be configured for wall mounting – when using the gantry in this configuration absolute care must be taken to prevent the gantry from being pulled over by non-vertical tension on the rope.

Mounting and Environmental Requirements

The Lite Home and Business HV models are designed strictly for indoor use away from moisture and direct sunlight.

No specific venting is required since the Lite emits no hazardous gases, however air circulation may be required to ensure room temperature is maintained at reasonable levels, preferably below 30°C (see Lite warranty for information upper temperature limits for hot environments).

Room heating may be required in cold climates to keep the room above 0°C, since charging of the Lite is not permitted below 0°C. Ambient environments that regularly exceeding 40°C should employ room cooling if practicable to ensure optimal Lite service life.

Temporary storage or transport of the battery is permitted in the range -20°C to 45°C, however extended storage should be between 0°C and 30°C.

The Lite may be mounted directly against a wall or on the floor. There is no minimum requirement for spacing around the battery from other objects provided that these objects do not generate heat and that the vents on the sides of the battery are not blocked. Note however that access is required to the USB programming port on the left side, and the CAN Bus plug sockets and cable exits on the right side.

The Lite should be installed at least 500mm way from a heat source.

The Lite Home and Business IP rating is IP20.

5. Connecting the Freedom Lite

5.1 Power Cables

The Freedom Lite is simple to connect to the battery inverter. First of all you will connect the battery positive and negative cables to the inverter terminals using the applicable lugs.

Caution: Prior to connecting the positive and negative cables to the inverter be sure to check that the main battery circuit breaker is switched off. This will ensure that there are no short circuits between the loose ends of the cables and that you do not shock yourself!

The cables are supplied with the Freedom Lite, permanently fixed into the unit and secured onto the casing using compression cable glands. Attach crimp lugs to the ends of both cables ensuring that the correct terminal size is used, and the lug is matched to the size of the cable. The positive cable is red, and the negative cable is black. This is confirmed by + and –

signs on the battery casing beside the respective cables. See Tables 2.1 for the cable size and quantity fitted to each Freedom Lite HV model. The cable cross sectional area is based on an acceptable voltage drop with the inverter being mounted on the wall adjacent to the Freedom Lite battery so that the cable run is less than 5m (note however that the standard cable length is 1,8m, longer cables available on request).

Cable runs longer than 5m should be assessed and larger cables considered for extending the Freedom Lite cables to minimise voltage drop. Double Insulation welding cable is recommended, rated for at least 600V.

The cables may be routed through trunking and connected into the inverter on the positive and negative terminals, respectively. On Installations where there is more than one inverter a DC connector box is required as a common point to route the DC cables to each inverter so that the DC cable run can be kept the same length to all inverters.

5.2 Control Cables – Overview

For controlling external devices, you will need to connect the CAN Bus cable that allows the Battery Management System inside the Freedom Lite to control, and interface with, these devices.

The CAN Bus connection is made using the RJ45 plug with the pin configuration on the battery plug end provided in Table 5.1.

Table 5.1 Colour Coding and Pin Configuration for CAN Bus UTP Control Cable

RJ45 Pin No.	Standard Ethernet Cable Colours	Wire Function
Pin 7	Brown/White	CAN High
Pin 8	Brown	CAN Low

Only Victron is accommodated by the pin populations in Table 5.1 using a standard Type T-568B RJ45 terminated UTP cable. For other inverter brands, please refer to the respective inverter brands' manuals for their pin configuration or contact Freedom Won for assistance. Some brands are covered in Table 5.2 below.

Special CAN cables for supported inverter brands are available from Freedom Won (see accessories section). Please ensure that you use a correctly configured cable to prevent damage to any CAN Bus devices.

5.3 CAN Bus Control – Detailed Description

CAN is a widely used communication protocol in systems with many devices that must report their status or send commands to other devices on the same network. The Freedom Lite BMS can transmit messages and commands in CAN protocol to provide information to, but more importantly to control, external devices. CAN allows great versatility and provides a simple installation because there are only two wires required in this form of communication, namely CAN High and CAN Low. In order for an inverter or charge

controller to be controlled by CAN it must first of all be equipped with a CAN interface as well as a suitable method of connecting the CAN wires. Further to this the Freedom Lite BMS must be programmed with a CAN messaging profile that is developed for the inverter or charge controller being used. This profile must be specifically developed for each inverter model or model range. To date Freedom Won has developed CAN profiles for the following high DC voltage inverter equipment in relation to the Home and Business HV and HV+ range:

- Ingeteam Sun Storage Battery Inverters
- ATESS (HPS and PCS ranges)
- Solax
- Goodwe
- Socomec
- Sofar Solar
- Solis
- Elpower
- Vensys
- ABB

Freedom Won welcomes any requests to produce and test BMS CAN profiles for other inverters that are CAN equipped for BMS interfacing. For a list of approved CAN interfaces for 48V inverters please refer to the Home and Business 52V manual.

The CAN interface can provide the following functionality to compatible devices:

- i. Charge Current Limit of all Lite's connected
- ii. Discharge Current Limit of all Lite's connected
- iii. Actual State of Charge (minimum of all lights connected)
- iv. Actual Battery Temperature (highest of all lights connected)
- v. Actual Voltage
- vi. Actual Current (total of all Lite's connected)
- vii. Maximum real time charge voltage setpoint
- viii. Battery Name
- ix. Highest Cell Voltage of all Lite's connected
- x. Lowest Cell Voltage of all Lite's connected.
- xi. Firmware Version
- xii. Ah capacity of all batteries connected
- xiii. Advanced communication between all connected Lites

The CAN 2.0 Part A and Part B standard uses the SAE J1939 standard in the Lite. It is necessary to install a 120 Ohm resistor on each extreme end of the CAN cable (splices do not require a resistor). Most devices operating on CAN have two plugs to connect an incoming cable in and then outgoing cable on the CAN Bus. The first and the last device in the chain must have a termination resistor plugged into the spare (second) plug. These resistor plugs are available from Freedom Won (if you are using Victron then you can use

the Victron supplied resistors). SMA, Imeon, Solax and Victron operate on this basis for example. Ingeteam has a separate CAN terminal block for bare wires to be inserted from the BMS and these units have an internal resistor fitted into the device. All Freedom Lite models have two CAN plugs for parallel configurations (Figure 4.2) and to allow fitment of the termination resistors on the end of line units. Where one Lite is installed or where it is the end of line CAN device, **the Lite must be fitted with a termination resistor**.

The Lite is supplied with a termination resistor as standard. The other devices must be fitted with the correct termination resistor for that particular brand, where applicable (some devices have a built-in resistor). Note that the resistor supplied by Freedom Won must only be used on the battery.

The third-party device manuals must be referenced for all details regarding connecting the CAN interface.

The Lite profile is in most cases specifically designed for a particular inverter from the above list. The inverter pairing should be stated when ordering a HV or HV+ battery so that the battery can be shipped with the correct profile. If this is not done the profile can easily be changed during commissioning by your distributor for Freedom Won technical support.

Fig 4.1 provides the standard colour coding for an Ethernet cable (note that there are other variations so double check this).

Fig 5.1 Pin Configuration of Type T-568B RJ45 Plug



Table 5.2 Pin Configuration for CAN Bus Control Cable for various supported inverters

Wire Function	Standard Lite and Victron	SMA	Ingeteam	Imeon, Sofar Solar	Solax	Goodwe, Solis, Sunsynk
CAN Low	Pin 8 (brown)	Pin 5 (blue/white)	Labelled on inverter	Pin 2 (orange)	Pin 1 (orange/white)	Pin 5 (blue/white)
CAN High	Pin 7 (brown/white)	Pin 4 (blue)		Pin 1 (orange/white)	Pin 2 (orange)	Pin 4 (blue)
		Bridge Pin 3 and Pin 6 on Inverter end of cable with a 120Ω resistor				

If your inverter is not included in this table or you require more information on how to connect the CAN Bus on your inverter, please contact Freedom Won for assistance.

5.4 Parallel Configurations

It is permissible to connect multiple Freedom Lite's in parallel provided that the Freedom Lite model size used is the same throughout. It is however more cost effective to purchase one larger Freedom Lite model than connecting multiple units in parallel. This type of installation should be reserved for future expansion where it is not feasible to purchase a model large enough upfront for future requirements (financial constraints).

The Lite operating system will automatically configure which battery is the master and which ones are slaves (the first battery to be switched on in a parallel setup will be the master). The Lite is therefore plug and play capable, there is no configuration required during commissioning.

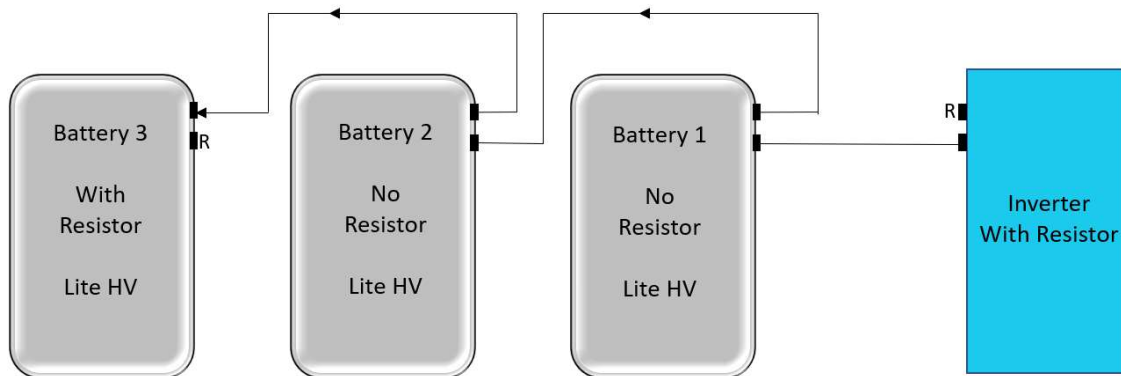
The Master Lite must be connected to the slave Lite's via the CAN Bus using standard LAN cable.

Where CAN Bus is used to control the inverter(s) and charge controller(s), the CAN Bus from any battery can be connected to the inverter directly or the system controller, depending on the product brand.

Figure 4.2 Picture Showing 2 x RJ45 Sockets for CAN Bus, the DC cables, High Voltage warning label, Model specifications Label and Manoeuvring Handle



Figure 4.2 CAN Bus Connection Example with Three Lite HV's – the inverter includes the CAN Bus connection; in some brands the CAN may connect to a separate controller.



In Fig 4.2 the inverter may include a built-in resistor with a dip switch to enable it or it may provide a second plug to accept a RJ45 termination resistor. Some inverters have screw terminals to accept a bare wire instead of a plug.

Freedom Lite batteries can configure themselves automatically for master and slave configurations with up to 20 slaves. No programming is required, simply connect the CAN Bus cables and switch on the Lite's. The Master will be the first battery that was switched on.

If the master Lite trips, one of the slaves will take over as the master automatically without any interruption of service.

Freedom Won offers a fair trade in on Freedom Lite's on the purchase of new units, which is an option for somebody wishing to expand their battery capacity instead of installing parallel units. Please request more detail from Freedom Won if this is your upgrade preference.

New units can be placed in parallel with old units up to about 5 years or 1 500 cycles, after which it is preferable to trade in for a new larger unit.

6. Programming the Freedom Lite

The USB plug on the left-hand side of the Freedom Lite is used for setting up the profile of the BMS. The computer must have the correct utility software installed. Programming of the BMS is intended only as a function to be performed by Freedom Won and approved installers. The manual on how to operate the BMS along with the utility is available to approved installers from Freedom Won. Write access to the BMS profile is password protected, however users and owners may request read only access.

7. Switching on the Lite

The Lite is fitted with an “ON” button. Press this button for at least 5 seconds to switch on the BMS inside the battery. Once the BMS has been energised you will observe the SoC display come to life with the SoC level shown. Confirm at this stage that the error lite is not illuminated. If it is, contact Freedom Won. If the Reduced Power light is illuminated, do not be concerned, it should extinguish after the battery has been in operation for a few hours.

Once the BMS has been energised, the main breaker may be switched on by pushing the breaker upwards. **Ensure beforehand that you have secured the DC cables to their proper locations and that the rest of the system is ready to receive battery voltage.**

CAUTION: The batteries in this range operate at potentially lethal voltages, the installer must make certain that there is no risk of electric shock before switching on the battery!

Note: On some inverters there is a large inrush current when switching on the DC supply. It is important in these instances to pre charge the DC bus. Other inverters are equipped with a pre-charge circuit – check before you switch on the battery to avoid damaging the battery breaker.

To switch off the DC output from the Lite, pull down the breaker. To switch off the power to the BMS, press the “OFF” button situated to the right of the “ON” button. This will also trip the breaker if it is still on at the time. The Lite must be switched off fully when not in use to prevent self-discharge.

Fig 7.1 “ON” and “OFF” Buttons



8. Settings Required for Setting up Inverters and Charge Controllers

The maximum and continuous discharge and charge currents for the respective models are provided in Table 2.1. The inverter should be configured within these limits. Generally the CAN bus messages from the battery will determine these limits.

The voltage settings on the inverter must align with the highest and lowest values discussed in Section 2. In some cases, the inverter menu requires the cell level voltage values. Please contact Freedom Won for assistance when configuring these inverters.

9. Accessories

Freedom Won offers the following accessories:

Table 9.1 List of Accessories

Item	Description
120 Ohm Termination Resistor – RJ45	For plugging into the second CAN port for an end of line Battery (usually these are supplied with CAN Enabled inverters and hence it is generally not necessary to purchase from Freedom Won.
Eye Bolt M12	Required for lifting 15/12 and 20/16 models using the hard point on top of the battery – for installation onto the wall
Gantry – see price list for options	Used for lifting Lite’s onto wall mount bolts as well as lifting the floor standing models into the upright position. Available with various width gantries (narrower to suit contracted installations). Fitted with 3 500kg electric winch, includes lithium battery and built in charger. Can be disassembled and reassembled in minutes for easy transportation.
CAN Bus Cables	For various inverters requiring non-standard cables.

10. Warranty and Repair

The Freedom Lite is sealed with a tamper proof warranty seal. It may not be opened by anyone other than Freedom Won and installers or repairers that have been explicitly approved by Freedom Won. The warranty on the unit will be void if the seal is damaged or missing.

If the Freedom Lite indicates an internal problem, please contact Freedom Won or the installer that installed the system. Freedom Won will arrange that it is inspected and repaired.

The warranty will not cover damage to the control wiring resulting from draw of excessive current or any damage resulting from lightning. Damage caused by physical means to the battery housing, external and internal fittings, such as impact with other objects, or being dropped, is not covered by the warranty.

The standard warranty period is 10 years or 4 000 cycles at an average of 80% DoD, whichever should first occur. The battery is required to provide at least 70% of its new capacity at the end of this period or cycle count. The BMS records the number of cycles

used. If you suspect that your Freedom Lite is delivering substantially below its minimum performance, please contact Freedom Won for an investigation. If the unit is found to be underperforming it will be serviced such that the minimum performance guarantee is again restored. Freedom Won may arrange for an on-site service or for collection of the unit for servicing at our facility. This will be mostly determined by the geographic location, ease of access to or removal of the unit, and size of the unit.

For more detailed warranty information please contact Freedom Won.

Note: the above warranty statements apply to Lites sold by Freedom Won on or after 1 September 2019 only. For Lites sold by Freedom Won prior please contact Freedom Won for the correct documentation.

11. Expected Product Life

Freedom Lite is designed for optimal life cycle cost, which is a fraction of any other battery technology available on the market, in particular from 25% to 35% of the lifecycle cost of the range of lead acid and associated variants on the market. Please contact Freedom Won if you would like more detailed information for comparison with lead acid batteries than what is available on our web site.

Freedom Lite is expected to operate for about 16 years in a daily cycling scenario for more than 5 500 cycles with an average of 80% DoD. For occasional cycling applications (for typical load shedding for instance, as is experienced in some countries) the service life expected is 20 years or more.

For applications where the cost per kWh delivered by the battery during its lifetime is of prime importance (i.e. maximum return on investment) we recommend that the battery be sized for an average cycle discharge of 50-60% DoD. In a daily cycling scenario such as for optimal solar self-consumption and off grid systems the expected service life is then 20 years or more than 7500 cycles. The defined end of life in this instance occurs when the battery capacity falls to 60% of the new capacity.

12. Troubleshooting Guide

Most issues with the Freedom Lite can be resolved using the guide below. If a problem cannot be resolved after referencing this table please contact Freedom Won or your approved Freedom Won supplier.

Table 12.1 Troubleshooting Guide (applicable to units with On and OFF buttons)

No	Problem Description	Cause/Solution
1	Eye bolts do not screw into hard point on top of Freedom Lite	Check that you have the correct eye bolt with the correct thread pitch – M12 x 1,75
2	The rawl bolt head does not fit into the hole on the back of Freedom Lite (wall mounted models)	Check that you are using the correct size Rawl Bolt as specified in this manual and that you have after positively tightening the internal gripping collar turned the bolt out again so that there is about 5mm of the bolt shank exposed so that the back plate can fit easily behind the bolt head. If the wall is uneven it may be necessary to turn the bolt head out a little more. Do not

		turn it so far out that there is less than the full thread length engaging on the internal locking collar.
3	The Freedom Lite has no voltage on the main output cables	<p>Check that you have switched on the main breaker switch. Note – only turn this on once you are satisfied that you have completed the installation and that there are no DC or control wires that can short out or touch ground or other wires. Also ensure that you are ready to accept AC voltage onto the inverter output before switching this breaker on. Also confirm that you have energised the BMS first by pressing the “ON” button for 3 seconds and as evidenced by the lights on the SoC display.</p> <p>If voltage is still not present with the breaker switched on it is possible the breaker has been damaged – please contact Freedom Won</p>
4	The BMS (indicated by battery SoC display lighting up) does not stay on after the ON button is pressed and released	<ol style="list-style-type: none"> 1. Error on the BMS. Check whether the red error light is illuminated on the SOC display when the ON button is held in. You can try to reset the error by pressing the RESET button for about 2 seconds and release. This should clear the error and allow the BMS to stay on after releasing the ON button. 2. Battery has been discharged to critically low level – remove all potential loads from the battery and switch off the inverter(s). Then try to switch on the BMS. 3. Battery has been charged to critically high voltage level – usually leaving the battery for an hour will allow the cell levels to drop down within acceptable levels and allow the BMS to be switched on again. 4. If the BMS still does not switch on, please contact Freedom Won or Authorised Distributor 5. Releasing the ON Button to soon – hold the ON Button in for at least 5 seconds before releasing.
4	The main breaker switch keeps tripping each time I attempt to switch it on	<p>There are several potential causes:</p> <ol style="list-style-type: none"> 1. The Battery Management System has not been switched on. The ON button must be pressed for 5 seconds. On release the SoC Display must remain illuminated. 2. High inrush current on certain inverters – First preference is to pre charge the DC bus by switching on the solar charge controllers if present and in daytime. If this is not possible switch on the AC feed into the inverter and switch on the inverter. Some makes will then pre charge the DC bus. You can also use a pre-charge resistor for this. If this does not work after the second attempt investigate the other options.

		<p>3. Short circuit on the DC Bus or faulty inverter or MPPT causing high currents</p> <p>4. In a system with multiple Lites in parallel the reason could be that the battery you are trying to switch on is at a different voltage to the others – the voltages must be similar (within 1V of each other) on all batteries when switching them onto a common DC bus.</p> <p>If none of the above solve the problem, you will need to contact Freedom Won or your authorised installer for assistance with this issue.</p> <p>It will be necessary to establish the reason for the error before continuing with normal operation of the system. Repeated tripping is damaging for the breaker.</p>
5	After resetting the BMS the main breaker still will not stay up.	<p>This is most likely because the battery is fully discharged and the BMS is protecting the cells from further discharge. Ensure that there is no chance of load being applied to the battery by isolating the AC output from the inverter. Ensure that the AC input to the inverter is live so that the charger may begin charging the battery after you switch it on. Alternatively, an MPPT can be used for this immediate charge if there is sunshine at the time. This charge should increase the battery voltage to prevent further tripping. This problem should not occur if the inverter control is working properly.</p> <p>If this does not work, it is because the battery has been discharged too deeply and will need to be reset remotely by Freedom Won by accessing your Windows PC connected to the battery. The PC must have TeamViewer installed and you will need the RS232 adapter to connect the PC to the battery. Please contact Freedom Won.</p>
6	I have switched off the main battery breaker switch to prevent discharge of the battery but the SOC display lights are still on.	<p>The BMS and SoC display receive power directly from the battery and therefore the “OFF” Button must be pressed to switch off the internal electronics.</p>
7	The inverter will not come on even though the inverter switch is selected to ‘on’.	<p>The enable command may not be coming from the BMS or may not be properly connected to the inverter or the inverter may not be properly configured to deal with the enable command.</p> <p>If you are running on a CAN Bus control with a compatible inverter and you are not observing the correct enable response from the inverter check that the CAN High and CAN Low wires are connected properly (ensure that you have the High and Low the right way around and that you have connected the two end of line 120 Ohm resistor in the applicable places. If this is not the problem then you need to confirm that you have the right CAN profile programmed onto the BMS for the</p>

		<p>inverter in use (baud rate or CAN messages may be for another inverter brand) or that you have configured the inverter or system controller correctly.</p> <p>Check that your CAN Cable is properly made up on the pin configuration and that the terminations are good.</p> <p>Contact Freedom Won or your Authorised Distributor for assistance</p>
8	<p>The charger will not come on even though there is power on the AC input of the inverter and the charger is activated in the inverter settings</p>	<p>The battery might be full. Try discharging the battery for a while and observe if the charger then comes on. If not then the fault finding process is similar to above.</p>
9	<p>The Freedom Lite error light keeps illuminating after each reset</p>	<p>If the battery voltage is within limits this should not ordinarily occur. Contact Freedom Won or an approved installer for assistance with determining the problem. If the main breaker does not trip it is not a critical error and you may continue using the battery while you make contact for assistance.</p>
10	<p>The pack voltage is within limits, but the main breaker still trips seemingly at random</p>	<p>This could be caused by many things but is most likely because the current draw is exceeding the battery current limit setting. Measure the current with a tong tester while drawing your maximum typical load to determine if you are exceeding the rated current for the respective Freedom Lite model. If it is not the current causing the trip it could be a weak cell or extreme temperature of the surroundings. Both are unlikely. If the problem persists, contact Freedom Won.</p>