INSTALLATION MANUAL

Modular LiFePO4 Energy Storage



This manual specifically covers the installation process.
For a comprehensive overview of other product ranges, visit www.freedomwon.co.za

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Amendment Record

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1. Introduction

The ENVA 16 is a 51.2V nominal, 314Ah, 16kWh lithium iron phosphate (LiFePO4) battery energy storage system designed specifically for residential and small commercial applications. Engineered for behind-the-meter deployment, the system delivers reliable energy storage performance in environments affected by grid instability, scheduled load shedding, constrained grid availability, and increasing electricity tariffs.

The unit incorporates a Battery Management System (BMS), providing comprehensive cell protection, thermal management, State-of-Charge (SoC) calculation, system monitoring, fault diagnostics, and communication functionality within a compact, self-contained enclosure. The BMS architecture is designed to support stable long-term cycling performance and seamless integration with a wide variety of leading inverter brands and hybrid energy platforms.

The ENVA 16 is suitable for on-grid, hybrid backup (UPS), and fully off-grid applications, enabling energy resilience across residential, small commercial, agricultural, and telecommunications infrastructure installations. The system supports integration with solar PV systems to maximise self-consumption, reduce peak demand reliance, and improve energy security during periods of grid interruption.

Designed with scalability in mind, the modular architecture supports the parallel connection of up to 15 battery units within a single cluster, allowing installed storage capacity to expand from 16kWh up to 240kWh. This provides flexibility for both new installations and future energy capacity expansion as site requirements evolve.

This manual does not cover the setup, interface, or functionality requirements for third-party equipment integration with the ENVA 16. However, Freedom Won is available to provide direct support specifically related to battery interfacing with supported third-party inverter brands.

2. Product Description

The ENVA 16 battery is designed as a robust, high-capacity storage solution suited to demanding residential and commercial applications that require reliable, scalable energy independence.

The product comes with an integrated suite of communication interfaces and a built-in fire suppression system, ensuring both a streamlined installation process and enhanced safety. The modules are floor-standing units with height-adjustable feet and integrated wheels for easy initial placement. A wall-retaining bracket is also included for added structural stability. Up to 15 units can be connected in parallel, with a custom combiner box required for configurations of this scale, allowing total system capacity to grow significantly over time.

The ENVA 16 is built with sixteen 314 Ah LiFePO4 cells in series to provide 16kWh of storage capacity with an expected service life of up to 15 years and a 5-year warranty covering 6 000 cycles at 90% DoD.

Connectivity is equally comprehensive, with CAN Bus and RS485 to support compatibility with all common inverter brands, RS232 for technicians to access to the BMS via a PC connection. The built-in Bluetooth, and Wi-Fi interfaces provide local connectivity and remote monitoring by use of the Freedom Won app.

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Freedom Won offers a range of products based on LiFePO4 (lithium iron phosphate) technology, including the following options:

Residential	12V Range eTower 2 ENVA 5 ENVA 16
Small Commercial HV	ENVA 60HV
Commercial and Industrial	SOLVA AC261 BESS Cabinet SOLVA DC261 BESS Cabinet SOLVA RT261 BESS Cabinet SOLVA AC418 BESS Cabinet
Large Scale ESS	COREVA 5

> **Note**
> This manual is exclusive to the ENVA 16. For other Freedom Won products, refer to their specific manuals.

The ENVA 16 operates at a nominal voltage of 51.2V, which is compatible with the "48V" systems. Refer to Figure 1 for a labelled illustration of the Freedom Won ENVA 16. The labelling corresponds with the legend table below the image.

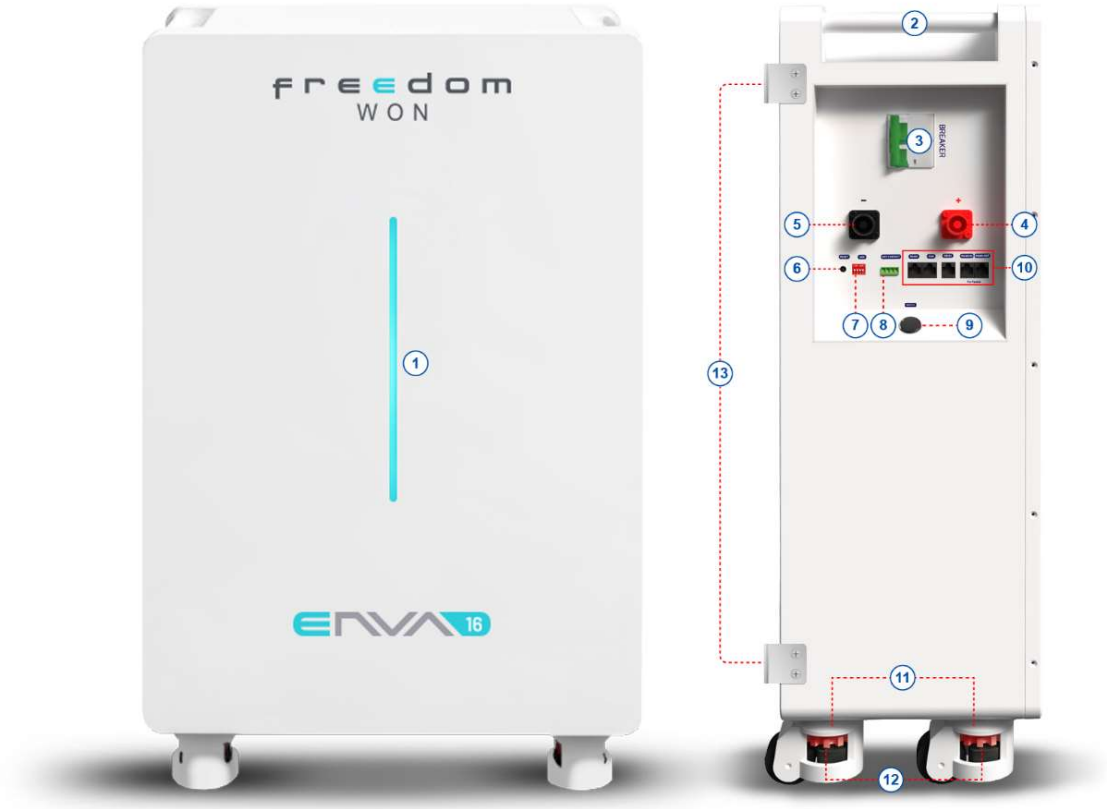


Figure 1: ENVA 16 Front and Side Interface Panel – Annotated Diagram

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Figure 2: Example of ENVA 16 secured against wall

Table 1 below describes each of the labelled components identified in Figure 1, outlining the function and purpose of each item on the ENVA 16 front and side interface panel.

Table 1: Figure 1 Annotation Descriptions

Label Number	Option Description
1. **SoC Colour Bar Display**	Provides an indication of battery charge level via blue LED colour bar.
2. **Handles**	To provide a secure grip for lifting, carrying, and positioning the battery safely.
3. **250 A Breaker**	Over-current protection and second level of protection after the BMS.
4. **Positive Terminal**	Used to connect the inverter/charger battery input (+).
5. **Negative Terminal**	Used to connect the inverter/charger battery input (-).
6. **Reset Button**	Press to reset the BMS.
7. **Dip Switch Block**	To set the Battery Address.
8. **Dry Contact**	Digital output dry contacts (DCT).
9. **Power Switch**	To power the battery On or Off.
10. **Communication Ports**	RS485, CAN, RS232 communication ports.
11. **Integrated Wheels**	Integrated wheels enable convenient movement and positioning of the battery.
12. **Wheel Lock Screw**	Used to fix the battery in place by lowering fixed rubber feet.
13. **Wall-Retaining Brackets**	Brackets to secure the battery to the wall.

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2.1 System Architecture

The diagram below illustrates a Hybrid energy solution incorporating the ENVA 16.

In this configuration the battery interfaces with the hybrid battery inverter. The battery inverter in turn communicates with the grid meter and controls the PV power and grid power flow according to system and battery requirements.

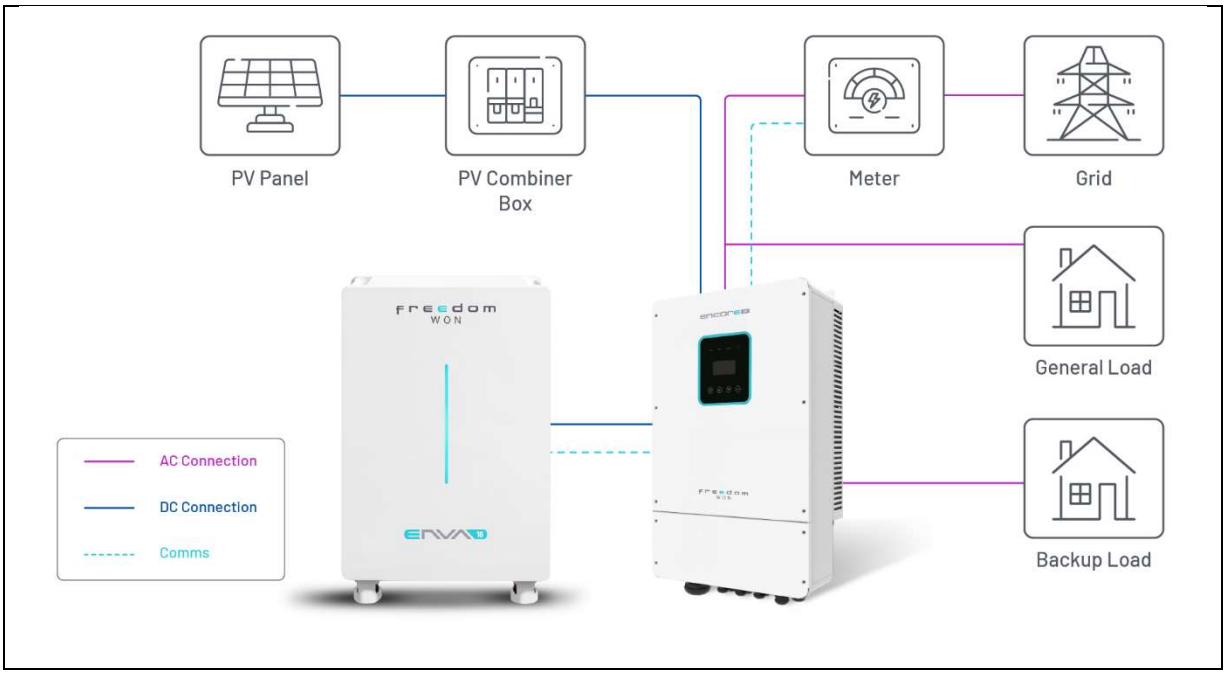


Figure 3: System Architecture

> **Note**
> The electrical diagrams in this section are for illustrative purposes only. They do not constitute a full engineering design.
>
> All system designs and installations must be carried out by qualified electrical personnel and must comply with the relevant electrical wiring standards and regulations relevant to the country of location.

2.2 Key Technical Features

The ENVA 16 comes with a number of key features:

- Certified to UN 38.3.
- Integrated BMS: full cell-level monitoring with over-voltage, under-voltage, over-current, short-circuit, over-temperature, under-temperature protection, effective cell balancing and SoC and SoH estimation.
- Scalability: up to 15 x ENVA 16 batteries can be connected in parallel, expanding system capacity in 16kWh increments. Master/Slave communication is achieved via a RS485 inter-module bus.
- High DoD: supports 90% depth of discharge in off-grid and back-up applications, maximising usable energy per cycle.

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- Connectivity: CAN Bus (500 kbit/s), RS485 (9 600 bps default), RS232 (9 600 bps default), dry contact outputs, and Wi-Fi/Bluetooth via the integrated IoT module.
- Integrated fire suppression module triggers on extreme heat detection and releases a fire suppression agent into the battery casing for added safety.

2.3 Technical Specifications

The table below lists the key specifications required for system sizing, inverter compatibility, and installation planning. Verify these parameters against the site design before commissioning.

Table 2: Technical Specifications

ENVA 16	
ELECTRICAL PARAMETERS	
Total Energy Capacity [kWh]	16
Current Capacity [Ah]	314
Energy, 80% DoD [kWh]	12.8
Energy, 90% DoD [kWh]	14.5
Max/Cont. Discharge Current [A] [1]	200/≤157
Max. Discharge Power [kW] [1]	10
Max/Ideal Charge Current [A] [1]	200/≤157
Max/Cont. Charge Power [kW] [1]	10/≤8
Nominal Voltage [V]	51.2V, to suit 48V Inverters
Max/Min. Operating Voltage [V]	56/46
Max. Recommended Inverter Total Rated Power (cont.) [kVA]	10 (per ENVA 16 unit)
Prospective Short Circuit Current [kA]	16
Max. Parallel Configuration	15 x ENVA 16 - Custom combiner box required
COMMUNICATION & INTERFACE	
Communication Interface	• CAN Bus (RJ45 socket x 1) - For interfacing with compatible inverters and system controllers (the ENVA 16 is fully compatible with all common CAN bus compatible brands) • RS485 (RJ45 socket x 1) - For interfacing with inverters equipped only with a RS485 lithium battery interface i.e. no CAN bus. • RS232 (RJ11 socket x 1) - For interfacing with a PC for firmware and setting updates (only by Freedom Won technicians) • RS485 (RJ45 x 2) - For the communication connection of parallel batteries • Digital outputs x 2 - For controlling external relays based on pre-set functions • Bluetooth - For local connection to Android or iOS App • Wi-Fi - For remote access to online portal via the App
Human Interface	• State of Charge Display (Indicated by colour bar) • Status LED

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	• On LED • BMS Reset button • Main power On/Off switch • BMS On/Off switch • Serial RS232 plug for programming via PC (by Freedom Won only) • Dip Switch block for selecting module addresses • Android or iOS App
PHYSICAL PARAMETERS	
Battery Dimensions - H x W x D [mm] [2]	827x520x252 (height includes feet)
Crated Dimensions - H x W x D [mm]	870x585x430
Battery Weight [kg]	126
Crated Weight [kg]	142
DC Connection Power Cables [mm^2]	1 Pair 35mm^2 x 1.2m long (included)
Enclosure	Mild Steel - Painted off-white. Floor-standing height-adjustable feet with integrated wheels for initial placement. Includes handles for easy handling. Bracket included to secure battery to wall.
Protection	Internal electronic protection including overcurrent, cell under and over voltage, temperature out of range, weak cell detection, minimum SoC control, active voltage-based charge current limiting *DO NOT short circuit or connect in reverse polarity.
Fire Protection	Thermally activated fire suppression aerosol canister for internal fire suppression
ENVIRONMENTAL PARAMETERS	
Operating Temperature [°C]	Charge: 0 to 55 | Discharge: -20 to 55
Storage Temperature [°C]	10 to 40 (3 months)
Operating Humidity [%]	≤90% RH, non-condensing
GENERAL DATA	
Battery Chemistry	Lithium Iron Phosphate (LiFePO4)
Battery Standards [3]	UN38.3, IEC62619* * In progress
Warranty	5 years (or 6 000 cycles)
Service Life	>15 years (>6 000 cycles) expected life

Notes to Specification Sheet

1. Max discharge and charge current duration - 5 min per 30-min cycle. Current limits rated for 10°C to 25°C. Derating applies outside this range.
2. Dimensions exclude protuberances.

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2.4 Terminal and Interface Reference



Figure 4: ENVA 16 Interface – Annotated Diagram

Table 3 below describes each of the labelled items identified in Figure 4, detailing the terminals, switches, and communication ports on the ENVA 16 interface panel to support correct wiring and connection during installation.

Table 3: ENVA 16 Interface Annotation Descriptions

No.	ITEMS	DESCRIPTION	REMARK
A	**Positive terminal**	Used to connect the inverter/charger	
B	**Negative terminal**	Used to connect the inverter/charger	
C	**Power switch**	To power the battery On or Off	
D	**Reset**	Used to reset the BMS	
E	**ADD**	Used to configure the RS485 baud rate and inverter communication protocol	
F	**Dry contacts**	Used to monitor battery status and control external equipment for safety and system operation.	Pin 1 is on the left
G	**RS485**	Connect to computer/inverter	
H	**CAN**	Connect to inverter	
I	**RS232**	Computer communication interface	
J	**RS485 IN**	For communication between batteries in parallel	
K	**RS485 OUT**	For communication between batteries in parallel	
L	**250 A Breaker**	Over-current protection and second level of protection after the BMS.	Connected to the positive busbar

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2.4.1 Communication and Interface Pin Configuration

2.4.1.1 CAN Bus – RJ45 (8P8C)

This interface connects the master ENVA 16 to CAN-Bus-compatible inverters and system controllers.

For reference, the pin configuration of the interface plug is as follows.

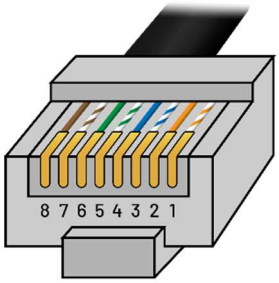


Figure 5: Pin Configuration for Standard RJ45 Plug (T568B)

Table 4: Pin Configuration for Standard RJ45 Plug (T568B)

RJ45 Plug Pin Numbers	Corresponding Signal Wires
1, 2, 3, 6, 7, 8	No connection
4	CANH
5	CANL

Note

The ENVA 16 includes a termination resistor in the CAN bus port.

Note that most inverter/chargers incorporate internal termination, this should be confirmed before installing an additional external resistor.

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2.4.1.2 RS485 Inverter Interface – RJ45 (8P8C)

This RJ45 plug is used to connect the battery's external control communications to RS485-compatible inverters (refer to the Freedom Won Inverter Compatibility Guide for more details). For support with Integration using RS485 communication, contact Freedom Won. For reference, the pin configuration of the interface plug is as follows.

Table 5: RS485 Inverter Interface RJ45 Pin Assignment Description

RJ45 Plug Pin Numbers	Corresponding Signal Wires
1, 8	RS485-B
2, 7	RS485-A
3, 4, 5, 6	No connection

2.4.1.3 RS232 Host Computer Interface – RJ11 (6P6C)

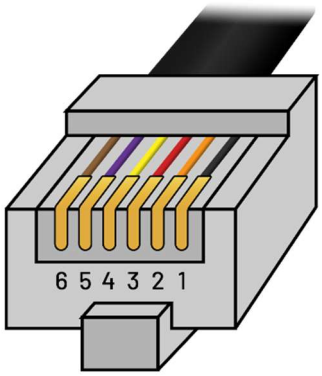


Figure 6: RS232 RJ11 Pin Assignment

Table 6: RS232 RJ11 Pin Assignment Description

No.	RJ11	Signal
1	Pin 1	Not connected
2	Pin 2	Not connected
3	Pin 3	TX
4	Pin 4	RX
5	Pin 5	GND
6	Pin 6	Not connected

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The figure below illustrates the RJ11 cable with a USB Type-A connector (available as an optional accessory from Freedom Won).



Figure 7: Battery to PC Communication Cable

2.5 DIP Switch Address Configuration

The Address Dip Switches (ADS) block, consisting of four binary dip switches, requires a specific configuration to assign a unique address to the ENVA 16 module. This setup ensures that each battery has a dedicated address on the network and that there are no duplicate addresses. Each ENVA 16 must have a unique address, starting from 1 and increasing consecutively.

The ENVA 16 Battery that is connected to the inverter through the communication cable must be assigned address 01. To simplify the setup process, assign address 01 to the top module external communication port (CAN or RS485) to the inverter. Then, assign consecutive addresses to each subsequent module below the top one, moving upwards in sequence.

The dip switch configuration is illustrated in Figure 6, with the numbering and ON/OFF positions following a standard binary sequence.

> **Note**
> The dip switch configuration is read from left to right, with the leftmost switch representing the least significant bit.
>
> Ensure that the dip switches are set correctly, to ensure reliable communication and proper system operation.

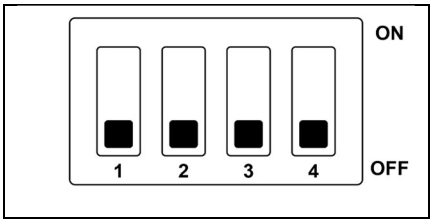


Figure 8: Dip Switch ON/OFF Positions

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To configure the dip switches, refer to Table 1, which outlines the settings for each module based on its assigned address. If the system does not support communication between the battery and inverter, ensure that all dip switches are set to the "OFF" position.

Refer to Table 1 below for dip switch positions for Address Numbers 1 to 15. Configure the towers according to the settings outlined in the table to ensure proper communication.

Table 7: Dip Switch Positions Address Numbers (1 to 15)

Address Number	Switch #1	Switch #2	Switch #3	Switch #4
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

Systems that require more than 150kWh capacity are better suited for the **Freedom Won ENVA HV** range of high-performance batteries.

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2.6 Colour Bar Display Description

The table below describes the LED bar behaviour for each battery status and operating condition, allowing users to quickly identify the unit's state - including charging, discharging, standby, alarms, and protection events - from the front panel indicator.

Table 8: Colour Bar Display Description

Status	Condition	ALM	Battery Level Indicator LED						Description	LED bands status
			L6	L5	L4	L3	L2	L1		
Off	Sleep	Off	Off	Off	Off	Off	Off	Off	All off	
Standby	Normal	Off	According to battery level						Standby state	
	Alarm	Flash	According to battery level						Module undervoltage	
Charging	Normal	Off	According to battery level						Highest battery LED flashes, ALM decodes flash during overcharge alarm.	
	Alarm	Flash	According to battery level (Highest battery LED flashes)							
	Overcharge protection	Off	Solid on	Solid on	Solid on	Solid on	Solid on	Solid on	If AC power is absent, indicator switches to standby status.	
	Temperature / overcurrent / failure protection	Solid on	Off	Off	Off	Off	Off	Off	Stop charging	
Discharging	Normal	Off	According to battery level							
	Alarm	Flash	According to battery level							
	Undervoltage protection	Off	Off	Off	Off	Off	Off	Off	Stop discharging	
	Temperature / overcurrent / short-circuit / reverse-connection / failure protection	Solid on	Off	Off	Off	Off	Off	Off	Stop discharging	
Failure	-	Solid on	Off	Off	Off	Off	Off	Off	Stop charging/discharging	

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2.7 Digital Output Dry Contacts

The digital output "dry" contacts include DO1 (pins 1 and 2) and DO2 (pins 3 and 4), which are normally closed potential-free contacts. DO1 opens when the battery has any type of fault protection enforced. DO2 opens the battery and raises a low State of Charge alarm.

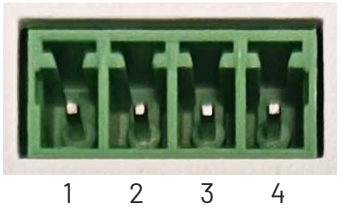


Figure 9: Dry Contacts

> **Note**
> The dry contact functionality is available upon request for customers who have purchased multiple ENVA 16 batteries.

> **Warning**
> Do not exceed 2A through these contacts. If a higher current is required to drive your external device use an interposing relay controlled by the battery and in turn, control your external device that requires more than 2A.

2.8 Audible Alarm Output

The ENVA 16 includes an audible alarm which is disabled by default. If enabled, the behaviour is described in the table below.

Table 9: Audible Alarm Output Buzzer Behaviour

Condition	Buzzer Behaviour
Fault condition (BMS FAULT state)	0.25 s ON / 0.75 s OFF | Duty cycle: 25% | Repeat: continuous
Protection condition (active protection)	0.25 s ON / 1.75 s OFF | Duty cycle: 12.5% | Exception: overvoltage protection is silent
Alarm condition (alert threshold exceeded)	0.25 s ON / 2.75 s OFF | Duty cycle: 8.3% | Exception: overvoltage alarm is silent
Factory default	Beeper disabled (OFF). Enable/disable via PC software.

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2.9 BMS Reset Button Function

The ENVA 16 includes Reset button which can be operated as per the table below.

Table 10: BMS Reset Button Behaviour

Button Action	Behaviour
Short press 3–6 s — Hibernation mode	Activates the BMS from hibernation to active mode. LED sequence: RUN illuminates for 0.5 s, followed by normal operation display.
Short press 3–6 s — Active mode	Places the BMS into hibernation mode from Active mode. LED sequence: lowest SOC LED illuminates for 0.5 s, then all LEDs extinguish.
Long press 6–10 s — Active mode	Performs a BMS soft reset from active mode. All LEDs illuminate simultaneously for 1.5 s. Parameters and settings are retained. See note below.
Long press for Wi-Fi reset (13–15s) – Active mode	Resets the Wi-fi connection. The SoC and other indicators will flash, and a beep will indicate that the reset is complete. Release the button once you've heard this beep.

> **Note**
> A reset (press and hold for 6–10 seconds) restarts the BMS without losing any saved settings.
> **(Avoid holding reset button for more than 13 seconds, as this performs a different reset function)**

Restoring normal operation and clearing alarms by using reset button.

- When the battery is in a dormant state, press the reset button with a pointed object to "wake up" or activate the BMS.
- If the battery is in a fault or alarm state, use the reset button to clear the alarm or fault to restore normal operation.

The button must be pressed for about 6-10 seconds to initiate a reset – while holding the reset button down, during the reset process, the SoC colour bar display will illuminate in the following patterns:

1. **Red LED (bottom)** - A single red LED illuminates briefly at the bottom of the colour bar.
2. **Cycling sequence** - A blue coloured LED illuminates from the top of the colour bar and cycles progressively downward through the LED segments.
3. **Settled display** - Once the LED settles at the bottom of the colour bar, it will alternate between solid blue and blue and white, indicating that the reset is in progress.

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Figure 10: Reset Button

2.10 Hibernation Mode

2.10.1 Conditions Triggering Hibernation

- An over-discharge protection event persists for more than 30 seconds without being cleared.
- The button is pressed for 3–6 s while the BMS is in active mode.
- The minimum cell voltage falls below the configured sleep threshold, and the sleep delay timer expires under conditions of inactivity (no charge/discharge current, no active communication, no active protection, or balancing).
- The system remains in standby (no charge/discharge, no communication, no mains supply detected) for more than 24 consecutive hours.

> **Note**
> The BMS cannot enter hibernation mode if an external voltage (e.g. a connected charger or live inverter DC bus) is present on the output terminals. Ensure the DC bus is de-energised before attempting to hibernate the system.

2.10.2 Conditions Waking the BMS from Hibernation

- A charger or active inverter DC bus presenting a voltage exceeding 48V is connected to the output terminals.
- The Reset button is pressed for 3–6s.

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2.11 Multiple ENVA 16 Parallel Configuration

2.11.1 Communication Cable Connection

Confirm the location of the Master battery, which is the battery interfacing with the inverter with address '1'. Insert the RJ45 plug into the Link Out port of the master and connect the other end into the Link IN port of the next battery in the parallel chain.

Repeat this process using the Link Out port of battery 2 in the parallel chain and plug the other end of the cable into the Link In port of battery 3 in the parallel chain. Ensure that all the batteries in the parallel configuration are connected to the last battery in the link.

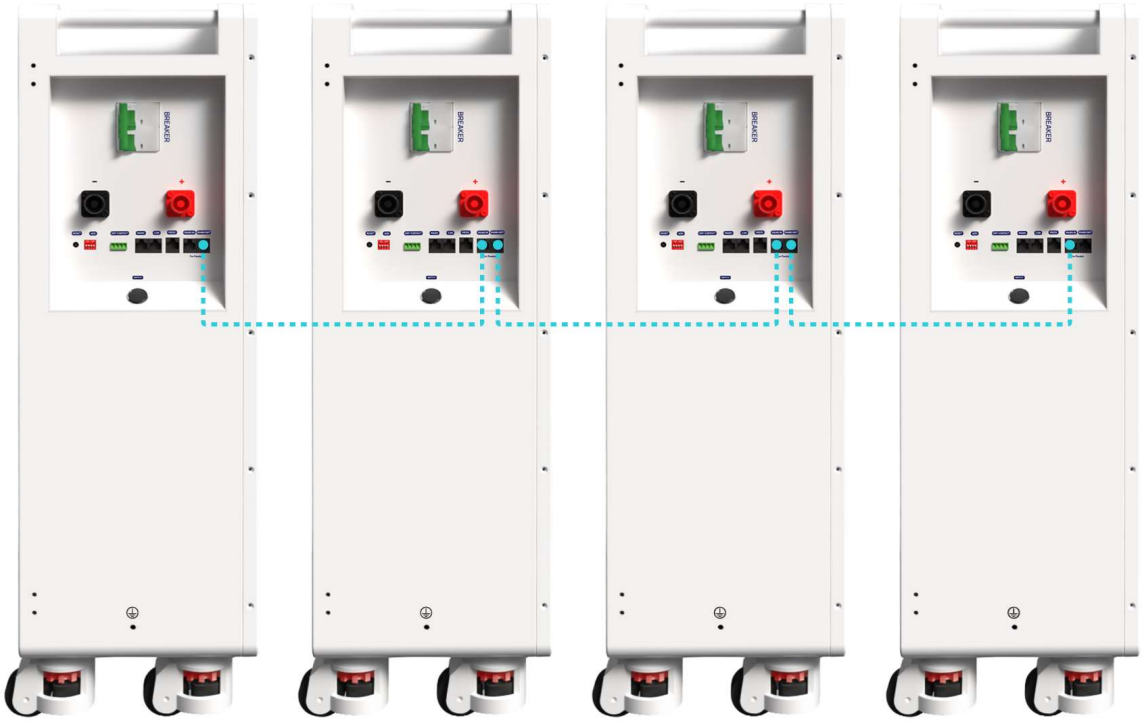


Figure 11: Parallel Communication

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2.11.2 DC Power Cable Connection

Use the power cable supplied with the battery. Ensure that all circuit breakers are switched OFF before proceeding. Connect the cables from the battery's DC power connectors and parallel them to the DC bus. Verify and confirm correct polarity before energizing the system to prevent damage or unsafe operation.

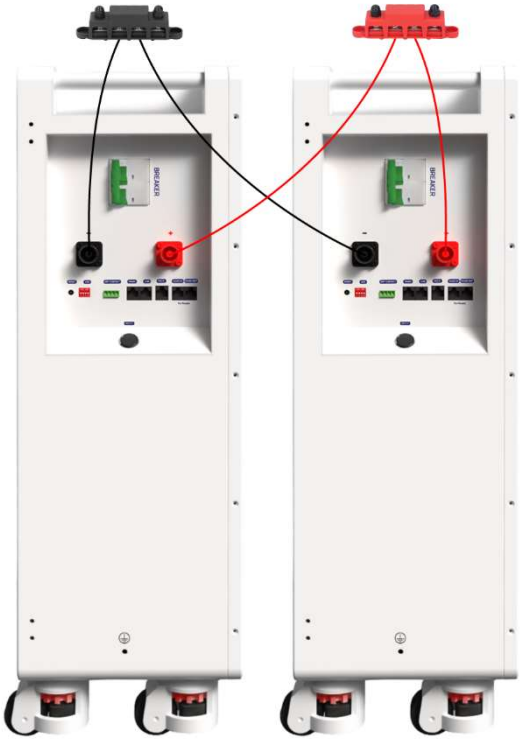


Figure 12: DC Power Cables Connection

2.11.3 Connecting with Inverter

Connect the inverter to the Master battery RS485 port (interface G on table 3) with inverter RS485 communication cable for RS485 compatible inverters. For CAN compatible inverters, connect the inverter CAN communication cable to the Master battery CAN port (interface H on table 3). Connect battery DC (+) with inverter battery INPUT (+), battery DC (-) with inverter battery INPUT (-), an external disconnection breaker/fuse is recommended between the battery/busbar and inverter.

Caution

Before proceeding with any wiring connections, ensure the inverter AC input and PV input are disconnected and all battery DC breakers are in the OFF position.

Note

Select a suitable external disconnection breaker/fuse in accordance with the inverter's power and current ratings, rated voltage, and overload characteristics.

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Recommended wiring diagram:

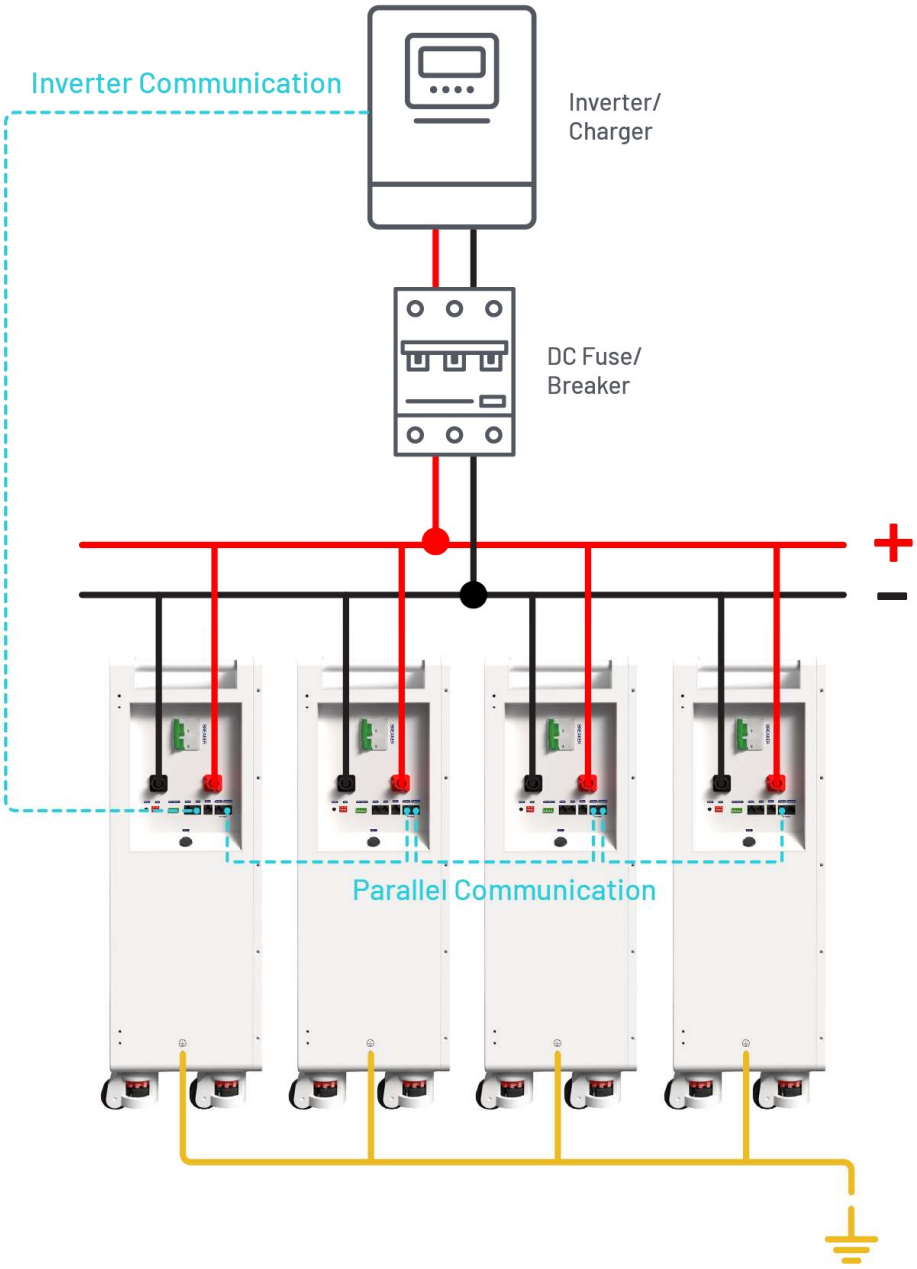


Figure 13: Battery & Inverter Connection

Note

A maximum communication cable length of 15m is allowed between the inverter/charger and battery.
A maximum power cable length of 10m is recommended between the inverter/charger and battery.

Caution

The maximum rated current per power cable and terminal is 125 A, with a recommended continuous current of 100 A. The number of power cable pairs used must be determined based on the field configuration and in compliance with local wiring requirements, standards, and directives.

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2.11.4 Commissioning

Set the DIP address of the Master battery and all the Slave batteries. Switch on all battery modules, wait 1 minute, and make sure that the ON/OFF LED is illuminated on all batteries. Turn on the breaker between the inverter and the battery/busbar if there is one, then turn on the inverter/charger. Complete the required settings on inverter/charger or any other control devices. Confirm proper communication between the Master battery and the inverter by observing the battery parameter values on the inverter screen. Once confirmed, the system may be placed into operation.

> **Caution**
> If the system is configured for backup or off-grid operation, verify that the inverter and battery power capability are sufficient to handle peak demand scenarios and the inverter is set up to protect the battery from over-discharge.

2.12 DC Circuit Breaker

ENVA 16 is equipped with a 250A DC-rated circuit breaker, which protects against overcurrent and short circuits, as well as allows the connection and disconnection of the battery module to and from the DC bus. After connecting all modules and ensuring that it is safe to apply power to the DC Bus, switch "ON" all module circuit breakers in quick succession, starting with the master ENVA 16 assigned as address "1".



Figure 14: ENVA 16 Circuit Breaker

When the ENVA 16 is active, the SoC colour bar and Run LED will illuminate. The circuit breaker also functions as a disconnect switch for the battery. When the breaker is "OFF", the battery will be disconnected from an external voltage source, such as the inverter.

The On/Off button when pushed to the off position will power off the Battery Management System of the ENVA 16, thus removing battery voltage from the DC terminals.

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2.13 DC Power Cables

The power cables supplied with the ENVA 16 are 1.2m Long. If other cables are used, ensure that they are sufficient for the voltage and current rating of the connected inverters or DC chargers. The positive cable is red, and the negative cable is black.

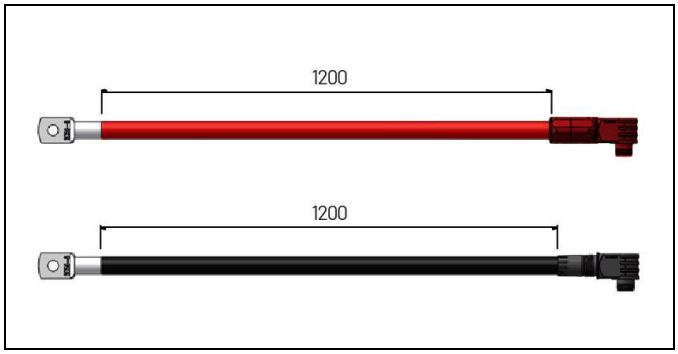


Figure 15: Power Cables

2.14 Earthing Point

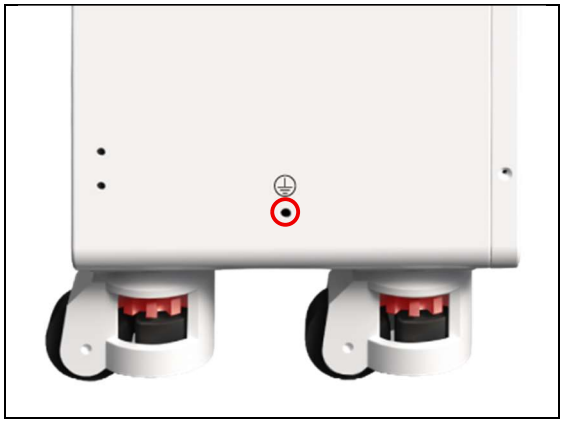


Figure 16: Earthing Point Example

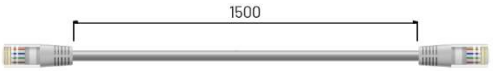
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3. Packaging, Transportation & Storage

3.1 Package Contents

Each ENVA 16 is supplied in protective packaging containing the battery pack and the accessories required for a standard installation. On receipt, inspect the packaging for damage and verify the contents against the table below before proceeding. Should any item be missing or damaged, contact your supplier before installation.

Table 11: ENVA 16 Package Contents

Type	Image	Description	Qty
Battery Pack (1pc)		ENVA 16 battery pack	1
Power Cables		A: Battery to inverter negative cable (2AWG/35mm2 1200mm BLACK)	1
		B: Battery to inverter positive cable (2AWG/35mm2 1200mm RED)	1
Communication Cable		C: Battery to inverter communication cable (1500mm)	1
Wall-retaining brackets		ENVA 16 wall-retaining bracket	4

3.2 Transport & Storage

- Do not shake or impact the battery and protect it from sun and rain during transportation.
- Handle with care during loading and unloading. Prevent falling, rolling, and heavy pressure.
- Store the battery in a dry, clean and well-ventilated environment for long-term storage. Recommended storage temperature: 15–25°C.
- Do not store the battery near harmful gases, flammable or explosive materials, or corrosive chemical substances.
- Store and transport the batteries at approximately 50% SOC. Do not store above 80% SOC for long periods.
- If the battery is not used for an extended time, complete a full charge/discharge cycle every 6 months.
- Do not drop the battery or stack objects on top of it unless packaged in the original packaging.

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3.3 Environment

ENVA 16 is designed strictly for indoor use, and the below table provides further important environmental guidelines.

Table 12: Environmental Parameters

Category	Description
Working temperature	15°C -30°C (practical ideal operating temperature range) 25°C (optimal operating temperature) -20°C-55°C (maximum operating range - for short durations)
Relative humidity	5%~90%, No condensation
Altitude	<3000m
Safety requirement	• Do not place the battery within reach of children/pets. • Do not place the battery near heat sources and flammable material. • Do not place the battery in a location with poor ventilation. • Do not drop, deform, impact or pierce the battery with a sharp object. • Do not put heavy things on battery. • Do not disassemble the battery. • The battery must not be exposed to water or any other liquids. • Contact Freedom Won immediately to report any product failure that may occur.

4. Maximum Current and Time Limit

The maximum current for each configuration is governed by the rating of the built-in circuit breaker and the BMS, as well as internal temperature rise considerations. The time limit for operation at the maximum current is 5 minutes in a 30-minute cycle.

4.1 Current Value

To prevent the circuit breaker from tripping during normal operation and to avoid overloading the BMS power electronics, it is recommended to design the system to operate at or below the continuous current value in most scenarios. (*Refer to technical specifications, page 11*).

4.2 Maximum Allowable Voltage

The absolute maximum allowable voltage when fully charged is 56V, however, a more typical inverter charge setting range is 55.5V to 55.8V.

4.3 Typical Inverter Charge Setting Range

The voltage normally used when setting up the inverter for the minimum cut-off is 48V, however, this will not typically be reached if operating down to 90% Depth of Discharge (DoD). The BMS will command the compatible connected inverter with CAN Bus or RS485 interface to stop discharging the battery at 10% SoC (90% DoD), which roughly equates to 49,0V). Under high load, the voltage may drop to 48V whilst still above 10% SoC.

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4.4 Undervoltage Protection

A voltage of 48V or even lower can be observed in systems without a CAN Bus interface or where the standby current draw on the inverter has caused the battery to be discharged below 10% SoC. The BMS will eventually cut off the battery from the DC bus at around 46V to protect the cells from undervoltage.

5. Setting up Inverters and Charge Controllers

The ENVA 16 supports integration only with inverters with a lithium battery communication interface (with CAN bus and/or RS485), which must be set to Lithium Battery mode. These settings are sufficient to ensure that critical communication between the inverter and battery is established.

The typical recommended charge current for the ENVA 16 is 100A to ensure optimal battery longevity.

The inverter must allow charge up to 100%. Extended operation (for longer than 5 days) without a full charge may result in reported SoC inaccuracy. The system setup should allow the battery to be charged fully on most days.

The battery is designed to operate optimally with a duty of 1 cycle per day.

> **Note**
> Refer to the Freedom Won Inverter interfacing guide for compatibility.

6. Start-up and Shutdown

6.1 Start up the ENVA 16

To switch on the ENVA 16, follow these steps.

1. Switch on the "ON/OFF" button on the ENVA 16.
2. The DC terminals of the ENVA 16 may immediately become live if the BMS is active.
3. If the BMS is not active, the ENVA 16 will detect an external voltage source and the BMS will wake up, indicated by the illumination of LEDs on the front panel.

6.1.1 Pre-Charging the DC Bus (If Necessary)

The ENVA 16 BMS manages most inverter inrush current levels. Some inverters may however have a particularly large inrush current when switching on the DC supply. If high inrush is expected, pre-charge the DC bus before switching on the ENVA 16 breaker. To pre-charge the DC bus, energise the inverter through the AC or PV (DC) input prior to switching on the battery.

6.2 Shutdown the ENVA 16

To switch off the ENVA 16, follow these steps:

1. Ensure no current flow in or out of the ENVA 16,
2. Switch off the "ON/OFF" breaker to disconnect the DC output from the ENVA 16,
3. To shut down the BMS, switch off the ON/OFF button.

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7. Freedom Won App Bluetooth and Wi-Fi Setup Guide

The ENVA 16 is fitted as standard with both Bluetooth and Wi-Fi. To access these interfaces download the Freedom Won APP from the Google Play or Apple store. The initial connection to the ENVA 16 must be made on site using Bluetooth. Once the ENVA 16 has been registered using Bluetooth, the ENVA 16 can be shared with others for remote access via the Internet provided that the ENVA 16 has been paired with the site Wi-Fi.

The ENVA 16 firmware can be updated Over The Air (OTA) by Freedom Won or authorised installers.

Please refer to the Freedom Won app Bluetooth and Wi-Fi Setup Guide for an explanation of how to configure and operate the Android or iOS app to interface with your ENVA 16 battery.

8. Warranty and Repair

The ENVA 16 is sealed with a tamper-evident label to prevent unauthorised access. Only Freedom Won and approved installers or repairers are authorised to open the unit. If the seal is damaged or missing, the warranty will be void.

In the event of an internal issue with the ENVA 16, contact Freedom Won or the installer to return the unit to Freedom Won for further inspection.

The warranty does not cover damage caused by lightning strikes. Physical damage to the battery housing, external and internal components, resulting from impacts, water drops, or other forms of physical damage, is also excluded from the warranty.

The standard warranty period is 5 years or the pro rata equivalent of 6,000 cycles at 90% 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 ENVA 16 is delivering below its minimum performance, contact your distributor or installer for an investigation.

If the ENVA 16 does not meet its performance standards, it must be returned to Freedom Won for service to restore its guaranteed performance. Freedom Won will determine whether the unit requires replacement.

For more detailed warranty information refer to the Freedom Won ENVA 16 Warranty Document.

8.1 Expected Product Life

The ENVA 16 is expected to operate for about 15 years in a daily cycling scenario for the pro rata equivalent of more than 6 000 cycles at 90% DoD per cycle, provided that the battery is operated under optimal conditions.

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9. Troubleshooting Procedure

For most issues with the ENVA 16, refer to troubleshooting Table 13 below for solutions. If the issues persist after consulting this table and the rest of the manual, contact your authorised Freedom Won supplier for further assistance.

Table 13: Troubleshooting Guide

Symptom	Solution	Further Action
Unable to start	1. Switch on battery and press RESET 6s to observe whether the battery can be started. 2. Charge the battery use a charge or inverter to provide 54~57.6V voltage and observe it can be started.	If the abnormal status still alive after above steps, please contact your supplier. If there is any other situation(s) excluding in this table, turn off the fault battery, contact your supplier.
Unable to charge	3. Check whether the cable connection between the battery and the inverter/charger is correct. 4. Check whether the inverter/charger setting is correct. 5. Check whether the battery is in charge protection mode, if yes, try to discharge the battery.	
Unable to discharge	6. Check whether the cable connection between the battery and the inverter/charger is correct 7. Check whether the battery occurs short circuit, reverse connection, pre-charge failure during connection inverter etc. 8. Check whether the battery is in discharge protection mode, if yes, try to charge the battery.	
High/Low temperature	9. Stop the battery system for a while, check whether the installation location temperature meet the requirement. 10. Avoid continuous full charging and discharging.	
High current	Check the configuration and parameters setting on the inverter/charger is correct.	
ALM ON	Turn off all the batteries, and remove the fault battery from the system.	
Communication fail	11. Check the communication cable type is correct and is contacted well. 12. Check the DIP switch setting is correct. 13. Check the inverter protocol related setting is correct. 14. Check both battery and inverter are working properly.	

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10. List of Abbreviations

Table 14: List of Abbreviations

Abbreviation / Term	Definition
BMS	Battery Management System — the embedded electronic control unit responsible for cell monitoring, protection, balancing, state estimation, and communication.
SOC	State of Charge — ratio of available charge to rated capacity, expressed as a percentage (0–100%).
SOH	State of Health — ratio of current full-charge capacity to original rated capacity, expressed as a percentage.
DOD	Depth of Discharge — proportion of rated capacity that has been discharged in a given cycle, expressed as a percentage.
LiFePO4	Lithium Iron Phosphate — the cathode material used in this battery chemistry. Characterised by excellent thermal stability, long cycle life, and low energy density relative to NMC chemistries.
DIP Switch	Dual In-line Package switch — a miniature slide or rocker switch array used to configure binary address and protocol settings on the BMS.
CAN	Controller Area Network — a robust differential serial bus (ISO 11898) widely used for BMS–inverter communication at baud rates up to 1 Mbit/s.
RS485	EIA-485 — a balanced differential serial standard used for multi-drop communication between BMS and inverter/charger over distances up to 1 200 m.
RS232	EIA-232 — a serial communication standard used for point-to-point connection between the BMS and a host computer (PC interface, firmware updates).
MPPT	Maximum Power Point Tracker — a DC-DC converter stage used to extract maximum power from PV panels.
PSCC	Prospective Short-Circuit Current — the maximum fault current that could flow at a given point in the circuit under bolted short-circuit conditions.
SANS	South African National Standard — published by the South African Bureau of Standards (SABS).
NRS	Nersa Rationalised Specification — technical standards applicable to electrical distribution in South Africa.
SSEG	Small-Scale Embedded Generation — generation plant with capacity ≤ 1 MVA connected at LV.
OHSA	Occupational Health and Safety Act, No. 85 of 1993.
EPR	Extended Producer Responsibility — producer obligations under the NEM:WA regulations.

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