Energy Management System (EMS) Installation Manual

Experience the future of Energy Management Systems

This manual covers the installation process for the Energy Management System (EMS). For a comprehensive overview of other product ranges, visit the Freedom Won website.

Update Record

Revision Number	Update Summary	Updated By	Date of Issue
0	First Release	Mike Marquis Jarod Lesser	23/01/2024
1	WAN Connectors Update	Jarod Lesser	15/08/2024
2	External Port, Formatting, and Panel Dimensions Updates	Technical Training Team	12/09/2024
3	Auxiliary Power to the Generator and Load Meters Updates	Technical Training Team	22/10/2024
4	Expanding on Existing Topics Updates	Mike Marquis	31/01/2024
5	General Updates	W Skosana	19/03/2025

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1 Introduction

The Energy Management System (EMS) is a combination of hardware and software designed to monitor, control, and optimise energy usage within a building, facility, or larger grid. This system maximises energy efficiency, reduces costs, and promotes sustainability.

With its integrated backup system, the EMS guarantees uninterrupted operations and secure data saving even during power outages. You will also receive real-time system alerts on performance, faults, and device status to assist you in addressing potential issues.

The EMS offers remote monitoring, allowing you to configure and adjust connected devices from anywhere. It uses cloud monitoring and control features, allowing you to track your system's performance and make adjustments as needed. It features a simple, no-code setup for quick installation, and it is compatible with most major energy devices.

The EMS enables you to manage multiple hybrid inverters as a unified system and monitor the individual performance and health of each inverter. This delivers a powerful, centralised energy solution.

EMS provides flexible software licenses that enable secure remote access, real-time and historical data, and remote configuration without restrictions on users, alerts, or data exports.

Licenses are available for 1-year or 5-year terms, with data point packages (tags) ranging from 50 to 500. Options include:

- EMS Essential: 5-year, 50 tags
- EMS Pro: 5-year, 150 tags
- EMS Ultra: Customisable for complex requirements

The manual does not cover the technical details required for the integration of third-party equipment. If this document does not cover the required integration or technical details, contact Freedom Won at support@freedomwon.co.za.

Freedom Won also offers the following ranges using LiFePO4 technology:

1. 12V Auxiliary Range
2. eTower
3. LiTE Home and Business 52V
4. LiTE Home and Business HV
5. LiTE Marine
6. LiTE Mobility (golf carts, forklifts, etc.)
7. LiTE Commercial HV and HV+
8. LiTE Industrial
9. megaTower Plus/Extra

2 Product Description

2.1 Verify Package Contents

Before installing the EMS, carefully inspect all equipment for any signs of damage. If damage is found, contact Freedom Won for further investigations. Refer to the Freedom Won Terms and Conditions document for detailed information.

Refer to the EMS package checklist in Table 1 to ensure all items are present before installation.

Table 1: EMS Package List

Items	Quantity
Wall Mount Bracket	4
Panel Door Key	1
GSIM Antenna	1
3m Cable SMA	1
Panel Brochure	Sticker Pack
Panel ID and Labels	Sticker Pack
PT100 Temperature Probes	2
Temperature Joiner Box	4
Magnetic Door Contact	2
RS-485 Termination Resistor 12ohm	10
Glands and Locknuts	X6
EMS Unit	1

2.1 EMS Unit Dimensions

Refer to the image below for the dimensions of the EMS top, bottom, and side panels.

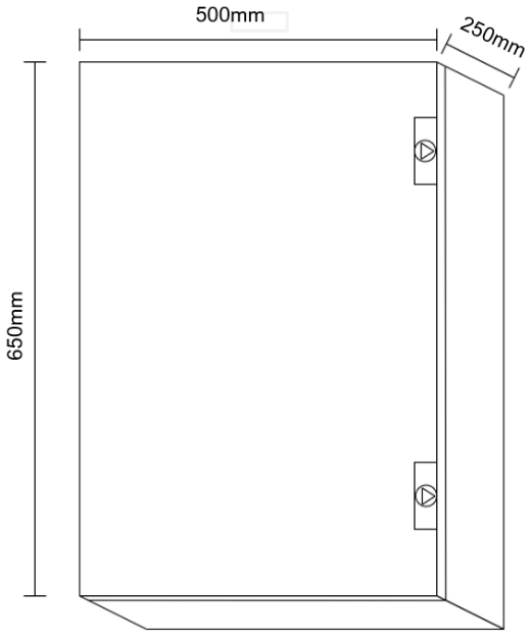

Figure 1: EMS Panel Dimensions

2.2 EMS Panel LED Lights

The EMS Panel has two (red and green) status LED lights on the front panel.

Table 2: EMS Panel LED Lights

LED Light	Status Indication
Green (Power) 	The green light (Power) on the EMS panel illuminates under the following conditions: • The EMS is functioning normally and within its expected parameters. • The EMS panel is receiving power, either from an AC source or a battery, confirming its operational status.
Red (Cloud) 	The red light (Cloud) on the EMS panel illuminates under the following conditions: • There is no internet connection.

2.3 EMS Unit Internal Components

Refer to the image below illustrating the EMS unit interior example and its components.

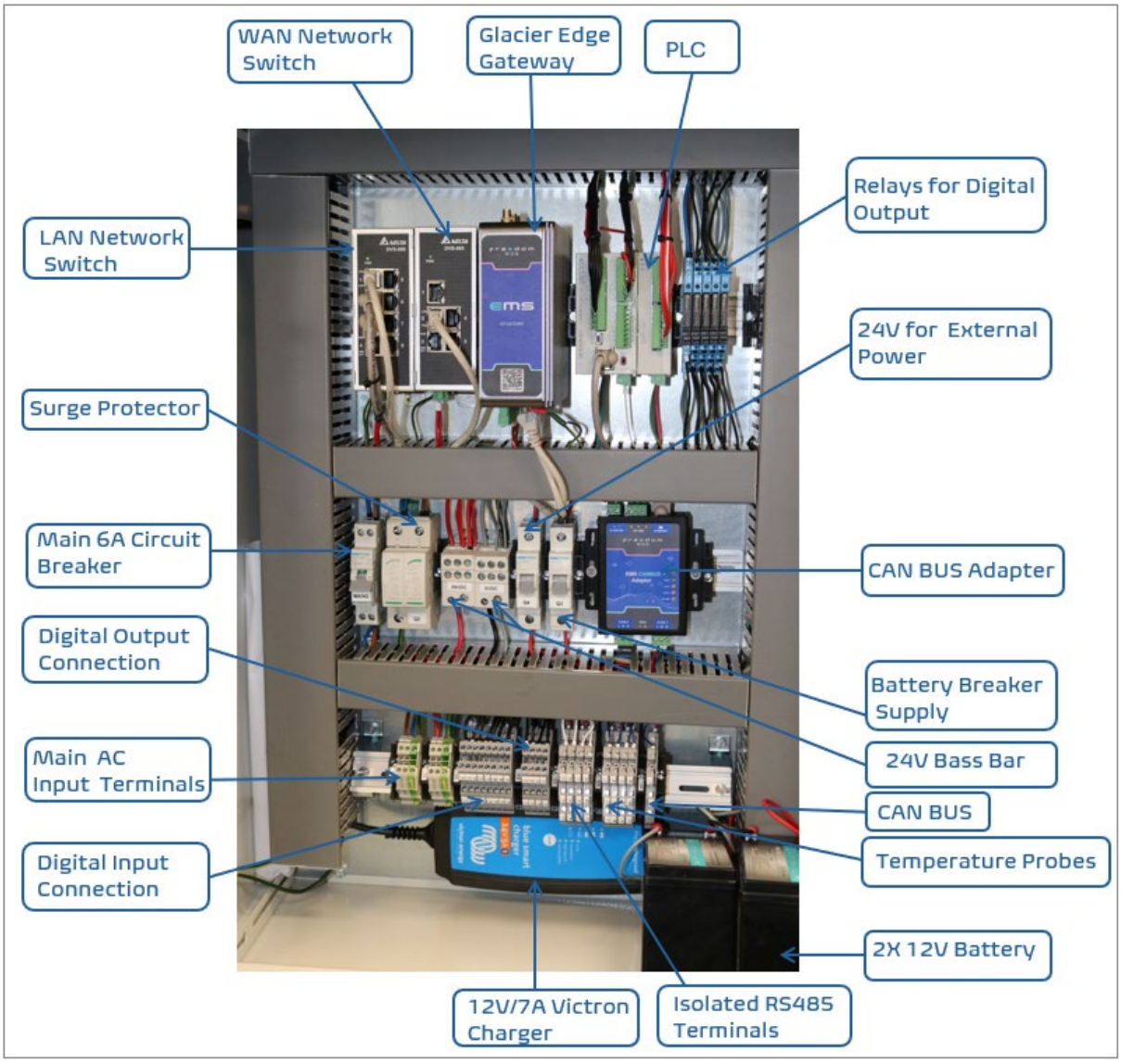

Figure 2: EMS Unit Example

Legend Table

Table 3: EMS Components and Function

Components	Function
1. Glacier Edge Gateway	The Glacier Edge Gateway connects industrial equipment and sensors at the network's edge, processing data locally before securely sending it to the cloud or a central system.
2. LAN Network Switch	Enables communication between devices on the same network.
3. WAN Network Switch	Enables the connection of remote sites, extending network reach, and providing secure and reliable connectivity for EMS applications.
4. Surge Protector	Protect electronic equipment from sudden, excessive voltage spikes or surges.
5. Main 6A Circuit Breaker	Supplies a 230V power supply to the panel.
6. Battery	2x 12VDC supply if the grid fails to supply the panel.
7. Relays for the Digital Output	Controls the on/off state of a load or device.
8. Programmable Logic Controller (PLC)	Monitors the inputs and controls the outputs.
9. Circuit Breaker for 24V External Power	Supplies power to the 24V connection bars.
10. 24V Bus Bar	The 24V supplies external devices such as routers.
11. Isolated RS-485 Terminals	Connection points for RS-485 A+ and B- signals.
12. 12V/7A Victron Charger	Charges the two 12V batteries.

13. Digital Input Connection	Receive binary signals (on/off) from digital sources such as sensors or switches. Input binary data (high/low) from digital sensors or switches. Acquire true/false signals from digital switches or sensors.
14. Digital Output Connection	Transmit binary signals (on/off) from digital sources such as sensors or switches.
15. Temperature Probes	Used to measure room temperature.
16. CAN BUS Adapter	This is a network-to-serial converter. It receives data from your network switch through a LAN cable and translates it into the RS-485 serial communication protocol. This adapter is specifically used to add two new serial ports, designated as COM1 and COM2, to your system. This setup helps manage your serial connections efficiently, especially since COM3 and COM4 are already in use on your Glacier device.

2.4 Advantages of the EMS

The EMS system provides several important advantages for your energy management system.

- Easy setup without coding makes installation faster and simpler.
- Integrates with most major device brands and models, giving you flexibility in equipment choices.
- Control and adjust settings remotely from any location, cutting down on site visits.
- Cloud-based platform runs online 24/7 to monitor and manage your EMS system.
- Backup systems keep everything running, including offline data storage and a backup internet connection during outages.
- Instant alerts notify you of system changes, problems, and device status to prevent downtime through early maintenance.

2.5 Features of the EMS

The EMS system offers a range of advanced features that enable effective energy management and optimisation.

- It manages and controls AC-coupled systems.
- Starts and stops generators automatically based on predetermined State of Charge (SOC) levels, ensuring optimal energy usage.
- Monitors critical environmental parameters of the battery, including temperature and humidity, to ensure optimal performance and longevity.
- Supports seamless integration with external control systems, facilitating effective communication and control.
- Maximises cost savings by shifting energy consumption patterns to take advantage of off-peak pricing through time of use.
- Prevents exceeding predefined power consumption thresholds, reducing the risk of penalties and fines.
- Provides data through Modbus TCP to third-party devices, such as SCADA or Building Management Systems, for integration and monitoring.
- Customise your dashboard to display the data according to your needs.

2.6 EMS Specification

Refer to the table below for the EMS specifications overview.

Table 4: EMS Specification Overview

Basic Parameter	Specifications	Model
Device Integration		
	Number of Supported Devices	12
	Polling Data Units (PDU)	900
	Power Input [V AC]	230
Integrated Control		
	24V DC	Max: 1A (24W)
	Operating Current	250mA @230V AC
	Battery Capacity (Usable) [Wh]	144
Edge Gateway	Integrated Control	Intel N100 4-core CPU
	Memory (RAM)	4GB
	Local Storage (SSD)	128GB
	Cooling	Fanless Design

	PLC	Control failsafes, additional I/O, temperature measurement	
Communication			
Modbus RTU	Baud Rate [bps]	9600	
	Data bits	8	
	Stop bits	1	
	Parity	None	
Serial Interface			
Modbus TCP	Communications Interface	Ethernet LAN	
	System Connectivity	DHCP	
	Managed Network IP Range	192.168.35.XXX	
	Subnet Mask	255.255.255.1	
Embedded Communications			
Embedded Communications	Ethernet	WAN Input	1
		Ethernet	5-Port 100Mbps Industrial Ethernet Switch
		GSM (Support Only)	GPRS, LTE
	Device Cross Compatibility	Application	Hybrid inverters / PV grid-tie inverters / Generator controllers / Power meters, power analysers / Temperature sensors / Fire suppression systems
Embedded Communications	Reporting & Analytics	Monitoring Portal	Via Freedom Won Cloud Monitoring Dashboard
		Reporting & Analytics	Via Polar Monitoring, Glacier Edge Gateway 100Mbps ethernet connection to uplink internet (to be supplied by client)
I/O			
Serial Ports	RS-485	4 (isolated)	
	Modbus TCP	5	
	Digital Inputs	8 x Digital inputs	
	Digital Outputs	4 x Relay outputs	
	Temperature Probe	4 x PT100 inputs	
	CAN BUS Adapter	1	
	24V Output	1	
	Panel Dimensions - H x W x D [mm]	650x500x250	
Physical			

Enclosure	Material	Powder Coated Steel
	Weight [kg]	23.2
	Ingress Protection	IP65
	Mounting	Wall mount
	Operating Temperature [°C]	0°C to +40°C
	Storage Temperature [°C]	0°C to +40°C
	Operating Humidity	85% relative humidity
	Antenna Interface	SMA Female
	Power Supply System	24V 120W
	Backup Power 2	2 x 98Wh lithium battery (12V)
Warranty	1 Year Warranty	

3 Safety Precautions

This section highlights safety procedures to prevent damage to the EMS unit and personnel. Follow the instructions below to prevent damage or harm to equipment and personnel.

3.1 Operator Safety Requirements

To operate the EMS safely and effectively, personnel must:

Important Safety Precautions

- Be familiar with the energy storage system's structure and working principle.
- Be aware of relevant local standards and regulations.
- The operator must have a thorough understanding of wiring and electrical theory. Failure to meet these requirements may result in serious injury, equipment damage, or system malfunction.

Warning Signs and Nameplates

To ensure safe operation, follow the labelling guidelines on the EMS panel.

- Do not remove or damage warning signs containing critical safety information on the EMS panel.
- The nameplate sticker is located on the EMS panel and provides essential product parameters.
- Do not remove or damage the nameplate.
- Ensure the equipment label always remains clear and readable. If the label is damaged or blurred, replace it immediately.

Electrical Safety Precautions

To ensure safe operation, avoid touching live components, inspect equipment before use, and observe electrostatic protection rules.

- Do not touch terminals or conductors connected to power.
- Inspect equipment for damage or hazards before operating.

Environmental and Space Requirements

To ensure the correct installation of the EMS, it is crucial to select an installation location that meets the following requirements.

- Select an installation location that is free from electromagnetic radiation, oil mist, corrosive or flammable gases, metal powder, dust, oil, water, or other foreign objects that could interfere with the EMS operation.
- Ensure that the selected location does not have flammable materials near the EMS, as they can pose a risk.
- Verify that the installation area is clear of radioactive or harmful gases and liquids that could compromise the system's performance or pose a risk to human safety.
- The EMS must be installed indoors in a well-cooled area protected from moisture and dust.
- Keep the EMS away from areas with high humidity, high temperatures, or exposure to corrosive gases. These elements can negatively impact performance and lifespan.
- Do not install the EMS in direct sunlight.
- Verify that the grounding cable in the power distribution room is properly installed and grounded. The ground resistance in a dry environment should not exceed 4 Ω. EMS frames must be grounded to the site's Protective Earth.
- The battery mounting surface must have adequate load-bearing capacity and must be properly levelled to within 3mm over the length of the EMS.

Personal Protective Equipment (PPE)

Failure to wear the required PPE may result in serious injury or death. Wear protective gear such as insulation gloves, safety shoes, etc.

Product Scrapping

When disposing of the EMS, do not treat it as regular waste. Return to Freedom Won (fees may apply) or contact a local authorised recycling agency.

Other Considerations

Take the necessary precautions when maintaining or repairing equipment:

- Wear protective gear (earplugs, insulating shoes, scald-proof gloves).
- Ensure emergency rescue facilities are available at remote installation sites.
- Implement all necessary measures to ensure personnel and equipment safety.
- Ensure EMS operations meet national/regional standards.
- This manual does not cover all situations. For unclear situations, contact Freedom Won.

Communication Cable Requirements

The communication cable between the inverter and EMS must be of high quality and shielded, and grounded on the inverter end to prevent noise interference from external equipment. Failure to use a suitable cable can lead to system malfunctions, damage, or safety hazards. All communication cables used must be routed away from machines with electrical noise emissions and any power cables (AC and DC).

Any noise picked up by the communication cable may result in bad or no communication.

3.2 Lifting Considerations

The EMS unit must be handled (or carried) by two individuals.

3.3 Environment Considerations

3.3.1 Site Inspection

Before installation, do a thorough site inspection to identify the best location for the EMS panel. Consider the following:

1. Minimise RS-485 and Modbus TCP cable lengths to reduce potential signal loss.
2. Ensure adequate ventilation and protection from extreme environmental conditions.
3. Avoid locations near high-voltage power lines. If unavoidable, follow these guidelines:
    a. Use shielded cables.
    b. Maintain a minimum distance of 100mm from high-power lines when running cables in parallel.
    c. Running cables perpendicular to power lines is acceptable.

3.3.2 System Requirements

The computer-based requirements for the system to be installed and function are as follows:

- Compatible web browser: Microsoft Edge, Google Chrome, Firefox, Opera, Safari.
- Compatible devices: Android or macOS (Mac Operating System).
- To set up the software portion of the EMS system, access the internet, set up a valid account on the EMS Portal, and have the relevant permissions on that account to add and configure the hardware installed on-site.


Ensure your internet speed is adequate to avoid issues during firmware updates.

3.3.3 Contents of the EMS Package

The following items are included with your EMS purchase.

Table 5: Package Check List

Item	Quantity
EMS Panel 650x500x250mm	1
Wall Mount Brackets	4
Temperature Joiner Box	2
PT100 Temperature Probe	2
GSM Antenna, 3m cable, SMA	1
Freedom Won 12V/7.5Ah LiFePO4 Battery	2
Installation Manual	1
Termination Resistors	10

4 EMS Panel Installation and Configuration

Refer to the components listed in Table 6 for a successful EMS installation. Each of these items is crucial for an efficient setup. Correct preparation before installation prevents delays and improves overall system performance.

Table 6: Necessary Components

No	Components	Description
1	EMS Panel	The main unit housing the control system.
2	6A Circuit Breaker	Required for safe electrical protection.
3	PG9 and PG11 Glands	Cable management and sealing components.
4	40x25mm Trunking	Protects and organises cables.
5	1mm^2 Flat Twin and Earth Cable	Used for power connections.
6	8mm Fischer Plugs and Screws or correct Rawl Bolts	For securely mounting the Panel.
7	Belden Shielded Twisted Pair Cable	(0.22mm^2 or 0.5mm^2) – Ensures reliable communication wiring.
8	CAT5 (Shielded) or CAT6 LAN Cable	Provides stable data connectivity.

9	RJ45 Connectors	For terminating Ethernet cables.
10	RJ45 Cable Rubber Boots	Protects Ethernet cable connections.
11	M12 4-Pin Connectors (120504-01-001)	For connecting external devices.
12	Phone, Laptop, or Tablet	Required for configuration and commissioning.
13	Stable Internet Connection	Essential for remote access and monitoring.

4.1 Modbus Over TCP Connection Setup

Ensure you have a basic understanding of TCP networking and follow these guidelines to set up a successful Modbus over TCP connection.

The standard communication protocol used in the EMS is Modbus, which comes in two forms:

- Modbus RS-485
- Modbus TCP

To establish a Modbus over TCP connection, follow these steps:

1. Use a Local Area Network (LAN) cable with an RJ45 Ethernet connector.
2. Make sure that you have a basic understanding of TCP networking principles.
3. Configure the following TCP parameters:
   - IP address for the device.
   - Subnet mask (e.g., 255.255.255.0).
   - Default Gateway (e.g., 192.168.35.5).
   - Port (Fixed: 502).
4. Use a CAT5 or CAT6 Ethernet cable. Ensure each cable run does not exceed 100 meters.
5. Connect devices using a network switch.

Refer to the diagram below for a typical Modbus TCP connection example.

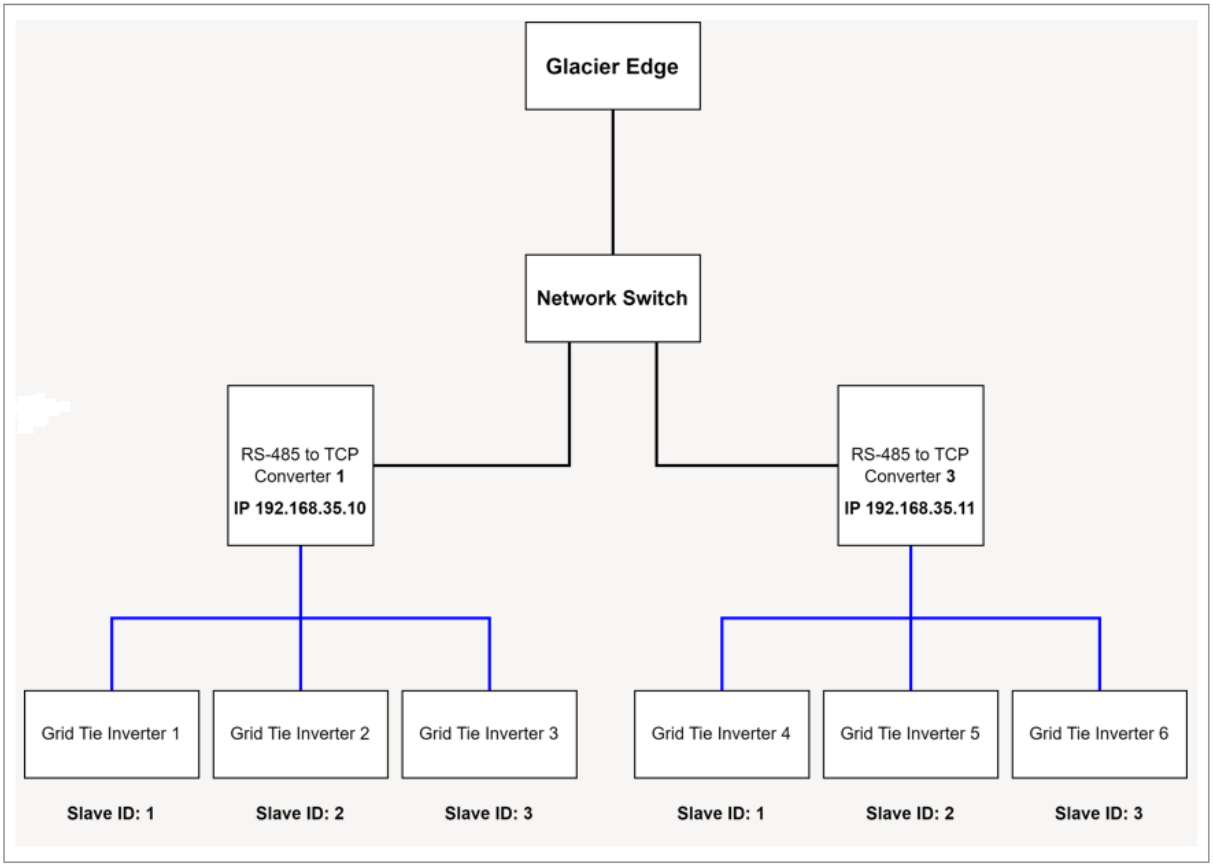

Figure 3: Typical Modbus TCP Connection Example

4.2 EMS Hardware and Software Components

To set up the system, users will need specific hardware. This includes electricity meters, which are necessary for accurately monitoring energy values, especially when combining multiple production or consumption points. These meters provide faster, and more reliable data compared to inverters. You also need to consider the available communication methods on-site, such as Modbus TCP, Modbus RS-485, or other options, as this will determine how the devices connect and share information. Keep a record of the makes, models, and quantities of all required hardware.

The EMS can be connected to the following hardware.

Table 7: Hardware Connections Examples

No	Option	Function
1	Power Meters/Analysers	Measure electricity consumption and flow.
2	Solar Grid-Tie Inverters	Manages energy from solar PV systems.
3	Hybrid Inverters	Handle energy directly from solar panels.
4	Freedom Won BESS (Battery Energy Storage Systems)	Store and supply backup energy.
5	Generators	Provide auxiliary or backup power.

4.3 Optimising EMS System Performance

To maximise efficiency and reliability, ensure that electricity meters or power analysers are installed at every key connection point in the power generation system. This allows the EMS to:

- Collect accurate real-time data.
- Improve energy management and automation.
- Enhance overall system performance.

4.4 Ensuring Uninterrupted Power for Meters

To avoid data loss during power outages or load shedding, power meters must always have a backup power source:

- Preferred method: Use auxiliary power from the hybrid inverter's output.
- Alternative method: Provide an external backup power source if hybrid inverters are unavailable.

4.5 Best Practice for Power Meter Placement

A power meter must be installed at the summation point whenever multiple power sources are combined into a single input. This ensures that:

- More precise energy tracking.
- Prevents errors from combining data
- Improved load balancing and efficiency.

Always rely on measured values from dedicated electricity meters or power analysers instead of estimated power figures. Measured data provides a higher level of precision.

Refer to the image below for a typical power meter example.

Figure 4: Typical Power Meter Example

4.5.1 Example System Configuration

The diagram in Figure 5 illustrates a basic EMS setup with two generators and two grid-tied solar systems. The blue-marked areas indicate optimal meter placement to achieve the highest accuracy and reliability.

4.5.1.1 Installation Best Practices

Follow these steps for a reliable operation.

- Ensure that all communication and power cables are properly shielded to avoid interference.
- Use high-quality cables for long-distance connections.
- Avoid running data cables parallel to high-voltage power lines to prevent signal disruption.
- Follow the manufacturer's recommended wiring guidelines for each controller.

Incorrect wiring or poor communication cable management will lead to system instability and unreliable data.

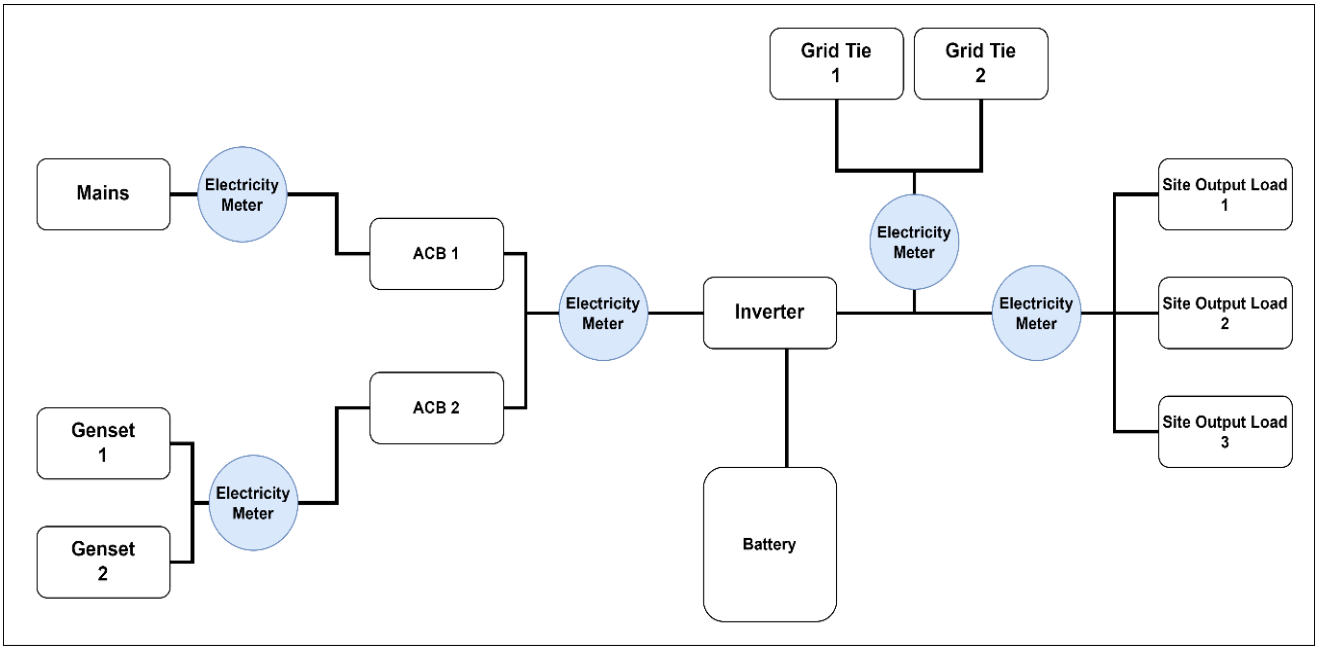

Figure 5: Electricity Meter Layout Example

5 EMS Terminal Layouts

The EMS panel has specific connection points for power, digital signals coming in, digital signals going out, PT100 temperature sensors, and RS-485 communication. Table 8 shows you exactly which terminal number on the panel corresponds to each of these connections.

Refer to the table below for the EMS Panel Terminal Descriptions.

Table 8: EMS Panel Terminal Descriptions

Terminal Group	Terminal Label	Description
Power Input		
	L	Live AC Input (230V, 50 Hz)
	N	Neutral AC Input
	E	Earth
Power Output		
	1	0V DC
	2	24V DC Output (1A)
Digital Inputs		
	1	Digital Input 1
	2	0V DC
	3	Digital Input 2
	4	0V DC
	5	Digital Input 3
	6	0V DC
	7	Digital Input 4
	8	0V DC
	9	Digital Input 5
	10	0V DC
	11	Digital Input 6
	12	0V DC
	13	Digital Input 7

	14	OV DC
	15	Digital Input 8
	16	OV DC
Digital Outputs		
	1	Normally Open - Output 1
	2	Common - Output 1
	3	Normally Open - Output 2
	4	Common - Output 2
	5	Normally Open - Output 3
	6	Common - Output 3
	7	Normally Open - Output 4
	8	Common - Output
Temperature Inputs		
	1	B- (PT100) - Probe 1 (White)
	2	B- (PT100) - Probe 1 (White)
	3	A+ (PT100) - Probe 1 (Red)
	4	B- (PT100) - Probe 2 (White)
	5	B- (PT100) - Probe 2 (White)
	6	A+ (PT100) - Probe 2 (Red)
	7	B- (PT100) - Probe 3 (White)
	8	B- (PT100) - Probe 3 (White)
	9	A+ (PT100) - Probe 3 (Red)
	10	B- (PT100) - Probe 4 (White)
	11	B- (PT100) - Probe 4 (White)
	12	A+ (PT100) - Probe 4 (Red)
Modbus RS-485 Input		
	1	A+ - Com Port 1
	2	B- - Com Port 1

	3	0V DC - Com Port 1
	4	A+ - Com Port 2
	5	B- - Com Port 2
	6	0V DC - Com Port 2
	7	A+ - Com Port 3
	8	B- - Com Port 3
	9	0V DC - Com Port 3
	10	A+ - Com Port 4
	11	B- - Com Port 4
	12	0V DC - Com Port 4
CANBUS		
	1	CAN H
	2	CAN L
	3	SNG

5.1 Auxiliary Power

The Auxiliary Power is found on the second bank of the terminal from the left in the EMS panel.

The External or Auxiliary power is used to power an external 24V DC (1A) device from the panel's internal power supply. This is achieved using 2x 12V batteries located in the EMS panel.

5.2 Digital Inputs

The following points show how to configure digital inputs.

- The input terminals are located on the third bank from the left side of the control panel.
- There are eight inputs in total, even-numbered terminals (2,4,6,8, etc) are connected to ground while odd-numbered terminals (1, 3, 5, 7, etc.) are wired directly to the PLC.
- When you connect an odd-numbered terminal with its corresponding even-numbered terminal, the input status will show as "On".

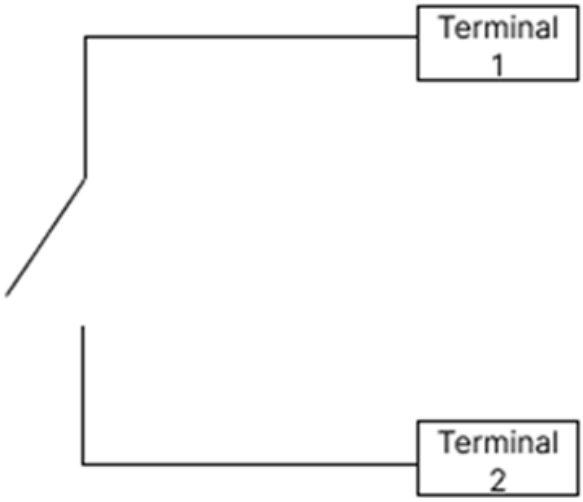

Figure 6: Digital Input Layout Example

5.3 Digital Output

The following points show you how to configure digital output.

- The output terminals are located on the fourth bank in the EMS panel.
- These dry contact outputs have odd-numbered terminals (1, 3, 5, etc.) that function as ground connections to complete the circuit.
- When triggered, with even-numbered terminals (2, 4, 6, etc.), provides +24V DC.

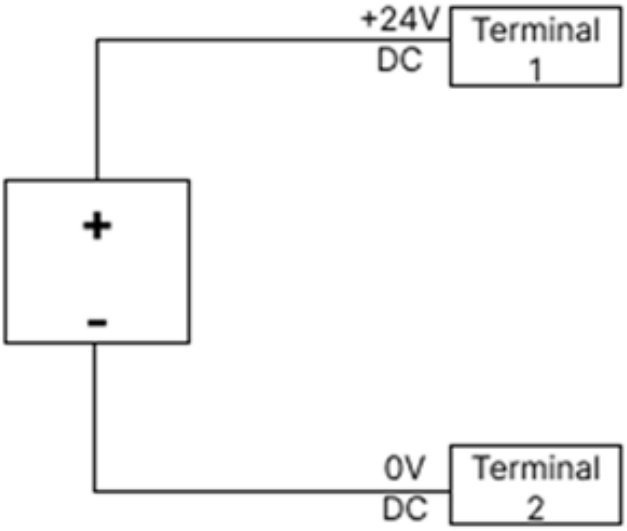

Figure 7: Digital Output Layout

5.4 Dry Contacts

Some of the latest EMS panels are equipped with dry contacts that use Finder 24V relays, driven by either the PLC or the Glacier Edge.

5.5 Temperature Inputs

The following points show you how to configure temperature inputs.

- The inputs are located on the fifth bank of terminals in the EMS panel.
- Allocated for 3-wire PT100 temperature probes.
- Follow the colour coding in the terminal assignment table to ensure you have the correct connections.

5.6 Modbus RS-485 Inputs

The following points show you how to configure Modbus RS-485 inputs.

- The inputs are located on the second-to-last bank on the left of the three-tier terminals.
- These inputs are used to wire in the communication cables.
- Modbus RS-485 is used for communications.

6 EMS Installation

This section provides a procedure for installing the EMS panel.

6.1 Site Inspection

Before installation, conduct a thorough site inspection to identify the best location for the EMS panel. Consider the following:

1. Minimise RS-485 and Modbus TCP cable lengths to reduce potential signal loss.
2. Ensure adequate ventilation and protection from extreme environmental conditions.
3. Avoid locations near high-voltage power lines. If unavoidable, follow these guidelines:
   - Use shielded cables.
   - Maintain a minimum distance of 100mm from high-power lines when running cables in parallel.
   - Running cables perpendicular to power lines is acceptable.

6.2 Mount the EMS Panel

When the installation location is determined, follow these steps to mount the EMS panel securely. Refer to Table *6*: Necessary Components for mounting the EMS panel.

1. Attach the four wall-mounting brackets on the rear of the panel.
2. Secure the panel to the wall using bolts or screws (minimum 5mm diameter).
3. Ensure the panel is mounted on a stable, vibration-free surface to prevent operational issues.

Refer to the illustration below for an EMS mount size example.

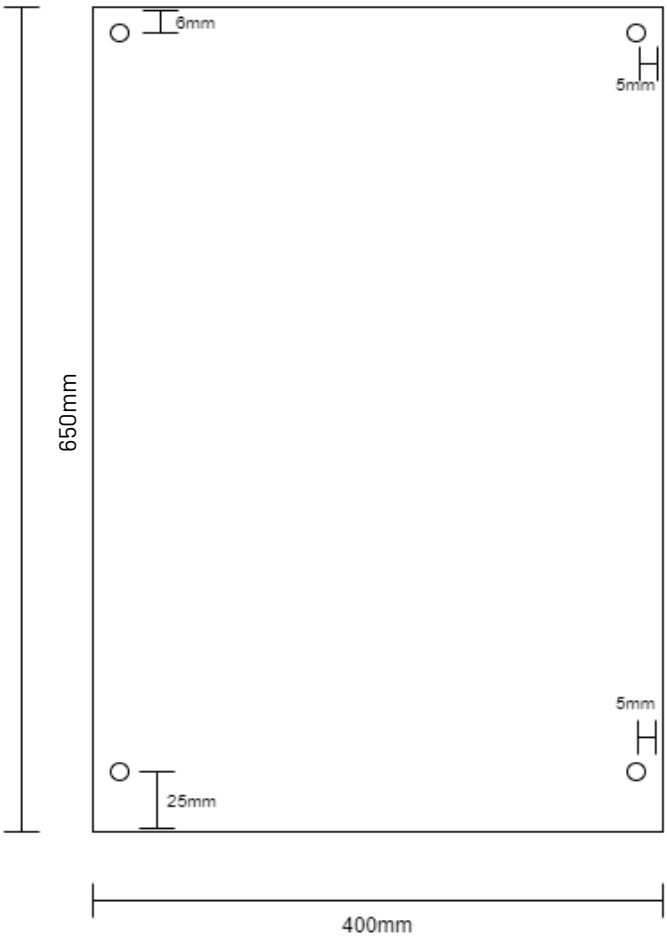

Figure 8: Panel Mounting Holes

6.3 Connect Power to the EMS Panel

The EMS panel operates on 230V AC power. Follow these steps to safely connect power.

1. Ensure all breakers in the EMS panel are in the OFF position before connecting power.
2. Connect the EMS panel to a permanent power source such as a Distribution Board (DB).
    a. The DB should be on the AC output load of the monitored inverter for a consistent power supply.
3. Install a 6A circuit breaker in the DB.
4. Run a 1mm^2 cable from the 6A breaker to the EMS panel terminal inputs.

5. Connect power to the three designated terminals as shown in the table below:

Table 9: Power Terminals

Terminal Name	Function
L	Live
N	Neutral
PE	Earth

Refer to the drawing below for more details on the terminal layout.

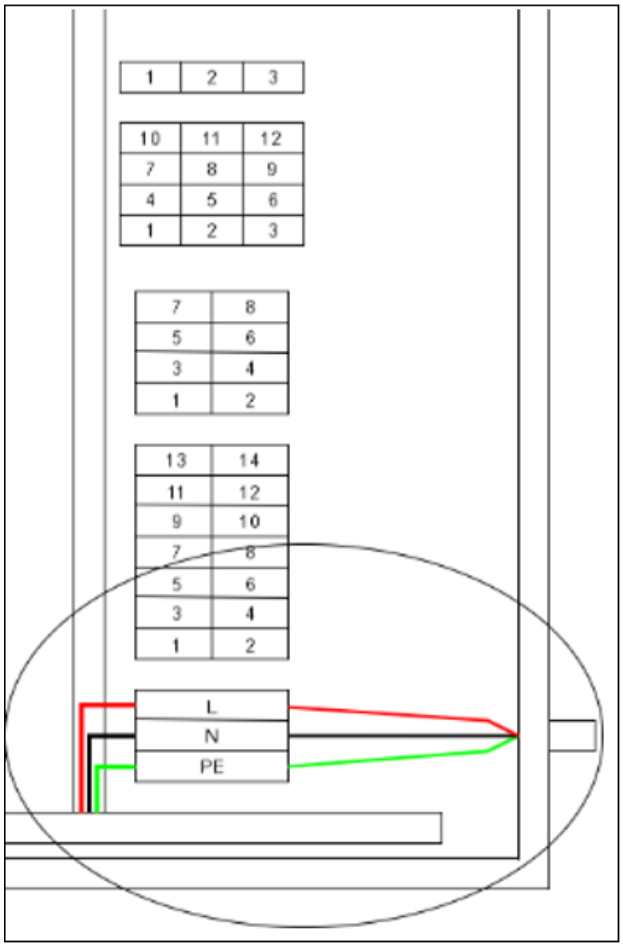

Figure 9: Power Terminal Position

6.4 Connect Communication Cables

Correct communication cable installation is crucial to ensure accurate data transmission, especially in environments with high power and voltage. If the communications cables are not connected correctly, this could result in signal degradation and equipment malfunction. The following guidelines provide information on how to run communication cables safely and effectively.

6.4.1 Selecting the Right Cables

Follow the steps below to select the correct cables.

1. Use shielded twisted-pair cables such as Belden Shielded Twisted Pair (STP) (0.22mm^2 or 0.5mm^2) or CAT5e/CAT6 with shielding.
2. For RS-485 connections, always use twisted-pair shielded cables to minimise interference.
3. For Ethernet connections, shielded CAT6 cables are preferred, especially when running cables near power lines.
4. Use outdoor-rated cables if running communication lines outside or in exposed conditions.

Avoid Electromagnetic Interference (EMI)

1. Maintain a minimum distance of 300mm between communication cables and high-power cables.
2. If communication cables must cross power lines, always cross them at a 90-degree angle to reduce electromagnetic interference.
3. Never run communication cables parallel to high-voltage or high-power lines without proper shielding.
4. Use metal conduit or cable trays to provide additional shielding in areas of extreme EMI.

6.4.2 Cable Routing

Follow the steps below for correct cable routing.

1. Route cables with designated low-voltage pathways, separate from high-voltage power lines.
2. Avoid placing communication cables near transformers, electric motors, or power generators.
3. In panel enclosures, use separate cable ducts for communication and power cables.

6.4.3 Grounding and Shielding

Follow the steps below for correct grounding and shielding.

1. Correct grounding of communication cable shielding is essential to minimise noise.
2. Ground the shielding at one end only to prevent ground loops.
3. Use surge protectors for outdoor cables to protect against lightning and electrical surges.

Refer to the image below for an EMS grounding example.

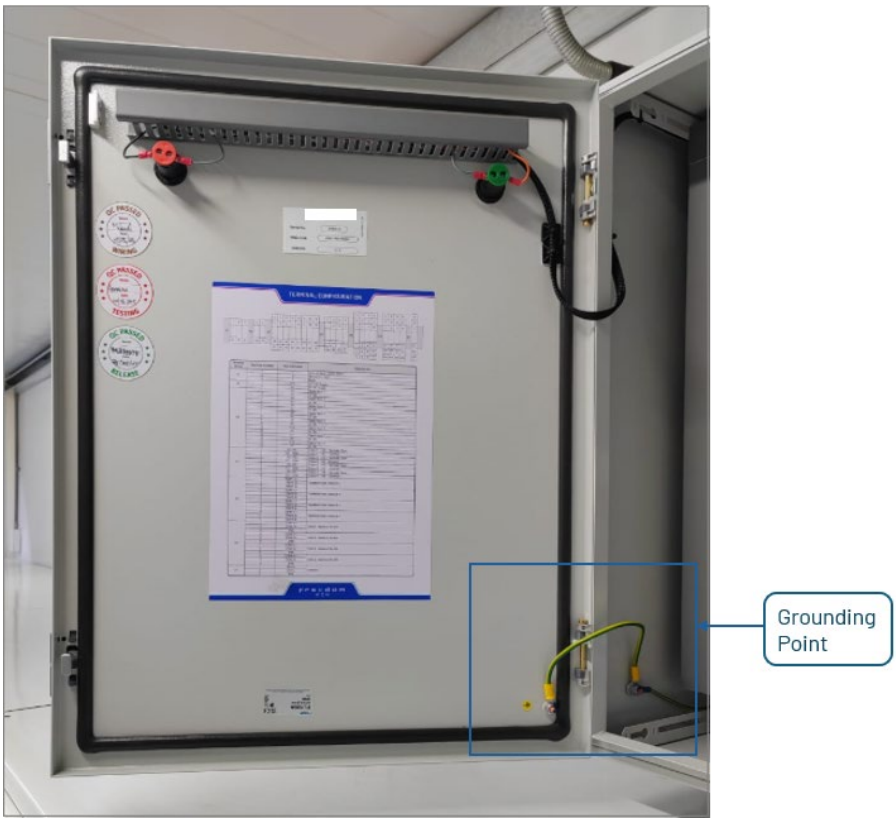

Figure 10: Grounding Point Example

WARNING **Cable Management and Protection**

- Secure cables with ties, trays, or conduits to prevent damage.
- Avoid over-bending or stretching cables; adhere to the manufacturer's minimum bend radius.
- Use waterproof connectors and enclosures for cables exposed to wet or outdoor conditions.

6.4.4 Test and Validate the Communication Cable

Follow the steps below to test and validate the communication cable.

1. Use a cable tester to check continuity and resistance before finalising the installation.
2. For RS-485 networks, verify correct termination using 120-ohm resistors on both ends.
3. Perform signal integrity tests on Ethernet and Modbus networks to ensure proper communication.

When planning the cable runs, ensure that they are not near any high-power lines. If there is no other option, follow these steps:

1. Use shielded cable.
2. Run the cables at a minimum of 100mm away from the high-power lines when running in parallel.
3. It is acceptable to run the communications cables perpendicular to the high-power lines. Refer to the image below for a cable run example.

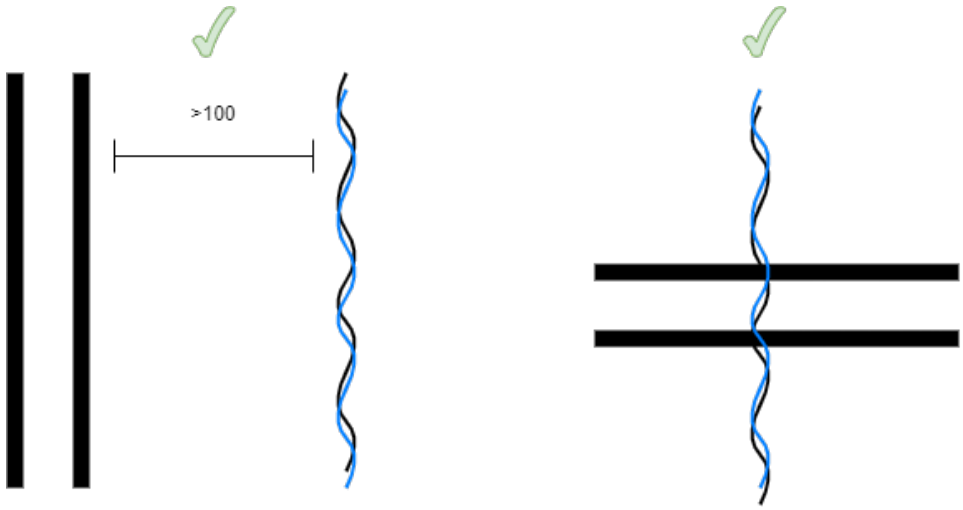

Figure 11: Cable Run Example

When identifying Comm Ports on these controllers, prioritise the plus (+) and minus (–) sign markings over the A and B designations.

6.5 Modbus TCP Connections

Ensure that you configure the serial communication settings on the controller you are connecting to.

1. For Modbus TCP connections, use CAT6 Ethernet cables with standard RJ45 connectors at both ends.
2. Connect your Modbus TCP controllers to the EMS panel using the ports labelled LAN 1, LAN 2, and LAN 3 located on the right side of the panel.

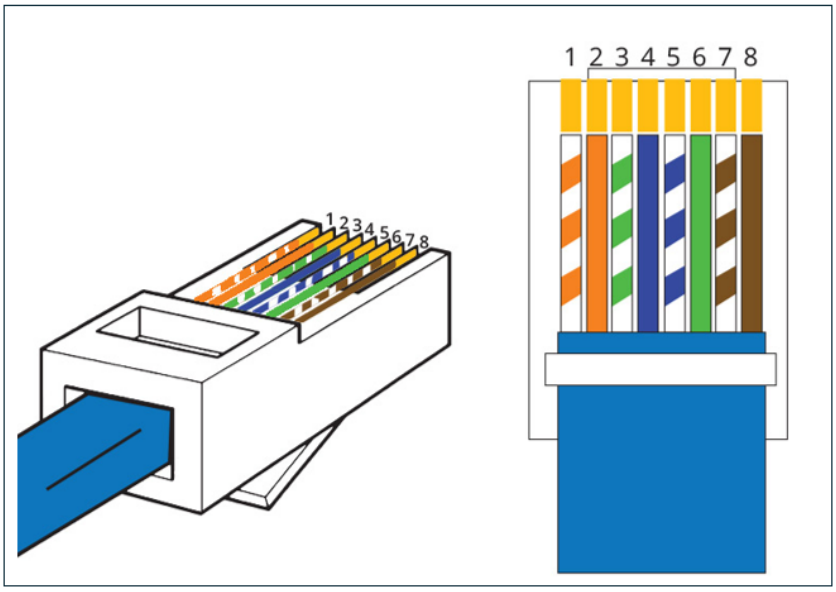

Figure 12: RJ45 Pinout

6.6 Configure Third-Party Devices

For reliable communication with the EMS panel, verify that the communication protocols for each connected device are correctly configured. Make sure that the communication settings for controllers, sensors, and any connected systems match the specifications below for a successful connection.

Table 10: Modbus RS Network Configurations

Option	Settings
Communication Protocol	Modbus RTU
Modbus Slave ID	Each device on the Modbus Network must have a unique ID. Record the assigned ID, as it will be needed for the Cloud Portal configuration.
Baud Rate:	9600pbs
Data bits:	8
Parity:	None
Stop Bits:	1
Modbus Type	Modbus RTU

The EMS panel operates with static IP addresses and preconfigured Modbus TCP and RS-485 settings, which simplifies the installation and commissioning.

You will need stable internet connectivity on-site. Some devices, such as inverters, are configured using mobile applications, and these apps will not work without internet access.

6.6.1 RS-485 Based Device Settings

For RS-485 devices, wire the devices to the RS-485 terminal in the panel. Refer to the terminal layout for wiring details. To adjust communication settings, access the menu or settings located directly on the device, using its keypad, software interface, or connection options.

The following settings must be set for the communications to work with the EMS system.

Refer to the diagram below for a typical RS-485 connection example to the gateway.

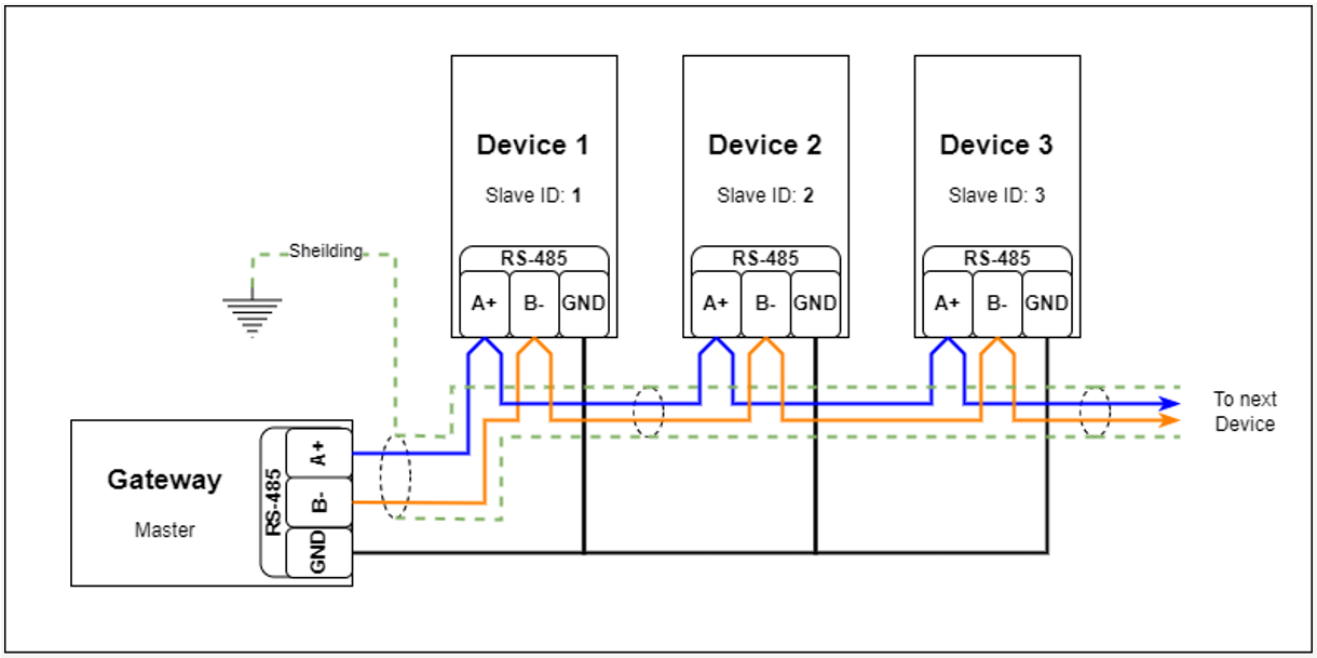

Figure 13: Typical RS-485 Connection Example

6.6.2 Modbus TCP-Based Device

- Modbus TCP device communication settings must be configured individually through the device.
- Configure communication settings directly on the device through its keypad or dedicated software.
- Modify communication parameters through the device's local interface (keypad or software).

When configuring the Modbus TCP network, ensure that each device has a unique IP address. These IP addresses must be entered identically in the Cloud Portal during setup to match the on-site configuration.

Refer to the table below for Modbus TCP Network Configuration.

Table 11: Modbus TCP Network Configurations

Option	Settings
Communication Protocol	Modbus TCP
Modbus Slave ID	• Ensure that this setting is unique for every device on the Modbus Network. • Record the controller's ID, as you will need it when setting up the Cloud Portal.
IP Address	192.168.35.XXX - (Unique to the device being connected)
Subnet Mark	255.255.255.0
Default Gateway	192.168.35.1
IP Port	502

Refer to the diagram below for a typical Modbus TCP connection example.

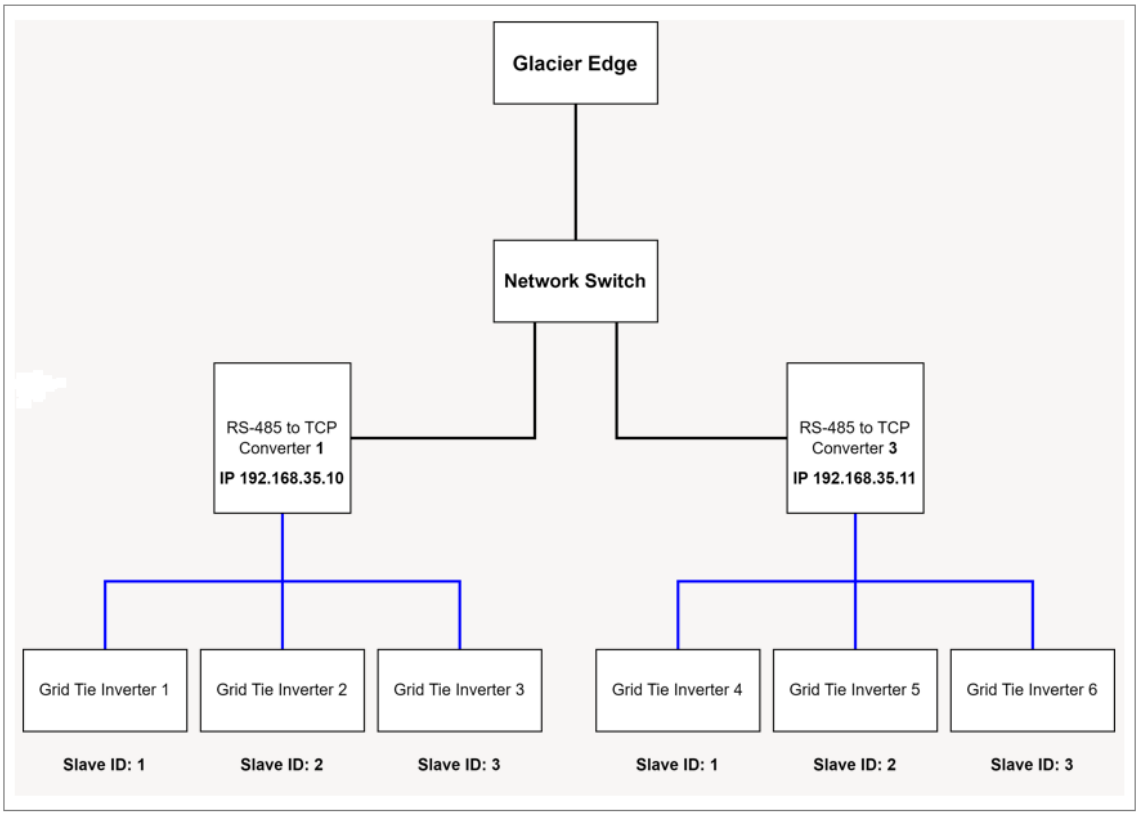

Figure 14: Typical Modbus TCP Connection Example

6.7 Connect the Internet to the EMS Panel

The EMS panel requires an internet connection from the site for cloud data transmission and remote access.

Run the Ethernet cable to the WAN port on the right of the EMS panel.

Figure 15: WAN Port

The EMS panel's internet (WAN) input is set to DHCP. If there is an internet connection is available, it will assign itself a correct IP address and connect. Glacier uses the static IP address 192.168.35.5.

If the internet connection is lost, the system will continue to run locally. It will store data directly on the Glacier Edge. When the connection is restored, it will automatically upload and synchronise with the Cloud. All site software, logic, and operation will remain uninterrupted.

6.8 Connect the GSM Antenna

The EMS panel includes a built-in SIM card and GSM (Global System for Mobile Communications) connectivity, which is exclusively for Freedom Won remote support. This does not provide monitoring access for clients. Instead, it is used solely for emergency remote access by Freedom Won technicians.

The internal SIM does not enable client access or remote monitoring. A separate dedicated internet connection must be provided for system monitoring.

6.8.1 Operational Considerations

Refer to the remote access and connectivity considerations below.

- This GSM connection is only for Freedom Won technicians and will be used when remote access is necessary.
- If you require monitoring or cloud connectivity, ensure the EMS panel is connected to an active internet source through Ethernet or Wi-Fi.
- In case of connectivity issues, contact Freedom Won support for troubleshooting and assistance.

6.8.2 How to Install the Antenna

To ensure reliable remote support, maintain system integrity, and avoid signal interference, install and position the GSM antenna correctly.

Figure 16: Antenna Port

1. Positioning for Best Signal Strength.
    a. Place the antenna in an open area, as high as possible, to improve signal reception.
    b. The antenna has a magnetic base and can be securely placed on top of the panel.

   c. If possible, install the antenna outside the enclosure to minimise signal interference.
2. Avoiding Interference
   a. Do not place the antenna near high-power cables, transformers, or large metal structures.
   b. Maintain a minimum clearance from electrical equipment that could cause interference.
3. Securing the Antenna Cable.
   a. Run the antenna cable neatly with the existing cable trays or conduits.
   b. Ensure there are no sharp bends or kinks in the cable to maintain signal integrity.
   c. Use cable ties to prevent movement and accidental disconnections.

6.9 Connect the Backup Batteries

After completing all connections and ensuring the site is ready to be powered up, connect the backup batteries as follows:

1. Inside the EMS panel, on the right-hand side trunking, you will find two sets of color-coded battery terminal connectors:
   - Red cable: Positive (+)
   - Black cable: Negative (-)
2. Connect batteries in series:
   a. Position the batteries end-to-end within the panel.
   b. Connect the red cables to the positive (+) terminal of battery.
   c. Connect the black cables to the negative (-) terminal of the battery.
   d. This series wiring configuration will provide the backup power.
   e. The EMS panel has a combined backup battery capacity of 15Ah, allowing it and the system to run for 24 hours without external power.

Refer to the drawing below for a backup battery connection example.

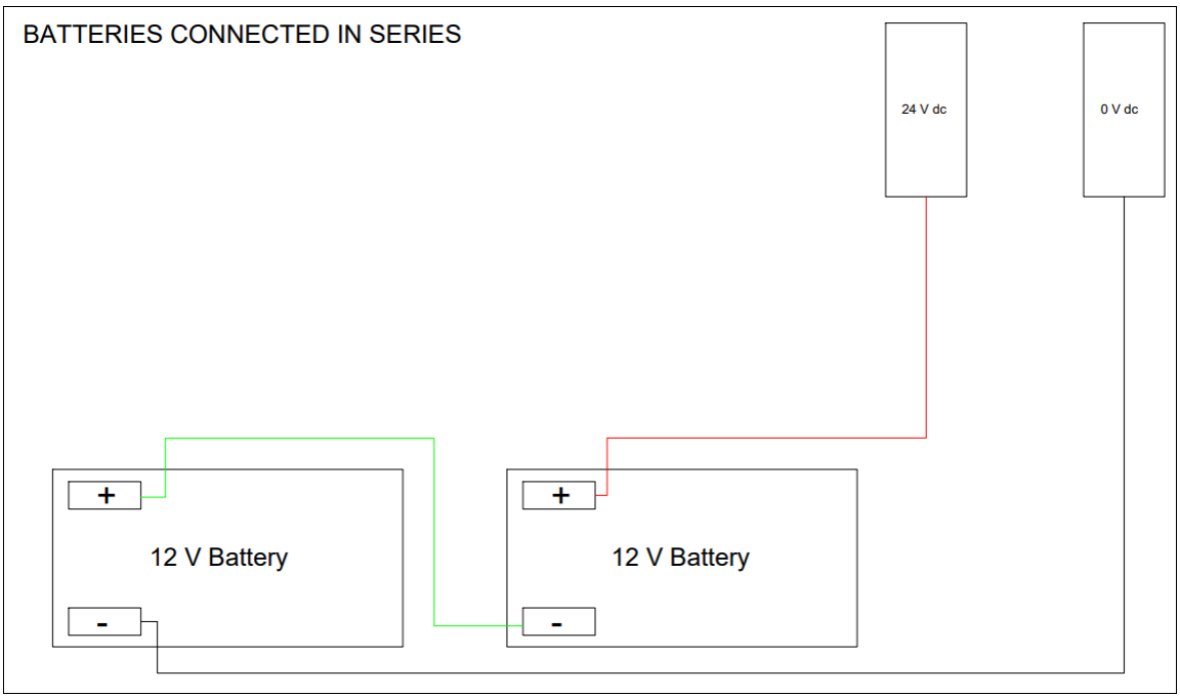

Figure 17: Batteries Connected in Series

7 Start-up, Commissioning, and Shutdown

7.1 Start up the EMS

When the installation is complete according to the steps above and the site is prepared to receive power, continue as follows to turn on the EMS

To turn on the EMS, follow the steps below.

1. Switch on the 6A breaker in the DB board.
2. Switch on the 6A breaker in the EMS panel.
    2.1 If there is power on site, the EMS green light will illuminate.
    2.2 If there is no power on site, proceed to the next step to run the EMS panel on its backup batteries.
3. Switch on the two 6A breakers for the batteries.
    3.1 If the mains power is unavailable, the EMS will operate using its backup batteries.
    3.2 If the mains power is present, as mentioned in 2.1, the EMS will start charging the batteries.

7.2 Commissioning of Device

7.2.1 Perquisites Before Commissioning

1. Verify that the SLD and EMS forms have all the required information, for instance, make, model, and brand are all correct.
2. Adjust and resubmit forms as required.

3. Verify that the equipment is the same as specified on the SLD and EMS form.
   - Devices
   - Sensors
   - Hardware locations
   - Cabling
4. All devices, sensors, etc., are connected and reading on the EMS Cloud. Contact the support team for the Control setup.

To commission the site, add all installed devices to the Cloud Portal. This step requires the Modbus RS-485 and TCP settings. You must apply these settings when setting up the controllers/devices on the Cloud.

To commission these devices, use the Freedom Won Cloud Portal online. Follow the link below to register an account and start adding your devices.

https://ems.freedomwon.co.za/Register

To set up these units for the first time, contact Freedom Won support for assistance.

An internet connection is required to finalise and test the setup of the EMS panel.

The Freedom Won Glacier Edge EMS panel has a unique serial number. Use this serial number to begin the setup procedure under the Gateways tab on the Cloud.

7.3 Shut down the EMS

To shut down the EMS, follow the steps below.

1. Switch off the 6A breaker in the DB board.
2. Switch off the 6A breaker in the EMS panel.
3. Verify that the EMS green light is not illuminated. This confirms that the EMS is off.

8 Access the Freedom Won EMS Portal

To access the EMS Portal, users must receive an invitation link from the installer, the Freedom Won support, or the commissioning team. This link will prompt the user to register on the portal. The installer or Freedom Won support/commissioning team will assign the user to the relevant group and link it to their site.

The Freedom Won EMS Portal gets regular updates with new features. This means some functions may change over time. It is recommended to check the portal frequently for the latest information or new features.

To access the Freedom Won EMS portal, follow the steps below.

1. You will receive the email invitation below. Click on the “Accept Invite” link to register on the EMS portal.

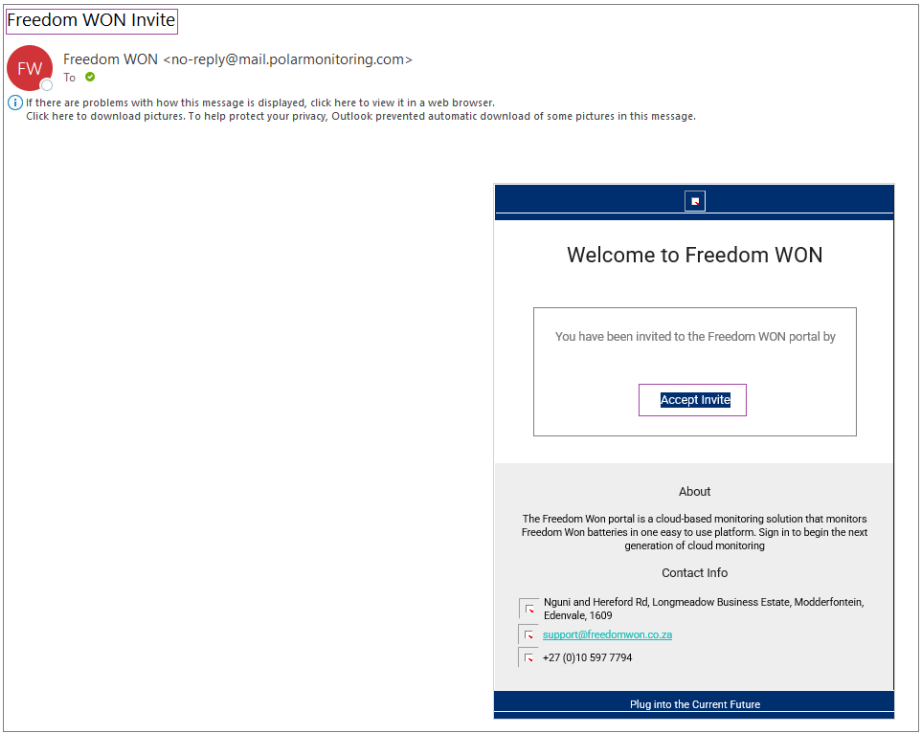

Figure 18: Freedom Won Invite

2. After clicking on the invitation link, the “Register” screen will open.
3. Type your “Name” and “Surname” in the required fields.
4. Type your “Phone Number” in the required field.
5. Type your “Email” address in the required field.
6. Type your site name in the “Group name” field.
7. Create a password and type it in the required field.
8. Type the same password in the “Confirm Password” field.
9. Click on the “Register” button.

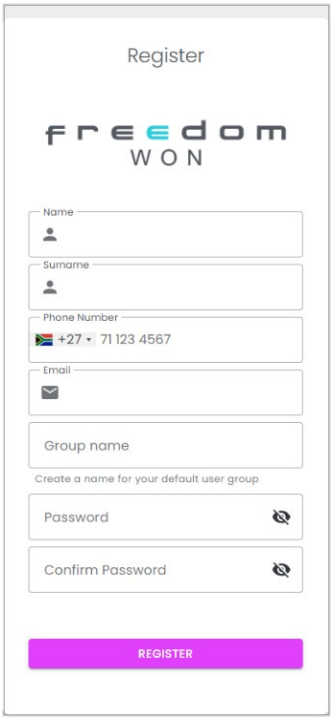

Figure 19: Register Screen

10. You will land on the "Security" tab under the "My profile" screen.
11. Click on the "Change Password" button if you want to change your existing password.
12. Click on the "Change 2FA" button to enable authentication. The QR code screen will open.

Users must have a QR code scanner application on their phone to enable two-factor authentication. This step is required and cannot be skipped.

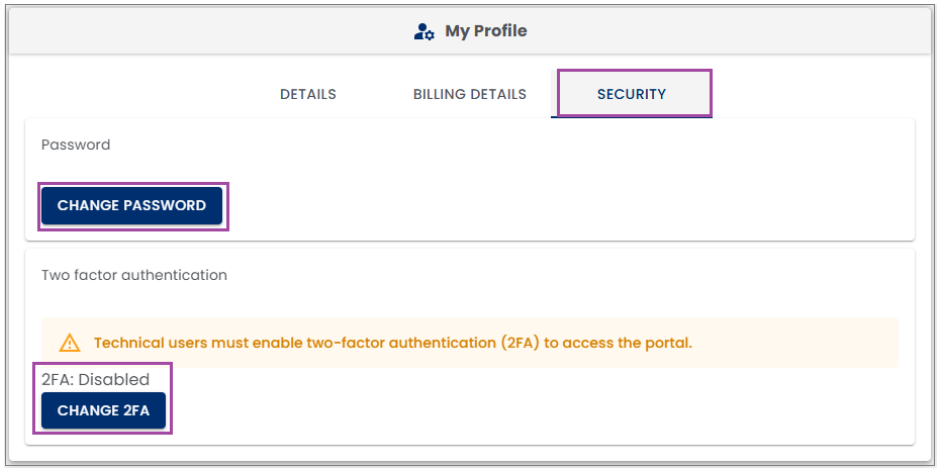

Figure 20: My Profile

13. Open your QR code scanner application on your phone and scan the QR code on the screen.

14. Choose the type of authentication method (Google Authenticator is recommended) from the drop-down menu.
15. An OTP verification number will pop-up on your phone.
16. Type the OTP number in the "Verify the OTP" field.

Figure 21: Change 2FA Screen

17. The "Change 2FA pop-up will show.
18. Click-and-drag the "Disable" adjustment button to enable the 2FA.
19. Click on the "Save" button.

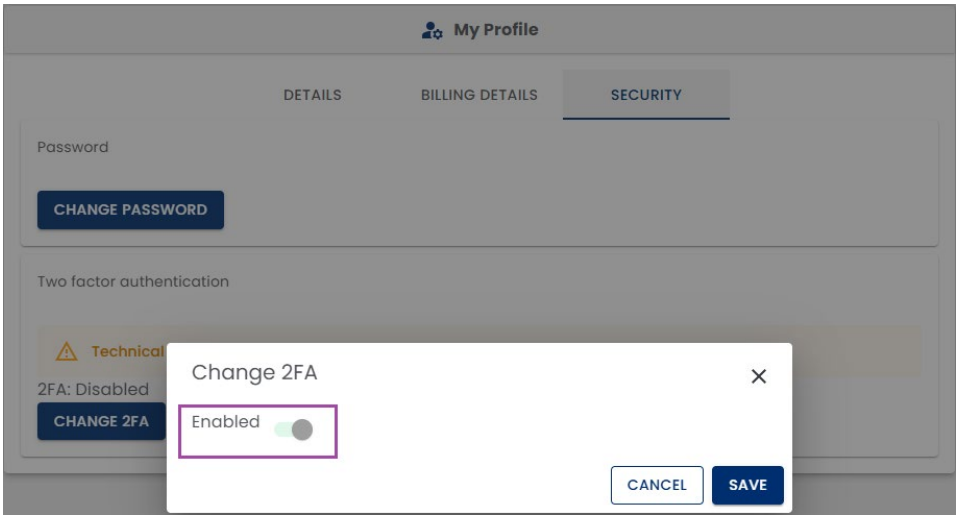

Figure 22: Enable Authentication

Once you have enabled two-factor authentication, you will see a pop-up message confirming that 2FA is now updated (active).

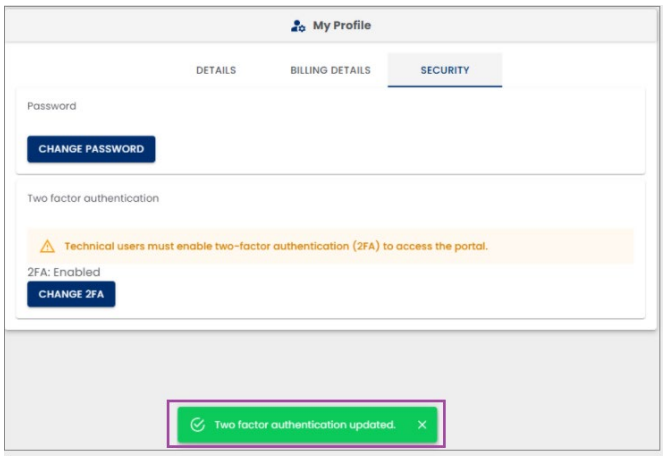

Figure 23: Two Factor Authentication

20. Exit the Portal to refresh the page, then log in again.
21. Click on the "Log in Here" link.

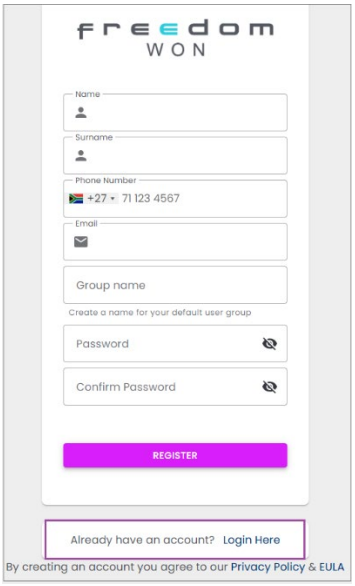

Figure 24: Login Screen

22. The "Sign in" screen will open.
23. Access the two-factor authentication application.
24. Type the generated OTP code from the authenticator application in the required field.
25. Click on the "Sign in" button.

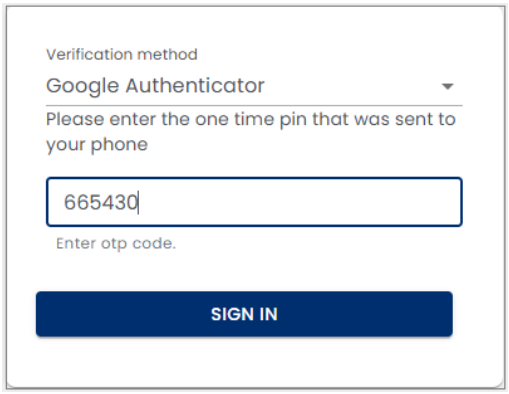

Figure 25: Sign in Screen

8.1 Receive Notifications Alert

You can set up the system to send you fault notification alerts. These alerts can notify you about critical errors, performance degradation, or system failures, helping you address issues quickly and minimise downtime. Follow the steps below to configure notification alerts.

1. When the portal opens, a pop-up alert message will show, prompting you to click on the “Yes” button if you want to receive alerts. Alternatively, you can click on the “No” button if you don’t want to receive alerts.

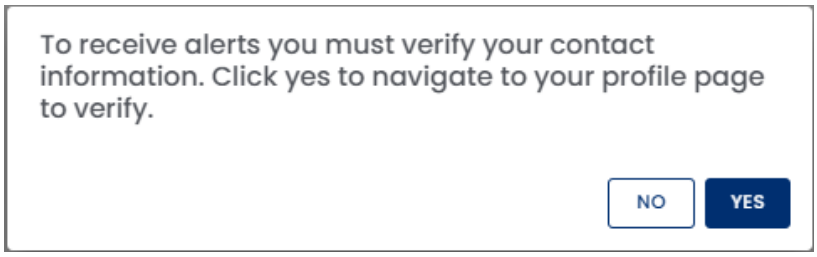

Figure 26: Alerts Window

2. Confirm that your name, email address, phone number, role, and device groups are correct on the "My Profile" screen. These options show when you want to receive alerts.
3. Make sure that the "Notification supported" option is checked for you to receive notifications.
4. Click the "Test Notification" button to test alerts.

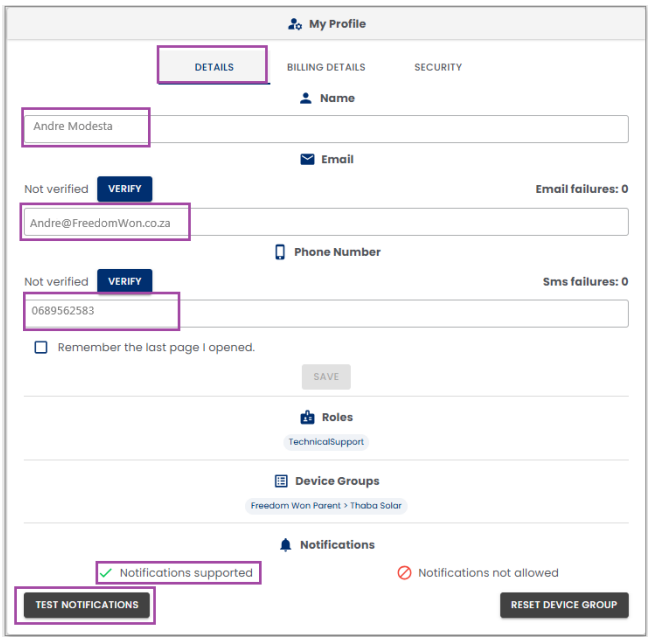

Figure 27: My Profile Screen

8.2 View the Freedom Won EMS Portal Tabs

As a new user, your portal will initially show a basic view without any data if you have not configured a dashboard. Once the Freedom Won commissioning team completes the EMS setup, your portal will display devices, gateway functionalities, and linked groups, as shown in Figure 30.

Refer to the table below for EMS portal options.

Table 12: EMS portal options

Option	Function
Dashboard	This is your central command centre that displays essential system status and real-time monitoring information.
Devices	Access and manage all your connected devices, and view live data, voltage, metering, and current.
Gateways	Monitor and configure your network gateways, which serve as connection points between your local network and external networks.
Sites	Organise and oversee different physical locations or network segments, allowing you to manage network environments.

Groups	This tab allows you to define different levels of access and control within your system. For example: • Parent Freedom Won: This is the main parent group, overseeing all sites. • Sub-parents: Users in this group have permission to make changes to device settings. • Child Accounts: These accounts have view-only access.
Users	Control user access and permissions, also manage user accounts. This includes setting up user accounts and assigning role-based access controls such as Manager, Technician, User, Read Only, or Notifications Only.

Refer to the image below for the Freedom Won Portal Welcome screen.

Figure 28: Freedom Won Portal Welcome Screen

The Freedom Won Portal also offers navigation shortcuts. Use them to access a different option, see below.

- Click the hamburger menu icon (☰) in the left corner of your screen to access the side shortcut menu, such as the home, dashboard, sites, devices, reports, alerts, etc.
- Click on the three dotted menu icon (⋮) on the right-hand corner of the screen to access your settings, such as profile, licence, billing entities, and the logout option.

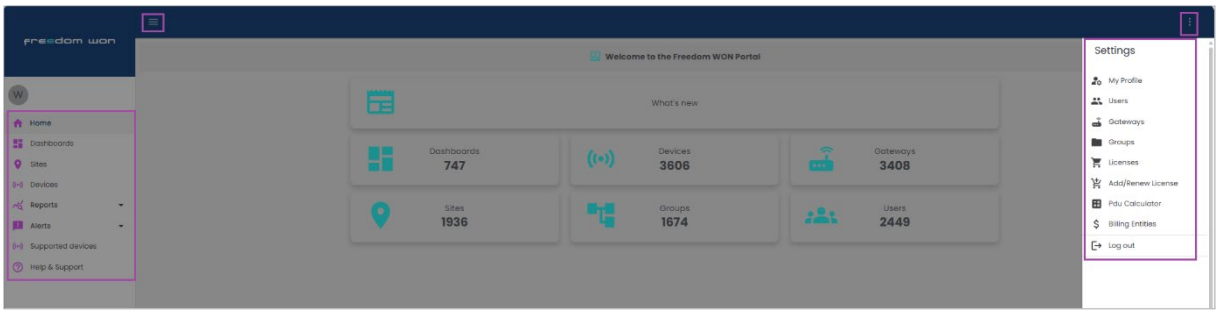

Figure 29: Shortcut Menu Icons

8.3 View the Dashboard

After signing in, the "Welcome to the Freedom Won Portal" screen will show. Use the "Dashboards" tab to view a summary of the EMS system. The Freedom Won Commissioning team sets up the dashboard with a standard view. If you wish to customise it or add more options, this might require a license upgrade. Alternatively, contact Freedom Won for training.

The dashboard displays daily data for your site, production, power consumption, battery, controls, grid tie, and DC PV information. Users can also use the Calendar feature to see previous data.

The following tabs provide different views and can be accessed from the dashboard.

- Site Overview: This tab shows daily live data of your site's energy use in kilowatts. For instance, how much power flows to and from the grid, generator, battery, internal PV, and load.
- Production and Consumption: Shows how much energy you are generating and using.
- Battery: Lets you monitor the status and performance of your battery.
- Controls: Allows you to manage and adjust your system settings.
- Grid Tie: Displays your connection to the main power grid.
- DC PV: Shows details about the energy coming from your solar panels (DC photovoltaic). Refer to the dashboard options example below.

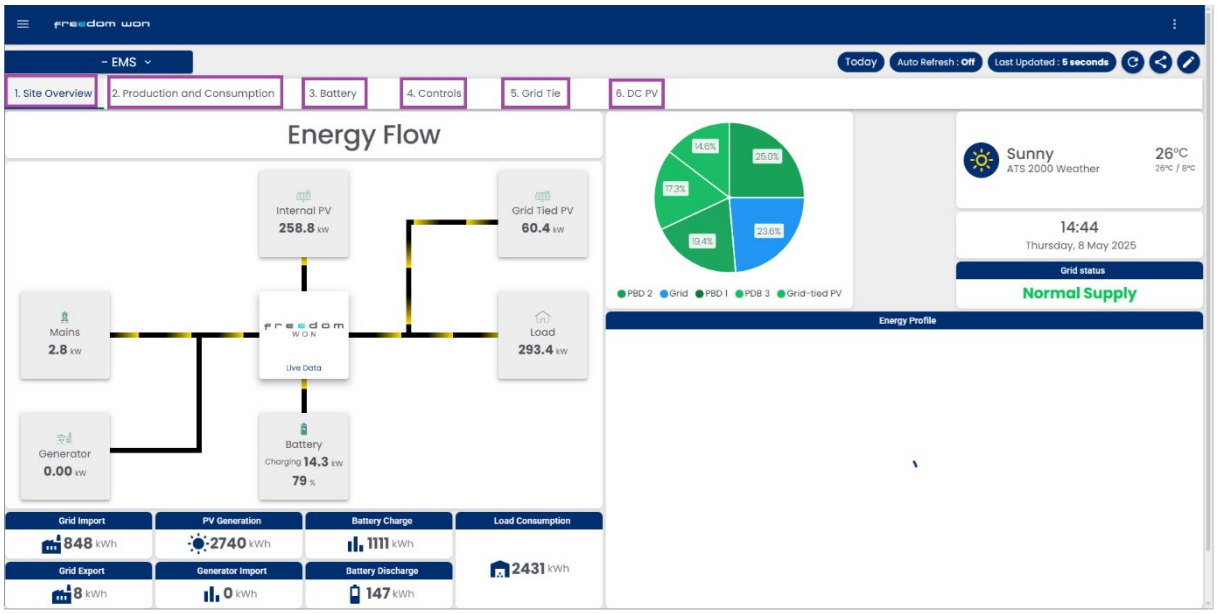

Figure 30: Dashboard Options Examples

8.3.1 Site Overview

8.3.1.1 Energy Flow Display

This tab shows the energy flow display, which provides a real-time visualisation of your power management system, using animated lines to show how electricity moves from multiple sources to your loads. When mains power is active, lines show electricity flowing from the utility grid to your appliances while simultaneously charging the battery if necessary.

PV integration flowing lines, showing both internal PV (photovoltaic) from grid PV feeding power to your loads and battery. The battery's operation is also indicated, with lines showing power flow during both charging (from power sources to battery) and discharging (from battery to loads), with the current charge level percentage.

When a generator is active, lines display the power flow from this backup source, which the system automatically prioritises over battery use. The display continuously updates to show real-time power usage in kilowatts, making it easy to monitor your energy consumption patterns and verify that your system is operating correctly by indicating which power source is currently supplying your electrical loads. Refer to the Site overview example below.

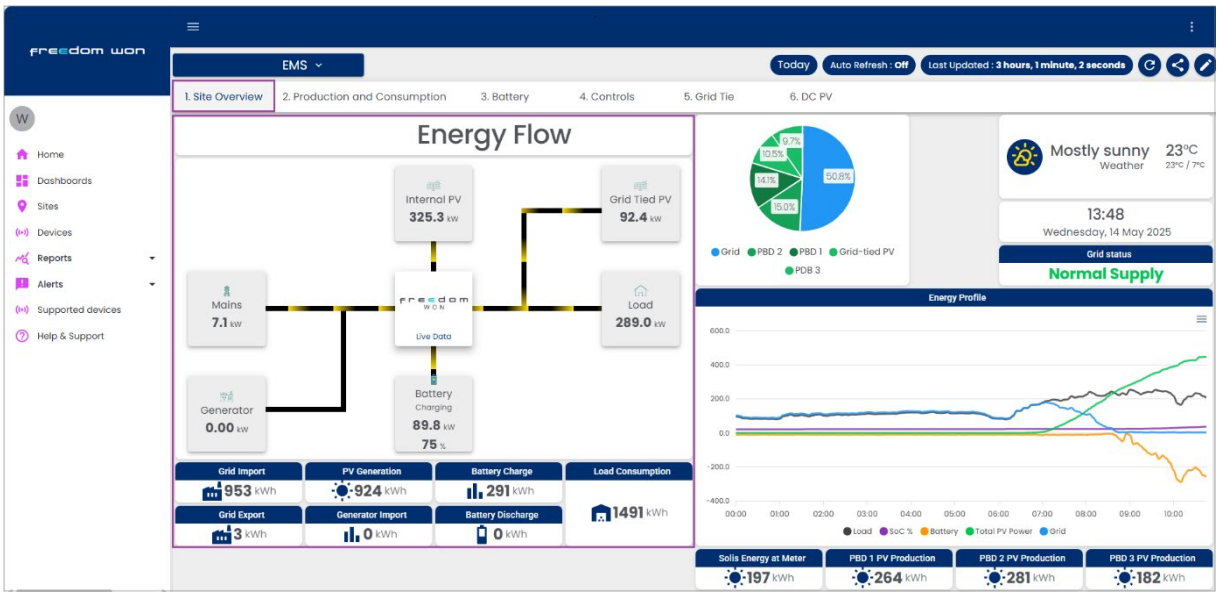

Figure 31: Site Overview Tab Example Screen

8.3.1.2 Pie Chart Display

The pie chart displays a summary of energy consumption in percentages or values. For a clearer identification, you can customise the colours of the pie chart segments to distinguish between various charge controllers or the grid. Hover with your mouse pointer over a section of the pie chart to view the specific charge controller or the grid details. Refer to the pie chart display example below.

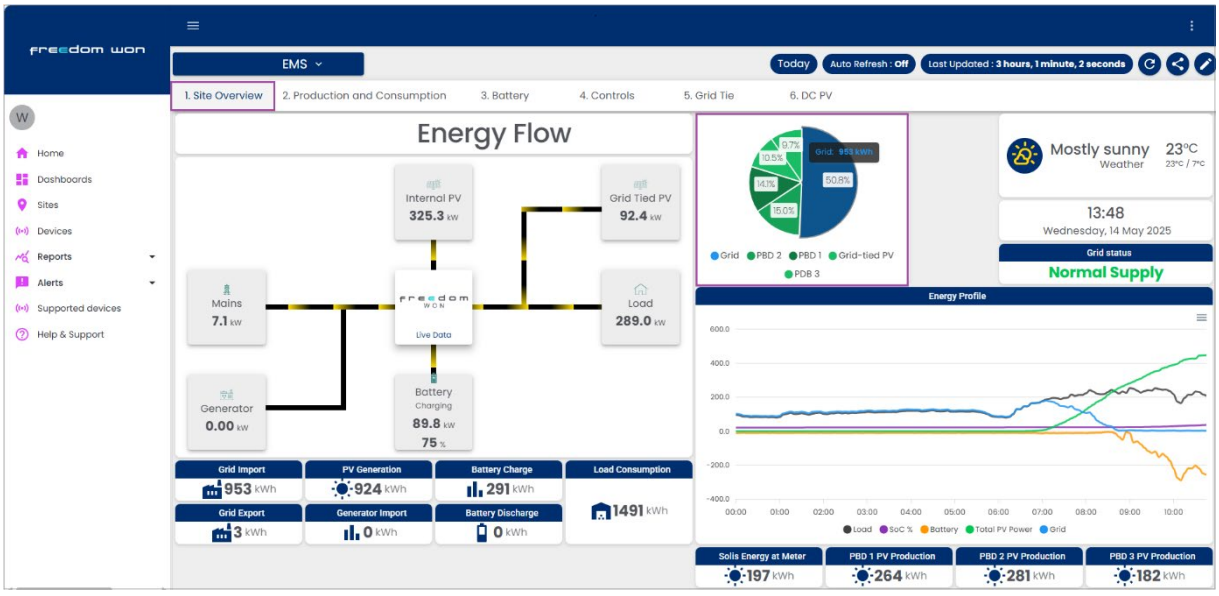

Figure 32: Pie Chart Example Screen

Follow the steps below to change the colour segments in the pie chart for various energy sources and the grid.

1. Click the pencil icon (edit mode) in the top right corner of the screen to enable editing.
2. Click the pencil icon (edit mode) at the top of the pie chart. The “Edit Widget” screen will open.

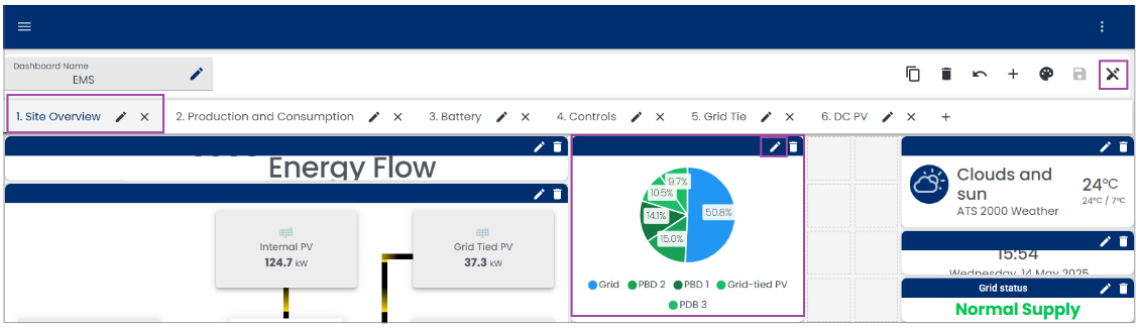

Figure 33: Edit Icon Example Screen

3. Click on the "Widget type" drop-down menu to choose from several widget options.

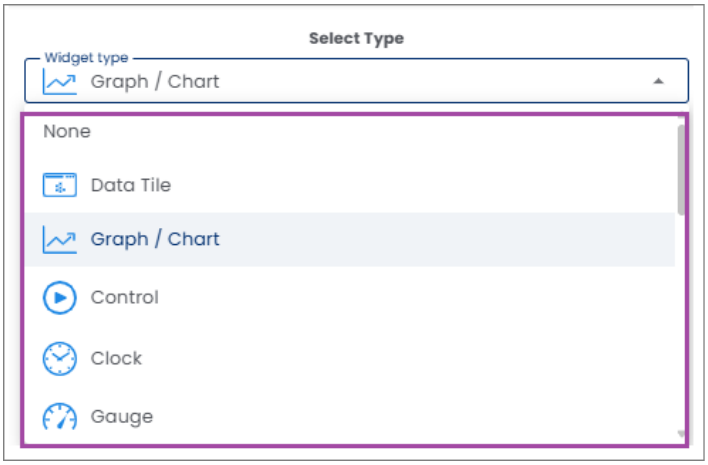

Figure 34: Widget Type Options Example Screen

4. Type your site name in the “Site” field.
5. Type the “Device” name in the required field.
6. To manage your “Datasets”, use the edit and delete icons next to each entry.
7. If you prefer seeing actual values instead of percentages, click the checkbox to change the display format.
8. Adjust the number of segments using the up and down arrow controls.
9. Click the "Save" button to update your settings.

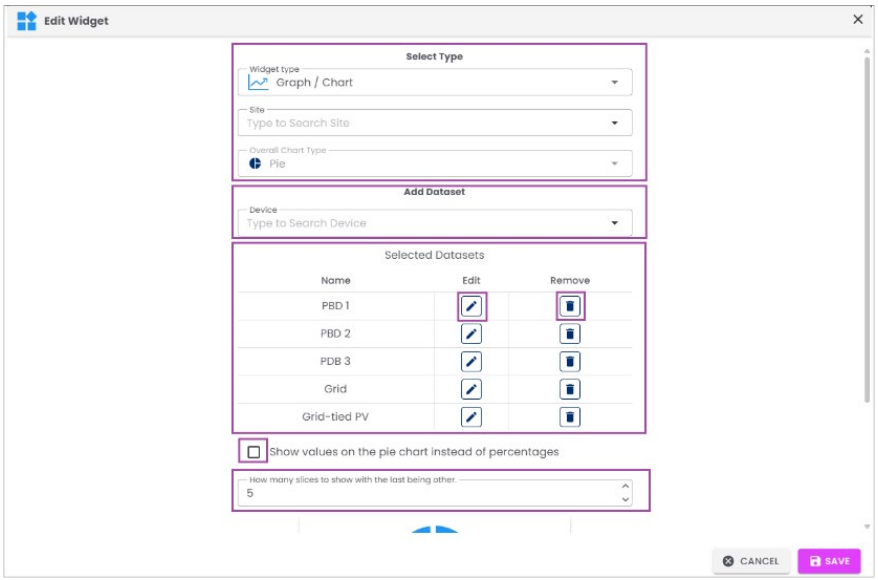

Figure 35: Edit Widget Example Screen

8.3.1.3 Weather and Time Displays

Add weather and time information to your dashboard using dedicated widgets. The weather widget displays temperature in Celsius and automatically shows conditions for your selected site. The time widget helps you track various sites by showing different time zones. You can also add the current date and day of the week for each site.

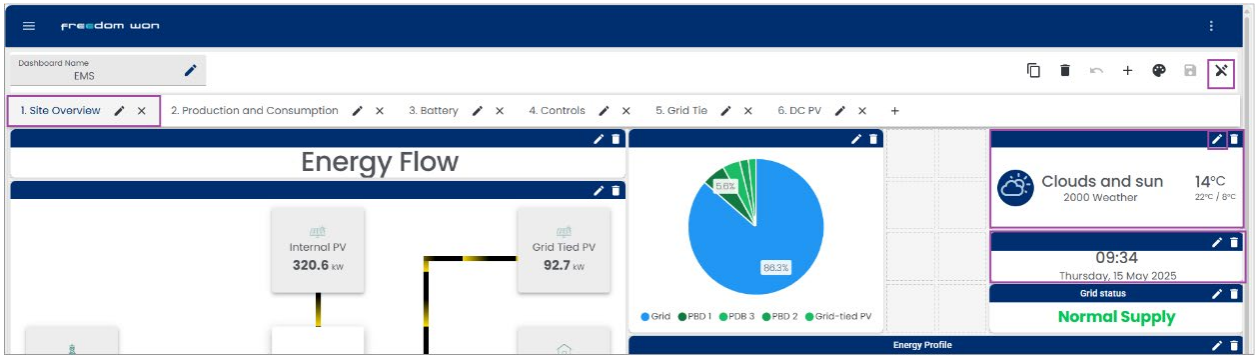

Figure 36: Weather Widget Display Example Screen

8.3.1.3.1 Edit Weather Display

Follow the steps below to edit the weather widget.

1. Click the pencil icon (edit mode) in the top right corner of the screen to enable editing.
2. Click the pencil icon (edit mode) at the top of the weather display. The “Edit Widget” screen will open.
3. Click the "Widget type" drop-down menu to choose from several widget options.

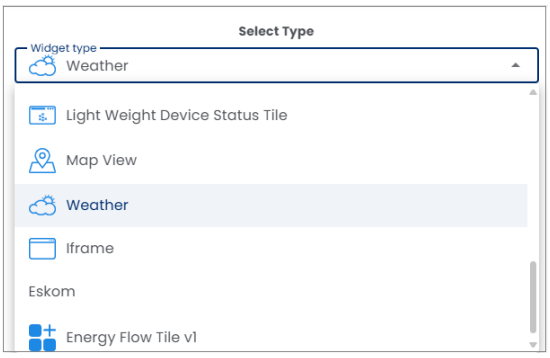

Figure 37: Select Type Example Screen

4. Select or type your site name in the “Site” field.
5. Select the “Device” from the drop-down menu.
6. Expand the screen using the up and down arrow controls.
7. You can display a header on screen by typing the text in the required field and selecting the "Show Widget header" checkbox.
8. Click on the “Click Actions” drop-down to add an action upon clicking on the header.
9. Click on the “Save” button to update the changes.

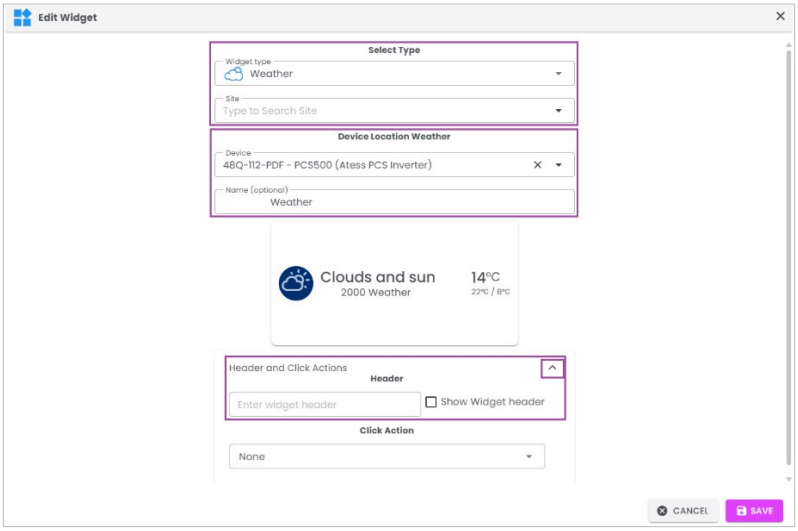

Figure 38: Edit Weather Display Widget Example Screen

8.3.1.3.2 Edit Time Display

Follow the steps below to edit the time widget.

1. Click the pencil icon (edit mode) in the top right corner of the screen to enable editing.
2. Click the pencil icon (edit mode) at the top of the time display. The “Edit Widget” screen will open.
3. Click the "Widget type" drop-down menu to choose from several widget options.
4. Click in the “Show Date” checkbox to show the time on the display.

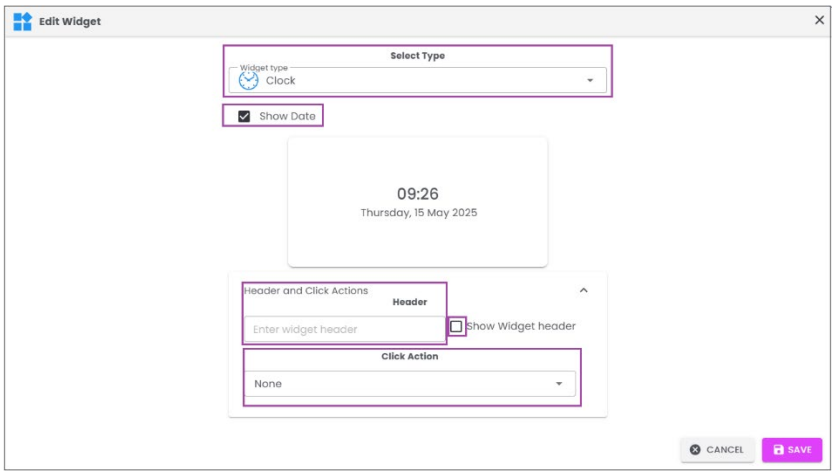

Figure 39: Time Widget Example Screen

5. You can display a header on screen by entering text in the required field and selecting the "Show Widget header" checkbox.
6. Click on the “Click Actions” drop-down to add an action upon clicking on the header.
7. Click on the “Save” button to update the changes.

8.3.1.3.3 Edit Grid Status Display

The grid status displays the current power supply condition. During load shedding, it indicates the "Grid Failure” text. This text can be customised to show in the colour red.

When electricity is available, the text shows "Normal Supply" and can be set to display in green. You can customise the grid status text appearance in the status display by choosing aggregation methods, selecting display types, and changing the text colour. The normal operating voltage range is 380 to 400V across L1 and L2. If the voltage falls below 380V, it will trigger a grid failure condition.

Follow the steps below to edit the grid status widget.

1. Click the pencil icon (edit mode) in the top right corner of the screen to enable editing.
2. Click the pencil icon (edit mode) at the top of the time display. The “Edit Widget” screen will open.

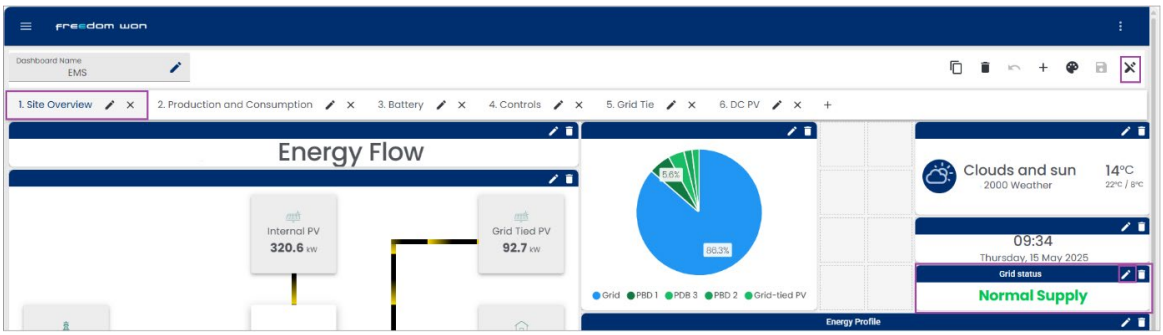

Figure 40: Grid Status Display Example Screen

3. Click the "Widget type" drop-down menu to choose from several widget options.
4. Select or type your site name in the “Site” field.
5. Select the “Device” from the drop-down menu.
6. Select the type of “Aggregation” from the drop-down menu, for instance, live, average, minimum, maximum, and sum.
7. Select the “Display type” from the drop-down menu, for instance, conditional.
8. Select the “Condition type” from the drop-down menu, for instance, less than, greater than, is null, Equal to, etc.

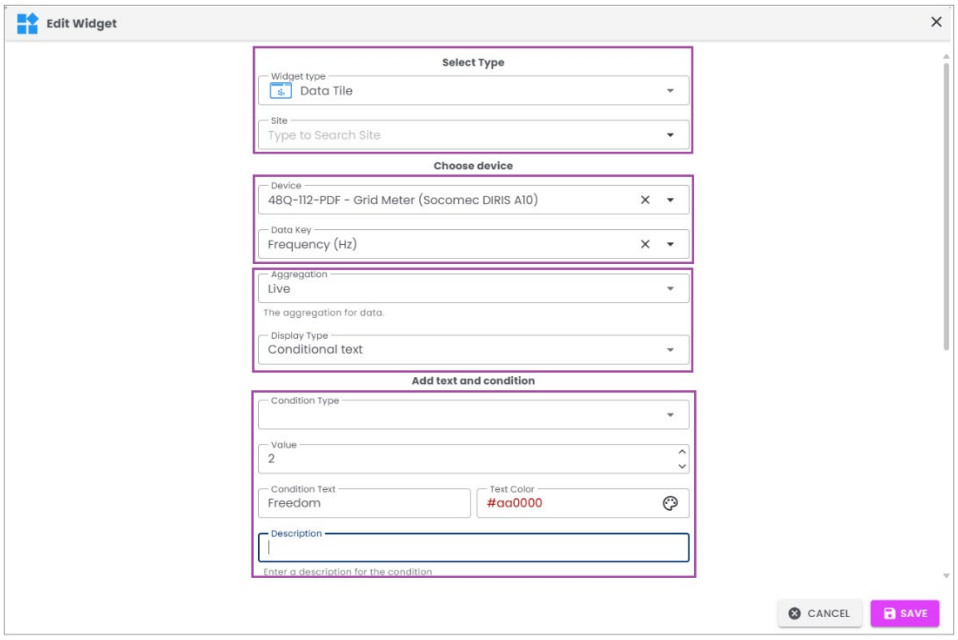

Figure 41: Grid Widget Example Screen

9. Adjust the “Value” using the up and down arrow controls.
10. Click on the “Text Colour” icon to change the condition text colour.

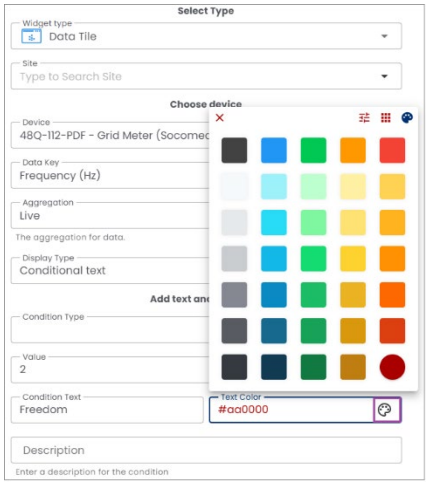

Figure 42: Text Colour Icon Example Screen

11. Type the description of the condition in the required field.

12. Click on the "Add" button to add a description. To manage your "Descriptions", use the edit and delete icons next to each entry.
13. Click in the checkbox to show a graph of average in the background.
14. You can change the "Chart Colour" when you click on the text colour icon.
15. Click on the "Finish" button and click the "Save" button to update the changes.

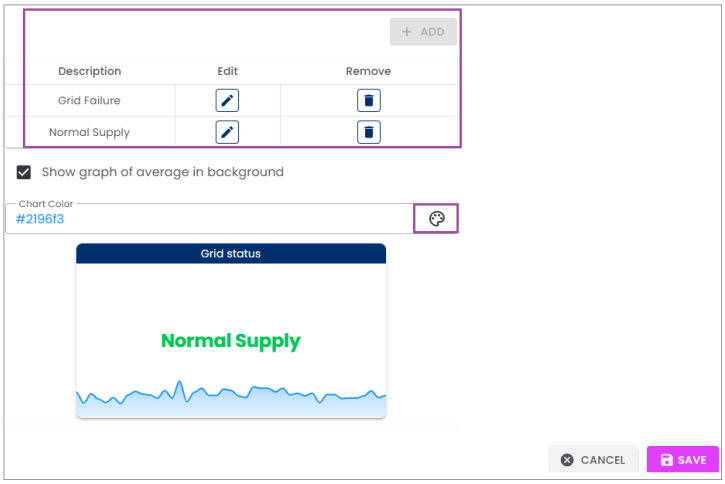

Figure 43: Edit Widget Example Screen

8.3.1.4 Energy Profile Display

The Energy Profile Display provides an overview of your energy system's current state, showing real-time values for load consumption, the battery's state of charge (SOC), the total photovoltaic (PV) power being generated, and the power being exchanged with the electrical grid.

For data analysis and reporting purposes, you have the options to export this information in different formats, such as SVG for scalable graphics, PNG for images, and CSV for detailed data analysis in spreadsheet applications to compare load consumption. Refer to the energy profile display example below.

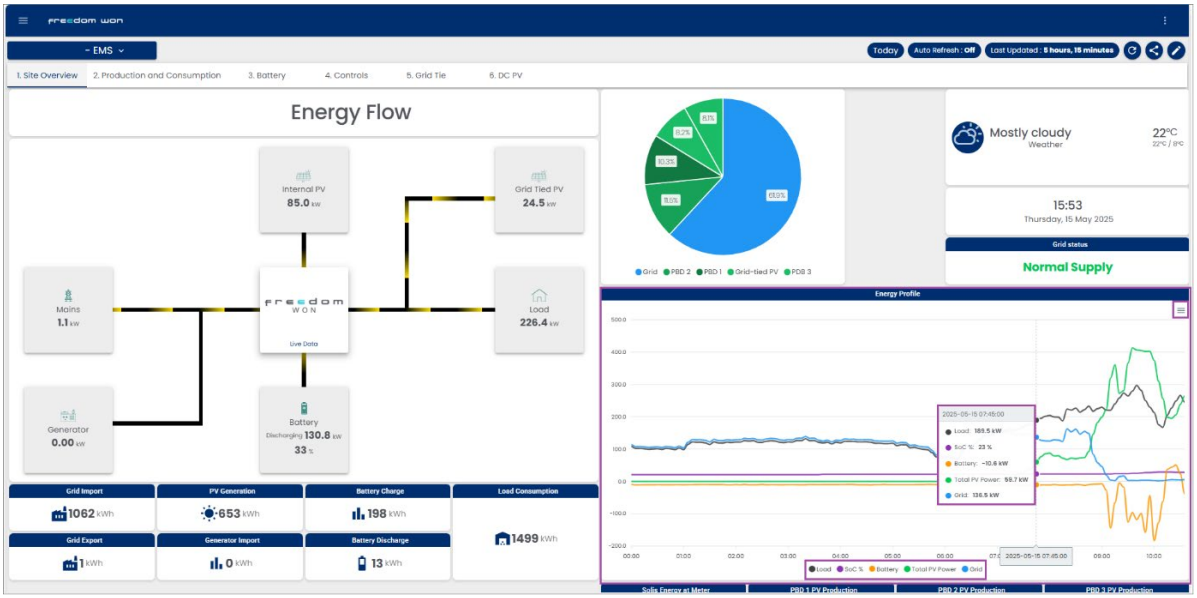

Figure 44: Energy Profile Display Example Screen

8.3.2 Production and Consumption Tab

The Production and Consumption tab provides a view of your power flow. It displays the energy generation from both solar panels and the grid, while tracking how much power is being drawn from your battery storage system. You can monitor the total power consumption through the load readings.

For data analysis and reporting purposes, you have the options to export this information in different formats, such as SVG for scalable graphics, PNG for images, and CSV for detailed data analysis in spreadsheet applications to compare load consumption. Hover your mouse over the graph to view the power consumption for a specific time. Refer to the production and consumption tab example below.

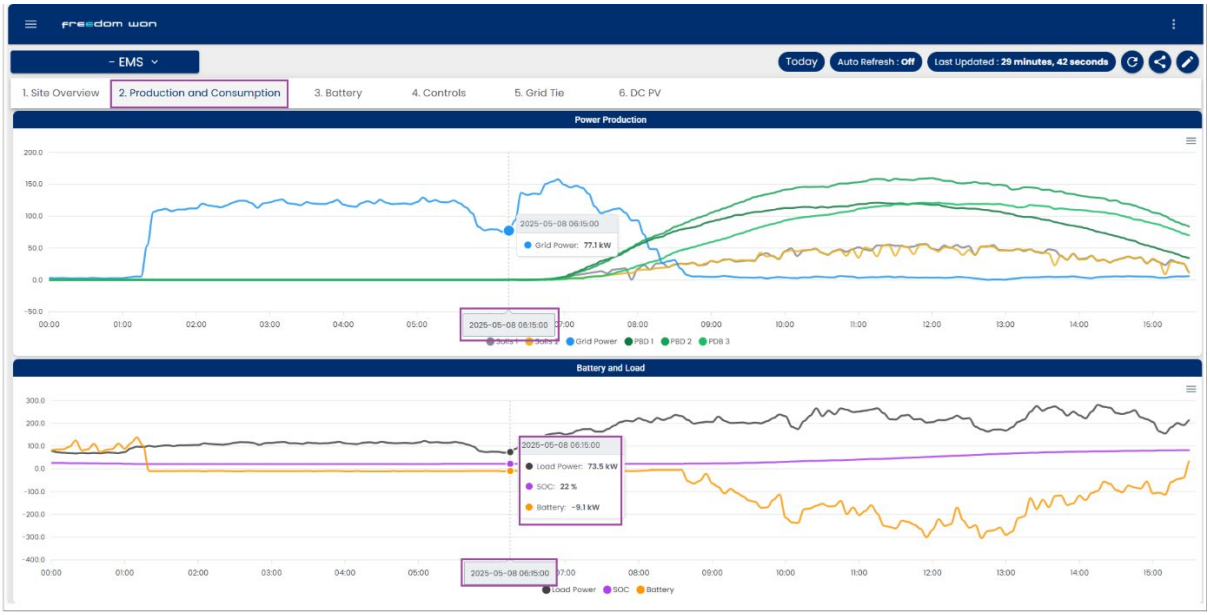

Figure 45: Production and Consumption Tab Example Screen

8.3.3 Battery Tab

The battery monitoring tab provides information about your battery system's performance. It shows the current state of charge (SoC) as a percentage, indicating how full your battery is. You can track real-time battery power measurements in watts, with the exact voltage levels.

The battery tab also monitors charging and discharging activities, showing power flow in both directions. For optimal battery health, the display tracks cell balancing status, ensuring all cells within the battery pack maintain consistent voltage levels and perform efficiently. Refer to the battery tab example below.

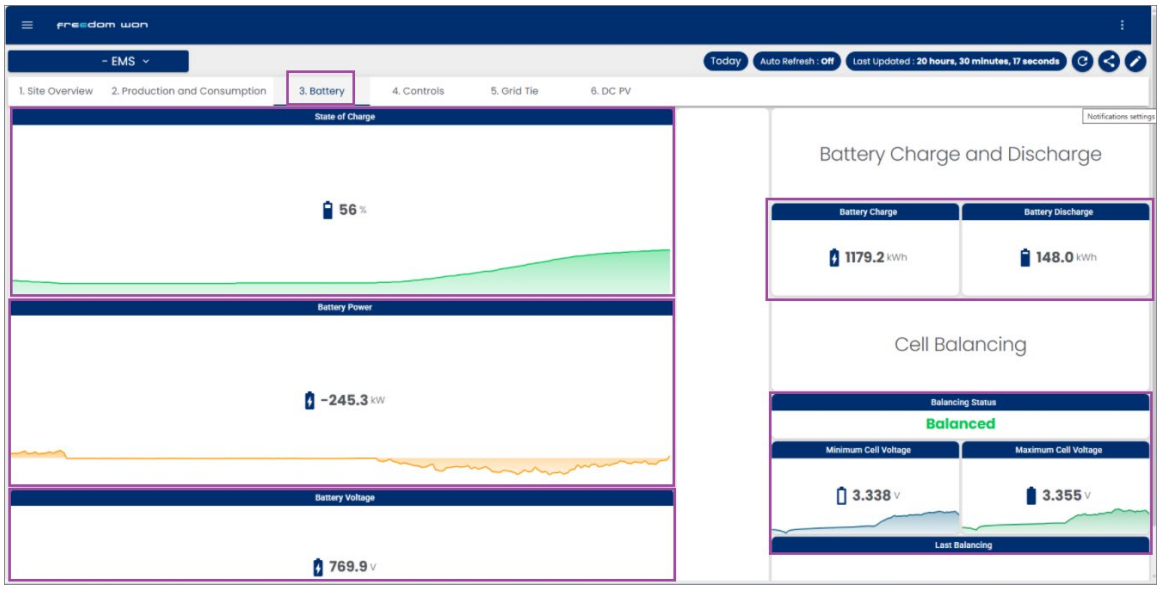

Figure 46: Battery Tab Example Screen

8.3.4 Control Tab

8.3.4.1 Generators Controls

To ensure correct setup and communication, it is essential to identify the controller's make, model, and communication type. You must also determine if the controller is a parallel or standard system, and remember that each controller has a unique ID.

Setting up these controllers requires specialised software, not the keypad, and this software must be downloaded before an installer visits the site. Some off-brand controllers, such as APM and Smartgen, may not be compatible. For the EMS to function correctly, all controllers must be mapped to be compatible with the EMS and set to Auto mode. Refer to the battery tab example below.

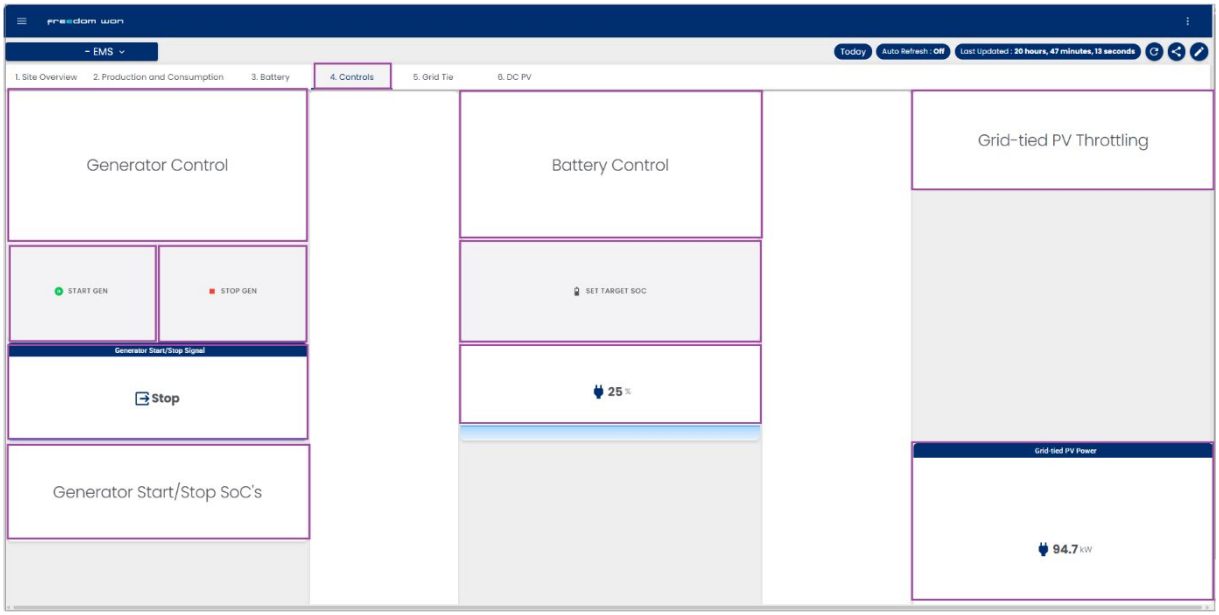

Figure 47: Controls Tab Example Screen

8.3.4.2 Generator Start and Stop

Follow the steps below to start and stop the generator.

1. Click on the "Start Gen" (green) button to start the generator manually. Click on the "Stop" (red) button to stop the generator manually. This setting allows you to instruct the generator to automatically stop when the battery reaches a specific percentage.
2. Click on the "Start/Stop" Generator Signal option to start or stop the generator. This setting allows you to instruct the generator to automatically start when the battery level drops to a specific percentage. This setting allows you to instruct the generator to automatically stop when the battery reaches a specific percentage.

8.3.4.3 Battery Control

Follow the steps below to set the target SOC.

1. Click on the "Set Target SOC" option to instruct the battery to stop charging when it reaches a specific percentage.
2. Type the target percentage in the field.
3. Click on the "Ok" button.

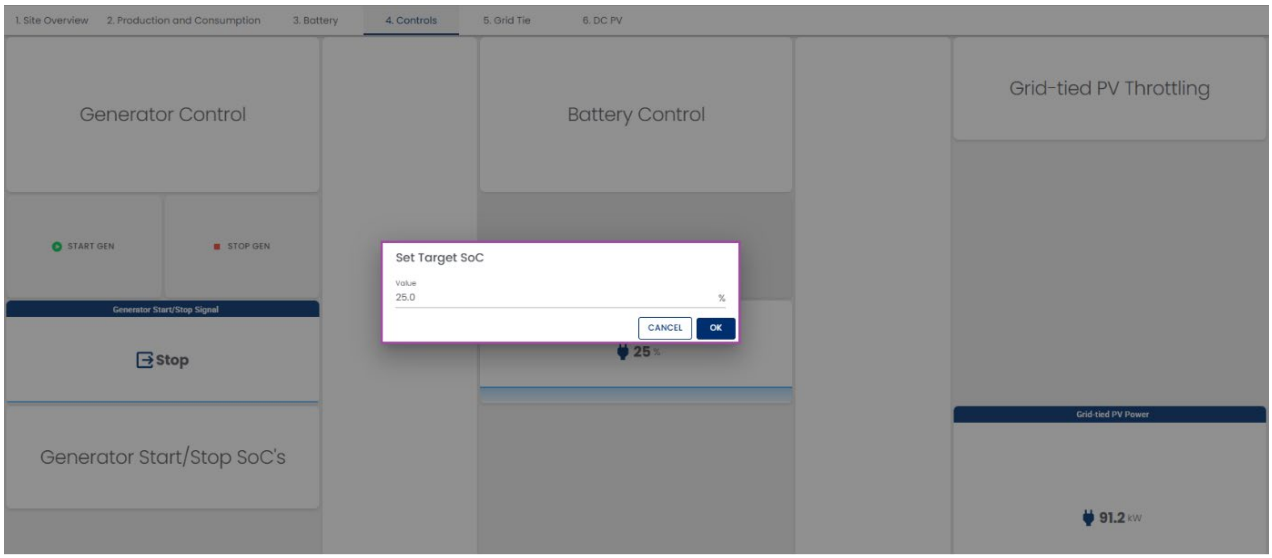

Figure 48: Set Target SoC Screen

8.3.5 Grid Tie Tab

The Grid-Tie tab acts as a central monitoring point, displaying the real-time power output of connected solar photovoltaic (PV) devices on sunny days. This allows users to track the energy being fed back into the grid and the real-time values of inverters. Refer to the grid tie tab example below.

Figure 49: Grid Tie Tab Example Screen

8.3.6 DC PV

The DC PV tab shows the total DC-coupled PV production with available string combiners. To ensure you get an accurate voltage reading, double-check that the combiners are wired correctly. Refer to the DC PV tab example below.

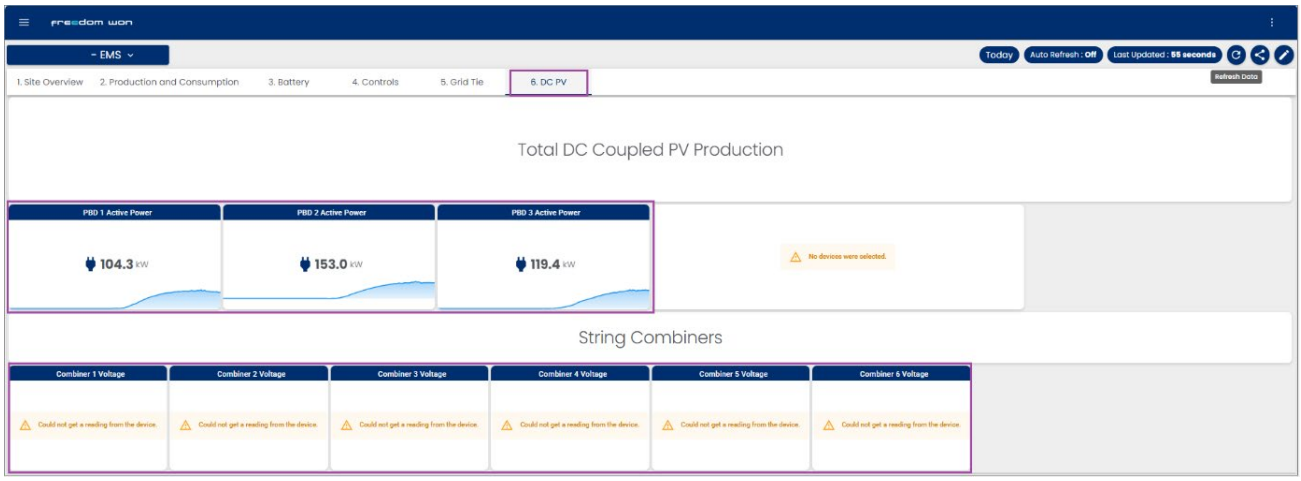

Figure 50: DC PV Tab Example Screen

8.4 Manage Devices and Sites

8.4.1 Add a Device

This task is performed by the Freedom Won support or commissioning team. They have the specialised knowledge and tools to ensure it is done correctly and efficiently. If you want to add devices, contact Freedom Won for training.

After successfully adding your device, it will show in the device list. You can add more devices if necessary. The status indicator will display "Connected" if your connection settings are correct and the device is online. If a configuration issue occurs, an error message will be displayed. You can also add a device directly from the Device tab by clicking the Add Device icon. To link the gateway, use the key found on the Glacier inside the EMS panel.

1. Click on the hamburger menu.
2. Click on the “Site” option. You can also add a device from the Device tab.
3. Click on the “Add Device” button.

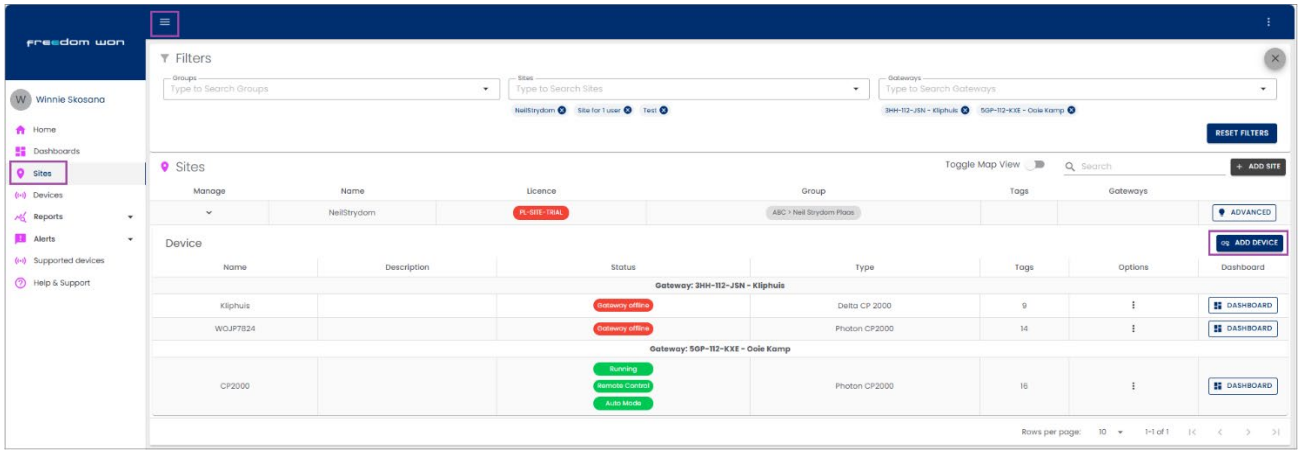

Figure 51: Add Device Button Example Screen

4. The “Link Device” screen will open. Click on the “Gateway” drop-down list to select the gateway.
5. Click on the “Device Type” drop-down list to select the type.
6. Use the up and down arrows to adjust the “Slave ID”. Ensure that your slave ID matches your device.
7. Type the “Device Name” in the required field.
8. Write the device “Description” in the required field. This will help you identify the device later.
9. Click on the “Link Device” button.

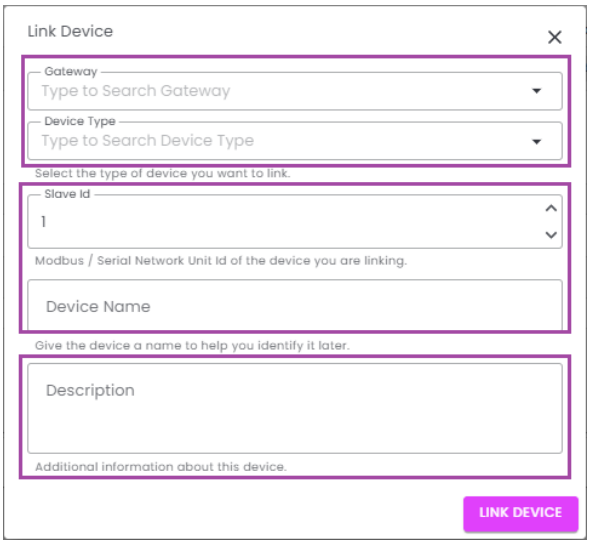

Figure 52: Link Device Button Example Screen

8.4.2 Add Groups

This is done by the Freedom Won support or commissioning team. When creating new groups, always set Freedom Won Device Group as the parent group. If you want to customise groups, contact Freedom Won for training.

For each new location you add:

- Create a unique new Device Group specifically for that site.
- Ensure this new site group is connected as a child group to the main 'Freedom Won Device Group'.
- Avoid placing individual customers directly into the 'Freedom Won Device Group'. Instead, add them to the specific Device Group created for their site.

When inviting new users, double-check that you are assigning them to the correct group based on their required access.

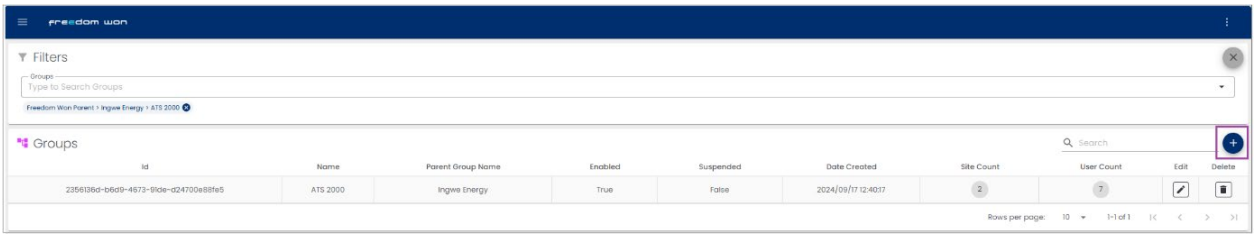

Figure 53: Add Groups Buttons Example Screen

Follow the steps below to add a group.

1. Navigate to the "Groups" section in the portal.
2. Click on the plus icon (+) to add a new device group.
3. Type the name of the new site you are adding in the "Name" field.

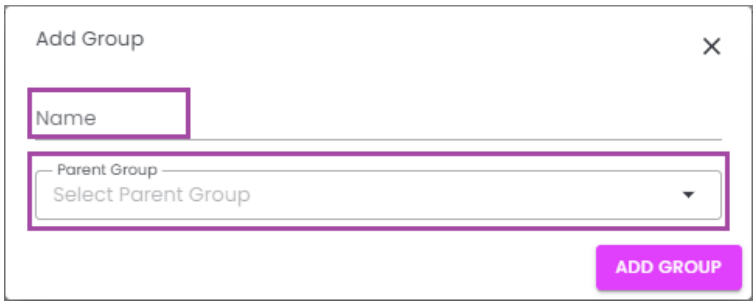

Figure 54: Add Group Button Example Screen

4. Select "Freedom Won" from the available options for the parent group.
5. Click the "Add Group" button to save the new device group with the specified name and parent.

8.4.3 Add a Site

Do the following steps to add a site name.

1. Navigate to the "Sites" section in the portal.
2. Click on the labelled "Add Site" option to add a new site.
3. Type the site “Name” in the required field to add a new site.
4. Type the site's “Description” in the required field.
5. Click on the “Group” drop-down list to select a device group.
6. Click on the "Add Site" button save the new site information.

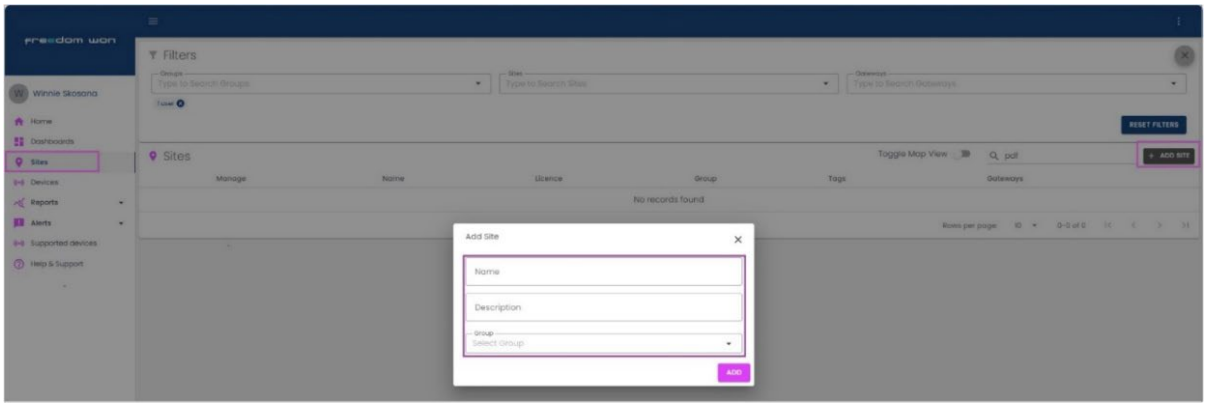

Figure 55: Add Site Example Screen

8.4.4 Link Gateway

Follow the steps below to link the gateway.

1. Navigate to the "Sites" section within the portal.
2. Click on the “Advanced” option next to the site you want to link.

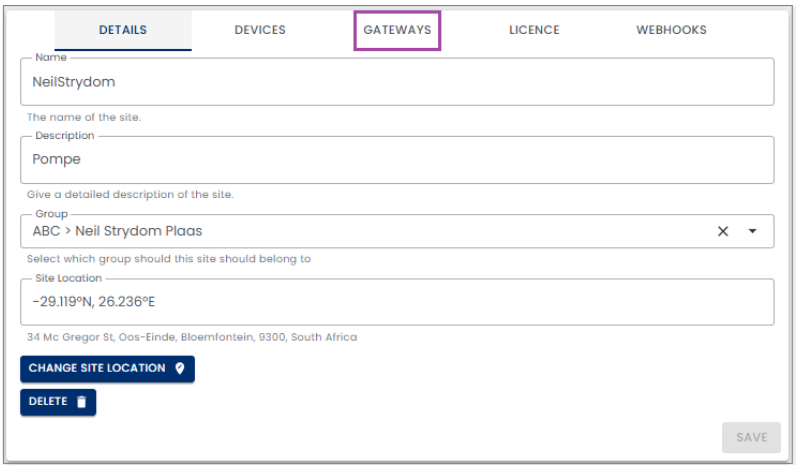

Figure 56: Gateway Tab Example Screen

3. Click on the Gateways tab and click the Link Gateway button.

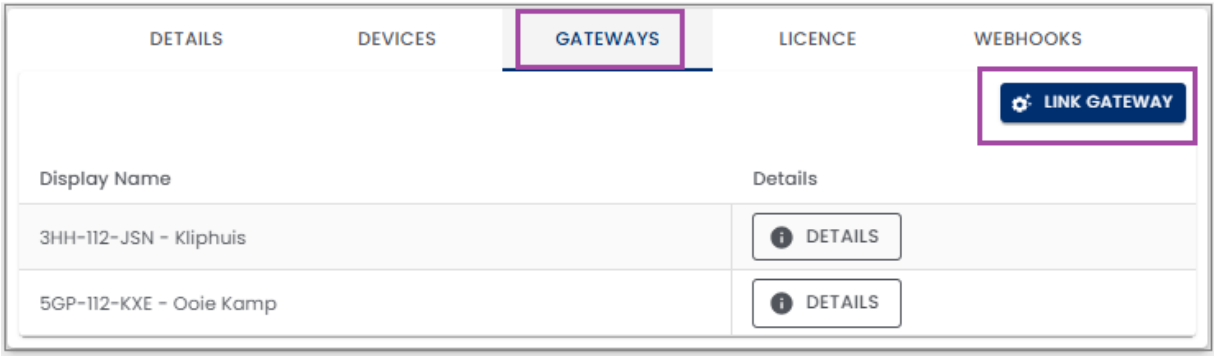

Figure 57: Link Gateway Button Example Screen

4. The Gateway Serial Number screen will open. Type the serial number in the required field.

Figure 58: Gateway Serial Number Field Example Screen

5. Click on the "Details" button to view the Gateway details and to check the state of the gateway.

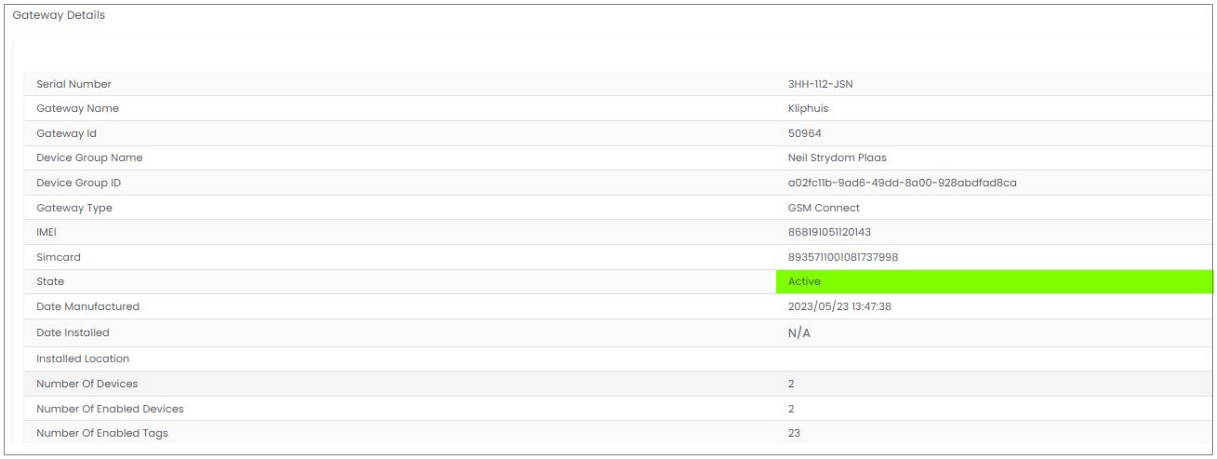

Figure 59: Gateway Details Example Screen

8.4.5 Renew Licences

This option allows you to renew your existing license using a license key obtained from Freedom Won. Follow the steps below to renew a licence. Contact Freedom Won for more information on using this option.

1. Click on the three-dotted menu in the top right corner of the screen.
2. The "Settings" screen will show. Click on the "Add/Renew License" option to renew a license.

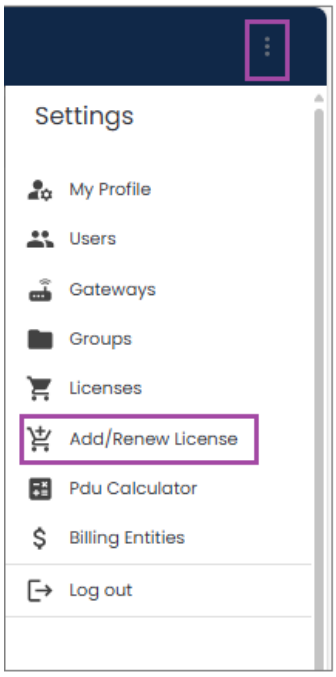

Figure 60: Renew License Option

3. Click on the "Site" drop-down menu to select the location of the license you want to renew.
4. Click on the "Renew Method" drop-down arrow.
5. Select the "Redeem existing license" option from the drop-down menu. You can obtain the "license key" from Freedom Won for a fee.

6. Type the "license key" in the required field.
7. Click on the "Add Key" button.

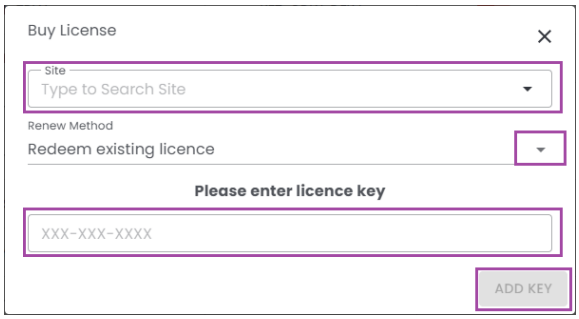

Figure 61: Renew License Screen

9 Troubleshooting Procedures

Refer to the troubleshooting table below to resolve common EMS issues. If the issues persist after consulting the table, contact Freedom Won.

Table 13: Troubleshooting Procedures

Issue Description	Solution
Power Switch Not Working	If the power light on the EMS panel does not illuminate, this can mean that the panel is not receiving power. The EMS light will only illuminate when there is a 230V AC power supply in the system. • Ensure that the DB (Distribution Board) supplying the EMS panel is connected to the output of the inverter. • Verify that the inverter is powered on and provides a 230V AC supply from each phase to neutral. • Make sure that the battery connection and voltage are correct.
Red (Error) light remains illuminated	The illuminated red error light on the front panel indicates the following potential issues: **No Internet Connection:** • Check your site's internet connection. Make sure your internet service is active and working correctly. • Inspect the cable. Verify that the cable connecting the EMS panel to the

	internet switch is undamaged and securely plugged in at both ends. **Firewall Interference:** • If your internet connection and Ethernet cable are working correctly, a firewall might be blocking the EMS panel's internet access. • Contact your IT administrator. Request that they configure the firewall to allow the EMS panel to connect to the internet. • Verify communication on all devices. Ensure all devices are communicating properly after the firewall configuration.

10 Maintenance

To ensure the longevity of your EMS panel, do a simple routine maintenance.
Annual maintenance checklist:

1. Inspect cable connections and terminals.
2. Ensure the EMS panel is clean and free from dust.
3. Verify backup battery status and replace when necessary.
4. Keep the panel clean and prevent water from entering the enclosure.

- The EMS system design lifespan is 10 years under proper maintenance conditions.
- Battery replacement is required every 5 years for backup system reliability.

Visually inspect the EMS panel and cables for any damage and ensure that the connections are secured at least

11 Help and Support

For help or support with your Freedom Won product, our Technical Support team is ready to assist you. You can contact us by telephone, WhatsApp, email, or by logging a ticket through the support portal. Follow the steps below to log a support ticket using the Freedom Won Portal.

The Freedom Won Support Services Portal is regularly updated with improvements. Note that the portal's functionalities are subject to change.

Follow these steps to log a ticket using the Freedom Won Portal.

1. Access the Freedom Won website at www.freedomwon.co.za.
2. Click on the "Contact" tab.

Figure 62: Contact Tab

3. Scroll to the bottom of the page.
4. On the left of the page, click on the "Request Technical Support" link. The "Sign-up" or "Login to the support portal" screen will open.

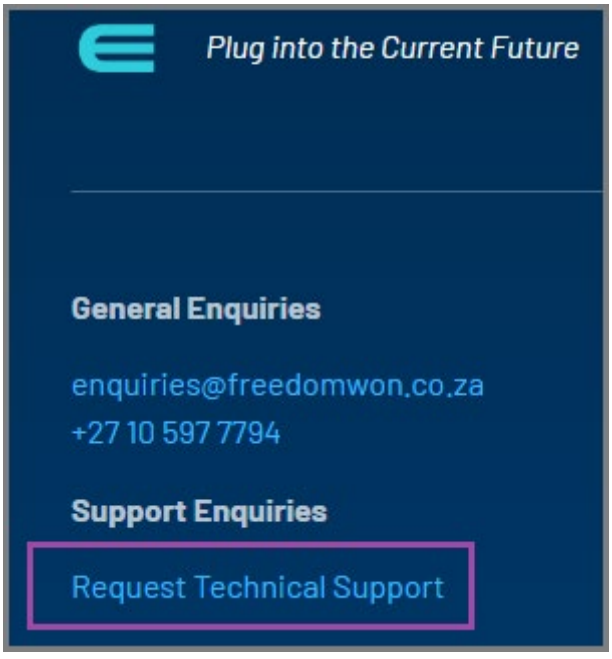

Figure 63: Request Technical Support Screen

5. If you don't have an account on the support portal, click on the "Sign UP With Us" button.

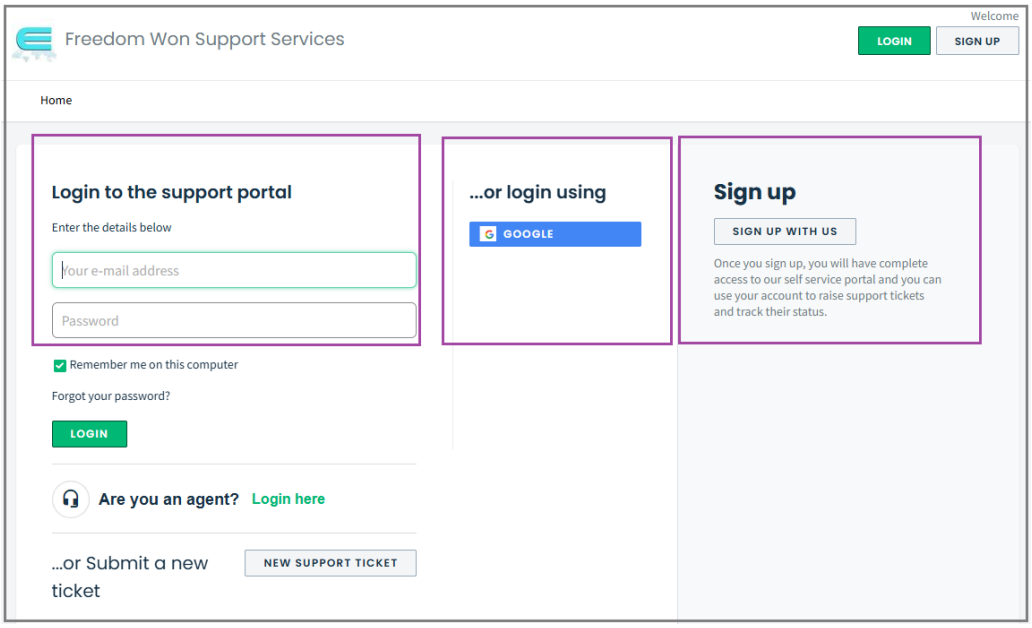

Figure 64: Sign up Option

6. The "Sign up" screen will open.
7. Type your "Full name" and "Email" address in the necessary fields.
8. Click in the "I am not a robot" checkbox to verify that you are a human user.
9. Select a few related items or images from the verification screen.
10. Click on the "REGISTER" button to register on the support portal.

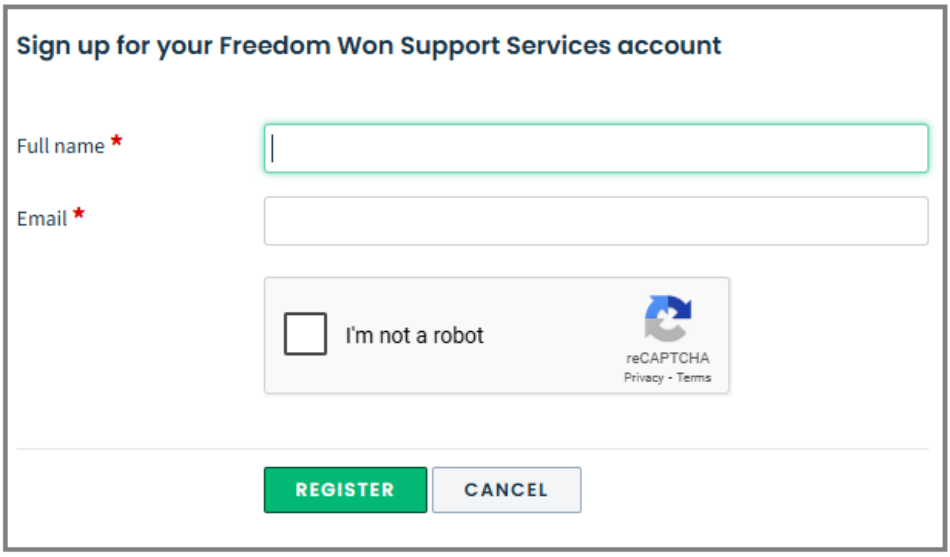

Figure 65: Register Button

11. An automatic email will be sent to you with a link to set up your password and activate your account.
12. Navigate to your email inbox and click on the link you received. The link will direct to the "Freedom Won Support Service" screen.
13. Your name will be populated in the field.
14. Create a password and type the password in the required field.

15. Retype the same password in the “Retype Password" field.
16. Click on the “Activate and Log in” button.

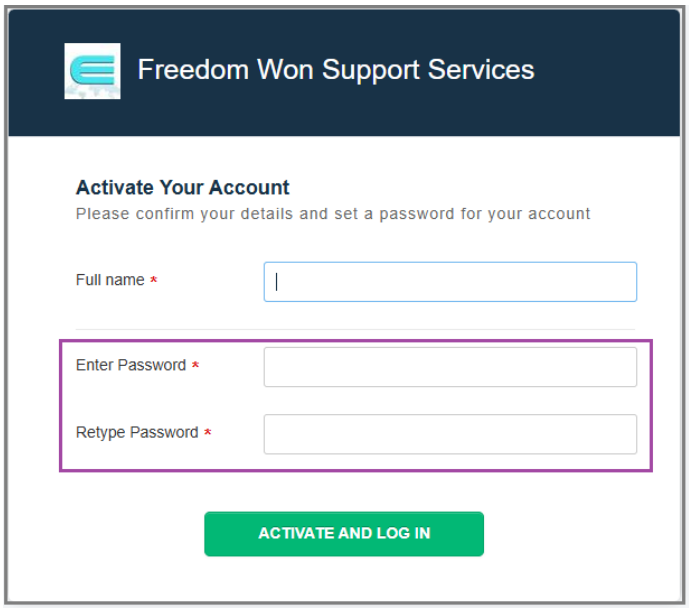

Figure 66: Freedom Won Support Service Screen

You will be directed to the “Freedom Won Support Service” screen.

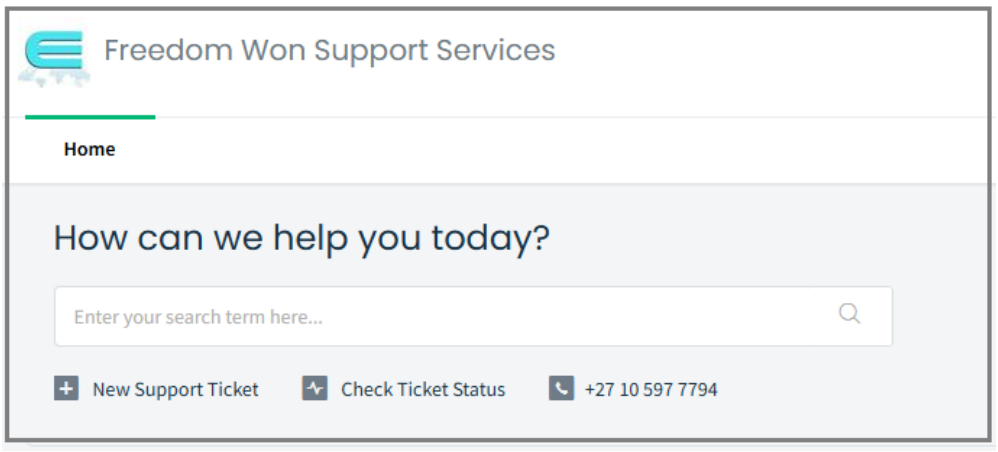

Figure 67: Freedom Won Support Service Screen

17. Click on the “New Support Ticket” plus (+) sign to expand it.
18. The “Submit a Ticket” screen will show.
19. Click on the “Support Type" drop-down menu and select the “Technical Support” option.

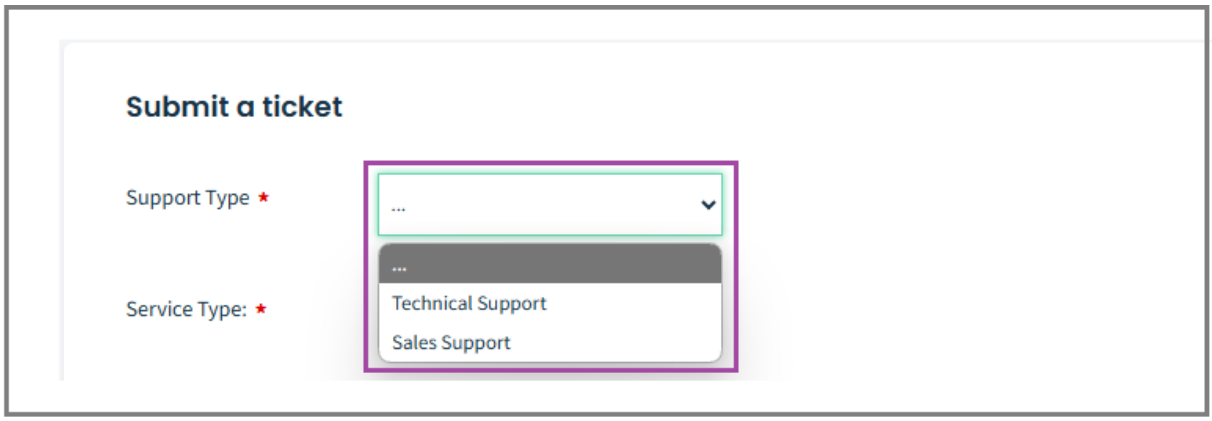

Figure 68: Support Type Drop-Down Menu

20. Click on the "Service Type" drop-down menu and select the type of service you would like to be assisted with.

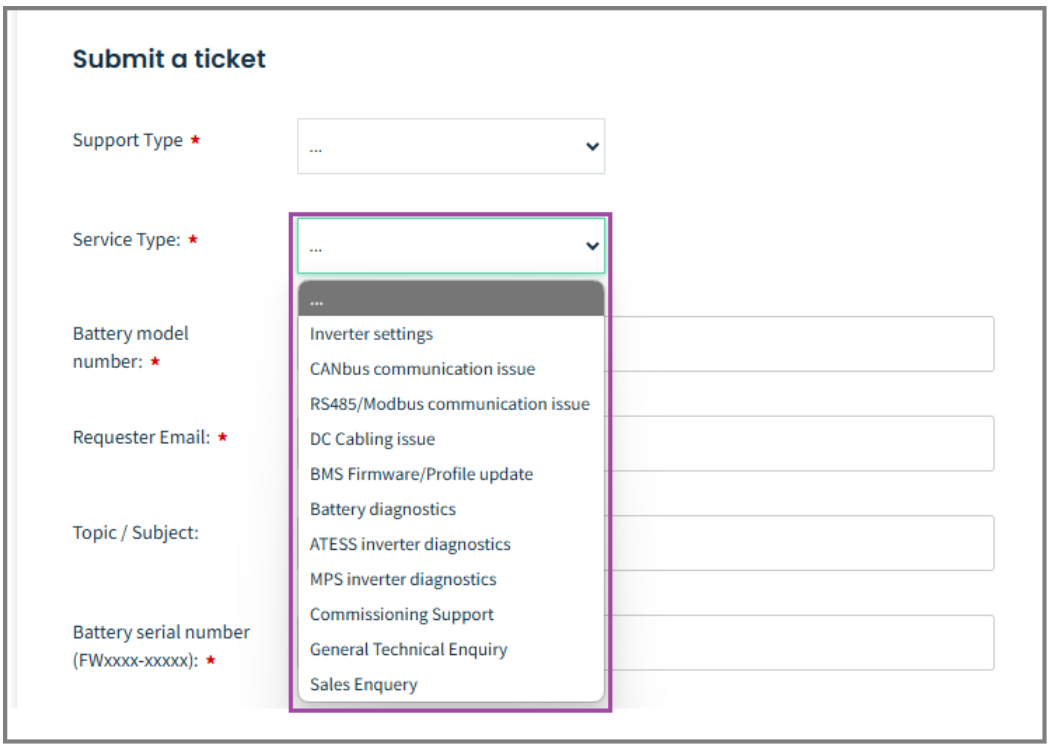

Figure 69: Service Type Drop-down Menu

21. Type the "Battery model number" in the required field.
22. Type the "Requester Email" address in the required field.
23. Type the "Topic/Subject" in the required field. This heading, also known as the subject line, will serve as a summary of your issue and must provide the recipient with a clear understanding of the issue you are addressing. Ensure that your topic/subject is concise, but informative, and accurately reflects the content of your message.
24. Type the "Battery serial number" in the required field.

Figure 70: Submit a Ticket Screen Continues

25. Click on the "Battery Model" drop-down menu to select the battery model.

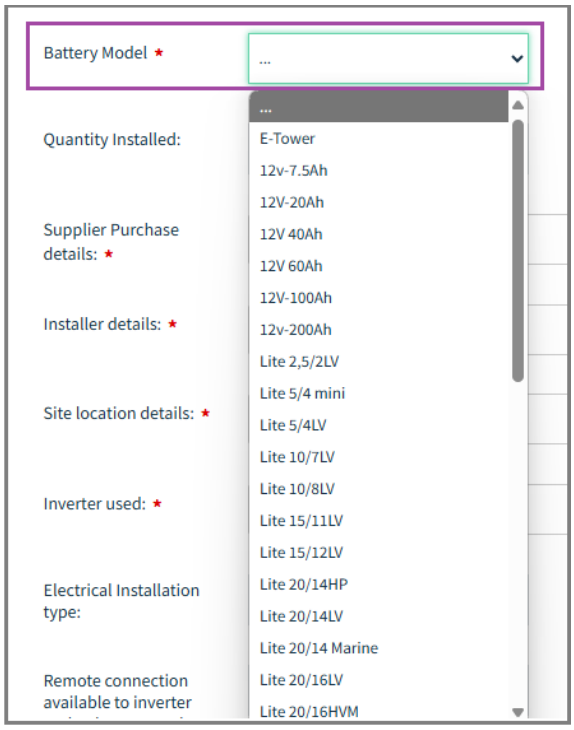

Figure 71: Battery Model Drop-down

26. Click on the "Quantity Installed" drop-down arrow to select the number of equipment.

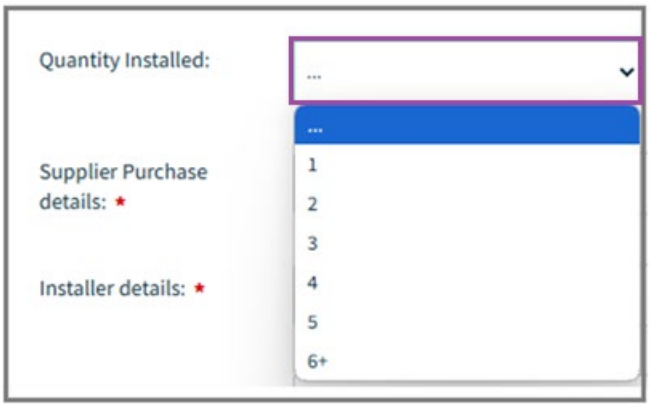

Figure 72: Quantity Installed Drop-down

27. Type the "Supplier Purchase details" in the required field.
28. Type the "Installer details" in the required field.
29. Type the "Site location details" in the required field.
30. Type the brand of the inverter in the "Inverter used" field.

Figure 73: Submit a Ticket Screen Continues

31. Click on the "Electrical Installation type" drop-down menu to select the phase type.

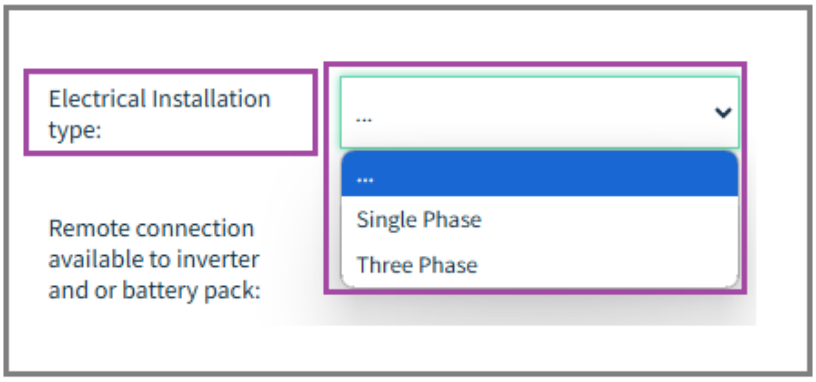

Figure 74: Electrical Installation type Drop-down

32. Click on the "Remote connection available to the inverter or battery pack" drop-down menu and select the "Yes" option. This will grant the Support Team remote access to your installation. And enable them to diagnose the issue quickly and accurately, and also provide effective support, reducing the need for on-site visits or lengthy phone calls.

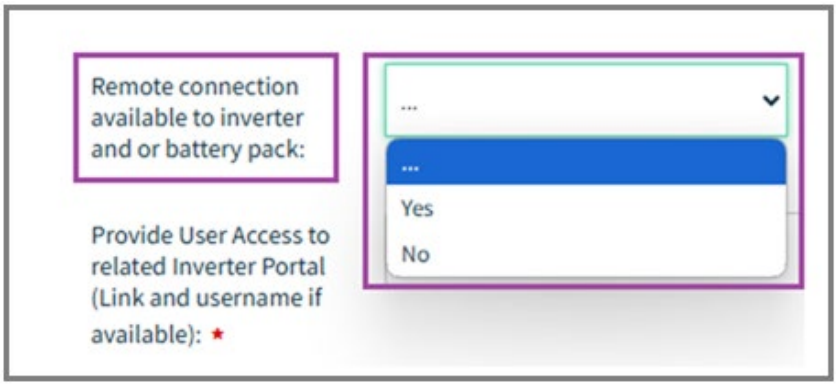

Figure 75: Available Internet Connection

33. Type your username linked to the portal in the required field.
34. Click on the "Access to battery programming cables" drop-down menu and select the "Yes" option.

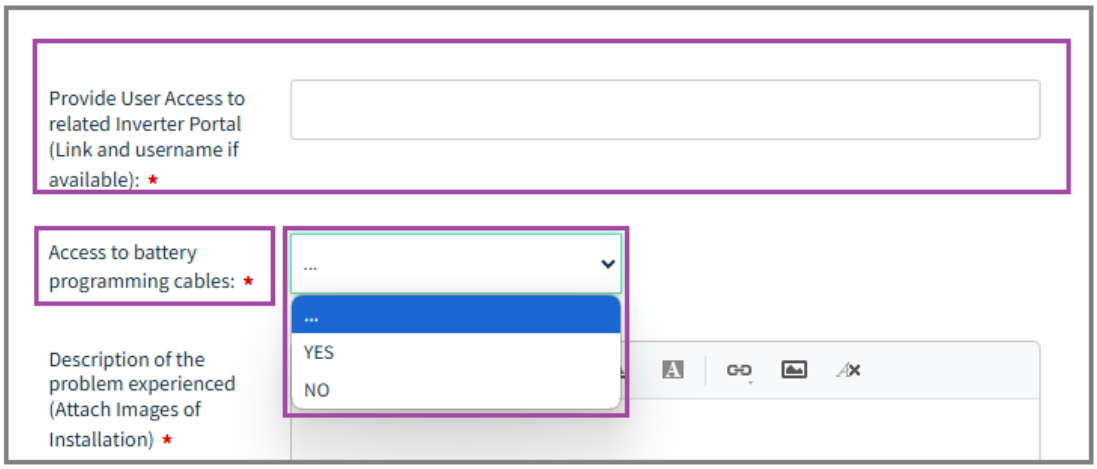

Figure 76: Access to Battery

35. Write the description of the problem in the required field.
36. Click on the "+ Attach a file" to add an image of the issue. Including pictures of the installation to show us how the product is set up and connected. These image details will help our support team to diagnose the problem accurately.

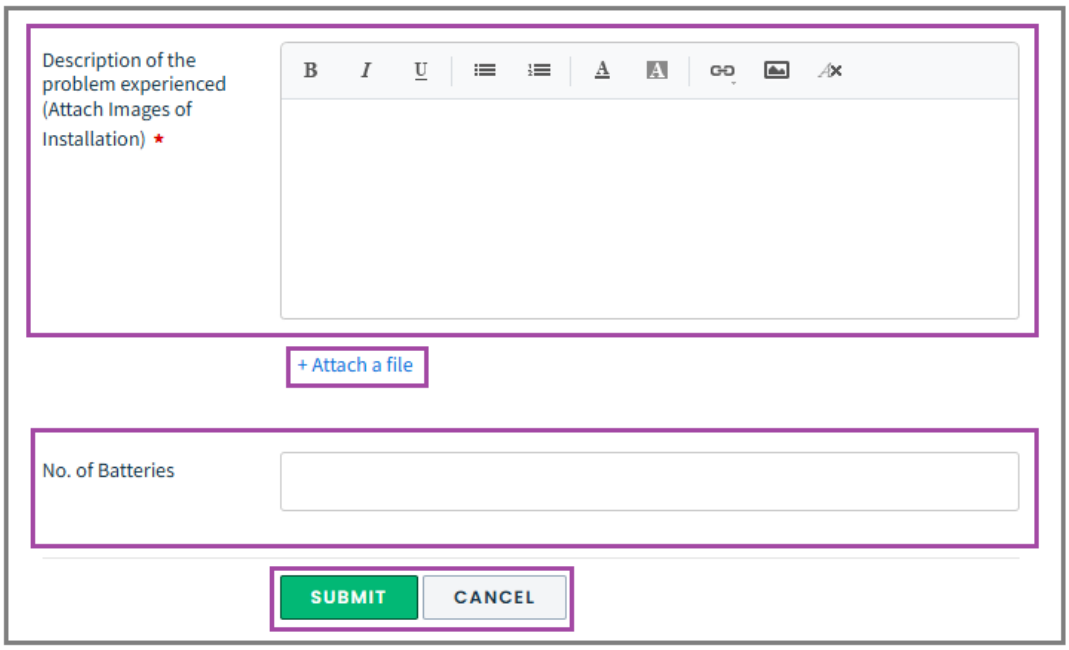

Figure 77: Submit Button

12 List of Abbreviations

A – Ampere

AC – Alternating Current

EMS – Energy Management System

DC – Direct Current

LED – Light-Emitting Diode

TCP – Transmission Control Protocol

GSM – Global System for Mobile

HV – High Voltage

SMA – SubMiniature version A

PLC – Programmable Logic Controller

SOC – State of Charge

LAN – Local Area Network

DB – Distribution Board

RTU – Remote Terminal Unit

SLD – Single-Line Diagram

OTP – One-Time Password

SCADA - Supervisory Control and Data Acquisition

WAN - Wide Area Network

SVG - Scalable Vector Graphics

PNG - Portable Network Graphics

CSV - Comma-Separated Value

kW – Kilo Watts

V - Volts

QR - Quick Response