

freedom  
WON

ENCORE

## HPS Series Quick Start Guide

Mechanical and Electrical



This document specifically covers the HPS mechanical and electrical installation. For more detailed information, refer to the HPS manual.

## 1. Contents

The table below outlines the sections and steps covered in this document. Refer to the corresponding sections for detailed information.

|   |          |
|---|----------|
| <b>2. Introduction</b>                                      | <b>1</b> |
| <b>3. Pre-installation Preparation</b>                      | <b>2</b> |
| 3.1. Product and Package Inspection                         | 2        |
| 3.2. Verify Package Contents                                | 2        |
| 3.3. Installation Tools and Parts                           | 3        |
| 3.4. Installation Temperature and Environment Consideration | 3        |
| 3.5. Safe Handling Practices                                | 4        |
| 3.6. Location and Installation                              | 5        |
| 3.7. Environment Ventilation                                | 6        |
| 3.8. Various Model Dimensions                               | 6        |
| 3.9. Base Mounting and Fixing                               | 6        |
| 3.10. Installation of Air Ducts                             | 7        |
| 3.11. Air Duct Setup  | 8        |
| 3.11.1. Maintaining Airflow                                 | 8        |
| <b>4. Installation</b>                                      | <b>9</b> |
| 4.1. Pre-Wiring Safety and Cable Considerations             | 9        |
| 4.1.1. Cable Selection Considerations                       | 10       |
| 4.1.2. Power Cable Terminals                                | 10       |
| 4.1.3. Wiring Specification                                 | 11       |
| 4.2. Installation and Cable Protection                      | 12       |
| 4.2.1. Cable Installation                                   | 12       |
| 4.2.2. Cable Protection                                     | 12       |
| 4.3. Remove Switch Panel and Lower Brackets                 | 13       |
| 4.3.1. Remove Baffle  | 13       |
| 4.3.2. Lower Brackets Installation                          | 13       |
| 4.4. Install DC Wiring                                      | 16       |
| 4.4.1. Essential Precautions for DC Wiring                  | 16       |
| 4.4.2. DC Terminal Connection                               | 16       |

|  |           |
|--|-----------|
| 4.5. Install AC Side Wiring .....                    | 18        |
| 4.5.1. AC Side Line Steps .....                      | 18        |
| 4.6. Install DC Wiring.....                          | 19        |
| 4.6.1. Essential Precautions for DC Wiring.....      | 19        |
| 4.7. Parallel Communication Connection .....         | 22        |
| 4.7.1. Parallel Wiring.....                          | 24        |
| <b>5. Grounding Requirements.....</b>                | <b>27</b> |
| 5.1. External Grounding Connection.....              | 27        |
| 5.2. Grounding Cable Specifications.....             | 27        |
| <b>6. Individual Grounding.....</b>                  | <b>27</b> |
| 6.1. Installation Complete.....                      | 27        |
| 5.2.1. PMDE Grounding .....                          | 27        |
| <b>7. Safe Startup Procedure .....</b>               | <b>28</b> |
| 7.1. Actual Startup Steps .....                      | 28        |
| 7.1.1. Photovoltaic Input Confirmation .....         | 30        |
| 7.1.2. Post-Startup Inverter Activation .....        | 30        |
| <b>8. Shutdown Procedures .....</b>                  | <b>33</b> |
| 8.1. Normal Shutdown.....                            | 33        |
| 8.1.1. Post-Startup Inverter Activation .....        | 33        |
| 8.1.2. Photovoltaic Controller Shutdown .....        | 34        |
| 8.1.3. Inverter Shutdown.....                        | 34        |
| 8.2. In Case of Emergency or Malfunction .....       | 35        |
| 8.3. Maintenance Bypass Procedure.....               | 35        |
| 8.4. Firmware Upgrade.....                           | 35        |
| 8.4.1. Upgrade DCDC Firmware.....                    | 35        |
| 8.4.2. Upgrade DCAC Firmware.....                    | 40        |
| 8.4.3. Monitor Upgrade (Display Screen Upgrade)..... | 43        |

## Tables

|   |    |                                  |    |
|---|----|----------------------------------|----|
| Table 1: HPS Package List                               | 2  | Figure 20: HPS500 Dial Switch    | 23 |
| Table 2: HPS Package List                               | 3  | Figure 21: HPS50 Example         | 24 |
| Table 3: Environmental Requirements                     | 3  | Figure 22: HPS100/HPS150 Example | 24 |
| Table 4: Dimensions of Various Models                   | 6  | Figure 23: HPS50 Example         | 25 |
| Table 5: Forced Air Cooling System                      | 7  | Figure 24: HPS500 Example        | 26 |
| Table 6: Power Cable Specifications (Reference only)    | 10 | Figure 25: HPS250                | 28 |
| Table 7: Wiring Terminals                               | 11 | Figure 26: KB Switches           | 29 |
| Table 8: Distance Between Signal Lines and Power Cables | 12 | Figure 27: HPS250 Example        | 29 |
| Table 9: Screw Dimensions and Required Torque Values    | 12 | Figure 28: HPS250 Example        | 30 |
| Table 10: Grid  | 18 | Figure 29: Menu Screen           | 31 |
| Table 11: Load  | 19 | Figure 30: Menu Screen           | 31 |
| Table 12: External Point for Communication Cables       | 20 | Figure 31: DCDC Converter ON     | 32 |

## Figures

|   |    |   |    |
|---|----|---|----|
| Figure 1: Packaged Handling                   | 4  | Figure 32: Menu Button                            | 32 |
| Figure 2: Unpackaged Handling                 | 4  | Figure 33: Menu Button                            | 33 |
| Figure 3: Installation Space Requirements     | 5  | Figure 34: Maintenance Bypass                     | 35 |
| Figure 4: Base Mounting and Fixing            | 7  | Figure 35: ON and OFF Button                      | 36 |
| Figure 5: Internal Vent Hose                  | 8  | Figure 36: USB Flash Drive                        | 36 |
| Figure 6: External Duct of Converter          | 9  | Figure 37: Stop (EPO) Button                      | 37 |
| Figure 7: Connected Terminal                  | 11 | Figure 38: Menu Screen                            | 37 |
| Figure 8: Switch Baffle                       | 13 | Figure 39: Menu Screen                            | 38 |
| Figure 9: Lower Bracket                       | 14 | Figure 40: Advanced Screen                        | 38 |
| Figure 10: HPS50 Bottom Section               | 14 | Figure 41: DCDC Option                            | 39 |
| Figure 11: HPS100/150 Bottom Section          | 15 | Figure 42: DCDC Option                            | 39 |
| Figure 12: HPS250 Bottom Section              | 15 | Figure 43: USB Port                               | 40 |
| Figure 13: HPS500 Bottom Section              | 16 | Figure 44: Black Start Button                     | 41 |
| Figure 14: PMDE Example                       | 17 | Figure 45: EPO Button                             | 41 |
| Figure 15: AC Side Wiring Schematic Diagram   | 18 | Figure 46: Menu Option                            | 42 |
| Figure 16: External Communication Wiring      | 19 | Figure 47: Menu Option                            | 42 |
| Figure 17: External Communication Wiring      | 22 | Figure 48: Ethernet                               | 43 |
| Figure 18: Split Machine Communication Wiring | 23 | Figure 49: Properties Screen                      | 43 |
| Figure 19: HPS250 Dial Switch                 | 23 | Figure 50: Internet Protocol Version 4 (TCP/IPv4) | 44 |
|   |    | Figure 51: IP Address                             | 44 |
|   |    | Figure 52: This PC Option                         | 45 |

## 2. Introduction

This guide is specifically for the HPS series energy storage inverter and provides a quick reference startup for the installation and commissioning.

This comprehensive guide provides a step-by-step instruction that covers the following:

- Safe and handling procedures for your equipment
- Mechanical installation steps
- Electrical installation steps
- Mounting and securing the HPS unit
- Choosing the correct cables and wiring specifications
- Proper startup and shutdown protocols for your HPS inverter
- Firmware updates

For a safe and proper installation of our product, users must possess a comprehensive understanding of electrical theory and circuit analysis, be familiar with electrical wiring, and have a solid grasp of mechanical concepts.

### 3. Pre-installation Preparation

This section highlights the importance of thorough preparation to ensure a smooth and successful HPS installation process.

#### 3.1. Product and Package Inspection



Before you start the installation, carefully inspect all equipment for any signs of damage. Should any damage be identified, please promptly contact Freedom Won and provide photographs for assistance.

#### 3.2. Verify Package Contents

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

Table 1: HPS Package List

| Items                  | Number   |
|------------------------|----------|
| Inverter               | 1 Piece  |
| Key                    | 2 Pieces |
| Certificate            | 1 Piece  |
| Warranty Card          | 1 Piece  |
| Product User Manual    | 1 Piece  |
| Exit Inspection Report | 1 Piece  |

### 3.3. Installation Tools and Parts

Refer to the HPS parts checklist in Table 2, to ensure all items are present before installation.

Table 2: HPS Package List

| Tools                 | Number        |
|-----------------------|---------------|
| Forklift or Crane     | 1 Vehicle     |
| Wire Stripper         | 1 Piece       |
| Crimping Pliers       | 1 Piece       |
| Socket Set            | 1 Piece       |
| Multimeter            | 1 Piece       |
| Screws, Nuts, Gaskets | Various items |

### 3.4. Installation Temperature and Environment Consideration

To achieve optimal performance of the inverter and ensure warranty validity, keep the internal temperature within specified limits. Refer to Table 3 below for detailed temperature requirements to ensure an optimal installation environment for your HPS inverter.

Table 3: Environmental Requirements

| Required Temperature | Measurements            |
|----------------------|-------------------------|
| Temperature          | -30°C - 55°C            |
| Humidity             | < 95% (No condensation) |
| Altitude             | < 3000m                 |

To ensure an efficient installation of the inverter, it is crucial to select an installation location that meets the following requirements to minimise the risk of malfunctions, damage, or safety hazards.

1. 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 inverter's operation.
2. Ensure that the selected location does not have wood or other flammable materials near the inverter, as they can pose a fire hazard.
3. Verify that the installation area is clear of radioactive or harmful gases and liquids that could compromise the inverter's performance or pose a risk to human safety.

### 3.5. Safe Handling Practices

This section highlights the importance of carefully handling procedures to prevent damage to the HPS inverter during installation.

1. When using a forklift to move the inverter box, it's important to ensure that the centre of gravity is evenly balanced between the two forks. This ensures optimal stability and control, as illustrated in Figure 1.



Figure 1: Packaged Handling

2. For safe and efficient movement without packaging the enclosed bottom frame must be removed as illustrated in Figure 2.



Figure 2: Unpackaged Handling

3. When moving a larger size inverter your view may be obstructed. It is recommended to arrange for assistant personnel.
4. During take-off and landing, it's important to handle the inverter gently to avoid damage to the equipment.

### 3.6. Location and Installation

This section details the ideal location for your HPS inverter to ensure optimal performance and safe operation.

1. For best performance, install the inverter indoors in a well-ventilated area.
2. Keep the inverter away from areas with high humidity, high temperatures, or exposure to corrosive gases. These elements can negatively impact performance and lifespan.
3. Avoid direct sunlight, this can cause overheating.
4. Ensure that the grounding cable in the power distribution room is properly grounded. The resistance in a dry environment should be less than  $4 \Omega$ .
5. The inverter mounting surface must have sufficient bearing capacity.

Figure 3 below illustrates the recommended clearance dimensions for the installation of the HPS inverter.

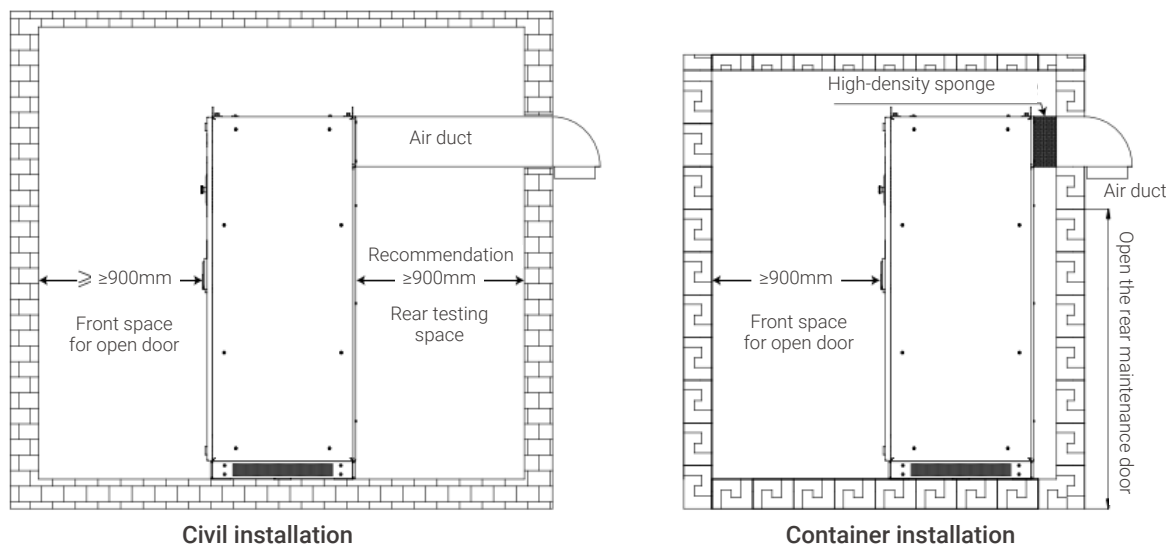


Figure 3: Installation Space Requirements

### 3.7. Environment Ventilation

For proper cooling, the HPS inverter relies on good airflow. To ensure a ventilated environment, the installation site must meet the following requirements:

1. Avoid installing the inverter in areas with poor ventilation and low air circulation.
2. Consider adding air conditioning measures like air supply grids or fans to ensure sufficient airflow.
3. The air inlet must have enough space and volume for unrestricted air intake.
4. Maintaining clean air is crucial. If the environment has a high concentration of sand and dust, installing air filters on the building's air supply grilles is recommended.

### 3.8. Various Model Dimensions

This section provides a clear overview of the physical size requirements for each HPS inverter model. Refer to the table below to identify the specific dimensions of your model.

Table 4: Dimensions of Various Models

| Inverter Model | Dimensions [mm]                  |
|----------------|----------------------------------|
| HPS50          | 800×800×1900                     |
| HPS100         | 1200×800×2050                    |
| HPS150         | 1200×800×2050 Box                |
| HPS250         | (600×720×2050) ×1+1200×800×2050  |
| HPS500         | (600×720×2050) ×2+1600×1050×2050 |



The HPS0250 is split-type which consists of one photo-voltaic controller (600×720×2050) and one energy storage inverter (1200×800×2050). HPS0500 is split-type which consists of two photo-voltaic controllers (600×720×2050) and one energy storage inverter (1600×1050×2050).

### 3.9. Base Mounting and Fixing

Securing the inverter to the base surface is essential for ensuring safe and stable operation. This section details the process:

The bottom of the HPS series inverter is equipped with designated fixing holes for secure attachment. These holes allow for fastening the inverter either to a bottom support channel or directly to the ground.

Refer to Figure 4 for dimension illustrations of the bottom section for each inverter model.

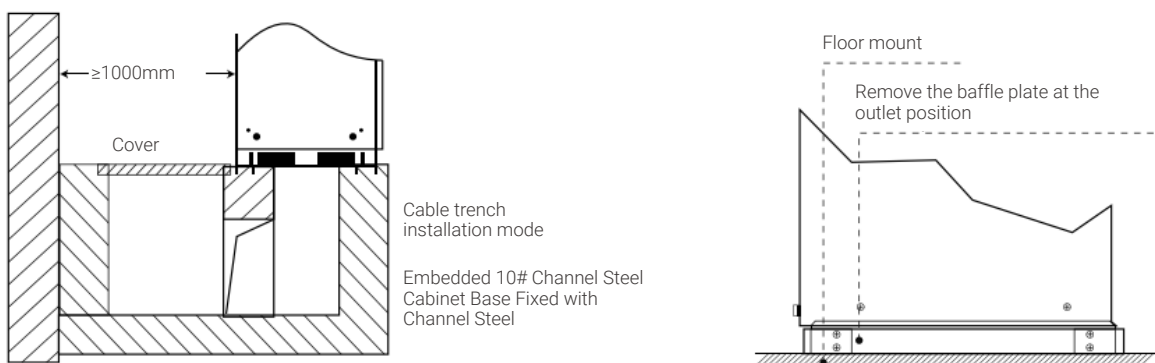


Figure 4: Base Mounting and Fixing

The channel steel should be designed according to the positioning holes at the bottom of the inverter, which are equipped with a base. The dimensions of the bottom section of each model are shown in millimetres (mm).

Cooling air enters the unit from the front and bottom. Cables are connected through the bottom of the inverter. Each HPS inverter features inlet and outlet holes at the front for DC and AC power connections.

### 3.10. Installation of Air Ducts

This section emphasises the importance of maintaining sufficient air intake for achieving optimal performance and ensuring the longevity of the inverter.

Air ducts are necessary for the inverter to expel heat and draw in cool air. The HPS series energy storage inverters utilise a forced air-cooling system to dissipate heat efficiently.

Refer to Table 5, for a specific inverter model and its minimum air intake requirements.

Table 5: Forced Air Cooling System

| Inverter Model | Minimum Area Air (m <sup>2</sup> ) |
|----------------|------------------------------------|
| HPS50          | 0.543858                           |
| HPS100/150     | 0.8068668                          |
| HPS250         | 0.9715392                          |
| HPS500         | 1.6123272                          |
| PMDE250        | 0.536526                           |
| PMDE300        | 0.536526                           |

### 3.11. Air Duct Setup

The inverter does not come equipped with air ducts. As a result, it is the user's responsibility to install an appropriate air ducting system.

The HPS inverter utilises a well-designed air duct for different models and site environments for efficient heat dissipation.

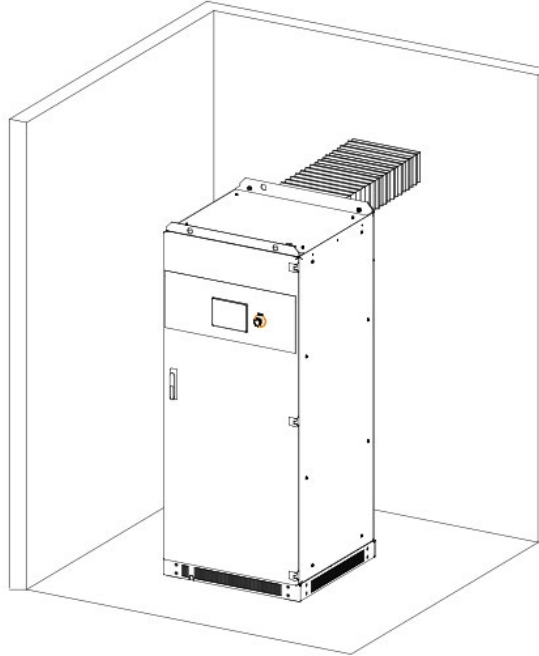


Figure 5: Internal Vent Hose

1. Fresh air enters the inverter through vents at the bottom and dustproof mesh on the front door to ensure a clean and cool air supply for internal cooling.
2. Hot air generated by the inverter's operation is expelled through exhaust vents at the top of the unit to maintain optimal internal temperatures for reliable performance.

#### 3.11.1. Maintaining Airflow

Due to the inverter's wall-mounted design, it is essential to install external air ducts to ensure adequate airflow. Proper air ducting is critical for maintaining optimal performance, as it facilitates the removal of hot air from the inverter. Effective cooling helps prevent overheating, thereby enhancing the longevity and efficiency of the inverter system. Ensuring a well-ventilated environment is crucial for the reliable operation of the inverter and the overall safety of the installation.

Specific requirements for adding external air ducts to inverters are as follows:

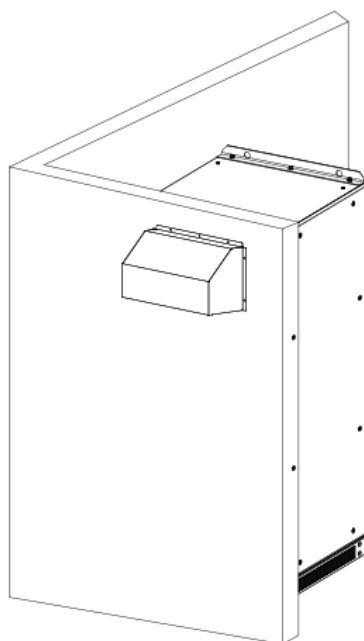


Figure 6: External Duct of Converter

1. The design of the air duct must not restrict the overall ventilation volume of the inverter cabinet.
2. The connection point between the air duct and inverter cabinet must be well sealed to prevent air leaks and to ensure efficient airflow through the intended part.
3. The outlet of the air duct must be angled downwards to prevent rainwater from entering the inverter.
4. Consider adding elements like barbed wire on the air duct outlet to deter rodents, birds, or other animals from entering the inverter.

## 4. Installation

### 4.1. Pre-Wiring Safety and Cable Considerations



CAUTION

Always ensure that both the grid input and battery input switches are disconnected before starting the wiring installation. Use warning signs to communicate that the switches should not be operated while wiring is in progress.



CAUTION

Route all power cables through trenches or metal wiring channels. This protects them from mechanical damage and minimises Radio Frequency (RF) interference with nearby devices.



The provided cable dimension in Table 6 is for reference only.

When selecting cables, consider the:

- Working environment temperature
- Cable laying method (e.g. underground, overhead)
- Heat dissipation conditions



The HPS inverter model does not include pre-installed external cables. Users are responsible for providing their own cables according to their specific needs.



All external cables must be routed through the designated bottom entry and exit holes to connect with their corresponding terminals.

The necessary terminals and fixing screws for power cable wiring are pre-installed on the respective wiring terminals upon delivery of the inverter.

#### 4.1.1. Cable Selection Considerations

Below are considerations for the selecting correct cables for your HPS.

- When selecting cables, consider the environmental conditions where they will be installed such as temperature, etc.
- Ensure all cables connected on the same side of the system are of the same size and type.
- Different cable suppliers have different ratings.
- The installer must ensure that cables meet specifications, refer to cable selection in Table 6. This table is for reference only.

Table 6: Power Cable Specifications (Reference only)

| Capacity | AC Output (Each Phase)  | Zero Line            | Ground Wire         | Positive and Negative DC Input (Per Pole)      | Photovoltaic             |
|----------|-------------------------|----------------------|---------------------|--|--------------------------|
| 50kW     | ≥ 35mm <sup>2</sup> ×3  | ≥ 35mm <sup>2</sup>  | ≥ 16mm <sup>2</sup> | Input 70mm <sup>2</sup>                        | 70mm <sup>2</sup> /group |
| 100kW    | ≥ 50mm <sup>2</sup> ×3  | ≥ 50mm <sup>2</sup>  | ≥ 25mm <sup>2</sup> | Input 95mm <sup>2</sup>                        | 50mm <sup>2</sup> /group |
| 150kW    | ≥ 95mm <sup>2</sup> ×3  | ≥ 50mm <sup>2</sup>  | ≥ 50mm <sup>2</sup> | Input 95mm <sup>2</sup>                        | 50mm <sup>2</sup> /group |
| 250kW    | ≥ 120mm <sup>2</sup> ×3 | ≥ 120mm <sup>2</sup> | ≥ 50mm <sup>2</sup> | 2 Input channel<br>120mm <sup>2</sup> /channel | 50mm <sup>2</sup> /group |
| 500kW    | ≥ 185mm <sup>2</sup> ×3 | ≥ 185mm <sup>2</sup> | ≥ 95mm <sup>2</sup> | 4 Input channel<br>120mm <sup>2</sup> /channel | 50mm <sup>2</sup> /group |

#### 4.1.2. Power Cable Terminals

This section provides detailed instructions on installing terminals and fixing screws for power cable connections on the HPS inverter.

For cable recommendations, refer to Figure 7 and Table 7 below as a reference guide.

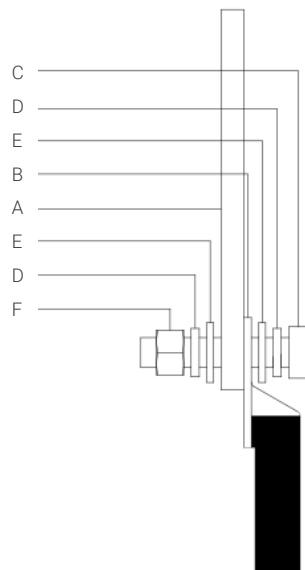


Figure 7: Connected Terminal

Table 7: Wiring Terminals

| Label | Parameter           |
|-------|---------------------|
| A     | Copper Bar          |
| B     | Connection Terminal |
| C     | Screw               |
| D     | Spring Washer       |
| E     | Large Pad           |
| F     | Nut                 |

#### 4.1.3. Wiring Specification

This section emphasises the importance of proper cable separation during installation. Maintaining the recommended spacing between cables minimizes electrical interference and ensures safe operation.

Refer to Table 8 below, for a specification of communication and power lines.

Table 8: Distance Between Signal Lines and Power Cables

| Label | Parameter |
|-------|-----------|
| 200m  | 0.3m      |
| 300m  | 0.5m      |
| 500m  | 1.2m      |

1. Always wire communication and power lines separately. This prevents electrical noise from power lines affecting the integrity of data signals.
2. Maintain physical separation between DC (Direct Current) and AD (Alternating Current) circuits. A minimum distance of 300 mm between these cable types is recommended.
3. If a control cable requires passing through a power cable, ensure a 90-degree angle of intersection. This helps reduce electromagnetic interference.



It is recommended to route data lines in proximity to the grounding structure of the installation environment, such as supporting beams, steel troughs, metal guideways, etc.

## 4.2. Installation and Cable Protection

### 4.2.1. Cable Installation

The screw dimension and torque values listed in Table 9 are specifically designed to secure the terminal input and output connections of the circuit breaker and earth points. The specified torque values are essential to achieve uniform compression and clamping force across the joint, ensuring a reliable connection between the cables and terminals. The installer must avoid over-tightening the screws to prevent damage.

Refer to the table below for screw dimensions and required torque values.

Table 9: Screw Dimensions and Required Torque Values

| Screw Dimensions | M4 | M5  | M6 | M8 | M10 | M12 | M14 | M16 |
|------------------|----|-----|----|----|-----|-----|-----|-----|
| Torques (N.M)    | 2  | 3.2 | 7  | 16 | 34  | 46  | 56  | 68  |

### 4.2.2. Cable Protection

The protection of cables includes communication cables and power cables. The protective methods are as follows:

- Communication cables are thin and susceptible to damage during installation. To minimise the risk of breakage, it is recommended that you start with connecting the power circuit first, followed by other connections.
- When connecting cables, the cable must be laid in a conduit or steel cable tray. In the absence of a conduit or steel cable tray, secure the cable using cable ties to prevent strains.

- During installation and connection avoid actions that could scratch or damage the insulation layer of the power cable. This helps prevent potential short circuits.
- Ensure all power cables are securely fixed to prevent strain or movement.

## 4.3. Remove Switch Panel and Lower Brackets

### 4.3.1. Remove Baffle

To access the connections of the HPS series inverters, the baffle must be removed. Upon removing the switch baffle, the power terminal becomes visible. Please note that internal wiring terminals and input/output terminals vary across different models.

Follow these steps to remove the baffle to access the breakers and install wiring.

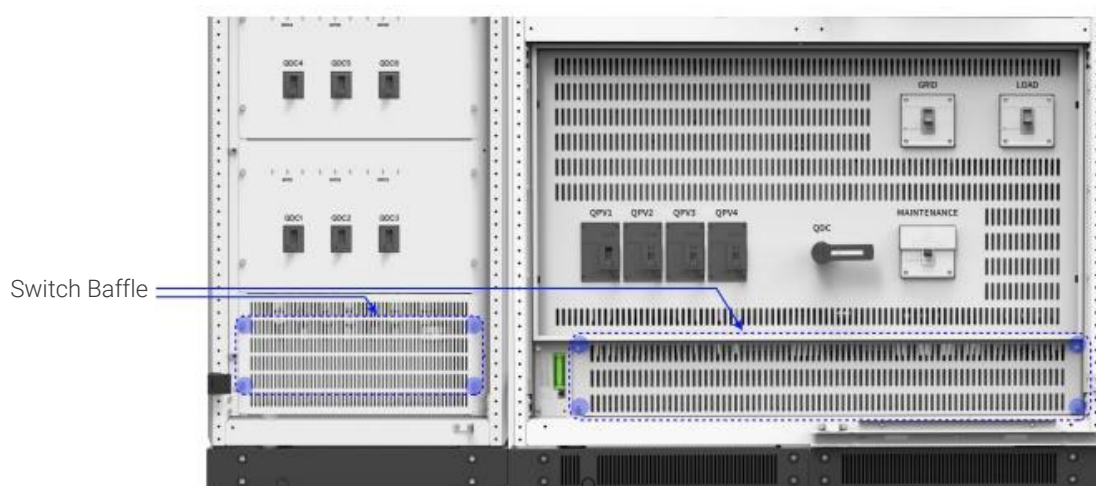


Figure 8: Switch Baffle

1. Open the front door as shown in Figure 8.
2. Use a screwdriver to loosen the four screws of the lower baffle of the switch.
3. Remove the screw and the lower baffle of the switch and continue with the operation.

### 4.3.2. Lower Brackets Installation

The HPS series energy storage inverters have separate lower brackets for the bottom front, back, left, and right. These brackets are typically placed at the bottom of the inverter to prevent dust and any foreign objects.

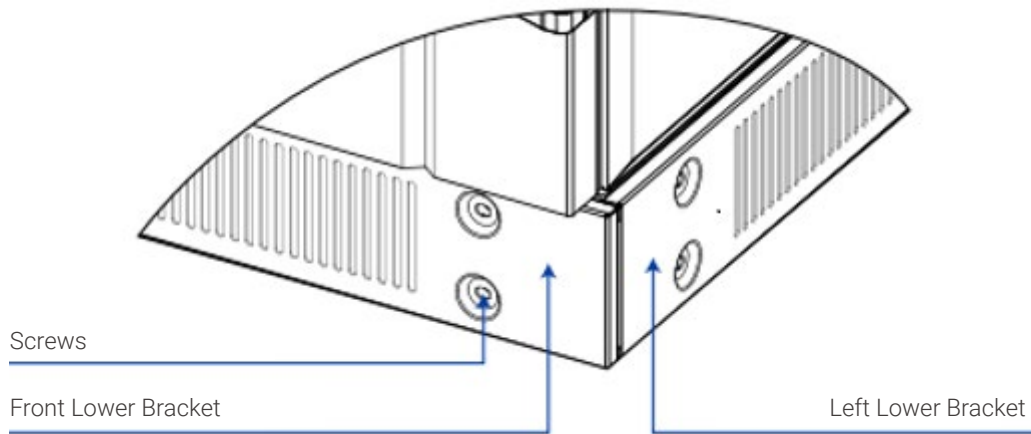


Figure 9: Lower Bracket

1. Before installation, remove all lower fencing boards from the packaging box and set them aside.
2. Once you have chosen the installation location, carefully position the inverter and secure it using the recommended mounting method.
3. After the inverter is secured and the screws are locked, take each lower coaming and install it on the corresponding side.
4. Ensure that dust-proof cotton is installed in the lower fencing board, which cannot be lost during installation.

Refer to the following example figures for specific model details.

HPS50 Bottom Section Illustration Diagram:

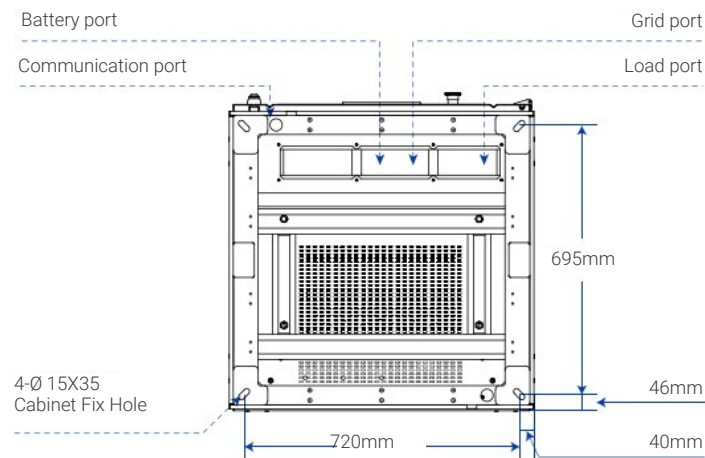


Figure 10: HPS50 Bottom Section

HPS100/150 Bottom Section Illustration Diagram:

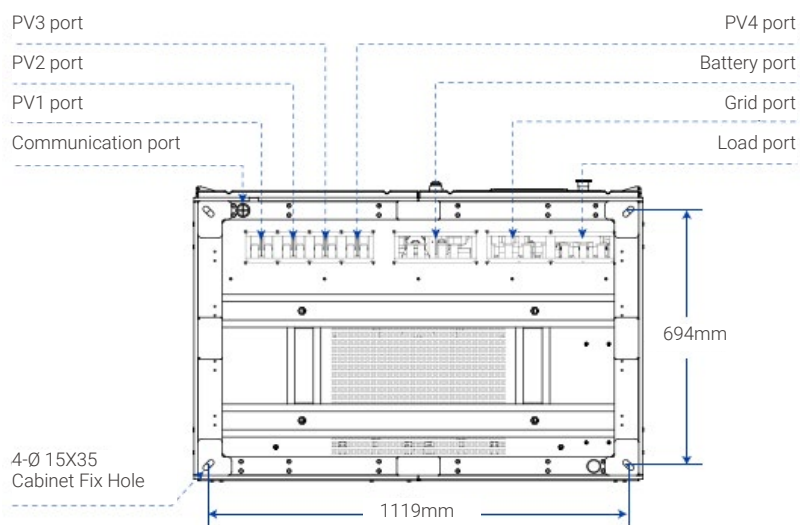


Figure 11: HPS100/150 Bottom Section

HPS250 Bottom Section Illustration Diagram:

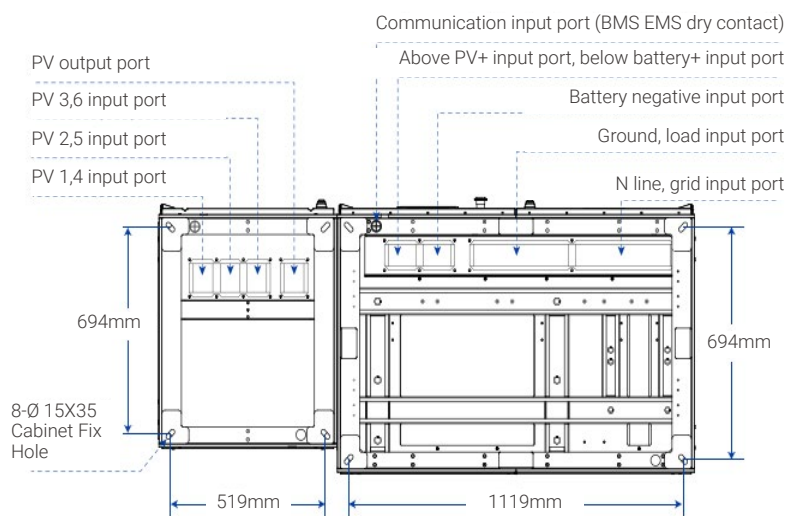


Figure 12: HPS250 Bottom Section

HPS500 Bottom Section Illustration Diagram:

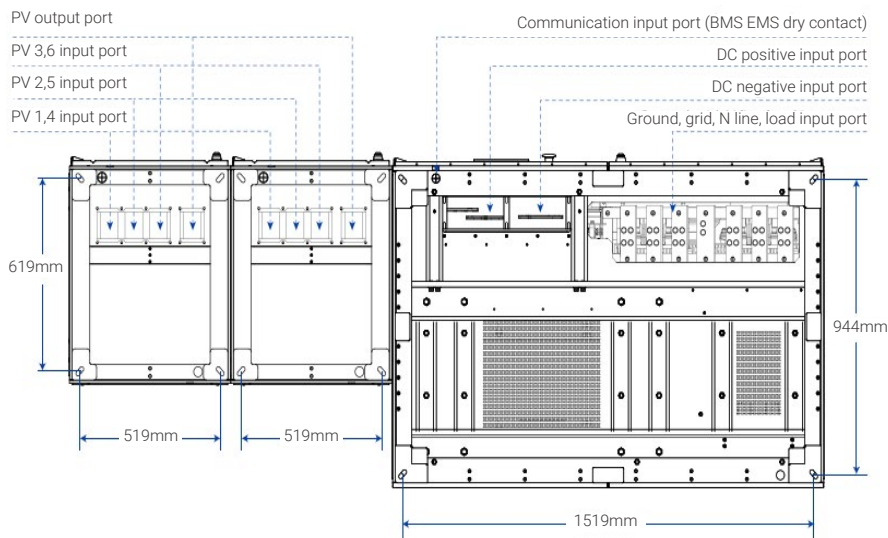


Figure 13: HPS500 Bottom Section

## 4.4. Install DC Wiring

### 4.4.1. Essential Precautions for DC Wiring

Always prioritise safety when working on the DC wiring of your HPS inverter system. To minimise the risk of personal injury or equipment damage, follow these essential steps:

1. Ensure all power is OFF before starting any wiring tasks. Verify this using a multimeter to confirm there is no voltage present on the DC wiring terminals.
2. Double-check that the DC disconnect switch is in the OFF position.



The HPS inverter has a maximum DC input voltage limit of 850V. Exceeding this limit can damage the unit and void your warranty.

3. Use the pre-installed terminals and fixing screws provided for DC cable connections.
4. If connecting copper and aluminium wires, always use specialised copper-aluminium connectors to prevent corrosion. Direct connections between copper and aluminium wires must be avoided.
5. Accurately identify the negative and positive poles of each DC cable. Mark these poles to avoid confusion during the connection.
6. For parallel systems, each Inverter must have its own battery.

### 4.4.2. DC Terminal Connection

This section states the connection of the battery cables to the inverter.

To connect the DC cables terminal, follow the steps below.

1. Connect the positive pole of the battery pack cable to the "BAT+" terminal on the inverter. Similarly, connect the negative pole of the battery pack cable to the "BAT-" terminal.
2. Repeat this process for the PV system, connecting the positive and negative poles of the PV to the "PV+" and "PV-" terminals on the inverter.
3. Ensure all connections are secure and tightened to the recommended torque specification.
4. Visually confirm that the positive and negative polarities are correctly matched between the cables and inverter terminals.

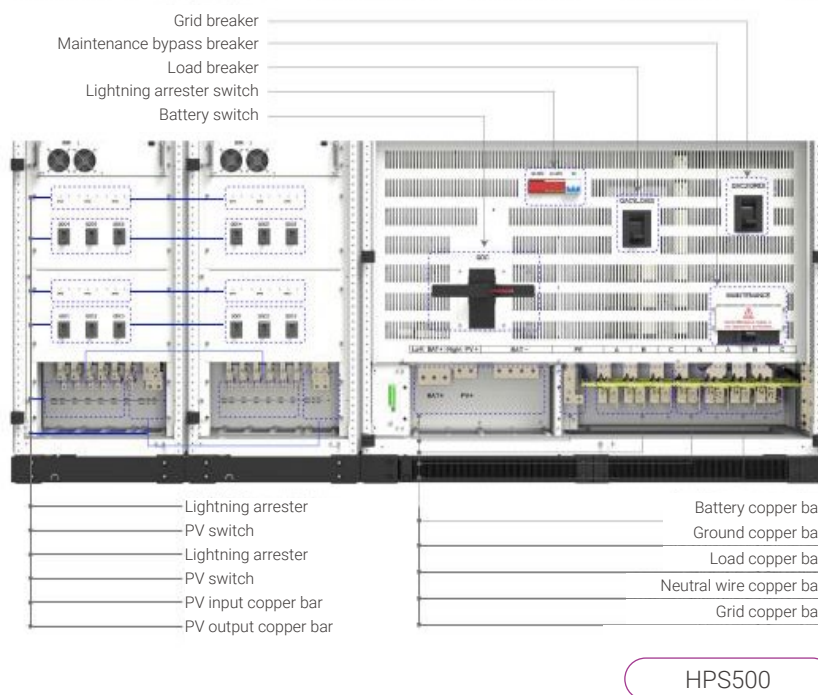


Figure 14: PMDE Example

PMDE 1 to inverter:

5. Connect the positive and negative terminals of your photovoltaic (PV) input cables to the corresponding "PV+" and "PV-" terminals on the PMDE cabinet.

PMDE 2 to HPS:

6. Locate the "DC+OUT" and "DC-OUT" terminals on the PMDE cabinet.
7. Connect the "DC+OUT" terminal from the PMDE cabinet to the "PV+" terminal on the HPS inverter. Then, connect the "DC-OUT" terminal from the PMDE cabinet to the "BAT-" terminal on the HPS inverter.

## 4.5. Install AC Side Wiring

Before commencing any AC wiring tasks, ensure to use a multimeter to verify that all terminals on the inverter are fully deactivated and free of any voltage.

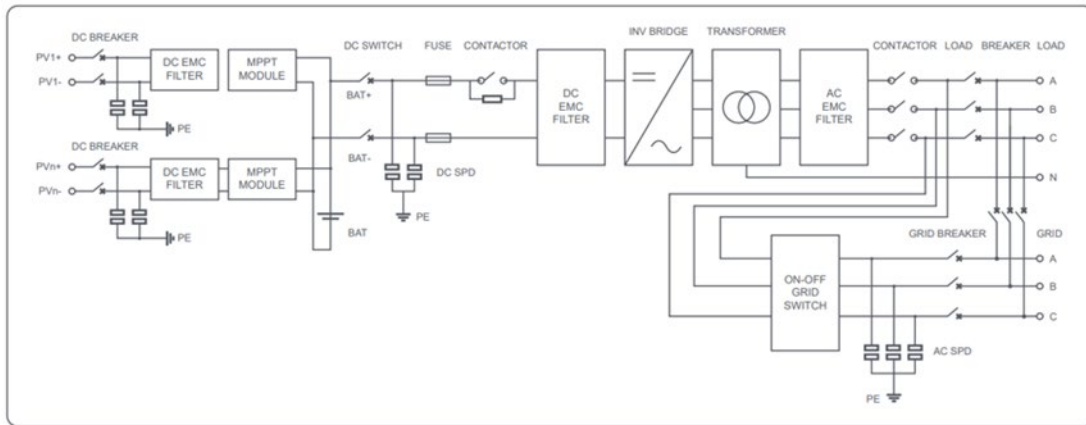


Figure 15: AC Side Wiring Schematic Diagram

Refer to Table 10 for wiring, and detailed instructions on connecting the three phases (A, B, C) of your AC cables to the grid. These sections include tables specifying the correct connection points for each phase based on your specific HPS inverter model.

Table 10: Grid

| Label | Parameter                     |
|-------|-------------------------------|
| A     | Phase A connected to the grid |
| B     | Phase B connected to the grid |
| C     | Phase C connected to the grid |

### 4.5.1. AC Side Line Steps

Before commencing any AC wiring tasks, ensure to use a multimeter to verify that all terminals on the inverter are fully deactivated and free of any voltage.

Accurately determine the phase sequence (order of the live wires) of your AC cables. Clearly label each cable with its corresponding phase (A, B, C, N) using color-coded insulating bushings for easy identification during connection.

1. Confirm the phase sequence of the cables and mark them well. Three-phase AC output cables A, B, C, and N should be added with insulating bushing respectively to distinguish the phase sequence.
2. Connect three phases A, B, and C connected to the grid according to the three phases A, B, and C connected to the load correctly according to the table.

Table 11: Load

| Label | Parameter                            |
|-------|--------------------------------------|
| A     | Phase A or U connected to the AC out |
| B     | Phase B or V connected to the AC out |
| C     | Phase C or W connected to the AC out |
| N     | Phase N connecting to the AC out     |

## 4.6. Install DC Wiring

### 4.6.1. Essential Precautions for DC Wiring

This section guides connecting the external communication cable to your HPS inverter. This cable enables the inverter to communicate with external systems for monitoring and control purposes.

The communication cable connection port is situated at the bottom of the HPS inverter. Refer to Figure 15 and Table 12 for the exact location and silkscreen labels of the port.

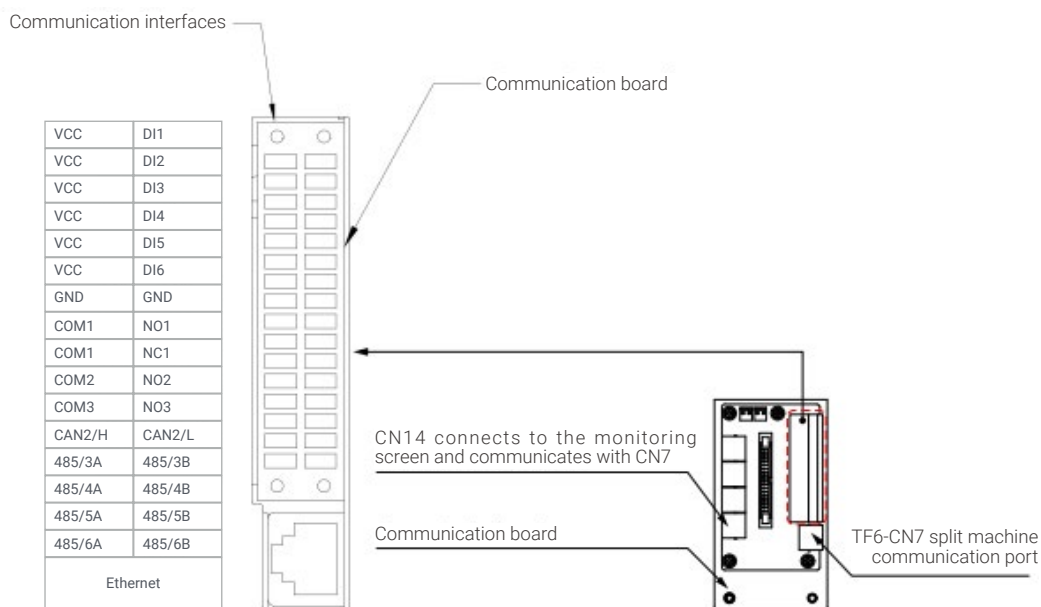


Figure 16: External Communication Wiring

Table 12: External Point for Communication Cables

| Terminal Item | Function  |
|---------------|---|
| DI1           | EPO (default)<br>Shutdown<br>Switch<br>ATS Signal<br>Water Logging<br>Fire protection                     |
| DI2           | EPO<br>Shutdown (default)<br>Switch<br>ATS Signal<br>Water Logging<br>Fire Protection                     |
| DI3           | EPO<br>Shutdown<br>Switch (default)<br>ATS Signal<br>Water Logging<br>Fire Protection<br>0% Active Power  |
| DI4           | EPO<br>Shutdown<br>Switch<br>ATS Signal (default)<br>Water Logging<br>Fire Protection<br>30% Active Power |
| DI5           | EPO<br>Shutdown<br>Switch<br>ATS Signal<br>Water Logging (default)<br>Fire Protection<br>60% Active Power |

| Terminal Item      | Function   |
|--------------------|--|
| DI6                | EPO<br>Shutdown<br>Switch<br>ATS Signal<br>Water Logging<br>Fire Protection (default)<br>100% Active Power |
| GND                | /  |
| NC1<br>COM1<br>NO1 | Generator  |
| NO2<br>COM2        | Warning Signal   |
| NO3<br>COM3        | Operation Signal   |
| 485/3A<br>485/3B   | Battery BMS Communication (default)  |
| 485/4A<br>485/4B   | /  |
| 485/5A<br>485/5B   | Electricity Meter  |
| 485/6A<br>485/6B   | HPS to EMS Communication   |

## 4.7. Parallel Communication Connection

The communication cable for the inverter is used to facilitate data exchange and control signals between the inverter and external systems, such as monitoring devices or control panels.

You may need to adjust the communication settings for the cable, depending on your system's technical protocols and the type of cable used.

This section details the process for establishing parallel communication between the HPS0250 and HPS0500 split-machine models.

To facilitate communication between these two units, connect the power cord and network cable in parallel between the HPS inverter and the DCDC multi-module cabinet.

- The HPS inverter is equipped with a TF6 communication interface board located on the top of the unit. The DCDC multi-module cabinet also has a TF1 communication board installed on the top side.

For a detailed illustration of the connection points and configuration, refer to Figure 18.

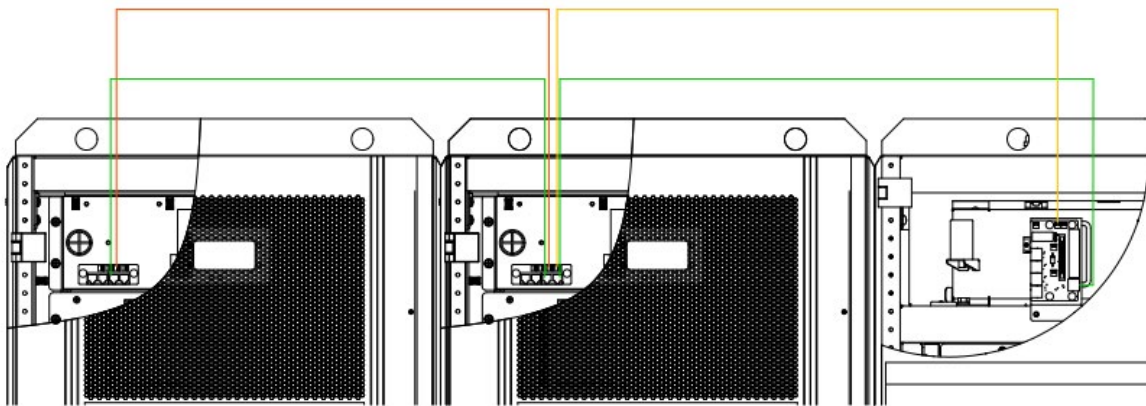


Figure 17: External Communication Wiring

The HPS series energy storage inverters provide a flexible solution for large-scale energy storage. The following section details how to connect multiple HPS inverter units in parallel to increase capacity.

- You can connect up to four HPS inverters in parallel, and significantly expand the overall energy storage capacity of your system.
- All HPS inverter models are equipped for parallel use. A TF6 communication board is located on the top of each unit to facilitate communication between parallel-connected inverters.
- When using multiple HPS inverters in parallel, connect them using network cables. These cables should be plugged into the designated parallel ports on each inverter.

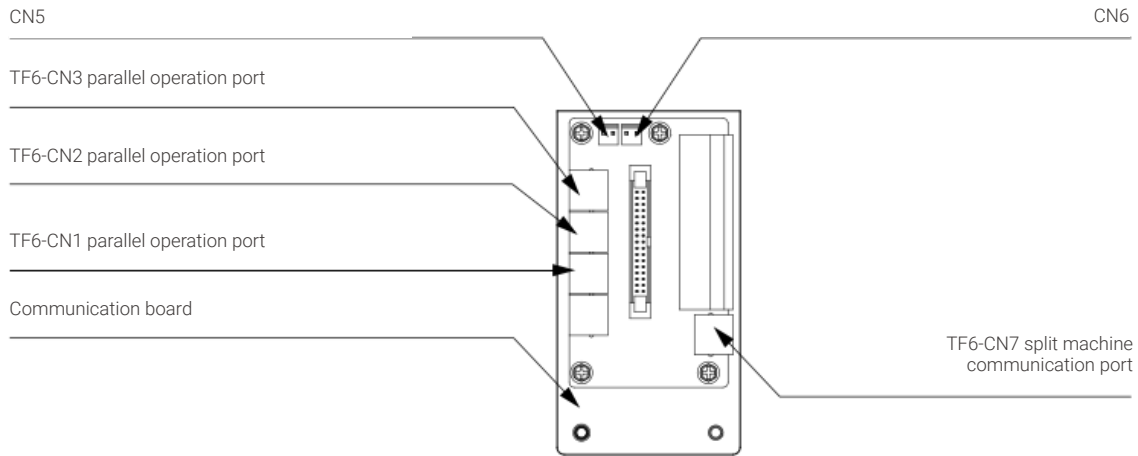


Figure 18: Split Machine Communication Wiring

- When connecting an HPS converter to a DCDC multi-module cabinet (split-machine system), use network port CN7 on the HPS converter for communication.
- Parallel Connection of Multiple Devices: If you're using multiple HPS converters in parallel, utilise network ports CN1 to CN3 for communication between the units.

The images below illustrate parallel connections for single and multiple PMDE devices.



The images below are for illustrations only.

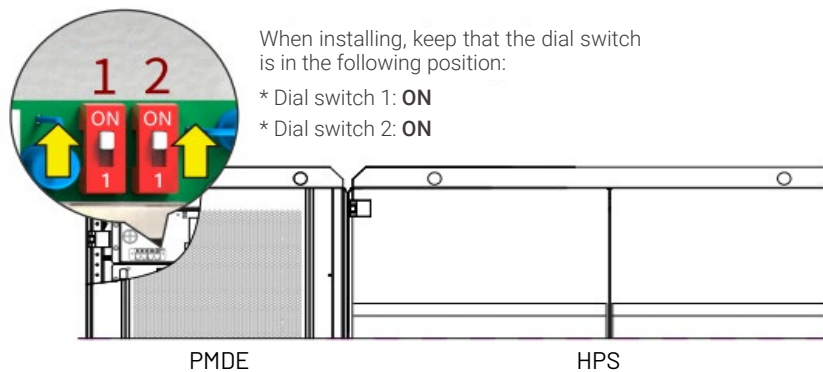


Figure 19: HPS250 Dial Switch

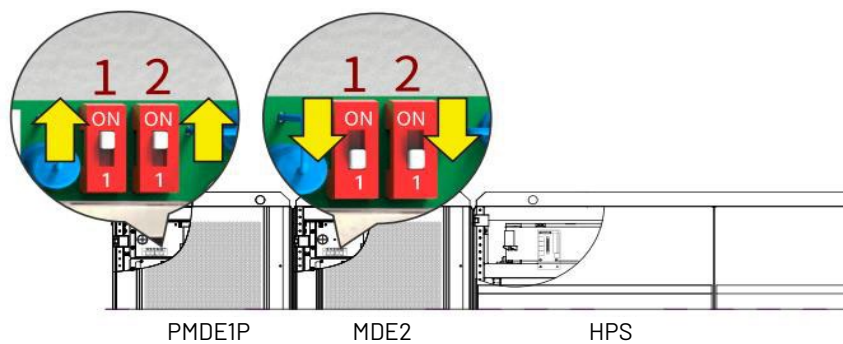


Figure 20: HPS500 Dial Switch

During the installation, ensure that the dial switch is in the following position:

- PMDE1 - Dial switch 1: "ON", Dial switch 2: "ON".
- PMDE2 - Dial switch 1: "1", Dial switch 2: "1".

#### 4.7.1. Parallel Wiring

Refer to the list of parallel diagrams below for different models.

##### Parallel wiring diagram for HPS0050

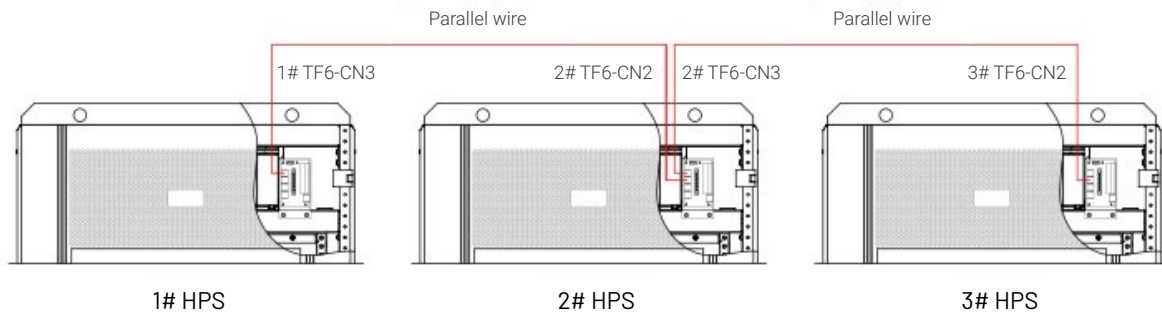


Figure 21: HPS50 Example

##### Parallel wiring diagram for HPS100/HPS150

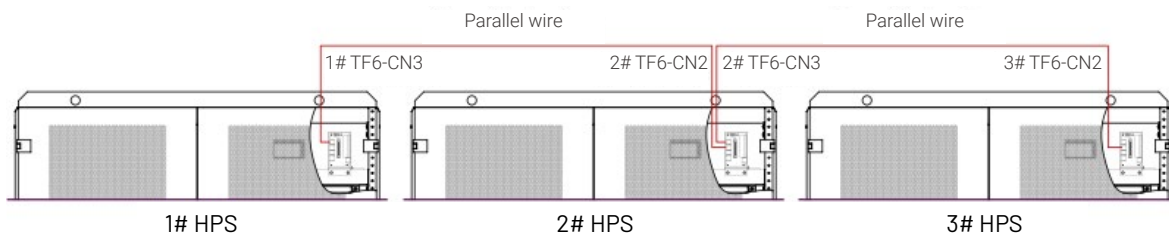


Figure 22: HPS100/HPS150 Example

Three Parallel Machine Power Cable Wiring Diagrams

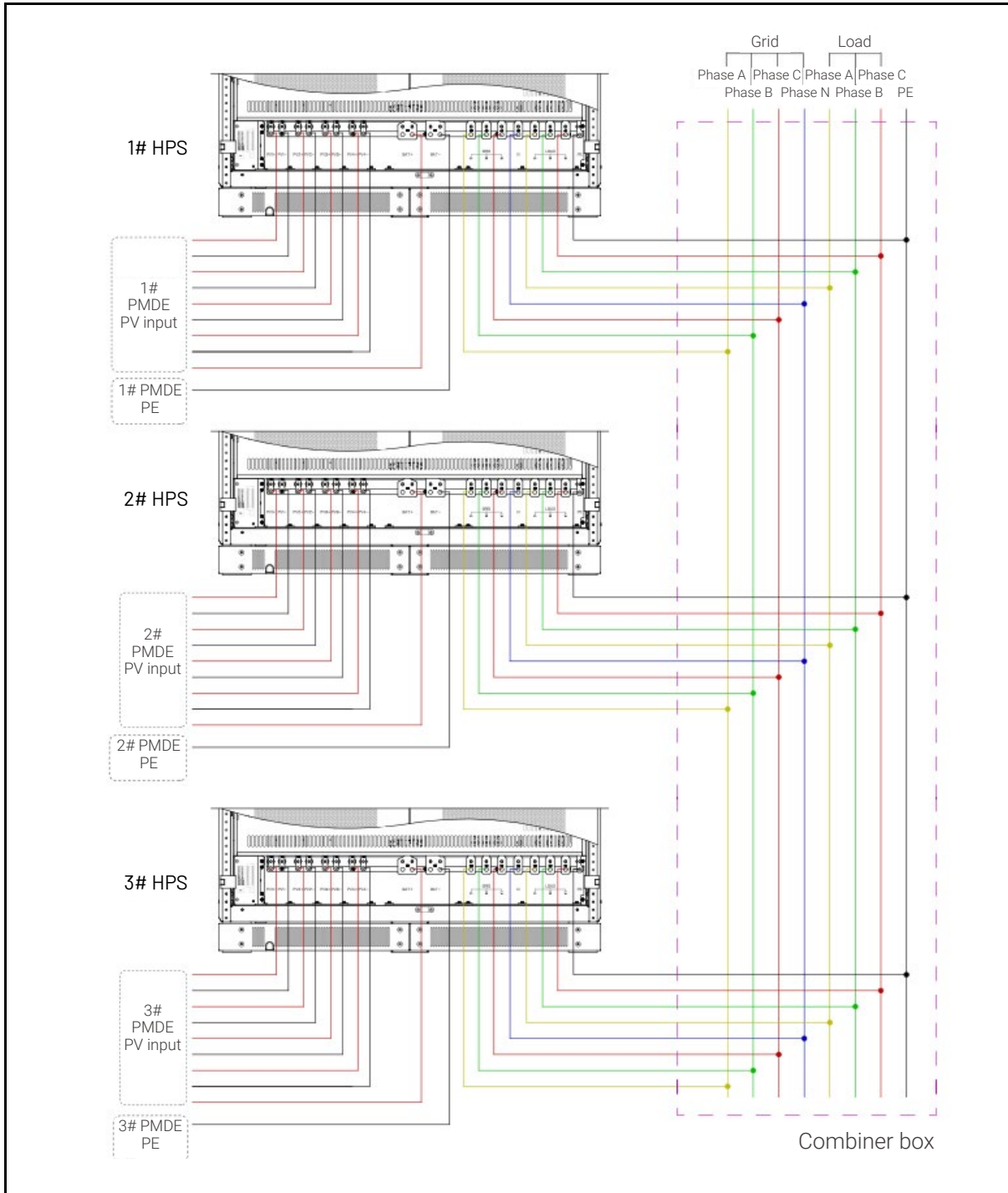


Figure 23: HPS50 Example

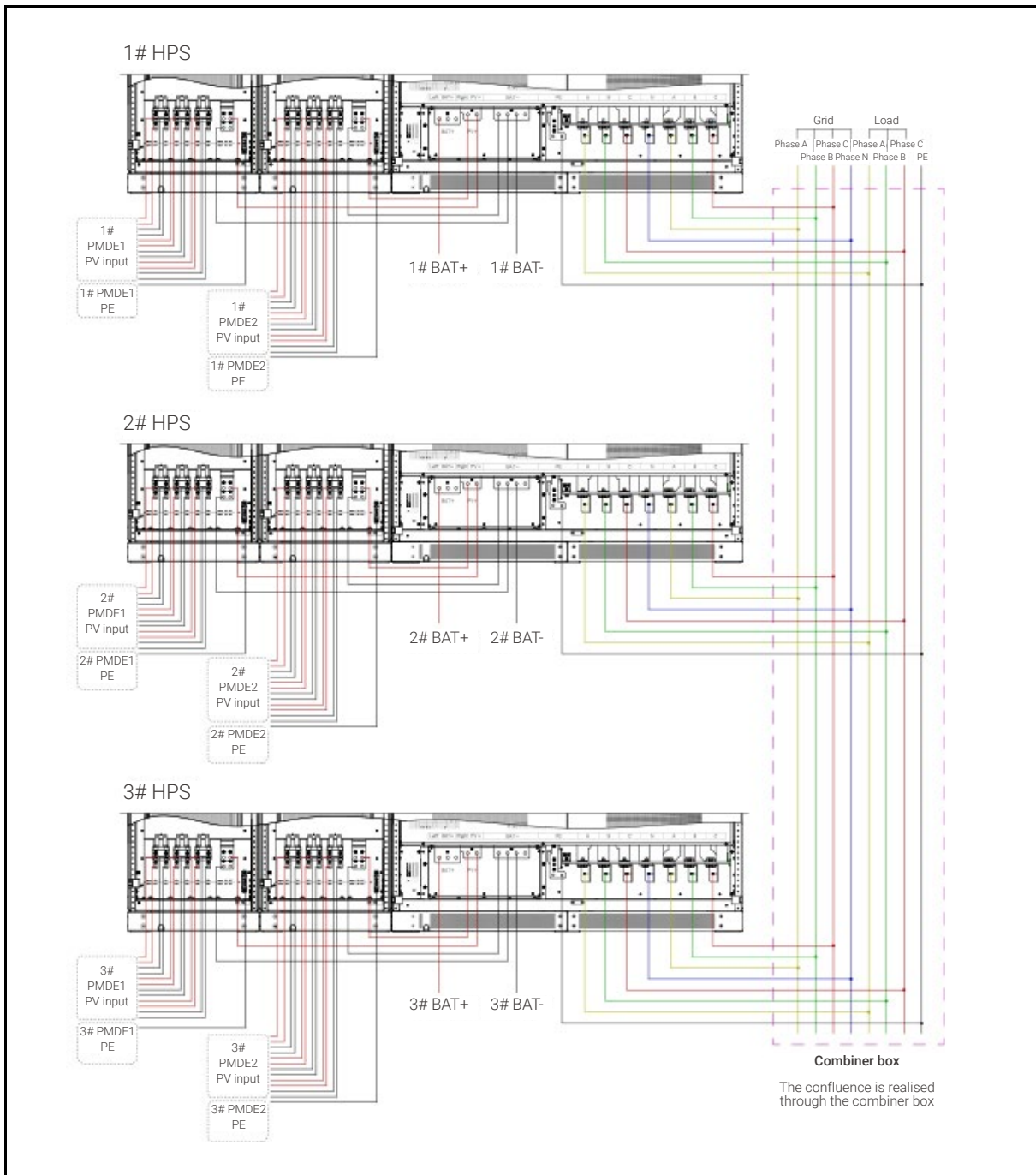


Figure 24: HPS500 Example

## 5. Grounding Requirements

Safe and reliable grounding is crucial for the HPS series converter. Adhering to these guidelines ensures proper grounding for the safe and reliable operation of your HPS series converter.

Grounding Bars:

- The converter comes equipped with grounding copper bars pre-connected to the outer shell within the cabinet.

### 5.1. External Grounding Connection

- These grounding bars need to be securely connected to the equipotential connection point of your installation site or electrical control room using grounding cables.

### 5.2. Grounding Cable Specifications

- The grounding cable resistance must be  $4\Omega$  or lower.
- The grounding cable diameter must be at least  $16\text{ mm}^2$ .

#### 5.2.1. PMDE Grounding

- In systems with PMDE (Power Monitoring and Disconnecting Equipment), the PMDE1 grounding cables connect directly to the ground terminal of the power distribution cabinet.
- Do not connect the PMDE2 grounding cables to the grounding copper bars of the HPS converter.

Ensure a reliable connection between the converter's grounding bars and the designated grounding point using appropriately sized, low-resistance cables.

For systems with PMDE, connect their grounding cables to the power distribution cabinet's ground terminal, rather than the HPS converter's grounding bars.

## 6. Individual Grounding

The ground terminal of the PMDE should be connected to the ground copper bar of the power distribution cabinet, not to the ground copper bar of the HPS.

### 6.1. Installation Complete

After completing all mechanical and electrical installations, reinstall the removed switch baffles (panel) and lower fences on the converter. Power-on operation is permitted only after confirming the correct installation.

## 7. Safe Startup Procedure

Pre-startup Procedure System Inspection:

1. Inspect the entire installation thoroughly, especially focusing on the AC and DC voltages.
2. Verify that these voltages meet the converter's requirements and confirm AC's correct polarity and phase sequence.
3. Ensure that all connections comply with relevant standards and specifications.
4. Check that the system is properly grounded.

Inverter checks:

1. Refer to Essential Precautions for DC Wiring for proper installation and wiring of the inverter.
2. Ensure all AC and DC circuit breakers are disconnected.

AC Side Voltage Verification:

1. Check for proper connection of the converter's three phases to the power grid.
2. Verify phase and line voltages fall within the specified range. Record these values.
3. If possible, measure and evaluate the Total Harmonic Distortion (THD). High THD may indicate inverter malfunction.

DC Side Voltage Verification:

1. Connect the battery pack to the inverter, to ensure correct polarity for each battery.
2. Connect the PV system to the inverter, to ensure correct polarity for each PV group.

Voltage Limits:

1. Battery voltage should not exceed 850V.
2. PV voltage should not exceed 1000V.
3. Investigate voltage deviations exceeding 3% (potential causes: load fluctuations, cable damage, loose connections).

### 7.1. Actual Startup Steps

Follow the instructions to switch the battery to ON.

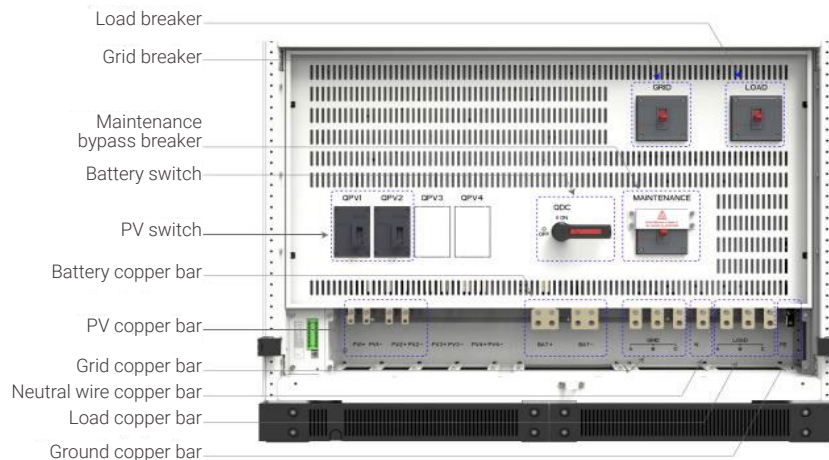


Figure 25: HPS250

1. Make sure that the battery system is powered ON.
2. After the photovoltaic input and battery are powered ON, you will hear the DC contactor closing inside the photovoltaic controller (the closing sound of the DC contactor after the bus is softly lifted). Subsequently, the status displayed in the lower right corner of the monitoring main interface will change from "OFF" to "Converter x Standby".

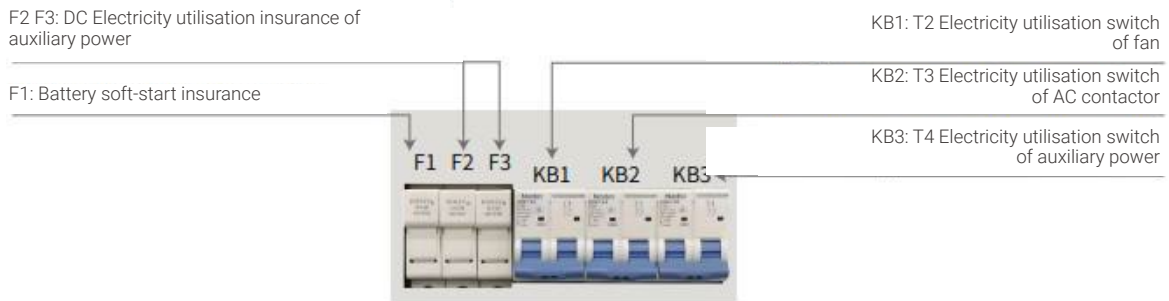


Figure 26: KB Switches

3. Open the cabinet door, close KB1, KB2, and KB3, wait about 30 seconds, and the battery voltage data will be displayed on the monitoring interface.

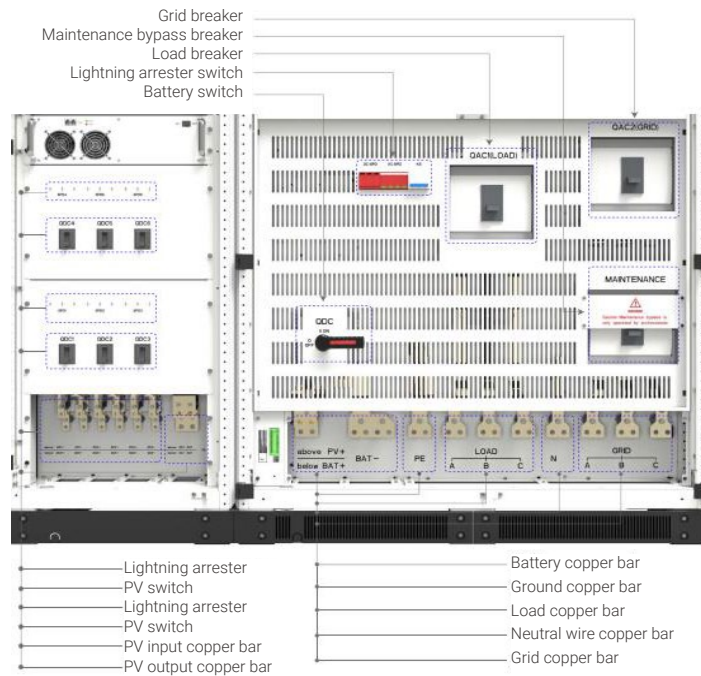


Figure 27: HPS250 Example

4. Take HPS150 as an example, check whether there is a red alarm signal in the upper right corner of the monitor, and it can be turned on if there is no red alarm signal.

### 7.1.1. Photovoltaic Input Confirmation

1. Verify photovoltaic input connections.

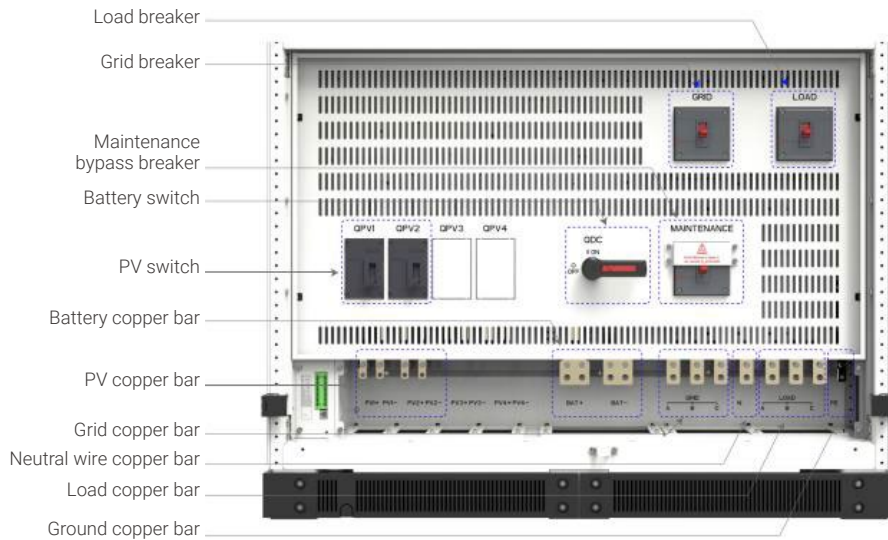


Figure 28: HPS250 Example

2. Close the photovoltaic input switches QPV1 and QPV2 (refer to Figure 28).
3. The monitor screen should turn on if it was previously black.
4. Measure each photovoltaic channel to prevent short circuits before transmitting power.
5. Confirm the photovoltaic input and close the photovoltaic input switches "QPV1" and "QPV2" in Figure 28. After closing the PV input switch, if the monitor screen was black before, the monitor screen will start running at this time (when photovoltaic power is transmitted, each photovoltaic channel must be measured to prevent short circuits).

### 7.1.2. Post-Startup Inverter Activation

1. After successful startup and verification of normal operation, close the cabinet door securely.
2. Hand over the key to a designated person for safekeeping.

After completing all of the above steps, the energy storage converter can be turned on. The operation steps are as follows:

1. Make sure that the DC side and AC side are connected correctly, and that the DC side voltage is lower than 850V.
2. Close AC and DC circuit breaker switches.
3. Close the lightning protection switch KS (applicable to split models), close KB1, KB2, KB3.
4. Ensure all previously mentioned steps are completed successfully. Verify correct DC and AC side connections, with DC voltage below 850V.



Using the HPS0150 as a reference, verify if the red alarm signal appears in the upper right corner of the monitor. If the alarm signal does not display, proceed to activate the device.

1. Close both AC and DC circuit breaker switches.
2. Turn ON the PV controller. Power up through Touchscreen (HMI).

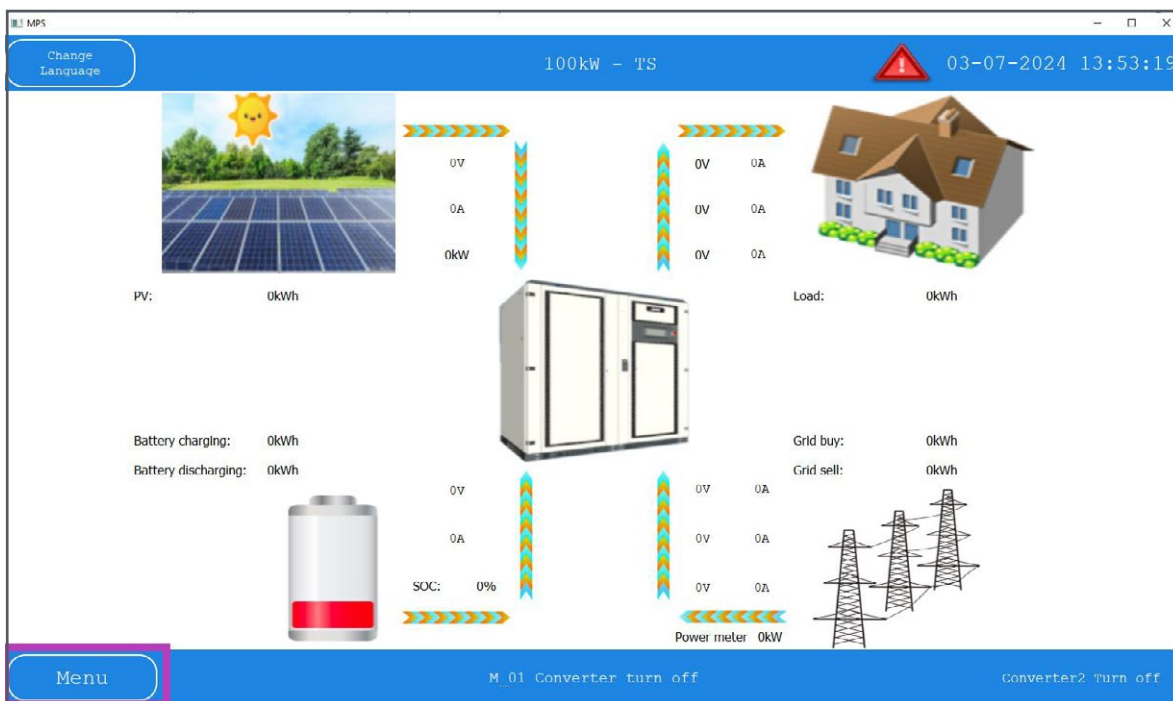


Figure 29: Menu Screen

3. Click on the "Menu" button on the touchscreen.

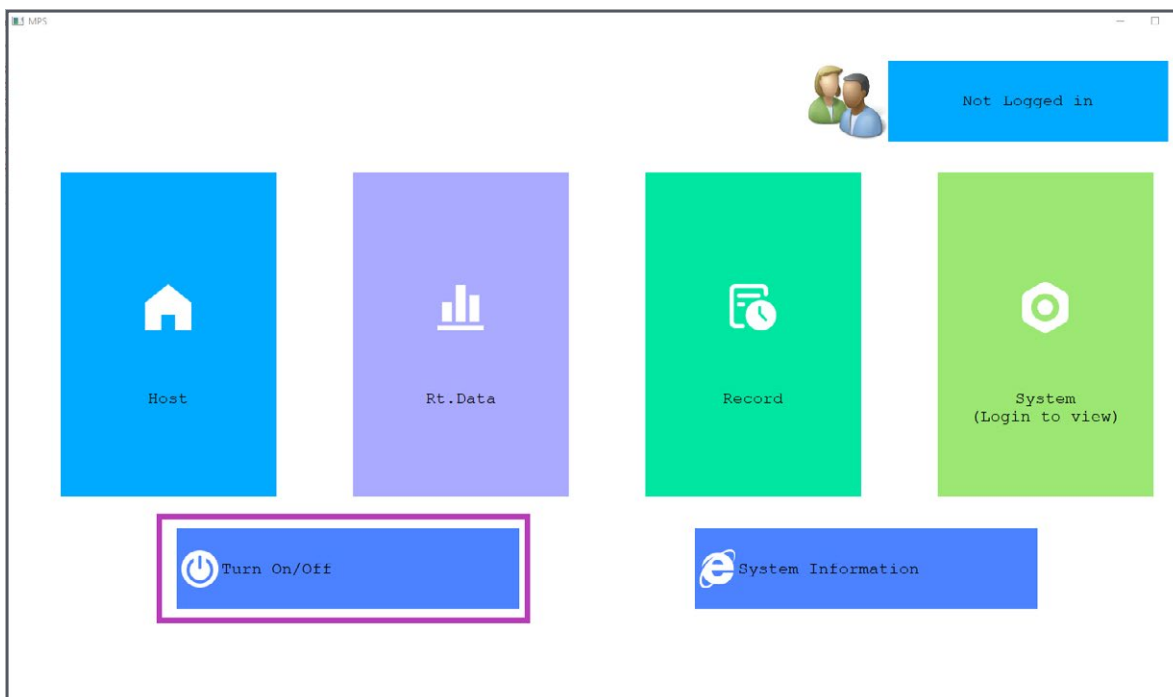


Figure 30: Menu Screen

4. Click on the "Turn On/Off" button.

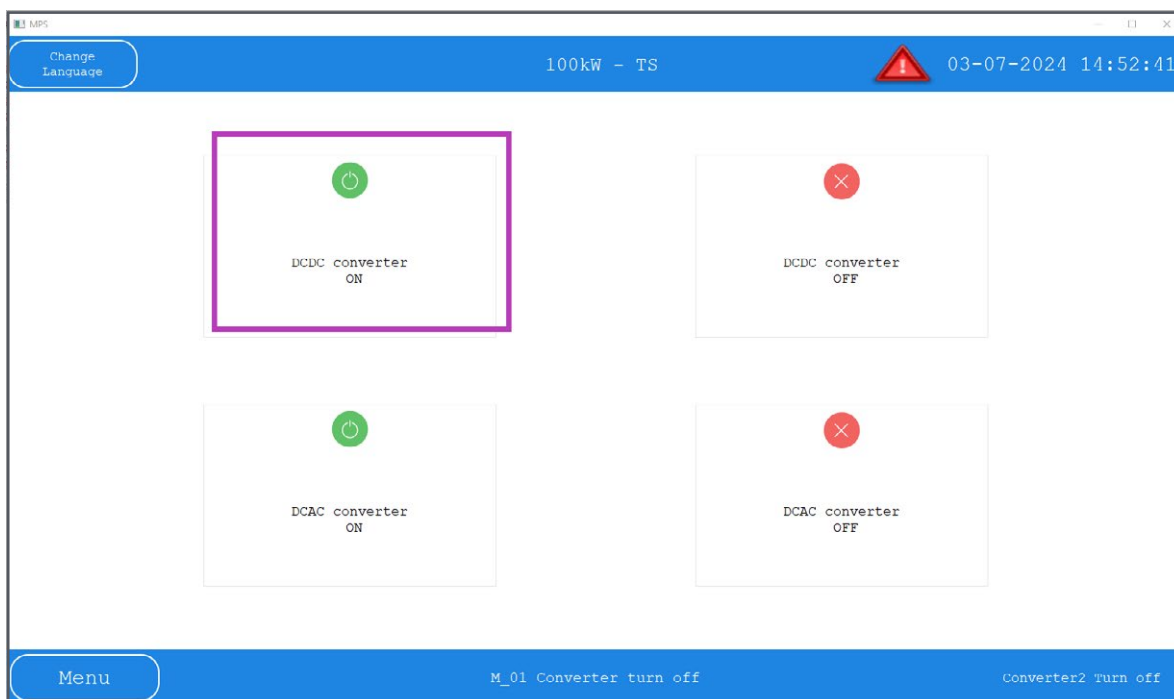


Figure 31: DCDC Converter ON

5. After activating the "DCDC Converter ON" function, the PV controller status in the lower right corner of the main monitoring interface will transition from its initial "Standby" state to "Converter xMPPT", indicating that the PV controller is now operating within normal parameters.
6. To start the converter, navigate to the "Menu" option at the bottom left corner of the monitoring interface, then select the "Switch" option, and the "DCAC converter ON" option.

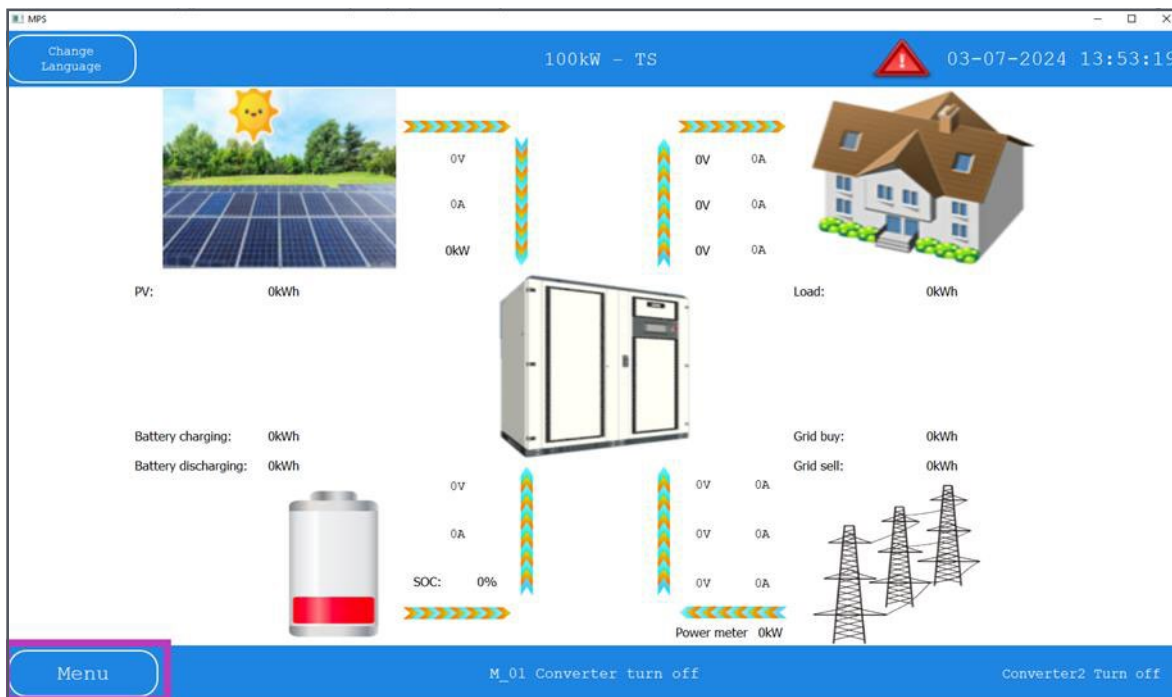


Figure 32: Menu Button

- After completing the above steps, go through the switch menu on the touch screen, and click on the "DC/DC converter ON" option until the bottom right of the screen displays from standby to MPPT.
- Click on the "DC/AC converter ON" option until the screen displays right below the switch from the converter.
- After selecting the "DCAC converter ON" option, you will hear the DC contactor engage, followed by the soft start of the converter. Once the soft start is completed, you will hear the AC contactor engage. At this point, the converter status displayed in the lower right corner of the monitoring main interface will update to either "off-grid discharge", "grid-connected charging", or "grid-connected discharge", indicating normal operation.

## 8. Shutdown Procedures



Always prioritise a normal shutdown using the touch panel button whenever possible. The emergency power-off (EPO) button should only be used in emergencies.

For planned shutdowns, use the designated button on the touch panel following the on-screen instructions.

### 8.1. Normal Shutdown

This procedure ensures a safe shutdown for maintenance or overhaul.

#### 8.1.1. Post-Startup Inverter Activation

- Navigate to the menu button on the touchscreen.

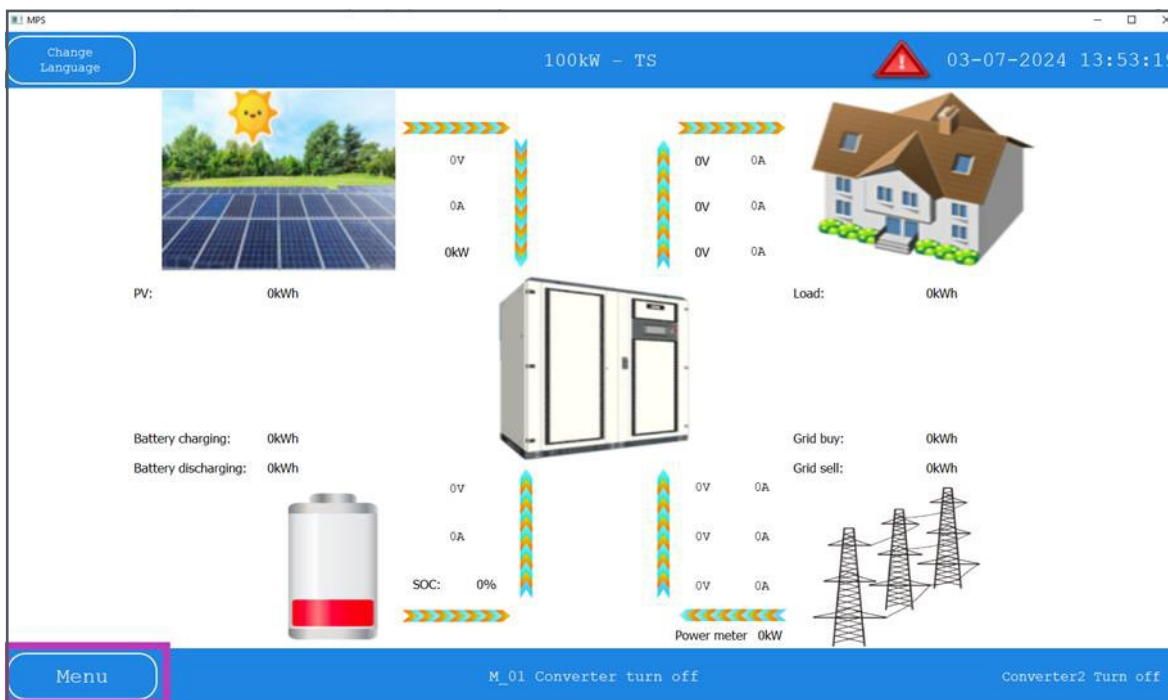


Figure 33: Menu Button

- Click on the "DCDC Converter OFF" followed by "DCAC Converter OFF" after the DCDC converter stops.

3. Verify Shutdown and Disconnect DC Power:
  - a. Listen for the AC contactor disconnection sound.
  - b. Ensure the touchscreen displays "Master-00 Converter OFF" and "Converter 1 Turn OFF."
  - c. Manually turn off the DC circuit breaker or load switch.
4. Power Down Additional Components:
  - a. Switch OFF the converter fan switch and KB1, KB2, KB3, and KS switches.
5. Isolate AC Power:
  - a. Disconnect the converter's AC-side circuit breaker (ensure the switch is "OFF").
6. Wait for Complete Shutdown:
  - a. Allow enough time (Wait for about 10 minutes for the bus capacitor to discharge completely).
  - b. Verify the touchscreen is OFF, indicating the energy storage converter is fully shut down.



To prevent damage to the breaker and converter from electrical arcing, never disconnect the circuit breaker while the converter is operating.

### 8.1.2. Photovoltaic Controller Shutdown

1. On the monitor, navigate to the "Menu" button in the lower-left corner of the screen.
2. Select the "Switch" button.
3. Click on the "DCDC Converter OFF" option.
4. After clicking, the PV controller status in the lower-right corner will change from "Converter xMPPT" to "standby," indicating the PV controller has stopped working.

### 8.1.3. Inverter Shutdown

1. On the monitor, navigate to the "Menu" button in the lower left corner.
2. Select the "Switch" option.
3. Click on the "DCAC Converter OFF" option.
4. You will hear a sound signifying the AC contactor disconnecting.

The converter status at the bottom of the main monitoring interface will change to "Host-00 converter OFF," indicating the converter has stopped working.



These detailed steps provide additional clarity for the shutdown process. However, following the core procedure outlined previously—shutting down via touchscreen, verifying shutdown, and disconnecting power—is sufficient for a safe shutdown.

## 8.2. In Case of Emergency or Malfunction

1. Immediate Stop: Press the stop button (EPO) to cut power quickly.
2. Isolating Power: Once safe, disconnect the machine's power supply from both the DC and AC sides using the circuit breakers or load switches.
3. Resetting: Only after addressing the emergency or fixing the malfunction, reset the stop button (EPO) to resume operation.

## 8.3. Maintenance Bypass Procedure

The maintenance bypass circuit breaker (MAINTENANCE), as depicted in Figure 34, is typically in the off state. This bypass ensures continuous power to the load during maintenance or in case of energy storage converter failure, assuming the grid is operational. After closing the maintenance bypass, connect the load to either the diesel generator or the grid.

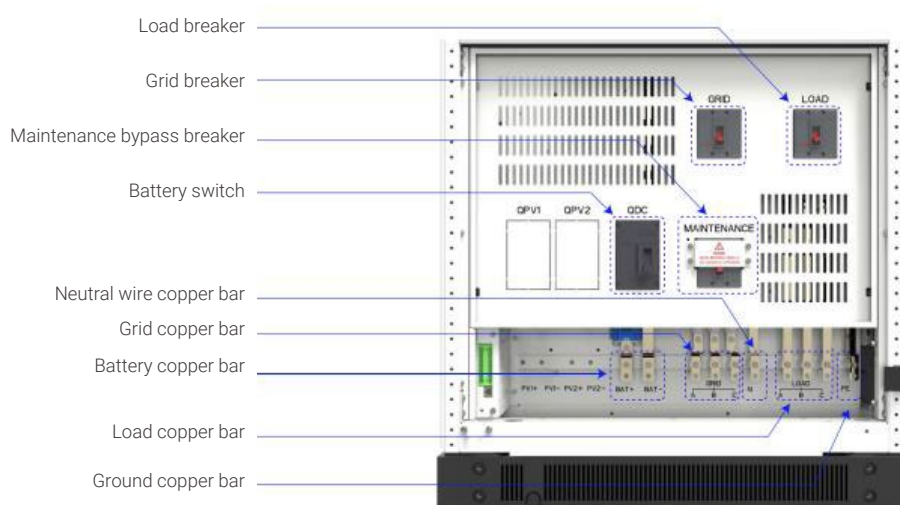


Figure 34: Maintenance Bypass

Ensure the diesel generator is operational, or there's grid power available.

1. Disconnect all relevant switches.
2. Remove the cover on the maintenance bypass circuit breaker (MAINTENANCE) located in Figure 33.
3. Close the maintenance bypass circuit breaker.
4. This bypass allows the load to receive power from the diesel generator or grid while the energy storage converter undergoes maintenance or repair.
5. Once maintenance or repairs are complete, remember to disconnect the maintenance bypass and replace the cover.

## 8.4. Firmware Upgrade

### 8.4.1. Upgrade DCDC Firmware

Follow these instructions carefully, to successfully update the DCDC module firmware. The DCDC module is responsible for the intake of PV DC energy that is coming from the MPPTs as well as the supply of this DC energy to the battery for charging.



Figure 35: ON and OFF Button

1. Set the defective module to OFF.



The "OFF and ON" switch are only used during the program update process.

2. Prepare a USB flash drive (not U-Disc) formatted with the FAT32 file system. The USB flash drive must contain the update program file (an ".hex" file) provided with this update.
3. Verify that the defective DCDC module is completely powered OFF.

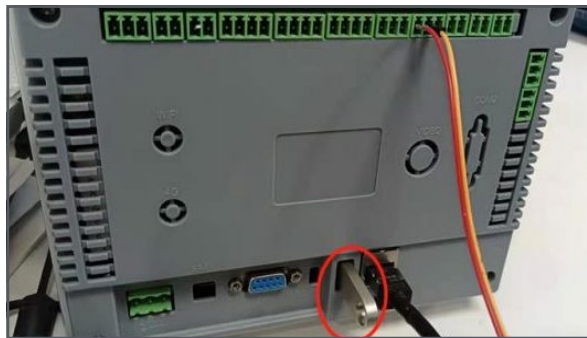


Figure 36: USB Flash Drive

4. Insert the USB flash drive containing the update program file into the designated USB port on the DCDC module.



Figure 37: Stop (EPO) Button

5. Press and hold the Emergency Stop (EPO) button.
6. While holding the EPO button, power ON the DCDC module.
7. Navigate to the inverter HMI screen.

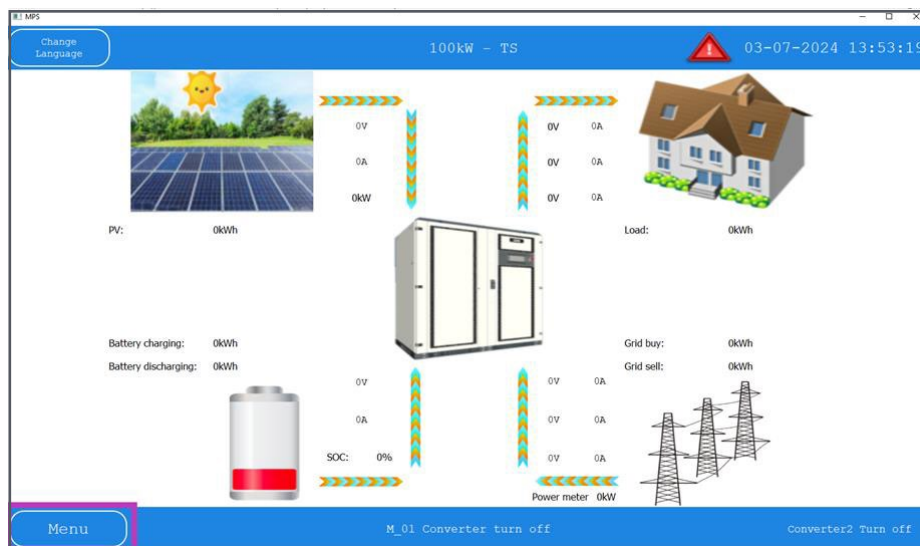


Figure 38: Menu Screen

8. The update process will automatically start once the module powers on while holding the EPO button.
9. Select the "Menu" option from the inverter's screen.

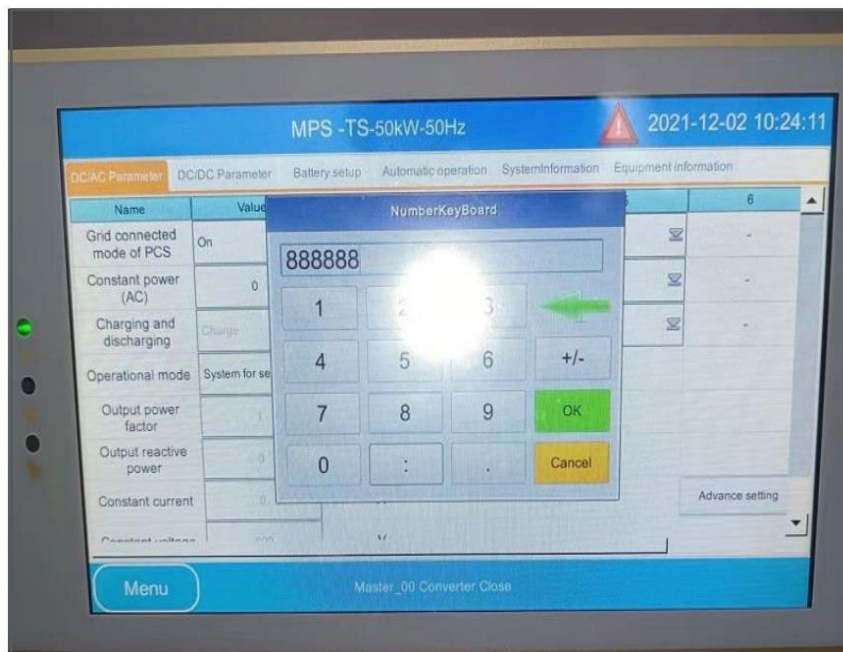


Figure 39: Menu Screen

10. Click on the "System" option.
11. Enter the password in the "NumberKeyboard" pop-up field.

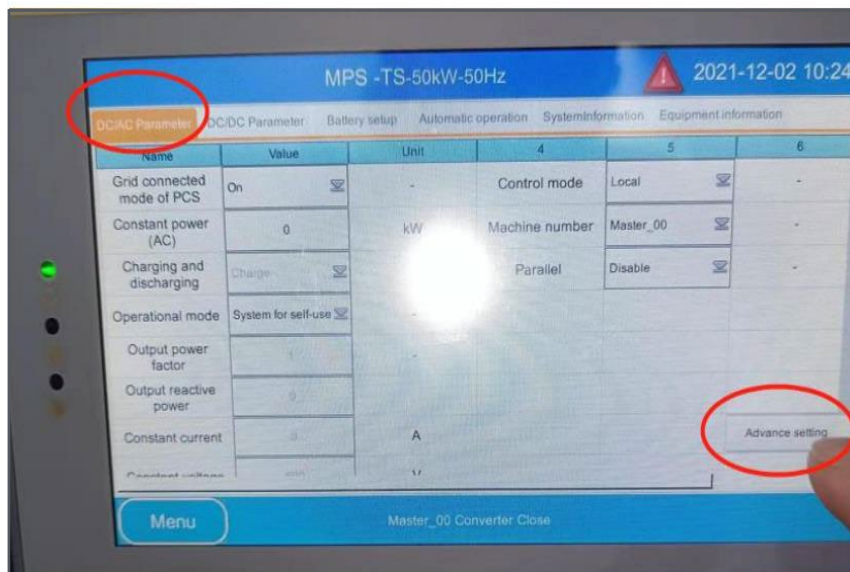


Figure 40: Advanced Screen

12. Select the "Advance settings" button.

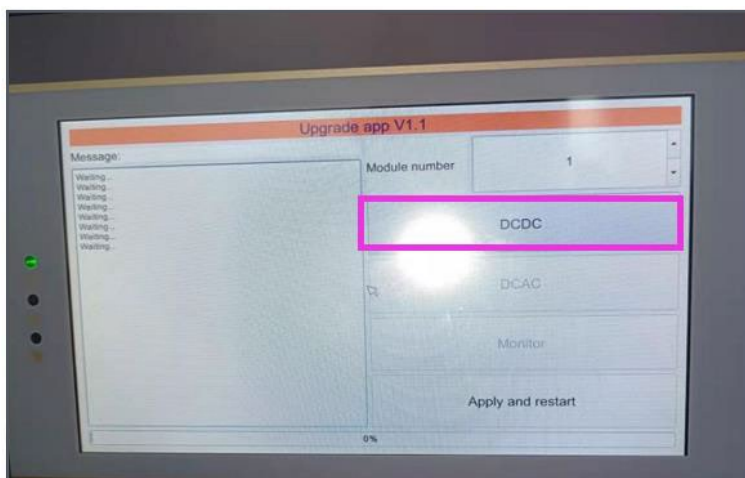


Figure 41: DCDC Option

- The system will automatically update. The DCDC and EPO warning options will show.

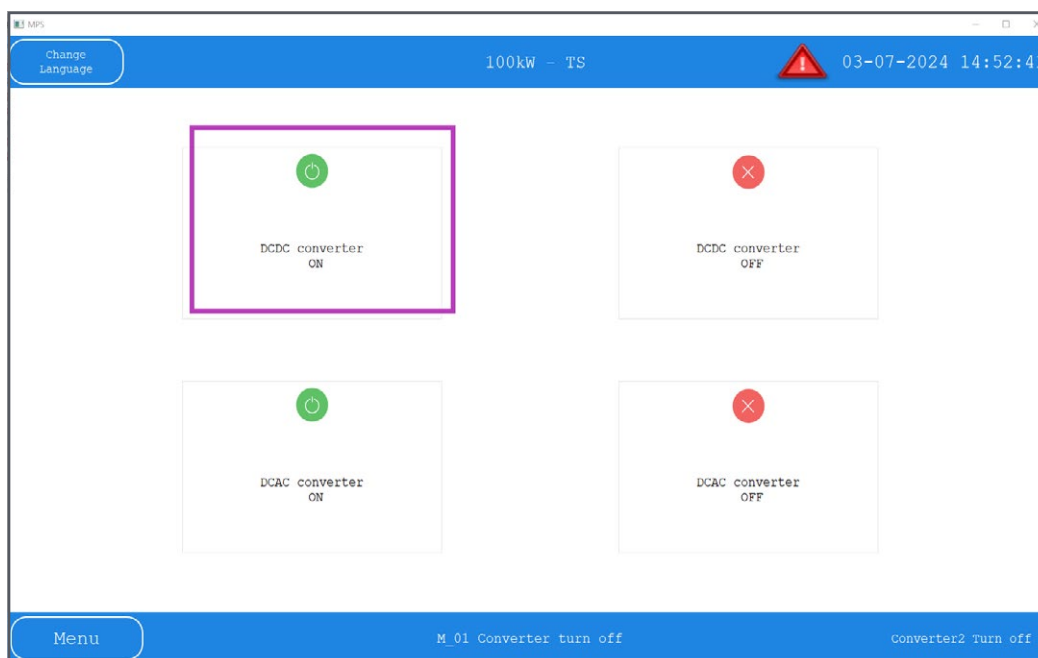


Figure 42: DCDC Option

- Select the "DCDC Converter ON" option.
- When working with multiple modules, use the drop-down arrow on the "Module number" option to select the required MPPT number. Select the number of the faulty module and the Update option.
- Click on the "DCAC" option. The system will restart.
- A blinking LED or other visual indicator might signify the update in progress. (Refer to the DCDC module user manual for specific update confirmation details).
- Release the EPO button once the update is complete (indicated by the LED or other signal).
- Power cycle the DCDC module by completely turning it off and back on. This ensures the new program is loaded properly.



Do not interrupt the update process once it has started, as this could corrupt the program and render the DCDC module inoperable.

The specific file format (".hex" in this case) and update procedure may vary depending on the model of the DCDC module.

### 8.4.2. Upgrade DCAC Firmware

The DCAC module converts DC power from the MPPTs and the battery into AC power for load supply. Follow these instructions carefully to update the DCAC module successfully.

1. Carefully, extract the Zip file of the upgrade package to a designated folder on your computer.
2. Locate the HEX file within the extracted package and place it in the root directory of the USB stick. Ensure the file is at the topmost level of the USB stick's directory structure.



Figure 43: USB Port

3. Insert the USB stick into the designated USB port located behind the screen. Ensure that it is securely connected to ensure a successful upgrade process.
4. Ensure the AC side (GRID) is closed.
5. Close the following circuit breakers in sequence: KB1, KB2, and KB3.
6. Close the DC side circuit breaker (QDC).

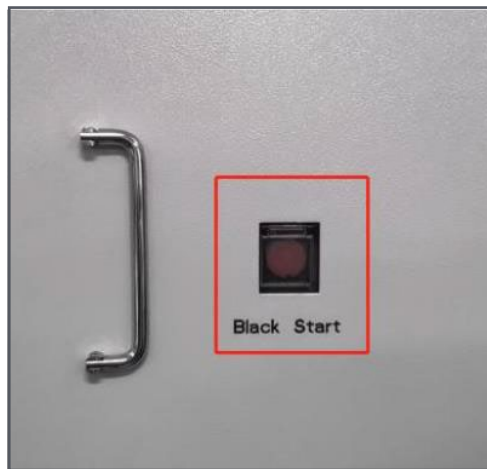


Figure 44: Black Start Button

7. Press and hold the Black Start button for 5 seconds to initiate system power-up.
8. Press the EPO button next to the screen (Emergency stop button).



Figure 45: EPO Button

- Select the "Menu" option from the inverter's screen.



Figure 46: Menu Option

- Click on the "System" option.
- Enter the password in the "NumberKeyBoard" pop-up field.
- Click on the "Advanced Settings" button and enter the password (888888).
- When the USB Flash Drive is successfully identified, the red box will display a confirmation message. Click on the 'DCAC' option, and the progress bar below will begin to advance. The system will automatically reboot once the upgrade is complete.



During the network upgrade process, please press and hold the cold start button (also known as the black start button) for 5 seconds.

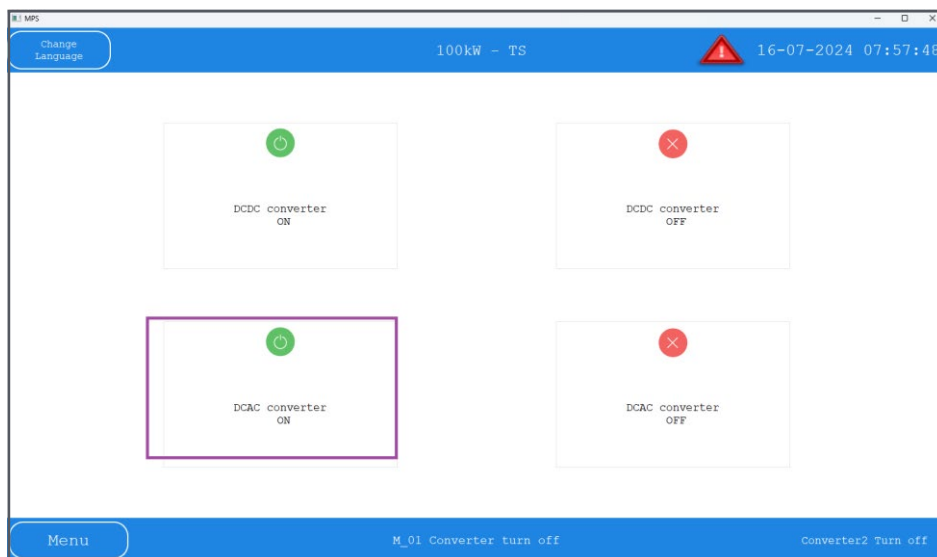


Figure 47: Menu Option

14. Click on the "Menu" button.
15. Select the "System" option and enter a password (88888888).
16. Select the "System Information" option and view the DCAC software version, the send zip file name and version number will be displayed.
17. Reset the EPO button, the system will update.

### 8.4.3. Monitor Upgrade (Display Screen Upgrade)

To successfully upgrade firmware, follow the steps below to set up your computer's network, access monitor/screen files, and transfer files.

1. Navigate to the Control Panel on your computer and select the "Network Connection" option.

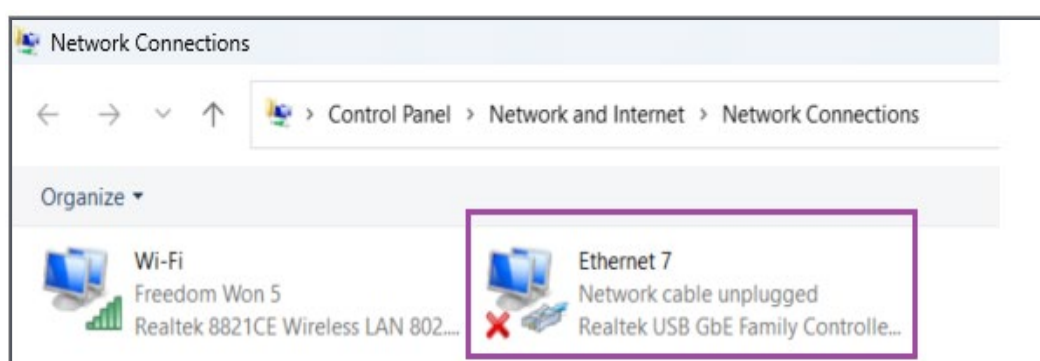


Figure 48: Ethernet

2. Right-click on the "Ethernet" option, a context menu opens.

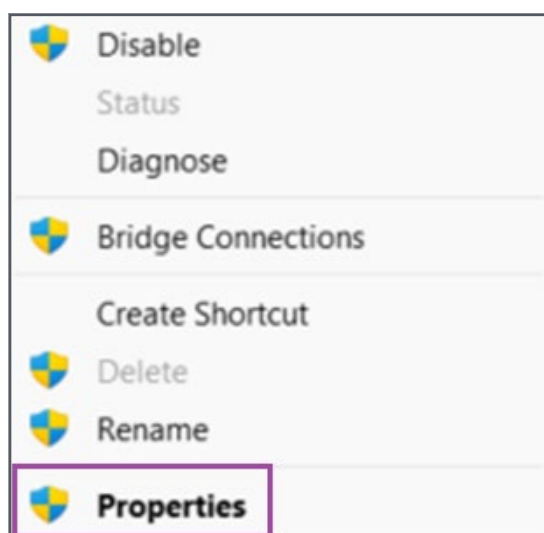


Figure 49: Properties Screen

3. Select the "Properties" option, and the Ethernet Properties will open.

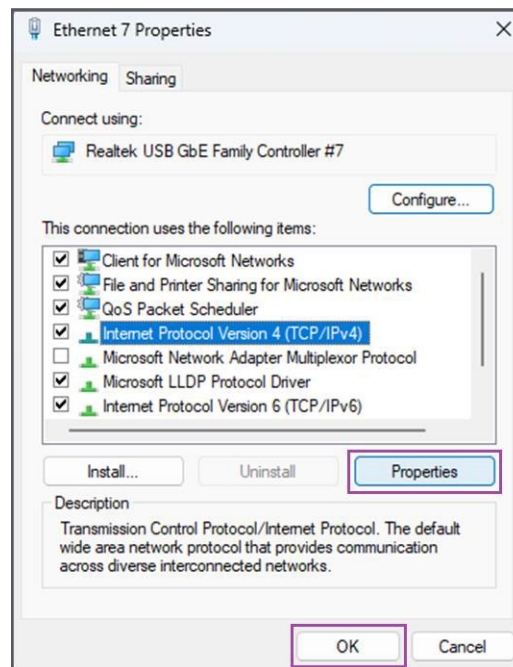


Figure 50: Internet Protocol Version 4 (TCP/IPv4)

4. Click on the Properties button and select the "OK" button.
5. Select the "Use the following IP address" option and enter the IP address in the field.

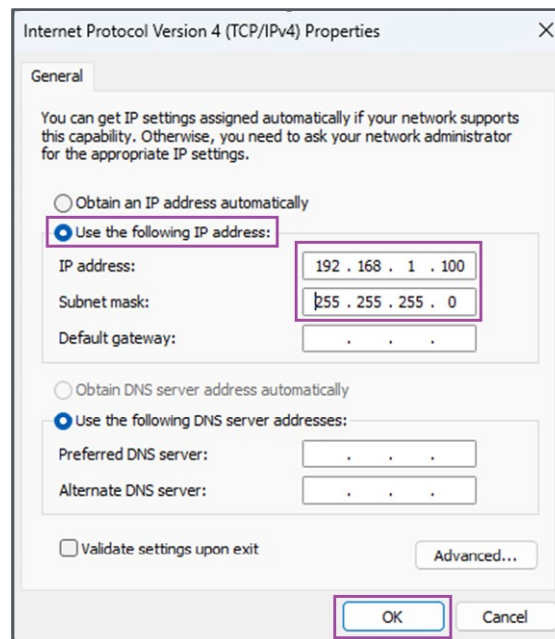


Figure 51: IP Address

6. Connect the network cable to the monitoring screen after changing the IP address. The network port is located at the back of the monitoring screen.

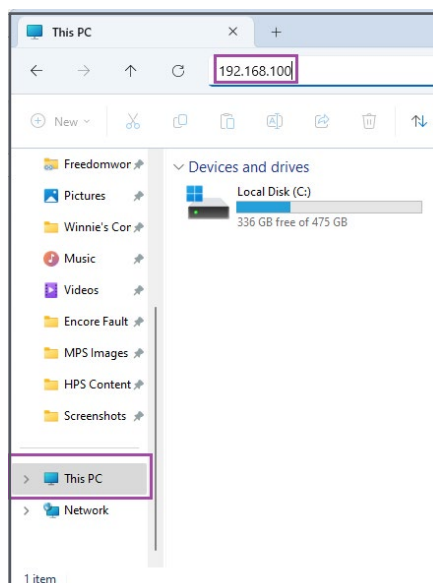


Figure 52: This PC Option

7. Open a folder on your computer and enter the address in the address field: ftp://192.168.1.100. This will open the monitoring folder.
8. Enter your username and password to access the monitoring files. The username and password are required to proceed with the process.
9. Username and Password = ftpadmin
10. Before upgrading, follow these steps:
  - a. Copy all files from the monitoring folder to your computer as a backup.
  - b. Copy all files from the upgrade package to the monitoring folder.
  - c. Replace the existing files in the monitoring folder with the new ones.
  - d. After copying the upgrade files to the monitoring folder, close the folder.
  - e. Disconnect the network cable.
11. To restart the monitoring system, do the following steps:
  - a. Navigate to the "Menu" option on the monitoring system.
  - b. Select the "System" option.
  - c. Choose the "System Info" option.
  - d. Click on the "Restart System" button.
  - e. Perform a power cycle (turn off and then turn on the system).

# HPS SERIES

---



SCAN ME  
TO LOG A  
SUPPORT  
TICKET

## Freedom Won Technical Support Contact Details

Please use the following contact details to make enquiries on technical matters or for actual technical support with design and/or commissioning:

**Email:**

support@freedomwon.co.za

**Mobile:**

+27(0)60 968 5145

**Office**

+27(0)10 597 7794

**f r e e d o m**  
W O N

www.freedomwon.co.za