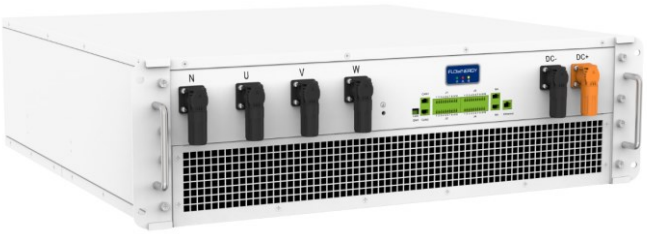
FLOWNERGY

ShenZhen HNergy Co., Ltd

ES-series Modular 125K Power Conversion System (CE)

Installation Manual



Power Conversion System (PCS)
User Manual-CE Model
Version A10
BOM No. 09012075

ShenZhen HNergy Co., Ltd provides comprehensive technical support to customers. Users can contact our nearest office or customer service center, or get in touch with the our headquarters directly.

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Statement

Personal Safety

1. This product must be installed and commissioned by professional engineers from the manufacturer or its authorized agents. Or it may result in product malfunction or pose a risk to personal safety.
2. Before installing and commissioning, be sure to read this product manual and the safety instructions thoroughly. Or it may result in product malfunction or pose a risk to personal safety.
3. This product must not be used as a power source for any life support equipment.
4. It is strictly prohibited to place the external battery of this product in a fire, as it may cause an explosion and endanger personal safety.

Equipment Safety

1. If stored or not in use for an extended period, this product must be placed in a dry, clean environment within the specified temperature range.
2. This product should be used in an appropriate working environment (refer to the environmental requirements section in this product manual for details).
3. The use of this product is prohibited in the following environments:

    1. Locations with temperatures or humidity levels that exceed the technical specifications of this product.
    2. Locations with conductive dust, corrosive gases, salt spray, or flammable gases.
    3. Locations subject to vibration or prone to impacts.
    4. Locations near heat sources or with strong electromagnetic interference.

Disclaimer

ShenZhen HNergy Co., Ltd is not responsible for defects or malfunctions caused by:

- Use beyond the specified operating range and working environment of the product.
- Unauthorized modification, repair, incorrect installation, or improper operation.
- Force majeure events.
- Any other violations of the provisions in this product manual.

This manual applies to the following models of energy storage inverters from ShenZhen HNergy Co., Ltd.:

Equipment	Model	AC Voltage
PCS 125kW	HNESPS125-34M0	400Vac, 3P/Back air intake
PCS 125kW	HNESPS125-44M0	400Vac, 3P+N/Back air intake
PCS 125kW	HNESPS125-34M0Q	400Vac, 3P/Front air intake
PCS 125kW	HNESPS125-44M0Q	400Vac, 3P+N/Front air intake

Note: The compatibility between three-phase three-wire and three-phase four-wire modules depends on the wiring configuration selected on the nameplate.

This manual uses the symbols shown in the table below to indicate different types of instructions. Different symbols may be used in combination.

Symbol	Meaning
	Warning
	Risk of electric shock, which may cause personal injury
	Highly dangerous, extremely cautious
	Capacitor discharge risk,Wait at least 15min

 Attention

1. When using the PCS energy storage converter for the first time, please calibrate the PCS time.

2. If the PCS energy storage converter is stored for a long period, ensure that the power is turned on at least once within half a year. The power-on duration should be no less than 6 hours. The input voltage must gradually increase to the rated voltage using a voltage regulator.

Safety Precautions

This manual contains important precautions and guidelines that must be followed during the installation, operation, and maintenance of the ES-series Modular Power Conversion System - Model B. Please read this manual thoroughly before installation.

Warning

1. Install the inverter strictly according to the instructions in this manual; failure to do so may result in equipment damage or endanger operator safety!

2. The inverter must be installed, commissioned, and maintained by engineers designated by the manufacturer or its authorized agents. Failure to do so may jeopardize personal safety and cause equipment malfunction, and any equipment damage caused by this will not be covered under warranty.

3. Personnel should be fully familiar with relevant standards and safety regulations in their region/country and must carry out operations in accordance with these regulations.

4. The ES-series Modular Power Conversion System - Model B complies with the electromagnetic compatibility standard CLASS A limits and is suitable for general industrial environments.

5. Before performing any work on the inverter, please read this manual, the safety labels and instructions on the inverter carefully.

Dangerous

1. The inverter must be properly grounded. The grounding of the equipment must comply with local electrical regulations; Or it may endanger operator safety!

2. When the front battery output switch is not turned off, the DC terminals of the PCS carry high DC voltage. Do not make contact with these terminals or any terminals directly electrically connected to them without proper protective measures or confirmation of the DC voltage, as this may cause personal injury. Clear hazard warnings and protective measures should be added if necessary!

3. There is hazardous voltage inside the inverter during normal operation! Do not remove the internal cover of the inverter without authorization or permission, as this may cause equipment damage or personal injury!

4. The inverter contains energy storage components. After the inverter is completely powered off, wait for at least 15 minutes before performing any further operations!

Content

Chapter 1: Product Introduction

1.1 PCS Introduction

The PCS (Power Conversion System) is the core unit of the energy storage system, responsible for energy conversion. The PCS can convert DC energy from storage components into AC power or convert AC power into DC energy for storage in the energy components.

Key Features:：

Convenient Operation and Maintenance

▲Standard modular design, string-type energy storage system; multiple modules can be connected in parallel with automatic master-slave configuration through software—no need for DIP switch settings. A fault in a single module does not affect the operation of other modules.

Grid-interactive Friendly

▲Improved grid-interactive algorithm based on second-order generalized integration, offering better grid connection compatibility.

▲Stable operation in grid environments with voltage distortion rate THDu ≤ 25%.

▲Supports both three-phase three-wire and three-phase four-wire systems.

Efficient Operation

▲Utilizes advanced neutral point clamped technology.

▲Conversion efficiency up to 98.5%.

▲Supports multi-machine off-grid parallel operation.

▲Charging and discharging conversion time ≤ 20 ms.

Comprehensive Functions

▲Provides operational modes such as VSG (Virtual Synchronous Generator), VF (Voltage Frequency), and PQ (Active and Reactive Power).

▲Supports high/low frequency, island, multi-machine parallel connection, and grid black-start.

▲Four-quadrant operation with battery charging and discharging cluster management functions.

▲In off-grid mode, supports 100% three-phase unbalanced load.

▲Supports scenarios such as pure grid-tie, pure off-grid, and grid-off-grid switching.

Safety and Stability

▲Control compartment with IP6X protection.

▲Supports low-temperature operation down to -40°C.

▲Comprehensive fault protection functions.

Battery-Friendly

▲Compatible with lead-acid and lithium batteries.

▲Supports battery cluster management to prevent circulating currents between clusters.

▲Supports RS485 and CAN communication (including various protocols such as Tuanbiao, High-Tech, and Xieneng).

Notes: The ES-series model series does not include a connection terminal for a remote battery temperature sensor. If installing the ES-series model series with lead acid batteries please check with ShenZhen HNergy Co., Ltd for advice regarding charge settings.

Application Scenario Limitations:

When the PCS energy storage inverter operates in off-grid mode, there are some restrictions on load power:

▲For motor loads with a frequency converter, the load power must be no more than 65% of the PCS rated power.

▲For motor loads without a frequency converter, please contact the pre-sales engineer to confirm the PCS capacity configuration.

▲For pure resistive loads, the load power must be no more than the PCS rated power.

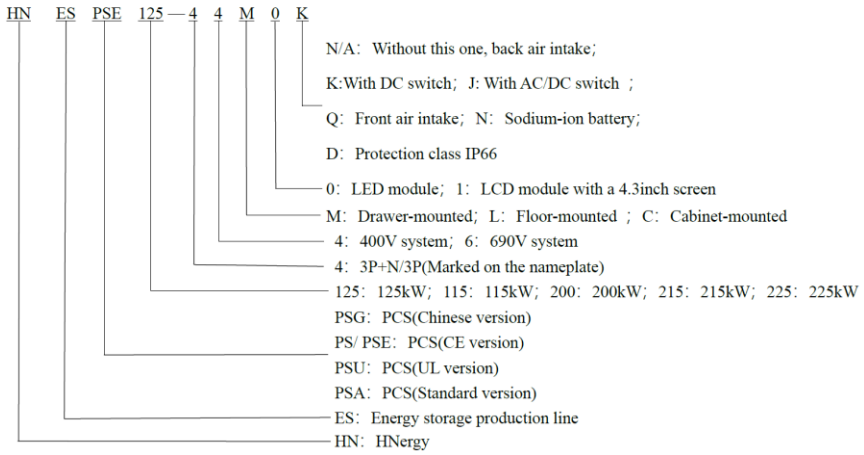
▲For RCD (Resistor/Capacitor/Diode) loads, the load power must be no more than 65% of the PCS rated power. If there are RCD loads, please contact the pre-sales engineer to confirm the PCS capacity configuration.

The specific power rating for motor loads that the PCS can handle depends on the actual load conditions on-site and must be discussed in advance with the pre-sales engineer.

Notes: Half-wave rectified loads are strictly prohibited in off-grid mode!

1.1.1 Product Model

The meanings of the product series names are as follows:



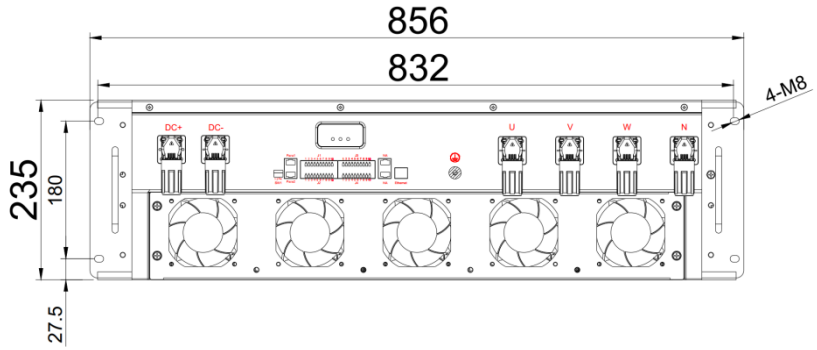
Notes:

1. When the last letter has multiple meanings, it is represented by two letters. For example, a sodium-ion batterywith a DC switch is represented as "NK," where the first letter is "'N" and the second letter is "K."

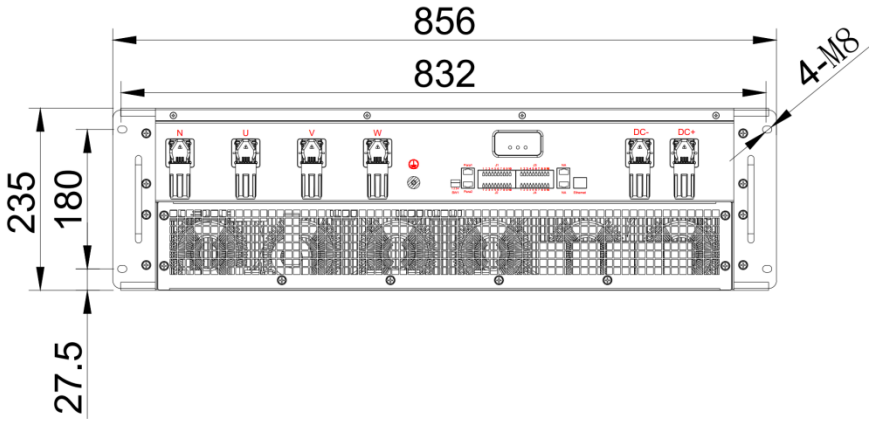
2. For the number representing the wiring system, if the module is compatible with both three-phase three-wireand three-phase four-wire systems, it is uniformly represented by the number "4" If the module only supports thethree-phase three-wire system, it is represented by thenumber "3."

1.2 Product Dimension

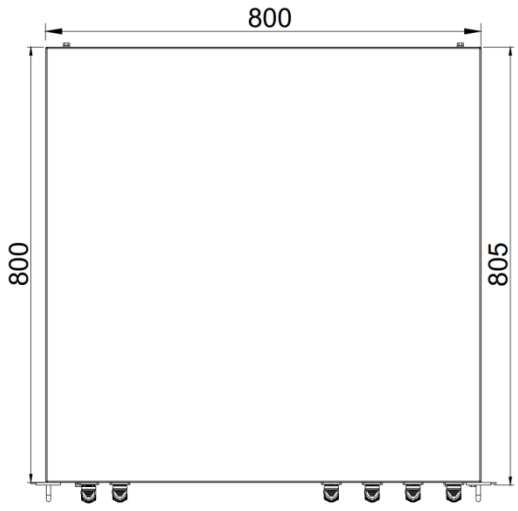
HNESPS125-34M0	HNESPS125-34M0Q
HNESPS125-44M0	HNESPS125-44M0Q



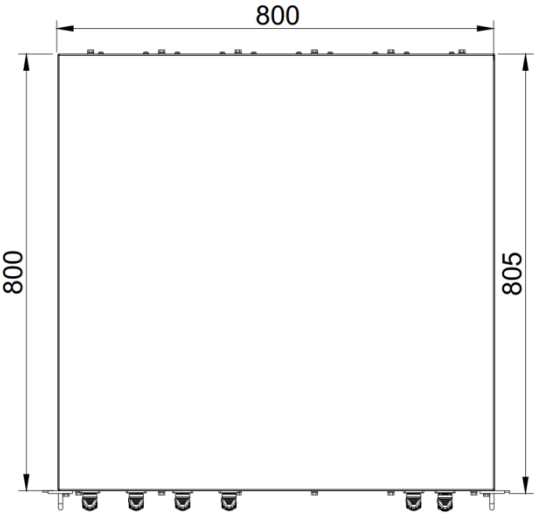
Front air intake module, front view



Back air intake module, front view



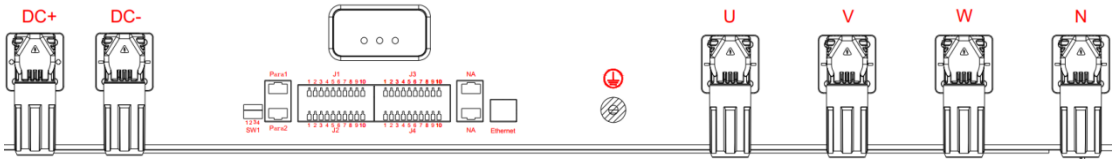
Front air intake module, top view



Back air intake module, top view

1.3 Terminal Definition

The wiring position for the module is the reserved terminal at the front of the device. During installation, the corresponding terminal should be connected to the appropriate position as shown in the diagram below:

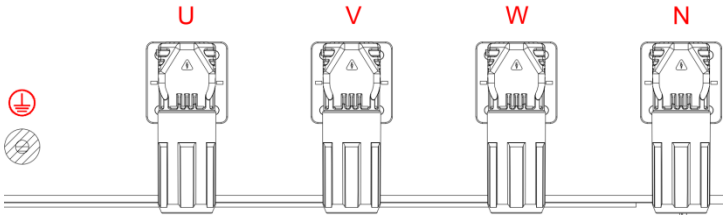
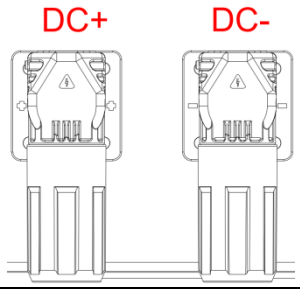


125kW front air intake module

125kW back air intake module

The functions of the module's wiring terminals are shown in the table below：

Diagram 1-1 Power wiring functionality introduction

	N: AC Neutral Terminal U: AC Phase U Terminal V: AC Phase V Terminal W: AC Phase W Terminal ⏚ : Ground Terminal
	DC+: DC Positive Terminal DC-: DC Negative Terminal

Signal Wiring Terminal Pin Definition Diagram

Diagram1-2 Signal Terminal Wiring Function Introduction

Terminal	Pin	Function	Notes
J1	1	Stable control equipment access through network A	DI signal，normally on by default
	2		
	3	Stable control equipment access through network A	DI signal，normally on by default
	4		
	5	Undefined function	DI signal，normally on by default
	6		
	7	Local emergency stop signal（DRM 0 signal）, connected to the cabinet	DI signal，normally on by default
	8		
	9	Battery current detection, CAN Hall communication interface(reserved)	Connect with BMS（CAN-H）
	10		Connect with BMS（CAN-L）
J2	1	PCS fault feedback signal，connected to EMS	DO signal，passive output
	2		
	3	PCS fault feedback signal，connected to EMS	DO signal，passive output
	4		
	5	Main Positive/Negative Relay Status Feedback	DO signal，passive output
	6		
	7	External 24VDC isolation Switch Drive (Reserved)	DC Isolating Switch 24V
	8		DC Isolating Switch GND
	9	DC Isolating Switch Feedback Signal (Reserved)	Contact feedback positive (P)
	10		Contact feedback negative (N)

J3	1	Connected to EMS through RS485	Connected to RS 485+
	2		Connected to RS 485-
	3	Connected to EMS through RS485	Connected to RS 485+
	4		Connected to RS 485-
	5	Remote emergency stop signal, connected to EMS	DI signal，normally on by default
	6		
	7	Remote emergency stop signal, connected to BMS	DI signal，normally on by default
	8		
	9	CAN3 communication interface（Reserved）	Connected to CAN-H
	10		Connected to CAN-L
J4	1	Connected to BMS through CAN	Connected to CAN-H
	2		Connected to CAN-L
	3	Connected to BMS through CAN	Connected to CAN-H
	4		Connected to CAN-L
	5	Connected to BMS through RS485	Connected to RS485+
	6		Connected to RS485-
	7	RS485 debugging interface on background	Connected to RS485+
	8		Connected to RS485-
	9	CAN3 communication interface（Reserved）	For PCS parallel connection, through CAN3-H
	10		For PCS parallel connection, through CAN3-L
Para1	Parallel connection communication interface 1		Communication interface between modules
Para2	Parallel connection communication interface 2		Communication interface between modules

Ethernet1	Ethernet communication interface 1		Communicate with EMS
NA	Ethernet communication interface 2		Communicate with EMS/BMS（Reserved）
NA	Ethernet communication interface 2		Communicate with EMS/BMS（Reserved）
SW1	1	Parallel connection, CAN1 termination resistor DIP switch	/
	2	Parallel connection, CAN2 termination resistor DIP switch	/
	3	Parallel connection, CAN3 termination resistor DIP switch	/
	4	Communicate with BMS, CAN3 termination resistor DIP switch	

CAN1~3 Resistor DIP Switch Instructions:

❖ For Parallel Connection of ≤ 6 Modules:
Only the CAN termination resistor DIP switches on the first module need to be switched off (down). The remaining modules should keep their DIP switches in the original position; no adjustments are needed.

❖ For Parallel Connection of ≥ 7 Modules:
An additional set of CAN termination resistor DIP switches must be switched off. For example, when using 8 modules in parallel, the CAN termination resistor DIP switches on two of the modules need to be switched off (down).

1.4 PCS Indicator Light

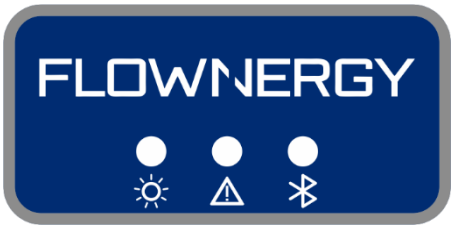


Diagram 1-3 PCS Indicator Light Description

LED color	Status	Meaning
Green	Solid	On
	Flashing (1 second)	Not started
Red	Solid	Device fault
	Flashing (1 second)	Device alarm
	Off	No alarm, no fault

1.5 Main Circuit Structure

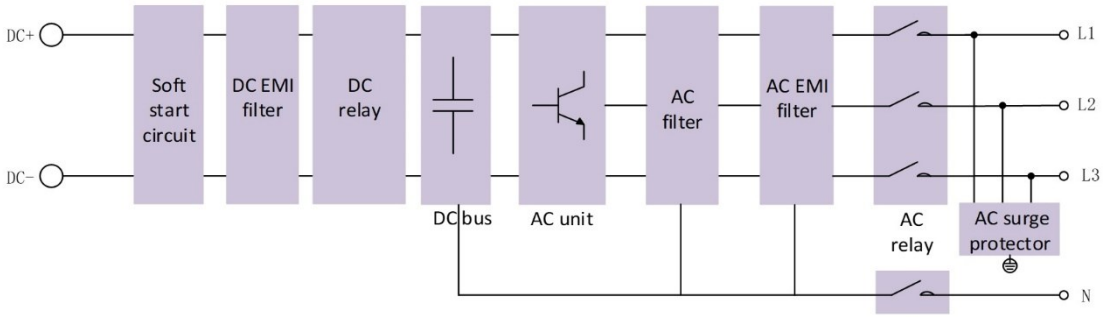


Diagram 1-4 PCS main circuit structure

Chapter 2: Installation of PCS

2.1 Storage before Installation

Warning

- PCS must be stored indoors and ensure that the PCS packaging is intact. It is strictly prohibited to store the PCS without packaging. Any damage, reduced lifespan, or other losses caused by improper storage are not the responsibility of the manufacturer.
- It is forbidden to stack more than 4 units! Storing PCS in a horizontal or inverted position is strictly prohibited!
- PCS storage should be within a temperature range of -40 to 70°C, with a relative humidity of 0 to 100%, and without condensation.

2.2 Transport, Handling, Packaging and Unpacking

Warning

- During transportation, to keep the converter in good condition, it is essential to use packaged transportation to avoid strong vibration and collision.

- Before handling, ensure that the PCS packaging is intact and undamaged! If the packaging is damaged, please stop further operations and contact the manufacturer or the shipping company.

- Read the instructions and warning labels on the PCS packaging carefully before starting any work.

- The PCS is heavy and requires at least 4 people for handling. When disassembling and moving the PCS, maintain balance to prevent the PCS from falling and causing injury. When handling, grasp the PCS at its four corners and avoid letting the DC/AC terminals at the back impact other objects to prevent damage to the PCS casing and internal components. Also, avoid squeezing or scratching the handlers.

- When hoisting the PCS, ensure that the lifting equipment is safe and reliable. Always maintain balance during the hoisting process and avoid collisions with walls or other obstacles. Never hoist or store the PCS upside down!

- When placing the PCS on the ground, use foam or cardboard padding under the

PCS to avoid damaging the DC/AC terminals at the bottom.

Follow the steps in Diagram 2-1 to unpack the module. Place the removed PCS on a flat surface to prevent tipping and potential damage to the PCS.

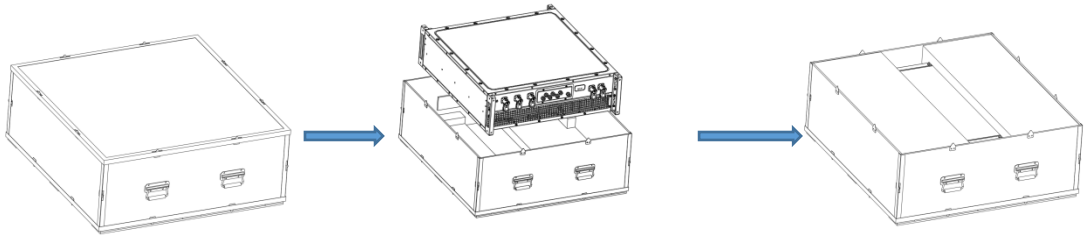


Diagram 2-1 PCS unpacking

2.3 PCS Installation

Warning

- Before installation, confirm that the PCS packaging is intact and undamaged!
- During normal operation, the temperature of the PCS casing and heat sink will be quite high. Do not install the inverter in areas with high foot traffic or in locations easily accessible to non-professional personnel!

2.3.1 Installation Environment Requirements

- Environmental category (Indoor – conditioned) .
- PCS need be installed indoors.
- PCS can be installed in a cabinet and combined to form an energy storage system.

  Notes: The system cabinet customers can either design and purchase it themselves or have it customized by our company. The system cabinet needs to reserve space for the installation of the PCS and a ventilation duct to meet the cooling requirements of the PCS. For specific design suggestions, please contact ShenZhen HNergy Co., Ltd.
- Install the PCS in a well-ventilated area to prevent poor heat dissipation from affecting its performance.
- During operation, the surface of the PCS (especially the heat sink) can become very hot. Ensure it is installed in a location that is not easily accessible to avoid

accidental contact. Keep it away from children and vulnerable individuals.

- The installation area should be free from flammable or explosive materials and free from strong electromagnetic interference.
- The installation rack or wall should have a certain level of fire resistance.
- Avoid installing the PCS near noise-sensitive office spaces or residential areas.

2.3.2 Ventilation Requirements

The cooling method of the PCS module of the energy storage converter adopts intelligent forced air cooling. The heat dissipation methods include forward air intake and rear air exhaust, and rear air intake and front air exhaust.

When installing, the inlet and outlet of the cabinet should face the PCS module directly and a separate air duct should be set. The air duct of the cabinet should be consistent with that of the PCS module.

The minimum gap around the installation of the PCS should be 10mm on the top and bottom, and 25mm on the left and right, as shown in the following figure.

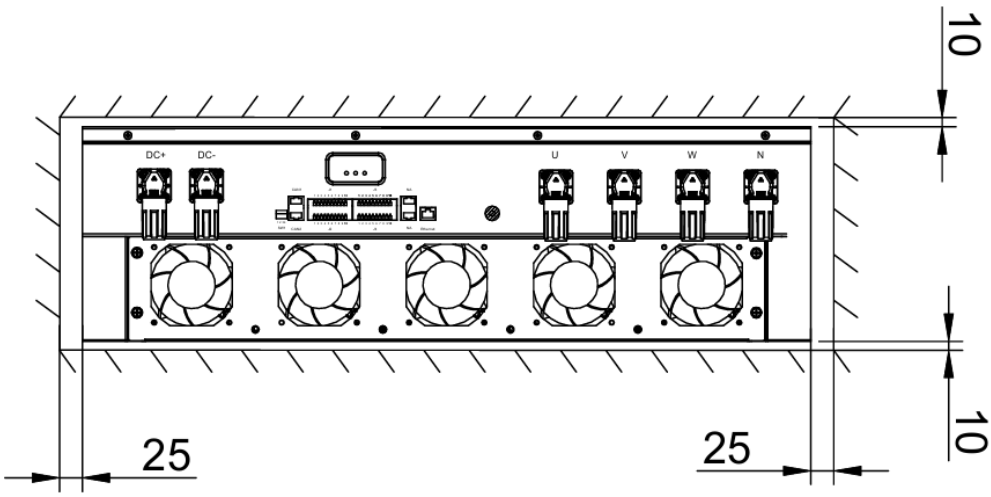


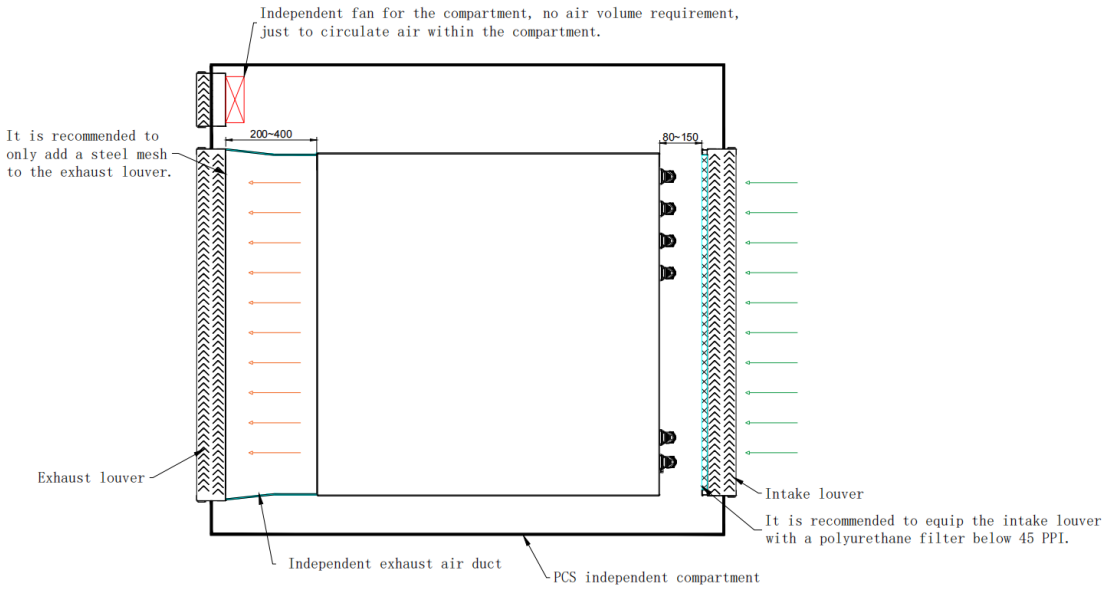
Diagram 2-2 Installation clearance

The installation gap before and after the PCS needs to be designed according to the ventilation duct of the cabinet. Please refer to the following louver example:

The air outlet louver should ideally have only a steel mesh.

The air intake louver should be equipped with a polyurethane filter with a 45 PPI rating or lower.

The following diagram provides a reference for the heat dissipation of the PCS module within an integrated cabinet.



Ventilation parameters for the PCS module installed in cabinets：

PCS effective airflow for a single module		Required effective area for air intake	Required effective area for air outlet
（CFM）	（m^3/min）	（mm^2）	（mm^2）
600	16.99	60000	60000

Notes：

1. Effective Area=Louver Blade Area*Louver Ventilation Rate*Filter Ventilation Rate.
2.The total air resistance from the front and rear louvers plus the filter should be less than 50 Pa (Pascal).

Chapter 3: Electrical Connection

Dangerous

- When the battery-side switch is not turned off, there is a high DC voltage at the PCS DC port that poses a risk to operator safety!
- The insulation on power cables must remain intact, with no damage or scratches. Otherwise, it could lead to short circuits and fires!
- Before wiring the PCS, ensure that all connected cables are free from hazardous voltages. Additionally, place clear warning labels at the external distribution switch to prevent accidental operation by others, which could endanger personnel safety!
- Before wiring the PCS, confirm that the AC connection ports are disconnected from the power grid and that there is no voltage at the AC ports!

Warning

- Strictly follow the labels inside the inverter for cable connections; failure to do so may result in equipment damage.
- The cable connections for the inverter must be secure and reliable. Cable selection and tightening torque must meet the requirements of this manual; otherwise, it could lead to fire hazards and inverter damage.

3.1 PCS Power Cable Connection

Diagram 3-1：Schematic diagram of PCS power cable connection

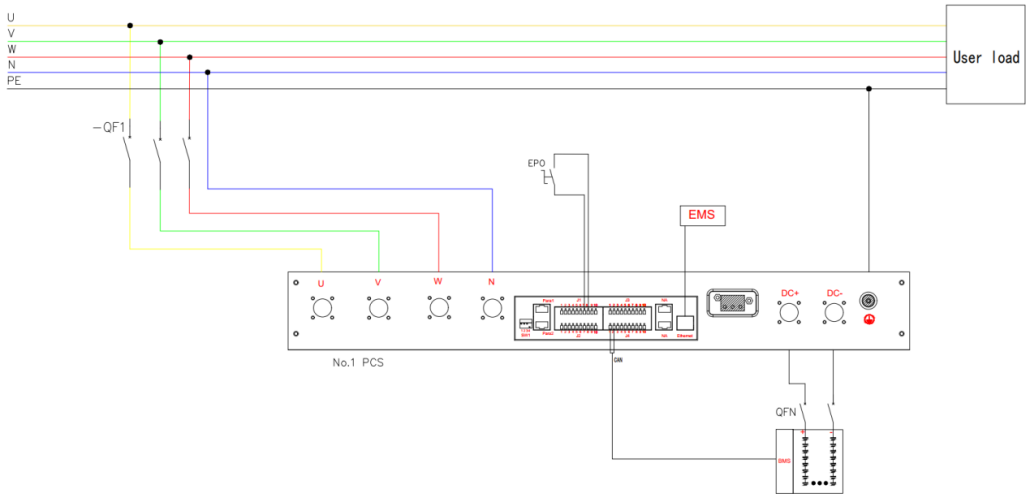


Diagram 3-1

3.2 Communication Interface

The PCS uses an RJ45 port as the external communication interface, which is a standard network port. Please follow general standards for network cable termination. Other interface connection refer to the definitions provided in Table 1-2.
The PCS supports Modbus RTU、Modbus TCP、and CAN protocols（including various standards such as Tuanbiao, Gaote, Xieneng etc.). It supports RS485, CAN, and Ethernet communication methods, facilitating backend monitoring and remote control of the energy storage system, including remote signaling, measurement, and adjustment.

3.2.1 String-type PCS Configuration for Multi-machine Grid-on Connection

In a grid-connected scenario where multiple PCS modules are paralleled on the AC side, Each PCS module connects to its own battery on the DC side, with each PCS's DC side isolated from the others, each PCS can be directly connected to the Battery Management System (BMS) via the CAN communication interface.

When controlling a single PCS, the EMS connects directly to the Ethernet1 port of the PCS without requiring a switch. For multiple PCS units, they can be connected through a switch before connecting to the EMS.

Diagram 3-2：Schematic diagram of grid communication wiring for parallel PCS modules on the AC side

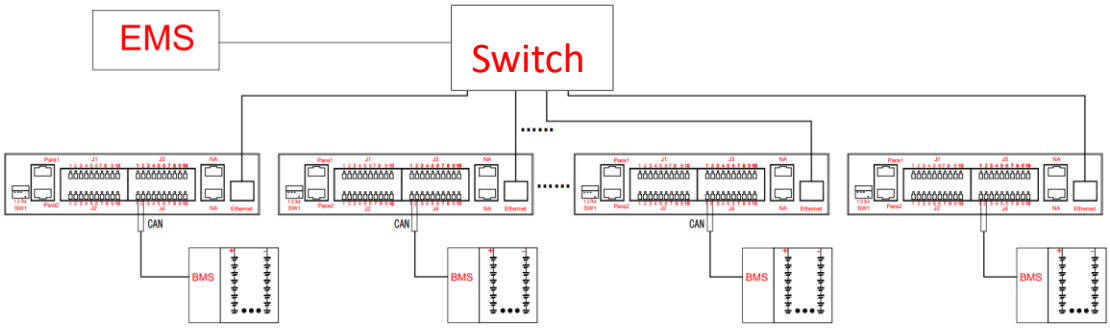


Diagram3-2

3.2.2 String-type PCS Configuration for Multi-machine Grid-on/Grid-off Connection

In grid-connected or off-grid scenarios where multiple PCS modules are paralleled on the AC side, each PCS module connects to its own battery on the DC side, ensuring that the DC sides of each PCS remain independent and do not interfere with each other, each PCS can connect to the BMS through a switch. However, if the EMS controls a single PCS directly, the EMS can connect directly to the PCS's Ethernet1 port, without

the need for a switch.

Differences from the Grid-connected Scheme:

1. The communication ports Para1/Para2 between the modules should be connected in a daisy-chain (hand-in-hand) manner, forming a ring connection.

2. SW1 CAN Termination Resistor Settings: When the parallel connected module≤6pcs, only the first module in the chain needs to have all its CAN termination resistor dip switches turned off. The remaining modules do not require any adjustments to their CAN termination resistor settings.

When the parallel connected module≥7pcs, For example, if 8 modules are paralleled, two modules within the chain must have their CAN termination resistor dip switches turned off.

Diagram 3-3：
Communication Wiring for Grid-Connected/Off-Grid PCS Modules in Parallel on the AC Side.

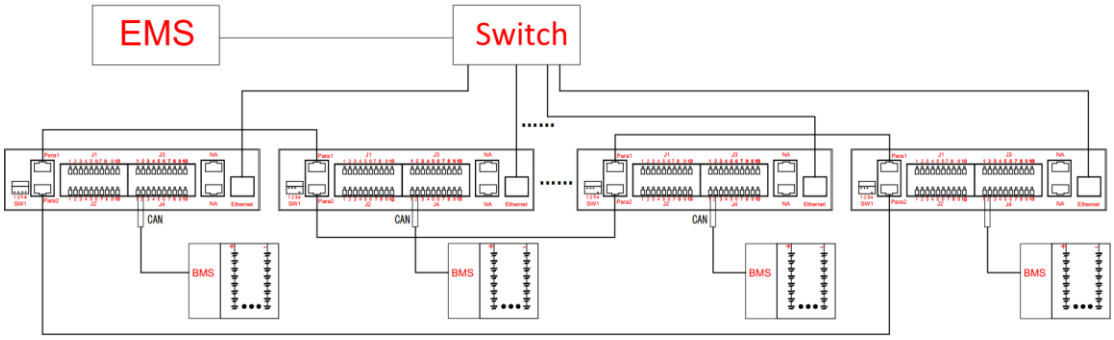


Diagram3-3

3.2.3 String-type PCS Single Unit Wiring

Parallel connection, When using a single PCS module in grid-on/grid-off scenarios, the DC side of the single PCS is connected to the battery. The PCS and EMS communicate via the Ethernet1 port on the PCS, directly connected without the need for a switch.

Diagram 3-4: Schematic Diagram of the PCS Standalone Grid Connection and Grid-on/grid-off Communication Wiring.

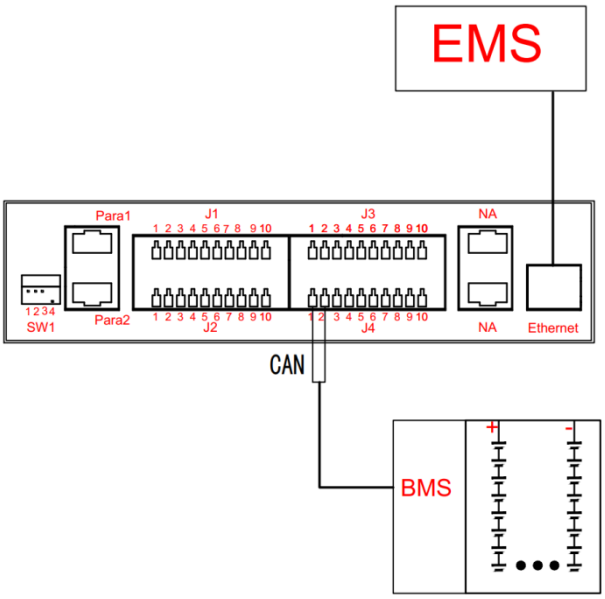


Diagram 3-4

3.3 PCS Emergency Stop (EPO) or Demand Response Mode Zero (DRM0) Signal Wiring Instructions

The demand response mode that the PCS can use is DRM0. The local EPO emergency stop signal is also a DRM0 signal.

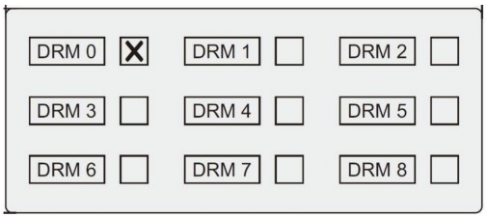


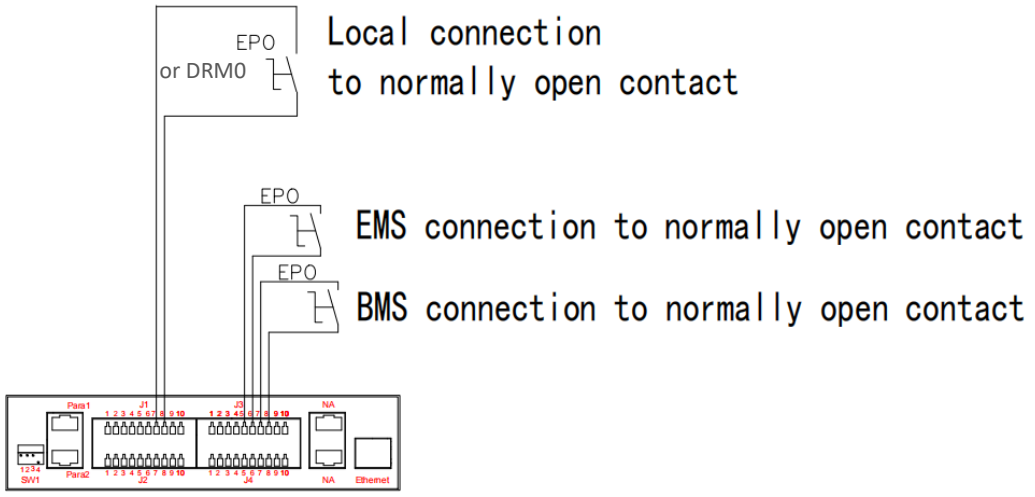
Diagram 3-5 DRM labeling

The EPO emergency stop signal or Demand Response Mode Zero (DRM0) Signal connection points for the PCS are as follows:

Local EPO (DRM 0) emergency stop signal: Connected to pins 7/8 of terminal J1, using a normally open contact.

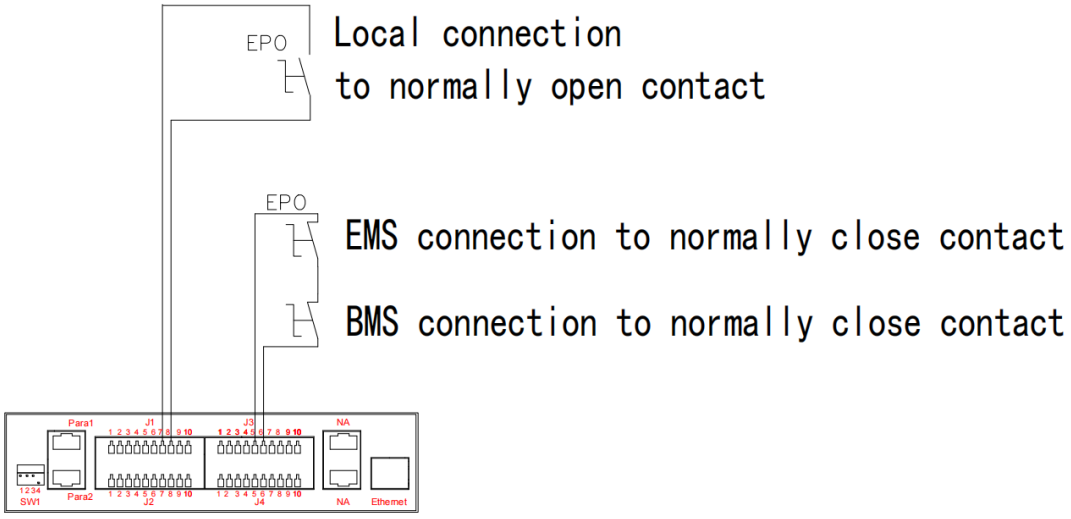
Remote EPO emergency stop signal: Pins 5/6 of terminal J3 are for the EMS emergency stop signal; Pins 7/8 of terminal J3 are for the BMS emergency stop signal.

The EPO wiring diagram is shown below:



Remote EPO set to normally open

Note: The remote EPO emergency stop signal is factory-set to normally open by default.



Remote EPO set to normally close

Note: If the remote EPO is set to normally closed, the EMS and BMS emergency stop signals need to be wired in series to pins 5/6 of terminal J3.

3.4 PCS Wiring Requirement

PCS wiring requirement：

- PCS must be grounded nearby. For multiple PCS units in parallel within the same system, all inverters' grounding wires should be connected to the same ground bus. Failure to do so could result in personal injury or inverter malfunctions!
- An AC circuit breaker matching the power rating of the PCS must be installed between the PCS's AC side and the grid.
- A DC circuit breaker matching the inverter's power rating must be installed between the PCS's DC side and the battery, with each PCS having its own dedicated DC circuit breaker.
- Quick-connect terminals must be fully inserted; otherwise, there is a risk of inverter damage or fire.
- When inserting or removing quick-connect terminals, ensure that the upstream switch is in the off position.

3.4.1 Power Cable Preparation Diagram

Operation Steps：

- Plug Assembly

  Open the connector and verify that all parts are complete.

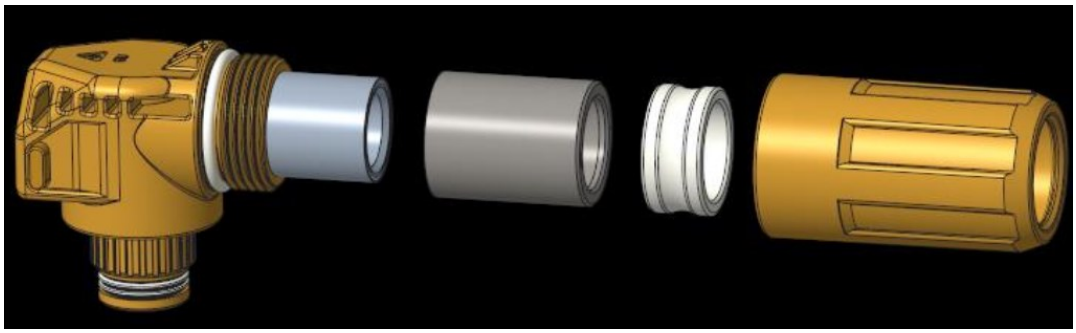


Diagram 3-6

- Place the components onto the cable in the order indicated in the diagram.

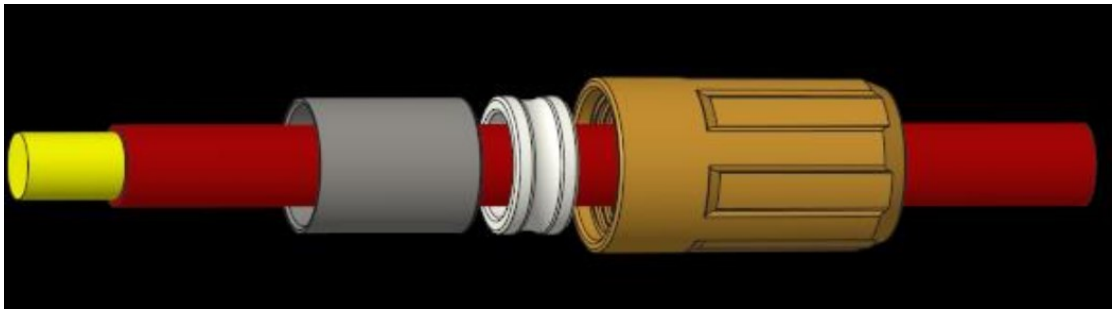


Diagram3-7

❖ Remove the insulation from the cable to the specified length 15.0-15.5mm

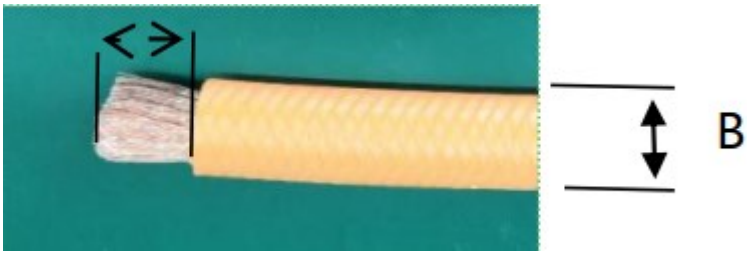


Diagram3-8

❖ Fully insert the conductors into the connector holes and crimp them. After crimping, the pull-out force must be no less than the values specified in the table below. The crimping dimensions are for reference only.

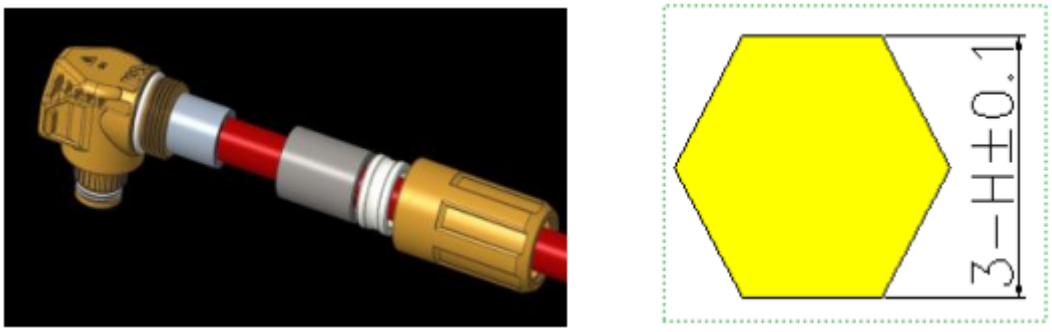


Diagram 3-9

Cable Dimension	Pull-Out Force (N)	Crimping Dimension (H)	Cable Outer Diameter (B)
2/0AWG	3900	11.7~11.9	15.0~16.9

❖ Move the cable clamp and tighten the cable end cap using a torque of 2.0-2.5 N·m. After tightening, the O-ring at the connection should not be visible.

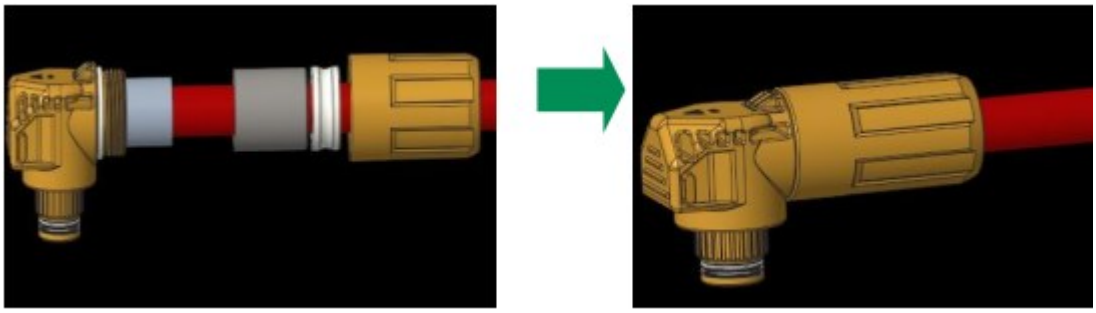


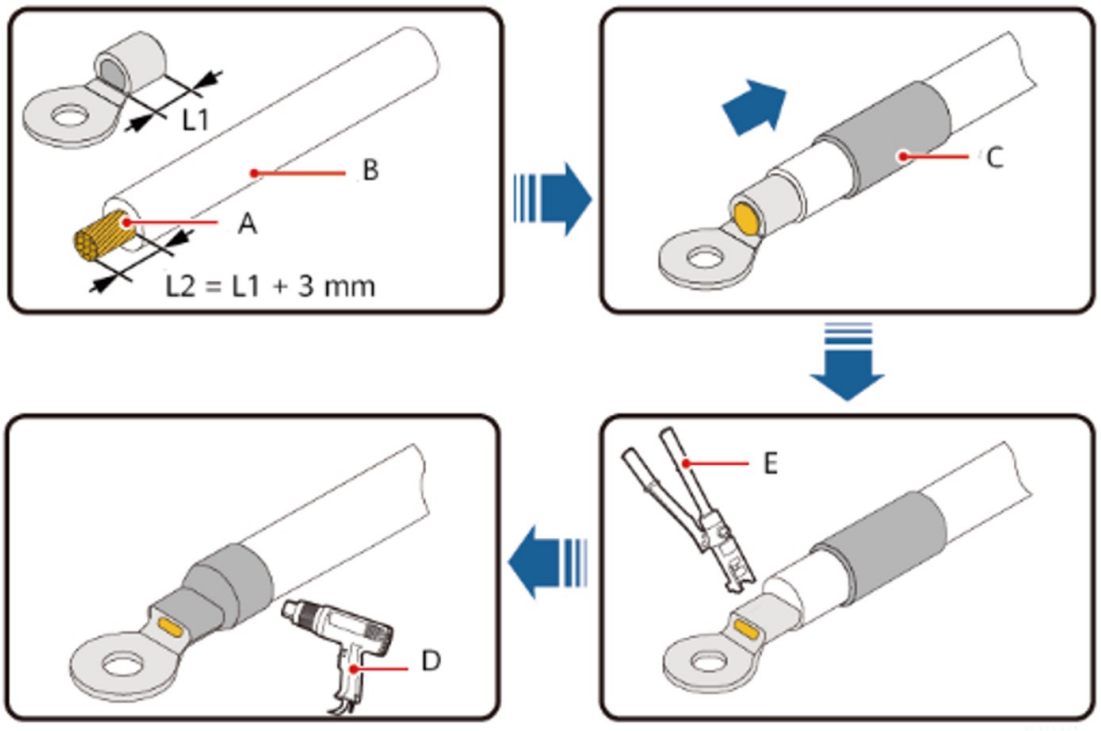
Diagram 3-10

3.4.2 The fabrication and connection of grounding cables

Operation Steps：

❖ Manufacturing grounding cables

Prepare multi-strand copper wires (conductor cross-sectional area 25mm^2) that meet the local cable requirements, along with M6 (OT terminals). Follow the requirements shown in the diagram to fabricate the grounding cable.



(A) Conductor wire (B) Insulation layer (C) Heat shrink tubing (D) Hot air gun (E) Hydraulic clamp

Diagram 3-11

❖ Protective grounding connection

According to the requirements shown in the following figure, connect the protective grounding point and the chassis shell.

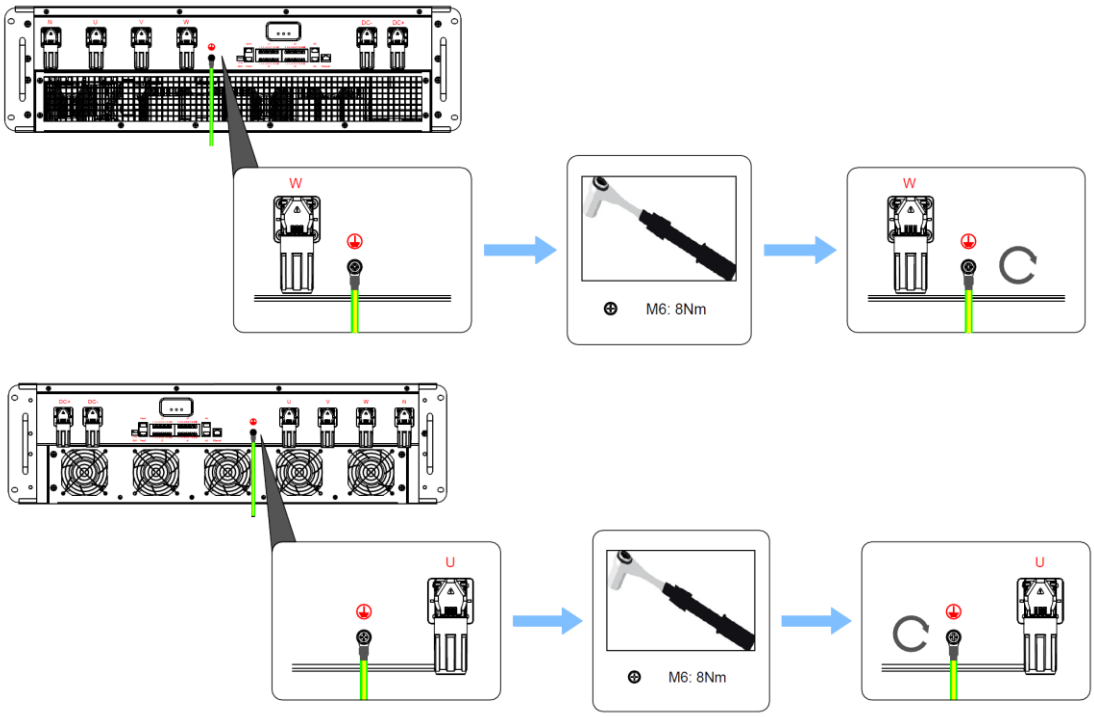


Diagram 3-12

3.5 AC Overcurrent Protection Device Selection

To ensure that the PCS disconnects properly from the grid in case of an abnormal situation, choose an appropriate AC circuit breaker. The recommended AC circuit breaker specification is: 400 Vac / 250 A.

3.6 DC Overcurrent Protection Device Selection

To ensure reliable disconnection between the PCS and the battery in case of an abnormal situation, choose an appropriate DC circuit breaker. The recommended DC circuit breaker specification is: 1000 Vdc / 250 A.

3.7 Cable Selection

The external cables for the PCS include DC input cables, AC output cables, communication cables, and protective grounding cables. The recommended cable specifications are as shown in Table 3-1.

Table 3-1 Recommended Cable Specifications

Cable Type	Type	Conductor Cross-Sectional Area (mm^2）	Terminal Specifications
Grounding cable	Stranded copper wire	25	M6(OT terminal）
AC cable	Stranded copper wire	70	Waterproof connector（Provide randomly）
DC cable	Stranded copper wire	70	Waterproof connector（Provide randomly）
Communication cable	Shielded twisted pair multi-strand copper cable	1-1.5	Terminal block-10PIN（Shipped with module together）

Chapter 4: PCS Operation

Dangerous

- Non-professionals can not open the PCS cover, as there is a high voltage risk!
- When the PCS is operating normally, there is dangerous voltage inside the equipment! Please operate the inverter according to the instructions in this manual!
- Only qualified professionals are allowed to operate the PCS; unauthorized personnel should not operate it!

4.1 Power-On Operation

Before powering on the PCS for the first time, please confirm the following:

- The installation environment meets the requirements outlined in Chapter 2 of this manual.
- Ensure the DC disconnect switch on the front stage of the PCS is in the "OFF" position.
- The circuit breaker of the AC distribution panel connected to the AC side of the PCS is in the "OFF" state.
- The power cables, communication cables, and grounding cables are connected according to the requirements in Chapter 3 of this manual.
- Check the polarity of the DC input cables, and ensure the phase sequence of the AC output cables meets the requirements in Chapter 3.
- Before grid connection, measure the voltage and frequency at the grid connection point to ensure the PCS grid connection specifications meet the requirements in Appendix 1.

Once the above conditions are met, follow these steps to power on:

- Close the circuit breaker on the AC side of the inverter or close the DC switch on the DC side of the inverter, supplying power from the grid or battery. The module's LED power indicator should light up (green light flashing).
- Observe the LED indicator panel status. When the inverter's LED shows no red light, set the PCS operating mode via the backend or Bluetooth app (if available) or EMS as required, and power on (green light steady).
- If the inverter's red light stays on, you can connect to the PCS through the backend or other communication methods, check the PCS alarm information, or export the PCS historical records (refer to the Fault Alarm List in this document for event handling methods). If the fault is not recoverable, please contact the customer service center promptly.

4.2 Power-off Procedure

Execute the PCS shutdown operation by issuing a shutdown command through the backend or EMS.

4.3 Grid-Connected and Off-Grid Operating Modes

The energy storage inverter can operate in both grid-connected and off-grid modes. In the grid-connected mode, the AC side follows the grid voltage. In the off-grid mode, it outputs a constant-frequency, constant-voltage AC power.

Note: The conversion between grid-connected and off-grid modes must be performed while the PCS is in the shutdown state.

4.3.1 Switching Between Grid-Connected and Off-Grid Modes

Steps for switching from grid-connected to off-grid mode:

Step 1: Issue the shutdown command via the EMS or backend software, ensuring the PCS is in the shutdown state.

Step 2: Disconnect the grid, ensuring there is no power in the grid.

Step 3: Issue the off-grid mode command via the EMS or backend software, then send the power-on command (in off-grid mode, the PCS output power depends on the load power).

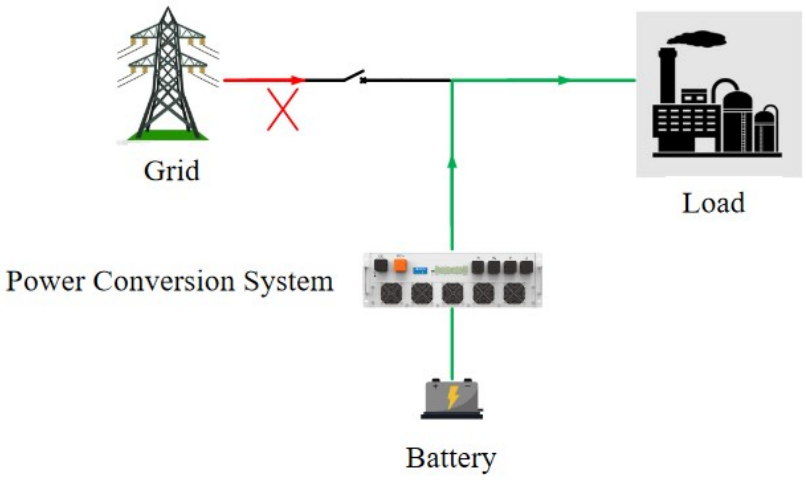


Diagram 4-1 Off-grid Mode

Note: In off-grid mode, the PCS outputs AC voltage. If the grid is not disconnected, the output voltage of the PCS will conflict with the grid voltage, which could result in the PCS outputting a large current, potentially damaging the load or the PCS module. Ensure that there is no voltage in the grid when powering on in off-grid mode.

Steps for Switching from off-grid to grid-connected mode:
Step 1: Issue the shutdown command via the EMS or backend software, ensuring the PCS is in the shutdown state.
Step 2: Power on the grid, ensuring there is voltage in the grid.
Step 3: Issue the grid-connected mode command via the EMS or backend software, then send the power-on command.

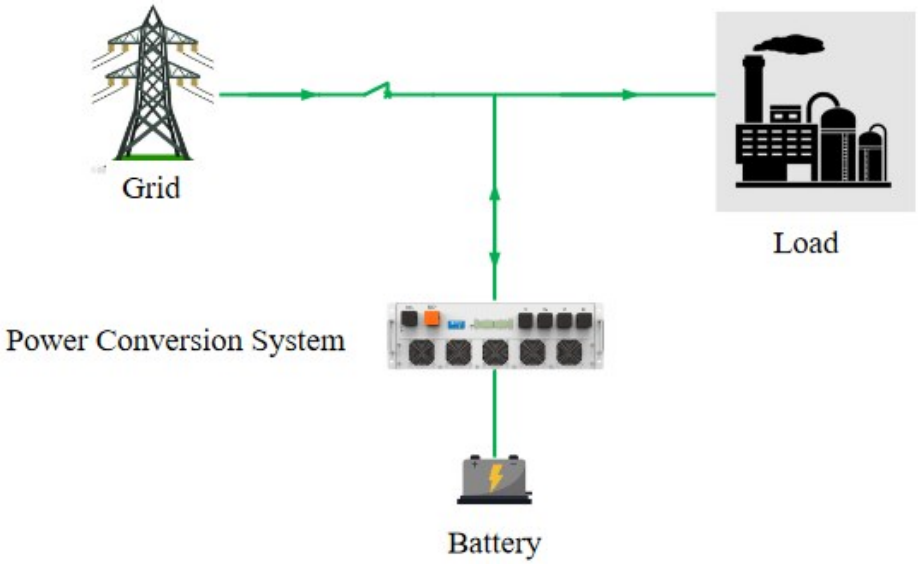


Diagram 4-2 On-grid Mode

4.3.2 PCS Control Process Overview

The PCS supports Ethernet and 485 communication, and the EMS can be configured accordingly. In a standalone system, the EMS sends control commands to the single PCS. In a parallel system, the EMS must send control commands to all PCS units. It is important to note that in a multi-unit grid-connected system, the EMS should send a power command to each PCS as System Power / N (where N is the number of PCS units in the parallel system).

The detailed operational flow of the PCS is shown in the diagram below. The PCS software supports both single and parallel systems, as well as grid-connected and off-grid operation. Therefore, the EMS only needs to perform the appropriate scheduling and send the necessary control commands. For alarms and faults mentioned in the flowchart, please refer to the communication protocol provided by our company, where detailed explanations are included.

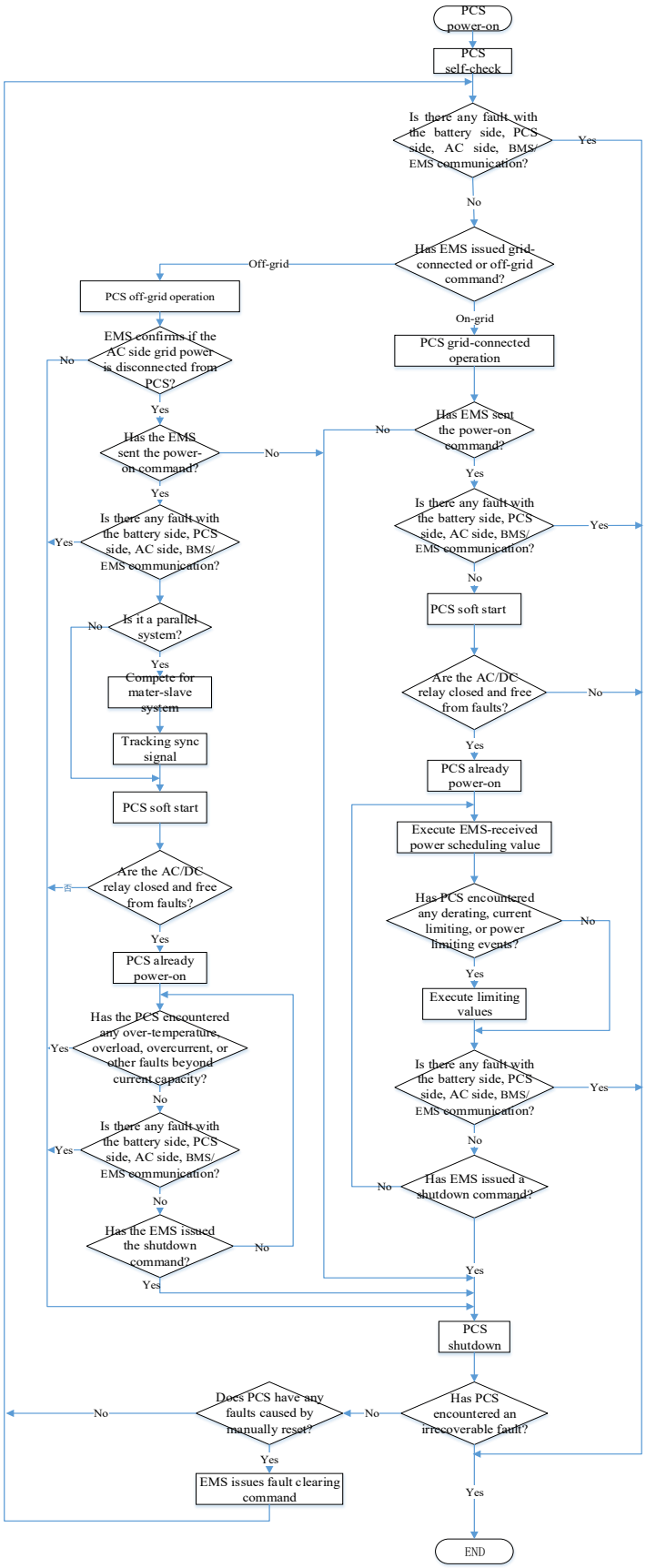


Diagram4-3 PCS Workflow Diagram

4.4 Complete Power-down Procedure

When replacing the converter module or performing maintenance, a complete power-down operation is required. Follow these steps:

- Execute the PCS shutdown operation by issuing a shutdown command through the backend or EMS.
- Disconnect the upstream DC switch on the DC side of the PCS.
- Disconnect the upstream AC switch on the AC side of the PCS.
- Wait 15 minutes to confirm that the energy storage components inside the PCS have discharged to a safe voltage level.

4.5 Emergency Shutdown Procedure

In the event of an emergency, follow these steps:

- Press the emergency shutdown button to trigger the local EPO alarm and shut down the PCS; remote EPO operation is also possible, where the BMS/EMS sends an EPO emergency stop signal to execute the PCS shutdown.

4.6 Disconnection Procedure

Dangerous

- After completing the complete power-down procedure, wait 15 minutes until the energy storage components inside the PCS have fully discharged before proceeding with cable disconnection.
- When maintaining the battery pack, always disconnect the corresponding DC switch of the PCS and the AC circuit breaker associated with that PCS to avoid electrical shock.

Before performing the cable disconnection, ensure that the PCS is in a complete power-down state. Follow these steps:

- Disconnect the DC side terminals.
- Disconnect the AC side terminals.

- ❖ Disconnect the communication quick-connect terminals.
- ❖ Disconnect the grounding wire.

4.7 Monitoring program usage and version information query

4.7.1 Hardware connection of the monitoring application

The connection monitoring application requires the use of the RS485 interface.
The RS485 port of PCS is defined as follows:

Diagram4-4 RS485 interface schematic diagram

Monitoring application RS485 (J4-7, J4-8): The RS485 communication terminals for the debugging backend and PCS.
Prepare an RS485 connection cable. Connect the + terminal of RS485 to J4-7 and the - terminal to J4-8. Then connect the other end to the serial port of the computer.
And thus, the hardware connection of the monitoring application has been completed.

4.7.2 Software connection of the monitoring application

The monitoring application needs to be obtained from the manufacturer. During the product installation process, there will be dedicated after-sales personnel to assist and provide the monitoring application.
The registration and usage steps for the monitoring application software are as follows:

- ❖ Obtain the License file
  The folder of the monitoring application provided by the manufacturer usually contains the License file.
  When you open the software "BgMon.exe", a dialog box will pop up. Enter the License provided by the manufacturer in this dialog box. The License can be manually input or imported by selecting a file. As shown in Diagram 4-5.

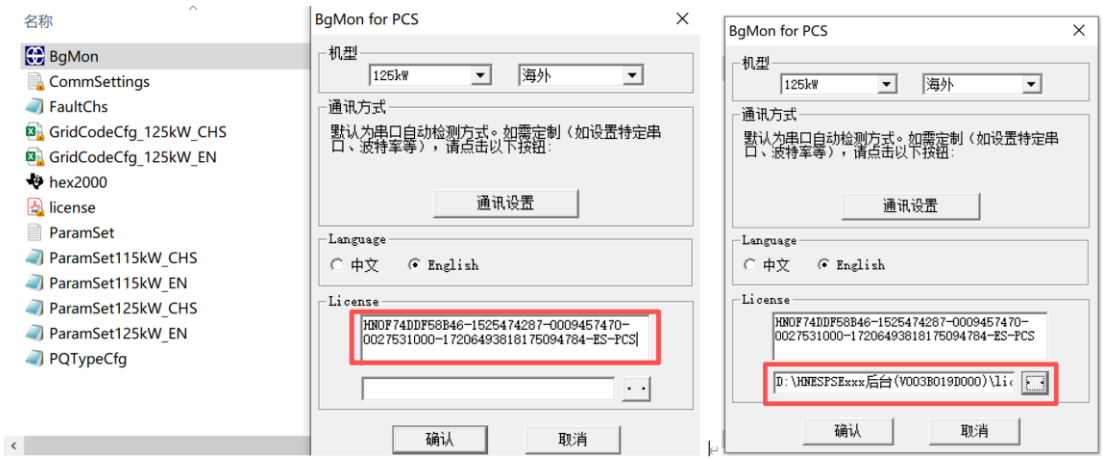


Diagram 4-5 Import License

❖ Select model information

After importing the License, proceed to select the product power type, language and communication method. Select the serial port connection mode for communication, and set the communication baud rate to the default value of 9600. As shown in Diagram 4-6.

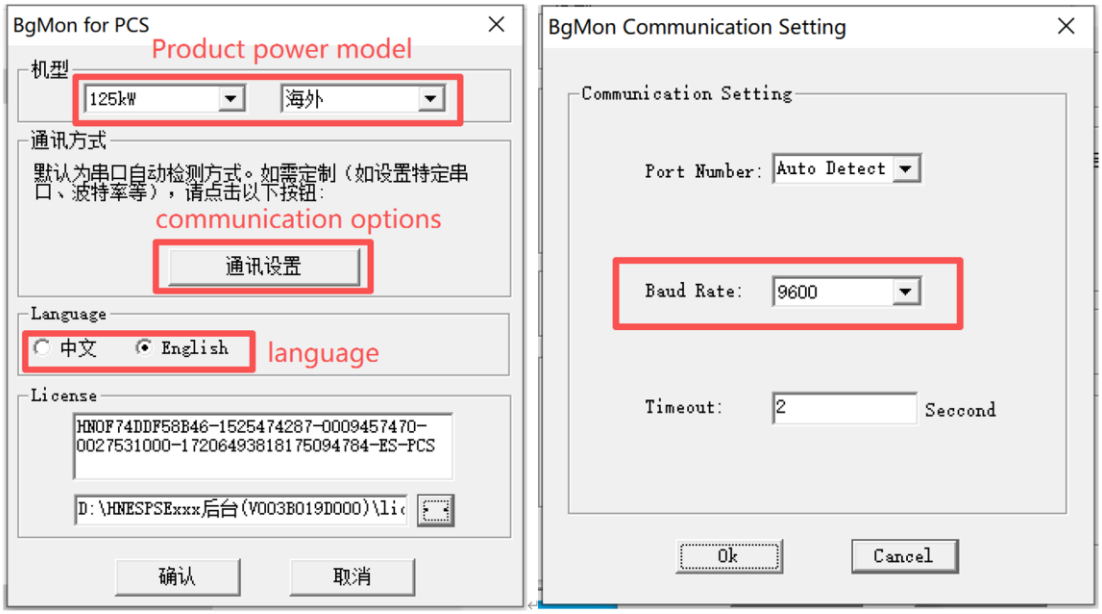


Diagram 4-6 Communication serial port selection

❖ Main page of the monitoring application

After selecting the serial port communication mode, one enters the main page of the monitoring application. You can query the status information of the inverter on the main page and perform operations such as inverter debugging. As shown in Diagram 4-7.

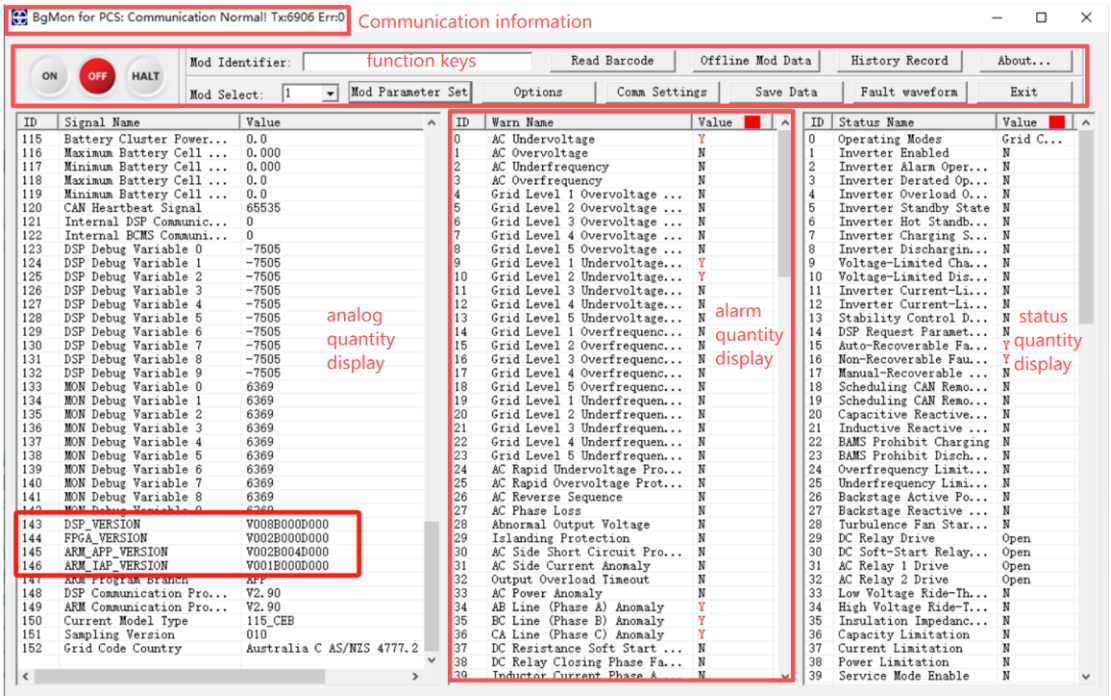


Diagram 4-7 Functional area division

4.7.3 Firmware version viewing

The firmware version of the converter can be viewed through the monitoring application. Instructions for how to view converter firmware version：

- ❖ Open the monitoring application.
- ❖ Find the version-related parameters in the signal name in the first column.
- ❖ DSP_VERSION, FPGA_VERSION, ARM_APP_VERSION and ARM_IAP_VERSION display the current firmware version information.

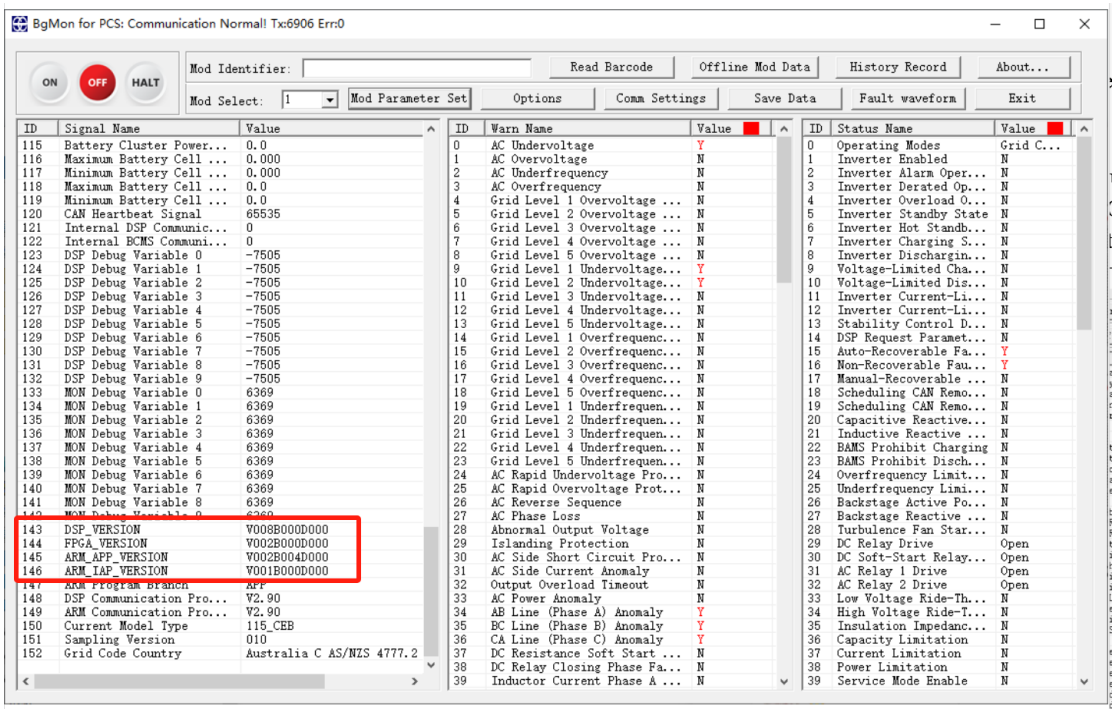


Diagram 4-8 Version Information Query

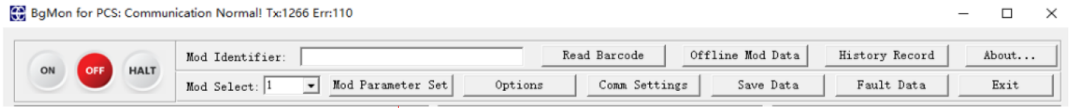
4.8 Country Code Configuration

4.8.1 Select/Activate Country Grid Code

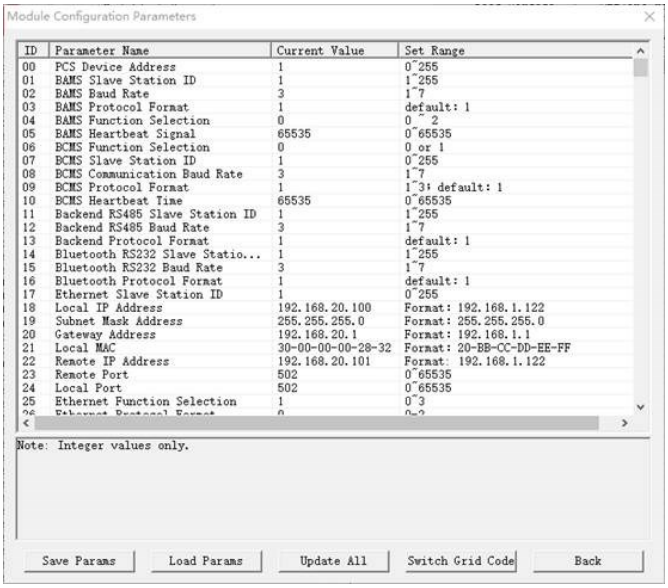
The inverter complies with AS/NZS 4777.2:2020 and supports the selection/activation of country grid codes, protection Settings, power quality response modes and regional Settings during the setup/debugging process.

The inverter supports regional Settings for Australia A, Australia B, Australia C and New Zealand. Once the relevant regions are successfully set, the power quality response mode and protection function of the inverter will automatically switch to that region to meet the requirements of that region.

The process for selecting/activating the country power grid code is as follows:



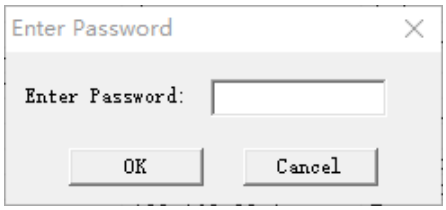
Step 1: Click on “Mod Parameter Set”;

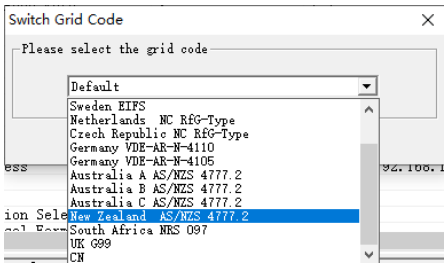


Step 2: Click on “Switch Grid Code”;

Step 3: Enter the password;

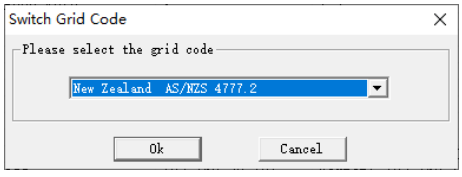
Note: Obtain the password from the manufacturer;

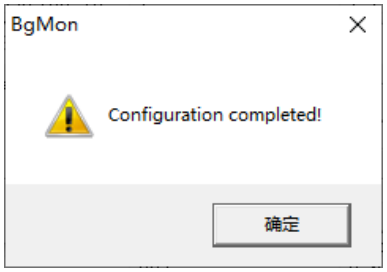




Step 4: Select the network code area and click “Ok”;

Prompt Configuration Completed!





4.8.2 View Country Grid Code

The current country/region grid code version of the converter can be viewed through the monitoring application.

Instructions on how to view the country grid code version of the converter:

- ❖ Open the monitoring application.
- ❖ Look for version-related parameters in the signal names in the first column.
- ❖ Parameter Grid Code Country shows the current version of the country grid code.

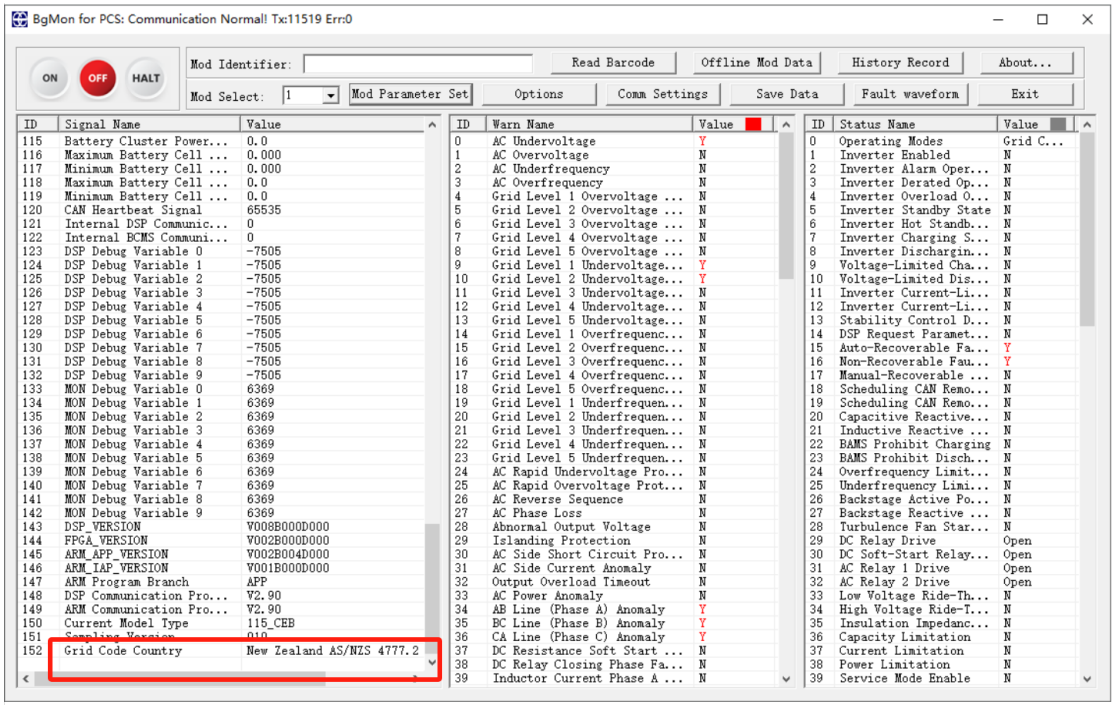


Diagram 4-9 National Version Information Query

Separate protection Settings and power quality response mode Settings：

Support the individual modification of protection parameters and power quality response modes during the debugging process.

- ❖ Open the monitoring application.
- ❖ Open the Mod Parameter Set and swipe down to find the parameters related to the protection Settings and power quality response mode.
- ❖ Set the power grid protection parameters and find the overvoltage parameters. The protection point and protection time represent the protection threshold and the time of tripping out of the power grid. Level 1 represents overvoltage 1 (U >), level 2 represents overvoltage 2 (U > >), and the same applies to undervoltage, overvoltage and underfrequency. It can be set according to the debugging needs.

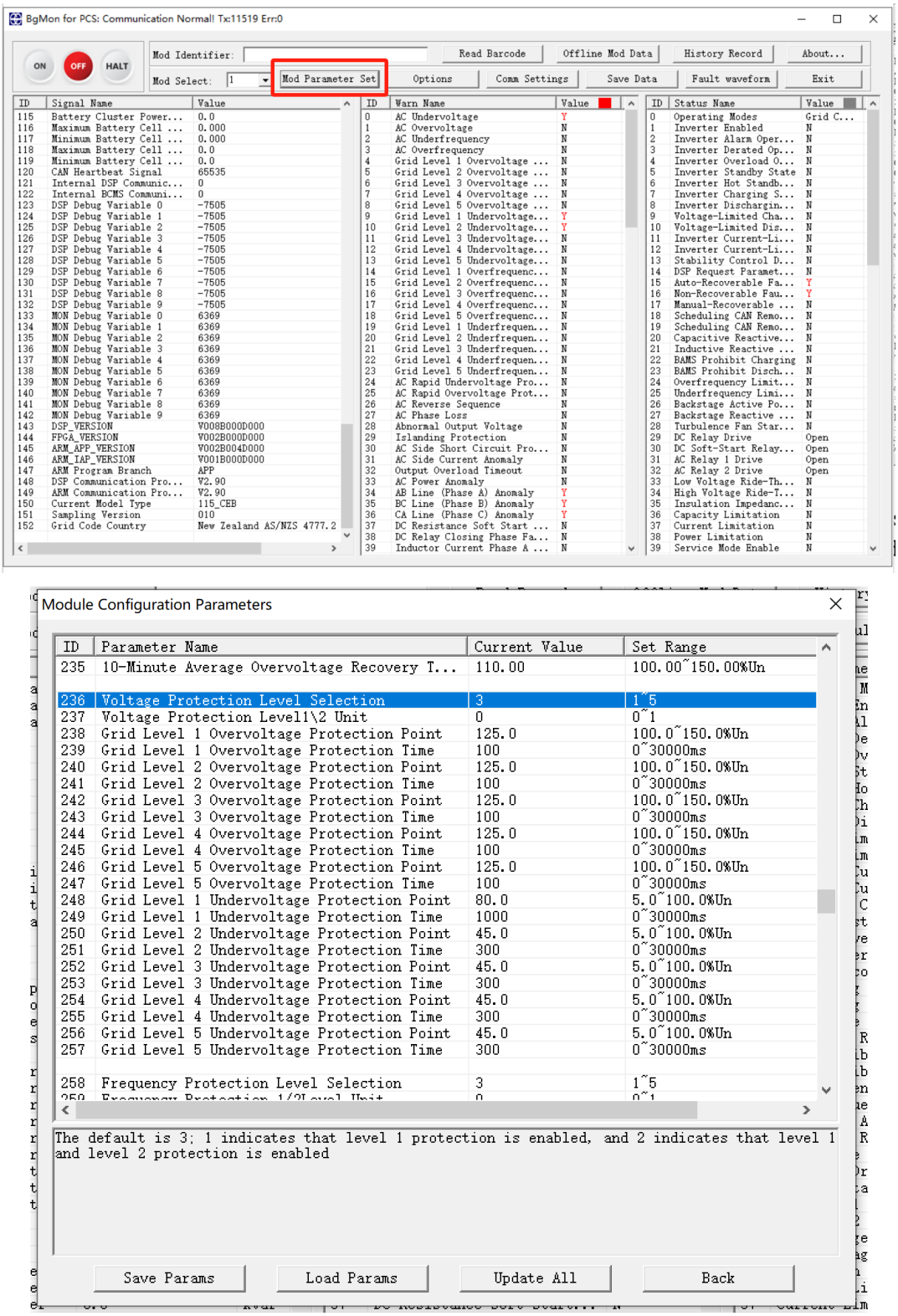
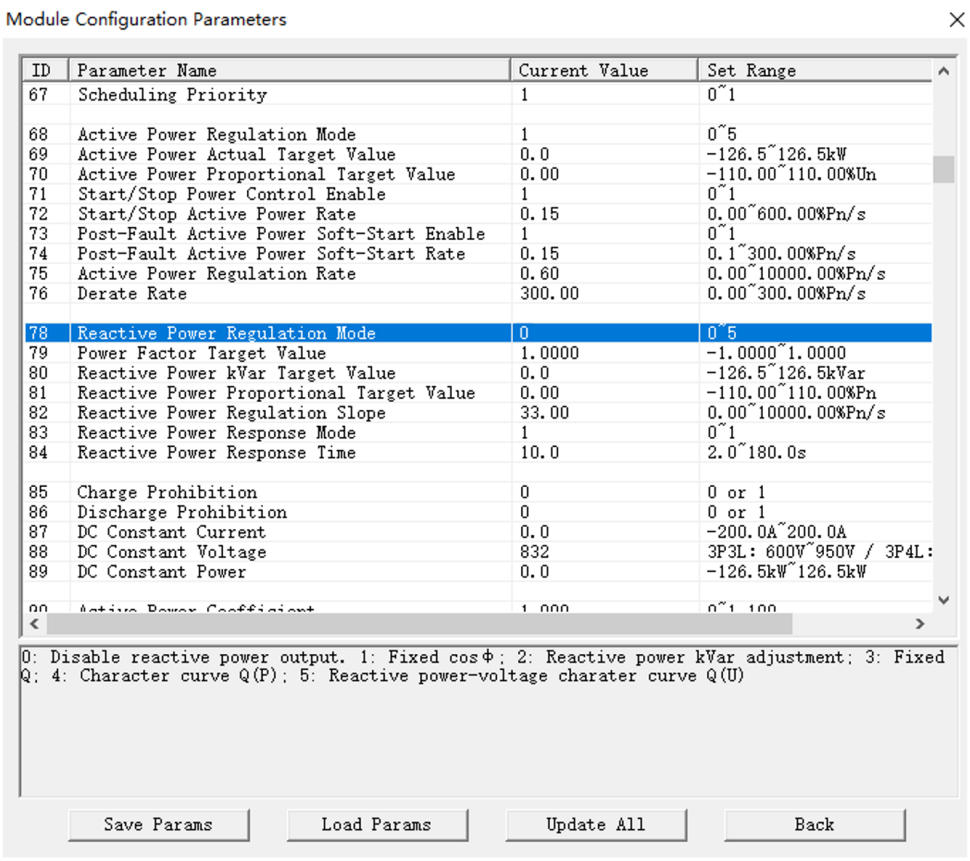


Diagram 4-10 Overvoltage and undervoltage protection settings

- power quality response mode setting, find the Reactive power regulation mode parameter, select the corresponding mode, and find the parameters under the corresponding mode for setting;



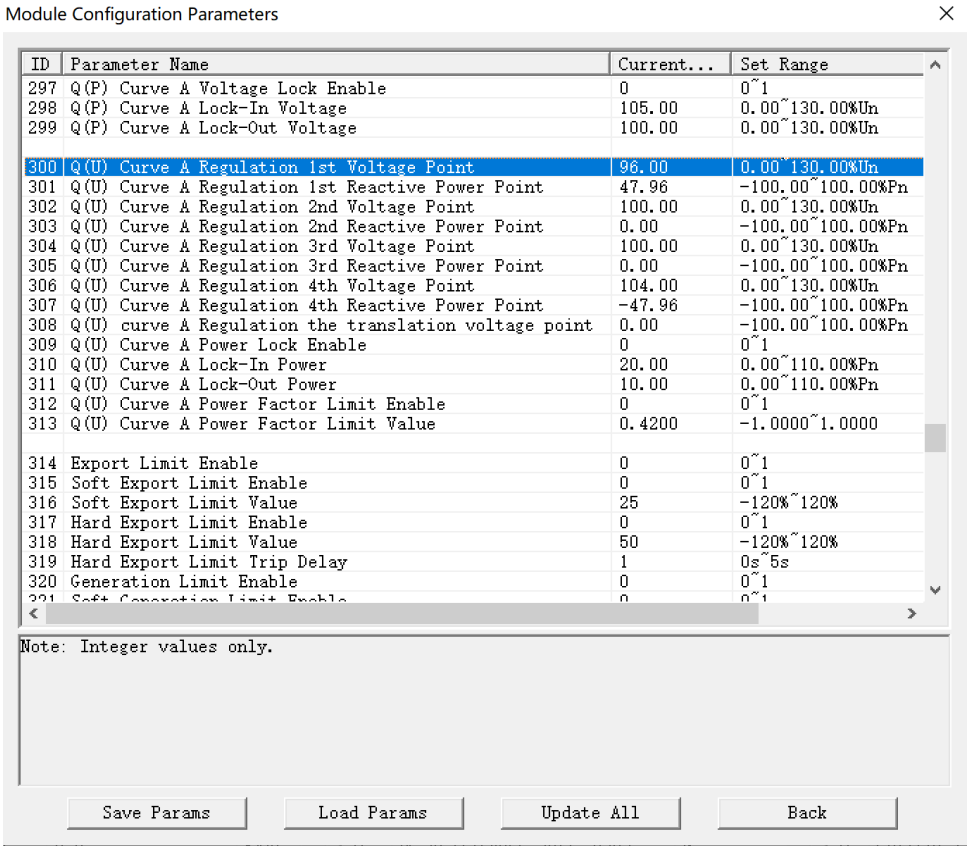


Diagram 4-10 Q(U) Curve Settings

❖ Set the voltage variation continuous operation and frequency variation continuous operation. Also find the corresponding Parameter Settings in Mod Parameter Set.

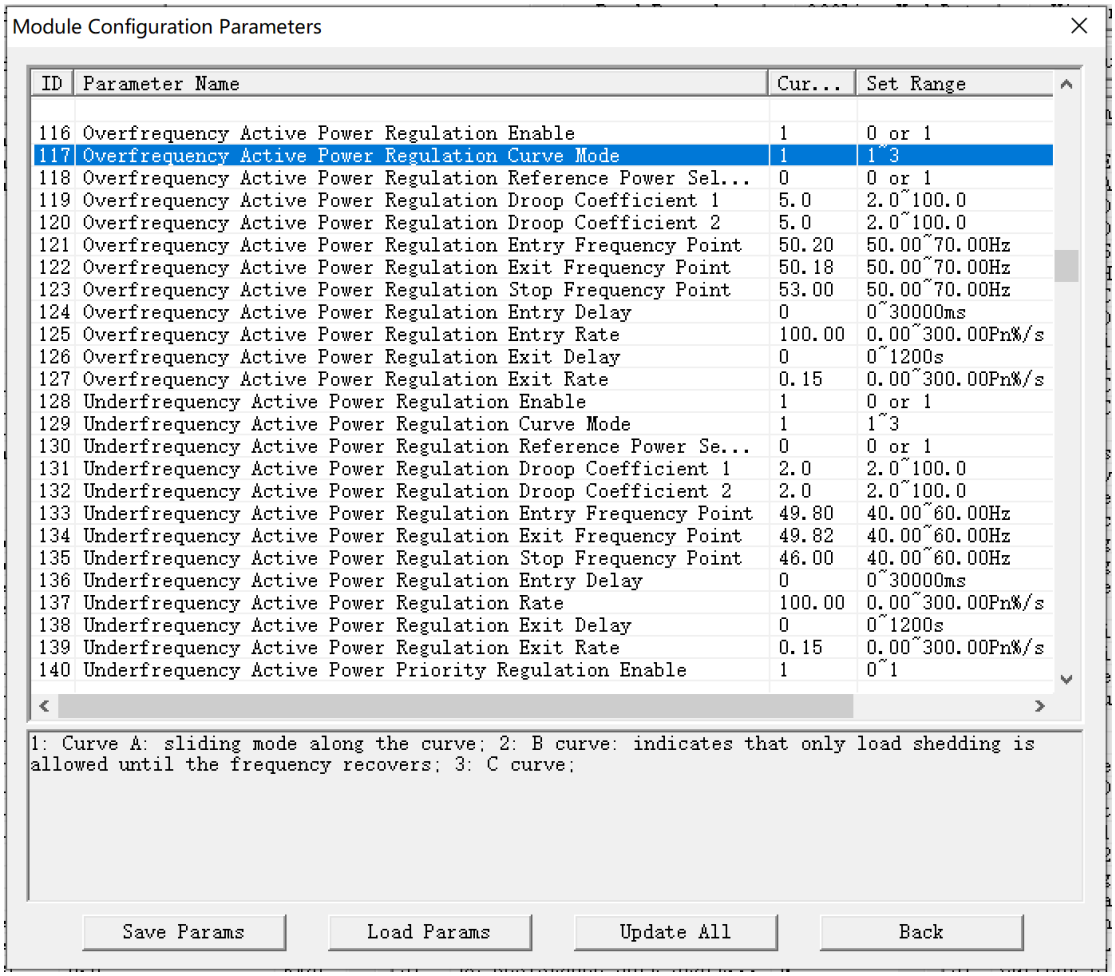


Diagram 4-11 LFSM Settings

❖ The above parameter Settings must be debugged by the professional engineers of the manufacturer or its authorized agent. The debugging is protected by a password. Please contact the manufacturer or its authorized agent to obtain the password.

4.9 Multiple inverter combinations

The three-phase inverter supports parallel grid-connected and off-grid operation of multiple units.
The wiring and debugging methods can be referred to in Chapter 3 Electrical Connection.

4.10 Generation limit and Export limit control

The power generation control function is used to control the active or apparent power

output level of the inverter or a combination of multiple inverters, so that it meets the predetermined power generation output level that may be less than the total fixed apparent power of the inverter or the combination of multiple inverters.
The converter supports two functions: power generation limit and export limit control.

4.10.1 Connect external measuring devices/controllers

The activation of the generation limit control and export limit control functions requires the connection of external measuring devices.
The manufacturers and models of electricity meters compatible with the converter are as follows：

Meter Model: ADL400N-CT
Manufacturer: Acrel Co., Ltd.

This electricity meter is an optional accessory. Please consult the manufacturer when placing an order for the converter.

The communication mode between the electricity meter and the converter is RS485. Schematic diagram of the electricity meter connection scheme：

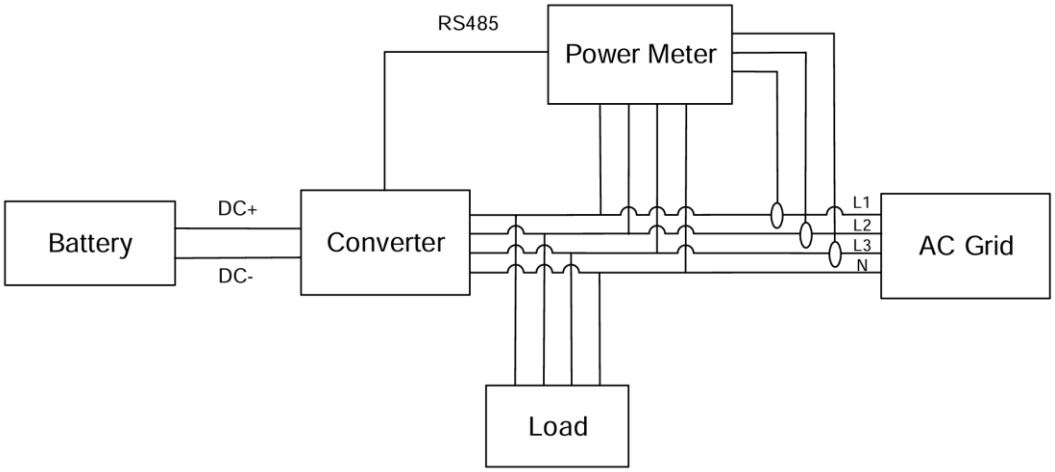


Diagram 4-12 Monitoring devices and solutions

The port connection diagram of the electricity meter is as follows：

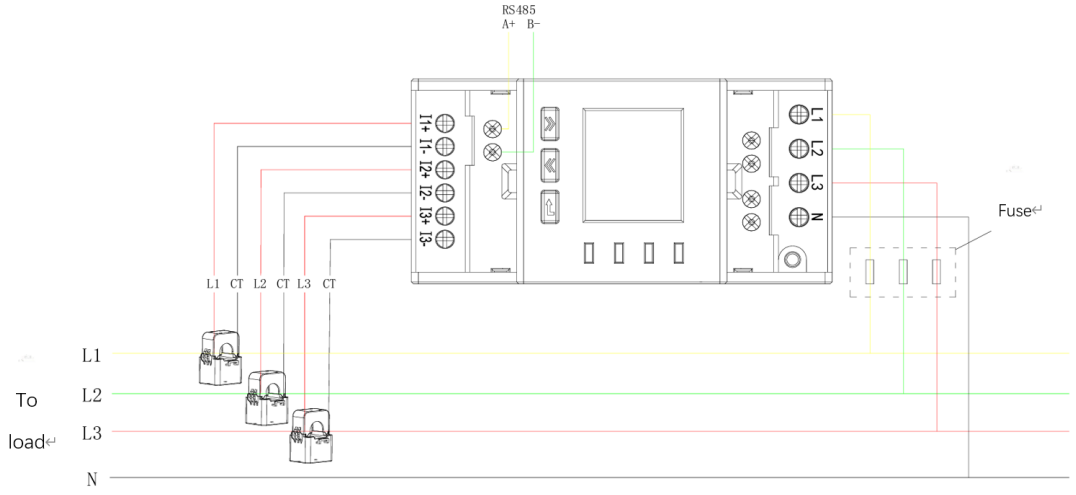


Diagram 4-13 Hardware connection of the electricity meter

The communication between the electricity meter and the converter is via the RS485 port.
The RS485 of the electricity meter is connected to ports 1 and 2 of the converter J3. The RS485 A+ of the electricity meter is connected to pin 1 of J3, and RS485 B- is connected to pin 2 of J3.

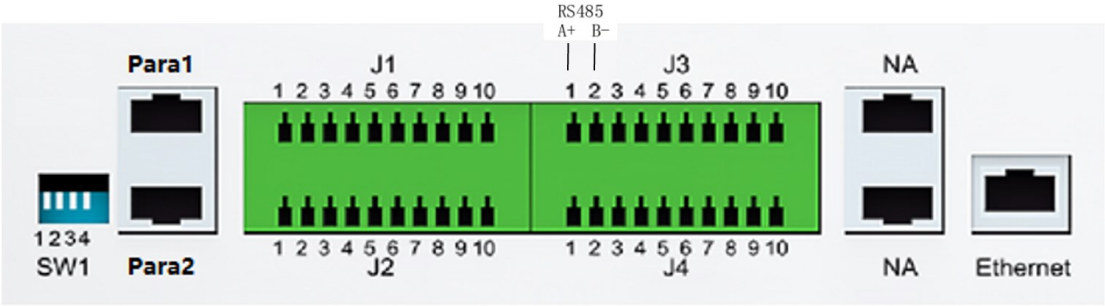


Diagram 4-14 Communication connection

4.10.2 Software Settings for power generation control functions

The adjustment of generation limit control and export limit control limits is achieved through the monitoring background.
Click on "Mod Parameter Set" in the monitoring background interface to find the parameters related to generation limit control.
The relevant parameters and functional descriptions are shown in the following table:

Table 4-1 Description of power generation control function

Generation limit control			
Parameter	Parameter function	Setting range	Setting step
Generation limit Enable	The enable position of the generation limit control function, with a setting value of "1", indicates that this function is enabled, and a setting value of "0" indicates that this function is disabled.	0：Disable 1：Enable	--
Soft Generation Limit Enable	The enable position of the soft generation limit control function, with a setting value of "1", indicates that this function is enabled, and a setting value of "0" indicates that this function is disabled.	0：Disable 1：Enable	--
Soft Generation Limit Value	The power setting limit of the generation soft limit control is set, and the output power level is controlled by adjusting this limit.	-120%Pn ... 120%Pn	1%Pn
Hard Generation Limit Enable	The enable position of the hard generation limit control function, with a setting value of "1", indicates that this function is enabled, and a setting value of "0" indicates that this function is disabled.	0：Disable 1：Enable	--
Hard Generation Limit Value	The power setting limit of the hard limit control for generation is set, and the output power level is controlled by adjusting this limit.	-120%Pn ... 120%Pn	1%Pn
Export limit control			
Parameter	Parameter function	Setting range	Setting step
Export limit Enable	The enable position of the Export limit control function, with a setting value of "1", indicates that this function is enabled, and a setting value of "0" indicates that this function is disabled.	0：Disable 1：Enable	--
Soft Export limit Enable	The enable position of the soft Export limit control function, with a setting value of "1", indicates that this function is enabled, and a setting value of "0" indicates that this function is disabled.	0：Disable 1：Enable	--
Soft Export limit Value	The power setting limit of the generation soft limit control is set, and the output power level is controlled by adjusting this limit.	-120%Pn ... 120%Pn	1%Pn
Hard Export limit Enable	The enable position of the hard Export limit control function, with a setting value of "1", indicates that this function is enabled, and a setting value of "0" indicates that this function is disabled.	0：Disable 1：Enable	--
Hard Export limit Value	The power setting limit of the hard limit control for generation is set, and the output power level is controlled by adjusting this limit.	-120%Pn ... 120%Pn	1%Pn

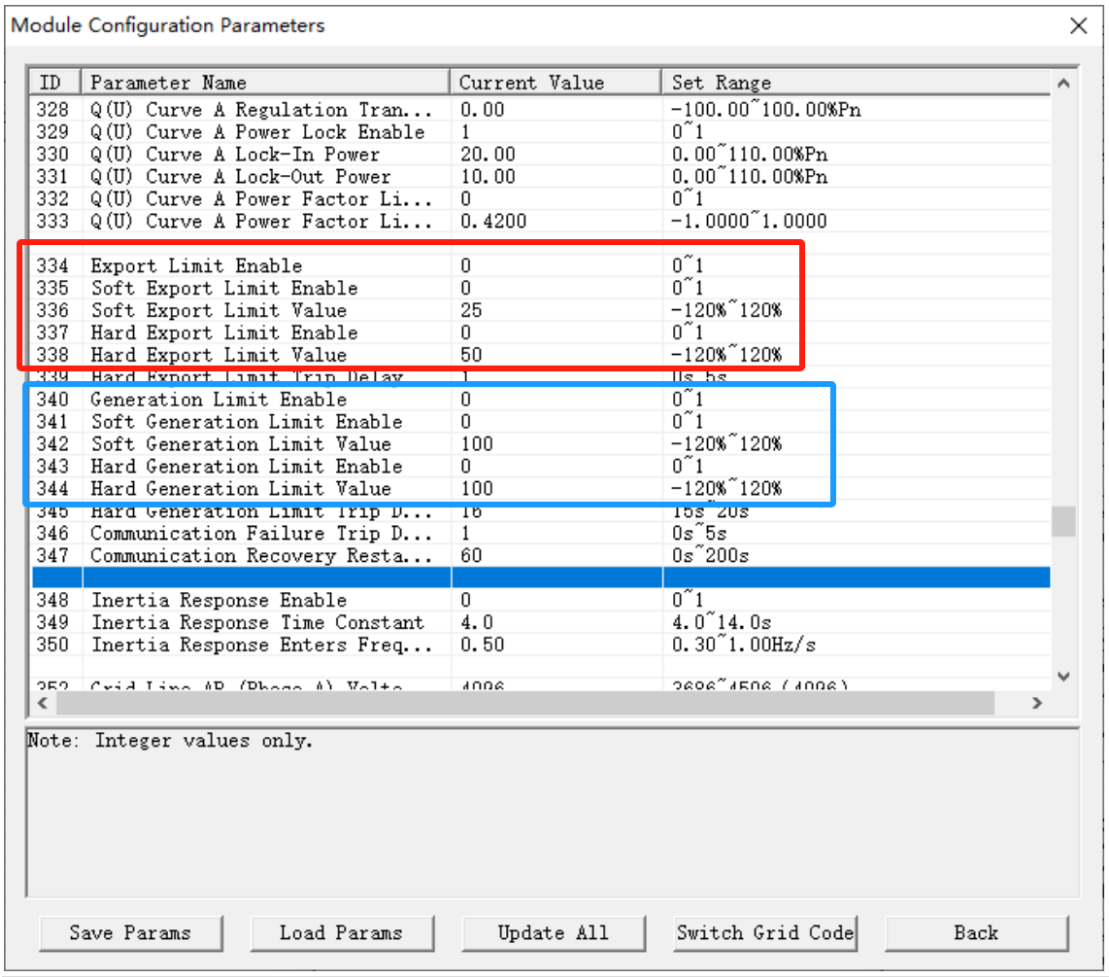


Diagram 4-15 Power Generation Control

The relevant limit values of the power generation control function are achieved by adjusting the above parameters. When debugging, please consult the professional engineers of the manufacturer or authorized agent.

Chapter 5: Events and Alarms

Warning

- ❖ Non-professionals should not handle PCS alarms or faults!
- ❖ When addressing PCS events, strictly follow the instructions outlined in this manual!

5.1 Events

Table 5-1 Events

Events	Explanation
Power-on	Displayed as "Power-On" when the power-on command is received from the backend.
Power-off	Displayed as "Power-Off" when the power-off command is received from the backend.
Grid-on operation	The module is in grid-connected operation status.
Grid-off operation	The module is in grid-off operation status.
PCS derated operation	The PCS operates at a reduced capacity as set.
PCS overload operation	The PCS operates according to the allowable overload value.
Charging status	PCS is on, and the charging current is greater than 0.5% of the rated current, displayed as "charging."
Discharging status	PCS is on, and the discharging current is greater than 0.5% of the rated current, displayed as "Discharging."
Voltage limiting charging	PCS is on, and the battery voltage has reached the charging voltage limit, displayed as "Voltage Limiting Charging."
Voltage limiting discharging	PCS is on, and the battery voltage has reached the discharging voltage limit, displayed as "Voltage Limiting Discharging."
Current limiting charging	PCS is on, and the charging current has reached the current limit, displayed as "Current Limiting Charging."
Current limiting discharging	PCS is on, and the discharging current has reached the current limit, displayed as "Current Limiting Discharging."
Charging forbidden	BMS reports that charging is prohibited.
Discharging forbidden	BMS reports that discharging is prohibited.
BMS operating	The Battery Management System is in normal operating status.
BMS main relay open	The battery main relay is open.
BMS main relay close	The battery main relay is closed.
BMS pre-charge relay	The battery pre-charge relay is open.

open	
BMS pre-charge relay close	The battery pre-charge relay is closed.

5.2 Alarms

When the PCS is running, if an abnormal condition is detected in the grid, battery pack, or PCS itself, the system will intelligently assess the situation, display the fault on the backend, and store it in the historical alarm records. The table below lists the alarm information, explanations of the alarms, and suggested handling methods.

Table 5-2 Fault Alarm Information

Alarm Information	Explanation	Suggested Handling Method
AC Voltage Abnormality	AC voltage is below the set lower limit or above the set upper limit.	Check if the AC voltage is within the specified range.
Inverter Voltage Abnormality	Inverter voltage is below the set lower limit or above the set upper limit.	Contact customer service.
Frequency Abnormality	AC frequency is outside the allowable range.	Check if the AC frequency is within the allowable range.
AC Current Abnormality	AC overcurrent, imbalance, or parallel operation current sharing fault.	Contact customer service.
Inductor Current Abnormality	Abnormal DC component in inductor current or uneven module inductor current.	Contact customer service.
Pre-Charge Fault	DC soft start failed.	Contact customer service.
Bus Voltage Abnormality	Bus overvoltage, undervoltage, or imbalance.	Contact customer service.
Battery Abnormality	BMS reports battery abnormality.	Check if the battery wiring, voltage, and current are normal.
DC Relay Fault	DC relay open circuit or short circuit.	Contact customer service.

AC Relay Fault	AC relay open circuit or short circuit.	Contact customer service.
IGBT Overtemperature	IGBT exceeds the set temperature.	Check if the air inlet and outlet are obstructed.
Internal Overtemperature	Control cabin exceeds the set temperature.	Check if the air inlet and outlet are obstructed.
Discharge Resistor Overtemperature	Discharge resistor exceeds the set temperature.	Contact customer service.
Fan Abnormality	Upper cabin cooling fan failure.	Contact customer service.
Auxiliary Power Supply Abnormality	Module auxiliary power failure.	Contact customer service.
Surge Protector Fault	AC/DC surge protector failure.	Contact customer service.
Scheduling Parameter Setting Error	Scheduling parameter setting error.	Check if the scheduling parameters are set correctly.
Emergency Shutdown	Module received an emergency stop signal.	Release the local or remote EPO button and clear the emergency stop signal.
External Communication Abnormality	Module communication with the backend is abnormal.	Check the communication cable between the module and the backend.
Internal Communication Abnormality	Communication between modules is abnormal.	Check the communication cables between modules.
Insulation resistance detection	The positive or negative bus is connected to ground	Check that the ground wire is connected correctly
Insulation Impedance Anomaly	Earth Fault alarm	Check the wiring of the system, including the DC side wiring and the grounding wire

Note: The earth fault alarm type is local indication.
The earth fault is detected before the converter is started. If the earth fault is detected, the red light of the panel fault indicator is always on.

Chapter 6: Maintenance and After-sales Service

6.1 Maintenance and Warranty Guidelines

- ❖ No maintenance during operation.
- ❖ Before maintenance, please cut off the power and wait for the internal capacitor to discharge completely. Use a multimeter or other instruments to measure the voltage between the metal parts that need to be touched and those that may be touched and the ground to avoid electric shock.
- ❖ Authorized maintenance only.

The power conversion system requires timely maintenance. The common maintenance items are shown in the following table.

Table 6-1 Power Conversion System maintenance project

Inspection area	Check items	Inspection items	Treatment measures	Maintenance cycle
Overall inspection	Appearance	Observe whether the inverter has any damage or deformation on its appearance	In severe cases, please replace it in time	Once every six months to once a year
	System cleaning	Check if there are any foreign objects or dust on the surface of the converter box	Clean up foreign objects and dust	
		Check if there are any obstructions or dust stains on the heat sink	Remove the obstructions and clean the dust	
System operation	Operating status	Is there any abnormal sound from the converter during operation	In severe cases, please replace it in time	Once every six months
	Operating parameters	When the converter is in operation, check whether all parameters are set correctly	Exclude abnormal Settings	
Connection part	Fall off, loosen	Check whether the cable connections are loose or detached	Tighten the connection as stipulated	The first test should be conducted half a year after the first test, and then every half a year to once a year thereafter
	Damage	Check if the cable is damaged, with particular attention to whether there are any cut marks on the skin where the cable comes into contact with the metal surface	In severe cases, please replace it in time	

Maintenance of the modules should only be carried out by engineers designated by ShenZhen HNergy Co., Ltd or its authorized agents. We're not responsible for any personal injuries or equipment damage caused by unauthorized maintenance, and such incidents are not covered under the warranty.

6.2 After-sales Service

If any equipment failure or damage occurs during the warranty period that is not due to human error or improper operation, our company will provide free repair services.

The following situations will incur repair and material costs:

- Damage caused by not following the instructions specified in the product manual.
- Damage resulting from unauthorized modifications.

Note: The interpretation of this manual is solely owned by Shenzhen HNergy Co., Ltd. Any changes to the content are subject to modification without prior notice.

Appendix A: PCS Parameter Table

Model: 125kW Power Conversion System	
Parameters for DC side	
DC Voltage	600～950Vdc (Three-phase three-wire) 650～950Vdc (Three-phase four-wire)
DC Max Power	154kW
DC Max Current	192A
Overvoltage Category	II
Rated Voltage	832V
Short Circuit Current	440A
Parameter for AC Side (Grid-interactive mode)	
Rated Voltage	400Vac
Rated Frequency【1】	50Hz/60Hz
Rated Output Current	180A
Max Output Current	217A
Rated Active Power	125kW
Max Active Power	150kW
Rated Apparent Power	125kVA
Max Apparent Power	150kVA
Output Harmonic	＜3%
Power Factor	＞0.99
Power Factor Range	-1~+1
Connection	3P+PE、3P+N+PE
Max Efficiency	98.5%
Overload Capacity	110% load，10mins；120% load，1min
DC Component	＜0.5%（Rated output current）
Overvoltage Category	III
Parameter for AC Side (Off-grid)	
Rated Output Voltage	400Vac
Rated Frequency【1】	50Hz/60Hz

AC Voltage Harmonic	＜3%（Linear load）
Rated Output Current	180A
Max Output Current	217A
Rated Apparent Power	125kVA
Max Apparent Power	150kVA
Environmental Index	
Pollution degree	PD2
Working Temperature	-40℃~60℃（>45℃ derating）
Storage Temperature	-40℃~70℃
Humidity	0～100%（No condensing）
Altitude	4000m（>2000m derating）
Noise	<70dB
Protection	AC overcurrent protection, AC overvoltage protection, AC short-circuit protection, Anti-islanding protection, DC reverse polarity protection
General Parameter	
Dimension (W*D*H mm)	800*800*235mm
Installation	Vertical installation / Horizontal installation
Weight	95kg
Protection Class	Control compartment IP66, power compartment IP20
Cooling Method	Intelligent forced air cooling
Storage type	Electrochemical energy storage
Inverter topology	Non-isolated
Active anti-islanding method	Current injection method
Communication	
Communication Interface	RS485/Ethernet
BMS	RS485、CAN
Protocol	MODBUS RTU/MODBUS TCP/IEC104/CAN
Display	LED，Bluetooth (Optional)

Note [1]: The factory default setting is 50Hz; 60Hz can be configured through software settings.