



User Manual

SPH-B(V1.0)

Copyright © Xiamen KehuaHengshengCo.,Ltd.2015.All rights reserved.

No part of this document may be reproduced or transmitted in any form or by any means without prior written consent of Xiamen KehuaHengshengCo.,Ltd.

Trademarks and Permissions



and other Kehua trademarks are trademarks of Xiamen KehuaHengsheng Co., Ltd.

All other trademarks and trade names mentioned in this document are the property of their respective holders.

Notice

The purchased products, services and features are stipulated by the contract made between Kehua and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specification in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute a warranty of any kind, express or implied.

XIAMENKEHUA HENGSHENG CO.,LTD.

Address:	No.457, Malong Road, Torch High-Tech Industrial Zone, Xiamen, Fujian, China
Manufacturer:	ZHANGZHOU KEHUA TECHNOLOGY CO., LTD.
Postal Code:	361000(XIAMEN), 363000(ZHANGZHOU)
Website:	www.kehua.com
E-mail:	service@kehua.com
The Customer Service Telephone:	400-808-9986
Tel:	0592-5160516
Fax:	0592-5162166

Foreword

Summaries

Thank you for choosing thePV energy storage grid-tied inverter SPH-B product!

This document gives a description of thePV energy storage grid-tied inverter SPH-B, including the features, performance, appearance, working principles, installation, operation and maintenance, etc.

Please save the information after reading,in order to consult in the future.

Symbol Conventions

The manual quotes the safety symbols, these symbols used to prompt users to comply with safety matters during installation, operation and maintenance. Safety symbol meanings is as follows.

Symbol	Description
 DANGER	Alerts you to a high risk hazard that could, if not avoided, result in serious injury or death.
 WARNING	Alerts you to a medium or low risk hazard that could, if not avoided, result in moderate or minor injury.
 CAUTION	Alerts you to a potentially hazardous situation that could, if not avoided, result in equipment damage, data loss, performance deterioration, or unanticipated results.
	Safety Prompting. if not avoided, it will result in serious injury or death.
	Risk of burns from hot surface. The product can get hot during operation. Avoid contact during operation. Allow the product to cool down sufficiently before carrying out any work. Wear personal protective equipment such as safety gloves.
 NOTE	Provides additional information to emphasize or supplement important points in the main text.

Product standard: NB-T 32004-2013

Nomenclature

Complete designation	Designation in this document
PV energy-stored grid- tied inverter SPH-B	Inverter
Lithium battery	Battery pack

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 001 (2015-08-13)

First issue.

Contents

1 Safety Description.....	1
1.1 Safety Announcements	1
1.2 Notice for Use	3
2 Overview.....	4
2.1 Product Intro.....	4
2.1.1 Appearance.....	4
2.1.2 Symbols	6
2.2 Features	7
2.3 Work Principle.....	8
2.4 Work MODE	9
3 Installation,Connection and Communication	11
3.1 Packaging List.....	11
3.2 Installation Environment	12
3.3 Installation Position.....	13
3.4 Installation.....	14
3.5 Electrical Connection	16
3.5.1 Wire Connection of AC Output Side.....	17
3.5.2 Wire Connection of DC Input Side	18
3.5.3 Wire Connection of Battery Packand Inverter	20
3.6 Communication	20
3.6.1 Sampling of CTCCurrent Transformer	20
3.6.2 Communication of Smart Meter.....	21
3.6.3 External Communication	22
3.6.4 Built-in Wi-Fi Communication	24

3.6.5 USBCommunication	24
4 Startup and Shutdown	25
4.1 Start the Inverter	25
4.2 Shutdown the Inverter	25
5 Operation	27
5.1 Operation Panel	27
5.2 Setting forFirst Startup	28
5.2.1 Startup	28
5.2.2 Initial Setting.....	29
5.3 MainMonitoring Interface	31
5.4 Function Menu Interface	32
5.5 Run Info.	33
5.6 EnergyQuery	35
5.6.2 Input Energy Query.....	35
5.6.3 Output Energy Query	37
5.6.4 Daily Battery Energy	39
5.7 LogQuery	40
5.7.2 Active Alarms.....	41
5.7.3 Historical Alarms	41
5.8 Settings.....	42
5.8.2 User Setting.....	43
5.8.3 Administrator Setting	45
5.9 ON/OFF	49
5.10 System Information.....	50
6 Maintenance	52
6.1 Cleanness	52
6.2 Maintenance	52
6.3 Replace Fuse	53
7 Troubleshooting.....	54

7.1 Fault Alarm.....	54
A Technical Specifications	57
B Acronyms and Abbreviations	61

1 Safety Description

This chapter introduces the safety announcements. Please read this user manual carefully prior to installing the device. It provides important information on safe and efficient installation.

1.1 Safety Announcements



DANGER

Danger to life due to high voltages of PV array

When exposed to sunlight, the PV array generates dangerous DC voltage which is present in the DC conductors and the live components of the inverter. Touching the DC conductors or the live components can lead to lethal shocks. If you disconnect the DC connectors from the inverter under load, an electric arc may occur leading to electric shock and burns.

- Do not touch uninsulated cable ends.
 - Do not touch the DC conductors.
 - Do not touch any live components of the inverter.
 - Have the inverter mounted, installed and commissioned by qualified persons with the appropriate skills only.
 - If an error occurs, have it rectified by qualified persons only.
-



DANGER

Danger to life due to high voltages on the battery pack

Lethal voltage is present at the pin connector for the power cable. Reaching into the pin connector for the power cable can result in lethal electric shock.

- Do not open the battery pack.
-

- Do not wipe over the battery pack with a damp cloth.
 - Leave the protective caps on the pin connectors for the power cable and the data cable until the inverter cables are connected to the battery pack.
-



DANGER

Danger to life due to electric shock

Touching an ungrounded PV module or an array frame can cause a fatal electric shock.

- Connect and ground the PV modules, array frame and electrically conductive surfaces so that there is continuous conduction. Observe the applicable local regulations.
-



WARNING

Risk of chemical burns from electrolyte or toxic gases

During normal operation, no electrolyte can leak from the battery pack, and no toxic gases can from. Despite careful construction, if the battery pack is damaged or fault occurs, it is possible that electrolyte may be leaked or toxic gases formed.

- Store the battery pack in a cool and dry place.
 - Do not drop the battery pack or damage it with sharp objects.
 - Only set the battery pack down on its back, i.e., on the side with the mounting lugs.
 - Do not install or operate the battery pack in potentially explosive atmosphere or areas of high humidity.
 - If moisture has penetrated the battery pack (e.g. due to a damaged enclosure), do not install or operate the battery pack.
 - In case of contact with electrolyte, rinse the affected areas immediately with water and consult a doctor without delay.
-



CAUTION

Damage to the inverter due to electrostatic discharge

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Ground yourself before touching any component.
-



CAUTION

Damage to the display or the type label due to the use of cleaning agents

If the inverter is dirty, clean the enclosure, the cooling fins, the enclosure lid, the type label, the display, and the LEDs using only water and a cloth.



Risk of high-temperature

The surface temperature of the inverter may reach 75°C. When the inverter is working, do not touch the surface, or, it may cause scald.

1.2 Notice for Use

The design of the inverter and battery pack meets the national safety standards, which can ensure the human safety. But if used improperly, it still may cause electric shock or scald. This manual includes important prompting for installation and maintenance, it is necessary to read this manual carefully before use.

While installing the inverter and battery pack, performed the installation according to the following requirements:

- The inverter should be installed steady.
- Ensure that the grounding connection of the inverter is good.
- The electrical installation should be accord with all the correlative laws and regulations and standards.
- Install the inverter and battery pack on the basis of the user manual.
- Only authorized professional technicians can open the case and do the maintenance.

2 Overview

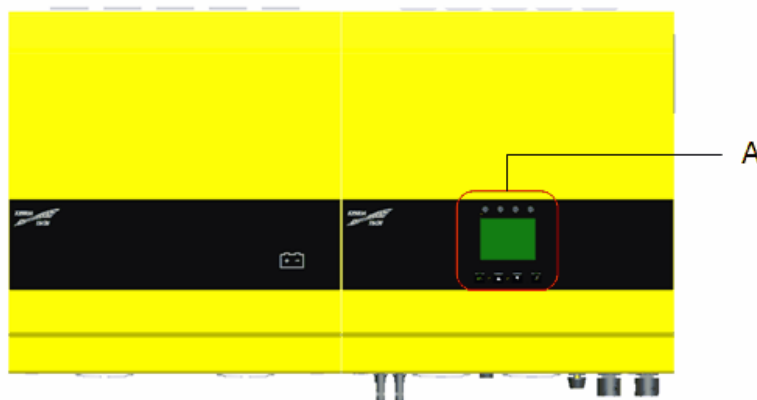
This chapter mainly introduces the appearance, symbols, features and work principle of the inverter.

2.1 Product Intro

The inverter is mainly used in the PV energy-stored grid-connected system in household and used with battery pack to achieve self-sufficiency of the energy in household and improves the match of PV power generation and load in household. It is designed for use indoor, which is special suitable for the application in house and small business system.

2.1.1 Appearance

The appearance of inverter and matched battery pack is as shown in Figure 2-1, Figure 2-2.



Battery pack

Inverter

Figure 2-1 Appearance

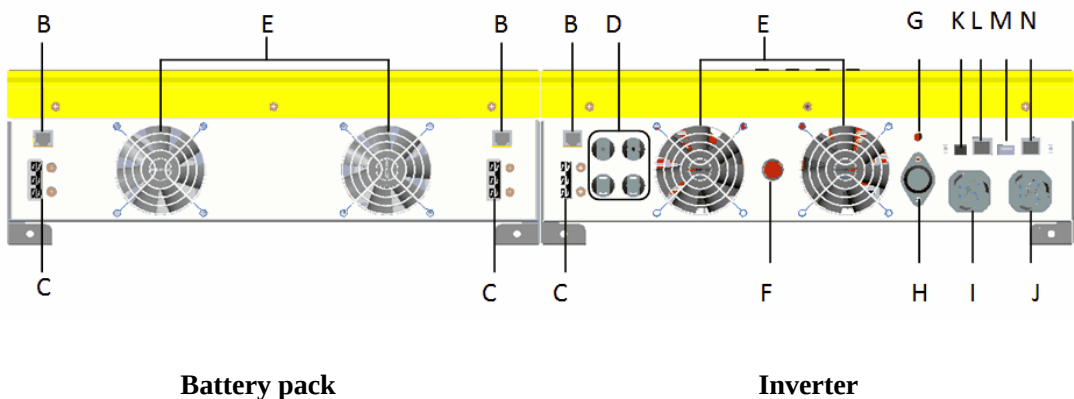


Figure2-2 Rear panel

Position	Name	Description
A	Operation panel	Includes LEDs, LCD and button.
B	BMS communication port	CAN communication port, it is used to communicate between the inverter and battery pack.
C	Battery port	It is used to connect the battery pack and the inverter.
D	DC input port	It is used to connect the PV array.
E	Fan	It is used to cool down the inverter and battery pack.
F	SWITCH button	Since there has no voltage in PV array at night, the relay inside the battery pack stay in disconnected status, and the inverter cannot start normally. After connecting the inverter and battery pack, press SWITCH button for 20s to start the inverter. Before pressing the switch, please ensure that the grid connector is connected to grid, or, it will not start normally.
G	Wi-Fi antenna	Built-in Wi-Fi antenna, used for wireless communication.
H	Installation position of fuse	It is used to install fuse. 30Afuse is recommended.
I	Grid port	It is used to connect with grid.
J	Load port	It is used to connect with load.

Position	Name	Description
K	Sampling port of current transformer	It is used to sample the grid current.
L	Communication port of smart meter	RS485communication port, it is used for communication of the inverter and smart meter.
M	USB port	It is used to export the historical data,import and export the configuration.
N	PC communication port	RS485 communication port, it is used to communicate with PC. It can also connect the matched Wi-Fi to realize wireless communication.

2.1.2 Symbols

Symbols on Inverter

Sign	Description
	WEEE designation Do not dispose of the product together with the household waste but in accordance with the locally applicable disposal regulations for electronic waste.
	Observe the documentation Observe all documentation supplied with the product.
	Danger to life due to high voltages The product operates at high voltages. All work on the product must be carried out by qualified persons only.
	Observe the waiting time of 30 minutes
	Danger This symbol indicates that the inverter must be additional grounded if additional grounding or equipotential bonding is required locally.

Sign	Description
	Risk of burns from hot surfaces The product can get hot during operation. Avoid contact during operation. Allow the product to cool down sufficiently before carrying out any work. Wear personal protective equipment such as safety gloves.

Symbols on Battery Pack

Sign	Description
	Danger to life due to high voltages The battery pack operates at high voltages. All work on the battery pack must be carried out by qualified persons only.
	Observe the documentation Observe all documentation supplied with the battery pack and the inverter.
	Risk of chemical burns
	Do not dispose of the battery pack together with the household waste but in accordance with the locally applicable disposal regulations for batteries.
	Fire, naked light and smoking prohibited.
	Recycling code

2.2 Features

- Adopts double-channel high-efficient MPPT technology, which can obviously improve the use ratio of PV power generation.
- Adopts high-frequency full bridge bidirectional converter technology.
- Battery charging and discharging adopt bidirectional DC/DC technology.
- Provides emergency power supply, which guarantees the safety of power supply for user.

- Intelligent energy storage project, optimize the cost of power.
- Adopts the design with little power dissipation, and the standby power dissipation in nighttime is very small.
- Adopts the fan with intelligent speed control and low noise.
- Intelligent battery charging management system, avoid over-charge, over-discharge and prolong the life span of the lithium battery.
- Accurately record the input and output electric capacity and battery charging & discharging capacity in latest 20 years.

2.3 Work Principle

Matched using the inverter and battery pack and smart meter to form household application of PV energy-stored grid-tied system, it can reduce the impact of PV generating to grid, enhance the grid capacity of adopting for PV generating, and at the same time, achieve self-sufficiency of the energy in household and improves the match of PV power generation and load in household, and also, reduce the relying of grid, guarantee the stability of grid. Under the circumstance of power outage of grid, it can supply emergency power for important load to use.

The PV array provides PV voltage, and stabilize the busbar voltage through boost circuit, at the same time, realizes the max. power point tracking (MPPT). The busbar voltage transform to mains through inverting. In grid-tied mode, it can send energy to grid, in off-grid mode, it can supply power for load directly.

When the PV energy is sufficient, it supplies power for load, besides, the surplus energy will be stored in battery, when the PV energy is not enough in nighttime, the battery will supply needed energy. The battery charging and discharging use a common main circuit to realize energy bidirection flow.

When the system working normally, it acts as inverter. When it charges battery by mains, it acts as rectifier. The inverter and rectifier use a full-bridge circuit together, which realizes the circulating bidirection, simplifies the circuit, save the cost and enhance the use ratio of the component.

As shown in Figure 2-3, the reform of PV energy-stored system to grid is small, and it can be adjusted and controlled, and switch between charging and discharging according to time setting (store energy at night and discharge in daytime).

The system block diagram of the inverter is as shown in Figure 2-3.

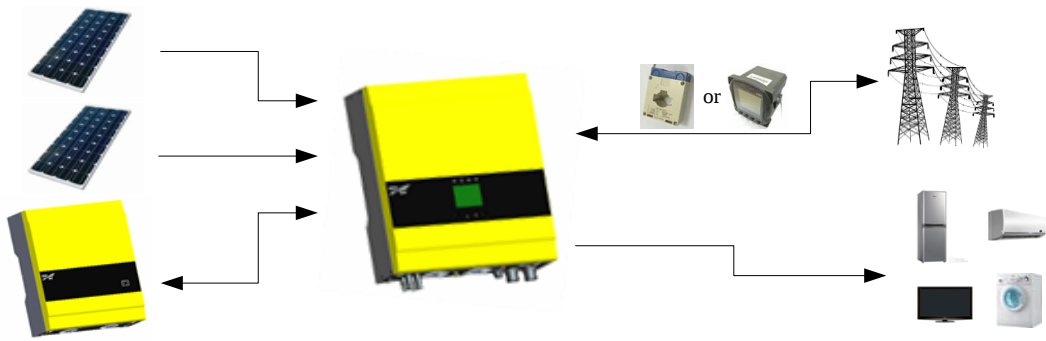


Figure2-3 System block diagram

**NOTE**

You can choose current sensor or smart meter either.

2.4 Work MODE

The work mode of the inverter includes standby, off-grid mode, grid-connected mode and fault.

Standby

When the inverter works normally, if it receives the shutdown instruction of screen or upper computer, it will turn to standby status.

Off-grid mode

Independent inversion function. It can stabilize the output voltage and frequency. When the grid is power outage or stay in independent system, the system can supply power for the load, which ensures normal life power supply in sudden power outage. At this moment, the inverter stay in discharging status.

Boost1 and Boost2 carry out MPPT, battery discharges to achieve stabilivolt of busbar. On the inversion end, it outputs according to load needs.

When the battery is about to fully charged, the control chip sends the instruction of power limiting to limit the output power of Boost1 and Boost2 until the input power and output power is balanced.

Grid-tied mode

In grid-tied mode, the inverter has two mode: grid-tied energy-stored mode and grid-tied balance mode.

In grid-tied energy-stored mode, the grid charge the battery in prior in the period whenever the power is cheap, if the PV energy exists, it works in MPPT status and charge the battery, after the battery is fully charged, it turns to inverting from rectification.

In grid-tied balance mode, it achieves busbar stabilizing by DC/AC. The PV power supply power for load in prior. When the PV energy is sufficient, it will charge the battery, but if the battery is full, it will feedback the surplus energy to grid. When the PV energy is not enough, the short part will be supplied by battery.

Fault

When the system detects fault, if the system is working, it will stop working immediately, and disconnect with grid and load. At this status, the alarm indicator lights on, buzzer beeps, LCD displays the current fault. User can deal with the fault according to display and Table in section 7.

3 Installation,Connection and Communication

This chapter mainly introduced the installation and wire connection of the inverter, including packaging list, installation environment, installation position, electrical connection, communication connection, etc.

3.1 Packaging List

Check the scope of delivery for completeness and any externally visible damage. Contact your distributor if the scope of delivery is incomplete or damaged.

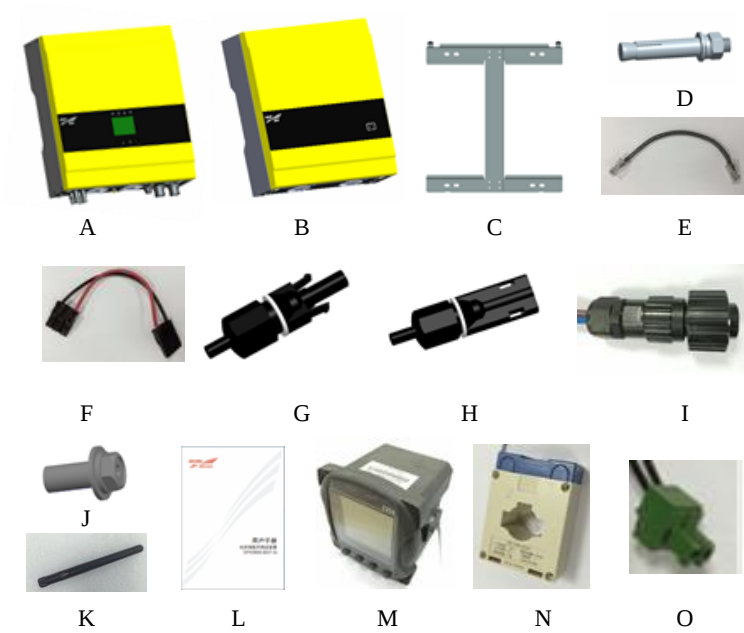


Figure3-1 Packaging list

Position	Quantity	Description
A	1	Inverter
B	1	Battery pack
C	2	Mounting bracket

Position	Quantity	Description
D	8	M8*60 expansion bolt
E	1	Battery communication wire
F	1	Connection wire of battery pack
G	2	DC+ connector (equipped with 1.5m wires)
H	2	DC- connector (equipped with 1.5m wires)
I	2	AC connector
J	4	M6*14 bolt
K	1	Wi-Fi antenna
L	1	User manual
M	1	Smart meter (optional)
N	1	Current transformer (optional)
O	1	Connector assembly (optional)

3.2 Installation Environment

- The installing position should be enough to install the inverter and battery pack side by side, and maintain a minimum clearance around the unit, as shown in Figure3-2.
- The area where the PV Inverter installed should be as dry as possible in order to extend their service life.
- Install the device indoor and keep the surrounding temperature below 40℃.
- Provide good ventilation for PV Inverter to ensure that heat is dissipated adequately.
- Install the PV inverter on a wall with enough bearing capacity.
- Ensure that install the device in the place where children cannot touch.

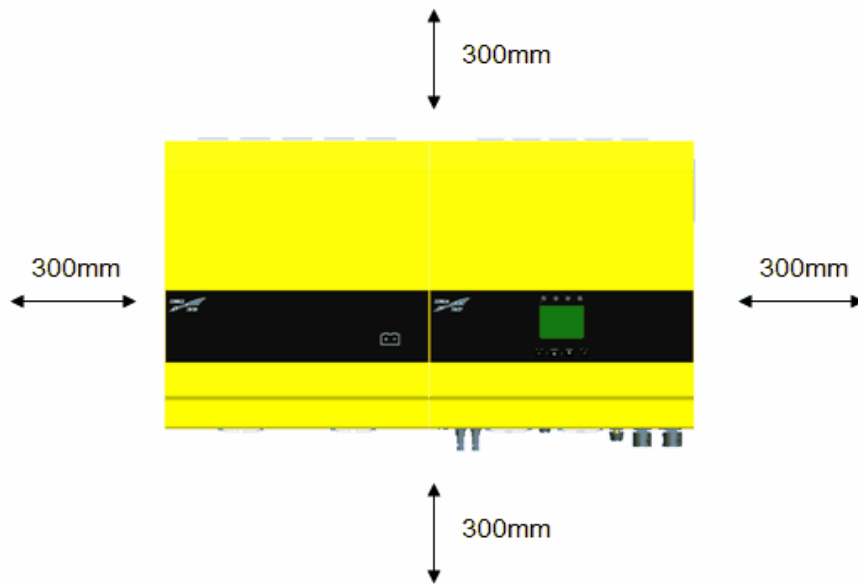


Figure 3-2 Installation clearance

3.3 Installation Position

- The unit has been designed for vertical or tilted backwards by max. 15° .
- Install the device at eye level to make it easy to operate and read the display.
- Don't install the PV inverter forwards.
- Never install it horizontally.

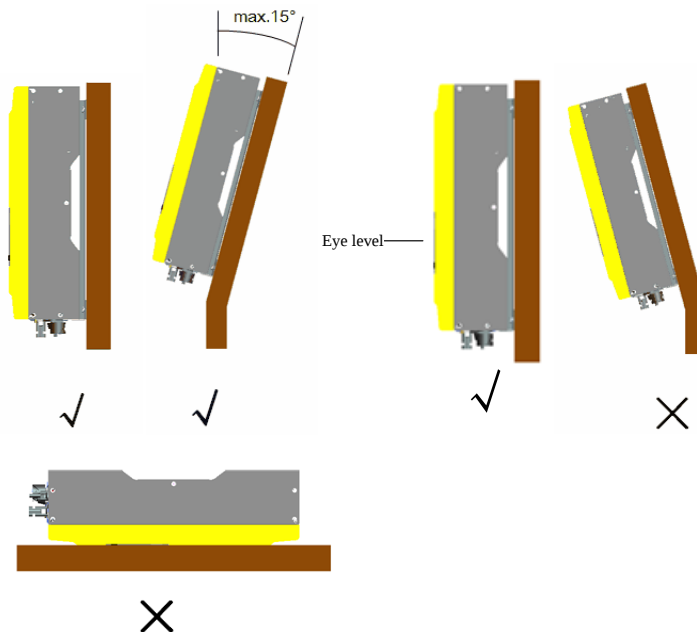


Figure 3-3 Installation position

3.4 Installation

- Step 1 Determine the installing position and drill 8 screw hole in proper height, the space of each hole is as shown in Figure3-4.



NOTE

The mounting bracket can help to determine the installation hole. Keep the drill be vertical to the wall, and without shake. The depth of the hole must be the same, the diameter of the hole is 10mm, the depth should be within the range of 40~45mm. Clean the dust in the hole, and measure the depth of the hole. If the depth exceeds 45mm or less than 40mm, the expansion cannot be installed or screwed down.

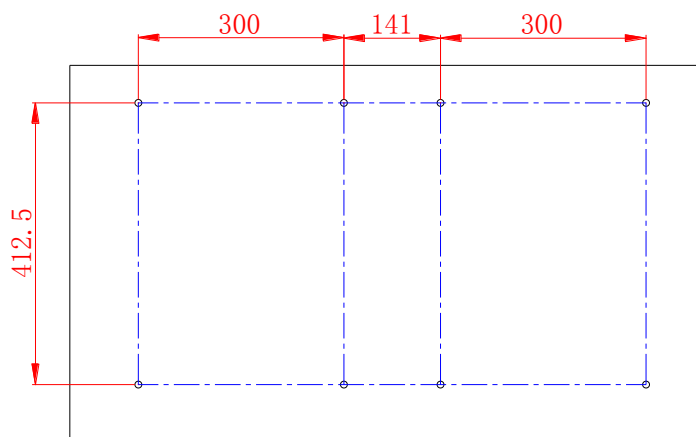


Figure3-4 Installation size

- Step 2 After drilling, install the expansion bolt, as shown in Figure3-5, into the hole with rubber hammer, align the hole of mounting bracket and expansion bolts, fix it with flat gasket, spring gasket and nut, as shown in Figure3-6.



NOTE

Pay attention to the orientation of mounting bracket.



Figure3-5 Expansion bolt

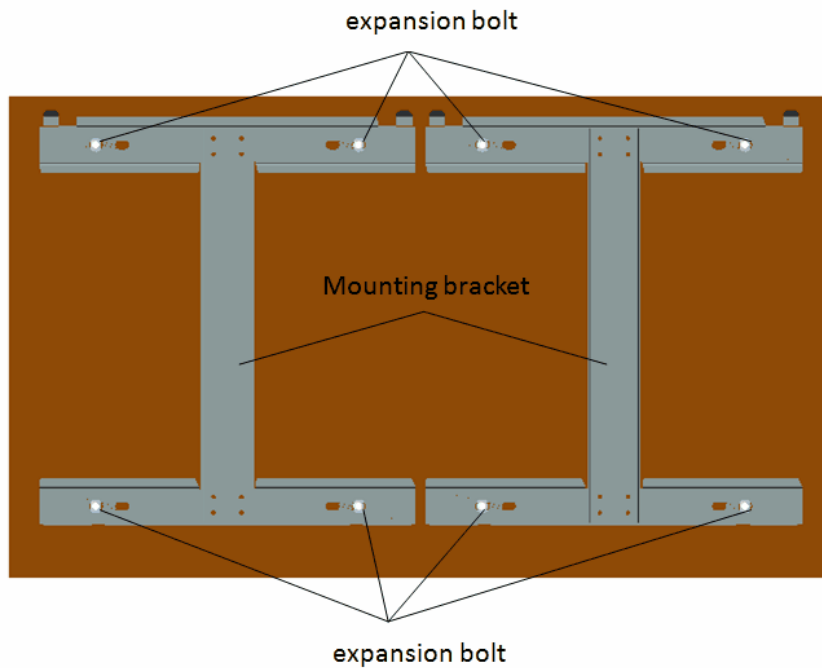


Figure3-6 Installation position of the expansion bolt

- Step 3 After installing the mounting bracket, hang the inverter and battery pack onto the mounting bracket, install the battery pack first, and then install the inverter. And screw up the bolts. as shown in Figure3-7.



NOTE

Install the battery pack on the left, install the inverter on the right.

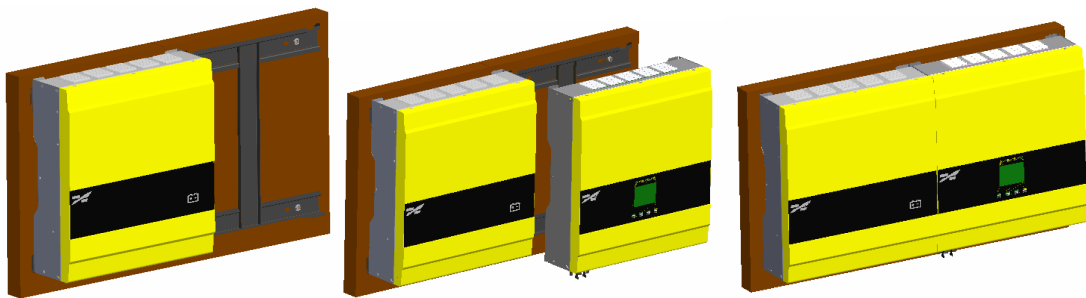


Figure3-7 Installation order

- Step 4 Fix the inverter and the battery pack from bottom with bolts M6, as shown in Figure3-78.

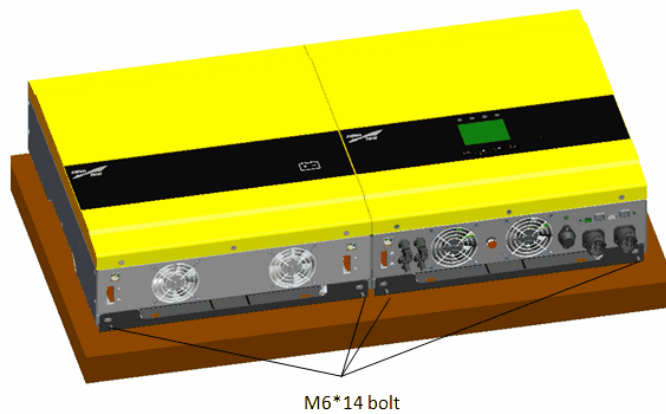
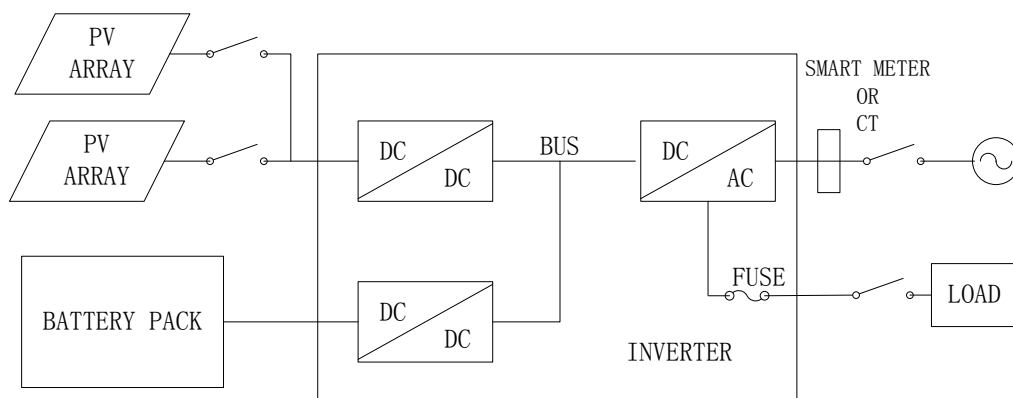


Figure 3-8 Installation diagram of bottom bolt

----End

3.5 Electrical Connection



CAUTION

All the operation and wire connection should be performed by qualified professional, which is to ensure all electric installation meet the safety standards.

For human safety, please use the fittings that manufacturers provided. If any non-original fittings are used, we cannot guarantee the electric safety, EMC and the device safety.

There has no switch on the inverter, it runs automatically. To ensure safety power outage with load, it needs to connect external breaker in addition.

The breakers on DC side and AC side: adopt proper breaker according to actual needs.

Adopt suitable input, output and grounding wire diameter (recommended AWG10).

Use the wires equipped in the accessory to connect the battery wire connection of the inverter.

3.5.1 Wire Connection of AC Output Side

The equipped AC connector is as shown in Figure 3-9.



Figure 3-9 AC connector

- Step 1 Disconnect the breaker, ensure that the device will not connect again.
- Step 2 Prepare cables. Peel the isolation layer of the wire end for 7mm to bare them.
- Step 3 Loosen the bolts of AC terminal, straighten the cables and cross them through the terminal module (the three cables are L, N, and PE corresponding), as shown in Figure 3-10. Insert the end of L, N and PE to the corresponding end of the connector and lock the bolts. The polarity has been marked beside the hole.



Figure 3-10 Inner AC connector

- Step 4 After fixing the three cables and terminal, install each module of AC connector together, as shown in Figure 3-11.

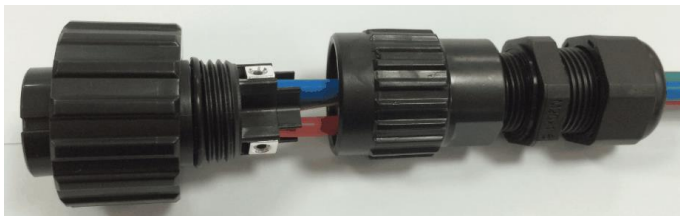


Figure 3-11 Assembling of the AC connector

- Step 5 Repeat the above steps, prepare 2 sets of AC connector, connect the end of one set to mains input, for the other set, connect the load.
- Step 6 Connect the 2 sets of AC connector to the inverter, and avoid wrong polarity connection, as shown in Figure 3-12.



Figure 3-12 Connection of AC connector

---End



CAUTION

When connecting the AC terminals, pay attention to that do not press the isolation layer of lead, or, it may result in bad contact.

Ensure that connect the live wire to terminal L, neutral wire to terminal N, grounding wire to terminal PE.

Pay attention to that do not reversely connect the grid and load connectors.

3.5.2 Wire Connection of DC Input Side

The equipped DC+ connector and DC- connector is as shown in Figure 3-13 and Figure 3-14.



Figure3-13 DC+ connector



Figure3-14 DC- connector

The assembling step of DC connector is as follows.

- Step 1 Disconnect the input breaker of PV array, ensure that the device will not connect again.
- Step 2 Peel the isolation layer of the connector wire end for 7mm to bare them.
- Step 3 Connect the DC+ end of the connector to PV+, connect the DC- end of the connector to PV-.
- Step 4 Butt joint the DC connector and the inverter.



Figure3-15 Connection of DC connector

----End



CAUTION

Before connecting the PV array to the DC end of the inverter, it needs to measure the voltage. The voltage of DC end cannot exceed the max. DC input voltage, or, it will damage the inverter.

The max.short-circuit current of DC input should be less than the max. DC input current of the inverter.

Before connecting the polarity to DC end of the inverter, ensure that the polarity is right.

3.5.3 Wire Connection of Battery Pack and Inverter

Step 1 Connect the BMS communication port of the inverter and that of battery pack by network wire.

Step 2 Connect the inverter and battery pack by power wire, as shown in Figure3-16.



Figure3-16 Wire connection of battery communication wire and power wire

----End

3.6 Communication

3.6.1 Sampling of CT Current Transformer

The inverter is equipped with **I GRID** sampling port, which is used to connect with the matched current mutual inductor, as shown in Figure3-17.



Figure3-17 Wire connection of grid current sampling

- Step 1 Connect the red wire of equipped green connector assembly to S1 of transformer, connect the green wire of equipped green connector assembly to S2 of transformer with proper length wire, as shown in 0.

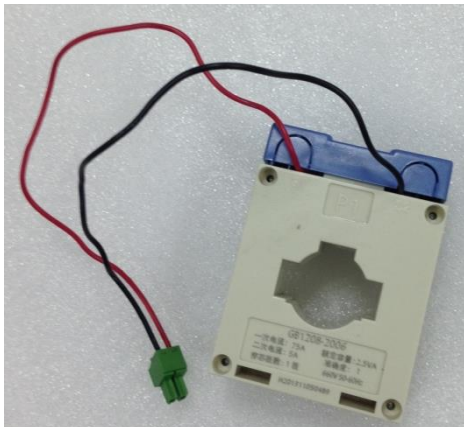


Figure3-18 Wire connection of current transformer

- Step 2 Connect the live wire of grid-tied AC connector through current transformer P2 to grid.
- Step 3 Connect the green connector assembly to the inverter.

----End

If there has CT fault after startup, exchange the connection of S1 and S2.

3.6.2 Communication of Smart Meter

The inverter is equipped with a port for the communication of smart meter, that is RS485 port, the connection with smart meter is as shown in Figure 3-19.



Figure3-19 Wire connection of smart meter

If you have got smart meter or purchased the matched smart meter, the port can realize the communication of the inverter and smart meter. When connecting with the inverter, it needs to peel the isolation layer of network wire. Connect the wire core to RJ45 on the basis of standard TIA/EIA568B, and use a dedicated wire plier to clamp the wire. In network wire, pin1 is white orange, blue 4 is RS485+A; orange pin2, white blue 5 is RS485-B, as shown in Figure3-20.

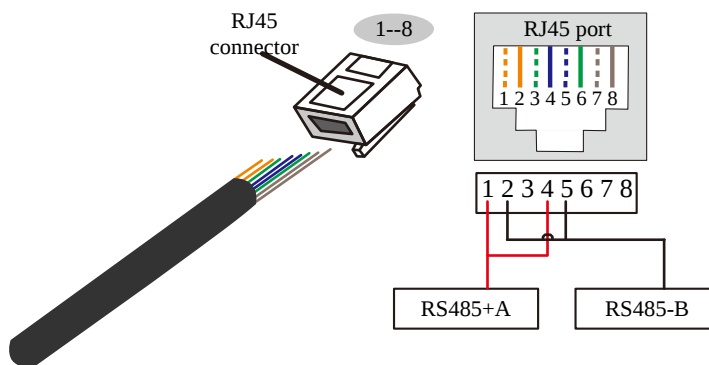


Figure3-20 Make the RJ45 network wire

NOTE

The current transformer is mainly used to sample the grid current of mains total input, which is to work out the total energy of the family. The smart meter is mainly used to uploading the total energy of the family, and the inverter schedules the PV and battery power according to the energy. They can be set through LCD.

3.6.3 External Communication

The inverter is equipped with a PC communication port, RS485 communication port, which can connect to PC to monitor, as shown in Figure3-21.

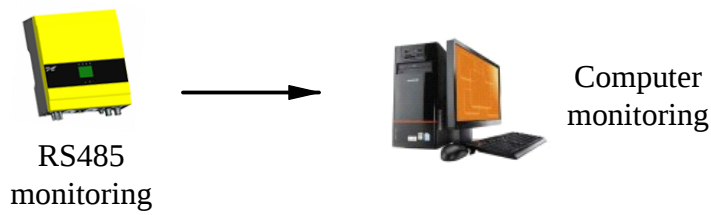


Figure3-21 Wired monitoring

It can also connect with matched external wifi module to realize long-distance monitoring, as shown in Figure3-22.

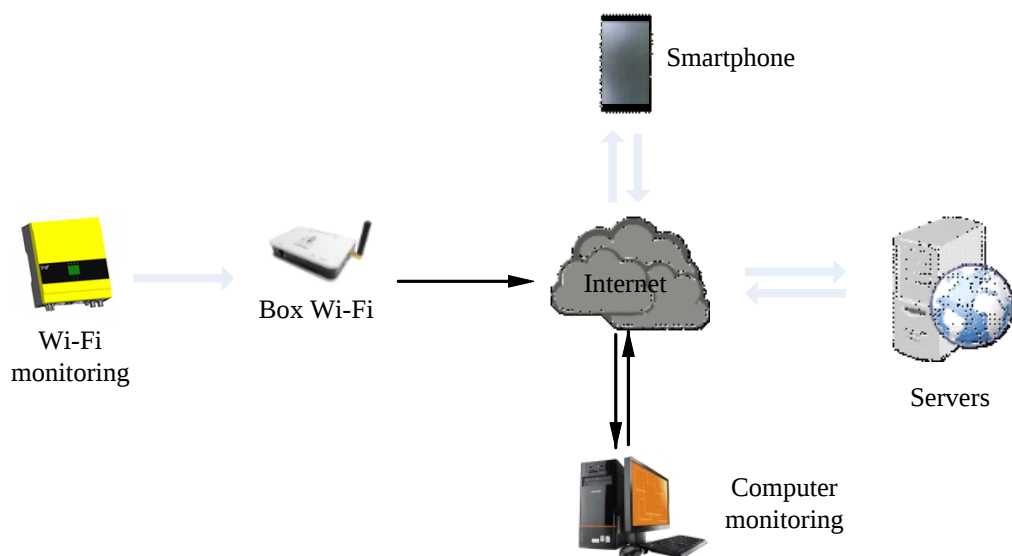


Figure3-22 Wireless monitoring

For detailed information, please consult corresponding manual of communication product. The connection of inverter is as the same as that of smart meter, as shown in Figure3-23.



Figure3-23 Wire connection of PC communication port

3.6.4 Built-in Wi-Fi Communication

The inverter is with a built-in wifi module for communication. It provides communication treaty, user can develop corresponding monitoring software according to the communication treaty.

3.6.5 USB Communication

The inverter is equipped with a USB port. Insert U disk, user can import and export the data in parameters setting and carry out the upgrade through operation panel.

4 Startup and Shutdown

This chapter mainly introduces the startup and shutdown of the inverter.

4.1 Start the Inverter



CAUTION

Ensure that the PV input voltage, battery voltage, AC voltage are all in the allowable range of the inverter.

Ensure that the connection of the inverter and grid and load is proper and reliable.

Ensure that the polarity of DC connector is connected properly and reliably.

Start the inverter according to following steps.

Step 1 Close the AC breaker.

Step 2 Close the DC breaker of PV array.

If the voltage of PV array is enough, the inverter will start.

If the inverter does not start, press SWITCH button on the panel for 20s to start the inverter.

After starting, the initial interface of the LCD will show “current status: standby” on the bottom left corner.

Step 3 Start the inverter through ON/OFF interface, as shown in Section 5.

----End

4.2 Shutdown the Inverter

Shut down the inverter according to following steps.

- Step 1 Shut down the inverter through ON/OFF interface, as shown in Section 5
- Step 2 Disconnect the AC breaker.
- Step 3 Disconnect the DC breaker.
- Step 4 Disconnect the battery wire connection.
- Step 5 The LED indicator and LCD will light off in 1min.

----End



WARNING

After power off first time, the battery still has electricity, please do not short connect the input of the battery!

If it isn't first startup, once connect the battery, the inverter will start directly, so, please ensure that the PV connector and AC connector have been connected properly.

5 Operation

This chapter mainly introduces the operation of the inverter.

5.1 Operation Panel

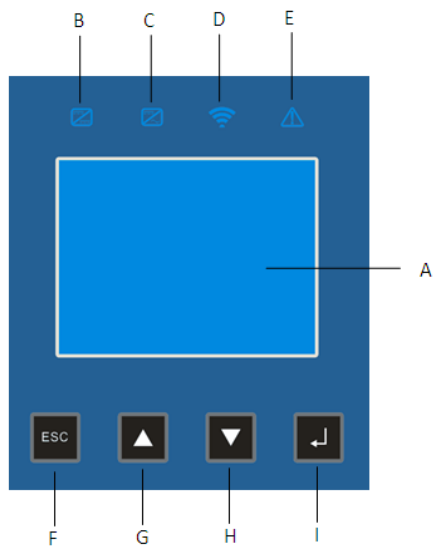


Figure5-1 Display and operation panel

Table5-1 Illustration

NO.	Name	Function
A	LCD	1. Display the current running status and basic information. 2. Looks up the running information, electric capacity statistics, running records, system information. 3. Sets the system parameters in different limits of authority. 4. Realizes startup and shutdown.
B	DC/DC indicator	During working, it lights on.
C	DC/AC indicator	In inverting mode, it lights on.

D	Wifi indicator	If the Wi-Fi module is working, it lights on.
E	Fault indicator	If there has any fault, it lights on.
F	ESC button	In function and parameter selection, it is used as a direction button (in parameter setting, it is used to decrease number, long press it, the number will rolling-over quickly).
G	▲ button	In function and parameter selection, it is used as a direction button (in parameter setting, it is used to add number, long press it, the number will rolling-over quickly).
H	▼ button	In function selecting, it is used to enter the selection; in parameter selecting and setting, it used to enter next level.
I	ENTER button	In function selecting, it is used to return to upper menu, in parameter selecting and setting, it is used to exit to previous parameter setting.

5.2 Setting forFirst Startup

5.2.1 Startup

After powering on, it will enter the LOGO interface, as shown inFigure5-2.



Figure5-2 LOGO interface

If it is started for the first time, it will enter initial interface for first startup, as shown in Figure5-3.If it is not first startup, it will enter main monitoring interface.



Figure5-3 Initial interface of first startup

Button operation illustration
Press ENTER button to enter the initial interface of first startup. It will enter language setting first, in default, the language setting is English.

5.2.2 Initial Setting

Language

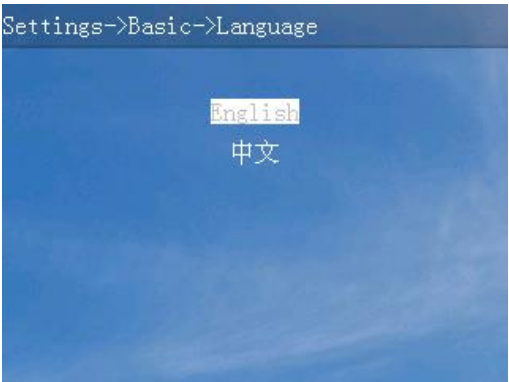


Figure5-4 Language setting

Button operation illustration
Press▲ and ▼ button to select language.
Press ENTER button to confirm to save the setting and turn to next setting.
Press ESC button to cancel the initial setting, after exiting, it can enter parameters setting >> basic setting to reset the parameters.

Date & time

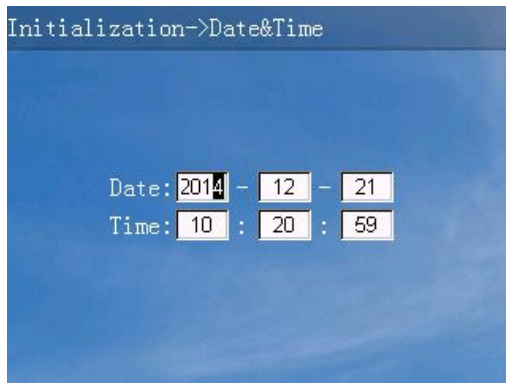


Figure5-5 Date & time setting interface

Button operation illustration
Press ▲and▼button to add/decrease number.
Long press ENTER button to enter Screen setting
Press ESC button to return previous setting or upper menu.

Screen setting

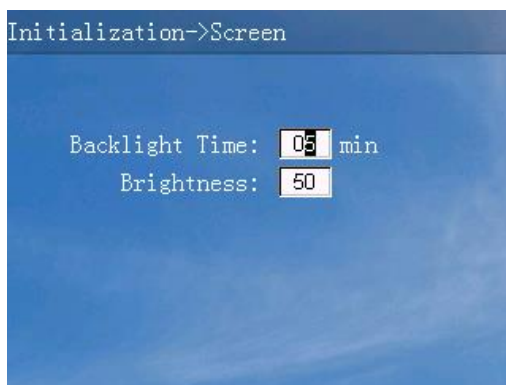


Figure5-6 Screen setting interface

Button operation illustration
Press ▲and▼button to add/decrease the brightness and backlight time
Press ENTER button to confirm the setting.
Press ESC button to return previous setting or upper menu.

5.3 MainMonitoring Interface

After finish the initial of first startup, it will enter main monitoring interface, as shown in Figure5-7.

The main monitoring interface includes:

- System topology and energy flow.
- Voltage and current of real-time input, output and battery.
- Numerical value display: PV power, grid power, load power, PV daily power generation
- Graph display: alarm indication, buzzer control
- Status display: standby, grid-connected, off-grid, fault
- Time and date

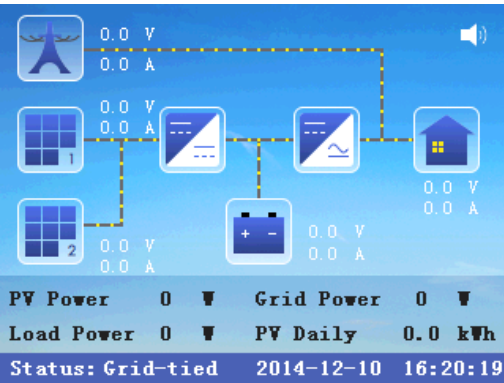


Figure5-7 Main monitoring interface1

Button operation illustration

- Press **ESC** button to quick look up the current alarm;
- Press **ENTER** button to enter function menu interface.

When the inverter is working, user can judge the current work status according to the flicking icon, as shown in Figure5-8, Figure5-9.

When there has alarm, the yellow icon on the right top of the interface, as shown in Figure5-10.

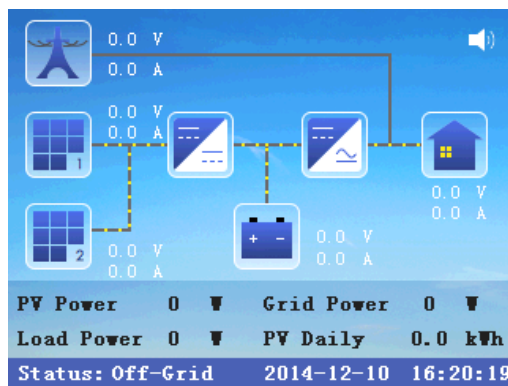


Figure5-8 Main monitoring interface2

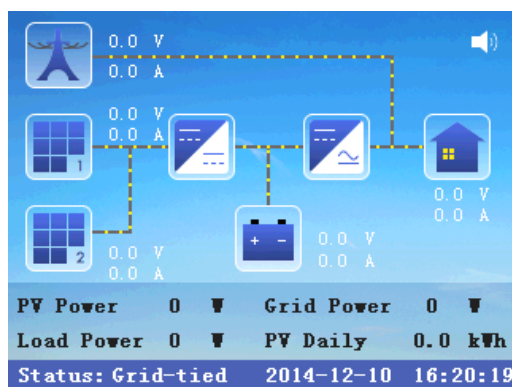


Figure5-9 Main monitoring interface3

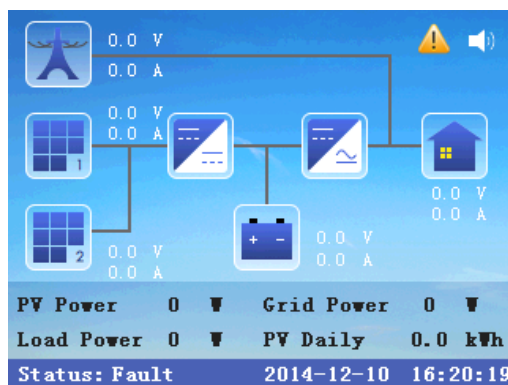


Figure5-10 Main monitoring interface4

5.4 Function Menu Interface

In main monitoring interface, press ENTER button, it will come to function menu interface, as shown in Figure5-11. There are 6 functions (running information, energy query, log query, settings, ON/OFF and about) can be selected.



Figure5-11 Function menu interface

Button operation illustration

Press **ESC** button to return.

Press▲ button and▼ button to select the function.

Press **ENTER** button to enter the option, press ESC button to back to main monitoring interface.If there is no action,it will back to main monitoring interface.

5.5 Run Info.

In function menu interface, select**RunInfo**.Icon, user can look up the following information: PV information, battery information, grid information, load information, as shown inFigure5-12, Figure5-13, Figure5-14and Figure5-15.

Run Info.				
	PV1		PV2	
Voltage	0.0	V	0.0	V
Current	0.0	A	0.0	A
Power	0.0	W	0.0	W
Daily PV Pmax	0.0	W		▼

Figure5-12 Run info. Interface 1

Run Info.		
Batt. Status	Charge	
Batt. Voltage	0.0	V
Batt. Current	0.0	A
Cap. Remain		
Max. Batt. Temp.	0.0	℃
Min. Batt. Temp.	0.0	℃

Figure5-13 Run info. Interface 2

Run Info.		
Grid Volt.	0.0	V
Grid Curr.	0.0	A
Grid Freq.	0.0	Hz
S-Grid	0	VA
P-Grid	0	W
Q-Grid	0	var
PF Grid-tied	0.00	

Figure5-14 Run info. Interface 3

Run Info.		
Load Voltage	0.0	V
Load Current	0.0	A
S-Load	0	VA
P-Load	0	W
Q-Load	0	var
Daily Load Pmax	0	W

Figure5-15 Run info.Interface 4

Button operation illustration

Press **ESC** button to return function menu interface.

Press **▲** and **▼** button to change the interface.

5.6 EnergyQuery

In function menu interface, select **Energy Query** icon, user can look up following information: input energy, output energy and daily battery energy, as shown inFigure5-16.



Figure5-16 Energy query interface

Button operation illustration
Press▲ button and▼ button to select the option.
Press ENTER button to enter the option.
Press ESC button to return function menu interface.

5.6.2 Input Energy Query

Input energy query includes daily input energy, monthly input energy and total input energy, as shown in Figure5-17. To conveniently inquire the daily input energy and monthly input energy, the statistics result will be display in table or figure, as shown inFigure5-18, Figure5-19, Figure5-20, and Figure5-21, total energy query is as shown in Figure5-22.

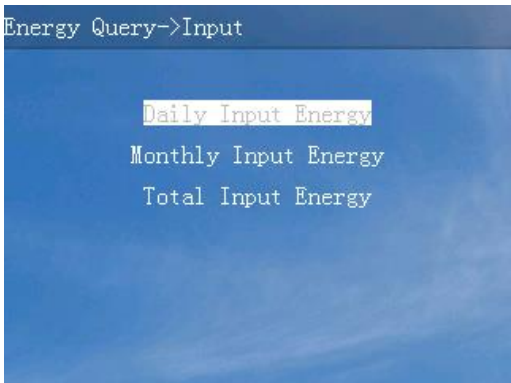


Figure5-17 Input energy query interface

Energy Query->Input->Daily(kWh)

2004 Year 01 Month Table 1/2 >

Date	PV	Grid	Date	PV	Grid
01	999.9	999.9	09	999.9	999.9
02	999.9	999.9	10	999.9	999.9
03	999.9	999.9	11	999.9	999.9
04	999.9	999.9	12	999.9	999.9
05	999.9	999.9	13	999.9	999.9
06	999.9	999.9	14	999.9	999.9
07	999.9	999.9	15	999.9	999.9
08	999.9	999.9	16	999.9	999.9

Figure5-18 Daily input energy query interface (table)

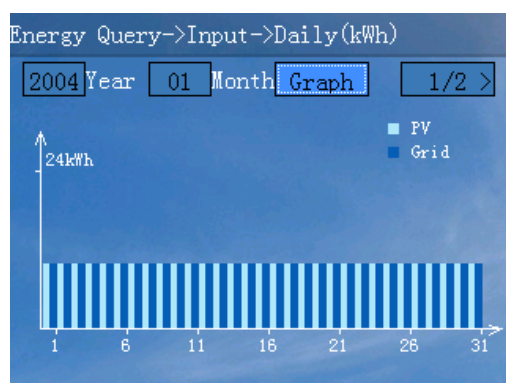


Figure5-19 Daily input energy query interface (figure)

Energy Query->Input->Monthly(kWh)

2025 Year Table

Month	PV	Grid	Month	PV	Grid
01	999.9	999.9	02	999.9	999.9
03	999.9	999.9	04	999.9	999.9
05	999.9	999.9	06	999.9	999.9
07	999.9	999.9	08	999.9	999.9
09	999.9	999.9	10	999.9	999.9
11	999.9	999.9	12	999.9	999.9

Figure5-20 Monthly input energy query interface (table)

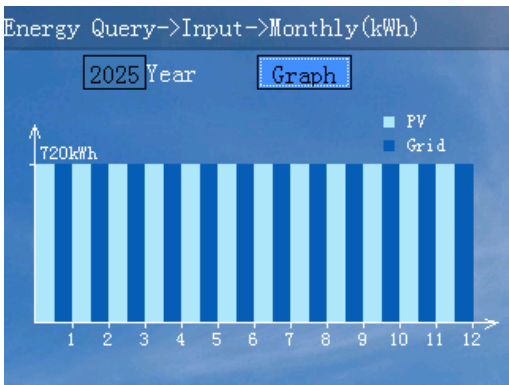


Figure5-21 Monthly input energy query interface (figure)

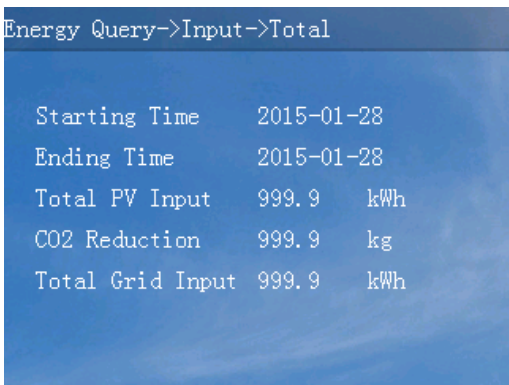


Figure5-22 Totalinput energy query interface

5.6.3 Output Energy Query

Output energy query includes daily output energy, monthly output energy and total output energy, as shown in Figure5-23. To conveniently inquire the daily output energy and monthly output energy, the statistics result will be display in table or figure, as shown inFigure5-24, Figure5-25, Figure5-26, Figure5-27, total output energy query is as shown inFigure5-28.

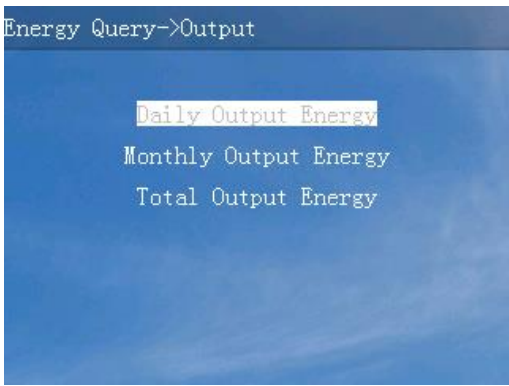


Figure5-23 Output energy query interface

Energy Query->Output->Daily(kWh)

2025 Year 01 Month Table 1/2 >

Date	Load	Grid	Date	Load	Grid
01	999.9	999.9	09	999.9	999.9
02	999.9	999.9	10	999.9	999.9
03	999.9	999.9	11	999.9	999.9
04	999.9	999.9	12	999.9	999.9
05	999.9	999.9	13	999.9	999.9
06	999.9	999.9	14	999.9	999.9
07	999.9	999.9	15	999.9	999.9
08	999.9	999.9	16	999.9	999.9

Figure5-24 Daily output energy query interface (table)

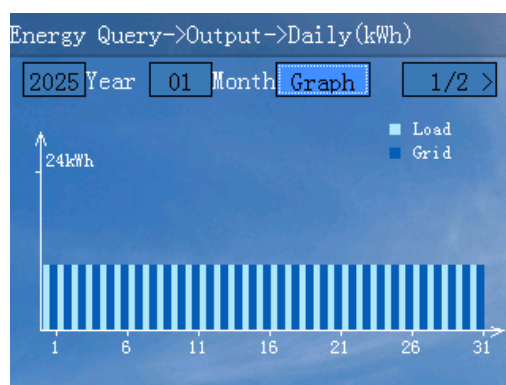


Figure5-25 Daily output energy query interface (figure)

Energy Query->Output->Monthly(kWh)

2025 Year Table

Month	Load	Grid	Month	Load	Grid
01	999.9	999.9	02	999.9	999.9
03	999.9	999.9	04	999.9	999.9
05	999.9	999.9	06	999.9	999.9
07	999.9	999.9	08	999.9	999.9
09	999.9	999.9	10	999.9	999.9
11	999.9	999.9	12	999.9	999.9

Figure5-26 Monthly output energy query interface (table)

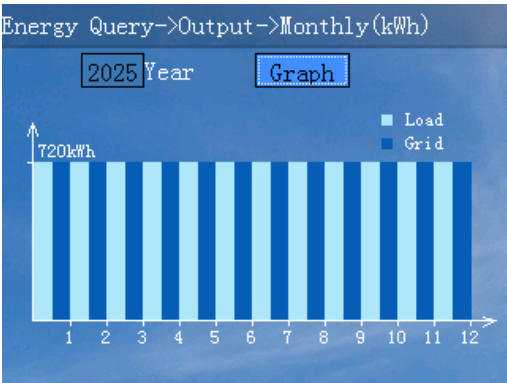


Figure5-27 Monthly output energy query interface (table)

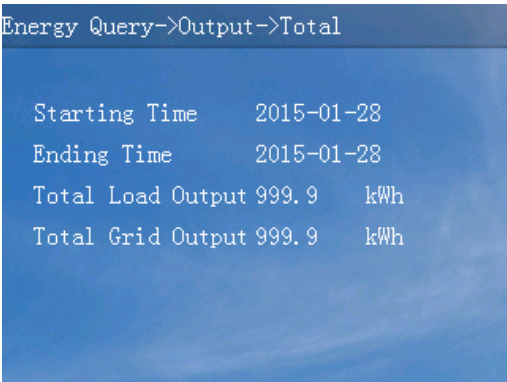


Figure5-28 Total output energy query interface

5.6.4 Daily Battery Energy

Daily battery energy query is as shown in Figure5-29 and Figure5-30.

Energy Query->Daily Battery Energy(kWh)

2004 Year 01 Month Table 1/2 >

Date	Charge	Disch.	Date	Charge	Disch.
01	999.9	999.9	09	999.9	999.9
02	999.9	999.9	10	999.9	999.9
03	999.9	999.9	11	999.9	999.9
04	999.9	999.9	12	999.9	999.9
05	999.9	999.9	13	999.9	999.9
06	999.9	999.9	14	999.9	999.9
07	999.9	999.9	15	999.9	999.9
08	999.9	999.9	16	999.9	999.9

Figure5-29 Daily battery energy query interface (table)

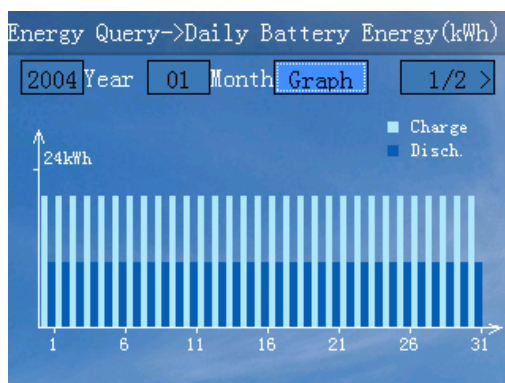


Figure5-30 Daily battery energy query interface (figure)

Button operation illustration

Press ▲ button to enter next setting. When setting the year/month, it is used to decrease number. When used in table/figure, it is used to select towards the left. When used in page setting, it is used to page up.

Press ▼ button to enter previous function setting. When setting the year/month, it is used to add number. When used in table/figure, it is used to select towards the right. When used in page setting, it is used to page down.

Press **ENTER** button to enter function setting.

Press **ESC** button to exit function setting or return to upper menu.

5.7 LogQuery

In function menu interface, select **Log Query** icon, user can look up the following information: active alarms, historical alarms, user logs, and grid-tied logs, as shown in Figure 5-31.



Figure5-31 Log query interface

Button operation illustration

Press ▲ button and ▼ button to select the option.

Press ENTER button to enter the option.

Press ESC button to return function menu interface.

5.7.2 Active Alarms

Active alarms record the current alarm information, which can help user to judge the current system work status, as shown in Figure5-32.

Log Query->Active Alarms		
7.	2015/03/03 15:15:15	1/2
>>Grid amplitude abnormal		
6.	2015/03/03 15:15:15	
>>Grid frequency abnormal		
5.	2015/03/03 15:15:15	
>>Overload alarm		
4.	2015/03/03 15:15:15	
>>BMS communication fault		
3.	2015/03/03 15:15:15	
>>Battery undervoltage alarm		

Figure5-32 Active alarms interface

5.7.3 Historical Alarms

Historical alarms record the happened alarm information, which make the historical alarm looking up come true, as shown in Figure5-33.

Log Query->Historical Alarms		
7.	2015/15/15 15:15:15	1/2
>>Grid amplitude abnormal recover		
6.	2015/15/15 15:15:15	
>>Grid frequency abnormal		
5.	2015/15/15 15:15:15	
>>Overload alarm recover		
4.	2015/15/15 15:15:15	
>>BMS communication fault		
3.	2015/15/15 15:15:15	
>>Batt. undervoltage alarm recover		

Figure5-33 Historical alarms interface

User logs record the user settings and operations, as shown in Figure5-34.



Figure5-34 User logs interface

Grid-tied logs display the past grid-tied/ off-grid information, as shown in Figure5-35.



Figure5-35 Grid-tied logs interface

Button operation illustration
Press ▲ button to page up.
Press ▼ button to page down.
Press ESC button to return upper menu.

5.8 Settings

In function menu interface, select **Setting** icon, it will enter login interface, as shown in Figure5-36. The setting interface requires the operating personnel who have user limits of authority.

Initial password for generaluser is 100000

Initial password for administrator is200000

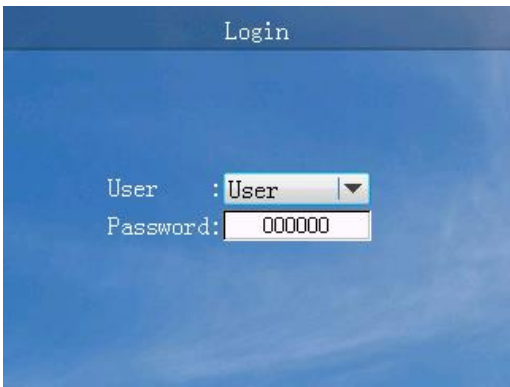


Figure5-36 Login interface

Button operation illustration
Press ▲ button to select user; when enter the password, it is used to add number.
Press ▼ button to select user; when enter the password, it is used to decrease number.
Press ENTER button to set the current value, when enter the password, it is used to switchover the position of cursor.
Press ESC button to return upper menu.

5.8.2 User Setting

The basic setting of user includes language setting, screen setting, buzzer setting, password modify, as shown in Figure5-37, Figure5-38, Figure5-39, Figure5-40 and Figure5-41.

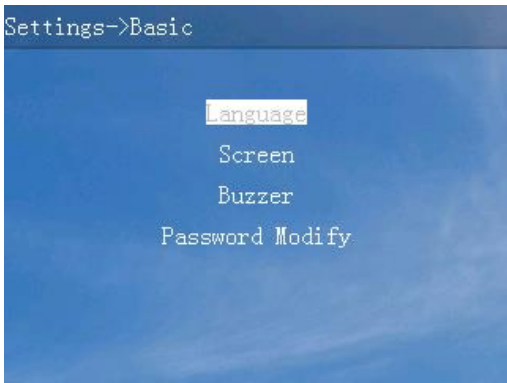


Figure5-37 User setting interface



Figure5-38 Language setting

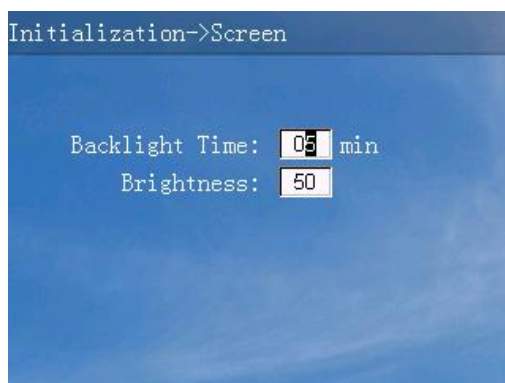


Figure5-39 Screen setting



Figure5-40 Buzzer setting



Figure5-41 Password modify

5.8.3 Administrator Setting

Except the setting authority of general user, the administrator setting also includes communication setting, password reset, log management, factory restore, engineer. Parameters setting. Besides, the basic setting increases date & time setting.



Figure5-42 Settings (for administrator)

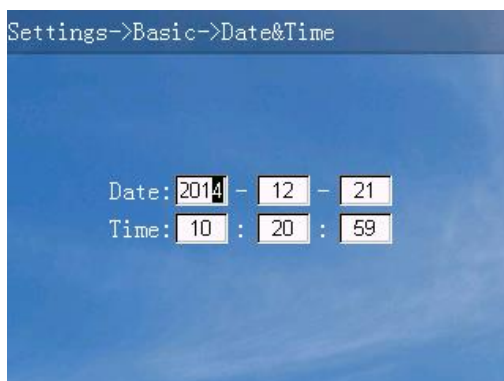


Figure5-43 Date & time setting

In communication setting, user can set the RS485 serial port of upper computer and WIFI at present.



Figure5-44 Setting of Communication

Password reset is used to reset the general user's password if they forget the user password.



Figure5-45 Password reset

Log management is used to backup the historical data (such as input energy, output energy, daily battery energy), and it also can clear the historical data.



Figure5-46 Log management setting interface

Factory restore is used to reset the system parameters to factory settings.



Figure5-47 Factory restore interface

Engineer.parameters is used to set the following parameters: PV parallel mode (off or on), MPPT disturbance step, battery over-voltage/ low-voltage protection point, battery over-voltage/ low-voltage alarm point, maximum charge current, maximum discharge current, rated voltage, initiative island, grid over-voltage/ low-voltage protection point, grid over-frequency/low-frequency protection point, power factor, external sensor (CT, smart meter or not connected), address of smart meter, CT ratio and work prior mode (load, energy storage, switch between charging and discharging). These parameters are configured by administrator according to user's actual condition. User can select the work prior mode by themselves.

Engineer.Parameters is as shown in Figure5-48, Figure5-49, Figure5-50 and Figure5-51.

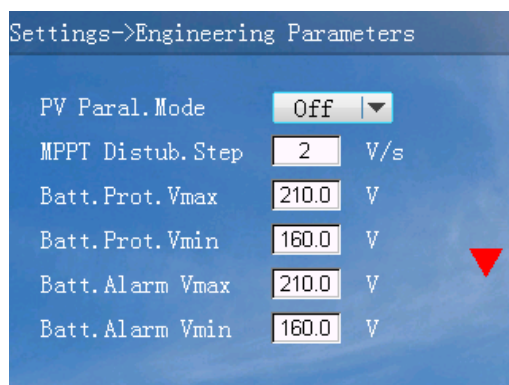


Figure5-48 Engineer. Parameters setting interface 1

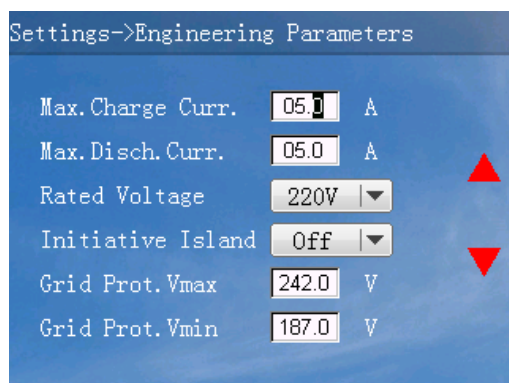


Figure5-49 Engineer. Parameters setting interface 2

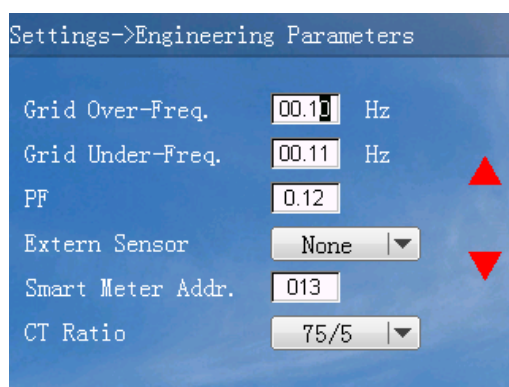


Figure5-50 Engineer. Parameters setting interface 3

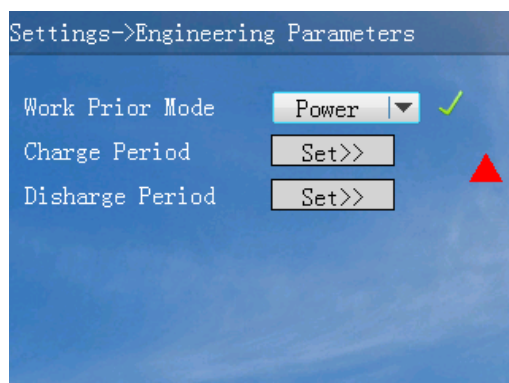


Figure5-51 Engineer. Parameters setting interface 4

The work prior mode can be set as following three mode.

Load prior: guarantee the power supply for load, and the surplus energy will be stored in the battery or feed back to the grid.

Energy storage prior: guarantee the battery is fully charged, and the surplus energy will be provided to load or feed back to the grid.

Switch between charging and discharging according to time setting: assign the energy on the basis of setting time section.

When the work prior mode is set to be Switch between charging and discharging according to time setting, it needs to set the charging periods and discharging period, as shown in Figure 5-52, Figure 5-53.

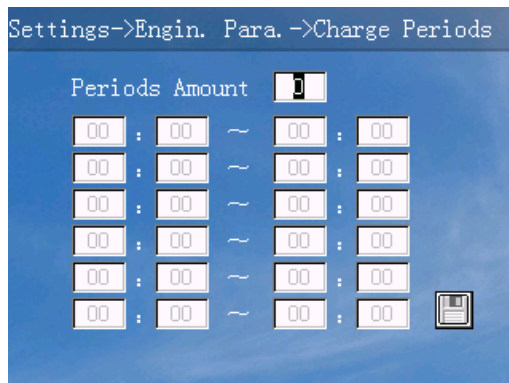


Figure 5-52 Charge periods setting

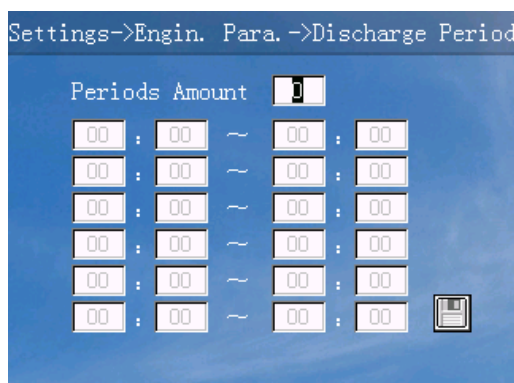


Figure 5-53 Discharge period setting

5.9 ON/OFF

The ON/OFF interface of the inverter is as shown in Figure 5-54, after carrying out the startup operation, the system starts to work, carrying out shutdown operation, it stays in standby status.



Figure5-54 ON/OFF interface



Figure5-55 Confirm to startup interface

5.10 System Information

User can look up the product information, such as software version, S/N, etc. in system information interface, as shown in Figure5-56, Figure5-57.



Figure5-56 System information interface 1



Figure5-57 System information interface 2

6 Maintenance

This chapter mainly introduces the maintenance of the inverter.

6.1 Cleanness

The inverter and battery pack do not need to clean constantly. But the top of the device is easy to corner dust, and it needs to clean irregularly.

Do the cleaning with dry cloth,donot use any solvent, abrasive tool or corrosive material to clear the device.

If the surface of LCD and LED is too dirty to read, clear them with wet cloth.



CAUTION

Do not clean the battery pack with wet cloth!

Do not touch the inverter during operating, some parts may get hot and may cause scald.

6.2 Maintenance

If the inverter needs to dismantle to maintain, please inform administrator.

Only authorized professional technician can open the cover to maintain.

The maintenance should be carried out after the AC grid, DC input and battery connection are disconnected, and wait at least 30 minutes to ensure the energy of capacitance is released completely.

During maintenance, ensure that the connection of the inverter and battery pack is disconnected completely, and set alarm symbols to avoid the connection by accident.

6.3 Replace Fuse

The fuse in AC side is the protection among the load. The inverter and grid. When there has any serious fault, the fuse will fusing, which is to ensure separation of load and the inverter.

The fuse needs to replace after damaging, and the fuse should be accord with the following requirement

Rated voltage: 600V

Rated current: 30A

Recommended model and brand: KLKD SERIES 10x38 mm FUSES

7 Troubleshooting

This chapter mainly introduces the dispose of common fault for the inverter.

7.1 Fault Alarm

Inverter is designed according to the standard of grid-tied, which meet the requirement of safety and EMC. Before providing to client, it has experienced several strict tests to ensure durable and reliable running.

If some faults occur, the LCD will show the alarm information. Under the circumstances, the inverter may stop generating. The fault condition and possible reason is as shown in Table7-1.

Table7-1 Fault alarm

Category	Item	Phenomenon	Prompting
Alarm	Abnormal grid amplitude alarm Abnormal grid frequency alarm Battery low-voltage alarm Battery over-voltage alarm Battery over-temperature alarm Battery low-temperature alarm PV1 over-voltage alarm PV2 over-voltage alarm Inner over-temperature alarm Radiator over-temperature alarm	Buzzer beeps slowly	The alarm will wipe out after the fault is eliminated
	Overload alarm	Buzzer beeps fast, LCD displays the prompting	The load exceed the rated power of system, please turn off some

Category	Item	Phenomenon	Prompting
			load, after the fault eliminates, the alarms will wipe out automatically.
Halt	Inverting over-current protection Abnormal inverting voltage protection Abnormal DC component of inverting current protection Overload protection Short-circuit protection Battery charging over-current protection Battery discharging over-current protection Abnormal DC component of inverting voltage protection PV1 over-current protection PV2 over-current protection Hardware fault protection Radiator over-temperature protection Battery over-voltage protection Battery low-voltage protection	Buzzer long beeps, and the fault indicator light on	If the fault eliminates, the inverter will restart, if the fault happens repeatedly, please contact us.

Category	Item	Phenomenon	Prompting
	Current leakage protection Isolation fault protection CT fault Smart meter is abnormal	Buzzer long beeps, and the fault indicator light on	Once the situation occurs, please contact us immediately.

Please get ready the following information in advance:

SN of the inverter;

The inverter dealer or distributor;

The date of Grid-tied power generation;

Fault description (that is the indicator status and alarm information showed in LCD. The other running information may also helpful);

Your contact method in detail.

A Technical Specifications

A.1 Photovoltaic

Model	SPH3000-B	SPH3600-B
Maximum power tracking route	2	2
Max. input power of each PV (W)	1800	2000
DC voltage range(Vd.c)	160 to 480	160 to 480
MPPT range with full load(Vd.c)	200 to 420	200 to 420
Max. input current(Ad.c.)	10	10
Shutdown voltage(Vd.c)	60	60
Startup voltage(Vd.c)	120	120

- Specifications are subject to change without prior notice.

A.2 Grid-tied

Model	SPH3000-B	SPH3600-B
Rated output power (W)	3000	3600
Max. output power (W)	3000	3600
Rated grid voltage (Va.c)	220/230/240	220/230/240
Rated grid frequency (Hz)	50	50
Rated output current (A)	13.6	16.3
Max. output current (A)	15.2	18.2
Grid voltage range (Va.c)	187 to 264	187 to 264

Model	SPH3000-B	SPH3600-B
Grid frequency range (Hz)	49.5 to 50.2	49.5 to 50.2
PV grid-tied inverting efficiency	95.5%	95.5%
PV grid-tied European efficiency	94.5%	94.5%
Power factor	0.99	0.99
THDi	≤3%	≤3%
Active anti-islanding	Yes	Yes

- Specifications are subject to change without prior notice.

A.3 Off-grid

Model	SPH3000-B	SPH3600-B
Max. output power (W)	3000	3600
Inverting efficiency	92%	92%
Frequency range (Hz)	49.5 to 50.2	49.5 to 50.2
THDu	≤3%	≤3%

- Specifications are subject to change without prior notice.

A.4 Basic parameters

Model	SPH3000-B	SPH3600-B
Monitor the leakage current to grounding	Meet NB-T 32004-2013	
Touching current	MeetNB-T 32004-2013	
Firing leakage current	MeetNB-T 32004-2013	
Matrix isolation impedance	MeetNB-T 32004-2013	
Operation voltage	MeetNB-T 32004-2013	
Switch time of grid-tied (ms)	≤200	
Environment	Install indoor	

Model	SPH3000-B	SPH3600-B
Meet the requirement used in indoor moist environment	Yes	
Installation way	Wall-mounted installation	
IP grade	IP20	
Isolation type	Without isolation	
Operation temperature range (°C)	-20 to 50	
Heat dissipation way	Forced wind cooling	
Noise (dB)	60 (in right front 1m)	
Atmosphere (KPa)	70 to 106	
Altitude (m)	0 to 2000	
Relative humidity	0 ~ 95%, with no condensation	
Size (W×H×D) (mm)	480 x 440 x 145	
Weight (kg)	18	

- Specifications are subject to change without prior notice.

A.5 Battery Pack Parameters

Model	Battery Pack
Battery working voltage range (Vd.c)	175 to 225
Battery rated voltage (Vd.c)	192
Configured battery capacity (Wh)	10
Max. charging current (A)	10
Max. discharging current (A)	30
Charging way	Constant voltage, constant current
Size (W×H×D) (mm)	480 x 440 x 145

Model	Battery Pack
Weight (kg)	32

- Specifications are subject to change without prior notice.

B Acronyms and Abbreviations

A

AC Alternating Current

AWG American Wire Gauge

B

BMS Battery Management System

C

CE Conformance Européenne

CT Current Transformer

D

DC Direct Current

L

LCD Liquid Crystal Display

LED Light-emitting Diode

M

MPPT Maximum Power Point Tracking

P

PE Protective Earthing

PV Photovoltaic

R

RS485 Recommend Standard485

T

THDi Total Distortion of the input current waveform

U

USB Universal Serial Bus



XIAMEN KEHUA HENGSHENG CO., LTD.

ADD: No. 457, Malong Road, Torch High-Tech Industrial
Zone, Xiamen, Fujian, China(361000)
TEL: 0592-5160516(8 lines) FAX: 0592-5162166
Http: //www.kehua.com

Manufacturer: Zhangzhou Kehua Technology Co., Ltd.
ADD: Beidou Industrial Zone, Jinfeng Industrial District,
Zhangzhou, Fujian, China(363000)
TEL: 0596-2600000 2600886 FAX: 0596-2895827