



User Manual

Energy Storage Inverter
SPH-BL(3600-5000) Series

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Foreword

Summaries








Thank you for choosing energy storage inverter SPH-BL(3600-5000) series product!

This document provides a description of energy storage inverter SPH-BL(3600-5000) series product, including the features, performance, appearance, structure, working principles, installation, operation and maintenance, etc.

Please save the manual 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 meaning 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.
	Anti-static prompting.
	Be care electric shock prompting.
 TIP	Provides a tip that may help you solve a problem or save time.
 NOTE	Provides additional information to emphasize or supplement important points in the main text.

Product standard: NB/T 32004-2013

Change History

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

Issue 001 (2018-06-08)

First issue.

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1 Safety Description

This chapter mainly describes safety description. Prior to performing any work on device, please read user manual carefully, follow operation and installation instructions and observe all danger, warning and safety information, which is to avoid human injury and device damage by irregular operations.

1.1 Safety Announcements

This section mainly describes safety announcements during operation and maintenance. For details, please refer to safety instructions in the relevant chapters.



CAUTION

Before attempting to operate device, please read safety announcements and operation instructions in this section carefully to avoid accident.

The promptings in the user manual, such as "Danger", "Warning", "Caution", etc. don't include all safety announcements. They are just only the supplement of safety announcements during operation.



NOTE

Any device damage caused by violating the general safety operation requirements or safety standards of design, production, and usage will be out of Xiamen Kehua's warranty range.

1.1.1 Safety Instructions



Multi-channel power supplies power for energy storage inverter. Be careful of electric shock!

**CAUTION**

Don't touch terminals or conductors connected with grid to avoid lethal risk !

**DANGER**

There is no operational part inside device. Don't open the crust of device, or it may cause electric shock. Device damage caused by illegal operation is out of the guarantee range.

**DANGER**

Device damage or device failure may cause electric shock or fire!

- Before attempting to operate device, check that there is no damage or other potential danger in the device visually.
 - Check that other external devices or circuit connection is safe.
-

**DANGER**

Before checking or maintenance, it must switch off each route of switch connected with device and wait for 5 minutes to ensure that device is completely discharged, and then the operation can be performed.

**WARNING**

In case of fire, please use dry power fire extinguisher. If using liquid fire extinguisher, it may cause electric shock.

**CAUTION**

No liquid or other objects are allowed to enter device.

**Danger of High Temperature**

The surface temperature of device may reach to 60°C. During running, don't touch the surface to avoid scald.






1.1.2 Device Label Illustartion






**WARNING**

The labels on the device contain important information about safety operation. Don't tear them up or damage them!

Pay attention to labels on the device. The label illustration is as shown in Table1-1.

Table1-1 The illustration of device label

Label	Illustration
	Pass CE authentication.
	Pass TUV authentication.
	Pass SAA authentication.
	Don't dispose with general garbage. Recycle them by special method.
	Read user manual when using device.

Label	Illustration
	Wait for 5 minutes to discharge completely after powering device off.
	Hot surface. Don't touch!
	Caution!
	Multi-channel power supplies power for energy storage inverter. Be careful of electric shock.
	External grounding label.

1.1.3 PV Array Protection

When installing PV array in daytime, it necessary to cover PV array by light-proof material, or the PV array will generate high voltage under sunshine. If touching PV array accidentally, it may cause electric shock or human injury!



DANGER

There exists dangerous voltage between the positive and negative of PV array!

When installing device, it must disconnect inverter with PV array completely. Set warning mark here to avoid reconnecting.

1.1.4 ESD Protection



CAUTION

To prevent human electrostatic damaging sensitive components(such as circuit board), make sure that you wear a anti-static wrist strap before touching sensitive components, and the other end is well grounded.

1.1.5 Grounding Requirements



WARNING

High leakage risk! Device must be grounded before performing electrical connection. The grounding terminal must be connected to ground.

- When installing device, it must be grounded first. When dismantling device, the grounding wire must be removed at last;
- Don't damage the grounding conductor;
- Device should be connected to the protection earth permanently. Before operation, it should check the electrical connection to ensure the device is grounded reliably.

1.1.6 Moistureproof Protection



CAUTION

Moisture invasion may cause device damage!

Observe the following items to ensure that device works normally.

- When the air humidity is more than 95%, don't open the door of inverter;
- In the wet or damp weather, don't open device perform maintenance or repair.

1.1.7 Warning Mark Setting

In order to avoid accident for unwanted person gets close to inverter or makes improper operation, it should observe the following requirements when performing installation, daily maintenance or repair.

- Set warning marks where the switches are to avoid turning them on improperly.
- Set warning signs or safety warning belt in the operation area, which is to avoid human injury or device damage.

1.1.8 Electrical Connection

Electrical connection must be performed according to description in the user manual and the electrical circuit schematic.

**WARNING**

When inverter is working, don't dismantle electrical connection.

**WARNING**

The configuration of PV array, grid level, grid frequency, etc. must meet the technical requirements of device.

Grid-connected generation should be allowed by the local power supply department and the related operation should be performed by professionals.

All electrical connection must meet the related country and district standard.

**WARNING**

Don't touch or replace components except terminals.

1.1.9 Measurement Under Operation

**CAUTION**

There exists high voltage in the device. If touching device accidentally, it may cause electric shock. So, when performing measurement under operation, it must take protection measure(such as wear insulated gloves, etc.)

The measuring device must meet the following requirements:

- The range and operation requirements of measuring device meets the site requirements;
- The connections for measuring device should be correct and standard to avoid arcing.

1.2 Operation Requirements



CAUTION

The operation and wiring for device should be performed by qualified person, which is to ensure that the electrical connection meets the related standards.



WARNING

Don't perform maintenance until disconnecting AC grid, AC load, DC input and battery input with inverter and wait for 5 minutes to discharge completely.

Before attempting to install, operate and maintain device, the operator must understand the safety announcements, know correct operations and be trained strictly.

- Operator should know the structure and working principle of PV grid-connected generation system well.
- Operator must be familiar with the related country and district standard.

1.3 Operation Environment Requirements

The operation environment may influence the life span and reliability of device. So, please avoid to use device in following environment:

- The place where temperature and humidity beyond the technical specifications.
- The place with vibration or impact.

2 Overview

This chapter introduces the inverter intro and its operating mode.

2.1 Product Intro

SPH-BL(3600-5000) series inverter is PV energy storage inverter, which mainly applies for household energy storage system, as shown in Figure2-1.

The household energy storage and management system consists of energy storage inverter, PV array, batteries, grid, and smart meter(optional), which allows customers to reduce their dependence on grid and even become energy self-sufficient. The system can achieve an optimal match between the PV generation, loads and grid and at the same time guarantee the stability of the grid. Moreover, the system can provide back-up power for important household appliances in case of a power outage.

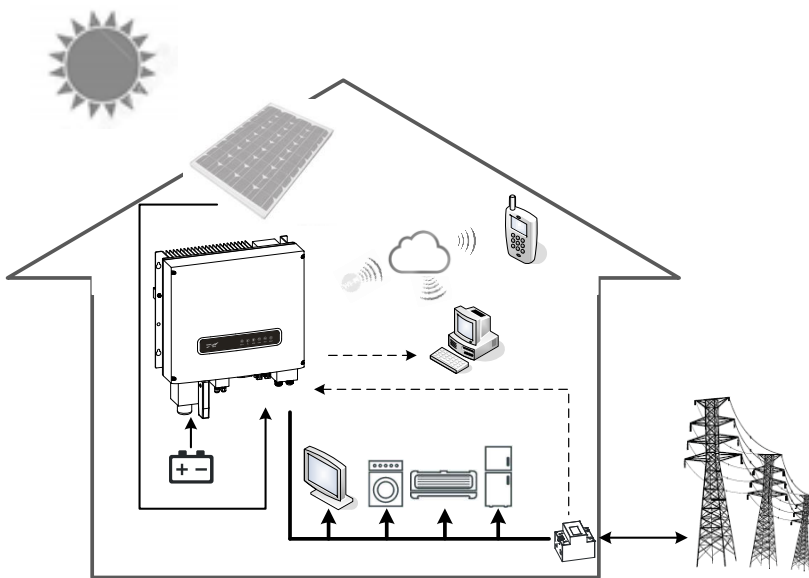


Figure2-1 PV energy storage system

2.1.1 Exterior View

The exterior view of SPH-BL(3600-5000) series inverter is as shown in Figure2-2.

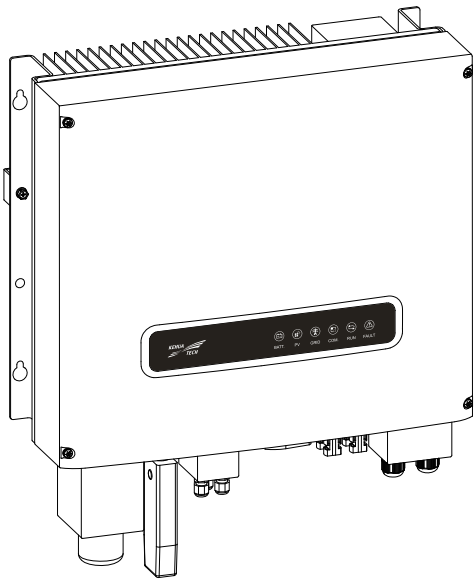


Figure2-2 The exterior view of SPH-BL(3600-5000) series inverter

2.1.2 Display Panel

The display panel of SPH-BL(3600-5000) series inverter is as shown in Figure2-3.

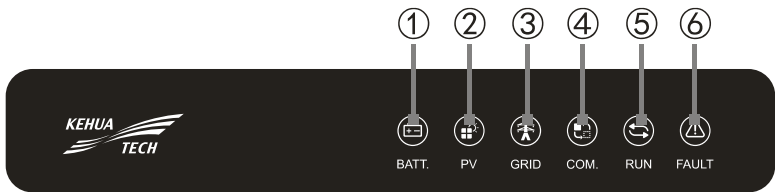


Figure2-3 Display panel

Table2-1 The illustration of display panel

No.	Mark	Meaning	Illustration
①	BATT.	Battery status	Green indicator is on, which means battery is discharging. Green indicator is cycle on 1s off 1s, which means battery is charging. Green indicator is off, which means battery stops charging and discharging.

No.	Mark	Meaning	Illustration
②	PV	PV status	<p>Green indicator is on, which means two routes of PV work normally.</p> <p>Green indicator is cycle on 0.5s off 0.5s, which means one route of PV works normally.</p> <p>Green indicator is off, which means PV stops working.</p>
③	GRID	Grid-connected status	<p>Green indicator is on, which means inverter performs grid-connected generation.</p> <p>Green indicator is cycle on 0.5s off 0.5s, which means inverter performs off-grid generation.</p> <p>Green indicator is off, which means inverter doesn't perform grid-connected or off-grid generation.</p>
④	COM.	Communication status	<p>Green indicator is cycle on 0.5s off 0.5s, which means inverter communicates with PC or WiFi/GPRS.</p> <p>Green indicator is off, which means inverter doesn't communicate with PC or WiFi/GPRS.</p>
⑤	RUN	Running status	<p>Green indicator is on, which means inverter works normally.</p> <p>Green indicator is cycle on 0.2s off 0.2s, which means inverter is on the prestart status.</p> <p>Green indicator is cycle 0.2s off 1.8s, which means inverter is on the standby status.</p> <p>Green indicator is off, which means inverter doesn't power on or has been turned off.</p>
⑥	FAULT	Fault status	<p>Red indicator is on, which means inverter failure.</p> <p>Red indicator is cycle on 1s off 1s, which means inverter has an alarm.</p> <p>Red indicator is off, which means inverter works normally.</p>

2.2 Operating mode

The inverter status can transfer automatically between grid-connected and off-grid mode according to grid status. In the grid-connected status, there are four operating modes: self-consumption priority, battery storage priority, peak shaving and energy shift scheduling. When grid is abnormal or failure, inverter will work in the off-grid emergency mode.

Self-consumption priority

When the energy generated by PV array is sufficient, PV array will supply power for load in advance, the remaining energy will charge battery. If there still has remaining energy, it will be supplied for grid-connection generation. When the energy generated by PV array is insufficient, PV array and battery will supply power for load in advance, as shown in Figure2-4.

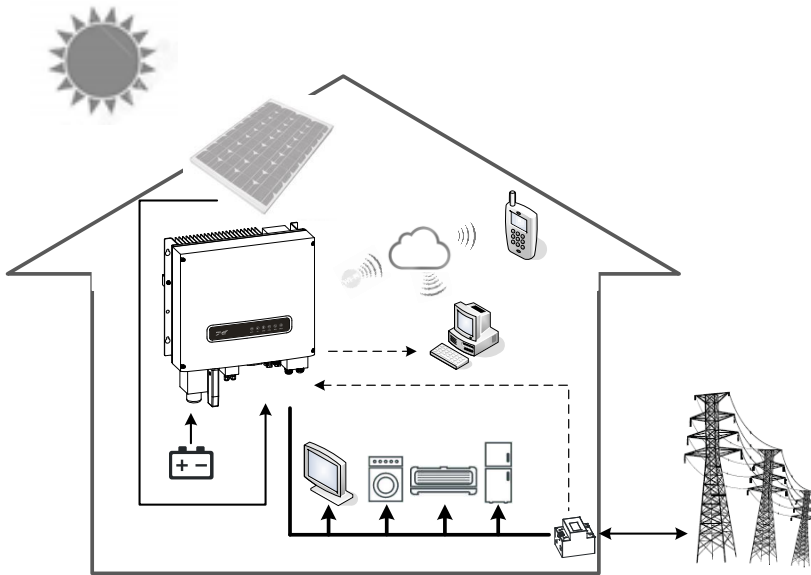


Figure2-4 Self-consumption priority

Battery storage priority

If battery doesn't charge fully, PV array and grid will charge battery fully in advance to meet the emergency power requirements of key loads. When the energy generated by PV array is sufficient (more than charging energy), it will charge battery in advance, the remaining energy will be supplied for load. If there still has remaining energy, it will be supplied for grid-connection generation, as shown in Figure2-5.

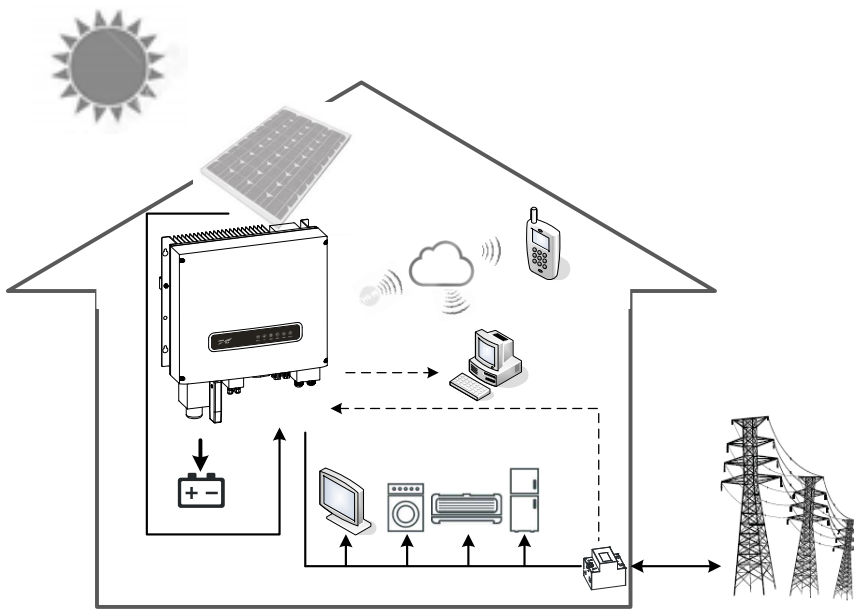


Figure2-5 Battery storage priority

Peak shaving

If the electricity price makes a big difference in the peak and valley time (In the valley time, the electricity price of grid-connected generation is cheaper than PV array generation, in the peak time, the electricity price of grid-connected generation is cheaper than PV array generation), user can set the charging time and discharging time of battery by WiseEnergy(Equipped monitoring software for PC). In the peak time, set to battery discharging mode(for household used);in the valley time, set to battery charging mode to charge battery, as shown in Figure2-6.

User not only can make full use of PV array generation, but also can use electricity price difference in the peak and valley time properly to improve power consumption strategy and save electricity, which can provide more economic self-consumption power supply plan.

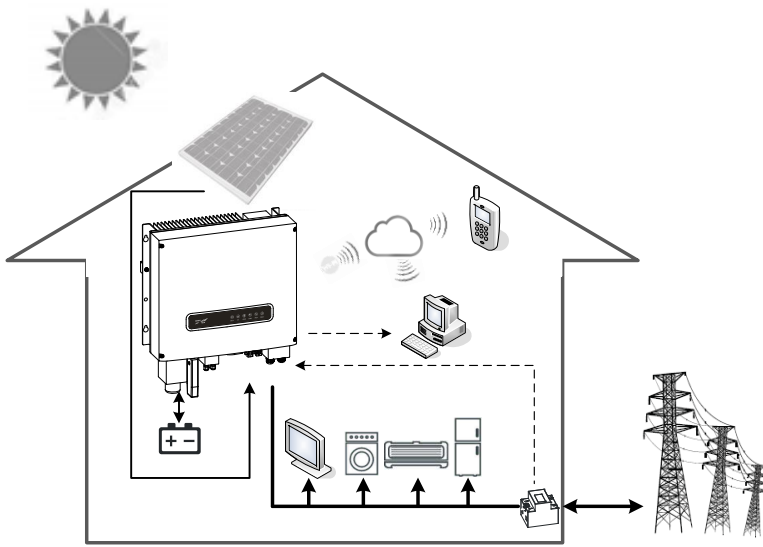


Figure2-6 Peak shaving

Energy shift scheduling

If the electricity price makes a big difference in the peak and valley time(In the valley time, the electricity price of grid-connected generation is cheaper than PV array generation, in the peak time, the electricity price of grid-connected generation is more expensive than PV array generation), user can set the charging time and discharging time of battery by WiseEnergy(Equipped monitoring software for PC). In the peak time, set to battery discharging mode(Except household used, the remaining energy will be supplied for grid-connection generation.); in the valley time, set to battery charging mode to charge battery, as shown in Figure2-7.

User not only can make full use of PV array generation, but also can use electricity price difference in the peak and valley time properly to improve power consumption and generation strategy and save electricity, which can provide more economic self-consumption power supply plan and get more benefits.



CAUTION

Generally, in the energy shift scheduling mode, the battery capacity should be more than 3-4 times of rated power.

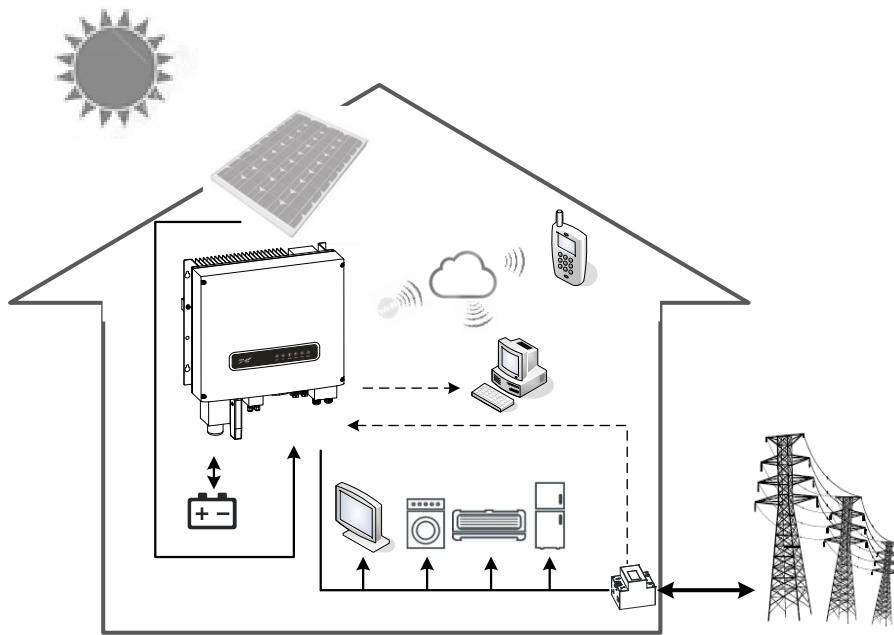


Figure2-7 Energy shift scheduling

Off-grid emergency mode

When grid abnormal or failure, inverter will work in the off-grid emergency mode. The inverter can be regarded as back-up power to supply power for major load, as shown in Figure2-8.



CAUTION

In the off-grid emergency mode, the remaining power supply time depends on battery capacity, load and battery remaining energy when grid failure. Set to the corresponding working mode according to different emergency requirements, which is to avoid affecting emergency power supply time for battery remaining energy isn't enough.

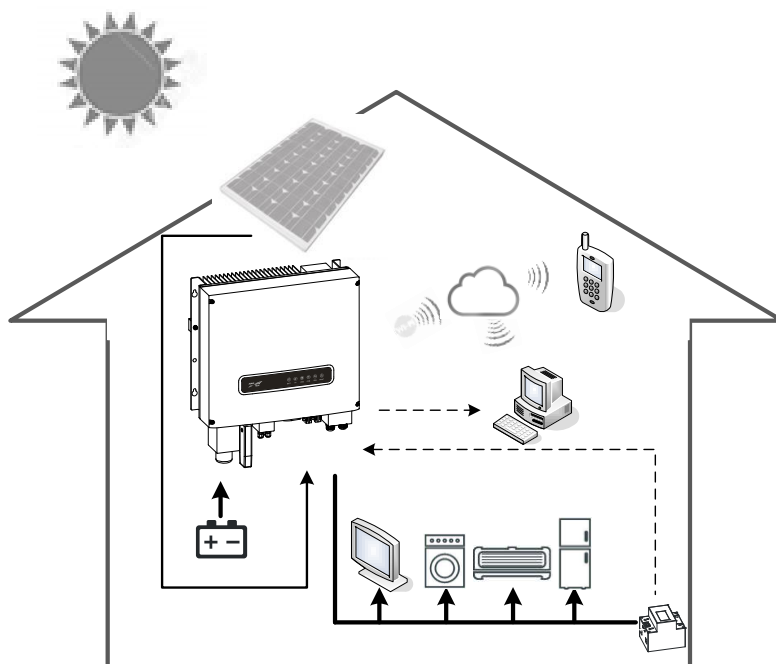


Figure2-8 Off-grid emergency mode

3 Installation

This chapter introduces the installation for inverter, include unpacking and checking, installation preparation and installation procedures, etc.

3.1 Unpacking and Checking

Unpacking the inverter and conduct the following items:

- Inspect the appearance for shipping damage. If any damage, report it to the carrier and your local dealer immediately.
- Check the delivery list to see if the types of accessories are complete and correct. If any discrepancy, contact the distributor immediately.

3.2 Installation Preparation

3.2.1 Installation Environment Requirements

- Keep the installation place as dry as possible and with good ventilation for heat dissipation.
- Keep environment temperature under 60°C.
- Install the device on a wall with enough bearing capacity.
- Install the device in the place where children can't touch.
- When installing device, the vertical gradient should be less than +15° . Don't install device forwards.

3.2.2 Installation Clearance

After installing inverter, the reserved min. installation clearance of inverter is as shown in Figure3-1.

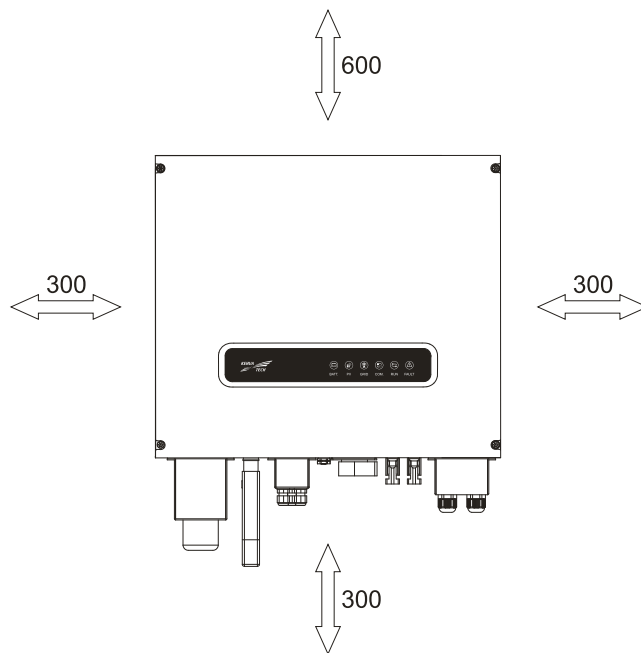


Figure3-1 Installation clearance(unit: mm)

3.3 Installation Procedures

Inverter can be installed on the wall or metal holder through equipped installation holder, the dimensions of installation holes of the installation holder is as shown in Figure3-2.

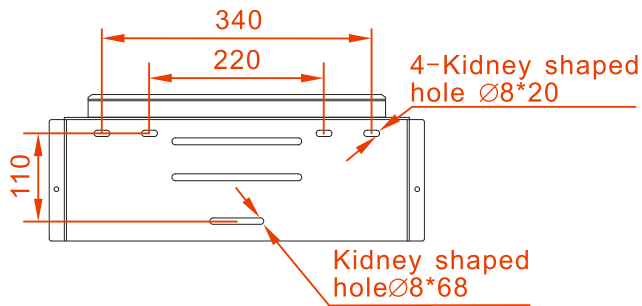


Figure3-2 The dimensions of installation holes of installation holder (Unit: mm)

NOTE

It can select the two outside kidney-shaped holes Ø8*20 or the two inside kidney-shaped holes Ø8*20.



WARNING

Vertical installation is perfect. If it should be tilt, the vertical gradient should not exceed $\pm 15^\circ$.

The following takes wall-mounted method for an example. If adopting other installation method, adjust installation procedures according to application.

- Step 1 Determine the installation site according to the dimensions of inverter(as shown in Figure3-3) and installation clearance requirements(as shown in Figure3-1).

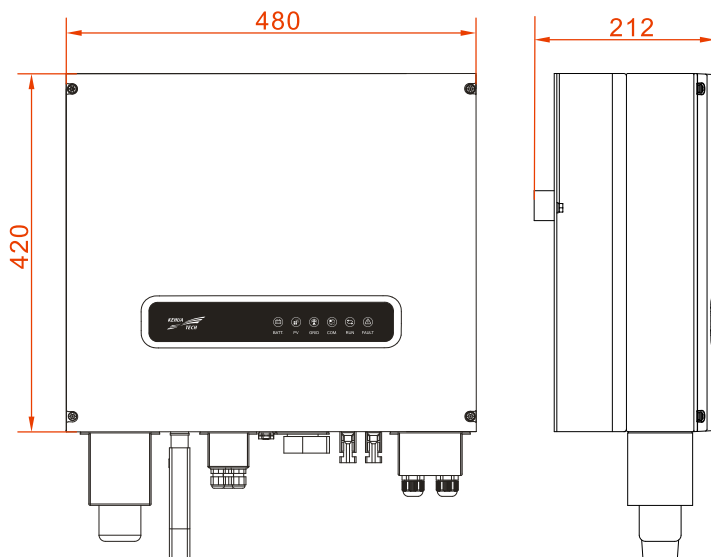


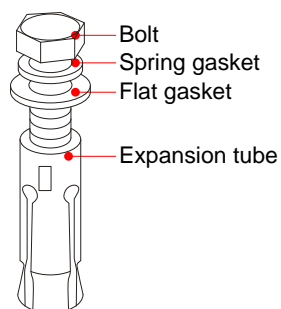
Figure3-3 The dimensions of inverter(Unit: mm)

- Step 2 According to the dimensions of installation holes of installation holder (as shown in Figure3-2), mark the position of installation holes on the wall. Drill holes on the wall vertically by hammer drilling according to the marked position.

NOTE

Drill three holes on the wall with $\Phi 10.5\text{mm}$ in diameter and 40~45mm in depth. Clear the dust and measure the net depth. Ensure that the depth of three holes are the same.

- Step 3 Install three M6 expansion bolts into installation holes. The structure and installation of expansion bolt is as shown in Figure3-4.



1. Drill holes on the installation surface by hammer drill.
2. Tighten the expansion bolts mildly, and put it to the hole vertically, and then knock the expansion bolt by rubber hammer till all the expansion tube into the hole.
3. Pre tighten the expansion bolt.
4. Screw out the bolt, take down the spring gasket and flat gasket.

Figure3-4 The structure and installation of expansion bolt

- Step 4 As shown in Figure3-5, put the installation holder in the prepared expansion bolts with the flat washer, spring washer and nut and fasten nuts clockwise by socket to fix the installation holder on the wall.

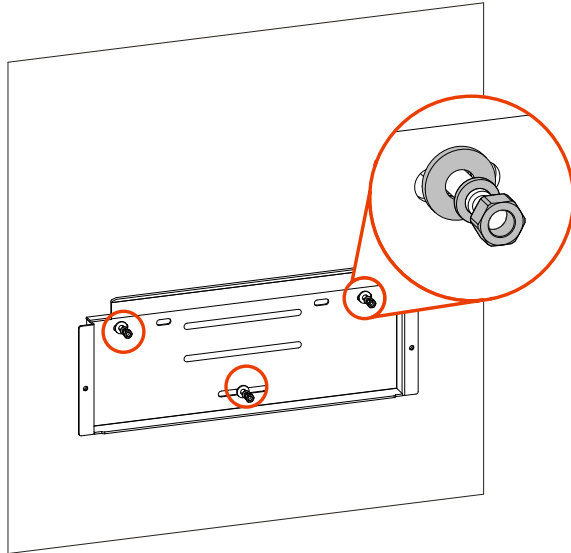


Figure3-5 Fix the installation holder on the wall

- Step 5 As shown in Figure3-6, uplift the inverter and insert the holes in the back of the inverter into the bulge of installation holder slowly. It can't release the inverter until it has been fastened firmly.

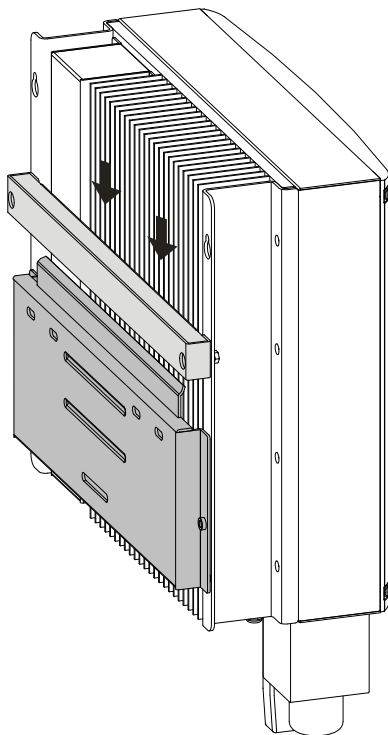


Figure3-6 Fasten the inverter to the installation holder

Step 6 As shown in Figure3-7, fasten the inverter to the installation holder in the two sides of the inverter by equipped bolts M6*16.

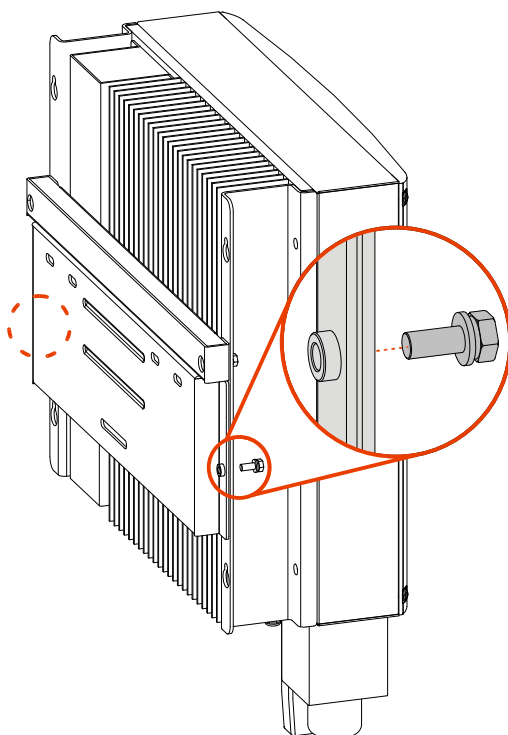


Figure3-7 Fasten the inverter

 **NOTE**

1. When installing inverter, it need a person to hold the bottom of inverter for safety concerns.
2. After finish installing inverter, if it doesn't perform electrical connection, it should take waterproof measures for terminals in the bottom of inverter.

----End

4 Electrical Connection

This chapter mainly introduces inverter electrical connection.

4.1 Operating Principle

Figure4-1 is an electric circuit diagram showing the operating principle of the system.

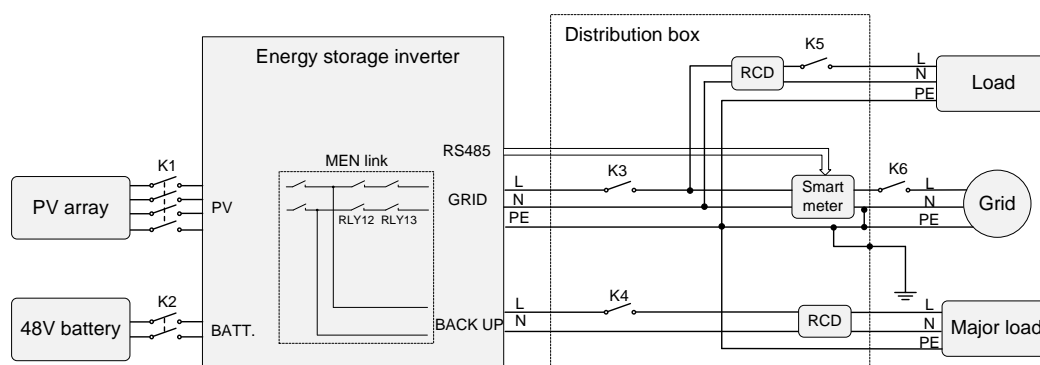


Figure4-1 Electric circuit diagram

NOTE

1. K1 is PV input switch, K2 is battery switch, K3 is grid-connected switch, K4 is major load switch, K5 is load switch, K6 is total grid switch.
2. Add a RCD in the BACK UP port and GRID port to avoid that leakage of electrical equipment endangers human safety.
3. If inverter is equipped with DC switch, it is unnecessary to add PV input switch K1.
4. MEN link: The inverter maintains connection for the internal relay(RLY12, RLY13) on neutral wire when entering the off-grid mode.

4.2 Connection Symbol

Perform the electrical connection and communication connection in the bottom of inverter. The symbol and its illustration is as shown Figure4-2 and Table4-1.

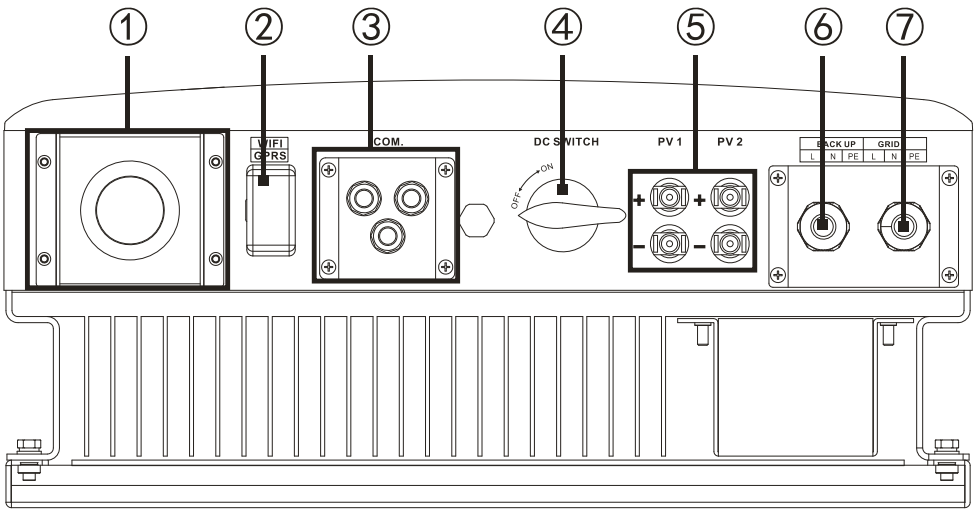


Figure4-2 Connection symbol

Table4-1 The illustration of connection symbol

No.	Symbol	Illustration
①	BATT.	Connect with battery
②	WiFi/GPRS	Install WiFi/GPRS module
③	COM.	Connect with DRM, PC, METER, BMS, TEMP to communicate.
④	DC SWITCH	DC switch(optional)
⑤	PV1(+, -), PV2(+, -)	Connect with PV array
⑥	BACK UP(L, N, PE)	Connect with major load
⑦	GRID(L, N, PE)	Connect with grid

4.3 AC Output Wiring

**CAUTION**

Install AC switch K3 between grid and inverter, which is convenient to disconnect inverter with grid when performing maintenance, as shown in Figure4-1. The recommended switch is with 250Vac/32A.

Install AC switch K4 between major load and inverter, which is convenient to disconnect inverter with major load when performing maintenance, as shown in Figure4-1. The recommended switch is with 250Vac/32A.

Don't connect grounding wire and neutral wire, neutral wire and live wire reversely to avoid short circuit.

As shown in Figure4-3, the grounding of inverter mustn't connect with the grounding of the lighting rod of the building where the inverter installed. It should separate them. The grounding of inverter should connect with the grounding system directly and the impedance should be less than $20\text{m}\Omega$.

Fasten AC cover and nylon cable gland firmly to avoid that water drops into wiring terminals.

The recommended wire is AWG12 or the cross-sectional area of wire is 4mm^2 .

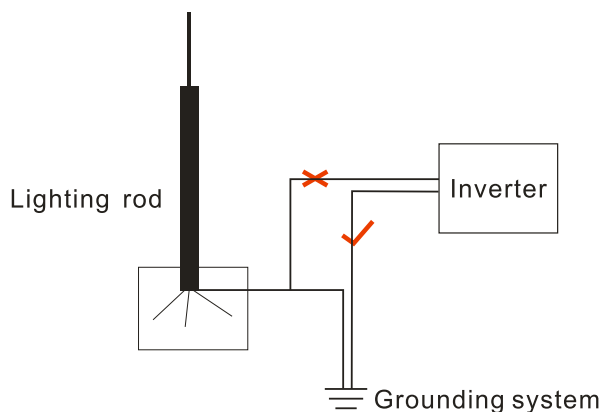


Figure4-3 The grounding of inverter

- Step 1 Check whether the voltage and frequency of grid-connected input meet grid-connected requirements of inverter.
- Step 2 Check whether the impedance between neutral wire and grounding wire is less than $10\text{m}\Omega$.
- Step 3 Disconnect all AC switches.
- Step 4 Prepare wires and strip the insulation layer of wires for about 7mm. Loosen the nylon cable gland in the AC cover and draw the wires through it, crimp the terminals and lock them on the inverter, as shown in Figure4-5.

Step 5 Connect the other end of grid wires with AC switch K3 and then connect K3 with smart meter or grid. Connect the other end of load wires with AC switch K4 and then connect K4 with load circuit that needs back up power.

- If inverter is equipped with smart meter, connect the neutral wire and live wire of AC switch K3 with L, N ports in the input of smart meter. Connect L, N ports in the output of smart meter with total grid switch K6, as shown in Figure4-4.

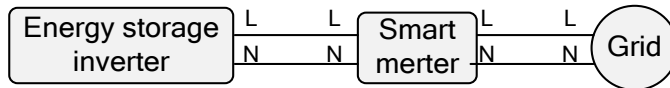


Figure4-4 Smart meter wiring

- If inverter isn't equipped with smart meter, connect the neutral wire and live wire of AC switch K3 with total grid switch K6.

Step 6 After wiring, install the AC cover and then tighten the nylon cable gland.

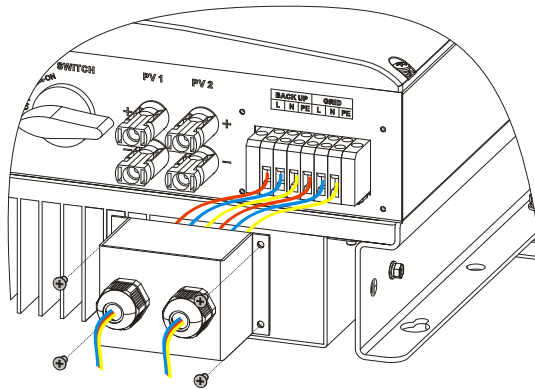


Figure4-5 AC output wiring



CAUTION

When using multiple inverters, don't connect BACK UP port in parallel or connect BACK UP port with grid to avoid inverter damage, as shown in Figure4-6 and Figure4-7.

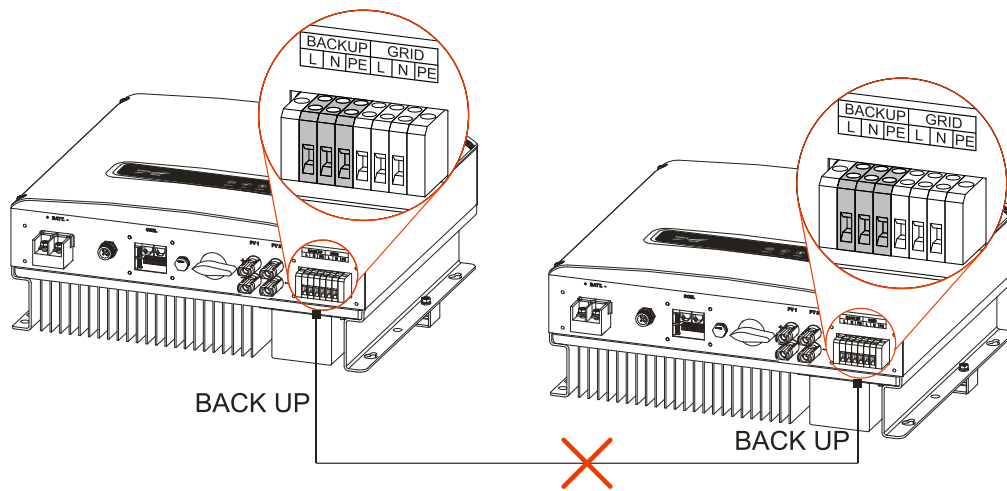


Figure4-6 Don't connect BACK UP port in parallel

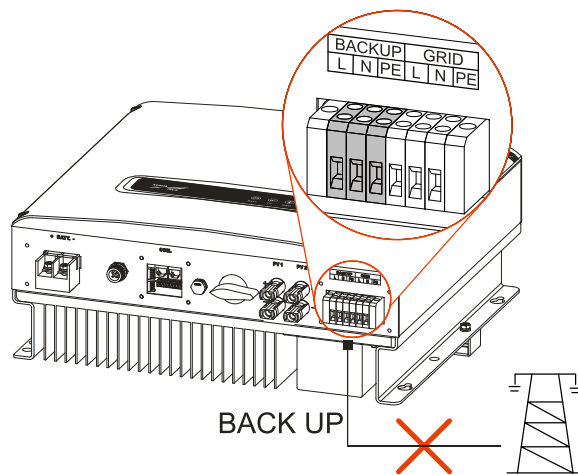


Figure4-7 Don't connect BACK UP port with grid

----End

4.4 PV Input Wiring

**CAUTION**

PV array meets the IEC61730 class A requirements.

If inverter isn't equipped with DC switch, install a DC switch between PV array and inverter. The recommended switch is with 600Vdc/16A.

Switch off DC switch before connecting with PV array.

Ensure the positive and negative connection is correct when connecting PV array with inverter.

The DC input voltage should be less than the max. input voltage of inverter.

As the inverter is non-isolation grid-connected inverter, don't connect the positive and negative of PV array with grounding wire to avoid that inverter can't work or inverter damage.

Use the equipped PV connector and terminals to perform DC input wiring to avoid poor connection or arcing.

The recommended wire is AWG12 or the cross-sectional area of wire is 4mm²

PV connector includes positive connector and negative connector. The corresponding matching is positive metal terminal and negative metal terminal respectively, as shown in Figure4-8 and Figure4-9.

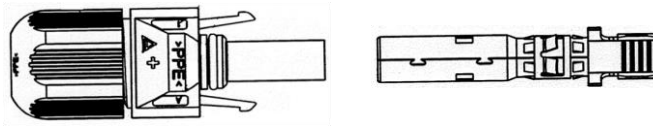


Figure4-8 Positive connector and positive metal terminal

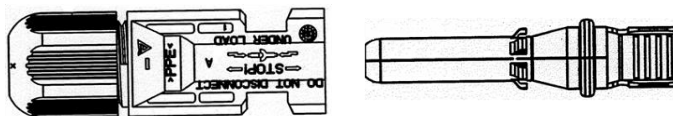


Figure4-9 Negative connector and negative metal terminal

- Step 1 Dismantle the sealing nuts of positive connector and negative connector respectively.
- Step 2 Strip the insulation layer of positive wire and negative wire for about 7mm by wire stripper, as shown in Figure4-10 and Figure4-11.

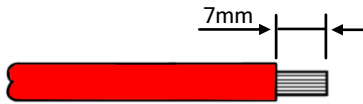


Figure4-10 Positive wire

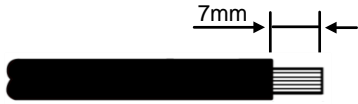


Figure4-11 Negative wire

- Step 3 Draw the positive wire and negative wire through the corresponding sealing nuts respectively.
- Step 4 Insert the positive wire and negative wire into the positive metal terminal and negative metal terminal respectively. Crimp the metal terminals firmly by crimping pliers, as shown in Figure4-12 and Figure4-13.

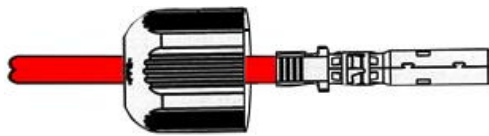


Figure4-12 Crimp the positive metal terminal



Figure4-13 Crimp the negative metal terminal

- Step 5 Insert the positive wire and negative wire into the corresponding insulation crust respectively. If there has a click sound, it means it have been inserted properly.
- Step 6 Tighten the sealing nuts of positive connector and negative connector to the corresponding insulation crusts respectively.
- Step 7 Insert the positive connector and negative connector into the ports marked with "+" and "-" in the inverter respectively. If there has a click sound, it means it have been inserted properly, as shown in Figure4-14 and Figure4-15.

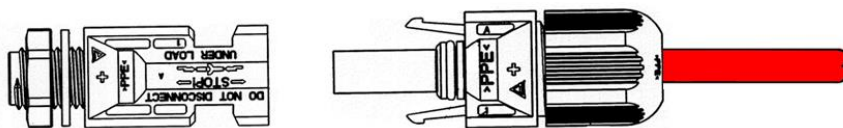


Figure4-14 Connect with the positive pole of DC input

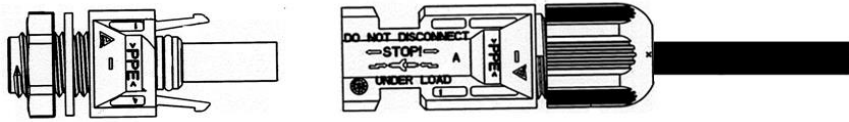


Figure4-15 Connect with the negative pole of DC input.

**CAUTION**

When using multiple inverters, don't connect PV port in parallel to avoid inverter damage, as shown in Figure4-16.

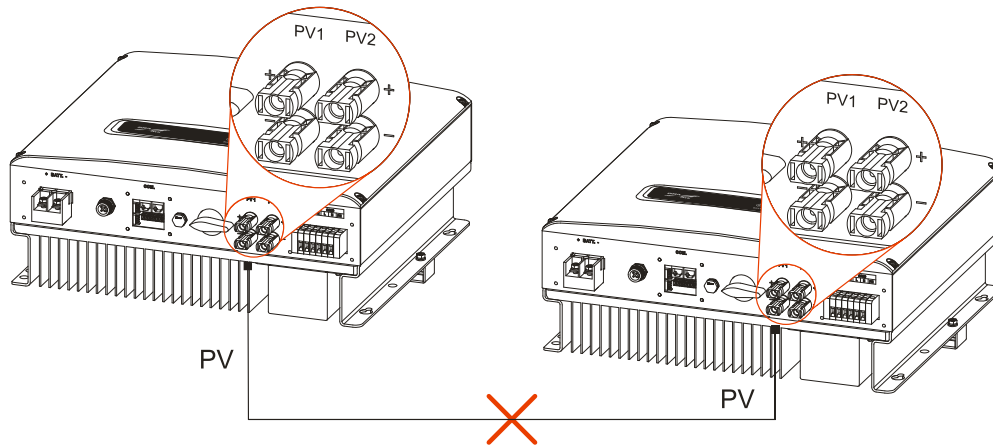


Figure4-16 Don't connect PV port in parallel

----End

4.5 Battery Wiring

**CAUTION**

Add DC switch K2 between battery and inverter to avoid arcing when wiring. The recommended switch is with 80Vdc/100A.

Don't connect positive and negative of battery reversely to avoid inverter damage.

Fasten battery cover and nylon cable gland firmly to avoid that water drops into wiring terminals.

The recommended wire is AWG6 or the cross-sectional area of wire is 16mm²

Step 1 Connect battery with one end of battery switch K2 and switch off battery switch K2.

- Step 2 Prepare wires and strip the insulation layer of wires for about 7mm. Loosen the nylon cable gland in the battery cover and draw the wires through it, cover the heat-shrinkable sleeve, crimp the terminals, tighten the heat-shrinkable sleeve and lock them in the inverter, as shown in Figure4-17.
- Step 3 Connect the other end of wires with battery switch K2.
- Step 4 After wiring, block fire-proofing mud from the inside of nylon cable gland, install the battery cover and then tighten the nylon cable gland.

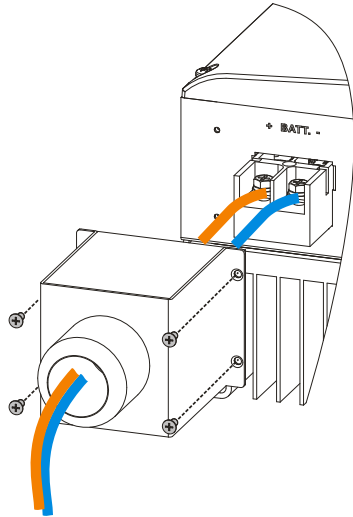


Figure4-17 Battery wiring

**CAUTION**

When using multiple inverters, don't connect battery port in parallel to avoid inverter damage, as shown in Figure4-18.

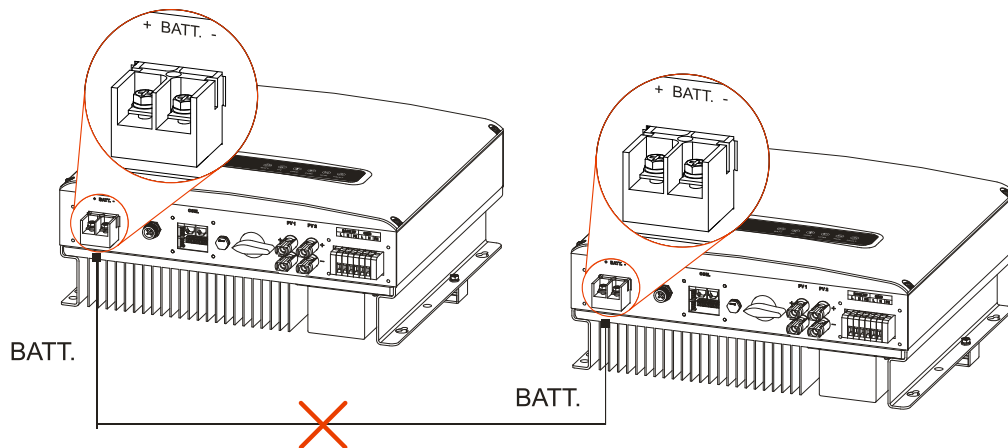


Figure4-18 Don't connect battery port in parallel

----End

4.6 COM. Communication Connection

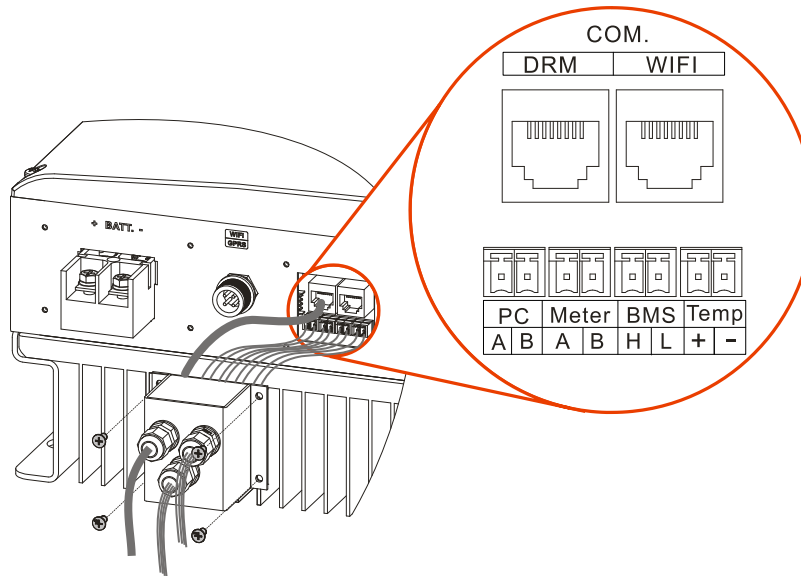


Figure4-19 COM. communication connection

There are five communication ports: DRM, PC, METER, BMS and TEMP.

- DRM port is connected with DRM control device. The pin definition of RJ45 plug is as shown in Figure4-20.

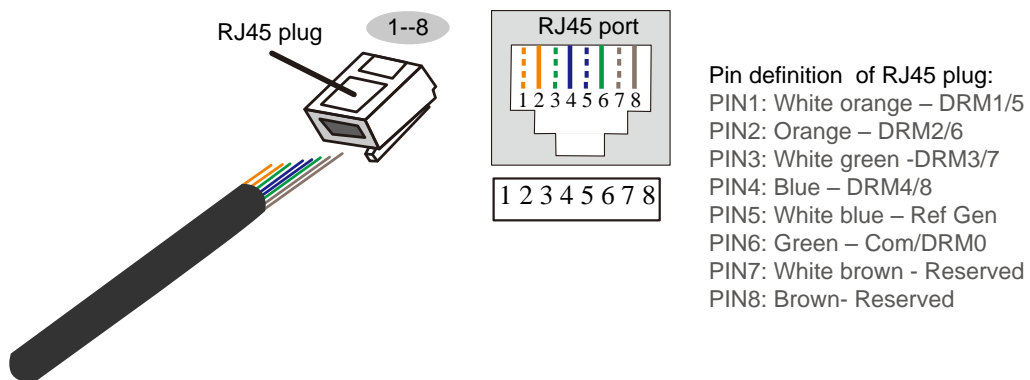


Figure4-20 Pin definition of RJ45 plug

- PC port is RS485 communication port, which is connected with PC by RS485 converter.
- METER port is RS485 communication port, which is connected with smart meter.
- BMS port is CAN communication port, which is connected with battery management module.
- TEMP port is to sample the temperature of lead acid battery.

- Step 1 Loosen the nylon cable gland in the communication cover.
- Step 2 Draw DRM signal wire through communication cover and crimp terminals according to Figure4-20, and insert it into DRM port. Connect the other end of DRM signal wire with DRM control device.
- Step 3 Draw A, B wire of METER through communication cover to corresponding terminals and connect the other end of wires with A, B ports of smart meter.
- Step 4 Draw H, L wire of BMS through communication cover to corresponding terminals and connect the other end of wires with H, L ports of BMS.
- Step 5 Draw "+", "-" wire of battery temperature sensor(The recommended type is 10k Ω NTC, such as 10KF3435, 103AT etc.) through communication cover to TEMP terminals and connect the other end of battery temperature sensor with the lead acid battery, as shown in Figure4-21.

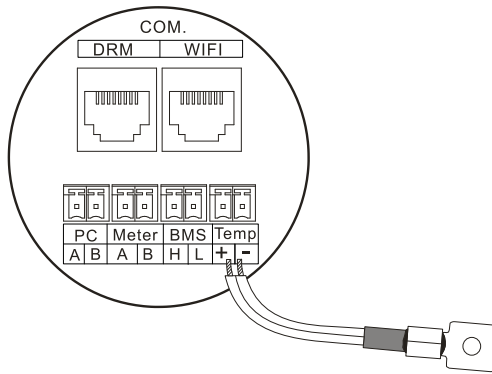


Figure4-21 Battery temperature sensor wiring

- Step 6 If it need to perform monitoring or setting in the PC, draw A, B wire of RS485 converter through communication cover to corresponding terminals and connect the other end of wires with PC.
- Step 7 After wiring, install the communication cover and then tighten the nylon cable gland.

----End

4.7 WiFi/GPRS Connection

Insert equipped WiFi/ GPRS module into WiFi/ GPRS port to perform remote monitoring, as shown in Figure4-22 and Figure4-23.

NOTE

When insert equipped WiFi/ GPRS module, align the cut in the WiFi/ GRPS module with the bump in the WiFi/ GPRS port.

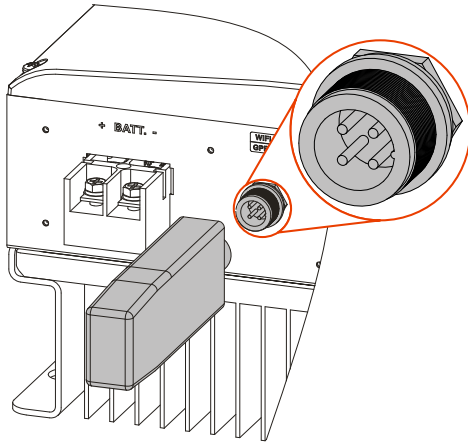


Figure4-22 WiFi/GPRS connection

The WiFi configuration refers to Appendix B WiFi Configuration.

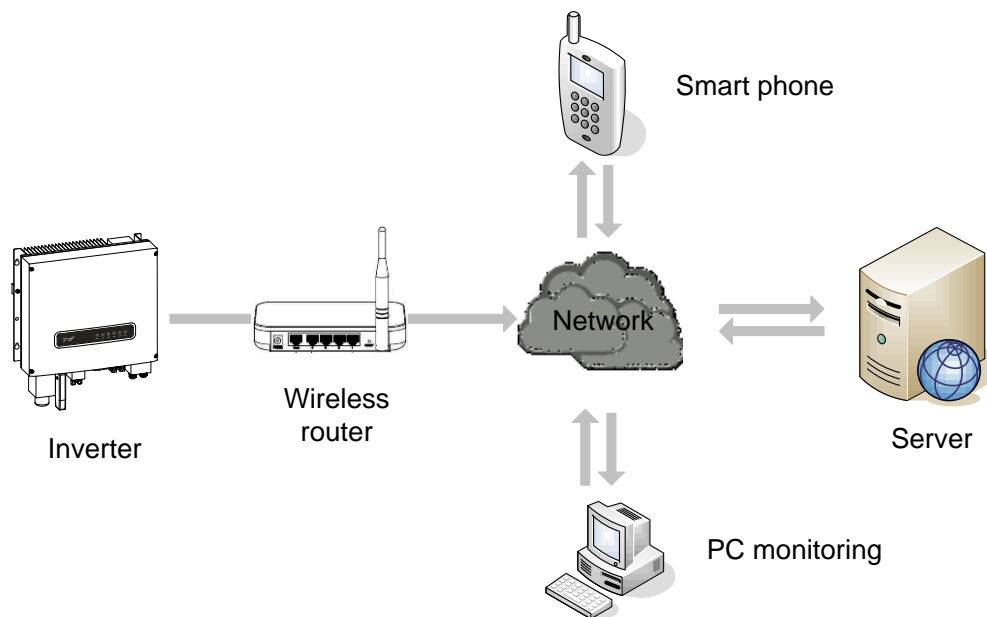


Figure4-23 WiFi monitoring plan

The monitoring APP can be downloaded in the official website, the corresponding QR barcode is as shown in Figure4-24.



Figure4-24 The QR barcode of monitoring APP

5 Operation Instruction

This chapter introduces inverter startup, shutdown and monitoring setting.

5.1 Opearaiion Announcements

- Load requirements in the BACK UP port is as below:
 - Resistive load $\leq 2.5\text{kw}$;
 - Capacitive load $\leq 1.5\text{kvar}$;
 - Inductive load $\leq 1.5\text{kvar}$.
- There may exists suspended voltage between live wire and neutral wire with grounding wire in the BACKUP port and GRID port. Don't touch live wire and neutral wire directly.
- If there has overload protection or short circuit protection, power down inverter and then power it on again.

5.2 Turn on Inverter

Step 1 Switch on AC output switch.

Step 2 Switch on DC input switch.

Step 3 Switch on battery switch.

----End

5.3 Turn off Inverter

Step 1 Switch off all switches.

Step 2 Wait all indicators are off.

----End

5.4 Monitoring Setting

If it needs to perform monitoring setting, connect PC with inverter and download WiseEnergy in the official website.

It also can perform monitoring setting through APP in the phone. The details refers to B WiFi Configuration and APP user manual. Download APP through scanning QR code in the Figure4-24.

5.5 Standard Type Setting

Inverter has set the factory standard setting based on the relevant country, which can be viewed in the WiseEnergy. The WiseEnergy user manual can be downloaded in the official website. The position of standard type is as shown in Figure5-1.

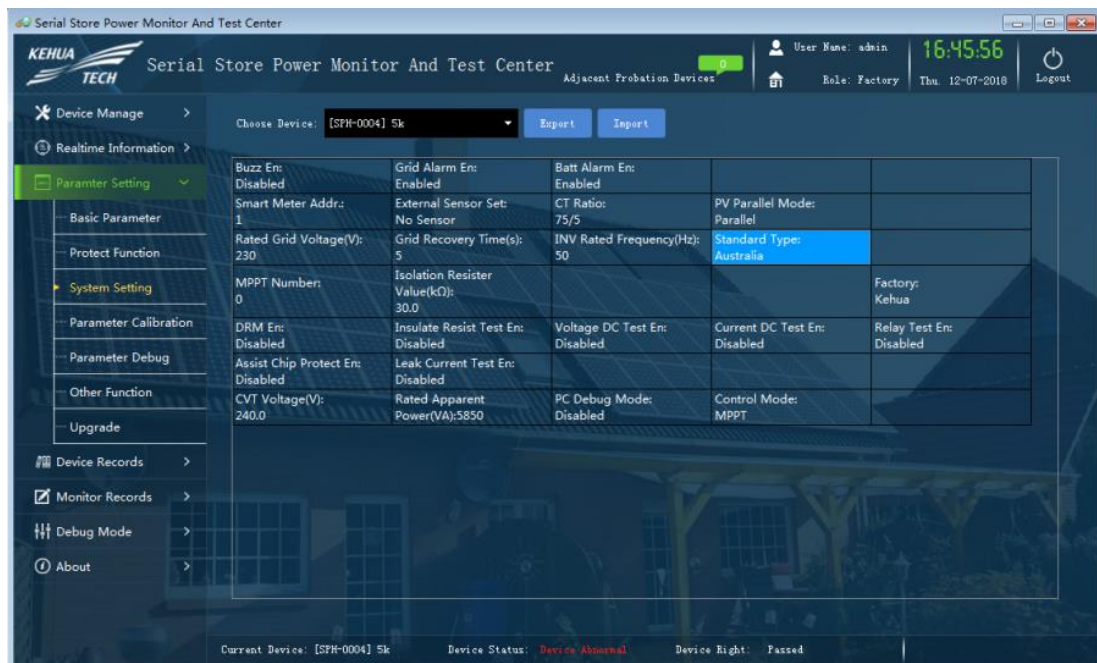


Figure5-1 The position of standard type

NOTE

If it needs to modify standard type, contact manufacturer to get password.

6 Maintenance and Troubleshooting

This chapter mainly introduces inverter maintenance and troubleshooting.

6.1 Maintenance

Clean dust on the top of inverter regularly by dry and soft cloth. Don't use water, corrosive material, cleaning agent and strong detergent, etc to clean the inverter.

If the display panel is too dirty to read, clear them by dry and soft cloth.

6.2 Troubleshooting

The inverter is designed according to the standards to meet the safety requirements. The system has been tested strictly prior to exiting the factory. If any fault happens, the system will show the alarm information and in the meantime, the system will stop operating. Potential reasons or causes for the faults are as shown in Table6-1.

Table6-1 Troubleshooting

Items		Protection	Recoverable or not	Measures
PV input protection	PV1 over-voltage	Included	Yes	Inform maintenance personnel.
	PV2 over-voltage	Included	Yes	Inform maintenance personnel.
	PV1 over-current	Included	Yes	Inform maintenance personnel.
	PV2 over-current	Included	Yes	Inform maintenance personnel.

Items		Protection	Recoverable or not	Measures
	Insulation fault	Included	Yes	Inform maintenance personnel.
Battery input protection	Battery over-voltage	Included	Yes	Inform maintenance personnel if it occurs frequently
	Battery under-voltage	None	Yes	Check whether battery is normal.
	Battery charging over-current	Included	Yes	Inform maintenance personnel if it occurs frequently.
	Battery discharging over-current	Included	Yes	Inform maintenance personnel if it occurs frequently.
	BMS communication fault	Included	Yes	Inform maintenance personnel if it occurs frequently.
	Battery abnormal	None	Yes	Check whether battery is normal.
	Battery over-temperature alarm	Included	Yes	Inform maintenance personnel if it occurs frequently.
	Battery low-temperature alarm	Included	Yes	Check whether battery communication wire is normal. If normal, inform maintenance personnel.
Grid-connected output protection	Grid frequency abnormal	Included	Yes	Inform maintenance personnel if it occurs frequently.

Items		Protection	Recoverable or not	Measures
	Grid amplitude abnormal	Included	Yes	Inform maintenance personnel if it occurs frequently.
	Inverter voltage abnormal	Included	Yes	Inform maintenance personnel if it occurs frequently.
	Inverter over-current	Included	Yes	Inform maintenance personnel if it occurs frequently.
	Inverter frequency abnormal	Included	Yes	Inform maintenance personnel if it occurs frequently.
	Inverter current DC component abnormal	Included	Yes	Inform maintenance personnel.
	Inverter over-current	Included	Yes	Inform maintenance personnel.
	Leakage current protection	Included	Yes	Inform maintenance personnel.
Off-grid output protection	Overload alarm	None	Yes	Disconnect some loads.
	Overload protection	Included	Yes	Disconnect some loads. Inform maintenance personnel if it occurs frequently.
	Short-circuit protection	Included	Yes	Check whether there has short-circuit phenomenon. If normal, inform maintenance personnel.

Items		Protection	Recoverable or not	Measures
	Inverter voltage DC component abnormal	Included	Yes	Inform maintenance personnel.
Temperature protection	Radiator over-temperature protection	Included	Yes	Inform maintenance personnel.
	Inner over-temperature	Included	Yes	Inform maintenance personnel.
Other	Fan fault	Included	Yes	Inform maintenance personnel.
	Relay fault	Included	Yes	Inform maintenance personnel.
	Smart meter connect fault	None	Yes	Check whether smart meter is normal. If normal, inform maintenance personnel.
	Communication fault	None	Yes	Inform maintenance personnel.
	Monitor communication fault	Included	Yes	Inform maintenance personnel.
	Hardware fault	Included	Yes	Inform maintenance personnel.
	Probation is up	Included	Yes	Inform maintenance personnel.

**CAUTION**

Don't perform maintenance until disconnecting AC grid, AC load, DC input and battery input with inverter and wait for 5 minutes to discharge completely.

**NOTE**

Please get ready the following information in advance before contacting with us.

1. Serial number of inverter.
2. Distributor.
3. Grid-connected date.
4. Fault description(i.e. alarm information, indicator status, running information, etc.).
5. Your detailed contact information.

7 Package, Transportation, Storage

This chapter mainly introduces package, transportation and storage.

7.1 Package

The inverter is packaged with carton. and the package size is 680(W)*660(D)*300(H) (mm). During packing, pay attention to the positioning direction requirements.

7.2 Transportation

During transportation, pay attention to warnings on the carton. Avoid severe impacts on the inverter. To avoid device damage, place the inverter strictly according to the placement directions. Don't carry device with the objects that inflammable, explosive, or corrosive. Don't put device in the open-air when midway transshipment. Leaching and mechanical damage by rain, snow or liquid objects must be prevented.

7.3 Storage

During storage, place the system strictly according to the directions as shown on the package. Keep the package at least 20cm from the floor and at least 50cm from walls, heat sources, cold sources, windows or air inlets

After being stored or transported beyond the operation temperature, keep the inverter aside and make its temperature return to normal range for more than 4h before installation. Poisonous gas, inflammable or explosive or corrosive chemical objects are prohibited in the warehouse. Besides, strong mechanical shaking, impact or strong magnetic field are also prohibited. Under the storage conditions above, the storage period is six months. If the inverter is storage beyond six months, it should be rechecked.

A Technical Specifications

Model		SPH3600-BL	SPH5000-BL
PV input features	Max. PV input power (W)	4000	5500
	Max. PV input voltage(VDC)	600	
	PV short-circuit current(A)	13.8	
	Max. PV input current(A)	11	
	Input group (N)	2	
	MPPT route (N)	2(can be paralleled)	
	Max. MPPT voltage range(VDC)	125~550	
	MPPT voltage range with full load (VDC)	250~450	
	Start-up PV voltage(VDC)	100	
	MPPT efficiency	99.90%	
	Max. inverter back feed current(A)	0	
	PV input short-circuit current(A)	202	
	Over-voltage class	Class II	
Battery features	Battery type	Li-ion/ASP/Lead-acid/Lead-carbon battery	
	Rated battery voltage(VDC)	48	
	Battery voltage range(VDC)	42~58	
	Max. battery charging power (W)	2500	

Model		SPH3600-BL	SPH5000-BL
	Max. battery charging current(A)	50	
	Max. battery discharging power (W)	2500	
	Max. battery discharging current(A)	60	
	Battery input short-circuit current(A)	196	
	Battery output short-circuit current(A)	180	
	Battery capacity(Ah)	100~250	
Grid input features	Rated grid input active power(W)	2500	
	Rated grid input voltage(Vac)	220/230/240	
	Rated grid input frequency(Hz)	50/60	
	Rated grid input current(A)	11.4/10.9/10.4	
	Max. grid input current(A)	12.5	
	Grid input short-circuit current(A)	213	
Grid output features	Rated grid output apparent power(VA)	3600	5000
	Rated grid output voltage(Vac)	220/230/240	
	Rated grid output frequency(Hz)	50/60	
	Rated grid output current(A)	16.4/15.7/15.0	22.7/21.7/20.8
	Max. grid output current(A)	16.4	22.7
	Grid output short-circuit current(A)	227	
	Grid inrush current(A)	30.5	
	Max. efficiency	97.5%	
	European efficiency	97.0%	
	THDi	<1.5%(Rated power))	
	Rated grid output power factor	>0.99(± 0.8 set)	

Model		SPH3600-BL	SPH5000-BL
	Over-voltage class	Class III	
Backup off-grid features	Rated off-grid output apparent power(VA)	3500	
	Rated off-grid output active power (W)	2500	
	Rated off-grid output voltage(Vac)	220/230/240	
	Rated off-grid output current(A)	11.4/10.9/10.4	
	Max. off-grid output current(A)	15.9	
	Off-grid output short-circuit current	221	
	Output waveform	Pure sine wave	
	Transfer time(ms)	10	
	Transfer efficiency (DC/AC)	94.0%	
	Voltage harmonic	<1%(Linear load)	
Protection features	Residual current protection	Included	
	Island protection	Included(frequency shift)	
	Output over-current protection	Included	
	Insulation impedance protection	Included	
System features	Installation method	Wall-mounted	
	Ingress protection rating	IP65	
	Environmental category	Outdoor	
	Protective class	I	
	Environment and pollution class	III	
	Dimension(Width × Height × Depth) (mm)	480×420×212	
	Weight(Kg)	27.5	

Model		SPH3600-BL	SPH5000-BL
	Inverter topology	Non-isolated	
	Cooling way	Natural cooling	
	Noise(dB)	<25	
	HMI	LED/ Cloud monitoring phone APP	
	Wet locations	Yes	
	Relative humidity	4%~100%	
	Operating temperature range(°C)	-25~ +60; If operating temperature exceeds 45°C, it is necessary to decrease 3% of rated power per 1°C.	
	Operating altitude (m)	0~2000	
	Communication port	DRM/ PC/ METER/ BMS/ TEMP/ WiFi	
	Optional component	DC switch, smart meter, temperature sensor, WiFi/ GPRS module	
Certification and standard	Grid-connected standards	VDE0126-1-1, VDE-AR-N4105, G83/2, G59/3, AS4777.2/3, ERDF, CEI 0-21	
	Safety	IEC62109-1, IEC62109-2, AS62040-1-1	
	EMC	EN61000-6-3, EN61000-6-2	

- Specifications are subject to change without prior notice.

B WiFi Configuration

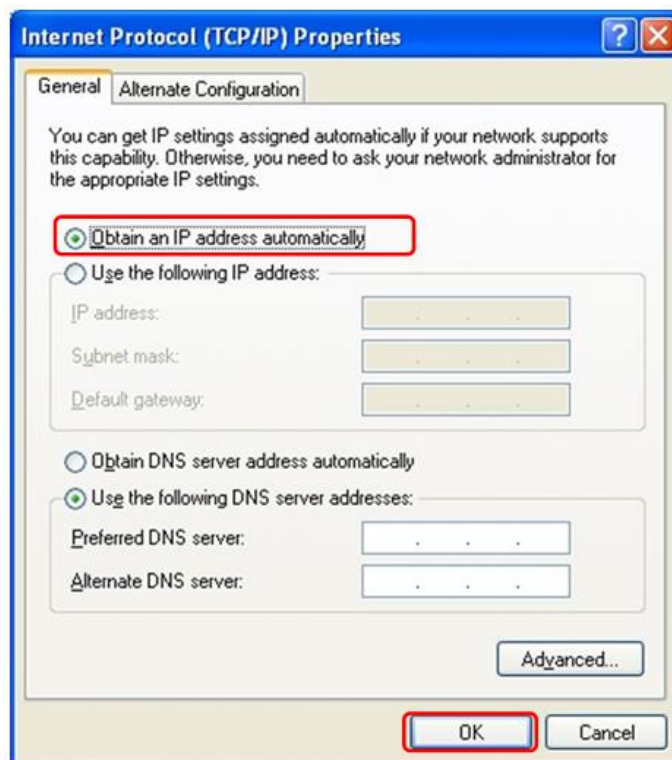
The configuration of WiFi may be set via PC or smart phone with WiFi function.

The setting hereinafter is operated with Windows XP for reference only. If other operating systems or smart phones are used, please follow the corresponding procedures.

1. Prepare a computer or device with WiFi function.
2. Obtain an IP address automatically.
- 1) Open "Wireless Network Connection Properties", double click "Internet Protocol (TCP/IP)".

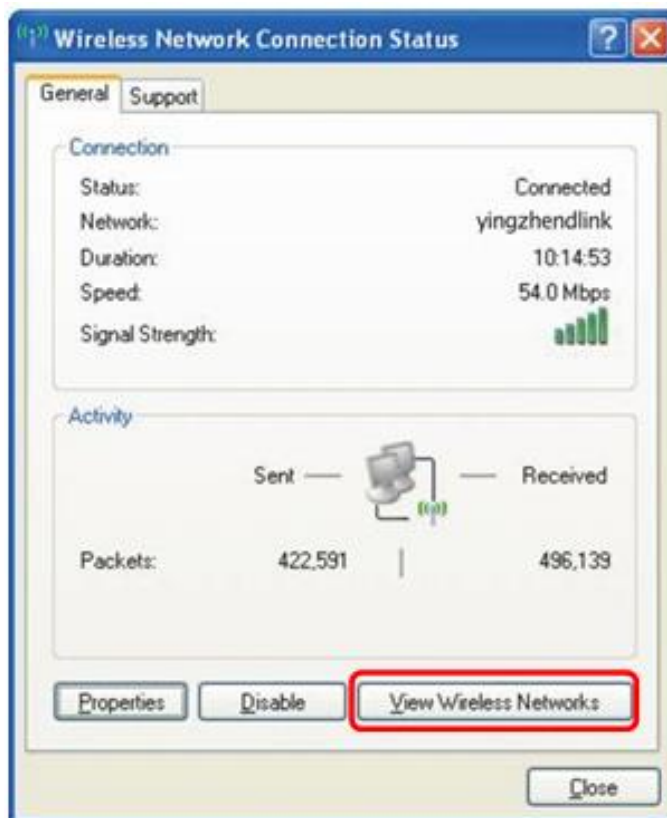


- 2) Select "Obtain an IP address automatically", and click "OK".

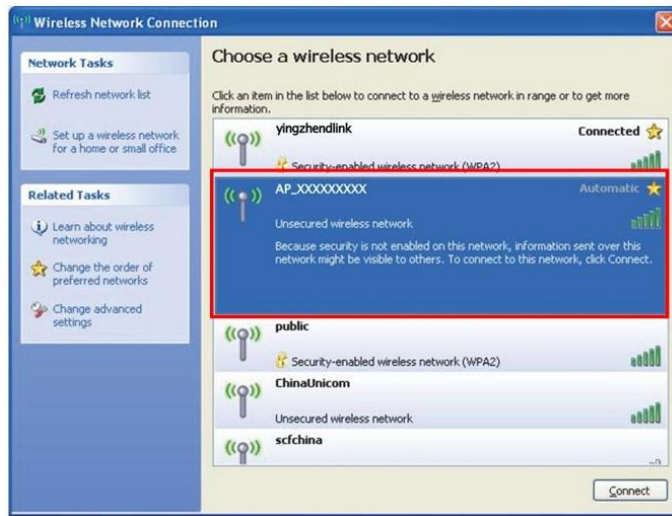


3. Set WiFi connection to the data logger.

1) Open "Wireless Network Connection Status" and click "View Wireless Networks".



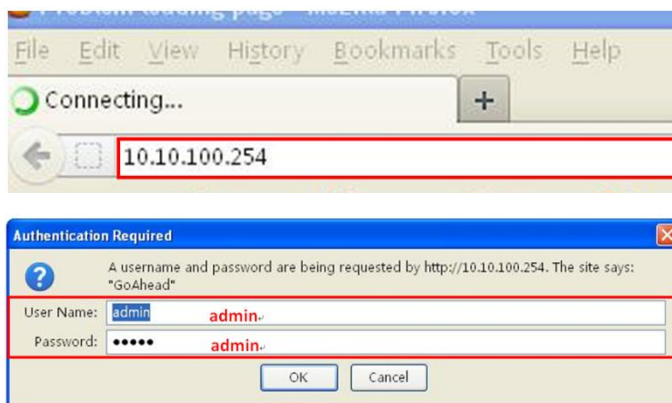
- 2) Select wireless network of the data logger, no passwords required as default. The network name consists of AP and the serial number of the product. Then click "Connect".



- 3) Connection successful.



4. Set parameters of data logger.
- 1) Open a web browser, and enter "10.10.100.254", or "http://wifi/", then fill in username and password, both of which are admin as default.



- 2) In the status page, you can view general information of the data logger.

中文 | English

Status Wizard Wireless Cable Advanced Upgrade Restart Reset	<p>Device information</p> <p>Device serial number: 601000000</p> <p>Firmware version: H4.01.36Y1.0.04W1.0.04(KL_V1.1)</p> <p>Wireless AP mode: Enable</p> <p>SSID: AP_601000000</p> <p>IP address: 10.10.100.254</p> <p>MAC address: AC:CF:23:10:F3:64</p> <p>Wireless STA mode: Enable</p> <p>Router SSID: yingzhendlink</p> <p>Signal Quality: 34%</p> <p>IP address: 192.168.1.187</p> <p>MAC address: AC:CF:23:10:F3:65</p> <p>Cable mode: Enable</p> <p>IP address: 192.168.1.187</p> <p>MAC address: AC:CF:23:10:F3:67</p> <p>Remote server information</p>	<p>Help</p> <p>The device can be used as a wireless access point (AP mode) to facilitate users to configure the device, or it can also be used as a wireless information terminal (STA mode) to connect the remote server via wireless router.</p>
---	--	---

3) Follow the setup wizard to start quick setting.

a. Click "Wizard" to start, then click "Start" to continue.

中文 | English

Status Wizard Wireless Cable Advanced Upgrade Restart Reset	<p>Dear user:</p> <p>Thank you for choosing our device. Next, you can follow the setup wizard to complete the network setting step by step, or you can select the left menu for detailed setting.</p> <p>★Note: Before setting, please make sure that your wireless network is working.</p> <p style="text-align: right;">Start</p> <p>1 2 3 4 5 6 7</p>	<p>Help</p> <p>The setup wizard will assist you to complete the device setting within one minute.</p>
---	--	--

b. Select "Wireless connection", and select the type of your inverter, then click "Next".

Network connection:

☒ Wireless connection ☐ Cable connection

Wireless Enabled

Select inverter brand: Power One

Back Next

1 2 3 4 5 6 7

- c. Click "Refresh" to search available wireless networks, or add it manually. Then select the wireless network you need to connect, then click "Next".

Please select your current wireless network:

Site Survey	SSID	BSSID	RSSI	Channel
<input type="radio"/> AP_603890570	ac:cf:23:10:f3:38	55%	1	
<input type="radio"/> ChinaNet-SFVe	0c:4c:39:10:65:c9	70%	1	
<input type="radio"/> ITV-SFVe	5a:4c:39:10:65:ca	70%	1	
<input type="radio"/> AP_603040574	ac:cf:23:10:f3:48	20%	1	
<input checked="" type="radio"/> yingzhendlink	ec:6c:9f:04:b3:2c	50%	1	
<input type="radio"/> AP_604779731	ac:cf:23:12:1e:9c	55%	1	
<input type="radio"/> AP_501201091	ac:cf:23:10:84:04	10%	1	
<input type="radio"/> AP_901000414	ac:cf:23:ff:33:2c	39%	1	
<input type="radio"/> on lead	a8:15:4d:6c:fb:a4	0%	1	
<input type="radio"/> AP_SOLAR_PORTAL_M2M_20120615	a4:99:47:29:67:f0	55%	5	

★Note: When RSSI of the selected WiFi network is lower than 15%, the connection may be unstable, please select other available network or shorten the distance between the device and router.

Refresh

Add wireless network manually:

Network name (SSID)

(Note: case sensitive)

Encryption method WPA2PSK

Encryption algorithm TKIP

Back Next

1 2 3 4 5 6 7

- d. Enter the password for the selected network, then click "Next".

This screenshot shows the 'Please enter the wireless network password:' screen of the WiFi configuration wizard. The interface includes a sidebar with options: Status, Wizard (selected), Wireless, Cable, Advanced, Upgrade, Restart, and Reset. The main area contains two password input fields: 'Password (8-64 bytes) (Note: case sensitive)' and 'Re-enter password'. A 'Show Password' checkbox is located below the second field. A 'Connecting' status indicator is present. At the bottom, there are 'Back' and 'Next' buttons, and a progress bar with steps 1 through 7, where step 4 is currently active. A 'Help' sidebar on the right provides instructions: 'Please make sure you have entered the correct password.'

- e. Select "Enable" to obtain an IP address automatically, then click "Next".

This screenshot shows the 'Please fill in the following information:' screen of the WiFi configuration wizard. The sidebar and progress bar are consistent with the previous screen, with step 5 now active. The main area contains a dropdown menu for 'Obtain an IP address automatically' set to 'Enable'. Below this are input fields for 'IP address', 'Subnet mask', 'Gateway address', and 'DNS server address', all currently showing '0.0.0.0'. 'Back' and 'Next' buttons are at the bottom. The 'Help' sidebar on the right explains: 'Most systems support the function of DHCP to obtain IP address automatically. Please select disable and add it manually if your router does not support such function.'

- f. Enhance security settings of the WiFi by selecting any options as listed, then click "Next".

Option 1: If you choose to hide AP, the SSID of the AP network for your WiFi will be invisible on your wireless network list. Please reconfirm the IP address of the collector on your router before you log in this server next time.

Enhance Security

You can enhance your system security by choosing the following methods

Hide AP ☒

Change the encryption mode for AP ☐

Change the user name and password for Web server ☐

Back **Next**

1 2 3 4 5 **6** 7

Help

Hide AP
The SSID of the AP network will be invisible if you hide the AP. Please enter the SSID manually when you need to connect to AP next time.

Change the encryption mode for AP
If you set password for the AP network, you will need to enter the password to connect to AP.

Change the user name and password for Web server
If you change the username and password for the web server, you will need to enter the new username and password

Option 2: If you wish to change the encryption mode of the AP network, you will need to enter the correspondent encryption method and password before connecting next time.

Enhance Security

You can enhance your system security by choosing the following methods

Hide AP ☐

Change the encryption mode for AP ☒

Encryption mode: WPA2-PSK

WPA encryption

Encryption algorithm: ☒ TKIP ☐ AES ☐ TKIPAES

Password (8 to 63 characters): 12345678

Change the user name and password for Web server ☐

Back **Next**

1 2 3 4 5 **6** 7

Help

Hide AP
The SSID of the AP network will be invisible if you hide the AP. Please enter the SSID manually when you need to connect to AP next time.

Change the encryption mode for AP
If you set password for the AP network, you will need to enter the password to connect to AP.

Change the user name and password for Web server
If you change the username and password for the web server, you will need to enter the new username and password to get access to the setting page.

Option3: If you wish to change the user name and the password of the Web server, please enter the new username and password when you need to re-log in this server.

Enhance Security

You can enhance your system security by choosing the following methods

Hide AP ☐

Change the encryption mode for AP ☐

Change the user name and password for Web server ☒

Current user name: admin

New user name: 123

Re-enter user name: 123

New password: •••••

Re-enter password: •••••

Back Next

1 2 3 4 5 6 7

Help

Hide AP
The SSID of the AP network will be invisible if you hide the AP. Please enter the SSID manually when you need to connect to AP next time.

Change the encryption mode for AP
If you set password for the AP network, you will need to enter the password to connect to AP.

Change the user name and password for Web server
If you change the username and password for the web server, you will need to enter the new username and password to get access to the setting page.

g. If setting is successful, the following page will display. Click "OK" to restart.

Setting complete!

Click OK, the settings will take effect and the system will restart immediately.

If you leave this interface without clicking OK, the settings will be ineffective.

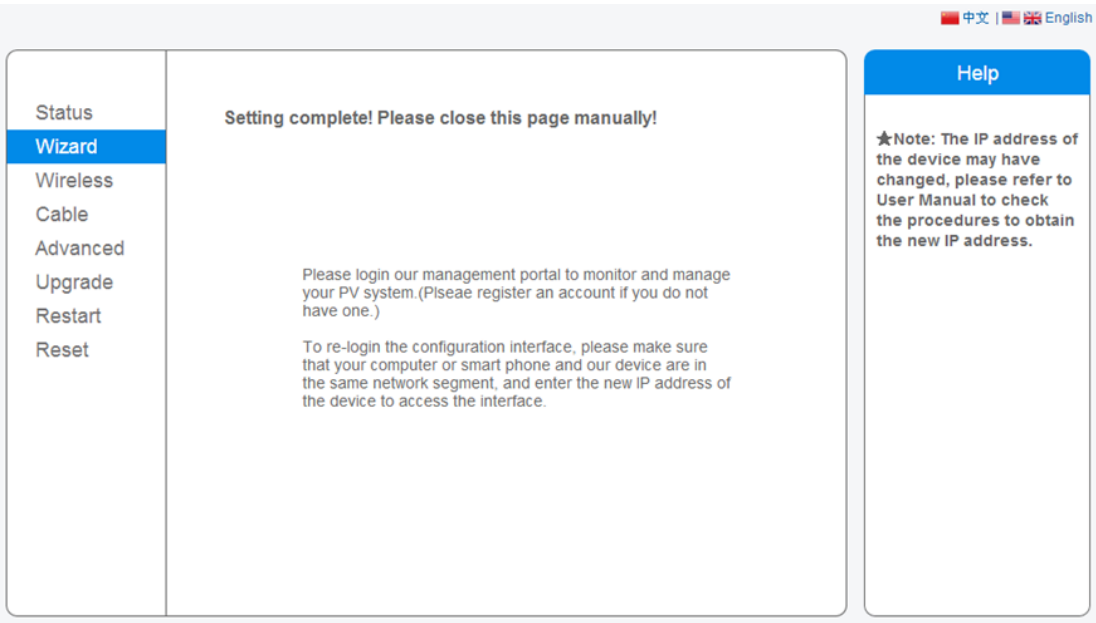
Back OK

1 2 3 4 5 6 7

Help

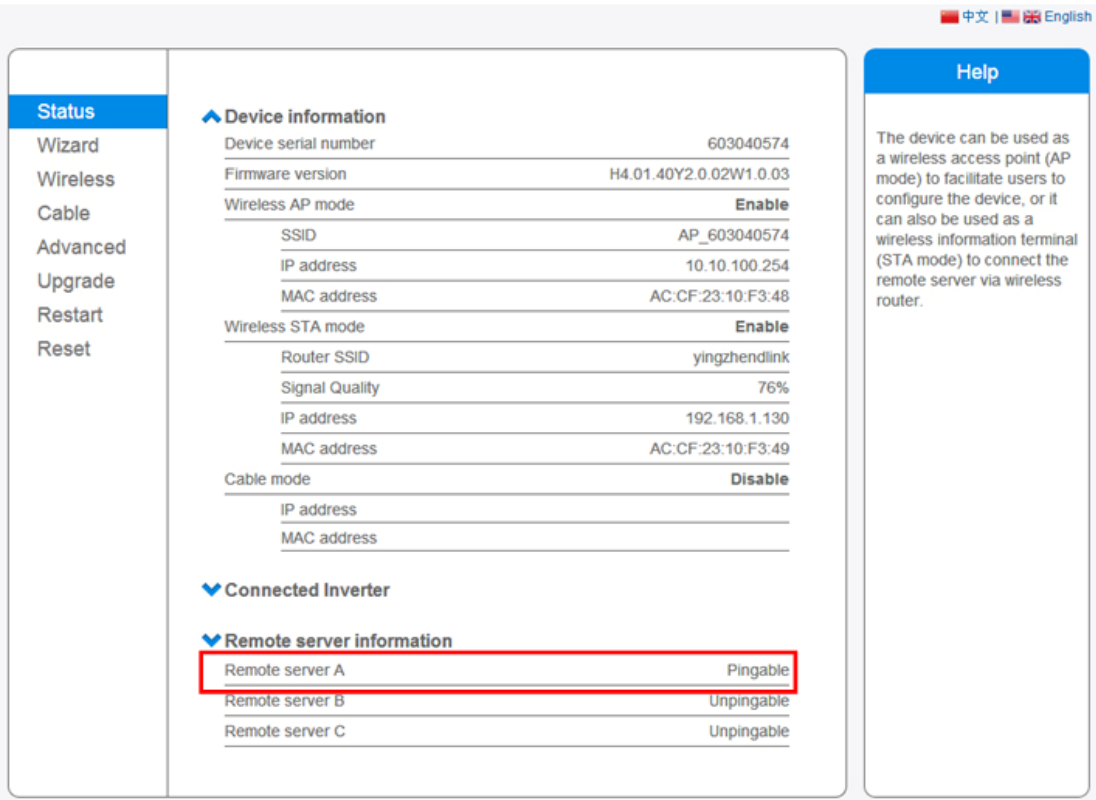
After clicking OK, the system will restart immediately.

h. If restart is successful, the following page will display. If this page does not display automatically, please refresh your browser.



- i. Re-log on this setting page to status interface after the Web server restart, and check the network connection status of the data logger.

After network setting is complete, the "Wireless STA mode" should be enabled and relative information of your router will display on the interface automatically. Besides the "Remote server A" should be pingable as the picture described.



C Acronyms and Abbreviations

A

AC	Alternating Current
AWG	American Wire Gauge

D

DC	Direct Current
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I

IEC	International Electrotechnical Commission
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L

LED	Light-emitting Diode
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M

MPPT	Maximum Power Point Tracking
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P

PE	Protective Earthing
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PV Photovoltaic

R

RS485 Recommend Standard485

T

THDi Total Distortion of the input current waveform



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001

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