AOHAI

User Manual

AH-3~6KSL-G2 Hybrid Inverter

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Hai power IOS

Hai power Android

AOHAI Technology

- AH-3KSL-G2
- AH-3.6KSL-G2
- AH-4KSL-G2
- AH-4.6KSL-G2
- AH-5KSL-G2
- AH-6KSL-G2

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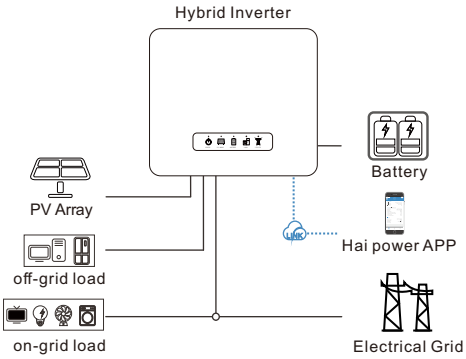
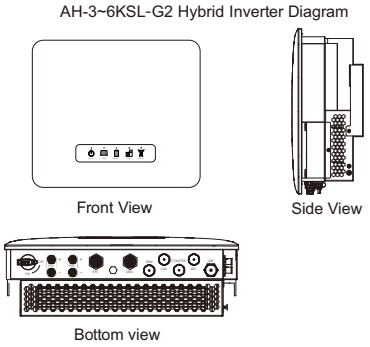
01 Introduction

AH-3~6KSL series inverters, also called hybrid or bidirectional solar inverters, apply to solar system with participation of PV, battery, loads and grid system for energy management. The energy produced by PV system can support household electricity consumption, as well as storage in battery, and the rest of power can be exported to the grid. The battery can discharge to support loads when PV power is insufficient to meet self-consumption needs. If battery power is not sufficient, the system will take power from the utility grid to support loads.

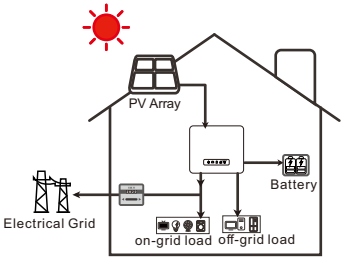
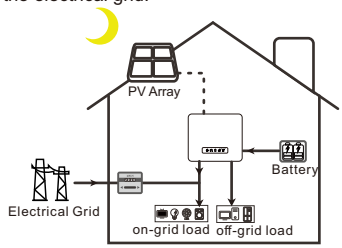




Note: The product introduction section introduces the common working conditions of the AH-3~6KSL system. Users can adjust according to the system layout on Aohai Hai Power APP to adjust the operating modes of the inverter. The general operating modes of the AH-3~6KSL system are as follows:

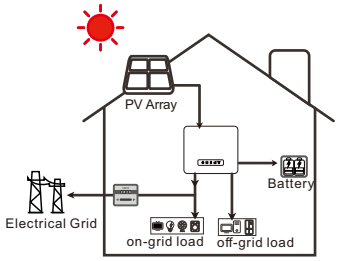
1.1 Operation Mode

According to different system configurations and layouts, the AH-3~6KSL ESS can usually be set to the following operating modes:

Load Priority Mode - Priority: Load > Battery > Grid	
Sufficient PV energy: Priority to meet the load power, and then charge the battery, and finally the excess energy into the grid.	**Insufficient PV energy:** PV and battery energy are preferentially provided to the load,and if the load consumption cannot be met, the power will be taken from the electrical grid.
	

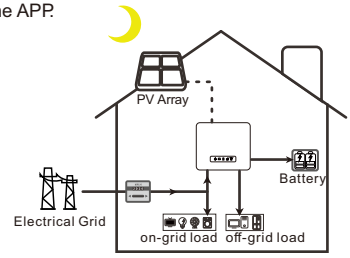
Battery Priority Mode - Priority: Battery > Load > Grid

Sufficient PV energy: Priority to meet the load power, and then charge the battery, and finally the excess energy into the grid.



Insufficient PV energy: The load energy is provided by the grid,which will recharge the battery at the same time.

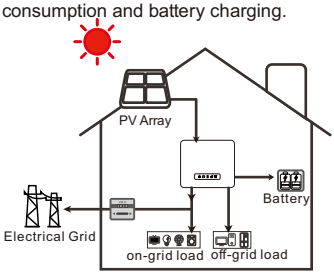
Note: AC charging needs to turn on the enable switch in the APP.



Grid Priority Mode - Priority: Grid > Load > Battery

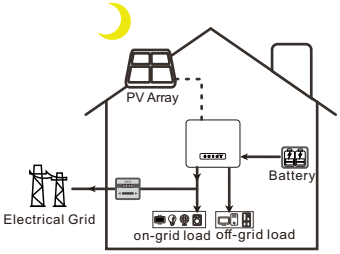
Sufficient PV energy: First meet the load power, and then deliver energy to the grid, and finally the remaining energy to charge the battery.

Note: If the anti-counter-current function is enabled, it will no longer supply power to the grid, but meet the load consumption and battery charging.



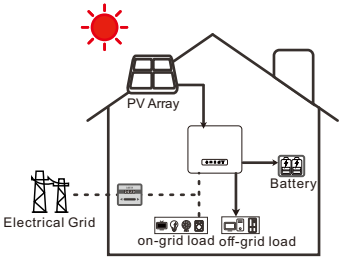
Insufficient PV energy: PV and the battery simultaneously (without PV, the battery alone) power the load and deliver energy to the grid.

Note: If the anti-counter-current function is enabled, it will no longer supply power to the grid, but meet the load consumption and battery charging.



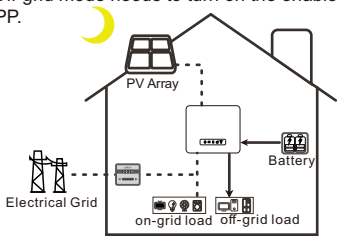
Back-up Mode - Priority: Critical Load > Battery

Sufficient PV energy: First meet the emergency load power, and then the excess energy to charge the battery.



Insufficient PV energy: The PV and the battery simultaneously (the battery alone when there is no PV) power the emergency load.

Note: Off-grid mode needs to turn on the enable switch in the APP.



1.2 Safety and Warning

The AH-3~6KSL-G2 hybrid inverters from Shenzhen AOHAI Digital Power Co.,Ltd. (also called AOHAI) strictly complies with related safety rules for product design and testing. Please read and follow all of the instructions and cautions appearing on the inverter or in the User Manual during installation, operation and maintenance,as any improper operation might cause personal injury or property damage.

Symbol Explanation

	Failure to observe any warnings contained in this manual may result in injury.
	Danger - high voltage and electric shock!
	Danger - hot surface!
	This side up! This package must always be transported, handled and stored in such a way that the arrows always point upwards.
	No more than five (5) identical packages being stacked on each other.
	Products shall not be disposed as household waste.
	Fragile - The package/product should be handled carefully and never be tipped over or slung.
	Refer to the operating instructions.
	Keep dry! The package/product must be protected from excessive humidity and must be stored under cover.
	This symbol indicates that you should wait at least 5mins after disconnecting the inverter from the utility grid and from the PV panel before touching any inner live parts.
	CE mark.

Safety Warnings

Any installation or operations on the inverter must be performed by qualified electricians in compliance with standards, wiring rules and the requirements of local grid authorities or companies (such as AS 4777 and AS/NZS 3000 in Australia).

Before any wiring connection or electrical operation on inverter, all battery and AC power must be disconnected from inverter for at least 5 minutes to make sure inverter is totally isolated to avoid electric shock.

The temperature of inverter surface might exceed 60℃ during operation, so please make sure it has cooled down before touching it, and make sure the inverter is out of reach of children.

Do not open the inverter's cover or change any components without manufacturer's authorization, otherwise the warranty commitment for the inverter will be invalid.

Usage and operation of the inverter must follow instructions in this user manual, otherwise the protection design might be impaired and warranty commitment for the inverter will be invalid.

Appropriate methods must be adopted to protect inverter from static damage. Any damage caused by static is not warranted by manufacturer.

PV negative (PV-) and battery negative (BAT-) on inverter side is not grounded as default design. Connecting PV- to EARTH are strictly forbidden.

PV modules used on the inverter must have an IEC61730 class A rating, and the total open circuit voltage of PV string/array is lower than the maximum rated DC input voltage of the inverter. Any damage caused by PV over-voltage is beyond warranty.

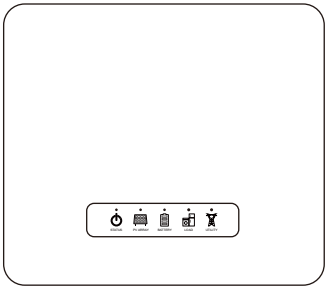
The inverter, with built-in RCMU, will exclude possibility of DC residual current to 6mA, thus in the system an external RCD (type A) can be used(≥ 30mA).

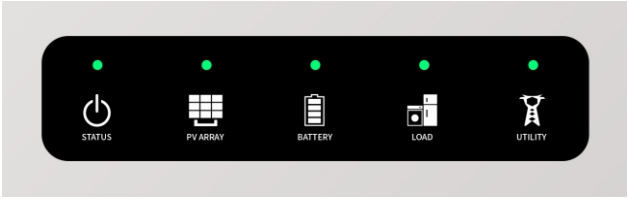
* In Australia, output of back-up side in switchbox should be labeled on "Main Switch UPS Supply".The output of normal load side in switch box should be labeled "Main Switch Inverter Supply".

* In Australia, the inverter internal switching does not maintain neutral integrity, which must be addressed by external connection arrangements like in the system connection diagram for Australia.

1.3 Product Overview

Light panel display instructions:

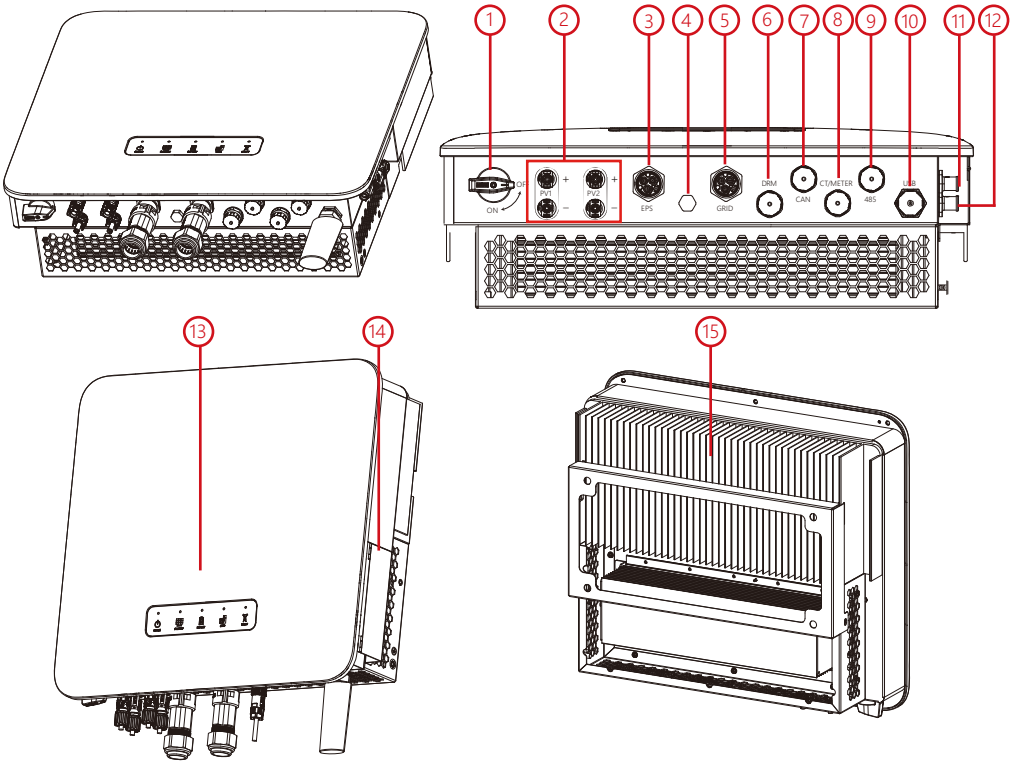




	No Fault	Fault	Upgrading	Warning
STATUS	The green light stays on	The red light stays on	the green light blinking for 0.5 second	the green light blinking for 1 second

	Voltage on Port	Power on Port	Upgrading
PV ARRAY	the green light blinking for 1 second	Light keep green	the green light is flashing for 0.5 second
BATTERY	the green light blinking for 1 second	Light keep green	the green light is flashing for 0.5 second
LOAD	the green light blinking for 1 second	Light keep green	the green light is flashing for 0.5 second
UTILITY	the green light blinking for 1 second	Light keep green	the green light is flashing for 0.5 second

Port Diagram:



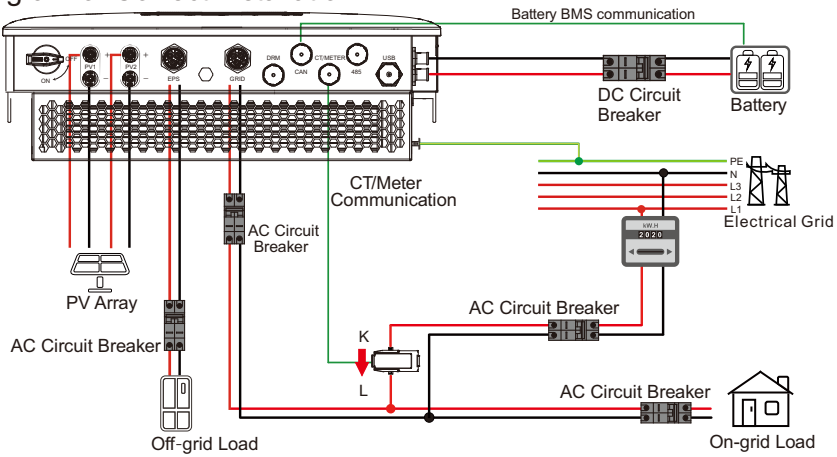
① PV Switch
② PV Input Port (PV1/PV2)
③ Off-grid Port(EPS)
④ Waterproof Ventilated Valve
⑤ On-grid Port(Grid)
⑥ DRM Port
⑦ CAN Port(BMS Port)
⑧ CT / Meter Port
⑨ RS485 Communication Port(External)
⑩ USB Port(WiFi/4G)
⑪ Battery - Input Port
⑫ Battery + Input Port
⑬ LED Display
⑭ Battery Terminal Shield
⑮ Wall mounted bracket

1.4 Storing The Inverter

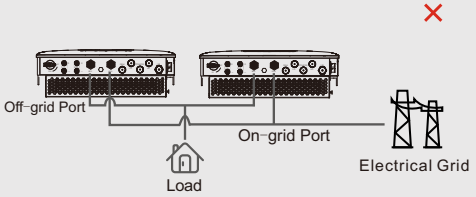
Store the inverter in a dry place where ambient temperatures are always between -25°C and +60°.

02 Installation Instructions

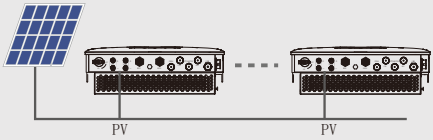
2.1 Diagram of Correct Installation



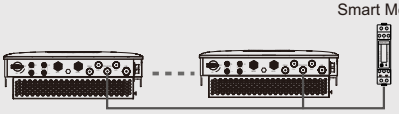
Wrong Instructions are as below:



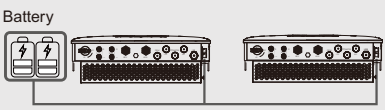
The off-grid side cannot be connected in parallel. Please contact AOHAI After-sales team if need.



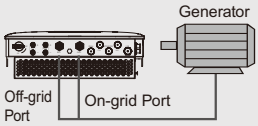
Every single PV Array can not be connected with multiple inverters



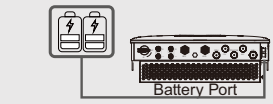
One meter cannot be connected to multiple inverters. Different CTs cannot connect to the same line cable.



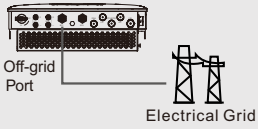
One battery bank cannot be connected to multiple inverters.



The on-Grid or Off-grid side cannot be connected to any AC generator directly.



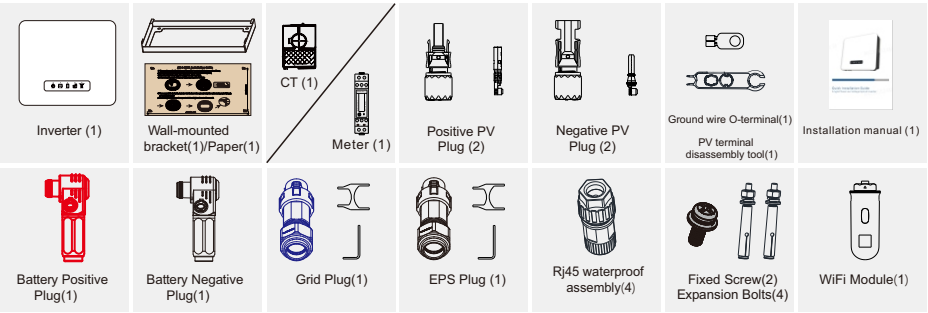
The inverter battery input must not be connected to incompatible batteries.



The Off-grid side cannot be connected to the grid.

2.2 Packing List

Upon receiving the hybrid inverter, please check if any of the components as shown below are missing or broken.



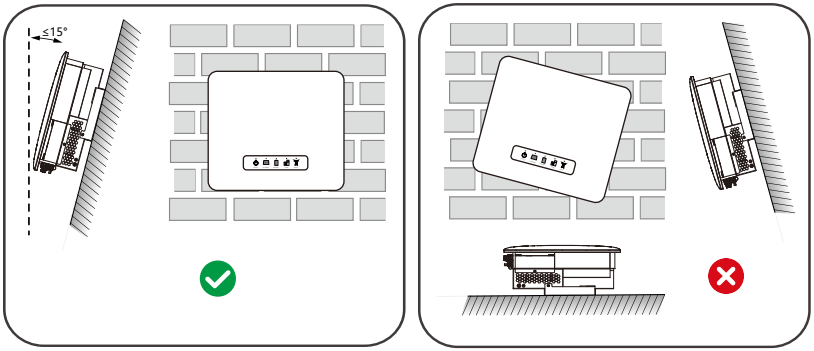
- CT/METER: CT or METER choice, standard CT, optional METER.
- WIFI Module: Standard models include a WIFI module, customer needs to install it to configure the functionality of the inverter.

Installation Tool Requirements

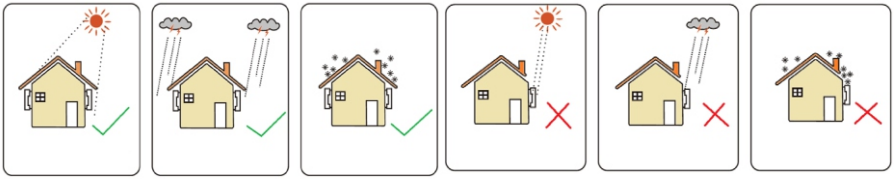
2.3 Select Mounting Location

For inverter's protection and convenient maintenance, mounting location for inverter should be selected carefully based on the following rules:

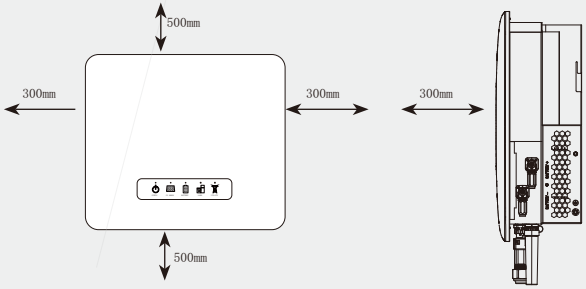
- Any part of this system shouldn't block the switch and breaker from disconnecting the inverter from DC and AC power.
- Inverter should be installed on a solid surface, where it is suitable for inverter's dimensions and weight (The weight of inverters: 30kg)
- Inverter should be installed vertically with a max rearward tilt of 15°



- It is recommended that the installation of the inverter should be prevented from direct sunlight,snow,rain and other negative influences which may cause function impact or life aging.
- The temperature and humidity at the installation site should be within the appropriate range (-25˚C~60˚C for outdoor unconditioned with solar effects).



- Inverter should be installed at eye level for convenient maintenance.
- Product label on inverter should be clearly visible after installation. Do not damage the label.
- Leave enough space around the inverter according to the below figure for natural heat dissipation.



Upward--------300mm
Downward----500mm
Front----------300mm
Both sides----300mm

The inverter cannot be installed near flammable, explosive or strong electromagnetic equipment.

Remember that this inverter is heavy! Please be careful when lifting out from the package.

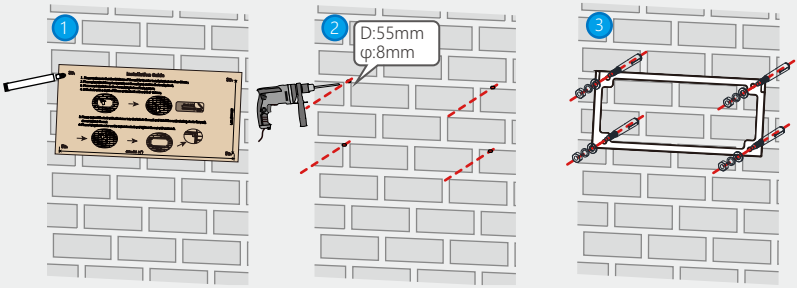
The inverter is suitable for mounting on concrete or other non-combustible surfaces only.

Step 1

Please use the Wall-mounted Paper as a template to drill 4 holes in the correct positions (8mm in diameter and 55mm in depth).

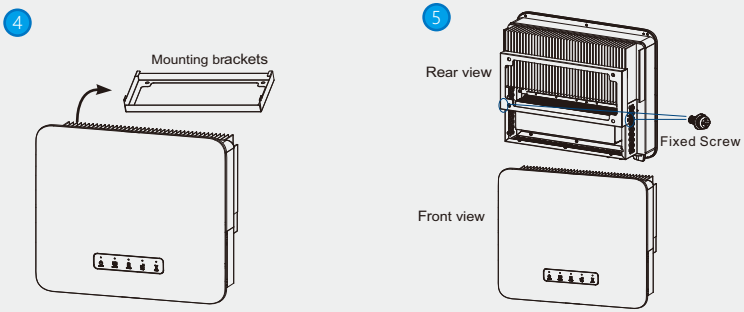
Use the expansion bolts in the accessory box and tightly attach the mounting bracket to the wall

Mounting bracket :



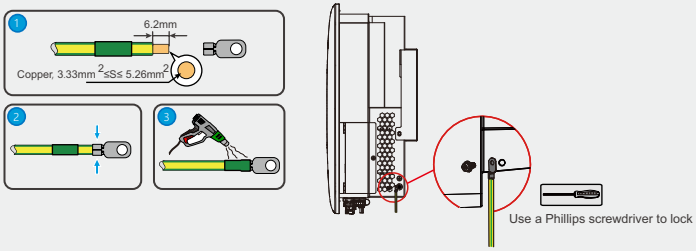
Step2

Carry the inverter by holding the heat sink on two sides and place the inverter on the mounting bracket.



Step 3

Connect the ground cable to the ground plate on the grid side



2.4 Electrical Wiring Connection

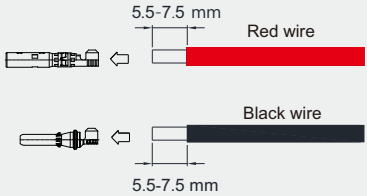
2.4.1 Connecting the DC Input Cable

Before connecting PV panels/strings to the inverter, please ensure that all requirements listed below are followed:

- The total short-circuit current of a PV string must not exceed the inverter's max DC current.
- The PV string must not be connected to the earth/grounding conductor.
- Use the right PV plugs in the accessory box. (BAT plugs are similar to PV plugs. Please check before using them.)

Note: There are PV connectors and plugs in the accessory box. The connection details are shown below.

Step 1



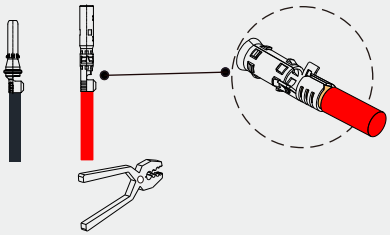
Note:

1.Please use the PV plugs and connectors from the accessory box.

2.The maximum input current of a single PV is 16A, conductor core section:copper,4.17mm²(11AWG).

Step 2

Connect the PV cable to the PV connectors.



Note:

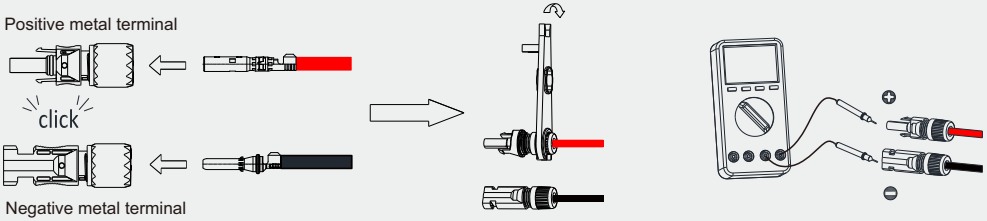
1.Please make sure cable can't put out from terminal after pressing.

Step 3

Screw the cap on and plug it into the inverter side.

Make sure the cable polarity is correct.

Note: There will be a clicking sound if the connectors are inserted correctly into the PV ports.



Lock nut to ensure fastening

Pull the PV cable make sure there is no loosen or shaking.

The polarity of the PV strings must not be connected in a reverse manner. Otherwise, the inverter could be damaged

Step 4

Note:

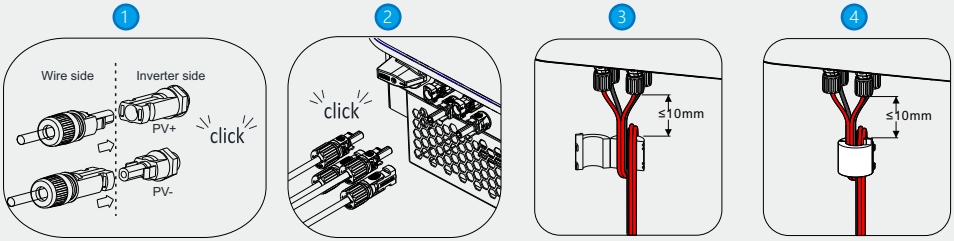
1.Please make sure the PV input voltage/current not beyond the specification before plug in.

2.When installing the PV terminal, pay attention to the distinction between the positive and negative terminals and the one-to-one correspondence between the terminals and hybrid inverter.

3.When the terminal is docked, there is a click sound. After the terminal is locked, gently pull the PV cable to observe whether looseness.

4.According to step 3 and step 4, wrap the PV wire around the magnetic ring and fasten the buckle.

5.The distance between the magnetic ring and the PV terminal should be less than 10mm.



2.4.2 Battery Wiring Connection

Please be careful of any electric shock or chemical hazards.

Make sure that the breaker is of and battery nominal voltage meets AH-3~6KSL series' specification (42V~59V) before connecting battery to inverter. Make sure inverter is totally isolated from PV and AC power.

For lithium battery (pack) the capacity should be 50Ah or larger. Battery cable requirements are as Figure2.4.2-1

picture 2.4.2-1

Grade	Description	Value
A	Outside diameter Insulation	8.1-9.7 mm
B	Insulation section	NA
C	copper cable,conductor cross-sectional area	31-35 mm^2
D	Maximum current	120A

Battery wiring connection process

Step 1

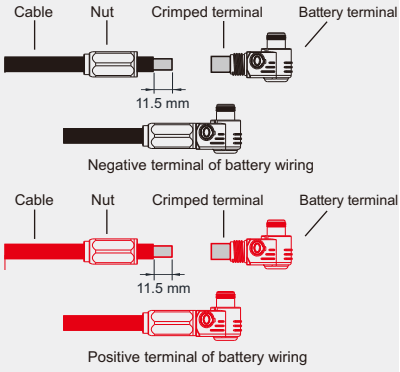
Prepare battery cables and accessories and put battery power cable through battery cover.

Note:

1. Please use accessories from accessory box.

2.Battery cable: copper,conductor cross-sectional area: 31~35mm^2, outside diameter of cable:11±0.5mm.

3.Crimp the battery terminal tightly with a special crimper.



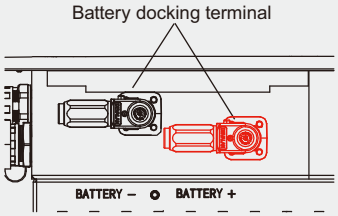
Step 2

Connect battery terminal onto inverter.

Note:

1.Please make sure the polarity (+/-) of battery is not reversed.

2.If a circuit breaker is added between the battery and the inverter,please don't operation the breaker with voltage.



Inverter compatible lithium battery:AOHAI(R-P48128EDA1,R-P48128EDB1,AS-5.12LB-GL1,AS-5.12LD-GL1,AS-10.24LD-GL1). please refer to the battery manual and 2.7 battery connection methods in his product description. If you choose AOHAI battery, will provide the battery line, do not need to make their own.

AOHAI will not be responsible for any problem if the user uses other brand batteries.

Battery will act as a protective charge/discharge current limitation under any condition as below:

- Battery SOC is lower than the set minimum SOC value (default value 10%).
- Battery voltage is lower than discharge voltage.
- Battery overheating protection.
- Battery communication is abnormal for lithium battery.
- BMS limitation for lithium battery.

When charge/discharge current limitation protection occurs:

- Under on-grid mode, battery charge/discharge operation could be abnormal.
- Under off-grid mode, off-grid supply will shut down.

Note:

- Under off-grid mode, if off-grid supply shuts off because of low battery SOC or low battery voltage, PV power will all be used to charge the battery until the battery SOC reaches the set minimum SOC+5% , and then activate the off-grid supply.
- Under on-grid mode & off-grid mode, battery is protected from over discharge by DOD and discharge voltage.
- The DOD setting of a battery prevents the inverter from discharging battery reserve power. As soon as the DOD is reached the load of building will only be supported by either PV power or the grid.
- If there are continuous days when little or no battery charging occurs, the battery may continue to self consume energy to support communications with the inverter.

  This behavior is different between battery manufactures products, however, if the SOC of the battery reaches a certain level, the inverter will boost the SOC back up. This protection mechanism safeguards the battery from falling to 0% SOC.

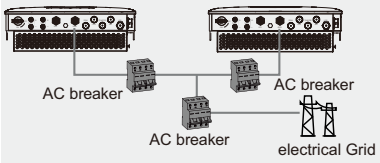
2.4.3 On-grid and Off-grid Connection

An external AC breaker is needed for on-grid connection to isolate the inverter from the utility grid when necessary. The requirements for the on-grid AC breaker are shown below.

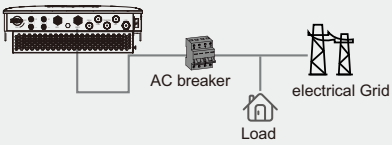
Inverter Model	AC Breaker Specification
AH-6KSL	50A / 230V

Note: The inverter may be damaged If an electrical short circuit occurs when the off-grid side is not connected to the AC circuit breaker.

1. Use separate AC breakers for each inverter.



2. On the AC side, an individual breaker should be connected between the inverter and grid.



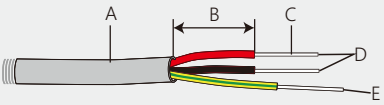
Requirement of AC cable connected to On-Grid and Off-Grid side

Make sure the inverter is totally isolated from any DC or AC power before connecting the AC cable.

Note:

1. Neutral cable shall be red, line cable shall be black or brown (preferred) and protective earth cable shall be yellow-green.
2. For AC cables, PE cable shall be longer than N&L cables, so in case that the AC cable slips or is taken out, the protecting earth conductor will be the last to take the strain.

Step 1



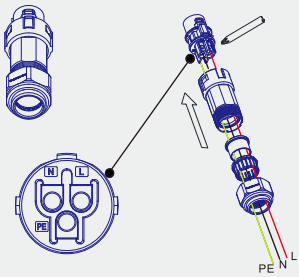
Position	Description	Recommended value
A	Outside diameter	>15mm
B	Separated wire length	20-25mm
C	Conductor wire length	12mm-14mm
D	Conductor core section	8.37mm²(8AWG)
E	Conductor core section	3.33mm² - 5.26 mm²

Note:maximum cable current is 27A(for 6kW inverter).

Step 2

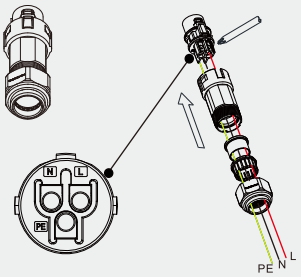
Put AC cable through terminal cover as shown in the figure, and crimp 3 terminals on the cable conductor core.

Schematic diagram of GRID installation and docking:



Enlarged view of terminal

Schematic diagram of EPS installation and docking:

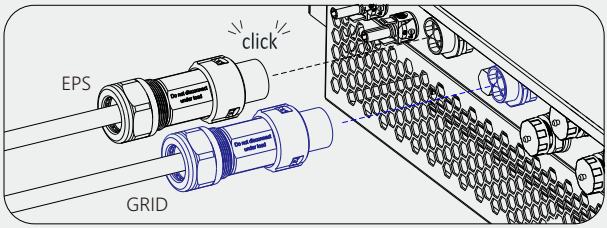


Enlarged view of terminal

Step 3

1.When installing the terminal, pay attention to the color terminals and the one-to-one correspondence between the terminals and hybrid inverter.

2.When the terminal is docked, there is a click sound. After the terminal is locked gently pull the cable to observe whether looseness.



Declarations For The Off-Grid Function

The off-grid output of AH-3~6KSL hybrid inverters has overload ability.

For details please refer to the technical parameters of AH-3~6KSL series inverters.

And the inverter has self-protection derating at high ambient temperature.

- For hybrid inverters (AH-3~6KSL), the standard PV installation typically consists of the connection of the inverter with both panels and batteries.
- In the case where the system is not connected to the batteries, the off-grid function is strongly not advised for use. Manufacturer shall not cover the standard warranty and is not liable for any consequences arising from users not following this instruction.
- Under normal circumstances, the off-grid switching time is less than 20ms (considering the minimum conditions of EPS). However, some external factors may cause the system failing on off-grid mode. As such, we recommend the users to be aware of conditions and follow the instructions as below:
  - Do not connect loads when they are dependent on a stable energy supply for a reliable operation.
  - Do not connect the loads which may in total exceed the maximum off-grid capacity.
  - Try to avoid those loads which may create very high start-up current surges such as inverter air-conditioner,high-power pump etc.
  - Due to the condition of the battery itself, battery current might be limited by some factors including but not limited to the temperature, weatheretc.
- The off-grid side of the AH-3~6KSL series inverter can provide 6000VA continuous output for the load. Acceptable loads are as below:
  - Inductive Load: Maximum 2KVA for single inductive load, maximum 3.6KVA for total inductive load power.
  - Capacitive Load: Total capacitive load (like computer, switch power etc.)power ⩽ 3.6KVA.
  - Any load with high inrush current at start-up is not accepted.

Note:Except for Pakistan, the EPS interface is not enabled by default in other regions, which needs to be enabled on the HaiPower APP.The Settings are as follows.

- Off-grid mode setting Procedure:
  - Open HaiPower APP and log in to your account.
  - Click "Equipment" below, find your device, click "settings" below, set the "Off-grid" column to "enable".

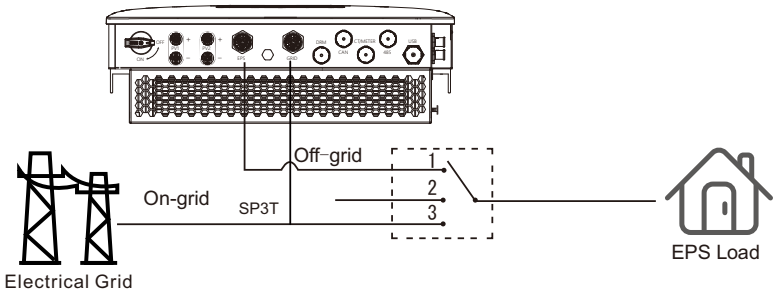
● **Note:**

If the bypass function is not enabled, add an SP3T.

- Off-grid load is supplied from off-grid side.
- Off-grid load is isolated.
- Off-grid load is supplied from grid side.

Note:

When the output of the off-grid end is abnormal, manually turn the dial to gear 3 (on-grid end), so that the EPS load can work normally.



Declarations For off-grid Overload Protection

Inverter will restart itself if overload protection triggers. The preparation time for restarting will be longer and longer (one hour at most) if overload protection repeats. Take following steps to restart inverter immediately.

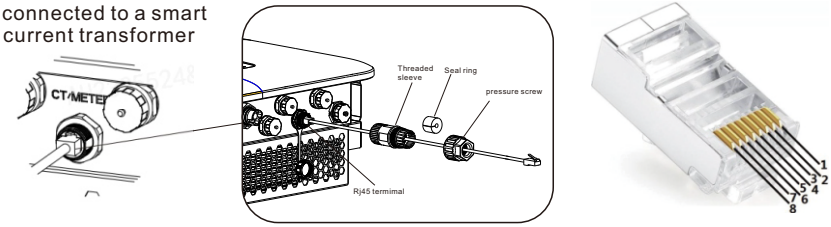
1. Decrease off-grid load power within maximum limitation.
2. On The Hai Power App > Advanced Settings > Click "Reset Off-grid Overload History".

2.4.4 Detailed PIN function

Position	Color	RS485(Main)	CAN(BMS)	Meter(Smart Meter)	CT(Current Transformer)
1	Orange & white	485_B	BAT_NTC	485_B	NC
2	Orange	485_A	NC	485_A	NC
3	Green & white	NC	GND	NC	NC
4	Blue	NC	CANH	NC	IGRID_LOADN
5	Blue & white	NC	CANL	NC	IGRID_LOADP
6	Green	RLY_NO	GND	NC	NC
7	Brown & white	RLY_NC	GND	NC	NC
8	Brown	RLY_GND	WAKE_UP	NC	NC

Take the connection of the CT/meter interface as an example:

METER is connected to a smart meter or a current transformer



Refer to the table above when reading the following:

1. The pins of diff erent serial numbers of the crystal head correspond to the wires of different colors for connection;For example: 1 pin = orange white, 5 pins = blue and white, 8 pins = brown.

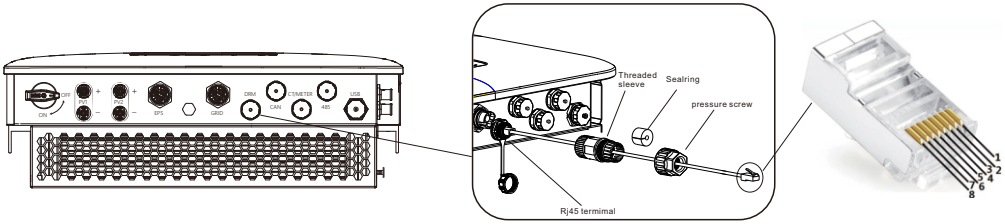
2. When the cr ystal head is connected to different devices, the signal connected to each pin is different due to the different communication signal formats;

Take CT current transformer as an example:

pin 1=NC (NC stands for floating), pin 2=NC,pin 3= NC,pin 4=black=IGRID_LOADP(indicating a signal),

pin 5=black and white=IGRID_LOADN(indicating a signal), pin 6=NC,pin 7=NC,pin 8=NC.

DRM Port Connection



1. Route the signal cable through the terminal protection cover as shown.
2. Insert the signal wire end into the terminal hole.
3. Install and lock the parts of the connector according to the diagram.
4. pin 1=DRM1/5, pin 2=DRM2/6,pin 3= DRM3/7,pin 4=3/7,pin 5=REF, pin 6=COM,pin 7=short to pin 8, pin 8=short to pin 7.

2.4.5 Smart Meter & CT Connections

Make sure the AC cable is totally isolated from AC power before connecting the Smart Meter and CT

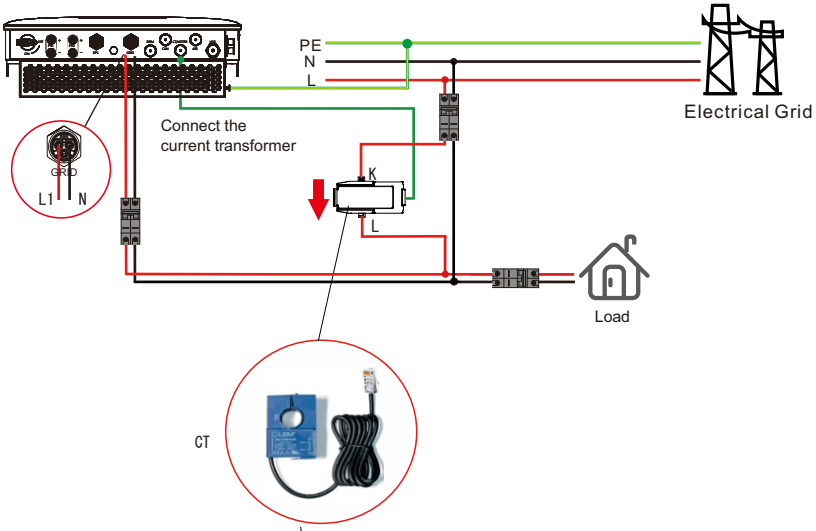
The "CT/Meter" port supports two connection modes -CT mode and Meter mode, where CT mode uses the attached CT, if you want to use the meter mode,you need to purchase a compatible smart meter.

Note:

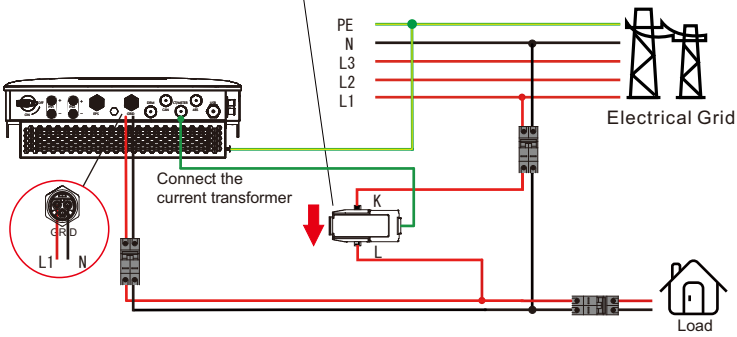
1. When using CT/Meter, please read the relevant instructions carefully.
2. One CT/Meter can only be used for one AH-3~6KSL series inverter.

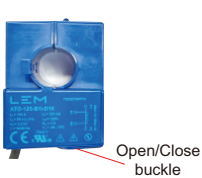
Schematic diagram of the CT Model connection

• For Single-phase Grid



• For three-phase Grid





CT closed state

CT open state (passing line port)

CT current direction (according to the arrow)

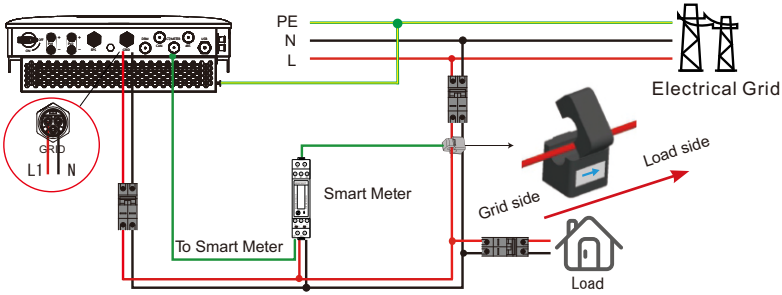
Note:

1. There is 1 CT in the product package, and the cable length is 5 meters. When using CT mode, you need to set the "CT model" option to "CT "in the" HaiPower "APP. The default setting is "CT".

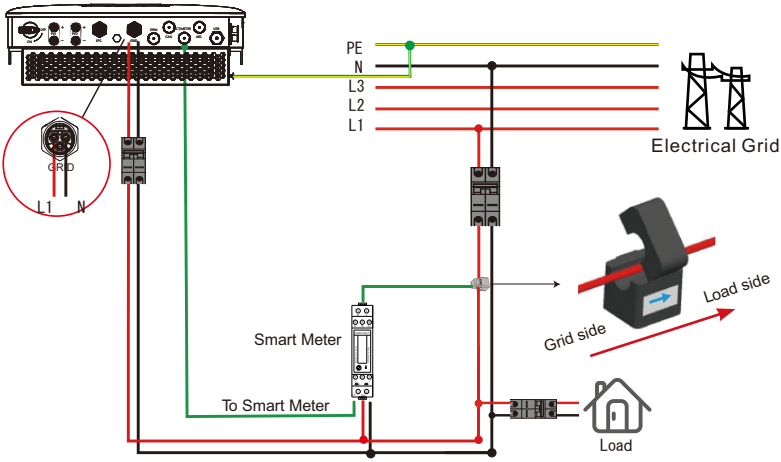
3. The CT products of the standard configuration can be used independently.

Smart Meter & CT connection diagram(optional scheme)

• For Single-phase Grid



• For Three-phase Grid



Note:

1. The smart meter & CT used in this solution needs to be selected by the customer, and this product is not provided.The CT of the optional scheme must be used with smart meters.

2. When using this solution, it must be used in accordance with the rules of use of this product and the instructions for use of smart meters.

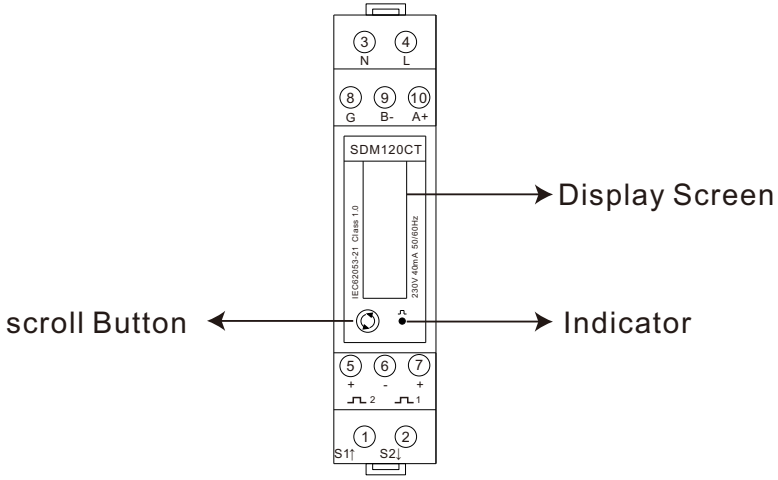
3. When using "Meter model", you need to set" CT mode" option to "meter" in" HaiPower"app.

2.4.6 Use of Smart Meters

Symbol	Meaning
V	LCD display data is voltage
A	LCD display data is current
W	LCD display data is active power
var	LCD display data is reactive power
Hz	LCD display data is frequency

Display (Optional):

when it is powered on,the meter will initialize and do self-checking.



*Note:The ratio of CT to meter is already set. Do not set it by yourself.

There is a button on the front of the meter.After initialization and self-check program,the meter display the measured values.The default page is total kWh.If the user wants to check other information,he needs to press the scroll button on the front panel.

	Click the button,the LCD display will scroll the measurements.
	Keep pressing the button for 3 seconds, the meter will enter set-up mode.

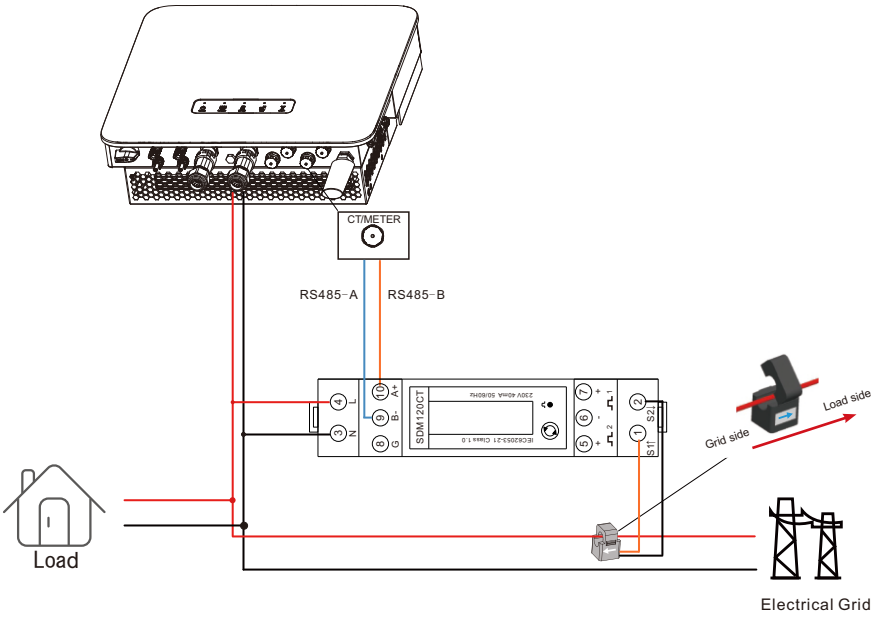
Smart meter connection method:

1. The 1th port is connected to the CT positive pole S1(white), and the 2th port is connected to the CT negative pole S2(black).

2. The 10th port is connected to RS485-A, and the 9th port is connected to RS485-B.

3. The 4th port is connected to L of AC, and the 3th port is connected to N of AC.

Smart meter connection diagram:



Note: Please be sure to connect according to the above wiring rules, otherwise the smart meter will not work normally.

2.5 WIFI Module Connection

The Wi-Fi communication function is only applied to WiFi Module, please refer to the following figure to install the WiFi module.

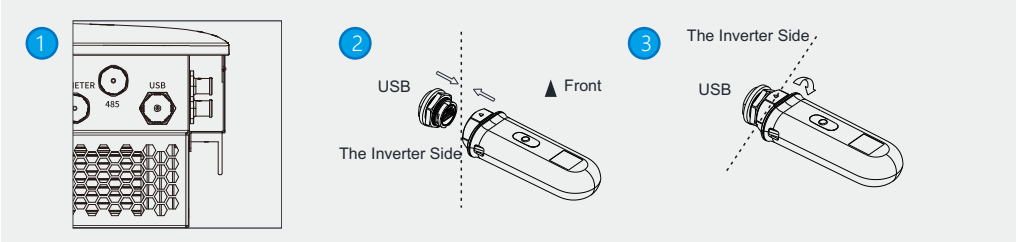
*Please refer to Section 2.8 for details on WIFI distribution network and APP usage.

Follow the installation steps:

1.Remove the USB waterproof.

2.Plug in the communication module.

3.Lock the communication module.



2.6 Earth Fault Alarm Connection

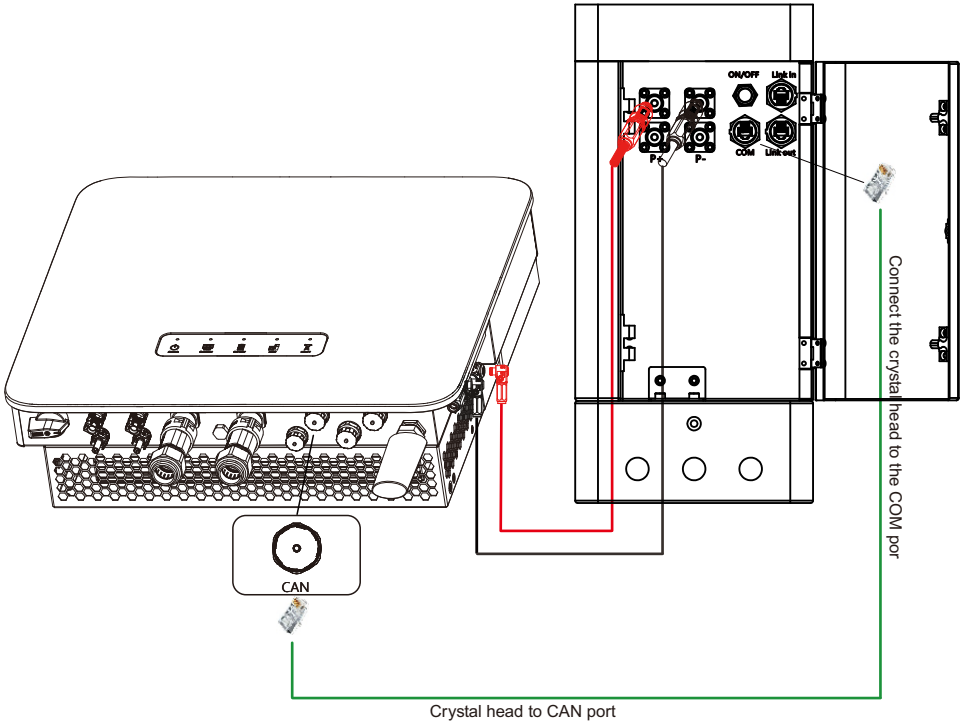
The AH-3~6KSL series inverter complies with IEC 62109-2 13.9. Fault indicator LED on inverter cover will light up when a fault occurs.

2.7 Battery Wiring Connection

2.7.1 Single Battery Wiring

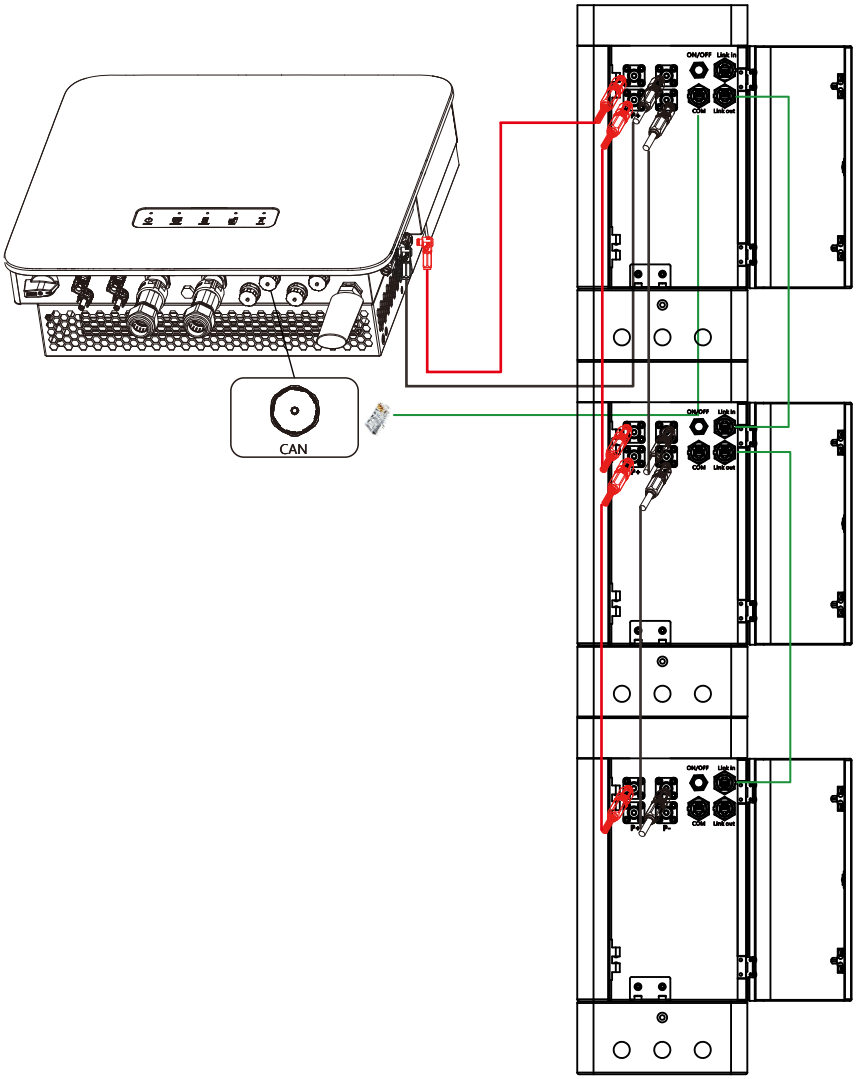
Taking lithiumvalley battery as an example, the connection mode between battery and inverter is introduced:

1. Please refer to Section 2.4.2 for the wiring installation of the positive and negative terminals of the battery.
2. During BMS communication, one end is connected to the CAN end of the inverter, and the other end is connected to the COM of the battery. A single battery pack does not need to be connected to the Link_IN and Link_OUT terminals.
3. For the wiring sequence of the battery BMS communication plug, please refer to the BMS column in the plug connections.



2.7.2 Multi-group Battery Wiring

1. When multiple batteries are connected, the BMS communication only needs to be connected to the host battery;
2. When the master battery is connected to the multi-level slave battery, the Link_OUT of the upper level is connected to the Link_IN of the lower level.
3. The master-slave communication line is provided by the battery manufacturer;
4. The figure below shows the battery pack parallel mode;
5. Other connection methods are consistent with Section 2.7.1



2.8 APP Operation And Equipment Distribution Network

● The AH-3~6KSL series inverter can be monitored and set through the HaiPower APP, which you can download through the following QR code.

HaiPower	HaiPower
IOS	Android

● Haipower app user manual can be downloaded through the following QR code.

● WIFI-U Date logger user manual can be downloaded through the following QR code.

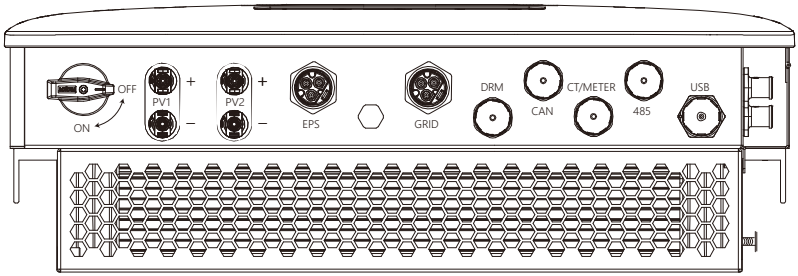
HaiPower	WiFi-U
Manual EN	EN/CN

03 Other

3.1 Troubleshooting

Check before AC power-on

- Battery connection: Make sure the polarity (+/-) connection is correct when connecting the AH-3~6KSL to the battery, see Figure 3.1-1.
- PV input connec tion: Make sure the polarity (+/-) connection is correct when connecting AH-3~6KSL to PV, see Figure 3.1-2.
- Grid-connected and off-grid connections: Make sure that the grid-connected side is connected to the grid, the off-grid side is connected to the load polarity correctly, and the L line and N line are connected in sequence, see Figure 3.1-3.
- CT connection: Make sure that the CT is connected between the load and the grid and the direction is pointing to the inverter, and follow the direction mark on the CT, see Figure 3.1-4.



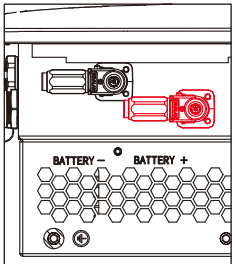


Figure 3.1-1

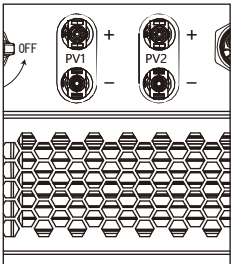


Figure 3.1-2

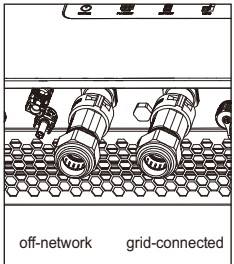


Figure 3.1-3

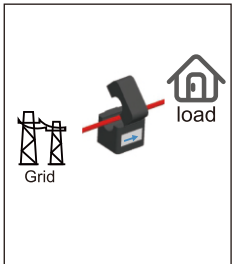


Figure 3.1-4

Check before start-up and AC power-on

Battery Settings, BMS Communication and Safety Country:
After connecting the data logger, please check the parameters in the Hai Power App to make sure the selected battery type is the same as the one you installed and "Safety Country " is selected correctly. If the setting is not correct, please set it correctly in "Settings".

Note : For compatible lithium batteries, after selecting the correct battery manufacturer, the BMS status will display "Normal".

3.2 Common Problems and Solutions

Operational problems

	Common operating problems	Solution
1	AH-3~6KSL cannot start with PV only	1. Make sure the PV voltage is higher than 120V. 2. Make sure the polarity (+/-) is correct when connecting the AH-3~6KSL's PV and battery.
2	AH-3~6KSL hybrid inverter still outputs when off-grid without discharging, or when there is no PV input, or PV power is lower than load power	1. Check whether the communication between AH-3~6KSL and smart meter is normal. 2. Make sure the load power is higher than 150W. Unless the load power is higher than 150W, the battery will not continue to discharge; The battery does not discharge when the meter power is higher than 150W, please check the smart meter and CT wiring and direction; 3. Make sure the battery SOC is higher than the set minimum SOC. If the battery discharges below the minimum SOC, the battery must be charged so that the SOC is greater than the minimum SOC+5%, the battery will discharge again. 4. Check whether the charging time has been set on the APP, because it will prioritize charging when it is charging and discharging at the same time.
3	Battery does not charge when PV power is higher than load power	1. If it is a lead-acid battery, please check whether the charging voltage in Hai Power is set correctly. If the battery voltage reaches the charging voltage, the battery will not charge. 2. Check the discharge time setting in Hai Power. 3. Check whether the battery is fully charged, or whether the battery voltage reaches the charging voltage.
4	High power fluctuations when charging or discharging the battery	1. Check whether the load power fluctuates. 2. Check for fluctuations in PV power.
5	Battery not charging	1. If it is a lithium battery, please check Hai Power to ensure that the BMS communication is normal. 2. Check that the CT connection position and orientation are correct. 3. Check that the total load power is much higher than the PV power.

Q & A

Troubleshooting	Problems	Answer
About WIFI-U configuration	Q : How do I connect my phone to WIFI-U?	Answer:you have to press the quick-press button at the end of the WiFi-U Data logger manually. Pressing the button for one second turns on the Bluetooth,and the indicator light turns blue and blinks slowly.Scan the QR code or discover the surrounding devices through the APP for quick connection.
	Q : How to connect to the collector-WiFi signal ?	Answer:The router's WiFi icon supports the discovery of nearby router signals.Click on therouter you are trying to connect to and enter the correct password for pairing.
	Q : I choose the right Router hotspot and input correctly the password, but I Can't connect to the network.	Answer: May be there are special characters in the hotspot password that the module does not support. Please input the password that contains only Arabic numerals or uppercase/ lowercase letters.
About the battery	Q : Why can't the battery discharge when the grid is not available?	Answer: Turn on the off-grid function on Hai Power App to make the battery Discharge.
	Q : Why is the battery SOC suddenly jump to 95%?	Answer : Generally, the BMS communication failure of the lithium battery. If the battery goes into floating charging mode, the SOC will automatically reset to 95%.
	Q : Why is there no output ?	Answer: For off-grid power supply, the "Off-grid power supply" on the Hai Power app must turn on ". In off-grid mode or when the grid power is off, "off-grid output switch" function must turn on.Note : Do not restart the inverter or battery when the "off-grid output switch" is on, otherwise, the function will turn off automatically.
	Q : Why does the battery always trip (lithium battery)?	Answer : The usual reasons for a lithium battery switch trip are as follows: 1. BMS communication failed. 2. The battery SOC is too low, and the battery trips to protect itself. 3. Electrical short circuit on battery connection side. Note : If there are still problems after the above reasons are checked, please contact the after-sales service.
	Q : What kind of battery should AH-3~6KSL series inverter use ?	Answer: AH-3~6KSL series inverters are compatible with lithium batteries with a nominal voltage of 48V. For more details, please refer to Battery Compatibility List on Hai Power App.

About Hai Power management and monitoring	Q : Why can't I save settings on Hai Power App?	Disconnected from the WiFi of the collector. 1. Make sure you have connected to the WiFi of the collector (make sure no other devices are connected equipment) or a router (if the collector is connected to a router). App Home shows a good connection. 2. Restart the inverter 10 minutes after changing some settings, because in normal mode the inverter saves the settings every 10 minutes. We recommend to change setup parameters while the inverter is in standby mode .
	Q : Why is the data on the homepage different from specifications, such as data of charging and discharging, PV, load or grid?	Answer: The frequency of data refreshing is different. So there will be data inconsistencies between different platforms.
	Q : Why do some columns show NA such as battery SOH?	Answer : NA means due to communication problems, such as battery communication problems, the communication problems between inverter and the App, or App not receiving data from inverter or server.
About CT and anti-reflux function	Q: How to enable the output anti-backflow function?	Answer: You can enable the anti-backflow function through the following ways: 1. Make sure that the CT connection and communication are good. 2. Enable the anti-backflow function on the App, and set the maximum allowable backflow power to the grid on the App. Note: Even if the allowed reverse current power limit is set to 0 W, there may still be a maximum deviation of about 100W in the output power to the grid.
	Q: Why is there still power output to the grid after I set the power limit to 0 W?	Answer: The output limit can be 0 W in theory, but there will be a deviation of about 50-100W for the AH-3~6KSL system.
	Q: Can I use other brands of meters to replace the smart meters in the AH-3~6KSL system or modify some settings of the smart meters?	Answer: No, because the inverter and the smart meter integrate the communication protocol, and the meters of other brands cannot communicate. Additionally, any manual setting changes may cause meter communication failures.
	Q: What is the maximum current allowed to pass through the CT?	Answer: The maximum RMS current is 88A.
Other questions	Q: Is there a way to get the system working quickly?	Answer : Please refer to "AH-3~6KSL Series User Manual"
	Q: What kind of load can be connected to the Back-up side?	Answer : Please refer to the user manual.
	Q: Is the warranty of the inverter still valid if it is not installed or operated 100% according to the instructions in the user manual in some special cases?	Answer: Under normal circumstances, we will still provide technical support for problems caused by failure to comply with the instructions in the user manual, but we cannot guarantee that the product can still be returned or replaced. Therefore, if you cannot follow the instructions 100% under special circumstances, please contact after-sales consultation.

3.3 Specifications

Technical Data	AH-3KSL-G2	AH-3.6KSL-G2	AH-4KSL-G2	AH-4.6KSL-G2	AH-5KSL-G2	AH-6KSL-G2
Input data(PV)						
Max. PV Input Power	6000W	7200W	8000W	9200W	10000W	10800W
Max. Input Voltage	550V	550V	550V	550V	550V	550V
Start-up Voltage	120V	120V	120V	120V	120V	120V
Nominal Input Voltage	360V	360V	360V	360V	360V	360V
MPPT Operating Voltage Range	90V-550V	90V-550V	90V-550V	90V-550V	90V-550V	90V-550V
Number of MPPT	2	2	2	2	2	2
Number of Strings per MPPT	1+1	1+1	1+1	1+1	1+1	1+1
Max. Input Current per MPPT(A)	16+16	16+16	16+16	16+16	16+16	16+16
Max. Short Circuit Current per MPPT(A)	20+20	20+20	20+20	20+20	20+20	20+20
AC Input/Output (On-grid)						
AC nominal power	3000W	3600W	4000W	4600W	5000W	6000W
Max. Apparent Power	3000VA	3600VA	4000VA	4600VA	5000VA	6000VA
Nominal Input/Output Voltage	230V,L/N/PE					
AC Frequency Range	50/45~55Hz, 60/55~65Hz					
Max. AC Current	16A	16A	22A	22A	27A	27A
Phase factor at rate power	1	1	1	1	1	1
Power Factor	~1(Adjustable from 0.8 leading to 0.8 lagging)					
THDI(nominal power)	<3%	<3%	<3%	<3%	<3%	<3%
Nominal Input/Output Current	16A	16A	22A	22A	27A	27A
AC Output (Back-up)						
AC nominal output power	3000W	3600W	4000W	4600W	5000W	6000W
Max. Apparent Power	3600VA	4320VA	4800VA	5520VA	6000VA	6000VA
Nominal AC voltage	230V	230V	230V	230V	230V	230V
Nominal AC frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
Nominal Output Current	16A	6A	22A	22A	27A	27A
THDv (@linear load)	<3%	<3%	<3%	<3%	<3%	<3%
BAT data (DC)						
Battery voltage range	42~59V	42~59V	42~59V	42~59V	42~59V	42~59V
Nominal Battery Voltage	52V	52V	52V	52V	52V	52V
Minimum full load voltage	45V	45V	46V	46V	50V	50V
Max. charging / discharging current	66.7A	80A	87A	100A	100A	120A
Continuous charging / discharging power	3000W	3600W	4000W	4600W	5000W	6000W
Battery Type	li-Ion/Lead-acid					
Efficiency						
Max. efficiency	97.2%	97.2%	97.2%	97.2%	97.2%	97.2%
Euro weighted efficiency	97%	97%	97.1%	97.1%	97.2%	97.2%
MPPT efficiency	⩾ 99.5%	⩾ 99.5%	⩾ 99.5%	⩾ 99.5%	⩾ 99.5%	⩾ 99.5%
Protection devices						
PV Reverse Polarity Protection	yes	yes	yes	yes	yes	yes
Anti-Islanding Protection	yes	yes	yes	yes	yes	yes
Output Short Protection	yes	yes	yes	yes	yes	yes
Ground fault monitoring/Grid Monitoring	yes	yes	yes	yes	yes	yes
Insulation Resistance Monitoring	yes	yes	yes	yes	yes	yes
Over-current Protection	yes	yes	yes	yes	yes	yes
Over-temperature Protection	yes	yes	yes	yes	yes	yes
AC/DC Surge Protection	yes	yes	yes	yes	yes	yes
DC Switch	yes	yes	yes	yes	yes	yes
Residual Current Monitoring	yes	yes	yes	yes	yes	yes
General Data						
Dimensions (W / H / D) in mm	550*500*190					
Weight	30KG	30KG	30KG	30KG	30KG	30KG
Operating Temperature Range	-25℃~+60℃ (Derating above +45℃)					
Noise emission (typical)	≤ 25 dB(A)	≤ 25 dB(A)	≤ 25 dB(A)	≤ 25 dB(A)	≤ 25 dB(A)	≤ 25 dB(A)
Altitude	4000m	4000m	4000m	4000m	4000m	4000m
Ingress Protection	IP 65	IP 65	IP 65	IP 65	IP 65	IP 65

Cooling Method	Natural	Natural	Natural	Natural	Natural	Natural
Communication	RS485/USB/CAN/WiFi, GPRS(Optional)					
Relative humidity	0~95%	0~95%	0~95%	0~95%	0~95%	0~95%
Display	LED&APP					
PV Connector	MC4					
AC connection	connector	connector	connector	connector	connector	connector
Battery Connector	connector	connector	connector	connector	connector	connector

3.4 Fault Information

When a fault occurs, the following error information can be viewed through Hai Power.

Warning Description	Display	Troubleshooting suggestions
Fan Abnormal	Fan Abnormal	1. Check whether the fan cables are properly connected. 2. Restart the inverter. 3. If the error message persists, please contact AOHAI support.
EEPROM abnormal	EEPROM abnormal	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
Battery SOC Low	CT Reversed	1. Check if the CT is reversely connected. 2. If the error message persists, contact AOHAI support.
Meter Reversed	Meter Reversed	1. Check if the Meter is reversely connected. 2. If the error message persists, please contact AOHAI support.
Battery voltage is below the lower threshold	Bat Volt Low	1. Check the battery voltage. 2. If the error message persists, please contact AOHAI support.
The inverter failed to communicate with the meter	Meter Com Fail	1. Check if the connection between the electricity meter and the inverter is normal. 2. Check if the distance between the electricity meter and the inverter is within the specified range. 3. Restart the inverter and meter, and reconnect them. 4. If the warning message persists, please contact AOHAI support.
CT Reversed	CT Reversed	1. Check if the CT is reversely connected. 2. If the error message persists, contact AOHAI support.
No AC Connection	No AC Connection	1. Check if the grid is down.
AC V Outrange	Grid V Abnormal	1. Check the grid voltage and restart the inverter. 2. If the error message persists, please contact AOHAI support.
AC F Outrange	Grid F Abnormal	1. Check the grid frequency and restart the inverter. 2. If the error message persists, please contact AOHAI support.
Generator No Output Voltage	No Gen Connection	1. Check if the generator is on and restart the inverte. 2. If the error message persists, contact AOHAI support.
Generator V Outrange	Gen V Abnormal	1. Check the generator voltage and restart the inverter. 2. If the error message persists, please contact AOHAI support.
Generator F Outrange	Gen F Abnormal	1. Check the generator frequency and restart the inverter. 2. If the error message persists, please contact AOHAI support.

Fault Description	Display	Troubleshooting suggestions
Grid voltage is beyond the permissible range	Grid V Abnormal	1. Check the grid voltage and restart the inverter. 2. If the error message persists, please contact AOHAI support.
Grid frequency exceeds the allowable range	Grid F Abnormal	1. Check the grid frequency and restart the inverter. 2. If the error message persists, please contact AOHAI support.
No utility grid connected	Grid Disconnect	1. After shutdown, check the grid wiring. 2. If the error message persists, please contact AOHAI support.
The DC component of the output current is too high	DCI High	1. Restart the inverter. 2. If the error message persists, contact AOHAI support.
Neutral-to-Ground voltage abnormal	NE Volt Abnormal	1. Check whether the N line on the inv erter side with PV negative grounding is short-circuited with the ground cable and whether the output side is isolated with a transformer. 2. If the error message persists, please contact AOHAI support.
ByPass Over Load	ByPass Over Load	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
Off grid output voltage too low	EPS Volt Low	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
Off grid output voltage too high	EPS Volt High	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
Short circuit of off grid output	EPS Output Short	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
EPS Over Load	EPS_Load Abnormal	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
Battery disconnected	Bat Open	1. Check the wiring of the battery terminals. 2. If the error message persists, please contact AOHAI support.
Battery voltage is below the lower threshold	Bat Volt Low	1. Check the battery voltage. 2. If the error message persists, please contact AOHAI support.
Battery voltage exceeds the upper threshold	Bat Volt High	1. Check the ba ttery voltage. If it is within the permissible range, please restart the inverter. 2. If the err or message persists, please contact AOHAI support.
DC input voltage exceeds the upper threshold	PV Volt High	1. Disconnect the DC switch immediately and check the voltage. 2. If the DC input volt age is within the permissible range and the error message persists, please contact AOHAI support.
PV panels have low insulation resistance	PV Isolation Low	1. Check if the PV strings are properly grounded. 2. If the error message persists, please contact AOHAI support.
An excessively high leakage current has been detected	Residual I High	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
Over Current	Error508(0) Error508(1) Error508(2)	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
System Software Version Error	Error510(0)	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
CT or Meter Over Current	Error512(0)	1. Check whether the power of the load exceeds the 1.05 times rated power. 2. If the error message persists, please contact AOHAI support.
Auto-test failed	Error503(0)	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
Temperature sensor disconnected	Error505(0)	1. Check if the temperature sensor module is properly connected. 2. If the error message persists, please contact AOHAI support.
Over temperature	Error506(0) Error506(1) Error506(2) Error506(3) Error506(4)	1.Verify that the inverter installation is away from the heat source and that there are items covering the inverter. 2. Restart the inverter. 3. If the error message persists, please contact AOHAI support.

Fault Description	Display	Troubleshooting suggestions
Over Current	Error306(0)	1. Restart the inverter. 2. If the error message persists, please contact AOHAI support.
BMS COM Warning	BMS COM Warning	1. Check if the battery is turned on. 2. Check if the battery is correctly and securely connected to the inverter.
BMS Fault	BMS Abnormal	1. Check if the battery is working well. 2. If the error message persists, please contact AOHAI support.

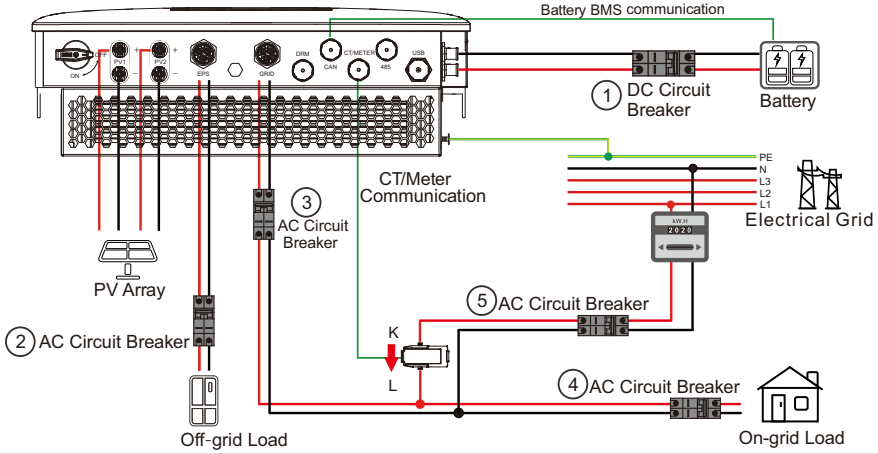
3.5 System Wiring Diagram

AH-3~6KSL series energy storage inverter wiring system.

Note: Picture below is Wiring diagram of AH-3~6KSL series inverter, not standard electrical wiring. Please choose circuit breaker according to the specification below.

inverter	①	②	③	④	⑤
AH-3KSL	100A/60V DC circuit breaker	25A/230V DC circuit breaker	16A/230V DC circuit breaker	According to the load	
AH-3.6KSL	125A/60V DC circuit breaker	25A/230V AC circuit breaker	16A/230V AC circuit breaker	According to the load	
AH-4KSL	125A/60V DC circuit breaker	32A/230V AC circuit breaker	25A/230V AC circuit breaker	According to the load	
AH-4.6KSL	140A/60V DC circuit breaker	32A/230V AC circuit breaker	25A/230V AC circuit breaker	According to the load	
AH-5KSL	140A/60V DC circuit breaker	40A/230V AC circuit breaker	32A/230V AC circuit breaker	According to the load	
AH-6KSL	180A/60V DC circuit breaker	50A/230V AC circuit breaker	40A/230V AC circuit breaker	According to the load	

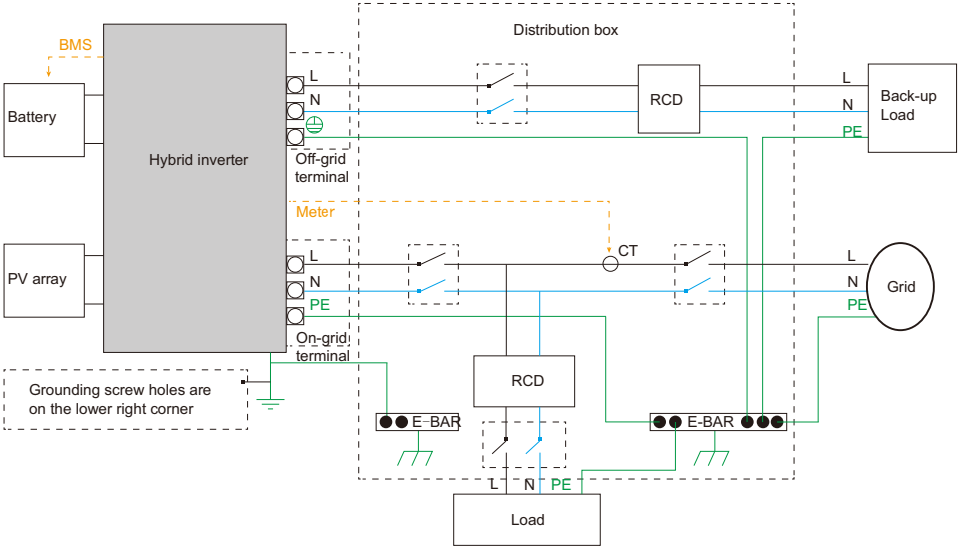
1. For the battery within circuit breaker, it do not need a circuit breaker outside.
2.Only applicable to lithium batteries with BMS communication.
3. The direction of the CT cannot be reversed, and the current direction should point to the inverter.



System wiring diagram

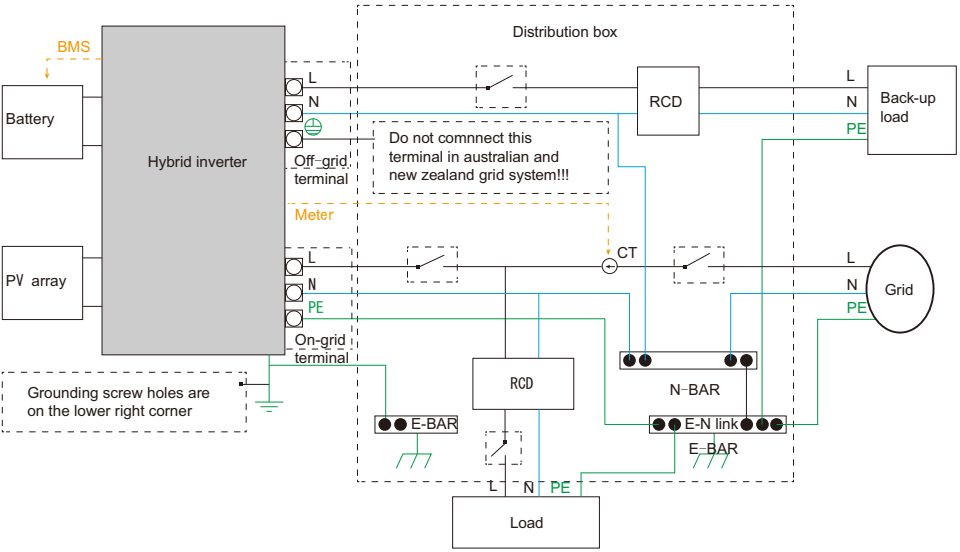
Picture below is a system diagram without special need for electrical connection.

Notice: off-grid grounding wire and grounding bar must connect correctly and run well. Otherwise, there might be abnormalities when grid failure occurs.



Notice: According to Australian Safety requirement: the Neutral wires of on-grid and off-grid must connect. Otherwise, the off-grid function cannot be used normally.

Picture below is an example of the PE wire inside the distribution box connecting with the neutral wire.i.e. Australia, New Zealand, South Africa, etc. (Please comply with local wiring regulations.)



3.6 Hazard Avoidance Quick Checklist

- Do not install the inverter near flammable, explosive or strong electromagnetic equipment.
- Remember this inverter is heavy, please be careful when taking it out of the package.
- Before connecting the battery to the inverter, ensure that the battery circuit breaker is disconnected and the nominal voltage of the battery complies with safety regulations, and Make sure the inverter is completely isolated from PV and AC power.
- Before connecting the AC cables, make sure the inverter is completely isolated from any DC or AC power source.
- Before connecting the CT, make sure the AC cable is completely isolated from the AC power supply.

Appendix: Definition of protection level

Definition of Overvoltage Classification

Overvoltage category I	Applies to equipment connected to a circuit in which measures are taken to limit transient overvoltages to low levels.
Overvoltage category II	Applies to equipment not permanently attached to a fixed installation. For example, appliances, portable tools, and other plug-in equipment.
Overvoltage category III	Applies to equipment permanently connected in fixed installations (i.e. equipment installed downstream of a power distribution panel, including power distribution disk itself). For example, switches and other equipment in industrial installations.
Overvoltage category IV	Applies to equipment already permanently connected at the start of the installation (i.e. installed upstream of the power distribution panel). Examples include electricity meters, primary overcurrent protection devices, and other devices directly connected to outdoor power lines.

Environment class definition

Humidity parameters	Grade		
	3K3	4K3	4K4H
Temperature	0~+40℃	-33~+40℃	-20~+55℃
Humidness	5%~85%	15%~100%	4%~100%

Wet place class definition

Environmental conditions	External temperature	Relative humidity	Suitable for
Outdoor	-20~50℃	4%~100%	PD3
Indoor, unregulated	-20~50℃	5%~95%	PD3
Indoor, regulated	0~40℃	5%~85%	PD2

Definition of pollution leve

Pollution degree 1	No pollution or only dry non-conductive pollution.
Pollution degree 2	In general, there is only non-conductive pollution, but occasional temporary conductivity due to condensation must be taken into account.
Pollution degree 3	Conductive pollution, or dry non-conductive pollution becomes conductive due to expected condensation.
Pollution degree 4	Causes persistent conductive pollution, such as pollution caused by conductive dust or rain and snow.

3.7 Disclaimer

AH-3~6KSL series inverters should be transported, used and operated under suitable environmental and electrical conditions. In the following cases, the manufacturer have the right not to provide after-sales service or assistance:

- The inverter was damaged during transportation.
- The inverter is out of warranty and no extended warranty has been purchased.
- Improper installation, modification or operation of the inverter not authorized by the manufacturer.
- Install or use the inverter under the unsuitable environmental or technical conditions mentioned in this user manual without the authorization of the manufacturer.
- Install and operate the inverter in violation of the requirements or warnings mentioned in this user manual.
- The inverter is damaged by any force majeure such as lightning, earthquake, fire, storm and volcanic eruption.
- Unauthorized disassembly , modification or update of the software or hardware of the inverter without the authorization of the manufacturer.
- The inverter is installed, used or operated in violation of any international policies and regulations or local policies and regulations.
- Connect any incompatible batteries, loads, or other devices to the AH-3~6KSL system.

The inverter needs regular maintenance, the details are as follows:

- Before servicing, make sure the inverter is completely isolated from all DC and AC power sources for at least 5 minutes.
- Heat sink: Please clean the heat sink with a clean towel every year.
- Torque: Use a torque wrench to tighten AC and DC wiring connections annually.
- DC circuit breaker: Check DC circuit breaker regularly and continuously activate DC circuit breaker 10x per year; operating DC circuit breaker will clean contacts and prolong
- The service life of the DC circuit breaker.

Waterproof board: Check whether the waterproof board of components such as RS485 is replaced once a year.

Note: The manufacturer reserves the right to interpret all content in this user manual. In order to maintain the protection class IP65, the inverter must be well sealed. Please install the inverter within one day after unpacking, otherwise please seal all unused terminals/holes.

AOHAI

Shenzhen Aohai Digital Power Co.,Ltd